

User's and Programmer's Reference

Agilent CSA Spectrum Analyzer

This manual provides documentation for the following instruments:

N1996A-503 (100 kHz to 3 GHz)

N1996A-506 (100 kHz to 6 GHz)

For firmware revision A.02.00 and above



Agilent Technologies

Manufacturing Part Number: N1996-90019

Supersedes N1996-90002

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Where to Find the Latest Information

Documentation is updated periodically.

- For the latest information about Agilent CSA Spectrum Analyzers, including firmware upgrades and application information, please visit the following Internet URL:

<http://www.agilent.com/find/csa>

1. Using This Document	33
About the User's and Programmer's Information	34
What is in This Book	34
Terms Used in This Book	35
2. Meas	37
Current Measurement Data Query (Remote Command Only)	38
Current Measurement Query (Remote Command Only)	39
3. Mode	41
4. Spectrum Analyzer	43
Meas Off (Spectrum Analyzer) Measurement	45
Meas Off Measurement Description	45
Remote Measurement Results	46
AMPTD Y Scale	46
Auto Tune	53
BW	53
Demod	58
FREQ Channel	59
Mode Setup	64
Marker	66
Marker ->	76
Meas Setup	77
Peak Search	98
Span/X Scale (Spectrum Analyzer Measurement)	98
Trace/Detector	100
View/Display (Spectrum Analyzer Mode)	111
Channel Power	114
Measurement Overview	114
Measurement Results	114
Remote SCPI Commands	114
AMPTD/Y Scale	115
Meas Setup	120
BW	126
Marker	127
SPAN/X Scale	132
Control/Sweep	133
Trace/Detector	134
View/Display	136
Occupied Bandwidth Measurement	137

Contents

Occupied BW—OBW Measurement Description	137
AMPTD Y Scale	139
Auto Tune	143
BW	143
Control/Sweep	146
FREQ Channel	147
Marker	147
Marker ->	155
Meas	156
Meas Setup	157
Peak Search	170
Span/X Scale	171
Trace/Detector	172
View/Display	174
5. Channel Analyzer	175
Adjacent Channel Power—ACP (I&M) Measurement	176
Adjacent Channel Power—ACP (I&M) Description	176
AMPTD Y Scale	179
Control/Sweep	180
FREQ Channel	181
Meas	185
Meas Setup	185
Trace/Detector	197
6. Stimulus / Response	199
Two Port Insertion Loss Measurement	200
Two Port Insertion Loss Measurement Description	200
AMPTD/Y Scale	206
Control/Sweep	207
FREQ/Channel	207
Marker	209
Marker ->	215
Meas	216
Meas Setup	216
Peak Search	231
Source	232
SPAN/X Scale	233
Trace/Detector	234
View/Display	238
One Port Insertion Loss Measurement	239

One Port Insertion Loss measurement Description	239
AMPTD/Y Scale	239
FREQ/Channel Menu	240
Meas	245
Meas Setup	245
SPAN/X Scale	258
Trace/Detector	259
View/Display	262
Return Loss	264
Return Loss Description	264
AMPTD/Y Scale	264
FREQ/Channel	266
Meas	270
Meas Setup	270
SPAN/X Scale	280
Trace/Detector	282
Distance To Fault	286
Distance to Fault Description	286
AMPTD/Y Scale Menu	286
FREQ/Channel	288
Meas	294
Meas Setup	297
SPAN/X Scale	311
Trace/Detector	312
View/Display Menu	315
7. Modulation Analyzer	317
AM Demodulation	318
AM Demodulation Description	318
AMPTD Y-scale	324
FREQ Channel Menu	334
Marker	335
Meas Setup	347
SPAN X Scale Menu	362
View/Display	366
FM Demodulation	367
FM Demodulation Description	367
AMPTD Y-scale	373
FREQ Channel Menu	383
Marker	384
Meas Setup	396

Contents

SPAN X Scale Menu	412
View/Display	415
8. Utility and Control/Sweep Functions	417
Control/Sweep Functions	418
Cont	418
Control/Sweep	418
Single	421
Utility Functions	422
Mode Preset	422
Print	422
Recall	422
Save	429
System	439
User Preset	455
9. Programming Fundamentals	457
SCPI Language Basics	458
Command Keywords and Syntax	458
Creating Valid Commands	458
Special Characters in Commands	459
Parameters in Commands	461
Putting Multiple Commands on the Same Line	463
Improving Measurement Speed	465
Use binary data format instead of ASCII	465
Avoid unnecessary use of *RST.	465
Minimize DUT/instrument setup changes.	466
Using the LAN to Control the Instrument	467
Using Telnet to Send Commands	467
Using Socket LAN to Send Commands	471
Using SICL LAN to Control the Instrument	472
Using HP/Agilent VEE Over Socket LAN	477
General LAN Troubleshooting	479
10. Using The Status Monitoring Subsystem	487
What Are Status Registers	488
What Are Status Register SCPI Commands	489
How to Use the Status Registers	490
Using a Status Register	492
Using the Service Request (SRQ) Method	494
Generating a Service Request	494

Status Register System	496
The Status Byte Register	498
Standard Event Status Register	501
Operation and Questionable Status Registers	504
Questionable Status Register	505
11. IEEE and STATUS Commands (Remote Commands Only)	507
Clear Status	508
Standard Event Status Enable	509
Standard Event Status Register Query	510
Identification Query	511
Operation Complete	512
Service Request Enable	513
Status Byte Query	514
Wait-to-Continue	515
Agilent CSA STATUS Register Model	516
Preset the Status Byte	516
Status Questionable Register	516
Questionable Frequency Register	518
Questionable Integrity Register	521

Contents

List of Commands

*CLS.....	508
*ESE.....	509
*ESE?.....	509
*ESR?.....	510
*IDN?.....	449
*IDN?.....	511
*OPC.....	512
*OPC?.....	512
*OPT?.....	450
*RCL <register>.....	424
*RST.....	422
*SAV <register#>.....	430
*SRE <integer>.....	513
*SRE?.....	513
*STB?.....	514
*TRG.....	95
*TST?.....	455
*WAI.....	515
:ABORt.....	421
:CALCulate:AM:LIMit ON OFF 1 0.....	360
:CALCulate:AM:LIMit:MINdex:LOWer <percent>.....	361
:CALCulate:AM:LIMit:MINdex:LOWer?.....	361
:CALCulate:AM:LIMit:MINdex:UPPer <percent>.....	361
:CALCulate:AM:LIMit:MINdex:UPPer?.....	361
:CALCulate:AM:LIMit:POWer:UPPer <ampl>.....	360
:CALCulate:AM:LIMit:POWer:UPPer?.....	360
:CALCulate:AM:LIMit?.....	360
:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer:AOFF.....	337
:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MAXimum.....	339
:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MAXimum:NEXT.....	340

List of Commands

:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MODE OFF POSition DELTA	335
:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MODE?	335
:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X <real>	337
:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X:POSition <integer>	338
:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X:POSition?	338
:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X?	337
:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:Y?	339
:CALCulate:AM:VIEW2:WINDow[1]:MARKer:AOFF	343
:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:MAXimum	346
:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:MAXimum:NEXT	346
:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:MODE OFF POSition DELTA	342
:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:MODE?	342
:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X <real>	344
:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X:POSition <integer>	344
:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X:POSition?	344
:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X?	344
:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:Y?	345
:CALCulate:CHPower:LIMit:CARRier[:POWer] <real>	123
:CALCulate:CHPower:LIMit:CARRier[:POWer]:AUTO ON OFF 1 0	123
:CALCulate:CHPower:LIMit:CARRier[:POWer]:AUTO?	123
:CALCulate:CHPower:LIMit:CARRier[:POWer]?	123
:CALCulate:CHPower:LIMit[:POWer]:LOWer <rel_ampl>	123
:CALCulate:CHPower:LIMit[:POWer]:LOWer:STATe ON OFF 1 0	123
:CALCulate:CHPower:LIMit[:POWer]:LOWer:STATe?	123
:CALCulate:CHPower:LIMit[:POWer]:LOWer?	123
:CALCulate:CHPower:LIMit[:POWer]:UPPer <rel_ampl>	122
:CALCulate:CHPower:LIMit[:POWer]:UPPer:STATe ON OFF 1 0	122
:CALCulate:CHPower:LIMit[:POWer]:UPPer:STATe?	122
:CALCulate:CHPower:LIMit[:POWer]:UPPer?	122
:CALCulate:CHPower:MARKer:AOFF	130
:CALCulate:CHPower:MARKer[1] 2 3 4:MAXimum	131

:CALCulate:CHPower:MARKer[1] 2 3 4:MODE POSition DELTA OFF	127
:CALCulate:CHPower:MARKer[1] 2 3 4:MODE?	127
:CALCulate:CHPower:MARKer[1] 2 3 4:STATe ON OFF 1 0	131
:CALCulate:CHPower:MARKer[1] 2 3 4:STATe?	131
:CALCulate:CHPower:MARKer[1] 2 3 4:X <frequency>	128
:CALCulate:CHPower:MARKer[1] 2 3 4:X:POSition <integer>	129
:CALCulate:CHPower:MARKer[1] 2 3 4:X:POSition?	129
:CALCulate:CHPower:MARKer[1] 2 3 4:X?	128
:CALCulate:CHPower:MARKer[1] 2 3 4:Y?	129
:CALCulate:DATA?	138
:CALCulate:DATA?	178
:CALCulate:DATA?	205
:CALCulate:DATA?	38
:CALCulate:FM:LIMit ON OFF 1 0	409
:CALCulate:FM:LIMit:FDLL:LOWer <freq>	410
:CALCulate:FM:LIMit:FDLL:LOWer?	410
:CALCulate:FM:LIMit:FDUL:UPPer <freq>	410
:CALCulate:FM:LIMit:FDUL:UPPer?	410
:CALCulate:FM:LIMit:FOUL:UPPer <freq>	411
:CALCulate:FM:LIMit:FOUL:UPPer?	411
:CALCulate:FM:LIMit:POWer:UPPer <ampl>	409
:CALCulate:FM:LIMit:POWer:UPPer?	409
:CALCulate:FM:LIMit?	409
:CALCulate:FM:VIEW [1]:WINDow[1]:MARKer[1] 2 3 4:X:POSition?	387
:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer:AOFF	386
:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MAXimum	388
:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MAXimum:NEXT	389
:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MODE OFF POSition DELTA	384
:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MODE?	384
:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X <real>	386
:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X:POSition <integer>	387

List of Commands

:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1]2 3 4:X?	386
:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1]2 3 4:Y?	388
:CALCulate:FM:VIEW2:WINDow[1]:MARKer:AOff	391
:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1]2 3 4:MAXimum	394
:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1]2 3 4:MAXimum:NEXT	394
:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1]2 3 4:MODE OFF POSition DELTA	390
:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1]2 3 4:MODE?	390
:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1]2 3 4:X <real>	392
:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1]2 3 4:X:POSition <integer>	393
:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1]2 3 4:X:POSition?	393
:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1]2 3 4:X?	392
:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1]2 3 4:Y?	393
:CALCulate:LMASK[1]2:FAIL?	93
:CALCulate:LMASK[1]2:SEGment:CENTer:LEVel <ampl>	84
:CALCulate:LMASK[1]2:SEGment:CENTer:LEVel?	84
:CALCulate:LMASK[1]2:SEGment:CENTer:SPAN <frequency>	85
:CALCulate:LMASK[1]2:SEGment:CENTer:SPAN?	85
:CALCulate:LMASK[1]2:SEGment:CENTer[:STATe] ON OFF 1 0	83
:CALCulate:LMASK[1]2:SEGment:CENTer[:STATe]?	83
:CALCulate:LMASK[1]2:SEGment:FIRSt ON OFF 1 0	85
:CALCulate:LMASK[1]2:SEGment:FIRSt:LEFT:LEVel <ampl>	87
:CALCulate:LMASK[1]2:SEGment:FIRSt:LEFT:LEVel?	87
:CALCulate:LMASK[1]2:SEGment:FIRSt:LEFT:SPAN <frequency>	88
:CALCulate:LMASK[1]2:SEGment:FIRSt:LEFT:SPAN?	88
:CALCulate:LMASK[1]2:SEGment:FIRSt:RIGHT:SPAN <frequency>	89
:CALCulate:LMASK[1]2:SEGment:FIRSt:RIGHT:SPAN?	89
:CALCulate:LMASK[1]2:SEGment:FIRSt?	85
:CALCulate:LMASK[1]2:SEGment:SECond ON OFF 1 0	90
:CALCulate:LMASK[1]2:SEGment:SECond:LEFT:LEVel <ampl>	92
:CALCulate:LMASK[1]2:SEGment:SECond:LEFT:LEVel?	92
:CALCulate:LMASK[1]2:SEGment:SECond:RIGHT:LEVel <ampl>	92

:CALCulate:LMASK[1] 2:SEGMent:SECond:RIGHt:LEVel?	92
:CALCulate:LMASK[1] 2:SEGMent:SECond?	90
:CALCulate:LMASK[1] 2:TRACe 1 2 3 4	82
:CALCulate:LMASK[1] 2:TRACe?	82
:CALCulate:MARKer:AOff	72
:CALCulate:MARKer[1] 2 3 4:MAXimum	98
:CALCulate:MARKer[1] 2 3 4:MAXimum:NEXT	98
:CALCulate:MARKer[1] 2 3 4:MODE OFF POSition DELTA	64
:CALCulate:MARKer[1] 2 3 4:MODE OFF POSition DELTA	66
:CALCulate:MARKer[1] 2 3 4:MODE?	64
:CALCulate:MARKer[1] 2 3 4:MODE?	66
:CALCulate:MARKer[1] 2 3 4:TRACe <integer>	68
:CALCulate:MARKer[1] 2 3 4:TRACe:AUTO OFF ON 0 1	69
:CALCulate:MARKer[1] 2 3 4:TRACe:AUTO?	69
:CALCulate:MARKer[1] 2 3 4:X <real>	73
:CALCulate:MARKer[1] 2 3 4:X:POSition <real>	75
:CALCulate:MARKer[1] 2 3 4:X:POSition?	75
:CALCulate:MARKer[1] 2 3 4:X:READout FREQuency TIME ITime PERiod	70
:CALCulate:MARKer[1] 2 3 4:X:READout?	70
:CALCulate:MARKer[1] 2 3 4:X?	73
:CALCulate:MARKer[1] 2 3 4:Y?	76
:CALCulate:MARKer[1] 2 3 4[:SET]:CENTer	77
:CALCulate:MARKer[1] 2 3 4[:SET]:RLEVel	77
:CALCulate:MASK[1] 2:SEGMent:FIRSt:RIGHt:LEVel <ampl>	87
:CALCulate:MASK[1] 2:SEGMent:FIRSt:RIGHt:LEVel?	87
:CALCulate:OBWidth:LMASK[1] 2:SEGMent:CENTer:LEVel <ampl>	162
:CALCulate:OBWidth:LMASK[1] 2:SEGMent:CENTer:LEVel?	162
:CALCulate:OBWidth:LMASK[1] 2:SEGMent:CENTer:SPAN <frequency>	162
:CALCulate:OBWidth:LMASK[1] 2:SEGMent:CENTer:SPAN?	162
:CALCulate:OBWidth:LMASK[1] 2:SEGMent:CENTer[:STATe] ON OFF 1 0	161
:CALCulate:OBWidth:LMASK[1] 2:SEGMent:CENTer[:STATe]?	161

List of Commands

:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt ON OFF 1 0	163
:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt:LEFT:LEVel <ampl>	164
:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt:LEFT:LEVel?	164
:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt:LEFT:SPAN <frequency>	165
:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt:LEFT:SPAN?	165
:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt:RIGHT:LEVel <ampl>	165
:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt:RIGHT:LEVel?	165
:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt:RIGHT:SPAN <frequency>	166
:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt:RIGHT:SPAN?	166
:CALCulate:OBWidth:LMASK[1]2:SEGment:FIRSt?	163
:CALCulate:OBWidth:LMASK[1]2:SEGment:SECond ON OFF 1 0	167
:CALCulate:OBWidth:LMASK[1]2:SEGment:SECond:LEFT:LEVel <ampl>	168
:CALCulate:OBWidth:LMASK[1]2:SEGment:SECond:LEFT:LEVel?	168
:CALCulate:OBWidth:LMASK[1]2:SEGment:SECond:RIGHT:LEVel <ampl>	169
:CALCulate:OBWidth:LMASK[1]2:SEGment:SECond:RIGHT:LEVel?	169
:CALCulate:OBWidth:LMASK[1]2:SEGment:SECond?	167
:CALCulate:OBWidth:LMASK[1]2:TRACe 1 2 3 4	160
:CALCulate:OBWidth:LMASK[1]2:TRACe?	160
:CALCulate:OBWidth:MARKer:AOff	155
:CALCulate:OBWidth:MARKer[1]2 3 4:MAXimum	170
:CALCulate:OBWidth:MARKer[1]2 3 4:MAXimum:NEXT	170
:CALCulate:OBWidth:MARKer[1]2 3 4:MODE OFF POStion DELta	147
:CALCulate:OBWidth:MARKer[1]2 3 4:MODE?	147
:CALCulate:OBWidth:MARKer[1]2 3 4:TRACe <integer>	149
:CALCulate:OBWidth:MARKer[1]2 3 4:TRACe:AUTO OFF ON 0 1	149
:CALCulate:OBWidth:MARKer[1]2 3 4:TRACe:AUTO?	149
:CALCulate:OBWidth:MARKer[1]2 3 4:TRACe?	149
:CALCulate:OBWidth:MARKer[1]2 3 4:X <real>	150
:CALCulate:OBWidth:MARKer[1]2 3 4:X:POStion <real>	152
:CALCulate:OBWidth:MARKer[1]2 3 4:X:POStion?	152
:CALCulate:OBWidth:MARKer[1]2 3 4:X:READout FREQuency TIME ITIME PERiod	153

:CALCulate:OBWidth:MARKer[1] 2 3 4:X:READout?	153
:CALCulate:OBWidth:MARKer[1] 2 3 4:X?	150
:CALCulate:OBWidth:MARKer[1] 2 3 4:Y?	152
:CALCulate:OBWidth:MARKer[1] 2 3 4[:SET]:CENTer	156
:CALCulate:OBWidth:MARKer[1] 2 3 4[:SET]:RLEVel	156
:CALCulate:TPILoss:MARKer:AOff	212
:CALCulate:TPILoss:MARKer[1] 2:MAXimum	231
:CALCulate:TPILoss:MARKer[1] 2:MAXimum:NEXT	231
:CALCulate:TPILoss:MARKer[1] 2:TRACe 1 2	211
:CALCulate:TPILoss:MARKer[1] 2:TRACe:AUTO OFF ON 0 1	211
:CALCulate:TPILoss:MARKer[1] 2:TRACe:AUTO?	211
:CALCulate:TPILoss:MARKer[1] 2:TRACe?	211
:CALCulate:TPILoss:MARKer[1] 2[:SET]:RLEVel	216
:CALCulate:TPILoss:MARKer[1] 2 3 4:MODE OFF POSition DELTA	210
:CALCulate:TPILoss:MARKer[1] 2 3 4:MODE?	210
:CALCulate:TPILoss:MARKer[1] 2 3 4:X <real>	213
:CALCulate:TPILoss:MARKer[1] 2 3 4:X:POSition <real>	214
:CALCulate:TPILoss:MARKer[1] 2 3 4:X:POSition?	214
:CALCulate:TPILoss:MARKer[1] 2 3 4:X?	213
:CALCulate:TPILoss:MARKer[1] 2 3 4:Y?	215
:CALCulate:TPILoss:MARKer[1] 2 3 4[:SET]:CENTer	215
:CALCulate:TPILoss:NORMalize[:IMMediate]	209
:CONFigure:<meas_name>	175
:CONFigure:<meas_name>	199
:CONFigure:<meas_name>	43
:CONFigure:ACPower	176
:CONFigure:AM	318
:CONFigure:CHPower	126
:CONFigure:OBWidth	137
:CONFigure:SANalyzer	45
:CONFigure:TPILoss	200

:CONFigure?	175
:CONFigure?	199
:CONFigure?	39
:CONFigure?	43
:DISPlay:ACPower:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_amp>	180
:DISPlay:ACPower:WINDow:TRACe:Y[:SCALe]:PDIVision?	180
:DISPlay:ACPower:WINDow:TRACe:Y[:SCALe]:RLEVel <amp;gt;	179
:DISPlay:ACPower:WINDow:TRACe:Y[:SCALe]:RLEVel?	179
:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle ON OFF 1 0	364
:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle?	364
:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision <real>	362
:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision?	362
:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOStion LEFT CTR RIGHT	363
:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOStion?	363
:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RVALue <real>	363
:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RVALue?	363
:DISPlay:AM:VIEW2:WINDow[1]:TRACe:X[:SCALe]:FSPan ON OFF 1 0	365
:DISPlay:AM:VIEW2:WINDow[1]:TRACe:X[:SCALe]:FSPan?	365
:DISPlay:AM:VIEW2:WINDow[1]:TRACe:X[:SCALe]:SPAN <freq>	365
:DISPlay:AM:VIEW2:WINDow[1]:TRACe:X[:SCALe]:SPAN?	365
:DISPlay:ANNOtation:CLOCK:DATE:FORMat MDY DMY	441
:DISPlay:ANNOtation:CLOCK:DATE:FORMat?	441
:DISPlay:ANNOtation:CLOCK[:STATe] OFF ON 0 1	441
:DISPlay:ANNOtation:CLOCK[:STATe]?	441
:DISPlay:CHPower:VIEW[1]:WINDow[1]:BGRaph ON OFF 1 0	136
:DISPlay:CHPower:VIEW[1]:WINDow[1]:BGRaph?	136
:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y [:SCALe]:PDIVision <rel_amp>	117
:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y [:SCALe]:PDIVision?	117
:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y [:SCALe]:RLEVel <real>	116

List of Commands

:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y [:SCALe]:RLEVel?	116
:DISPlay:DTFault:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_amp>	287
:DISPlay:DTFault:WINDow:TRACe:Y[:SCALe]:PDIVision?	287
:DISPlay:DTFault:WINDow:TRACe:Y[:SCALe]:RLEVel <insertion_loss>	287
:DISPlay:DTFault:WINDow:TRACe:Y[:SCALe]:RLEVel?	287
:DISPlay:ENABLE OFF ON 0 1	113
:DISPlay:ENABLE?	113
:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPlE ON OFF 1 0	414
:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPlE?	414
:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision <real>	412
:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision?	412
:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOSition LEFT CTR RIGHT	413
:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOSition?	413
:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RVALue <real>	412
:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RVALue?	412
:DISPlay:FM:VIEW2:WINDow[1]:TRACe:X[:SCALe]:FSPan ON OFF 1 0	415
:DISPlay:FM:VIEW2:WINDow[1]:TRACe:X[:SCALe]:FSPan?	415
:DISPlay:FM:VIEW2:WINDow[1]:TRACe:X[:SCALe]:SPAN <freq>	415
:DISPlay:FM:VIEW2:WINDow[1]:TRACe:X[:SCALe]:SPAN?	415
:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_amp>	140
:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALe]:PDIVision?	140
:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALe]:RLEVel <amp;lt;math>ampl</math>>	139
:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALe]:RLEVel?	139
:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALe]:SPACing LINear LOGarithmic	141
:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALe]:SPACing?	141
:DISPlay:OPILoss:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_amp>	240
:DISPlay:OPILoss:WINDow:TRACe:Y[:SCALe]:PDIVision?	240
:DISPlay:OPILoss:WINDow:TRACe:Y[:SCALe]:RLEVel <insertion_loss>	240
:DISPlay:OPILoss:WINDow:TRACe:Y[:SCALe]:RLEVel?	240
:DISPlay:TPILoss:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_amp>	207

List of Commands

:DISPlay:TPILoss:WINDow:TRACe:Y[:SCALe]:PDIVision?	207
:DISPlay:TPILoss:WINDow:TRACe:Y[:SCALe]:RLEVel <insertion_loss>	206
:DISPlay:TPILoss:WINDow:TRACe:Y[:SCALe]:RLEVel?	206
:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_ampl>	48
:DISPlay:WINDow:TRACe:Y[:SCALe]:PDIVision?	48
:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel <ampl>	47
:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel?	47
:DISPlay:WINDow:TRACe:Y[:SCALe]:SPACing LINear LOGarithmic	49
:DISPlay:WINDow:TRACe:Y[:SCALe]:SPACing?	49
:FORMat:BORDER NORMAl SWAPped	110
:FORMat:BORDER?	110
:FORMat[:TRACe][:DATA] ASCii INTeger,32 REAL,32 REAL,64	110
:FORMat[:TRACe][:DATA]?	110
:INITiate:CONTInuous ON OFF 1 0	418
:INITiate:CONTInuous?	418
:INITiate:REStart	420
:INITiate[:IMMEDIATE]	421
:INSTrument:SElect SA	43
:INSTrument:SElect?	43
:INSTrument[:SElect] SA SR CHAN MA	41
:INSTrument[:SElect]:<mode_name>	317
:INSTrument[:SElect]?	317
:INSTrument[:SElect]?	41
:MMEMory:CATalog?	429
:MMEMory:CATalog?	438
:MMEMory:DATA <'file_name'>,<definite_length_block>	438
:MMEMory:DATA? <'file_name'>	438
:MMEMory:DELEte <filename>?	429
:MMEMory:DELEte <filename>?	438
:MMEMory:LOAD:STATe 1,<filename>	424
:MMEMory:LOAD:TRACe <trace>,<file_name>	424

:MMEMory:STORe:SCReen <'file_name'>	430
:MMEMory:STORe:STATe 1,<'file_name'>	430
:MMEMory:STORe:TRACe <label>,<'file_name'>	430
:SOURce:TPILoss:POWer[:LEVel][:IMMEdiate][:AMPLitude] <power>	232
:SOURce:TPILoss:POWer[:LEVel][:IMMEdiate][:AMPLitude]:AUTO OFF ON 0 1	232
:SOURce:TPILoss:POWer[:LEVel][:IMMEdiate][:AMPLitude]:AUTO?	232
:SOURce:TPILoss:POWer[:LEVel][:IMMEdiate][:AMPLitude]?	232
:STATus:PRESet	516
:STATus:QUEStionable:CONDition?	516
:STATus:QUEStionable:ENABle <integer>	517
:STATus:QUEStionable:ENABle?	517
:STATus:QUEStionable:FREQuency:CONDition?	519
:STATus:QUEStionable:FREQuency:ENABle <integer>	519
:STATus:QUEStionable:FREQuency:ENABle?	519
:STATus:QUEStionable:FREQuency:NTRansition <integer>	520
:STATus:QUEStionable:FREQuency:NTRansition?	520
:STATus:QUEStionable:FREQuency:PTRansition <integer>	521
:STATus:QUEStionable:FREQuency:PTRansition?	521
:STATus:QUEStionable:FREQuency[:EVENT]?	520
:STATus:QUEStionable:INTegrity:CONDition?	521
:STATus:QUEStionable:INTegrity:ENABle <integer>	522
:STATus:QUEStionable:INTegrity:ENABle?	522
:STATus:QUEStionable:INTegrity:NTRansition <integer>	523
:STATus:QUEStionable:INTegrity:NTRansition?	523
:STATus:QUEStionable:INTegrity:PTRansition <integer>	523
:STATus:QUEStionable:INTegrity:PTRansition?	523
:STATus:QUEStionable:INTegrity[:EVENT]?	522
:STATus:QUEStionable:NTRansition <integer>	518
:STATus:QUEStionable:NTRansition?	518
:STATus:QUEStionable:PTRansition <integer>	518
:STATus:QUEStionable:PTRansition?	518

List of Commands

:STATus:QUEStionable[:EVENTf]?	517
:SYSTem:DATE <year>,<month>,<day>	442
:SYSTem:DATE?	442
:SYSTem:LKEY <“Option”>,<“LicenseKey”>	451
:SYSTem:LKEY:DELeTe <“Option”>[,<“LicenseKey”>	452
:SYSTem:LKEY? <“option”>	451
:SYSTem:OPTions?	449
:SYSTem:PRESet:USER	456
:SYSTem:PRESet:USER:SAVE	456
:SYSTem:PRESet[:MODE]	422
:SYSTem:TIME <hour>,<minute>,<second>	442
:SYSTem:TIME?	442
:SYSTem:VERsion?	448
:TRACe:CLear TRACE1 TRACE2 TRACE3 TRACE4	108
:TRACe:CLear:ALL	108
:TRACe[:DATA] <trace_name>,<definite_length_block> <comma_separated_ASCII_data>	109
:TRACe[:DATA]? <trace_name>	109
:TRACe[:DATA]? TRACE1 TRACE2 TRACE3 TRACE4	109
:TRACe[1] 2 3 4:DISPlay[:STATe] ON OFF 0 1	105
:TRACe[1] 2 3 4:DISPlay[:STATe] ON OFF 0 1	237
:TRACe[1] 2 3 4:DISPlay[:STATe] ON OFF 0 1	262
:TRACe[1] 2 3 4:DISPlay[:STATe] ON OFF 0 1	284
:TRACe[1] 2 3 4:DISPlay[:STATe] ON OFF 0 1	315
:TRACe[1] 2 3 4:DISPlay[:STATe]?	105
:TRACe[1] 2 3 4:DISPlay[:STATe]?	237
:TRACe[1] 2 3 4:DISPlay[:STATe]?	262
:TRACe[1] 2 3 4:DISPlay[:STATe]?	284
:TRACe[1] 2 3 4:DISPlay[:STATe]?	315
:TRACe[1] 2 3 4:TYPE WRITe AVERAge MAXHold MINHold	100
:TRACe[1] 2 3 4:TYPE?	100
:TRACe[1] 2 3 4:UPDate[:STATe] ON OFF 0 1	104

:TRACe[1] 2 3 4:UPDate[:STATe] ON OFF 0 1	236
:TRACe[1] 2 3 4:UPDate[:STATe] ON OFF 0 1	261
:TRACe[1] 2 3 4:UPDate[:STATe] ON OFF 0 1	284
:TRACe[1] 2 3 4:UPDate[:STATe] ON OFF 0 1	314
:TRACe[1] 2 3 4:UPDate[:STATe]?	104
:TRACe[1] 2 3 4:UPDate[:STATe]?	236
:TRACe[1] 2 3 4:UPDate[:STATe]?	261
:TRACe[1] 2 3 4:UPDate[:STATe]?	284
:TRACe[1] 2 3 4:UPDate[:STATe]?	314
:TRIGger:AM[:SEQuence]:DELay <real>	359
:TRIGger:AM[:SEQuence]:DELay?	359
:TRIGger:AM[:SEQuence]:SOURce EXTernal	357
:TRIGger:AM[:SEQuence]:SOURce IMMEDIATE	356
:TRIGger:AM[:SEQuence]:SOURce RFBurst	357
:TRIGger:AM[:SEQuence]:SOURce?	356
:TRIGger:FM[:SEQuence]:DELay <real>	408
:TRIGger:FM[:SEQuence]:DELay?	408
:TRIGger:FM[:SEQuence]:EXTernal:SLOPe POSitive NEGative	407
:TRIGger:FM[:SEQuence]:EXTernal:SLOPe?	407
:TRIGger:FM[:SEQuence]:LEVel:ABSolute <ampl>	407
:TRIGger:FM[:SEQuence]:LEVel:ABSolute?	407
:TRIGger:FM[:SEQuence]:SOURce EXTernal	406
:TRIGger:FM[:SEQuence]:SOURce IMMEDIATE	406
:TRIGger:FM[:SEQuence]:SOURce RFBurst	406
:TRIGger:FM[:SEQuence]:SOURce?	406
:TRIGger[:SEQuence]:DELay <time>	97
:TRIGger[:SEQuence]:DELay?	97
:TRIGger[:SEQuence]:EXTernal:SLOPe POSitive NEGative	96
:TRIGger[:SEQuence]:EXTernal:SLOPe?	96
:TRIGger[:SEQuence]:SOURce IMMEDIATE EXTernal RFBurst VIDeo	94
:TRIGger[:SEQuence]:SOURce?	94

List of Commands

:TRIGger[:SEquence]:VIDeo EXTeRnal RFBurst:LEVel: <real>	96
:TRIGger[:SEquence]:VIDeo EXTeRnal RFBurst:LEVel?	96
:UNIT:LOSS PDB NDB	230
:UNIT:LOSS PDB NDB	279
:UNIT:LOSS PDB NDB	309
:UNIT:LOSS PDB NDB	257
:UNIT:LOSS PDB NDB	280
:UNIT:LOSS?	230
:UNIT:LOSS?	257
:UNIT:LOSS?	279
:UNIT:LOSS?	280
:UNIT:LOSS?	309
:UNIT:OBWidth:POWer DBM DBMV DBUV V W A	141
:UNIT:OBWidth:POWer?	141
:UNIT:POWer DBM DBMV DBUV V W A	50
:UNIT:POWer?	50
[:SENSe]: OPILoss:AVERAge:TCONtrol?	246
[:SENSe]: OPILoss:FREQuency:SPAN:PREVious	259
[:SENSe]: OPILoss:FREQuency:SPAN:PREVious	282
[:SENSe]: OPILoss:FREQuency:SPAN:PREVious	312
[:SENSe]:ACPower:AVERAge:COUNt <integer>	187
[:SENSe]:ACPower:AVERAge:COUNt?	187
[:SENSe]:ACPower:AVERAge:TCONtrol EXPonential MAXHold REPeat RMAXhold	185
[:SENSe]:ACPower:AVERAge:TCONtrol?	185
[:SENSe]:ACPower:AVERAge[:STATe] OFF ON 0 1	186
[:SENSe]:ACPower:AVERAge[:STATe]?	186
[:SENSe]:ACPower:DETeCtor[:FUNction] AVERAge POSitive	197
[:SENSe]:ACPower:DETeCtor[:FUNction]?	197
[:SENSe]:ACPower:SWEEp:TIME?	181
[:SENSe]:AM:AVERAge:COUNt <integer>	347
[:SENSe]:AM:AVERAge:COUNt?	347

List of Commands

[[:SENSe]:AM:AVERage[:STATe] ON OFF 1 0	347
[[:SENSe]:AM:AVERage[:STATe]?	347
[[:SENSe]:AM:DEMod:DETEctor[:FUNctioN] PPK NPK PNPK RMS	349
[[:SENSe]:AM:DEMod:DETEctor[:FUNctioN]?	349
[[:SENSe]:AM:DEMod:MFILter ON OFF 1 0	351
[[:SENSe]:AM:DEMod:MFILter?	351
[[:SENSe]:AM:DEMod:MTIME <time>	349
[[:SENSe]:AM:DEMod:MTIME?	349
[[:SENSe]:AM:DEMod:PHOLd ON OFF 1 0	350
[[:SENSe]:AM:DEMod:PHOLd?	350
[[:SENSe]:AM:IFBWidth <freq>	354
[[:SENSe]:AM:IFBWidth:AUTO ON OFF 1 0	354
[[:SENSe]:AM:IFBWidth:AUTO?	354
[[:SENSe]:AM:IFBWidth?	354
[[:SENSe]:AM:SYNC:SLENgth <real>	353
[[:SENSe]:AM:SYNC:SLENgth?	353
[[:SENSe]:AM:SYNC:SOURce NONE RFAMplitude	352
[[:SENSe]:AM:SYNC:SOURce?	352
[[:SENSe]:AM:SYNC:STHReshold <rel_amp>	352
[[:SENSe]:AM:SYNC:STHReshold?	352
[[:SENSe]:AVERage:COUNt <integer>	79
[[:SENSe]:AVERage:COUNt?	79
[[:SENSe]:AVERage:TCONtrol EXPOntial REPeat RMAXhold	78
[[:SENSe]:AVERage:TCONtrol?	78
[[:SENSe]:AVERage:TYPE RMS LOG	80
[[:SENSe]:AVERage:TYPE:AUTO OFF ON 0 1	80
[[:SENSe]:AVERage:TYPE:AUTO?	80
[[:SENSe]:AVERage:TYPE?	80
[[:SENSe]:BANDwidth BWIDth:VIDeo <freq>	144
[[:SENSe]:BANDwidth BWIDth:VIDeo <freq>	56
[[:SENSe]:BANDwidth BWIDth:VIDeo:RATio <real>	145

[:SENSe]:BANDwidth BWIDth:VIDeo:RATio <real>	57
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio:AUTO OFF ON 0 1	145
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio:AUTO OFF ON 0 1	57
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio:AUTO?	145
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio:AUTO?	57
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio?	145
[:SENSe]:BANDwidth BWIDth:VIDeo:RATio?	57
[:SENSe]:BANDwidth BWIDth:VIDeo?	144
[:SENSe]:BANDwidth BWIDth:VIDeo?	56
[:SENSe]:BANDwidth BWIDth[:RESolution] <freq>	54
[:SENSe]:BANDwidth BWIDth[:RESolution]?	54
[:SENSe]:BANDwidth BWIDth[:RESolution]AUTO OFF ON 0 1	54
[:SENSe]:BANDwidth BWIDth[:RESolution]AUTO?	54
[:SENSe]:CHPower:AVERage:COUNt <integer>	120
[:SENSe]:CHPower:AVERage:COUNt?	120
[:SENSe]:CHPower:AVERage:TCONtrol EXPonential REPeat	121
[:SENSe]:CHPower:AVERage:TCONtrol?	121
[:SENSe]:CHPower:AVERage[:STATe] ON OFF 1 0	120
[:SENSe]:CHPower:AVERage[:STATe]?	120
[:SENSe]:CHPower:BANDwidth:INTegration <bandwidth>	121
[:SENSe]:CHPower:BANDwidth:INTegration?	121
[:SENSe]:CHPower:BANDwidth[:RESolution] <bandwidth>	126
[:SENSe]:CHPower:BANDwidth[:RESolution]:AUTO ON OFF 1 0	126
[:SENSe]:CHPower:BANDwidth[:RESolution]:AUTO?	126
[:SENSe]:CHPower:BANDwidth[:RESolution]?	126
[:SENSe]:CHPower:DETEctor:AUTO ON OFF 1 0	134
[:SENSe]:CHPower:DETEctor:AUTO?	134
[:SENSe]:CHPower:DETEctor[:FUNction] POSitive SAMPlE NEGAtive AVERage	135
[:SENSe]:CHPower:DETEctor[:FUNction]?	135
[:SENSe]:CHPower:FILTer[:RRC]:ALPHA <real>	125
[:SENSe]:CHPower:FILTer[:RRC]:ALPHA?	125

List of Commands

[[:SENSe]:CHPower:FILTer[:RRC]:BANDwidth <bandwidth>	124
[[:SENSe]:CHPower:FILTer[:RRC]:BANDwidth?	124
[[:SENSe]:CHPower:FILTer[:RRC][:STATe] ON OFF 1 0	124
[[:SENSe]:CHPower:FILTer[:RRC][:STATe]?	124
[[:SENSe]:CHPower:FREQuency:SPAN <freq>	132
[[:SENSe]:CHPower:FREQuency:SPAN:FULL	133
[[:SENSe]:CHPower:FREQuency:SPAN:PREVious	133
[[:SENSe]:CHPower:FREQuency:SPAN?	132
[[:SENSe]:CHPower:SWEep:POINts <integer>	134
[[:SENSe]:CHPower:SWEep:POINts?	134
[[:SENSe]:CORRection:OFFSet[:MAGNitude] <rel_ampl>	119
[[:SENSe]:CORRection:OFFSet[:MAGNitude] <rel_ampl>	329
[[:SENSe]:CORRection:OFFSet[:MAGNitude] <rel_ampl>	52
[[:SENSe]:CORRection:OFFSet[:MAGNitude] <rel-ampl>	333
[[:SENSe]:CORRection:OFFSet[:MAGNitude] <rel-ampl>	377
[[:SENSe]:CORRection:OFFSet[:MAGNitude] <rel-ampl>	382
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe OFF ON 0 1	119
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe OFF ON 0 1	52
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe ON OFF 1 0	329
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe ON OFF 1 0	333
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe ON OFF 1 0	377
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe ON OFF 1 0	382
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe?	119
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe?	329
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe?	333
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe?	377
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe?	382
[[:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe?	52
[[:SENSe]:CORRection:OFFSet[:MAGNitude]?	119
[[:SENSe]:CORRection:OFFSet[:MAGNitude]?	329
[[:SENSe]:CORRection:OFFSet[:MAGNitude]?	333

List of Commands

[[:SENSe]:CORRection:OFFSet[:MAGNitude]?	377
[[:SENSe]:CORRection:OFFSet[:MAGNitude]?	382
[[:SENSe]:CORRection:OFFSet[:MAGNitude]?	52
[[:SENSe]:DEMod AM FM	58
[[:SENSe]:DEMod:STATe OFF ON 0 1	58
[[:SENSe]:DEMod:STATe?	58
[[:SENSe]:DEMod:TIME <time>	59
[[:SENSe]:DEMod:TIME?	59
[[:SENSe]:DEMod?	58
[[:SENSe]:DETEctor:TRACe[1] 2 3 4:AUTO OFF ON 0 1	105
[[:SENSe]:DETEctor:TRACe[1] 2 3 4:AUTO?	105
[[:SENSe]:DETEctor:TRACe[1] 2 3 4[:FUNCTION] AVERAge POSitive SAMPlE NEGative	105
[[:SENSe]:DETEctor:TRACe[1] 2 3 4[:FUNCTION]?	105
[[:SENSe]:DTFault:FREQuency:SPAN <frequency>	233
[[:SENSe]:DTFault:FREQuency:SPAN <frequency>	258
[[:SENSe]:DTFault:FREQuency:SPAN <frequency>	281
[[:SENSe]:DTFault:FREQuency:SPAN <frequency>	311
[[:SENSe]:DTFault:FREQuency:SPAN:PREVious	234
[[:SENSe]:DTFault:FREQuency:SPAN:PREVious	259
[[:SENSe]:DTFault:FREQuency:SPAN:PREVious	282
[[:SENSe]:DTFault:FREQuency:SPAN:PREVious	312
[[:SENSe]:DTFault:FREQuency:SPAN?	233
[[:SENSe]:DTFault:FREQuency:SPAN?	258
[[:SENSe]:DTFault:FREQuency:SPAN?	281
[[:SENSe]:DTFault:FREQuency:SPAN?	311
[[:SENSe]:FM:AVERAge:COUNt <integer>	396
[[:SENSe]:FM:AVERAge:COUNt?	396
[[:SENSe]:FM:AVERAge:TCONtrol EXPonential REPeat	397
[[:SENSe]:FM:AVERAge:TCONtrol?	397
[[:SENSe]:FM:AVERAge[:STATe] ON OFF 1 0	396
[[:SENSe]:FM:AVERAge[:STATe]?	396

List of Commands

[[:SENSe]:FM:DEMod:AUTocarrfreq ON OFF 1 0	400
[[:SENSe]:FM:DEMod:AUTocarrfreq?	400
[[:SENSe]:FM:DEMod:DETEctor[:FUNction] PPK NPK PNPK RMS	398
[[:SENSe]:FM:DEMod:DETEctor[:FUNction]?	398
[[:SENSe]:FM:DEMod:MFILter ON OFF 1 0	401
[[:SENSe]:FM:DEMod:MFILter?	401
[[:SENSe]:FM:DEMod:MTIME <time>	398
[[:SENSe]:FM:DEMod:MTIME?	398
[[:SENSe]:FM:DEMod:PHOLd ON OFF 1 0	399
[[:SENSe]:FM:DEMod:PHOLd?	399
[[:SENSe]:FM:IFBWidth <freq>	403
[[:SENSe]:FM:IFBWidth:AUTO ON OFF 1 0	403
[[:SENSe]:FM:IFBWidth:AUTO?	403
[[:SENSe]:FM:IFBWidth?	403
[[:SENSe]:FM:SYNC:SLENgth <real>	402
[[:SENSe]:FM:SYNC:SLENgth?	402
[[:SENSe]:FM:SYNC:SOURce NONE RFAMplitude	401
[[:SENSe]:FM:SYNC:SOURce?	401
[[:SENSe]:FM:SYNC:STHReshold <amp >	402
[[:SENSe]:FM:SYNC:STHReshold?	402
[[:SENSe]:FREQuency:CENTer <freq>	184
[[:SENSe]:FREQuency:CENTer <freq>	59
[[:SENSe]:FREQuency:CENTer <freq>	334
[[:SENSe]:FREQuency:CENTer <freq>	383
[[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>	184
[[:SENSe]:FREQuency:CENTer:STEP[:INCRement] <freq>	62
[[:SENSe]:FREQuency:CENTer:STEP[:INCRement]:AUTO 1 0 ON OFF	62
[[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?	184
[[:SENSe]:FREQuency:CENTer:STEP[:INCRement]?	62
[[:SENSe]:FREQuency:CENTer?	184
[[:SENSe]:FREQuency:CENTer?	334

List of Commands

[[:SENSe]:FREQuency:CENTer?	383
[[:SENSe]:FREQuency:CENTer?	59
[[:SENSe]:FREQuency:SPAN <frequency>	99
[[:SENSe]:FREQuency:SPAN:FULL	99
[[:SENSe]:FREQuency:SPAN:PREVious	100
[[:SENSe]:FREQuency:SPAN?	99
[[:SENSe]:FREQuency:STARt <freq>	208
[[:SENSe]:FREQuency:STARt <freq>	61
[[:SENSe]:FREQuency:STARt <freq>	241
[[:SENSe]:FREQuency:STARt?	208
[[:SENSe]:FREQuency:STARt?	241
[[:SENSe]:FREQuency:STARt?	61
[[:SENSe]:FREQuency:STOP <freq>	208
[[:SENSe]:FREQuency:STOP <freq>	61
[[:SENSe]:FREQuency:STOP <freq>	241
[[:SENSe]:FREQuency:STOP?	208
[[:SENSe]:FREQuency:STOP?	241
[[:SENSe]:FREQuency:STOP?	61
[[:SENSe]:GLOBal:FREQuency:CENTer[::STATe] ON OFF 1 0	64
[[:SENSe]:GLOBal:FREQuency:CENTer[::STATe]?	64
[[:SENSe]:OBWidth:AVERage:COUNt <integer>	158
[[:SENSe]:OBWidth:AVERage:COUNt?	158
[[:SENSe]:OBWidth:AVERage:TCONtrol EXPonential REPeat RMAXhold	157
[[:SENSe]:OBWidth:AVERage:TCONtrol?	157
[[:SENSe]:OBWidth:AVERage:TYPE RMS LOG	159
[[:SENSe]:OBWidth:AVERage:TYPE?	159
[[:SENSe]:OBWidth:BANDwidth BWIDth[::RESolution] <freq>	144
[[:SENSe]:OBWidth:BANDwidth BWIDth[::RESolution]?	144
[[:SENSe]:OBWidth:DETector:AUTO OFF ON 0 1	173
[[:SENSe]:OBWidth:DETector:AUTO?	173
[[:SENSe]:OBWidth:DETector[::FUNCTion] AVERage POSitive SAMPle NEGative	173

List of Commands

[:SENSe]:OBWidth:DETECTOR[:FUNCTION]?	173
[:SENSe]:OBWidth:FREQUENCY:SPAN <frequency>	171
[:SENSe]:OBWidth:FREQUENCY:SPAN:FULL	171
[:SENSe]:OBWidth:FREQUENCY:SPAN:PREVIOUS	172
[:SENSe]:OBWidth:FREQUENCY:SPAN?	171
[:SENSe]:OBWidth:PERCENT <percent>	170
[:SENSe]:OBWidth:PERCENT?	170
[:SENSe]:OBWidth:POWER:SENSITIVITY LOW HIGH	169
[:SENSe]:OBWidth:POWER:SENSITIVITY?	169
[:SENSe]:OBWidth:SWEPT:TIME?	146
[:SENSe]:OPILoss:AVERAGE:COUNT?	247
[:SENSe]:OPILoss:AVERAGE:TCONTROL EXPONENTIAL MAXHOLD REPEAT RMAXHOLD	246
[:SENSe]:OPILoss:FREQUENCY:SPAN <frequency>	233
[:SENSe]:OPILoss:FREQUENCY:SPAN <frequency>	258
[:SENSe]:OPILoss:FREQUENCY:SPAN <frequency>	281
[:SENSe]:OPILoss:FREQUENCY:SPAN <frequency>	311
[:SENSe]:OPILoss:FREQUENCY:SPAN:PREVIOUS	234
[:SENSe]:OPILoss:FREQUENCY:SPAN?	233
[:SENSe]:OPILoss:FREQUENCY:SPAN?	258
[:SENSe]:OPILoss:FREQUENCY:SPAN?	281
[:SENSe]:OPILoss:FREQUENCY:SPAN?	311
[:SENSe]:OPILoss:AVERAGE:COUNT <integer>	247
[:SENSe]:POWER:SENSITIVITY LOW HIGH	93
[:SENSe]:POWER:SENSITIVITY?	93
[:SENSe]:POWER[:RF]:ARANGE ON OFF 1 0	118
[:SENSe]:POWER[:RF]:ARANGE ON OFF 1 0	327
[:SENSe]:POWER[:RF]:ARANGE ON OFF 1 0	332
[:SENSe]:POWER[:RF]:ARANGE ON OFF 1 0	376
[:SENSe]:POWER[:RF]:ARANGE ON OFF 1 0	381
[:SENSe]:POWER[:RF]:ARANGE ON OFF 1 0	49
[:SENSe]:POWER[:RF]:ARANGE?	118

List of Commands

[[:SENSe]:POWer[:RF]:ARANge?	327
[[:SENSe]:POWer[:RF]:ARANge?	332
[[:SENSe]:POWer[:RF]:ARANge?	376
[[:SENSe]:POWer[:RF]:ARANge?	381
[[:SENSe]:POWer[:RF]:ARANge?	49
[[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>	116
[[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>	326
[[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>	331
[[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>	375
[[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>	380
[[:SENSe]:POWer[:RF]:ATTenuation <rel_ampl>	48
[[:SENSe]:POWer[:RF]:ATTenuation?	116
[[:SENSe]:POWer[:RF]:ATTenuation?	326
[[:SENSe]:POWer[:RF]:ATTenuation?	331
[[:SENSe]:POWer[:RF]:ATTenuation?	375
[[:SENSe]:POWer[:RF]:ATTenuation?	380
[[:SENSe]:POWer[:RF]:ATTenuation?	48
[[:SENSe]:POWer[:RF]:GAIN[:STATe] ON OFF 1 0	118
[[:SENSe]:POWer[:RF]:GAIN[:STATe] ON OFF 1 0	328
[[:SENSe]:POWer[:RF]:GAIN[:STATe] ON OFF 1 0	333
[[:SENSe]:POWer[:RF]:GAIN[:STATe] ON OFF 1 0	377
[[:SENSe]:POWer[:RF]:GAIN[:STATe] ON OFF 1 0	382
[[:SENSe]:POWer[:RF]:GAIN[:STATe] ON OFF 1 0	52
[[:SENSe]:POWer[:RF]:GAIN[:STATe]?	118
[[:SENSe]:POWer[:RF]:GAIN[:STATe]?	328
[[:SENSe]:POWer[:RF]:GAIN[:STATe]?	333
[[:SENSe]:POWer[:RF]:GAIN[:STATe]?	377
[[:SENSe]:POWer[:RF]:GAIN[:STATe]?	382
[[:SENSe]:POWer[:RF]:GAIN[:STATe]?	52
[[:SENSe]:RADio:STANdard[:SElect] NONE W3GPP	66
[[:SENSe]:RADio:STANdard[:SElect]?	66

[:SENSe]:RLOSs:FREQuency:SPAN <frequency>	233
[:SENSe]:RLOSs:FREQuency:SPAN <frequency>	258
[:SENSe]:RLOSs:FREQuency:SPAN <frequency>	281
[:SENSe]:RLOSs:FREQuency:SPAN <frequency>	311
[:SENSe]:RLOSs:FREQuency:SPAN:PREVious	234
[:SENSe]:RLOSs:FREQuency:SPAN:PREVious	259
[:SENSe]:RLOSs:FREQuency:SPAN:PREVious	282
[:SENSe]:RLOSs:FREQuency:SPAN:PREVious	312
[:SENSe]:RLOSs:FREQuency:SPAN?	233
[:SENSe]:RLOSs:FREQuency:SPAN?	258
[:SENSe]:RLOSs:FREQuency:SPAN?	281
[:SENSe]:RLOSs:FREQuency:SPAN?	311
[:SENSe]:ROSCillator:EXTernal:FREQuency 0.5HZ 1MHZ 2.1048MHZ 4.95MHZ 10MHZ 13MHZ 15MHZ 19.6608MHZ.	440
[:SENSe]:ROSCillator:EXTernal:FREQuency?	440
[:SENSe]:ROSCillator:SOURce INTernal EXTernal.	439
[:SENSe]:ROSCillator:SOURce?	439
[:SENSe]:SWEep:POINts <integer>	421
[:SENSe]:SWEep:POINts?	421
[:SENSe]:SWEep:TIME <time>	419
[:SENSe]:SWEep:TIME AUTO OFF ON 0 1	419
[:SENSe]:SWEep:TIME AUTO?	419
[:SENSe]:SWEep:TIME?	419
[:SENSe]:TPILoss:AVERage:COUNT <integer>	219
[:SENSe]:TPILoss:AVERage:COUNT?	219
[:SENSe]:TPILoss:AVERage:TCONtrol EXPonential MAXHold REPeat RMAXhold	217
[:SENSe]:TPILoss:AVERage:TCONtrol?	217
[:SENSe]:TPILoss:AVERage[:STATe] OFF ON 0 1	217
[:SENSe]:TPILoss:AVERage[:STATe]?	217
[:SENSe]:TPILoss:FREQuency:SPAN <frequency>	233
[:SENSe]:TPILoss:FREQuency:SPAN <frequency>	258

[:SENSe]:TPILoss:FREQuency:SPAN <frequency>	281
[:SENSe]:TPILoss:FREQuency:SPAN <frequency>	311
[:SENSe]:TPILoss:FREQuency:SPAN:PREVious	234
[:SENSe]:TPILoss:FREQuency:SPAN:PREVious	259
[:SENSe]:TPILoss:FREQuency:SPAN:PREVious	282
[:SENSe]:TPILoss:FREQuency:SPAN:PREVious	312
[:SENSe]:TPILoss:FREQuency:SPAN?	233
[:SENSe]:TPILoss:FREQuency:SPAN?	258
[:SENSe]:TPILoss:FREQuency:SPAN?	281
[:SENSe]:TPILoss:FREQuency:SPAN?	311
[:SENSe]:TRIGger:AM[:SEQuence]:EXTernal:SLOPe POSitive NEGative	358
[:SENSe]:TRIGger:AM[:SEQuence]:EXTernal:SLOPe?	358
[:SENSe]:TRIGger:AM[:SEQuence]:LEVel:ABSolute <ampI>	358
[:SENSe]:TRIGger:AM[:SEQuence]:LEVel:ABSolute?	358

1

Using This Document

The Agilent CSA is a portable radio frequency (RF) (3 or 6 GHz) spectrum analyzer. It has several different measurement Modes. Each mode offers a set of automatic measurements that pre-configure the analyzer settings for ease of use.

The latest instrument software and documentation can be found at: <http://www.agilent.com/find/csa>

About the User's and Programmer's Information

This document provides user and programmer information for the spectrum analyzer functions.

NOTE The front- and rear-panel features, along with the numeric keypad and alpha-numeric menu key fundamentals, are illustrated and described in the “Getting Started” chapter of the measurement guide.

What is in This Book

- **Instrument Functions** - provides information about the front-panel and lower-level key functions of your analyzer and their associated programming commands. The information is organized in alphabetical order based on the labels of the front-panel keys. The lower-level menu key functions are described under the front-panel keys in the same order as they appear in the menus.
- **Programming Fundamentals** - provides information on SCPI and on using the LAN. Refer to [Chapter 9](#), “Programming Fundamentals,” on page 457.
- **Using the STATus System** - provides information about the instrument's internal status monitoring system with information on how to monitor the status using a remote program and descriptions of all the available commands. Refer to [Chapter 10](#), “Using The Status Monitoring Subsystem,” on page 487 and [Chapter 11](#), “IEEE and STATus Commands (Remote Commands Only),” on page 507.

Terms Used in This Book

There are many terms used throughout this book, for example “active function block,” that are explained in detail in the “Getting Started” chapter of the measurements guide. It is recommended that you read that section first.

The following terms are used to describe each key. Note that a key description may not use all the terms.

State Saved: Indicates what happens to a particular function when the instrument state is saved (either to a USB drive or the internal memory). It also indicates whether the current settings of the function are maintained if the instrument is powered on or preset using **Mode Preset** or **User Preset**.

Dependencies/ Couplings:

Describes dependencies or interactions to other functions or settings in the analyzer.

Preset: Describes the function settings after a **Mode Preset**.

Default

Terminator: Indicates the units that will be attached to the numerical value that you have entered. This default will be used from the front panel, when you terminate your entry by pressing the **Enter** key, rather than selecting a units key. This default will be used remotely when you send the command without specifying any units after your value(s).

Range (or Min/Max): Describes the range of the smallest to largest values to which the function can be set. If you try to set a value below the minimum value, the analyzer defaults to the minimum value. If you try to set a value above the maximum value, the analyzer defaults to the maximum value.

History: Describes the firmware revision history. *Only applies after second software release.*

Remote

Command: Shows the syntax requirements for each SCPI command.

Example: Provides command examples using the indicated remote command syntax.

Mode: Indicates to which modes a key functionality or parameter is applicable. If it is applicable to more than one mode, then all modes should be listed.

Key Path: Describes how to access the menu key. The key path is described in a comma-separated style stating with the front-panel key name and then listing each menu key name needed to access the key being described. If a function has no front panel access (that is, a SCPI only function) this should indicate “None”.

Using This Document
About the User's and Programmer's Information

(No one-button measurements in this section)

This key displays a menu that lets you to make one-button measurements such as adjacent channel power and occupied bandwidth measurements. In the Spectrum Analysis mode (see the Mode key), the default status is Measurement Off. This default setting allows you to make your measurements specifying your unique setup requirements. In addition, you may use the **Meas** key to select one-button measurements such as Occupied BW (Occupied Bandwidth).

If other modes are available and have been selected, the measurements for that particular mode will be displayed. Parameter settings can be made for these measurements using the functions under the **Meas Setup** key. Some of these settings will be common to other measurements in the same mode. For example, you may select one of several radio standards available by pressing **Meas Setup, Format/BW, Chan Std**.

For information on the function of this key in specific modes, refer to that mode.

Mode: All

Current Measurement Data Query (Remote Command Only)

This command returns data from the currently running measurement. A measurement must be selected under the **Meas** key. The response will be in a block format that consists of a block of data bytes. The first information sent in the block is an ASCII header beginning with #.

Each measurement will have different results. The following example is from the results of an occupied bandwidth measurement. Refer to the specific measurement for the scalar results expected for your measurement.

- INIT
- *OPC?
- CALC:DATA?

Produces the following output:

```
#2421122924465,916972000,69,160,1213313125,975
```

- The first digit in the header (2) tells you how many additional digits/bytes there are in the header.
- The 42 means forty-two bytes will follow. Note this also includes the commas.
- 1122924465, is the time stamp seconds
- 916972000, is the time stamp in nano seconds
- 69, is the OBW start index
- 160, is the OBW stop index
- 1,213,313,125, is the OBW
- 975, is the OBW power, in mdBm

Mode	All
Remote Command	:CALCulate:DATA?
Example	CALCulate:DATA?
Remote Command Notes	Returns current measurement data

Current Measurement Query (Remote Command Only)

This command returns the name of the measurement that is currently running.

Mode	All
Remote Command	:CONFigure?
Example	CONF?
Remote Command Notes	Returns current measurement name

Meas
Current Measurement Query (Remote Command Only)

Accesses menu keys enabling you to select the measurement mode of your analyzer. **Spectrum Analyzer** mode is the default mode and is for general-purpose measurement use. Additional measurement modes can be added to your instrument. Example modes include the Stimulus / Response Measurement Suite.

Other modes, besides Spectrum Analyzer, must be licensed in your instrument before they will appear in the **Mode** menu. Refer to the N1996A measurement guide for instructions on how to install the licenses. Some modes also require the presence of specific hardware.

Mode	All
Remote Command	:INSTrument [:SElect] SA SR CHAN MA :INSTrument [:SElect] ?
Example	INST SA sets the analyzer to the spectrum analyzer mode.
Dependencies / Couplings	Other modes, besides Spectrum Analysis, must be installed/licensed in your instrument before they will appear in the Mode menu. Some modes also require the presence of specific hardware.
Remote Command Notes	The actual available measurement mode selections depend upon which modes (measurement applications) are installed/licensed in the instrument. Once an instrument mode is selected, only the commands that are valid for that mode can be executed. Mode keywords available for this command include: SA (Spectrum Analyzer) SR (Stimulus / Response) CHAN (Channel Analyzer) MA (Modulation Analyzer)
Preset	Spectrum Analyzer
State Saved	Saved in instrument state.
Key Path	Front-panel key

Mode

Selects the Spectrum Analysis measurement mode for your analyzer. This mode allows you to make all your measurements specifying your unique setup requirements. The Spectrum Analysis mode defaults to Measurement Off status. In addition, you may use the **Meas** key to select one-button measurements such as Occupied BW (Occupied Bandwidth).

Remote Command :INSTRument:SELEct SA
:INSTRument:SELEct?

Example INST:SEL SA

Preset SA

Key Path **Mode, Spectrum Analyzer**

Mode All

Remote Command :CONFIgure:<meas_name>
:CONFIgure?

Example CONF:OBW — selects the Occupied Bandwidth measurement and sets the instrument settings to the factory defaults.

CONF? — returns the current measurement name

Remote Command Notes This command stops the current measurement and sets up the instrument for the specified measurement using the factory default instrument settings. It does not initiate the taking of measurement data. This command will always set :INITiate:CONTinuous OFF (single sweep mode) and place the instrument in the idle state.

:CONFIgure? returns the current measurement name

:CONFIgure:<meas_name>:NDEFaults

This command simply selects the specified measurement. It does not affect the current instrument settings.

The measurement keywords that are available for these commands depend on the current mode selected. They can include:

OBW (Occupied Bandwidth)
ACP (Adjacent Channel Power)
CHP (Channel Power)
TPILoss (Two Port Insertion Loss)
OPILoss (One Port Insertion Loss)
RLOSs (Return Loss)
DTFault (Distance to Fault)

Spectrum Analyzer

Preset	Spectrum Analyzer
State Saved	Saved in instrument state.
Key Path	Mode, Spectrum Analyzer

Meas Off (Spectrum Analyzer) Measurement

To configure measurement settings, select **Meas Off** and then press **Meas Setup**. Pressing **Control/Sweep** accesses the sweep control menu keys. The sweep (measurement) can be restarted, the number of sweep points can be set, and sweep time can be set in zero span. (In any other span setting, the sweep time setting can be viewed only.) For more information, refer to “[Control/Sweep](#)” on page 418.

Meas Off Measurement Description

This key accesses the core spectrum analysis measurement functionality and turns off the current one-button measurement. With this key selected, you will have access to the measurement setup functionality for the Spectrum Analyzer measurement.

Mode	Spectrum Analyzer
Remote Command	:CONFigure:SANalyzer
Example	CONF:SAN selects the Spectrum Analyzer measurement.
State Saved	Saved in instrument state.
Remote Command Notes	You must be in the Spectrum Analysis mode to use this command. Use INSTRument:SElect SA to set the mode.
Key Path	Meas, Meas Off

Remote Measurement Results

Command		Return Value
:FETCh:SAN[n]? :MEASure:SAN[n]? :READ:SAN[n]?	Not specified or n = 1	This query returns Trace 1 data as a list of x,y pairs. The y-axis values are in the current Y-Axis Unit of the analyzer (for this measurement, dB). The x-axis values are the values of the trace, in the x-axis scale units of the trace (Hz for frequency domain traces, seconds for time domain traces.) When querying trace data, it is best if the analyzer is not sweeping during the query. Therefore, it is good to be in Single Sweep or Update = Off when querying trace data from the analyzer.
	2	Returns Trace 2 data as a series of x,y pairs.
	3	Returns Trace 3 data as a series of x,y pairs.
	4	Returns Trace 4 data as a series of x,y pairs.

AMPTD Y Scale

Activates the reference level function, and accesses the amplitude menu keys. The amplitude menu keys set functions that affect the way data on the vertical axis is displayed or corrected.

Mode: SA
 Key Path Front-panel key

Autoscale

Executes an automatic scaling of the **Reference Level**, and the **Scale/Div** settings. Autoscale is a front-panel only function and has no SCPI command.

Mode SA
 Key Path **AMPTD Y Scale, Autoscale**

Reference Level

Sets the reference level value used for amplitude measurements. The reference level is the amplitude power or voltage represented by the top graticule line on the display. Changing the value of the reference

level changes the absolute amplitude level of the top graticule line. The reference level (in selected amplitude units) can be set with the step keys, knob, or numeric keypad.

Mode	SA
Remote Command	:DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel <ampl> :DISPlay:WINDow:TRACe:Y[:SCALe]:RLEVel?
Example	:DISP:WIND:TRAC:Y:RLEV 10dBm
Preset	0 dBm
State Saved	Saved in State
Min	-150 dBm
Max	100 dBm
Key Path	AMPTD Y Scale, Ref Level

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Electronic Attenuation

Sets the RF input attenuation level for all measurements in the Spectrum Analyzer mode. The input attenuation level can be set in 1 dB or 10 dB increments from the current setting. Attenuation can be changed using the step keys, the knob, or the numeric keypad (1 dB steps using the left/right arrows, and 10 dB steps using the up/down arrows). You may select 0 dB using the RPG or step keys.

Mode	SA
Remote Command	<code>[:SENSE] :POWER [:RF] :ATTenuation <rel_ampl></code> <code>[:SENSE] :POWER [:RF] :ATTenuation?</code>
Example	<code>:POW:ATT 10</code>
Restriction and Notes	Elec Atten is settable in 1 dB and 10 dB steps. 1 dB using the left/right arrows and 10 dB steps using the up/down arrows. You may select 0 dB using RPG or step keys.
Dependencies / Couplings	When the Auto Ranging is On (refer to “ Auto Range ” on page 49), this value is automatically determined by the measurement. When you set a value manually, Auto Ranging automatically changes to Off.
Remote Command Notes	When this SCPI command is received and SA mode is selected (<code>:INSTrument:SELEct SA</code>) the electronic attenuation will be set to the given value for all measurements in the Spectrum Analyzer mode.
Preset	0
State Saved	Saved in instrument state.
Min	0
Max	40
Key Path	AMPTD/Y Scale

Scale/Div

Sets the logarithmic units per vertical graticule division on the display. This function is available only when the **Scale Type** key is set to **Log**.

Mode	SA
Remote Command	<code>:DISPlay:WINDow:TRACe:Y [:SCALE] :PDIVision <rel_ampl></code> <code>:DISPlay:WINDow:TRACe:Y [:SCALE] :PDIVision?</code>
Preset	10.00 dB / Div
State Saved	Saved in State
Range	0.1 to 20
Key Path	AMPTD Y Scale, Scale/Div

Scale Type

Sets the vertical scaling to logarithmic (**Log**) or linear (**Lin**). When **Scale Type (Log)** is selected, the vertical divisions are scaled in logarithmic units. **Scale Type (Lin)** scales the vertical divisions linearly, and sets the default amplitude units to volts.

Mode	SA
Remote Command	:DISPlay:WINDow:TRACe:Y[:SCALe]:SPACing LINear LOGarithmic :DISPlay:WINDow:TRACe:Y[:SCALe]:SPACing?
Preset	Log
State Saved	Saved in State
Range	Log Lin
Key Path	AMPTD Y Scale, Scale Type

Auto Range

For the “Electronic Attenuation” parameter, when the “Auto Range” is ON the current frequency span of the analyzer is scanned to determine the total power applied to the analyzer. The RF input attenuation is then automatically set to ensure that the analyzer input is not overloaded.

For the “Internal Preamplifier” parameter, turning on the preamp gives a better noise figure, but a decreased TOI to noise floor dynamic range. So when the “Auto Range” is ON, the instrument will optimize this setting.

Mode	SA
Remote Command	[:SENSe]:POWer[:RF]:ARANge ON OFF 1 0 [:SENSe]:POWer[:RF]:ARANge?
Example	:POW:ARAN OFF
Remote Command Notes	When this SCPI command is received and SA mode is selected (:INSTrument:SElect SA) the Auto Range State will be set for all measurements in the Spectrum Analyzer mode.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	AMPTD/Y Scale

Y Axis Units

Displays the menu keys that enable you to change the vertical (Y) axis amplitude units. The analyzer retains the entered Y Axis Units separately for both Log and Lin amplitude scale types. For example, you can set **Scale Type** to Log and **Y Axis Units** to dBmV. Then you can set **Scale Type** to Lin and **Y Axis Units** to W. When you switch between Log and Lin the **Y Axis Units** will remain to dBmV in Log and W in Lin.

When you preset the analyzer, Scale Type is set to Log with dBm default Y Axis units. When you switch the Scale Type to Lin, the Y Axis units default to Volts.

Mode	SA
Remote Command	:UNIT:POWer DBM DBMV DBUV V W A :UNIT:POWer?
Preset	dBm (Scale Type = Log)
Range	dBm dBmV dBuV Watts Volts Amps
Key Path	AMPTD Y Scale, More (2 of 2), Y Axis Units

dBm Sets the amplitude unit for the selected amplitude scale (log/lin) to dBm.

Example	UNIT:POW DBM
Key Path	AMPTD Y Scale, More (2 of 2), Y Axis Units, dBm

dBmV Sets the amplitude unit for the selected amplitude scale (log/lin) to dBmV.

Example	UNIT:POW DBMV
Key Path	AMPTD Y Scale, More (2 of 2), Y Axis Units, dBmV

dBuV Sets the amplitude unit for the selected amplitude scale (log/lin) to dBuV.

Example	UNIT:POW DBUV
Key Path	AMPTD Y Scale, More (2 of 2), Y Axis Units, dBuV

Watts Sets the amplitude unit for the selected amplitude scale (log/lin) to watts.

Example	UNIT:POW W
Key Path	AMPTD Y Scale, More (2 of 2), Y Axis Units, Watts

Volts Sets the amplitude unit for the selected amplitude scale (log/lin) to volts.

Example	UNIT:POW V
Key Path	AMPTD Y Scale, More (2 of 2), Y Axis Units, Volts

Amps Sets the amplitude unit for the selected amplitude scale (log/lin) to Amperes.

Example	UNIT:POW A
Key Path	AMPTD Y Scale, More (2 of 2), Y Axis Units, Amps

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Internal Preamp

The Internal Preamp menu key sets the internal preamplifier to On or Off. Turning on the preamp provides a better noise figure, but reduces TOI to noise floor dynamic range. This key is unavailable if the preamplifier option (Option P03 or P06) is not installed.

Mode	SA
Remote Command	<code>[:SENSE] :POWER [:RF] :GAIN [:STATE] ON OFF 1 0</code> <code>[:SENSE] :POWER [:RF] :GAIN [:STATE] ?</code>
Example	<code>:POW:GAIN ON</code>
Restriction and Notes	If the preamplifier option (Option P03 or P06) is not installed or is unlicensed, the key does not appear.
Remote Command Notes	When this SCPI command is received and SA mode is selected (<code>:INSTRUMENT:SELECT SA</code>) the Auto Range State will be set for all measurements in the Spectrum Analyzer mode.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	AMPTD/Y Scale, More

External Gain

Sets a correction value to compensate for gain (or loss) through an external amplifier or attenuator connected between a signal source and the RF input. The correction value is applied to the displayed measurement values.

Mode	SA
Remote Command	<code>[:SENSE] :CORREction:OFFSet [:MAGNitude] <rel_ampl></code> <code>[:SENSE] :CORREction:OFFSet [:MAGNitude] ?</code> <code>[:SENSE] :CORREction:OFFSet [:MAGNitude] :STATE OFF ON 0 1</code> <code>[:SENSE] :CORREction:OFFSet [:MAGNitude] :STATE?</code>
Example	<code>:CORR:OFFS 10.0</code> <code>:CORR:OFFS:STAT ON</code>
Restriction and Notes	The “External Gain” parameter settings are retained through a Mode Preset but are reset to their default settings (Value = 0 dB, State = OFF) by a Restore System Defaults. A User Preset or Recall State will set the External Gain to the value saved in User Preset or the State being loaded.

Dependencies / Couplings	<p>If the external gain is changed whilst in the Spectrum Analyzer mode, the external gain will be changed for all applications installed in the CSA analyzer. Similarly, if the external gain is changed when in another mode, it will also change for the Spectrum Analyzer mode.</p> <p>If the external gain state is changed whilst in the Spectrum Analyzer mode, the external gain state will be changed for all applications installed in the CSA analyzer.</p>
Remote Command Notes	<p>When this SCPI command is received the external gain will be set to the given value for all modes in the CSA analyzer.</p> <p>When this SCPI command is received the external gain state will be set for all modes in the CSA analyzer.</p>
Preset	<p>0.0</p> <p>OFF</p>
State Saved	Saved in instrument state.
Min	-100.0
Max	100.0
Key Path	AMPTD/Y Scale, More

Auto Tune

Auto Tune is an immediate action key. When pressed, **Auto Tune** causes the analyzer to change center frequency to center the strongest signal on screen. When **Auto Tune** decreases the span significantly, the signal may not be centered due to the increased resolution at the new span. However, repeated use of the **Auto Tune** key will continue zooming in and centering the signal.

Mode	SA
Key Path	Front-panel key

Undo Auto Tune

Undo Auto Tune sets the center frequency back to the center frequency that was in effect prior to pressing the **Auto Tune** key.

BW

Activates the Resolution Bandwidth function and displays the **Res BW** menu keys.

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Key Path Front-panel key

Res BW

Selects the 3 dB resolution bandwidth (RBW) of the analyzer in discrete choices of an E24 series from 10 Hz to 200 kHz and plus individual values of 240 kHz, 300 kHz, 510 kHz, 1 MHz, 1.2 MHz, 3 MHz, or 5 MHz above 200 kHz. The E24 series and the listed values are for data entries made from the front-panel numeric key pad or from a remote SCPI command, the front-panel step keys will follow a 1-3-10 sequence. If an unavailable bandwidth is entered with the numeric keypad or using a remote SCPI command, the closest available bandwidth is selected. For a complete list of the available RBW values, refer to Table 4-1, “Resolution Bandwidth Values,” on page 55.

A # mark appears next to Res BW on the bottom of the analyzer display when it is not coupled. To couple the resolution bandwidth, press Res BW (Auto).

NOTE The discrete values of RBW available in Zero Span are a subset of the RBW values available in non-Zero Span.

NOTE When measuring pulsed RF signals, set the RBW to less than 0.3 times the pulse repetition frequency (PRF). By keeping the RBW < 0.3 x PRF, the analyzer will be making narrowband (“line mode”) measurements.

NOTE For applications that require 6 dB resolution bandwidths, it is possible to use an equivalent 3 dB resolution bandwidth. Because the analyzer has Gaussian RBW, the equivalent 6 dB bandwidth of any RBW filter can be determined using the following formula: 6 dB RBW = 3 dB RBW x 1.414. For example, if a 6 dB RBW of 100 kHz is required, the equivalent 3 dB RBW Filter would be 100 kHz/1.414 = 70.7 kHz. The closest RBW filter for the analyzer that would be used is 68 kHz.

Remote Command [:SENSe]:BANDwidth|BWIDth[:RESolution] <freq>
[:SENSe]:BANDwidth|BWIDth[:RESolution]?
[:SENSe]:BANDwidth|BWIDth[:RESolution]AUTO OFF|ON|0|1
[:SENSe]:BANDwidth|BWIDth[:RESolution]AUTO?

Example BAND:RES 3MHz
BAND:RES:AUTO OFF

Restrictions and Notes If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

Dependencies / Couplings	<p>Sweep time in non-zero span is coupled to RBW. As the RBW changes, the sweep time is changed to maintain amplitude calibration.</p> <p>When Res BW is set to Auto, resolution bandwidth is autocoupled to span. The factory default for the Span to RBW ratio is approximately 106:1 when auto coupled. When Res BW is set to Man, bandwidths are entered by the user, and these bandwidths are used regardless of other analyzer settings.</p>
Preset	5 MHz, Auto
State Saved	Saved in instrument state.
Range	1.0 Hz to 200 kHz, plus bandwidths of 240 kHz, 300 kHz, 510 kHz, 1 MHz, 1.2 MHz, 3 MHz, or 5 MHz
Key Path	BW, Res BW

Table 4-1 Resolution Bandwidth Values

Span > 0 Hz	Span = 0 Hz	Span > 0 Hz	Span = 0 Hz	Span > 0 Hz	Span = 0 Hz	Span > 0 Hz	Span = 0 Hz	Span > 0 Hz	Span = 0 Hz
10 Hz		100 Hz		1.0 kHz		10 kHz	10 kHz	100 kHz	100 kHz
11 Hz		110 Hz		1.1 kHz		11 kHz		110 kHz	
12 Hz		120 Hz		1.2 kHz		12 kHz		120 kHz	
13 Hz		130 Hz		1.3 kHz		13 kHz		130 kHz	
15 Hz		150 Hz		1.5 kHz		15 kHz		150 kHz	
16 Hz		160 Hz		1.6 kHz		16 kHz		160 kHz	
18 Hz		180 Hz		1.8 kHz		18 kHz		180 kHz	
20 Hz		200 Hz		2.0 kHz		20 kHz		200 kHz	
22 Hz		220 Hz		2.2 kHz		22 kHz		240 kHz	240 kHz
24 Hz		240 Hz		2.4 kHz		24 kHz		300 kHz	300 kHz
27 Hz		270 Hz		2.7 kHz		27 kHz		510 kHz	510 kHz
30 Hz		300 Hz		3.0 kHz	3.0 kHz	30 kHz	30 kHz	1.0 MHz	1.0 MHz
33 Hz		330 Hz		3.3 kHz		33 kHz		1.2 MHz	1.2 MHz
36 Hz		360 Hz		3.6 kHz		36 kHz		3.0 MHz	3.0 MHz
39 Hz		390 Hz		3.9 kHz		39 kHz		5 MHz	5 MHz
43 Hz		430 Hz		4.3 kHz		43 kHz			
47 Hz		470 Hz		4.7 kHz		47 kHz			
51 Hz		510 Hz		5.1 kHz	5.1 kHz	51 kHz	51 kHz		
56 Hz		560 Hz		5.6 kHz		56 kHz			

Table 4-1 Resolution Bandwidth Values

Span > 0 Hz	Span = 0 Hz	Span > 0 Hz	Span = 0 Hz	Span > 0 Hz	Span = 0 Hz	Span > 0 Hz	Span = 0 Hz	Span > 0 Hz	Span = 0 Hz
62 Hz		620 Hz		6.2 kHz		62 kHz			
68 Hz		680 Hz		6.8 kHz		68 kHz			
75 Hz		750 Hz		7.5 kHz		75 kHz			
82 Hz		820 Hz		8.2 kHz		82 kHz			
91 Hz		910 Hz		9.1 kHz		91 kHz			

Video BW

Lets you change the virtual post-detection filter (Video BW), which is implemented by averaging multiple FFTs.

Normally, **Video BW (Auto)** selects automatic coupling of the Video BW filter to the Resolution Bandwidth filter using the ratio set by the **VBW:RBW** key. To decouple the video bandwidth, press Video BW until Man is highlighted, or simply enter a new value.

When the **Video BW** is manually selected, it may be returned to the coupled state by pressing the **Video BW** key until **Auto** is highlighted. This may also be done by performing a **Mode Preset**.

If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected. The Video Bandwidths below 10 Hz are limited to integer values, and hence the E24 series does not hold below 10 Hz. 1 Hz resolution is the limitation here. The lowest Video BW will however still be 1 Hz.

Remote Command [:SENSe]:BANDwidth|BWIDth:VIDeo <freq>
 [:SENSe]:BANDwidth|BWIDth:VIDeo?

Example BAND:VID 1 KHZ
 BAND:VID?
 BWID:VID:AUTO ON
 BWID:VID:AUTO?
 BAND:VID:AUTO OFF

Restrictions and Notes If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

Dependencies / Couplings When in Auto, Video BW should be set as close as possible to RBW times the VBW: RBW parameter

Preset 5 MHz
 ON

State Saved Saved in instrument state.

Range 1 Hz, 2, 3, 4, 5, 6, 7, 8, 9, 10 then E24 Series; from 10, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91 Hz etc. up to 3 MHz, then 4, 5, 6, 8, 50 MHz

Key Path BW

VBW:RBW

Selects the ratio between the Video Bandwidth and the Resolution Bandwidth to be used for setting Video BW when Video BW is in Auto.

Normally, **VBW:RBW (Auto)** selects automatic coupling of the **VBW:RBW** ratio to **Detector**. To decouple the ratio, press VBW:RBW until Man is underlined, or simply enter a new value.

When the VBW:RBW is manually selected, it may be returned to the coupled state by pressing the VBW:RBW key until **Auto** is highlighted. This may also be done by pressing **Auto Couple** or by performing a **Preset**.

Remote Command [:SENSe] :BANDwidth|BWIDth:VIDeo:RATio <real>
 [:SENSe] :BANDwidth|BWIDth:VIDeo:RATio?
 [:SENSe] :BANDwidth|BWIDth:VIDeo:RATio:AUTO OFF|ON|0|1
 [:SENSe] :BANDwidth|BWIDth:VIDeo:RATio:AUTO?

Example BAND:VID:RAT 2
 BAND:VID:RAT?
 BAND:VID:RAT:AUTO 0
 BAND:VID:RAT:AUTO?

Dependencies / Couplings When set to AUTO, there is a 1:1 coupling between RBW and Video BW if either of them are set to AUTO.

Preset 1
 ON

State Saved Saved in Instrument State

Min 0.00001

Max 3000000

Key Path BW



Demod

The Demod front-panel key accesses a menu for controlling the AM/FM Tune and Listen capability. Option N1996A-AFM is required for accessing this menu.

Dependencies / Couplings	Option N1996A-AFM is required for the Demod Menu to be displayed. If N1996A-AFM is not installed, error -250 is reported: “The file save operation executed successfully”.
Remote Command Notes	No remote command for this key.
Key Path	Front-Panel Key

Demod at Marker

When Demod at Marker is On, the analyzer pauses at the end of every sweep, tunes to the selected Marker frequency, and sends the selected demodulated signal to the speaker for the Demod Time you have set.

In Zero Span, the demod is always taken at the analyzer center frequency.

If no marker is switched On prior to setting Demod at Marker to On, then Marker 1 is turned On and placed at the center of the screen. If Demod at Marker is On, and you then turn all markers Off, Demod at Marker is also turned Off.

Demodulation is only performed at your selected marker when your selected marker is On. If your selected marker is Off, no demodulation is performed, even if all other markers are On.

Remote Command	<code>[:SENSe] :DEMod :STATe OFF ON 0 1</code> <code>[:SENSe] :DEMod :STATe?</code>
Example	<code>:DEM ON</code>
Preset	OFF
State Saved	Saved in State
Key Path	Demod

Demod at Marker Type

Demod at Marker Type selects whether AM or FM demodulation is performed on the signal at the selected marker frequency.

Remote Command	<code>[:SENSe] :DEMod AM FM</code> <code>[:SENSe] :DEMod?</code>
Example	<code>:DEM FM</code>
Preset	AM
State Saved	Saved in State
Key Path	Demod

Demod Time

Demod Time is the length of time the instrument demodulates the signal after each sweep. The demodulated signal can be heard during demodulation when the Speaker is On.

Remote Command	[:SENSE] :DEMod:TIME <time> [:SENSE] :DEMod:TIME?
Example	:DEM:TIME 1S
Preset	500 ms
State Saved	Saved in State
MIN	2 ms
MAX	100 s
Key Path	Demod

FREQ Channel

Displays the menu of frequency functions.

Center Frequency

Sets the frequency that corresponds to the horizontal center of the graticule.

The SCPI commands only change the Center Frequency for the current application. For example, in SA mode, the Center Frequency SCPI command only changes the Center Frequency for SA. No other application mode's Center Frequency will be changed, unless Mode Global CF is enabled. For more information on Mode Global CF, refer to [“Use Global CF” on page 64](#).

Mode	SA, Channel Analyzer
Remote Command	[:SENSE] :FREQuency:CENTer <freq> [:SENSE] :FREQuency:CENTer?
Example	FREQ:CENT 50 MHz FREQ:CENT?
Remote Command Notes	The preset/min/max/range values provided below are valid only in the Frequency Domain. Time domain (zero span) values will be different.
Dependencies / Couplings	Not displayed on front-panel when Units is set to Chan .
Preset	1.50005 GHz (Option 503) 3.00005 GHz (Option 506)
State Saved	Saved in State

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Range	From 0 Hz to 3.0199995 GHz (Option 503) From 0 Hz to 6.0199995 GHz (Option 506)
Default Unit	Hz
Key Path	Front-panel key

Channel

Enables you to set the channel value and the channel type. Based on the selected channel standard, a center frequency is set that corresponds to the horizontal center of the graticule. The available channel type options are:

Forward (Fwd or Dn): the base station is transmitting (downlink)

Reverse (Rev or Up): the mobile is Transmitting (uplink)

NOTE Dn & Up are used for UARFCN UMTS, UARFCN Band B UMTS, and all GSM/EDGE channel standards. All other channel standards use Fwd & Rev.

Mode	SA, Channel Analyzer
Remote Command	No SCPI command. Front Panel only.
Dependencies / Couplings	Not displayed on front-panel when Units is set to Freq . The Channel parameter is coupled with the Center Frequency parameter and is dependent on the Channel Standard selected for the measurement. For instance, if the Channel Standard selected is GSM-850, and the Channel is set to 128 Fwd, the Center Frequency value is automatically changed to 869.2 MHz. Conversely, if the Center Frequency parameter is set to 893.8 MHz, then the Channel value is automatically changed to 251 Fwd.
State Saved	Saved in instrument state.
Preset	Dependent on the Channel Standard selected.
Range	Dependent on the Channel Standard selected.
Key Path	FREQ Channel, Channel

Start Freq

Sets the frequency at the left side of the graticule.

When **Start Freq** reaches the upper frequency limit, the stop frequency is set to the highest available frequency and the start frequency is changed to be less than the stop frequency by the minimum span

(1 kHz). **Center Freq** will be updated to the stop frequency minus one-half of the span, or to the stop frequency minus 500 Hz, and **Res BW** will be set to 10 Hz.

Remote Command	[:SENSe] :FREQuency:STARt <freq> [:SENSe] :FREQuency:STARt?
Example	FREQ:STAR 200 MHz FREQ:STAR?
Dependencies / Couplings	You cannot set the Start frequency equal to the Stop frequency. You cannot select zero span by setting Start frequency equal to the Stop frequency. The instrument will alter the value of the last setting to maintain a minimum value of 1 kHz difference between the Start and Stop frequencies.
Remote Command Notes	The range values provided below are valid only in the Frequency Domain. Time domain (zero span) values will be different.
Preset	100 kHz
State Saved	Saved in State
Range	–35 MHz to 3.019999 GHz (Option 503) / to 6.019999 GHz (Option 506)
Key Path	FREQ Channel, Start Freq
Default Unit	Hz

Stop Freq

Sets the frequency at the right side of the graticule.

When **Stop Freq** reaches the lower frequency limit, the Start Frequency is set to the lowest available frequency and the Stop Frequency is changed to be more than the start frequency by the minimum span (1 kHz). **Center Freq** will be updated to the Start Frequency plus one-half of the span, or to the Start Frequency plus 500 Hz, and **Res BW** will be set to 10 Hz.

Remote Command	[:SENSe] :FREQuency:STOP <freq> [:SENSe] :FREQuency:STOP?
Example	FREQ:STOP 220 MHz FREQ:STOP?
Remote Command Notes	The preset/min/max/range values provided below are valid only in the Frequency Domain. Time domain (zero span) values will be different.

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Preset	3 GHz (Option 503) 6 GHz (Option 506)
State Saved	Saved in State
Range	500 Hz to 3.02 GHz (Option 503) 500 Hz to 6.02 GHz (Option 506)
Key Path	FREQ Channel, Stop Freq
Default Unit	Hz

CF Step

Enables you to set the step size for the Center Frequency and Start/Stop Frequency functions. Once a step size has been selected and the Center Frequency function is active, the step keys change Center Frequency by the step-size value. In addition, the step keys change the start and stop frequencies twice the value of the CF Step setting. The step size function is useful for finding harmonics and sidebands beyond the current frequency span of the analyzer.

Remote Command	[:SENSE]:FREQUENCY:CENTer:STEP[:INCRement] <freq> [:SENSE]:FREQUENCY:CENTer:STEP[:INCRement]? [:SENSE]:FREQUENCY:CENTer:STEP[:INCRement]:AUTO 1 0 ON OFF
Example	FREQ:CENT:STEP 500 MHz FREQ:CENT:STEP?
Dependencies / Couplings	Span, RBW, Center Frequency When auto-coupled in a non-zero span, the center frequency step size is set to 10% of the span. When auto-coupled in zero span, the center frequency step size is set to the RBW value. Not displayed on front-panel when Units is set to Chan .
Remote Command Notes	The default value provided below is valid only in the Frequency Domain. In Time Domain, the default CF Step will be equal to the RBW.
Preset	Freq Step Auto = (Stop Freq – Start Freq) /10
State Saved	Saved in State
Range	1 Hz to 2 GHz
Key Path	FREQ Channel, CF Step
Default Unit	Hz

Channel Step

Sets the channel step size.

Mode	Channel Analyzer
Dependencies / Couplings	Not displayed on front-panel when Units is set to Chan .
State Saved	Saved in instrument state.
Range	1 to 100
Key Path	FREQ Channel, Channel Step

Units

Sets the Freq Channel menu to display the parameters with either Frequency values (Freq) or with Channel values (Chan).

Notes	This Units parameter is a Front Panel parameter only.
Remote Command Notes	No SCPI command. Front Panel only.
Preset	Freq
Range	Freq Chan
Key Path	Freq Channel, Units

Mode Setup

Mode Setup opens menu keys that allow you to select a radio standard, channel standards, or the Mode Global center frequency function.

Mode	All
Remote Command	:CALCulate:MARKer [1] 2 3 4:MODE OFF POSition DELTa :CALCulate:MARKer [1] 2 3 4:MODE?
Preset	OFF
Key Path	Front-panel key

Use Global CF

In the Mode Setup menu of GPSA and any other mode that supports it, a menu key will appear labeled “Use Global CF”. This is a binary key that toggles between On and Off. Global CF” is a Mode Global CF

Mode	SA, W-CDMA
Remote Command	[:SENSe] :GLOBal:FREQuency:CENTer [:STATe] ON OFF 1 0 [:SENSe] :GLOBal:FREQuency:CENTer [:STATe] ?
Example	GLOB:FREQ:CENT ON
Restriction and Notes	The Global CF is a separate variable from the Meas Global CFs of each mode. If the user turns Use Global CF to Off for a Mode, the CF for that Mode reverts to that Mode’s own CF. When this happens, the Global CF is unaffected; that is, it stays where that Mode left it. In general, it always has the value to which it was set by the last Mode that was using it.
Dependencies / Couplings	If a Mode has this set to On, then it reads and modifies a GLOBAL center frequency variable, which is the same for all Modes; and if it doesn’t then it only reads and modifies its LOCAL center frequency variable. Thus, as long as two applications both have this variable set to On, they can use the same CF and none of the other applications will be affected. It could default to On or Off depending on the Mode.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	Mode Setup

Spectrum Analyzer

Meas Off (Spectrum Analyzer) Measurement

Range	None North American Cellular CDMA North American PCS CDMA Japan CDMA Korean PCS CDMA Secondary 800 CDMA IMT-2000 cdma2000 GSM-850 GSM-900 EGSM-900 GSM DCS-1800 GSM PCS-1900 North American Cellular TDMA North American PCS TDMA iDEN-800 iDEN-900 North American Cellular AMPS NMT-450 UARFCN UMTS UARFCN Band B UMTS RGSM-900 GSM-450 GSM-480
Key Path	Frequency, Chan Std

Radio Standard

Allows you to specify the radio standard to be used.

Mode	SA
Remote Command	[:SENSE] :RADio:STANdard [:SElect] NONE W3GPP [:SENSE] :RADio:STANdard [:SElect] ?
Example	:RAD:STAN W3GPP
Restriction and Notes	By changing the radio standard, the measurement parameters will be automatically set to an appropriate default value.
State Saved	Saved in instrument state.
Range	None 3GPP W-CDMA
Key Path	Mode Setup

Marker

Accesses the marker control keys which select the type and number of markers and turns them on and off. Markers are diamond-shaped characters that identify points on traces. Up to four pairs of markers may appear on the display simultaneously; only one pair can be controlled at a time. The marker that is controlled is called the “active” marker. Pressing Marker activates the Normal menu key.

Mode	All
Remote Command	:CALCulate:MARKer [1] 2 3 4 :MODE OFF POSition DELTa :CALCulate:MARKer [1] 2 3 4 :MODE?
Preset	OFF
Key Path	Front-panel key

Marker

Selects one of four possible markers. A marker that has already been turned on will become active when

it is selected. If a marker has been turned on and assigned to a specific trace, it will become active on that trace if that marker is selected.

Mode	All
State Saved	Saved in State
Key Path	Marker, Marker

Normal

Activates a single marker at the center of the display.

Mode	All
Example	CALC:MARK2:POS POS selects Marker 2 in the Normal position type marker mode.
Remote Command Notes	See Marker
Key Path	Marker, Normal

Delta

Activates a pair of markers, one of which is fixed at the current marker location. The other marker can then be moved around on the trace. The marker readout shows the difference between the two markers.

NOTE Pressing Delta moves the reference marker to the active marker position, so you can make delta measurements from differing reference points without having to turn off the markers and begin again.

Mode	All
Example	CALC:MARK:MODE DELT selects marker 1 in Delta mode
Remote Command Notes	See Marker
Key Path	Marker, Delta

Off

Turns the selected marker Off.



Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Mode	All
Example	CALC:MARK3:MODE OFF selects marker 3 and turns it off
Remote Command Notes	See Marker
Key Path	Marker, Off

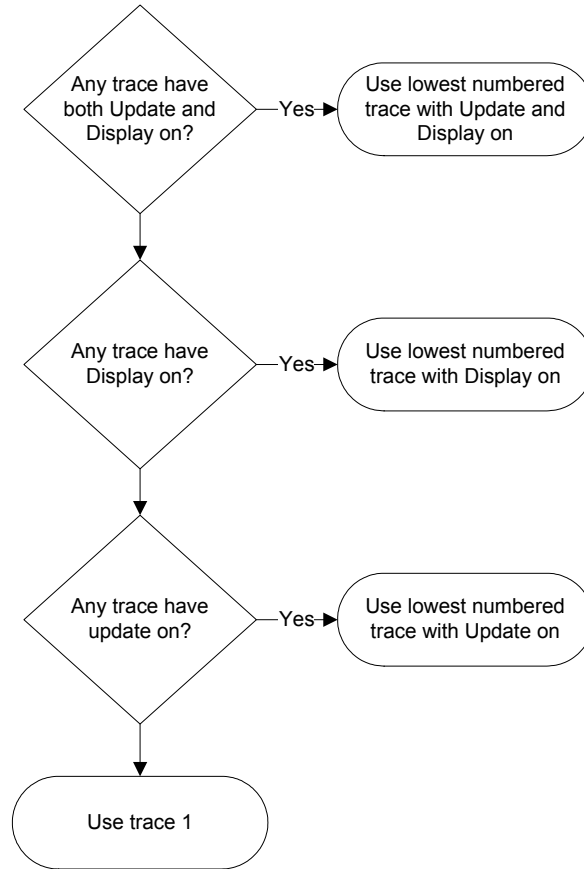
Marker Trace

Assigns a marker to a trace. If a marker is currently active, press **Marker Trace** until **1, 2, 3,** or **4** is highlighted. The active marker will be moved to the selected trace.

Mode	All
Remote Command	:CALCulate:MARKer [1] 2 3 4 :TRACe <integer>
Example	CALC:MARK:TRAC 2
Dependencies / Couplings	This key is only available on measurements that have multiple traces.
Preset	1
State Saved	Saved in State
Range	The number of traces on which you can place a marker varies depending on the current selected measurement.
Key Path	Marker, Marker Trace

Auto Init

Turns automatic initialization On or Off. When **Auto Init** is set to On the marker's trace attribute is re-determined automatically by the analyzer whenever the marker turns On (Normal or Delta) from an Off state. Auto Init is set to On at **Mode Preset** or **Marker All Off**. The following flowchart depicts the Auto Init rules:



Mode	SA
Remote Command	:CALCulate:MARKer [1] 2 3 4:TRACe:AUTO OFF ON 0 1 :CALCulate:MARKer [1] 2 3 4:TRACe:AUTO?
Remote Command Notes	
Example	CALC:MARK 2:TRAC:AUTO OFF
Preset/Default	On
Range	On Off
Key Path	Marker

Marker Readout

Accesses a menu that enables you to affect how the X Axis information for the selected marker is displayed in the marker area (top-right of display) and the active function area of the display and how the marker is controlled. The available settings for the X Axis Scale are **Frequency**, **Period**, **Time**, and **Inverse Time**.

Mode	Spectrum Analyzer with Meas OFF
Remote Command	:CALCulate:MARKer [1] 2 3 4 :X:READout FREQuency TIME ITIME PERiod :CALCulate:MARKer [1] 2 3 4 :X:READout?
SCPI Example	CALC:MARK3:X 1GHz activates the Marker3 and positions it on the trace at 1GHz.
Remote Command Notes	In Time Domain, only “Time” & “Inverse Time” are valid as parameters. “Frequency” & “Period” menu key are grayed out. “Inverse Time” is grayed out as well if the Marker Mode is not set to Delta. “Inverse Time” is not a valid parameter in Frequency Domain, so the associated menu key is always grayed out.
Preset/Default	Depending on the Trace Domain. If domain is Frequency, default is Frequency; if Domain is Time, default is Time.
State Saved	Yes
Range	Frequency Period Time Inverse Time
Key Path	Marker, Marker Readout

Frequency Sets the Marker Readout (Marker X Axis scale) to Frequency, displaying the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker.

Mode	Spectrum Analyzer with Meas OFF
Remote Command	See details in “Marker Readout (Marker X Axis Scale Type)” Table described above
SCPI Example	CALC:MARK2:X:READ FREQ sets marker 2 with a Marker Readout type (Marker X Axis scale) to Frequency.
Dependencies / Couplings	Only available when x axis scale is frequency.
Key Path	Marker, Marker Readout, Frequency

Period Sets the Marker Readout (Marker X Axis scale) to Period, displaying the reciprocal of the frequency of the marker, or the reciprocal of the frequency separation of the two markers in a delta-marker mode. In non-zero span, this is 1/frequency. The units are those of time (s, ms, etc.).

Mode	Spectrum Analyzer
Key Path	Marker, Marker Readout, Period
Dependencies / Couplings	Only available when X axis scale is frequency.

Mode	Spectrum Analyzer with Meas OFF
Remote Command	See details in “Marker Readout (Marker X Axis Scale Type)” Table described above
SCPI Example	CALC:MARK2:X:READ FREQ sets marker 2 with a Marker Readout type (Marker X Axis scale) to Frequency.
Remote Command Notes	In the Frequency Domain, note the following equation: $\text{Period Marker Readout} = 1 / \text{Frequency Marker Readout}$ <p>In a delta marker mode, if the markers are at the same frequency, the result will be the reciprocal of 0, which is infinitely large. The display will show “---” and a SCPI query will return not a number (NAN).</p>
Dependencies / Couplings	Only available when X axis scale is frequency.
Key Path	Marker, Marker Readout, Period

Time Sets the Marker Readout (Marker X Axis scale) to Time, displaying the time interval between a normal marker and the start of a sweep or the time of the delta marker relative to the reference marker. Time is the auto setting for time domain traces. In a delta-marker mode it is the (sweep) time interval between the two markers.

Mode	Spectrum Analyzer with Meas OFF
Remote Command	See details in “Marker Readout (Marker X Axis Scale Type)” Table described above
SCPI Example	CALC:MARK2:X:READ TIME sets marker 2 with a Marker Readout type (Marker X Axis scale) to Time.
Remote Command Notes	In the Frequency Domain, note the following equation: $\text{Time Marker Readout} = (\text{Frequency Marker Readout} * \text{SweepTime}) / \text{Default Freq Stop}$
Dependencies / Couplings	Only available when x axis scale is time.
Key Path	Marker, Marker Readout, Time

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Inverse Time Sets the Marker Readout (Marker X Axis scale) to Inverse Time, displaying the reciprocal of the marker delta time. It is useful in a delta mode to show the reciprocal of (sweep) time between two markers. This function is only meaningful when on a time domain trace and in the Delta control mode.

Sets the marker readout to inverse time. In non-zero span, this is 1/frequency.

Mode	Spectrum Analyzer with Meas OFF
Remote Command	See details in “Marker Readout (Marker X Axis Scale Type)” Table described above
SCPI Example	CALC:MARK2:X:READ ITIM sets marker 2 with a Marker Readout type (Marker X Axis scale) to Inverse Time.
Remote Command Notes	<p>Inverse Time” parameter is not available in the Frequency Domain, and in the Time Domain, the parameter is only accessible if Marker Mode is set to Delta. Note the following equation:</p> <p style="text-align: center;">Inverse Time Marker Readout = 1 / Time Delta Marker Readout</p> <p>If the Normal and Delta markers are at the same X Axis value, the time between them is 0, so the reciprocal of sweep time is infinitely large. The display will show “---” and a SCPI query will return not a number (NAN).</p>
Dependencies / Couplings	Only available when x axis scale is time and a delta marker is selected.
Key Path	Marker, Marker Readout, Inverse Time

Marker All Off

Turns off all the markers on all traces.

Mode	All
Remote Command	:CALCulate:MARKer:AOFF
Remote Command Notes	CALC:MARK:AOFF
Key Path	Marker, Marker All Off

Marker X Axis Value (Remote Command Only)

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is Off, but is the SCPI equivalent of entering an X value if the control mode is Normal or Delta.

Parameter Name	Marker X Axis Value
Parameter Type	Float64
Mode	Spectrum Analyzer
SCPI Name	Marker X Axis Value
Remote Command	:CALCulate:MARKer [1] 2 3 4 :X <real> :CALCulate:MARKer [1] 2 3 4 :X?
SCPI Example	CALC:MARK3:X 1GHz activates the Marker3 and positions it on the trace at 1 GHz.
Remote Command Notes	<p>You must be in the SA mode to use this command. Use INSTRument:SElect to set the mode.</p> <p>Remotely, if no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” will be generated.</p> <p>The query returns the marker's absolute X Axis value if the control mode is Normal, or the offset from the marker's reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number (NAN).</p>
Dependencies / Couplings	Marker X parameter is coupled with the Type/Start/Stop of the X Axis scale and by the number of sweep points used by the measurement.
Unit/Terminator	GHz MHz kHz Hz if X Axis Scale is a Frequency Scale s ms μs ns if X Axis Scale is a Time Scale
Preset/Default	<p>After a preset, all Markers are turned Off, so Marker X Axis Value query will return a not a number (NAN). If Marker X is queried with no value sent first but if the Marker is active, the Frequency center of screen value will be returned. Note that per default after a preset, the trace domain is frequency.</p> <p>As well, the default Marker X Axis value will be depending on the frequency range of the instrument. 3.00005 GHz is correct for the 6 GHz Instrument only (Option 506). For a 3 GHz Instrument (Option 503), the default will be 1.50005 GHz.</p>
State Saved	No

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Min	<p>Determined by the min value used by the X Axis Scale.</p> <p>In Frequency Domain, per default, Start Frequency (starting point of the Frequency X axis scale) is 100 kHz, so the Marker X Axis Min value that can be entered is 100 kHz.</p> <p>The Marker X Axis Min Value that can be used is –35 MHz (it's the minimum value that the Start Freq can accept)</p> <p>In Time Domain, per default, the Marker X Axis Min value is 0 s, but a lower a value can be entered if a “negative” Trigger Delay is used.</p>
Max	<p>Determined by the max value used by the X Axis Scale.</p> <p>In Frequency Domain, per default, for a 6 GHz Instrument, Stop Frequency (ending point of the Frequency X axis scale) is 6 GHz, so the Marker X Axis Max value that can be entered is 6 GHz.</p> <p>The Marker X Max Value that can be used is 3.02 GHz for a 3 GHz Instrument and 6.02 GHz for 6 GHz Instrument (they are the maximum values that the Stop Freq can accept)</p> <p>In Time Domain, it is the RBW choice which determines the sweep time (which defines the X Axis Scale's range). Preset sets the RBW to 5 MHz, the sweep time used in the span zero is then 27.307ms. So per default, Marker X Max value is 27.307ms.</p> <p>But a higher value can be entered if originally in the Frequency Domain a lower RBW than 5 MHz has been used.</p> <p>For instance, if after a Preset, the RBW is set to 1 MHz, and then the zero span is selected, the sweep time would be 102.4 ms. So the Marker X Max value that could be used will be 102.4ms</p>
SCPI Resolution	<p>Determined by the number of sweep points and type/start/stop of the X Axis scale.</p> <p>With a Frequency X Axis scale:</p> <p>Resolution = (Stop Freq – Start Freq) / (Sweep points – 1) Example: With default settings after a preset (6 GHz Instrument): Resolution = (6 GHz – 100 kHz) / (401 – 1) = 14999.75 kHz</p> <p>With a Time X Axis scale:</p> <p>Resolution = (Sweep Time – Start Time) / (Sweep points – 1) Example: With default settings after set Span to Zero Resolution = (27.307 ms – 0 s) / (401 – 1) = 68.2675 μs</p>
Key Path	<p>N/A - Remote Feature Only</p>

Marker X Axis Position (Remote Command Only)

Sets the marker X position in trace points. It has no effect if the control mode is Off, but is the SCPI equivalent of entering a value if the control mode is Normal or Delta except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Parameter Name	Marker X Axis Position
Parameter Type	Int32
Mode	Spectrum Analyzer
SCPI Name	Marker X Axis Position
Remote Command	:CALCulate:MARKer[1] 2 3 4 :X:POSition <real> :CALCulate:MARKer[1] 2 3 4 :X:POSition?
SCPI Example	CALC:MARK2:X:POS 300
Remote Command Notes	You must be in the SA mode to use this command. Use INSTRument:SElect to set the mode. The query returns the marker's absolute X Axis value in trace points if the control mode is Normal, or the offset from the marker's reference marker in trace points if the control mode is Delta. If the marker is Off the response is not a number (NAN).
Dependencies / Couplings	Marker X parameter is coupled with the Type/Start/Stop of the X Axis scale and by the number of sweep points used by the measurement.
Preset/Default	Center of screen - Number of sweep points per default is 401(X position scale goes from 0 to 400), so the default center position is 200
State Saved	No
Min	0
Max	This Max value will clip to the value set for the number of sweep points. Per default, this number is 401. The max value that can be entered for the number of sweep points is 1001, so the Max value that could be reached for this Marker X Axis position is 1000.
SCPI Resolution	1
Key Path	N/A - Remote Feature Only

Marker Y Axis Value (Remote Command Only)

Returns the marker Y Axis value in the current marker Y Axis units.

The “result” of a marker is the value which is displayed on the second line of the Marker Result block. To properly interpret the returned value the remote programmer must also know what the analyzer's Y-Axis Unit is set to as described below.

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

A marker can have up to two results, only one of which is displayed or returned on a query, as follows:

- Absolute result: every marker has an absolute result and it is simply:
 - For Normal and Delta markers, the Y-axis value of the trace point the marker is currently on.
 The absolute result is displayed in the result block or returned on a query unless the marker control mode is Delta.
- Relative result: if a marker's control mode is Delta, the relative result is displayed in the result block or returned on a query. This is the difference between the Absolute Result of a delta marker (expressed in dBm) to the Absolute Result of its reference marker (expressed in dBm). The difference is expressed in dB.

Parameter Name	Marker Y Axis Value Query
Parameter Type	Float64
Mode	Spectrum Analyzer
SCPI Name	Marker Y Axis Value
Remote Command	:CALCulate:MARKer [1] 2 3 4 : Y?
SCPI Example	CALC:MARK2:Y?
Remote Command Notes	You must be in the SA mode to use this command. Use INSTRument:SElect to set the mode. The query returns the marker Y-axis result. If the marker is Off the response is not a number.
Preset/Default	Current Marker Y Axis value in the marker Y Axis unit
State Saved	No
Min	-150 dBm (Smallest value that the query could return if Y Axis uses dBm as unit)
Max	100 dBm (Highest value that the query could return if Y Axis uses dBm as unit)
Key Path	N/A - Remote Feature Only

Marker ->

Accesses the marker function menu keys that change value of center frequency or reference level to the current value of the selected marker.

Mode	Spectrum Analyzer
Key Path	Marker ->

Mkr -> CF

Sets the center frequency equal to the specified marker frequency, which moves the marker to the center of the screen. In delta marker mode, the center frequency is set to the frequency value of the delta marker. This feature is not available in zero span.

Mode	Spectrum Analyzer
Remote Command	:CALCulate:MARKer [1] 2 3 4 [:SET] :CENTer
Example	CALC:MARK2:SET:CENT
Key Path	Marker ->, Mkr -> CF

Mkr -> RL

Sets the reference level to the amplitude of the specified marker. In delta marker mode, the reference level is set to the amplitude difference between the two markers.

Mode	Spectrum Analyzer
Remote Command	:CALCulate:MARKer [1] 2 3 4 [:SET] :RLEVEl
Example	CALC:MARK2:SET:RLEV
Key Path	Marker ->, Mkr -> RL

Meas Setup

In the Spectrum Analysis mode, **Meas Setup** accesses a menu of keys associated with the current measurement. the following keys for setting up a signal measurement, press **Meas**, **Meas Off** and then the **Meas Setup** key.

Mode:	SA
Key Path	Front-panel key

Avg Mode

Sets the type of termination control used for the averaging function. This determines the averaging action after the specified number of measurements (see **Avg Number**) has been reached.

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Mode	SA
Remote Command	[:SENSE] :AVERage:TCONtrol EXPonential REPeat RMAXhold [:SENSE] :AVERage:TCONtrol?
Example	AVER:TCON REP
Preset	Exponential
State Saved	Saved in instrument state.
Range	Exponential Repeat Repeat Max Hold
Key Path	Meas Setup, Avg Mode

Exponential Sets the **Avg Mode** function to Exponential. With exponential averaging mode, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Example	AVER:TCON EXP
Key Path	Meas Setup, Avg Mode, Exponential

Repeat Sets **Avg Mode** to the Repeat function. Repeat averaging shows resulting data after the selected number of sweeps has been averaged, then clears the data before repeating the process.

NOTE With large average counts and/or slow traces, the trace from the last completed result remains on the display while **Repeat** averaging is running – the trace is not updated until the last average count has been reached.

Example	AVER:TCON REP
Key Path	Meas Setup, Avg Mode, Repeat

Repeat Max Hold Sets **Avg Mode** to Repeat with Max Hold function. Repeat with Max Hold captures and holds the highest magnitude data at the end of each sweep count.

NOTE With large average counts and/or slow traces, the trace from the last completed result remains on the display while **Repeat** Max Hold is running – the trace is not updated until the last average count has been reached. (Maximum data points are

held with each consecutive sweep)

Example	AVER:TCON RMAX
Key Path	Meas Setup, Avg Mode, Repeat Max Hold

Avg Number

Sets the average count number (the number of sweeps) used with measurement averaging.

Mode	SA
Remote Command	[:SENSe] :AVERage:COUNT <integer> [:SENSe] :AVERage:COUNT?
Example	AVER:COUN 50
Preset	100
Min	1
Max	4096
Key Path	Meas Setup, Avg Number

Avg Type

Accesses averaging settings that determine how the signal will be measured. You can set the measurement to logarithmic (video) averaging, or power (RMS) averaging. Trace averaging is turned on by pressing **Trace/Detector, Average**.

Accesses averaging settings that enables you choose one of the averaging scales of log-power (video) or power (RMS). Also lets you choose Auto Average Type (default).

When you select log-power averaging, the measurement results are the average of the signal level in logarithmic units (decibels). When you select power average (RMS), all measured results are converted into power units before averaging and filtering operations, and converted back to decibels for displaying. Remember: there can be significant differences between the average of the log of power and the log of the average power.

These are the averaging processes within a spectrum analyzer and all of them are affected by this setting:

1. Trace averaging (see [“Trace/Detector” on page 100](#)) averages signal amplitudes on a trace-to-trace basis. The average type applies to all traces in Trace Average (it is not set on a trace-by-trace basis).
2. Average detector (see [“Trace/Detector” on page 100](#)) averages signal amplitudes during the time or frequency interval represented by a particular measurement point.

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

- VBW filtering (see “BW” on page 53) adds video filtering which is a form of averaging of the video signal.

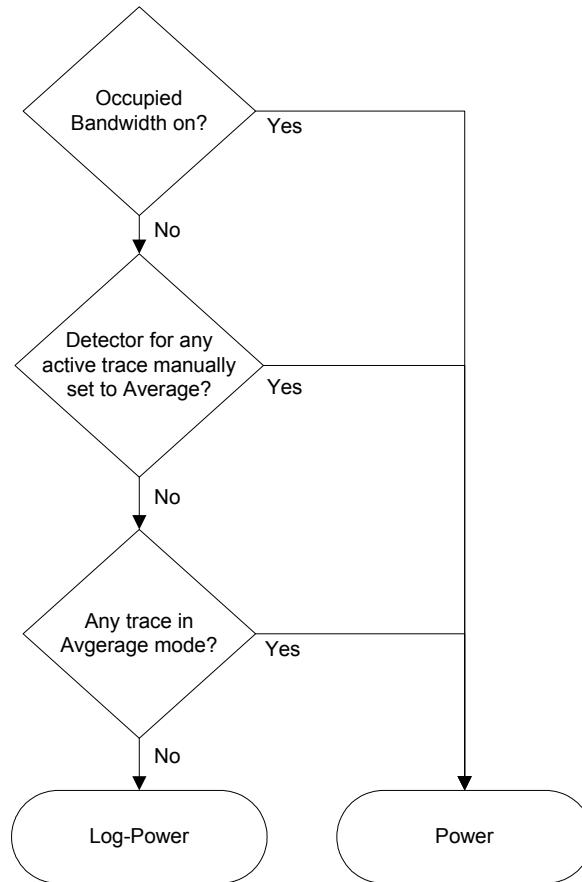
When **Auto** is selected, the analyzer chooses the type of averaging (see below). When one of the average types is selected manually, the analyzer uses that type regardless of other analyzer settings, and shows **Man** on the **Average Type** menu key.

Mode	SA
Parameter Name	Average Type
Remote Command	[:SENSe] :AVERage:TYPE RMS LOG [:SENSe] :AVERage:TYPE?
Example	AVERage:TYPE RMS LOG AVERage:TYPE?
Preset	Log-Pwr Avg (Video), LOG
State Saved	Saved in instrument state.
Key Path	Meas Setup, Avg Type
Dependencies / Couplings	If the Average detector is currently selected then Log-Pwr Avg (Video) trace averaging is not available (grayed out). You must change the detector (see Trace/Detector, Detector) to access the Log-Pwr Avg (Video) type of trace averaging.

Auto Chooses the optimum type of averaging for the current instrument measurement settings.

Mode	SA
Remote Command	[:SENSe] :AVERage:TYPE:AUTO OFF ON 0 1 [:SENSe] :AVERage:TYPE:AUTO?
Example	AVER:TYPE:AUTO ON
Preset	ON
Dependencies / Couplings	See flowchart below.
Remote Command Notes	See Avg Type, above
State Saved	Saved in Instrument State
Key Path	Meas setup, Avg Type
Annunciation	Auto is underlined on the Avg Type key

The following flowchart depicts the meas setup rules for Average Type:



Log-Pwr Avg (Video) Sets the logarithmic (decibel) scale for all filtering and averaging processes. This scale is also referred to as “Video” because it is the most common display and analysis scale for the video signal within a spectrum analyzer.

Example	AVER:TYPE LOG
Key Path	Meas Setup, Avg Type, Log-Pwr Avg (Video)

Pwr Avg (RMS) Sets the signal power level (the square of the magnitude) as the scale for the filtering and averaging processes. This scale is sometimes called RMS because the resulting voltage is proportional to the square root of the mean of the square of the voltage.

Example	AVER:TYPE RMS
Key Path	Meas Setup, Avg Type, Pwr Avg (RMS)

Limit Masks

Access the Limit Masks submenu keys, enabling you to select to configure either Limit Mask 1 (Upper) or Limit Mask 2 (Lower).

Mode	Spectrum Analyzer
Dependencies / Couplings	<p>The Limit Mask 1 (Upper) menu link key accesses the keys to configure the upper limit mask for the Center, 1st, or 2nd segments (dependent on selected segment).</p> <p>The Limit Mask 2 (Lower) menu link key accesses the keys to configure the lower limit mask for the Center, 1st, or 2nd segments (dependent on selected segment).</p>
Remote Command Notes	<p>The Limit Masks SCPI command syntax uses:</p> <p>The keyword “LMASk[1]” to define the Upper limit mask.</p> <p>The keyword “LMASk2” to define the Lower limit mask.</p>
State Saved	Saved in instrument state.
Key Path	Meas Setup, Limit Masks

Limit Mask 1 (upper) or Limit Mask 2 (Lower)

Limit Mask 1 (upper) accesses the upper limit mask keys.

Limit Mask 2 (Lower) accesses the lower limit mask keys.

You can define a limit mask that matches your maximum or minimum measurement requirements. This mask can then be compared with the measured trace data to determine pass/fail conditions.

Limit Trace

Selects the trace to which the currently selected limit mask (1 or 2) will be applied. The limit masks can be applied to separate traces. Only 2 traces are available in the Stimulus Response mode (compared to 4 traces in the Spectrum Analyzer Mode).

Mode	SA
Remote Command	<pre>:CALCulate:LMASk[1] 2:TRACe 1 2 3 4 :CALCulate:LMASk[1] 2:TRACe?</pre>
Example	<pre>:CALC:LMAS1:TRAC 2</pre>

Dependencies / Couplings	The limit mask is always displayed when the center segment is turned on; even if the trace to which it is being applied is blanked ('Show' set to Off).
Preset	1
State Saved	Saved in instrument state.
Range	1 2 3 4
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Limit Trace

Segment (Center, 1st or 2nd)

Selects the **Center**, **1st** or, **2nd** segment for limit mask 1 or 2. With each segment setting, the Limits menu is updated to show the span and level settings available for the currently selected segment

Mode	SA
Dependencies / Couplings	Key menu structure is dependent on selected segment.
Remote Command Notes	The Limit Mask SCPI command syntax uses: The keyword "CENTer" to define the Center segment level and span. The keyword "FIRSt" to define the 1 st segments left and right level and span. The keyword "SECOnd" to define the 2 nd segments left and right level and span.
Preset	Center
State Saved	Saved in instrument state.
Range	Center 1st 2nd
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Segment (Center, 1st or 2nd)

Center Segment

Sets the state of the Center Segment to On or Off. This key is available only when Center has been selected with the Segments key.

Mode	SA
Remote Command	:CALCulate:LMASK [1] 2:SEGMENT:CENTer[:STATE] ON OFF 1 0 :CALCulate:LMASK [1] 2:SEGMENT:CENTer[:STATE] ?
Example	:CALC:LMAS1:SEGM:CENT ON
Restrictions and Notes	Key is only displayed when the selected segment is Center.

Spectrum Analyzer

Meas Off (Spectrum Analyzer) Measurement

Dependencies / Couplings	If Off no limit mask will be displayed even if the 1 st or 2 nd segments are turned On.
	If On the center segment is drawn on the display centered around the current center frequency.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment

Level: Center

Sets the power level for the center segment of the current selected limit mask. This key is available only when Center has been selected with the Segments key.

Mode	SA
Remote Command	:CALCulate:LMASK [1] 2:SEGMENT:CENTer:LEVel <ampl> :CALCulate:LMASK [1] 2:SEGMENT:CENTer:LEVel?
Example	:CALC:LMAS2:SEGM:CENT:LEV -20.0 dBm
Notes	Key is only displayed when the selected segment is Center.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	-10.0 dBm
State Saved	Saved in instrument state.
Min	-200.0 dBm
Max	100.0 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Level
Default Unit	dBm

Span: Center

Sets the frequency span for the center segment of the currently selected limit mask. This key is only available when Center has been selected with the Segment key.

Mode	SA
Remote Command	:CALCulate:LMASK [1] 2 : SEGMENT : CENTER : SPAN <frequency> :CALCulate:LMASK [1] 2 : SEGMENT : CENTER : SPAN?
Example	:CALC:LMAS1:SEGM:CENT:SPAN 1.75 MHz
Notes	Key is only displayed when the selected segment is Center.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling.
State Saved	Saved in instrument state.
Min	0 Hz
Max	Current measurement span
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Span
Default Unit	Hz



1st Segment

Sets the state of the first segment to On or Off. This key is available only when **1st** has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:LMASK [1] 2 : SEGMENT : FIRST ON OFF 1 0 :CALCulate:LMASK [1] 2 : SEGMENT : FIRST?
Example	:CALC:LMAS1:SEGM:FIRS ON
Notes	Key is only displayed when the selected segment is 1 st .

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Dependencies / Couplings	<p>If Off the 2nd limit mask segment will not be displayed even if turned On.</p> <p>If On and the Center segment is On:</p> <p>The left hand side 1st segment is drawn to the left hand side of the center segment at the specified power level.</p> <p>The right hand side 1st segment is drawn to the right hand side of the center segment at the specified power level.</p> <p>For both left and right 1st segments when On.</p> <p>If the 2nd segment is Off the 1st segment extends so the total limit mask span is equal to the current frequency span.</p> <p>If the 2nd segment is On the left and right 1st segments use the specified span values.</p>
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment

1st Segment (Left or Right Limits)

Sets **1st Segment** to allow definition of the limits Left or Right of the center segment. The Left or Right amplitude limits can be changed with the **Level** key. The Left or Right span limits can be changed with the limits menu **Span** key. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
Notes	Key is only displayed when the selected segment is 1 st .
Remote Command Notes	<p>The Limit Mask SCPI command syntax uses:</p> <p>The keyword “LEFT” to define the level and span for the segment to the Left of the center segment.</p> <p>The keyword “RIGHT” to define the level and span for the segment to the Right of the center segment.</p>
Preset	Not affected by a preset but set per default to Left after a power cycling
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment (Left or Right)

Level: 1st Segment Left

Sets the power level, for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:LMASK [1] 2:SEGMENT:FIRST:LEFT:LEVEL <ampl> :CALCulate:LMASK [1] 2:SEGMENT:FIRST:LEFT:LEVEL?
Example	:CALC:OBW:LMAS:SEGM:FIRS:LEFT:LEV -14 dBm
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Left.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	Not affected by a preset but set per default to -30 dBm after a power cycling
State Saved	Saved in instrument state.
Min	-200.0 dBm
Max	100.0 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Left, Level
Default Unit	dBm

Level: 1st Segment Right

Sets the power level, for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:MASK [1] 2:SEGMENT:FIRST:RIGHT:LEVEL <ampl> :CALCulate:MASK [1] 2:SEGMENT:FIRST:RIGHT:LEVEL?
Example	:CALC:LMAS:SEGM:FIRS:RIGH:LEV -14 dBm
Notes	Key is only displayed when the selected segment is 1 st and the selected segment side is Right.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	Not affected by a preset but set per default to -10 dBm after a power cycling
State Saved	Saved in instrument state.

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Min	-200.0 dBm
Max	100.0 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Right Level
Default Unit	dBm

Span: 1st Segment Left

Sets the frequency span for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:LMASK [1] 2:SEGment:FIRSt:LEFT:SPAN <frequency> :CALCulate:LMASK [1] 2:SEGment:FIRSt:LEFT:SPAN?
Example	:CALC:LMAS1:SEGM:FIRS:LEFT:SPAN 1.75 MHz
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Left.
Dependencies / Couplings	If the Center, 1 st , and 2 nd segments are On, the left 2 nd segment span adjusts on a change in the left 1 st segment span.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.
Min	0 Hz
Max	Current measurement span. See Dependencies / Couplings “1st Segment” on page 85.
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Left, Span
Default Unit	Hz

Span: 1st Segment Right

Sets the frequency span for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
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Remote Command	:CALCulate:LMASK [1] 2 : SEGMENT : FIRSt : RIGHt : SPAN <frequency> :CALCulate:LMASK [1] 2 : SEGMENT : FIRSt : RIGHt : SPAN?
Example	:CALC:LMAS1:SEGM:FIRS:RIGH:SPAN 1.75 MHz
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Right.
Dependencies / Couplings	If the Center, 1 st , and 2 nd segments On, the right 2 nd segment span adjusts on a change in the right 1 st segment span.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.
Min	0 Hz
Max	Current measurement span. See Dependencies / Couplings “1st Segment” on page 85.
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Right, Span
Default Unit	Hz

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

2nd Segment

Sets the state of the first segment to On or Off. This key is available only when 2nd has been selected with the Segments key.

Mode	SA
Remote Command	:CALCulate:LMASK [1] 2:SEGMent:SECond ON OFF 1 0 :CALCulate:LMASK [1] 2:SEGMent:SECond?
Example	:CALC:LMAS1:SEGM:SEC ON
Notes	Key is only displayed when the selected segment is 2 nd .
Dependencies / Couplings	If On, and the First and Center segments are On: The left hand side 2 nd segment is drawn to the left hand side of the left first segment at the specified power level The right hand side 1 st segment is drawn to the right hand side of the right first segment at the specified power level
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment

2nd Segment (Left or Right Limits)

Sets 2nd segment to allow the definition of the limits Left or Right of the center segment for the 2nd Segment. The Left or Right amplitude limits can be changed with the **Level** key. This key is only available when 2nd has been selected with the **Segments** key.

Mode	SA
Notes	Key is only displayed when the selected segment is 2 nd .

Dependencies / Couplings	<p>The Left span is calculated as follows:</p> $(\text{<maximum span>/2}) - (\text{<center segment span>/2}) - \text{<first segment left span>}$ <p>The Right span is calculated as follows:</p> $(\text{<maximum span>/2}) - (\text{<center segment span>/2}) - \text{<first segment right span>}$ <p>Where <maximum span> is the maximum frequency span of the instrument (3 GHz or 6 GHz)</p>
Remote Command Notes	<p>The Limit Mask SCPI command syntax uses:</p> <p>The keyword “LEFT” to define the level and span for the second segment to the Left of the center segment.</p> <p>The keyword “RIGHT” to define the level and span for the second segment to the Right of the center segment.</p>
Preset	Not affected by a preset but set per default to Left after a power cycling.
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment (Left or Right)

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Level: 2nd Segment Left

Sets the power level, for the 2nd segment to the Left of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Spectrum Analyzer
Remote Command	:CALCulate:LMASK [1] 2:SEGment:SECond:LEFT:LEVel <ampl> :CALCulate:LMASK [1] 2:SEGment:SECond:LEFT:LEVel?
Example	:CALC:LMAS:SEGM:SEC:LEFT:LEV -39 dBm
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Left.
Preset	Not affected by a preset but set per default to -20 dB after a power cycling
State Saved	Saved in instrument state.
Min	-200 dBm
Max	100 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment: Left, Level
Default Unit	dBm

Level: 2nd Segment Right

Sets the power level, for the 2nd segment to the Right of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:LMASK [1] 2:SEGment:SECond:RIGHT:LEVel <ampl> :CALCulate:LMASK [1] 2:SEGment:SECond:RIGHT:LEVel?
Example	:CALC:LMAS:SEGM:SEC:RIGH:LEV -39 dBm
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Right.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	Not affected by a preset but set per default to -20 dBm after a power cycling.
State Saved	Saved in instrument state.
Min	-200.0 dBm

Max	100.0 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment: Right, Level
Default Unit	dBm

Limit Pass/Fail Returns a 1 if any of the results have been deemed to fail the Limit Masks. If no limit Masks have been set, this function will return 0 at all times.

Key Path:	Remote capability only
Remote Command:	:CALCulate:LMASK[1]2:FAIL?
Preset:	0
State Saved:	No
Range:	1 0
Remote Command Notes:	Query Only. Only has an effect when the Limit Mask is set (See “Limit Mask 1 (upper) or Limit Mask 2 (Lower)” on page 82).
Example:	:CALC:LMAS2:FAIL? will return 1 if the measurement trace does fail any of the segments defining the Upper Mask.

Sensitivity

The sensitivity setting changes how the auto-range algorithm is applied to input signals. The default setting is High, which optimizes dynamic range but may introduce distortion with large signal levels. Setting sensitivity to Low removes signal distortion, but may decrease dynamic range.

Mode	SA
Remote Command	[[:SENSE]:POWER:SENSitivity LOW HIGH [:SENSE]:POWER:SENSitivity?
Preset	High
Range	Low High
Key Path	Meas Setup, Sensitivity

Trigger

Displays the trigger settings menu.

When using a trigger source other than Free Run, the analyzer will begin a sweep only with the trigger conditions are met. A trigger event occurs when your trigger source signal meets the specified trigger level and polarity requirements (if any).

Each Trigger source supports some or all of the trigger setting parameters:

Trigger Type	Parameter		
	Delay	Level	Slope
Video	Yes	Yes	
External	Yes		Yes
RF Burst	Yes	Yes	

Trigger Delay and Trigger Level will change the delay and level for any trigger source that supports these features. For example, if the Trigger Delay is set to 100 ms for Video Trigger, the Trigger Delay for External Triggers is now 100 ms.

Remote Command	:TRIGger [:SEquence] :SOURce IMMEDIATE EXTernal RFBurst VIDeo :TRIGger [:SEquence] :SOURce?
Example	TRIG:SOUR VID
Notes	The Trigger Source Selection command is the only command that is measurement-dependent. It has its unique syntax per measurement :TRIGger[:SEquence]:SOURce would be used for “Measurement = SA” :TRIGger:”measurement name”[:SEquence]:SOURce would be used for all other measurements
Remote Command Notes	IMMEDIATE – free run triggering EXTernal – triggers on an externally connected trigger source on the rear panel RFBurst – triggers on the bursted frame VIDeo – triggers on the video signal level Other trigger-related commands are found in the INITiate and ABORt subsystems. *OPC? should be used after requesting data. This will hold off any subsequent changes to the selected trigger source, until after the sweep is completed and the data is returned.
Preset	Free Run (Immediate)
State Saved	Saved in State

Key Path **Meas Setup**

Free Run (Immediate) When free run is selected, triggering occurs immediately after the sweep/measurement is initiated.

Remote Command	*TRG
Example	TRIG:SOUR IMM *TRG
Remote Command Notes	The *TRG command immediately initiates a trigger.
Key Path	Meas Setup, Trigger, Free Run (Immediate)

Video Sets the video signal as the trigger source. With Video selected, the trigger condition is met when the video signal crosses the filtered and detected version of the input signal, including RBW filtering.

The video trigger level is shown as a labeled line on the display. The line is displayed as long as video is the selected trigger source.

Example	TRIG:SOUR VID selects video triggering.
Dependencies / Couplings	Triggers and detector modes are independent. Trigger slope cannot be set for Video triggering.
Remote Command Notes	See Trigger
Key Path	Meas Setup, Trigger, Video

External Sets an external input signal as the trigger source. A new sweep/measurement will start when the external trigger condition is met by the signal applied at the External Trigger Input.

Example	TRIG:SOUR EXT This selects the external trigger input.
Remote Command Notes	See Trigger
Dependencies / Couplings	Trigger level cannot be set for External triggering.
Key Path	Meas Setup, Trigger, External

RF Burst (Wideband) Sets the RF Burst as the trigger source. A new sweep/measurement will start

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

when an RF burst envelope signal is identified from the signal input to the RF INPUT connector.

Example	TRIG:SOUR RFB
Remote Command Notes	See Trigger
Key Path	Meas Setup, Trigger, RF Burst (Wideband)

Trigger Level Sets the level where a trigger occurs. When the trigger signal level crosses the specified level (for the selected slope), the trigger occurs. This level is displayed with a horizontal line only if Video is the selected trigger source.

For RF Burst, sets the absolute trigger level for the RF burst envelope.

Remote Command	:TRIGger [:SEquence] :VIDeo EXTernal RFBurst:LEVel : <real> :TRIGger [:SEquence] :VIDeo EXTernal RFBurst:LEVel?
Preset	-30 dBm
State Saved	Saved in State
Min	-100 dBm or the current reference level, whichever is lower
Max	+30 dBm or 10 divisions below the current reference level, whichever is higher
Dependencies / Couplings	The range of the Video Trigger Level is dependent on the Reference Level. Trigger level selection is not available with free run or external triggering.
Key Path	Meas Setup, Trigger, Trigger Level

Trig Slope Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Remote Command	:TRIGger [:SEquence] :EXTernal:SLOPe POSitive NEGative :TRIGger [:SEquence] :EXTernal:SLOPe?
Example	TRIG:EXT:SLOP NEG
Preset	POSitive
State Saved	Saved in State

Dependencies / Couplings	Trigger slope selection is only available with external triggering.
Key Path	Meas Setup, Trigger, Trig Slope

Trig Delay Controls a time delay during which the analyzer will wait to begin a sweep after meeting the trigger criteria. You can use negative delay to pre-trigger the instrument in time domain, but not in swept spans.

Remote Command	:TRIGger[:SEquence]:DELay <time> :TRIGger[:SEquence]:DELay?
Example	TRIG:DEL 100 ms
Preset	1 μ s
State Saved	Saved in State
Min	-204.8 s Note this is RBW dependent: $-102400 / \text{RBW (Hz)}$ with a maximum of -27 ms
Max	+4.5 hours Note this is RBW dependent: $-102400 / \text{RBW (Hz)}$ with a minimum of +2 s
Dependencies / Couplings	Trigger delay selection is not available with free run triggering.
Key Path	Meas Setup, Trigger, Trig Delay

Auto Trig Sets the time that the analyzer will wait for the trigger conditions to be met. If they are not met after that much time, then the analyzer is triggered anyway. Auto Trig defaults to Off and is not accessible remotely.

Preset	2 s, OFF
State Saved	Saved in State
Min	1 ms
Max	100 s
Key Path	Meas Setup, Trigger, Auto Trig

Peak Search

Accesses the marker peak functions and places a marker on the highest peak of the currently selected trace.

Mode:	All
Remote Command	:CALCulate:MARKer [1] 2 3 4 :MAXimum
Example	CALC:MARK2:MAX
Key Path	Front-panel key

Next Peak

Places the selected marker on the next highest signal peak from the current marked peak.

Mode	All
Remote Command	:CALCulate:MARKer [1] 2 3 4 :MAXimum:NEXT
Example	CALC:MARK2:MAX:NEXT
Key Path	Peak Search, Next Peak, Next Peak

Span/X Scale (Spectrum Analyzer Measurement)

Activates the span functions menu. The menu selections are determined by the current measurement mode.

Mode	All
Preset	Full span (depends on hardware present)
State Saved	Saved in State
Key Path	Front-panel key

Span

Sets the span frequency value. Span frequency describes the frequency range that is positioned symmetrically about center frequency.

Changing span changes the displayed frequency range symmetrically about the center frequency.

While in the SA measurement, setting the span to 0 Hz through SCPI or the front-panel numeric key pad puts the analyzer into the Zero Span Measurement.

While in the Zero Span measurement, setting the Span to a non-zero value through SCPI or Front Panel puts the analyzer in the SA measurement.

In a Zero Span measurement, the frequency entry mode is always center/span.

Mode	SA
Remote Command	[:SENSE] :FREQUENCY:SPAN <frequency> [:SENSE] :FREQUENCY:SPAN?
Example	FREQ:SPAN 2 GHz sets the span to 2 GHz FREQ:SPAN 0 Hz sets the span to 0 Hz and puts the instrument in Zero Span measurement mode.
Dependencies / Couplings	Span affects RBW
Remote Command Notes	Preset and Max values are dependent on Hardware (Options)
Preset	2.9999 GHz (Option 503) 5.9999 GHz (Option 506)
State Saved	Saved in State
Range	0 Hz, 1 kHz to 3.00 GHz (Option 503) 0 Hz, 1 kHz to 6.00 GHz (Option 506)
Key Path	Span/X Scale, Span

Full Span

Changes the displayed frequency span to show the full frequency range of the analyzer.

Mode	SA
Remote Command	[:SENSE] :FREQUENCY:SPAN:FULL
Preset	Full Span
Key Path	Span/X Scale, Full Span

Zero Span

Changes the displayed frequency span to zero Hertz. The horizontal axis changes to time rather than frequency. The input signal that is at the current center frequency is the displayed amplitude. This is a

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

special operation mode that changes several measurement functions or couplings.

Mode	SA
Example	FREQ:SPAN 0
Key Path	Span/X Scale, Zero Span

Last Span

Changes the displayed frequency span to the previous span setting. There is no memory of the last span after a power off or a mode preset.

Mode	SA
Remote Command	[:SENSe] :FREQuency:SPAN:PREVious
Key Path	Span/X Scale, Last Span

Trace/Detector

Accesses the **Trace/Detector** menu keys that control the acquisition, display, storage, detection and manipulation of trace data.

Mode	SA
Remote Command	:TRACe [1] 2 3 4 :TYPE WRITE AVERAge MAXHold MINHold :TRACe [1] 2 3 4 :TYPE?
Example	TRAC:TYPE AVER
Remote Command Notes	1 2 3 4 selects the trace.
Preset	Write. Only trace 1 is displayed at Preset.
Key Path	Trace Detector

Select Trace

Selects which trace the **Trace Type** menu keys will affect. Press **Select Trace** until the number of the desired trace is underlined.

Remote Command Notes	No equivalent remote command.
Preset	1
State Saved	The number of the selected trace is saved in Instrument State
Range	1 2 3 4
Key Path	Trace/Detector, Select Trace

Clear Write

Activates the **Clear Write** function for the selected trace. Pressing **Clear Write** erases previously stored data in the selected trace and continuously displays any signals during the sweep of the analyzer. The sweep count for **Average**, **Max Hold** and **Min Hold** is reset.

Because pressing **Clear Write** stops the current sweep and prepares to begin a new one, **Average**, **Max Hold** and **Min Hold** data may be interrupted in mid-sweep and the trace restarts and the count is reset. In general, the count is updated at the end of each trace. When **Clear Write** is pressed for one trace, **Average**, **Max Hold** and **Min Hold** restarts for all traces.

When in **Clear Write**, if a measurement-related instrument setting is changed the instrument begins a new sweep and the trace is updated.

Example	TRAC:TYPE WRIT
Dependencies / Couplings	Whenever you press Clear Write or send the equivalent SCPI command, Update is set to On and Display is set to Show .
State Saved	The type information for each trace is saved in Instrument State
Key Path	Trace/Detector, Clear Write

Average

Activates the **Average** function for the selected trace. Pressing **Average** maintains and displays an average trace, which represents the cumulative average on a point-to-point basis of the new trace data and previous averaged trace data.

Example	TRAC:TYPE AVER
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Spectrum Analyzer

Meas Off (Spectrum Analyzer) Measurement

Dependencies / Couplings	Affected by Avg Mode and Avg Number Whenever you press Average or send the equivalent SCPI command, Update is set to On and Display is set to Show . Automatic detector selection rules depend on the trace type selections.
State Saved	The type information for each trace is saved in Instrument State
Key Path	Trace/Detector, Average

Max Hold

Pressing Max Hold causes the trace to be cleared and a new maximum-hold measurement sequence is started. Max hold maintains the maximum level for each trace point of the selected trace, and updates each trace point if a new maximum level is detected in a successive sweep. Max hold is restarted if any parameter is changed. Restarting max hold also restarts averaging and min hold, because there is only one counter for Average and Hold.

Example	TRAC:TYPE MAXH
Dependencies / Couplings	Affected by Avg Mode and Average/Hold Count Whenever the user presses Max Hold or sends the equivalent SCPI command, Update is set to On and Display is set to Show . Automatic detector selection and the VBW:RBW ratio auto rules both depend on the trace type selections.
State Saved	The type information for each trace is saved in Instrument State
Key Path	Trace/Detector, Max Hold

Min Hold

Pressing **Min Hold** causes the trace to be cleared and a new minimum-hold measurement sequence to be started. A min hold sequence maintains the minimum level for each trace point of the selected trace, and updates each trace point if a new minimum level is detected in a successive sweep. Min Hold is restarted if any parameter is changed. Restarting Min Hold also restarts averaging and max hold, because there is only one count for Average and Hold.

Example	TRAC:TYPE MINH
Dependencies / Couplings	Affected by Avg Mode and Avg Number Whenever the user presses Min Hold or sends the equivalent SCPI command, Update is set to On and Display is set to Show . Automatic detector selection rules depend on the trace type selections.
State Saved	The type information for each trace is saved in Instrument State
Key Path	Trace/Detector, Min Hold

View/Blank

View/Blank lets you set the state of the two trace variables, Update and Display. The four choices available in this menu are:

- **Trace On:** Update and Display both On
- **View:** Update Off and Display On
- **Blank:** Update Off and Display Off
- **Background:** Update On, Display Off (this allows a trace to be blanked and continue to update “in the background”, which was not possible in the past)

When a trace becomes inactive, the following things happen:

- Any update from the SENSE system (detectors) immediately stops (That is, the current update does not continue to the end of the sweep)
- The trace is displayed at half intensity as long as it stays inactive.

Inactive traces display across the entire X Axis of the instrument. Their horizontal placement does not change even if X Axis settings subsequently are changed, although Y-axis settings will affect the vertical placement of data.

In most cases, inactive traces are static and unchanging; however, there are cases when an inactive trace will update, specifically:

- If data is written to that trace from remote
- If trace data is loaded from mass storage
- If the trace is the target of a Copy or participant in an Exchange
- If the trace is cleared using the Clear Trace function (below)

When a trace becomes active (Update = On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Traces which are blanked (Display = off) do not display nor appear on printouts but are otherwise

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

unaffected. They may be queried and markers may be placed on them.

NOTE The action of putting a trace in Display = Off and/or Update = Off does not restart the sweep and does not restart Averaging or Hold functions for any traces.

NOTE Whenever the you set Update to On for any trace, Display is set to On for that trace.

Parameter Name	Trace View/Blank
Key Path	Trace/Detector
Key Notes	<p>The four states of this menu set two variables, Update and Display, to their four possible combinations:</p> <ul style="list-style-type: none"> • Trace On: Update and Display both On • View: Update Off and Display On • Blank: Update Off and Display Off • Background: Update On, Display Off <p>See tables below for details on the SCPI to control these two variables.</p>

Parameter Name	Trace Update State
Remote Command	<pre>:TRACe [1] 2 3 4 :UPDate [:STATE] ON OFF 0 1 :TRACe [1] 2 3 4 :UPDate [:STATE] ?</pre>
Example	TRAC2:UPD 0 Makes trace 2 inactive (stops updating)
Dependencies / Couplings	<p>Setting the trace type (even to the type it was already in) puts the trace in Active.</p> <p>Loading a trace from a file makes that trace inactive regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange.</p> <p>Whenever the user sets Update to On for any trace, the Display is set to On for that trace.</p>
Preset	1 0 0 0 (On for Trace 1; Off for 2-6)
State Saved	Saved in Instrument State
Key Path	Trace/Detector
Annunciation	An inactive trace is indicated by dimming the type letter in the trace annotation panel in the Measurement bar (see “Annunciation” in the table below).

Parameter Name	Trace Display State
Remote Command	:TRACe [1] 2 3 4 :DISPlay [:STATe] ON OFF 0 1 :TRACe [1] 2 3 4 :DISPlay [:STATe] ?
Example	TRAC2:DISP,1 Makes trace 2 visible TRAC3:DISP,0 Blanks trace 3
Dependencies / Couplings	Setting the trace type (even to the type it was already in) puts the trace in Display On. Whenever the user sets Update to On for any trace, the Display is set to On for that trace. Loading a trace from a file puts that trace in Display On regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange.
Preset	1 0 0 0 (On for Trace 1; Off for 2-4)
State Saved	Saved in Instrument State
Key Path	Trace/Detector
Annunciation	A trace in Blank is indicated by a strikethrough thorough the type letter in the trace annotation panel in the Measurement bar.



Detector

Accesses the detector selection menu. Manually selecting a detector turns off the automatic detector selection functionality.

Mode	SA
Remote Command	[:SENSE] :DETECTOR:TRACe [1] 2 3 4 [:FUNction] AVERAge POSitive SAMPlE NEGAtive [:SENSE] :DETECTOR:TRACe [1] 2 3 4 [:FUNction] ? [:SENSE] :DETECTOR:TRACe [1] 2 3 4 :AUTO OFF ON 0 1 [:SENSE] :DETECTOR:TRACe [1] 2 3 4 :AUTO?

Spectrum Analyzer
Meas Off (Spectrum Analyzer) Measurement

Example	TRAC2:TYPE WRIT DET:TRAC2 AVER This sets the selected trace to trace 2, sets its write mode and then sets the detector to average. DET:TRAC:AUTO ON turns off the manual detector selection.										
Remote Command Notes	Sending a DETector:TRACe command sets DETector:TRACe:AUTO to off.										
Remote Command Notes	The query returns a name that corresponds to the detector type as shown below, and indicates the setting for the specified trace. The RMS selection is identical to AVERage. If RMS has been selected, the query will return the “AVER” string.										
	<table border="0"> <thead> <tr> <th>String Returned</th> <th>Definition</th> </tr> </thead> <tbody> <tr> <td>AVER</td> <td>Average/RMS</td> </tr> <tr> <td>POS</td> <td>Positive peak</td> </tr> <tr> <td>SAMP</td> <td>Sample</td> </tr> <tr> <td>NEG</td> <td>Negative peak</td> </tr> </tbody> </table>	String Returned	Definition	AVER	Average/RMS	POS	Positive peak	SAMP	Sample	NEG	Negative peak
String Returned	Definition										
AVER	Average/RMS										
POS	Positive peak										
SAMP	Sample										
NEG	Negative peak										
Preset	Preset returns all traces to “auto” detector. The type of detection used depends on the trace type. Since the preset trace type is Clear/Write, the auto detector is “Positive peak”.										
State Saved	Saved in State										
Range	Peak Sample Negative Peak Average (RMS)										
Key Path	Trace/Detector, More 1 of 2, Detector										
History	The following Legacy Auto State command: [:SENSe]:DETECTOR:AUTO ON OFF 1 0 [:SENSe]:DETECTOR:AUTO? will be supported for Backwards Compatibility. The command [:SENSe]:DETECTOR:AUTO will turn the AUTO state ON or OFF for ALL detectors. This implementation is required to preserve the classic functionality wherein all traces are affected when a detector is addressed										

Peak For each display point (interval) on the trace, Peak detection displays the highest amplitude within the frequency interval represented by that display point.

Peak detection should be used for measuring CW signals and for some pulsed-RF measurements. For FFT analysis, the highest amplitude across the frequency width of a display point is shown, even if that peak amplitude falls between samples of the spectrum computed in the FFT process.

Example	DET:TRAC3 POS sets trace 3 to positive detection.
Key Path	Trace/Detector, Detector, Peak

Sample The sample detector displays the instantaneous level of the signal at the first sample in the frequency interval represented by each display point. It does not matter how many samples there are for each display point because only the first sample is used.

Sample detection is good for displaying noise or noise-like signals.

Sample detection is not the best for making amplitude measurements of CW-like signals. The peak response to a signal can occur between samples, so unless the Span to RBW ratio is lower than usual, then the chosen sample can be well below the peak signal amplitude.

Example	DET:TRAC SAMP sets trace 1 to sample detection.
Key Path	Trace/Detector, Detector, Sample

Negative Peak For each display point (interval) in the trace, Negative Peak detection displays the lowest sample within the frequency range represented by that display point. Negative peak detection is similar to peak detection, but selects the minimum value.

Example	DET:TRAC2 NEG sets trace 2 to negative peak detection.
Key Path	Trace/Detector, Detector, Negative Peak

Average For each display point (interval) on the trace, Average detection displays the power average (RMS) of the amplitude within the frequency interval represented by that display point.

The most accurate averaged amplitude measurement will be made when you have at least 8 samples in each display point. Annotation will appear on the display when the current instrument settings have reduced the number of samples/display point to less than 8. “<8 Smpl/Pt” will be displayed until the instrument settings change so that the number of samples increases.

The Average detector is very good for measuring noise or noise-like signals. For example, an occupied power measurement will be more accurate using the Average detector than the Sample detector. The Average detector is not recommended for measuring CW signals because it can under represent the signal power that is best measured using the Peak detector.

Example	DET:TRAC AVER sets trace 1 to average detection.
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Spectrum Analyzer

Meas Off (Spectrum Analyzer) Measurement

Key Path	Trace/Detector, Detector, Average (Log/RMS/V)
Dependencies / Couplings	When the Average detector is selected, the only type of trace averaging that is available is Pwr Avg (RMS) . (See Meas Setup, Avg Type .) You must select a different detector to use Log-Pwr Avg (Video) trace averaging.

Clear Trace

Clears the selected trace. Does not affect the state of any function or variable in the box. Loads minimum trace value into all of the points in the selected trace, unless the trace is in **Min Hold** in which case it loads maximum trace value. Does so even if Update is Off.

Remote Command	:TRACe:CLEAr TRACE1 TRACE2 TRACE3 TRACE4
Example	TRAC2:CLE clears trace 2
Key Path	Trace/Detector, Clear Trace

Clear All Traces

Clears all traces. Does not affect the state of any function or variable in the box. Loads minimum trace value into all of the points all traces, except traces in Min Hold in which case it loads maximum trace value. Does so even if Update is Off for one or more traces.

Remote Command	:TRACe:CLEAr:ALL
Example	TRAC:CLE:ALL clears all traces
Key Path	Trace/Detector, Clear All Traces

Send/Query Trace Data (Remote Command Only)

This command allows trace data to be sent to the analyzer or queried from the analyzer. The response to the query is a list of the amplitude points which comprise the requested trace in the current y axis unit of the analyzer. The x axis unit is that of the destination trace (for send) or the source trace (for query).

The format and byte-ordering of the sent or received data will be dependent on the FORMat:DATA and FORMat:BORDER commands. ASCII data consists of a string of comma separated values. REAL or INTeger data is sent as a definite length block, with a header describing the data to follow.

For example, a four point trace might look like this if in ASCII (FORMat:DATA ASCII):

```
-5.87350E+01, -5.89110E+01, -5.87205E+01, -5.12345E+01<NL><END>
```

and like this if in INTeger with 4 bytes per point (FORMat:DATA INT,32):

```
#216<16 bytes of data><NL><END>
```

where the 2 in the #216 means “2 digits of numeric data to follow”, and the 16 is the 2 digits and means “16 binary bytes to follow” (this is the definite length block format).

Note that the data is terminated with <NL><END>. (For LAN, this is <newline> only.)

The data format set by FORMat:DATA and FORMat:BORDER is used both for sending data to the instrument and receiving data from the instrument.

No units terminator (for example, dB or V) is used when sending data; the data is taken as being in the current y axis unit of the analyzer.

When a trace is sent to the instrument, it immediately overwrites all of the data in the target trace, even if that trace is inactive, or even if it is active and in the middle of a sweep. If in the middle of a set of **Average** or **Max/Min Hold** operations, it can result in invalid measurement data, so caution should be exercised by the user. Similarly, when querying trace data, it is best if the analyzer is not sweeping during the query. Therefore, it is generally advisable to be in **Single Sweep**, or **Update = Off** when sending trace data to the analyzer or querying trace data from the analyzer.

Remote Command	:TRACe[:DATA] <trace_name>, <definite_length_block> <comma_separated_ASCII_data> :TRACe[:DATA]? <trace_name> where <trace_name> = TRACE1 TRACE2 TRACE3 TRACE4
Dependencies / Couplings	The FORMat:DATA command describes the different types of data formats that can be used with trace data. Use the FORMat:BORDER command to set the byte order.

Remote Command	:TRACe[:DATA]? TRACE1 TRACE2 TRACE3 TRACE4
Example	TRAC TRACE1,-1,-2,-3,-4,-5 Sends five points to Trace 1. Assuming that FORMat:DATA is set to ASCII, Y Axis Unit is set to dBm, and sweep points is set to 5, this will result in Trace 1 consisting of the five points -1 dBm, -2 dBm, -3 dBm, -4 dBm, and -5 dBm. TRAC? TRACE2 queries the analyzer for the contents of trace 2.

Numeric Data Format (Remote Command Only)

This remote command specifies the format of the trace data input and output. It specifies the formats used for trace data during data transfer across any remote port. It affects only the data format for setting and querying trace data for the :TRACe[:DATA] and query TRACe[:DATA]? commands.

Spectrum Analyzer

Meas Off (Spectrum Analyzer) Measurement

The command syntax is:

Remote Command	<code>:FORMat [:TRACe] [:DATA] ASCii INTeger, 32 REAL, 32 REAL, 64</code> <code>:FORMat [:TRACe] [:DATA] ?</code>
Example	<code>FORM:DATA ASCii</code> With 4 points looks like: <code>-5.87350E+01, -5.89110E+01, -5.87205E+01, -5.12345E+01<NL><END></code> <code>FORM:DATA INT,32</code> With 4 bytes per point looks like: <code>#216<16 bytes of data><NL><END></code> Where the 2 in the #216 means “2 digits of numeric data to follow”, and the 16 is the 2 digits and means “16 binary bytes to follow” (this is the definite length block format).
Preset	<code>ASCii</code>

Byte Order (Remote Command Only)

This command selects the binary data byte order for data transfer. It controls whether binary data is transferred in normal or swapped mode. This command affects only the byte order for setting and querying trace data for the `:TRACe[:DATA]` and query `:TRACe[:DATA]?` commands.

Normal mode is when the byte sequence begins with the most significant byte (MSB) first, and ends with the least significant byte (LSB) last in the sequence: 1|2|3|4. Swapped mode is when the byte sequence begins with the LSB first, and ends with the MSB last in the sequence: 4|3|2|1.

Remote Command	<code>:FORMat :BORDER NORMal SWAPped</code> <code>:FORMat :BORDER?</code>
Example	<code>FORM:BORD SWAP</code>
Preset	<code>NORMal</code>

View/Display (Spectrum Analyzer Mode)

Displays keys to set the display to spectrogram views (spectrum analyzer mode only), or to select which measurement values to display with the current measurement mode.

Dependencies / Couplings:	The features available under the View/Display key vary depending on the current Mode selected, and on the current Measurement.
Key Path	Front-panel key

Spectrogram

Accesses the spectrogram display menu. The spectrogram function is only available when Option 271 has been installed.

Key Path:	View/Display, Spectrogram
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Spectrogram On/Off Turns the spectrogram display mode on/off.

Mode	SA
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	View/Display, Spectrogram, Spectrogram On/Off

Reset Spectrogram Resets the spectrogram display.

Mode	SA
Key Path	View/Display, Spectrogram, Reset Spectrogram

Update Interval Enables you to set the interval of time to update data to 1 or more seconds. Or, you may set it to automatically determine the Update Interval that provides the maximum data collection speed.

A data sample is taken every time interval for display on the spectrogram. Increasing the update time

Spectrum Analyzer

Meas Off (Spectrum Analyzer) Measurement

allows data capturing over a longer period of time in the spectrogram. However, it is a sampling technique that allows intermittent events that occur between samplings, to be lost. Therefore, if you are searching for intermittent signals, consider using **Repeat Max Hold** instead of Update Interval.

Mode	SA
Preset	Max Speed (0 s.)
State Saved	Saved in State
Min	400 nS
Max	$(200 * 1024) / (2 * \text{RBW})$
Key Path	View/Display, Spectrogram, Update Interval

Frame Skip Enables you to set the number of frames you would like to skip when capturing data. You may set this value from 0 to 2,147,483,647 frames. Increasing the frame skip value causes the display to redraw the spectrum every nth frame and a block of lines are shown at once instead of a single line at a time. Higher frame skip values are for use with fast measurements.

Mode	SA
Preset	0 frames
State Saved	Saved in State
Min	0
Max	2,147,483,647
Key Path	View/Display, Spectrogram, Frame Skip

Palette Switches the spectrogram color mode between full color and grayscale.

Mode	SA
Preset	Full Color
Range	Full Color Grayscale
Key Path	View/Display, Spectrogram, Palette

Display Enable (Remote Command Only)

Turns the display on/off, including the display drive circuitry and the backlight. The three goals of turning the display off are:

- To increase speed as much as possible by freeing the instrument from having to update the display
- To reduce emissions from the display, drive circuitry and backlight
- For security purposes

If you have turned off the display and you are in local operation, the display can be turned back on by sending the DISPLAY:ENABLE ON command (neither *RST nor SYSTem:PRESet enable the display.)

Mode	SA
Remote Command	:DISPlay:ENABle OFF ON 0 1 :DISPlay:ENABle?
State Saved	Not saved in instrument state
Mode Preset	Not affected by *RST or SYSTem:PRESet
Factory Default	On
Couplings	DISP:ENAB OFF turns Backlight OFF and DISP:ENAB ON turns Backlight ON. However, settings of Backlight do not change the state of DISP:ENAB
Example	DISP:ENAB OFF
Key Path	None, no front-panel control

Channel Power

Measurement Overview

The Channel Power measurement is used to find the total power present in a specified bandwidth. The power spectral density (the power in the signal normalized to 1 Hz) is also reported.

This measurement will include the following functionality:

- Averaging
- Flexibility for measuring any signal bandwidth
- Storage of a results file (.xls) to disk
- Integration BW markers
- Auto reference level setting key
- Root-Raised Cosine filter with user settable α (alpha) and filter bandwidth
- Ability to turn the Root-Raised Cosine filter on or off

Measurement Results

Channel Power

The Channel Power is the total power measured in the specified integration bandwidth.

Limits: refer to [“Upper Limit” on page 122](#).

Units: dBm

Spectral Density

The power spectral density is the measured power in the signal normalized to 1 Hz.

Limits: None

Units: dBm/Hz

Remote SCPI Commands

Command	Return Value
:CONFigure:CHPower	N/A
:INITiate:CHPower	

Command	Return Value
:FETCh:CHPower[n]? :MEASure:CHPower[n]? :READ:CHPower[n]?	Refer to “Remote Measurement Results” on page 46
:FETCh:CHPower:CHPower? :MEASure:CHPower:CHPower? :READ:CHPower:CHPower?	Returns the Channel Power (dBm) Provided for Backward Compatibility
:FETCh:CHPower:DENSity? :MEASure:CHPower:DENSity? :READ:CHPower:DENSity?	Returns the Power Spectral Density (dBm/Hz) Provided for Backward Compatibility

n	Results Returned
n=1 (or not specified)	Returns scalar results: Channel Power is a floating point number representing the total channel power in the specified integration bandwidth. PSD (Power Spectral Density) is the power (in dBm/Hz) in the specified integration bandwidth.
2	Returns floating point numbers that are the captured trace data of the power (in dBm/resolution bandwidth) of the signal. The frequency span of the captured trace data is specified by the Span key (refer to “Span” on page 132)
3	Returns the state of the pass/fail result based on the following limits (1 = pass, 0 = fail, -999.0 = if limit turned off) 1. Upper Limit (refer to “Upper Limit” on page 122) 2. Lower Limit (refer to “Lower Limit” on page 123)

AMPTD/Y Scale

Autoscale

Executes an automatic scaling of the Reference Value and Scale/Div settings. Autoscale is a front panel only function and has no associated SCPI command.

Mode	SA
Dependencies / Couplings	Pressing this menu key automatically determines the Y Scale Per Division (refer to “Scale/Div” on page 117) and Reference Level (refer to “Reference Level” on page 116) based on the current trace results.

Spectrum Analyzer Channel Power

Remote Command Notes	No SCPI. Front panel only.
Key Path	AMPTD/Y Scale

Reference Level

Sets the absolute power reference level.

Mode	SA
Remote Command	<code>:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel <real></code> <code>:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y[:SCALe]:RLEVel?</code>
Example	<code>:DISP:CHP:VIEW:WIND:TRAC:Y:RLEV 10 dBm</code>
Dependencies / Couplings	When the Autoscale key is pressed the reference level is determined automatically. Refer to “Autoscale” on page 115)
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELEct SCPI command to set the mode.
Preset	10.00 dBm
State Saved	Saved in instrument state.
Min	-250.0 dBm
Max	250.0 dBm
Key Path	AMPTD/Y Scale

Electronic Attenuation

Sets the RF input attenuation level for all measurements in the Spectrum Analyzer mode. The input attenuation level can be set in 1 dB or 10dB increments from the current setting. Attenuation can be changed using the step keys, the knob, or the numeric keypad (1 dB steps using the left/right arrows, and 10 dB steps using the up/down arrows). You may select 0 dB using the RPG or step keys.

Mode	SA
Remote Command	<code>[:SENSE]:POWER[:RF]:ATTenuation <rel_ampl></code> <code>[:SENSE]:POWER[:RF]:ATTenuation?</code>
Example	<code>:POW:ATT 10</code>
Restriction and Notes	Elec Atten is settable in 1 dB and 10 dB steps. 1 dB using the left/right arrows and 10 dB steps using the up/down arrows. You may select 0 dB using RPG or step keys.

Dependencies / Couplings	When the Auto Ranging is On (refer to “Auto Range” on page 49), this value is automatically determined by the measurement. When you set a value manually, Auto Ranging automatically changes to Off.
Remote Command Notes	When this SCPI command is received and SA mode is selected (:INSTrument:SElect SA) the electronic attenuation will be set to the given value for all measurements in the Spectrum Analyzer mode.
Preset	0
State Saved	Saved in instrument state.
Min	0
Max	40
Key Path	AMPTD/Y Scale

Scale/Div

Sets the unit per division of the vertical scale in the logarithmic display.

Mode	SA
Remote Command	:DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y [:SCALe]:PDIVision <rel_amp1> :DISPlay:CHPower:VIEW[1]:WINDow[1]:TRACe:Y [:SCALe]:PDIVision?
Example	:DISP:CHP:VIEW:WIND:TRAC:Y:PDIV 2 dB
Dependencies / Couplings	When the Autoscale key is pressed the reference value is determined automatically. Refer to “Autoscale” on page 115 for further details.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTrument:SElect SCPI command to set the mode.
Preset	10.00 dB
State Saved	Saved in instrument state.
Min	1.0 dB
Max	20.00 dB
Key Path	AMPTD Y Scale

Auto Range

Sets auto ranging of the electronic attenuator and internal preamplifier (if available) to On or Off. For the “Electronic Attenuation” parameter, when the “Auto range” is On, the entire frequency range of the

Spectrum Analyzer Channel Power

analyzer is scanned to determine the total power applied to the analyzer. The RF input attenuation is then automatically set to ensure that the analyzer input is not overloaded.

For the “Internal Preamplifier” parameter, turning on the preamp gives a better noise figure, but a poorer TOI to noise floor dynamic range. When the “Auto range” is ON, depending on your measurement, the instrument will optimize this setting.

Mode	SA
Remote Command	[:SENSe] :POWer [:RF] :ARANge ON OFF 1 0 [:SENSe] :POWer [:RF] :ARANge?
Example	:POW:ARAN OFF
Remote Command Notes	When this SCPI command is received and SA mode is selected (:INSTRument:SElect SA) the Auto Range State will be set for all measurements in the Spectrum Analyzer mode.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	AMPTD/Y Scale

Internal Preamp

The Internal Preamp menu key sets the internal preamplifier to On or Off. Turning on the preamp provides a better noise figure, but reduces TOI to noise floor dynamic range. This key is unavailable if the preamplifier option (Option P03 or P06) is not installed.

Mode	SA
Remote Command	[:SENSe] :POWer [:RF] :GAIN [:STATe] ON OFF 1 0 [:SENSe] :POWer [:RF] :GAIN [:STATe] ?
Example	:POW:GAIN ON
Restriction and Notes	If the preamplifier option (Option P03 or P06) is not installed or is unlicensed, the key does not appear.
Remote Command Notes	When this SCPI command is received and SA mode is selected (:INSTRument:SElect SA) the Auto Range State will be set for all measurements in the Spectrum Analyzer mode.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	AMPTD/Y Scale, More

External Gain

Sets a correction value to compensate for gain (or loss) through an external amplifier or attenuator connected between a signal source and the RF input. The correction value is applied to the displayed measurement values.

Mode	SA
Remote Command	<pre>[:SENSE] :CORRection:OFFSet [:MAGNitude] <rel_ampl> [:SENSE] :CORRection:OFFSet [:MAGNitude] ? [:SENSE] :CORRection:OFFSet [:MAGNitude] :STATe OFF ON 0 1 [:SENSE] :CORRection:OFFSet [:MAGNitude] :STATe?</pre>
Example	<pre>:CORR:OFFS 10.0 :CORR:OFFS:STAT ON</pre>
Restriction and Notes	The “External Gain” parameter settings are retained through a Mode Preset but are reset to their default settings (Value = 0 dB, State = OFF) by a Restore System Defaults. A User Preset or Recall State will set the External Gain to the value saved in User Preset or the State being loaded.
Dependencies / Couplings	<p>If the external gain is changed whilst in the Spectrum Analyzer mode, the external gain will be changed for all applications installed in the CSA analyzer. Similarly, if the external gain is changed when in another mode, it will also change for the Spectrum Analyzer mode.</p> <p>If the external gain state is changed whilst in the Spectrum Analyzer mode, the external gain state will be changed for all applications installed in the CSA analyzer.</p>
Remote Command Notes	<p>When this SCPI command is received the external gain will be set to the given value for all modes in the CSA analyzer.</p> <p>When this SCPI command is received the external gain state will be set for all modes in the CSA analyzer.</p>
Preset	0.0 OFF
State Saved	Saved in instrument state.
Min	-100.0
Max	100.0
Key Path	AMPTD/Y Scale, More

Meas Setup

Average Number

Allows you to specify the number of measurements used when calculating the average measurement result. The average is displayed at the end of each sweep.

When averaging is turned On, the sweep points are averaged for a number of successive sweeps, resulting in trace smoothing.

In Single Sweep, when Average Mode is set to Repeat, the specified number of averages is taken and then the sweep stops. When Average Mode is set to Exponential, only a single sweep is taken.

In Continuous sweep, the specified number of averages is taken. The averaging continues with each new sweep averaged in with a weight of $1 / \text{Average Number}$, and the old average reduced by multiplying it by $(\text{Average Number} - 1) / \text{Average Number}$.

Mode	SA
Remote Command	<pre>[:SENSe] :CHPower:AVERage:COUNT <integer> [:SENSe] :CHPower:AVERage:COUNT? [:SENSe] :CHPower:AVERage [:STATe] ON OFF 1 0 [:SENSe] :CHPower:AVERage [:STATe] ?</pre>
Example	<pre>:CHP:AVER:COUN 100 :CHP:AVER ON</pre>
Restriction and Notes	<p>When averaging is On, the following are averaged:</p> <p>Trace Data</p> <p>Channel Power (refer to “Channel Power” on page 114 for further details)</p> <p>Spectral Density (refer to “Spectral Density” on page 114 for further details)</p>
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELEct SCPI command to set the mode.
Preset	<pre>SA: 10 WCDMA: 200 OFF</pre>
State Saved	Saved in instrument state.
Min	1
Max	10000
Key Path	Meas Setup

Average Mode

Press Avg Mode (Exp) to continue measurement averaging using the specified number of averages to compute each averaged value. The average is displayed at the end of each sweep. Avg Mode (Repeat) will cause the measurement to reset the average counter each time the specified number of averages is reached.

With Exponential averaging mode, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Repeat averaging shows resulting data after the selected number of sweeps has been averaged, then clears the data before repeating the process.

NOTE With large average counts and/or slow traces, the trace from the last completed result remains on the display while Repeat averaging is running. The trace is not updated until the last average count has been reached

Mode	SA
Remote Command	[:SENSe] :CHPower:AVERAge:TCONtrol EXPonential REPEAT [:SENSe] :CHPower:AVERAge:TCONtrol?
Example	:CHP:AVER:TCON EXP
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRument:SElect SCPI command to set the mode.
Preset	EXPonential
State Saved	Saved in instrument state.
Range	Exp Repeat
Key Path	Meas Setup

Integration Bandwidth

Allows you to specify the range of integration to be used in calculating the power in the channel. Note that the integration bandwidth is displayed on the graticule as two vertical markers connected by an arrow.

Mode	SA
Remote Command	[:SENSe] :CHPower:BANDwidth:INTEgration <bandwidth> [:SENSe] :CHPower:BANDwidth:INTEgration?
Example	:CHP:BAND:INT 10MHz

Spectrum Analyzer

Channel Power

Dependencies / Couplings	The span of the instrument is set within a range determined by the integration bandwidth. Refer to “Span” on page 132 for further details.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SElect SCPI command to set the mode.
Preset	SA: 2 MHz WCDMA: 5 MHz
State Saved	Saved in instrument state.
Min	100 Hz
Max	2 GHz
Key Path	Meas Setup

Limits

Upper Limit Allows you to specify and turn on or off the Upper Limit. When On, the trace points within the integration bandwidth are checked to see if they are less than the Total Pwr Ref + Upper Limit Value. If all the points are less than this value, the upper limit test is passed. If any point is greater than this limit, the upper limit test is failed.

Mode	SA
Remote Command	:CALCulate:CHPower:LIMit[:POWer]:UPPer <rel_amp1> :CALCulate:CHPower:LIMit[:POWer]:UPPer? :CALCulate:CHPower:LIMit[:POWer]:UPPer:STATe ON OFF 1 0 :CALCulate:CHPower:LIMit[:POWer]:UPPer:STATe?
Example	:CALC:CHP:LIM:UPP 3.0 dB :CALC:CHP:LIM:STAT:UPP ON
Restriction and Notes	Parameter range is equivalent to range of Ref Value parameter.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SElect SCPI command to set the mode.
Preset	2.70 dB ON
State Saved	Saved in instrument state.
Min	-150.0 dB
Max	150.0 dB
Key Path	Meas Setup, Limits

Lower Limit Allows you to specify and turn on or off the Lower Limit. When On, the trace points within the integration bandwidth are checked to see if they are greater than the Total Pwr Ref + Lower Limit Value. If all the points are greater than this value, the lower limit test is passed. If any point is less than this limit, the lower limit test is failed.

Mode	SA
Remote Command	:CALCulate:CHPower:LIMit[:POWER]:LOWer <rel_ampl> :CALCulate:CHPower:LIMit[:POWER]:LOWer? :CALCulate:CHPower:LIMit[:POWER]:LOWer:STATE ON OFF 1 0 :CALCulate:CHPower:LIMit[:POWER]:LOWer:STATE?
Example	:CALC:CHP:LIM:LOW 3.0 dB :CALC:CHP:LIM:STAT:LOW ON
Restriction and Notes	Parameter range is equivalent to range of Ref Value parameter.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRument:SElect SCPI command to set the mode.
Preset	-2.70 dB ON
State Saved	Saved in instrument state.
Min	-150.0 dB
Max	150.0 dB
Key Path	Meas Setup, Limits

Total Pwr Ref The power in the carrier (reference channel) that is used to compute the absolute power values for limit checking. When set to Auto, the total power reference reflects the measured channel power value. When set to Manual, the result takes on the last measured value, or it can be manually entered.

Mode	SA
Remote Command	:CALCulate:CHPower:LIMit:CARRier[:POWER] <real> :CALCulate:CHPower:LIMit:CARRier[:POWER]? :CALCulate:CHPower:LIMit:CARRier[:POWER]:AUTO ON OFF 1 0 :CALCulate:CHPower:LIMit:CARRier[:POWER]:AUTO?
Example	:CALC:CHP:LIM:CARR 75dBm :CALC:CHP:LIM:CARR:AUTO ON

Spectrum Analyzer Channel Power

Dependencies / Couplings	Mode is set to Man when you have set the power reference.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SElect SCPI command to set the mode.
Preset	Measured carrier reference power
State Saved	Yes if mode set to Man
Min	-200.0 dBm
Max	200.0 dBm
Key Path	Meas Setup, Limits

RRC Filter

Turns the Root Raised Cosine (RRC) filter On or Off. The a value (roll off) for the filter is set to the value of the Filter Alpha (Refer to “[Filter Alpha](#)” on page 125 for further details) parameter, and the RRC filter bandwidth is set to the Filter BW (Refer to “[Filter BW](#)” on page 124 for further details).

Mode	SA
Remote Command	[:SENSe] :CHPower :FILTer [:RRC] [:STATe] ON OFF 1 0 [:SENSe] :CHPower :FILTer [:RRC] [:STATe] ?
Example	:CHP:FILT OFF
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SElect SCPI command to set the mode.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, More

Filter BW

Allows you to set the Root Raised Cosine (RRC) filter bandwidth. Normally, the filter bandwidth is the same as the symbol rate of the signal.

Mode	SA
Remote Command	[:SENSe] :CHPower :FILTer [:RRC] :BANDwidth <bandwidth> [:SENSe] :CHPower :FILTer [:RRC] :BANDwidth?

Example	:CHP:FILT:BAND 10 MHz
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELECT SCPI command to set the mode.
Preset	SA: 1.23 MHz WCDMA: 3.84 MHz
State Saved	Saved in instrument state.
Min	100 Hz
Max	2 GHz
Key Path	Meas Setup, More

Filter Alpha

Allows you to set the alpha value for the Root Raised Cosine (RRC) filter.

Mode	SA
Remote Command	[:SENSE] :CHPower:FILTer [:RRC] :ALPHa <real> [:SENSE] :CHPower:FILTer [:RRC] :ALPHa?
Example	:CHP:FILT:ALPH 0.5
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELECT SCPI command to set the mode.
Preset	0.22
State Saved	Saved in instrument state.
Min	0.01
Max	1.00
Key Path	Meas Setup, More

Meas Preset

Sets all measurement local parameters to their default value.

Mode	SA
Remote Command	:CONFigure:CHPower
Example	:CONF:CHP
Restriction and Notes	The 'Meas Preset' menu key has a green background.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SElect SCPI command to set the mode.
Key Path	Meas Setup, More

BW

Res BW

Allows you to set the resolution bandwidth (RBW). If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.

Mode	SA
Remote Command	[:SENSe]:CHPower:BANDwidth[:RESolution] <bandwidth> [:SENSe]:CHPower:BANDwidth[:RESolution]? [:SENSe]:CHPower:BANDwidth[:RESolution]:AUTO ON OFF 1 0 [:SENSe]:CHPower:BANDwidth[:RESolution]:AUTO?
Example	:CHP:BAND 5MHz :CHP:BAND:AUTO ON
Dependencies / Couplings	When Res BW is set to Auto, the resolution bandwidth is auto coupled to span (Refer to " Span " on page 132 for further details). The Span to Res BW ratio is approximately 106:1 when auto coupled. When Res BW is set to Man, bandwidths are entered manually, and these bandwidths are used regardless of other analyzer settings.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SElect SCPI command to set the mode. Previous SCPI command was [:SENSe]:BANDwidth BWIDth[:RESolution]:AUTO
Preset	SA: 30 kHz WCDMA: 240 kHz SA: ON WCDMA: OFF

State Saved	Saved in instrument state.
Range	E24 Series 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91 Hz etc. up to 200 kHz, plus bandwidths of 240 KHz, 300 kHz, 510 kHz, 1 MHz, 1.2 MHz, 3 MHz, or 5 MHz
Key Path	BW

Marker

Select Marker

Allows you to select one of four possible markers. A marker that has already been turned on will become active when it is selected. A marker that has not been turned on only becomes active on the trace if it is selected when the marker type is changed to Normal or Delta.

Mode	SA
Restriction and Notes	Each of the four markers can be identified by a unique color. This only applies to the marker and marker number displayed on the trace.
Dependencies / Couplings	The selected marker X axis value (refer to “ Marker Y Axis Value (Remote Command Only) ” on page 129) is the active function (when it is of type Normal or Delta) when in the Marker menu.
Remote Command Notes	No SCPI. Front panel only. The active marker is changed dependent on the marker sub op-code used with the marker control SCPI. For example, commands beginning with ‘:CALC:MARK2’ set marker 2 to the active marker.
Preset	1
State Saved	Saved in instrument state.
Range	1 2 3 4
Key Path	Marker

Marker Type

Sets the Marker Type to Normal, Delta, or Off. All interactions and dependencies detailed under the key description are enforced when the remote command is sent.

Mode	SA
Remote Command	:CALCulate:CHPower:MARKer [1] 2 3 4 :MODE POSITION DELTA OFF :CALCulate:CHPower:MARKer [1] 2 3 4 :MODE?

Spectrum Analyzer

Channel Power

Example	:CALC:CHP:MARK2:MODE DELT
Restriction and Notes	If the selected marker is Off, pressing Marker sets it to Normal and places it at the center of the screen on the trace. At the same time, Marker X Axis Value appears on the Active Function area.
Dependencies / Couplings	The marker annotation only appears on the display when the currently selected marker is of type Normal or Delta.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELEct SCPI command to set the mode.
	The active marker is changed dependent on the marker sub op-code used with the marker control SCPI. For example, commands beginning with ‘:CALC:CHP:MARK2’ set marker 2 to the active marker.
Preset	OFF
State Saved	Saved in instrument state.
Range	Normal Delta Off
Key Path	Marker

Marker X Axis Value (Remote Command Only)

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the marker type is set to Off, but is the SCPI equivalent of entering an X value if the marker type is Normal or Delta.

Mode	SA
Remote Command	:CALCulate:CHPower:MARKer [1] 2 3 4 :X <frequency> :CALCulate:CHPower:MARKer [1] 2 3 4 :X?
Example	:CALC:CHP:MARK2:X 2.5 MHz
Restriction and Notes	The query returns the markers absolute X axis value if the marker type is Normal, or the offset from the marker’s reference marker if the marker type is Delta.
Dependencies / Couplings	After a preset, all Markers are turned OFF, so Marker X Axis Value query will return a not a number (NAN).
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELEct SCPI command to set the mode.
Preset	After a preset, all Markers are turned Off, so Marker X Axis Value query will return a not a number (NAN).
State Saved	No
Min	0

Max	Hardware dependent
Key Path	None (Remote Command Only)

Marker X Axis Position

Sets the marker X axis scale position in trace points. This setting has no effect if the marker type is Off, but is the SCPI equivalent of entering a value if the marker type is Normal, or Delta – except in trace points rather than X axis scale units. The entered value is immediately translated into the current axis scale units for setting the value of the marker.

Mode	SA
Remote Command	:CALCulate:CHPower:MARKer [1] 2 3 4 :X:POSition <integer> :CALCulate:CHPower:MARKer [1] 2 3 4 :X:POSition?
Example	:CALC:CHP:MARK2:X:POS 500
Restriction and Notes	The parameter maximum value is the currently set number of sweep points (refer to “Points” on page 134).
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELEct SCPI command to set the mode.
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query will return a not a number (NAN).
State Saved	No
Min	0
Max	Refer to ‘Restriction and Notes’
Key Path	None. SCPI only.

Marker Y Axis Value (Remote Command Only)

Returns the Marker Y Axis value, in the current marker Y axis unit. This is a query only SCPI command. There is no associated front panel key.

Mode	SA
Remote Command	:CALCulate:CHPower:MARKer [1] 2 3 4 :Y?
Example	:CALC:CHP:MARK:Y?

Spectrum Analyzer Channel Power

Restriction and Notes	<p>The query returns the marker Y-axis result if the marker type is Normal or Delta. If the marker is Off the response is not a number.</p> <p>If the marker type is Normal, the absolute result is returned.</p> <p>If the marker type is Delta, the relative result is returned. This is the ratio of the absolute result of the delta marker to the absolute result of the reference marker. The ratio is expressed in dB.</p>
Remote Command Notes	<p>Query only.</p> <p>You must be in the SA mode to use this command. Use the INSTRUMENT:SElect SCPI command to set the mode.</p> <p>The active marker is changed dependent on the marker sub op-code used with the marker control SCPI command. For example, commands beginning with ‘:CALC:MARK2’ set marker 2 to the active marker.</p>
Preset	Result dependent on marker setup, and signal input.
State Saved	No
Key Path	None. (Remote Command Only).

Marker All Off

Turns off all markers.

Mode	SA
Remote Command	:CALCulate:CHPower:MARKer:AOff
Example	:CALC:CHP:MARK:AOff
Remote Command Notes	<p>You must be in the SA mode to use this command. Use the INSTRUMENT:SElect SCPI command to set the mode.</p> <p>The active marker is changed dependent on the marker sub op-code used with the marker control SCPI. For example, commands beginning with ‘:CALC:CHP:MARK2’ set marker 2 to the active marker.</p>
Key Path	Marker

Marker State (Backwards Compatibility SCPI Command)

Sets or queries the state of a marker. Setting a marker which is Off to state On or 1 puts it in Normal mode and places it at the center of the screen.

Mode	SA
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Remote Command	:CALCulate:CHPower:MARKer [1] 2 3 4 :STATE ON OFF 1 0 :CALCulate:CHPower:MARKer [1] 2 3 4 :STATE?
Example	:CALC:CHP:MARK:STAT ON
Dependencies / Couplings	If selected marker type is Off, the marker state returns OFF. If the selected marker type is Normal or Delta, the marker state returns ON. If the marker state is changed from OFF to ON, the specified marker is set to type Normal and placed at the center of the screen.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELEct SCPI command to set the mode. The active marker is changed dependent on the marker sub op-code used with the marker control SCPI. For example, commands beginning with ‘:CALC:CHP:MARK2’ set marker 2 to the active marker.
Preset	OFF
State Saved	Saved in instrument state.

Peak Search

Pressing the ‘Peak Search’ front panel key places a marker on the highest peak on the current trace. No menu is activated as there is no further peak search functionality available.

If all markers are turned Off (that is, there is no active marker), and you press this key, marker 1 is activated at the highest peak on the selected trace for marker 1.

If there is a marker currently active, the currently selected marker (refer to [“Select Marker” on page 127](#)) will be moved. If the active marker is a Normal marker this will move to the highest peak. If the active marker is a Delta marker, the reference marker position will remain unchanged and the delta marker will be moved to the highest peak on the trace.

Mode	SA
Remote Command	:CALCulate:CHPower:MARKer [1] 2 3 4 :MAXimum
Example	:CALC:CHP:MARK:MAX
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELEct SCPI command to set the mode.
Key Path	Front-Panel

SPAN/X Scale

Span

Allows you to set the frequency span for the Channel Power measurement.

Mode	SA
Remote Command	[:SENSE] :CHPower:FREQUENCY:SPAN <freq> [:SENSE] :CHPower:FREQUENCY:SPAN?
Example	:CHP:FREQ:SPAN 10 MHz
Restriction and Notes	When the RRC Filter (refer to “RRC Filter” on page 124) is On, the lower limit for the span (1 + Filter Alpha (refer to “Filter Alpha” on page 125)) * Integration BW (refer to “Integration Bandwidth” on page 121). When the RRC Filter is off, the lower limit for the span is 1 kHz.
Dependencies / Couplings	Span cannot be a fraction of a KHz, will automatically round up to nearest KHz value when setting Integration Bandwidth or Span. When Res BW is set to Auto, resolution bandwidth is auto-coupled to span. The span to Res BW ratio is approximately 106:1 when auto coupled. When Res BW is set to Man, bandwidths are entered manually, and these bandwidths are used regardless of other analyzer settings. Since Span is coupled to Integ BW in the factory default condition, if you change the integration bandwidth setting, the channel power span setting changes to a proportional value (preserving the ratio between channel power span and integration bandwidth) until a limit value is reached. However, the channel power span can be individually set.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELEct SCPI command to set the mode.
Preset	SA: 3.0 MHz WCDMA: 7.5 MHz
State Saved	Saved in instrument state.
Min	Refer to ‘Restriction and Notes’
Max	2 GHz
Key Path	SPAN/X Scale

Full Span

Changes the Channel Power span to show the full frequency range of the measurement. This is set to

2 GHz.

Mode	SA
Remote Command	[:SENSe] :CHPower :FREQuency :SPAN :FULL
Example	:CHP:FREQ:SPAN:FULL
Dependencies / Couplings	Selecting full span will change the measurement span value and integration BW to a minimum of 1/100 of the span. The integration bandwidth will remain unchanged if already greater than 200 MHz.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRument:SElect SCPI command to set the mode.
Key Path	Span

Last Span

Changes the Channel Power span to the previous measurement span setting. If there is no existing previous span value, the span will remain unchanged.

Mode	SA
Remote Command	[:SENSe] :CHPower :FREQuency :SPAN :PREVious
Example	:CHP:FREQ:SPAN:PREV
Dependencies / Couplings	Selecting last span will change the measurement span value
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRument:SElect SCPI command to set the mode.
Key Path	Span

Control/Sweep

Restart

Forces a restart of the Channel Power measurement.

Mode	SA
Remote Command Notes	No SCPI. Front panel only.
Key Path	Control/Sweep

Points

Allows you to set the number of points per sweep. If Preset is selected, the number of points per sweep will default to 401. The current value of points is displayed in parentheses next to the sweep time in the lower-right hand corner of the graph display.

Changing the number of points has several effects on the analyzer. Since markers are read at a point location, the marker reading may change. All trace data is cleared

Mode	SA
Remote Command	[:SENSE] :CHPower:SWEEp:POINTs <integer> [:SENSE] :CHPower:SWEEp:POINTs?
Example	:CHP:SWEE:POIN 601
Restriction and Notes	Whenever the number of sweep points is changed: <ul style="list-style-type: none"> • All trace data is erased • Averaging is reset <p>The default and range is convergent with GPSA operation in CSA, the default number of sweep points in MXA is 1001.</p>
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELEct SCPI command to set the mode.
Preset	401
State Saved	Saved in instrument state.
Min	2
Max	1001
Key Path	Control/Sweep

Trace/Detector

Auto

Sets the selected detector to Auto.

Mode	SA
Remote Command	[:SENSE] :CHPower:DETECTOR:AUTO ON OFF 1 0 [:SENSE] :CHPower:DETECTOR:AUTO?
Example	:CHP:DET:AUTO ON

Dependencies / Couplings	When the Detector choice is Auto, the detector is set to Average which is the default for the channel power measurement.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELECT SCPI command to set the mode. If you change the selected detector type (refer to “Detector Selection” on page 135) manually using either the front panel key or a remote command, the command ‘:CHP:DET:AUTO?’ will return 0.
Preset	ON
State Saved	Saved in instrument state.
Key Path	Trace/Detector

Detector Selection

Selects a detector to be used by the analyzer for the current measurement.

Mode	SA
Remote Command	[:SENSe] :CHPower:DETECTOR [:FUNCTION] POSitive SAMPLe NEGAtive AVERAge [:SENSe] :CHPower:DETECTOR [:FUNCTION] ?
Example	:CHP:DET POS
Restriction and Notes	When you manually select a detector (instead of selecting Auto), that detector is used regardless of other analyzer settings. The Peak detector determines the maximum of the signal within the bucket. The Sample detector indicates the instantaneous level of the signal at the center of the bucket represented by each display point. The Negative Peak detector determines the minimum of the signal within the bucket. The Average detector determines the average of the signal within the bucket. The averaging method is Power Average (RMS).
Dependencies / Couplings	When the Detector choice is Auto (refer to “Auto” on page 134), the detector is set to Average the default for the channel power measurement.
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRUMENT:SELECT SCPI command to set the mode.
Preset	AVERAge
State Saved	Saved in instrument state.
Range	Peak Sample Negative Peak Average
Key Path	Trace/Detector

View/Display

The display functionality is shared with the Meas Off (Spectrum Analyzer) measurement in the Spectrum Analyzer Modes. For details about how it operates, see “View/Display (Spectrum Analyzer Mode)” on page 111.

Mode	SA
Key Path	Front-panel key

Bar Graph

Turns the bar graph On and Off.

Mode	SA
Remote Command	:DISPlay:CHPower:VIEW[1]:WINDow[1]:BGRaph ON OFF 1 0 :DISPlay:CHPower:VIEW[1]:WINDow[1]:BGRaph?
Example	:DISP:CHP:VIEW:WIND:BGR ON
Remote Command Notes	You must be in the SA mode to use this command. Use the INSTRument:SELEct SCPI command to set the mode.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	View/Display

Occupied Bandwidth Measurement

To configure measurement settings, select **Occupied BW** and then press **Meas Setup**. Pressing **Control/Sweep** enables you to pause or restart a measurement, or toggle between continuous and single measurement, refer to [“Control/Sweep” on page 146](#).

Occupied BW—OBW Measurement Description

Occupied Bandwidth integrates the power of the displayed spectrum and puts markers at the frequencies between which a selected percentage of the power is contained. The measurement defaults to 99% of the occupied bandwidth power. The power-bandwidth routine first computes the combined power of all signal responses contained in the trace. For 99% occupied power bandwidth, markers are placed at the frequencies on either side of 99% of the power. 1% of the power is evenly distributed outside the markers. The difference between the marker frequencies is the 99% power bandwidth and is the value displayed.

The occupied bandwidth measurement can be made in single or continuous sweep mode. The center frequency, reference level, and channel spacing must be set by the user.

To configure measurement settings, select **Occupied BW** and then press **Meas Setup**. Pressing **Control/Sweep** allows you to restart a measurement, refer to [“Control/Sweep” on page 146](#).

Mode	Spectrum Analyzer
Remote Command	:CONFigure:OBWidth
Example	CONF:OBW
Remote Command Notes	You must be in the Spectrum Analyzer mode to use this command. Use INSTRument:SELEct SA to set the mode.
Key Path	Meas, Occupied BW

Remote Measurement Results

To query the results of the measurement, the desired measurement has to be configured, initiated and then the measurement results can be queried using the CALCulate:DATA? command.

If you execute the remote command CALCulate:DATA? when the Occupied Bandwidth (OBW) measurement is active, the query will return 6 comma-separated scalar results in the following order:

Result #	Field Name	Description
1	Time Stamp Seconds	Time of measurement, instrument clock in seconds
2	Time Stamp Nanoseconds	Time of measurement, instrument clock in nanoseconds

Notes	You must be in the Spectrum Analyzer mode and in the OBW measurement in order to get the OBW results using this <code>CALCulate:DATA?query</code> .
Key Path	N/A. Function is only available remotely.

AMPTD Y Scale

AMPTD Y Scale key activates the reference level function, and accesses the amplitude menu keys. The amplitude menu keys set functions that affect the way data on the vertical axis is displayed or corrected.

Mode:	SA
Key Path	Front-panel key

Autoscale

Executes an automatic scaling of the **Reference Level** setting. Autoscale is a front panel only function and has no SCPI command.

Mode	SA
Key Path	AMPTD Y Scale, Autoscale

Reference Level

Sets the reference level value used for amplitude measurements. The reference level is the amplitude power or voltage represented by the top graticule line on the display. Changing the value of the reference level changes the absolute amplitude level of the top graticule line. The reference level (in selected amplitude units) can be set with the step keys, knob, or numeric keypad.

Mode	SA
Remote Command	<code>:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALE]:RLEVel <ampl></code> <code>:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALE]:RLEVel?</code>
Example	<code>:DISP:OBW:WIND:TRAC:Y:RLEV 10dBm</code>
Preset	0 dBm
State Saved	Saved in State

Spectrum Analyzer

Occupied Bandwidth Measurement

Min	-150 dBm
Max	100 dBm
Key Path	AMPTD Y Scale, Reference Level

Auto Range / Elec Atten / Internal preamp

Auto Range, the electronic attenuator and the internal preamp functionality is shared across all the Modes. See AMPTD/Y Scale in the Meas Off (Spectrum Analyzer mode) section for details about how they operate.

Ext Gain

The External Gain feature is shared across all the Modes. See the AMPTD/Y Scale in the Meas Off (Spectrum Analyzer mode) section for details about how it operates.

Scale/Div

Sets the logarithmic units per vertical graticule division on the display. This function is available only when the **Scale Type** key is set to **Log**.

Mode	SA
Remote Command	:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALE]:PDIVision <rel_ampl> :DISPlay:OBWidth:WINDow:TRACe:Y[:SCALE]:PDIVision?
Example	DISP:OBW:WIND:TRACe:Y:PDIV 10dB
Preset	10.00 dB / Div
State Saved	Saved in State
Range	1.0 to 20
Key Path	AMPTD Y Scale, Scale/Div

Scale Type

Sets the vertical scaling to logarithmic (**Log**) or linear (**Lin**). When **Scale Type (Log)** is selected, the vertical divisions are scaled in logarithmic units. **Scale Type (Lin)** scales the vertical divisions linearly, and sets the default amplitude units to volts.

Mode	SA
Remote Command	:DISPlay:OBWidth:WINDow:TRACe:Y[:SCALe]:SPACing LINear LOGarithmic :DISPlay:OBWidth:WINDow:TRACe:Y[:SCALe]:SPACing?
Example	DISP:OBW:WIND:TRAC:Y:PDIV LIN
Preset	Log
State Saved	Saved in State
Range	Log Lin
Key Path	AMPTD Y Scale, Scale Type

Y Axis Units

Displays the menu keys that enable you to change the vertical (Y) axis amplitude unit. The analyzer retains the entered Y Axis Units separately for both Log and Lin amplitude scale types. For example, if **Scale Type** has been set to Log, and you set **Y Axis Units** to dBm, pressing **Scale Type (log)** sets the **Y Axis Units** to dBm. If **Scale Type** has been set to Lin and you set **Y Axis Units** to V, pressing **Scale Type (Lin)** sets the Y Axis Units to V. Pressing **Scale Type (Log)** again sets the Y Axis Units back to dBm.

Mode	SA
Remote Command	:UNIT:OBWidth:POWer DBM DBMV DBUV V W A :UNIT:OBWidth:POWer?
Example	UNIT:OBW:POW DBMV
Preset	dBm (Scale Type = Log)
Range	dBm dBmV dBuV Watts Volts Amps
Key Path	AMPTD Y Scale, Y Axis Units

Spectrum Analyzer
Occupied Bandwidth Measurement

dBm Sets the amplitude unit for the selected amplitude scale (log/lin) to dBm.

Example	UNIT:OBW:POW DBM
Key Path	AMPTD Y Scale, Y Axis Units, dBm

dBmV Sets the amplitude unit for the selected amplitude scale (log/lin) to dBmV.

Example	UNIT:OBW:POW DBMV
Key Path	AMPTD Y Scale, Y Axis Units, dBmV

dB μ V Sets the amplitude unit for the selected amplitude scale (log/lin) to dB μ V.

Example	UNIT:OBW:POW DB micro V
Key Path	AMPTD Y Scale, Y Axis Units, dB μ V

Watts Sets the amplitude unit for the selected amplitude scale (log/lin) to watts.

Example	UNIT:OBW:POW W
Key Path	AMPTD Y Scale, Y Axis Units, Watts

Volts Sets the amplitude unit for the selected amplitude scale (log/lin) to volts.

Example	UNIT:OBW:POW V
Key Path	AMPTD Y Scale, Y Axis Units, Volts

Amps Sets the amplitude unit for the selected amplitude scale (log/lin) to Amperes.

Example	UNIT:OBW:POW A
Key Path	AMPTD Y Scale, Y Axis Units, Amps

Auto Tune

Auto Tune and Undo Auto Tune functionality is shared across all the Modes. For details about how Auto Tune operates, see [“Auto Tune” on page 53](#).

BW

Activates the resolution bandwidth function and displays the **Res BW** key.

Key Path	Front-panel key
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Res BW

Selects the 3.01 dB resolution bandwidth (RBW) of the analyzer in 10% steps from 10 Hz to 200 kHz, plus bandwidths of 250 kHz, 300 kHz, and 1, 3, or 5 MHz.

A # mark appears next to Res BW on the bottom of the analyzer display when it is not coupled. To couple the resolution bandwidth, press Res BW (Auto).

NOTE When measuring pulsed RF signals, set the RBW to less than 0.3 times the pulse repetition frequency (PRF). By keeping the $RBW < 0.3 \times PRF$, the analyzer will be making narrowband (“line mode”) measurements.

NOTE For applications that require 6 dB resolution bandwidths, it is possible to use an equivalent 3 dB resolution bandwidth. Because the analyzer has Gaussian RBW, the equivalent 6 dB bandwidth of any RBW filter can be determined using the following formula: $6 \text{ dB RBW} = 3 \text{ dB RBW} \times 1.414$. For example, if a 6 dB RBW of 100 kHz is required, the equivalent 3 dB RBW Filter would be $100 \text{ kHz} / 1.414 = 70.7 \text{ kHz}$. The closest RBW filter for the analyzer that would be used is 68 kHz.

Spectrum Analyzer

Occupied Bandwidth Measurement

Remote Command	<pre>[:SENSE] :OBwidth:BANDwidth BWIDth[:RESolution] <freq> [:SENSE] :OBwidth:BANDwidth BWIDth[:RESolution] ?</pre>
Example	<pre>BAND:RES 3MHz BAND:RES:AUTO OFF</pre>
Restrictions and Notes	If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.
Dependencies / Couplings	<p>Sweep time in non-zero span is coupled to RBW. As the RBW changes, the sweep time is changed to maintain amplitude calibration.</p> <p>When Res BW is set to Auto, resolution bandwidth is autocoupled to span. The factory default for the Span to RBW ratio is approximately 106:1 when auto coupled. When Res BW is set to Man, bandwidths are entered by the user, and these bandwidths are used regardless of other analyzer settings.</p>
Preset	5 MHz, ON
State Saved	Saved in instrument state.
Range	10 Hz to 200 kHz, plus bandwidths of 250 kHz, 300 kHz, and 1, 3, or 5 MHz
Key Path	BW, Res BW

Video BW

Lets you change the virtual post-detection filter (Video BW), which is implemented by averaging multiple FFTs.

Normally, **Video BW (Auto)** selects automatic coupling of the Video BW filter to the Resolution Bandwidth filter using the ratio set by the **VBW:RBW** key. To decouple the video bandwidth, press Video BW until Man is highlighted, or simply enter a new value.

When the **Video BW** is manually selected, it may be returned to the coupled state by pressing the **Video BW** key until **Auto** is highlighted. This may also be done by performing a **Mode Preset**.

If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected. The Video Bandwidths below 10 Hz are limited to integer values, and hence the E24 series does not hold below 10 Hz. 1 Hz resolution is the limitation here. The lowest Video BW will however still be 1 Hz.

Remote Command	<pre>[:SENSE] :BANDwidth BWIDth:VIDeo <freq> [:SENSE] :BANDwidth BWIDth:VIDeo?</pre>
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Example	BAND:VID 1 KHZ BAND:VID? BWID:VID:AUTO ON BWID:VID:AUTO? BAND:VID:AUTO OFF
Restrictions and Notes	If an unavailable bandwidth is entered with the numeric keypad, the closest available bandwidth is selected.
Dependencies / Couplings	When in Auto, Video BW should be set as close as possible to RBW times the VBW: RBW parameter
Preset	5 MHz ON
State Saved	Saved in instrument state.
Range	1 Hz, 2, 3, 4, 5, 6, 7, 8, 9, 10 then E24 Series; from 10, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91 Hz etc. up to 3 MHz, then 4, 5, 6, 8, 50 MHz
Key Path	BW

VBW:RBW

Selects the ratio between the Video Bandwidth and the Resolution Bandwidth to be used for setting Video BW when Video BW is in Auto.

Normally, **VBW:RBW (Auto)** selects automatic coupling of the **VBW:RBW** ratio to **Detector**. To decouple the ratio, press VBW:RBW until Man is underlined, or simply enter a new value.

When the VBW:RBW is manually selected, it may be returned to the coupled state by pressing the VBW:RBW key until **Auto** is highlighted. This may also be done by pressing **Auto Couple** or by performing a **Preset**.

Remote Command	[:SENSE] :BANDwidth BWIDth:VIDeo:RATio <real> [:SENSE] :BANDwidth BWIDth:VIDeo:RATio? [:SENSE] :BANDwidth BWIDth:VIDeo:RATio:AUTO OFF ON 0 1 [:SENSE] :BANDwidth BWIDth:VIDeo:RATio:AUTO?
Example	BAND:VID:RAT 2 BAND:VID:RAT? BAND:VID:RAT:AUTO 0 BAND:VID:RAT:AUTO?
Dependencies / Couplings	When set to AUTO, there is a 1:1 coupling between RBW and Video BW if either of them are set to AUTO.
Preset	1 ON

Spectrum Analyzer

Occupied Bandwidth Measurement

State Saved	Saved in Instrument State
Min	0.00001
Max	3000000
Key Path	BW

Control/Sweep

Accesses the sweep and sweep control settings that can be changed when using the OBW measurement.

Mode	SA
Key Path	Front-panel key

Sweep Time Query (Remote Command Only)

The sweep time value can be queried using the [:SENSe]:OBWidth:SWEEp:TIME? command. The OBW measurement is a Frequency Domain measurement only, so the Sweep Time key is disabled (not available) in the OBW measurement.

Mode	SA
Remote Command	[:SENSe]:OBWidth:SWEEp:TIME?
Example	OBW:SWE:TIME?
Notes	In OBW measurement (Frequency Domain measurement), you can only query the “sweep” time. Trying to set the Sweep Time will generate a system error message
Dependencies / Couplings	Sweep time is coupled to RBW and Span. It is also impacted by the number of sweep points, so changing those parameters may change the sweep time.
Preset	The default value is auto-calculated. This default value will depend upon the span of the analyzer, which could be either 2.9999 GHz or 5.9999 GHz
Key Path	N/A - Remote Feature Only

Restart, Single, Cont

The sweep control functionality is shared across all the Modes. See the “Control/Sweep” on page 146 section for details about how they operate.

FREQ Channel

The frequency/channel functionality is shared across all the Modes. For details about how it operates, see “FREQ Channel” on page 59

Marker

Accesses the marker control keys which select the type and number of markers and turns them on and off. Markers are diamond-shaped characters that identify points of traces. Up to four pairs of markers may appear on the display simultaneously; only one pair can be controlled at a time. The marker that is controlled is called the “active” marker. Pressing Marker activates the Normal menu key.

Marker

Selects one of four possible markers. A marker that has already been turned on will become active when it is selected. If a marker has been turned on and assigned to a specific trace, it will become active on that trace if that marker is selected.

Mode	SA
State Saved	Saved in State
Key Path	Front-panel key

Marker Type

Sets the marker type to normal or delta.

Mode	SA
Remote Command	:CALCulate:OBWidth:MARKer [1] 2 3 4 :MODE OFF POSition DELTa :CALCulate:OBWidth:MARKer [1] 2 3 4 :MODE?
Preset	NORMAL
Key Path	Marker, Marker Type

Spectrum Analyzer Occupied Bandwidth Measurement

Normal Activates a single marker at the center of the display.

Mode	SA
Example	CALC:OBW:MARK2:MODE NORM selects marker 2 in NORM mode
Key Path	Marker, Normal

Delta Activates a pair of markers, one of which is fixed at the current marker location. The other marker can then be moved around on the trace. The marker readout shows the difference between the two markers.

NOTE Pressing Delta moves the reference marker to the active marker position, so you can make delta measurements from differing reference points without having to turn off the markers and begin again.

Mode	SA
Example	CALC:OBW:MARK:MODE DELT selects marker 1 in Delta mode
Key Path	Marker, Delta

Off Turns the selected marker off.

Mode	SA
Example	CALC:OBW:MARK3:MODE OFF selects marker 3 and turns it off
Key Path	Marker, Off

Marker Trace

Assigns a marker to a trace. Pressing **Marker Trace** will activate a marker on trace 1 if there are no markers turned on. If a marker is currently active, press **Marker Trace** until **1**, **2**, **3**, or **4** is underlined. The active marker will be moved to the selected trace.

Mode	SA
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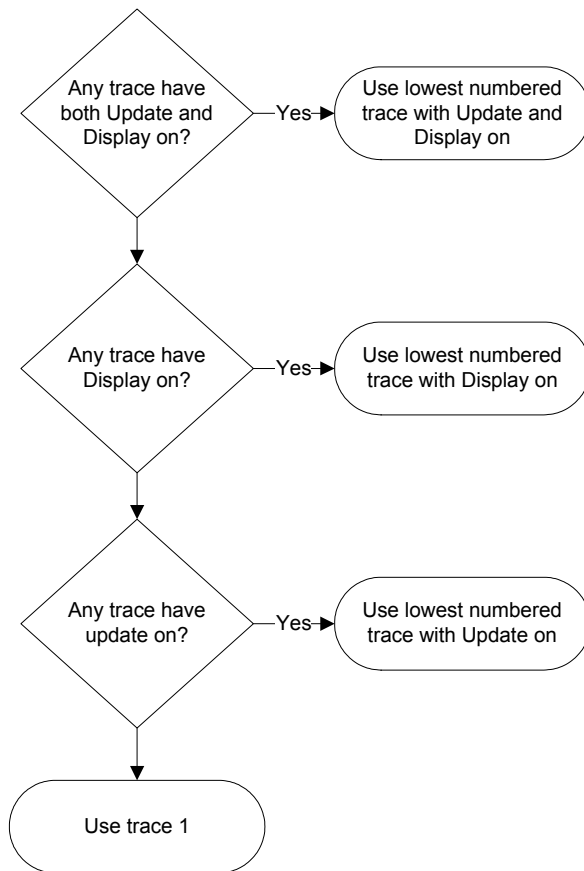
Remote Command	<pre> :CALCulate:OBWidth:MARKer [1] 2 3 4 :TRACe <integer> :CALCulate:OBWidth:MARKer [1] 2 3 4 :TRACe? :CALCulate:OBWidth:MARKer [1] 2 3 4 :TRACe:AUTO OFF ON 0 1 :CALCulate:OBWidth:MARKer [1] 2 3 4 :TRACe:AUTO? </pre>
Example	<pre> CALC:OBW:MARK2:TRAC 4 CALC:OBW:MARK2:TRAC:AUTO OFF </pre>
Dependencies / Couplings	This key is only available on measurements that have multiple traces.
Preset	Trace selection is preset to Auto, so the default trace depends on the available traces and the predefined order of selection.
State Saved	Saved in State
Range	The number of traces available to put a marker on, varies depending on the current selected measurement. In the OBW measurement, 4 traces are available.
Key Path	Marker, Marker Trace

Auto Init

Turns automatic initiate On or Off. When **Auto Init** is set to On the marker's trace attribute is automatically determined by the analyzer whenever the marker turns on (Normal or Delta) from an Off state. Auto Init is set to On at **Preset** or **All Markers Off**. The following flowchart depicts the Auto Init rules:



Spectrum Analyzer Occupied Bandwidth Measurement



Mode	SA
Remote Command Notes	Front panel capability Only
Key Path	Marker, Auto Init

Marker X Axis Value

Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off**, but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Mode	Spectrum Analyzer
Remote Command	:CALCulate:OBwidth:MARKer [1] 2 3 4 :X <real> :CALCulate:OBwidth:MARKer [1] 2 3 4 :X?

Example	CALC:OBW:MARK3:X 1GHz activates the Marker3 and positions it on the trace at 1GHz.
Restriction and Notes	<p>Remotely, if no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” will be generated.</p> <p>The query returns the marker’s absolute X Axis value if the control mode is Normal, or the offset from the marker’s reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency and Inverse Time, seconds for Period and Time. If the marker is Off the response is not a number (NAN).</p>
Dependencies / Couplings	Marker X parameter is coupled with the Start/Stop of the X Axis scale and by the number of sweep points used by the measurement.
Remote Command Notes	You must be in the SA mode to use this command. Use INSTRUMENT:SELEct to set the mode.
Preset	<p>After a preset, all Markers are turned OFF, so Marker X Axis Value query will return a not a number (NAN). If Marker X is queried with no value sent first but if the Marker is active, the Frequency center of screen value will be returned. Note that per default after a preset, the trace domain is frequency.</p> <p>As well, the default Marker X Axis value will be depending on the frequency range of the instrument. For the 6 GHz Instrument only (Option 506), 3.00005 GHz is correct. For a 3 GHz Instrument (Option 503), the default is 1.50005 GHz.</p>
State Saved	No
Min	<p>In Frequency Domain, per default, Start Frequency (starting point of the Frequency X axis scale) is 100 kHz, so the Marker X Axis Min value that can be entered is 100 kHz.</p> <p>The Marker X Axis Min Value that can be used is –35 MHz (it’s the minimum value that the Start Freq can accept)</p>
Max	<p>In Frequency Domain, per default, for a 6 GHz Instrument, Stop Frequency (ending point of the Frequency X axis scale) is 6 GHz, so the Marker X Axis Max value that can be entered is 6 GHz.</p> <p>The Marker X Max Value that can be used is 3.02 GHz for a 3 GHz Instrument and 6.02 GHz for 6 GHz Instrument (they are the maximum values that the Stop Freq can accept)</p>
Key Path	Marker, Normal

Marker X Axis Position

Sets the marker X position in trace points. It has no effect if the control mode is **Off**, but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Spectrum Analyzer

Occupied Bandwidth Measurement

Remote Command	:CALCulate:OBwidth:MARKer[1] 2 3 4:X:POSition <real> :CALCulate:OBwidth:MARKer[1] 2 3 4:X:POSition?
Example	CALC:OBW:MARK2:X:POS 300
Restriction and Notes	The query returns the marker's absolute X Axis value in trace points if the control mode is Normal , or the offset from the marker's reference marker in trace points if the control mode is Delta . If the marker is Off the response is not a number (NAN).
Remote Command Notes	You must be in the SA mode to use this command. Use INSTRument:SELEct to set the mode.
Preset	Center of screen - Number of sweep points per default is 401(X position scale goes from 0 to 400), so the default center position is 200
State Saved	No
Min	0
Max	This Max value will clip to the value set for the number of sweep points. Per default, this number is 401. The max value that can be entered for the number of sweep points is 1001, so the Max value that could be reached for this Marker X Axis position is 1000.

Marker Y Axis Value

Returns the marker Y Axis value in the current marker Y Axis unit.

The “result” of a marker is the value which is displayed on the second line of the Marker Result block. To properly interpret the returned value the remote programmer must also know what the analyzer's Y-Axis Unit is set to as described below.

A marker can have up to two results, only one of which is displayed or returned on a query, as follows:

Absolute result: every marker has an absolute result and it is simply:

For Normal and Delta markers, the Y-axis value of the trace point the marker is currently on.

The absolute result is displayed in the result block or returned on a query unless the marker control mode is **Delta**.

Relative result: if a marker's control mode is **Delta**, the relative result is displayed in the result block or returned on a query. This is the difference between the Absolute Result of a delta marker (expressed in dBm) to the Absolute Result of its reference marker (expressed in dBm). The difference is expressed in dB.

Mode	Spectrum Analyzer
Remote Command	:CALCulate:OBwidth:MARKer[1] 2 3 4:Y?

Example	CALC:OBW:MARK2:Y?
Restriction and Notes	The query returns the marker Y-axis result. If the marker is Off the response is not a number.
Remote Command Notes	You must be in the SA mode to use this command. Use INSTRUMENT:SELEct to set the mode.
Preset	Current Marker Y Axis value in the marker Y Axis unit
State Saved	No
Min	-150 dBm (Smallest value that the query could return if Y Axis uses dBm as unit)
Max	100 dBm (Highest value that the query could return if Y Axis uses dBm as unit)
Key Path	N/A – Remote Feature Only

Marker Readout

Accesses a menu that enables you to affect how the X Axis information for the selected marker is displayed in the marker area (top-right of display) and the active function area of the display and how the marker is controlled. The available settings for the X Axis Scale are Frequency, Period, Time, and Inverse Time.

Mode	Spectrum Analyzer with Meas OFF
Remote Command	:CALCulate:OBWidth:MARKer [1] 2 3 4 :X:READout FREQuency TIME ITIME PERiod :CALCulate:OBWidth:MARKer [1] 2 3 4 :X:READout?
Restriction and Notes	“Inverse Time” is not a valid parameter in Frequency Domain, so in the Occupied Bandwidth measurement, the “Inverse Time” menu key is always grayed out.
Remote Command Notes	:CALCulate:OBWidth:MARKer [1] 2 3 4 :X:READout ITIME will return -221, “Settings Conflict” system error message and will not have any effect on the “Marker Readout” setting.
Preset	FREQuency
State Saved	Saved in instrument state.
Range	Frequency Period Time Inverse Time
Key Path	Marker, More 1 of 2

Spectrum Analyzer

Occupied Bandwidth Measurement

Frequency Sets the Marker Readout (Marker X Axis scale) to Frequency, displaying the absolute frequency of a normal marker or the frequency of the delta marker relative to the reference marker.

Mode	Spectrum Analyzer
Remote Command	See details in “Marker Readout (Marker X Axis Scale Type)” Table described above
Example	CALC:OBW:MARK2:X:READ FREQ sets marker 2 with a Marker Readout type (Marker X Axis scale) to Frequency.
Key Path	Marker, More 1 of 2, Marker Readout

Period Sets the Marker Readout (Marker X Axis scale) to Period, displaying the reciprocal of the frequency of the marker, or the reciprocal of the frequency separation of the two markers in a delta-marker mode. The units are those of time (sec, msec, etc.)

Mode	Spectrum Analyzer
Remote Command	See details in “Marker Readout (Marker X Axis Scale Type)” Table described above
Example	CALC:OBW:MARK2:X:READ PER sets marker 2 with a Marker Readout type (Marker X Axis scale) to Period.
Restriction and Notes	In the Frequency Domain, note the following equation: Period Marker Readout = 1 / Frequency Marker Readout In a delta marker mode, if the markers are at the same frequency, the result will be the reciprocal of 0, which is infinitely large. The display will show “---” and a SCPI query will return not a number (NAN).
Key Path	Marker, More 1 of 2, Marker Readout

Time Sets the Marker Readout (Marker X Axis scale) to Time, displaying the time interval between a normal marker and the start of a sweep or the time of the delta marker relative to the reference marker. Time is the auto setting for time domain traces. In a delta-marker mode it is the (sweep) time interval between the two markers.

Mode	Spectrum Analyzer
Remote Command	See details in “Marker Readout (Marker X Axis Scale Type)” Table described above
Example	CALC:OBW:MARK2:X:READ TIME sets marker 2 with a Marker Readout type (Marker X Axis scale) to Time.

Restriction and Notes	In the Frequency Domain, note the following equation: $\text{Time Marker Readout} = (\text{Frequency Marker Readout} * \text{SweepTime}) / \text{Default Freq Stop}$
Key Path	Marker, More 1 of 2, Marker Readout

Inverse Time Not available in Occupied Bandwidth measurement.

Mode	Spectrum Analyzer
Remote Command	See details in “Marker Readout (Marker X Axis Scale Type)” Table described above
Example	CALC:OBW:MARK2:X:READ ITIM return -221, “Settings Conflict” system error message and leave the “Marker Readout” setting the Marker2 unchanged.
Restriction and Notes	“Inverse Time” parameter is not available in the Frequency Domain, so in the Occupied Bandwidth measurement, the “Inverse Time” menu key is always grayed out.
Key Path	Marker, More 1 of 2, Marker Readout



Marker All Off

Turns off all the markers on all traces.

Mode	SA
Remote Command	:CALCulate:OBWidth:MARKer:AOff
Remote Command Notes	CALC:OBW:MARK:AOff
Key Path	Marker, Marker All Off

Marker ->

Accesses the marker function menu keys that change value of center frequency or reference level to the current value of the selected marker.

Mode	SA
Key Path	Front-panel key

Mkr -> CF

Sets the center frequency equal to the specified marker frequency, which moves the marker to the center of the screen. In delta marker mode, the center frequency is set to the marker delta value. This feature is not available in zero span.

Mode	SA
Remote Command	:CALCulate:OBwidth:MARKer [1] 2 3 4 [:SET] :CENTer
Example	CALC:OBW:MARK2:SET:CENT
Key Path	Marker ->, Mkr -> CF

Mkr -> RL

Sets the reference level to the amplitude of the specified marker. In delta marker mode, the reference level is set to the amplitude difference between the markers. (For example, if the difference is -15 dB, the reference level will be set to -15 dBm.)

Mode	SA
Remote Command	:CALCulate:OBwidth:MARKer [1] 2 3 4 [:SET] :RLEVel
Example	CALC:OBW:MARK2:SET:RLEV
Key Path	Marker ->, Mkr -> RL

Meas

The **Meas** key displays a menu that lets you make one-button measurements such as the occupied bandwidth measurement. In the Spectrum Analyzer mode (see [“Spectrum Analyzer” on page 43](#)), Measurements Off is the default measurement. You must select Occupied BW. The measurement runs using the current default setup. Or you can change settings for your unique measurement requirements.

Settings can be changed for these measurements using the functions under the Meas Setup key (see [“Meas Setup” on page 157](#)).

Mode:	All
Key Path	Front-panel key

Meas Setup

In the Spectrum Analyzer mode, **Meas Setup** accesses a menu of keys associated with the current measurement. To access the following keys for setting up an Occupied BW measurement, you must have that measurement selected. Press **Meas, Occupied BW** to select the measurement.

Mode:	SA
Key Path	Front-panel key

Avg Mode

Averaging functions are the same as defined in the Spectrum Analyzer measurement, but the parameter values are measurement dependent. Therefore, the remote commands are different.

Sets the type of termination control used for the averaging function. This determines the averaging action after the specified number of measurements (see **Avg Number**) has been reached.

Mode	SA
Remote Command	[:SENSe] :OBWidth:AVERage:TCONtrol EXPonential REPeat RMAXhold [:SENSe] :OBWidth:AVERage:TCONtrol?
Example	AVER:OBW:TCON REP
Preset	EXPonential
State Saved	Saved in instrument state.
Range	Exponential Repeat Repeat Max Hold
Key Path	Meas Setup, Avg Mode

Exponential Sets the **Avg Mode** function to exponential. With exponential averaging mode, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Example	AVER:OBW:TCON EXP
Key Path	Meas Setup, Avg Mode, Exponential

Spectrum Analyzer

Occupied Bandwidth Measurement

Repeat Sets **Avg Mode** to the repeat function. Repeat averaging shows resulting data after the selected number of sweeps has been averaged, then clears the data before repeating the process.

NOTE With large average counts and/or slow traces, the trace from the last completed result remains on the display while **Repeat** averaging is running – the trace is not updated until the last average count has been reached.

Example	AVER:OBW:TCON REP
Key Path	Meas Setup, Avg Mode, Repeat

Repeat Max Hold Sets **Avg Mode** to repeat with max hold function. Repeat with max hold captures and holds the highest magnitude data at the end of each sweep count.

NOTE With large average counts and/or slow traces, the trace from the last completed result remains on the display while **Repeat Max Hold** is running – the trace is not updated until the last average count has been reached. (Maximum data points are held with each consecutive sweep)

Example	AVER:OBW:TCON RMAX
Key Path	Meas Setup, Avg Mode, Repeat Max Hold

Avg Number

Sets the average count number (the number of sweeps) used with measurement averaging.

Mode	SA
Remote Command	[:SENSE] :OBWidth:AVERage:COUNT <integer> [:SENSe] :OBWidth:AVERage:COUNT?
Example	AVER:OBW:COUN 50
Preset	100
Min	1
Max	4096
Key Path	Meas Setup, Avg Number

Avg Type

Accesses averaging settings that determine how the signal will be measured. You can set the measurement to logarithmic (video) scaling, or power (RMS) scaling.

Mode	SA
Remote Command	[:SENSe] :OBWidth:AVERAge:TYPE RMS LOG [:SENSe] :OBWidth:AVERAge:TYPE?
Example	AVER:OBW:TYPE RMS
Preset	LOG
Preset	Log-Pwr Avg (Video)
State Saved	Saved in instrument state.
Range	Log-Pwr Avg (Video) Pwr Avg (RMS)
Key Path	Meas Setup, Avg Type

Log-Pwr Avg (Video) Sets the logarithmic (decibel) scale for all filtering and averaging processes. This scale is also referred to as “Video” because it is the most common display and analysis scale for the video signal within a spectrum analyzer.

Example	AVER:OBW:TYPE LOG
Key Path	Meas Setup, Avg Type, Log-Pwr Avg (Video)

Pwr Avg (RMS) Sets the signal power level (the square of the magnitude) as the scale for the filtering and averaging processes. This scale is sometimes called RMS because the resulting voltage is proportional to the square root of the mean of the square of the voltage.

Example	AVER:OBW:TYPE RMS
Key Path	Meas Setup, Avg Type, Pwr Avg (RMS)

Limit Masks

Displays the Limit Masks submenu keys. It is possible to select and configure either Limit Mask 1 (Upper) or Limit Mask 2 (Lower).

Spectrum Analyzer

Occupied Bandwidth Measurement

Mode	Spectrum Analyzer
Dependencies / Couplings	<p>The Limit Mask 1 (Upper) menu link key accesses the keys to configure the upper limit mask for the Center, 1st, or 2nd segments (dependent on selected segment).</p> <p>The Limit Mask 2 (Lower) menu link key accesses the keys to configure the lower limit mask for the Center, 1st, or 2nd segments (dependent on selected segment).</p>
State Saved	Saved in instrument state.
Key Path	Meas Setup, Limit Masks

Limit Mask 1 (upper) or Limit Mask 2 (Lower)

Limit Mask 1 (upper) access the upper limit mask keys.

Limit Mask 2 (Lower) access the lower limit mask keys.

You can define a limit mask that matches your maximum or minimum measurement requirements. This mask can then be compared with the measured trace data to determine pass/fail conditions.

Limit Trace

Selects the trace to which the currently selected limit mask (1 or 2) will be applied. The limit masks can be applied to separate traces. Only 2 traces are available in the Stimulus Response mode (compared to 4 traces in the Spectrum Analyzer Mode).

Mode	SA
Remote Command	<pre>:CALCulate:OBWidth:LMASK[1] 2:TRACe 1 2 3 4 :CALCulate:OBWidth:LMASK[1] 2:TRACe?</pre>
Example	<pre>:CALC:OBW:LMAS1:TRAC 2</pre>
Dependencies / Couplings	The limit mask is always displayed when the center segment is turned on; even if the trace to which it is being applied is blanked ('Show' set to Off).
Preset	1
State Saved	Saved in instrument state.
Range	1 2
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Limit Mask Trace

Segment (Center, 1st or 2nd)

Selects the **Center**, **1st** or, **2nd** segment for limit mask 1 or 2. With each segment setting, the Limits menu is updated to show the span and level settings available for the currently selected segment

Mode	SA
Dependencies / Couplings	Key menu structure is dependent on selected segment.
Remote Command Notes	The Limit Mask SCPI command syntax uses: The keyword “CENTer” to define the Center segment level and span. The keyword “FIRSt” to define the 1 st segments left and right level and span. The keyword “SECOnd” to define the 2 nd segments left and right level and span.
Preset	Center
State Saved	Saved in instrument state.
Range	Center 1st 2nd
Key Path	Meas Setup, Limit Mask 1, Segment (Center, 1st or 2nd)

Center Segment

Segments (Center) Sets the state of the center segment to On or Off. This key is available only when Center has been selected with the Segments key.

Mode	SA
Remote Command	:CALCulate:OBWidth:LMASK [1] 2 :SEGment:CENTer [:STATe] ON OFF 1 0 :CALCulate:OBWidth:LMASK [1] 2 :SEGment:CENTer [:STATe] ?
Example	:CALC:OBW:LMAS1:SEGM:CENT ON
Restrictions and Notes	Key is only displayed when the selected segment is Center.
Dependencies / Couplings	If Off no limit mask will be displayed even if the 1 st or 2 nd segments are turned On. If On the center segment is drawn on the display centered around the current center frequency.
Preset	OFF
State Saved	Saved in instrument state.

Spectrum Analyzer

Occupied Bandwidth Measurement

Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment

Level: Center

Sets the power level for the center segment of the current selected limit mask. This key is available only when Center has been selected with the Segments key.

Mode	SA
Remote Command	:CALCulate:OBwidth:LMASK [1] 2:SEGment:CENTer:LEVel <ampl> :CALCulate:OBwidth:LMASK [1] 2:SEGment:CENTer:LEVel?
Example	:CALC:OBW:LMAS2:SEGM:CENT:LEV -20.0 dBm
Notes	Key is only displayed when the selected segment is Center.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	-10.0 dBm
State Saved	Saved in instrument state.
Min	-175.0 dBm
Max	100.0 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment Level
Default Unit	dBm

Span: Center

Sets the frequency span for the center segment of the currently selected limit mask. This key is only available when Center has been selected with the Segment key.

Mode	SA
Remote Command	:CALCulate:OBwidth:LMASK [1] 2:SEGment:CENTer:SPAN <frequency> :CALCulate:OBwidth:LMASK [1] 2:SEGment:CENTer:SPAN?
Example	:CALC:OBW:LMAS1:SEGM:CENT:SPAN 1.75 MHz
Notes	Key is only displayed when the selected segment is Center.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.

Min	0 Hz
Max	6 GHz
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment Span
Default Unit	Hz

1st Segment

Sets the state of the first segment to On or Off. This key is available only when **1st** has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:OBWidth:LMASK[1] 2:SEGment:FIRSt ON OFF 1 0 :CALCulate:OBWidth:LMASK[1] 2:SEGment:FIRSt?
Example	:CALC:OBW:LMAS1:SEGM:FIRS ON
Notes	Key is only displayed when the selected segment is 1 st .
Dependencies / Couplings	If Off the 2 nd limit mask segment will not be displayed even if turned On. If On and the Center segment is On: The left hand side 1 st segment is drawn to the left hand side of the center segment at the specified power level. The right hand side 1 st segment is drawn to the right hand side of the center segment at the specified power level. For both left and right 1 st segments when On. If the 2 nd segment is Off the 1 st segment extends so the total limit mask span is equal to the current frequency span. If the 2 nd segment is On the left and right 1 st segments use the specified span values.
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment

1st Segment (Left or Right Limits)

Sets **1st Segment** to allow definition of the limits Left or Right of the center segment. The Left or Right amplitude



Spectrum Analyzer

Occupied Bandwidth Measurement

limits can be changed with the **Level** key. The Left or Right span limits can be changed with the limits menu **Span** key. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
Notes	Key is only displayed when the selected segment is 1 st .
Remote Command Notes	The Limit Mask SCPI command syntax uses: The keyword “LEFT” to define the level and span for the segment to the Left of the center segment. The keyword “RIGHT” to define the level and span for the segment to the Right of the center segment.
Preset	Not affected by a preset but set per default to Left after a power cycling
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment (Left or Right Limits)

Level: 1st Segment Left

Sets the power level, for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:OBWidth:LMASK [1] 2:SEGment:FIRSt:LEFT:LEVel <ampl> :CALCulate:OBWidth:LMASK [1] 2:SEGment:FIRSt:LEFT:LEVel?
Example	:CALC:OBW:LMAS:SEGM:FIRS:LEFT:LEV -14 dBm
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Left.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	Not affected by a preset but set per default to -10 dBm after a power cycling
State Saved	Saved in instrument state.
Min	-175.0 dBm
Max	100.0 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Left Level
Default Unit	dBm

Level: 1st Segment Right

Sets the power level, for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:OBWidth:LMASK [1] 2:SEGment:FIRSt:RIGHT:LEVel <ampl> :CALCulate:OBWidth:LMASK [1] 2:SEGment:FIRSt:RIGHT:LEVel ?
Example	:CALC:OBW:LMAS:SEGM:FIRS:RIGH:LEV -14 dBm
Notes	Key is only displayed when the selected segment is 1 st and the selected segment side is Right.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	Not affected by a preset but set per default to -10 dBm after a power cycling
State Saved	Saved in instrument state.
Min	-175.0 dBm
Max	100.0 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Right Level
Default Unit	dBm

Span: 1st Segment Left

Sets the frequency span for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:OBWidth:LMASK [1] 2:SEGment:FIRSt:LEFT:SPAN <frequency> :CALCulate:OBWidth:LMASK [1] 2:SEGment:FIRSt:LEFT:SPAN?
Example	:CALC:OBW:LMAS1:SEGM:FIRS:LEFT:SPAN 1.75 MHz
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Left.
Dependencies / Couplings	If the Center, 1 st , and 2 nd segments are On, the left 2 nd segment span adjusts on a change in the left 1 st segment span.

Spectrum Analyzer Occupied Bandwidth Measurement

Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.
Min	0 Hz
Max	See Restriction & Notes
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Left Span
Default Unit	Hz

Span: 1st Segment Right

Sets the frequency span for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	SA
Remote Command	:CALCulate:OBWidth:LMASK [1] 2 :SEGment :FIRSt :RIGHT :SPAN <frequency> :CALCulate:OBWidth:LMASK [1] 2 :SEGment :FIRSt :RIGHT :SPAN?
Example	:CALC:OBW:LMAS1:SEGM:FIRS:RIGH:SPAN 1.75 MHz
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Right.
Dependencies / Couplings	If the Center, 1 st , and 2 nd segments On, the right 2 nd segment span adjusts on a change in the right 1 st segment span.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.
Min	0 Hz
Max	See Dependencies / Couplings “1st Segment” on page 163 .
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Right Span
Default Unit	Hz

2nd Segment

Sets the state of the first segment to On or Off. This key is available only when 2nd has been selected with the Segments key.

Mode	SA
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Remote Command	:CALCulate:OBWidth:LMASK [1] 2:SEGMent:SECond ON OFF 1 0 :CALCulate:OBWidth:LMASK [1] 2:SEGMent:SECond?
Example	:CALC:OBW:LMAS1:SEGM:SEC ON
Notes	Key is only displayed when the selected segment is 2 nd .
Dependencies / Couplings	If Off the 2 nd limit mask segment will not be displayed even if turned On. If On, and the First and Center segments are On: The left hand side 2 nd segment is drawn to the left hand side of the left first segment at the specified power level The right hand side 1 st segment is drawn to the right hand side of the right first segment at the specified power level
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment

2nd Segment (Left or Right Limits)

Sets the 2nd segment to allow definition of the limits Left or Right of the center segment for the 2nd Segment. The Left or Right amplitude limits can be changed with the **Level** key. This key is only available when **2nd** has been selected with the **Segments** key.

Mode	SA
Notes	Key is only displayed when the selected segment is 2 nd .
Dependencies / Couplings	The Left span is calculated as follows: $(<\text{maximum span}>/2) - (<\text{center segment span}>/2) - <\text{first segment left span}>$ The Right span is calculated as follows: $(<\text{maximum span}>/2) - (<\text{center segment span}>/2) - <\text{first segment right span}>$ Where <maximum span> is the maximum frequency span of the instrument (3 GHz or 6 GHz)

Spectrum Analyzer

Occupied Bandwidth Measurement

Remote Command Notes	The Limit Mask SCPI command syntax uses: The keyword “LEFT” to define the level and span for the second segment to the Left of the center segment. The keyword “RIGHT” to define the level and span for the second segment to the Right of the center segment.
Preset	Not affected by a preset but set per default to Left after a power cycling.
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment (Left or Right Limits)

Level: 2nd Segment Left

Sets the power level, for the 2nd segment to the Left of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Spectrum Analyzer
Remote Command	:CALCulate:OBwidth:LMASK [1] 2:SEGment:SECond:LEFT:LEVel <ampl> :CALCulate:OBwidth:LMASK [1] 2:SEGment:SECond:LEFT:LEVel?
Example	:CALC:OBW:LMAS:SEGM:SEC:LEFT:LEV -39 dBm
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Left.
Preset	Not affected by a preset but set per default to -10 dBm after a power cycling
State Saved	Saved in instrument state.
Min	-175 dBm
Max	100 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment: Left Level
Default Unit	dB

Level: 2nd Segment Right

Sets the power level, for the 2nd segment to the Right of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	SA
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Remote Command	:CALCulate:OBWidth:LMASK [1] 2 : SEGment : SECond: RIGHt : LEVel <ampl> :CALCulate:OBWidth:LMASK [1] 2 : SEGment : SECond: RIGHt : LEVel ?
Example	:CALC:OBW:LMAS:SEGM:SEC:RIGH:LEV -39 dBm
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Right.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	Not affected by a preset but set per default to -10 dBm after a power cycling.
State Saved	Saved in instrument state.
Min	-175.0 dBm
Max	100.0 dBm
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment: Right Level
Default Unit	dBm

Sensitivity

The sensitivity setting changes how the auto-range algorithm is applied to input signals. The default setting is High, which optimizes dynamic range but may introduce distortion with large signal levels. Setting sensitivity to Low removes signal distortion, but may decrease dynamic range.

Mode	SA
Remote Command	[:SENSe] :OBWidth:POWer:SENSitivity LOW HIGH [:SENSe] :OBWidth:POWer:SENSitivity?
Preset	High
Range	Low High
Key Path	Meas Setup, Sensitivity

Trigger

The Trigger features are only available in zero span. In non-zero span, the trigger type is always free run.

Power

Sets the percentage of total input signal power used when determining the occupied bandwidth.

Mode	SA
Remote Command	<code>[:SENSE] :OBwidth:PERCent <percent></code> <code>[:SENSE] :OBwidth:PERCent?</code>
Preset	99%
State Saved	Saved in instrument state.
Min	10
Max	99.9
Key Path	Meas Setup, Power

Peak Search

Accesses the marker peak functions and places a marker on the highest peak of the currently selected trace.

Mode	SA
Remote Command	<code>:CALCulate:OBwidth:MARKer [1] 2 3 4 :MAXimum</code>
Example	<code>:CALC:OBW:MARK2:MAX</code>
Key Path	Front-panel key

Next Peak

Places the selected marker on the next highest signal peak from the current marked peak.

Mode	SA
Remote Command	<code>:CALCulate:OBwidth:MARKer [1] 2 3 4 :MAXimum:NEXT</code>
Example	<code>CALC:OBW:MARK2:MAX:NEXT</code>
Key Path	Peak Search, Next Peak,

Span/X Scale

Activates the span functions menu.

Mode	All
Preset	Full span (depends on hardware present – options)
State Saved	Saved in State
Key Path	Front-panel key

Span

Changes the displayed frequency range symmetrically about the center frequency.

In the OBW measurement, since the measurement is a Frequency Domain measurement only, you will not be able to enter 0 Hz as a minimum span. The Span value will clip to 1 kHz at the lower range.

Mode	SA
Remote Command	<code>[:SENSe] :OBWidth:FREQuency:SPAN <frequency></code> <code>[:SENSe] :OBWidth:FREQuency:SPAN?</code>
Example	OBW:FREQ:SPAN 2MHz
Remote Command Notes	Preset and Max values are dependent on Hardware (Options 503 & 506)
Preset	2.9999 GHz (Option 503) 5.9999 GHz (Option 506)
State Saved	Saved in State
Range	1 kHz to 3.00 GHz (Option 503) 1 kHz to 6.00 GHz (Option 506)
Key Path	Span/X Scale, Span

Full Span

Changes the displayed frequency span to show the full frequency range of the analyzer.

Mode	SA
Remote Command	<code>[:SENSe] :OBWidth:FREQuency:SPAN:FULL</code>

Spectrum Analyzer

Occupied Bandwidth Measurement

Example	OBW:FREQ:SPAN:FULL
Preset	Full Span
Key Path	Span/X Scale, Full Span

Zero Span

In the OBW measurement, this function is not available and the key is disabled. The OBW measurement is a Frequency Domain measurement. You can not work in the Time Domain in this measurement.

Mode	SA
Example	OBW:FREQ:SPAN 0 sets the Span to its minimum Frequency span value (1 kHz for OBW).
Key Path	None

Last Span

Changes the displayed frequency span to the previous span setting. There is no memory of the last span after a power off or a mode preset.

Mode	SA
Remote Command	[:SENSE] :OBwidth :FREQuency :SPAN :PREVIOUS
Example	OBW:FREQ:SPAN:PREV
Key Path	Span/X Scale, Last Span

Trace/Detector

Accesses the trace and detector settings that can be changed when using the Occupied BW measurement.

Mode	SA
Key Path	Front-panel key

Select Trace, Clear Write, Trace Average, Max Hold, Min Hold, View/Blank, Clear Trace, Clear All Traces

The trace features are shared across all the measurements in the Spectrum Analyzer Mode. For details

about how they operate, see “Trace/Detector” on page 100.

Mode	SA
Key Path	Trace/Detector

Detector Function

Accesses the detector menu keys where you can select **Auto**, **Peak**, **Sample**, **Negative Peak**, or **Average**.

The detector features are shared across all the measurements in the Spectrum Analyzer Mode. See the Trace/Detector section for details about how they operate.

NOTE	<p>For accurate OBW measurements, it is recommended that you use the sample or average trace detectors. The default detector is the Average detector.</p> <p>You can also use other detectors like peak, or negative peak. The analyzer in this case will provide a correction to the result to improve the accuracy of the OBW Power measurement. This correction is calculated under the assumption that the signal has gaussian time domain statistics. Consequently, the measurement may be in error when this assumption is violated (for example: when measuring a CW signal).</p>
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Mode	SA
Remote Command	<pre>[:SENSE] :OBWidth:DETECTOR [:FUNCTION] AVERage POSitive SAMPlE NEGative [:SENSE] :OBWidth:DETECTOR [:FUNCTION] ? [:SENSE] :OBWidth:DETECTOR:AUTO OFF ON 0 1 [:SENSE] :OBWidth:DETECTOR:AUTO?</pre>
Example	<pre>OBW:DET AVER sets the detector to average. OBW:DET:TRAC:AUTO ON</pre>

Spectrum Analyzer

Occupied Bandwidth Measurement

Remote Command Notes The query returns a name that corresponds to the detector type as shown below, and indicates the setting for the specified trace. The RMS selection is identical to AVERage. If RMS has been selected, the query will return the “AVER” string.

String Returned	Definition
AVER	Average/RMS
POS	Positive peak
SAMP	Sample
NEG	Negative peak

Preset Preset returns all traces to “auto” detector.
 The type of detection used depends on the trace type. Since the preset trace type is Clear/Write, the auto detector is “Average”.

State Saved Saved in State

Range Peak | Sample | Negative Peak | Average (RMS)

Key Path **Trace/Detector, Detector Function**

View/Display

The display functionality is shared with the Meas Off (Spectrum Analyzer) measurement in the Spectrum Analyzer Modes. For details about how it operates, see [“View/Display \(Spectrum Analyzer Mode\)” on page 111](#).

Mode SA

Key Path Front-panel key

Selects the Channel Analyzer measurement mode for your analyzer. This mode enables you to use the **Meas** key to select one-button measurements such as Adjacent Channel Power (labelled **ACP (I&M)** on the key). The Channel Analyzer mode defaults to the Adjacent Channel Power measurement.

Mode	All
Remote Command	:CONFigure:<meas_name> :CONFigure?
Example	:CONF:ACPower
State Saved	Saved in instrument state.
Key Path	Mode, Channel Analyzer

Adjacent Channel Power—ACP (I&M) Measurement

Adjacent Channel Power—ACP (I&M) Description

Adjacent Channel Power (ACP (I&M)) is a measure of the power that leaks into adjacent transmit channels. The ACP measurements, as currently implemented, are suitable for quick checks in installation and maintenance (I&M) applications. They are not necessarily suitable for ACP measurements in manufacturing or R & D applications.

ACP measures the power present in adjacent transmit channels and their associated integration bandwidths defined by you or the selected radio standard (Meas Setup, Format/BW, Chan Std (Radio Std)).

This measurement is defined by the Channel center and number of adjacent channels (up to 3). The bandwidth of the Center and Adjacent Channels are automatically set according to the channel standard selected (Meas Setup, Format/BW, Format Type (Chan), Chan Std), or can be independently specified if the Format Type is in the “Cust mode” (Meas Setup, Format/BW, Format Type (Cust)).

To configure measurement settings, select **ACP (I&M)** and then press **Meas Setup**. Pressing **Format/BW, Format Type (List), Format List** will access all the Radio Standards available for which this measurement can be applied. Pressing **Control/Sweep** enables you to restart a measurement. Refer to the “Control/Sweep Functions” on page 418.

Mode	Channel Analyzer (CHAN)
Remote Command	:CONFigure:ACPpower
Example	CONF:ACP selects the ACP measurement.
Remote Command Notes	You must be in the Channel Analyzer mode to use this command. Use INSTRument:SElect CHAN to set the mode.
Key Path	Meas, ACP (I&M)

Remote Measurement Results

To query the results of the measurement, the desired measurement has to be configured, initiated and then the measurement results can be queried using the CALCulate:DATA? command.

If you execute the remote command CALCulate:DATA? when the Adjacent Channel Power (ACP (I&M)) is active, the query will return 29 comma-separated scalar results in the following order:

Result #	Field Name	Description
1	Primary Channel Power	Power (dBm) for the requested primary channel.
2	Primary Channel Frequency Error	Frequency error (in Hz) for the requested primary channel.

Adjacent Channel Power—ACP (I&M) Measurement

3–7	Low Adjacent Channel Powers	The powers (in dBc) for the “low” side adjacent channels. The first Adjacent Channel Count entries are used. Unused channels will contain the value 9.91E37.
8–12	High Adjacent Channel Powers	The powers (in dBc) for the “high” side adjacent channels. The first Adjacent Channel Count entries are used. Unused channels will contain the value 9.91E37.
13	Primary Channel Center Frequency	Center frequency (in Hz) for the primary channel
14	Primary Channel Width	Width of the primary channel in Hz
15	Primary Channel Measurement Time	Time (in seconds) over which to calculate channel power for the primary channel
16	Adjacent Channel Width	Width of the adjacent channels in Hz
17	Adjacent Channel Offset	Offset (in Hz) of the 1 st adjacent channel center frequency from the primary channel’s center frequency
18	Adjacent Channel Step Size	In Hz, the step between adjacent channels
19	Adjacent Channel Count	Number of high and low adjacent channel pairs to measure. Example: value of 1 means measure the 1 st High and Low adjacent channels
20	Adjacent Channel Measurement Time	Time (in seconds) over which to calculate channel power for the adjacent channels
21	Attenuation	Power offset for RF INPUT attenuation (dB)
22	Average Type	0 = no averaging 1 = exponential average 2 = max hold 3 = repeat average 4 = repeat max
23	Num Averages	Number of averages
25	Peak Power Mode	Measure peak or average power. 0 = average, 1 = peak Note: You can not change these settings.

Channel Analyzer
Adjacent Channel Power—ACP (I&M) Measurement

26	Range Hold	Auto-ranging behavior. 0 = auto, 1 = hold (keep current value), default = Note: You can not change these settings.
28	Range Setting	Receiver front-end gain/attenuation (dB)
29	Average Count	Number of measurements averaged into this data.

Example of what it looks like from the scpi command:

CONF:ACP

INIT

*OPC?

CALC:DATA?

```
#3314-6.4232e+01,7.130e+03,-1.5241e+01,9.91E37,9.91E37,9.91E37,9.91E37,-1.5992e+01,9.91E37,
9.91E37,9.91E37,9.91E37,1.955000000e+09,1.250000e+06,1e-03,3.0000e+04,6.40000e+05,3.0000e+
04,1,7e-03,0.00e+00,0e+00,1e+00,1e+00,0e+00,0e+00,0e+00,0.00e+00,1
```

This response is in standard block format. It will always begin with a #, then the next number indicates the # digits that give the size of the block, i.e. 3. So, the next 3 digits are the size, i.e. 314. After this is the data in a comma separated list:

- 6.4232e+01: Primary Channel Power (in dBm)
- 7.130e+03: Primary Channel Frequency Error (in Hz)
- 1.5241e+01: Low Adjacent Channel Power (in dBc)
- ...
- 1.955000000e+09: Primary Channel Center Frequency (in Hz)

Mode	Channel Analyzer (CHAN)
Remote Command	:CALCulate:DATA?
Example	CONF:ACP selects the ACP measurement. INIT:IMM starts a measurement cycle. *OPC? holds off the return of data until the above commands have completed. :CALC:DATA? returns the current measurement data.

Notes	You must be in the Channel Analyzer mode to use this query. Use INSTRument:SElect CHAN to set the mode.
Key Path	N/A. Function is only available remotely.

AMPTD Y Scale

AMPTD Y Scale activates the reference level function, and accesses the amplitude menu keys. The amplitude menu keys set functions that affect the way data on the vertical axis is displayed or corrected.

Mode:	SA
Key Path	Front-panel key

Autoscale

Executes an automatic scaling of the **Reference Level** setting. Autoscale is a front-panel only function and has no remote command.

Mode	SA
Key Path	AMPTD Y Scale, Autoscale

Reference Level

Sets the reference level value used for amplitude measurements. The reference level is the amplitude power (expressed in current Y-axis units) represented by the top graticule line on the display. Changing the value of the reference level changes the absolute amplitude level of the top graticule line. The reference level can be set with the step keys, knob, or numeric keypad.

Mode	SA
Remote Command	:DISPlay:ACPower:WINDow:TRACe:Y[:SCALE]:RLEVel <amp;lt;1> :DISPlay:ACPower:WINDow:TRACe:Y[:SCALE]:RLEVel?
Example	:DISP:ACP:WIND:TRAC:Y:RLEV 10dBm
Notes	In ACP measurement, only Y-axis unit supported is dBm.
Preset	0 dBm

Channel Analyzer

Adjacent Channel Power—ACP (I&M) Measurement

State Saved	Saved in State
Min	-150 dBm
Max	100 dBm
Key Path	AMPTD Y Scale, Reference Level

Auto Range / Elec Atten / Internal preamp

Auto Range, the electronic attenuator and the internal preamp functionality is shared across all the Modes. See “AMPTD Y Scale” on page 46 for details about how they operate.

Ext Gain

The External Gain feature is shared across all the Modes. See the AMPTD/Y Scale of Meas Off (Spectrum Analyzer mode) section for details about how it operates.

Scale/Div

Sets the logarithmic units per vertical graticule division on the display.

Mode	SA
Remote Command	:DISPlay:ACPower:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_amp1> :DISPlay:ACPower:WINDow:TRACe:Y[:SCALe]:PDIVision?
Example	:DISP:ACP:WIND:TRACe:Y:PDIV 10dB
Preset	10.00 dB / Div
State Saved	Saved in State
Range	1.0 to 20
Key Path	AMPTD Y Scale, Scale/Div

Control/Sweep

Accesses the sweep and measurement control settings that can be changed when using the ACP measurement.

Mode:	SA
Key Path	Front-panel key

Restart, Single, Cont

The sweep control functionality is shared across all the Modes. See “Control/Sweep Functions” on page 418 for details about how they operate.

Sweep Time Query (Remote Command Only)

The sweep time value can be queried using the [:SENSe]:ACPower:SWEep:TIME? command. The ACP measurement is a frequency domain measurement only, so the Sweep Time key is disabled (not available) in the ACP measurement.

Mode	SA
Remote Command	[:SENSe]:ACPower:SWEep:TIME?
Example	ACP:SWE:TIME?
Notes	In ACP measurement (Frequency Domain measurement), you can only query the “sweep” time. Trying to set the Sweep Time will generate a system error message
Preset	The default value is auto-calculated and will depend on the Frequency range of the Analyzer.
Key Path	N/A - Remote Feature Only

FREQ Channel

Accesses the frequency/channel settings that can be changed when using the ACP measurement.

Mode:	SA
Key Path	Front-panel key

FREQ / Channel

The **FREQ / Channel** front-panel key displays the frequency or channel menu functions available with the adjacent channel power measurement. The frequency/channel keys can be toggled with the **Units** menu key.

Channel

Sets the channel value and the channel type:

Forward (Fwd or Dn): the base station is transmitting (downlink)

Reverse (Rev or Up): the mobile is Transmitting (uplink)

NOTE Dn & Up are used for UARFCN UMTS, UARFCN Band B UMTS, and all GSM/EDGE channel standards. All other channel standards use Fwd & Rev.

Mode	Channel Analyzer
Dependencies / Couplings	The “Channel” parameter is coupled with the “Center Frequency” parameter and is dependent on the Channel Standard selected for the measurement. For instance, if the “Channel Standard” selected is GSM–850, if the “Channel” is set to 128 Fwd, the “Center Frequency” value is automatically changed to 869.2 MHz. Conversely, if the “Center Frequency” parameter is set to 893.8 MHz, then the “Channel” value is automatically changed to 251 Fwd.
Preset	500 Fwd
State Saved	Saved in instrument state.
Range	Dependent on the Channel Standard selected for the measurement.
Key Path	FREQ/Channel, Channel

Channel Step

Sets the channel step size.

Mode	Channel Analyzer
Preset	1
State Saved	Saved in instrument state.
Range	1 to 100
Key Path	FREQ/Channel, Channel Step

Chan STD (Radio Std)

Opens a table with a list of available channel standards such as North American Cellular CDMA, North American PCS CDMA, and Japan CDMA. The current standard is highlighted. Choose a new standard with the arrow keys, then press **Select** to change the standard.

NOTE When Format Type is preset to **List**, changing the channel standard does not cause a corresponding change to the format. With a List Format Type set, the Channel Standard setting effects instrument tuning but does not change the ACP Format used. This can be useful when you are testing at a frequency outside of the explicit range of the channel standard. It can also be useful when you want to use your channel standard to examine a neighbor's signal.

If you wish the ACP format to change to correspond to Channel Standard changes, set the Format Type to **Chan**.

Notes	This “Units” parameter is a Front Panel parameter only and is only visible/accessible if the “Units” parameter is set to “Chan”.
Preset	North American Cellular CDMA
Range	North American Cellular CDMA North American PCS CDMA Japan CDMA Korean PCS CDMA Secondary 800 CDMA IMT-2000 cdma2000 GSM-850 GSM-900 EGSM-900 GSM DCS-1800 GSM PCS-1900 North American Cellular TDMA North American PCS TDMA iDEN-800 iDEN-900 North American Cellular AMPS NMT-450 UARFCN UMTS UARFCN Band B UMTS RGSM-900 GSM-450 GSM-480
Key Path	FREQ/Channel, Chan STD (Radio Std)

Units Freq/Chan

The **Units** key lets you switch between the adjacent channel power frequency settings and channel settings.

Preset	Freq
State Saved	Saved in instrument state.
Range	Freq Chan
Key Path	FREQ/Channel, Units Freq/Chan

Center Frequency

Sets the channel center frequency.

Mode	Channel Analyzer
Remote Command	[:SENSE] :FREQuency:CENTer <freq> [:SENSE] :FREQuency:CENTer?
Example	FREQ:CENT 1GHz FREQ:CENT?
Preset	1.955 GHz
Min	The minimum value that can be set for this Center Frequency has to take into account the bandwidth of the Lower Adjacent Channels. So depending on the Channel Standard selected the minimum value for the Center Frequency can be different.
Max	The maximum value that can be set for this Center Frequency has to take into account the bandwidth of the Upper Adjacent Channels. So depending on the Channel Standard selected the maximum value for the Center Frequency can be different.
Key Path	FREQ/Channel, Center Frequency
Default Unit	Hz

Freq Step

Sets the frequency step size between channels.

Mode	Channel Analyzer
Remote Command	[:SENSE] :FREQuency:CENTer:STEP [:INCRement] <freq> [:SENSE] :FREQuency:CENTer:STEP [:INCRement] ?
Example	FREQ:CENT:STEP 500 MHz
Preset	200 kHz
State Saved	Saved in State
Range	100 Hz to 1 GHz
Key Path	FREQ/Channel, Freq Step
Default Unit	Hz

Meas

This **Meas** key displays a menu that lets you to make one-button measurements such as the adjacent channel power measurement. In the Channel Analyzer mode, Adjacent Channel Power is the default measurement. This default allows you to make immediate measurements using the current default setup. You can change settings as required for your unique measurement.

Settings can be changed using the functions under the Meas Setup key (see “[Meas Setup](#)” on page 185).

Mode:	All
Key Path	Front-panel key

Meas Setup

Accesses the settings that can be selected for the ACP measurement. The ACP measurement must be selected to access these features. Press **Meas, ACP (I&M)** to select the measurement.

Mode:	Channel Analyzer
Key Path	Front-panel key

Avg Mode

Sets the type of termination control used for the averaging function. This determines the averaging action after the specified number of measurements has been reached (see “[Avg Number](#)” on page 187).

Mode	Channel Analyzer
Remote Command	[:SENSe] :ACPower:AVERage:TCONtrol EXPOnential MAXHold REPeat RMAXhold [:SENSe] :ACPower:AVERage:TCONtrol?
Example	ACP:AVER:TCON EXP
Preset	The averaging state default is OFF. If averaging was turned ON, the default averaging mode for the measurement would be EXPOnential.
State Saved	Saved in State
Range	Exponential Max Hold Repeat RMaxHold
Key Path	Meas Setup, Avg Mode

Channel Analyzer
Adjacent Channel Power—ACP (I&M) Measurement

Off Turns averaging functions off.

Mode	Channel Analyzer
Remote Command	[:SENSE] :ACPower :AVERage [:STATE] OFF ON 0 1 [:SENSE] :ACPower :AVERage [:STATE] ?
Example	ACP:AVER OFF
Dependencies / Couplings	If Averaging State is turned ON, the Averaging Mode used per default by the measurement is Exponential.
Preset	OFF
State Saved	Saved in State
Key Path	Meas Setup, Avg Mode, Off

Exponential Sets the averaging function to exponential. With exponential averaging mode, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Example	ACP:AVER:TCON EXP
Key Path	Meas setup, Avg Mode, Exponential

Max Hold In **Max Hold** the analyzer maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data. Pressing the **Max Hold** key for the selected trace sets the trace type to **Max Hold**, causes the trace to be cleared and causes the **Max Hold** sequence to be restarted.

Example	ACP:AVER:TCON MAXH
Key Path	Meas setup, Avg Mode, Max Hold

Repeat Sets the averaging function to the repeat function. Repeat averaging shows resulting data after the selected number of sweeps has been averaged, then clears the data before repeating the process.

NOTE While Repeat averaging is running, the results from the last completed measurement remains on the display, the results are not updated until the last average count has been reached.

Example	ACP:AVER:TCON REP
Key Path	Meas setup, Avg Mode, Repeat

Repeat Max Hold Sets the averaging function to repeat with max hold function. Repeat with max hold captures and holds the highest magnitude data at the end of each sweep count.

NOTE While Repeat Max Hold is running, the results from the last completed measurement remains on the display, the results are not updated until the last average count has been reached. (Maximum data points are held with each consecutive sweep.)

Example	ACP:AVER:TCON RMAX
Key Path	Meas setup, Avg Mode, Repeat Max Hold

Avg Number

Sets the number of measurement averages used when calculating the measurement result.

Mode	Channel Analyzer
Remote Command	[:SENSe] :ACPower:AVERage:COUNT <integer> [:SENSe] :ACPower:AVERage:COUNT?
Example	AVER:COUN 100
Preset	1
Min	1
Max	4096
Key Path	Meas Setup, Avg Number

Format/BW

Accesses menu keys that enable you to set and define the measurement parameters for the ACP measurement.

When performing an adjacent channel power measurement, you may specify the channel standard determined by the modulation type of the signal you are trying to measure (CDMA, GSM, etc.). In

Channel Analyzer

Adjacent Channel Power—ACP (I&M) Measurement

In addition, you may customize the measurement by specifying several measurement settings. The measurement settings include bandwidth and measurement time for the center channel and the following measurement settings for the adjacent channels:

- number of adjacent channels
- offset of the first adjacent channel from the center channel
- offset of the adjacent channels from each other
- measurement bandwidth and measurement time for adjacent channel (one setting for all adjacent channels)

These settings determine how the analyzer measures the center channel and its adjacent channels. Depending on the modulation type of the signal you are trying to measure (CDMA, GSM, etc.), different measurement bandwidths, times, and offsets are required.

Key Path: Meas Setup, Format/BW

Format Type Sets the method you want to use to determine the measurement parameters.

Default adjacent channel power measurement settings, called ACP formats, are provided in the Agilent CSA platforms. Generally, the ACP format is determined by the channel standard you select. However, to accommodate your particular situation, you can decouple the default formats from the channel standard, or you can change each measurement setting independently. The three methods of selecting your measurement settings are:

Chan (Channel): Each channel standard has an associated ACP format. With this method, the optimum measurement bandwidth and measurement time for the modulation type are automatically selected when you set the channel standard. For example, when you select GSM–950 as the channel standard, with this method the analyzer selects the bandwidth and time and adjacent channel offsets for the GSM format.

List: Select the ACP format from a list of values that are set automatically—independent of the channel standard.

Cust (Custom): Manually set all parameters: the measurement bandwidth and measurement time for the center and adjacent channel(s), the offset from the center channel for the first adjacent channel, and the offset between adjacent channels.

The option you select determines which menu keys are active. If you select Chan or List, Channel BW/Time/Freq Err is available, but all menu keys on the next level are unavailable and grayed out, enabling you only to view the settings. To change any of the settings, you must choose Cust.

NOTE When Format Type is preset to **List**, changing the channel standard does not cause a corresponding change to the format. With a List Format Type set, the Channel Standard setting effects instrument tuning but does not change the ACP Format used. This can be useful when you are testing at a frequency outside of the explicit range of the channel standard. It can also be useful when you want to use your

channel standard to examine a neighbor's signal.

If you wish the ACP format to change to correspond to Channel Standard changes, set the Format Type to **Chan**.

Mode	Channel Analyzer
Preset	Chan
Range	Chan List Cust
Key Path	Meas Setup, Format/BW, Format Type

Chan Std (Radio Std) Opens a table with a list of available channel standards such as North American Cellular CDMA, North American PCS CDMA, and Japan CDMA. The current standard is highlighted. This enables you to select one of the available channel (radio) standards. You must use the up and down arrow navigation keys to select the standard you want and then use the **Select** key to set the standard. To abort your selection, use the **Cancel** key.

Mode	Channel Analyzer
Dependencies / Couplings	Format Type must be set to Chan
Key Path	Meas Setup, Format/BW, Chan Std (Radio Std)

Select Sets the selected channel (radio) standard as the standard for the measurement. The different Channel Standards available are:

North American Cellular CDMA | North American PCS CDMA | Japan CDMA | Korean PCS CDMA | Secondary 800 CDMA | IMT-2000 cdma2000 | GSM-850 | GSM-900 | EGSM-900 | GSM DCS-1800 | GSM PCS-1900 | North American Cellular TDMA | North American PCS TDMA | iDEN-800 | iDEN-900 | North American Cellular AMPS | NMT-450 | UARFCN UMTS | UARFCN Band B UMTS | RGSM-900 | GSM-450 | GSM-480

Mode	Channel Analyzer
Key Path	Meas Setup, Format/BW, Chan Std (Radio Std), Select

Channel Analyzer

Adjacent Channel Power—ACP (I&M) Measurement

Cancel Aborts the selected channel (radio) standard as the standard for the measurement.

Mode	Channel Analyzer
Key Path	Meas Setup, Format/BW, Chan Std (Radio Std), Cancel

Format List Opens a table with a list of available channel formats such as CDMA Cellular, CDMA PCS, and W-CDMA (UMTS). The current format is highlighted. This enables you to decouple the default formats from the channel standard by selecting one of the available ACP formats. When you set one of the listed ACP formats, new parameter values are set that are different from the channel (radio) standard default values. You must use the up and down arrow navigation keys to select the standard you want and then use the **Select** key to set the standard. To abort your selection, use the **Cancel** key.

Choose a new format with the arrow keys, then press **Select** to change the format.

Mode	Channel Analyzer
Dependencies / Couplings	Format Type must be set to List
Key Path	Meas Setup, Format/BW, Format List

Select Sets the selected ACP format as the default parameters for the measurement. The different Formats available are:

CDMA Cellular BTS IS95A | CDMA Cellular BTS IS95C BC0 | CDMA PCS BTS IS95C BC1 | CDMA PCS J-STD-008 | W-CDMA | GSM/EDGE/GPRS | TDMA North America | iDEN-800 | iDEN-900 | AMPS North America | NMT-450 | Tetra

Mode	Channel Analyzer
Key Path	Meas Setup, Format/BW, Format List, Select

Cancel Aborts the selected ACP format as the default parameters for the measurement.

Mode	Channel Analyzer
Key Path	Meas Setup, Format/BW, Format List, Cancel

Channel BW/Time/Freq Err Opens a menu of channel bandwidth and time settings that can be changed when the **Format Type** is set to **Cust**.

Mode	Channel Analyzer
Dependencies / Couplings	Format Type must be set to List
State Saved	Saved in State
Key Path	Meas Setup, Format/BW, Channel BW/Time/Freq Err

Center Chan Meas BW Sets the center channel measurement bandwidth.

Mode	Channel Analyzer
Dependencies / Couplings	Format Type must be set to Cust
Preset	200 kHz
State Saved	Saved in instrument state.
Min	10 kHz
Max	5 MHz
Key Path	Meas Setup, Format/BW, Channel BW/Time/Freq Err, Center Chan Meas BW

Center Chan Meas Time Sets the center channel measurement time.

Mode	Channel Analyzer
Dependencies / Couplings	Format Type must be set to Cust
Preset	23.077 ms
State Saved	Saved in instrument state.
Min	BW dependent
Max	BW dependent
Key Path	Meas Setup, Format/BW, Channel BW/Time/Freq Err, Center Chan Meas Time

Channel Analyzer

Adjacent Channel Power—ACP (I&M) Measurement

Adj Chan Meas BW Sets the adjacent channel measurement bandwidth.

Mode	Channel Analyzer
Dependencies / Couplings	Format Type must be set to Cust
Preset	30 kHz
State Saved	Saved in instrument state.
Min	10 kHz
Max	5 MHz
Key Path	Meas Setup, Format/BW, Channel BW/Time/Freq Err, Adj Chan Meas BW

Adj Chan Meas Time Sets the adjacent channel measurement time. This feature is mainly for bursted signals. The sweep time has to be defined such that it does cover a complete frame or period of the signal.

Mode	Channel Analyzer
Dependencies / Couplings	Format Type must be set to Cust
Preset	10 ms
State Saved	Saved in instrument state.
Min	BW dependent
Max	BW dependent
Key Path	Meas Setup, Format/BW, Channel BW/Time/Freq Err, Adj Chan Meas Time

Freq Error Limits On/Off Turns the frequency error limits for the adjacent channel power measurement On or Off.

Mode	Channel Analyzer
Dependencies / Couplings	This key is coupled with the “Frequency Error Limits” key under the “Meas Setup > Limits > Freq Error Limits” Menu.
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Format/BW, Channel BW/Time/Freq Err, Freq Error Limits On/Off

Ctr to Adj Step Size Sets the frequency step size between the center and the adjacent channels.

Mode	Channel Analyzer
Dependencies / Couplings	Format Type must be set to Cust
Preset	200 kHz
State Saved	Saved in instrument state.
Min	10 kHz
Max	5 MHz
Key Path	Meas Setup, Format/BW, Ctr to Adj Step Size

Adj to Adj Step Size Sets the frequency step size between adjacent channels.

Mode	Channel Analyzer
Dependencies / Couplings	Format Type must be set to Cust
Preset	200 kHz
State Saved	Saved in instrument state.
Min	12.5 kHz
Max	5 MHz
Key Path	Meas Setup, Format/BW, Adj to Adj Step Size

Num Adj Chans Sets the number of adjacent channels to show on the display.

Dependencies / Couplings	Format Type must be set to Cust
Preset	3
State Saved	Saved in instrument state.
Min	1
Max	3
Key Path	Meas Setup, Format/BW, Num Adj Chans

Limits

Accesses menu keys that enable you to create and define the power or the frequency error parameters for the ACP measurement. You can create and define high and low frequency limits, or high and low power limits for center and adjacent channels.

Key Path: Meas Setup, Limits

Power Limits Accesses the power limits menu. **Power Limits** sets the high and low limits of the center channel, as well as the high limit of the adjacent channels. Center channel limits are absolute values and can be set in dBm or in Watts. Adjacent channel limits are relative to the Center channel power. The settings you choose define the shape of the mask displayed on the screen. To measure only the outer frequencies, turn off the mask. These settings affect the metrics color display: red represents fail, green represents pass.

Key Path: Meas Setup, Limits, Power Limits

Power Limits On/Off Turns the power limits for the adjacent channel power measurement On or Off. **Frequency Limits** sets the high and low frequency limits for the center channel only. These settings affect the metrics color display: red represents fail, green represents pass.

Mode	Channel Analyzer
Preset	On
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limits, Power Limits, Power Limits On/Off

Center Chan High Limit Sets the high limit for center channel power.

Mode	Channel Analyzer
Preset	-10 dBm
State Saved	Saved in State
Min	-100 dBm
Max	+100 dBm

Center Chan Low Limit Sets the low limit for center channel power.

Mode	Channel Analyzer
Preset	-30 dBm
State Saved	Saved in State
Min	-100 dBm
Max	+100 dBm

Adj Chan 1 High Limit Sets the high limit for adjacent channel 1 power.

Mode	Channel Analyzer
Preset	-30 dB
State Saved	Saved in State
Min	-100 dB
Max	+100 dB

Adj Chan 2 High Limit Sets the high limit for adjacent channel 2 power.

Mode	Channel Analyzer
Preset	-50 dB
State Saved	Saved in State
Min	-100 dB
Max	+100 dB

Adj Chan 3 High Limit Sets the high limit for adjacent channel 3 power.

Mode	Channel Analyzer
Preset	-70 dB
State Saved	Saved in State

Channel Analyzer
Adjacent Channel Power—ACP (I&M) Measurement

Min	-100 dB
Max	+100 dB

Freq Error Limits Accesses the frequency error limits menu.

Key Path: Meas Setup, Limits, Freq Error Limits

Freq Error Limits On/Off Turns the frequency error limits for the adjacent channel power measurement On or Off.

Mode	Channel Analyzer
Dependencies / Couplings	This key is coupled with the “Frequency Error Limits” key under the “Meas Setup > Format/BW > Channel BW/Time/Freq Err” Menu.
Preset	On
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limits, Freq Error Limits, Freq Error Limits On/Off

Frequency High Limit Sets the positive frequency error limit for the adjacent channel power measurement.

Mode	Channel Analyzer
Preset	100 kHz
State Saved	Saved in State
Min	0 Hz
Max	Maximum Span

Frequency Low Limit Sets the negative frequency error limit for the adjacent channel power measurement.

Mode	Channel Analyzer
Preset	–100 kHz
State Saved	Saved in State
Min	Maximum Span
Max	0 Hz

Trace/Detector

Accesses the trace and detector settings that can be changed when using the ACP measurement.

Detector Avg/Peak

Sets the detector function to average or peak detector. For pulsed signals, you can get a more accurate measurement of the signal’s peak or average power by using the Peak Power Detector option in the analyzer.

The analyzer measures average power of signals by default. However, for non-constant-duty-cycle signals such as GSM, an average power reading fails to accurately show amplitude when the signal is on and if other timeslots in the frame are powered off.

If the input signal is not bursted, it is probably better to select Average for a more accurate result.

Remote Command	<code>[:SENSE] :ACPower:DETECTOR [:FUNCTION] AVERAge POSitive</code> <code>[:SENSE] :ACPower:DETECTOR [:FUNCTION] ?</code>
Preset	AVERAge
State Saved	Saved in instrument state.
Range	Avg Pk
Key Path	Trace/Detector, Detector Avg/Peak

Channel Analyzer
Adjacent Channel Power—ACP (I&M) Measurement

Selects the Stimulus/ Response measurement mode for your analyzer. The Stimulus Response mode includes several pre-configured measurements and enables you to use the **Meas** key to select one-button measurements such as, Two-Port Insertion Loss, One-Port Insertion Loss, Return Loss, or Distance to Fault.

When you press the Stimulus / Response mode key, a menu of available Stimulus/Response measurements is displayed. Once you are in a Stimulus Response measurement, you can change to a different Stimulus Response measurement by pressing **Meas** and then selecting the desired measurement.

Mode	All
Remote Command	:CONFigure:<meas_name> :CONFigure?
Example	:CONF:TPILoss sets the analyzer to the Two Port Insertion Loss measurement.
State Saved	Saved in instrument state.
Key Path	Mode, Stimulus / Response

Two Port Insertion Loss Measurement

Two Port Insertion Loss Measurement Description

This **Two Port Insertion Loss** measurement characterizes the gain or loss of active devices such as amplifiers and passive devices such as filters, attenuators, and cables over a specified frequency range.

Insertion loss measurements are important in accurately quantifying the amount of gain or loss a signal will incur as it passes through the device. In S-parameter terms, insertion loss is referred to as an S21 measurement. “S” stands for scattering.

To configure measurement settings, select **Two Port Insertion Loss** and then press **Meas Setup**. Pressing **Control/Sweep** enables you to restart a measurement, refer to [“Control/Sweep Functions” on page 418](#).

Mode	Stimulus Response
Remote Command	:CONFigure:TPILoss
Remote Command Notes	You must be in the Stimulus Response mode to use this command. Use INSTRument:SElect SR to set the mode.
Key Path	Meas, Two Port Insertion Loss

Remote Measurement Results

Command		Return Value
:FETCh:TPILoss[n]? :MEASure:TPILoss[n]? :READ:TPILoss[n]?	Not specified or n = 1	Returns the following comma-separated results: 1. Start Frequency (Hz) 2. Stop Frequency (Hz) 3. Number of Averages 4. Average Count 5. Number of points in sweep 6. Normalized Results (0 = unnormalized, 1 = normalized) 7. Source Amplitude (dBm) 8. Average Insertion Loss (dB) 9. 0 (reserved for future use) 10. 0 (reserved for future use) 11. 0 (reserved for future use) 12. 0 (reserved for future use) 13. 0 (reserved for future use)
	2	This query returns Trace 1 data as a list of x,y pairs. The y-axis values are in the current Y-Axis Unit of the analyzer (for this measurement, dB). The x-axis values are the values of the trace, in the x-axis scale units of the trace (Hz for frequency domain traces, seconds for time domain traces.) When querying trace data, it is best if the analyzer is not sweeping during the query. Therefore, it is good to be in Single Sweep or Update = Off when querying trace data from the analyzer.
	3	Returns Trace 2 data as a series of x,y pairs.

Remote Measurement Results Query

To get the results of the measurement remotely, the desired measurement has to be configured, initiated and then the measurement results can be queried using the CALCulate:DATA? command.

Example:

```
:INSTRument:SELect SR
```

```
:CONFigure:TPILoss
```

```
INITiate:IMMEDIATE
```

Stimulus / Response
Two Port Insertion Loss Measurement

*OPC?

CALCulate:DATA?

If you execute the remote command CALCulate:DATA? when the Two Port Insertion Loss measurement is active, the query will return 532 comma-separated scalar results in the following order:

Result #	Field Name	Description
1–256	Insertion Loss Trace	Insertion Loss trace (dB)
257	Average Insertion Loss	Average Insertion Loss of the trace (dB)
258	Valid Calibration	Indicates if there is a valid calibration (0 = false, 1 = true)
259	Calibration/Measurement Mode	8 = calibrate, 9 = measure insertion loss (un-calibrated), 10 = measure normalized insertion loss
260	Start Frequency	In Hz
261	Stop Frequency	In Hz
262	Automatic Source Amplitude	Automatically or manually set the Source Amplitude for the sweep (0 = manual, 1 = automatic)
263	Source Amplitude	Power output of the source for the sweep (dBm)
264	Average Type	0 = no averaging 1 = exponential average 2 = max hold 3 = repeat average 4 = repeat max
265	Num Averages	Number of averages
266	Interference Mode	Compensate for interference from existing signal. Turning this mode on will significantly slow the measurement but improve its accuracy when interfering signals are present. 0 = off, 1 = on

267	Optimization Mode	Optimize for range or accuracy. 0 = accuracy 1 = range
268	Average Count	Number of measurements averaged into this data.
269	Time Stamp Seconds	Time of measurement, instrument clock seconds
270	Time Stamp Nanoseconds	Time of measurement, instrument clock nanoseconds
271	Limit Packet Coming	Reserved for future use.
272–527	Insertion Loss Trace – 2	Insertion Loss Trace #2. In dB.
528	Meas Valid	Measurement Validity. 0 = OK, 1 = Over range
529	Update Trace 1	Update Trace #1. 0 = Off, 1 = On.
530	Update Trace 2	Update Trace #2. 0 = Off, 1 = On.
531	Display Trace 1	Display Trace #1. 0 = Off, 1 = On.
532	Display Trace 2	Display Trace #2. 0 = Off, 1 = On.

The remote commands might look like:

```
:INST:SEL SR
:CONF:TPIL
INIT
*OPC?
CALC:DATA?
```

Example of what the results looks like from the query command:

```
#457324.076e+00,4.076e+00,7.691e+00,7.121e+00,6.859e+00,6.785e+00,7.344e+00,8.844e+00,8.332e+00,6.629e+00,6.395e+00,6.420e+00,6.900e+00,6.568e+00,6.773e+00,5.830e+00,5.658e+00,5.174e+00,6.215e+00,5.711e+00,7.135e+00,6.449e+00,7.363e+00,6.859e+00,8.988e+00,8.422e+00,8.008e+00,5.967e+00,7.660e+00,8.270e+00,9.039e+00,7.615e+00,6.555e+00,6.773e+00,5.779e+00,6.604e+00,5.715e+00,6.111e+00,4.293e+00,4.666e+00,5.273e+00,7.570e+00,7.672e+00,9.063e+00,7.189e+00,8.375e+00,7.086e+00,7.705e+00,6.375e+00,5.729e+00,5.201e+00,4.670e+00,4.813e+00,5.475e+00,6.320e+00,5.619e+00,6.127e+00,5.447e+00,5.557e+00,4.242e+00,3.638e+00,3.612e+00,3.921e+00,7.059e+00,7.723e+00,7.732e+00,4.691e+00,4.334e+00,4.496e+00,6.313e+00,7.145e+00,6.916e+00,5.445e+00,
```


AMPTD/Y Scale

The following **AMPTD/Y Scale** keys are for setting up a Two Port Insertion Loss measurement. The measurement must already be running to access these keys. Press **Meas, Two Port Insertion Loss** to turn on the measurement.

Mode	SR
Key Path	Front-panel key

Autoscale

Executes an automatic scaling of the **Reference Level** setting. Autoscale is a front-panel function only, and has no SCPI command.

Mode	SR
Key Path	AMPTD Y Scale, Auto Scale

Reference Level

Sets the reference level value used for amplitude measurements. In the Two Port Insertion Loss measurement, this Reference Level represents insertion loss in dB.

Changing the value of the reference level changes the Insertion loss level of the top graticule line. The reference level (in selected amplitude units) can be set with the step keys, knob, or numeric keypad.

Mode	Stimulus/Response
Remote Command	:DISPlay:TPILoss:WINDow:TRACe:Y[:SCALe]:RLEVel <insertion_loss> :DISPlay:TPILoss:WINDow:TRACe:Y[:SCALe]:RLEVel?
Example	DISP:TPIL:WIND:TRAC:Y:RLEV 10dB
Preset	0 dB
State Saved	Saved in State
Range	-100 dB to 150 dB
Key Path	AMPTD Y Scale, Reference Level

Scale/Div

Sets the logarithmic units per vertical graticule division on the display.

Mode	Stimulus/Response
Remote Command	:DISPlay:TPILoss:WINDow:TRACe:Y[:SCALE]:PDIVision <rel_ampl> :DISPlay:TPILoss:WINDow:TRACe:Y[:SCALE]:PDIVision?
Example	DISP:TPIL:WIND:TRAC:Y:PDIV 10dB
Preset	10.00 dB
State Saved	Saved in State
Range	1.0 to 20
Key Path	AMPTD Y Scale, Scale/Div

Control/Sweep

Accesses the sweep and measurement control settings that can be changed when using the Two Port Insertion Loss measurement.

Mode	SR
Key Path	Front-panel key

Restart, Single, Cont

The control sweep functionality is shared across all the Modes. See “Control/Sweep” on page 418 of the “Utility and Control/Sweep Functions” section for details about how they operate.

FREQ/Channel

The following **FREQ/Channel** keys are for setting up a Two Port Insertion Loss measurement. The measurement must already be running to access these keys. Press **Meas, Two Port Insertion Loss** to turn on the measurement.

Mode	SR
Key Path	Front-panel key

Stimulus / Response
Two Port Insertion Loss Measurement

Start Freq

Use this key to specify the Start Frequency of your frequency range.

Mode	Stimulus / Response
Remote Command	<code>[:SENSE] :FREQuency:STARt <freq></code> <code>[:SENSE] :FREQuency:STARt?</code>
Example	<code>FREQ:STAR 200 MHz</code> <code>FREQ:STAR?</code>
Dependencies / Couplings	You cannot set the Start frequency equal to the Stop frequency. The instrument will alter the value of the last setting to maintain a minimum value of 1 kHz difference between the Start and Stop frequencies.
Preset	1.85 GHz
State Saved	Saved in instrument state.
Range	From 10 MHz to 2.999999 GHz (Option 503) / 5.999999 GHz (Option 506)
Key Path	FREQ/Channel, Start Freq

Stop Freq

Use this key to specify the Stop Frequency of your frequency range.

Mode	Stimulus / Response
Remote Command	<code>[:SENSE] :FREQuency:STOP <freq></code> <code>[:SENSE] :FREQuency:STOP?</code>
Example	<code>FREQ:STOP 220 MHz</code> <code>FREQ:STOP?</code>
Dependencies / Couplings	You cannot set the Start frequency equal to the Stop frequency. The instrument will alter the value of the last setting to maintain a minimum value of 1 kHz difference between the Start and Stop frequencies.
Preset	1.99 GHz
State Saved	Saved in instrument state.
Range	From 10.001 MHz to 3 GHz (Option 503) / 6 GHz (Option 506)
Key Path	FREQ/Channel, Stop Freq

Normalize

Before you perform a two port insertion loss measurement, you must first normalize the measured values for insertion loss by compensating for the loss associated with the devices (adapters, cables) that connect the Agilent CSA Spectrum Analyzer to the device or assembly being tested. Otherwise, the loss introduced by these connecting devices is added to the loss of the device under test.

Mode	Stimulus / Response
Remote Command	:CALCulate:TPILoss:NORMalize[:IMMEDIATE]
Example	CALC:TPIL:NORM
Remote Command Notes	In Two Port Insertion Loss, pressing the Normalized button will take a sweep, and after the user finished with the “Normalization screen”, the analyzer will do another sweep to complete the normalization process. Remotely, sending the “normalize” command will notify the analyzer to do the correct thing. The “Normalization Screen” will not be displayed, the normalization process will start immediately.
Key Path	FREQ/Channel, Normalize

Marker

Accesses the marker selection and settings functions.

Mode	SR
Key Path	Front-panel key

Marker

Selects one of four possible markers. A marker that has already been turned on will become active when it is selected. If a marker has been turned on and assigned to a specific trace, it will become active on that trace if that marker is selected.

Mode	SR
State Saved	Saved in State
Key Path	Marker, Marker 1 2 3 4

Marker Type

Mode	SR
Remote Command	:CALCulate:TPILoss:MARKer[1] 2 3 4 :MODE OFF POSition DELTa :CALCulate:TPILoss:MARKer[1] 2 3 4 :MODE?
Example	CALC:TPIL:MARK3:MODE DELT selects marker 3 in delta mode.
Preset	NORMal
Key Path	Marker, Marker Type

Normal Activates a single marker at the center of the display.

Mode	SR
Example	CALC:TPIL:MARK2:MODE NORM selects marker 2 in NORM mode
Key Path	Marker, Normal

Delta Activates a pair of markers, one of which is fixed at the current marker location. The other marker can then be moved around on the trace. The marker readout shows the difference between the two markers.

NOTE Pressing Delta moves the reference marker to the active marker position, so you can make delta measurements from differing reference points without having to turn off the markers and begin again.

Mode	SR
Example	CALC:TPIL:MARK:MODE DELT selects Marker 1 in Delta mode
Key Path	Marker, Delta

Off Turns the selected marker off.

Mode	SR
Example	CALC:TPIL:MARK2:MODE OFF selects Marker 2 and turns it Off
Key Path	Marker, Off

Marker Trace

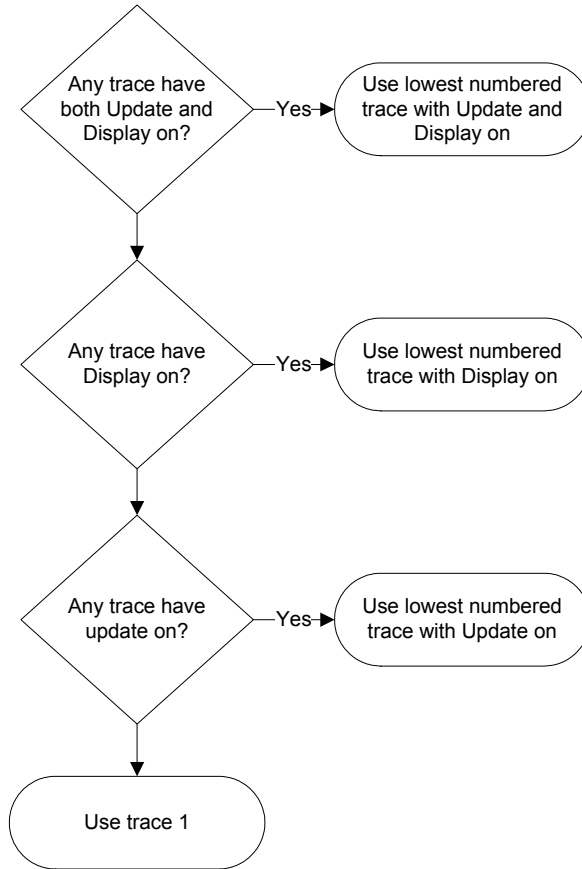
Assigns a marker to a trace. Pressing **Marker Trace** will activate a marker on Trace 1 if there are no markers turned on. In the Two Port Insertion Loss measurement, only 2 traces are available. So if a marker is currently active, press **Marker Trace** until **1** or **2** is underlined. The active marker will be moved to the selected trace.

Mode	SR
Remote Command	:CALCulate:TPILoss:MARKer [1] 2:TRACe 1 2 :CALCulate:TPILoss:MARKer [1] 2:TRACe? :CALCulate:TPILoss:MARKer [1] 2:TRACe:AUTO OFF ON 0 1 :CALCulate:TPILoss:MARKer [1] 2:TRACe:AUTO?
Example	CALC:TPIL:MARK2:TRAC 2 CALC:TPIL:MARK2:TRAC:AUTO OFF
Dependencies / Couplings	This key is only available on measurements that have multiple traces.
Preset	Trace selection is preset to Auto, so the default trace depends on the available traces and the predefined order of selection.
State Saved	Saved in State
Range	1 2
Range	The number of traces available to put a marker on, varies depending on the current selected measurement. In the TPIL measurement, 2 traces are available.
Key Path	Marker, Marker Trace

Auto Init

Turns automatic initiate On or Off. When **Auto Init** is set to On the marker's trace attribute is re-determined automatically by the analyzer whenever the marker turns on (Normal or Delta) from an Off state. Auto Init is set to On at **Preset** or **All Markers Off**. The following flowchart depicts the Auto Init rules:

Stimulus / Response
Two Port Insertion Loss Measurement



Mode	SR
Remote Command Notes	Front panel capability Only
Key Path	Marker, Auto Init

Marker All Off

Turns off all the markers on all traces.

Mode	SR
Remote Command	:CALCulate:TPILoss:MARKer:AOff
Remote Command Notes	CALC:TPIL:MARK:AOff
Key Path	Marker, Marker All Off

Marker X Axis Value

Sets the marker X Axis value in the marker X Axis Scale unit which is Hz in the TPIL measurement. It has no effect if the control mode is **Off**, but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Mode	Stimulus Response
Remote Command	:CALCulate:TPILoss:MARKer [1] 2 3 4:X <real> :CALCulate:TPILoss:MARKer [1] 2 3 4:X?
Example	CALC:TPIL:MARK3:X 1.86GHz activates Marker 3 and positions it on the trace at 1.86GHz.
Restriction and Notes	Remotely, if no suffix is sent it will use Hz as a default unit. If a suffix is sent that does not match a Frequency unit, an error “Invalid suffix” will be generated. The query returns the marker’s absolute X Axis value if the control mode is Normal , or the offset from the marker’s reference marker if the control mode is Delta . The query is returned in Hz. If the marker is Off the response is not a number (NAN).
Dependencies / Couplings	Marker X parameter is coupled with the Start/Stop Freq of the X Axis scale.
Remote Command Notes	You must be in the SR mode to use this command. Use INSTRument:SElect to set the mode.
Preset	After a preset, all Markers are turned OFF, so Marker X Axis Value query will return a not a number (NAN). If Marker X is queried with no value sent first, but with the Marker active, the center value of the X Axis is returned.
State Saved	No
Min	In TPIL measurement, per default, Start Frequency (starting point of the X axis scale) is 1.85 GHz, so the minimum Marker X Axis value that can be entered is 1.85 GHz. The Marker X Axis Min Value that can be used is 10 MHz (it is the minimum value that the Start Freq can accept in TPIL measurement)
Max	In TPIL measurement, per default, Stop Frequency (ending point of the X axis scale) is 1.99 GHz, so the Marker X Axis Max value that can be entered is 1.99 GHz. The Marker X Max Value that can be used is 3 GHz for a 3 GHz Instrument and 6 GHz for 6 GHz Instrument (they are the maximum values that the Stop Freq can accept in TPIL measurement)
Key Path	Marker, Normal

Marker X Axis Position

Sets the marker X position in trace points. It has no effect if the control mode is **Off**, but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Mode	Stimulus Response
Remote Command	:CALCulate:TPILoss:MARKer[1] 2 3 4:X:POSition <real> :CALCulate:TPILoss:MARKer[1] 2 3 4:X:POSition?
Example	CALC:TPIL:MARK2:X:POS 300
Restriction and Notes	The query returns the marker's absolute X Axis value in trace points if the control mode is Normal , or the offset from the marker's reference marker in trace points if the control mode is Delta . If the marker is Off , the response is not a number (NAN).
Remote Command Notes	You must be in the SR mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Center of screen - Number of sweep points in TPIL is fixed at 401 (X position scale goes from 0 to 400), so the default center position is 200
State Saved	No
Min	0
Max	This Max value will clip to the value set for the number of sweep points. Number of sweep points in TPIL is currently fixed at 401.
Key Path	N/A - Remote Feature Only

Marker Y Axis Value

Returns the marker Y Axis value in the current marker Y Axis units.

The “result” of a marker is the value which is displayed on the second line of the Marker Result block. To properly interpret the returned value the remote programmer must also know what the analyzer's Y-Axis Unit is set to as described below.

A marker can have up to two results, only one of which is displayed or returned on a query, as follows:

Absolute result: every marker has an absolute result and it is simply:

For Normal and Delta markers, the Y-axis value of the trace point the marker is currently on.

The absolute result is displayed in the result block or returned on a query unless the marker control mode is **Delta**.

Relative result: if a marker's control mode is **Delta**, the relative result is displayed in the result block or returned on a query. This is the difference between the Absolute Result of a delta marker (expressed in dBm) to the Absolute Result of its reference marker (expressed in dBm). The difference is expressed in dB.

Mode	Stimulus Response
Remote Command	:CALCulate:TPILoss:MARKer [1] 2 3 4 : Y?
Example	CALC:TPIL:MARK2:Y?
Restriction and Notes	The query returns the marker Y-axis result. If the marker is Off the response is not a number.
Remote Command Notes	You must be in the SR mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Amplitude value of the center point of the current trace.
State Saved	No
Min	-150 dBm (Smallest value that the query could return)
Max	100 dBm (Highest value that the query could return)
Key Path	N/A - Remote Feature Only

Marker ->

Accesses the marker function menu keys that change value of center frequency or reference level to the current value of the selected marker.

Mode	SR
Key Path	Front-panel key

Mkr -> CF

Sets the center frequency equal to the specified marker frequency, which moves the marker to the center of the screen. In delta marker mode, the center frequency is set to the marker delta value. This feature is not available in zero span.

Mode	SR
Remote Command	:CALCulate:TPILoss:MARKer [1] 2 3 4 [:SET] :CENTer

Stimulus / Response Two Port Insertion Loss Measurement

Example	CALC:TPIL:MARK2:SET:CENT
Key Path	Marker ->

Mkr -> RL

Sets the reference level to the amplitude of the specified marker. In delta marker mode, the reference level is set to the amplitude difference between the markers. For example, if the difference is -15 dB, the reference level will be set to -15 dBm.

Mode	SR
Remote Command	:CALCulate:TPILoss:MARKer[1] 2[:SET]:RLEVel
Example	CALC:TPIL:MARK2:SET:RLEV
Key Path	Marker ->, Mkr -> RL

Meas

In the Stimulus Response mode, **Meas** accesses a menu of keys associated with the Stimulus Response mode. The measurement runs using the current default setup. Or you can change settings for your unique measurement requirements. Settings can be changed using the functions available under the **Meas Setup** key.

Mode:	All
Key Path	Front-panel key

Meas Setup

In the Two Port Insertion Loss measurement, **Meas Setup** accesses a menu of keys associated with this measurement.

Mode	Stimulus / Response
Range	Averaging Average Clear Normalize Limits Optimize Store As
Key Path	Front-panel key

Avg Mode

Averaging functions are the same as defined in the Spectrum Analyzer Mode, but the parameter values are measurement independent. So, SCPI commands are different. See descriptions below.

Avg Mode sets the type of termination control used for the averaging function. This determines the averaging action after the specified Averaging number has been reached.

Mode	Stimulus / Response
Remote Command	[:SENSe] :TPILoss :AVERage :TCONtrol EXPonential MAXHold REPeat RMAXhold [:SENSe] :TPILoss :AVERage :TCONtrol ? [:SENSe] :TPILoss :AVERage [:STATe] OFF ON 0 1 [:SENSe] :TPILoss :AVERage [:STATe] ?
Example	TPIL:AVER:TCON RMAX TPIL:AVER ON
Preset	EXPonential, ON
Range	EXPonential MAXHold REPeat RMAXhold
Key Path	Meas Setup, Avg Mode

Off Turns averaging functions off.

Example	TPIL:AVER OFF
Key Path	Meas setup, Avg Mode, Off

Exponential Sets the **Averaging** function to exponential. With exponential averaging mode, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Example	TPIL:AVER:TCON EXP
Key Path	Meas setup, Avg Mode, Exponential

Repeat Sets **Avg Mode** to the repeat function. Repeat averaging updates the trace after the selected

Stimulus / Response
Two Port Insertion Loss Measurement

number of sweeps has been averaged. It is not updated again until the next set of data from “Average Number” sweeps has been collected.

Example	TPIL:AVER:TCON REP
Key Path	Meas setup, Avg Mode, Repeat

Max Hold In **Max Hold** the analyzer maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data. Pressing the **Max Hold** key for the selected trace sets the trace type to **Max Hold**, causes the trace to be cleared and causes the **Max Hold** sequence to be restarted.

Example	TPIL:AVER:TCON MAXH
Key Path	Meas setup, Avg Mode, Max Hold

Repeat Max Hold Sets **Avg Mode** to repeat with max hold function. Repeat with max hold captures and holds the highest magnitude data at the end of each sweep count. Repeat with max hold updates the trace after the selected number of sweeps has been made. It is not updated again until the next set of data from “Average Count” sweeps has been collected.

Example	TPIL:AVER:TCON RMAX
Key Path	Meas setup, Avg Mode, Repeat Max Hold

Avg Number

Sets the number of measurement averages used when calculating the measurement result.

Mode	Stimulus / Response
Remote Command	[:SENSe] :TPILoss :AVERAge :COUNT <integer> [:SENSe] :TPILoss :AVERAge :COUNT ?
Example	TPIL:AVER:COUN 50
Preset	4
Min	0
Max	100
Key Path	Meas Setup, Avg Number

Clear Normalize

Clear Normalize deletes the current normalization data.

Mode	Stimulus / Response
Remote Command Notes	Front Panel feature only. There is no remote command to clear the normalization. Working remotely, you will use the current normalization data. Or else you must perform another normalization if you do not want to use the current one.
Key Path	Meas Setup, Clear Normalize

Limits

Access the limit mask keys. You can define a limit mask that matches your maximum or minimum measurement requirements. This mask can then be compared with the measured trace data to determine pass/fail conditions.

Limit Masks Sets the Limit Masks submenu keys, it is then possible to select to configure either Limit Mask 1 (Upper) or Limit Mask 2 (Lower).

Mode	Stimulus / Response
------	---------------------

Stimulus / Response
Two Port Insertion Loss Measurement

Dependencies / Couplings	The Limit Mask 1 (Upper) menu link key accesses the keys to configure the upper limit mask for the Center, 1 st , or 2 nd segments (dependent on selected segment).
	The Limit Mask 2 (Lower) menu link key accesses the keys to configure the lower limit mask for the Center, 1 st , or 2 nd segments (dependent on selected segment).
State Saved	Saved in instrument state.
Key Path	Meas Setup, Limits, Limit Masks

Limit Mask 1 (upper) or Limit Mask 2 (Lower)

Limit Mask 1 (upper) access the upper limit mask keys.

Limit Mask 2 (Lower) access the lower limit mask keys.

You can define a limit mask that matches your maximum or minimum measurement requirements. This mask can then be compared with the measured trace data to determine pass/fail conditions.

Limit Trace

Selects the trace to which the currently selected limit mask (1 or 2) will be applied. The limit masks can be applied to separate traces. Only 2 traces are available in the Stimulus Response mode (compared to 4 traces in the Spectrum Analyzer Mode).

Mode	Stimulus / Response
Dependencies / Couplings	The limit mask is always displayed when the center segment is turned on, even if the trace to which it is being applied is blanked ('Show' set to Off).
Preset	1
State Saved	Saved in instrument state.
Range	1 2
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, Limit Trace or Meas Setup, Limits, Limit Masks, Limit Mask 2, Limit Trace

Segment (Center, 1st or 2nd)

Selects the **Center**, **1st** or **2nd** segment for limit mask 1 or 2. With each segment setting, the **Limits** menu is updated to show the span and level settings available for the currently selected segment

Mode	Stimulus / Response
------	---------------------

Dependencies / Couplings	Key menu structure is dependent on selected segment.
Preset	Center
State Saved	Saved in instrument state.
Range	Center 1st 2nd
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, Segment (Center, 1st or 2nd)

Center Segment

Segments (Center) Sets the state of the center segment to On or Off. This key is available only when Center has been selected with the Segments key.

Notes	Key is only displayed when the selected segment is Center
Dependencies / Couplings	If Off no limit mask will be displayed even if the 1 st or 2 nd segments are turned On. If On the center segment is drawn on the display centered round the current center frequency.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, Center Segment

Level: Center

Sets the power level for the center segment of the current selected limit mask. This key is available only when Center has been selected with the Segments key.

Mode	Stimulus / Response
Restrictions and Notes	Key is only displayed when the selected segment is Center.
Preset	Not affected by a preset but set per default to 30 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, Center Segment Level
Default Unit	dB

Stimulus / Response
Two Port Insertion Loss Measurement

Span: Center

Sets the frequency span for the center segment of the currently selected limit mask. This key is only available when Center has been selected with the Segment key.

Mode	Stimulus / Response
Restrictions and Notes	Key is only displayed when the selected segment is Center.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.
Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, Center Segment Span
Default Unit	Hz

1st Segment

Sets the state of the first segment to On or Off. This key is available only when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st .
Dependencies / Couplings	<p>If Off the 2nd limit mask segment will not be displayed even if turned On.</p> <p>If On and the Center segment is On:</p> <p>The left hand side 1st segment is drawn to the left hand side of the center segment at the specified power level</p> <p>The right hand side 1st segment is drawn to the right hand side of the center segment at the specified power</p> <p>For both left and right 1st segments when On</p> <p>If the 2nd segment is Off the 1st segment extends so the total limit mask span is equal to the current frequency span.</p> <p>If the 2nd segment is On the left and right 1st segments use the specified span values.</p>
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment

1st Segment (Left or Right Limits)

Sets **1st Segment** to allow definition of the limits Left or Right of the center segment. The Left or Right amplitude limits can be changed with the **Level** key. The Left or Right span limits can be changed with the limits menu **Span** key. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st .
Preset	Not affected by a preset but set per default to Left after a power cycling
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment (Left or Right Limits)

Stimulus / Response

Two Port Insertion Loss Measurement

Level: 1st Segment Left

Sets the power level, for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Left.
Preset	Not affected by a preset but set per default to 30 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment: Left Level
Default Unit	dB

Level: 1st Segment Right

Sets the power level, for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Right.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	Not affected by a preset but set per default to 30 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment: Right Level
Default Unit	dB

Span: 1st Segment Left

Sets the frequency span for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Left.
Dependencies / Couplings	If the Center, 1 st , and 2 nd segments are On, the left 2 nd segment span adjusts on a change in the left 1 st segment span.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.
Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Left Span
Default Unit	Hz

Span: 1st Segment Right

Sets the frequency span for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Right.
Dependencies / Couplings	If the Center, 1 st , and 2 nd segments On, the right 2 nd segment span adjusts on a change in the right 1 st segment span.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.
Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Right Span
Default Unit	Hz

Stimulus / Response
Two Port Insertion Loss Measurement

2nd Segment

Sets the state of the first segment to On or Off. This key is available only when 2nd has been selected with the Segments key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd .
Dependencies / Couplings	If Off the 2 nd limit mask segment will not be displayed even if turned On. If On, and the First and Center segments are On: The left hand side 2 nd segment is drawn to the left hand side of the left first segment at the specified power level The right hand side 1 st segment is drawn to the right hand side of the right first segment at the specified power The segment spans are calculated as documented in section above
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 2nd Segment

2nd Segment (Left or Right Limits)

Sets 2nd segment to allow definition of the limits Left or Right of the center segment for the 2nd Segment. The Left or Right amplitude limits can be changed with the **Level** key. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd .

Dependencies / Couplings	<p>The Left span is calculated as follows:</p> $(<\text{maximum span}>/2) - (<\text{center segment span}>/2) - <\text{first segment left span}>$ <p>The Right span is calculated as follows:</p> $(<\text{maximum span}>/2) - (<\text{center segment span}>/2) - <\text{first segment right span}>$ <p>Where:</p> <p><maximum span> is the maximum frequency span of the instrument (3 GHz or 6 GHz)</p> <p><center segment span></p> <p><first segment left span></p> <p><first segment right span></p>
Preset	Not affected by a preset but set per default to Left after a power cycling
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 2nd Segment (Left or Right Limits)

Level: 2nd Segment Left

Sets the power level, for the 2nd segment to the Left of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Left.
Preset	Not affected by a preset but set per default to 50 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 2nd Segment: Left Level
Default Unit	dB

Stimulus / Response

Two Port Insertion Loss Measurement

Level: 2nd Segment Right

Sets the power level, for the 2nd segment to the Right of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Right.
Preset	Not affected by a preset but set per default to 50 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 2nd Segment: Right Level
Default Unit	dB

Avg Limits

Accesses menu keys that enable you to control and set the average limits. These are minimum and maximum values that the average measured insertion loss is compared against. Average insertion loss is the average of the measured insertion loss values across the frequency range being swept.

Mathematically, it is calculated by summing the insertion loss values at each frequency point and then dividing that sum by 256 (there are 256 sweep points.)

The average insertion loss is useful when you are sweeping only within the pass band or only within the stop band of a filter, or a device such as a cable or attenuator. The frequency range should have a fairly flat response across the range. The average value will not be meaningful if you are sweeping a frequency range that includes both the pass band and the stop band of a filter.

The maximum and minimum values that you specify are compared to the calculated average. Pass/fail results are shown on the average insertion loss metric panel. You can turn this display panel off by selecting **View/Display, Avg Insertion Loss (Off)**.

Mode	Stimulus/Response
Key Path	Meas Setup, Avg Limits

Avg Limits On/Off Turns on/off the average limit values.

Mode	Stimulus / Response
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Preset	0
Range	On Off
Key Path	Meas Setup, Avg Limits, Avg Limits On/Off

Max Loss Limit Sets the maximum average limit value. If the average limits are turned on, then the measured average insertion loss will be compared with this value.

Mode	Stimulus / Response
Preset	20 dB
Key Path	Meas Setup, Avg Limits, Max Loss Limit

Min Loss Limit Sets the minimum average limit value. If the average limits are turned on, then the measured average insertion loss will be compared with this value.

Mode	Stimulus / Response
Preset	50 dB
Key Path	Meas Setup, Avg Limits, Min Loss Limit

Optimize

When using the default settings, the spectrum analyzer optimizes measurement accuracy at the expense of dynamic range. There may be times, however, when you prefer to gain dynamic range and lose some accuracy. For example, you may be making a measurement where you want to see a relatively large dynamic range, and your results will not be impaired significantly by 1 to 2 dB less accuracy. Optimizing for dynamic range gains you approximately 30 dB of dynamic range.

Mode	Stimulus / Response
Remote Command Notes	N/A. Front Panel feature only
Preset	Accy
Range	Accy Range
Key Path	Meas Setup, Optimize

Report Loss As

The “Report Loss As” key resides in the “Meas Setup” menu. It allows selection of the signal loss to be represented as positive dB or negative dB. “Report Loss As” is a measurement global parameter, and its setting is preserved over power cycles.

Remote Command	:UNIT:LOSS PDB NDB :UNIT:LOSS?
Example	UNIT:LOSS NDB UNIT:LOSS?
Dependencies / Couplings	None This key is measurement global
Preset	Survives Preset
State Saved	Saved in State, survives Preset, survives power cycle

Store As

You can store External Gain/Loss values for use in later measurements.

Mode	Stimulus / Response
Key Path	Meas Setup, Store As

Store as Ext Loss/Gain You can store External Gain/Loss values for use in later measurements.

Some measurements refer to this value as “Ext Loss” and some as “Ext Gain”. There are also some conditions where this label is changed based on Scale Type (Loss|Gain). Loss and Gain are the negatives of each other. So, if the value you want to enter is a loss and the key label shows “Loss”, then enter it as a positive value. But if the value you enter is a loss and the key label shows “Gain”, then enter it as a negative value.

Mode	Stimulus / Response
Remote Command Notes	N/A. Front Panel feature only
Key Path	Meas Setup, Store As, Store as Ext Loss/Gain

Ext Gain Inputs a value for any external gain that is in your measurement system, that is not from the unit under test. This lets you correct the displayed measurement values to account for this gain. A gain would be a positive value, while a loss would be a negative value.

Mode	Stimulus / Response
Remote Command Notes	N/A. Front Panel feature only
Key Path	Meas Setup, Store As, Ext Gain

Peak Search

Accesses the marker peak functions and places a marker on the highest peak of the currently selected trace.

Mode	SR
Remote Command	:CALCulate:TPILoss:MARKer [1] 2 :MAXimum
Example	:CALC:TPIL:MARK2:MAX
Key Path	Front-panel key

Next Peak

Places the selected marker on the next highest signal peak from the current marked peak.

Mode	SR
Remote Command	:CALCulate:TPILoss:MARKer [1] 2 :MAXimum:NEXT
Example	CALC:TPIL:MARK2:MAX:NEXT
Key Path	Peak Search, Next Peak

Source

The following **Source** key is for setting up a Two Port Insertion Loss measurement. The measurement must already be running to access this key. Press **Meas, Two Port Insertion Loss** to turn on the measurement.

Mode:	All
Key Path	Front-panel key

Source Level

Sets the RF power output level of the internal instrument source

Mode	Stimulus / Response
Remote Command	<pre>:SOURce:TPILoss:POWer[:LEVel] [:IMMediate] [:AMPLitude] <power> :SOURce:TPILoss:POWer[:LEVel] [:IMMediate] [:AMPLitude]? :SOURce:TPILoss:POWer[:LEVel] [:IMMediate] [:AMPLitude]:AUTO OFF ON 0 1 :SOURce:TPILoss:POWer[:LEVel] [:IMMediate] [:AMPLitude]:AUTO ?</pre>
Restrictions and Notes	<p>When Source Lev is set to Auto, the source output level will be set to its maximum output. This maximum output level will vary between approximately 0 dBm to approximately -15 dBm, depending upon frequency. The output power might spike higher, so it is recommended that any device-under-test (DUT) connected to the RF OUT connector be able to tolerate at least +10 dBm at its input.</p> <p>The large output power variation in Auto will be suitable for measuring passive devices, such as cables, attenuators, and filters. However, this variation might not be suitable for measuring active devices, such as amplifiers. The Source Lev (Man) setting is recommended for measuring such devices.</p> <p>When Source Lev is set to Man (manual), the power level can be set to any value between -15 dBm and -30 dBm. The output power variation relative to the set value will typically be less than +/- 1 dB.</p>
Preset	Source Lev is set to Auto. Output level may vary between 0 dBm and -15 dBm, depending upon frequency. Refer to Restrictions and Notes above.
State Saved	Saved in instrument state.
Min	Auto: -15 dBm (frequency-dependent; user cannot set this value) Man: -30 dBm

Max	Auto: 0 dBm (frequency-dependent; user cannot set this value) Man: -15 dBm
Key Path	Source

SPAN/X Scale

The following **SPAN/X Scale** keys are for setting up a Two Port Insertion Loss measurement. The measurement must already be running to access these keys. Press **Meas, Two Port Insertion Loss** to turn on the measurement.

Mode	SR
Key Path	Front-panel key

Span

Sets the span frequency value. Span frequency describes the frequency range that is positioned symmetrically about center frequency.

The minimum span is 1 kHz. Zero-span is not applicable to SR measurements.

Span is measurement specific. It survives mode-preset.

Parameter Name	Span
Mode	Stimulus Response
Remote Command	<pre>[:SENSe] :TPILoss:FREQuency:SPAN <frequency> [:SENSe] :TPILoss:FREQuency:SPAN? [:SENSe] :OPILoss:FREQuency:SPAN <frequency> [:SENSe] :OPILoss:FREQuency:SPAN? [:SENSe] :RLOSs:FREQuency:SPAN <frequency> [:SENSe] :RLOSs:FREQuency:SPAN? [:SENSe] :DTFault:FREQuency:SPAN <frequency> [:SENSe] :DTFault:FREQuency:SPAN?</pre>
Example	<pre>TPIL:FREQ:SPAN 2GHz sets the span to 2GHz for TPIL TPIL: FREQ:SPAN? queries the span for TPIL</pre>
Dependencies / Couplings	See section 1.6

Stimulus / Response
Two Port Insertion Loss Measurement

Preset	140 MHz (Option 506) 140 MHz (Option 503)
State Saved	Saved in State
Range	1 kHz to 6.0 GHz (Option 506) 1 kHz to 3.0 GHz (Option 503)
MIN/MAX/DEF Support	No
Key Path	Span/X Scale
Menu Key Label	Span
Active Function Text	Span
Knob Increment	10% of Span
Step (UP/DOWN)	No SCPI support
Step (Front Panel)	1, 2, 5 sequence
Front Panel Unit/Terminator Keys	GHz MHz kHz Hz

Last Span

Changes the displayed frequency span to the previous span setting. There is no memory of the last span after a power off or a mode preset.

Mode	Stimulus Response
Remote Command	<code>[:SENSe] :TPILoss :FREQuency :SPAN :PREVious</code> <code>[:SENSe] :OPILoss :FREQuency :SPAN :PREVious</code> <code>[:SENSe] :RLOsS :FREQuency :SPAN :PREVious</code> <code>[:SENSe] :DTFault :FREQuency :SPAN :PREVious</code>
Example	<code>RLOS:FREQ:SPAN:PREV</code>
Remote Command Notes	No query form
Key Path	Span/X Scale

Trace/Detector

The following **Trace/Detector** keys are for setting up a Two Port Insertion Loss measurement. The

measurement must already be running to access these keys. Press **Meas, Two Port Insertion Loss** to turn on the measurement.

Mode:	All
Key Path	Front-panel key

Select Trace

Selects which trace the menu keys will affect. Press **Select Trace** until the number of the desired trace is underlined. Only 2 traces are available in the Stimulus Response mode (compared to 4 traces in the Spectrum Analyzer Mode). Note as well that in the “Two Port Insertion Loss” measurement, there is only one trace being generated, so if both are active using the “Update On/Off” feature described below, they will contain identical data and the one on top will hide the bottom one (only one will be seen, but both are there). The purpose of the “Trace/Detector” feature in this measurement is to allow an A/B comparison. For instance, you could store one set of measurement results in Trace 2 (Turn ON first the “Update” parameter of this Trace 2 to get the results then turning back OFF this “Update” parameter to store the results) and then compare it with set of measurement results displayed by Trace 1 (Set the “Update” parameter of the Trace 1 to ON).

Preset	Trace 1
State Saved	The number of the selected trace is saved in Instrument State
Range	1 2
Key Path	Trace/Detector, Select Trace

View/Blank

View/Blank lets you set the state of the two trace variables, Update and Display. The four choices available in this menu are:

- **Trace On:** Update and Display both On
- **View:** Update Off and Display On
- **Blank:** Update Off and Display Off
- **Background:** Update On, Display Off (this allows a trace to be blanked and continue to update “in the background”, which was not possible in the past)

When a trace becomes inactive, the following things happen:

- Any update from the SENSE system (detectors) immediately stops (That is, the current update does not continue to the end of the sweep)
- The trace is displayed at half intensity as long as it stays inactive.

Inactive traces display across the entire X Axis of the instrument. Their horizontal placement does not

Stimulus / Response
Two Port Insertion Loss Measurement

change even if X Axis settings subsequently are changed, although Y-axis settings will affect the vertical placement of data.

In most cases, inactive traces are static and unchanging; however, there are cases when an inactive trace will update, specifically:

- If data is written to that trace from remote
- If trace data is loaded from mass storage
- If the trace is the target of a Copy or participant in an Exchange
- If the trace is cleared using the Clear Trace function (below)

When a trace becomes active (Update = On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Traces which are blanked (Display = off) do not display nor appear on printouts but are otherwise unaffected. They may be queried and markers may be placed on them.

NOTE The action of putting a trace in Display = Off and/or Update = Off does not restart the sweep and does not restart Averaging or Hold functions for any traces.

NOTE Whenever the you set Update to On for any trace, Display is set to On for that trace.

Parameter Name	Trace View/Blank
Key Path	Trace/Detector
Key Notes	<p>The four states of this menu set two variables, Update and Display, to their four possible combinations:</p> <ul style="list-style-type: none"> • Trace On: Update and Display both On • View: Update Off and Display On • Blank: Update Off and Display Off • Background: Update On, Display Off <p>See tables below for details on the SCPI to control these two variables.</p>

Parameter Name	Trace Update State
Remote Command	<pre>:TRACe [1] 2 3 4 :UPDate [:STATE] ON OFF 0 1 :TRACe [1] 2 3 4 :UPDate [:STATE] ?</pre>
Example	TRAC2:UPD 0 Makes trace 2 inactive (stops updating)

Dependencies / Couplings Setting the trace type (even to the type it was already in) puts the trace in Active.
 Loading a trace from a file makes that trace inactive regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange.
 Whenever the user sets Update to On for any trace, the Display is set to On for that trace.

Preset 1|0|0|0 (On for Trace 1; Off for 2-6)

State Saved Saved in Instrument State

Key Path **Trace/Detector**

Annunciation An inactive trace is indicated by dimming the type letter in the trace annotation panel in the Measurement bar (see [Annunciation](#) in the table below).

Parameter Name Trace Display State

Remote Command :TRACe [1] | 2 | 3 | 4 :DISPlay [:STATe] ON|OFF|0|1
 :TRACe [1] | 2 | 3 | 4 :DISPlay [:STATe] ?

Example TRAC2:DISP,1 Makes trace 2 visible
 TRAC3:DISP,0 Blanks trace 3

Dependencies / Couplings Setting the trace type (even to the type it was already in) puts the trace in Display On.
 Whenever the user sets Update to On for any trace, the Display is set to On for that trace.
 Loading a trace from a file puts that trace in Display On regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange.

Preset 1|0|0|0 (On for Trace 1; Off for 2-4)

State Saved Saved in Instrument State

Key Path **Trace/Detector**

Annunciation A trace in Blank is indicated by a strikethrough thorough the type letter in the trace annotation panel in the Measurement bar.



View/Display

The following **View/Display** keys are for setting up a Two Port Insertion Loss measurement. The measurement must already be running to access these keys. Press **Meas**, **Two Port Insertion Loss** to turn on the measurement.

Mode:	All
Key Path	Front-panel key

Avg Insertion Loss

Sets the Average Insertion Loss setting to either On or Off. Average insertion loss is the average of the measured insertion loss values across the frequency range being swept. Mathematically, it is calculated by summing the insertion loss values at each frequency point and then dividing that sum by 256. (There are 256 sweep points.)

The average insertion loss is useful when you are sweeping only within the pass band or only within the stop band of a filter, or a device such as a cable or attenuator. The frequency range should have a fairly flat response across the range. The average value will not be meaningful if you are sweeping a frequency range that includes both the pass band and the stop band of a filter.

Mode	Stimulus / Response
Preset	On
Range	On Off
Key Path	View/Trace, Avg Insertion Loss

One Port Insertion Loss Measurement

One Port Insertion Loss measurement Description

The one port insertion loss measurement allows you to quantify signal loss in a cable or other device without connecting both ends of the cable or device to the test set. This measurement can be especially useful in measuring the loss of a feedline connected to the antenna on a tower. This method of measuring antenna feedline insertion loss is accurate for results up to 10 dB.

This measurement is less accurate than Two Port Insertion Loss. When it is not practical to connect both ends of a device to the test set or for insertion loss measurements greater than 10 dB — for example when measuring a 40 dB high power attenuator — it is better to use Two Port Insertion Loss.

To configure measurement settings, select **One Port Insertion Loss** and then press **Meas Setup**. Pressing **Control/Sweep** enables you to restart a measurement, for more information, refer to “Control/Sweep” on page 418.

NOTE The test signal emitted from the RF Output connector is a sine wave, swept from the starting frequency to the stop frequency. When testing cables that are attached to antennas, test signals are radiated, and these test signals can cause interference. Verify that the signal used for the test cannot cause interference to another antenna.

Mode:	Stimulus/Response
Key Path	Stimulus/Response

AMPTD/Y Scale

The following **AMPTD/Y Scale** keys are for setting up a One Port Insertion Loss measurement. The measurement must already be running to access these keys. Press **Meas**, **One Port Insertion Loss** to turn on the measurement.

Autoscale

Executes an automatic scaling of the **Reference Level** setting. Autoscale is a front-panel only function and has no SCPI command.

Mode	SA
Key Path	Front-panel key

Stimulus / Response

One Port Insertion Loss Measurement

Reference Level

Sets the reference level value used for amplitude measurements. The reference level is the amplitude power or voltage represented by the top graticule line on the display. Changing the value of the reference level changes the absolute amplitude level of the top graticule line. The reference level (in dB) can be set with the step keys, knob, or numeric keypad.

Mode	Stimulus/Response
Remote Command	:DISPlay:OPILoss:WINDow:TRACe:Y[:SCALe]:RLEVel <insertion_loss> :DISPlay:OPILoss:WINDow:TRACe:Y[:SCALe]:RLEVel?
Example	DISP:OPIL:WIND:TRAC:Y:RLEV 10dB
Preset	0 dB
State Saved	Saved in State
Range	-100 dB to 150 dB
Key Path	AMPTD Y Scale

Scale/Div

Sets the logarithmic units per vertical graticule division on the display.

Mode	Stimulus/Response
Remote Command	:DISPlay:OPILoss:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_ampl> :DISPlay:OPILoss:WINDow:TRACe:Y[:SCALe]:PDIVision?
Example	DISP:OPIL:WIND:TRAC:Y:PDIV 10dB
Preset	10.00 dB
State Saved	Saved in State
Range	1.0 to 20
Key Path	AMPTD Y Scale

FREQ/Channel Menu

The following **FREQ/Channel** keys are for setting up a One Port Insertion Loss measurement. The measurement must already be running to access these keys. Press **Meas, Return Loss** to turn on the

measurement.

Start Freq

Use this key to specify the Start Frequency of your frequency range.

Mode	Stimulus / Response
Remote Command	[:SENSe] :FREQuency:STARt <freq> [:SENSe] :FREQuency:STARt?
Example	FREQ:STAR 200 MHz FREQ:STAR?
Dependencies / Couplings	You cannot set the Start frequency equal to the Stop frequency. The instrument will alter the value of the last setting to maintain a minimum value of 1 kHz difference between the Start and Stop frequencies.
Preset	1.85 GHz
State Saved	Saved in instrument state.
Range	From 10 MHz to 2.999999 GHz (Option 503) / 5.999999 GHz (Option 506)
Key Path	FREQ/Channel

Stop Freq

Use this key to specify the Stop Frequency of your frequency range.

Mode	Stimulus / Response
Remote Command	[:SENSe] :FREQuency:STOP <freq> [:SENSe] :FREQuency:STOP?
Example	FREQ:STOP 220 MHz FREQ:STOP?
Dependencies / Couplings	You cannot set the Start frequency equal to the Stop frequency. The instrument will alter the value of the last setting to maintain a minimum value of 1 kHz difference between the Start and Stop frequencies.
Preset	1.99 GHz
State Saved	Saved in instrument state.
Range	From 10.001 MHz to 3 GHz (Option 503) / 6 GHz (Option 506)
Key Path	FREQ/Channel

Calibrate

Use this key to start the process of calibrating your measurement. Follow the instructions on the screen to complete the calibration process.

Mode	Stimulus / Response
Key Path	FREQ/Channel, Calibrate

The One-Port Insertion Loss calibration is the same calibration as performed for the Return Loss and Distance to Fault (when it is performed with Frequency Range set to manual) measurements. If you have already calibrated for any of these three measurements, the calibration will apply to the other two measurements and “Calibrated” (together with the frequency range over which the calibration was performed) will be displayed on top left of the screen for all three.

The Distance to Fault calibration (when it is performed with Frequency Range set to Auto) is only valid for other Distance to Fault measurements that are also performed with Frequency Range set to Auto, and then only if the calibrated frequency range falls within the previously calibrated frequency range.

If you have not previously performed a calibration, the words “Factory Calibration” appear at the top left of the measurement screen.

It is important that you keep the calibration frequency range as close as possible to the actual sweep frequencies you intend using for the measurement or measurements. Calibrating over a wide frequency range (for example, 1 GHz) when you only intend measuring over a narrower frequency range (for example, a few tens of kHz) will induce inaccuracies into your results.

NOTE	The Calibrate Start/Stop frequencies define the frequency range over which the CALIBRATION will take place, and do NOT define the frequency range over which the MEASUREMENT will be made.
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If you plan to perform a combination of One-Port Insertion Loss measurement, Return Loss measurement, and Distance to Fault measurements using a frequency range that you will set manually, you can perform one calibration for all three measurements as long as you calibrate over a frequency range that incorporates all three of your measurements, and as long as your cables do not change. For this reason, if you are doing Distance to Fault measurements (using a frequency range that you have set manually) as well as any type of Insertion Loss measurement, Agilent recommends that you select your cable type before performing calibrations. Press **Meas, Distance to Fault, Meas Setup, Cable Type** to set the cable type.

The calibration remains valid until you do any one of the following:

- set the Distance to Fault frequency range to Auto. Note that the calibration will become valid again as soon as you switch from Auto back to Manual Frequency Range.
- power off the spectrum analyzer

- change the start frequency to a new value that lies below the start frequency of your previous calibration
- change the stop frequency to a new value that lies above the stop frequency of your previous calibration
- change any of the cables that you used for the calibration
- change any of the attenuators that you used for the calibration
- change the type of cable specified under the **Cable Type** menu key.

To perform a One Port Insertion Loss Calibration, first select the desired frequency and then follow the steps in the calibration wizard. To calibrate your spectrum analyzer, you will need the following pieces of equipment:

- Open/ Short connector, Type N (m) part number 00909–60009
- Calibrated 50 ohm Load connector, Type N (m) part number 85032–60011

NOTE These parts are available as part of the N1996A-SRK Stimulus Response Calibration Kit.

Mode	Stimulus / Response
Key Path	FREQ/Channel, Calibrate

Continue Use this key after you have made any desired changes to the calibration start or stop frequencies, and you are ready to continue to the next step of the calibration.

Mode	Stimulus / Response
State Saved	No
Key Path	Freq/Channel, Calibrate

Calibration Start Freq Use this key to specify the Start Frequency of your calibration frequency range. It is important that you keep the calibration frequency range as close as possible to the actual sweep frequencies you intend using for the measurement or measurements. For additional information, refer to “Calibrate” on page 242.

NOTE The Calibrate Start/Stop frequencies define the frequency range over which the CALIBRATION will take place, and do NOT define the frequency range over which the MEASUREMENT will be made.

Stimulus / Response
One Port Insertion Loss Measurement

Mode	Stimulus / Response
State Saved	No
Preset	The same value as the Start Freq set for the measurement.
Range	10 MHz to 3.0 GHz (Option 503) / to 6.0 GHz (Option 506)
Dependencies / Couplings	The Calibration Start Freq must be set lower than the Calibration Stop Freq. If you set the Calibration Start Freq higher than the Calibration Stop Freq, the stop frequency will automatically be set to a value higher than the start frequency.
Key Path	Freq/Channel, Calibrate

Calibration Stop Freq Use this key to specify the Calibration Stop Frequency of your calibration frequency range. It is important that you keep the calibration frequency range as close as possible to the actual sweep frequencies you intend using for the measurement or measurements. For additional information, refer to “[Calibrate](#)” on page 242.

NOTE The Calibrate Start/Stop frequencies define the frequency range over which the CALIBRATION will take place, and do NOT define the frequency range over which the MEASUREMENT will be made.

Mode	Stimulus / Response
State Saved	No
Preset	The same value as the Start Freq set for the measurement.
Range	10 MHz to 3.0 GHz (Option 503) / to 6.0 GHz (Option 506)
Dependencies / Couplings	The Calibration Stop Freq must be set higher than the Calibration Start Freq. If you set the Calibration Stop Freq lower than the Calibration Start Freq, the start frequency will automatically be set to a value lower than the stop frequency.
Key Path	Freq/Channel, Calibrate

Cancel Use this key to abort the Calibration process.

Mode	Stimulus / Response
Key Path	Freq/Channel, Calibrate

Meas

In the Stimulus Response mode, **Meas** accesses a menu of keys associated with the Stimulus Response mode. The measurement runs using the current default setup. Or you can change settings for your unique measurement requirements. Settings can be changed using the functions available under the **Meas Setup** key.

To configure measurement settings, select **One Port Insertion Loss** and then press **Meas Setup**.

Use **Control/Sweep** to restart the currently selected measurement and change the sweep points. To select between continuous or single measurements, press the **Cont** or **Single** front-panel keys. For information about controlling sweep, refer to the.

Mode	Stimulus / Response
State Saved	Saved in instrument state.
Range	Two Port Insertion Loss One Port Insertion Loss Return Loss Distance to Fault
Key Path	Meas

Meas Setup

Meas Setup accesses a menu of keys to set up the Return Loss measurement. This section describes the menu keys available with **One Port Insertion Loss** measurement selected. To turn on the measurement, select **Meas, One Port Insertion Loss**.

Mode	Stimulus / Response
Key Path	Front-panel key

Avg Mode

Sets the type of termination control used for the averaging function. This determines the type of averaging that will be used for the specified number of measurements.

Mode	Stimulus / Response
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Stimulus / Response

One Port Insertion Loss Measurement

Remote Command	[:SENSe] :OPILoss :AVERAge :TCONtrol EXPonential MAXHold REPeat RMAXhold [:SENSe] : OPILoss :AVERAge :TCONtrol?
Example	OPIL:AVER:TCON RMAX OPIL:AVER ON
Preset	EXPonential ON
Range	Off Exponential Repeat Repeat Max Hold
Key Path	Meas Setup

Off Turns averaging functions off.

Key Path: **Meas setup, Avg Mode, Off**

Exponential Sets the averaging function to exponential. With exponential averaging mode, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Key Path: **Meas setup, Avg Mode, Exponential**

Max Hold In **Max Hold** the analyzer maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data. Pressing the **Max Hold** key for the selected trace sets the trace type to **Max Hold**, causes the trace to be cleared and causes the **Max Hold** sequence to be restarted.

Key Path: **Meas setup, Avg Mode, Max Hold**

Repeat Sets averaging to the repeat function. Repeat averaging updates the trace after the selected number of sweeps has been averaged. It is not updated again until the next set of data from the Avg Number of sweeps has been collected.

Key Path: **Meas setup, Avg Mode, Repeat**

Repeat Max Hold Sets averaging to repeat with max hold function. Repeat with max hold captures and holds the highest magnitude data at the end of each sweep count. Repeat with max hold updates the trace after the selected number of sweeps has been made. It is not updated again until the next set of data from the Avg Number of sweeps has been collected.

Key Path: **Meas setup, Avg Mode, Repeat Max Hold**

Avg Number

Sets the number of measurement averages used when calculating the measurement result.

Mode	Stimulus / Response
Remote Command	[:SENSe] :OPILossAVERAge:COUNT <integer> [:SENSe] :OPILoss:AVERAge:COUNT?
Example	OPIl:AVER:COUN 60
Preset	4
State Saved	Saved in instrument state.
Range	0 to 4096
Key Path	Meas Setup

Clear Normalize

Clear Normalize deletes the current normalization data.

Mode	Stimulus / Response
Key Path	Meas Setup, Clear Normalize

Limits

Access the limit mask keys. You can define a limit mask that matches your maximum or minimum measurement requirements. This mask can then be compared with the measured trace data to determine pass/fail conditions.

Stimulus / Response
One Port Insertion Loss Measurement

Limit Masks Sets the Limit Masks submenu keys, it is then possible to select to configure either Limit Mask 1 (Upper) or Limit Mask 2 (Lower).

Mode	Stimulus / Response
Dependencies / Couplings	The Limit Mask 1 (Upper) menu link key accesses the keys to configure the upper limit mask for the Center, 1st, or 2nd segments (dependent on selected segment). The Limit Mask 2 (Lower) menu link key accesses the keys to configure the lower limit mask for the Center, 1st, or 2nd segments (dependent on selected segment).
Remote Command Notes	The Limit Mask SCPI command syntax uses: The keyword “LMASK[1]” to define the Upper limit mask. The keyword “LMASK2” to define the Lower limit mask.
State Saved	Saved in instrument state.
Key Path	Meas Setup, Limit Masks, Limit Masks

Limit Mask 1 (upper) or Limit Mask 2 (Lower)

Limit Mask 1 (upper) accesses the upper limit mask keys.

Limit Mask 2 (Lower) accesses the lower limit mask keys.

You can define a limit mask that matches your maximum or minimum measurement requirements. This mask can then be compared with the measured trace data to determine pass/fail conditions.

Limit Trace

Selects the trace to which the currently selected limit mask (1 or 2) will be applied. The limit masks can be applied to separate traces. Only 2 traces are available in the Stimulus Response mode (compare to 4 traces in the Spectrum Analyzer Mode).

Mode	Stimulus / Response
Dependencies / Couplings	The limit mask is always displayed when the center segment is turned on; even if the trace to which it is being applied is blanked (‘Show’ set to Off).
Preset	1
State Saved	Saved in instrument state.
Range	1 2
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, Limit Mask Trace Meas Setup, Limits, Limit Masks, Limit Mask 2, Limit Mask Trace

Segment (Center, 1st or 2nd)

Selects the **Center, 1st** or, **2nd** segment for limit mask 1 or 2. With each segment setting, the **Limits** menu is updated to show the span and level settings available for the currently selected segment

Mode	Stimulus / Response
Dependencies / Couplings	Key menu structure is dependent on selected segment.
Preset	Center
State Saved	Saved in instrument state.
Range	Center 1st 2nd
Key Path	Meas Setup, Limits, Limit Mask 1, Segment (Center, 1st or 2nd)

Center Segment

Segments (Center) Sets the state of the center segment to On or Off. This key is available only when Center has been selected with the Segments key.

Notes	Key is only displayed when the selected segment is Center
Dependencies / Couplings	If Off no limit mask will be displayed even if the 1 st or 2 nd segments are turned On. If On the center segment is drawn on the display centered round the current center frequency.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, Center Segment

Level: Center

Sets the power level for the center segment of the current selected limit mask. This key is available only when Center has been selected with the Segments key.

Mode	Stimulus / Response
Restrictions and Notes	Key is only displayed when the selected segment is Center.
Preset	Not affected by a preset but set per default to 30 dB after a power cycling
State Saved	Saved in instrument state.

Stimulus / Response
One Port Insertion Loss Measurement

Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment Level
Default Unit	dB

Span: Center

Sets the frequency span for the center segment of the currently selected limit mask. This key is only available when Center has been selected with the Segment key.

Mode	Stimulus / Response
Restrictions and Notes	Key is only displayed when the selected segment is Center.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.
Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, Center Segment Span
Default Unit	Hz

1st Segment

Sets the state of the first segment to On or Off. This key is available only when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st .

Dependencies / Couplings	<p>If Off the 2nd limit mask segment will not be displayed even if turned On.</p> <p>If On and the Center segment is On:</p> <p>The left hand side 1st segment is drawn to the left hand side of the center segment at the specified power level</p> <p>The right hand side 1st segment is drawn to the right hand side of the center segment at the specified power</p> <p>For both left and right 1st segments when On</p> <p>If the 2nd segment is Off the 1st segment extends so the total limit mask span is equal to the current frequency span.</p> <p>If the 2nd segment is On the left and right 1st segments use the specified span values.</p>
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment

1st Segment (Left or Right Limits)

Sets **1st Segment** to allow definition of the limits Left or Right of the center segment. The Left or Right amplitude limits can be changed with the **Level** key. The Left or Right span limits can be changed with the limits menu **Span** key. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st .
Preset	Not affected by a preset but set per default to Left after a power cycling
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment (Left or Right Limits)

Level: 1st Segment Left

Sets the power level, for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
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Stimulus / Response
One Port Insertion Loss Measurement

Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Left.
Preset	Not affected by a preset but set per default to 10 dB after a power cycling
State Saved	Saved in instrument state.
Min	-100 dB
Max	100 dB
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment: Left Level
Default Unit	dB

Level: 1st Segment Right

Sets the power level, for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Right.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	Not affected by a preset but set per default to 30 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment: Right Level
Default Unit	dB

Span: 1st Segment Left

Sets the frequency span for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Left.

Dependencies / Couplings	If the Center, 1 st , and 2 nd segments are On, the left 2 nd segment span adjusts on a change in the left 1 st segment span.
State Saved	Saved in instrument state.
Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment: Left Span
Default Unit	Hz

Span: 1st Segment Right

Sets the frequency span for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Right.
Dependencies / Couplings	If the Center, 1 st , and 2 nd segments On, the right 2 nd segment span adjusts on a change in the right 1 st segment span.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.
Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 1st Segment: Right Span
Default Unit	Hz

2nd Segment

Sets the state of the first segment to On or Off. This key is available only when 2nd has been selected with the Segments key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd .

Stimulus / Response
One Port Insertion Loss Measurement

Dependencies / Couplings	<p>If Off the 2nd limit mask segment will not be displayed even if turned On.</p> <p>If On, and the First and Center segments are On:</p> <p>The left hand side 2nd segment is drawn to the left hand side of the left first segment at the specified power level</p> <p>The right hand side 1st segment is drawn to the right hand side of the right first segment at the specified power</p> <p>The segment spans are calculated as documented in section above</p>
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 2nd Segment

2nd Segment (Left or Right Limits)

Sets to allow definition of the limits Left or Right of the center segment for the 2nd Segment. The Left or Right amplitude limits can be changed with the **Level** key. This key is only available when **2nd** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd .
Dependencies / Couplings	<p>The span for each of the left</p> <p>The Left span is calculated as follows:</p> $(<\text{maximum span}>/2) - (<\text{center segment span}>/2) - <\text{first segment left span}>$ <p>The Right span is calculated as follows:</p> $(<\text{maximum span}>/2) - (<\text{center segment span}>/2) - <\text{first segment right span}>$ <p>Where:</p> <p><maximum span> is the maximum frequency span of the instrument (3 GHz or 6 GHz)</p> <p><center segment span></p> <p><first segment left span></p> <p><first segment right span></p>
Preset	Not affected by a preset but set per default to Left after a power cycling

State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 2nd Segment (Left or Right Limits)

Level: 2nd Segment Left

Sets the power level, for the 2nd segment to the Left of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Left.
Preset	Not affected by a preset but set per default to 50 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 2nd Segment: Left Level
Default Unit	dB

Stimulus / Response

One Port Insertion Loss Measurement

Level: 2nd Segment Right

Sets the power level, for the 2nd segment to the Right of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd , and the selected segment side is Right.
Preset	Not affected by a preset but set per default to 50 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limits, Limit Masks, Limit Mask 1, 2nd Segment: Right Level
Default Unit	dB

Avg Limits

Accesses menu keys that enable you to control and set the average limits. These are minimum and maximum values that the average measured insertion loss is compared against. Average insertion loss is the average of the measured insertion loss values across the frequency range being swept.

Mathematically, it is calculated by summing the insertion loss values at each frequency point and then dividing that sum by 256 (there are 256 sweep points.)

The average insertion loss is useful when you are sweeping only within the pass band or only within the stop band of a filter, or a device such as a cable or attenuator. The frequency range should have a fairly flat response across the range. An average value has less significance if you are sweeping a frequency range that includes both the pass band and the stop band of a filter.

The maximum and minimum values that you specify are compared to the calculated average. Pass/fail results are shown on the average insertion loss metric panel. You can turn this display panel off by selecting **View/Display, Avg Insertion Loss (Off)**.

Mode	Stimulus/Response
Key Path	Meas Setup, Avg Limits

Avg Limits On/Off Turns on/off the average limit values.

Mode	Stimulus / Response
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Preset	0
Range	On Off
Key Path	Meas Setup, Avg Limits, Avg Limits On/Off

Max Loss Limit Sets the maximum average limit value. If the average limits are turned on, then the measured average insertion loss will be compared with this value.

Mode	Stimulus / Response
Preset	10 dB
Key Path	Meas Setup, Avg Limits, Max Loss Limit

Min Loss Limit Sets the minimum average limit value. If the average limits are turned on, then the measured average insertion loss will be compared with this value.

Mode	Stimulus / Response
Preset	0 dB
Key Path	Meas Setup, Avg Limits, Min Loss Limit

Report Loss As

The “Report Loss As” key resides in the “Meas Setup” menu. It allows selection of the signal loss to be represented as positive dB or negative dB. “Report Loss As” is a measurement global parameter, and its setting is preserved over power cycle.

Remote Command	:UNIT:LOSS PDB NDB :UNIT:LOSS?
Example	UNIT:LOSS NDB UNIT:LOSS?
Dependencies / Couplings	None This key is measurement global
Preset	Survives Preset
State Saved	Saved in State, survives Preset, survives power cycle

SPAN/X Scale

The following **SPAN/X Scale** keys are for setting up a One Port Insertion Loss measurement. The measurement must already be running to access these keys. Press **Meas, One Port Insertion Loss** to turn on the measurement.

Mode	SR
Key Path	Front-panel key

Span

Sets the span frequency value. Span frequency describes the frequency range that is positioned symmetrically about center frequency.

The minimum span is 1 kHz. Zero-span is not applicable to SR measurements.

Span is measurement specific. It survives mode-preset.

Parameter Name	Span
Mode	Stimulus Response
Remote Command	<pre>[:SENSE] :TPILoss:FREQUENCY:SPAN <frequency> [:SENSE] :TPILoss:FREQUENCY:SPAN? [:SENSE] :OPILoss:FREQUENCY:SPAN <frequency> [:SENSE] :OPILoss:FREQUENCY:SPAN? [:SENSE] :RLOSS:FREQUENCY:SPAN <frequency> [:SENSE] :RLOSS:FREQUENCY:SPAN? [:SENSE] :DTFault:FREQUENCY:SPAN <frequency> [:SENSE] :DTFault:FREQUENCY:SPAN?</pre>
Example	<p>TPIL:FREQ:SPAN 2GHz sets the span to 2GHz for TPIL</p> <p>TPIL: FREQ:SPAN? queries the span for TPIL</p>
Dependencies / Couplings	See section 1.6
Preset	<p>140 MHz (Option 506)</p> <p>140 MHz (Option 503)</p>
State Saved	Saved in State

Range	1 kHz to 6.0 GHz (Option 506) 1 kHz to 3.0 GHz (Option 503)
MIN/MAX/DEF Support	No
Key Path	Span/X Scale
Menu Key Label	Span
Active Function Text	Span
Knob Increment	10% of Span
Step (UP/DOWN)	No SCPI support
Step (Front Panel)	1, 2, 5 sequence
Front Panel Unit/Terminator Keys	GHz MHz kHz Hz

Last Span

Changes the displayed frequency span to the previous span setting. There is no memory of the last span after a power off or a mode preset.

Mode	Stimulus Response
Remote Command	[:SENSe] : TPILoss : FREQuency : SPAN : PREVIOUS [:SENSe] : OPILoss : FREQuency : SPAN : PREVIOUS [:SENSe] : RLOs : FREQuency : SPAN : PREVIOUS [:SENSe] : DTFault : FREQuency : SPAN : PREVIOUS
Example	RLOS:FREQ:SPAN:PREV
Remote Command Notes	No query form
Key Path	Span/X Scale

Trace/Detector

Accesses the **Trace/Detector** menu keys. **Trace/Detector** menu keys allow the user to control the acquisition, display, storage, detection and manipulation of trace data. The **Trace/Detector** keys are for setting up a One Port Insertion Loss measurement. The measurement must already be running to access these keys. Press **Meas, One Port Insertion Loss** to turn on the measurement.

Stimulus / Response

One Port Insertion Loss Measurement

Mode	Stimulus / Response
Key Path	Front-panel key

Select Trace

Selects which trace the menu keys will affect. Press **Select Trace** until the number of the desired trace is underlined. Only 2 traces are available in the Stimulus Response mode (compared to 4 traces in the Spectrum Analyzer Mode). Note as well that in the “One Port Insertion Loss” measurement, there is only one trace being generated, so if both are active using the “Update On/Off” feature described below, they will contain identical data and the one on top will hide the bottom one (only one will be seen, but both are there). The purpose of the “Trace/Detector” feature in this measurement is to allow an A/B comparison. For instance, you could store one set of measurement results in Trace 2 (Turn ON first the “Update” parameter of this Trace 2 to get the results then turning back OFF this “Update” parameter to store the results) and then compare it with set of measurement results displayed by Trace 1 (Set the “Update” parameter of the Trace 1 to ON).

Preset	Trace 1
State Saved	The number of the selected trace is saved in Instrument State
Range	1 2
Key Path	Trace/Detector, Select Trace

View/Blank

View/Blank lets you set the state of the two trace variables, Update and Display. The four choices available in this menu are:

- **Trace On:** Update and Display both On
- **View:** Update Off and Display On
- **Blank:** Update Off and Display Off
- **Background:** Update On, Display Off (this allows a trace to be blanked and continue to update “in the background”, which was not possible in the past)

When a trace becomes inactive, the following things happen:

- Any update from the SENSE system (detectors) immediately stops (That is, the current update does not continue to the end of the sweep)
- The trace is displayed at half intensity as long as it stays inactive.

Inactive traces display across the entire X Axis of the instrument. Their horizontal placement does not change even if X Axis settings subsequently are changed, although Y-axis settings will affect the vertical placement of data.

In most cases, inactive traces are static and unchanging; however, there are cases when an inactive trace will update, specifically:

- If data is written to that trace from remote
- If trace data is loaded from mass storage
- If the trace is the target of a Copy or participant in an Exchange
- If the trace is cleared using the Clear Trace function (below)

When a trace becomes active (Update = On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Traces which are blanked (Display = off) do not display nor appear on printouts but are otherwise unaffected. They may be queried and markers may be placed on them.

NOTE The action of putting a trace in Display = Off and/or Update = Off does not restart the sweep and does not restart Averaging or Hold functions for any traces.

NOTE Whenever the you set Update to On for any trace, Display is set to On for that trace.

Parameter Name	Trace View/Blank
Key Path	Trace/Detector
Key Notes	<p>The four states of this menu set two variables, Update and Display, to their four possible combinations:</p> <ul style="list-style-type: none"> • Trace On: Update and Display both On • View: Update Off and Display On • Blank: Update Off and Display Off • Background: Update On, Display Off <p>See tables below for details on the SCPI to control these two variables.</p>

Parameter Name	Trace Update State
Remote Command	<pre>:TRACe [1] 2 3 4 :UPDate [:STATe] ON OFF 0 1 :TRACe [1] 2 3 4 :UPDate [:STATe] ?</pre>
Example	TRAC2:UPD 0 Makes trace 2 inactive (stops updating)
Dependencies / Couplings	<p>Setting the trace type (even to the type it was already in) puts the trace in Active.</p> <p>Loading a trace from a file makes that trace inactive regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange.</p> <p>Whenever the user sets Update to On for any trace, the Display is set to On for that trace.</p>
Preset	1 0 0 0 (On for Trace 1; Off for 2-6)

Stimulus / Response
One Port Insertion Loss Measurement

State Saved	Saved in Instrument State
Key Path	Trace/Detector
Annunciation	An inactive trace is indicated by dimming the type letter in the trace annotation panel in the Measurement bar (see Annunciation in the table below).
Parameter Name	Trace Display State
Remote Command	:TRACe [1] 2 3 4 :DISPly [:STATe] ON OFF 0 1 :TRACe [1] 2 3 4 :DISPly [:STATe] ?
Example	TRAC2:DISP,1 Makes trace 2 visible TRAC3:DISP,0 Blanks trace 3
Dependencies / Couplings	Setting the trace type (even to the type it was already in) puts the trace in Display On. Whenever the user sets Update to On for any trace, the Display is set to On for that trace. Loading a trace from a file puts that trace in Display On regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange.
Preset	1 0 0 0 (On for Trace 1; Off for 2-4)
State Saved	Saved in Instrument State
Key Path	Trace/Detector
Annunciation	A trace in Blank is indicated by a strikethrough thorough the type letter in the trace annotation panel in the Measurement bar.



View/Display

The following **View/Display** keys are for setting up a One Port Insertion Loss measurement. The measurement must already be running to access these keys. Press **Meas, One Port Insertion Loss** to turn on the measurement.

Mode	Stimulus / Response
Key Path	Front-panel key

Avg Insertion Loss

Sets the Average Insertion Loss setting to either On or Off.

Mode	Stimulus / Response
Range	On Off
Key Path	View/Trace, Avg Insertion Loss

Return Loss

Return Loss Description

Return loss is a measure of reflection characteristics. The return loss measurement allows you to quantify how much of a signal is reflected back from a device instead of being absorbed by the device or passed through it.

One way you can use the return loss measurement is to detect problems in the antenna feedline system and the antenna itself. A portion of the incident power will be reflected back to the source from each transmission line fault as well as the antenna. The ratio of the reflected voltages to the incident voltage is called the reflection coefficient. The reflection coefficient is a complex number, meaning it has both magnitude and phase information. In S-parameter terms, Return Loss is referred to as an S11 measurement.

To configure measurement settings, select **Return Loss** and then press **Meas Setup**. Pressing **Control/Sweep** enables you to restart a measurement. Refer to “[Control/Sweep Functions](#)” on page 418.

NOTE The test signal emitted from the RF OUTPUT connector is a sine wave, swept from the starting frequency to the stop frequency. When testing cables that are attached to antennas, test signals are radiated, and these test signals can cause interference. Verify that the signal used for the test cannot cause interference to another antenna.

Mode	Stimulus / Response
State Saved	Saved in instrument state.
Key Path	MEAS, Return Loss

AMPTD/Y Scale

Activates the reference level function, and accesses the amplitude menu keys. The amplitude menu keys set functions that affect the way data on the vertical axis is displayed or corrected. The **AMPTD/Y Scale** keys are for setting up a Return Loss measurement. The measurement must already be running to access these keys. Press **Meas, Return Loss** to turn on the measurement.

Mode:	SA
Key Path	Front-panel key

Autoscale

Executes an automatic scaling of the **Reference Level** setting. Autoscale is a display-only function and has no SCPI command.

Mode	SA
Key Path	AMPTD Y Scale, Autoscale

Ref Level

Sets the reference level value used for amplitude measurements. The reference level is the amplitude power ratio represented by the top graticule line on the display. Changing the value of the reference level changes the amplitude ratio of the top graticule line. The reference level (in dB) can be set with the step keys, knob, or numeric keypad.

Mode	SA
Preset	0 dB
State Saved	Saved in State
Min	-150 dB
Max	100 dB
Key Path	AMPTD Y Scale, Ref Level

Scale/Div

Sets the logarithmic units per vertical graticule division on the display. This function is available only when the **Scale Type** key is set to **Log**.

Mode	SA
Preset	5 dB / Div
State Saved	Saved in State
Range	1 to 20
Key Path	AMPTD Y Scale, Scale/Div

FREQ/Channel

The following **FREQ/Channel** keys are for setting up a Return Loss measurement. The measurement must already be running to access these keys. Press **Meas, Return Loss** to turn on the measurement.

Mode:	SA
Key Path	Front-panel key

Start Freq

Use this key to specify the Start Frequency of your frequency range.

Mode	Stimulus / Response
State Saved	Saved in State
Range	From 10 MHz to 2.999999 GHz (Option 503) / 5.999999 GHz (Option 506)
Key Path	FREQ/Channel, Start Freq

Stop Freq

Use this key to specify the Stop Frequency of your frequency range.

Mode	Stimulus / Response
Remote Command Notes	The default/min/max/range values provided below are valid only in the Frequency Domain. Time domain (zero span) values will be different.
Preset	3.0 GHz (Option 503), 6.0 GHz (Option 506)
State Saved	Saved in State
Range	From 10.001 MHz to 3 GHz (Option 503) / 6 GHz (Option 506)
Key Path	FREQ/Channel, Stop Freq
SCPI Status Bits/OPC Dependencies	Non-overlapped

Calibrate

Use this key to start the process of calibrating your measurement. Follow the instructions on the screen to complete the calibration process.

Mode	Stimulus / Response
Key Path	FREQ/Channel, Calibrate

The Return Loss calibration is the same calibration as performed for the One Port Insertion Loss and Distance to Fault (when it is performed with Frequency Range set to manual) measurements. If you have already calibrated for any of these three measurements, the calibration will apply to the other two measurements and “Calibrated” (together with the frequency range over which the calibration was performed) will be displayed on top left of the screen for all three.

The Distance to Fault calibration (when it is performed with Frequency Range set to Auto) is only valid for other Distance to Fault measurements that are also performed with Frequency Range set to Auto, and then only if the calibrated frequency range falls within the previously calibrated frequency range.

If you have not previously performed a calibration, the word “Factory Calibration” appears at the top left of the measurement screen.

It is important that you keep the calibration frequency range as close as possible to the actual sweep frequencies you intend using for the measurement or measurements. Calibrating over a large frequency range, such as >2 GHz, when you only intend measuring over a much smaller frequency range, such as <10 MHz, will induce inaccuracies into your results.

NOTE	The Calibrate Start/Stop frequencies define the frequency range over which the CALIBRATION will take place, and do NOT define the frequency range over which the MEASUREMENT will be made.
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If you plan to perform a combination of Return Loss measurement, One-Port Insertion Loss measurement, and Distance to Fault measurements using a frequency range that you will set manually, you can perform one calibration for all three measurements as long as you calibrate over a frequency range that incorporates all three of your measurements, and as long as your cables do not change. For this reason, if you are doing Distance to Fault measurements (using a frequency range that you have set manually) as well as any type of Insertion Loss measurement, Agilent recommends that you select your cable type before performing calibrations. Press **Mode, Stimulus/Response, Meas, Distance to Fault, Meas Setup, Cable Type** to set the cable type.

The calibration remains valid until you do any one of the following:

- Set the Distance to Fault frequency range to Auto. Note that the calibration will become valid again as soon as you switch from Auto back to Manual Frequency Range.
- Power off the spectrum analyzer
- Change the start frequency to a new value that lies below the start frequency of your previous calibration

Stimulus / Response
Return Loss

- Change the stop frequency to a new value that lies above the stop frequency of your previous calibration
- Change any of the cables that you used for the calibration
- Change any of the attenuators that you used for the calibration
- Change the type of cable specified under the Cable Type menu key (Distance to Fault measurement).

To perform a Return Loss Calibration, first select the desired frequency and then follow the steps in the calibration wizard. To calibrate your spectrum analyzer, you will need the following pieces of equipment:

- Open/Short, Type N(m) 85032–60011
- 50 Ohm Load, Type N(m) 00909–60009

NOTE These parts are available as part of the N1996A-SRK Stimulus Response Calibration Kit.

Mode	Stimulus / Response
Key Path	FREQ/Channel, Calibrate

Continue Use this key after you have made any desired changes to the calibration start or stop frequencies, and you are ready to continue to the next step of the calibration.

Mode	Stimulus / Response
State Saved	No
Key Path	Freq/Channel, Calibrate

Calibration Start Freq Use this key to specify the Start Frequency of your calibration frequency range. It is important that you keep the calibration frequency range as close as possible to the actual sweep frequencies you intend using for the measurement or measurements. For additional information, refer to [“Calibrate” on page 242](#).

NOTE The Calibrate Start/Stop frequencies define the frequency range over which the CALIBRATION will take place, and do NOT define the frequency range over which the MEASUREMENT will be made.

Mode	Stimulus / Response
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State Saved	No
Preset	The same value as the Start Freq set for the measurement.
Range	10 MHz to 3.0 GHz (Option 503) / to 6.0 GHz (Option 506)
Dependencies / Couplings	The Calibration Start Freq must be set lower than the Calibration Stop Freq. If you set the Calibration Start Freq higher than the Calibration Stop freq, the stop frequency will automatically be set to a value higher than the start frequency.
Key Path	Freq/Channel, Calibrate

Calibration Stop Freq Use this key to specify the Calibration Stop Frequency of your calibration frequency range. It is important that you keep the calibration frequency range as close as possible to the actual sweep frequencies you intend using for the measurement or measurements. For additional information, refer to [“Calibrate” on page 242](#).

NOTE The Calibrate Start/Stop frequencies define the frequency range over which the CALIBRATION will take place, and do NOT define the frequency range over which the MEASUREMENT will be made.

Mode	Stimulus / Response
State Saved	No
Preset	The same value as the Start Freq set for the measurement.
Range	10 MHz to 3.0 GHz (Option 503) / to 6.0 GHz (Option 506)
Dependencies / Couplings	The Calibration Stop Freq must be set higher than the Calibration Start Freq. If you set the Calibration Stop Freq lower than the Calibration Start freq, the start frequency will automatically be set to a value lower than the stop frequency.
Key Path	Freq/Channel, Calibrate

Cancel Use this key to abort the Calibration process.

Mode	Stimulus / Response
Key Path	Freq/Channel, Calibrate

Meas

In the Stimulus Response mode, **Meas** accesses a menu of keys associated with the Stimulus Response mode. The measurement runs using the current default setup. Or you can change settings for your unique measurement requirements. Settings can be changed using the functions available under the **Meas Setup** key.

To configure measurement settings, select **Return Loss** and then press **Meas Setup**.

Use **Control/Sweep** to restart the currently selected measurement and change the sweep points. To select between continuous or single measurements, press the **Cont** or **Single** front-panel keys. For information about controlling sweep, refer to the.

Mode	Stimulus / Response
Range	Two Port Insertion Loss One Port Insertion Loss Return Loss Distance to Fault
Key Path	Front-panel key

Meas Setup

Meas Setup accesses a menu of keys to set up the Return Loss measurement. This section describes the menu keys available with **Return loss** measurement selected. To turn on the measurement, select **Meas**, **Return loss**.

Mode	Stimulus / Response
Key Path	Front-panel key

Avg Mode

Sets the type of termination control used for the averaging function. This determines the type of averaging used for the specified number of measurements.

Mode	Stimulus / Response
Preset	Exponential, ON
Range	Off Exponential Repeat Repeat Max Hold
Key Path	Meas Setup, Avg Mode

Off Turns averaging functions off.

Key Path: **Meas setup, Avg Mode, Off**

Exponential Sets the averaging function to exponential. With exponential averaging mode, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Key Path: **Meas setup, Avg Mode, Exponential**

Max Hold In **Max Hold** the analyzer maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data. Pressing the **Max Hold** key for the selected trace sets the trace type to **Max Hold**, causes the trace to be cleared and causes the **Max Hold** sequence to be restarted.

Key Path: **Meas setup, Avg Mode, Max Hold**

Repeat Sets averaging to the repeat function. Repeat averaging updates the trace after the selected number of sweeps has been averaged. It is not updated again until the next set of data from the Avg Number of sweeps has been collected.

Key Path: **Meas setup, Avg Mode, Repeat**

Repeat Max Hold Sets averaging to repeat with max hold function. Repeat with max hold captures and holds the highest magnitude data at the end of each sweep count. Repeat with max hold updates the trace after the selected number of sweeps has been made. It is not updated again until the next set of data from the Avg Number of sweeps has been collected.

Key Path: **Meas setup, Avg Mode, Repeat Max Hold**

Avg Number

Sets the number of measurement averages used when calculating the measurement result.

Mode	Stimulus / Response
Preset	4
Min	0
Max	4096
Key Path	Meas Setup, Avg Number

Clear Calibration

Clear Calibration deletes the current normalization data, or to calibrate the analyzer for a new frequency range.

Mode	Stimulus / Response
Key Path	Meas Setup, Clear Calibration

Limits

Access the limit mask keys. You can define a limit mask that matches your maximum or minimum measurement requirements. This mask can then be compared with the measured trace data to determine pass/fail conditions.

Limit Masks

Sets the Limit Masks submenu keys, it is then possible to select to configure either Limit Mask 1 (Upper) or Limit Mask 2 (Lower).

Mode	Stimulus / Response
Dependencies / Couplings	The Limit Mask 1 (Upper) menu link key accesses the keys to configure the upper limit mask for the Center, 1 st , or 2 nd segments (dependent on selected segment). The Limit Mask 2 (Lower) menu link key accesses the keys to configure the lower limit mask for the Center, 1 st , or 2 nd segments (dependent on selected segment).

State Saved	Saved in instrument state.
Key Path	Meas Setup, Limit Masks, Limit Masks

Limit Mask 1 (upper) or Limit Mask 2 (Lower)

Limit Mask 1 (upper) access the upper limit mask keys.

Limit Mask 2 (Lower) access the lower limit mask keys.

You can define a limit mask that matches your maximum or minimum measurement requirements. This mask can then be compared with the measured trace data to determine pass/fail conditions.

Limit Trace

Selects the trace to which the currently selected limit mask (1 or 2) will be applied. The limit masks can be applied to separate traces. Only 2 traces are available in the Stimulus Response mode (compared to 4 traces in the Spectrum Analyzer Mode).

Mode	Stimulus / Response
Dependencies / Couplings	The limit mask is always displayed when the center segment is turned on; even if the trace to which it is being applied is blanked ('Show' set to Off).
Preset	1
State Saved	Saved in instrument state.
Range	1 2
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Limit Mask Trace

Segment (Center, 1st or 2nd)

Selects the Center, 1st or, 2nd segment for limit mask 1 or 2. With each segment setting, the Limits menu is updated to show the span and level settings available for the currently selected segment

Mode	Stimulus / Response
Dependencies / Couplings	Key menu structure is dependent on selected segment.
Preset	Center
State Saved	Saved in instrument state.
Range	Center 1st 2nd
Key Path	Meas Setup, Limit Mask 1, Segment (Center, 1st or 2nd)

Center Segment

Stimulus / Response

Return Loss

Segments (Center) Sets the state of the center segment to On or Off. This key is available only when Center has been selected with the Segments key.

Notes	Key is only displayed when the selected segment is Center
Dependencies / Couplings	If Off no limit mask will be displayed even if the 1 st or 2 nd segments are turned On. If On the center segment is drawn on the display centered round the current center frequency.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment

Level: Center

Sets the power level for the center segment of the current selected limit mask. This key is available only when Center has been selected with the Segments key.

Mode	Stimulus / Response
Restrictions and Notes	Key is only displayed when the selected segment is Center.
Preset	0 dB for mask 1, 40 dB for mask 2
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment Level
Default Unit	dB

Span: Center

Sets the frequency span for the center segment of the currently selected limit mask. This key is only available when Center has been selected with the Segment key.

Mode	Stimulus / Response
Restrictions and Notes	Key is only displayed when the selected segment is Center.
Preset	5 MHz

State Saved	Saved in instrument state.
Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment Span
Default Unit	Hz

1st Segment

Sets the state of the first segment to On or Off. This key is available only when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st .
Dependencies / Couplings	<p>If Off the 2nd limit mask segment will not be displayed even if turned On.</p> <p>If On and the Center segment is On:</p> <p>The left hand side 1st segment is drawn to the left hand side of the center segment at the specified power level</p> <p>The right hand side 1st segment is drawn to the right hand side of the center segment at the specified power</p> <p>For both left and right 1st segments when On</p> <p>If the 2nd segment is Off the 1st segment extends so the total limit mask span is equal to the current frequency span.</p> <p>If the 2nd segment is On the left and right 1st segments use the specified span values.</p>
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment

1st Segment (Left or Right Limits)

Sets **1st Segment** to allow definition of the limits Left or Right of the center segment. The Left or Right amplitude limits can be changed with the **Level** key. The Left or Right span limits can be changed with the limits menu **Span** key. This key is only available when **1st** has been selected with the **Segments** key.

Stimulus / Response Return Loss

Mode	Stimulus/Response
Preset	Left
Range	Left Right
Key Path	Meas Setup, Limits

Level: 1st Segment Left

Sets the power level, for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus/Response
Preset	0 dB for mask 1, 40 dB for mask 2
State Saved	Saved in instrument State
Range	-100 dBm to 100 dBm
Key Path	Meas Setup, Limits

Level: 1st Segment Right

Sets the power level, for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus/Response
Preset	0 dB for mask 1, 40 dB for mask 2
State Saved	Saved in instrument State
Range	-100 dBm to 100 dBm
Key Path	Meas Setup, Limits

Span: 1st Segment Left

Sets the frequency span for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus/Response
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Preset	1 MHz
State Saved	Saved in instrument State
Range	0 Hz to Span
Key Path	Meas Setup, Limits

Span: 1st Segment Right

Sets the frequency span for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus/Response
Preset	1 MHz
State Saved	Saved in instrument State
Range	0 Hz to Span
Key Path	Meas Setup, Limits

2nd Segment

Sets the state of the first segment to On or Off. This key is available only when 2nd has been selected with the Segments key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd .
Dependencies / Couplings	<p>If Off the 2nd limit mask segment will not be displayed even if turned On.</p> <p>If On, and the First and Center segments are On:</p> <p>The left hand side 2nd segment is drawn to the left hand side of the left first segment at the specified power level</p> <p>The right hand side 1st segment is drawn to the right hand side of the right first segment at the specified power</p> <p>The segment spans are calculated as documented in section above</p>
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment

2nd Segment (Left or Right Limits)

Sets to allow definition of the limits Left or Right of the center segment for the 2nd Segment. The Left or Right amplitude limits can be changed with the **Level** key. This key is only available when **2nd** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd .
Dependencies / Couplings	The span for each of the left The Left span is calculated as follows: $(\langle \text{maximum span} \rangle / 2) - (\langle \text{center segment span} \rangle / 2) - \langle \text{first segment left span} \rangle$ The Right span is calculated as follows: $(\langle \text{maximum span} \rangle / 2) - (\langle \text{center segment span} \rangle / 2) - \langle \text{first segment right span} \rangle$ Where: $\langle \text{maximum span} \rangle$ is the maximum frequency span of the instrument (3 GHz or 6 GHz) $\langle \text{center segment span} \rangle$ $\langle \text{first segment left span} \rangle$ $\langle \text{first segment right span} \rangle$
Preset	Not affected by a preset but set per default to Left after a power cycling
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment (Left or Right Limits)

Level: 2nd Segment Left

Sets the power level, for the 2nd segment to the Left of the Center segment. This key is only available when **2nd** has been selected with the **Segments** key.

Mode	Stimulus/Response
Preset	0 dB for mask 1, 40 dB for mask 2

State Saved	Saved in instrument State
Range	-100 dBm to 100 dBm
Key Path	Meas Setup, Limits

Level: 2nd Segment Right

Sets the power level, for the 2nd segment to the Right of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Stimulus/Response
Preset	0 dB for mask 1, 40 dB for mask 2
State Saved	Saved in instrument state
Range	-100 dBm to 100 dBm
Key Path	Meas Setup, Limits

Report Loss As The “Report Loss As” key resides in the “Meas Setup” menu. It allows selection of the signal loss to be represented as positive dB or negative dB. “Report Loss As” is a measurement global parameter, and its setting is preserved over power cycle.

Remote Command	:UNIT:LOSS PDB NDB :UNIT:LOSS?
Example	UNIT:LOSS NDB UNIT:LOSS?
Dependencies / Couplings	None This key is measurement global
Preset	Survives Preset
State Saved	Saved in State, survives Preset, survives power cycle

Report Loss As

The “Report Loss As” key resides in the “Meas Setup” menu. It allows selection of the signal loss to be represented as positive dB or negative dB. “Report Loss As” is a measurement global parameter, and its

Stimulus / Response Return Loss

setting is preserved over power cycle.

Remote Command	:UNIT:LOSS PDB NDB :UNIT:LOSS?
Example	UNIT:LOSS NDB UNIT:LOSS?
Dependencies / Couplings	None This key is measurement global
Preset	Survives Preset
State Saved	Saved in State, survives Preset, survives power cycle

SPAN/X Scale

The following **SPAN/X Scale** keys are for setting up a Return Loss measurement. The measurement must already be running to access these keys. Press **Meas, Return Loss** to turn on the measurement.

Mode	SR
Key Path	Front-panel key

Span

Sets the span frequency value. Span frequency describes the frequency range that is positioned symmetrically about center frequency.

The minimum span is 1 kHz. Zero-span is not applicable to SR measurements.

Span is measurement specific. It survives mode-preset.

Parameter Name	Span
Mode	Stimulus Response

Remote Command	[:SENSe] :TPILoss:FREQuency:SPAN <frequency> [:SENSe] :TPILoss:FREQuency:SPAN? [:SENSe] :OPILoss:FREQuency:SPAN <frequency> [:SENSe] :OPILoss:FREQuency:SPAN? [:SENSe] :RLOSS:FREQuency:SPAN <frequency> [:SENSe] :RLOSS:FREQuency:SPAN? [:SENSe] :DTFault:FREQuency:SPAN <frequency> [:SENSe] :DTFault:FREQuency:SPAN?
Example	TPIL:FREQ:SPAN 2GHz sets the span to 2GHz for TPIL TPIL: FREQ:SPAN? queries the span for TPIL
Dependencies / Couplings	See section 1.6
Preset	140 MHz (Option 506) 140 MHz (Option 503)
State Saved	Saved in State
Range	1 kHz to 6.0 GHz (Option 506) 1 kHz to 3.0 GHz (Option 503)
MIN/MAX/DEF Support	No
Key Path	Span/X Scale
Menu Key Label	Span
Active Function Text	Span
Knob Increment	10% of Span
Step (UP/DOWN)	No SCPI support
Step (Front Panel)	1, 2, 5 sequence
Front Panel Unit/Terminator Keys	GHz MHz kHz Hz

Last Span

Changes the displayed frequency span to the previous span setting. There is no memory of the last span after a power off or a mode preset.

Mode	Stimulus Response
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Stimulus / Response

Return Loss

Remote Command	[:SENSE] : TPILoss : FREQUENCY : SPAN : PREVIOUS [:SENSE] : OPILoss : FREQUENCY : SPAN : PREVIOUS [:SENSE] : RLOSS : FREQUENCY : SPAN : PREVIOUS [:SENSE] : DTFAULT : FREQUENCY : SPAN : PREVIOUS
Example	RLOS:FREQ:SPAN:PREV
Remote Command Notes	No query form
Key Path	Span/X Scale

Trace/Detector

Accesses the **Trace/Detector** menu keys. **Trace/Detector** menu keys allow the user to control the acquisition, display, storage, detection and manipulation of trace data. The **Trace/Detector** keys are for setting up a Return Loss measurement. The measurement must already be running to access these keys. Press **Meas**, **Return Loss** to turn on the measurement.

Mode	Stimulus / Response
Range	Two Port Insertion Loss One Port Insertion Loss Return Loss Distance to Fault
Key Path	Front-panel key

Select Trace

Selects which trace the menu keys will affect. Press **Select Trace** until the number of the desired trace is underlined.

Preset	Trace 1
State Saved	The number of the selected trace is saved in Instrument State
Range	1 2
Key Path	Trace/Detector, Select Trace

View/Blank

View/Blank lets you set the state of the two trace variables, Update and Display. The four choices available in this menu are:

- **Trace On:** Update and Display both On

- **View:** Update Off and Display On
- **Blank:** Update Off and Display Off
- **Background:** Update On, Display Off (this allows a trace to be blanked and continue to update “in the background”, which was not possible in the past)

When a trace becomes inactive, the following things happen:

- Any update from the SENSE system (detectors) immediately stops (That is, the current update does not continue to the end of the sweep)
- The trace is displayed at half intensity as long as it stays inactive.

Inactive traces display across the entire X Axis of the instrument. Their horizontal placement does not change even if X Axis settings subsequently are changed, although Y-axis settings will affect the vertical placement of data.

In most cases, inactive traces are static and unchanging; however, there are cases when an inactive trace will update, specifically:

- If data is written to that trace from remote
- If trace data is loaded from mass storage
- If the trace is the target of a Copy or participant in an Exchange
- If the trace is cleared using the Clear Trace function (below)

When a trace becomes active (Update = On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Traces which are blanked (Display = off) do not display nor appear on printouts but are otherwise unaffected. They may be queried and markers may be placed on them.

NOTE The action of putting a trace in Display = Off and/or Update = Off does not restart the sweep and does not restart Averaging or Hold functions for any traces.

NOTE Whenever the you set Update to On for any trace, Display is set to On for that trace.

Parameter Name	Trace View/Blank
Key Path	Trace/Detector
Key Notes	<p>The four states of this menu set two variables, Update and Display, to their four possible combinations:</p> <ul style="list-style-type: none"> • Trace On: Update and Display both On • View: Update Off and Display On • Blank: Update Off and Display Off • Background: Update On, Display Off <p>See tables below for details on the SCPI to control these two variables.</p>

Stimulus / Response
Return Loss

Parameter Name	Trace Update State
Remote Command	:TRACe [1] 2 3 4 :UPDate [:STATe] ON OFF 0 1 :TRACe [1] 2 3 4 :UPDate [:STATe] ?
Example	TRAC2:UPD 0 Makes trace 2 inactive (stops updating)
Dependencies / Couplings	Setting the trace type (even to the type it was already in) puts the trace in Active. Loading a trace from a file makes that trace inactive regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange. Whenever the user sets Update to On for any trace, the Display is set to On for that trace.
Preset	1 0 0 0 (On for Trace 1; Off for 2-6)
State Saved	Saved in Instrument State
Key Path	Trace/Detector
Annunciation	An inactive trace is indicated by dimming the type letter in the trace annotation panel in the Measurement bar (see Annunciation in the table below).

Parameter Name	Trace Display State
Remote Command	:TRACe [1] 2 3 4 :DISPlay [:STATe] ON OFF 0 1 :TRACe [1] 2 3 4 :DISPlay [:STATe] ?
Example	TRAC2:DISP,1 Makes trace 2 visible TRAC3:DISP,0 Blanks trace 3
Dependencies / Couplings	Setting the trace type (even to the type it was already in) puts the trace in Display On. Whenever the user sets Update to On for any trace, the Display is set to On for that trace. Loading a trace from a file puts that trace in Display On regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange.
Preset	1 0 0 0 (On for Trace 1; Off for 2-4)
State Saved	Saved in Instrument State
Key Path	Trace/Detector

Annunciation

A trace in Blank is indicated by a strikethrough thorough the type letter in the trace annotation panel in the Measurement bar.



Distance To Fault

Distance to Fault Description

A signal is transmitted from the RF OUTPUT connector of the spectrum analyzer to the cable-under-test. The signals reflected from faults in the cable are received by analyzer.

In performing this measurement, the analyzer uses frequency domain reflectometry. The changing interference of the transmitted and reflected signals contains information about the distance to one or more faults. This information can be used to find the physical distance to the faults. The distance displayed on the analyzer is the physical distance to the probable faults, corrected for the cable loss and velocity factor of the cable.

To configure measurement settings, select **Distance to Fault** and then press **Meas Setup**. Pressing **Control/Sweep** enables you to restart a measurement, refer to “[Control/Sweep Functions](#)” on page 418.

Mode	Stimulus / Response
State Saved	Saved in instrument state.
Key Path	MEAS, Return loss

AMPTD/Y Scale Menu

The following **AMPTD/Y Scale** keys are for setting up a Distance To Fault measurement. The measurement must already be running to access these keys. Press **Meas, Distance To Fault** to turn on the measurement.

Mode	Stimulus / Response
Key Path	Front-panel key

Autoscale

Executes an automatic scaling of the **Reference Level** setting. Autoscale is a GUI only function and has no SCPI command.

Mode	Stimulus/Response
Key Path	AMPTD Y Scale, Autoscale

Reference Level

Sets the reference level value used for amplitude measurements. In the Distance to Fault measurement,

this Reference Level represents return loss in dB.

Example of conversion between a “VSWR” and a “Return Loss”

VSWR = 1.01 => Return Loss = 46.1 dB

VSWR = 6 => Return Loss = 2.9 dB

Changing the value of the reference level changes the absolute return loss level of the top graticule line. The reference level (in selected amplitude units) can be set with the step keys, knob, or numeric keypad.

Mode	Stimulus/Response
Remote Command	:DISPlay:DTFault:WINDow:TRACe:Y[:SCALe]:RLEVel <insertion_loss> :DISPlay:DTFault:WINDow:TRACe:Y[:SCALe]:RLEVel?
Example	DISP:DTF:WIND:TRAC:Y:RLEV 10dB
Preset	0 dB
State Saved	Saved in State
Range	-100 dB to 150 dB
Key Path	AMPTD Y Scale

Scale/Div

Sets the logarithmic units per vertical graticule division on the display.

Mode	Stimulus/Response
Remote Command	:DISPlay:DTFault:WINDow:TRACe:Y[:SCALe]:PDIVision <rel_ampl> :DISPlay:DTFault:WINDow:TRACe:Y[:SCALe]:PDIVision?
Example	DISP:DTF:WIND:TRAC:Y:PDIV 10dB
Preset	10.00 dB
State Saved	Saved in State
Range	1.0 to 20
Key Path	AMPTD Y Scale

FREQ/Channel

Mode	Stimulus / Response
Key Path	Front-panel key

Freq Range

Sets the Frequency Range to be specified manually by you, or to be set automatically. If you select Auto, the Start and the Stop Frequencies will be determined by your Start Distance and Stop Distance settings.

Mode	Stimulus / Response
Range	Man Auto 1 0
Key Path	FREQ/Channel, Freq Range

Automatic Frequency Range. You select the measurement distance and the spectrum analyzer automatically selects the Start Frequency and the Stop Frequency. This measurement distance is set using the **Start Distance** and **Stop Distance** menu keys on the Freq/Dist/Calibrate menu. In this mode, the displayed and measured distances are the same. There are 256 measurement points across the distance you set. This approach provides the maximum measurement resolution across the selected distance. The disadvantage is that the start and stop frequencies are automatically set and may limit the spectrum analyzer's ability to sweep through filters or lightning protectors. This mode is best used for checking a cable that has no frequency limiting devices.

Example 1: If you set **Start Distance** to 0 m (0 ft.) and the to 60 m (197 ft.), and you specify 256 Data Points, the instrument automatically selects a **Start Freq** of 10 MHz and a **Stop Freq** of 303.23 MHz.

Example 2: If you again set **Start Distance** to 0 m (0 ft.) and the **Stop Distance** to 60 m (197 ft.), and but this time you specify 1024 Data Points to give you greater resolution, the instrument automatically selects a **Start Freq** of 10 MHz and a **Stop Freq** of 1.183 GHz.

NOTE For more detail on how the frequency range affects the Distance to Fault measurement, see [“Measured Distance - the Effects of Frequency and Points” on page 295.](#)

Manual Frequency Range. When set to Manual, you must specify the Start Frequency and the Stop Frequency, and the measured distance is worked out from these frequencies. Generally, the typical start and stop frequencies you use will result in a measured distance that will be larger than the distance over which you want to look for faults.

The Measured Distance and the Displayed Distance can be different. The distance over which the

instrument has made its measurements, and which has been derived from the frequencies you specified, is called the Measured Distance. This is displayed at the top right corner of the measurement screen.

The Displayed Distance refers to that part of the entire Measured Distance that you choose to display on your measurement screen. You set the Displayed Distance manually by pressing the **Start Distance** and the **Stop Distance** menu keys on the **Freq/Dist/Calibrate** menu.

To help isolate faults over the length of interest, you can set a displayed distance less than the measured distance. The displayed distance is set using the **Start Distance** and the **Stop Distance** menu keys on the **Freq/Dist/Calibrate** menu.

Keep in mind that there are 256, 512, or 1024 measurement points across the measured distance. The exact number of measurement points is set using the **FFT Size** key on the **Meas Setup** menu. Therefore, the measurement points across the chosen displayed distance will be a ratio of displayed distance to measured distance times the number of points you have specified. The higher the number of data points, the greater the measurement resolution.

In most cases, the default resolution using 256 data points will be adequate to locate the faults, but if more resolution is needed you can increase the span between the start and stop frequencies (which will decrease the measured distance) or use the other approach, automatic frequency range. If the measurement distance is not long enough for the cable you are testing, reduce the span between the start and stop frequencies (which will increase the measurement distance) or use automatic frequency range.

NOTE When testing cables attached to antennas, test signals are radiated from the test antenna. Verify that the signal used for the test, and therefore being radiated from the test antenna, cannot interfere with other radiated signals from other antennas.

Start Freq

Use this key to specify the Start Frequency of your frequency range.

Mode	Stimulus / Response
Dependencies / Couplings	You cannot set the Start frequency equal to the Stop frequency. The instrument will alter the value of the last setting to maintain a minimum value of 1 kHz difference between the Start and Stop frequencies.
Preset	100 kHz
State Saved	Saved in instrument state.
Range	From -35 MHz to 3.019999 GHz (Option 503) / 6.019999 GHz (Option 506)
Key Path	FREQ/Channel

Stop Freq

Use this key to specify the Stop Frequency of your frequency range.

Mode	Stimulus / Response
Dependencies / Couplings	You cannot set the Start frequency equal to the Stop frequency. The instrument will alter the value of the last setting to maintain a minimum value of 1 kHz difference between the Start and Stop frequencies.
Preset	3 GHz (Option 503), 6 GHz (Option 506)
State Saved	Saved in instrument state.
Range	From -34.999 MHz to 3.02 GHz (Option 503) / 6.02 GHz (Option 506)
Key Path	FREQ/Channel

Start Distance

Use this key to specify the Start Distance of the cable you wish to measure.

The start distance you can enter cannot be greater than the distance displayed in the Measured Distance window at the top right. If you need a larger distance, reduce the frequency span by adjusting the start and stop frequencies.

If your Start Distance is 0 m (0 ft.), you will see a peak corresponding to 0 m (0 ft.). This is caused by reflection from the junction between your analyzer and the cable under test. This DC component, sometimes referred to as the “dead zone”, does not necessarily indicate a problem, but be sure that this connection is tight and clean.

Mode	Stimulus / Response
Min	0 m (if Unit is Meters) 0 ft. (if Unit is Feet)
Max	304.8 m (if Unit is Meters) 1000 ft. (if Unit is Feet)
Key Path	FREQ/Channel, Start Distance

Stop Distance

Use this key to specify the Stop Distance of the cable you wish to measure.

The stop distance you can enter cannot be greater than the distance displayed in the Measured Distance window at the top right, but must be greater than the start distance previously entered. If you need a

larger distance, reduce the frequency span by adjusting the start and stop frequencies.

Mode	Stimulus / Response
Min	0 m (if Unit is Meters) 0 ft. (if Unit is Feet)
Max	304.8 m (if Unit is Meters) 1000 ft. (if Unit is Feet)
Key Path	FREQ/Channel, Stop Distance

Calibrate

Use this key to start the process of calibrating your measurement. Follow the instructions on the screen to complete the calibration process.

Mode	Stimulus / Response
Key Path	FREQ/Channel, Calibrate

The Distance to Fault calibration (when it is performed with Frequency Range set to manual) is the same calibration as performed for the Return Loss and One-Port Insertion Loss measurements. If you have already calibrated for any of these three measurements, the calibration will apply to the other two measurements and “Calibrated” (together with the frequency range over which the calibration was performed) will be displayed on top left of the screen for all three.

The Distance to Fault calibration (when it is performed with Frequency Range set to Auto) is only valid for other Distance to Fault measurements that are also performed with Frequency Range set to Auto, and then only if the calibrated frequency range falls within the previously calibrated frequency range.

If you have not previously performed a calibration, the word “Factory Calibration” appears at the top left of the measurement screen.

It is important that you keep the calibration frequency range as close as possible to the actual sweep frequencies you intend using for the measurement or measurements. Calibrating over a large frequency range (1 GHz, for example) when you only intend measuring over a smaller frequency range (a few tens of kHz, for example) will induce inaccuracies into your results.

NOTE The Calibrate Start/Stop frequencies define the frequency range over which the CALIBRATION will take place, and do NOT define the frequency range over which the MEASUREMENT will be made.

If you plan to perform a combination of One-Port Insertion Loss measurement, Return Loss

Stimulus / Response
Distance To Fault

measurement, and Distance to Fault measurements using a frequency range that you will set manually, you can perform one calibration for all three measurements as long as you calibrate over a frequency range that incorporates all three of your measurements, and as long as your cables do not change. For this reason, if you are doing Distance to Fault measurements (using a frequency range that you have set manually) as well as any type of Insertion Loss measurement, Agilent recommends that you select your cable type before performing calibrations. Press **Meas, Distance to Fault, Meas Setup, Cable Type** to set the cable type.

The calibration remains valid until you do any one of the following:

- set the Distance to Fault frequency range to Auto. Note that the calibration will become valid again as soon as you switch from Auto back to Manual Frequency Range.
- power off the spectrum analyzer
- change the start frequency to a new value that lies below the start frequency of your previous calibration
- change the stop frequency to a new value that lies above the stop frequency of your previous calibration
- change any of the cables that you used for the calibration
- change any of the attenuators that you used for the calibration
- change the type of cable by selecting **Meas Setup, Cable Type**.

None of the following calibrations are valid for Distance to Fault calibrations with Frequency Range set to Auto:

- Distance to Fault calibrations performed with the Frequency Range set to Manual
- One Port Insertion Loss calibrations
- Two Port Insertion Loss calibrations

NOTE Note also that Distance to Fault calibrations performed with the Frequency Range set to Auto are not valid for any other measurement, including Distance to Fault with the Frequency Range set to Manual.

Continue Use this key after you have made any desired changes to the calibration start or stop frequencies, and you are ready to continue to the next step of the calibration.

Mode	Stimulus / Response
State Saved	No
Key Path	Freq/Channel, Calibrate

Calibration Start Freq Use this key to specify the Start Frequency of your calibration frequency range. It is important that you keep the calibration frequency range as close as possible to the actual sweep

frequencies you intend using for the measurement or measurements. For additional information, refer to “Calibrate” on page 242.

NOTE The Calibrate Start/Stop frequencies define the frequency range over which the CALIBRATION will take place, and do NOT define the frequency range over which the MEASUREMENT will be made.

Mode	Stimulus / Response
State Saved	No
Preset	The same value as the Start Freq set for the measurement.
Range	10 MHz to 3.0 GHz (Option 503) / to 6.0 GHz (Option 506)
Dependencies / Couplings	The Calibration Start Freq must be set lower than the Calibration Stop Freq. If you set the Calibration Start Freq higher than the Calibration Stop freq, the stop frequency will automatically be set to a value higher than the start frequency.
Key Path	Freq/Channel, Calibrate

Calibration Stop Freq Use this key to specify the Calibration Stop Frequency of your calibration frequency range. It is important that you keep the calibration frequency range as close as possible to the actual sweep frequencies you intend using for the measurement or measurements. For additional information, refer to “Calibrate” on page 242.

NOTE The Calibrate Start/Stop frequencies define the frequency range over which the CALIBRATION will take place, and do NOT define the frequency range over which the MEASUREMENT will be made.

Mode	Stimulus / Response
State Saved	No
Preset	The same value as the Start Freq set for the measurement.
Range	10 MHz to 3.0 GHz (Option 503) / to 6.0 GHz (Option 506)
Dependencies / Couplings	The Calibration Stop Freq must be set higher than the Calibration Start Freq. If you set the Calibration Stop Freq lower than the Calibration Start freq, the start frequency will automatically be set to a value lower than the stop frequency.
Key Path	Freq/Channel, Calibrate

Stimulus / Response Distance To Fault

Cancel Use this key to abort the Calibration process.

Mode	Stimulus / Response
Key Path	Freq/Channel, Calibrate

Units

Use this key to specify whether all your measurement distances are given in meters or in feet.

Mode	Stimulus / Response
Range	Feet Meters
Key Path	FREQ/Channel, Units

Meas

In the Stimulus Response mode, **Meas** accesses a menu of keys associated with the Stimulus Response mode. This section describes the menu keys available with **Distance to Fault** measurement.

To configure measurement settings, select **Distance to Fault** and then press **Meas Setup**.

Use **Control/Sweep** to restart the currently selected measurement and change the sweep points. To select between continuous or single measurements, press the **Cont** or **Single** front-panel keys. For information about controlling sweep, refer to the.

Mode	Stimulus / Response
Range	Two Port Insertion Loss One Port Insertion Loss Return Loss Distance to Fault
Key Path	Front-panel key

Making Distance to Fault Measurements

Measuring Distance to Fault A signal is transmitted from the RF OUTPUT connector of the spectrum analyzer to the cable-under-test. The signals reflected from faults in the cable are received by the spectrum analyzer.

In performing this measurement, the spectrum analyzer uses frequency domain reflectometry. The changing interference of the transmitted and reflected signals contains information about the distance to one or more faults. This information can be used to find the physical distance to the faults. The distance displayed on the spectrum analyzer is the physical distance to the probable faults, corrected for the cable loss and propagation factor of the cable.

Measured Distance - the Effects of Frequency and Points It is not always obvious how frequency range affects measured distance and resolution, and it often appears to be counter-intuitive. If you are new to making Distance to Fault measurements, this section will help clarify what is happening.

In the following equations

The Speed of Light ('c') in a vacuum is a constant value of 3×10^8 m/s.

Your test cable's transmission speed (relative to light) is VRel.

The Measured Distance (in meters) of the DTF measurement is determined by the following equation:

$$\text{Measured distance (in meters)} = (1/4 * \text{Number of points} * c * \text{VRel}) / \text{Freq. Span}$$

You can see from this equation that:

To increase the measured distance:

- you can increase the number of points, or
- you can reduce the frequency span.

To reduce the measured distance:

- you can reduce the number of points, or
- you can increase the frequency span.

Resolution - the Effects of Frequency and Points It is not always obvious how frequency range affects measured distance and resolution, and it often appears to be counter-intuitive. If you are new to making Distance to Fault measurements, this section will help clarify what is happening.

Resolution Distance (in meters) of the DTF measurement, that is, the shortest distance between two faults that can still be resolved by the analyzer, is determined by the following equation:

$$\text{Resolution Distance (in meters)} = \text{Measured distance (in meters)} / (1/2 * \text{Number of Points})$$

NOTE Please be careful how you interpret this equation. Note that to increase the resolution, you need to reduce the Resolution Distance; to reduce the resolution, you need to increase the Resolution Distance.

You can see from this equation that:

To increase the resolution, that is, to reduce the Resolution Distance:

- you can increase the number of points, or
- you can reduce the measured distance.

To reduce the resolution, that is, to increase the Resolution Distance:

- you can reduce the number of points, or
- you can increase the measured distance.

NOTE Although you can set your number of points to 256, 512, or 1024, you will only ever be able to save 256 data points when you save trace data. This is because only 256 points are ever used to display the trace, regardless of how many points you have used to actually make the measurement. You will not, however, be losing any resolution, or reducing the quality of your data. The results will still reflect the true number of data points that you specified.

Automatic and Manual Distance to Fault Measurements The spectrum analyzer provides two ways of measuring distance to fault:

Automatic Frequency Range. You select the measurement distance and the spectrum analyzer automatically selects the Start Frequency and the Stop Frequency. This measurement distance is set using the **Distance** menu key on the **Freq/Dist/Calibrate** menu (accessed by pressing **FREQ Channel**). In this mode, the displayed and measured differences are the same. There are 256 measurement points across the distance you set. This approach provides the maximum measurement resolution across the selected distance. The disadvantage is that the start and stop frequencies are automatically set and may limit the spectrum analyzer's ability to sweep through filters or lightning protectors. This mode is best used for checking a cable that has no frequency limiting devices.

Example 1: If you set **Start Distance** to 0 m (0 ft.) and the **Stop Distance** to 60 m (197 ft.), and you specify 256 Data Points, the instrument automatically selects a **Start Freq** of 10 MHz and a **Stop Freq** of 303.228 MHz.

Example 2: If you again set **Start Distance** to 0 m (0 ft.) and the **Stop Distance** to 60 m (197 ft.), but this time you specify 1024 Data Points to give you greater resolution, the instrument automatically selects a **Start Freq** of 10 MHz and a **Stop Freq** of 1.183 GHz.

Manual Frequency Range. When set to Manual, you must specify the Start Frequency and the Stop Frequency, and the measured distance is worked out from these frequencies. Generally, the typical start and stop frequencies you use will result in a measured distance that will be larger than the distance over which you want to look for faults.

The Measured Distance and the Displayed Distance can be different. The distance over which the instrument has made its measurements, and which has been derived from the frequencies you specified, is called the Measured Distance. This is displayed at the top right corner of the measurement screen.

The Displayed Distance refers to that part of the entire Measured Distance that you choose to display on your measurement screen. You set the Displayed Distance manually by pressing the **Start Distance** and the **Stop Distance** menu keys on the **Freq/Dist/Calibrate** menu.

To help isolate faults over the length of interest, you can set a displayed distance less than the measured distance. The displayed distance is set using the **Start Distance** and the **Stop Distance** menu keys on the **Freq/Dist/Calibrate** menu.

Keep in mind that there are 256, 512, or 1024 measurement points across the measured distance. The exact number of measurement points is set using the **FFT Size** key. Therefore, the measurement points across the chosen displayed distance will be a ratio of displayed distance to measured distance times the number of points you have specified. The higher the number of data points, the greater the measurement resolution.

In most cases, the default resolution using 256 data points will be adequate to locate the faults, but if

more resolution is needed you can increase the span between the start and stop frequencies (which will decrease the measured distance) or use the other approach, automatic frequency range. If the measurement distance is not long enough for the cable you are testing, reduce the span between the start and stop frequencies (which will increase the measurement distance) or use automatic frequency range.

When testing cables attached to antennas, test signals are radiated from the test antenna. Verify that the signal used for the test, and therefore being radiated from the test antenna, cannot interfere with other radiated signals from other antennas.

To configure measurement settings, select **Distance to Fault** and then press **Meas Setup**.

Meas Setup

This section describes the keys available with **Distance to Fault** measurement. To access the **Meas Setup** keys used to set up a Distance to Fault measurement. That measurement must already be selected by pressing **Meas, Distance to Fault**.

Mode	Stimulus / Response
Key Path	Front-panel key

Avg Mode

Sets the type of termination control used for the averaging function. This determines the type of averaging used for the specified number of measurements.

Mode	Stimulus / Response
Preset	Exponential, On
Range	Off Exponential Repeat Repeat Max Hold
Key Path	Meas Setup, Avg Mode

Off Turns averaging functions off.

Key Path:	Meas setup, Avg Mode, Off
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Exponential Sets the **Averaging** function to exponential. With exponential averaging mode, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Key Path: **Meas setup, Avg Mode, Exponential**

Repeat Sets **Averaging** to the repeat function. Repeat averaging updates the trace after the selected number of sweeps has been averaged. It is not updated again until the next set of data from **Avg Number** sweeps has been collected.

Key Path: **Meas setup, Avg Mode, Repeat**

Max Hold In **Max Hold** the analyzer maintains and displays a max hold trace, which represents the maximum data value on a point-by-point basis of the new trace data and previous trace data. Pressing the **Max Hold** key for the selected trace sets the trace type to **Max Hold**, causes the trace to be cleared and causes the **Max Hold** sequence to be restarted.

Key Path: **Meas setup, Avg Mode, Max Hold**

Repeat Max Hold Sets **Averaging** to repeat with max hold function. Repeat with max hold captures and holds the highest magnitude data at the end of each sweep count. Repeat with max hold updates the trace after the selected number of sweeps has been made. It is not updated again until the next set of data from **Avg Number** sweeps has been collected.

Key Path: **Meas setup, Avg Mode, Repeat Max Hold**

Avg Number

Sets the number of measurement averages used when calculating the measurement result.

Mode	Stimulus / Response
Preset	4
Min	1
Max	100
Key Path	Meas Setup, Avg Number

Clear Calibration

Clear Calibration deletes the current calibration data, enabling you to re-calibrate the instrument for the same frequency range.

Mode	Stimulus / Response
Key Path	Meas Setup, Clear Calibration

Limit Masks

Sets the Limit Masks submenu keys, it is then possible to select to configure either Limit Mask 1 (Upper) or Limit Mask 2 (Lower).

Mode	Stimulus / Response
Dependencies / Couplings	<p>The Limit Mask 1 (Upper) menu link key accesses the keys to configure the upper limit mask for the Center, 1st, or 2nd segments (dependent on selected segment).</p> <p>The Limit Mask 2 (Lower) menu link key accesses the keys to configure the lower limit mask for the Center, 1st, or 2nd segments (dependent on selected segment).</p>
State Saved	Saved in instrument state.
Key Path	Meas Setup, Limit Masks, Limit Mask 1 or Limit Mask 2

Limit Mask 1 (upper) or Limit Mask 2 (Lower)

Limit Mask 1 (upper) access the upper limit mask keys.

Limit Mask 2 (Lower) access the lower limit mask keys.

You can define a limit mask that matches your maximum or minimum measurement requirements. This mask can then be compared with the measured trace data to determine pass/fail conditions.

Limit Trace

Selects the trace to which the currently selected limit mask (1 or 2) will be applied. The limit masks can be applied to separate traces. Only 2 traces are available in the Stimulus Response mode (compared to 4 traces in the Spectrum Analyzer Mode).

Mode	Stimulus / Response
Dependencies / Couplings	The limit mask is always displayed when the center segment is turned on; even if the trace to which it is being applied is blanked ('Show' set to Off).
Preset	1
State Saved	Saved in instrument state.
Range	1 2
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Limit Mask Trace

Segment (Center, 1st or 2nd)

Selects the **Center**, **1st** or **2nd** segment for limit mask 1 or 2. With each segment setting, the **Limits** menu is updated to show the span and level settings available for the currently selected segment

Mode	Stimulus / Response
Dependencies / Couplings	Key menu structure is dependent on selected segment.
Preset	Center
State Saved	Saved in instrument state.
Range	Center 1st 2nd
Key Path	Meas Setup, Limit Mask 1, Segment (Center, 1st or 2nd)

Center Segment

Segments (Center) Sets the state of the center segment to On or Off. This key is available only when Center has been selected with the Segments key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is Center
Dependencies / Couplings	If Off no limit mask will be displayed even if the 1 st or 2 nd segments are turned On. If On the center segment is drawn on the display centered round the current center frequency.
Preset	OFF
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment

Level: Center

Sets the power level for the center segment of the current selected limit mask. This key is available only when Center has been selected with the Segments key.

Mode	Stimulus / Response
Restrictions and Notes	Key is only displayed when the selected segment is Center.
Preset	Not affected by a preset but set per default to 30 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment Level
Default Unit	dB

Span: Center

Sets the frequency span for the center segment of the currently selected limit mask. This key is only available when Center has been selected with the Segment key.

Mode	Stimulus / Response
Restrictions and Notes	Key is only displayed when the selected segment is Center.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling

Stimulus / Response
Distance To Fault

State Saved	Saved in instrument state.
Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limit Masks, Limit Mask 1, Center Segment Span
Default Unit	Hz

1st Segment

Sets the state of the first segment to On or Off. This key is available only when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st .
Dependencies / Couplings	<p>If Off the 2nd limit mask segment will not be displayed even if turned On.</p> <p>If On and the Center segment is On:</p> <p>The left hand side 1st segment is drawn to the left hand side of the center segment at the specified power level</p> <p>The right hand side 1st segment is drawn to the right hand side of the center segment at the specified power</p> <p>For both left and right 1st segments when On</p> <p>If the 2nd segment is Off the 1st segment extends so the total limit mask span is equal to the current frequency span.</p> <p>If the 2nd segment is On the left and right 1st segments use the specified span values.</p>
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment

1st Segment (Left or Right Limits)

Sets **1st Segment** to allow definition of the limits Left or Right of the center segment. The Left or Right amplitude limits can be changed with the **Level** key. The Left or Right span limits can be changed with the limits menu **Span** key. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st .
Preset	Left [segment]
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment (Left or Right Limits)

Level: 1st Segment Left

Sets the power level, for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Left.
Preset	Not affected by a preset
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Left Level
Default Unit	dB

Level: 1st Segment Right

Sets the power level, for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 1 st , and the selected segment side is Right.
Dependencies / Couplings	Value is displayed on the key in the currently selected Y Axis Unit.
Preset	Not affected by a preset

Stimulus / Response
Distance To Fault

State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 1st Segment: Right Level
Default Unit	dB

Span: 1st Segment Left

Sets the frequency span for the 1st segment to the Left of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Restriction and Notes	Key is only displayed when the selected segment is 1st, and the selected segment side is Left.
Dependencies / Couplings	If the Center, 1st, and 2nd segments are On, the left 2nd segment span adjusts on a change in the left 1st segment span.
State Saved	Saved in instrument state.
Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limit Masks, Limit Mask 1
Default Unit	Hz

Span: 1st Segment Right

Sets the frequency span for the 1st segment to the Right of the Center segment. This key is only available when **1st** has been selected with the **Segments** key.

Mode	Stimulus / Response
Restriction and Notes	Key is only displayed when the selected segment is 2nd, and the selected segment side is Right.
Dependencies / Couplings	If the Center, 1st, and 2nd segments On, the right 2nd segment span adjusts on a change in the right 1st segment span.
Preset	Not affected by a preset but set per default to 2 MHz after a power cycling
State Saved	Saved in instrument state.

Min	0 Hz
Max	Frequency Span Setting
Key Path	Meas Setup, Limit Masks, Limit Mask 1
Default Unit	Hz

2nd Segment

Sets the state of the first segment to On or Off. This key is available only when 2nd has been selected with the Segments key.

Mode	Stimulus / Response
Notes	Key is only displayed when the selected segment is 2 nd .
Dependencies / Couplings	If Off the 2 nd limit mask segment will not be displayed even if turned On. If On, and the First and Center segments are On: The left hand side 2 nd segment is drawn to the left hand side of the left first segment at the specified power level The right hand side 1 st segment is drawn to the right hand side of the right first segment at the specified power The segment spans are calculated as documented in section above
Preset	Off
State Saved	Saved in instrument state.
Range	On Off
Key Path	Meas Setup, Limit Masks, Limit Mask 1, 2nd Segment

2nd Segment (Left or Right Limits)

Sets to allow definition of the limits Left or Right of the center segment for the 2nd Segment. The Left or Right amplitude limits can be changed with the **Level** key. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Stimulus / Response
Restriction and Notes	Key is only displayed when the selected segment is 2nd.

Stimulus / Response Distance To Fault

Dependencies / Couplings	<p>The Left span is calculated as follows:</p> $(\langle \text{maximum span} \rangle / 2) - (\langle \text{center segment span} \rangle / 2) - \langle \text{first segment left span} \rangle$ <p>The Right span is calculated as follows:</p> $(\langle \text{maximum span} \rangle / 2) - (\langle \text{center segment span} \rangle / 2) - \langle \text{first segment right span} \rangle$ <p>Where:</p> <p>$\langle \text{maximum span} \rangle$ is the maximum frequency span of the instrument (3 GHz or 6 GHz)</p> <p>$\langle \text{center segment span} \rangle$</p> <p>$\langle \text{first segment left span} \rangle$</p> <p>$\langle \text{first segment right span} \rangle$</p>
Preset	Not affected by a preset but set per default to Left after a power cycling
State Saved	Saved in instrument state.
Range	Left Right
Key Path	Meas Setup, Limit Masks, Limit Mask 1

Level: 2nd Segment Left

Sets the power level, for the 2nd segment to the Left of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Stimulus / Response
Restriction and Notes	Key is only displayed when the selected segment is 2nd, and the selected segment side is Left.
Preset	Not affected by a preset but set per default to 50 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limit Masks, Limit Mask 1
Default Unit	dB

Level: 2nd Segment Right

Sets the power level, for the 2nd segment to the Right of the Center segment. This key is only available when 2nd has been selected with the **Segments** key.

Mode	Stimulus / Response
Restriction and Notes	Key is only displayed when the selected segment is 2nd, and the selected segment side is Right.
Preset	Not affected by a preset but set per default to 50 dB after a power cycling
State Saved	Saved in instrument state.
Min	-10 dB
Max	150 dB
Key Path	Meas Setup, Limit Masks, Limit Mask 1
Default Unit	dB

FFT Size

This sets the FFT size by specifying the number of FFT points.

NOTE	You can set the number of points to 256, 512, or 1024, but you will only be able to save 256 data points when you save trace data. This is because only 256 points are ever used to display the trace, regardless of how many points you have used to actually make the measurement. You will not, however, be losing any resolution, or reducing the quality of your data. The results will still reflect the true number of data points that you specified.
-------------	---

Mode	Stimulus / Response
Preset	256
Range	256 512 1024
Key Path	Meas Setup, FFT Size

Measured Distance - the Effects of Frequency and Points

It is not always obvious how frequency range affects measured distance and resolution, and it often appears to be the opposite of what you would expect. If you are new to making Distance to Fault measurements, this section will help clarify what is happening.

Stimulus / Response Distance To Fault

In the following equations

The Speed of Light ('c') in a vacuum is a constant value of $3e+8$ m/s.

Your test cable's transmission speed (relative to light) is VRel

The Measured Distance (in meters) of the DTF measurement is determined by the following equation:

$$\text{Measured distance (in meters)} = (1/4 * \text{Number of points} * c * \text{VRel}) / \text{Freq. Span}$$

You can see from this equation that:

To increase the measured distance:

- you can increase the number of points, or
- you can reduce the frequency span.

To reduce the measured distance:

- you can reduce the number of points, or
- you can increase the frequency span.

Resolution - the Effects of Frequency and Points

It is not always obvious how frequency range affects measured distance and resolution, and it often appears to be counter-intuitive. If you are new to making Distance to Fault measurements, this section will help clarify what is happening.

Resolution Distance (in meters) of the DTF measurement, that is, the shortest distance between two faults that can still be resolved by the analyzer, is determined by the following equation:

$$\text{Resolution Distance (in meters)} = \text{Measured distance (in meters)} / (1/2 * \text{Number of Points})$$

Please be careful how you interpret this equation. Note that to increase the resolution, you need to reduce the Resolution Distance; to reduce the resolution, you need to increase the Resolution Distance.

You can see from this equation that:

To increase the resolution, that is, to reduce the Resolution Distance:

- you can increase the number of points, or
- you can reduce the measured distance.

To reduce the resolution, that is, to increase the Resolution Distance, you can

- you can reduce the number of points, or
- you can increase the measured distance.

Report Loss As

The “Report Loss As” key resides in the “Meas Setup” menu. It allows selection of the signal loss to be represented as positive dB or negative dB. “Report Loss As” is a measurement global parameter, and its setting is preserved over power cycle.

Remote Command	:UNIT:LOSS PDB NDB :UNIT:LOSS?
Example	UNIT:LOSS NDB UNIT:LOSS?
Dependencies / Couplings	None This key is measurement global
Preset	Survives Preset
State Saved	Saved in State, survives Preset, survives power cycle

Cable Type

Accesses the features for defining the type of cable that you are measuring.

Mode	Stimulus / Response
Key Path	Meas Setup, Cable Type

Cable Type Selects the type of cable. Each time you press this key, the selected type changes. If you select RG or BTS, you will be asked to select the specific type of cable you are measuring from a list of common cable types.

If the type of cable you are measuring is not listed, you need to select **Cust** (Custom Cable).

Mode	Stimulus / Response
Range	RG BTS Cust
Key Path	Meas Setup, Cable Type

Stimulus / Response
Distance To Fault

Select Cable Each time you press this key, the selected option changes. If you select RG or BTS, you will be asked to select the specific type of cable you are measuring from a list of common cable types.

If the type of cable you are measuring is not listed, you need to select **Cust** (Custom Cable).

Mode	Stimulus / Response
Key Path	Meas Setup, Cable Type, Select Cable

Cable Atten Use this key to specify the attenuation per unit distance of the cable you are measuring. You only need to specify this parameter if the cable you are testing is not shown in the list of common cable types.

If the type of cable you are measuring is not listed, you need to select **Cust** (Custom Cable), and then specify its attenuation in dB per 100 m (or in dB per 100 ft.) You will also need to specify the speed at which signals travel along this cable [Vel Factor], measured as a percentage of the speed of light in a vacuum.

Most cable manufactures provide a table showing attenuation versus frequency for each type of cable. Remember that attenuation varies with frequency, so select an attenuation value that corresponds as closely as possible to the center of the frequency range you are using.

Mode	Stimulus / Response
Key Path	Meas Setup, Cable Type, Cable Atten

Vel Factor Use this key to specify the relative propagation velocity of the cable you are measuring. You only need to specify this parameter if the cable you are testing is not shown in the list of common cable types.

If the type of cable you are measuring is not listed, you need to select **Cust** (Custom Cable), and then specify the speed at which signals travel along this cable measured as a percentage of the speed of light in a vacuum. You will also need to specify its attenuation in dB per 100 m (or in dB per 100 ft.) Most cable manufactures provide a table showing attenuation versus frequency for each type of cable.

Mode	Stimulus / Response
Range	0.0 to 100.0 (%C – speed of light)
Key Path	Meas Setup, Cable Type, Vel Factor

SPAN/X Scale

The following **SPAN/X Scale** keys are for setting up a Distance to Fault measurement. The measurement must already be running to access these keys. Press **Meas, Distance to Fault** to turn on the measurement.

Mode	SR
Key Path	Front-panel key

Span

Sets the span frequency value. Span frequency describes the frequency range that is positioned symmetrically about center frequency.

The minimum span is 1 kHz. Zero-span is not applicable to SR measurements.

Span is measurement specific. It survives mode-preset.

Parameter Name	Span
Mode	Stimulus Response
Remote Command	<pre>[:SENSe] :TPILoss :FREQuency :SPAN <frequency> [:SENSe] :TPILoss :FREQuency :SPAN? [:SENSe] :OPILoss :FREQuency :SPAN <frequency> [:SENSe] :OPILoss :FREQuency :SPAN? [:SENSe] :RLOSs :FREQuency :SPAN <frequency> [:SENSe] :RLOSs :FREQuency :SPAN? [:SENSe] :DTFault :FREQuency :SPAN <frequency> [:SENSe] :DTFault :FREQuency :SPAN?</pre>
Example	<pre>TPIL:FREQ:SPAN 2GHz sets the span to 2GHz for TPIL TPIL: FREQ:SPAN? queries the span for TPIL</pre>
Dependencies / Couplings	See section 1.6
Preset	140 MHz (Option 506) 140 MHz (Option 503)
State Saved	Saved in State
Range	1 kHz to 6.0 GHz (Option 506) 1 kHz to 3.0 GHz (Option 503)

Stimulus / Response
Distance To Fault

MIN/MAX/DEF Support	No
Key Path	Span/X Scale
Menu Key Label	Span
Active Function Text	Span
Knob Increment	10% of Span
Step (UP/DOWN)	No SCPI support
Step (Front Panel)	1, 2, 5 sequence
Front Panel Unit/Terminator Keys	GHz MHz kHz Hz

Last Span

Changes the displayed frequency span to the previous span setting. There is no memory of the last span after a power off or a mode preset.

Mode	Stimulus Response
Remote Command	[:SENSe] : TPILoss : FREQuency : SPAN : PREVIOUS [:SENSe] : OPILoss : FREQuency : SPAN : PREVIOUS [:SENSe] : RLOsS : FREQuency : SPAN : PREVIOUS [:SENSe] : DTFault : FREQuency : SPAN : PREVIOUS
Example	RLOS:FREQ:SPAN:PREV
Remote Command Notes	No query form
Key Path	Span/X Scale

Trace/Detector

Accesses the **Trace/Detector** menu keys. **Trace/Detector** menu keys allow the user to control the acquisition, display, storage, detection and manipulation of trace data. The **Trace/Detector** keys are for setting up a Distance To Fault measurement. The measurement must already be running to access these keys. Press **Meas**, **Distance To Fault** to turn on the measurement.

Mode	Stimulus / Response
Key Path	Front-panel key

Select Trace

Selects which trace the menu keys will affect. Press **Select Trace** until the number of the desired trace is underlined. Only 2 traces are available in the Stimulus Response mode (compare to 4 traces in the Spectrum Analyzer Mode). Note as well that in the “Distance to Fault” measurement, there is only one trace being generated, so if both are active using the “Update On/Off” feature described below, they will contain identical data and the one on top will hide the bottom one (only one will be seen, but both are there). The purpose of the “Trace/Detector” feature in this measurement is allow to an A/B comparison. For instance, you could store one set of measurement results in Trace 2 (Turn ON first the “Update” parameter of this Trace 2 to get the results then turning back OFF this “Update” parameter to store the results) and then compare it with set of measurement results display by Trace 1 (Set the “Update” parameter of the Trace 1 to ON).

Preset	Trace 1
State Saved	The number of the selected trace is saved in Instrument State
Range	1 2
Key Path	Trace/Detector, Select Trace

View/Blank

View/Blank lets you set the state of the two trace variables, Update and Display. The four choices available in this menu are:

- **Trace On:** Update and Display both On
- **View:** Update Off and Display On
- **Blank:** Update Off and Display Off
- **Background:** Update On, Display Off (this allows a trace to be blanked and continue to update “in the background”, which was not possible in the past)

When a trace becomes inactive, the following things happen:

- Any update from the SENSE system (detectors) immediately stops (That is, the current update does not continue to the end of the sweep)
- The trace is displayed at half intensity as long as it stays inactive.

Inactive traces display across the entire X Axis of the instrument. Their horizontal placement does not change even if X Axis settings subsequently are changed, although Y-axis settings will affect the vertical placement of data.

In most cases, inactive traces are static and unchanging; however, there are cases when an inactive trace will update, specifically:

- If data is written to that trace from remote
- If trace data is loaded from mass storage
- If the trace is the target of a Copy or participant in an Exchange

Stimulus / Response
Distance To Fault

- If the trace is cleared using the Clear Trace function (below)

When a trace becomes active (Update = On), the trace is cleared, the average count is reset, and a new sweep is initiated.

Traces which are blanked (Display = off) do not display nor appear on printouts but are otherwise unaffected. They may be queried and markers may be placed on them.

NOTE The action of putting a trace in Display = Off and/or Update = Off does not restart the sweep and does not restart Averaging or Hold functions for any traces.

NOTE Whenever the you set Update to On for any trace, Display is set to On for that trace.

Parameter Name	Trace View/Blank
Key Path	Trace/Detector
Key Notes	<p>The four states of this menu set two variables, Update and Display, to their four possible combinations:</p> <ul style="list-style-type: none"> • Trace On: Update and Display both On • View: Update Off and Display On • Blank: Update Off and Display Off • Background: Update On, Display Off <p>See tables below for details on the SCPI to control these two variables.</p>

Parameter Name	Trace Update State
Remote Command	:TRACe [1] 2 3 4 :UPDate [:STATe] ON OFF 0 1 :TRACe [1] 2 3 4 :UPDate [:STATe] ?
Example	TRAC2:UPD 0 Makes trace 2 inactive (stops updating)
Dependencies / Couplings	<p>Setting the trace type (even to the type it was already in) puts the trace in Active.</p> <p>Loading a trace from a file makes that trace inactive regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange.</p> <p>Whenever the user sets Update to On for any trace, the Display is set to On for that trace.</p>
Preset	1 0 0 0 (On for Trace 1; Off for 2-6)
State Saved	Saved in Instrument State
Key Path	Trace/Detector

Annunciation	An inactive trace is indicated by dimming the type letter in the trace annotation panel in the Measurement bar (see Annunciation in the table below).
Parameter Name	Trace Display State
Remote Command	:TRACe [1] 2 3 4 :DISPlay [:STATE] ON OFF 0 1 :TRACe [1] 2 3 4 :DISPlay [:STATE] ?
Example	TRAC2:DISP,1 Makes trace 2 visible TRAC3:DISP,0 Blanks trace 3
Dependencies / Couplings	Setting the trace type (even to the type it was already in) puts the trace in Display On. Whenever the user sets Update to On for any trace, the Display is set to On for that trace. Loading a trace from a file puts that trace in Display On regardless of the state it was in when it was saved; as does being the target of a Copy or a participant in an Exchange.
Preset	1 0 0 0 (On for Trace 1; Off for 2-4)
State Saved	Saved in Instrument State
Key Path	Trace/Detector
Annunciation	A trace in Blank is indicated by a strikethrough thorough the type letter in the trace annotation panel in the Measurement bar.



View/Display Menu

To access the following keys for setting up a Distance to Fault measurement, press **Meas, Distance to Fault** and then the **View/Display** key.

Mode	Stimulus / Response
Key Path	Front-panel key

Fault Indicators

Sets the Fault Indicator setting to either On or Off.

When measuring distance to fault, you can display the top four faults with markers on the trace. Even if

Stimulus / Response
Distance To Fault

the Fault Indicators are set to Off, the position and the severity of the top four cable faults are still listed in the Metrics Display section at the bottom of the screen.

When set to On, the positions of the top four faults are indicated on the trace with four numbered yellow triangles. If you have Pass/Fail Limits set to On, the yellow triangles will be colored red for any faults that exceed your pre-defined limit.

If your Start Distance is 0 m (0 ft.), you will see a peak corresponding to 0 m (0 ft.). This is caused by reflection from the junction between your analyzer and the cable under test. This DC component, sometimes referred to as the “dead zone”, does not necessarily indicate a problem, but be sure that the connection is tight and clean.

Mode	Stimulus / Response
Range	On Off 1 0
Key Path	View/Trace, Fault Indicators

7

Modulation Analyzer

Selects the Modulation Analyzer measurement mode for your analyzer. This mode enables you to use the **Meas** key to select one-button measurements such as AM and FM. The Modulation Analyzer mode defaults to the FM measurement.

Mode	All
Remote Command	:INSTrument [:SElect] :<mode_name> :INSTrument [:SElect] ?
Example	:INST:MA
State Saved	Saved in instrument state.
Key Path	Mode, Modulation Analyzer

AM Demodulation

AM Demodulation Description

Amplitude modulation was the original method used for transmitting audio signals over radio frequency waves. It is still used today in AM radio.

In an AM signal, the idea is to modulate the carrier waveform without changing phase - only the amplitude is supposed to change. that leads us to the model of a single carrier and two oppositely-rotating vectors that sum to change the amplitude of the carrier, but not its phase.

Mode	Modulation Analyzer (MA)
Remote Command	:CONFigure:AM
Example	CONF:AM
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect MA to set the mode.
Key Path	Meas, AM

Front Panel Results & Views

The measurement display will consist of two areas: the graphical display and the numeric results window. The AM Measured Time View will be the default AM measurement display; the AM demodulate Spectrum View can only be accessed using the 'Display' menu.

Waveform View The AM demodulated signal versus time plot will be displayed in the graphical area of the measurement display with the numeric results window displayed below. The trace length is 401 points.

Numeric Results Window The numeric results window displayed below the AM measured time view displays numeric results. Following is the detail on numeric results window:

AM Index This is the measured average AM Index.

Limits: No

Units: %

Rate This is the measured average mod rate.

Limits: No

Units: Hz

Distortion This id the measured average distortion.

Limits: No

Units: %

SINAD This is the measured average SINAD.

Limits: No

Units: dB

Spectrum View The AM demodulation spectrum will be displayed in the graphical area of the measurement display with the numeric results window displayed below. The trace length is 401 points.

Numeric Results Window Following is the detail on numeric results window:

AM Index This is the measured average AM Index.

Limits: No

Units: %

Rate This is the measured average mod rate.

Limits: No

Units: Hz

Distortion This is the measured average distortion.

Limits: No

Units: %

SINAD This is the measured average SINAD.

Limits: No

Units: dB

Numeric Results View The numeric results view displays the following results:

Max Carrier Power This is the maximum TX carrier power among several measurement time.

Limits: Yes; please refer to [“Carrier Power Upper” on page 360](#)

Units: dBm

Avg/Current Carrier Power This is the average TX carrier power among several measurement time. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: dBm

Max Peak+ AM Index This is the maximum positive AM Index among several measurement times.

Limits: Yes; please refer to section [“AM Index Upper” on page 361](#)

Units: %

Avg/Current Peak+ AM Index This is the average positive AM Index among several measurement times. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: %

Min Peak+ AM Index This is the minimum positive AM Index among several measurement time.

Modulation Analyzer

AM Demodulation

Limits: Yes; please refer to “AM Index Lower ” on page 361

Units: %

Max Peak- AM Index This is the maximum negative AM Index among several measurement time.

Limits: Yes; please refer to “AM Index Upper” on page 361

Units: %

Avg/Current Peak- AM Index This is the average negative AM Index among several measurement time. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: %

Min Peak- AM Index This is the minimum negative AM Index among several measurement time.

Limits: Yes; please refer to “AM Index Lower ” on page 361

Units: %

Max Peak+/-2 AM Index This is the maximum peak-to-peak/2 AM Index among several measurement time.

Limits: Yes; please refer to “AM Index Upper” on page 361

Units: %

Avg/Current Peak+/-2 AM Index This is the average peak-to-peak/2 AM Index among several measurement time. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: %

Min Peak+/-2 AM Index This is the minimum peak-to-peak/2 AM Index among several measurement time.

Limits: Yes; please refer to “AM Index Lower ” on page 361

Units: %

Max RMS AM Index This is the Maximum RMS AM Index among several measurement time.

Limits: Yes; please refer to “AM Index Upper” on page 361

Units: %

Avg/Current RMS AM Index This is the average RMS AM Index among several measurement time. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: %

Min RMS AM Index This is the minimum RMS AM Index among several measurement time.

Limits: Yes; please refer to “AM Index Lower ” on page 361

Units: %

Max Modulation Rate This is the maximum modulate rate of AM signal among several measurement time.

Limits: No

Units: Hz

Avg/Current Modulation Rate This is the average modulate rate of AM signal among several measurement time. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: Hz

Max Distortion This is the maximum value of Distor. Here Distor represents the ratio of distortion (noise and harmonic) to signal.

Limits: No

Units: %

Avg/Current Distortion This is the average value of Distor. Here Distor represents the ratio of distortion (noise and harmonic) to signal. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: %

Max SINAD This is the maximum value of SINAD. Here SINAD represents the ratio of signal to distortion (noise and harmonic).

Limits: No

Units: dB

Avg/Current SINAD This is the average value of SINAD. Here SINAD represents the ratio of signal to distortion (noise and harmonic). If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: dB

Remote Measurement Results

Query the Current measurement results. You must be in the Modulation Analyzer mode and AM measurement to query AM results. Use INSTRUMENT:SELEct MA to set the mode, use CONFigure:AM to set the measurement. Use CONFigure? to query the name of the measurement that is currently running.

Demod Metrics

Command sequences:

INST:SELE MA

CONF:AM

INIT

*OPC?

Modulation Analyzer

AM Demodulation

CALC:DATA?

If you execute the remote command “:CALCulate:DATA?” when the AM is active, the query will return following comma-separated scalar results in order:

Result Number	Field Name	Description
1	Avg/Current Carrier Frequency Offset	Avg/Current Carrier Frequency Offset (Hz)
2	Max Carrier Frequency Offset	Maximum Carrier Frequency Offset (Hz)
3	Min AM Index	Based on the current detector type, may be one of peak+, Peak-, Peak+/-2, RMS
4	Avg/Current AM Index	Based on the current detector type, may be one of peak+, Peak-, Peak+/-2, RMS
5	MaxAM Index	Based on the current detector type, may be one of peak+, Peak-, Peak+/-2, RMS
6	Avg/Current Carrier Power	Avg/Current Carrier Power (dBm)
7	MaxCarrier Power	Maximum Carrier Power (dBm)
8	Avg/Current Mod Rate	Avg/Current Mod Rate (Hz)
9	MAX Mod Rate	Maximum Mod Rate (Hz)
10	Avg/Current SINAD	Avg/Current SINAD (dB)
11	Max SINAD	Maximum SINAD (dB)
12	Avg/Current Distortion	Avg/Current Distortion (%)
13	Max Distortion	Maximum Distortion (%)
14	Test result of RF Carrier Power Upper Limit	Test result of RF Carrier Power Upper: 1 = PASS, 0 = FAIL, -1 = Limit Test OFF
15	Test result of AM Index Upper Limit	Test result of AM Index Upper Limit: 1 = PASS, 0 = FAIL, -1 = Limit Test OFF
16	Test result of AM Index Lower Limit	Test result of RF AM Index Lower Limit: 1 = PASS, 0 = FAIL, -1 = Limit Test OFF

The response will be in standard block format:

```
#[Length of header-1][Length of block][xxx,xxx,...xxx]
|-----header-----|
```

It will always begin with a #, then followed by a header. After this is the data in a comma separated list.

The first digit in the header tells you how many additional digits there are in the header.

From the second digit to the last digit in the header tells you the size of the block.

For example:

```
#2421122924465,916972000,69,160,1213313125,975
```

The first digit in the header (2) tells you how many additional digits/bytes there are in the header.

The 42 means forty-two bytes will follow. Note this also includes the commas.

Traces

Command sequences:

```
INST:SELE MA
```

```
CONF:AM
```

```
INIT
```

```
*OPC?
```

```
TRACE:DATA? <trace_name>
```

where <trace_name> = WAVEform|SPECTrum

This command allows trace data to be sent to the analyzer or queried from the analyzer. The response to the query is a list of the amplitude points which comprise the requested trace in the current y axis unit of the analyzer. The x axis unit is that of the destination trace (for send) or the source trace (for query).

The format and byte-ordering of the sent or received data will be dependent on the FORMat:DATA and FORMat:BORDER commands. ASCII data consists of a string of comma separated values. REAL or INTeger data is sent as a definite length block, with a header describing the data to follow.

For example, a four point trace might look like this if in ASCII (FORMat:DATA ASCii):

```
-5.87350E+01, -5.89110E+01, -5.87205E+01, -5.12345E+01<NL><END>
```

and like this if in INTeger with 4 bytes per point (FORMat:DATA INT,32):

Modulation Analyzer

AM Demodulation

≈#216<16 bytes of data><NL><END>

where the 2 in the #216 means “2 digits of numeric data to follow”, and the 16 is the 2 digits and means “16 binary bytes to follow” (this is the definite length block format).

Note that the data is terminated with <NL><END>. (For LAN, this is <newline> only.)

In AM, there are 2 traces as follows:

Trace Number	Trace Name	Description
1	WAVEform	AM Demod Waveform trace - Returns series of floating point numbers that represent the AM demod signal, as comma-separated trace points. The number of trace points equal to 401.
2	SPECtrum	AM Demod Spectrum trace - Returns a trace of the Demod Spectrum, as comma-separated trace. The number of trace points is 401. The data is in decimal format. The X-axis unit of this trace is frequency.

AMPTD Y-scale

Waveform View

Autoscale Automatically sets Ref Value, Ref Position and Scale/Div. There is no associated SCPI command.

The Autoscale function automatically sets the scale per division and the Ref Value based on the currently displayed trace data

When you press Autoscale:

Reference position = Ctr

Ref value = (maximum value of the trace + minimum value of the trace)/2

Scale/Div = (maximum value of the trace – minimum value of the trace)/8

Menu key Label	Autoscale
Mode	Modulation Analyzer

Restriction and Notes	The Autoscale automatically determines the scale per division and reference values based on the measurement results if this parameter is set to On. When the Autoscale is pressed, the center position reference value = (maximum value of the trace + minimum value of the trace)/2, and the Scale/Div = (maximum value of the trace – minimum value of the trace)/8.
Dependencies / Couplings	The Autoscale function automatically determines the scale per division and reference values based on the measurement results. When the Autoscale is set On, the center position reference value = (maximum value of the trace + minimum value of the trace)/2; And the Scale/Div = (maximum value of the trace – minimum value of the trace)/8.
Remote Command Notes	No SCPI command is associated with this menu key
State Saved	No
Key Path	AMPTD/Y Scale

Ref Value Allows you to set the reference value on the display.

Menu key Label	Ref Value
Mode	Modulation Analyzer
Restriction and Notes	If Autoscale is pressed, this value is automatically determined by the measurement result.
Dependencies / Couplings	When the Autoscale is pressed, the center position reference value = (maximum value of the trace + minimum value of the trace)/2, and the Scale/Div = (maximum value of the trace – minimum value of the trace)/8
Remote Command Notes	No SCPI command is associated with this menu key
Preset	0%
State Saved	Saved in instrument state.
Min	–100%
Max	100%
Key Path	AMPTD/Y Scale

Modulation Analyzer

AM Demodulation

Elec Atten Sets the RF input attenuation mode to Manual and sets the attenuation level. **Manual attenuation** enables you to set the input attenuation value in 1 dB or 10 dB increments. Attenuation can be changed using the step keys, the knob, or the numeric keypad. Step size is 1 dB using the left/right arrows and 10 dB using the up/down arrows. You may select 0 dB using the knob or the step keys.

Menu key label	Elec Atten
Mode	Modulation Analyzer
Remote Command	<code>[:SENSe] :POWer [:RF] :ATTenuation <rel_ampl></code> <code>[:SENSe] :POWer [:RF] :ATTenuation?</code>
Example	<code>:POW:ATT 6dB</code> <code>:POW:ATT:ARAN ON</code>
Restriction and Notes	Elec Atten is settable in 1 dB and 10 dB steps. 1 dB using the left/right arrows and 10 dB steps using the up/down arrows. You may select 0 dB using knob or step keys.
Dependencies / Couplings	When the Auto Range is On, this value is automatically determined by the measurement. When you set a value manually, Auto Range automatically changes to Off.
Preset	0.0 dB
State Saved	Saved in instrument state.
Min	0.0 dB
Max	40.0 dB
Key Path	AMPTD/Y Scale

Scale/Div This key allows you to set the scale per division on the display graticule.

Menu key label	Scale/Div
Mode	Modulation Analyzer
Restriction and Notes	If the Autoscale is pressed, this value is automatically determined by the measurement result. When you set this value manually, Autoscale automatically changes to ineffective.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	No SCPI command is associated with this menu key
Preset	20%
State Saved	Saved in instrument state.

Min	0.1%
Max	100%
Key Path	AMPTD/Y Scale

Ref Position Allow you to set the display Ref Position to either Top, Ctr (center), or Bot (bottom).

Menu key Label	Ref Position
Mode	Modulation Analyzer
Remote Command Notes	No SCPI command is associated with this menu key
Preset	Ctr
State Saved	Saved in instrument state.
Range	Top Ctr Bot
Key Path	AMPTD/Y-Scale

Auto Range Sets the auto ranging of Elec Atten and Internal Preamp to On or Off.

For the Elec Atten, when Auto Range is On, the entire frequency range of the analyzer is scanned to determine the total power applied to the analyzer. The RF input attenuation is then automatically set to ensure that the analyzer input is not overloaded.

For the Internal Preamp, turning on the Preamp gives a better noise figure, but a poorer TOI to noise floor dynamic range. So when the Auto Range is On, depending on your measurement, the instrument will optimize this setting.

There is no separate auto ranging controls for Elec Atten and Preamp. There is only one overall auto ranging on/off control.

Menu key label	Auto Range
Mode	Modulation Analyzer
Remote Command	[:SENSe] :POWer [:RF] :ARANge ON OFF 1 0 [:SENSe] :POWer [:RF] :ARANge?
Example	:POWer:ARANge OFF :POWer:ARANge?

Modulation Analyzer

AM Demodulation

Restriction and Notes	There is no separate auto ranging controls for elec atten and preamp. There is only one overall auto ranging on/off control
Dependencies / Couplings	See Restriction and Notes
Preset	ON
State Saved	Saved in instrument state.
Range	Off On
Key Path	AMPTD/Y Scale

Internal Preamp The Internal Preamp key set the internal preamplifier to On, Off, or Auto Range mode to On or Off. Turning on the preamp provides a better noise figure, but reduces TOI to noise floor dynamic range. This key does not appear if the preamplifier option (Option P03 or P06) is not licensed.

Menu key label	Internal Preamp
Mode	Modulation Analyzer
Remote Command	[:SENSe] :POWer [:RF] :GAIN[:STATe] ON OFF 1 0 [:SENSe] :POWer [:RF] :GAIN[:STATe] ?
Example	:POWer:GAIN 1 :POWer:GAIN?
Restriction and Notes	If the preamplifier option (Option P03 or P06) is not installed or is unlicensed, the key does not appear There are no separate auto ranging controls for electric attenuation and preamp. There is only one overall auto ranging on/off control
Dependencies / Couplings	When Auto Range is On, the state of this Preamp is automatically determined by the measurement. When the user sets a value manually, Auto Range automatically changes to Off.
State Saved	Saved in instrument state.
Range	Off On
Key Path	AMPTD/Y Scale, More

Ext Gain Sets the external gain value.

Menu key label	Ext Gain
Mode	Modulation Analyzer
Remote Command	[:SENSe]:CORRection:OFFSet[:MAGNitude] <rel_amp1> [:SENSe]:CORRection:OFFSet[:MAGNitude]? [:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe ON OFF 1 0 [:SENSe]:CORRection:OFFSet[:MAGNitude]:STATe?
Example	:CORRection:OFFSet 20 :CORRection:OFFSet? :CORR:OFFSet:STATe OFF.
Restriction and Notes	Ext Gain state (on/off) and value (i.e. 5 dB) are unaffected by preset. The state will be affected by power cycle.
Preset	0.0 dB ON
State Saved	Saved in instrument state.
Min	-100.0 dB
Max	100.0 dB
Key Path	AMPTD/Y Scale, More

Spectrum view

Autoscale Automatically sets the Ref Value, Ref Position and Scale/Div. There is no associated SCPI command.

The Autoscale function automatically sets the scale per division and Ref Value based on the currently displayed trace data.

When the autoscale is pressed:

Reference position = Ctr

Ref value = (maximum value of the trace + minimum value of the trace)/2;

Scale/Div = (maximum value of the trace – minimum value of the trace)/8.

Menu key Label	Autoscale
Mode	Modulation Analyzer

Modulation Analyzer

AM Demodulation

Restriction and Notes	The Autoscale automatically determines the scale per division and reference values based on the measurement results.
Dependencies / Couplings	When Autoscale is pressed, Ref Position = Ctr Ref value = (maximum value of the trace + minimum value of the trace)/2; Scale/Div = (maximum value of the trace –minimum value of the trace)/8
Remote Command Notes	No SCPI command is associated with this menu key
State Saved	No
Key Path	AMPTD/Y Scale

Ref Value Allows you to set the reference value used on the display.

Menu key Label	Ref Value
Mode	Modulation Analyzer
Restriction and Notes	If the Autoscale is pressed, this value is automatically determined by the measurement result.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	No SCPI command is associated with this menu key
Preset	0 dB%(rms)
State Saved	Saved in instrument state.
Min	–150 dB%(rms)
Max	150 dB%(rms)
Key Path	AMPTD/Y Scale

Elec Atten Sets the RF Input Attenuation mode to Manual and sets the attenuation level. **Manual attenuation** enables you to set the input attenuation value in 1 dB or 10 dB increments. Attenuation can be changed using the step keys, the knob, or the numeric keypad. Step size is 1 dB using the left/right arrows and 10 dB using the up/down arrows. You may select 0 dB using knob or step keys.

There is no separate auto ranging controls for elec atten and preamp. There is only one overall auto

ranging on/off control

Menu key label	Elec Atten
Mode	Modulation Analyzer
Remote Command	[:SENSe] :POWer [:RF] :ATTenuation <rel_ampl> [:SENSe] :POWer [:RF] :ATTenuation?
Example	POW:ATT 6dB POW:ATT:ARANG ON
Restriction and Notes	Elec Atten is settable in 1 dB and 10 dB steps. 1 dB using the left/right arrows and 10 dB steps using the up/down arrows. You may select 0 dB using knob or step keys.
Dependencies / Couplings	When the Auto Range is On, this value is automatically determined by the measurement. When you set the value manually, Auto Range automatically changes to Off.
Preset	0.0 dB
State Saved	Saved in instrument state.
Min	0.0 dB
Max	40.0 dB
Key Path	AMPTD/Y Scale

Scale/Div This key allows you to specify the scale per division used on the graticule.

Menu key label	Scale/Div
Mode	Modulation Analyzer
Restriction and Notes	If the Autoscale is set to On, this value is automatically determined by the measurement result. When you set this value manually, Autoscale automatically changes to Off.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	No SCPI command is associated with this menu key
Preset	20.0 dB
State Saved	Saved in instrument state.
Min	0.1 dB
Max	30.0 dB
Key Path	AMPTD/Y Scale

Modulation Analyzer

AM Demodulation

Ref Position Allows you to set the display Ref Position to either Top, Ctr (center), or Bot (bottom).

Menu key Label	Ref Position
Mode	Modulation Analyzer
Remote Command Notes	No SCPI command is associated with this menu key
Preset	Ctr
State Saved	Saved in instrument state.
Range	Top Ctr Bot
Key Path	AMPTD/Y-Scale

Auto Range Sets the auto ranging of Elec Atten and Internal Preamp to On or Off.

For the Elec Atten, when Auto Range is On, the entire frequency range of the analyzer is scanned to determine the total power applied to the analyzer. The RF input attenuation is then automatically set to ensure that the analyzer input is not overloaded.

For the Internal Preamp, turning on the Preamp gives a better noise figure, but a poorer TOI to noise floor dynamic range. So when the Auto Range is On, depending on your measurement, the instrument will optimize this setting.

There is no separate auto ranging controls for Elec Atten and Preamp. There is only one overall auto ranging on/off control.

Menu key label	Auto Range
Mode	Modulation Analyzer
Remote Command	<code>[:SENSE] :POWER [:RF] :ARANGE ON OFF 1 0</code> <code>[:SENSE] :POWER [:RF] :ARANGE?</code>
Example	<code>:POW:ARAN 0</code> <code>:POW:ARAN?</code>
Restriction and Notes	There are no separate auto ranging controls for elec atten and preamp. There is only one overall auto ranging on/off control
Dependencies / Couplings	See Restriction and Notes
Preset	ON
State Saved	Saved in instrument state.
Key Path	AMPTD/Y Scale

Internal Preamp The Internal Preamp key sets the internal preamplifier to On or to Off, or Auto Range mode On or Off. Turning on the preamp provides a better noise figure, but reduces TOI to noise floor dynamic range. This key does not appear if the preamplifier option (Option P03 or P06) is not installed.

There are no separate auto ranging controls for elec atten and preamp. There is only one overall auto ranging on/off control

Menu key label	Internal Preamp
Mode	Modulation Analyzer
Remote Command	<code>[:SENSE] :POWER [:RF] :GAIN [:STATE] ON OFF 1 0</code> <code>[:SENSE] :POWER [:RF] :GAIN [:STATE] ?</code>
Example	<code>:GAIN[:STATE] ON OFF 1 0</code> <code>:GAIN[:STATE] ?</code>
Restriction and Notes	If the preamplifier option (Option P03 or P06) is not installed or is unlicensed, the key does not appear. There are no separate auto ranging controls for elec atten and preamp. There is only one overall auto ranging on/off control
Dependencies / Couplings	When Auto Range is On, the state of this Preamp is automatically determined by the measurement.
Preset	OFF
State Saved	Saved in instrument state.
Range	Off On
Key Path	AMPTD/Y Scale, More

Ext Gain This key allows you to set the value of external gain if applicable

The Ext Gain state (On or Off) and the value (for example, 5 dB) are unaffected by Preset. The state will be affected by a power cycle.

Menu key label	Ext Gain
Mode	Modulation Analyzer
Remote Command	<code>[:SENSE] :CORREction:OFFSet [:MAGNitude] <rel-amp></code> <code>[:SENSE] :CORREction:OFFSet [:MAGNitude] ?</code> <code>[:SENSE] :CORREction:OFFSet [:MAGNitude] :STATE</code> <code>ON OFF 1 0</code> <code>[:SENSE] :CORREction:OFFSet [:MAGNitude] :STATE?</code>

Modulation Analyzer

AM Demodulation

Example	:CORRection:OFFSet 0 CORR:OFFSet:STATe OFF
Restriction and Notes	The Ext Gain state (On or Off) and its value (for example, 5 dB) are unaffected by Preset. The state will be affected by a power cycle.
Preset	0.0 dB ON
State Saved	Saved in instrument state.
Min	-100.0 dB
Max	100.0 dB
Key Path	AMPTD/Y Scale, More

FREQ Channel Menu

Allows you to set the Center Frequency for a measurement.

Menu key Label	Center Freq
Mode	MA
Remote Command	[:SENSe] :FREQuency:CENTer <freq> [:SENSe] :FREQuency:CENTer?
Example	:FREQ:CENT 2GHz :FREQ:CENT?
Preset	1 GHz
State Saved	Saved in instrument state.
Min	Hardware Dependent:
Max	Hardware Dependent:
Key Path	FREQ/Channel

Marker

Waveform View

Marker Accesses the marker control keys which select the type and number of markers and turns them on and off. Markers are diamond-shaped characters that identify points on traces. Up to four pairs of markers may appear on the display simultaneously; only one pair can be controlled at a time. The marker that is controlled is called the “active” marker. Pressing Marker activates the Normal menu key.

For numeric results, no markers will be available. There is no SCPI control for that view, but you can retrieve results using SCPI commands.

When the 'Marker' front panel key is pressed in the 'Numeric Results view', there is no response.

Marker Selecting one of four possible markers in the Waveform view. A marker that has already been turned on will become active when it is selected. If a marker has been turned on, it will become active on that trace if that marker is selected.

Menu key Label	Marker
Mode	All
Remote Command Notes	No SCPI. Front panel only.
Preset	1
State Saved	Saved in instrument state.
Range	1 2 3 4
Key Path	Marker

Marker Type Allows you to set the type of the Marker.

Mode	All
Remote Command	:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MODE OFF POSition DELTA :CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MODE ?
Dependencies / Couplings	If the currently active marker is a delta marker and it is changed to a normal marker, it becomes a normal marker at the delta marker position on the X scale.

Modulation Analyzer

AM Demodulation

Remote Command Notes When this SCPI command is sent and the currently selected measurement view is Spectrum or Numeric Results, the SCPI command still has effect to the waveform view.

When the SCPI command is sent, the active marker is changed in the Waveform view. For example, if the currently active marker is marker 1 and the SCPI command `CALC:AM:VIEW1:WIND1:MARK2:MODE POS` is sent, the Waveform view active marker will change to marker 2.

Preset	POS
State Saved	Saved in instrument state.
Range	Normal Delta Off
Key Path	Marker

Normal Activate a normal marker at the center of the display.

Menu key Label	Normal
Mode	SA
Example	:CALC:AM:VIEW1:WIND1:MARK2:MODE POS
Key Path	Marker

Delta Activate a pair of markers, one of which is fixed at the current marker location. The other marker can then be moved around on the trace. The marker readout shows the difference between the two markers.

Pressing Delta moves the reference marker to the active marker position, so you can make delta measurements from differing reference points without having to turn off the markers and begin again.

Menu key Label	Delta
Mode	SA
Example	:CALC:AM:VIEW1:WIND1:MARK:MODE DELT
Key Path	Marker

Off Turns the selected marker Off.

Menu key Label	Off
Mode	SA
Example	:CALC:AM:VIEW1:WIND1:MARK3:MODE OFF
Key Path	Marker

Marker All Off Turns off all the markers on the trace.

Menu key Label	Marker All Off
Mode	All
Remote Command	:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer:AOFF
Example	:CALC:AM:VIEW1:WIND1:MARK:AOFF
Restriction and Notes	no
Dependencies / Couplings	no
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Spectrum or Numeric Results, the SCPI command still has effect to the Waveform view.
State Saved	Saved in instrument state.
Key Path	Marker

Marker X Axis Value Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off**, but the SCPI command is equivalent to entering an X value if the control mode is **Normal** or **Delta**.

Menu key Label	Marker
Mode	Modulation Analyzer
Remote Command	:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X <real> :CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X?
Example	:CALC:AM:VIEW1:WIND1:MARK3:X?

Modulation Analyzer

AM Demodulation

Restriction and Notes	<p>If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” will be generated.</p> <p>The query returns the marker’s absolute X Axis value if the control mode is Normal, or the offset from the marker’s reference marker if the control mode is Delta. The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency, seconds for Period and Time. If the marker is Off the response is 9.91E37.</p>
Dependencies / Couplings	Maximum value would be changed by Meas Time parameter value.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Center of screen
State Saved	No
Key Path	Marker, Normal

Marker X Axis Position Sets the marker X position in trace points. It has no effect if the control mode is **Off**, but the SCPI is equivalent of entering a value if the control mode is **Normal** or **Delta** except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	<pre>:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X:PO Sition <integer></pre> <pre>:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X:PO Sition?</pre>
Example	<pre>:CALC:AM:VIEW1:WIND1:MARK2:X:POS?</pre>
Restriction and Notes	The query returns the marker’s absolute X Axis value in trace points if the control mode is Normal , or the offset from the marker’s reference marker in trace points if the control mode is Delta . If the marker is Off the response is 9.91E37.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	200
State Saved	No
Min	0
Max	400

Marker Y Axis Value Returns the marker Y Axis value in the current marker Y Axis unit.

The “result” of a marker is the value which is displayed on the second line of the Marker Result block. To properly interpret the returned value, the remote programmer must also know what the analyzer’s Y-Axis Unit is set to as described below.

A marker can have up to two results, only one of which is displayed or returned on a query, as follows:

Absolute result: Every marker has an absolute result and it is simply:

For Normal and Delta markers, the Y-axis value of the trace point the marker is currently on.

The absolute result is displayed in the result block or returned on a query unless the marker control mode is **Delta**.

Relative result: If a marker’s control mode is **Delta**, the relative result is displayed in the result block or returned on a query. This is the offset of the Absolute Result of a delta marker to the Absolute Result of its reference marker.

The ratio is expressed in %.

Mode	Modulation Analyzer
Remote Command	:CALCulate:AM:VIEW [1] :WINDow [1] :MARKer [1] 2 3 4 :Y?
Example	:CALC:AM:VIEW1:WIND1:MARK2:Y?
Restriction and Notes	The query returns the marker Y-axis result. If the marker is Off the response is 9.91E37.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	0
State Saved	No
Key Path	N/A – Remote Feature Only

Peak Search Link to the front panel key Peak search; places a marker on the highest peak on the current trace.

If there is no marker active and the key is pressed marker 1 is activated at the highest peak.

If there is a marker currently active, the currently selected marker (refer to appropriate section on how it is selected) will be moved.

If the active marker is a normal marker this will move to the highest peak, if the active marker is a delta marker the reference marker position will remain unchanged and the delta marker will be moved to the highest peak on the trace

Mode	All
Remote Command	:CALCulate:AM:VIEW [1] :WINDow [1] :MARKer [1] 2 3 4 :MAXimum
Example	:CALC:AM:VIEW1:WIND1:MARK2:MAX

Modulation Analyzer

AM Demodulation

Remote Command Notes When this SCPI command is sent and the currently selected measurement view is Spectrum or Numeric Results, the SCPI command still has effect to the waveform view.

Key Path **Peak search**

Next Peak Places the selected marker on the next highest signal peak from the current marked peak. This will find the next highest peak to the left OR right of the current marker position. If the currently active marker is a delta marker, when this key is pressed the reference marker position remains unchanged and the delta marker moves to the next highest peak on the trace.

Menu key Label	Next Peak
Mode	All
Remote Command	:CALCulate:AM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MAXimum:NEXT
Example	:CALC:AM:VIEW1:WIND1:MARK2:MAX:NEXT
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Spectrum or Numeric Results, the SCPI command still has effect to the waveform view.
Key Path	Peak Search

Marker -> Link to the front panel key Marker ->. Accesses the marker function menu keys that change the values of center frequency or the Ref Value to the current value of the selected marker.

Mode	All
Key Path	Marker ->

Mkr -> RL Sets the Ref Value to the amplitude value of the selected marker, moving the marked point to the Ref Value (top line of the graticule). The marker's mode (Normal, Delta) doesn't matter in this case. For example, given a delta marker, if the delta marker is the selected marker, its amplitude is applied to the Ref Value. If the reference marker is selected, its amplitude is applied to the Ref Value.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker, and its amplitude applied to the Ref Value

Menu key Label	Marker ->RL
Mode	All
Remote Command Notes	No SCPI command is associated with this menu key
State Saved	no
Key Path	Marker ->

Spectrum View

Marker Accesses the marker control keys which select the type and number of markers and turns them on and off. Markers are diamond-shaped characters that identify points on traces. Up to four pairs of markers may appear on the display simultaneously; only one pair can be controlled at a time. The marker that is controlled is called the “active” marker. Pressing Marker activates the Normal menu key.

For numeric results, no markers will be available. There is no SCPI control for that view, but you can retrieve results using SCPI commands.

When the 'Marker' front panel key is pressed in the 'Numeric Results view', there is no response.

Marker Selecting one of four possible markers in the Spectrum view. A marker that has already been turned on will become active when it is selected. If a marker has been turned on, it will become active on that trace if that marker is selected.

Menu key Label	Marker
Mode	All
Remote Command Notes	No SCPI. Front panel only.
Preset	1
State Saved	Saved in instrument state.
Range	1 2 3 4
Key Path	Marker

Modulation Analyzer AM Demodulation

Marker Type Allows you to set the type of the Marker

Mode	All
Remote Command	:CALCulate:AM:VIEW2:WINDow [1] :MARKer [1] 2 3 4 :MODE OFF POSition DELTa :CALCulate:AM:VIEW2:WINDow [1] :MARKer [1] 2 3 4 :MODE?
Dependencies / Couplings	If the currently active marker is a delta marker and it is changed to a normal marker, it becomes a normal marker at the delta marker position on the X scale.
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Waveform or Numeric Results, the SCPI command still has effect to the Spectrum view. When the SCPI command is sent, the active marker is changed in the Spectrum view. For example, if the currently active marker is marker 1 and the SCPI command CALC:AM:VIEW2:WIND1:MARK2:MODE POS is sent, the Spectrum view active marker will change to marker 2.
Preset	POS
State Saved	Saved in instrument state.
Range	Normal Delta Off
Key Path	Marker

Normal Activate a normal marker at the center of the display.

Menu key Label	Normal
Mode	SA
Example	:CALC:AM:VIEW2:WIND1:MARK2:MODE POS
Key Path	Marker

Delta Activate a pair of markers, one of which is fixed at the current marker location. The other marker can then be moved around on the trace. The marker readout shows the difference between the two markers.

Pressing Delta moves the reference marker to the active marker position, so you can make delta measurements from differing reference points without having to turn off the markers and begin again.

Menu key Label	Delta
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Mode	SA
Example	:CALC:AM:VIEW2:WIND1:MARK:MODE DELT
Key Path	Marker

Off Turns the selected marker Off.

Menu key Label	Off
Mode	SA
Example	:CALC:AM:VIEW2:WIND1:MARK3:MODE OFF
Remote Command Notes	In the AM measurement, this selects Marker 3 and inactivates this marker.
Key Path	Marker

Marker All Off Turns off all the markers on the trace.

Menu key Label	Marker All Off
Mode	All
Remote Command	:CALCulate:AM:VIEW2:WINDow [1] :MARKer:AOff
Example	:CALC:AM:VIEW2:WIND1:MARK:AOff
Restriction and Notes	no
Dependencies / Couplings	no
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Waveform or Numeric Results, the SCPI command still has effect to the Spectrum view.
State Saved	Saved in instrument state.
Key Path	Marker

Marker X Axis Value Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is **Off**, but the SCPI is equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Menu key Label	Marker
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Modulation Analyzer

AM Demodulation

Mode	Modulation Analyzer
Remote Command	:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X <real> :CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X?
Example	:CALC:AM:VIEW2:WIND1:MARK3:X?
Restriction and Notes	If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” will be generated. The query returns the marker’s absolute X Axis value if the control mode is Normal , or the offset from the marker’s reference marker if the control mode is Delta . The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency , seconds for Period and Time . If the marker is Off the response is 9.91E37.
Dependencies / Couplings	Maximum value would be changed by Span value.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Center of screen
State Saved	No
Key Path	Marker, Normal

Marker X Axis Position Sets the marker X position in trace points. It has no effect if the control mode is **Off**, but the SCPI is equivalent of entering a value if the control mode is **Normal** or **Delta** except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X:POSition <integer> :CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X:POSition?
Example	:CALC:AM:VIEW2:WIND1:MARK2:X:POS?
Restriction and Notes	The query returns the marker’s absolute X Axis value in trace points if the control mode is Normal , or the offset from the marker’s reference marker in trace points if the control mode is Delta . If the marker is Off the response is 9.91E37.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	200

State Saved	No
Min	0
Max	400

Marker Y Axis Value Returns the marker Y Axis value in the current marker Y Axis unit.

The “result” of a marker is the value which is displayed on the second line of the Marker Result block. To properly interpret the returned value, the remote programmer must also know what the analyzer’s Y-Axis Unit is set to as described below.

A marker can have up to two results, only one of which is displayed or returned on a query, as follows:

Absolute result: Every marker has an absolute result and it is simply:

For Normal and Delta markers, the Y-axis value of the trace point the marker is currently on.

The absolute result is displayed in the result block or returned on a query unless the marker control mode is **Delta**.

Relative result: If a marker’s control mode is **Delta**, the relative result is displayed in the result block or returned on a query. This is the offset of the Absolute Result of a delta marker to the Absolute Result of its reference marker. The result is expressed in dB.

Mode	Modulation Analyzer
Remote Command	:CALCulate:AM:VIEW2:WINDow [1] :MARKer [1] 2 3 4 :Y?
Example	:CALC:AM:VIEW2:WIND1:MARK2:Y?
Restriction and Notes	The query returns the marker Y-axis result. If the marker is Off the response is 9.91E37.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	0
State Saved	No
Key Path	N/A – Remote Feature Only

Peak Search Link to the front panel key Peak search; places a marker on the highest peak on the current trace.

If there is no marker active and the key is pressed marker 1 is activated at the highest peak.

If there is a marker currently active, the currently selected marker (refer to appropriate section on how it is selected) will be moved.

If the active marker is a normal marker this will move to the highest peak, if the active marker is a delta

Modulation Analyzer

AM Demodulation

marker the reference marker position will remain unchanged and the delta marker will be moved to the highest peak on the trace

Mode	All
Remote Command	:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:MAXimum
Example	:CALC:AM:VIEW2:WIND1:MARK2:MAX
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Waveform or Numeric Results, the SCPI command still has effect to the Spectrum view.
Key Path	Peak search

Next Peak Places the selected marker on the next highest signal peak from the current marked peak. This will find the next highest peak to the left OR right of the current marker position. If the currently active marker is a delta marker, when this key is pressed the reference marker position remains unchanged and the delta marker moves to the next highest peak on the trace.

Menu key Label	Next Peak
Mode	All
Remote Command	:CALCulate:AM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:MAXimum :NEXT
Example	:CALC:AM:VIEW2:WIND1:MARK2:MAX:NEXT
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Waveform or Numeric Results, the SCPI command still has effect to the Spectrum view.
Key Path	Peak Search

Marker -> Link to the front panel key Marker ->. Accesses the marker function menu keys that change the values of center frequency or the Ref Value to the current value of the selected marker.

Mode	All
Key Path	Marker ->

Mkr -> RL Sets the Ref Value to the amplitude value of the selected marker, moving the marked point to the Ref Value (top line of the graticule). The marker's mode (Normal, Delta, Fixed) doesn't matter in this case. For example, given a delta marker, if the delta marker is the selected marker, its amplitude is applied to the Ref Value. If the reference marker is selected, its amplitude is applied to the Ref Value.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker, and its amplitude applied to the Ref Value.

Menu key Label	Marker ->RL
Mode	All
Remote Command Notes	No SCPI command is associated with this menu key
State Saved	no
Key Path	Marker ->

Meas Setup

Avg Number

Turns averaging On or Off and sets the Average Count Number used with measurement averaging.

In Single mode, when Average Mode is set to Repeat, the specified number of averages are executed and then the measurement stops. When Average Mode is set to Exponential, only one sweep is executed and then the measurement stops.

In Continuous mode, when Average Mode is set to Repeat, the specified number of averages are executed and then clears the old data and restart the new repeat cycle. When Average Mode is set to Exponential, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Menu key Label	Average Number
Mode	Modulation Analyzer
Remote Command	[:SENSe] :AM:AVERAge:COUNT <integer> [:SENSe] :AM:AVERAge:COUNT? [:SENSe] :AM:AVERAge [:STATe] ON OFF 1 0 [:SENSe] :AM:AVERAge [:STATe] ?

Modulation Analyzer

AM Demodulation

Example	:AM:AVER:COUN 10 :AM:AVER:COUN? :AM:AVER ON :AM:AVER?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode. You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
Preset	10
State Saved	Saved in instrument state.
Min	1
Max	4096
Key Path	Meas Setup

Avg Mode

Repeat Sets Averaging to the repeat function. When Average Mode is set to Repeat, the averaging continues with each new sweep averaged with a weight of $1 / \text{Average Number}$. Repeat averaging shows the resulting data after the selected number of sweeps has been averaged, then clears the data before the next repeat cycle.

Exponential When Average Mode is set to Exponential, the averaging continues with each new sweep averaged with a weight of $1 / \text{Average Number}$ and the old average reduced by multiplying it by $(\text{Average Number} - 1) / \text{Average Number}$.

Demod

Accesses to the Demod sub menu, no associated SCPI command, enables user to configure the demodulation parameters

AM Detector The AM Detector menu enables you to configure the detector settings for a measurement. For AM, CSA supports four types detector, that is, Peak+, Peak-, Peak+/-2, and RMS.

Menu key Label	AM Detector
Mode	Modulation Analyzer

Remote Command	<code>[:SENSE] :AM:DEMod:DETEctor [:FUNction] PPK NPK PNPK RMS [:SENSe] :AM:DEMod:DETEctor [:FUNction] ?</code>
Example	<code>:AM:DEMod:DET PPK :AM:DEMod:DET?</code>
Remote Command Notes	PPK – peak+. The Detector used by the demodulation takes into account only the maximum peaks of the trace NPK – peak-. The Detector used by the demodulation takes into account only the minimum peaks of the trace PNPK – peak+/-2. The Detector used by the demodulation takes into account as a measurement point the following calculated trace points (Minimum peak + Maximum peak) divided by 2. RMS – RMS. The Detector used by the demodulation takes into account only average points of the trace
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Peak+
State Saved	Saved in instrument state.
Range	Peak + Peak - Peak +/-2 RMS
Key Path	Meas Setup, Demod

Meas Time This specifies the period of time during which measuring takes place.

Menu key Label	Meas Time
Mode	Modulation Analyzer
Remote Command	<code>[:SENSe] :AM:DEMod:MTIME <time> [:SENSe] :AM:DEMod:MTIME?</code>
Example	<code>:AM:DEMod:MTIM 320ms :AM:DEMod:MTIM?</code>
Dependencies / Couplings	When Burst Search is set to None, Meas Time is related with IF BW. When Burst Search is set to RF Amptd, Meas Time <= search length.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	50 ms
State Saved	Saved in instrument state.

Modulation Analyzer

AM Demodulation

Min	IF BW	Meas Time Min
	5 MHz	13.33 us
	3 MHz	13.33 us
	1.25 MHz	40 us
	1.0 MHz	50 us
	500 kHz	100 us
	300 kHz	0.167 ms
	250 kHz	0.2 ms
	100 kHz	0.5 ms
	50 kHz	1 ms
	30 kHz	1 ms
	10 kHz	1 ms
	5 kHz	1 ms
	3 kHz	1 ms
Max	Search Length and coupling to IFBW	
	IF BW	Meas Time Max
	5 MHz	21.845 ms
	3 MHz	21.845 ms
	1.25 MHz	65.536 ms
	1.0 MHz	81.92 ms
	500 kHz	163.84 ms
	300 kHz	273.067 ms
	250 kHz	327.68 ms
	100 kHz	819.2 ms
	50 kHz	1638.4 ms
	30 kHz	2730.7 ms
	10 kHz	8192 ms
	5 kHz	16384 ms
	3 kHz	27306.7 ms
Key Path	Meas Setup, Demod	

Peak Hold Peak is only valid for detector mode Peak+ or Peak-. If Peak Hold is On, the value of the AM Index (Peak+ or Peak- mode) is the maximum or minimum value of these peaks over the whole measurement time. If peak hold is Off, the value of the AM Index (Peak+ or Peak- mode) is the average of these peaks over the whole measurement time.

Menu key Label	Peak Hold
Mode	Modulation Analyzer
Remote Command	[:SENSE] :AM:DEMod:PHOLD ON OFF 1 0 [:SENSE] :AM:DEMod:PHOLD?
Example	:AM:DEMod:PHOL ON :AM:DEMod:PHOL?

Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Off
State Saved	Saved in instrument state.
Range	Off On
Key Path	Meas Setup, Demod, Peak Hold

Meas Filter Meas Filter is a shortened form of Measurement Filter, and it is a low pass filter. Measurement Filter here is used to filter the AM demodulated signal. If IFBW is much larger than the modulation rate, more noise will be allowed into the measurement, thereby degrading the accuracy. In order to decrease the interference of noise, we can select the Meas Filter to filter out the noise and improve the accuracy of measurement.

Menu key Label	Meas Filter
Mode	Modulation Analyzer
Remote Command	[:SENSE] :AM:DEMod:MFILter ON OFF 1 0 [:SENSE] :AM:DEMod:MFILter?
Example	:AM:DEMod:MFIL ON :AM:DEMod:MFIL?
Dependencies / Couplings	If Meas Filter is on, the bandwidth of the Meas Filter is equal to the span of demod spectrum.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Off
State Saved	Saved in instrument state.
Range	Off On
Key Path	Meas Setup, Demod, Meas Filter

Burst/Sync Search

Menu key that leads to a sub menu where you can configure the burst /sync parameters. Not valid for free run; no associated SCPI command; no command table.

Sync This specifies whether the analyzer needs to do burst searching.

Modulation Analyzer

AM Demodulation

None - means the input data is continuous and needs no burst searching;

RF Amplitude - means the input data is burst mode and needs burst searching;

Menu key Label	Sync
Mode	Modulation Analyzer
Remote Command	<code>[:SENSe] :AM:SYNC:SOURce NONE RFAMplitude</code> <code>[:SENSe] :AM:SYNC:SOURce?</code>
Example	<code>:AM:SYNC:SOUR NONE</code> <code>:AM:SYNC:SOUR?</code>
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
State Saved	Saved in instrument state.
Range	None RF Amptd
Key Path	Meas Setup, Burst/Sync Search

Burst Search Threshold

This specifies the burst searching power threshold when the signal is in burst mode and needs to do burst searching in order to locate the useful part of the signal. It means the $10 \cdot \log$ ratio of the none-data part power to the data part power, unit is dB.

Menu key Label	Burst Search Threshold
Mode	Modulation Analyzer
Remote Command	<code>[:SENSe] :AM:SYNC:STHReshold <rel_amp1></code> <code>[:SENSe] :AM:SYNC:STHReshold?</code>
Example	<code>:AM:SYNC:STHR -12.6</code> <code>:AM:SYNC:STHR?</code>
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
Preset	-20.0 dB
State Saved	Saved in instrument state.
Min	-100.0 dB
Max	0.0 dB
Key Path	Meas Setup, Burst/Sync Search

Search Length Specifies the length of time over which the search is performed. If the input is a bursted signal, the minimum search length is equal to the data length plus 2*idle data length.

Menu key Label	Search Length																												
Mode	Modulation Analyzer																												
Remote Command	[:SENSe] :AM:SYNC:SLENgth <real> [:SENSe] :AM:SYNC:SLENgth?																												
Example	:AM:SYNC:SLEN 500 us :AM:SYNC:SLEN?																												
Dependencies / Couplings	Related with IF BW.																												
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.																												
Preset	50 ms																												
State Saved	Saved in instrument state.																												
Min	<table border="0"> <thead> <tr> <th>IF BW</th> <th>Search Length Min</th> </tr> </thead> <tbody> <tr><td>5 MHz</td><td>13.33 us</td></tr> <tr><td>3 MHz</td><td>13.33 us</td></tr> <tr><td>1.25 MHz</td><td>40 us</td></tr> <tr><td>1.0 MHz</td><td>50 us</td></tr> <tr><td>500 kHz</td><td>100 us</td></tr> <tr><td>300 kHz</td><td>0.167 ms</td></tr> <tr><td>250 kHz</td><td>0.2 ms</td></tr> <tr><td>100 kHz</td><td>0.5 ms</td></tr> <tr><td>50 kHz</td><td>1 ms</td></tr> <tr><td>30 kHz</td><td>1 ms</td></tr> <tr><td>10 kHz</td><td>1 ms</td></tr> <tr><td>5 kHz</td><td>1 ms</td></tr> <tr><td>3 kHz</td><td>1 ms</td></tr> </tbody> </table>	IF BW	Search Length Min	5 MHz	13.33 us	3 MHz	13.33 us	1.25 MHz	40 us	1.0 MHz	50 us	500 kHz	100 us	300 kHz	0.167 ms	250 kHz	0.2 ms	100 kHz	0.5 ms	50 kHz	1 ms	30 kHz	1 ms	10 kHz	1 ms	5 kHz	1 ms	3 kHz	1 ms
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Modulation Analyzer

AM Demodulation

Max	IF BW	Search Length Max
	5 MHz	21.845 ms
	3 MHz	21.845 ms
	1.25 MHz	65.536 ms
	1.0 MHz	81.92 ms
	500 kHz	163.84 ms
	300 kHz	273.067 ms
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	100 kHz	819.2 ms
	50 kHz	1638.4 ms
	30 kHz	2730.7 ms
	10 kHz	8192 ms
	5 kHz	16384 ms
	3 kHz	27306.7 ms
Key Path	Meas Setup, Burst/Synv Search	

IF BW

This specifies the width of the intermediate frequency (IF) filter. There is coupling between the IF BW and the Search Length, which limits your choice either on IF BW or Search Length.

Menu key Label	IF BW
Mode	Modulation Analyzer
Remote Command	[:SENSe]:AM:IFBWidth <freq> [:SENSe]:AM:IFBWidth? [:SENSe]:AM:IFBWidth:AUTO ON OFF 1 0 [:SENSe]:AM:IFBWidth:AUTO?
Example	:AM:IFBW 1MHz :AM:IFBW? :AM:IFBW:AUTO ON :AM:IFBW:AUTO?

Restriction and Notes	Auto clipped to the following values: IF BW 5 MHz 3 MHz 1.25 MHz 1.0 MHz 500 kHz 300 kHz 250 kHz 100 kHz 50 kHz 30 kHz 10 kHz 5 kHz 3 kHz
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SELEct to set the mode. You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SELEct to set the mode.
Preset	30 kHz
State Saved	Saved in instrument state.
Min	3 kHz
Max	5 MHz
Key Path	Meas Setup

IFBW List Your analyzer supports the IFBW values shown in the table below.

IFBW	Sampling Frequency
5 MHz	7.5 MHz
3 MHz	7.5 MHz
1.25 MHz	2.5 MHz
1.0 MHz	2.0 MHz
500 kHz	1.0 MHz
300 kHz	600 kHz
250 kHz	500 kHz
100 kHz	200 kHz
50 kHz	100 kHz

Modulation Analyzer

AM Demodulation

30 kHz	60 kHz
10 kHz	20 kHz
5 kHz	10 kHz
3 kHz	6 kHz

Trigger

This menu key displays the sub menu that enables you to configure the triggering parameters.

The Trigger Menu enables you to select the trigger settings for an AM measurement.

When using a trigger source other than Free Run, the analyzer will begin a sweep only with the selected trigger conditions are met. A trigger event is defined as the point at which the trigger source signal meets the specified trigger level and polarity requirements (if any).

Each Trigger Type supports some or all of the trigger parameters:

Trigger Type	Parameter		
	Delay	Level	Slope
Free run	No	No	No
External	Yes	No	Yes
RF Burst	Yes	Yes	No

Trigger Delay and Trigger Level will change the delay and level respectively for all Trigger Types to which the parameter applies. For example, if the Trigger Delay is set to 100 ms for RF Burst Triggering, the Trigger Delay for External Triggers is now 100 ms.

Free Run (Immediate) Pressing this key, when it is not selected, selects free-run triggering. When free run is selected, triggering occurs immediately after the sweep/measurement is initiated.

Menu key Label	Free Run
Mode	Modulation Analyzer
Remote Command	:TRIGger:AM[:SEquence]:SOURce IMMEDIATE :TRIGger:AM[:SEquence]:SOURce?

Example	:TRIG:AM:SOUR IMM :TRIG:AM:SOUR?
Key Path	Meas Setup, Trigger

External Pressing this key, when it is not selected, selects an external input signal as the trigger. A new sweep/measurement will start when the external trigger condition is met by the signal applied to the External Trigger Input.

There are no external trigger level settings.

Menu key Label	External
Mode	Modulation Analyzer
Remote Command	:TRIGger:AM[:SEQuence]:SOURce EXTernal
Example	:TRIG:AM:SOUR EXT
Key Path	Meas Setup, Trigger

RF Burst (Wideband) Pressing this key selects the RF Burst as the trigger. A measurement will trigger when a RF burst envelope signal is identified from the RF signal input.

Menu key Label	RF Burst
Mode	Modulation Analyzer
Remote Command	:TRIGger:AM[:SEQuence]:SOURce RFBurst
Example	:TRIG:AM:SOUR RFB
Key Path	Meas Setup, Trigger

Trigger Level

For RF Burst, sets the absolute trigger level for the RF burst envelope. Relative trigger level is not supported in your CSA.

Menu key Label	Trigger Level
Mode	Modulation Analyzer

Modulation Analyzer

AM Demodulation

Remote Command	<code>[:SENSE] :TRIGger:AM [:SEQuence] :LEVel:ABSolute <ampl></code> <code>[:SENSE] :TRIGger:AM [:SEQuence] :LEVel:ABSolute?</code>
Example	<code>:TRIG:AM:LEV:ABS -30 dBm</code> <code>:TRIG:AM:LEV:ABS?</code>
Dependencies / Couplings	
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use <code>INSTrument:SElect</code> to set the mode.
Preset	-30.0 dBm
State Saved	Saved in instrument state.
Min	-100.0 dBm or the upper Ref Value
Max	+30.0 dBm or the upper Ref Value
Key Path	Meas Setup, Trigger

Trigger Slope Control the trigger polarity. It is set Positive to trigger on a rising edge and Negative to trigger on a falling edge.

Menu key Label	Trigger Slope
Mode	Modulation Analyzer
Remote Command	<code>[:SENSE] :TRIGger:AM [:SEQuence] :EXTernal:SLOPe</code> <code>POSitive NEGative</code> <code>[:SENSE] :TRIGger:AM [:SEQuence] :EXTernal:SLOPe?</code>
Example	<code>:TRIG:AM:EXT:SLOP NEG</code> <code>:TRIG:AM:EXT:SLOP?</code>
Dependencies / Couplings	
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use <code>INSTrument:SElect</code> to set the mode.
Preset	POS
State Saved	Saved in instrument state.
Range	Pos Neg
Key Path	Meas Setup, Trigger

Trigger Delay Controls a time delay during which the analyzer will wait to begin a measure after meeting the trigger criteria.

Menu key Label	Trigger Delay																												
Mode	Modulation Analyzer																												
Remote Command	:TRIGger:AM[:SEquence]:DELay <real> :TRIGger:AM[:SEquence]:DELay?																												
Example	:TRIG:AM:DEL 1 us :TRIG:AM:DEL?																												
Dependencies / Couplings	The Trigger Delay is related with IF BW, but it is not valid for free run.																												
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.																												
Preset	0 s																												
State Saved	Saved in instrument state.																												
Min	Coupling to IFBW. <table border="0"> <thead> <tr> <th>IF BW</th> <th>Trigger Delay Min</th> </tr> </thead> <tbody> <tr><td>5 MHz</td><td>-21.845 ms</td></tr> <tr><td>3 MHz</td><td>-21.845 ms</td></tr> <tr><td>1.25 MHz</td><td>- 65.536 ms</td></tr> <tr><td>1.0 MHz</td><td>-81.92 ms</td></tr> <tr><td>500 kHz</td><td>-163.84 ms</td></tr> <tr><td>300 kHz</td><td>-273.067 ms</td></tr> <tr><td>250 kHz</td><td>-327.68 ms</td></tr> <tr><td>100 kHz</td><td>-819.2 ms</td></tr> <tr><td>50 kHz</td><td>-1638.4 ms</td></tr> <tr><td>30 kHz</td><td>-2730.7 ms</td></tr> <tr><td>10 kHz</td><td>-8192 ms</td></tr> <tr><td>5 kHz</td><td>-16384 ms</td></tr> <tr><td>3 kHz</td><td>-27306.7 ms</td></tr> </tbody> </table>	IF BW	Trigger Delay Min	5 MHz	-21.845 ms	3 MHz	-21.845 ms	1.25 MHz	- 65.536 ms	1.0 MHz	-81.92 ms	500 kHz	-163.84 ms	300 kHz	-273.067 ms	250 kHz	-327.68 ms	100 kHz	-819.2 ms	50 kHz	-1638.4 ms	30 kHz	-2730.7 ms	10 kHz	-8192 ms	5 kHz	-16384 ms	3 kHz	-27306.7 ms
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Key Path	Meas Setup, Trigger																												

Modulation Analyzer

AM Demodulation

Limits

Accesses the sub-menu that enables you to configure maximum and minimum AM Index, and maximum power.

Limits Allows you to activate/deactivate the limits displaying.

Only if limits mode is selected as On, the limits setting can work, If limits mode is selected as Off, these limits setting can't work.

Menu key Label	Limits
Mode	Modulation Analyzer
Remote Command	:CALCulate:AM:LIMit ON OFF 1 0 :CALCulate:AM:LIMit?
Example	:CALC:AM:LIM OFF :CALC:AM:LIM?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	OFF
State Saved	Saved in instrument state.
Range	Off On
Key Path	Meas Setup, More, Limit

Carrier Power Upper Sets the RF Carrier Power Upper Limit to warn you if the measured maximum RF Carrier Power value exceeds your limit. When the maximum RF Carrier Power result exceeds this limit, the font changes from green to red. When the maximum RF carrier power result is less than the limit, the font changes from red to green.

Menu key Label	Carrier Power
Remote Command	:CALCulate:AM:LIMit:POWer:UPPer <ampl> :CALCulate:AM:LIMit:POWer:UPPer?
Example	:CALC:AM:LIM:POW:UPP 20dBm :CALC:AM:LIM:POW:UPP?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	30.0 dBm

State Saved	Saved in instrument state.
Min	-100.0 dBm
Max	40.0 dBm
Key Path	Meas Setup, More, Limit

AM Index Upper Sets the AM Index Upper Limit. When the maximum AM Index result exceeds the limit, the font changes from green to red. When the maximum AM Index result is less than the limit, the font changes from red to green.

Menu key Label	AM Index Upper limit
Remote Command	:CALCulate:AM:LIMit:MINDEX:UPPer <percent> :CALCulate:AM:LIMit:MINDEX:UPPer?
Example	:CALC:AM:LIM:MIND:UPP 50 :CALC:AM:LIM:MIND:UPP?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	100%
State Saved	Saved in instrument state.
Min	0%
Max	100%
Key Path	Meas Setup, More, Limit

AM Index Lower Set a AM Index Lower Limit. When the minimum AM Index result is less than the Lower Limit, the font changes from green to red. When the minimum AM Index result exceeds the Lower Limit, the font changes from red to green.

Menu key Label	AM Index Lower
Remote Command	:CALCulate:AM:LIMit:MINDEX:LOWer <percent> :CALCulate:AM:LIMit:MINDEX:LOWer?
Example	:CALC:AM:LIM:MIND:LOW 50 :CALC:AM:LIM:MIND:LOW?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.

Modulation Analyzer

AM Demodulation

Preset	0%
State Saved	Saved in instrument state.
Min	0%
Max	100%
Key Path	Meas Setup, More, Limit

SPAN X Scale Menu

Waveform View

Scale/Div This key allows you to specify the scale per division of the granularity on your screen.

Menu key label	Scale/Div
Mode	Modulation Analyzer
Remote Command	:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVi sion <real> :DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVi sion?
Example	:DISP:AM:VIEW:WIND:TRAC:X:PDIV 6.0 :DISP:AM:VIEW:WIND:TRAC:X:PDIV?
Restriction and Notes	If Autoscale is set to On, this value equals to the minimum value of Meas Time/10 and 3/mod Rate. And the maximum value of scale/div is 3/mod Rate. When you set this value manually, Autoscale automatically changes to Off.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	The minimum value of Meas Time/10 and 3/mod Rate.
State Saved	Saved in instrument state.
Min	1 us

Max	If measurement time >30/mod Rate, the maximum scale/div will be 3/mod Rate.
Key Path	SPAN/X Scale

Ref Value Allows you to set the Reference Value of the display.

Menu key Label	Ref Value
Mode	Modulation Analyzer
Remote Command	:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RVALue <real> :DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RVALue?
Example	:DISP:AM:VIEW:WIND:TRAC:X:RVAL 0 :DISP:AM:VIEW:WIND:TRAC:X:RVAL?
Restriction and Notes	If the Autoscale is set to On, this value is automatically determined by the measurement result. When you set this value manually, Autoscale automatically changes to Off.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	0 s
State Saved	Saved in instrument state.
Min	0
Max	Meas Time
Key Path	SPAN/X Scale

Ref Position This key allows you to set the display Reference Position to either Left, Ctr (center), or Right.

Menu key Label	Ref Position
Mode	Modulation Analyzer
Remote Command	:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOSition LEFT CTR RIGHT :DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOSition?

Modulation Analyzer

AM Demodulation

Example	:DISP:AM:VIEW:WIND:TRAC:X:RPOS LEFT :DISP:AM:VIEW:WIND:TRAC:X:RPOS?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SELEct to set the mode.
Preset	LEFT
State Saved	Saved in instrument state.
Range	Left Ctr Right
Key Path	SPAN/X Scale

Autoscale This key allows you to switch the Autoscale function On and Off.

Menu key Label	Autoscale
Mode	Modulation Analyzer
Remote Command	:DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALE]:COUPle ON OFF 1 0 :DISPlay:AM:VIEW[1]:WINDow[1]:TRACe:X[:SCALE]:COUPle?
Example	:DISP:AM:VIEW:WIND:TRAC:X:COUP ON :DISP:AM:VIEW:WIND:TRAC:X:COUP?
Restriction and Notes	<p>The Autoscale function automatically determines the scale per division and the reference values based on the measurement results. If the measurement time < 30 /Modulation Rate, the system will display the whole measurement time. The Scale/Div = meas time /10.</p> <p>If meas time > 30/ mod Rate, it will only display 30/ mod Rate and not the whole measurement time. The display accuracy will be reduced depending on the measurement time. If the total number of points exceeds 401, then the accuracy will be reduced by re-sampling to 401 points. The Autoscale function automatically determines the scale per division and reference values based on the measurement results. When you specify either Scale/Div or Ref Value, Autoscale automatically changes to Off.</p>
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SELEct to set the mode.
Preset	ON
State Saved	Saved in instrument state.
Range	Off On
Key Path	SPAN/X Scale

Spectrum View

Span This key allows you to specify the span of your measurement as displayed on the X-axis of the display.

Mode	Modulation Analyzer
Remote Command	:DISP:AM:VIEW2:WINDow[1]:TRACe:X[:SCALE]:SPAN <freq> :DISP:AM:VIEW2:WINDow[1]:TRACe:X[:SCALE]:SPAN? :DISP:AM:VIEW2:WINDow[1]:TRACe:X[:SCALE]:FSPan ON OFF 1 0 :DISP:AM:VIEW2:WINDow[1]:TRACe:X[:SCALE]:FSPan?
Example	:DISP:AM:VIEW2:WIND:TRAC:X:SPAN 30.0 :DISP:AM:VIEW2:WIND:TRAC:X:SPAN? :DISP:AM:VIEW2:WIND:TRAC:X:FSP ON :DISP:AM:VIEW2:WIND:TRAC:X:FSP?
Restriction and Notes	If Span is set to Auto, the value equals to IFBW/2. If you want to change the span value, you have to set the Span to Man and enter the required value. Span represents the observed bandwidth of the demodulated signal. The start frequency is 0 Hz and the stop frequency is the span value.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SELEct to set the mode. You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SELEct to set the mode.
Preset	15 kHz.
State Saved	Saved in instrument state.
Min	100 Hz
Max	IFBW/2
Key Path	SPAN/X Scale

Modulation Analyzer

AM Demodulation

View/Display

Allows you to select different views.

Menu key Label	View/ Display
Mode	Modulation Analyzer
Preset	Demod Waveform
State Saved	Saved in instrument state.
Range	Demod Waveform Demod Spectrum Numeric Results
Key Path	View/Display

FM Demodulation

FM Demodulation Description

Frequency modulation, called FM, is a more sophisticated modulation than AM. Instead of changing the amplitude of the carrier, the frequency of the carrier is changed according to differences in the signal amplitude. Part of the advantage of FM systems is buried in mathematical analyses that show that the signal-to-noise ratio at the receiver. Receiver fidelity can be improved by increasing the deviation of the carrier. FM is widely used in Military Radio, Analog Cordless Phone, Private Mobile Radio, and so on.

Front Panel Results & Views

The measurement display will consist of two areas: the graphical display and the numeric results window. The FM Measured Time View will be the default FM measurement display; the FM Demodulation Spectrum View can be accessed using the 'View/Display' menu.

Waveform View The FM demodulate signal versus time plot will be displayed in the graphical area of the measurement display with the numeric results window displayed below. The trace length is 401 points.

Numeric Results Window The numeric results window displayed underneath the FM measured time view window; and displays measurement results. Following is the displayed numeric results:

FM Deviation This is the measured average FM Deviation.

Limits: No

Units: Hz

Rate This is the measured average modulation rate.

Limits: No

Units: Hz

Distortion This is the measured average distortion.

Limits: No

Units: %

SINAD This is the measured average SINAD.

Limits: No

Units: dB

Spectrum View The FM demodulation spectrum will be displayed in the graphical area of the measurement display with the numeric results window displayed below. The trace length is 401 points.

Numeric Results Window Following is the displayed numeric results:

FM Deviation This is the measured average FM Deviation.

Limits: No

Modulation Analyzer

FM Demodulation

Units: Hz

Rate This is the measured average modulation rate.

Limits: No

Units: Hz

Distortion This is the measured average distortion.

Limits: No

Units: %

SINAD This is the measured average SINAD.

Limits: No

Units: dB

Numeric Results View The numeric results view displays the following results:

Max Carrier Power This is the maximum TX carrier power.

Limits: yes; please refer to [“Carrier Power Upper” on page 409](#)

Units: dBm

Avg/Current Carrier Power This is the average value of TX carrier power. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: dBm

Max Peak+ Frequency Deviation This is the maximum positive peak frequency deviation relative to the detected carrier frequency.

Limits: yes; please refer to [“Freq Deviation Upper” on page 410](#)

Units: Hz

Avg/Current Peak+ Frequency Deviation This is the average value of positive peak frequency deviation relative to the detected carrier frequency. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: Hz

Min Peak+ Frequency Deviation This is the minimum positive peak frequency deviation relative to the detected carrier frequency.

Limits: yes; please refer to [“Freq Deviation Lower” on page 410](#)

Units: Hz

Max Peak- Frequency Deviation This is the maximum negative peak frequency difference relative to the detected carrier frequency.

Limits: yes; please refer to [“Freq Deviation Upper” on page 410](#)

Units: Hz

Avg/Current Peak- Frequency Deviation This is the average value of negative peak frequency difference relative to the detected carrier frequency. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: Hz

Min Peak- Frequency Deviation This is the minimum negative peak frequency deviation relative to the detected carrier frequency.

Limits: yes, please refer to [“Freq Deviation Lower” on page 410](#)

Units: Hz

Max Peak+- / 2 Frequency Deviation This is the Maximum value of peak-to-peak/2 among several measurement time.

Limits: yes; please refer to [“Freq Deviation Upper” on page 410](#)

Units: Hz

Avg/Current Peak+- / 2 Frequency Deviation This is the average value of peak-to-peak/2 among several measurement time. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: Hz

Min Peak+-/2 Frequency Deviation This is the minimum average value of peak - to peak-/2 peak frequency deviation relative to the detected carrier frequency.

Limits: yes, please refer to [“Freq Deviation Lower” on page 410](#)

Units: Hz

Max RMS Frequency Deviation This is the maximum RMS frequency deviation relative to the detected carrier frequency.

Limits: yes; please refer to [“Freq Deviation Upper” on page 410](#)

Units: Hz

Avg/Current RMS Frequency Deviation This is the average value of RMS frequency deviation relative to the detected carrier frequency. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: Hz

Min RMS Frequency Deviation This is the minimum RMS frequency deviation relative to the detected carrier frequency.

Limits: yes, please refer to [“Freq Deviation Lower” on page 410](#)

Units: Hz

Max Carrier Frequency Offset This is the maximum carrier frequency error relative to the analyzer’s center frequency.

Modulation Analyzer

FM Demodulation

Limits: yes; please refer to “Freq Deviation Upper” on page 410

Units: Hz

Avg/Current Carrier Frequency Offset This is the average value of carrier frequency error relative to the analyzer’s center frequency. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: Hz

Max Mod Rate This is the maximum modulation rate.

Limits: No

Units: Hz

Avg/Current Mod Rate This is the average value of modulation rate. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Max Distortion This is the maximum value of Distor. Here Distor represents the ratio of distortion (noise and harmonic) to signal.

Limits: No

Units: %

Avg/Current Distortion This is the avg value of Distor. Here Distor represents the ratio of distortion (noise and harmonic) to signal. If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: %

Max SINAD This is the maximum value of SINAD. Here SINAD represents the ratio of signal to distortion (noise and harmonic).

Limits: No

Units: dB

Avg/Current SINAD This is the avg value of SINAD. Here SINAD represents the ratio of signal to distortion (noise and harmonic). If average mode is selected as off, the display of “Avg” will change into “Current”.

Limits: No

Units: dB

Remote Measurement Results

Query the Current measurement results. You must be in the Modulation Analyzer mode and FM measurement to query FM results. Use INSTRument:SElect MA to set the mode, use CONFigure:FM to set the measurement. Use CONFigure? to query the name of the measurement that is currently running.

Metrics

Command sequences:

INST:SELE MA

CONF:FM

INIT

*OPC?

CALC:DATA?

If you execute the remote command “:CALCulate:DATA?” when the FM is active, the query will return the following comma-separated scalar results in order:

Result Number	Field Name	Description
1	Avg/Current Carrier Frequency Offset	Avg/Current Carrier Frequency Offset (Hz)
2	Max Carrier Frequency Offset	Maximum Carrier Frequency Offset (Hz)
3	Min Frequency Deviation	Based on the current detector type, may be one of peak+, Peak-, Peak+/-2, RMS
4	Avg/Current Frequency Deviation	Based on the current detector type, may be one of peak+, Peak-, Peak+/-2, RMS
5	Max Frequency Deviation	Based on the current detector type, may be one of peak+, Peak-, Peak+/-2, RMS
6	Avg/Current Carrier Power	Avg/Current Carrier Power (dBm)
7	Max Carrier Power	Maximum Carrier Power (dBm)
8	Avg/Current Mod Rate	Avg/Current Mod Rate (Hz)
9	MAX Mod Rate	Maximum Mod Rate (Hz)
10	Avg/Current SINAD	Avg/Current SINAD (dB)
11	Max SINAD	Maximum SINAD (dB)
12	Avg/Current Distortion	Avg/Current Distortion (%)
13	Max Distortion	Maximum Distortion (%)
14	Test result of RF Carrier Power	Test result of RF Carrier Power: 1 = PASS, 0 = FAIL, -1 = Limit Test OFF
15	Test result of Frequency Deviation Upper	Test result of Frequency Deviation: 1 = PASS, 0 = FAIL, -1 = Limit Test OFF

Modulation Analyzer

FM Demodulation

16	Test result of Frequency Deviation Lower	Test result of Frequency Deviation: 1 = PASS, 0 = FAIL, -1 = Limit Test OFF
17	Test result of Carrier Frequency Offset	Test result of Carrier Frequency Offset: 1 = PASS, 0 = FAIL, -1 = Limit Test OFF

The response will be in standard block format:

```
#[Length of header-1][Length of block][xxx,xxx,...xxx]
|-----header-----|
```

It will always begin with a #, and then followed by a header. After this is the data in a comma separated list.

The first digit in the header tells you how many additional digits there are in the header.

From the second digit to the last digit in the header tells you the size of the block.

For example:

```
#2421122924465,916972000,69,160,1213313125,975
```

The first digit in the header (2) tells you how many additional digits/bytes there are in the header.

The 42 means forty-two bytes will follow. Note this also includes the commas.

Traces

Command sequences:

```
INST:SELE MA
```

```
CONF:FM
```

```
INIT
```

```
*OPC?
```

```
TRACE:DATA? <trace_name>
```

Where <trace_name> =WAVEform|SPECtrum

This command allows trace data to be sent to the analyzer or queried from the analyzer. The response to the query is a list of the Amplitude points which comprise the requested trace in the current y axis unit of

the analyzer. The x axis unit is that of the destination trace (for send) or the source trace (for query).

The format and byte-ordering of the sent or received data will be dependent on the FORMat:DATA and FORMat:BORDER commands. ASCII data consists of a string of comma separated values. REAL or INTeger data is sent as a definite length block, with a header describing the data to follow. For example, a four point trace might look like this if in ASCII (FORMat:DATA ASCii):

-5.87350E+01, -5.89110E+01, -5.87205E+01, -5.12345E+01<NL><END>

And like this if in INTeger with 4 bytes per point (FORMat:DATA INT,32):

#216<16 bytes of data>

Where the 2 in the #216 means “2 digits of numeric data to follow”, and the 16 is the 2 digits and means “16 binary bytes to follow” (this is the definite length block format).

Note that the data is terminated with <NL><END>. (For LAN, this is <newline> only.)

In FM, there are 2 traces as follows:

Trace Number	Trace Name	Description
1	WAVEform	FM Demod Waveform versus Time trace - Returns series of floating point numbers that represent the FM demod signal, as comma-separated trace points. The number of trace points equal to 401.
2	SPECTrum	FM Demod Spectrum - Returns a trace of the Demod Spectrum, as comma-separated trace. The number of trace points is 401. The data is in decimal format. The X-axis unit of this trace is Frequency

AMPTD Y-scale

Waveform View

Autoscale Automatically set the Ref Value, Scale/Div, and Ref Position. There is no associated SCPI command.

The Autoscale function automatically sets the Scale/Div and the Ref Value based on the currently displayed trace data.

When you press Autoscale,

The center position reference value = (maximum value of the trace + minimum value of the trace)/2;

And the Scale/Div = (maximum value of the trace – minimum value of the trace)/8

Modulation Analyzer

FM Demodulation

Menu key Label	Autoscale
Mode	Modulation Analyzer
Restriction and Notes	The Autoscale function automatically determines the Scale/Div and reference values based on the measurement results.
Dependencies / Couplings	When Autoscale is pressed, The center position reference value = (maximum value of the trace + minimum value of the trace)/2; And the Scale/Div = (maximum value of the trace – minimum value of the trace)/8
Remote Command Notes	No SCPI command is associated with this menu key.
State Saved	No
Key Path	AMPTD/Y Scale

Ref Value Allows you to set the reference value for the Y scale

Menu key Label	Ref Value
Mode	Modulation Analyzer
Restriction and Notes	If Autoscale is pressed, this value is automatically determined by the measurement result.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	No SCPI command is associated with this menu key
Preset	0 Hz
State Saved	Saved in instrument state.
Min	-1 MHz
Max	1 MHz
Key Path	AMPTD/Y Scale

Elec Atten Sets the RF input attenuation mode to Manual and sets the attenuation level. Manual attenuation enables you to set the input attenuation value in 1 dB or 10 dB increments. Attenuation can be changed using the step keys, the knob, or the numeric keypad; 1 dB using the left/right arrows and 10 dB using the up/down arrows. You may select 0 dB using the knob or the step keys.

Menu key label	Elec Atten
Mode	Modulation Analyzer
Remote Command	<code>[:SENSe]:POWER[:RF]:ATTenuation <rel_ampl></code> <code>[:SENSe]:POWER[:RF]:ATTenuation?</code>
Example	:ATT 6dB
Restriction and Notes	Elec Atten is settable in 1 dB and 10 dB steps. 1 dB using the left/right arrows and 10 dB using the up/down arrows. You may select 0 dB using the knob or the step keys.
Dependencies / Couplings	When the Auto Range is On, this value is automatically determined by the measurement. When you set a value manually, Auto Range automatically changes to Off.
Preset	0 dB
State Saved	Saved in instrument state.
Min	0.0 dB
Max	40.0 dB
Key Path	AMPTD/Y Scale

Scale/Div This key allows you to set the scale per division on the display graticule.

Menu key label	Scale/Div
Mode	Modulation Analyzer
Restriction and Notes	If the Autoscale is pressed, this value is automatically determined by the measurement result.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	No SCPI command is associated with this menu key
Preset	1 kHz
State Saved	Saved in instrument state.
Min	1 Hz
Max	100 kHz
Key Path	AMPTD/Y Scale

Modulation Analyzer

FM Demodulation

Ref Position Allows you to set the Ref Position of the display to either Top, Ctr (center), or Bot (bottom).

Menu key Label	Ref Position
Mode	Modulation Analyzer
Remote Command Notes	No SCPI command is associated with this menu key.
Preset	Ctr
State Saved	Saved in instrument state.
Range	Top Ctr Bot
Key Path	AMPTD/Y-Scale

Auto Range Sets the auto ranging of Elec Atten and Internal Preamp to On or Off.

For the Elec Atten, when Auto Range is On, the entire frequency range of the analyzer is scanned to determine the total power applied to the analyzer. The RF input attenuation is then automatically set to ensure that the analyzer input is not overloaded.

For the Internal Preamp, turning on the Preamp gives a better noise figure, but a poorer TOI to noise floor dynamic range. So when the Auto Range is On, depending on your measurement, the instrument will optimize this setting.

There is no separate auto ranging controls for Elec Atten and Preamp. There is only one overall auto ranging on/off control.

Menu key label	Auto Range
Mode	Modulation Analyzer
Remote Command	[:SENSE] :POWER [:RF] :ARANge ON OFF 1 0 [:SENSe] :POWER [:RF] :ARANge?
Example	:POWER:ARANge 0 :POWER:ARANge?
Dependencies / Couplings	See Restriction and Notes
Preset	ON
State Saved	Saved in instrument state.
Range	Off On
Key Path	AMPTD/Y Scale

Internal Preamp The Internal Preamp key sets the internal preamplifier to On, Off, or Auto Range mode On or Off. Turning on the Preamp provides a better noise figure, but reduces TOI to noise floor dynamic range.

If the Preamp option (Option P03 or P06) is not installed or licensed, the key should be blank.

Range	Off On
Menu key label	Internal Preamp
Mode	Modulation Analyzer
Remote Command	[:SENSE] :POWER [:RF] :GAIN [:STATE] ON OFF 1 0 [:SENSE] :POWER [:RF] :GAIN [:STATE] ?
Example	:POW:GAIN ON :POW:GAIN?
Restriction and Notes	If the preAmp option (Option P03 or P06) is not installed or licensed, the key should be blank.
Dependencies / Couplings	When Auto Range is On, the state of this Preamp is automatically determined by the measurement. When you set a value manually, Auto Range automatically changes to Off.
Preset	OFF
State Saved	Saved in instrument state.
Key Path	AMPTD/Y Scale

Ext Gain This key allows you to select an external input signal as the trigger, when it is not selected. A new sweep/measurement will start when the external trigger condition is met by the signal applied to the External Trigger Input. Ext Gain state (on/off) and value (i.e. 5 dB) are unaffected by preset. The state will be affected by power cycle.

Menu key label	Ext Gain
Mode	Modulation Analyzer
Remote Command	[:SENSE] :CORREction:OFFset [:MAGNitude] <rel-amp1> [:SENSE] :CORREction:OFFset [:MAGNitude] ? [:SENSE] :CORREction:OFFset [:MAGNitude] :STATE ON OFF 1 0 [:SENSE] :CORREction:OFFset [:MAGNitude] :STATE?

Modulation Analyzer

FM Demodulation

Example	:CORRection:OFFset 0 :CORRection:OFFset? CORR:OFFSet:STATe OFF
Restriction and Notes	Ext Gain state (on/off) and value (i.e. 5 dB) are unaffected by preset. The state will be affected by power cycle.
Preset	0.0 dB ON
State Saved	Saved in instrument state.
Min	-100.0 dB
Max	100.0 dB
Key Path	AMPTD/Y Scale

Spectrum View

Autoscale Automatically sets the scale of the Ref Value, Scale/Div, and Ref Position. Autoscale is a front panel only function and has no associated SCPI command.

When you press Autoscale,

Ref position = Ctr;

Ref Value = (maximum value of the trace + minimum value of the trace)/2;

Scale/Div = (maximum value of the trace – minimum value of the trace)/8

Menu key Label	Autoscale
Mode	Modulation Analyzer
Restriction and Notes	The Autoscale function automatically determines the Scale/Div and reference values based on the measurement results.
Dependencies / Couplings	When Autoscale is pressed, Ref Position = Ctr Ref value = (maximum value of the trace + minimum value of the trace)/2; Scale/Div = (maximum value of the trace –minimum value of the trace)/8
Remote Command Notes	No SCPI command is associated with this menu key
State Saved	No
Key Path	AMPTD/Y Scale

Ref Value Allows you to set the reference value of the display.

Menu key Label	Ref Value
Mode	Modulation Analyzer
Dependencies / Couplings	If the Autoscale is pressed, this value is automatically determined by the measurement result.
Remote Command Notes	No SCPI command is associated with this menu key
Preset	0 dBHz(rms)
State Saved	Saved in instrument state.
Min	–200 dBHzrms
Max	+200 dBHz(rms)
Key Path	AMPTD/Y Scale

Modulation Analyzer

FM Demodulation

Elec Atten Sets the RF input attenuation mode to manual and sets the attenuation level. Manual attenuation enables you to set the input attenuation value in 1 dB or 10 dB increments. Attenuation can be changed using the step keys, the knob, or the numeric keypad. Elec Atten is settable in 1 dB and 10 dB steps. Step 1 dB using the left/right arrows and 10 dB using the up/down arrows. You may select 0 dB using the knob or the step keys.

Menu key label	Elec Atten
Mode	Modulation Analyzer
Remote Command	<code>[:SENSE] :POWER [:RF] :ATTenuation <rel_ampl></code> <code>[:SENSE] :POWER [:RF] :ATTenuation?</code>
Example	<code>:POW:ATT 6dB</code> <code>:POW:ATT:ARANG ON</code>
Dependencies / Couplings	When the Auto Range is On, this value is automatically determined by the measurement. When you set a value manually, Auto Range automatically changes to Off.
Preset	0.0 dB
State Saved	Saved in instrument state.
Min	0.0 dB
Max	40.0 dB
Key Path	AMPTD/Y Scale

Scale/Div This key allows you to specify the scale per division used on the graticule.

Menu key label	Scale/Div
Mode	Modulation Analyzer
Restriction and Notes	If the Autoscale is pressed, this value is automatically determined by the measurement result.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	No SCPI command is associated with this menu key
Preset	20.0 dB
State Saved	Saved in instrument state.
Min	0.1 dB
Max	40.0 dB
Key Path	AMPTD/Y Scale

Ref Position Allows you to set the Ref Position of the display to either Top, Ctr (center), or Bot (bottom).

Menu key Label	Ref Position
Mode	Modulation Analyzer
Remote Command Notes	No SCPI command is associated with this menu key
Preset	Ctr
State Saved	Saved in instrument state.
Range	Top Ctr Bot
Key Path	AMPTD/Y-Scale

Auto Range Sets the auto ranging of Elec Atten and Internal Preamp to On or Off.

For the Elec Atten, when Auto Range is On, the entire frequency range of the analyzer is scanned to determine the total power applied to the analyzer. The RF input attenuation is then automatically set to ensure that the analyzer input is not overloaded.

For the Internal Preamp, turning on the Preamp gives a better noise figure, but a poorer TOI to noise floor dynamic range. So when the Auto Range is On, depending on your measurement, the instrument will optimize this setting.

There is no separate auto ranging controls for Elec Atten and Preamp. There is only one overall auto ranging on/off control.

Menu key label	Auto Range
Mode	Modulation Analyzer
Remote Command	[:SENSe] :POWer [:RF] :ARANge ON OFF 1 0 [:SENSe] :POWer [:RF] :ARANge?
Example	:POW:ARAN 0 :POW:ARAN?
Dependencies / Couplings	See Restriction and Notes
Preset	ON
State Saved	Saved in instrument state.
Key Path	AMPTD/Y Scale

Modulation Analyzer

FM Demodulation

Internal Preamp The Internal Preamp key set the internal preamplifier to On, Off, or Auto Range mode On or Off. Turning on the preAmp provides a better noise figure, but reduces TOI to noise floor dynamic range.

This key does not appear if the preamplifier option (Option P03 or P06) is not installed/license.

There is no internal preAmp menu in SA mode anymore. There is simply Preamp On/Off. There is no auto range associated solely with the preamp.

Menu key label	Internal Preamp
Mode	Modulation Analyzer
Remote Command	[:SENSe] :POWer [:RF] :GAIN [:STATe] ON OFF 1 0 [:SENSe] :POWer [:RF] :GAIN [:STATe] ?
Example	:POW: GAIN ON :POW:GAIN ?
Restriction and Notes	If the preamplifier option (Option P03 or P06) is not installed or licensed, the key should be blank.
Dependencies / Couplings	When Auto Range is On, the state of this Preamp is automatically determined by the measurement. When you set a value manually, Auto Range automatically changes to Off.
Preset	OFF
State Saved	Saved in instrument state.
Range	Off On
Key Path	AMPTD/Y Scale, More

Ext Gain

Menu key label	Ext Gain
Mode	Modulation Analyzer
Remote Command	[:SENSe] :CORRection:OFFSet [:MAGNitude] <rel-amp> [:SENSe] :CORRection:OFFSet [:MAGNitude] ? [:SENSe] :CORRection:OFFSet [:MAGNitude] :STATe ON OFF 1 0 [:SENSe] :CORRection:OFFSet [:MAGNitude] :STATe?
Example	:CORRection:OFFset 0 CORR:OFFSet:STATe OFF

Dependencies / Couplings	Ext Gain state (on/off) and value (i.e. 5 dB) are unaffected by preset. The state will be affected by power cycle.
Preset	0.0 dB ON
State Saved	Saved in instrument state.
Min	-100.0 dB
Max	100.0 dB
Key Path	AMPTD/Y Scale, More

FREQ Channel Menu

Allows you to set the Center Frequency for a measurement.

Menu key Label	Center Freq
Mode	MA
Remote Command	[:SENSE] :FREQuency:CENTer <freq> [:SENSe] :FREQuency:CENTer?
Example	:FREQ:CENT 2GHz :FREQ:CENT?
Preset	1 GHz
State Saved	Saved in instrument state.
Min	Hardware Dependent:
Max	Hardware Dependent:
Key Path	FREQ/Channel

Marker

Waveform View

Marker

Marker Allows you to select one of the four possible markers in the Waveform view. A marker that has already been turned on will become active when it is selected. If a marker has been turned on, it will become active on that trace if that marker is selected.

Menu key Label	Marker
Mode	All
Remote Command Notes	No SCPI. Front panel only.
State Saved	Saved in instrument state.
Range	1 2 3 4
Key Path	Marker

Marker Type

Mode	All
Remote Command	:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MODE OFF POSition DELTA :CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MODE?
Dependencies / Couplings	If the currently active marker is a delta marker and it is changed to a normal marker, it becomes a normal marker at the delta marker position on the X scale.
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Spectrum or Numeric Results, the SCPI command still has effect to the Waveform view. When the SCPI command is sent, the active marker is changed in the Waveform view. For example, if the currently active marker is Marker 1 and the SCPI command CALC:FM:VIEW1:WIND1:MARK2:MODE POS is sent, the Waveform view active marker will change to Marker 2.
Preset	POS
State Saved	Saved in instrument state.
Range	Normal Delta Off
Key Path	Marker

Normal Position activates a normal marker at the center of the display.

Menu key Label	Normal
Mode	SA
Example	:CALC:FM:VIEW1:WIND1:MARK2:MODE POS
Key Path	Marker

Delta Activates a pair of markers, one of them is fixed at the current marker location. the other marker can then be moved around on the trace. The marker readout shows the difference between the two markers.

Pressing Delta moves the reference marker to the active marker position, so you can make delta measurements from differing reference points without having to turn off the markers and starting again.

Menu key Label	Delta
Mode	SA
Example	:CALC:FM:VIEW1:WIND1:MARK:MODE DELT
Key Path	Marker

Off Turns the selected marker off.

Menu key Label	Off
Mode	SA
Example	:CALC:FM:VIEW1:WIND1:MARK3:MODE OFF
Key Path	Marker

Marker All Off Turns off all the markers on the trace.

Menu key Label	Marker All Off
Mode	All

Modulation Analyzer

FM Demodulation

Remote Command	:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer:AOff
Example	:CALC:FM:VIEW1:WIND1:MARK:AOff
Restriction and Notes	no
Dependencies / Couplings	no
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Spectrum or Numeric Results, the SCPI command still has effect to the Waveform view.
State Saved	Saved in instrument state.
Key Path	Marker

Marker X Axis Value Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is Off, but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Menu key Label	Marker
Mode	Modulation Analyzer
Remote Command	:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X <real> :CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X?
Example	:CALC:FM:VIEW1:WIND1:MARK3:X 1ms :CALC:FM:VIEW1:WIND1:MARK3:X?
Restriction and Notes	If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” will be generated. The query returns the marker’s absolute X Axis value if the control mode is Normal , or the offset from the marker’s reference marker if the control mode is Delta . The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency , seconds for Period and Time . If the marker is Off the response is 9.91E37.
Dependencies / Couplings	Maximum value would be changed by Meas Time parameter value.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Center of screen
State Saved	No
Key Path	Marker, Normal

Marker X Axis Position Sets the marker X position in trace points. It has no effect if the control mode is Off, but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:X:POSition <integer> :CALCulate:FM:VIEW [1]:WINDow[1]:MARKer[1] 2 3 4:X:POSition?
Example	CALC:FM:VIEW1:WIND1:MARK2:X:POS 100 CALC:FM:VIEW1:WIND1:MARK2:X:POS?
Restriction and Notes	The query returns the marker's absolute X Axis value in trace points if the control mode is Normal , or the offset from the marker's reference marker in trace points if the control mode is Delta . If the marker is Off the response is 9.91E37.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	200
State Saved	No
Min	0
Max	400

Marker Y Axis Value Returns the marker Y Axis value in the current marker Y Axis unit.

The "result" of a marker is the value which is displayed on the second line of the Marker Result block. To properly interpret the returned value the remote programmer must also know what the analyzer's Y-Axis Unit is set to as described below.

A marker can have up to two results, only one of which is displayed or returned on a query, as follows:

Absolute result: Every marker has an absolute result and it is simply:

For Normal and Delta markers, the Y-axis value of the trace point the marker is currently on.

The absolute result is displayed in the result block or returned on a query unless the marker control mode is **Delta**.

Relative result: If a marker's control mode is **Delta**, the relative result is displayed in the result block or returned on a query. For Waveform view, it is the offset of the Absolute Result of a delta marker to the Absolute Result of its reference marker. The result is expressed in Hz.

Mode	Modulation Analyzer
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Modulation Analyzer

FM Demodulation

Remote Command	:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:Y?
Example	:CALC:FM:VIEW1:WIND1:MARK2:Y?
Restriction and Notes	The query returns the marker Y-axis result. If the marker is Off the response is 9.91E37.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	0
State Saved	No
Key Path	N/A – Remote Feature Only

Peak Search Link to the front panel key Peak search; places a marker on the highest peak on the current trace.

If there is no marker active and the key is pressed marker 1 is activated at the highest peak.

If there is a marker currently active, the currently selected marker (refer to appropriate section on how it is selected) will be moved.

If the active marker is a normal marker this will move to the highest peak, if the active marker is a delta marker the reference marker position will remain unchanged and the delta marker will be moved to the highest peak on the trace

Mode	All
Remote Command	:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MAXimum
Example	:CALC:FM:VIEW1:WIND1:MARK2:MAX
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Spectrum or Numeric Results, the SCPI command still has effect to the Waveform view.
Key Path	Peak search

Next Peak Places the selected marker on the next highest signal peak from the current marked peak. This will find the next highest peak to the left OR right of the current marker position. If the currently active marker is a delta marker, when this key is pressed the reference marker position remains unchanged and the delta marker moves to the next highest peak on the trace.

Menu key Label	Next Peak
Mode	All

Remote Command	:CALCulate:FM:VIEW[1]:WINDow[1]:MARKer[1] 2 3 4:MAXimum:NEXT
Example	:CALC:FM:VIEW1:WIND1:MARK2:MAX:NEXT
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Spectrum or Numeric Results, the SCPI command still has effect to the Waveform view.
Key Path	Peak Search

Marker -> Link to the front panel key marker ->; Accesses the marker function menu keys that change the value of the center frequency or the Ref Value to the current value of the selected marker.

Mode	All
Key Path	Marker ->

Mkr -> **RL** Sets the Ref Value to the amplitude value of the selected marker, moving the marked point to the Ref Value (top line of the graticule). The marker's mode (Normal, Delta, Fixed) doesn't matter in this case. For example, given a delta marker, if the delta marker is the selected marker, its amplitude is applied to the Ref Value. If the reference marker is selected, its amplitude is applied to the Ref Value.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker, and its amplitude applied to the Ref Value.

Menu key Label	Marker ->RL
Mode	All
Remote Command Notes	No SCPI command is associated with this menu key
State Saved	no
Key Path	Marker ->

Modulation Analyzer

FM Demodulation

Spectrum View

Marker

Marker Allows you to select one of the four possible markers in the Spectrum view. A marker that has already been turned on will become active when it is selected. If a marker has been turned on, it will become active on that trace if that marker is selected.

Menu key Label	Marker
Mode	All
Remote Command Notes	No SCPI. Front panel only.
State Saved	Saved in instrument state.
Range	1 2 3 4
Key Path	Marker

Marker Type

Mode	All
Remote Command	:CALCulate:FM:VIEW2:WINDow [1] :MARKer [1] 2 3 4 :MODE OFF POSition DELTa :CALCulate:FM:VIEW2:WINDow [1] :MARKer [1] 2 3 4 :MODE?
Dependencies / Couplings	If the currently active marker is a delta marker and it is changed to a normal marker, it becomes a normal marker at the delta marker position on the X scale.
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Waveform or Numeric Results, the SCPI command still has effect to the Spectrum view. When the SCPI command is sent, the active marker is changed in the Spectrum view. For example, if the currently active marker is Marker 1 and the SCPI command CALC:FM:VIEW2:WIND1:MARK2:MODE POS is sent, the Spectrum view active marker will change to Marker 2.
Preset	POS
State Saved	Saved in instrument state.
Range	Normal Delta Off
Key Path	Marker

Normal Position activates a normal marker at the center of the display.

Menu key Label	Normal
Mode	SA
Example	:CALC:FM:VIEW2:WIND1:MARK2:MODE POS
Key Path	Marker

Delta Activates a pair of markers, one of them is fixed at the current marker location. the other marker can then be moved around on the trace. The marker readout shows the difference between the two markers.

Pressing Delta moves the reference marker to the active marker position, so you can make delta measurements from differing reference points without having to turn off the markers and starting again.

Menu key Label	Delta
Mode	SA
Example	:CALC:FM:VIEW2:WIND1:MARK:MODE DELT
Key Path	Marker

Off Turns the selected marker off.

Menu key Label	Off
Mode	SA
Example	:CALC:FM:VIEW2:WIND1:MARK3:MODE OFF
Key Path	Marker

Marker All Off Turns off all the markers on the trace.

Menu key Label	Marker All Off
Mode	All
Remote Command	:CALCulate:FM:VIEW2:WINDow[1]:MARKer:AOff

Modulation Analyzer

FM Demodulation

Example	:CALC:FM:VIEW2:WIND1:MARK:AOFF
Restriction and Notes	no
Dependencies / Couplings	no
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Waveform or Numeric Results, the SCPI command still has effect to the Spectrum view.
State Saved	Saved in instrument state.
Key Path	Marker

Marker X Axis Value Sets the marker X Axis value in the current marker X Axis Scale unit. It has no effect if the control mode is Off, but is the SCPI equivalent of entering an X value if the control mode is **Normal** or **Delta**.

Menu key Label	Marker
Mode	Modulation Analyzer
Remote Command	:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X <real> :CALCulate:FM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X?
Example	:CALC:FM:VIEW2:WIND1:MARK3:X 10kHz :CALC:FM:VIEW2:WIND1:MARK3:X?
Restriction and Notes	If no suffix is sent it will use the fundamental units for the current marker X Axis Scale. If a suffix is sent that does not match the current marker X Axis Scale unit, an error “Invalid suffix” will be generated. The query returns the marker’s absolute X Axis value if the control mode is Normal , or the offset from the marker’s reference marker if the control mode is Delta . The query is returned in the fundamental units for the current marker X Axis scale: Hz for Frequency , seconds for Period and Time . If the marker is Off the response is 9.91E37.
Dependencies / Couplings	Maximum value would be changed by Span value.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Center of screen
State Saved	No
Key Path	Marker, Normal

Marker X Axis Position Sets the marker X position in trace points. It has no effect if the control mode is Off, but is the SCPI equivalent of entering a value if the control mode is **Normal** or **Delta** except in trace points rather than X Axis Scale units. The entered value is immediately translated into the current X Axis Scale units for setting the value of the marker.

Remote Command	:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X:POSition <integer> :CALCulate:FM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:X:POSition?
Example	:CALC:FM:VIEW2:WIND1:MARK2:X:POS 100 :CALC:FM:VIEW2:WIND1:MARK2:X:POS?
Restriction and Notes	The query returns the marker's absolute X Axis value in trace points if the control mode is Normal , or the offset from the marker's reference marker in trace points if the control mode is Delta . If the marker is Off the response is 9.91E37.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	Center of screen
State Saved	No
Min	0
Max	400

Marker Y Axis Value Returns the marker Y Axis value in the current marker Y Axis unit.

The "result" of a marker is the value which is displayed on the second line of the Marker Result block. To properly interpret the returned value the remote programmer must also know what the analyzer's Y-Axis Unit is set to as described below.

A marker can have up to two results, only one of which is displayed or returned on a query, as follows:

Absolute result: Every marker has an absolute result and it is simply:

For Normal and Delta markers, the Y-axis value of the trace point the marker is currently on.

The absolute result is displayed in the result block or returned on a query unless the marker control mode is **Delta**.

Relative result: If a marker's control mode is **Delta**, the relative result is displayed in the result block or returned on a query. This is the offset of the Absolute Result of a delta marker to the Absolute Result of its reference marker. The result is expressed in dB.

Mode	Modulation Analyzer
Remote Command	:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:Y?
Example	:CALC:FM:VIEW2:WIND1:MARK2:Y?

Modulation Analyzer

FM Demodulation

Restriction and Notes	The query returns the marker Y-axis result. If the marker is Off the response is 9.91E37.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
Preset	0
State Saved	No
Key Path	N/A – Remote Feature Only

Peak Search Link to the front panel key Peak search; places a marker on the highest peak on the current trace.

If there is no marker active and the key is pressed marker 1 is activated at the highest peak.

If there is a marker currently active, the currently selected marker (refer to appropriate section on how it is selected) will be moved.

If the active marker is a normal marker this will move to the highest peak, if the active marker is a delta marker the reference marker position will remain unchanged and the delta marker will be moved to the highest peak on the trace

Mode	All
Remote Command	:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:MAXimum
Example	:CALC:FM:VIEW2:WIND1:MARK2:MAX
Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Waveform or Numeric Results, the SCPI command still has effect to the Spectrum view.
Key Path	Peak search

Next Peak Places the selected marker on the next highest signal peak from the current marked peak. This will find the next highest peak to the left OR right of the current marker position. If the currently active marker is a delta marker, when this key is pressed the reference marker position remains unchanged and the delta marker moves to the next highest peak on the trace.

Menu key Label	Next Peak
Mode	All
Remote Command	:CALCulate:FM:VIEW2:WINDow[1]:MARKer[1] 2 3 4:MAXimum:NEXT
Example	:CALC:FM:VIEW2:WIND1:MARK2:MAX:NEXT

Remote Command Notes	When this SCPI command is sent and the currently selected measurement view is Waveform or Numeric Results, the SCPI command still has effect to the Spectrum view.
Key Path	Peak Search

Marker -> Link to the front panel key marker ->; Accesses the marker function menu keys that change the value of the center frequency or the Ref Value to the current value of the selected marker.

Mode	All
Key Path	Marker ->

Mkr -> RL Sets the Ref Value to the amplitude value of the selected marker, moving the marked point to the Ref Value (top line of the graticule). The marker's mode (Normal, Delta, Fixed) doesn't matter in this case. For example, given a delta marker, if the delta marker is the selected marker, its amplitude is applied to the Ref Value. If the reference marker is selected, its amplitude is applied to the Ref Value.

If the currently selected marker is not on when this key is pressed, it will be turned on at the center of the screen as a normal type marker, and its amplitude applied to the Ref Value.

Menu key Label	Marker ->RL
Mode	All
Remote Command Notes	No SCPI command is associated with this menu key
State Saved	no
Key Path	Marker ->

Meas Setup

Avg Number

Turns averaging On or Off and sets the Average Count Number used with measurement averaging.

In Single mode, when Average Mode is set to Repeat, the specified number of averages are executed and then the measurement stops. When Average Mode is set to Exponential, only one sweep is executed and then the measurement stops.

In Continuous mode, when Average Mode is set to Repeat, the specified number of averages are executed and then clears the old data and restart the new repeat cycle. When Average Mode is set to Exponential, each successive data acquisition is exponentially weighted and combined with the existing average. This weights new data more than the old data, which facilitates tracking of slow changing signals.

Menu key Label	Average Number
Mode	Modulation Analyzer
Remote Command	<pre>[:SENSe] :FM:AVERAge:COUNT <integer> [:SENSe] :FM:AVERAge:COUNT? [:SENSe] :FM:AVERAge [:STATe] ON OFF 1 0 [:SENSe] :FM:AVERAge [:STATe] ?</pre>
Example	<pre>:FM:AVER:COUN 10 :FM:AVER:COUN? :FM:AVER ON :FM:AVER?</pre>
Remote Command Notes	<p>You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.</p> <p>You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.</p>
Preset	10
State Saved	Saved in instrument state.
Min	1
Max	4096
Key Path	Meas Setup

Avg Mode

Sets the type of termination control used for the averaging function. This determines the averaging behaviors after the specified number of measurements (see Average) has been reached.

Please note that the average function only applies to numeric results and spectrum trace. Waveform traces are not averaged.

Menu key Label	Avg Mode
Mode	Modulation Analyzer
Remote Command	[:SENSE] :FM:AVERage:TCONtrol EXPonential REPEAT [:SENSE] :FM:AVERage:TCONtrol?
Example	:FM:AVER:TCON REP :FM:AVER:TCON?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	REPEAT
State Saved	Saved in instrument state.
Range	Exponential Repeat
Key Path	Meas Setup

Repeat Sets Averaging to the repeat function. When Average Mode is set to Repeat, the averaging continues with each new sweep averaged with a weight of $1 / \text{Average Number}$. Repeat averaging shows the resulting data after the selected number of sweeps has been averaged, then clears the data before the next repeat cycle.

Exponential

When Average Mode is set to Exponential, the averaging continues with each new sweep averaged with a weight of $1 / \text{Average Number}$ and the old average reduced by multiplying it by $(\text{Average Number} - 1) / \text{Average Number}$.

Demod

Accesses to the Demod sub menu, no associated SCPI command, enables user to configure the demodulation parameters.

FM Detector The detector menus enable you to select the detection settings for a measurement. For FM, CSA supports 4 types detector, that is Peak+, Peak-, Peak+/-2, RMS (avg).

Menu key Label	FM Detector
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Modulation Analyzer

FM Demodulation

Mode	Modulation Analyzer
Remote Command	[:SENSe] :FM:DEMod:DETEctor [:FUNction] PPK NPK PNPK RMS [:SENSe] :FM:DEMod:DETEctor [:FUNction]?
Example	:FM:DEMod:DET PPK :FM:DEMod:DET?
Remote Command Notes	PPK – peak+ as the point to be displayed. NPK – peak- as the point to be displayed. PNPK – peak+/-2 as the value to be displayed. RMS – RMS as the value to be displayed.
Preset	PPK
State Saved	Saved in instrument state.
Range	Peak + Peak - Peak +/-2 RMS
Key Path	Meas Setup, Demod

Meas Time This key enables the user to set the measuring length in term of time.

Menu key Label	Meas Time
Mode	Modulation Analyzer
Remote Command	[:SENSe] :FM:DEMod:MTIME <time> [:SENSe] :FM:DEMod:MTIME?
Example	:FM:DEMod:MTIM 320 :FM:DEMod:MTIM?
Dependencies / Couplings	When Burst Search is set to None, Meas Time is related with IF BW. When Burst Search is set to RF Amptd, Meas Time <= search length.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	50 ms
State Saved	Saved in instrument state.

Min	IF BW	Meas Time Min
	5 MHz	13.33 us
	3 MHz	13.33 us
	1.25 MHz	40 us
	1.0 MHz	50 us
	500 kHz	100 us
	300 kHz	0.167 ms
	250 kHz	0.2 ms
	100 kHz	0.5 ms
	50 kHz	1 ms
	30 kHz	1 ms
	10 kHz	1 ms
	5 kHz	1 ms
	3 kHz	1 ms
Max	Search Length and coupling to IFBW	
	IF BW	Meas Time Max
	5 MHz	21.845 ms
	3 MHz	21.845 ms
	1.25 MHz	65.536 ms
	1.0 MHz	81.92 ms
	500 kHz	163.84 ms
	300 kHz	273.067 ms
	250 kHz	327.68 ms
	100 kHz	819.2 ms
	50 kHz	1638.4 ms
	30 kHz	2730.7 ms
	10 kHz	8192 ms
	5 kHz	16384 ms
	3 kHz	27306.7 ms
Key Path	Meas Setup, Demod	

Peak Hold Peak Hold is only valid for detect mode peak+ or peak-. If peak hold is On, the value of the frequency deviation (peak+ or peak- mode) is the maximum or minimum value of these peaks of the whole measurement time. If peak hold is Off, the value of the frequency deviation (peak+ or peak-mode) is the average of these peaks of the whole measurement time.

Menu key Label	Peak Hold
Mode	Modulation Analyzer
Remote Command	[:SENSe] :FM:DEMod:PHOLd ON OFF 1 0 [:SENSe] :FM:DEMod:PHOLd?
Example	:FM:DEMod:PHOL ON :FM:DEMod:PHOL?

Modulation Analyzer

FM Demodulation

Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
Preset	Off
State Saved	Saved in instrument state.
Range	Off On
Key Path	Meas Setup, Demod, Peak Hold

AutoCarrFreq If AutoCarrFreq is On, it means frequency offset estimation and frequency offset calibration are enabled. If AutoCarrFreq is Off, it means frequency offset estimation and frequency offset Calibration are disabled.

Menu key Label	AutoCarrFreq
Mode	Modulation Analyzer
Remote Command	[:SENSe] :FM:DEMod:AUTocarrfreq ON OFF 1 0 [:SENSe] :FM:DEMod:AUTocarrfreq?
Example	[:SENSe]:FM:DEMod:AUT ON [:SENSe]:FM:DEMod:AUT?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
Preset	On
State Saved	Saved in instrument state.
Range	Off On
Key Path	Meas Setup, Demod, AutoCarrFreq

Meas Filter Meas Filter is a shortened form of Measurement Filter, and it is a low pass filter. Measurement Filter here is used to filter the FM demodulated signal. If IFBW is much larger than the modulation rate, more noise will be allowed into the measurement, thereby degrading the accuracy. In order to decrease the interference of noise, we can select the Meas Filter to filter out noise and improve the accuracy of measurement.

Menu key Label	Meas Filter
Mode	Modulation Analyzer

Remote Command	<code>[:SENSe] :FM:DEMod:MFILter ON OFF 1 0</code> <code>[:SENSe] :FM:DEMod:MFILter?</code>
Example	<code>:FM:DEMod:MFIL ON</code> <code>:FM:DEMod:MFIL?</code>
Dependencies / Couplings	If Meas Filter is On, the bandwidth of the Meas Filter is equal to the span of demod spectrum.
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use <code>INSTrument:SElect</code> to set the mode.
Preset	Off
State Saved	Saved in instrument state.
Range	Off On
Key Path	Meas Setup, Demod, Meas Filter

Burst/Sync Search

Sync This specifies whether the input data needs to do burst searching.

None, the input data is continuous and needs no burst searching;

RF Amplitude, the input data is burst mode and needs burst searching;

Menu key Label	Sync
Mode	Modulation Analyzer
Remote Command	<code>[:SENSe] :FM:SYNC:SOURce NONE RFAMplitude</code> <code>[:SENSe] :FM:SYNC:SOURce?</code>
Example	<code>:FM:SYNC:SOUR NONE</code> <code>:FM:SYNC:SOUR?</code>
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use <code>INSTrument:SElect</code> to set the mode.
State Saved	Saved in instrument state.
Range	None RF Amptd
Key Path	Meas Setup, Burst/Sync Search

Modulation Analyzer

FM Demodulation

Burst Search Threshold This specifies the burst searching power threshold when the signal is in burst mode and needs to do burst searching in order to locate the useful signal part. It means the $10 \cdot \log$ ratio of the none-data part power to the data part power, unit is dB.

Menu key Label	Burst Search Threshold
Mode	Modulation Analyzer
Remote Command	<code>[:SENSe] :FM:SYNC:STHReshold <ampl></code> <code>[:SENSe] :FM:SYNC:STHReshold?</code>
Example	<code>[:SENSe]:FM:SYNC:STHReshold -12.6</code> <code>[:SENSe]:FM:SYNC:STHReshold?</code>
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use <code>INSTrument:SElect</code> to set the mode.
Preset	-20.0 dB
State Saved	Saved in instrument state.
Min	-100.0 dB
Max	0.0 dB
Key Path	Meas Setup, Burst/Sync Search

Search Length Specifies the length of time over which the burst search is performed. If the input is the burst signal, at least the search length is equal to data length plus $2 \cdot$ idle data length.

Menu key Label	Search Length
Mode	Modulation Analyzer
Remote Command	<code>[:SENSe] :FM:SYNC:SLENgth <real></code> <code>[:SENSe] :FM:SYNC:SLENgth?</code>
Example	<code>[:SENSe]:FM:SYNC:SLENgth 500 us</code> <code>[:SENSe]:FM:SYNC:SLENgth?</code>
Dependencies / Couplings	Related with IF BW
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use <code>INSTrument:SElect</code> to set the mode.
Preset	50 ms
State Saved	Saved in instrument state.

Min	IF BW	Search Length Min
	5 MHz	13.33 us
	3 MHz	13.33 us
	1.25 MHz	40 us
	1.0 MHz	50 us
	500 kHz	100 us
	300 kHz	0.167 ms
	250 kHz	0.2 ms
	100 kHz	0.5 ms
	50 kHz	1 ms
	30 kHz	1 ms
	10 kHz	1 ms
	5 kHz	1 ms
3 kHz	1 ms	
Max	IF BW	Search Length Max
	5 MHz	21.845 ms
	3 MHz	21.845 ms
	1.25 MHz	65.536 ms
	1.0 MHz	81.92 ms
	500 kHz	163.84 ms
	300 kHz	273.067 ms
	250 kHz	327.68 ms
	100 kHz	819.2 ms
	50 kHz	1638.4 ms
	30 kHz	2730.7 ms
	10 kHz	8192 ms
	5 kHz	16384 ms
3 kHz	27306.7 ms	
Key Path	Meas Setup, Burst/Sync Search	

IF BW

This specifies the width of the intermediate frequency (IF) filter selected. There exists the coupling between the IF BW and the search length, which limits the user's choice either on IF BW or search length.

Menu key Label	IF BW
Mode	Modulation Analyzer
Remote Command	[:SENSe]:FM:IFBWidth <freq> [:SENSe]:FM:IFBWidth? [:SENSe]:FM:IFBWidth:AUTO ON OFF 1 0 [:SENSe]:FM:IFBWidth:AUTO?

Modulation Analyzer

FM Demodulation

Example	:FM:IFBW 1MHz :FM:IFBW? :FM:IFBW:AUTO ON :FM:IFBW:AUTO?
Restriction and Notes	Auto clipped to the following values: IF BW 5 MHz 3 MHz 1.25 MHz 1.0 MHz 500 kHz 300 kHz 250 kHz 100 kHz 50 kHz 30 kHz 10 kHz 5 kHz 3 kHz
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	30 kHz
State Saved	Saved in instrument state.
Min	3 kHz
Max	5 MHz
Key Path	Meas Setup

IFBW List Your CSA supports the IFBW values shown in the table below.

IFBW	Sampling Frequency
5 MHz	7.5 MHz
3 MHz	7.5 MHz
1.25 MHz	2.5 MHz
1.0 MHz	2.0 MHz
500 kHz	1.0 MHz
300 kHz	600 kHz

250 kHz	500 kHz
100 kHz	200 kHz
50 kHz	100 kHz
30 kHz	60 kHz
10 kHz	20 kHz
5 kHz	10 kHz
3 kHz	6 kHz

Trigger

The Trigger enables you to select the trigger settings for a FM measurement.

3 trigger types (Trigger Source) are supported for a FM measurement, when using a trigger source other than Free Run, the analyzer will begin a sweep only with the selected trigger conditions are met. A trigger event is defined as the point at which your trigger source signal meets the specified trigger level and polarity requirements (if any).

Each Trigger Type supports some or all of the trigger parameters:

Trigger Type	Parameter		
	Delay	Level	Slope
Free run	No	No	No
External	Yes	No	Yes
RF Burst	Yes	Yes	No

Trigger Delay and Trigger Level will change the delay and level respectively for all Trigger Types to which the parameter applies. For example, if the Trigger Delay is set to 100 ms for RF Burst Trigger, the Trigger Delay for External Triggers is now also 100 ms.

Free Run (Immediate) Pressing this key, when it is not selected, selects free-run triggering. When free run is selected, trigger occurs immediately after the sweep/measurement is initiated.

Menu key Label	Free Run
Mode	Modulation Analyzer

Modulation Analyzer

FM Demodulation

Remote Command	:TRIGger:FM[:SEquence]:SOURce IMMEDIATE :TRIGger:FM[:SEquence]:SOURce?
Example	:TRIG:FM:SOUR IMM :TRIG:FM:SOUR?
Key Path	Meas Setup, Trigger

External Pressing this key, when it is not selected, selects an external input signal as the trigger. A new sweep/measurement will start when the external trigger condition is met by the signal applied to the External Trigger Input.

There are no external trigger level settings

Menu key Label	External
Mode	Modulation Analyzer
Remote Command	:TRIGger:FM[:SEquence]:SOURce EXTERNAL
Example	:TRIG:FM:SOUR EXT
Key Path	Meas Setup, Trigger

RF Burst (Wideband) Pressing this key, when it is not selected, selects the RF Burst as the trigger. A new sweep/measurement will start when an RF burst envelope signal is identified from the signal input to the RF Input connector.

Menu key Label	RF Burst
Mode	Modulation Analyzer
Remote Command	:TRIGger:FM[:SEquence]:SOURce RFBURST
Example	:TRIG:FM:SOUR RFB
Key Path	Meas Setup, Trigger

Trigger Level For RF Burst, sets the absolute trigger level for the RF burst envelope. Relative trigger level is not supported in CSA.

Menu key Label	Trigger Level
----------------	---------------

Mode	Modulation Analyzer
Remote Command	:TRIGger:FM[:SEquence]:LEVel:ABSolute <ampl> :TRIGger:FM[:SEquence]:LEVel:ABSolute?
Example	:TRIG:FM:LEV:ABS -30dBm :TRIG:FM:LEV:ABS?
Dependencies / Couplings	The input value is clipped to the min/max when it falls out of the respective Min/Max range
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	-30.0 dBm
State Saved	Saved in instrument state.
Min	-100.0 dBm
Max	+30.0 dBm
Key Path	Meas Setup, Trigger

Trigger Slope Controls the trigger polarity. It is set positive to trigger on a rising edge and negative to trigger on a falling edge.

Menu key Label	Trigger Slope
Mode	Modulation Analyzer
Remote Command	:TRIGger:FM[:SEquence]:EXTernal:SLOPe POSitive NEGative :TRIGger:FM[:SEquence]:EXTernal:SLOPe?
Example	:TRIG:FM[:SEquence]:EXT:SLOP NEG :TRIG:FM[:SEquence]:EXT:SLOP?
Dependencies / Couplings	
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	POS
State Saved	Saved in instrument state.
Range	Pos Neg
Key Path	Meas Setup, Trigger

Modulation Analyzer

FM Demodulation

Trigger Delay Controls a time delay during which the analyzer will wait before a sweep starting after meeting the triggering criteria, not valid for free run

Menu key Label	Trigger Delay																												
Mode	Modulation Analyzer																												
Remote Command	:TRIGger:FM[:SEquence]:DELay <real> :TRIGger:FM[:SEquence]:DELay?																												
Example	:TRIG:FM:DEL 1us :TRIG:FM:DEL?																												
Dependencies / Couplings	The Trigger Delay is related with IF BW, but it is not valid for free run.																												
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.																												
Preset	0 s																												
State Saved	Saved in instrument state.																												
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Key Path	Meas Setup, Trigger																												

Limits

Limits Allows you to activate/deactivate the limits displaying.

Only if limits mode is selected as On, the limits setting can work, If limits mode is selected as Off, these limits setting can't work.

Menu key Label	Limits
Mode	Modulation Analyzer
Remote Command	:CALCulate:FM:LIMit ON OFF 1 0 :CALCulate:FM:LIMit?
Example	:CALC:FM:LIM OFF :CALC:FM:LIM?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	OFF
State Saved	Saved in instrument state.
Range	Off On
Key Path	Meas Setup, More, Limits

Carrier Power Upper Sets the RF Carrier Power Upper Limit to warn you if the measured maximum RF carrier power value exceeds the value specified here; the font changes from green to red when alarm triggers.

Menu key Label	Carrier Power Upper
Remote Command	:CALCulate:FM:LIMit:POWER:UPPer <ampl> :CALCulate:FM:LIMit:POWER:UPPer?
Example	:CALC:FM:LIM:POW:UPP 20dBm :CALC:FM:LIM:POW:UPP?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.

Modulation Analyzer

FM Demodulation

Preset	30.0 dBm
State Saved	Saved in instrument state.
Min	-100.0 dBm
Max	40.0 dBm
Key Path	Meas Setup, More, Limits

Freq Deviation Upper Sets the Frequency Deviation Upper Limit to warn you if the measured maximum frequency deviation value exceeds the value specified here; the font changes from green to red when alarm triggers.

Menu key Label	Freq Deviation Upper
Remote Command	:CALCulate:FM:LIMit:FDUL:UPPer <freq> :CALCulate:FM:LIMit:FDUL:UPPer?
Example	:CALC:FM:LIM:FDUL:UPP 100kHz :CALC:FM:LIM:FDUL:UPP?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	100 kHz
State Saved	Saved in instrument state.
Min	0 Hz
Max	500 kHz
Key Path	Meas Setup, More, Limits

Freq Deviation Lower Sets the Frequency Deviation Lower Limit to warn you if the measured minimum frequency deviation value exceeds a limit. When the minimum frequency deviation result is lower than the lower limit; the font changes from green to red when alarm triggers. When the minimum frequency deviation result is more than the limit, the font changes back to green.

Menu key Label	Freq Deviation Lower
Remote Command	:CALCulate:FM:LIMit:FDLL:LOWer <freq> :CALCulate:FM:LIMit:FDLL:LOWer?

Example	:CALC:FM:LIM:FDLL:LOW 100 kHz :CALC:FM:LIM:FDLL:LOW?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
Preset	0 Hz
State Saved	Saved in instrument state.
Min	0 Hz
Max	500 kHz
Key Path	Meas Setup, More, Limits

Carrier Freq Offset Upper Sets the frequency offset upper limit alarm to warn you if the measured maximum frequency offset value exceed the value specified here. The font changes from green to red when alarm triggers.

Menu key Label	Carrier Freq Offset Upper
Remote Command	:CALCulate:FM:LIMit:FOUL:UPPer <freq> :CALCulate:FM:LIMit:FOUL:UPPer?
Example	:CALC:FM:LIM: FOUL:UPPer 116kHz :CALC:FM:LIM: FOUL:UPPer?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
Preset	10 kHz
State Saved	Saved in instrument state.
Min	-500 kHz
Max	500 kHz
Key Path	Meas Setup, More, Limits

Modulation Analyzer

FM Demodulation

SPAN X Scale Menu

Waveform View

Scale/Div This key allows you to specify the scale per division of the granularity on your screen.

Menu key label	Scale/Div
Mode	Modulation Analyzer
Remote Command	:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision <real> :DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:PDIVision?
Example	:DISP:FM:VIEW:WIND:TRAC:X:PDIV 6.0 :DISP:FM:VIEW:WIND:TRAC:X:PDIV?
Restriction and Notes	If Autoscale is set to On, this value equals to the minimum value of Meas Time/10 and 3/ mod Rate. And the maximum value of scale/div is 3/ mod Rate. When you set this value manually, Autoscale automatically changes to Off.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SELEct to set the mode.
Preset	The minimum value of Meas Time/10 and 3/ mod Rate.
State Saved	Saved in instrument state.
Min	1 us
Max	The maximum scale/div will be 3/ mod Rate.
Key Path	SPAN/X Scale

Ref Value This key allows you to set the reference value of the display.

Menu key Label	Ref Value
Mode	Modulation Analyzer
Remote Command	:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RVALue <real> :DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RVALue?

Example	:DISP:FM:VIEW:WIND:TRAC:X:RVAL 0 :DISP:FM:VIEW:WIND:TRAC:X:RVAL?
Restriction and Notes	If the Autoscale is set to On, this value is automatically determined by the measurement result. When you set this value manually, Autoscale automatically changes to Off.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
Preset	0 s
State Saved	Saved in instrument state.
Min	0
Max	Meas Time
Key Path	SPAN/X Scale

Ref Position This key allows you to set the display Reference Position to either Left, Ctr (center), or Right.

Menu key Label	Ref Position
Mode	Modulation Analyzer
Remote Command	:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOStion LEFT CTR RIGHT :DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:RPOStion?
Example	:DISP:FM:VIEW:WIND:TRAC:X:RPOS LEFT :DISP:FM:VIEW:WIND:TRAC:X:RPOS?
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRUMENT:SElect to set the mode.
Preset	LEFT
State Saved	Saved in instrument state.
Range	Left Ctr Right
Key Path	SPAN/X Scale

Modulation Analyzer

FM Demodulation

Autoscale This key allows you to switch the Autoscale between On and Off.

Menu key Label	Autoscale
Mode	Modulation Analyzer
Remote Command	:DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle ON OFF 1 0 :DISPlay:FM:VIEW[1]:WINDow[1]:TRACe:X[:SCALe]:COUPle?
Example	:DISP:FM:VIEW:WIND:TRAC:X:COUP ON :DISP:FM:VIEW:WIND:TRAC:X:COUP?
Restriction and Notes	Reference values based on the measurement results if this parameter is set to On. If meas time < 30 / mod Rate, the system will display the whole measurement time; The Scale/Div = meas time /10; If meas time > 30/ mod Rate, it will only display the time of 30/ mod Rate and not the whole measurement time. The display accuracy will be reduced depending on the measurement time. If the total number of points exceeds 401, then the accuracy will be reduced by re-sampling to 401 points. And the Autoscale function automatically determines the Scale/Div and reference values based on the measurement results. When you specify either Scale/Div or Ref Value manually, Autoscale automatically changes to Off.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SELEct to set the mode.
Preset	ON
State Saved	Saved in instrument state.
Range	Off On
Key Path	SPAN/ X Scale

Spectrum View

Span This key allows you to specify the span of your measurement as displayed on the X-axis of the display.

Mode	Modulation Analyzer
------	---------------------

Remote Command	:DISPlay:FM:VIEW2:WINDow [1] :TRACe:X [:SCALE] :SPAN <freq> :DISPlay:FM:VIEW2:WINDow [1] :TRACe:X [:SCALE] :SPAN? :DISPlay:FM:VIEW2:WINDow [1] :TRACe:X [:SCALE] :FSPan ON OFF 1 0 :DISPlay:FM:VIEW2:WINDow [1] :TRACe:X [:SCALE] :FSPan?
Example	:DISP:FM:VIEW2:WIND:TRAC:X:SPAN 30.0 :DISP:FM:VIEW2:WIND:TRAC:X:SPAN? :DISP:FM:VIEW2:WIND:TRAC:X:FSP ON :DISP:FM:VIEW2:WIND:TRAC:X:FSP?
Restriction and Notes	If Span is set to Auto, the value equals to IFBW/2. If you want to change the span value, you have to set the Span to Man and enter the required value. Span represents the observed bandwidth of the demodulated signal. The start frequency is 0 Hz and the stop frequency is the span value.
Dependencies / Couplings	See Restriction and Notes
Remote Command Notes	You must be in the Modulation Analyzer mode to use this command. Use INSTRument:SElect to set the mode.
Preset	15 kHz.
State Saved	Saved in instrument state.
Min	100 Hz
Max	IFBW/2
Key Path	SPAN/X Scale

View/Display

Allows you to select different views.

Menu key Label	View/Display
Mode	Modulation Analyzer
Remote Command Notes	No SCPI command is associated with this menu key.
Preset	Demod Waveform
State Saved	Saved in instrument state.
Range	Demod Waveform Demod Spectrum Numeric Results
Key Path	View/Display

Modulation Analyzer
FM Demodulation

The Utility and Control/Sweep front-panel key groupings have functionality that is shared across all the Modes

Control/Sweep Functions

Cont

Sets the analyzer for continuous sweep measurements. Does not restart the current sweep.

Mode	SA
Remote Command	:INITiate:CONTinuous ON OFF 1 0 :INITiate:CONTinuous?
Example	INIT:CONT ON Turns on continuous sweep

Control/Sweep

Accesses the sweep control menu keys. The sweep (measurement) can be restarted and the number of sweep points can be set. The sweep time setting can be viewed, but it can only be set when in zero span.

Mode:	SA
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Sweep Time

In firmware revision A.02.00, Sweep Time enables you to set the length of time that the spectrum analyzer sweeps the displayed frequency span manually and set the sweep time to the automatic mode. In Auto mode, the sweep will default to the shortest calibrated value. When in Manual mode, the displayed Sweep Time is calculated based on a model which is a function of RBW, Span, VBW, and the number of sweep points in the trace. Since the Sweep Time model yields discrete values, times entered by you will be corrected to the closest achievable value greater than or equal to the entered amount. The menu key, active function dialog, and the annotation will be updated to reflect this correction.

You cannot decrease the sweep time below what the analyzer picks in Auto. However, the sweep time can be made longer than the Auto Sweep time. As you increase the sweep time it changes in discrete increments. As the knob is turned in the clockwise direction, the value in the active function dialog box will be incremented by 0.01 using the units being displayed (e.g., 1.00 s will be incremented to 1.01 s, whereas 43.22 ms will be incremented to 43.23 ms). In no case can it be decreased below the nominal (auto selected) sweep time.

The Sweep Time reads out in the bottom right of the screen on the second line below the graticule. A “#” mark appears before “Sweep Time” in the annotation when it is not coupled.

Sweep Time will never be allowed to be set above 4000 seconds, although the resulting Sweep Time reported may be longer due to the discrete nature of the Sweep Time model. Additionally, depending on the RBW, VBW, Span, and the number of points in the trace, 4000 might not always be an achievable.

The analyzer permits you to measure the same spectrum on different traces with each trace using a different detector. This is sometimes referred to as detector diversity. There are cases where detector diversity and a fast measurement are in conflict in a spectral measurement. In other words, there are cases where either you can have either detector diversity or a fast measurement, but not both.

Detector diversity in the analyzer is defined as having 8 or more samples that fall into a sweep point (≥ 8 samples / sweep point). If this condition is met, then the peak detector will yield an average of 6.43 dB more power than the average or sample detector. The negative peak detector will yield 6.43 dB less power than the sample or average detector. Therefore, there is significant difference in power between the 4 types of detectors when this condition is met.

If this condition is not met, the “<8 Smpl/Pt” annotation is displayed to the right of the active function block. To clear this condition, you can increase detector diversity in two ways. First, you can increase the number of samples for each sweep point by increasing the span:rbw ratio, or by increasing the sweep time. Second, you can decrease the number of sweep points.

NOTE In firmware version A.01.xx, Sweep Time enables you to set the length of time in which the spectrum analyzer sweeps while in the zero span mode only. In non-zero span, the sweep time is set automatically. Setting Sweep Time is available only in zero span. Sweep Time can be queried in zero span or non-zero span.

Mode	SA
Remote Command	<pre>[:SENSe] :SWEep:TIME <time> [:SENSe] :SWEep:TIME? [:SENSe] :SWEep:TIME AUTO OFF ON 0 1 [:SENSe] :SWEep:TIME AUTO?</pre>
Example	<pre>SWEep:TIME 100 ms SWEep:TIME? SWEep:TIME:AUTO ON SWEep:TIME:AUTO? SWEep:TIME:AUTO OFF</pre>
Restrictions and Notes	<p>See text above the table for restrictions in zero span.</p> <p>The minimum or maximum values for sweep time may never be achieved, as CSA does not permit oversweeping, a value entered lower than the physical limit will have the value adjusted to the minimum sweep time permitted for the given measurement settings. Likewise, the maximum value will be adjusted to permit a calibrated measurement for the given measurement settings.</p>

Utility and Control/Sweep Functions

Control/Sweep Functions

Dependencies / Couplings	In Auto Sweep Time, sweep time is coupled to RBW and Video BW, and is impacted by sweep points. See details in text section above. When in zero span the state of AUTO or MAN is disabled and becomes just the active function part.
Preset	Automatically calculated For A.01.xx: ~ 550 ms for N1996A-503, 1 s for N1996A-506 For A.02.00: ~ 760.7 ms for N1996A-503, 1.45 s for N1996A-506 ON
State Saved	Saved in instrument state.
Range	1 ms to 4 ks Off, On
Key Path	Control/Sweep
Min	1 ms
Max	4000 s (Zero Span Max is 10 s, but dependent on RBW)
Key Path	Control/Sweep, Sweep Time

Restart

Pressing **Restart** restarts the current sweep, or measurement, or set of averaged/held sweeps or measurements. The **Restart** function first aborts the current sweep/measurement as quickly as possible. It then resets the sweep and trigger systems, sets up the measurement and initiates a new data measurement sequence with a new data acquisition (sweep) taken once the trigger condition is met.

Mode	SA
Remote Command	:INITiate:REStart
Key Path	Control/Sweep, Restart

Points

Sets the number of points per sweep, from 2 to 1001. The default setting is 401 points. Increasing the number of sweep points increases frequency resolution and accuracy but reduces measurement speed. The current value of points is displayed next to the sweep time in the lower-right corner of the display.

Changing the number of points has several effects on the analyzer. Since markers are read at the point location, the marker reading may change. Trace data for all traces is cleared. If sweep is set to Cont, a new sweep begins immediately. If any trace is in average or hold, the averaging starts over. If limit masks are set to On, the limit masks are updated.

In addition to sweep points, the span, resolution bandwidth, average detection and center frequency will

also affect measurement speed.

Mode	SA
Remote Command	[:SENSE] :SWEep:POINts <integer> [:SENSe] :SWEep:POINts?
Example	SWE:POIN 1001
Preset	401
Range	2 to 1001
Key Path	Control/Sweep, Points

Abort (Remote Command Only)

Stops any sweep or measurement in progress and resets the sweep and trigger system. A measurement refers to any of the measurements found in the MEASURE menu.

Mode	all
Remote Command	:ABORt
Example	ABOR
Notes	If you are in single sweep/measure (INITiate:CONTinuous is off), then you must start another sweep (send INITiate:IMMediate). When the trigger conditions are met, a new measurement will start. If you are in continuous sweep/measure (INITiate:CONTinuous is on), a new measurement begins as soon as the trigger conditions are met.

Single

Enables single measurements. Pressing Single is equivalent to sending the remote command sequence:

INIT:CONT OFF

INIT:IMMediate

Therefore, **Single** turns **Cont** (continuous sweep) off. The current sweep will finish.

Mode	SA
Remote Command	:INITiate [:IMMediate]
Example	INIT

Utility Functions

Mode Preset

Recalls the factory default for the active mode.

Mode	All
Remote Command	:SYSTem:PRESet [:MODE]
Example	SYST:PRES

Mode	All
Remote Command	*RST
Remote Command Notes	Performs a mode preset and puts the instrument in single sweep.

Print

The Print front-panel key opens up a screen that enables you to print a screen image to a file on removable mass storage media. You can then remove the storage media from the instrument and use a PC with a printer to print the screen image. For more information on the screen save process, refer to Save.

NOTE Never remove the external memory media during a save operation. To do so could corrupt all data on the memory media.

Mode:	All
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Recall

Accesses the menu keys used to restore saved states or trace data files from an external storage device or the internal analyzer memory.

NOTE Recalling any state, including the user preset state, will affect the conditions of more parameters than are affected by a factory preset. For example, external gain

is not affected by a Preset but may be affected by a user preset.

Mode: All

Recall Now

Initiates the recall of a saved state or trace data file depending on the file type currently selected. When pressed a screen is displayed that shows a list of saved files. Using the up and down arrow navigation keys, you must highlight one of the file names and press either the **Select** navigation key or the **Select** menu key. The selected file data will then be recalled into the analyzer. When traces are recalled, they always recall in View mode.

Traces saved in TRC format can be recalled individually. When a trace is recalled, the state that existed when that trace was saved is recalled along with the trace. In addition, the sweep is set to single.

NOTE To compare two saved traces from different saves, place traces in view mode before saving them. This prevents the trace from being rewritten based on a state change from subsequent recalls.

Mode	SA, Stimulus/Response
Remote Command	<pre> :MMEMory:LOAD:STATe 1,<filename> :MMEMory:LOAD:TRACe <trace>,<file_name> *RCL <register> </pre>
Example	<p>MMEM:LOAD:STAT 1,'MyState.sta' recalls the saved instrument state file name 'MyState.sta' into the analyzer. The .sta extension is required.</p> <p>*RCL 12 recalls the instrument state from the instrument memory register REG12. The available register numbers are 0 to 127.</p> <p>MMEM:LOAD:TRAC TRACE3,'MyTrace.trc' recalls the trace + state file MyTrace.trc into the analyzer as trace 3.</p>

Remote Command Notes

For the MMEM:LOAD:TRAC <trace>,<'file_name'> command, <'file_name'> must include the following:

- A file extension of TRC. The .trc extension is for files that include both trace and state data.
- File names are case sensitive.
- Trace names are: TRACE1|TRACE2|TRACE3|TRACE4|ALL
Measurements in the Stimulus/Response mode have only TRACE1|TRACE2 available

For the MMEM:LOAD:STAT 1 command:

- This command only recalls the state of the Signal Analysis mode. Use *RCL to recall all mode states.
*RCL <register#> recalls the state from the specified internal register into the current active state of the instrument. The available register numbers are 0 to 127

When you are making measurements in the Stimulus/Response Mode, the :MMEMory:LOAD:STATe 1,<'file_name'> command is only supported in the Two-Port Insertion Loss measurement. It is not supported in the One-Port Insertion Loss, Return Loss, or Distance To Fault measurements.

Key Path

Recall, Recall Now

Type

Enables you to select the type of file you want to recall. The file types available for recall are described below.

Type	Format	Source	Extension
State	State		sta
Trace	Trace + state	Trace 1, 2, 3, 4, or all traces	trc

Mode

All

Preset

Type survives Preset and *RST, but is set to State at power on.

State Saved

Type is not saved in the instrument state.

Key Path

Recall, Type

State Recalling a state restores most settings to the previously saved values. When you recall a State file

Utility and Control/Sweep Functions

Utility Functions

into the analyzer, the file data restores most analyzer settings to the previously saved values. Some settings are not saved and restored in the State files, for example the save state options; these settings are called “persistent.” In this guide, each function describes whether that function is saved in “Instrument State” or is persistent.

Mode	All
Key Path	Recall, Type, State

Trace Traces can be recalled individually or as a group. When a trace is recalled, the state that existed when that trace was saved is recalled along with the trace. In addition, the recalled trace is placed in view mode.

The contents of the file are recalled into TRACE 1. The file name must have a file extension of .trc. The file extension determines whether a trace is recalled, or a trace with its state, are recalled. The .trc extension is for files that include both trace and state data.

Mode	All
Key Path	Recall, Type, Trace

Sort

Displays the Sort menu keys that enable you to view your saved files according to a selected file attribute. The selections include, **By Date**, **By Name**, **By Extension**, **By Size**, and **Order**.

Mode	All
State Saved	Sort is not saved in the instrument state.
Key Path	Recall, Sort

By Date Sorts and displays the current file catalog by the date of the files.

Mode	All
Key Path	Recall, Sort, By Date

By Name Sorts and displays the current file catalog. The files are sorted in alphabetical order according to filename.

Mode	All
Key Path	Recall, Sort, By Name

By Extension Sorts and displays the current file catalog, in alphabetical order, by the file extension of the file names (for example: .trc, .sta).

Mode	All
Key Path	Recall, Sort, By Extension

By Size Sorts and displays the current file catalog by the size of the files.

Mode	All
Key Path	Recall, Sort, By Size

Order Changes the order of the display of the current file catalog.

Mode	All
Key Path	Recall, Sort, Order

Destination

When Type is set to Trace, Destination allows you to direct your data to Trace 1, Trace 2, Trace 3, or Trace 4 for a single-trace file. If the data is for all four traces (Source was All when they were saved), the data will be returned to the original trace registers, regardless of the **Destination** setting.

For any other Recall type, **Destination** is disabled (grayed out).

Mode	All
Preset	Not affected by Preset. Power up and Restore Sys Defaults sets Trace 1.
State Saved	Destination is not saved in the instrument state
Key Path	Recall, Destination

Utility and Control/Sweep Functions Utility Functions

Trace 1 Selects trace 1 into which trace data is recalled.

Mode	All
Key Path	Recall, Destination, Trace 1

Trace 2 Selects trace 2 into which trace data is recalled.

Mode	All
Key Path	Recall, Destination, Trace 2

Trace 3 Selects trace 3 into which trace data is recalled.

Mode	All
Key Path	Recall, Destination, Trace 3

Trace 4 Selects trace 4 into which trace data is recalled.

Mode	All
Key Path	Recall, Destination, Trace 4

Device

When you have selected a recall type of State or Trace, a menu is displayed that enables you to recall a file normally from the internal drive or import the one from a USB device.

Mode	All
Preset	Location survives Factory Preset, *RST, and power on.
Key Path	Recall, Device

Catalog

This displays the directory defined by the current device and type. For example, the device could be the

internal or external drive. Only file types that can be recalled are cataloged. For example, the displayed file type might be trace or state.

Mode	All
Remote Command	:MMEMory:CATalog?
Example	MMEM:CAT lists the saved files.
Key Path	Recall, Catalog

Delete Enables you to delete selected saved files.

Mode	All
Remote Command	:MMEMory:DElete <filename>?
Example	MMEM:DEL C:/MyTrace.sta deletes the saved state file MyTrace.sta.
Key Path	Recall, Catalog, Delete

Save

Accesses the menu keys used to save and manage data on an external storage device or the internal analyzer drive.

NOTE Never remove the external memory media during a save operation. To do so could corrupt all data on the memory media.

Mode:	All
-------	-----

Save Now

Executes the save function. When the save is complete, the message XXXXXX file saved (where XXXXXX is the filename) will appear on your display. If you have previously used the **Save**, **Save Now** keys to setup and save a file, **Save Now** will perform an immediate save of your file in the same format and to the same location.

For example, if you use the Save menu to configure the analyzer to save Screen in reverse bitmap format on the selected storage device, using the automatically generated file name (Screen_20051215_143240.png), then every time the **Save Now** menu key is pressed, a screen image will be saved in a .png format, and the filename will be incremented (Screen_20051215_143240.png, Screen_20051215_143357.png). This provides a convenient format for saving several files with the same format quickly. For more information on file naming, refer to [“Name” on page 434](#).

NOTE In the event that a valid save cannot be performed because a location has not been selected, the **Save Now** key will report the error No location selected. In this case, press **Save**, **Location** and select storage location.

NOTE Never remove the external memory media during a save operation. To do so could corrupt all data on the memory media.

Mode	SA, Stimulus/Response
Remote Command	<pre> :MMEMory:STORe:SCREen <'file_name'> :MMEMory:STORe:STATe 1,<'file_name'> :MMEMory:STORe:TRACe <label>,<'file_name'> *SAV <register#> </pre>
Example	<p>MMEM:STOR:STAT 1, 'C:/MyTrace.sta' saves the current instrument state to the specified file name. The .sta extension is required.</p> <p>*SAV 12 saves the current instrument state to a file name REG12. The available register numbers are 0 to 127. The file will be saved to the location selected under the save location menu.</p> <p>MMEM:STOR:SCR, 'E:/MyScreen.png' The file must have a .png file extension. The specified file extension determines which file format the instrument will use to save the image.</p> <p>MMEM:STOR:TRAC TRACE3, 'C:/MyTrace.trc' Saves trace 3 to the trace + state file MyTrace.trc</p>

Remote Command Notes

For the :MMEMory:STORe:TRACe <label>,<“file_name”> command:

- Trace names are: TRACE1|TRACE2|TRACE3|TRACE4|ALL
Measurements in the Stimulus/Response mode have only TRACE1|TRACE2 available
- The file name must have a file extension of .trc.
- The <“file_name”> must include the complete path, for example ‘C:/MyTrace.trc’

When you are making measurements in the Stimulus/Response Mode, the :MMEMory:STORe:STATe 1,<“file_name”> command is only supported in the Two-Port Insertion Loss measurement. It is not supported in the One-Port Insertion Loss, Return Loss, or Distance To Fault measurements.

Key Path

Save, Save Now

Type

Enables you to select the type of information you want to save. The file types available for saving are described below.

Type	Format	Source	Extension
Screen	Bit-Mapped Graphic		png
	Reverse Bit-Mapped Graphic (light background)		png
State	State		sta
Trace	Trace + state	Trace 1, 2, 3, 4, or all traces	trc
Measurement Results Data	Spreadsheet	Trace 1	xls

Mode

All

Preset

Type survives Preset and *RST, but is set to State at power on.

State Saved

Type is not saved in the instrument state

Key Path

Save, Type

Screen Defines the data to be saved as a file containing an exact representation of the analyzer display

at the time it was saved. Screen files look exactly as the display looked when the file was saved. You cannot extract data from Screen files as you can with Trace files, but you can print them or include them in other documents. In addition, they cannot be recalled into the analyzer. There are two formats for screen files, Bit-Mapped Graphic and Reverse Bit-Mapped Graphic (Light Background). You can select the format you want using the **Bitmap** and **Reverse Bitmap** keys under the Format menu.

- **Bit-Mapped Graphic:** A file containing an exact bit representation of the screen stored in Portable Network Graphics (PNG) format.
- **Light Background:** This is the same as Bit-Mapped Graphic, but the black display backgrounds are changed to white and the yellow traces are turned to green to preserve printer black ink.

Mode	All
Key Path	Save, Type, Screen

State Defines the data to be saved as a state file containing a copy of the state of the analyzer at the time the file is saved. The settings of most analyzer functions are saved in the state files but not traces and limits. When a State file is recalled into the analyzer, the analyzer is restored to the same state as when the file was saved. Some settings are not saved in the State files, for example the save state options; these settings are called “persistent.” In this guide, each function describes whether that function is saved in “Instrument State” or is persistent.

Mode	All
Key Path	Save, Type, State

Trace Defines the data to be saved as a trace file containing a copy of the trace data for one or more traces. Trace files are saved in Trace + State format.

Trace + State format defines the data to be saved as a file containing the trace data and a copy of the current analyzer state. The trace and state are stored in an internal data format (TRC), which cannot be viewed on a PC, but can be recalled back into the analyzer. Traces can be recalled individually or as a group.

When a Trace + State file is recalled into the analyzer the trace data that was on the screen, when saved, is recalled into the analyzer. This enables you to view the trace as it looked when it was saved. Because the state data is also saved, the analyzer settings, including all the annotation on the screen, is restored as well.

To preserve the trace data, the traces contained in the saved files are placed in View mode (see Trace/View) so that they are not immediately overwritten by new trace data. This means that you can save traces while making a measurement, and later recall them back into the analyzer. Then you can print them or transfer them to a computer, in XLS format (using Measurement Results Data), for analysis. If you want to compare two saved traces, place both traces in view mode before saving them. This prevents the trace from being rewritten based on a state change from subsequent recalls.

Mode	All
Key Path	Save, Type, Trace

Measurement Results Data Defines the data to be saved as a file containing a copy of the analyzer measurement data that was current at the time the file is saved. Measurement results files are saved in .xls format (for importing into spreadsheets). That is, a file containing trace data in a Microsoft Excel Spreadsheet format for analysis. They cannot be recalled back into the analyzer. A Measurement Results file cannot be recalled into the analyzer.

Mode	All
Key Path	Save, Type, Measurement Results,

Source

Enables you to select the source for the information you want to save.

- When **Type** is set to **Trace**, **Source** enables you to save trace 1, 2, 3, or 4 along with state. **All** saves all traces in a single .trc file, along with the state.

For any other Save type, **Source** is disabled (grayed out).

Mode	All
Preset	File save source survives Preset and *RST, but is set to All Traces at power up.
State Saved	File save format is not saved in the instrument state
Key Path	Save, Source

Trace 1 Selects trace 1 to be saved.

Mode	All
Key Path	Save, Source, Trace 1

Trace 2 Selects trace 2 to be saved.

Mode	All
Key Path	Save, Source, Trace 2

Trace 3 Selects trace 3 to be saved.

Mode	All
Key Path	Save, Source, Trace 3

Trace 4 Selects trace 4 to be saved.

Mode	All
Key Path	Save, Source, Trace 4

All Selects all traces to be saved in a single file.

Mode	All
Key Path	Save, Source, All

Name

Access a menu that enables you to set a file-naming method, enter a filename, and select file save rules.

Mode	All
Key Path	Save, Name

Filename Enables you to select the method used to select the name for the file you are saving. You can toggle between the Auto, User, and Ask naming methods.

- When Auto is selected and you press **Save Now**, the analyzer will pick a filename for you based on

the table below.

- *For Trace and State* – the ### in the auto-generated file name represents a three-digit number which the analyzer has chosen to be the lowest number in the current sequence that does not conflict with an existing file name. The number starts at 000 with a new analyzer or after the installation of new firmware and counts up with each attempted Save. After a Restore Sys Defaults, the number will start at a number that may be lower than the lowest number of the existing files in the currently saved files. The number counts up with each attempted Save, but will skip the numbers already in use and not over write existing files.
- *For Screen* – the #####_##### in the auto-generated file name represents the date (yyyymmdd) and time in seconds that the fill was saved.

Type	Auto-Generated File Name	Extension
State	State###	.sta
Trace	Trace###	.trc
Screen	Screen_#####_#####	.png

- When User is selected and you press **Save Now**, the analyzer will use the same auto increment algorithm as in Auto mode, except that instead of using the default base name it will use the name you have entered in the User Filename.
- When Ask is selected and you press **Save Now**, the analyzer will display the Alpha Editor and enable you to enter a filename. The numeric keypad can also be used while entering file names. Press Enter or Return to complete the name entry.

Uppercase (A-Z), lowercase letters (a-z), and digits (0–9) may appear in file names. Additionally, file names include a 3-digit extension that is automatically set by the instrument depending on the file type and format.

NOTE Never remove the external memory media during a save operation. To do so could corrupt all data on the memory media.

Mode	All
Preset	Filename survives Factory Preset, *RST, and power on.
Range	Auto User Ask
Key Path	Save, Name, Filename

User Filename Accesses the Alpha Editor and enables you to enter a filename.

NOTE Uppercase (A-Z), lowercase letters (a-z), and digits (0–9) may appear in file names. Additionally, file names include a 3-character extension that is automatically set by the instrument.

Mode	All
Preset	User Filename survives Factory Preset, *RST, and power on.
Key Path	Save, Name, User Filename

If File Exists... Enables you to select the action to take if the analyzer detects the selected file already exists. You can choose to Overwrite, Append, Prompt, Auto Incr, or Timestamp. For more information on these functions, refer to the following key descriptions.

Mode	All
Preset	If File Exists... setting survives Factory Preset, *RST, and power on.
Key Path	Save, Name, If File Exists...

Overwrite If the analyzer detects the file name already exists, the existing file will be overwritten by the new file.

Mode	All
Key Path	Save, Name, If File Exists..., Overwrite

Append If the analyzer detects a Measurement Results Data file of the same name already exists, the new data will be appended to the end of the existing file data. Append is not applicable to screens captures, states, or trace data.

Mode	All
Key Path	Save, Name, If File Exists..., Append

Prompt If the analyzer detects the file name already exists, a screen will be displayed asking you if you want to Overwrite the existing file or append the new data onto the existing file data.

Mode	All
Key Path	Save, Name, If File Exists..., Prompt

Auto Incr If the analyzer detects the file name already exists, numeric characters will be added to the file name or existing numeric characters will be incremented to the next higher number.

Mode	All
Key Path	Save, Name, If File Exists..., Auto Incr

Timestamp If the analyzer detects the file name already exists, a timestamp date and time will be added to the file name.

Mode	All
Key Path	Save, Name, If File Exists..., Timestamp

Location

When you have selected a save type of Screen or Measurement Results, a screen listing the attached USB drives is displayed. Thus enabling you to select where you want to save the file when **Save Now** is pressed. (The drives are shown at the root level only; subdirectories cannot be selected.)

When you have selected a save type of State, a screen is displayed that enables you to save the state normally to the internal drive or export the state to a USB device.

Mode	All
Preset	Location survives Factory Preset, *RST, and power on.
Key Path	Save, Location

Catalog

This displays the directory defined by the current device and type. For example, the device could be the internal or external drive. The type might be screen, trace, state.

Utility and Control/Sweep Functions Utility Functions

Mode	All
Remote Command	:MMEMory:CATalog?
Example	MMEM:CAT lists the saved files.
Key Path	Save, Catalog

Delete Enables you to delete selected saved instrument states or traces. Pressing this key opens a list screen where you can select and remove from memory the saved state or traces that you want to delete.

Mode	All
Remote Command	:MMEMory:DElete <filename>?
Example	MMEM:DEL C:/MyTrace.sta deletes the saved state file MyTrace.sta.
Key Path	Save, Catalog, Delete

Move Data to a File (Remote Command Only)

This command loads a block of data in the format <definite_length_block> into the instrument memory location <'file_name'>. The query form of the command returns the contents of the file identified by <'file_name'>, in the format of a definite length block of data. The query can be used for copying files out of the analyzer over the remote bus.

Mode:	All
Remote Command	:MMEMory:DATA <'file_name'>,<definite_length_block> :MMEMory:DATA? <'file_name'>
SCPI Remarks	<definite length block> data: <ul style="list-style-type: none">• A definite length block of data starts with an ASCII header that begins with # and indicates how many additional data points are following in the block. Suppose the header is #512320.• The first digit in the header (5) tells you how many additional digits/bytes there are in the header.• The 12320 means 12,320 data bytes follow the header.• Divide this number of bytes by your selected data format bytes/point, either 8 (for real 64), or 4 (for real 32). In this example, if you are using real 64 then there are 1540 points in the block.

SCPI Example

MMEM:DATA 'C:\DEST.TXT', '#14abcd' Loads the data "abcd" into C:\DEST.TXT.

MMEM:DATA? 'C:\SCREN001.GIF' Initiates a transfer of data from file C:\SCREN001.GIF.

System

Accesses instrument level features that are available in all Modes and Measurements. These are features such as:

- External reference control
- System settings like time and date
- System/hardware information
- Input/Output interface settings
- Service information

Freq/Time Ref

Specifies the frequency reference as being internal or external. If the frequency reference is specified as internal, the frequency of the reference is automatically identified as being 10 MHz. If the frequency reference is specified as external, you must select the frequency of the external reference being used. If External Reference is selected, Ext Ref will appear on the right side of the display.

The frequency of an external frequency reference is not automatically detected. If an external frequency source is selected, the frequency of the source must be selected.

If the external reference is missing or out of range, or the frequency reference is unlocked, the Reference frequency source indicator on the lower right of the display will indicate red.

An external frequency of ½ Hz referred to as “even second” time reference may be specified with the value of 0.5 Hz. This is used as a CDMA reference frequency and also synchronizes the timing of CDMA measurements.

Mode	All
Remote Command	[:SENSe] :ROSCillator :SOURce INTernal EXTernal [:SENSe] :ROSCillator :SOURce?
Example	ROSC:SOUR EXT selects the external reference.
Notes	The only Frequency value available for the Internal Reference is 10 MHz. For the External Reference, the possible Frequency values are 0.5 Hz 1 MHz 2.1048 MHz 4.95 MHz 10 MHz 13 MHz 15 MHz 19.6608 MHz. See details in next table.
Preset	INTernal

Utility and Control/Sweep Functions

Utility Functions

State Saved	Not Saved in Instrument State. Neither the external reference frequency nor the state of this function (Int or Ext) are affected by factory preset or power cycle.
Key Path	System, Freq/Time Ref
Mode	All
Remote Command	<code>[:SENSE] :ROSCillator:EXTernal:FREQuency 0.5HZ 1MHZ 2.1048MHZ 4.95MHZ 10MHZ 13MHZ 15MHZ 19.6608MHZ</code> <code>[:SENSE] :ROSCillator:EXTernal:FREQuency?</code>
Example	<code>ROSC:EXT:FREQ 13 MHz</code> sets the external reference frequency to 13 MHz, but does not select the external reference. <code>ROSC:SOUR EXT</code> selects the external reference.
Notes	Only the values shown are valid External Frequencies. You may specify these in numeric form, but they are interpreted as an enumeration and an error will result if the value does not match one of the choices in the list.
Remote Command Notes	Before switching to the external reference source, specify the frequency of the external reference that you plan to use.
Preset	Not affected by Preset.
State Saved	Not Saved in Instrument State. Neither the external reference frequency nor the state of this function (Int or Ext) are affected by Preset or power cycle.
Min	1 MHz The external even second reference is set remotely by selecting 0.5 Hz.
Max	19.6608 MHz
Key Path	System, Freq/Time Ref

Time/Date/Location

Displays the Time/Date/Location function menu keys used to set and display the real-time clock.

Mode	All
Key Path	System, Time/Date/Location

Time/Date Displays the Time/Date function menu keys used to set and display the real-time clock.

Mode	All
Key Path	System, Time/Date/Location, Time/Date

Time/Date Turns the display of the real-time clock On or Off.

Mode	All
Remote Command	:DISPlay:ANNotation:CLOCk[:STATe] OFF ON 0 1 :DISPlay:ANNotation:CLOCk[:STATe]?
Example	DISP:ANN:CLOC ON
Preset	On
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Key Path	System, Time/Date/Location, Time/Date, Time/Date

Date Format Enables you to set the date display to month-day-year or day-month-year. It is set to a month-day-year format when the instrument System Defaults are restored. This key only effects display of date at the top of the screen, not in the file catalog.

Mode	All
Remote Command	:DISPlay:ANNotation:CLOCk:DATE:FORMat MDY DMY :DISPlay:ANNotation:CLOCk:DATE:FORMat?
Example	DISP:ANN:CLOC:DATE:FORM DMY
Preset	MDY
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Key Path	System, Time/Date/Location, Time/Date, Date Format

Set Time Enables you to set the time of the real-time clock. Enter the time in 24 hour HHMMSS format.

Mode	All
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Utility and Control/Sweep Functions

Utility Functions

Remote Command	:SYSTem:TIME <hour>, <minute>, <second> :SYSTem:TIME?
Example	SYST:TIME 12,42,00 Sets the clock to 12:42:00 PM.
Preset	Not affected by Preset. Depends on the time of the day.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Range	Hour (HH): 00 to 23 Minute (MM): 00 to 59 Second (SS): 00 to 59
Key Path	System, Time/Date/Location, Time/Date, Set Time

Set Date Enables you to set the date of the real-time clock. Enter the date in the YYYYMMDD format.

Mode	All
Remote Command	:SYSTem:DATE <year>, <month>, <day> :SYSTem:DATE?
Example	SYST:DATE 2000,12,24 Sets the date to December 24, 2000
Preset	Not affected by Preset. Depends on the date of the day.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Range	Year (YYYY): 1970 to 2037 Month (MM): 01 to 12 Day: 01 to 31
Min	1970,1,1
Max	2037,12,31
Key Path	System, Time/Date/Location, Time/Date, Set Date

Controls

Displays the menu keys used to manage the analyzer IP information and setting power conservation screen save settings.

Mode	All
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Utility and Control/Sweep Functions

Utility Functions

Mode	All
Preset	Not affected by Preset.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Key Path	System, Controls, IP Admin, IP Config

None Enables the option of not accepting a LAN connection. Even if a LAN connection is made, the network cannot connect to the instrument. This selection disables the IP Address, Net Mask and Gateway features.

Mode	All
Notes	Selecting None disables IP Address, Net Mask, and Gateway key functions.
Key Path	System, Controls, IP Admin, IP Config, None

DHCP Selects the DHCP function for assigning the IP address. When you connect to a network with DHCP selected, if the Host Name is recognized by the network, then an IP address and other network information will automatically assigned.

Mode	All
Notes	Selecting DHCP disables IP Address, Net Mask, and Gateway key functions.
Key Path	System, Controls, IP Admin, IP Config, DHCP

Static Lets you to select a static IP address. When you connect to a network, if the Host Name is recognized by the network, then the instrument will use the IP address that you choose.

Mode	All
Notes	Static is the only selection that allows you to set values for IP Address, Net Mask, and Gateway.
Key Path	System, Controls, IP Admin, IP Config, Static

IP Address Enables you to set the IP Address for your analyzer. If IP Config is set to DHCP, this key is unavailable and the IP Address is automatically assigned if the Host Name is recognized by the network. So the displayed IP address is not used. The IP address displayed on the menu key will only be used if IP Config is set to Static. To view the DHCP-assigned IP address, press Mode.

The Internet address is a 32-bit station Internet Protocol (IP) address by which a specific device on the network host can be found. An Internet address consists of a network number and a node ID. It is assigned to every host that wants to use TCP/IP to communicate across an internet:

- The address typically consists of a network and a host field
- IP addresses are written in dotted decimal notation; for example, 123.45.67.89

Mode	All
Preset	Not affected by Preset.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Key Path	System, Controls, IP Admin, IP Address

Net Mask Enables you to set the Net Mask for your analyzer. If IP Config is set to DHCP, this key is unavailable and the Net Mask is automatically assigned if the Host Name is recognized by the network. So the displayed setting is not used.

The IP network mask is a number that describes which portion of the device's IP address represents the network address and which portion of the IP address represents the host address. The mask contains 1s for the bit positions in the 32-bit address used for the network and subnet parts, and 0s for the host part. The mask should contain at least the standard network portion.

Mode	All
Preset	Not affected by Preset.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Key Path	System, Controls, IP Admin, Net Mask

Gateway Enables you to set the Gateway for your analyzer. If IP Config is set to DHCP, this key is unavailable and the Gateway is automatically assigned if the Host Name is recognized by the network. So the displayed setting is not used.

The Gateway is an IP Address that identifies the network gateway through which your instrument will be connected to the network. A Gateway is a device used to interconnect networks, subnets, or other network devices:

- Gateways allow networks using different communications protocols to transfer information.
- Equivalent to a router, a gateway is an intelligent device used to connect two or more networks at the upper protocol layers of the Open Systems Interconnection (OSI) reference model.
- The networks can use different protocols and different physical media.

Mode	All
------	-----

Utility and Control/Sweep Functions

Utility Functions

Preset	Not affected by Preset.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Key Path	System, Controls, IP Admin, Gateway

Save Saves the IP Admin data you have created. When you save this data, you will be required to reboot the analyzer for your changes to take effect.

Mode	All
Key Path	System, Controls, IP Admin, Save

Display Settings Displays the menu keys used to set the screen saver function to active and the time delay before the screen saver activates. You can set this time delay to different values depending on the power source, battery or external DC power supply.

Mode	All
Key Path	System, Control, Display Settings

Screen Save (Battery) Displays the table used to set the screen saver function to active and the time delay before the screen saver activates. You use this key to set the time delay when you are operating the analyzer on the internal battery or batteries. You can set Screen Save to Disabled, or to enabled with time intervals of 15 s., 30 s., 1 to 5 min. (in 1 min. intervals), 10 min., 15 min., 30 min., 45 min., or 60 min.

Mode	All
Preset	Not affected by Preset.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Range	15 s., 30 s., 1 min., 2 min., 3 min., 4 min., 5 min., 10 min., 15 min., 30 min., 45 min., or 60 min., Disabled
Key Path	System, Control, Display Settings, Screen Save (Battery)

Screen Save (Ext DC) Displays the table used to set the screen saver function to active and the time delay before the screen saver activates. You use this key to set the time delay when you are operating the analyzer on external DC power supply. You can set Screen Save to Disabled, or to enabled with time intervals of 15 s., 30 s., 1 to 5 min. (in 1 min. intervals), 10 min., 15 min., 30 min., 45 min., or 60 min.

Mode	All
Preset	Not affected by Preset.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Range	15 s., 30 s., 1 min., 2 min., 3 min., 4 min., 5 min., 10 min., 15 min., 30 min., 45 min., or 60 min., Disabled
Key Path	System, Control, Display Settings, Screen Save (Ext DC)

Power Switch Selects your preference for how the analyzer responds to an extended interruption of external power.

The **Power Switch (On)** setting turns the analyzer on whenever external power is applied. This mode is useful if an external power switch is used to control a rack of several instruments.

The **Power Switch (Off)** setting assigns analyzer on/off control to the front-panel **On/Standby** key (default setting). If the analyzer is on or in standby and the external power is removed and restored, the analyzer will remain in standby.

Mode	All
Preset	Not affected by Preset.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Default	Off
Key Path	System, Controls

System Stats

Displays the System Stats menu that enables you to View the following analyzer System Statistics:

- Check analyzer system software version
- Check analyzer memory size and availability
- Check analyzer battery status
- Verify copyrights

Mode	All
Key Path	System, System Stats

Utility and Control/Sweep Functions

Utility Functions

Rev Info Displays a table that lists the current version of software and key software and firmware components. The following information is listed: GUI revision and build time; JVM version; N1996A server version and build; GPS navigation and DSP firmware; Power supply firmware; Kernel version and build.

Mode	All
Remote Command	:SYSTem:VERSion?
Remote Command Notes	The query returns only the software version information.
Key Path	System, System Stats, Rev Info

Memory Displays a table that lists the current allocation and usage statistics of the available memory. Total and available memory information is listed.

Mode	All
Key Path	System, System Stats, Memory

Battery Displays a table that lists the status of the batteries. It shows whether a battery is present or missing. If the battery is present, the following information is listed: percent charged, run time until empty, fuel gage error, temperature, voltage, current draw, number of charge cycles, battery serial number, and manufacture date.

Mode	All
Key Path	System, System Stats, Battery

Copyrights Displays a table that lists the Agilent Technologies, Inc. firmware copyrights date and the copyrights for software components from other manufactures used in the analyzer.

Mode	All
Key Path	System, System Stats, Copyrights

Identification Query (Remote Command Only) Returns a string of instrument identification information. The string will contain the model number, serial number and software revision.

The response is organized into four fields separated by commas. The field definitions are as follows:

- Manufacturer
- Model
- Serial number
- Software version

Mode	All modes
Remote Command	*IDN?
Example	*IDN? Returns instrument identification information, such as: Agilent Technologies,N1996A,US45310109,A.01.02
Remote Command Notes	There is no equivalent key. But this information can found on the instrument “Splash Screen” by pressing the Mode key. Parts of this information are also found by pressing System, System Stats, and System, Option Manager, Install Info.
Key Path	No equivalent key. See related key System, System Stats, Identification Query (Remote Command Only)

Option Manager

Displays the System Stats menu that enables you to use the Option Manager to:

- View installed options
- View installable options (by user and by factory)
- View installation information
- Install an option

Mode	All
Key Path	System, Option Manager

Installed Options Displays a table that lists the options that have been installed and are licensed on your analyzer. If an option has been installed but not licensed, then it will not show on this list.

Mode	All
Remote Command	:SYSTEM:OPTIONS?

Utility and Control/Sweep Functions

Utility Functions

Example	SYST:OPT? returns a comma-separated list with quotes, of the options that are installed. For example: “503,P03,271”
Key Path	System, Options Manager, Installed Options
Mode	All
Remote Command	*OPT?

Installable Options Displays a table that lists the options, available at the time of the installed firmware release, that you can install or have Agilent install on your analyzer. The list will include: the available measurement options that you have licensed, the options that are installed but not licensed, and all other available options.

Mode	All
Key Path	System, Options Manager, Installable Options

Install an Option Displays a menu that enables you to install a user-installable option. You may install an option from a list of available options, from a file you have saved on a USB memory device, or by option type.

Mode	All
Key Path	System, Options Manager, Install an Option

From List Displays a table of available options for installation. Using the up and down navigation keys you can highlight and then select the option you want to install.

Mode	All
Key Path	System, Options Manager, Install an Option, From List

From File Displays a browser window for you to locate and select an option file from mass storage media for installation. Using the up and down navigation keys you can highlight and then select the option you want to install.

Mode	All
Key Path	System, Options Manager, Install an Option, From File

From Type Displays a form for you to enter an option identification number for installation. For example, 271 for the Spectrogram option or N8995A for the Stimulus/Response Measurement Suite option.

Mode	All
Key Path	System, Options Manager, Install an Option, From Type

Install Info Displays a table that lists the current manufacturing information about your analyzer that you must provide to Agilent to install a user-installable option. When you call your Agilent sales representative to order an option, you will need to provide the following information shown on this table:

- Model number
- Serial number
- Host ID

Mode	All
Key Path	System, Options Manager, Install Info

License Key (Remote command only) Enables you to enter the license key for the option to be installed. The license key is a hexadecimal number that will require entry of both letters and numbers. A license key is a 12-character hexadecimal string. The license key is unique to a specific option installed and instrument host ID.

Mode:	All
Remote Command	:SYSTem:LKEY <"Option">,<"LicenseKey"> :SYSTem:LKEY? <"option">
Key Path	No equivalent key.

Utility and Control/Sweep Functions

Utility Functions

SCPI Remarks	<p>The <“Option”> is a string that specifies the option or application that is to be installed. For example, 271 for Spectrogram or N8995A for Stimulus/Response Measurement Suite. The option must be enclosed in quotes.</p> <p>The <LicenseKey> is a 12-character hexadecimal string. The license key must be enclosed in quotes.</p> <p>The License key is unique to a specific combination of option and host ID. The license key can be obtained remotely by using the :SYSTem:LKEY? <Option> query. The Host ID can be obtained by pressing System, Option Manager, and Install Info.</p> <p>The query returns a string that contains the license key for a specified application or option that is already installed in the instrument. The license key will also be returned if the application is not currently in memory, but had been installed at some previous time. The license key is unique to a specific option and host ID.</p>
SCPI Example	<pre>SYST:LKEY “271”, “B043920A51CA”</pre> <pre>SYST:LKEY? “271”</pre> <p>The query would return “B043920A51CA”</p> <p>If the instrument does not have a license key for that option, the query would return “ “.</p>
Key Path	No equivalent key. Remote Command Only

Delete License (Remote command only) Deletes the license key from memory, however, the option firmware is not deleted.

Mode:	All
Remote Command	:SYSTem:LKEY:DELeTe <“Option”> [, <“LicenseKey”>]
Key Path	No equivalent key.
SCPI Remarks	<p>The <“Option”> is a string that specifies the option or application license to be deleted. For example, 271 for Spectrogram or N8995A for Stimulus/Response Measurement Suite. The option must be enclosed in quotes.</p> <p>The <LicenseKey> is a 12-character hexadecimal string and is optional. When provided, the license key must be enclosed in quotes.</p> <p>The license key can be obtained remotely by using the :SYSTem:LKEY? <Option> query or manually by pressing System, Option Manager, and Installed Options.</p>
SCPI Example	SYST:LKEY:DEL “N8995A”
Key Path	No equivalent key., Self Test Query (Remote Command Only)

Service

Displays a menu that enables you to perform two simple tests to check basic system functionality: a display test and a keyboard test.

Mode	All
Key Path	System, Service

Verification Displays a menu that enables you to perform two simple tests to check basic system functionality: a display test and a keyboard test.

Mode	All
Key Path	System, Service, Functional Checks

Display Test Displays a screen with instructions that you follow to check the correct operation of your display device. The display tests consists of two color tests and two hue tests performed using one of five colors you select.

Mode	All
Key Path	System, Service, Verification, Display Test

Test #1 Sets the display to the color you have selected using Set Test Color. The screen will appear a solid color if the display is working correctly. If the color does not match the expected color, the display has failed the test. Press Esc to return to the display test instruction screen.

Mode	All
Key Path	System, Service, Verification, Display Test, Test #1

Test #2 Sets the display to the color you have selected using Set Test Color. The screen will appear with vertical strips of black and the color you have selected if the display is working correctly. If you have selected black as the test color, the screen will appear solid black. If the stripes of color do not match the expected color, the display has failed the test. Press Esc to return to the display test instruction screen.

Mode	All
Key Path	System, Service, Verification, Display Test, Test #2

Utility and Control/Sweep Functions

Utility Functions

Set Test Color Enables you to set the display color. You can set the color to white, black, red, green, or blue.

Mode	All
Preset	White
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Range	white, black, red, green, or blue
Key Path	System, Service, Verification, Display Test, Set Test Color

Custom Half Brightness Sets the display to red, the same as that available under Set Test Color, but with the hue at half the intensity of the full color hue. You can adjust the hue using the front-panel knob. When the screen appears black, you have reached the end of the intensity adjustment. If the display is working correctly, the screen will appear a solid red approximately half as bright as in the Color Test #1. If the analyzer fails this test, the screen will not adjust to a half hue level of red. Press Esc to return to the display test instruction screen.

Mode	All
Preset	Not affected by Preset.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Key Path	System, Service, Verification, Display Test, Custom Half Brightness

Custom Full Brightness Sets the display to red, the same as that available under Set Test Color with the intensity of the full color hue. You can adjust the hue using the front-panel knob. When the screen appears black, you have reached the end of the hue adjustment. The screen will appear solid red with full hue intensity if the display is working correctly. If the analyzer fails this test, the screen will not adjust to a fully intense red hue. Press Esc to return to the display test instruction screen.

Mode	All
Preset	Not affected by Preset.
State Saved	Survives Preset and power cycle, but not saved in Instrument State.
Key Path	System, Service, Verification, Display Test, Custom Full Brightness

Keyboard Test Displays a table screen that enables you to verify the correct operation of your front-panel keys, menu keys, navigation keys, and the front-panel knob. The display lists all of the keys on the analyzer followed by a zero (0). The integer toggles by one every time you press the listed key. Press Esc to exit the Keyboard Test. Pressing the Mode key will not exit the test.

Mode	All
Notes	This test will also check the external keyboard, if it is attached.
Key Path	System, Service, Verification, Keyboard Test

Self Test Query (Remote Command Only) This query performs the internal self-test routines and returns a number indicating the success of the testing. A zero is returned if the test is successful, 1 if it fails.

Mode	All modes
Remote Command	*TST?
Example	*TST? Runs the self-test routines and returns 0 = passed, 1 = some part failed.
Key Path	No equivalent key., Self Test Query (Remote Command Only)

User Preset

User Preset behaves similarly to Recall State in that it recalls a hidden Save State file.

The User Preset file is a Save State file. **User Preset** sets the state of all modes back to the state that was previously saved using the **Save User Preset** menu key or the `SYST:PRES:USER:SAVE` command.

The user has no control over the user preset filename and has no direct access to the user preset file.

The instrument always powers up in the User Preset state.

User Preset recalls a state which includes all of the variables affected by doing a full preset. It not only recalls Mode Preset settings, but it also recalls all of the mode persistent settings and possibly data. Each mode determines whether data is part of mode state.

If a **Save User Preset** has not been done at any time, **User Preset** recalls the default user preset file for the currently active mode. The default user preset files are created at power-on when each mode detects there is no user preset file, so there will never be a scenario when there is no user preset file to restore. For each mode, the default user preset state is the same state that would be saved if a **Save User Preset** is performed in each mode right after doing a Restore Mode Default and after a Restore Input/Output Settings Defaults.

User Preset does the following:

- Aborts the currently running measurement
- Recalls the state.
- Clears the input and output buffers.

Utility and Control/Sweep Functions

Utility Functions

- Status Byte is set to 0.

Remote Command	:SYSTem:PRESet:USER
Example	:SYST:PRES:USER:SAVE :SYST:PRES:USER
Restriction and Notes	Clears all pending OPC bits. The Status Byte is set to 0.
Dependencies/Couplings	A user preset will cause the currently running measurement to be aborted and cause the saved measurement to be active. Recalling a User Preset file has the same issues that recalling a Save State file has. Some settings may need to be limited and therefore re-coupled, since the capabilities of the mode may have changed when the User Preset file was last saved.
Remote Command Notes	:SYST:PRES:USER:SAVE is used to save the current state as the user preset state.
Key Path	User Preset

Save User Preset

Save User Preset saves the current state. The way the user recalls this User Preset file is by pressing the User Preset menu key or sending the SYST:PRES:USER remote command. This same state is also saved by the Save State function.

Remote Command	:SYSTem:PRESet:USER:SAVE
Example	:SYST:PRES:USER:SAVE
Restriction and Notes	:SYST:PRES:SAVE creates the same file as if the user requested a *SAV or a MMEM:STOR:STAT, except User Preset Save does not allow the user to specify the filename or the location of the file.
Key Path	User Preset

The latest instrument software and documentation can be found at:
<http://www.agilent.com/find/csa>

- “SCPI Language Basics” on page 458
- “Improving Measurement Speed” on page 465
- “Using the LAN to Control the Instrument” on page 467

SCPI Language Basics

This section is not intended to teach you everything about the SCPI (Standard Commands for Programmable Instruments) programming language. The SCPI Consortium or IEEE can provide that level of detailed information.

Topics covered in this chapter include:

- “Creating Valid Commands” on page 458
- “Command Keywords and Syntax” on page 458
- “Special Characters in Commands” on page 459
- “Parameters in Commands” on page 461
- “Putting Multiple Commands on the Same Line” on page 463

For more information refer to:

IEEE Standard 488.1-1987, *IEEE Standard Digital Interface for Programmable Instrumentation*. New York, NY, 1998.

IEEE Standard 488.2-1987, *IEEE Standard Codes, Formats, Protocols and Comment Commands for Use with ANSI/IEEE Std488.1-1987*. New York, NY, 1998.

Command Keywords and Syntax

A typical command is made up of keywords set off by colons. The keywords are followed by parameters that can be followed by optional units.

Example: `SENSe:FREQuency:STARt 1.5 MHZ`

The instrument does not distinguish between upper and lower case letters. In the documentation, upper case letters indicate the short form of the keyword. The lower case letters, indicate the long form of the keyword. Either form may be used in the command.

Example: `Sens:Freq:Star 1.5 mhz`

is the same as `SENSE:FREQ:start 1.5 MHz`

NOTE

The command `SENS:FREQU:STAR` is not valid because `FREQU` is neither the short, nor the long form of the command. Only the short and long forms of the keywords are allowed in valid commands.

Creating Valid Commands

Commands are not case sensitive and there are often many different ways of writing a particular command. These are examples of valid commands for a given

command syntax:

Command Syntax	Sample Valid Commands
[SENSe:] BANDwidth[:RESolution] <freq>	<p>The following sample commands are all identical. They will all cause the same result.</p> <ul style="list-style-type: none"> • Sense:Band:Res 1700 • BANDWIDTH:RESOLUTION 1.7e3 • sens:band 1.7KHZ • SENS:band 1.7E3Hz • band 1.7kHz • bandwidth:RES 1.7e3Hz
MEASure:SPECTrum[n] ?	<ul style="list-style-type: none"> • MEAS:SPEC? • Meas:spec? • meas:spec3? <p>The number 3 in the last meas example causes it to return different results then the commands above it. See the command description for more information.</p>
[[:SENSe]:DETector[:FUNCTION] NEGative POSitive SAMPLE	<ul style="list-style-type: none"> • DET:FUNC neg • Detector:Func Pos
INITiate:CONTinuous ON OFF 1 0	<p>The sample commands below are identical.</p> <ul style="list-style-type: none"> • INIT:CONT ON • init:continuous 1

Special Characters in Commands

Special Character	Meaning	Example
	A vertical stroke between parameters indicates alternative choices. The effect of the command is different depending on which parameter is selected.	<p>Command: TRIGger:SOURce EXTernal INTernal LINE</p> <p>The choices are external, internal, and line. Ex: TRIG:SOURCE INT</p> <p>is one possible command choice.</p>
	A vertical stroke between keywords indicates identical effects exist for both keywords. The command functions the same for either keyword. Only one of these keywords is used at a time.	<p>Command: SENSE: BANDwidth BWIDth:OFFSet</p> <p>Two identical commands are: Ex1: SENSE: BWIDTH: OFFSET Ex2: SENSE: BAND: OFFSET</p>

Programming Fundamentals
SCPI Language Basics

Special Character	Meaning	Example
[]	keywords in square brackets are optional when composing the command. These implied keywords will be executed even if they are omitted.	Command: [SENSe:]BANDwidth[:RESolution]:AUTO The following commands are all valid and have identical effects: Ex1: bandwidth:auto Ex2: band:resolution:auto Ex3: sense:bandwidth:auto
< >	Angle brackets around a word, or words, indicates they are not to be used literally in the command. They represent the needed item.	Command: SENS:FREQ <freq> In this command example the word <freq> should be replaced by an actual frequency. Ex: SENS:FREQ 9.7MHz.
{ }	Parameters in braces can optionally be used in the command either not at all, once, or several times.	Command: MEASure:BW <freq>{ ,level} A valid command is: meas:BW 6 MHz, 3 dB, 60 dB

Parameters in Commands

There are four basic types of parameters: booleans, keywords, variables and arbitrary block program data.

OFF|ON|0|1
 (Boolean) This is a two state boolean-type parameter. The numeric value 0 is equivalent to OFF. Any numeric value other than 0 is equivalent to ON. The numeric values of 0 or 1 are commonly used in the command instead of OFF or ON. Queries of the parameter always return a numeric value of 0 or 1.

keyword The keywords that are allowed for a particular command are defined in the command syntax description.

Units Numeric variables may include units. The valid units for a command depend on the variable type being used. See the following variable descriptions. The indicated default units will be used if no units are sent. Units can follow the numerical value with, or without, a space.

Variable A variable can be entered in exponential format as well as standard numeric format. The appropriate range of the variable and its optional units are defined in the command description.

The following keywords may also be used in commands, but not all commands allow keyword variables.

- DEFault - resets the parameter to its default value.
- UP - increments the parameter.
- DOWN - decrements the parameter.
- MINimum - sets the parameter to the smallest possible value.
- MAXimum - sets the parameter to the largest possible value.

The numeric value for the function's MINimum, MAXimum, or DEFault can be queried by adding the keyword to the command in its query form. The keyword must be entered following the question mark.

Example query: SENSE:FREQ:CENTER? MAX

Variable Parameters

<integer> is an integer value with no units.

<real> Is a floating point number with no units.

<freq>

<bandwidth> Is a positive rational number followed by optional units. The default unit is Hertz. Acceptable units include: Hz, kHz, MHz, GHz.

<time>	
<seconds>	Is a rational number followed by optional units. The default units are seconds. Acceptable units include: ks, s, ms, us, ns.
<voltage>	Is a rational number followed by optional units. The default units are Volts. Acceptable units include: V, mV, uV, nV
<current>	Is a rational number followed by optional units. The default units are Amperes. Acceptable units include: A, mA, uA, nA.
<power>	Is a rational number followed by optional units. The default units are W. Acceptable units include: mAW, kW, W, mW, uW, nW, pW.
<ampl>	Is a rational number followed by optional units. The default units are dBm. Acceptable units include: dBm, dBmV, dBuV.
<rel_power>	
<rel_ampl>	Is a positive rational number followed by optional units. The default units are dB. Acceptable units include: dB.
<percent>	Is a rational number between 0 and 100. You can either use no units or use PCT.
<angle>	
<degrees>	Is a rational number followed by optional units. The default units are degrees. Acceptable units include: DEG, RAD.
<string>	Is a series of alpha numeric characters.
<bit_pattern>	Specifies a series of bits rather than a numeric value. The bit series is the binary representation of a numeric value. There are no units. Bit patterns are most often specified as hexadecimal numbers, though octal, binary or decimal numbers may also be used. In the SCPI language these numbers are specified as: <ul style="list-style-type: none">• Hexadecimal, #Hdddd or #hdddd where 'd' represents a hexadecimal digit 0 to 9 and 'a' to 'f'. So #h14 can be used instead of the decimal number 20.• Octal, #Odddddd or #oddddd where 'd' represents an octal digit 0 to 7. So #o24 can be used instead of the decimal number 20.• Binary, #Bdddddddddddddd or #bdddddddddddddd where 'd' represents a 1 or 0. So #b10100 can be used instead of the decimal number 20.

Block Program Data

Some parameters consist of a block of data. There are a few standard types of block data. Arbitrary blocks of program data can also be used.

<trace>	Is an array of rational numbers corresponding to displayed trace data. See FORMat:DATA for information about available data
---------	---

formats.

A SCPI command often refers to a block of current trace data with a variable name such as: Trace1, TRACE2, or trace3, depending on which trace is being accessed.

<arbitrary block data> Consists of a block of data bytes. The first information sent in the block is an ASCII header beginning with #. The block is terminated with a semi-colon. The header can be used to determine how many bytes are in the data block. There are no units. (You will not get block data if your data type is ASCII, using `FORMat :DATA ASCII` command. Your data will be comma separated ASCII values.

Block data example: suppose the header is #512320.

- The first digit in the header (5) tells you how many additional digits/bytes there are in the header.
- The 12320 means 12 thousand, 3 hundred, 20 data bytes follow the header.
- Divide this number of bytes by your current data format (bytes/data point), either 8 (for real,64), or 4 (for real,32). For this example, if you're using real64 then there are 1540 points in the block.

Putting Multiple Commands on the Same Line

Multiple commands can be written on the same line, reducing your code space requirement. To do this:

- Commands must be separated with a semicolon (;).
- If the commands are in different subsystems, the key word for the new subsystem must be preceded by a colon (:).
- If the commands are in the same subsystem, the full hierarchy of the command key words need not be included. The second command can start at the same key word level as the command that was just executed.

SCPI Termination and Separator Syntax

A terminator must be provided when an instrument is controlled. Most interfaces automatically provide a terminator. A semicolon (;) is not a SCPI terminator, it is a separator. The purpose of the separator is to queue multiple commands or queries in order to obtain multiple actions and/or responses.

All binary trace and response data is terminated with `<NL><END>`, as defined in Section 8.5 of IEEE Standard 488.2-1992, *IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1-1987*. New York, NY, 1992. (Although one intent of SCPI is to be interface independent, `<END>` is only defined for IEEE 488 operation.)

Programming Fundamentals

SCPI Language Basics

The following are some examples of good and bad commands. The examples are created from a theoretical instrument with the simple set of commands indicated below:

```
[ :SENSe]
  :POWer
    [:RF]
    :ATTenuation 40dB

:TRIGger
  [:SEQuence]
  :EXTernal [1]
  :SLOPe
    POSitive

[:SENSe]
  :FREQuency
    :STARt
  :POWer
  [:RF]
  :MIXer
    :RANGe
    [:UPPer]
```

Bad Command	Good Command
PWR:ATT 40dB	POW:ATT 40dB
The short form of POWER is POW , not PWR .	
FREQ:STAR 30MHz;MIX:RANG -20dBm	FREQ:STAR 30MHz;POW:MIX:RANG -20dBm
The MIX:RANG command is in the same :SENSE subsystem as FREQ , but executing the FREQ command puts you back at the SENSE level. You must specify POW to get to the MIX:RANG command.	
FREQ:STAR 30MHz;POW:MIX RANG -20dBm	FREQ:STAR 30MHz;POW:MIX:RANG -20dBm
MIX and RANG require a colon to separate them.	
:POW:ATT 40dB;TRIG:FREQ:STAR 2.3GHz	:POW:ATT 40dB;:FREQ:STAR 2.3GHz
:FREQ:STAR is in the :SENSE subsystem, not the :TRIGGER subsystem.	
:POW:ATT?::FREQ:STAR?	:POW:ATT?::FREQ:STAR?
:POW and FREQ are within the same :SENSE subsystem, but they are two separate commands, so they should be separated with a semicolon, not a colon.	
:POW:ATT -5dB;:FREQ:STAR 10MHz	:POW:ATT 5dB;:FREQ:STAR 10MHz
Attenuation cannot be a negative value.	

Improving Measurement Speed

There are some basic things you can do in your programs to make them run faster:

“Use binary data format instead of ASCII” on page 465

“Avoid unnecessary use of *RST.” on page 465

“Minimize DUT/instrument setup changes.” on page 466

Use binary data format instead of ASCII

The ASCII data format is the instrument default since it is easier for people to understand and is required by SCPI for *RST. However, data input/output is faster using the binary formats.

:FORMat:DATA REAL, 64 selects the 64-bit binary data format for all your numerical data queries. You may need to swap the byte order if you are using a PC rather than UNIX. **NORMal** is the default byte order. Use **:FORMat:BOReR SWAP** to change the byte order so that the least significant byte is sent first. (Real,32 which is smaller and somewhat faster, should only be used if you don't need full resolution for your data. Some frequency data may require full 64 bit resolution.)

When using the binary format, data is sent in a block of bytes with an ASCII header. A data query would return the block of data in the following format: #DNNN<nnn binary data bytes>

To parse the data:

- Read two characters (#D), where D tells you how many N characters follow the D character.
- Read D characters, the resulting integer specifies the number of data bytes sent.
- Read the bytes into a real array.

For example, suppose the header is #512320.

- The first character/digit in the header (5) tells you how many additional digits there are in the header.
- The 12320 means 12 thousand, 3 hundred, 20 data bytes follow the header.
- Divide this number of bytes by your current data format (bytes/data point), 8 for real,64. For this example, there are 1540 data points in the block of data.

Avoid unnecessary use of *RST.

Remember that while *RST does not change the current Mode, it presets all the measurements and settings to their factory defaults. This forces you to reset your analyzer's measurement settings even if they use similar mode setup or measurement settings. See [Minimize DUT/instrument setup changes](#). below. (Also note that *RST may put the instrument in single measurement/sweep for some modes.)

Minimize DUT/instrument setup changes.

Some instrument setup parameters are common to multiple measurements. You should look at your measurement process with an eye toward minimizing setup changes. If your test process involves nested loops, make sure that the inner-most loop is the fastest. Also, check if the loops could be nested in a different order to reduce the number of parameter changes as you step through the test.

Using the LAN to Control the Instrument

Refer to the function description chapters for information about configuring the instrument input/output settings from the front panel. Use the SYSTem commands to change settings remotely.

NOTE

Remember that in any type programming using LAN you should avoid constantly opening and closing connections. This uses up processing resources, adds to your system overhead, and can cause problems with asynchronous implementation of successive commands. When you are sending the instrument multiple commands: open the connection, send all the commands, and close the connection.

- [“Using Telnet to Send Commands” on page 467](#)
- [“Using Socket LAN to Send Commands” on page 471](#)
- [“Using SICL LAN to Control the Instrument” on page 472](#)
- [“Using HP/Agilent VEE Over Socket LAN” on page 477](#)
- [“General LAN Troubleshooting” on page 479](#)

Using Telnet to Send Commands

Using telnet to send commands to your instrument works in a similar way to communicating over GPIB. You establish a connection with the instrument, and then send or receive information using SCPI commands.

NOTE

If you need to control the bus using “device clear” or SRQ’s, you can use SICL LAN. SICL LAN provides control of your instrument via IEEE 488.2 GPIB over the LAN. See [“Using SICL LAN to Control the Instrument” on page 472](#).

NOTE

STATus bits that are already set when the socket connection is made cannot be read. Only status bit changes that occur after the socket connection is made will be returned when the status register is queried.

On unix or PC:

The syntax of the telnet command is:

```
telnet <IP address> <5023>
```

The initial telnet connection message will be displayed and then a SCPI> prompt. At the SCPI prompt, simply enter the desired SCPI commands.

On a PC (with telnet gui that has host/port setting menu):

You would type at the dos prompt

```
telnet
```

NOTE

Early versions of Windows XP Telnet will initially only send a LF, not a CRLF. So the telnet port 5023 does not work. You can manually correct this situation by sending the escape sequence and then a CRLF. After connecting to the instrument, type in the telnet window:

- Ctrl-] (press the control and] keys simultaneously)
- set crlf <enter key>
- <enter key>

You should now see the SCPI> prompt and you can continue working.

The Windows XP Service Pack 2 fixes this problem. You can get Service Pack 2 from the Microsoft Windows update website.

Unix Telnet Example:

To connect to the instrument with host name and port number 5023, enter the following command:

```
telnet A-N1996A-00265 5023
```

When you connect to the instrument, it will display a welcome message and a command prompt. The instrument is now ready to accept your SCPI commands. As you type SCPI commands, query results appear on the next line. At any time, you can send a <device clear> by pressing ctrl-c on your keyboard. When you are done, break the telnet connection using your escape character, and type `quit`.

When the instrument responds with the welcome message and the SCPI prompt, you can immediately enter programming (SCPI) commands. Typical commands might be:

```
CALC:MARK:MODE POS
CALC:MARK:MAX
CALC:MARK:X?
```

The small program above sets the instrument to measure a signal amplitude by placing a marker on the maximum point of the trace, and then querying the instrument for the amplitude of the marker.

You need to press Enter after typing in each command. After pressing Enter on the last line in the example above, the instrument returns the amplitude level of the marker to your computer and displays it on the next line. For example, after typing `CALC:MARK:MAX?` and pressing Enter, the computer could display:

```
+2.500000000000E+009
```

When you are done, close the telnet connection. Enter the escape character to get the telnet prompt. The escape character (Ctrl and “]” in this example) does not print.

At the telnet prompt, type `quit` or `close`.

The telnet connection closes and you see your regular prompt.

```
Connection closed.
```

The following example shows a terminal screen using the example commands above.

Telnet Example:

```
Welcome to at42

Agilent Technologies,N1996A,US45310095,A.01.04 20060921
10:52:07

SCPI>calc:mark:mode pos
SCPI>calc:mark:max
SCPI>calc:mark:x?
+2.5000000000000000E+009
SCPI>
```

NOTE

If your telnet connection is in a mode called “line-by-line,” there is no local echo. This means you will not be able to see the characters you are typing on your computer's display until *after* you press the Enter key.

To remedy this, you need to change your telnet connection to “character-by-character” mode. This can be accomplished in most systems by escaping out of telnet to the `telnet>` prompt and then typing `mode char`. If this does not work, consult your telnet program's documentation for how to change to “character-by-character” mode.

The Standard UNIX TELNET Command:

Synopsis `telnet [host [port]]`

Description The `telnet` command is used to communicate with another host using the TELNET protocol. When `telnet` is invoked with `host` or `port` arguments, a connection is opened to `host`, and input is sent from the user to `host`.

Options and Parameters `telnet` operates in line-by-line mode or in character-at-a-time mode. In line-by-line mode, typed text is first echoed on the screen. When the line is completed by pressing the **Enter** key, the text line is then sent to `host`. In character-at-a-time mode, text is echoed to the screen and sent to `host` as it is typed.

In some cases, if your `telnet` connection is in “line-by-line” mode, there is no local echo. This means you will not be able to see the characters you are typing on your computer's display until *after* you press the **Enter** key.

To remedy this, you need to change your `telnet` connection to “character-by-character” mode. This can be accomplished in most systems by escaping out of `telnet` to the `telnet>` prompt and then typing `mode char`. Consult your `telnet` program's documentation for how to change to “character-by-character” mode.

Using Socket LAN to Send Commands

Your instrument implements a sockets Applications Programming Interface (API) compatible with Berkeley sockets, Winsock, and other standard sockets APIs. You can write programs using sockets to control your instrument by sending SCPI commands to a socket connection you create in your program.

Setting Up Your Instrument for Socket Programming

Before you can use socket programming, you must identify your instrument's socket port number. The default is 5025.

The port number you will use for your socket connection to the instrument is 5025.

NOTE

STATUS bits that are already set when the socket connection is made cannot be read. Only status bit changes that occur after the socket connection is made will be returned when the status register is queried.

Troubleshooting help:

You can verify that you can open a socket connection to your instrument by using telnet:

```
telnet <IP address> 5025
```

Characters typed from your keyboard won't be echoed from the instrument and the SCPI prompt won't be given. However, you will be able to send commands and query the instrument. For example, you can type `*idn?` and the instrument identification string will be returned.

Using SICL LAN to Control the Instrument

SICL LAN is a LAN protocol using the Standard Instrument Control Library (SICL). It provides control of your instrument over the LAN, using a variety of computing platforms, I/O interfaces, and operating systems. With SICL LAN, you control your remote instrument over the LAN with the same methods you use for a local instrument connected directly to the controller with a GPIB. More information about SICL LAN can be found in the *HP Standard Instrument Control Library* user's guide for HP-UX, part number E2091-90004.

Your instrument implements a SICL LAN *server*. To control the instrument, you need a SICL LAN *client* application running on a computer or workstation that is connected to the instrument over a LAN. Typical applications implementing a SICL LAN client include

- Agilent VEE
- Agilent BASIC
- National Instrument's LabView with Agilent VISA/SICL client drivers

NOTE

The SICL LAN protocol is Agilent's implementation of the VXI-11.3 Instrument Protocol, defined by the VXIbus Consortium working group.

Older versions of National Instruments' VISA does not support the VXI-11.3 Instrument Protocol. Contact National Instruments for their latest version.

SICL LAN can be used with Windows 98, Windows NT, Windows XP, and HP-UX.

Your instrument has a SICL LAN server to emulate GPIB over LAN, but it cannot be used to control other externally connected GPIB instruments.

Collecting SICL LAN Set-up Information

Before you set up your instrument as a SICL LAN server, you need some information about your instrument. The "value" of the following parameters is used to set up your VISA/SICL LAN client application:

Emulated GPIB

Name The GPIB name is the name given to a device used to communicate with the instrument. Your instrument is shipped with `gpib7` as its GPIB name. The GPIB name is the same as the remote SICL address.

Emulated GPIB

Logical Unit The logical unit number is a unique integer assigned to the device to be controlled using SICL LAN. Your instrument is shipped with the logical unit number set to 8.

This can't be change. Numbers 0 through 30, excluding 21, are valid logical unit numbers for your instrument. Logical unit number 21 is used for the instrument's internal emulation mode. (If you are using Agilent VEE and SICL LAN, the logical unit

number is limited to the range of 0-8.)

Emulated GPIB

Address The emulated GPIB address (bus address) is assigned to the device to be controlled using SICL LAN. The instrument is shipped with the emulated GPIB address set to 18. The emulated GPIB address will always be 18, regardless of what you set the GPIB address to.

The SICL LAN server uses the GPIB name, GPIB logical unit number, and GPIB address configuration on the SICL LAN client to communicate with the client. You must match these parameters *exactly* (including case) when you set up the SICL LAN client and server.

Configuring Your Instrument as a SICL LAN Server

After you have collected the required information from the SICL LAN client, perform the following steps to set up your instrument as a SICL LAN server:

1. Identify the emulated GPIB name is **gpib7**.
2. The emulated **GPIB Logical Unit** is set to **8**.
3. The emulated **GPIB Address** is set to **18**.

Configuring a PC as a SICL LAN Client

The descriptions here are based on Agilent's VISA revision G.02.02, model number 2094G. A copy of Agilent VISA instrument io libraries can be found on Agilent's website:

<http://www.agilent.com/find/iolib>

see also

<http://www.agilent.com/find/vee>

The VISA User's Guide information on LAN programming may also be useful, see:

<ftp://ftp.agilent.com/pub/mpusup/pc/binfiles/iop/index.html>

The following assumes a LAN connection between your computer and your instrument. This will not work for the GPIB to LAN gateway.

1. Install VISA revision G.02.02 or higher.
2. Run I/O configuration.
3. Select LAN Client from the available interface types.
4. Press Configure.
5. Enter an interface name, such as lan1.
6. Enter a logical unit number, such as 7.
7. Select Okay.

8. Select VISA LAN Client from the available interface types.
9. Press Configure.
10. Enter a VISA interface name, such as GPIB1.
11. Enter the host name or IP address of your instrument in the host name field, such as aaa.companyname.com or 137.12.255.255.

NOTE

Changing the host name in your instrument does not change your LAN system representation of the host name. You must work through your local system administrator to change the host name on your LAN system and then change it to match in your instrument.

12. Enter a Remote SICL address, such as GPIB7.
13. Set the LAN interface to match the defined LAN client.
14. Select OK.
15. Close I/O Configuration by selecting OK.

Controlling Your Instrument with SICL LAN and Agilent VEE

Before you can use SICL LAN with VEE, you need to set up VISA/SICL LAN I/O drivers for use with your VEE application. Consult your VEE documentation for information how to do this.

NOTE

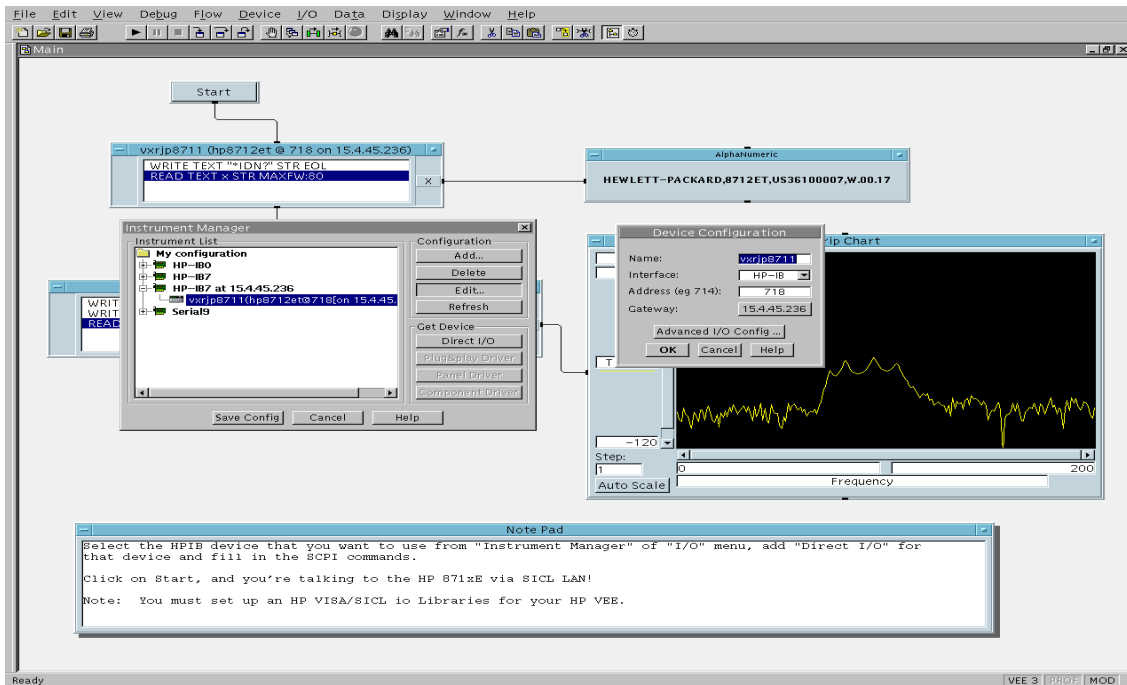
If you are using Agilent VEE and SICL LAN, the logical unit number is limited to the range of 0-8.

The logical unit number is the same as the interface select code (ISC). VEE reserves ISC values 9-18, and does not allow you to use them for SICL/LAN communications with your instrument. VEE also does not allow any ISC values higher than 18.

After you have the VISA/SICL LAN I/O drivers installed, perform the steps below to set up VEE to control your instrument:

1. On your computer or workstation, select I/O | Instrument Manager.
2. Add a new GPIB device with an address of 7XX, where XX is the GPIB device address from your instrument.

Figure 9-1 Adding Your Instrument as a VEE Device



To send SCPI commands to the instrument, select I/O|Instrument Manager, and the GPIB device just added. Select Direct I/O. You can now type SCPI commands in the command window, and they are sent over the LAN to your instrument.

Controlling Your Instrument with SICT LAN and Agilent BASIC for Windows

Before you can use Agilent BASIC for Windows with SICT LAN, you need to set up VISA/SICT LAN I/O drivers for use with your BASIC applications. Consult your BASIC documentation for information how to do this.

To set up SICT LAN for BASIC, add the following statement to your AUTOST program (all on a single line):

```
LOAD BIN "GPIBS;DEV lan[analyzer IP address]:GPIB name TIME 30 ISC 7"
```

Replace analyzer IP address with the IP address of your instrument, GPIB name with the GPIB name given to your instrument, and 7 with the logical unit number.

For example, the following LOAD statement should be added to your AUTOST program for the parameters listed below:

instrument IP address **191.108.344.225**

instrument GPIB name **inst0**

logical unit number **7**

Programming Fundamentals

Using the LAN to Control the Instrument

timeout value (seconds) **30**

LOAD statement (all on a single line)

```
LOAD BIN "GPIBS;DEV lan[191.108.344.225]:inst0 TIME 30 ISC 7"
```

Consult your BASIC documentation to learn how to load the SICL driver for BASIC.

After the SICL driver is loaded, you control your instrument using commands such as the following:

```
OUTPUT 718; "*IDN?"  
ENTER 718; S$
```

where 18 is the device address for the instrument.

See the BASIC example program in this chapter for more information.

Controlling Your Instrument with SICL LAN and BASIC for UNIX (Rocky Mountain BASIC)

Before you can use Rocky Mountain Basic (HPRMB) with SICL LAN, you will need to set up the SICL LAN I/O drivers for HPRMB. Consult your system administrator for details.

Create a `.rmbrc` file in your root directory of your UNIX workstation with the following entries:

```
SELECTIVE_OPEN=ON  
Interface 8= "lan[analyzer IP address]:GPIB name";NORMAL
```

Replace `analyzer IP address` with the IP address of your instrument, and `GPIB name` with the GPIB name given to your instrument. Also replace the "8" of `Interface 8` with the logical unit number. Consult your HPRMB documentation for the exact syntax.

After your SICL driver is configured correctly on your UNIX workstation, you control your instrument using commands such as the following:

```
OUTPUT 818; "*IDN?"  
ENTER 818; S$
```

where 18 is the device address for the instrument.

Using HP/Agilent VEE Over Socket LAN

To control your instrument via socket LAN using VEE, click on the VEE menu titled “I/O.” Then select “To/From Socket” and position the I/O object box on the screen. Fill in the following fields:

```
Connect Port: 5025
Host Name: <your_hostname>
Timeout: 15
```

For faster troubleshooting, you may want to set the timeout to a smaller number. If the host name you enter doesn't work, try using the IP address of your instrument (example: 191 . 108 . 43 . 5). Using the IP address rather than the hostname may also be faster. See [Figure 9-3](#) for an example of a VEE screen.

NOTE

The hostname can be found under **System, Controls, IP Admin**.

Changing the host name in the instrument does not change your LAN system's representation of the host name. You must work through your local system administrator to change the host name on your LAN system.

Figure 9-2 Sample VEE Screen

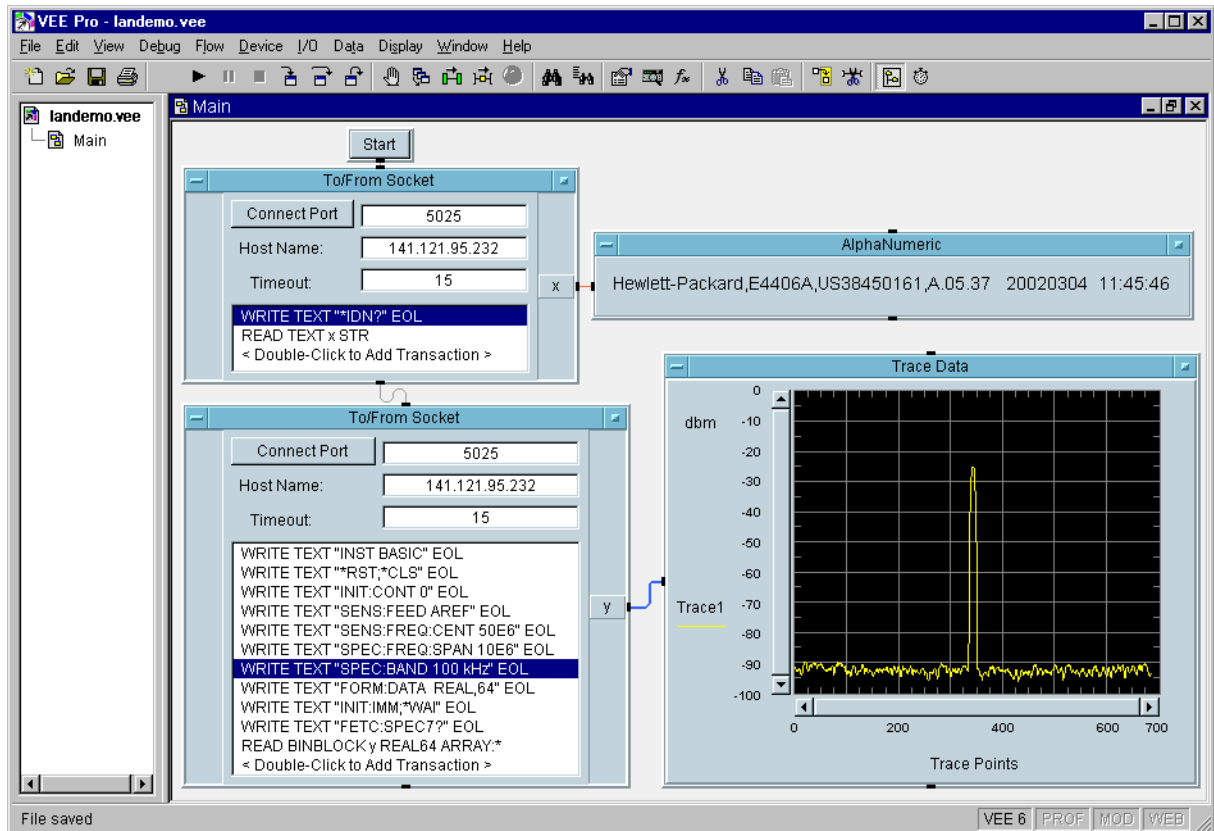
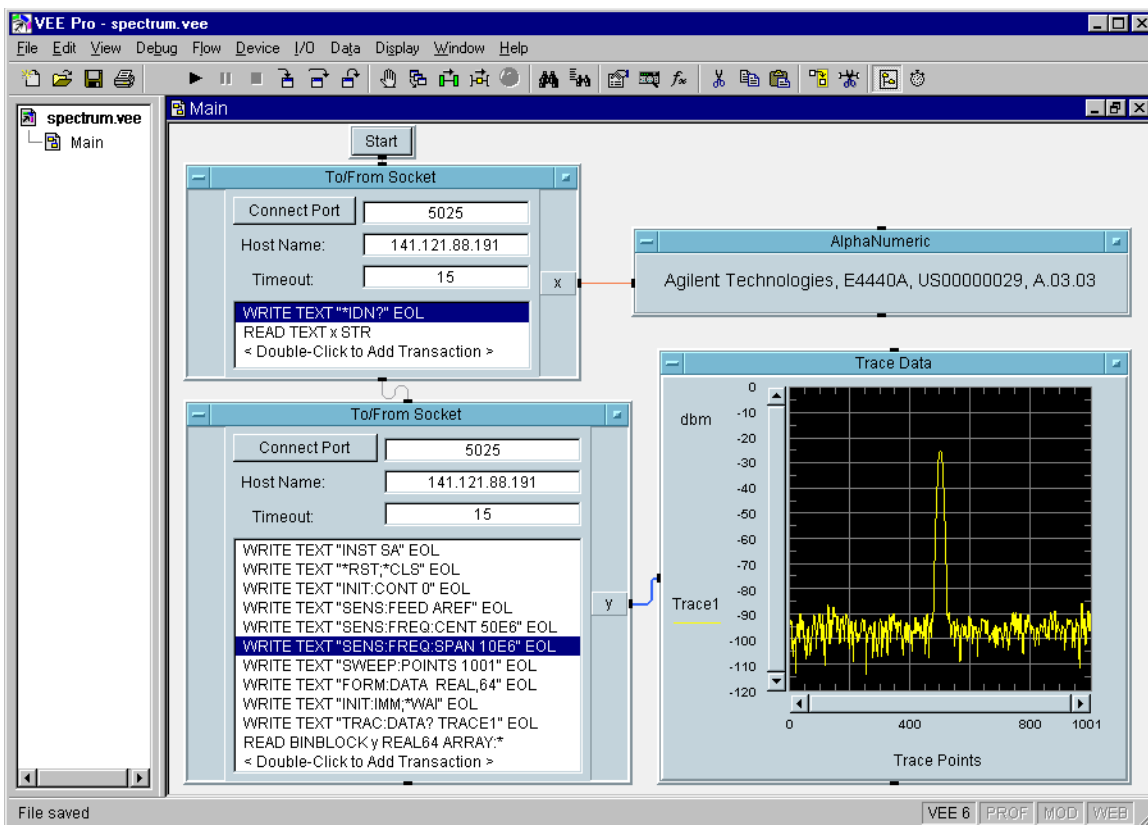


Figure 9-3 Sample VEE Screen



General LAN Troubleshooting

- [“Troubleshooting the Initial Connection” on page 479](#)
- [“Common Problems After a Connection is Made” on page 480](#)
- [“Pinging the Instrument from a Computer or Workstation” on page 481](#)
- [“EIA/TIA 568B Wiring Information” on page 483](#)

Troubleshooting the Initial Connection

Getting the instrument to work with your network often requires detailed knowledge of your local network software. This section attempts to help you with some common problems. Contact your network administrator for additional assistance.

The instrument LAN interface does not need or include any proprietary driver software. It was designed to operate with common network utilities and drivers.

Either a hardware problem or a software problem can prevent the instrument's remote file server from communicating over the LAN. The following common problems may be encountered:

Communications Not Established If you have just installed and configured the LAN interface and you have never been able to access the instrument via ftp or telnet, go directly to [“Pinging the Instrument from a Computer or Workstation” on page 481](#).

If you have previously been able to access the instrument via ftp or telnet and now cannot do so, check the following:

- o Has any hardware been added or moved on your network? This includes adding or removing any workstations or peripherals, or changing any cabling.
- o Have software applications been added to the network?
- o Have any configuration files been modified?
- o Is the upper- and lower-case character usage in your host name consistent?
- o Have any of the following files been deleted or overwritten?

UNIX:

- /etc/hosts
- /etc/inetd.conf
- /etc/services

PCs:

- dependent network files

If you know or suspect that something has changed on your network, consult with your network administrator.

Timeout Errors Timeout errors such as “Device Timeout,” “File Timeout,” and “Operation Timeout,” are symptoms of one or both of the following problems:

- The currently configured timeout limits are too short compared to the time it takes the LAN to complete some operations. This problem may occur during periods of increased LAN traffic.
- The LAN connection has failed, or fails occasionally.

To increase your timeout period, refer to your computer documentation for instructions. Contact your LAN administrator if problems continue.

Packets Routinely Lost If packets are routinely lost, proceed to the troubleshooting section in this chapter relating to your network.

Problems Transferring or Copying Files If you have problems copying files out of or into the instrument, you might be experiencing timeout problems. See the previous section on “Timeout Errors.”

Common Problems After a Connection is Made

This section describes common problems you may encounter when using the instrument on a LAN. It assumes you have been able to connect to the instrument in the past. If this is not so, refer to the previous sections first.

NOTE Pressing **Mode Preset** does not affect LAN settings.

NOTE Remember that in any type of programming using LAN you should avoid constantly opening and closing connections. This uses up processing resources, adds to your system overhead, and can cause problems with asynchronous implementation of successive commands. When you are sending the instrument multiple commands: open the connection, send all the commands, and close the connection.

Cannot connect to the analyzer

- If you suspect a bad LAN connection between your computer and instrument, you can verify the network connection by using the ping command described later in this chapter or another similar echo request utility.
- If a bad connection is revealed, try the following solutions:
 - Make sure the instrument is turned on.
 - Check the physical connection to the LAN.
 - Make sure the internet (IP) Address of the instrument is set up correctly in the LAN port setup menu. (Press **System, Controls, IP Admin.**)
 - When connecting to your instrument over a closed network (directly through a hub or crossover cable) it may help to set the instrument to its default settings for subnet mask and gateway. (subnet mask: 255.255.0.0, gateway 0.0.0.0)

- If the instrument and the computer are on different networks or subnets, make sure the gateway address and subnet mask values are set correctly.

Cannot access the file system via ftp

- If you get a “connection refused” message, try the following solutions:
 - If the power to the instrument was just turned on, make sure that you wait about 25 seconds before attempting the connection.
- If you get a “connection timed out” message
 - Verify the LAN connection between your computer and the instrument. Refer to “If you cannot connect to the instrument” earlier in this section.

Cannot telnet to the command parser port

- For a “connection refused” message
 - Check the telnet port number from the front-panel keys.
- For a “connection timed out” or “no response from host” message
 - Verify the LAN connection between your computer and the instrument. Refer to “If you cannot connect to the instrument” earlier in this section.
- For a “connection refused” or “no response from host” message
 - If the instrument was just turned on, make sure that you wait about 25 seconds before attempting the connection.

An “operation timed-out” message

- Check the LAN connection between the computer and the instrument. Refer to “If you cannot connect to the instrument” in this section.
- Increase the file time-out value on your PC or workstation.

Cannot access internal web pages or import graphic images when using a point-to-point connection

- Disable the use of proxy servers. You may have to specify this in a number of locations, depending on the operating system and software you are using.
- Disable the use of cached copies of web pages to ensure that you always get a new copy of the instrument’s screen image.

If all else fails

- Contact your network administrator.
- If you still cannot solve the problem, contact an Agilent Service Center for repair information.

Pinging the Instrument from a Computer or Workstation

Verify the communications link between the computer and the instrument remote

file server using the ping utility.

From a UNIX workstation, type:

```
ping hostname 64 10
```

where 64 is the packet size, and 10 is the number of packets transmitted.

From a DOS or Windows environment, type:

```
ping hostname 10
```

where 10 is the number of echo requests.

Normal Response for UNIX

A normal response to the ping will be a total of 9, 10, or possibly 11 packets received with a minimal average round-trip time. The minimal average will be different from network to network. LAN traffic will cause the round-trip time to vary widely.

Because the number of packets received depends on your network traffic and integrity, the normal number might be different for your network.

Normal Response for DOS or Windows

A normal response to the ping will be a total of 9, 10, or possibly 11 packets received if 10 echo requests were specified.

Because the number of packets received depends on your network traffic and integrity, the normal number might be different for your network.

Error Messages

If error messages appear, then check the command syntax before continuing with the troubleshooting. If the syntax is correct, then resolve the error messages using your network documentation, or by consulting your network administrator.

If an unknown host error message appears, then check that the host name and IP address for your instrument are correctly entered from the front panel. Press **System, Controls, IP Admin**.

No Response No packets received indicates no response from a ping.

If there is no response, try typing in the IP address with the ping command, instead of using the host name. Check that the typed address matches the IP address displayed on the Mode screen.

Check that the host name and IP address are correctly entered in the node names database.

If you are using a UNIX environment, ping each node along the route between your workstation and the instrument, starting with the your workstation. Ping each gateway, then attempt a ping of the remote file server.

If the instrument still does not respond to ping, then you should suspect a

hardware problem with the instrument. To check the instrument performance, refer to “Verify the Instrument Performance” in this chapter.

Intermittent Response If you received 1 to 8 packets back, there is probably a problem with the network. Because the number of packets received depends on your network traffic and integrity, the number might be different for your network.

Use a LAN analyzer or LAN management software to monitor activity and determine where bottlenecks or other problems are occurring. The instrument will still function, but communications over the LAN will be slower.

On a single-client/single-server network, the most likely cause of intermittent response to an echo request is a hardware problem with the LAN module installed in the PC, the cable, or the instrument. To check the instrument, refer to “Verify the Instrument Performance” later in this chapter.

The Standard UNIX PING Command Synopsis `ping [-r] [-v] [-o] host [packetsize] [count]`

Description The ping command sends an echo request packet to the host once per second. Each echo response packet that is returned is listed on the screen, along with the round-trip time of the echo request and echo response.

Options and Parameters `-r` Bypasses the routing tables, and sends the request directly to the host.

`-v` Reports all packets that are received, including the response packets.

`-o` Requests information about the network paths taken by the requests and responses.

`host` The host name or IP address.

`packetsize` The size of each packet (8 bytes - 4096 bytes).

`count` The number of packets to send before ending ping ($1-(2^{31}-1)$). If count is not specified, ping sends packets until interrupted.

EIA/TIA 568B Wiring Information

Table 9-1

Straight-Through Cable (Unshielded-twisted-pair (UTP) cable with RJ-45 connectors)

Standard, Straight-Through Wiring (each end)			
Signal Name	RJ-45 Pin #	Wire Color	Pair #
RX+	1	white/orange	2
RX-	2	orange	
TX+	3	white/green	3
TX-	6	green	

Table 9-1 Straight-Through Cable (Unshielded-twisted-pair (UTP) cable with RJ-45 connectors)

Standard, Straight-Through Wiring (each end)			
Signal Name	RJ-45 Pin #	Wire Color	Pair #
Not Used	4	blue	1
	5	white/blue	
	7	white/brown	4
	8	brown	

Table 9-2 Cross-Over Cable (Unshielded-twisted-pair (UTP) cable with RJ-45 connectors)

Cross-Over Wiring ^a			
Connector A		Connector B	
Signal Name	RJ-45 Pin #	RJ-45 Pin #	Signal Name
RX+	1	3	TX+
RX-	2	6	TX-
TX+	3	1	RX+
TX-	6	2	RX-
Not Used	4	4	Not Used
	5	5	
	7	7	
	8	8	

a. Either end of this cable can be used at the instrument or LAN device. The connector names are a convention useful during cable construction only.

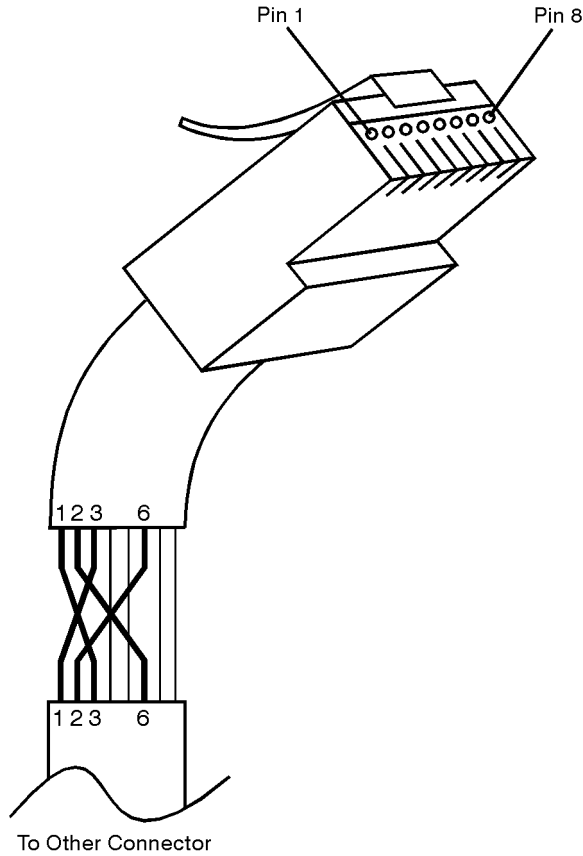
This cable can be used to cascade hubs or to make point-to-point connections without a LAN hub.

NOTE A convenient way to make a cross-over adapter is to use two RJ-45 *jacks* wired according to [Table 9-2](#), above. Standard straight-through patch cables can then be used from the instrument to the adapter, and from the adapter to other LAN devices. If you use a special-purpose adapter, you will avoid having a cross-over cable mistaken for a standard, straight-through patch cable.

NOTE Some commercially-available cross-over cables do not implement the cross-over

wiring required for your instrument. Please refer to [Table 9-2](#), above, and verify all connections before using cables not made by Agilent Technologies.

Figure 9-4 Cross-Over Patch Cable Wiring (cross-over end)



sd623c

When you are programming the instrument you may need to monitor instrument status to check for error conditions or monitor changes. You can determine the state of certain instrument events/conditions by programming the status register system. IEEE common commands (those beginning with *) access the higher-level summary registers. To access the information from specific registers you would use the STATus commands.

The STATus subsystem remote commands set and query the status hardware registers. This system of registers monitors various events and conditions in the instrument. Software written to control the instrument may need to monitor some of these events and conditions.

What Are Status Registers

The status system contains multiple registers that are arranged in a hierarchical order. The lower-level status registers propagate their data to the higher-level registers in the data structures by means of summary bits. The status byte register is at the top of the hierarchy and contains general status information for the instrument's events and conditions. All other individual registers are used to determine the specific events or conditions.

The Agilent CSA implementation is shown in [Figure 10-2](#).

The questionable status registers are a set of registers that monitor the overall instrument condition. They are accessed with the `STATUS:OPERation` and `STATUS:QUESTIONable` commands in the `STATUS` command subsystem. Each register set is made up of five registers:

- **Condition Register** It reports the real-time state of the signals monitored by this register set. There is no latching or buffering for a condition register.
- **Positive Transition Register** This filter register controls which signals will set a bit in the event register when the signal makes a low to high transition (when the condition bit changes from 0 to 1).
- **Negative Transition Register** This filter register controls which signals will set a bit in the event register when the signal makes a high to low transition (when the condition bit changes from 1 to 0).
- **Event Register** It latches any signal state changes, in the way specified by the filter registers. Bits in the event register are never cleared by signal state changes. Event registers are cleared when read. They are also cleared by `*CLS` and by presetting the instrument.
- **Event Enable Register** It controls which of the bits, being set in the event register, will be summarized as a single output for the register set. Summary bits are then used by the next higher register.

The `STATUS:QUESTIONable` registers report abnormal operating conditions. The status register hierarchy is:

1. The summary outputs from the six `STATUS:QUESTIONable:<keyword>` detail registers are inputs to the `STATUS:QUESTIONable` register.
2. The summary output from the `STATUS:QUESTIONable` register is an input to the Status Byte Register. See the overall system in [Figure](#) at the beginning of this section.

What Are Status Register SCPI Commands

Most monitoring of the instrument conditions is done at the highest level using the IEEE common commands indicated below. Complete command descriptions are available in the IEEE commands section at the beginning of the language reference. Individual status registers can be set and queried using the commands in the STATus subsystem of the language reference.

- *CLS (clear status) clears the status byte by emptying the error queue and clearing all the event registers.
- *ESE, *ESE? (event status enable) sets and queries the bits in the enable register part of the standard event status register.
- *ESR? (event status register) queries and clears the event register part of the standard event status register.
- *OPC, *OPC? (operation complete) sets the standard event status register to monitor the completion of all commands. The query stops any new commands from being processed until the current processing is complete, then returns a '1'.
- *PSC, *PSC? (power-on state clear) sets the power-on state so that it clears the service request enable register and the event status enable register at power on.
- *SRE, *SRE? (service request enable) sets and queries the value of the service request enable register.
- *STB? (status byte) queries the value of the status byte register without erasing its contents.

How to Use the Status Registers

A program often needs to be able to detect and manage error conditions or changes in instrument status. There are two methods you can use to programmatically access the information in status registers:

- The polling method
- The service request (SRQ) method

In the polling method, the instrument has a passive role. It only tells the controller that conditions have changed when the controller asks the right question. In the SRQ method, the instrument takes a more active role. It tells the controller when there has been a condition change without the controller asking. Either method allows you to monitor one or more conditions.

The polling method works well if you do not need to know about changes the moment they occur. The SRQ method should be used if you must know immediately when a condition changes. To detect a change using the polling method, the program must repeatedly read the registers.

Use the SRQ method when:

- you need time-critical notification of changes
- you are monitoring more than one device which supports SRQs
- you need to have the controller do something else while waiting
- you can't afford the performance penalty inherent to polling

Use polling when:

- your programming language/development environment does not support SRQ interrupts
- you want to write a simple, single-purpose program and don't want the added complexity of setting up an SRQ handler
- To monitor a condition:
 - Determine which register contains the bit that reports the condition.
 - Send the unique SCPI query that reads that register.
 - Examine the bit to see if the condition has changed.

You can monitor conditions in different ways.

- Check the current instrument hardware and firmware status.

Do this by querying the condition registers which continuously monitor status. These registers represent the current state of the instrument. Bits in a condition register are updated in real time. When the condition monitored by a particular bit becomes true, the bit is set to 1. When the condition becomes false, the bit is reset to 0.

- Monitor a particular condition (bit).

You can enable a particular bit(s), using the event enable register. The instrument will then monitor that particular condition(s). If the bit becomes true (0 to 1 transition) in the event register, it will stay set until the event register is cleared. Querying the event register allows you to detect that this

condition occurred even if the condition no longer exists. The event register can only be cleared by querying it or sending the *CLS command.

- Monitor a particular type of change in a condition (bit).
 - The transition registers are preset to register if the condition goes from 0 to 1 (false to true, or a positive transition).
 - This can be changed so the selected condition is detected if the bit goes from 1 to 0 (true to false, or a negative transition).
 - It can also be set for both types of transitions occurring.
 - Or it can be set for neither transition. If both transition registers are set to 0 for a particular bit position, that bit will not be set in the event register for either type of change.

Using a Status Register

Each bit in a register is represented by a numerical value based on its location. See figure below. This number is sent with the command to enable a particular bit. If you want to enable more than one bit, you would send the sum of all the bits that you want to monitor.

Figure 10-1 Figure: Status Register Bit Values

Decimal Value																	
	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1	
Bit Number	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	

STATus:QUEStionable:ENABle <num>
STATus:QUEStionable:ENABle?

Status Questionable Event Enable Register

Stat_question

NOTE: Bit 15 is not used to report status.

Example 1:

1. To enable bit 0 and bit 6 of standard event status register, you would send the command *ESE 65 because $1 + 64 = 65$.
2. The results of a query are evaluated in a similar way. If the *STB? command returns a decimal value of 140, ($140 = 128 + 8 + 4$) then bit 7 is true, bit 3 is true and bit 2 is true.

Example 2:

1. Suppose you want to know if an ADC over range occurs, and you only cared about that specific condition. So you would want to know what was happening with bit 4 in the Status Questionable Integrity register, and not about any other bits.
2. It's usually a good idea to start by clearing all the status registers with *CLS.
3. Sending the STAT:QUES:INT:ENAB 16 command lets you monitor only bit 4 events, instead of the default monitoring all the bits in the register. The register default is for positive transition events (0 to 1 transition). That is, when an ADC over range occurs. If instead, you wanted to know when the ADC over range condition is cleared, then you would set the STAT:QUES:INT:PTR 0 and the STAT:QUES:INT:NTR 32767.
4. So now the only output from the Status Questionable Integrity register will come from a bit 4 positive transition. That output goes to the Integrity Sum bit 9 of the Status Questionable register.

5. You can do a similar thing with this register to only look at bit 9 using, STAT:QUES:ENAB 512.
6. The Status Questionable register output goes to the “Status Questionable Summary” bit 3 of the Status Byte Register. The output from this register can be enabled using the *SRE 8 command.
7. Finally, you would use the serial polling functionality available for the particular bus/software that you are using to monitor the Status Byte Register. (You could also use *STB? to poll the Status Byte Register.)

Using the Service Request (SRQ) Method

Your language, bus and programming environment must be able to support SRQ interrupts. For example, BASIC used with VXI-11.3 (GPIB over LAN). When you monitor a condition with the SRQ method, you must:

1. Determine which bit monitors the condition.
2. Determine how that bit reports to the request service (RQS) bit of the status byte.
3. Send SCPI commands to enable the bit that monitors the condition and to enable the summary bits that report the condition to the RQS bit.
4. Enable the controller to respond to service requests.

When the condition changes, the instrument sets its RQS bit. The controller is informed of the change as soon as it occurs. As a result, the time the controller would otherwise have used to monitor the condition can be used to perform other tasks. Your program determines how the controller responds to the SRQ.

Generating a Service Request

To use the SRQ method, you must understand how service requests are generated. Bit 6 of the status byte register is the request service (RQS) bit. The *SRE command is used to configure the RQS bit to report changes in instrument status. When such a change occurs, the RQS bit is set. It is cleared when the status byte register is queried using *SRE? (with a serial poll.) It can be queried without erasing the contents with *STB?.

When a register set causes a summary bit in the status byte to change from 0 to 1, the instrument can initiate the service request (SRQ) process. However, the process is only initiated if both of the following conditions are true:

- The corresponding bit of the service request enable register is also set to 1.
- The instrument does not have a service request pending. (A service request is considered to be pending between the time the instrument's SRQ process is initiated and the time the controller reads the status byte register.)

The SRQ process sets the SRQ true. It also sets the status byte's request service (RQS) bit to 1. Both actions are necessary to inform the controller that the instrument requires service. Setting the SRQ line only informs the controller that some device on the bus requires service. Setting the RQS bit allows the controller to determine which instrument requires service.

If your program enables the controller to detect and respond to service requests, it should instruct the controller to perform a serial poll when the SRQ is set true. Each device on the bus returns the contents of its status byte register in response to this poll. The device whose RQS bit is set to 1 is the device that requested service.

NOTE: When you read the instrument's status byte register with a serial poll, the RQS bit is reset to 0. Other bits in the register are not affected.

NOTE: If the status register is configured to SRQ on end-of-measurement and the measurement is in continuous mode, then restarting a measurement (INIT command) can cause the measuring bit to pulse low. This causes an SRQ when you have not actually reached the "end-of-measurement" condition. To

avoid this:

- Set INITiate:CONTInuous off.
- Set/enable the status registers.
- Restart the measurement (send INIT).

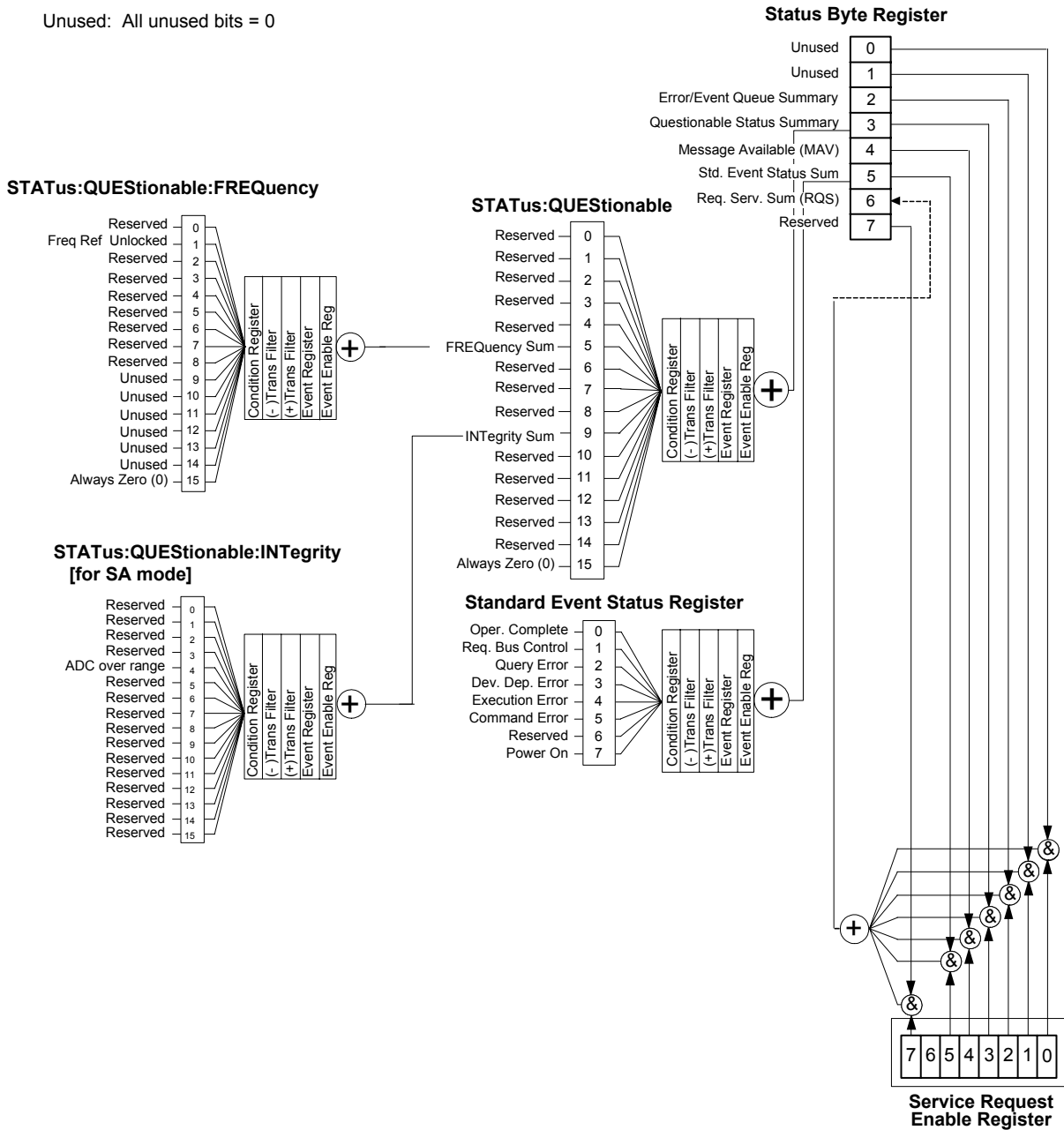
Status Register System

The hardware status registers are combined to form the instrument status system. Specific status bits are assigned to monitor various aspects of the instrument operation and status. See the following diagram of the status system for information about the bit assignments and status register interconnections.

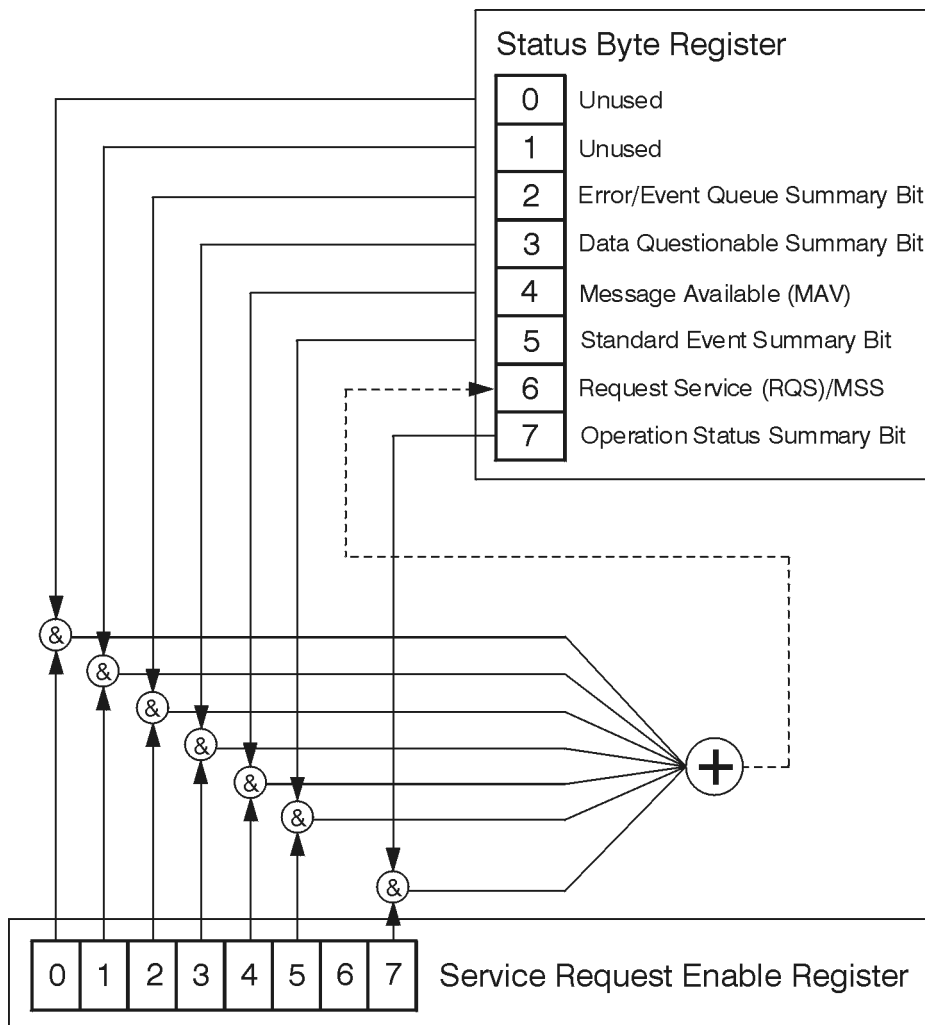
Figure 10-2 Agilent CSA Status Register System

Preset Values

- For All Registers: (-) Transition Filter = 0's
 (+) Transion Filter = 1's
- For STAT:QUES, STAT:OPER, & all OPER:INST:ISUM registers: Event Enable = 0's
- For all Other Registers: Event Enable = 1's
- Unused: All unused bits = 0



The Status Byte Register



ck776a

The RQS bit is read and reset by a serial poll. The same bit position (MSS) is read, non-destructively by the *STB? command. If you serial poll bit 6 it is read as RQS, but if you send *STB it reads bit 6 as MSS. For more information refer to IEEE 488.2 standards, section 11.

	Description	Standard Operation Status Summary Bit	Request Service (RQS) Summary Bit	Standard Event Status Summary Bit	Message Available (MAV)	Data Questionable Status Summary Bit	Error/Event Queue Summary Bit	Unused	Unused
Bit Number	7	6	5	4	3	2	1	0	

*STB?

Status Byte Register

ck725a

Bit	Description
Bit	Description
0, 1	These bits are always set to 0.
2	A 1 in this bit position indicates that the SCPI error queue is not empty which means that it contains at least one error message.
3	A 1 in this bit position indicates that the data questionable summary bit has been set. The data questionable event register can then be read to determine the specific condition that caused this bit to be set.
4	A 1 in this bit position indicates that the instrument has data ready in the output queue. There are no lower status groups that provide input to this bit.
5	A 1 in this bit position indicates that the standard event summary bit has been set. The standard event status register can then be read to determine the specific event that caused this bit to be set.
6	A 1 in this bit position indicates that the instrument has at least one reason to report a status change. This bit is also called the master summary status bit (MSS).
7	A 1 in this bit position indicates that the standard operation summary bit has been set. The standard operation event register can then be read to determine the specific condition that caused this bit to be set.

To query the status byte register, send the command *STB? The response will be the decimal sum of the

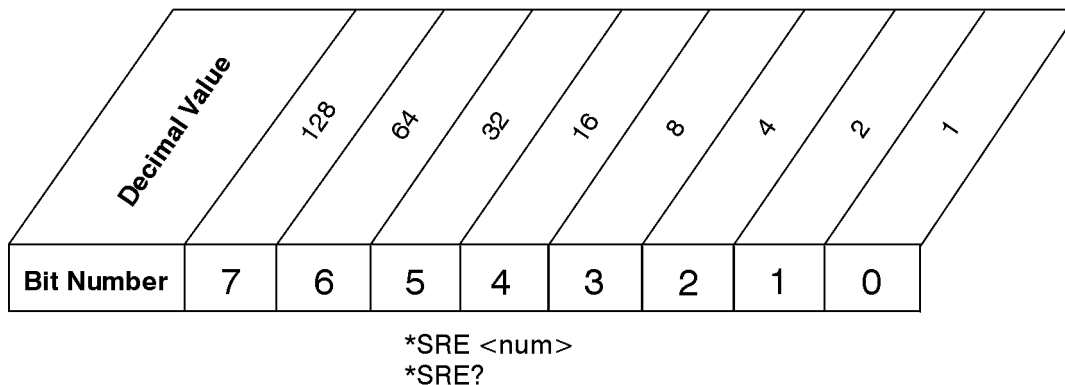
Using The Status Monitoring Subsystem The Status Byte Register

bits which are set to 1. For example, if bit number 7 and bit number 3 are set to 1, the decimal sum of the 2 bits is 128 plus 8. So the decimal value 136 is returned. The *STB command does not clear the status register.

In addition to the status byte register, the status byte group also contains the service request enable register. This register lets you choose which bits in the status byte register will trigger a service request.

Send the *SRE <integer> command where <integer> is the sum of the decimal values of the bits you want to enable plus the decimal value of bit 6. For example, assume that you want to enable bit 7 so that whenever the standard operation status register summary bit is set to 1 it will trigger a service request. Send the command *SRE 192 (because $192 = 128 + 64$). You must always add 64 (the numeric value of RQS bit 6) to your numeric sum when you enable any bits for a service request. The command *SRE? returns the decimal value of the sum of the bits previously enabled with the *SRE <integer> command.

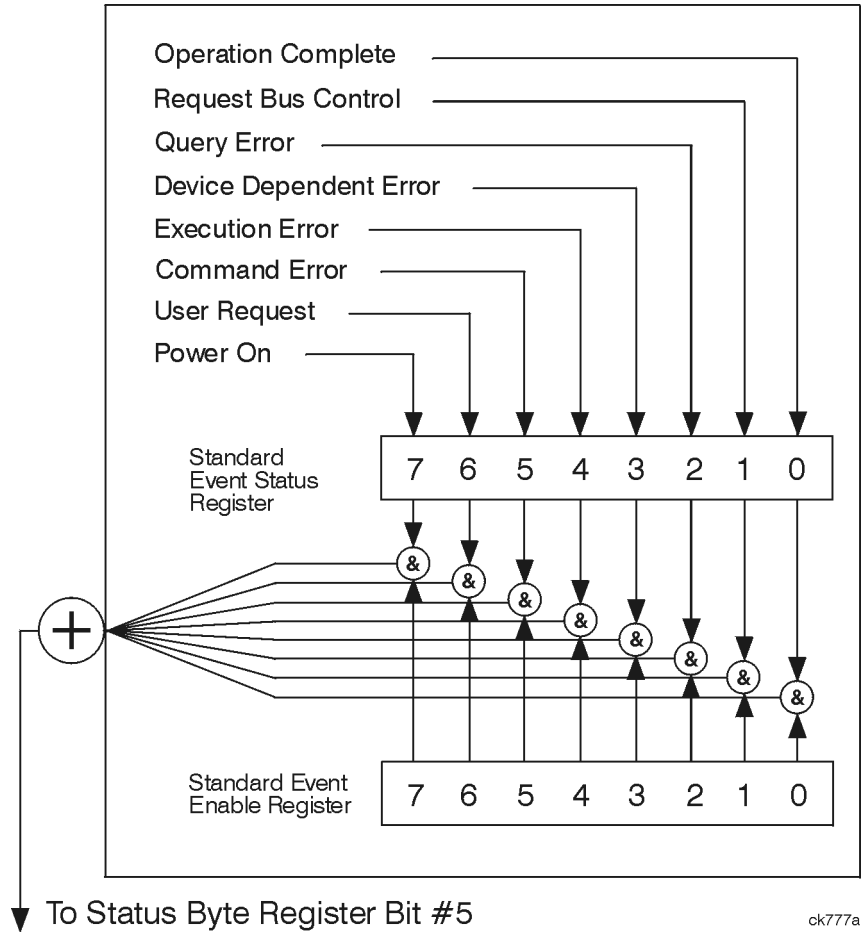
The service request enable register presets to zeros (0).



Service Request Enable Register

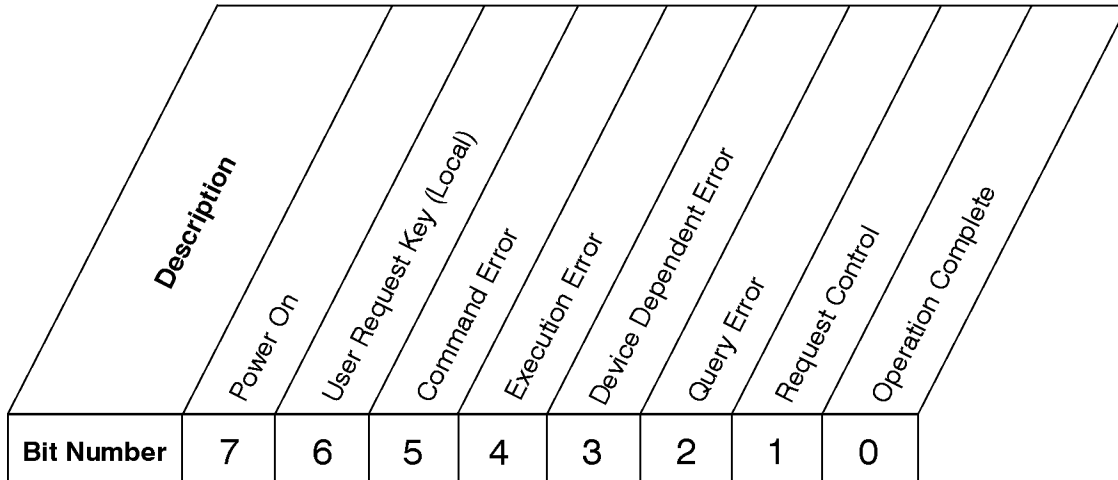
ck726a

Standard Event Status Register



Using The Status Monitoring Subsystem Standard Event Status Register

The standard event status register contains the following bits:



*ESR?

Standard Event Status Register

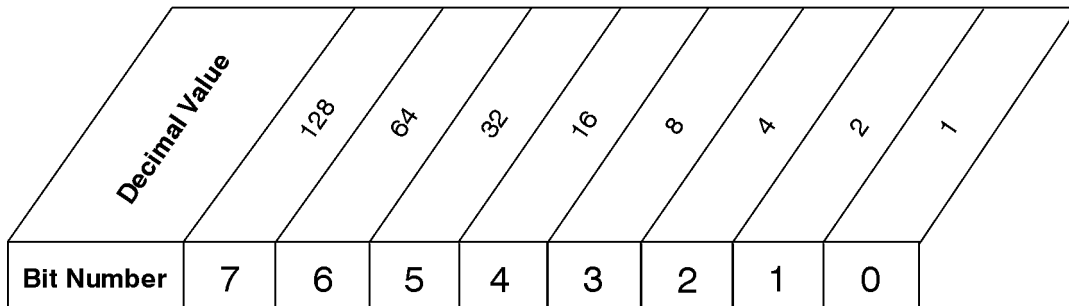
ck727a

Bit	Description
Bit	Description
0	A 1 in this bit position indicates that all pending operations were completed following execution of the *OPC command.
1	This bit is for GPIB handshaking to request control. Currently it is set to 0 because there are no implementations where the spectrum analyzer controls another instrument.
2	A 1 in this bit position indicates that a query error has occurred. Query errors have SCPI error numbers from -499 to -400.
3	A 1 in this bit position indicates that a device dependent error has occurred. Device dependent errors have SCPI error numbers from -399 to -300 and 1 to 32767.
4	A 1 in this bit position indicates that an execution error has occurred. Execution errors have SCPI error numbers from -299 to -200.
5	A 1 in this bit position indicates that a command error has occurred. Command errors have SCPI error numbers from -199 to -100.
6	Unused.
7	A 1 in this bit position indicates that the instrument has been turned off and then on.

The standard event status register is used to determine the specific event that set bit 5 in the status byte register. To query the standard event status register, send the command *ESR?. The response will be the decimal sum of the bits which are enabled (set to 1). For example, if bit number 7 and bit number 3 are enabled, the decimal sum of the 2 bits is 128 plus 8. So the decimal value 136 is returned.

In addition to the standard event status register, the standard event status group also contains a standard event status enable register. This register lets you choose which bits in the standard event status register will set the summary bit (bit 5 of the status byte register) to 1. Send the `*ESE <integer>` command where `<integer>` is the sum of the decimal values of the bits you want to enable. For example, to enable bit 7 and bit 6 so that whenever either of those bits is set to 1, the standard event status summary bit of the status byte register will be set to 1, send the command `*ESE 192 (128 + 64)`. The command `*ESE?` returns the decimal value of the sum of the bits previously enabled with the `*ESE <integer>` command.

The standard event status enable register presets to zeros (0).



`*ESE <num>`
`*ESE?`

Standard Event Status Enable Register

ck728a

Operation and Questionable Status Registers

The operation and questionable status registers are registers that monitor the overall instrument condition. They are accessed with the STATus:OPERation and STATus:QUESTionable commands in the STATus command subsystem. See the figure at the beginning of this document.

Questionable Status Register

The questionable status register monitors the instrument's condition to see if anything questionable has happened to it. It is looking for anything that might cause an error or a bad measurement like a hardware problem, an out of calibration situation, or a unusual signal. All the bits are summary bits from lower-level event registers.

Bit	Condition	Operation
5	Frequency summary	The instrument hardware has detected an unlocked condition or a problem with the external frequency reference.
9	Integrity summary	The instrument hardware has detected a signal integrity problem. The signal amplitude may be too high.

Using The Status Monitoring Subsystem
Questionable Status Register

11

IEEE and STATUS Commands (Remote Commands Only)

Numeric values for bit patterns can be entered using decimal or hexadecimal representations. (i.e. 0 to 32767 is equivalent to #H0 to #H7FFF).

IEEE Standard Commands:
*CLS, *ESE, *ESE?, *ESR?, *RCL, *SAV, *SRE, *SRE?, *STB?, *IDN?, *RST, *TRG, *TST?, *OPC, *OPC?, *OPT?, *WAI
Some of the above commands are documented in other sections: *RCL, *SAV - Recall/Save *TRG - Trigger *RST, *OPT?, *TST?, *IDN? - System/Preset
STATUS Commands:
STATUS:PRESet STATUS:QUESTIONable register commands STATUS:QUESTIONable:FREQuency register commands STATUS:QUESTIONable:INTEgrity register commands

IEEE and STATUS Commands (Remote Commands Only)

Clear Status

Clear Status

Clears the status byte register. It does this by emptying the error queue and clearing all bits in all of the event registers. The status byte register summarizes the states of the other registers. It is also responsible for generating service requests.

Mode	All modes
Remote Command	*CLS
Example	*CLS Clears the error queue and the Status Byte Register.
Remote Command Notes	For related commands, see the SYSTem:ERRor[:NEXT]? command. See also the STATus:PRESet command and all commands in the STATus subsystem.
SCPI Status Bits/OPC Dependencies	Resets all bits in all event registers to 0, which resets all the status byte register bits to 0 also

Standard Event Status Enable

Selects the desired bits from the standard event status enable register. This register monitors I/O errors and synchronization conditions such as operation complete, request control, query error, device dependent error, status execution error, command error and power on. The selected bits are OR'd to become a summary bit (bit 5) in the byte register which can be queried.

The query returns the state of the standard event status enable register.

Mode	All modes
Remote Command	*ESE *ESE?
Example	*ESE 36 Enables the Standard Event Status Register to monitor query and command errors (bits 2 and 5). *ESE? Returns a 36 indicating that the query and command status bits are enabled.
Remote Command Notes	For related commands, see the STATus subsystem and SYSTem:ERRor[:NEXT]? commands.
Preset	255
Min	0
Max	255
SCPI Status Bits/OPC Dependencies	Event Enable Register of the Standard Event Status Register.

IEEE and STATUS Commands (Remote Commands Only)

Standard Event Status Register Query

Standard Event Status Register Query

Queries and clears the standard event status event register. (This is a destructive read.) The value returned is a hexadecimal number that reflects the current state (0/1) of all the bits in the register.

Mode	All modes
Remote Command	*ESR?
Example	*ESR? Returns a 1 if there is either a query or command error, otherwise it returns a zero.
Remote Command Notes	For related commands, see the STATUS subsystem commands.
Preset	0
Min	0
Max	255
SCPI Status Bits/OPC Dependencies	Standard Event Status Register (bits 0 – 7)

Identification Query

Returns a string of instrument identification information. The string will contain the model number, serial number and software revision.

The response is organized into four fields separated by commas. The field definitions are as follows:

- Manufacturer
- Model
- Serial number
- Software version

Mode All modes

Remote Command *IDN?

Example *IDN? Returns instrument identification information, such as:
Agilent Technologies,N1996A,US45310116,A.01.02

Restrictions and Notes See related key System, System Stats

Operation Complete

The *OPC command sets bit 0 in the standard event status register (SER) to “1” when pending operations have finished, that is when all overlapped commands are complete. It does not hold off subsequent operations. You can determine when the overlapped commands have completed either by polling the OPC bit in SER, or by setting up the status system such that a service request (SRQ) is asserted when the OPC bit is set.

The *OPC? query returns a “1” after all the current overlapped commands are complete. So it holds off subsequent commands until the “1” is returned, then the program continues. This query can be used to synchronize events of other instruments on the external bus.

Mode	All modes
Remote Command	*OPC *OPC?
Example	INIT:CONT 0 Selects single sweeping. INIT:IMM Initiates a sweep. *OPC? Holds off any further commands until the sweep is complete.
SCPI Status Bits/OPC Dependencies	Not global to all remote ports or front panel. *OPC only considers operation that was initiated on the same port as the *OPC command was issued from. *OPC is an overlapped command, but *OPC? is sequential.

Service Request Enable

This command enables the desired bits of the service request enable register.

The query returns the value of the register, indicating which bits are currently enabled.

Mode	All modes
Remote Command	*SRE <integer> *SRE?
Example	*SRE 22 Enables bits 1, 2, and 4 in the service request enable register.
Restrictions and Notes	See related key System, System Stats
Remote Command Notes	For related commands, see the STATus subsystem and SYSTem:ERRor[:NEXT]? commands.
Preset	255
Min	0
Max	255
SCPI Status Bits/OPC Dependencies	Service Request Enable Register (all bits, 0 – 7).

IEEE and STATUS Commands (Remote Commands Only)

Status Byte Query

Status Byte Query

Returns the value of the status byte register without erasing its contents.

Mode	All modes
Remote Command	*STB?
Example	*STB? Returns a decimal value for the bits in the status byte register. For example, if a 16 is returned, it indicates that bit 5 is set and one of the conditions monitored in the standard event status register is set.
Remote Command Notes	See related command *CLS.

Wait-to-Continue

This command causes the instrument to wait until all overlapped commands are completed before executing any additional commands. There is no query form for the command.

Mode	All modes
Remote Command	*WAI
Example	INIT:CONT OFF; INIT;*WAI Sets the instrument to single sweep. Starts a sweep and waits for its completion.
Restrictions and Notes	See related key System, Service
SCPI Status Bits/OPC Dependencies	Not global to all remote ports or front panel. *WAI only considers operation that was initiated on the same port as the *WAI command was issued from.

Agilent CSA STATUS Register Model

The hierarchy of the status registers is shown in [Figure 10-2 on page 497](#).

Preset the Status Byte

Sets bits in most of the enable and transition registers to their default state. It presets all the Transition Filters, Enable Registers, and the Error/Event Queue Enable. It has no effect on Event Registers, Error/Event QUEUE, IEEE 488.2 ESE, and SRE Registers as described in IEEE Standard 488.2–1992, IEEE Standard Codes, Formats, Protocols and Common Commands for Use with ANSI/IEEE Std 488.1–1987. New York, NY, 1992.

Mode	All modes
Remote Command	:STATUS:PRESet
Example	STAT:PRES

Status Questionable Register

Questionable Condition

This query returns the decimal value of the sum of the bits in the Questionable Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Mode	All modes
Remote Command	:STATUS:QUEStionable:CONDition?
Example	STAT:QUES:COND?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Enable

This command determines which bits in the Questionable Event register will set the Questionable Status Summary bit (bit3) in the Status Byte Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

NOTE: The preset condition is all bits in this enable register set to 0. To have any Questionable Events reported to the Status Byte Register, one or more bits need to be set to 1. The Status Byte Event Register should be queried after each measurement to check the Questionable Status Summary (bit 3). If it is equal to 1, a condition during the test may have made the test results invalid. If it is equal to 0, this indicates that no hardware problem or measurement problem was detected by the analyzer for the condition bit(s) enabled.

Mode	All modes
Remote Command	:STATus:QUEStionable:ENABle <integer> :STATus:QUEStionable:ENABle?
Example	STAT:QUES:ENAB 32 Sets the register so that the Frequency summary will be reported to the Status Byte Register.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Event Query

This query returns the decimal value of the sum of the bits in the Questionable Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Mode	All modes
Remote Command	:STATus:QUEStionable[:EVENT]?
Example	STAT:QUES?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Negative Transition

This command determines which bits in the Questionable Condition register will set the corresponding

IEEE and STATUS Commands (Remote Commands Only)

Agilent CSA STATUS Register Model

bit in the Questionable Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All modes
Remote Command	:STATUS:QUESTIONABLE:NTRANSITION <integer> :STATUS:QUESTIONABLE:NTRANSITION?
Example	STAT:QUES:NTR 32 Frequency summary 'questionable cleared' will be reported to the Status Byte Register.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Positive Transition

This command determines which bits in the Questionable Condition register will set the corresponding bit in the Questionable Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All modes
Remote Command	:STATUS:QUESTIONABLE:PTRANSITION <integer> :STATUS:QUESTIONABLE:PTRANSITION?
Example	STAT:QUES::PTR 32 Frequency summary 'questionable cleared' will be reported to the Status Byte Register.
Preset	32767
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Frequency Register

Questionable Frequency Condition

This query returns the decimal value of the sum of the bits in the Questionable Frequency Condition

register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Mode	All modes
Remote Command	:STATus:QUESTionable:FREQuency:CONDition?
Example	STAT:QUES:FREQ:COND?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Frequency Enable

This command determines which bits in the Questionable Frequency Condition Register will set bits in the Questionable Frequency Event register, which also sets the Frequency Summary bit (bit 5) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

Mode	All modes
Remote Command	:STATus:QUESTionable:FREQuency:ENABle <integer> :STATus:QUESTionable:FREQuency:ENABle?
Example	STAT:QUES:FREQ:ENAB 2 Frequency Reference Unlocked will be reported to the Frequency Summary of the Status Questionable register.
Preset	32767
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Frequency Event Query

This query returns the decimal value of the sum of the bits in the Questionable Frequency Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is

IEEE and STATUS Commands (Remote Commands Only) Agilent CSA STATUS Register Model

latched until it is queried. Once queried, the register is cleared.

Mode	All modes
Remote Command	:STATus:QUESTionable:FREQuency[:EVENT]?
Example	STAT:QUES:FREQ?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Frequency Negative Transition

This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All modes
Remote Command	:STATus:QUESTionable:FREQuency:NTRansition <integer> :STATus:QUESTionable:FREQuency:NTRansition?
Example	STAT:QUES:FREQ:NTR 2 Frequency Reference 'regained lock' will be reported to the Frequency Summary of the Status Questionable register.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Frequency Positive Transition

This command determines which bits in the Questionable Frequency Condition register will set the corresponding bit in the Questionable Frequency Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All modes
Remote Command	:STATus:QUEStionable:FREQuency:PTRansition <integer> :STATus:QUEStionable:FREQuency:PTRansition?
Example	STAT:QUES:FREQ:PTR 2 Frequency Reference 'became unlocked' will be reported to the Frequency Summary of the Status Questionable register.
Preset	32767
Min	0
Max	32767

Questionable Integrity Register

Questionable Integrity Condition

This query returns the decimal value of the sum of the bits in the Questionable Integrity Condition register.

NOTE The data in this register is continuously updated and reflects the current conditions.

Mode	All modes
Remote Command	:STATus:QUEStionable:INTEgrity:CONDition?
Example	STAT:QUES:INT:COND?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Enable

This command determines which bits in the Questionable Integrity Condition Register will set bits in the Questionable Integrity Event register, which also sets the Integrity Summary bit (bit 9) in the Questionable Register. The variable <integer> is the sum of the decimal values of the bits you want to enable.

IEEE and STATUS Commands (Remote Commands Only) Agilent CSA STATUS Register Model

Mode	All modes
Remote Command	:STATus:QUESTionable:INTEgrity:ENABle <integer> :STATus:QUESTionable:INTEgrity:ENABle?
Example	STAT:QUES:INT:ENAB 16 ADC Over Range will be reported to the Integrity Summary of the Status Questionable register.
Preset	32767
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Event Query

This query returns the decimal value of the sum of the bits in the Questionable Integrity Event register.

NOTE The register requires that the associated PTR or NTR filters be set before a condition register bit can set a bit in the event register. The data in this register is latched until it is queried. Once queried, the register is cleared.

Mode	All modes
Remote Command	:STATus:QUESTionable:INTEgrity[:EVENT]?
Example	STAT:QUES:INT?
Preset	0
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Negative Transition

This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when the condition register bit has a negative transition (1 to 0). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All modes
------	-----------

Remote Command	:STATus:QUEStionable:INTEgrity:NTRansition <integer> :STATus:QUEStionable:INTEgrity:NTRansition?
Example	STAT:QUES:FREQ:NTR 16 ADC Over Range ‘within range’ will be reported to the Integrity Summary of the Status Questionable register.
Preset	0
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

Questionable Integrity Positive Transition

This command determines which bits in the Questionable Integrity Condition register will set the corresponding bit in the Questionable Integrity Event register when the condition register bit has a positive transition (0 to 1). The variable <integer> is the sum of the decimal values of the bits that you want to enable.

Mode	All modes
Remote Command	:STATus:QUEStionable:INTEgrity:PTRansition <integer> :STATus:QUEStionable:INTEgrity:PTRansition?
Example	STAT:QUES:INT:PTR 16 ADC Over Range ‘became over range’ will be reported to the Integrity Summary of the Status Questionable register.
Preset	32767
Min	0
Max	32767
SCPI Status Bits/OPC Dependencies	Sequential command

IEEE and STATus Commands (Remote Commands Only)
Agilent CSA STATus Register Model

Symbols

*CLS, 488
 *ESE, 502, 503
 *ESR?, 502
 *RST, 35
 *SRE, 499
 *STB?, 499

A

abort command, 421
 ACP measurement
 averaging, 185
 adjacent channel power
 measurement settings, 188
 Adjacent Channel Power front-panel
 key, 176
 adjustments
 time base, 453
 align
 now, 455
 AM demodulation, 318
 AM Detector, 348
 AM Index, 318, 319
 AM Index Lower limit, 361
 AM Index Upper limit, 361
 AMPTD Y Scale key, 46
 AMPTD Y-scale, 373
 angle parameter (variables), 462
 applications, selecting, 37, 41, 45,
 137, 176, 200, 239, 264, 286,
 318, 367, 417
 APTD Y-Scale, 324
 arbitrary block data, 463
 attenuation
 electronic, 326, 330, 374, 380
 Auto key, 80
 Auto Range, 327, 332, 376, 381
 Auto Range menu key, 49
 Auto Tune key, 53
 AutoCarrFreq, 400
 Autoscale, 324, 329, 364, 373, 379,
 414
 Autoscale key, 139, 179, 206, 239,
 265, 286
 Autoscale menu key, 46
 averaging
 type
 Auto, 80
 Averaging key, 219
 Avg Carrier Power, 319
 Avg Mod Rate, 321
 Avg Mode, 348, 397
 Avg Mode key, 77, 185, 217, 245,
 270, 297
 Avg Number, 347, 396
 Avg Number key, 79, 158, 219, 247,
 272, 299

Avg Peak- AM Index, 320
 Avg Peak+ AM Index, 319
 Avg Peak+/-2 AM Index, 320
 Avg RMS AM Index, 320
 Avg Type key, 79, 159
 Avg(Current) Carrier Frequency
 Offset, 370
 Avg(Current) Carrier Power, 368
 Avg(Current) Distortion, 321, 370
 Avg(Current) Mod Rate, 370
 Avg(Current) Peak- Frequency
 Deviation, 369
 Avg(Current) Peak+ / 2 Frequency
 Deviation, 369
 Avg(Current) Peak+ Frequency
 Deviation, 368
 Avg(Current) RMS Frequency
 Deviation, 369
 Avg(Current) SINAD, 321, 370

B

bandwidth ratio
 video to resolution, 57, 145
 BASIC programming, 472
 battery status, 448
 bit_pattern parameter (variables), 462
 Bit-Mapped Graphic
 screen file, 432
 block data
 arbitrary, 463
 identifying block size, 462
 parsing output, 462
 book
 terms, 35
 using, 35
 boolean parameter (commands), 461
 burst search, 351
 Burst Search Threshold, 352, 402
 Burst/Sync Search, 351
 bus
 LAN, 467
 LAN cable, 483

C

Cable Type key, 309
 cable, LAN, 483
 Calibration key, 267
 Carrier Frequency Offset Upper
 Limits, 411
 Carrier Power Upper Limit, 360, 409
 Channel Analyzer key, 175, 317
 Clear Calibration key, 272, 299
 clear status, IEEE command, 508
 Clear Write key, 101
 CLS command, 489
 command complete, 512
 commands

boolean parameter, 461
 keyword parameter, 461
 multiple on a line, 463
 parameters, 461
 syntax, 458
 termination, IEEE, 463
 units parameter, 461
 valid commands, 458
 variable parameter, 461
 variable parameter keywords, 461
 condition of instrument, 487
 condition register, 488
 configuring for network connectivity,
 443, 444, 445, 446
 connection errors, 479
 connection refused error, 481
 connection timed out error, 481
 Cont key, 418
 Control/Sweep key, 418
 copyright information, 448
 couplings, 35

D

data
 arbitrary blocks, 463
 date, 440, 441
 display on/off, 441
 setting, 440, 441
 defaults
 LAN, 479
 definitions
 dependencies/couplings, 35
 example, 35
 factory preset, 35
 maximum value, 35
 remote command, 35
 state saved, 35
 terms, 35
 degree parameter (variables), 462
 Delete
 key, 452
 deleting
 options, 452
 saved states, 429, 438
 states, 429, 438
 Delta, 336, 342, 385, 391
 Demod, 348, 397
 demodulation
 AM, 318, 348
 FM, 367, 397
 dependencies, 35
 Dependencies/Couplings term, 35
 destination
 trace 1, 428
 trace 2, 428
 trace 3, 428
 trace 4, 428

- detector
 - FM, 397
 - display
 - on/off, 113
 - display test, 453
 - full brightness, 454
 - half brightness, 454
 - set test color, 454
 - test #1, 453
 - test #2, 453
 - distance to fault
 - manual vs. automatic frequency range, 296
 - Distance to Fault front-panel key, 286
 - Distortion, 318, 319, 367, 368
 - documentation, using, 35
- E**
- echo, lack of, 468
 - Elec Atten, 326, 330, 374, 380
 - electronic attenuation, 326, 330, 374, 380
 - error
 - questionable status register, 505
 - error messages, 482
 - error monitoring, 513
 - errors
 - connecting remotely, 479
 - connection refused, 481
 - connection timed out, 481
 - file moving/copying, 480
 - LAN troubleshooting, 479
 - no response from host, 481
 - packets lost, 480
 - timeout, 480
 - ESE command, 489
 - event enable register, 488
 - event register, 488
 - event status byte, 509
 - event status enable, IEEE command, 509
 - event status register
 - query and clear, 510
 - Example term, 35
 - Exponential, 348, 397
 - Ext Gain, 329, 333, 377, 382
 - External, 357, 406
 - external gain, 333, 377, 382
 - external power cycle power settings, 447
- F**
- factory defaults
 - LAN, 479
 - factory preset, 422
 - Factory Preset term, 35
 - faster measurements, display off, 113
- F**
- FFT Size key, 307
 - file
 - save, 429, 430
 - sort, 426
 - type, 431
 - file copying/moving errors, 480
 - file recall, 422, 424
 - file save, 430
 - rules, 434
 - file source
 - all, 434
 - trace 1, 433
 - trace 2, 434
 - trace 3, 434
 - trace 4, 434
 - file type
 - measurement results, 433
 - screen, 431
 - state, 425, 426, 432
 - trace, 426, 432
 - filter
 - negative transition, 488
 - positive transition, 488
 - filtering, 351, 400
 - FM demodulation, 367
 - FM Detector, 397
 - FM Deviation, 367
 - Free Run, 356, 405
 - FREQ Channel, 334, 383
 - frequency condition register, 519, 520, 521
 - Frequency Deviation Lower Limit, 410
 - Frequency Deviation Upper Limit, 410
 - frequency parameter (variables), 461
 - frequency span
 - changing, 98, 171, 233, 258, 280, 311
 - Front Panel Results & Views, 318, 367
 - front-panel features (see Getting Started guide), 35
 - functional checks, 453
 - functional test
 - keyboard, 454
 - functional test, basic
 - display, 453, 454
 - display, full brightness, 454
 - display, half brightness, 454
 - display, test #1, 453
 - display, test #2, 453
 - keyboard, 453, 454
- G**
- gain
 - external, 333, 377, 382
- H**
- hardware status, 487, 496
- H**
- HP BASIC, 472
 - HP VEE, over socket LAN, 477
 - HP VISA libraries, 473
- I**
- identity, IEEE command
 - options, query
 - model number, query, 448, 511
 - IEEE command termination, 463
 - IF BW, 354, 403
 - installable options
 - viewing, 450
 - installed options
 - viewing, 449
 - installing an option, 450, 451
 - from file, 450
 - from list, 450
 - from Type, 451
 - instrument status, 487
 - monitoring, 513
 - monitoring status monitoring, 514
 - integer variable (variables), 461
 - integrity condition register, 521, 522, 523
 - Internal Preamp, 328, 333, 377, 382
 - IP information
 - setting, 442, 443
- K**
- key
- Adjacent Channel Power, 176
 - All, 434
 - AM Detector, 348
 - AM Index Lower, 361
 - AM Index Upper, 361
 - AMPTD Y Scale, 46
 - AMPTD Y-Scale, 324
 - AMPTD Y-scale, 373
 - Append, 436
 - Auto Incr, 437
 - Auto Range, 49, 327, 332, 376, 381
 - Auto Tune, 53
 - AutoCarrFreq, 400
 - Autoscale, 46, 139, 179, 206, 239, 265, 286, 324, 329, 364, 373, 379, 414
 - Avg Mode, 77, 185, 217, 245, 270, 348, 397
 - Avg Number, 79, 158, 219, 247, 272, 347, 396
 - Avg Type, 79, 159
 - Battery, 448
 - Burst Search Threshold, 352, 402
 - Burst/Sync Search, 351
 - By Date, 426
 - By Extension, 427
 - By Name, 426

- By Size, 427
 - Calibration, 267
 - Carrier Frequency Offset Upper Limits, 411
 - Carrier Power Upper Limit, 360, 409
 - Channel Analyzer, 175, 317
 - Clear Calibration, 272
 - Clear Write, 101
 - Controls, 442
 - Copyrights, 448
 - Custom Full Brightness, 454
 - Custom Half Brightness, 454
 - Date Format, 441
 - Date/Time, 441
 - Date/Time/Location, 440
 - Delete States, 429, 438
 - Delta, 336, 342, 385, 391
 - Demod, 348, 397
 - Destination, 427
 - DHCP, 444
 - Display Settings, 446
 - Display Test, 453
 - Distance to Fault, 286
 - Elec Atten, 326, 330, 374, 380
 - Exponential, 348, 397
 - Ext Gain, 141, 329, 333, 377, 382
 - External, 357, 406
 - Filename, 434
 - FM Detector, 397
 - Free Run, 356, 405
 - FREQ Channel, 334, 383
 - Freq/Time Ref, 439
 - Frequency Deviation Lower Limit, 410
 - Frequency Deviation Upper Limit, 410
 - From File, 450
 - From List, 450
 - From Type, 451
 - Gateway, 445
 - Host Name, 443
 - IF BW, 354, 403
 - If File Exists..., 436
 - Install an Option, 450
 - Install Info, 451
 - Installable Options, 450
 - Installed Options, 449
 - Internal Preamp, 328, 333, 377, 382
 - IP Address, 444
 - IP address, 444
 - IP addressing, 443
 - IP Admin, 443
 - Keyboard, 454
 - Limits, 360, 409
 - Location, 428, 437
 - Marker, 335, 341, 384, 390
 - Marker ->, 340, 346, 389, 395
 - Marker All Off, 337, 343, 385, 391
 - Marker Type, 384, 390
 - Max Hold, 102
 - Meas, 37, 45, 245, 270, 294
 - Meas Filter, 351, 400
 - Meas Setup, 77, 245, 270, 297, 347, 396
 - Meas Time, 349, 398
 - Measurement Results, 433
 - Memory, 448
 - Min Hold, 103
 - Mkr -> RL, 340, 347, 389, 395
 - Mode, 41, 417
 - Mode Preset, 422
 - Modulation Analyzer, 318, 367
 - Name, 434
 - Net Mask, 445
 - Next Peak, 340, 346, 388, 394
 - Normal, 336, 342, 385, 391
 - Occupied BW, 137
 - Off, 337
 - One Port Insertion Loss, 239
 - Option Manager, 449
 - Order Up Down, 427
 - Overwrite, 436
 - Peak Hold, 350, 399
 - Peak Search, 339, 345, 388, 394
 - Power Switch, 447
 - Print, 422
 - Prompt, 437
 - Recall, 422
 - Recall Now, 424
 - Ref Position, 327, 332, 363, 376, 381, 413
 - Ref Value, 325, 330, 363, 374, 379, 412
 - Reference Level, 46, 139, 179, 206, 240, 265, 286
 - Repeat, 348, 397
 - Return Loss, 264
 - Rev Info, 448
 - RF Burst, 357, 406
 - Save, 429, 446
 - Save Now, 430
 - Scale Type, 49
 - Scale/Div, 48, 140, 180, 207, 240, 265, 287, 326, 331, 362, 375, 380, 412
 - Screen
 - screen file type, 431
 - Screen Save (Battery), 446
 - Screen Save (Ext DC), 446
 - Search Length, 353, 402
 - Select Trace, 101, 235, 260, 282, 313
 - Sensitivity, 93, 169
 - Service, 453
 - Set Date, 442
 - Set Test Color, 454
 - Set Time, 441
 - Sort, 426
 - Source, 433
 - Span, 98, 171, 233, 258, 280, 311, 365, 414
 - SPAN X Scale, 362, 412
 - Spectrum Analyzer, 43
 - Start Freq, 266
 - State
 - file type, 425
 - state file type, 432
 - static IP address, 444
 - Stimulus / Response, 199
 - Stop Freq, 266
 - Sync, 401
 - System Stats, 447
 - Test #1, 453
 - Test #2, 453
 - Time/Date, 441
 - Timestamp, 437
 - Trace, 426, 432
 - Trace 1, 428, 433
 - Trace 2, 428, 434
 - Trace 3, 428, 434
 - Trace 4, 428, 434
 - Trace/Detector, 312
 - Trigger, 356, 405
 - Trigger Delay, 359, 408
 - Trigger Level, 357, 406
 - Trigger Slope, 358, 407
 - Two Port Insertion Loss, 200
 - Type, 431
 - User Filename, 435
 - VBW/RBW, 57, 145
 - Verification, 453
 - Video BW, 56, 144
 - View/Display, 366, 415
 - Y Axis Units, 50, 141
 - keyboard test, 453
 - keyword parameter (commands), 461
- ## L
- LAN
 - bus, 467
 - cable, 483
 - SICL, 472
 - socket programming, 471
 - telnet, 467
 - using, 467
 - VEE program, 477
 - LAN defaults, 479
 - LAN troubleshooting, 479
 - License Key
 - key, 451
 - limit

- AM Index, 361
 - lower, 361, 410
 - upper, 360, 361, 409, 410, 411
- Limits, 360, 409
- local echo, lack of, 468
- location
 - recall file, 428
 - save file, 437
- lower limit
 - frequency deviation, 410
- M**
- manual, using, 35
- Marker, 335, 341, 384, 390
- Marker ->, 340, 346, 389, 395
- Marker All Off, 337, 343, 385, 391
- Marker Type, 335, 342, 384, 390
- Marker X Axis Position, 338, 344, 387, 393
- Marker X Axis Value, 337, 343, 386, 392
- Marker Y Axis Value, 339, 345, 387, 393
- Max Carrier Frequency Offset, 369
- Max Carrier Power, 319, 368
- Max Distortion, 321, 370
- Max Hold key, 102
- Max Mod Rate, 320, 370
- Max Peak- AM Index, 320
- Max Peak- Frequency Deviation, 368
- Max Peak+ / 2 Frequency Deviation, 369
- Max Peak+ AM Index, 319
- Max Peak+ Frequency Deviation, 368
- Max Peak+/-2 AM Index, 320
- Max RMS AM Index, 320
- Max RMS Frequency Deviation, 369
- Max SINAD, 321, 370
- Maximum Value term, 35
- Meas Filter, 351, 400
- Meas front-panel key, 37, 45
- Meas key, 245, 270, 294
- Meas Setup, 347, 396
- Meas Setup key, 77, 245, 270, 297
- Meas Time, 349, 398
- measurement modes
 - selecting, 37, 41, 45, 137, 176, 200, 239, 264, 286, 318, 367, 417
- measurement results file type, 433
- measurement time, 349, 398
- measurements
 - increasing speed, 465
 - memory information, 448
- Metrics, 321, 371
- Min Hold key, 103
- Min Peak- AM Index, 320
- Min Peak- Frequency Deviation, 369
- Min Peak+ AM Index, 319
- Min Peak+ Frequency Deviation, 368
- Min Peak+/-2 AM Index, 320
- Min Peak+/-2 Frequency Deviation, 369
- Min RMS AM Index, 320
- Min RMS Frequency Deviation, 369
- Mkr -> RL, 340, 347, 389, 395
- Mode front-panel key, 41, 417
- mode preset, 422
- Modulation Analyzer, 318, 367
- Modulation Index Lower Limit, 361
- Modulation Index Upper Limit, 361
- monitoring
 - errors, 513
 - status, 514
 - the instrument, 487
- N**
- negative transition filter, 488
- network connectivity, 443, 444, 445, 446
- Next Peak, 340, 346, 388, 394
- no response from host error, 481
- Normal, 336, 342, 385, 391
- Numeric Results View, 319, 368
- Numeric Results Window, 318, 319, 367
- O**
- Occupied BW front-panel key, 137
- Off, 337, 343, 385, 391
- One Port Insertion Loss front-panel key, 239
- OPC command, 489
- operation complete, IEEE command, 512
- option install info
 - viewing, 451
- option manager, 449
- options
 - deleting, 452
 - viewing, 450
- output data, identifying block size, 462
- P**
- packet errors, 480
- parameter (variables), 461
- parameters (commands), 461
- parameters, variable, 461
- Peak Hold, 350, 399
- Peak Search, 339, 345, 388, 394
- percent parameter (variables), 462
- persistent settings, 479
- personalities
 - selecting, 37, 41, 45, 137, 176, 200, 239, 264, 286, 318, 367, 417
- phase parameter (variables), 462
- pinging the analyzer, 482
- Points menu key, 420
- positive transition filter, 488
- power conservation settings, 446
- power parameter (variables), 462
- preset
 - mode, 422
- preset defaults
 - LAN, 479
- print
 - screen, 422
- programmer's reference, using, 35
- programming
 - command parameters, 461
 - command syntax, 458
 - SCPI basics, 458
 - socket LAN, 471
 - valid commands, 458
 - via LAN, 471
- Q**
- query
 - current measurement, 39
- questionable condition register, 516, 517, 518
- questionable status register, 505
- R**
- Rate, 318, 319, 367, 368
- ratio
 - VBW/RBW, 57, 145
- rear-panel features (see Getting Started guide), 35
- recall file, 422, 424
- Ref Position, 327, 332, 376, 381, 413
- Ref Position key, 363
- Ref Value, 325, 330, 374, 379, 412
- Ref Value key, 363
- Reference Level key, 139, 179, 206, 240, 265, 286
- Reference Level menu key, 46
- register
 - frequency condition, 519, 520, 521
 - integrity condition, 521, 522, 523
 - questionable condition, 516, 517, 518
 - status byte preset, 516
 - temperature condition, 520
- registers
 - condition, 488
 - event, 488
 - event enable, 488
 - service request enable, 500
 - standard event status, 501

- status, 496
- relative power parameter (variables), 462
- Remote Command term, 35
- Remote Measurement Results, 321
- Repeat, 348, 397
- Restart menu key, 420
- results data, identifying block size, 462
- Return Loss front-panel key, 264
- RF Burst, 357, 406
- RST term, 35
- S**
- save file, 430
 - filename, 434
 - naming method, 434
 - rules, 436, 437
 - user filename, 435
- Save User Preset, 456
- saved
 - state, 35
- saved states
 - deleting, 429, 438
- Scale Type key, 141
- Scale Type menu key, 49
- Scale/Div, 331, 375, 380, 412
- Scale/Div key, 140, 180, 207, 240, 265, 287, 326, 362
- Scale/Div menu key, 48
- SCPI language
 - basic info, 458
 - command parameters, 461
 - command syntax, 458
 - keyword parameters, 461
 - valid commands, 458
- screen
 - save, 429, 430
- Screen files
 - Bit-Mapped Graphic, 432
- screen save, 442
 - setting, 446
- Search Length, 353, 402
- Select Trace key, 101, 260
- selecting, 37, 45, 137, 176, 200, 239, 264, 286, 318, 367
 - measurement application modes, 41, 417
 - modes, 37, 45, 137, 176, 200, 239, 264, 286, 318, 367
- SelectTrace key, 235, 282
- self-test, 455
- Sensitivity key, 93, 169
- serial number, query, 448, 511
- service request enable register, 500
- service request, IEEE command, 513
- service requests, 494
- setting, 443
 - date, 442
 - external power cycle preference, 447
 - IP information, 442, 443
 - power conservation settings, 446
 - screen save, 442, 446
 - system name, 443
 - time, 441
 - time and date, 440, 441
- SICL LAN, 472
- SINAD, 318, 319, 367, 368
- Single key, 421
- slope
 - trigger, 407
- socket LAN
 - programming, 477
- socket programming, 471
- sort
 - by date, 426
 - by extension, 427
 - by name, 426
 - by size, 427
 - order up down, 427
- source
 - trace file source, 433
- Span, 365, 414
- Span key, 98, 171, 233, 258, 280, 311
- SPAN X Scale, 362, 412
- Spectrum Analyzer key, 43
- Spectrum View, 319, 367
- SRE command, 489
- SRQ, 513
- SRQ command, 494
- standard event status, 501
 - enable register, 503
- standard event status byte, enable and read, 509
- standard event status register, IEEE
 - command, 510
- Start Freq key, 266
- State
 - file type, 426
- state
 - saved, 35
- State Saved term, 35
- status byte
 - clearing, 508
 - register system, 487, 496
- status byte register, 498
- status byte register preset, 516
- status byte, IEEE command, 514
- status enable register, 503
- status register
 - questionable status, 505
- status registers
 - setting and querying, 489
- STB command, 489
- Stimulus / Response key, 199
- Stop Freq key, 266
- string parameter (variables), 462
- Sweep Time menu key, 418
- Sync, 401
- synchronization, 401, 512, 515
- system name, setting, 443
- system operations
 - configuring for network
 - connectivity, 443, 444, 445, 446
 - using the option manager, 449
- system statistics
 - viewing, 447, 448
- T**
- telnet, using, 467
- temperature condition register, 520
- terms
 - *RST, 35
 - book, 35
 - definition, 35
 - dependencies/couplings, 35
 - example, 35
 - factory preset, 35
 - maximum value, 35
 - remote command, 35
 - state saved, 35
- test, IEEE command, 455
- throughput, improving, 465
- time
 - display on/off, 441
 - setting, 440, 441
- time base adjustment, 453
- time parameter (variables), 462
- time, measurement, 349, 398
- timeout errors, 480
- timing control, 512, 515
- trace
 - destination, 427
 - file type, 426
- trace data format, 462
- trace file source, 433
- trace file type, 432
- Traces, 323, 372
- Trigger, 356, 405
- Trigger Delay, 359, 408
- Trigger Level, 357, 406
- Trigger Slope, 358, 407
- Two Port Insertion Loss front-panel key, 200
- U**
- units parameter (commands), 461
- upper limit
 - carrier frequency offset, 411
 - carrier power, 409
 - frequency deviation, 410

User Preset, [455](#)
user's reference, using, [35](#)

V

variable parameter (commands), [461](#)
variables
 angle parameter, [462](#)
 bit_data parameter, [462](#)
 degree parameter, [462](#)
 frequency parameter, [461](#)
 integer parameter, [461](#)
 parameters, [461](#)
 percent parameter, [462](#)
 phase parameter, [462](#)
 power parameter, [462](#)
 relative power parameter, [462](#)
 string parameter, [462](#)
 time parameter, [462](#)
 voltage parameter, [462](#)
VBW/RBW key, [57](#), [145](#)
VBW/RBW ratio, [57](#), [145](#)
VEE over socket LAN, [477](#)
video bandwidth, adjusting, [56](#), [144](#)
Video BW, [56](#), [144](#)
Video BW key, [56](#), [144](#)
View/Display, [366](#), [415](#)
viewing, [447](#), [448](#)
 battery status, [448](#)
 copyright information, [447](#), [448](#)
 installable options, [450](#)
 installed options, [449](#)
 memory information, [448](#)
 option install info, [451](#)
 system statistics, [447](#), [448](#)
VISA libraries, [473](#)
voltage parameter (variables), [462](#)

W

wait, IEEE command, [515](#)
Waveform View, [318](#), [367](#)

Y

Y Axis Units key, [141](#)
Y Axis Units menu key, [50](#)