Manual Supplement

Agilent Technologies
8590 Series Spectrum Analyzer Option 103

Agilent Technologies

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CAUTION *Caution* denotes a hazard. It calls attention to a procedure that, if not correctly performed or adhered to, could result in damage to or destruction of the instrument. Do not proceed beyond a caution sign until the indicated conditions are fully understood and met.

NOTE *Note* calls out special information for the user's attention. It provides operational information or additional instructions of which the user should be aware.

The instruction documentation symbol. The product is marked with this symbol when it is necessary for the user to refer to the instructions in the documentation.

This symbol is used to mark the on position of the power line switch.

This symbol is used to mark the standby position of the power line switch.

This symbol indicates that the input power required is AC.

WARNING **This is a Safety Class 1 Product (provided with a protective earth ground incorporated in the power cord). The mains plug shall be inserted only in a socket outlet provided with a protected earth contact. Any interruption of the protective conductor inside or outside of the product is likely to make the product dangerous. Intentional interruption is prohibited.**

WARNING **No operator serviceable parts inside. Refer servicing to qualified personnel. To prevent electrical shock do not remove covers.**

WARNING **If this product is not used as specified, the protection provided by the equipment could be impaired. This product must be used in a normal condition (in which all means for protection are intact) only.**

CAUTION Always use the three-prong AC power cord supplied with this product. Failure to ensure adequate grounding may cause product damage.

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How to Use This Supplement

This supplement provides information about the quasi-peak detector and demodulator (Option 103) only. See the Operating Manual for the spectrum analyzer for information about the analyzer or other analyzer options. If the HP 85712D EMC Auto-measurement Personality is installed in the analyzer, consult the documentation accompanying the HP 85712D for information about the EMC Auto-measurement Personality.

Where to Start

- Read Chapter 1 for a brief introduction to the quasi-peak detector and demodulator and, if necessary, follow the instructions for installing the quasi-peak detector driver.
- If you need to verify the operation of the quasi-peak detector, perform the verification test in Chapter 2.
- Read Chapter 3, "Making Quasi-Peak Measurements," for operating information.
- *For Option 021 or 023:* Read Chapter 4, "Operating Option 103 Remotely," for information about the quasi-peak commands for remote programming.

Supplement Terms and Conventions

Front-Panel Key	Front-panel keys are the labeled keys that are located on the front panel of the analyzer. Front-panel keys appear within a box, for example, FREQUENCY.
`Softkey`	Softkeys are accessed by pressing a front-panel key. For example, pressing FREQUENCY accesses the softkey `CENTER FREQ`. Softkeys appear within a shaded box, for example, `CENTER FREQ`.
`CRT Text`	Text which appears on the analyzer screen is printed in computer font, for example, `SRQ 140`.

Note Generic HP 8590 series spectrum analyzer front and back panel illustrations are used throughout this manual. Your analyzer's front and rear panels may be different, depending on the model number and options.

Contents

Figures

Tables

1

Getting Started

What You Will Find in This Chapter

Introduction to Option 103, the Quasi-Peak Detector and

Demodulator

The quasi-peak detector and demodulator (Option 103) is available for the 8590 Series spectrum analyzers. With Option 103 installed, you can make automatic or manual quasi-peak measurements and listen to the demodulated signal. Option 103 consists of the following:

- A quasi-peak detector and demodulator circuit board (installed in the analyzer).
- An internal speaker to listen to the demodulated signal.
- A radio frequency interference (RFI) plate (instead of the standard plastic plate that covers the analyzer screen). The RFI plate prevents signal emissions from the analyzer screen. This is not required for Series "E" models.
- An external earphone jack to listen to the demodulated signal with an earphone. The earphone jack is located on the rear panel of the analyzer.
- A quasi-peak detector driver read only memory (ROM) card that provides a back-up copy of the quasi-peak detector driver program.

Note This is a manual supplement for Option 103 only. Refer to the *8590 Series Spectrum Analyzer User's Guide* for information about the spectrum analyzer or other spectrum analyzer options.

The following sections provide further information about Option 103.

The Quasi-Peak Detector

The quasi-peak detector portion of the quasi-peak detector and demodulator circuit board provides fast charge, slow discharge time constants and equivalent meter display time constants to smooth out the amplitude value of a pulse signal so a single amplitude value can be obtained. The quasi-peak value will always be less than or equal to the peak value of the signal. Many international electromagnetic interference (EMI) regulations based on Comité International Spécial des Perturbations Radioélectriques (CISPR) standards require the use of a quasi-peak detector for EMI measurements. To guarantee consistent results, specific

measurement bandwidths (200 Hz, 9 kHz, and 120 kHz) must be used. See Chapter 3 for more information about quasi-peak detection.

The Quasi-Peak Detector Driver and ROM Card

The quasi-peak detector driver is a program (also referred to as a downloadable program or DLP) that accesses the quasi-peak detector functions to the analyzer. When the quasi-peak detector driver is installed in analyzer memory, the quasi-peak functions are available under the (AUX CTRL) menu. If Option 103 was installed by the factory, the quasi-peak detector driver has been installed into analyzer memory. If Option 103 is installed as an installation kit or the quasi-peak detector driver program has been deleted from analyzer memory, the quasi-peak detector driver can be installed in analyzer memory using the quasi-peak detector driver ROM card. See "Installing the Quasi-Peak Detector Driver" later in this chapter for more information about installing the driver into analyzer memory.

The Demodulator

The demodulator portion of the quasi-peak detector and demodulator circuit board enables you to use amplitude or frequency demodulation and to listen to a demodulated signal. The demodulator capabilities of Option 103 are the same as the demodulator capabilities of Option 102, AM/FM Speaker and TV Sync Trigger Circuitry (the TV trigger circuitry is *not* included in Option 103). The demodulation functions are not covered in this supplement. See the *8590 Series Spectrum Analyzer User's Guide* for more information.

Note If Options 102 and 103 are installed in the spectrum analyzer, the demodulation circuitry of Option 103 is used.

If You Have the 85712D EMC Auto-measurement Personality

Installed

All of the functions of the quasi-peak detector driver are available with the 85712D EMC Auto-measurement Personality also. If the EMC Auto- measurement Personality and the quasi-peak detector driver are both installed in analyzer memory, the quasi-peak functions can be accessed from the EMC Auto- measurement Personality menu or the Auxiliary Control ((AUX CTRL)) menu.

Accessories Supplied with Option 103

In addition to the accessories for the 8590 Series spectrum analyzers listed in Chapter 9 of the *8590 Series Spectrum Analyzer User's Guide*, one read-only memory card (with the quasi-peak detector driver) is shipped with an Option 103. The part number of the read-only memory card is 11946-10004.

Installing the Quasi-Peak Detector Driver

The quasi-peak detector driver is a program (also referred to as a downloadable program or DLP). The quasi-peak functions are available only if the quasi-peak detector driver program has been installed in analyzer memory. To determine if the quasi-peak detector driver program is installed in analyzer memory, press (AUX CTRL). If QUASI PEAK is one of the softkeys that are displayed, the quasi-peak detector driver is installed in analyzer memory. If QUASI PEAK is not displayed, use the following procedure to install the quasi-peak detector driver in analyzer memory.

Procedure for Installing the Quasi-Peak Detector Driver

1. Locate the arrow printed on the card's label.

Note Improper insertion causes error messages to occur, but generally does not damage the card or instrument. Care must be taken, however, not to force the card into place. The card is easy to insert when installed properly.

2. Insert the card with its arrow matching the raised arrow on the bezel around the card-insertion slot. See Figure 1-1.

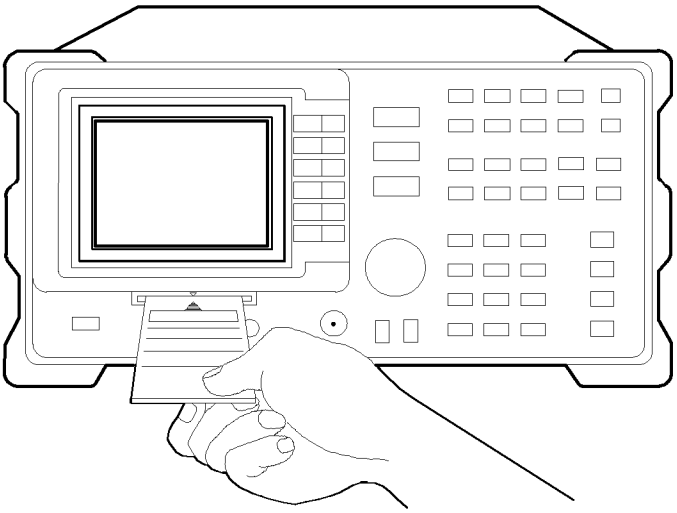

Figure 1-1. Inserting the Quasi-Peak Card

3. Press the card into the slot. When correctly inserted, about 19 mm (0.75 in) of the card is exposed.
4. Press (SAVE) or (RECALL). INTERNAL CARD is displayed on the right side of the display. If INTERNAL is underlined, press INTERNAL CARD to select CARD. The memory card is selected when CARD is underlined.
5. Press CATALOG CARD, CATALOG ALL, then LOAD FILE. In approximately 5 seconds the quasi-peak detector driver will be installed into analyzer memory.

Note Loading the quasi-peak detector driver causes trace A, trace B, and trace C to be set to the store-blank trace mode. Press (TRACE), CLEAR WRITE A to view trace A.

6. Press (AUX CTRL). QUASI PEAK should be displayed.

Note If the quasi-peak detector and demodulator circuit board is *not* installed in the analyzer, QUASI PEAK will not be displayed. To verify that the quasi-peak detector and demodulator circuit board is installed in the analyzer, press (CONFIG), MORE 1 of 3, SHOW OPTIONS. If 103: DEMOD/QPD is displayed, the quasi-peak detector and demodulator circuit board is installed in the analyzer.

If the error message INVALID SYMTAB ENTRY: SYMTAB OVERFLOW appears, read the following section, "Managing Memory."

Managing Memory

If there are other personalities or downloadable programs in analyzer memory, there may not be enough analyzer memory available to install the quasi-peak detector driver program. If there is not enough available analyzer memory, an error message INVALID SYMTAB ENTRY: SYMTAB OVERFLOW is displayed. If this happens, one or more personalities should be deleted from analyzer memory.

Deleting a Personality from Analyzer Memory

Refer to the documentation accompanying the personality to determine how to dispose of the personality. For example, the function DISPOSE CATV disposes of the CATV measurement personality. If you wish to dispose of all the personalities in analyzer memory, press (CONFIG), MORE 1 of 2, DISPOSE USER MEM, DISPOSE USER MEM (DISPOSE USER MEM requires two key presses).

Note DISPOSE USER MEM disposes of all personalities, user-defined functions, user-defined variables, and user-defined keys. If you want to save a user-defined function, user-defined variable, or user-defined key, save it on a memory card before using DISPOSE USER MEM. User-defined functions, user-defined variables, and user-defined key definitions can be created with remote programming commands (Option 021 or 023 only). See the *8590 Series Spectrum Analyzer Programming Manual* for more information.

Deleting the Quasi-Peak Detector Driver from Analyzer Memory

If necessary, the quasi-peak detector driver can be disposed from analyzer memory by pressing (CONFIG), MORE 1 of 2, DISPOSE USER MEM, DISPOSE USER MEM.

An alternate way to dispose of the quasi-peak detector driver without disposing of personalities, user-defined variables, user-defined functions, or user-defined key definitions is to execute the programming command QP_DISPOSE. QP_DISPOSE can be executed remotely (Option 021 or 023 only; see Chapter 4 of this supplement), or with EXECUTE TITLE.

Note If the 85712D EMC Auto-measurement Personality is also loaded into analyzer memory, it should be deleted before using QP_DISPOSE. If the QP_DISPOSE programming command is executed when the 85712D EMC Auto-measurement Personality is loaded into the analyzer memory, accessing some of the precompliance test keys in the 85712D will cause errors.

To execute QP_DISPOSE using `EXECUTE TITLE`:

1. Press (DISPLAY), `CHANGE TITLE`.
2. If necessary, clear the current screen title by pressing `YZ_# SPC CLEAR`, `CLEAR`.
3. Use the softkeys to enter QP_DISPOSE as the screen title.
4. Press `MORE 1 of 2`, `()',;:`, `; SEMI` to enter a semicolon. The screen title should read `QP_DISPOSE;`.
5. Press (CAL), `MORE 1 of 3`, `MORE 2 of 3`, `SERVICE CAL`, `EXECUTE TITLE` to execute the QP_DISPOSE programming command.

The quasi-peak detector driver can be reinstalled in analyzer memory using the previous procedure, "Installing the Quasi-Peak Detector Driver."

8590 Series Spectrum Analyzer Option 103 Specifications

The specifications for Option 103 are listed in Table 1-1. These are in addition to the standard 8590 Series spectrum analyzer specifications in Table 1-1 or 1-3 of the spectrum analyzer Installation and Verification Manual.

Note The Option 103 specifications and characteristics are not valid for 8591A spectrum analyzers with Option 001 or 011.

Note If you have an "E" model analyzer, refer to the specifications in your instrument's calibration guide.

The specifications for Option 103 have been based on the following:

- The spectrum analyzer displays the quasi-peak amplitude of pulsed radio frequency (RF) or continuous wave (CW) signals.
- Amplitude response conforms with Publication 16 of Comité International Spécial des Perturbations Radioélectriques (CISPR) Section 1, Clause 2.

Table 1-1. 8590 Series Spectrum Analyzer Option 103 Specifications

AMPLITUDE SPECIFICATIONS

All specifications apply over 0°C to +55°C. 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.

Relative Quasi-Peak Response to a CISPR Pulse (dB)

Pulse Repetition Frequency (Hz)	Frequency Band: 9 kHz Resolution BW 0.15 to 30 MHz	Frequency Band: 120 kHz Resolution BW 0.03 to 1 GHz
1000	+4.5 ±1.0	+8.0 ±1.0
100	0 dB (reference)*	0 dB (reference)*
60	—	—
25	—	—
20	−6.5 ±1.0	−9.0 ±1.0
10	−10.0 ±1.5	−14.0 ±1.5
5	—	—
2	−20.5 ±2.0	−26.0 ±2.0
1	−22.5 ±2.0	−28.5 ±2.0
Isolated Pulse	−23.5 ±2.0	−31.5 ±2.0

GENERAL SPECIFICATIONS

Temperature Range	
Operating	0°C to +55°C
Storage	−40°C to +75°C
EMI Compatibility	Conducted and radiated interference CISPR Pub. 11 and Messempfaenger Postverfuegung 526/527/79

* Reference pulse amplitude accuracy relative to a 66 dBμV CW signal is <1.5 dB. CISPR reference pulse: 0.316 μVs for 0.15 to 30 MHz, 0.044μVs for 0.03 to 1 GHz.

Note Absolute amplitude accuracy is the sum of the pulse amplitude response relative to the reference, plus the reference pulse amplitude accuracy, plus the spectrum analyzer amplitude accuracy (calibrator output, reference level, frequency response, input attenuator, resolution bandwidth switching, linear display scale fidelity, and gain compression).

8590 Series Spectrum Analyzer Option 103 Characteristics

The characteristics for Option 103 are listed in Table 1-2. These are in addition to the standard 8590 Series spectrum analyzer characteristics in Table 1-2 or 1-4 of the spectrum analyzer Installation and Verification Manual.

Table 1-2. 8590 Series Spectrum Analyzer Option 103 Characteristics

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

AMPLITUDE CHARACTERISTICS

Displayed Quasi-Peak Measurement Range	70 dB
Total Quasi-Peak Measurement Range	115 dB
FM Demod *(Option 102 or 103)*	
Demod Tune Listen	Internal speaker, rear-panel earphone jack and front-panel volume control. Adjustable squelch control mutes the audio signal to the speaker and earphone jack based on the level of the demodulated signal above 22 kHz. An uncalibrated demodulated signal is available on the AUX VIDEO OUT connector at the rear panel.

FUNDAMENTAL CHARACTERISTICS

Frequency Band (MHz)	Bandwidth at 6 dB (kHz)	Charge-Time Constant (ms)	Discharge-Time Constant (ms)	Meter-Time Constant (ms)
0.15 to 30	9	1	160	160
30 to 1000	120	1	550	100

REAR-PANEL INPUTS AND OUTPUTS

EARPHONE *(Option 102 or 103)*	
Connector	1/8 inch monaural jack.

2

Verifying the Quasi-Peak Detector

What You Will Find in This Chapter

This chapter contains the test procedure which tests the electrical performance of the quasi-peak detector.

Note This performance verification test is also in the spectrum analyzer Installation and Verification Manuals with print dates of November 1990 or later. If you have an Installation and Verification Manual printed in November 1990 or later, disregard this chapter.

Note If you have an "E" model spectrum analyzer, disregard these verification tests and turn to the verification tests in your instrument's calibration guide.

The test procedures does not involve removing the cover of the spectrum analyzer.

Note There are no specifications for the AM/FM demodulation functions of Option 103. Perform the procedure "Demodulating and Listening to an AM or FM Signal" in the spectrum analyzer Operating Manual to verify the functionality of the AM/FM demodulator.

Before You Start the Verification Test

There are two things you should do before starting a verification test:

1. Switch the analyzer on and let it warm up in accordance with the Temperature Stability specification in Table 1-1 or 1-3 of the spectrum analyzer Installation and Verification Manual.
2. After the analyzer has warmed up as specified, perform the self-calibration procedure documented in "Improving Accuracy with Self-Calibration Routines" in the spectrum analyzer Operating Manual. The performance of the analyzer is only specified after the analyzer calibration routines have been run and if the analyzer is autocoupled.

Test Equipment You'll Need

Table 2-1 lists the recommended test equipment for the performance test. Any equipment that meets the critical specifications given in the table can be substituted for the recommended models.

If the Analyzer Doesn't Meet Specifications

If the analyzer fails the test, rerun the `CAL FREQ & AMPTD` routine, press `CAL STORE`, and repeat the test. If the analyzer still fails one or more specifications, complete the test and record all test results on a copy of the performance test record. The performance test record is located at the end of the chapter. Then refer to "Problems" in the spectrum analyzer Installation and Verification Manual for instructions on how to solve the problem.

Periodically Verifying Operation

The analyzer requires periodic verification of operation. Under most conditions of use, you should test the analyzer at least once a year with either Operation Verification or the complete set of Performance Verification tests.

Table 2-1. Recommended Test Equipment

Instrument	Critical Specifications for Equipment Substitution	Recommended Model	Use*
Pulse Generator	Period Range: 1 ms to 980 ms ±2%, single pulse mode Level −2 V to +2 V Transition Time: 6 ns ±10%, ±1 ns Pulse Width: 150 ns to 3 μs ±1% ±1 ns	8161A	P,T
Synthesizer/Level Generator	Frequency: 50 MHz Amplitude Range: +12 to −85 dBm Flatness: ±0.15 dB Attenuator Accuracy: ±0.09 dB	3335A	P,T
Power Meter	Power Range: Calibrated in dBm and dB relative to reference power −70 dBm to +10 dBm, sensor dependent	436A	P,T
Power Sensor	Frequency: 50 MHz Maximum SWR: 1.1 (50 MHz)	8482A	P,T
3 dB Attenuator	Type N (m to f) Attenuation: 3 dB Frequency: dc to 12.4 GHz	8491A Option 003	P
Modulator	Frequency: 50 MHz On/Off Ratio: >70 dB Switching Speed: 2 ns Insertion Loss: 5 dB	Teletech SC35B	P,T
Cable	Frequency Range: dc to 1 GHz Length: ≥122 cm (48 in) Connectors: BNC (m) both ends *(3 required)*	10503A	P,T
Adapter	Type N (m) to BNC (f)	1250-1476	P,T
Adapter	Type N (f) to Type N (f)	1250-1472	P,T

* P = Performance Test, A = Adjustment, T=Troubleshooting

CISPR Pulse Response

Specification

See Table 1-1 of this supplement.

Note The Option 103 specifications are not valid for 8591A Option 001 or 011 Spectrum Analyzers.

Related Adjustment

There are no related adjustment procedures for this performance test.

Description

This CISPR Pulse Response measurement is made using a pulsed RF input signal rather than a pulse signal because the equipment is readily available, easily calibrated, and flexible in use. Pulsed RF setup considerations as well as the relationship between the two techniques are explained in Application Note 150-2.

The CISPR Pulse Response test measures the spectrum analyzer quasi-peak detector receiver systems's response to a pulsed RF input signal relative to that of a CW input signal and as a function of pulse repetition frequency. The output of the 3335A Frequency Synthesizer is modulated by the 8161A Pulse Generator using the pulse modulator to yield the pulsed RF signal. The output of the pulse modulator is connected to the input of the device under test (DUT) with a BNC cable through a 3 dB attenuator. The 3 dB attenuator provides a controlled source match. Amplitude accuracy is ensured by measuring the output signal of the 3 dB attenuator using the 436A Power Meter with the pulse modulator DC biased to provide a CW signal. This measured CW amplitude also corresponds to the burst amplitude of the pulsed RF input signal when the pulse modulator is appropriately driven. The system is tested, through the 9 kHz and 120 kHz EMI bandwidth filters, with a pulse repetition frequency (PRF) corresponding to CISPR specifications. The required CW amplitude for the tests are calculated based on the device under test's impulse bandwidth, the pulse width of the pulsed RF, and the CISPR specified spectral intensity.

Equipment

Pulse Generator	8161A
Synthesizer/Level Generator	3335A
Power Meter	436A
Power Sensor	8482A
3 dB Attenuator	8491A Option 003
TeleTech Modulator	SC35B

Cable

BNC Cable, 122 cm (48 in) (3 required)	10503A

Adapters

Type N (m) to BNC (f) 1250-1476
Type N (f) to Type N (f) 1250-1472

Procedure

Input Amplitude Calibration

1. Zero and Calibrate the 436A and 8482A, as described in the *436A Operation Manual*.
2. Connect the equipment as shown in Figure 2-1.

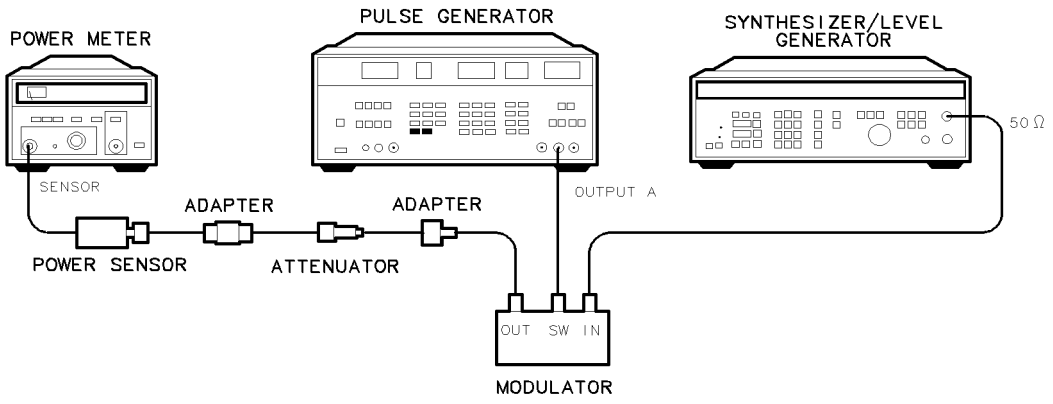

Figure 2-1. Input Amplitude Calibration Test Setup

3. Press (RCL) 0 on the 8161A to preset the pulse generator. To bias the modulator on, set the 8161A Pulse Generator to the following settings:

   Parameters:

   LEE ..... 3 ns
   TRE ..... 3 ns
   HIL ..... +2 volts
   LOL ..... +1.8 volts
   DEL ..... 0 ns

   Output Mode: Enabled

   Channel A 50Ω
   Channel A ..... NORM

4. Press (STO) 1 on the 8161A to store the 8161A settings in storage register 1.
5. Set the 3335A Level Generator to the following settings:

   FREQUENCY ..... 50 MHz
   AMPLITUDE ..... −3 dBm

6. Set the 436A Power Meter to the following settings:

   MODE ..... dBm
   CAL FACTOR ..... 8482 Ref Cal Factor for 50 MHz

7. Adjust 3335A Power level for a −6.99 dBm (±0.03) reading on the 436A.
8. Record the 3335A amplitude setting in Table 2-3 under Reference Amplitude at 50 MHz for the 200 Hz, 9 kHz and 120 kHz EMI bandwidths. Calculate the Required Amplitude for the 200 Hz, 9 kHz and 120 kHz resolution bandwidths using the following formula:

   Reference Amplitude at 50 MHz + Amplitude Offset = Required Amplitude

Note The reference amplitude is the same for both the 9 kHz and 120 kHz filters.

Enter the calculated 9 kHz and 120 kHz Required Amplitude values in Table 2-3.

9. On the 3335A, press [STORE] 1 to store the reference setting of the level generator in storage register 1.

Isolation Check

10. Connect the equipment as shown in Figure 2-2.

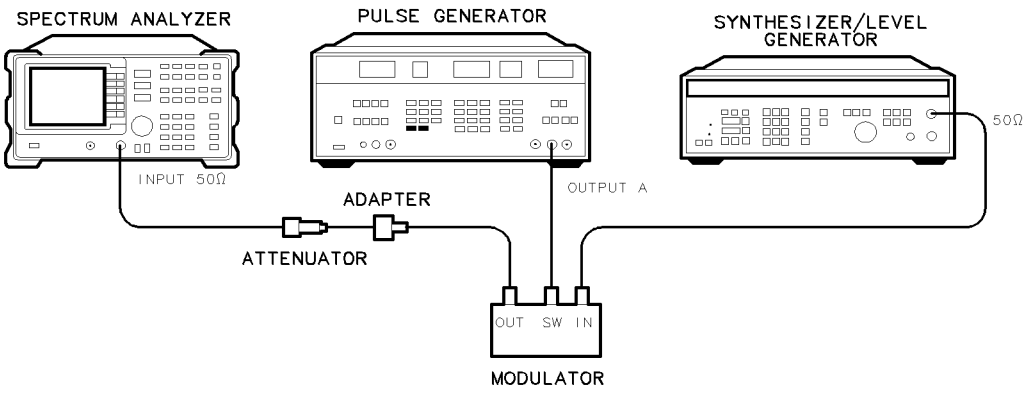

Figure 2-2. Isolation Check Test Setup

11. Press [PRESET] on the spectrum analyzer. Press the following analyzer keys:

    [FREQUENCY] 50 [MHz]
    [SPAN] 1 [MHz]
    [PEAK SEARCH] [SAVE] STATE -> INTRNL 1
    [MKR ->] MARKER ->REF LVL [MKR] MARKER DELTA

12. Press [RCL] 1 on the 8161A. Set the 8161A to the following settings to bias the modulator off:

    HIL ..... −1.5 volts
    LOL ..... −1.7 volts

Note On the 8161A, use [CHS] to change sign of the enter value.

13. Verify that the isolation of the modulator (the marker delta reading) exceeds 70 dBc.

CW Measurement

14. Press (RCL) 1 on the 8161A.
15. Subtract 40 dB from the Reference Amplitude at 50 MHz in Table 2-3. Set the 3335A amplitude to the calculated value by pressing (AMPLITUDE), enter the calculated value, (−dBm).
16. Press (STORE) 2 on the 3335A.
17. Press the following keys on the spectrum analyzer:

    `MARKER NORMAL` (BW) `9 kHz EMI BW`

    (AUX CTRL) `QUASI PEAK` `AUTO QP AT MKR`

Note A message will be displayed warning that an improper bandwidth is selected. Disregard the message and press `CONTINUE`.

Record the quasi-peak reading displayed below the signal on the spectrum analyzer screen in Table 2-4, under the Measured CW Amplitude for 9 kHz.

9 kHz Pulse RF Signal Setup

18. Press (RCL) 1 on the 8161A. Set the 8161A to the following conditions:

PER	10 ms
WID	2.2 μs
LOL	−1.7 volts

Note On the 8161A, use (CHS) to change the sign of the value entered.

---

19. Press (RECALL) 1 on the 3335A. Set the 3335A amplitude to the required amplitude value for the 9 kHz filter recorded in Table 2-3 by pressing (AMPLITUDE), enter the Required Amplitude for 9 kHz, (−dBm).
20. Press `MAN QP AT MKR`.

Note A message will be displayed warning that an improper bandwidth is selected. Disregard the message and press `CONTINUE`.

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21. Record the marker amplitude reading in Table 2-4 as the Measured 100 Hz Amplitude for 9 kHz. Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Band B, 100 Hz Repetition Frequency.
22. Set the PERIOD to 1 ms on the 8161A. On the spectrum analyzer, press `MARKER NORM PK` (so that PK is underlined), then (SGL SWP).

Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Band B, 1000 Hz Repetition Frequency.

23. Set the PERIOD to 50 ms on the 8161A. Press [SGL SWP] on the spectrum analyzer.

    Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Band B, 20 Hz Repetition Frequency.

24. Set the PERIOD to 100 ms on the 8161A. Press [SGL SWP] on the spectrum analyzer.

    Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Band B, 10 Hz Repetition Frequency.

25. Set the PERIOD to 500 ms on the 8161A. Press `QP X10 ON OFF` so that ON is underlined, [SGL SWP] on the spectrum analyzer.

    Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Band B, 2 Hz Repetition Frequency.

26. Set the PERIOD to 980 ms on the 8161A. Press [SGL SWP] on the spectrum analyzer.

    Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Band B, 1 Hz Repetition Frequency.

    Press [TRIG] on the 8161A. Press [SGL SWP] on the spectrum analyzer. Let the spectrum analyzer sweep 3 divisions then press [MAN] on the 8161A. Record the Marker reading for Isolated Pulse Measurement for Band B in Table 2-5.

CW Measurement

27. Press [RCL] 1 on the 8161A.
28. Press [RECALL] 2 on the 3335A.
29. Press [RECALL], `INTRNL -> STATE` 1 on the spectrum analyzer.
30. On the spectrum analyzer, press the following keys:

    [PEAK SEARCH] [MKR] [AUX CTRL]
    `QUASI PEAK` `RETURN` `AUTO QP AT MKR` `120 kHz EMI BW` `CONTINUE`

    Record the reading displayed below signal on the spectrum analyzer screen in Table 2-4 under the Measured CW Amplitude for 120 kHz.

120 kHz Pulse RF Signal Setup

31. Set the 8161A to the following conditions:

    PER ..... 10 ms
    WID ..... 167 ns
    LOL ..... −1.7 volts

32. Press [RECALL] 1 on the 3335A. Set the 3335A amplitude to the required amplitude value for the 120 kHz filter recorded in Table 2-3 by pressing [AMPLITUDE], (enter the Required Amplitude value for the 120 kHz EMI bandwidth), [−dBm].
33. Press `MAN QP AT MKR` on the spectrum analyzer.

34. Record the marker reading in Table 2-4 as the Measured 100 Hz Amplitude for the 120 kHz EMI bandwidth. Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 100 Hz Repetition Frequency.

35. Set PERIOD to 1 ms on the 8161A. Press MARKER NORM PK (so that PK is underlined), SGL SWP on the spectrum analyzer.

    Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 1000 Hz Repetition Frequency.

    Set the PERIOD to 50 ms on the 8161A. Press QP X10 ON OFF so that ON is underlined on the spectrum analyzer. Press SGL SWP on the spectrum analyzer.

    Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 20 Hz Repetition Frequency.

Note For the following sweeps, it may be necessary to trigger a second sweep (press SGL SWP again) to obtain an accurate reading.

---

36. Set PERIOD to 100 ms on the 8161A. Press SGL SWP on the spectrum analyzer.

    Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 10 Hz Repetition Frequency.

37. Set the PERIOD to 500 ms on the 8161A. Press SGL SWP on the spectrum analyzer.

    Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 2 Hz Repetition Frequency.

38. Set PERIOD to 980 ms on the 8161A. Press SGL SWP on the spectrum analyzer.

    Record the marker amplitude reading in Table 2-5 as the Measured Relative Equivalent Level of Pulse for Bands C and D, 1 Hz Repetition Frequency.

    Press TRIG on the 8161A. Press SGL SWP on the spectrum analyzer. Let the spectrum analyzer sweep 3 divisions then press MAN on the 8161A. Record the marker reading as the Isolated Pulse for Bands C and D in Table 2-5.

39. Enter the Measured value for the Band B 100 Hz Repetition Frequency as the Reference value for all the Repetition Frequencies listed for Band B.

40. Enter the Measured value for the Bands C and D 100 Hz Repetition Frequency as the Reference value for all the Repetition Frequencies listed for Bands C and D.

41. Determine the Error for each of the frequencies in Table 2-5 by the following formula:

$$\text{Measured} - \text{Reference} = \text{Error}$$

Performance Verification Test Record

Table 2-2. Performance Verification Test Record (Page 1 of 2)

Calibration Entity _____

Address: Report No. _____

_____

_____ Date _____

_____ (e.g. 10 SEP 1989)

Model 8590 Series Spectrum Analyzer Option 103

Serial No. _____

Options _____

Firmware Revision _____

Customer _____ Tested by _____

Ambient temperature _____ °C Relative humidity _____ %

Power mains line frequency _____ Hz (nominal)

Test Equipment Used:

Description	Model No.	Trace No.	Cal Due Date
Pulse Generator			
Synthesizer/Level Generator			
Power Meter			
Power Sensor			

Notes/Comments

_____

_____

_____

_____

Table 2-2. Performance Verification Test Record (Page 2 of 2)

Calibration Entity _____
Model 8590 Series Spectrum Analyzer Option 103 Report No. _____

Serial No. _____ Date _____

Test Description	Results			Measurement Uncertainty
	Min.	Measured	Max.	
CISPR Pulse Response				
		Amplitude Error		
Measured 100 Hz Amplitude,				
9 kHz EMI BW	−1.5 dB	_____	+1.5 dB	+0.44 dB/−0.48 dB
120 kHz EMI BW	−1.5 dB	_____	+1.5 dB	+0.80 dB/−0.98 dB
Relative Level, 9 kHz EMI BW				
1000	+5.5 dB	_____	+3.5 dB	±0.14 dB
100	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)
20	−5.5 dB	_____	−7.5 dB	±0.41 dB
10	−8.5 dB	_____	−11.5 dB	±0.41 dB
2	−18.5 dB	_____	−22.5 dB	±0.22 dB
1	−20.5 dB	_____	−24.5 dB	±0.14 dB
Isolated Pulse	−21.5 dB	_____	−25.5 dB	±0.10 dB
Relative Level, 120 kHz EMI BW				
1000	+9.0 dB	_____	+7.0 dB	±0.36 dB
100	0 (Ref)	0 (Ref)	0 (Ref)	0 (Ref)
20	−8.0 dB	_____	−10.0 dB	+0.42 dB/−0.43 dB
10	−12.5 dB	_____	−15.5 dB	+0.57 dB/−0.59 dB
2	−24.0 dB	_____	−28.0 dB	+0.49 dB/−0.51 dB
1	−26.5 dB	_____	−30.5 dB	+0.42 dB/−0.43 dB
Isolated Pulse	−29.5 dB	_____	−33.5 dB	±0.3 dB

Performance Verification Test Data

Calibration Entity _____
Model 8590 Series Spectrum Analyzer Option 103 Report No. _____

Serial No. _____ Date _____

Table 2-3. Input Amplitude Calibration

EMI Bandwidth	Reference Amplitude at 50 MHz	Amplitude Offset	Required Amplitude
9 kHz	_____	0.05	_____
120 kHz	_____	5.42	_____

Table 2-4. Quasi-Peak Detector Reference Accuracy

EMI Bandwidth	Measured CW Amplitude	Measured 100 Hz Amplitude	Error	Limit
9 kHz	_____	_____	_____	±1.5
120 kHz	_____	_____	_____	±1.5

Table 2-5. Quasi-Peak Detector Accuracy

Repetition Frequency	Relative Equivalent Level of Pulse Band B (9 kHz EMI BW)			
	Measured	Reference	Error	Limit
(Hz)	(dBμV)	(dBμV)	(dB)	
1000	_____	_____	_____	+4.5 ±1.0
100	_____	_____	_____	0 (Ref)
20	_____	_____	_____	−6.5 ±1.0
10	_____	_____	_____	−10.0 ±1.5
2	_____	_____	_____	−20.5 ±2.0
1	_____	_____	_____	−22.5 ±2.0
Isolated pulse	_____	_____	_____	−23.5 ±2.0
Repetition Frequency	**Relative Equivalent Level of Pulse Bands C and D (120 kHz EMI BW)**			
	Measured	**Reference**	**Error**	**Limit**
(Hz)	**(dBμV)**	**(dBμV)**	**(dB)**	
1000	_____	_____	_____	+8.0 ±1.0
100	_____	_____	_____	0 (Ref)
20	_____	_____	_____	−9.0 ±1.0
10	_____	_____	_____	−14.0 ±1.5
2	_____	_____	_____	−26.0 ±2.0
1	_____	_____	_____	−28.5 ±2.0
Isolated pulse	_____	_____	_____	−31.5 ±2.0

3

Making Quasi-Peak Measurements

What You Will Find in This Chapter

An Introduction to Quasi-Peak Measurements

Quasi-peak detection is a form of detection where a signal level is weighted based on the repetition frequency of the spectral components making up the signal. That is to say; the result of a quasi-peak measurement depends on the repetition rate of the signal. Signals can be classified into two general categories based upon their repetition rate: narrowband or broadband. A narrowband signal is a signal that can be resolved by the spectrum analyzer. An example of a narrowband signal is a continuous wave (CW) signal. A CW signal is one signal at a fixed frequency. A broadband signal is a signal that cannot be resolved by the spectrum analyzer. An example of a broadband signal is a pulse signal. Peak, quasi-peak, and average detection will yield the same amplitude level for a narrowband signal. A broadband signal will yield a quasi-peak level lower than the peak level. The weighting (accounted for through specific charge and discharge time constants in the quasi-peak detector circuit), is a function of the repetition frequency of the signal being measured. The lower the repetition frequency, the lower the quasi-peak level.

Many agencies governing the electromagnetic interference (EMI) from commercial products require quasi-peak detection to be used. Even if the emission from a device is over a test limit when measured with peak detection, the device will be considered to pass *if* the quasi-peak level is below the test limit.

Because of the charge and discharge time constants used in the quasi-peak detector, the spectrum analyzer must sweep considerably slower when the quasi-peak detector is on. Because the quasi-peak level of a signal is always equal to or less than the peak level of that signal, quasi-peak detection need be employed only when a signal is close to or over the test limit when measured with peak detection. For initial measurements, use peak detection because peak detection does not require the slower sweep times.

To make a quasi-peak measurement, several spectrum analyzer parameters must be set properly. The spectrum analyzer must be set to one of the three CISPR bandwidths (200 Hz, 9 kHz, or 120 kHz). The sweep time must be slow enough to allow the detector to fully charge and discharge. The spectrum analyzer must be in the linear display mode. The Option 103 quasi-peak functions help you make the quasi-peak measurement by setting many of the analyzer parameters for you. You can choose to make the quasi-peak measurement "automatically" or "manually."

Note The 200 Hz bandwidth is only available on the HP 8590 "E" Series spectrum analyzers with narrow bandwidth Option 130. For earlier models the 1 kHz resolution bandwidth may be used to approximate a quasi-peak measurement. A quasi-peak measurement using the 1 kHz bandwidth will be greater than or equal to a quasi-peak measurement using a 200 Hz bandwidth.

Making Automatic or Manual Quasi-Peak Measurements

An "automatic" measurement uses the quasi-peak function for making automatic measurements, `AUTO QP AT MKR`. `AUTO QP AT MKR` performs the quasi-peak measurement, then returns to the previous analyzer settings with the quasi-peak amplitude value displayed below the marker.

A "manual" measurement uses the quasi-peak functions for making a manual measurement, `MAN QP AT MKR`. Like `AUTO QP AT MKR`, `MAN QP AT MKR` changes the analyzer settings to make a quasi-peak measurement, but `MAN QP AT MKR` does not return the quasi-peak amplitude value or to the previous analyzer settings immediately. Instead, it accesses additional softkey functions that are helpful when making a manual quasi-peak measurement.

Use `AUTO QP AT MKR` when you want to make a measurement without changing analyzer settings or altering the test setup. Use `MAN QP AT MKR` when you wish to change analyzer settings before accepting the quasi-peak level or to monitor the quasi-peak level of a signal.

The quasi-peak functions are found in the Auxiliary Control (AUX CTRL) menu. See Figure 3-1.

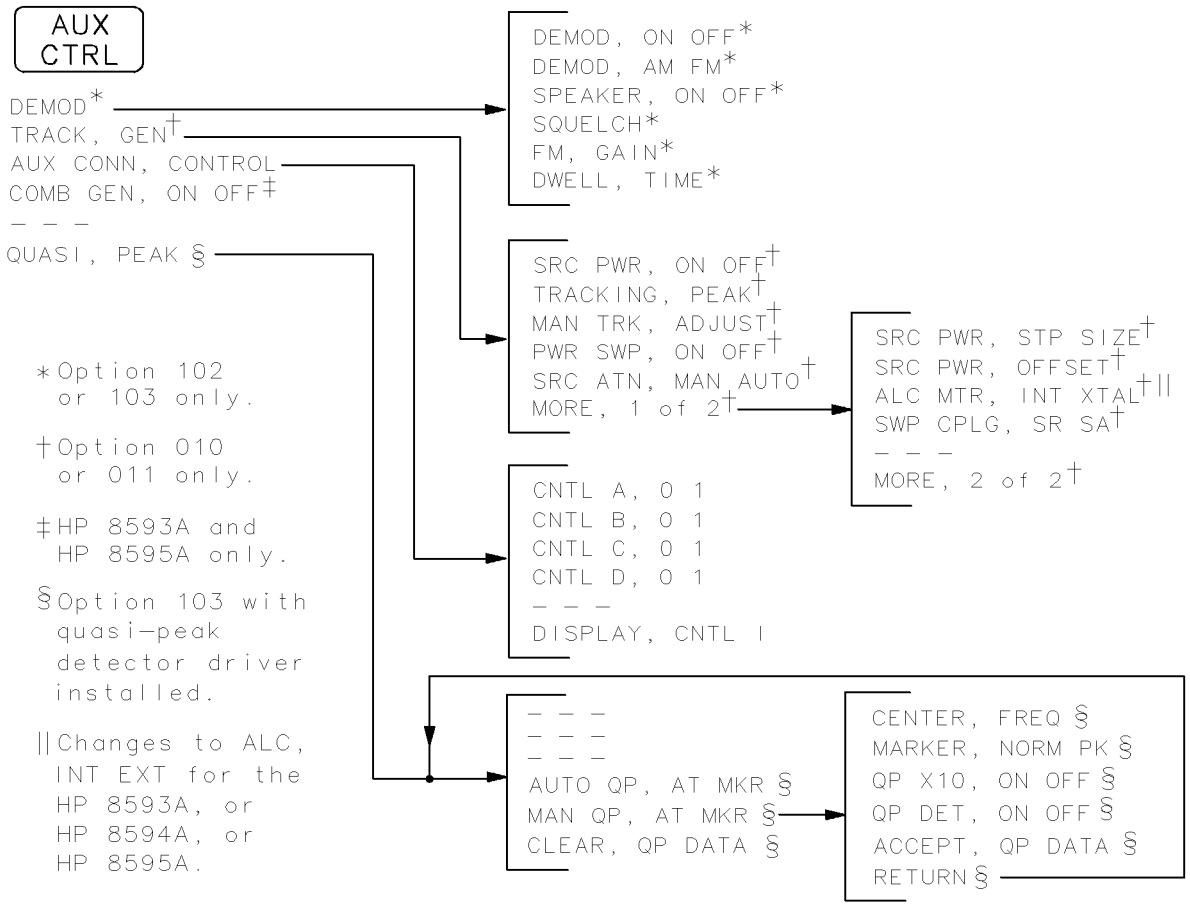


Figure 3-1. The Auxiliary Control Menu

See the following examples for making automatic and manual quasi-peak measurements.

Example of Making an Automatic Quasi-Peak Measurement

Note The following keys will only be displayed if the quasi-peak detector driver has been installed into analyzer memory. See Chapter 1 "Installing the Quasi-Peak Detector Driver" if the quasi-peak detector driver has *not* been installed in analyzer memory.

Follow these steps to make an automatic quasi-peak measurement:

1. Press PRESET.
2. Identify a signal to be measured. For this example, we are using an HP 8116A Pulse Generator to simulate a broadband signal. The pulse generator's output is a 1 kHz pulse signal, with a pulse width of 173 nanoseconds and amplitude of 3.6 volts.

3. Change the frequency range to narrow in on the signal. For this example, we are using a start frequency of 30 MHz, and a stop frequency of 80 MHz. Press (FREQUENCY), START FREQ 30 (MHz), STOP FREQ 80 (MHz).

4. The marker frequency determines the EMI bandwidth that should be used. Because the frequency of the signal in this example is in the 30 MHz to 80 MHz range, the EMI bandwidth needs to be set to 120 kHz. Press (BW), 120 kHz EMI BW. If the frequency of the marker is not in the 30 MHz to 1 GHz range, use Table 3-1 to determine the EMI bandwidth that should be used.

Table 3-1. Determining the EMI Bandwidth

Marker Frequency	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 1 GHz
EMI Bandwidth	200 Hz	9 kHz	120 kHz

5. Press (TRACE), then MAX HOLD A (the quasi-peak measurement is made with trace A only).

Note The quasi-peak measurement can be made with trace A in clear-write or view mode also. Use the maximum-hold mode (MAX HOLD A) if it is difficult to keep the marker on the signal peak.

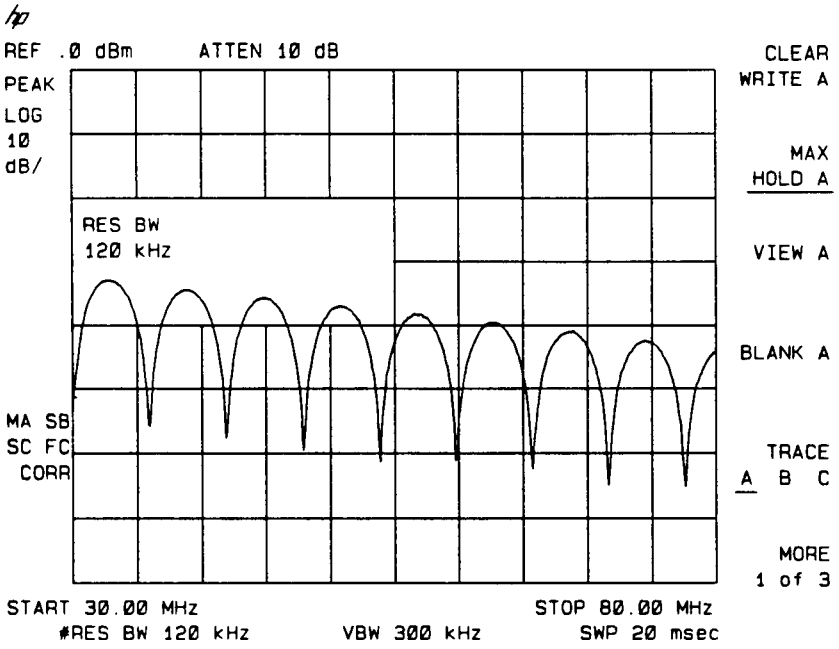


Figure 3-2. Using Maximum-Hold Mode (MAX HOLD A)

Note The manual and automatic quasi-peak functions cannot differentiate between the signal with the marker and a signal less than half a graticule away. If the signal with the marker is within one half a graticule from another signal, the marker will be placed on the higher signal automatically when

AUTO QP AT MKR or MAN QP AT MKR is pressed. To avoid this, reduce the frequency span so that the signals are more than half a graticule apart.

6. Press (MKR), then use the knob to position the marker on the peak of the signal of interest. (If you do not place a marker on screen, the QUASI PEAK function will place a marker on the on-screen signal with the highest amplitude automatically.)

Note When measuring a signal with a low repetition rate, it is important that the marker be on the signal peak. To ensure the marker is on the signal peak, use MAX HOLD A or decrease the sweep time to ensure the marker is on the signal peak.

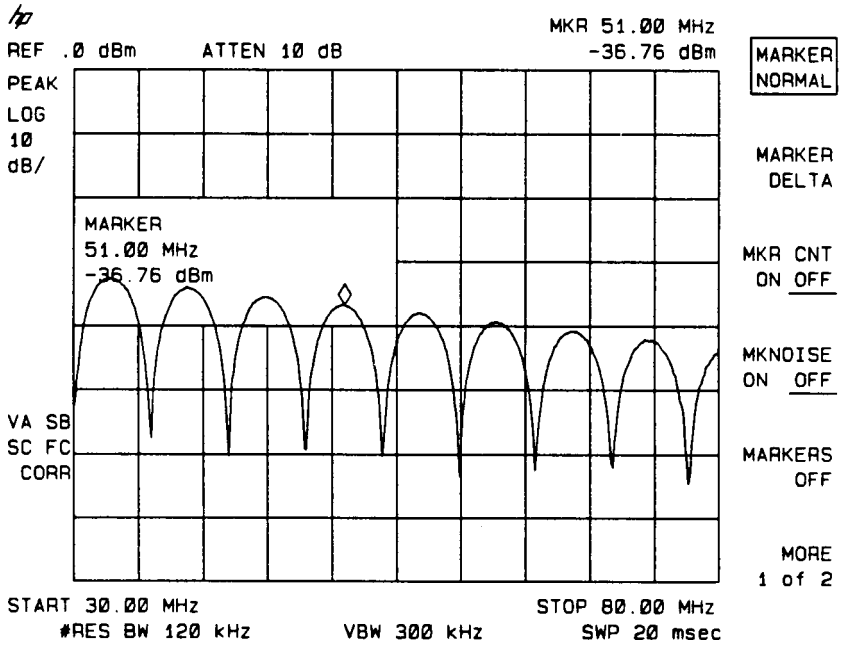


Figure 3-3. Placing the Marker

7. Press (AUX CTRL), QUASI PEAK.

Note If the analyzer is set to the incorrect EMI or video bandwidth for the marker frequency, the quasi-peak function will display a message, display the correct EMI or video bandwidth for the marker frequency, prompt you to select the softkey for the correct bandwidth, and prompt you to press CONTINUE.

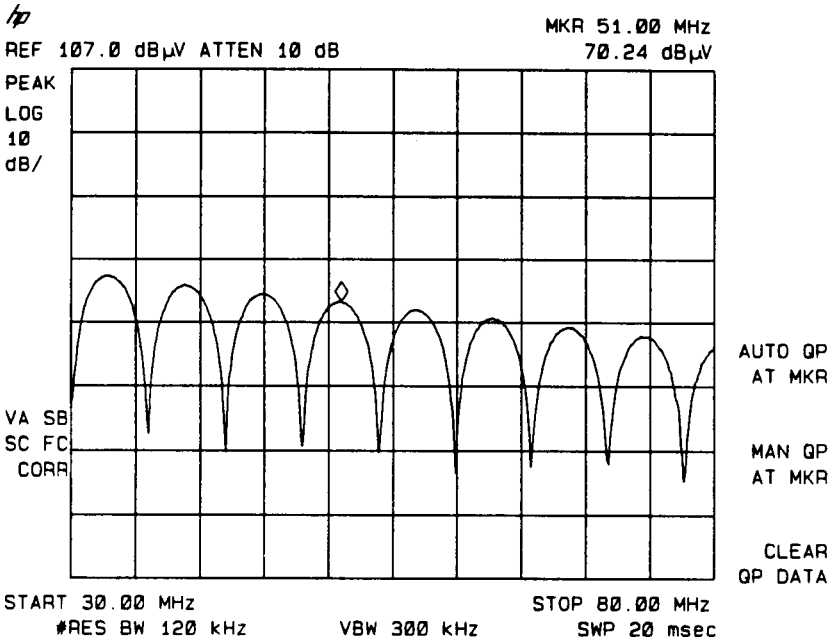


Figure 3-4. Marker on a Signal to Be Measured Using Automatic Quasi-Peak Detection

8. Press AUTO QP AT MKR. AUTO QP AT MKR makes the quasi-peak measurement and then returns to the state the analyzer was in before AUTO QP AT MKR was pressed. Notice that the softkeys are blanked while the quasi-peak measurement is being performed.

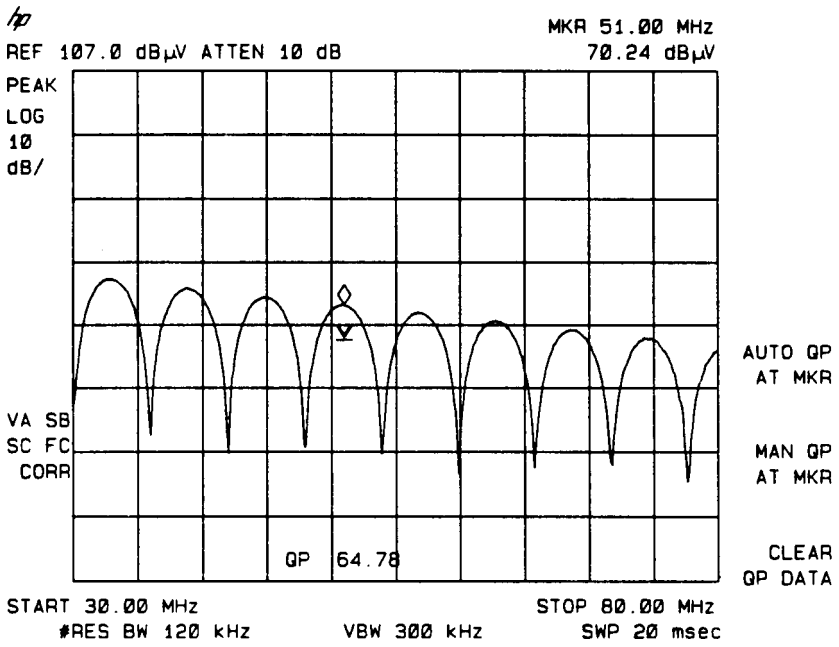


Figure 3-5. The Results of an Automatic Quasi-Peak Measurement

Note that the quasi-peak measurement result is displayed on the analyzer screen as a quasi-peak marker (a diode symbol consisting of an inverted triangle with a small line touching to the point of the triangle). The small line at the point of the triangle indicates the quasi-peak level. The quasi-peak amplitude value is displayed below the quasi-peak marker.

If the display of trace A interferes with the quasi-peak amplitude value display, you can do one of the following to blank or move the trace:

- Blank the lower portion of the trace display by pressing (DISPLAY), THRESHLD ON OFF (so that ON is underlined), then use the knob to adjust the threshold.
- Blank the trace display by pressing (TRACE), BLANK A.

Note To clear the displayed data from the analyzer screen press CLEAR QP DATA, CLEAR QP DATA (CLEAR QP DATA requires a double key press). The quasi-peak marker cannot be cleared by using MARKERS OFF.

Example of Making a Manual Quasi-Peak Measurement

`MAN QP AT MKR` performs the same routine as `AUTO QP AT MKR` to get the correct spectrum analyzer settings. However, instead of taking the marker reading, it accesses the following softkeys for making a manual quasi-peak measurement: `CENTER FREQ`, `MARKER NORM PK`, `QP X10 ON OFF`, `QP DET ON OFF`, `ACCEPT QP DATA`, and `RETURN`.

Follow these steps to make a manual quasi-peak measurement:

1. Repeat steps 1 through 7 from the previous example.
2. Press `MAN QP AT MKR`. Notice that `MAN QP AT MKR` sets the reference level to 2 dB above the marker's amplitude, sets the span to zero, and displays `QPD` in the upper left corner of the analyzer screen (`QPD` indicates that the quasi-peak detector is being used).

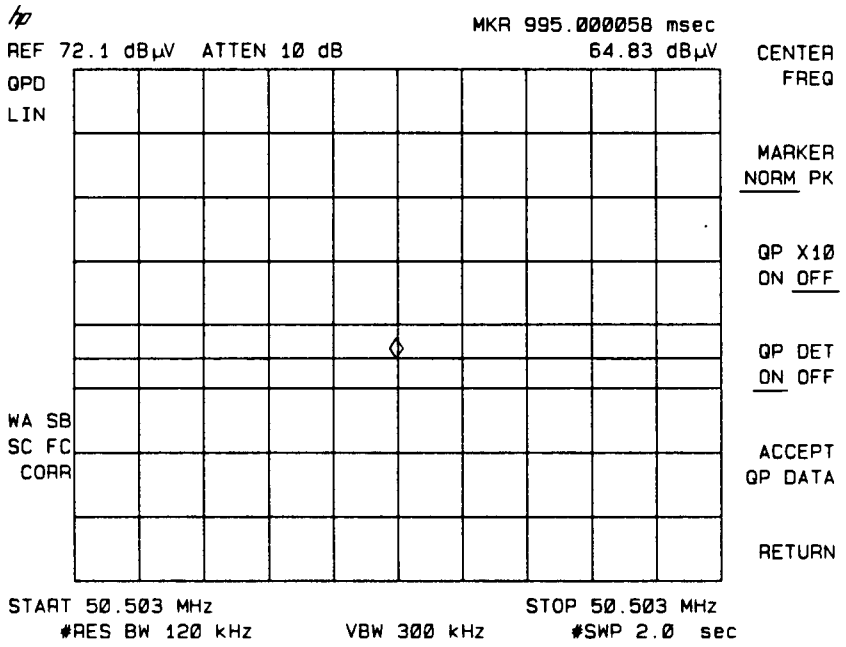


Figure 3-6. Signal to Be Measured Using Manual Quasi-Peak Detection

At this point, the analyzer settings can be changed before taking marker data.

Note Changing the center frequency, frequency span, sweep time, resolution bandwidth, video bandwidth, or reference level can degrade the accuracy of the quasi-peak measurement. See "Changing Analyzer Setting During a Manual Quasi-Peak Measurement" at the end of this procedure for more information.

3. Press `CENTER FREQ`, then use the knob or step keys to change the center frequency. If you are viewing a continuous wave (CW) signal, the quasi-peak amplitude will decrease as the center frequency is moved away from the frequency of the signal peak.

Note If the signal has a low repetition rate, changing the center frequency may cause the amplitude of the quasi-peak signal to decrease. If the amplitude falls below 7.2 graticule divisions from the top graticule, use `QP X10 ON OFF`. See the description of `QP X10 ON OFF` at the end of the chapter for more information.

4. Note that `MAN QP AT MKR` places the marker at the center of the screen. If you want to move the marker, press `MARKER NORM PK` (makes the marker the active function), then use the knob to place the marker. To place the marker on the highest on-screen signal peak after each sweep, press `MARKER NORM PK` so that PK is underlined. Note that the marker readout is in time units versus frequency units because the frequency span is zero.

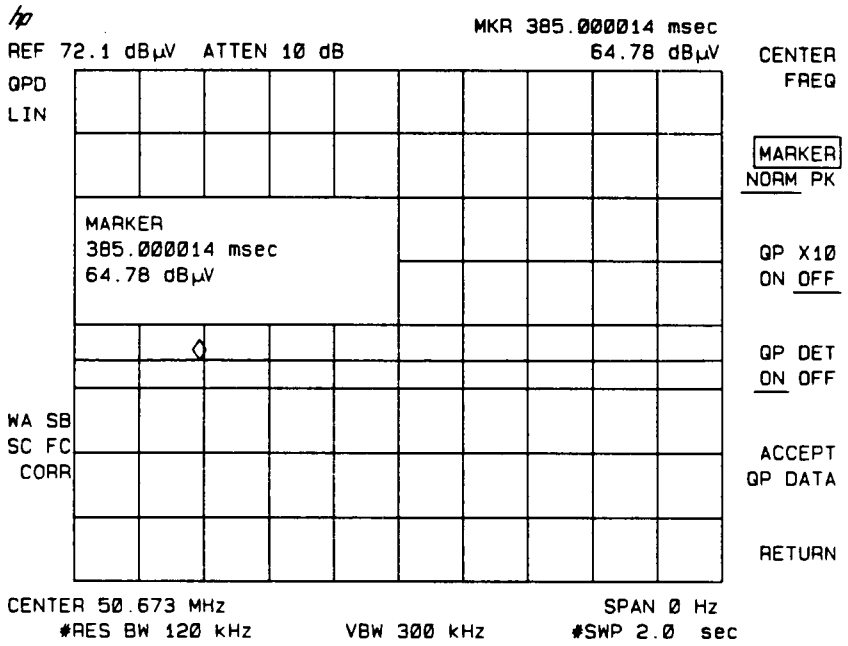


Figure 3-7. Using the Marker During a Manual Quasi-Peak Measurement

5. To compare the peak-signal level with the quasi-peak level, press `QP DET ON OFF` (so that OFF is underlined) to turn the quasi-peak detector off. Press `QP DET ON OFF` (so that ON is underlined) to turn the quasi-peak detector on again.

Note Because quasi-peak amplitude data cannot be accepted while the quasi-peak detector is turned off, `ACCEPT QP DATA` is blanked when the quasi-peak detector is off.

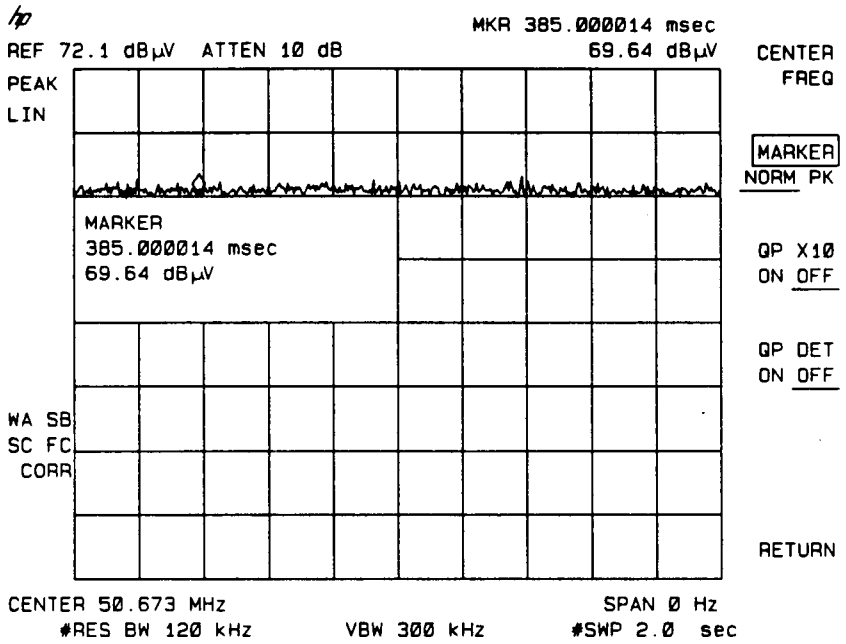


Figure 3-8. Displaying the Peak Signal (Quasi-Peak Detector Off)

6. At this point we want to retain the quasi-peak measured amplitude value. To accept the measured data, press ACCEPT QP DATA. The quasi-peak level at the marker is displayed near the bottom of the screen.

Note The marker data is not updated if the analyzer settings are changed. If the analyzer settings are changed or you wish to make another measurement, press ACCEPT QP DATA again.

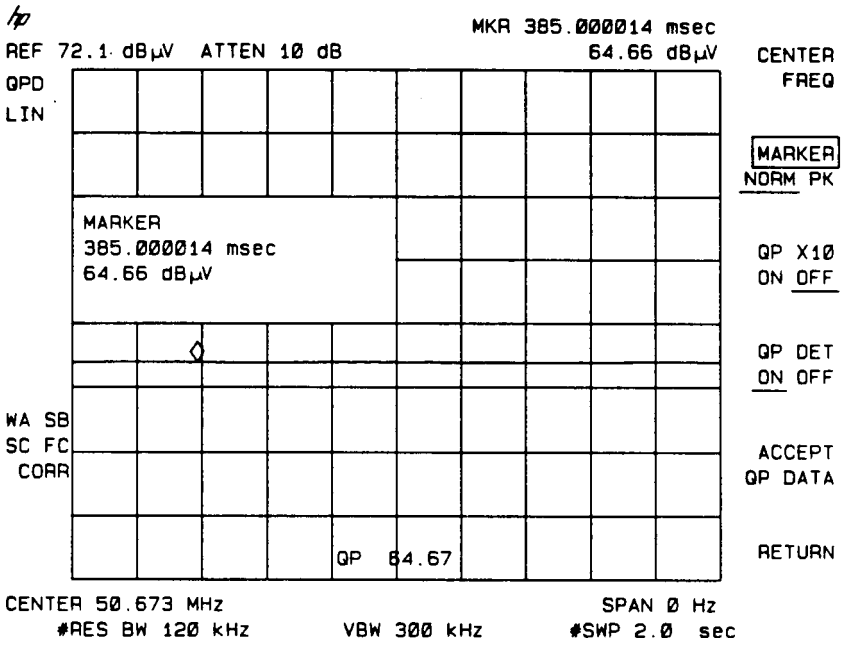


Figure 3-9. Making a Manual Quasi-Peak Measurement

7. Press RETURN to exit the MAN QP AT MKR menu. RETURN recalls the analyzer settings present when MAN QP AT MKR was pressed, returns the quasi-peak marker, and returns the quasi-peak amplitude level.

Note Until RETURN or (PRESET) is pressed, the analyzer remains in the manual quasi-peak measurement mode. Other softkey functions can be used, but pressing QUASI PEAK accesses the softkeys of the manual quasi-peak measurements, not AUTO QP AT MKR, MAN QP AT MKR, and CLEAR QP DATA.

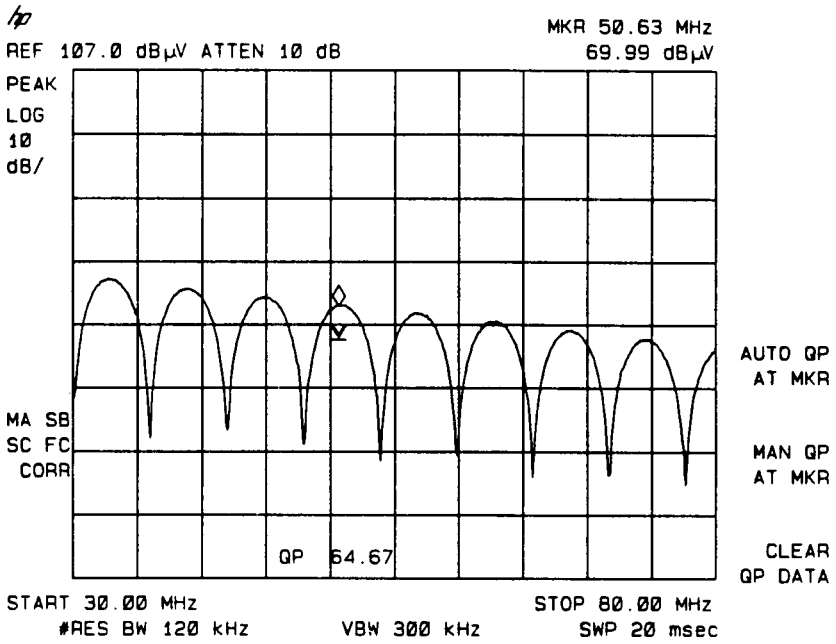


Figure 3-10. The Results of a Manual Quasi-Peak Measurement

Note that the quasi-peak measurement result is displayed on the analyzer screen as a quasi-peak marker (a diode symbol consisting of an inverted triangle with a small line touching the point of the triangle). The small line at the point of the triangle indicates the quasi-peak level. The quasi-peak amplitude value is displayed below the quasi-peak marker.

If the display of trace A interferes with the quasi-peak amplitude value display, you can do one of the following to blank or move the trace:

- Blank the lower portion of the trace display by pressing (DISPLAY), `THRESHLD ON OFF` (so that ON is underlined), then use the knob to adjust the threshold.
- Blank the trace display by pressing (TRACE), `BLANK A`.

Note To clear the displayed data from the analyzer screen press `CLEAR QP DATA`, `CLEAR QP DATA` (`CLEAR QP DATA` requires a double key press). The quasi-peak marker cannot be cleared by using `MARKERS OFF`.

Changing Analyzer Settings During a Manual Quasi-Peak Measurement

Changing the center frequency, resolution bandwidth, video bandwidth, sweep time, span, or reference level may degrade the accuracy of the quasi-peak measurement. The following sections provide information about changing the analyzer settings.

Changing the Center Frequency, Resolution Bandwidth, or Video Bandwidth

When changing the center frequency during a quasi-peak measurement, remember that the marker frequency determines the resolution bandwidth of a quasi-peak measurement. Refer to Table 3-2 to determine the correct EMI bandwidth for the marker frequency setting.

Note The quasi-peak measurement results are not valid if the correct EMI or video bandwidths are not used.

Table 3-2. Determining the EMI Bandwidth

Marker Frequency	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 1 GHz
EMI Bandwidth	200 Hz	9 kHz	120 kHz
Video Bandwidth	3 kHz	30 kHz	300 kHz

When making a quasi-peak measurement, the video bandwidth should be set for the EMI bandwidth. See Table 3-2 to determine the correct video bandwidth for the marker frequency.

Changing the Sweep Time or Frequency Span

When changing the sweep time or frequency span, remember that the time to charge and discharge the quasi-peak detector limits the how fast the frequency span can be swept. Refer to Table 3-3 to determine the sweep time for a given frequency span and EMI bandwidth.

Note If the span is changed the sweep time is not changed automatically; you must change the sweep time manually if you change the frequency span during a manual quasi-peak measurement.

Table 3-3. Determining the Sweep Time

Frequency Span	EMI Bandwidth	Sweep Time
0	9 kHz or 120 kHz	2 s
>0	9 kHz	200 s/MHz or 10 s*
>0	120 kHz	20 s/MHz or 10 s*
* Select whichever is greater.		

Note In non-zero frequency spans, the first second of trace data is *not* valid. For example, the first division (the first second of the trace display) is not valid if the sweep time is 10 seconds. To increase the portion of the trace that is valid, use a slower sweep time.

Changing the Reference Level

If you adjust the reference level with the quasi-peak detector on, you can cause gain compression of the signal (gain compression can occur if the signal is above the top graticule). If you need to change the reference level during a manual measurement, turn the quasi-peak detector off with `QP DET ON OFF`, change the reference level while keeping the signal on screen, then turn the quasi-peak detector back on with `QP DET ON OFF`. Use `QP X1O ON OFF` if the quasi-peak signal is below 7.2 graticule divisions from the top graticule.

Descriptions of the Quasi-Peak Functions

This section contains detailed descriptions of the quasi-peak functions. The functions are listed alphabetically. Refer to the spectrum analyzer Operating Manual for descriptions of the demodulation functions or other analyzer functions.

`ACCEPT QP DATA` is accessed by `MAN QP AT MKR`. It displays the quasi-peak amplitude value of the marker. You may press `ACCEPT QP DATA` repeatedly. If the marker is off when `ACCEPT QP DATA` is pressed, a marker is placed at the center of the screen automatically. Because quasi-peak amplitude data cannot be accepted if the quasi-peak detector is turned off, `ACCEPT QP DATA` is blanked when the quasi-peak detector is turned off.

Note The marker data is not updated if the analyzer settings are changed. If the analyzer settings are changed or you wish to make another measurement, press `ACCEPT QP DATA` again.

`AUTO QP AT MKR` causes the spectrum analyzer to run through the following sequence:

Note The quasi-peak measurement is made with trace A only.

1. Records the amplitude of the on-screen marker.
2. Checks that the EMI and video bandwidth is set correctly for the marker frequency. If it is not, a message is displayed, the softkey for the correct bandwidth is displayed and the `CONTINUE` softkey is displayed.
3. Sets the spectrum analyzer center frequency to the marker frequency.
4. Decreases the frequency span to zero while keeping the marker at center frequency. (A special routine is performed when measuring signals with low-repetition rates, see the note at the end of the `AUTO QP AT MKR` description.)
5. Sets the spectrum analyzer reference level to bring the marker amplitude close to the top of the analyzer screen.
6. Puts the spectrum analyzer in the linear display mode.
7. Turns on the quasi-peak detector.
8. Sets the spectrum analyzer sweep time to 2 seconds.
9. Turns on `QP X10 ON OFF` to add ten times (20 dB) quasi-peak gain if the signal is 20 dB below the reference level.
10. Takes a complete sweep.
11. Puts the marker on the quasi-peak signal and remembers the quasi-peak amplitude level.

12. Returns the analyzer to the settings present when AUTO QP AT MKR was pressed.
13. Displays the measured quasi-peak level with a diode symbol and denotes the quasi-peak amplitude level with annotation at the bottom of the analyzer screen.

Note

The quasi-peak detector driver uses a special routine when measuring a pulse signal with low repetition rate because signals with low repetition rates are more difficult to keep on screen. When decreasing the frequency span in step 4 of the previous procedure, the quasi-peak detector driver does the following:

a. The quasi-peak detector driver compares the amplitude value of the marker from step 1 with the marker amplitude of the signal *after* the span has been decreased.

b. If the difference of the marker's amplitudes is more than 5 dB, the sweep time is increased by a factor of ten, another measurement sweep and marker amplitude reading is made.

c. Repeats the previous step until the difference between the marker amplitudes is less than 5 dB or the sweep time has slowed to 100 seconds.

d. If the sweep time has slowed to 100 seconds and a signal cannot be found within 5 dB of the marker amplitude, a message is displayed indicating that no signal could be found and the analyzer returns to the settings present when AUTO QP AT MKR or MAN QP AT MKR was pressed. If this happens, place trace A in clear-write mode (if it is in view or maximum hold mode) and check that there is a signal to be measured.

CLEAR QP DATA clears the displayed quasi-peak amplitude and quasi-peak marker (the diode symbol) from the analyzer screen. Pressing CLEAR QP DATA causes IF YOU ARE SURE, PRESS KEY AGAIN TO CLEAR QP DATA to be displayed on screen to caution you that the quasi-peak marker data will be cleared. To clear the quasi-peak marker data, press CLEAR QP DATA again. The quasi-peak amplitude and marker cannot be cleared using MARKERS OFF. CLEAR QP DATA clears all user-generated graphics.

CENTER FREQ is accessed by MAN QP AT MKR. It allows you to change the center frequency of the spectrum analyzer. This is identical to the CENTER FREQ function that can be accessed by pressing (FREQUENCY). Changing the center frequency is useful for determining the true peak while making a manual quasi-peak measurement. If you are measuring a continuous wave (CW) signal, the amplitude of the signal will decrease as the center frequency is moved away from the frequency of the peak of the signal.

MAN QP AT MKR Pressing MAN QP AT MKR performs the same routine as AUTO QP AT MKR to get the correct spectrum analyzer settings (steps 1 through 10 in the AUTO QP AT MKR description). However, rather than performing steps 11 through 13, the analyzer displays the following softkeys: CENTER FREQ, MARKER NORM PK, QP X1O ON OFF, QP DET ON OFF, ACCEPT QP DATA,

and RETURN. RETURN or (PRESET) must be used to end a manual quasi-peak measurement.

MARKER NORM PK

is accessed by MAN QP AT MKR. It allows you to move the on-screen marker. When NORM is underlined, the marker can be moved anywhere on the trace (similar to MARKER NORMAL). When PK is underlined, the marker is placed on the highest on-screen signal peak after each sweep.

QP X10 ON OFF

is accessed by MAN QP AT MKR. When QP X10 ON OFF is on, it amplifies the video signal ten times (20 dB). This amplification is necessary to make an accurate measurement of a quasi-peak signal that is too low on the analyzer screen. When MAN QP AT MKR is pressed, QP X10 ON OFF is set automatically for the signal being measured. If the signal has a very low repetition rate which causes the quasi-peak level to be below 7.2 graticule divisions from the top graticule, the quasi-peak gain will be turned on (ON is underlined). If the quasi-peak level is not below 7.2 graticule divisions from the top graticule, the quasi-peak gain will remain off (OFF is underlined). If, during a manual measurement, the signal falls below 7.2 graticule divisions from the top graticule, you will need to turn the quasi-peak gain on before accepting the data. If a signal goes above the top graticule, you will need to turn the quasi-peak gain off before accepting the data. Figure 3-11 is an example of when QP X10 ON OFF should be turned on.

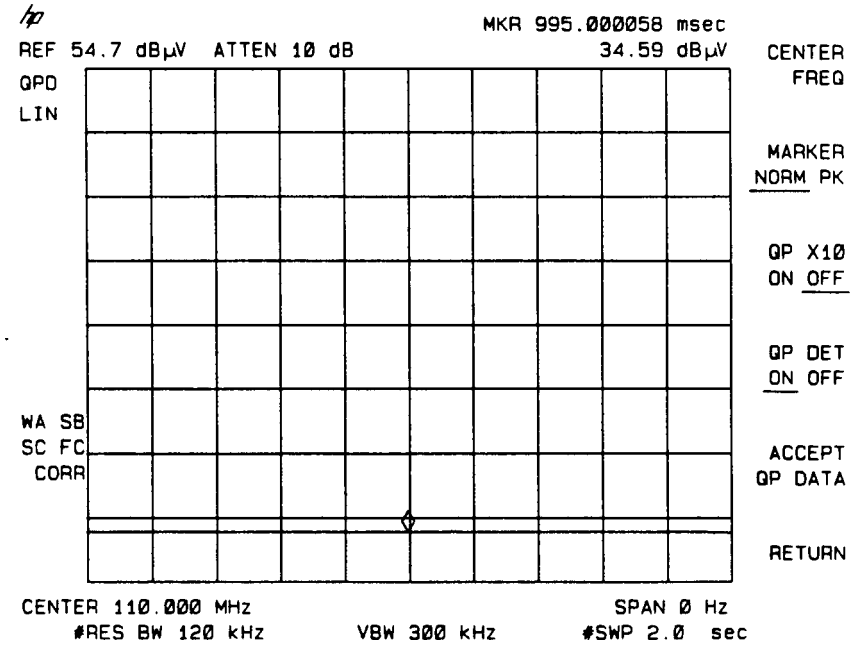


Figure 3-11. A Quasi-Peak Signal 7.2 Divisions Below the Reference Level

Because quasi-peak gain amplifies the video signal and not the signal at the analyzer input, it should be used instead of changing the reference level. Changing the reference level may cause gain compression and invalidate the measurement results.

When QP X10 ON OFF is on, the reference level offset is set to 20 dB to correct the reference level and marker amplitude readouts for the quasi-peak gain.

QP DET ON OFF is accessed by MAN QP AT MKR. It turns the quasi-peak detector on or off. The quasi-peak detector is turned on automatically when AUTO QP AT MKR or MAN QP AT MKR is pressed. If the quasi-peak detector is on, QPD is displayed in the upper left corner of the analyzer screen. Turning the quasi-peak detector off allows you to see the amplitude of the signal without quasi-peak detection. Because a quasi-peak measurement cannot be made if the quasi-peak detector is off, ACCEPT QP DATA is blanked while the quasi-peak detector is off. With the quasi-peak detector off, the peak detected signal should be on screen to avoid gain compression. Press QP DET ON OFF so that ON is underlined to turn the quasi-peak detector on, press QP DET ON OFF so that OFF is underlined to turn the quasi-peak detector off.

QUASI PEAK accesses the quasi-peak softkey functions and, if there is not an on-screen marker, places a marker on the highest on-screen signal.

RETURN is accessed by MAN QP AT MKR. It returns the analyzer to the settings that were present when MAN QP AT MKR was pressed, displays the quasi-peak amplitude value and the quasi-peak marker if ACCEPT QP DATA was pressed, and returns to the previous quasi-peak softkey menu.

Summary of the Quasi-Peak Functions

The following table summarizes the quasi-peak functions and where the softkey is located:

Table 3-4. Quasi-Peak Softkey Functions

Softkey	Description	Path to Softkey
ACCEPT QP DATA	Displays the quasi-peak amplitude value of the marker on the analyzer display.	(AUX CTRL), QUASI PEAK, MAN QP AT MKR.
AUTO QP AT MKR	Performs the automatic quasi-peak measurement routine.	(AUX CTRL), QUASI PEAK.
CLEAR QP DATA	Clears the displayed quasi-peak amplitude and quasi-peak marker (the diode symbol) from the analyzer screen.	(AUX CTRL), QUASI PEAK.
CENTER FREQ	Allows you to change the center frequency of the spectrum analyzer.	(AUX CTRL), QUASI PEAK, MAN QP AT MKR.
MAN QP AT MKR	Changes the analyzer settings for a manual quasi-peak measurement.	(AUX CTRL), QUASI PEAK.
MARKER NORM PK	Allows you to move the on-screen marker.	(AUX CTRL), QUASI PEAK, MAN QP AT MKR.
QP X10 ON OFF	Amplifies the video signal ten times for signals that are too low on the analyzer screen to make an accurate quasi-peak measurement.	(AUX CTRL), QUASI PEAK, MAN QP AT MKR.
QP DET ON OFF	Turns the quasi-peak detector on or off. Turning the quasi-peak detector on and off allows you to check for gain compression.	(AUX CTRL), QUASI PEAK, MAN QP AT MKR.
QUASI PEAK	Accesses the quasi-peak functions.	(AUX CTRL).
RETURN	Returns the analyzer to the previous analyzer settings and displays the quasi-peak amplitude value and marker.	(AUX CTRL), QUASI PEAK, MAN QP AT MKR.

Quasi-Peak Service Functions

The following functions are service diagnostic functions that can be accessed by pressing (CAL). These functions are for service use only, do *not* use them to make a quasi-peak measurement.

- QP DET ON OFF turns the quasi-peak detector on or off.
- QP GAIN ON OFF amplifies the video signal ten times (20 dB). Unlike QP X10 ON OFF, the reference level offset is not changed. The marker readout and reference level readout must be divided by 10 to obtain the correct amplitude readout.
- QPD RST ON OFF is used to discharge and reset the quasi-peak detector.

- `QPD OFFSET` sets the offset of the quasi-peak detector. For accurate quasi-peak measurements, `QPD OFFSET` should be set to a value of 29. `QPD OFFSET` is set to a value of 29 by pressing (PRESET).

4

Operating Option 103 Remotely (Option 021 or 023 Only)

What You Will Find in This Chapter

- A list of Option 103 programming commands.
- Guidelines for operating Option 103 remotely.
- Descriptions of the remote programming commands for Option 103.

Option 103 Programming Commands

The programming commands listed in the *HP 8590 Series Spectrum Analyzer Programming Manual* also apply to an HP 8590 Series spectrum analyzer with Option 103 installed. The commands DEMOD, FMGAIN, SPEAKER, SQLCH, which are documented in the programming manual for Option 102, apply to Option 103 also. The following programming commands apply to Option 103 and are *not* documented in the programming manual (they are documented in this chapter).

Option 103 Programming Commands Documented in This Chapter

Command Mnemonic	Corresponding Softkey	Description
QP_DISPOSE		Disposes of the quasi-peak detector driver downloadable program from analyzer memory.
QPGAIN	`QP GAIN ON OFF`	Turns on or off the video gain of the quasi-peak detected signal.
QPOFFSET	`QPD OFFSET`	Specifies the frequency offset for the quasi-peak detector.
QPRST	`QPD RST ON OFF`	Discharges and resets the quasi-peak detector.

Note The DET or the DEMOD command can be used to turn on the quasi-peak detector. See the following programming guidelines.

Guidelines for Remote Operation of Option 103

Remote operation of Option 103 is similar to manual quasi-peak operation; EMI bandwidth, video bandwidth, sweep time, span, and quasi-peak gain must be set correctly to make an accurate measurement. To make an accurate quasi-peak measurement, follow these guidelines:

- Use the IP command prior to a quasi-peak measurement. The IP command sets the value of `QPD OFFSET` to 29.
- Decrease the span before placing a marker on a signal (a narrow span is recommended).
- Set the EMI bandwidth according to the marker frequency (see Table 3-1).
- Set the video bandwidth according to the EMI bandwidth (see Table 3-1).
- Set the span to zero, or, if it is necessary to use a nonzero span, use a narrow span.
- Set the sweep time according to the span (see Table 4-2).
- Set the amplitude scale to linear.
- Set the amplitude units to dBμV.
- If in zero span, activate the quasi-peak detector by executing `DEMOD QPD;DEMOD ON`.
- If in nonzero span, activate the quasi-peak detector by executing `DET QPD`.
- Use quasi-peak gain (QPGAIN) if the quasi-peak amplitude level is too low.

The QPGAIN programming example demonstrates many of these guidelines.

Table 4-1. Determining the EMI Bandwidth

Marker Frequency	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 1 GHz
EMI Bandwidth	200 Hz	9 kHz	120 kHz
Video Bandwidth	3 kHz	30 kHz	300 kHz

Table 4-2. Determining the Sweep Time

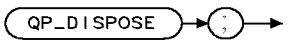
Frequency Span	Resolution Bandwidth	Sweep Time
0	9 kHz or 120 kHz	2 s
>0	9 kHz	200 s/MHz or 10 s*
>0	120 kHz	20 s/MHz or 10 s*
* Select whichever is greater.		

Note In nonzero frequency spans, the first second of trace data is *not* valid. For example, the first division (the first second of the sweep) is not valid if the sweep time is 10 seconds. To increase the portion of the trace that is valid, use a slower sweep time.

QP_DISPOSE
Dispose of the Quasi-Peak Detector Driver

The QP_DISPOSE command deletes the quasi-peak detector driver downloadable program from analyzer memory.

Syntax



Example

```
OUTPUT 718;"QP_DISPOSE;"
```

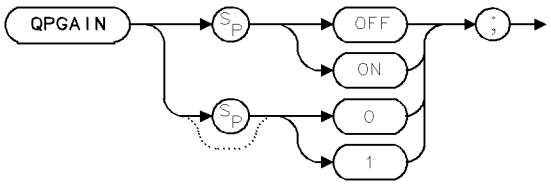
Description

If the HP 85712D EMC Auto-measurement Personality is loaded into analyzer memory also, it should be deleted before using QP_DISPOSE. If the QP_DISPOSE command is executed when the HP 85712D EMC Auto-measurement Personality is loaded into the analyzer memory, some of the precompliance test keys in the HP 85712D will cause errors. Use `DISPOSE EMC` to delete the EMC personality, then execute QP_DISPOSE.

QPGAIN
Quasi-Peak Gain

The QPGAIN command turns the times 10 video gain of the quasi-peak detected signal on or off.

Syntax



Preset State: QPGAIN OFF
Related Commands: DEMOD, DET.

Example

```
10    OUTPUT 718;"IP;"
20    OUTPUT 718;"FA 30MHZ;FB 40MHZ;"
30    OUTPUT 718;"RB 120KHZ;TS;SNGLS;"
40    OUTPUT 718;"MKPK HI;MKCF;TS;"
50    OUTPUT 718;"SP 500KHZ;TS;MKPK HI;MKCF;TS;"
60    OUTPUT 718;"SP 0;ST 2SC;TS;MKPK HI;"
70    OUTPUT 718;"MKRL;"
80    OUTPUT 718;"LN;AUNITS DBUV;"
90    OUTPUT 718;"TS;MKPK HI;MKA?;"
100   ENTER 718;A
110   OUTPUT 718;"DEMOD QPD;DEMOD ON;ST 2SC;"
```

Initializes the analyzer and sets the value of `QPD OFFSET` *to 29.*

Sets the frequency span, a narrow frequency span is recommended.

Sets the EMI bandwidth.

Places the marker on the peak signal, sets the center frequency to the marker frequency.

Decreases the span.

Decreases the span to zero, places marker on signal peak.

Sets the reference level to the marker amplitude.

Changes the amplitude scale to linear, amplitude units to dBμV.

Finds the marker amplitude.

Variable A contains the peak amplitude level.

Turns on the quasi-peak detector, sets the sweep time to 2 seconds.

```
120   OUTPUT 718;"TS;MKPK HI;MKA?;"          Finds the quasi-peak amplitude level.
130   ENTER 718;B
140   IF A-B>20 THEN OUTPUT 718;"QPGAIN ON;"  If the peak amplitude is more than 20 dB less than the quasi-peak amplitude, use QPGAIN.
150   OUTPUT 718;"TS;MKPK HI;MKA?;"          Finds the quasi-peak amplitude level.
160   ENTER 718;C                            Quasi-peak amplitude level is placed in variable C.
170   IF A-B>20 THEN C=C-20                  If QPGAIN is used, change the quasi-peak marker amplitude.
180   PRINT "PEAK AMPLITUDE LEVEL = ",A;"dBuV"
210   PRINT "QUASI-PEAK AMPLITUDE LEVEL = ",C;"dBuV"
220   !
230   OUTPUT 718;"QPGAIN OFF;DEMOD OFF;"     Lines 230 to 250 restore the analyzer to its previous settings.
240   OUTPUT 718;"LG 10DB;CONTS;"
250   OUTPUT 718;"FA 30MHZ;FB 40MHZ;"
260   !
270   END
```

Description

Unlike using `MAN QP AT MKR`, the quasi-peak detector gain is *not* set automatically during remote operation. If the amplitude of the quasi-peak signal is more than 20 dB lower than the peak signal amplitude, QPGAIN should be used. When quasi-peak detector gain is used, the linear video signal is amplified 10 times, resulting in a 20 dB gain. Since the quasi-peak detector gain amplifies the video signal, it should be used instead of changing the reference level (changing the reference level can cause gain compression and invalidate the measurement results). QPGAIN does not correct the reference level and marker amplitude readouts automatically.

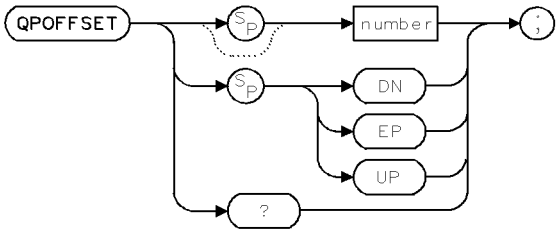
Note When QPGAIN is on and the amplitude units are dBμV, the marker amplitude and the reference level is off by 20 dB. To compensate for this, subtract the marker amplitude value and the reference level by 20. If the amplitude units are in volts, the marker amplitude and reference level is off by a factor of 10. To compensate for this, divide the marker amplitude value and the reference level by 10. (The recommended amplitude units are dBμV.)

The function of QPGAIN and `QP GAIN ON OFF` (located in the CAL menu) are equivalent. The functions of QPGAIN and `QP X10 ON OFF` (located in the AUX CTRL menu) are similar, except `QP X10 ON OFF` adds the reference level offset automatically so the reference level and the marker amplitude readout is correct.

QPOFFSET
Quasi-Peak Offset

The QPOFFSET command specifies the offset for the quasi-peak detector.

Syntax



Item	Description/Default	Range
Number	Any real or integer number.	0 to 255

Preset Value: 29.
Related Commands: DEMOD, DET.

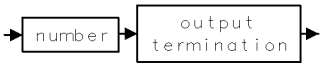
Example

```
OUTPUT 718;"QPOFFSET 29;"
```

Description

To make accurate quasi-peak measurements, the quasi-peak offset value should be set to 29. The quasi-peak offset value is set to 29 by the quasi-peak detector driver and by the instrument preset command (IP), however the offset value can be changed by using `QPD OFFSET`. The functions of `QPD OFFSET` and QPOFFSET are equivalent.

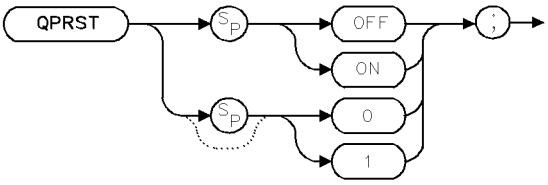
Query Response



QPRST
Quasi-Peak Detector Reset

The QPRST command is used to discharge and reset the quasi-peak detector.

Syntax



Preset State: QPRST OFF
Related Commands: DEMOD, DET.

Example

```
OUTPUT 718;"QPRST ON;"
OUTPUT 718;"QPRST OFF;"
```

Discharges the quasi-peak detector.
Turns off QPRST.

Description

QPRST is for diagnostic purposes only. The functions of QPRST and `QPD RST ON OFF` are equivalent.

Index

R

S

T

U

V

W