8594Q Option R95 Data Measurements Retrofit Kit

Installation Note and Calibration Guide Update

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Notice

Hewlett-Packard to Agilent Technologies Transition

This documentation supports a product that previously shipped under the Hewlett-Packard company brand name. The brand name has now been changed to Agilent Technologies. The two products are functionally identical, only our name has changed. The document still includes references to Hewlett-Packard products, some of which have been transitioned to Agilent Technologies.

Printed in USA March 2000

Data Measurements Retrofit (Option R95)

This kit contains the parts and instructions required to retrofit the Data Measurements hardware and Down Loadable Program (DLP) into the 8594Q Option 190 DVB-C QAM Analyzer.

Parts List

Parts included with this kit;

Part Number	Quantity	Description
08594-10003	1	Measurement Software DLP card
08594-60060	1	FEC Decoder Assembly
08594-60063	1	MPEG Ribbon Cable Assembly
08594-60064	1	Bus Cable Assembly
08594-60069	1	Co-axial Cable Assembly
08594-90053	1	Installation Note (and Calibration Guide update) *This document.*
08594-90055	1	User’s Guide and Programming Reference
0380-2079	2	Hexagonal Stand-off
2190-0102	1	Lock Washer 15/32
2950-0035	1	Nut 15/32

Introduction

IMPORTANT This Procedure should only be carried out by Trained engineering personnel in an approved Agilent Technologies Customer Service Centre.

Purpose The Field retro-fit of 8594Q Option R95 to an existing customer's 8594Q Option 190 DVB-C QAM Analyzer.

Reason To add Data Measurements capability to the 8594Q DVB-C QAM Analyzer.

Installation Procedure

The installation of the 8594Q Option R95 Retrofit kit involves fitting the Forward Error Correction (FEC) card and associated cables to the 8594Q Option 190 DVB-C QAM Analyzer and loading new measurement software.

Carry out the FEC card installation first:

FEC Card Installation

Cover

1. Ensure all power cables are disconnected from the analyzer.
2. Protect the front face of the analyzer and place it, face down, on a smooth work surface.
3. Loosen the 4 Allen headed fixing bolts on the rear of the analyzer.
4. Loosen and remove the 4 screws that fix the analyzer cover to the rear panel.
5. Remove the analyzer cover.

Rear Panel

6. Loosen and remove 6 screws fixing the rear panel to the sides of the analyzer.
7. Allow the rear panel to come away from the analyzer without stressing the attached cable assemblies.
8. Remove the blanking plate from the **Parallel Data Output** connector location. Retain the 4 fixing screws.
9. Remove the plug from the **Serial Data Output** connector location.

Card Cage

10. Remove the Ribbon Cable connecting the Digital Signal Processing card (A190A3) to the Digital Demod card (A190A2).
11. Fit the FEC card (08594-60060) into the vacant slot in the card cage.
12. Fit the Bus Cable Assembly (08594-60064). Use this ribbon cable to connect the three cards; DSP, Digital Demod and FEC.

Rear Panel

13. Fit the **Parallel Data Output** assembly (08594-60063) to the rear panel using the hexagonal stand-offs provided.
14. Fit the **Serial Data Output** cable assembly (08594-60069) to the rear panel.

Card Cage

15. Fit the free end of the **Parallel Data Output** cable assembly (08594-60063) to the FEC card routing it under the I.F. section cable to prevent snagging on the cover.
16. Fit the free end **Serial Data Output** cable assembly (08594-60069) to the FEC card.

Rear Panel and Cover

17. Refit the rear panel to the sides of the analyzer. Ensure you dress the cables to avoid snags.
18. Refit the analyzer cover. Again, take care to avoid snagging any loose cables.
19. Fix the 4 screws and 4 bolts to the rear of the analyzer.

The assembly of the analyzer is now complete.

Loading the DLP and Verification

The next procedure details the installation of the new measurement software (DLP) and verifies the correct operation of the analyzer.

CAUTION: *Do not* connect AC power until you have verified that the line voltage is correct, the proper fuse is installed, and the line voltage selector switch is properly positioned. Damage to the analyzer could result.

Delete old DLP

1. Press (LINE) to power up the analyzer.
2. Erase the currently installed measurement DLP by pressing (CONFIG), `More 1 of 3`, `Dispose User Mem`, `ERASE DLP MEM`. Press `ERASE DLP MEM` again to delete the DLP.

Install new DLP

3. Insert the DLP card (08594-10003) into the analyzer card reader.
4. Load the new measurement DLP by pressing (RECALL), `INTERNAL CARD` (to underline CARD), `Catalog Card`, `Catalog All`. Ensure the file **dDCATV_D** is highlighted and press `LOAD FILE` to load the DLP.

Verification

5. Test and evaluate the Data Measurements functionality using STE-9000 code and Test Equipment as described in the *8594Q Test Procedures.*

On successful completion of Verification the analyzer is ready to be returned to the customer

Preparing the Analyzer for Return

In addition to your normal operating procedures for returning equipment to the customer please also ensure that:

- All of the following pages, beginning "*Returned with your ....*" are included in the return package. This allows the customer to bring his up to date with the additional specifications for the Data Measurements functionality.
- The supplied *User's Guide and Programing Reference* is included in the return package.
- The supplied measurement DLP card (08594-10003) is included in the return package.

Returned with your 8594Q DVB-C QAM Analyzer

Thank you for adding the extra functionality of the 8594Q Option R95 to your analyzer.

In addition to the new measurement functions, also returned with you analyzer are:

- A replacement 8594Q Specifications and Characteristics section for your *8590 Series Analyzer Calibration Guide*. Please replace this section (Chapter 8) with the pages supplied. This ensures your *8590 Series Analyzer Calibration Guide* is consistent with your analyzer.
- A new *User's Guide and Programing Reference* detailing all the analyzer DVB-C measurements and remote programming commands.
- A new measurement DLP card (08594-10003). This contains all the DVB-C measurement functionality and should be kept in a safe place.

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HP 8594Q Specifications and Characteristics

This chapter contains specifications and characteristics for the HP 8594Q QAM Analyzer.

The specifications and characteristics in this chapter are listed separately. The specifications are described first and are followed by the characteristics.

General	General specifications.
QAM Measurement	QAM measurement specifications and characteristics.
Spectrum Analysis Frequency	Frequency-related specifications and characteristics.
Spectrum Analysis Amplitude	Amplitude-related specifications and characteristics.
Physical	Input, output and physical characteristics.

The distinction between specifications and characteristics is described as follows.

- Specifications describe warranted performance over the temperature range 0 °C to +55 °C* (unless otherwise noted). The analyzer will meet its specifications under the following conditions:
  - The instrument is within the one year calibration cycle.
  - 2 hours of storage at a constant temperature within the operating temperature range.
  - 30 minutes after the analyzer is turned on.
  - After the CAL frequency, and CAL amplitude routines have been run.
- Characteristics provide useful, but nonwarranted information about the functions and performance of the analyzer. Characteristics are specifically identified.
- Typical Performance, where listed, is not warranted, but indicates performance that most units will exhibit.
- Nominal Value indicates the expected, but not warranted, value of the parameter.

*0 °C to +50 °C with Option 015 or Option 016 operating/carrying case.

General Specifications

All specifications apply over 0 °C to +55 °C unless equipped with Option 015 or 016. The analyzer will meet its specifications after 2 hours of storage at a constant temperature, within the operating temperature range, 30 minutes after the analyzer is turned on and after CAL FREQ and CAL AMPTD have been run.

Temperature Range	
Operating	0 °C to +55 °C*
Storage	−40 °C to +75 °C
* 0 °C to +50 °C with Option 016 operating and carrying case.	

EMI Compatibility	Conducted and radiated emission is in compliance with CISPR Pub. 11/1990 Group 1 Class A.

Audible Noise	<37.5 dBA pressure and <5.0 Bels power (ISODP7779)

Power Requirements	
ON (LINE 1)	90 to 132 V rms, 47 to 440 Hz 195 to 250 V rms, 47 to 66 Hz Power consumption <500 VA; <180 W
Standby (LINE 0)	Power consumption <7 W

Environmental Specifications	Type tested to the environmental specifications of Mil-T-28800 class 5

QAM Analysis Measurement Specifications

These specifications describe the warranted performance of the HP 8594Q analyzer with the HP 8594Q Option 190/195 DVB-C QAM hardware and application software. Typical performance on corresponding specifications is noted.

Channel Selection	
Standard Tuning Ranges	DVB-C D channel 31–41, 330–445 CCIR VHF S channel 21–41 CCIR UHF U channel 21–69
User Defined Channel Tuning	10 MHz–2.9 GHz 10 MHz–1 GHz (with internal preamplifier)

DVB-C Standard Channel Bandwidths	
DVB-C Channel Bandwidths available	8 MHz, 4 MHz, and 2 MHz

Average Power Measurement Without Preamplifier	**Single Carrier at Input**	**Multiple Carriers at Input***
Minimum average power in 8 MHz bandwidth†	−60 dBm *(−62 dBm typical)*	−40 dBm *(−42 dBm typical)*
Average power accuracy (averaging 10 traces)	±2.8 dB *(±1 dB typical)*	±2.8 dB *(±1 dB typical)*

* Total incident power at Input 50Ω < +20 dBm.
† Without external pad. With external pad, add pad value. For 4 MHz bandwidth, subtract 3 dB. For 2 MHz bandwidth, subtract 6 dB.

Modulation Accuracy Measurement*		
Residual Error Vector Magnitude (EVM) Channel Bandwidth	**Residual EVM with a Single Carrier at Input**	**Residual EVM with Multiple Carriers at Input§**
8 MHz, 4 MHz, 2 MHz	1.47%† *(1.16% typical‡)*	2.07%† *(1.74% typical‡)*
Minimum average power for modulation accuracy measurement		−55 dBm††

* All measurements using 800 symbols.
† Reflects mean residual EVM of 50 individual measurements.
‡ Typical values are at 20 °C – 30 °C (room) temperature.
§ Total incident power at Input 50Ω < +20 dBm.
†† Single carrier at input with internal preamplifier and no external pad.

QAM Analysis Measurement Specifications

Modulation Accuracy Measurement*		
Residual Modualtion Error Ratio (MER)	**Residual MER with a Single Carrier at Input**	**Residual MER with Multiple Carriers at Input§**
Channel Bandwidth		
8 MHz, 4 MHz, 2 MHz	33 dB† *(35 dB typical‡)*	30 dB† *(31.5 dB typical‡)*
Minimum average power for modulation accuracy measurement		−55 dBm††

* All measurements using 800 symbols.
† Reflects mean residual MER of 50 individual measurements.
‡ Typical values are at 20 °C – 30 °C (room) temperature.
§ Total incident power at Input 50Ω < +20 dBm.
†† Single carrier at input with internal preamplifier and no external pad.

PID Statistics Measurement	
Maximum number of PID's analyzed simultaneously	64
Transport stream net data rate	1% (no averaging)
PID net data rate	1% (no averaging)
Transport stream gross data rate	1% (no averaging)

Multiplex Overview Measurement	
Maximum number of PID's detected in transport stream	5000
Maximum number of PID's analyzed simultaneously	11
Transport stream net data rate	1% (no averaging)
PID net data rate	1% (no averaging)
Transport stream gross data rate	1% (no averaging)

Spectrum Analysis Frequency Specifications

Frequency Range	
dc Coupled	9 kHz to 2.9 GHz
ac Coupled	100 kHz to 2.9 GHz

Frequency Reference *(Option 704)*	
Aging	$\pm 2 \times 10^{-6}$/year
Settability	$\pm 0.5 \times 10^{-6}$
Temperature Stability	$\pm 5 \times 10^{-6}$

Precision Frequency Reference *(Option 190)*	
Aging	$\pm 1 \times 10^{-7}$/year
Settability	$\pm 2.2 \times 10^{-8}$
Temperature Stability	$\pm 1 \times 10^{-8}$

Frequency Readout Accuracy	
(Start, Stop, Center, Marker)	±(frequency readout × frequency reference error* + span accuracy + 1% of span + 20% of RBW + 100 Hz)‡

* frequency reference error = (aging rate × period of time since adjustment + initial achievable accuracy + temperature stability). See "Spectrum Analysis Frequency Characteristics".
‡ See "Drift" under "Stability" in "Spectrum Analysis Frequency Characteristics".

Marker Count Accuracy†	
Frequency Span ≤ 10 MHz	±(marker frequency × frequency reference error* + counter resolution + 100 Hz)
Frequency Span >10 MHz	±(marker frequency × frequency reference error* + counter resolution + 1 kHz)
Counter Resolution	
Frequency Span ≤ 10 MHz	Selectable from 10 Hz to 100 kHz
Frequency Span > 10 MHz	Selectable from 100 Hz to 100 kHz

* frequency reference error = (aging rate × period of time since adjustment + initial achievable accuracy and temperature stability). See "Spectrum Analysis Frequency Characteristics".
† Marker level to displayed noise level > 25 dB, RBW/Span ≥ 0.01. Span ≤ 300 MHz. Reduce SPAN annotation is displayed when RBW/Span < 0.01.

Frequency Span	
Range	0 Hz (zero span), 10 kHz to 2.9 GHz
Resolution	Four digits or 20 Hz, whichever is greater.
Accuracy	
Span ≤10 MHz	±2% of span
Span >10 MHz	±3% of span

Frequency Sweep Time	
Range	20 ms to 100 s
Accuracy	
20 ms to 100 s	±3%
Sweep Trigger	Free Run, Single, Line, Video, External

Spectrum Analysis Frequency Specifications

Resolution Bandwidth	
Range	1 kHz to 3 MHz, 8 selectable resolution (3 dB) bandwidths in 1-3-10 sequence. 9 kHz and 120 kHz (6 dB) EMI bandwidths.
Accuracy	
3 dB bandwidths	±20%

Stability	
Noise Sidebands	(1 kHz RBW, 30 Hz VBW and sample detector)
>10 kHz offset from CW signal	≤−90 dBc/Hz
>20 kHz offset from CW signal	≤−100 dBc/Hz
>30 kHz offset from CW signal	≤−105 dBc/Hz
Residual FM	
1 kHz RBW, 1 kHz VBW	≤250 Hz pk-pk in 100 ms
System-Related Sidebands	
>30 kHz offset from CW signal	≤−65 dBc

Calibrator Output Frequency	300 MHz ±(freq. ref. error* x 300 MHz)
* frequency reference error = (aging rate x period of time since adjustment + initial achievable accuracy + temperature stability). See "Spectrum Analysis Frequency Characteristics".	

Spectrum Analysis Amplitude Specifications

Amplitude specifications only apply with internal preamplifier turned off.

Amplitude Range	−112 dBm to +30 dBm

Maximum Safe Input Level	
Average Continuous Power	+30 dBm (1 W, 7.1 V rms), input attenuation ≥10 dB.
Peak Pulse Power	+50 dBm (100 W) for <10 μs pulse width and <1% duty cycle, input attenuation ≥30 dB.
dc	0 V (dc coupled) 50 V (ac coupled)

Gain Compression	
>10 MHz	≤0.5 dB (total power at input mixer* = −10 dBm)
* Mixer Power Level (dBm) = Input Power (dBm) − Input Attenuation (dB) + Preamplifier Gain (dB)	

Displayed Average Noise Level	(Input terminated, 0 dB attenuation, 30 Hz VBW, sample detector)
	1 kHz RBW
400 kHz to <5 MHz	≤−107 dBm
5 MHz to 2.9 GHz	≤−112 dBm

Spurious Responses	
Second Harmonic Distortion	
>10 MHz	<−70 dBc for −40 dBm tone at input mixer.*
Third Order Intermodulation Distortion	
>10 MHz	<−70 dBc for two −30 dBm tones at input mixer* and >50 kHz separation.
Other Input Related Spurious	<−65 dBc at ≥30 kHz offset, for −20 dBm tone at input mixer ≤2.9 GHz.
* Mixer Power Level (dBm) = Input Power (dBm) − Input Attenuation (dB) + Preamplifier Gain (dB).	

Residual Responses	(Input terminated and 0 dB attenuation)
150 kHz to 2.9 GHz	<−90 dBm

Display Range	
Log Scale	0 to −70 dB from reference level is calibrated; 0.1, 0.2, 0.5 dB/division and 1 to 20 dB/division in 1 dB steps; eight divisions displayed.
Linear Scale	eight divisions
Scale Units	dBm, dBmV, dBμV, mV, mW, nV, nW, pW, μV, μW, V, and W

Spectrum Analysis Amplitude Specifications

Marker Readout Resolution	0.05 dB for log scale 0.05% of reference level for linear scale

Reference Level	
Range	
Log Scale	Minimum amplitude to maximum amplitude**
Linear Scale	−99 dBm to maximum amplitude**
Resolution	
Log Scale	±0.01 dB
Linear Scale	±0.12% of reference level
Accuracy	(referenced to −20 dBm reference level, 10 dB input attenuation, at a single frequency, in a fixed RBW)
0 dBm to −59.9 dBm	±(0.3 dB + .01 x dB from −20 dBm)
−60 dBm and below	
1 kHz to 3 MHz RBW	±(0.6 dB + .01 x dB from −20 dBm)
** See "Amplitude Range."	

Frequency Response (dc coupled)	(10 dB input attenuation)	
	Absolute§	**Relative Flatness**†
9 kHz to 2.9 GHz	±1.5 dB	±1.0 dB
† Referenced to midpoint between highest and lowest frequency response deviations. § Referenced to 300 MHz CAL OUT.		

Calibrator Output	
Amplitude	−20 dBm ±0.4 dB

Absolute Amplitude Calibration Uncertainty ‡‡	±0.15 dB
‡‡ Uncertainty in the measured absolute amplitude of the CAL OUT signal at the reference settings after CAL FREQ and CAL AMPTD self-calibration. Absolute amplitude reference settings are: Reference Level −20 dBm; Input Attenuation 10 dB; Center Frequency 300 MHz; Res BW 3 kHz; Video BW 300 Hz; Scale Linear; Span 50 kHz; Sweep Time Coupled, Top Graticule (reference level), Corrections ON, DC Coupled.	

Input Attenuator	
Range	0 to 70 dB, in 10 dB steps

Resolution Bandwidth Switching Uncertainty	(At reference level, referenced to 3 kHz RBW)
3 kHz to 3 MHz RBW	±0.4 dB
1 kHz RBW	±0.5 dB

Linear to Log Switching	±0.25 dB at reference level

Display Scale Fidelity	
Log Maximum Cumulative	
0 to −70 dB from Reference Level	
3 kHz to 3 MHz RBW	± (0.3 dB + 0.01 x dB from reference level)
1 kHz RBW	± (0.4 dB + 0.01 x dB from reference level)
Log Incremental Accuracy	
0 to −60 dB from Reference Level	±0.4 dB/4 dB
Linear Accuracy	±3% of reference level

QAM Analysis Measurement Characteristics

These are not specifications. Characteristics provide useful but nonwarranted information about the HP 8594Q Option 190/195 performance.

Demodulator Characteristics	
Supported Digital Modulation Format:	64 QAM
Nyquist Filter Alpha:	0.15
Real Time DFE/FFE Adaptive Equalizer	

Supported Symbol Rates			
Channel Bandwidth	**8 MHz**	**4 MHz**	**2 MHz**
Symbol Rate	6.9 MHz	3.45 MHz	1.725 MHz
	6.89 MHz	3.445 MHz	1.72 MHz
	6.875 MHz	3.4375 MHz	1.71875 MHz
	6.872 MHz	3.436 MHz	1.718 MHz

Adjacent Channel Power Measurement	
Adjacent channel power dynamic range	58 dB

Internal Preamplifier Characteristics	
Maximum Safe Input Level	−5 dBm (average or peak power)
Gain	23 dB ±3 dB
Frequency Range	100 kHz to 1 GHz
Flatness	±0.5 dB
Noise Figure	4.0 dB maximum
TOI	+14 dBm minimum

Average Power Measurement		
With Internal Preamplifier*	**Single Carrier at Input**	**Multiple Carriers at Input†**
Minimum average power in 8 MHz bandwidth‡	−81 dBm *(−83 dBm typical)*	−41 dBm *(−43 dBm typical)*
Average power accuracy (averaging 10 traces)	±2.8 dB *(±1 dB typical)*	±2.8 dB *(±1 dB typical)*

* Gain error of the internal preamplifier not included.
† Total incident power at Input 50Ω < +17 dBm.
‡ Without external pad. With external pad, add pad value. For 4 MHz bandwidth, subtract 3 dB. For 2 MHz bandwidth, subtract 6 dB.

Immunity Testing	
Radiated Immunity	When tested at 3 V/m, according to IEC 801-3/1984, the residual EVM level will be within specifications over the full immunity test frequency range of 27 to 500 MHz except that at immunity test frequencies of 278.6 MHz ± selected resolution bandwidth and 321.4 MHz ± selected resolution bandwidth, the residual EVM may be up to 8.0%. When the analyzer tuned frequency is identical to the immunity test signal frequency the residual EVM may be up to 8.0%.
Electrostatic Discharge:	When an air discharge of up to 8 kV according to IEC 801-2/1991 occurs to the shells of the BNC connectors on the rear panel of the instrument, spikes may be seen on the CRT display. Discharges to the center pins of any of the connectors may cause damage to the associated circuitry.

Reed-Solomon Error Statistics Measurement	
Measurement Displays:	
Byte error count	
Byte error ratio	
Packet error count	
Packet error ratio	
Estimated bit error count	
Estimated bit error ratio	

Bit Error Ratio Measurement	
Measurement Stimulus Types:	
2^{23}-1 continuous PRBS	
Sync (47 hex, no inversion) + 203-byte 2^{23}-1 PRBS (*)	
R-S encoded packet with payload of 187 bytes of $2^{23} - 1$ PRBS (*)	
R-S encoded packet with user-definable PID and payload of 184 bytes of $2^{23} - 1$ PRBS (*)	
R-S encoded packet with null PID value and payload of 184 bytes of 0's	

Spectrum Analysis Frequency Characteristics

These are not specifications. Characteristics provide useful but nonwarranted information about instrument performance.

Frequency Reference *(Option 704)*	
Initial Achievable Accuracy	$\pm 0.5 \times 10^{-6}$
Aging	$\pm 1.0 \times 10^{-7}$/day

Precision Frequency Reference *(Option 190)*	
Aging	5×10^{-10}/day, 7-day average after being powered on for 7 days.
Warm-Up	1×10^{-8} after 30 minutes on.
Initial Achievable Accuracy	$\pm 2.2 \times 10^{-8}$ after being powered on for 24 hours.

Stability	
Drift* (after warmup at stabilized temperature)	
Frequency Span $\leq$10 MHz, Free Run	<2 kHz/minute of sweep time
* Because the analyzer is locked at the center frequency before each sweep, drift occurs only during the time of one sweep. For Line, Video or External trigger, additional drift occurs while waiting for the appropriate trigger signal.	

Resolution Bandwidth (–3 dB)	
Range	1 kHz to 3 MHz, selectable in 1, 3 and 10 increments, and 5 MHz. Resolution bandwidths may be selected manually, or coupled to frequency span.
Shape	Synchronously tuned four poles. Approximately Gaussian shape.
60 dB/3 dB Bandwidth Ratio	
Resolution Bandwidth	
100 kHz to 3 MHz	15:1
30 kHz	16:1
3 kHz to 10 kHz	15:1
1 kHz	16:1

Video Bandwidth (–3 dB)	
Range	30 Hz to 1 MHz, selectable in 1, 3, 10 increments, accuracy ±30% and 3 MHz. Video bandwidths may be selected manually, or coupled to resolution bandwidth and frequency span.
Shape	Post detection, single pole low-pass filter used to average displayed noise.

FFT Bandwidth Factors	**FLATTOP**	**HANNING**	**UNIFORM**
Noise Equivalent Bandwidth†	3.63x	1.5x	1x
3 dB Bandwidth†	3.60x	1.48x	1x
Sidelobe Height	<−90 dB	−32 dB	−13 dB
Amplitude Uncertainty	0.10 dB	1.42 dB	3.92 dB
Shape Factor (60 dB BW/3 dB BW)	2.6	9.1	>300

† Multiply entry by one-divided-by-sweep time.

Input Level	> (−60 dBm + attenuator setting)
Signal Level	0 to −30 dB below reference level
FM Offset	
Resolution	400 Hz nominal
FM Deviation (FM GAIN)	
Resolution	1 kHz nominal
Range	10 kHz to 1 MHz
Bandwidth	FM deviation/2
FM Linearity (for modulating frequency < bandwidth/100)	≤ 1% of FM deviation + 290 Hz

Spectrum Analysis Amplitude Characteristics

These are not specifications. Characteristics provide useful but nonwarranted information about instrument performance.

Amplitude characteristics only apply with internal preamplifier turned off.

Log Scale Switching Uncertainty	Negligible error

Input Attenuation Uncertainty*	
Attenuator Setting	
0 dB	±0.2 dB
10 dB	Reference
20 dB	±0.4 dB
30 dB	±0.5 dB
40 dB	±0.7 dB
50 dB	±0.8 dB
60 dB	±1.0 dB
70 dB	±1.0 dB
* Referenced to 10 dB input attenuator setting. See "Frequency Response" in "Spectrum Analysis Amplitude Specifications".	

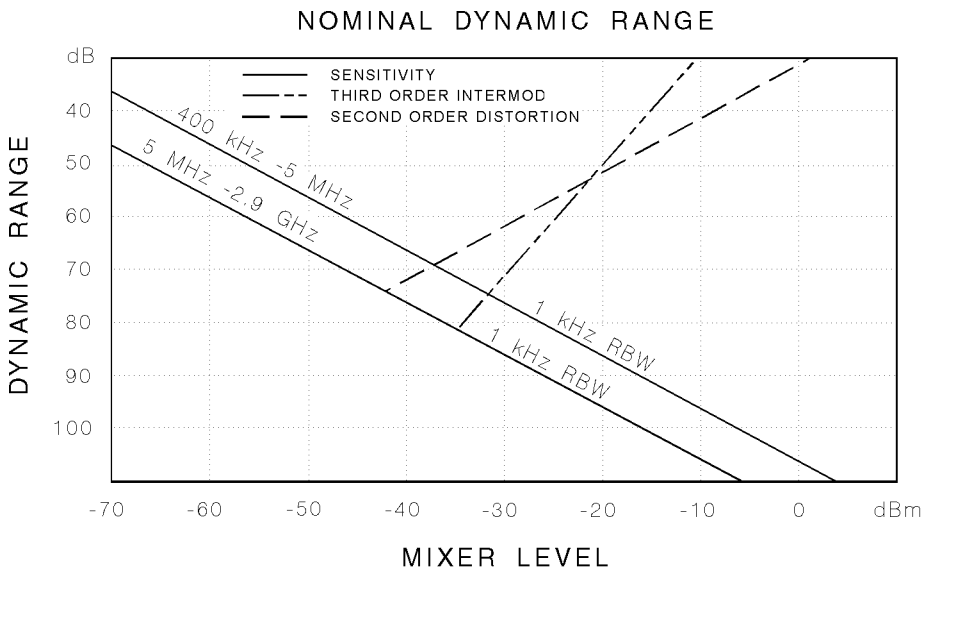
ac Coupled Insertion Loss‡	
100 kHz to 300 kHz	0.7 dB
300 kHz to 1 MHz	0.7 dB
1 MHz to 100 MHz	0.05 dB
100 MHz to 2.9 GHz	0.05 dB + (0.06 × F)† dB
† F = frequency in GHz. ‡ Referenced to dc coupled mode.	

Input Attenuator 10 dB Step Uncertainty	(Attenuator setting 10 to 70 dB) ±0.8 dB/10 dB

Input Attenuator Repeatability	±0.05 dB

RF Input SWR		
10 dB attenuation	**dc Coupled**	**ac Coupled**
300 MHz	1.15:1	1.4:1
10 dB to 70 dB attenuation		
100 kHz to 300 kHz	1.3:1	2.3:1
300 kHz to 1 MHz	1.3:1	1.4:1
1 MHz to 2.9 GHz	1.3:1	1.3:1

DYNAMIC RANGE



Dynamic Range

Immunity Testing	
Radiated Immunity	When tested at 3 V/m according to IEC 801-3/1984 the displayed average noise level will be within specifications over the full immunity test frequency range of 27 to 500 MHz except that at immunity test frequencies of 278.6 MHz ± selected resolution bandwidth and 321.4 MHz ± selected resolution bandwidth the displayed average noise level may be up to −45 dBm. When the analyzer tuned frequency is identical to the immunity test signal frequency there may be signals of up to −70 dBm displayed on the screen.
Electrostatic Discharge	When an air discharge of up to 8 kV according to IEC 801-2/1991 occurs to the shells of the BNC connectors on the rear panel of the instrument spikes may be seen on the CRT display. Discharges to center pins of any of the connectors may cause damage to the associated circuitry.

Physical Characteristics

Front-Panel Inputs and Outputs

INPUT 50Ω	
Connector	Type N female
Impedance	50 Ω nominal

PROBE POWER‡	
Voltage/Current	+15 Vdc, ±7% at 150 mA max. −12.6 Vdc ±10% at 150 mA max.
‡ Total current drawn from the +15 Vdc on the PROBE POWER and the AUX INTERFACE cannot exceed 150 mA. Total current drawn from the −12.5 Vdc on the PROBE POWER and the −15 Vdc on the AUX INTERFACE cannot exceed 150 mA.	

PROBE POWER	
Voltage/Current	+15 Vdc, ±7% at 150 mA max. −12.6 Vdc ±10% at 150 mA max.

Rear-Panel Inputs and Outputs

10 MHz REF OUTPUT	
Connector	BNC female
Impedance	50 Ω nominal
Output Amplitude	>0 dBm

EXT REF IN	
Connector	BNC female Note: Analyzer noise sideband and spurious response performance may be affected by the quality of the external reference used.
Input Amplitude Range	−2 to +10 dBm
Frequency	10 MHz

AUX IF OUTPUT	
Frequency	21.4 MHz
Amplitude Range	−10 to −60 dBm
Impedance	50 Ω nominal

AUX VIDEO OUTPUT	
Connector	BNC female
Amplitude Range	0 to 1 V (uncorrected)

EXT KEYBOARD *(Option 041 or 043)*	Interface compatible with HP part number C1405B using adapter C1405-60015 and most IBM/AT non-auto switching keyboards.

EXT KEYBOARD	Interface compatible with HP part number C1405B using adapter C1405-60015 and most IBM/AT non-auto switching keyboards.

EXT TRIG INPUT	
Connector	BNC female
Trigger Level	Positive edge initiates sweep in EXT TRIG mode (TTL).

Digital Video Outputs	
Parallel Data Output *(Option 195)*	Recovered data stream available from DVB-PI (DVB parallel interface) 25 pin subminature D-type female connector. 188 or 204 byte mode, user selectable.
Serial Data Output *(Option 195)*	Recovered data stream available from 75 Ω BNC connector, typically meets DVB-ASI (DVB asynchronous serial interface) requirements. 188 or 204 byte mode, user selectable.

HI-SWEEP IN/OUT	
Connector	BNC female
Output	High = sweep, Low = retrace (TTL)
Input	Open collector, low stops sweep.

MONITOR OUTPUT *(Spectrum Analyzer Display)*	
Connector	BNC female
Format	
SYNC NRM	Internal Monitor
SYNC NTSC	NTSC Compatible 15.75 kHz horizontal rate 60 Hz vertical rate
SYNC PAL	PAL Compatible 15.625 kHz horizontal rate 50 Hz vertical rate

REMOTE INTERFACE	
HP-IB and Parallel	HP 10833A, B, C or D and 25 pin subminiature D-shell, female for parallel
HP-IB Codes	SH1, AH1, T6, SR1, RL1, PP0, DC1, C1, C2, C3 and C28
RS-232 and Parallel *(Option 043)*	9 pin subminiature D-shell, male for RS-232 and 25 pin subminiature D-shell, female for parallel

Physical Characteristics

SWEEP OUTPUT	
Connector	BNC female
Amplitude	0 to + 10 V ramp

AUX INTERFACE				
Connector Type: 9 Pin Subminiature "D" Connector Pinout				
Pin #	Function	Current	"Logic" Mode	"Serial Bit" Mode
1	Control A	—	TTL Output Hi/Lo	TTL Output Hi/Lo
2	Control B	—	TTL Output Hi/Lo	TTL Output Hi/Lo
3	Control C	—	TTL Output Hi/Lo	Strobe
4	Control D	—	TTL Output Hi/Lo	Serial Data
5	Control I	—	TTL Input Hi/Lo	TTL Input Hi/Lo
6	Gnd	—	Gnd	Gnd
7†	– 15 Vdc ±7%	150 mA	—	—
8*	+ 5 Vdc ±5%	150 mA	—	—
9†	+ 15 Vdc ±5%	150 mA	—	—

* Exceeding the + 5 V current limits may result in loss of factory correction constants.
† Total current drawn from the + 15 Vdc on the PROBE POWER and the AUX INTERFACE cannot exceed 150 mA. Total current drawn from the – 12.6 Vdc on the PROBE POWER and the – 15 Vdc on the AUX INTERFACE cannot exceed 150 mA.

WEIGHT	
Net	
HP 8594Q	16.4 kg (36 lb)
Shipping	
HP 8594Q	19.1 kg (42 lb)

DIMENSIONS

A = 8 in (200 mm)
B = 7.25 in (184 mm)
C = 14.69 in (373 mm)
D = 13.25 in (337 mm)
E = 18.12 in (460.5 mm)