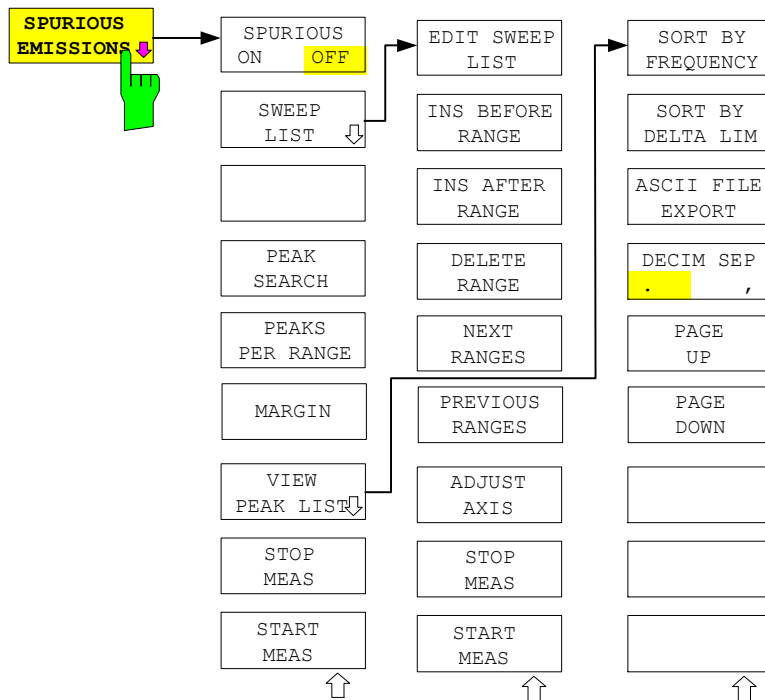


Supplement to Operating Manual

Measuring Spurious Emissions

All real amplifiers also generate unwanted RF products outside the assigned frequency band. These spurious emissions are usually measured across a wide frequency range, for example from 9 kHz to 12.75 GHz (ETSI). The spectrum analyzer settings are specified for each frequency range.

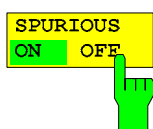


In the Spurious Emissions mode, the FSQ performs measurements in predefined frequency ranges with settings that can be specified individually for each of these ranges.

For this purpose, the SWEEP TABLE settings or the current device settings are used. Up to 20 subranges can be defined (they need not directly follow one another) across which the FSQ sweeps in subsequent order. However, the measurement ranges must not overlap. The measurement parameters can be selected independently from each other in every subrange (*SWEEP LIST* menu, *EDIT SWEEP LIST*).

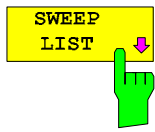
Limit lines are defined and displayed irrespective of the sweep ranges, i.e. they are not part of the sweep ranges. The unit of the limit lines is restricted to dB or dBm.

The frequency range where measurements are actually performed is set by the start and stop frequency parameters of the FSQ; these parameters are independent of the sweep ranges. It is thus possible to define sweep ranges for a measurement task that can be stored and reloaded and to quickly and easily set the frequency range to be actually measured by means of two parameters; complex editing in the sweep table is not necessary.



The SPURIOUS ON OFF softkey switches the spurious emissions measurement on or off according to the current configuration.

IEC/IEEE bus command: `SWEEP:MODE LIST` switches the spurious list on
`SWEEP:MODE AUTO` switches the spurious list off



The SWEEP LIST softkey opens a submenu where predefined sweep ranges can be edited, or new ranges generated or deleted. A table listing the current sweep ranges is displayed.

IEC/IEEE bus command: --



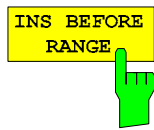
The EDIT SWEEP LIST softkey opens the table for editing the sweep ranges.

In the SWEEP LIST table, the individual sweep ranges are set.

- Range Start: Start frequency of the range
- Range Stop: Stop frequency of the range
- Filter Type: Filter type: NORMAL, CHANNEL, RRC
- RBW: Resolution filter bandwidth
- VBW: Video filter bandwidth; not applicable for CHANNEL and RRC filters
- Sweep Time Mode: AUTO / MANUAL
- Sweep Time: Sweep time; if AUTO is indicated for the sweep time mode, the automatically calculated sweep time is displayed. If the cell is edited, the associated sweep time mode is automatically set to MANUAL.
- Detector: Specifies the range detector: Sample, Average, Max Peak, RMS, Min Peak and Auto Peak
- REF-Level: Reference level in dBm
The upper edge of the displayed screen area is the value of the maximum reference level, corrected by the associated transducer factor.
- RF-Attenuator-Mode: AUTO / MANUAL
- RF-Attenuator: Number; as with Sweep Time
- PRE-AMP: ON / OFF; preamplifier selection (options B23, B25, if available)
- Sweep Points: Number of sweep points per range (sweep segment).
The number of sweep points must not exceed **100001**.
- Stop after Sweep: ON / OFF; if ON, the sweep is stopped after the range and continued only if confirmed by you via a message box.
- Transd. factor: NONE or factor (enter via selection list)

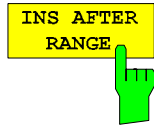
IEC/IEEE bus commands: SENS:LIST:RANGE<1...20>:...

SWEEP LIST					
	RANGE 1	RANGE 2	RANGE 3	RANGE 4	RANGE 5
Range Start	9 kHz	50 MHz	500 MHz		
Range Stop	50 MHz	500 MHz	1 GHz		
Filter Type	NORMAL	CHANNEL	RRC		
RBW	10 kHz	100 kHz	3 MHz		
VBW	30 kHz	300 kHz	10 MHz		
Sweep time mode	AUTO	MANUAL	AUTO		
Sweep time	10 ms	10 ms	100 ms		
Detector	Peak	RMS	Peak		
REF-Level	-20 dBm	-20 dBm	-20 dBm		
RF-Att. mode	AUTO	MANUAL	AUTO		
RF-Attenuator	10 dB	10 dB	5 dB		
PRE-AMP	OFF	OFF	OFF		
Sweep Points	625	625	625		
Stop after sweep	ON	OFF	OFF		
Transd. factor	LOWFREQ	MIDFREQ	MIDFREQ		



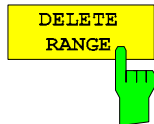
The *INS BEFORE RANGE* softkey inserts a range in front of the marked line.

IEC/IEEE bus command --



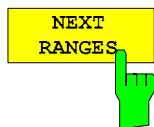
The *INS AFTER RANGE* softkey inserts a range following the marked line.

IEC/IEEE bus command --



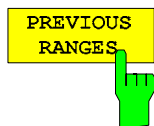
The *DELETE RANGE* softkey deletes the current range. All higher ranges are set back by one.

IEC/IEEE bus command `LIST:RANGe<1...20>:DELeTe`



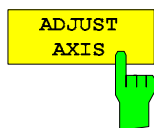
The *NEXT RANGES* softkey activates the displays of the next higher subranges, i.e. 6 to 10, 11 to 15 or 16 to 20.

IEC/IEEE bus command --



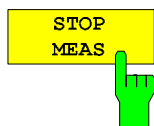
The *PREVIOUS RANGES* softkey activates the displays of the next lower subranges, i.e. 1 to 5, 6 to 10 or 11 to 15.

IEC/IEEE bus command: --



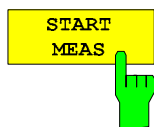
The *ADJUST AXIS* softkey automatically adjusts the frequency axis of measurement diagram so that the start frequency matches the start frequency of the first sweep range, and the stop frequency of the last sweep range.

IEC/IEEE bus command: -- (via `FREQuency:STARt <num_value> / FREQuency:STOP <num_value>`)



The *STOP MEAS* softkey stops the measurement. The measurement data can be analyzed.

IEC/IEEE bus command: `ABORt`



Using the *START MEAS* softkey, you can start the measurement while the submenu is simultaneously exited.

When the measurement is started, the FSQ sets up the measurement diagram in the selected measurement window and starts the measurement in the selected mode.

With *SINGLE*, a single frequency sweep occurs; afterwards the FSQ remains on the stop frequency.

With *CONTINUOUS*, the measurement continues until it is stopped.

You can stop the measurement with *STOP SWEEP*.

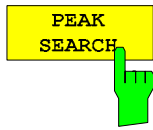
If a *STOP AFTER SWEEP* point has been defined in the range, the sweep stops automatically at the end of the respective range to allow you to change the external circuitry, for example. This is indicated in a message box:

`SWEEP Range# reached CONTINUE/BREAK`

If *CONTINUE* is selected, the sweep is continued in the next range. If *BREAK* is selected, the sweep is stopped.

IEC/IEEE bus command: `INIT:SPUR` starts the measurement
`INIT:CONM` starts the measurement after a *BREAK* has been reached

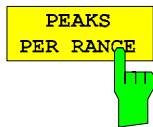
ABORT stops the measurement after a range has been reached



The *PEAK SEARCH* softkey starts the process of determining the list of the subrange maximums from the existing sweep results. This procedure can be repeated as often as desired, e.g. to experiment with the various threshold settings.

It is activated only after a measurement has been performed with *START MEAS*.

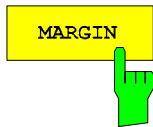
IEC/IEEE bus command `CALC:PEAK`



The *PEAKS PER RANGE* softkey activates entry of the number of peaks per range that are stored in the list. The value range extends from 1 to 50. Once the selected number of peaks has been reached, the peak search is stopped in the current range and continued in the next range.

IEC/IEEE bus command: `CALC:PEAK:SUBR 1...50`

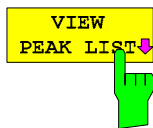
Default: 25;



The *MARGIN* softkey activates entry of the margin, i.e. the acceptance threshold for determining the peak list. The limit line is shifted by this value when the maximums are determined. The value range extends from -200 dB to 200 dB.

IEC/IEEE bus command: `CALC:PEAK:MARG -200dB...200dB`

Default: 6 dB



The *VIEW PEAK LIST* softkey opens the submenu for viewing the peak list.

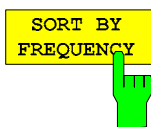
It is activated for display only after a *PEAK SEARCH* has been performed with *PEAK SEARCH*.

A delta limit of +200dB is listed if no limit check is active.

IEC/IEEE bus command: `TRACe? SPURious`

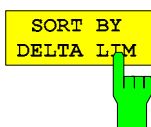
The table below shows a peak list after a *PEAK SEARCH*:

VIEW PEAK LIST			
TRACE / Detector	FREQUENCY	LEVEL dBm	DELTA LIMIT dB
1 RMS	80.0000 MHz	-36.02	-5.02
1 RMS	80.0001 MHz	-30.07	+0.24
1 RMS	85.1234 MHz	-30.02	-0.02
1 AVERAGE	130.234 MHz	-29.12	-5.12



The *SORT BY FREQUENCY* softkey sorts the table according to the entries in the *FREQUENCY* column in descending order.

IEC/IEEE bus command `--`



The *SORT BY DELTA LIM* softkey sorts the table according to the entries in the *DELTA LIM* column (default) in descending order. If no limit line has been specified, an offset of 200 dB is assumed for all peaks.

IEC/IEEE bus command: `--`



The *ASCII FILE EXPORT* softkey stores the peak list in ASCII format to a file on a diskette.

IEC/IEEE bus command: `MMEM:STOR:SPUR,'A:\TEST.ASC'`

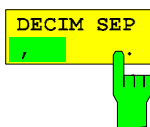
The file has a header containing important parameters for scaling, several data sections containing the sweep settings per range and a data section containing the peak list.

The header data is made up of three columns, separated by ';':
parameter name; numeric value; basic unit

The data section for the measurement values starts with the keyword "TRACE <n>:", where <n> includes the number of the used trace. Next comes the peak list with several columns also separated by ';':

Spreadsheet programs such as MS Excel can read this format. Use ';' as the delimiter for the table cells.

Note: *Different language versions of evaluation programs may require different handling of the decimal point. Using the DECIM SEP softkey, you can thus choose between the delimiters '.' (decimal point) and ',' (comma).*



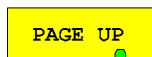
In the case of floating-point numbers, use the *DECIM SEP* softkey to select between '.' (decimal point) and ',' (comma) as the decimal delimiter for the ASCII FILE EXPORT function.

By selecting the decimal delimiter, various language versions of evaluation programs (e.g. MS Excel) are supported.

IEC/IEEE bus command: `FORM:DEXP:DSEP POIN`

The ASCII export table is structured as shown below:

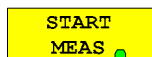
	File contents	Explanation
File header	Type;FSQ; Version;3.55; Date;02.Aug 2004; Mode;ANALYZER; SPURIOUS; Start;9000.000000;Hz Stop;8000000000.000000;Hz x-Axis;LIN; Sweep Count;1;	Model Firmware version Storage date of data set Operating mode of the device Start/stop of the span Unit: Hz Linear (LIN) or logarithmic (LOG) (future feature) scaling of the x-axis Selected number of sweeps
File data section	TRACE 1: Trace Mode;CLR/WRITE; x-Unit;Hz; y-Unit;dBm; Margin;6.000000;s Values;8; 1;1548807257.5999999000;- 65.602280;-5.602280 1;1587207214.4000001000;- 65.327530;-5.327530 1;2112006624.0000000000;- 4.388008;55.611992	Selected trace Display mode of trace: CLR/WRITE,AVERAGE,MAX HOLD,MIN HOLD, VIEW, BLANK Unit of x values: Unit of y values: Peak List margin Number of measurement points Measurement values: <Trace>;<x value>; <y value>;<delta limit>



Using PAGE UP and PAGE DOWN, you can scroll forward and backward through the peak list pages.

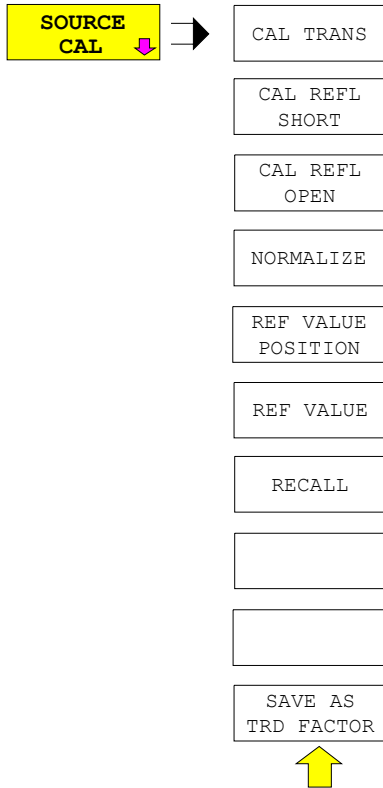


They are active only as long as a peak list is displayed.
See above.



See above.

Menu NETWORK



SAVE AS TRD FACTOR uses the normalized measurement data to generate a transducer factor with up to 625 points. The trace data are converted to a transducer with unit dB after the transducer name has been entered. The number of points is defined by SWEEP COUNT. The frequency points are allocated in equidistant steps between start and stop frequency. The generated transducer factor can be further adapted in the menu SETUP – TRANSDUCER. SAVE AS TRD FACTOR is only available if normalization is switched on.

IEC/IEEE bus command:CORR:TRAN:GEN <name>

Detector;RMS;	Detector: MAX PEAK, MIN PEAK, RMS, AVERAGE
REF-Level; -10.000000;dBm	Setting of the reference level in the current range
Auto RF-Attenuator; OFF;	Manual (OFF) or automatic (ON) setting of the RF attenuator
RF Att;15.000000;dB	Range input attenuation
Sweep Points;625;	Number of sweep points in the current range
Preamp; 0.000000;dB	Range preamplifier, on (20 dB) or off (0 dB)
Stop after range;OFF;	Stop after range, switched on (ON) or off (OFF) for the current range
Transducer;TRD1;	Transducer name (if activated) repeated for all sweep list ranges
File data section TRACE 1:	Selected trace
x-Unit;Hz;	Unit of x values:
y-Unit;dBm;	Unit of y values:
Values;2500;	Number of measurement points
9000.000000;-99.619965;	Measurement values:
9225.961538;-105.416908;	<x value>; <y value>
9451.923077;-100.938057;	
9677.884615;-99.483894;	
9903.846154;-106.879539;	
10129.807692;-108.772316;	

[SENSe<1|2>:]CORRection:TRANsdruceR:GENerate <name>

This command generates a transducer factor <name> using normalized trace data. The function is only available when normalization is switched on.

Parameter: <name>::= Name of the transducer factors as string data with up to 8 characters.

Example: "CORR:TRAN:GEN 'FACTOR1'"

Characteristics: *RST value: -
SCPI: device-specific

Mode: A

[SENSe<1|2>:]IQ:DITHer[:STATe] ON | OFF

Option FSQ-B71: This command inserts a 2 MHz wide noise signal at 42.67 MHz into the signal path of the baseband input.

Option FSQ-B72: This command inserts a 2 MHz wide noise signal with 81 MHz spacing from the center frequency into the signal path.

[SENSe<1|2>:]LIST:RANGe<1...20>:BANDwidth[:RESolution] <numeric_value>

This command selects the resolution bandwidth (RBW) of a range in the spurious measurement.

Example: ":LIST:RANG2:BAND 10E3" 'sets the RBW to 10 KHz

Features: *RST value: 10 kHz
SCPI: device-specific

Mode: A

[SENSe<1|2>:]LIST:RANGe<1...20>:POINTs <numeric_value>

This command defines the number of sweep points of a range in the spurious measurement.

Example: ":LIST:RANG2:POIN 300" 'sets 300 sweep points in range 2

Features: *RST value: 625
 SCPI: device-specific

Mode: A

[SENSe<1|2>:]LIST:RANGe<1...20>:RLEVEL <numeric_value>

This command defines the reference level of a range in the spurious measurement.

Example: ":LIST:RANG2:RLEV -30" 'sets the reference level in range 2 to -30 dBm

Features: *RST value: ???
 SCPI: device-specific

Mode: A

[SENSe<1|2>:]LIST:RANGe<1...20>:SWEp:TIME <numeric_value>

This command defines the sweep duration of a range in the spurious measurement.

Example: ":LIST:RANG2:SWE:TIME 1MS" 'sets the sweep time in range 2 to 1 ms

Features: *RST value: --
 SCPI: device-specific

Mode: A

[SENSe<1|2>:]LIST:RANGe<1...20>:SWEp:TIME:AUTO ON | OFF

This command controls the automatic coupling of the sweep duration on the frequency span and the bandwidth settings in a spurious measurement range.

Example: ":LIST:RANG2:SWE:TIME:AUTO ON" 'activates the coupling of frequency range and bandwidths in range 2

Features: *RST value: ON
 SCPI: device-specific

Mode: A

[SENSe<1|2>:]LIST:RANGe<1...20>:TRANsducer <string>

This command sets the transducer factor for a range in the spurious measurement.

Example: ":LIST:RANG2:TRAN ON 'fac_1'" 'sets the transducer factor fac_1 in 'range 2

Features: *RST value: --
 SCPI: device-specific

Mode: A

[SENSe<1|2>:]SWEep:MODE AUTO | LIST

This command controls the sweep continuation.

AUTO free-running sweep

LIST Activates the spurious emissions measurement, defined with SENS:LIST:RANGE

Example: "SWE:MODE AUTO" 'activates free-running sweep

Features: *RST value: AUTO
SCPI: device-specific

Mode: A

TRACe<1|2>[:DATA] TRACE1| TRACE2| TRACE3 | SPURious | ABITstream | PWCDp | CTABLE, <block> | <numeric_value>

SPURious reads the peak list in the spurious measurement. As results a list of frequency, level and delta to limit line values is returned. A delta limit of +200dB indicates no limit check is active

Number and format of the measurement values for the different operating modes

The number of measurement values depends on the instrument setting:

SPECTRUM mode (span > 0 and zero span):

501 results are output in the unit selected for display.

625 results are output in the unit selected for display.

For spurious emissions measurement the number of results is the sum of all sweep points, specified in the sweep list configuration.

Note: *With AUTO PEAK detector, only positive peak values can be read out. Trace data can be written into the instrument with logarithmic display only in dBm, with linear display only in volts.*

FORMat REAL,32 is to be used as format for binary transmission, and FORMat ASCii for ASCII transmission.

TRACe<1|2>:IQ:DATA:FORMatCOMPatible | IQBLock | IQPair

This command sets the data output formatting (using the TRAC:IQ:DATA? command):

COMPatible 512k I data and 512k Q data is alternately transferred

IQBLock First, all I and then all Q data is transferred

IQPair I/Q data is transferred in pairs

Example: "TRAC:IQ:DATA:FORM IQP"

Features: *RST value: COMP
SCPI: device-specific

Mode: A

TRACe<1|2>:IQ:DATA:MEMory:AIQ? <offset samples>,<# of samples>

This command allows you to read baseband Q data from the memory that was previously sampled (and frequency-response-corrected) if you indicate the offset at the beginning of the sampling and the number of measurement values. A data set once sampled can thus be read in smaller portions. The maximum number of measurement results depends on the TRACe:IQ:SET command specifications, the output format on the presetting via the FORMat subsystem.

Note: *The command requires that all requested measurement data be completely retrieved before the device accepts any further commands.
If no baseband Q data is available in the memory because the associated measurement has not yet been started, the command generates a query error.*

Parameter:	<offset samples>	Offset of the values to be output, referenced to the start of the sampled data. Value range: 0 ... <# of samples> - 1, where <# of samples> is the value specified with the TRACe:IQ:SET command.
	<# of samples>	Number of measurement values to be output. Value range: 1 ... <# of samples> - <offset samples> where <# of samples> is the value specified with the TRACe:IQ:SET command.

Examples:

"TRAC:IQ:STAT ON"	'activates the I/Q data sampling
"TRAC:IQ:SET NORM,10MHz,32MHz,EXT,POS,100,4096"	'configures the measurement: 'Filter type: Normal 'RBW: 10 MHz 'Sample Rate: 32 MHz 'Trigger Source: External 'Trigger Slope: Positive 'Pretrigger Samples: 100 '# of Samples: 4096
"INIT;*WAI"	'starts the measurement and waits for its end
"FORMat REAL,32"	'specifies the format of the response data
'Reading the results:	
"TRAC:IQ:DATA:MEM:AIQ? 0,2048"	'reads in 2048 I/Q values starting with the beginning of the sampling
"TRAC:IQ:DATA:MEM:AIQ? 2048,1024"	'reads in 1024 I/Q values starting at half the 'sampled data
"TRAC:IQ:DATA:MEM:AIQ? 100,512"	'reads in 512 I/Q values starting with the trigger time (<Pretrigger Samples> was 100)

Return values:

Irrespective of the output format selected, the data is scaled linearly with 'V' as the unit and corresponds to the voltage at the RF input of the device.

The return buffer is similarly configured to the return buffer with the TRACe:IQ:DATA? command where all I data has the value 0.

Features:	*RST value:	--
	SCPI:	device-specific
Mode:	A	

TRACe<1|2>:IQ:WBANd[:STATe] ON|OFF

This command switches the Bandwidth Extension FSQ-B72 on or off. At sampling rates exceeding 81.6 MHz, the option B72 is automatically switched on. To measure also at sampling rates <=81.6 MHz with a larger bandwidth, the option B72 can be activated using this command.

Example: TRAC:IQ:WBAN ON 'switches the B72 on

Features: *RST value: ON
SCPI: device-specific

Mode: A to Z