User's Guide

HP 8572A EMI Receiver

HEWLETT PACKARD

HP Part No. 08572-90003
Printed in USA April 1992

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CAUTION

The *CAUTION* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in damage to or destruction of the product or the user's work. Do not proceed beyond a *CAUTION* sign until the indicated conditions are fully understood and met.

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The *WARNING* sign denotes a hazard. It calls attention to a procedure which, if not correctly performed or adhered to, could result in injury to the user. Do not proceed beyond a *WARNING* sign until the indicated conditions are fully understood and met.

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General Safety Considerations

WARNING

- **The instructions in this document are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing unless you are qualified to do so.**
- **The opening of covers or removal of parts is likely to expose dangerous voltages. Disconnect the instrument from all voltage sources while it is being opened.**
- **The power cord is connected to internal capacitors that may remain live for five seconds after disconnecting the plug from its power supply.**
- **This is a Safety Class 1 Product (provided with a protective earthing ground incorporated in the power cord). The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. Any interruption of the protective conductor inside or outside of the instrument is likely to make the instrument dangerous. Intentional interruption is prohibited.**
- **For continued protection against fire hazard, replace fuse only with same type and ratings, (type nA/nV). The use of other fuses or materials is prohibited.**

WARNING

- **Before this instrument is switched on, make sure it has been properly grounded through the protective conductor of the ac power cable to a socket outlet provided with protective earth contact.**

  Any interruption of the protective (grounding) conductor, inside or outside the instrument, or disconnection of the protective earth terminal can result in personal injury.
- **Before this instrument is switched on, make sure its primary power circuitry has been adapted to the voltage of the ac power source.**

  Failure to set the ac power input to the correct voltage could cause damage to the instrument when the ac power cable is plugged in.

In This Book . . .

Chapter 1	How and when to calibrate your EMI receiver system.
Chapter 2	How to perform operation verification.
Chapter 3	How to set up your test equipment for operation verification.
Chapter 4	How to make typical measurements with your EMI receiver system.
Chapter 5	How to make measurements with downloadable programs.

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1

Calibrating Your Receiver

In this chapter, you'll learn how and when to calibrate your HP 8572A microwave EMI receiver:

- how often to calibrate your receiver
- how to calibrate receiver INPUT 1 and receiver INPUT 2
- how to calibrate receiver INPUT 3
- how to perform preselector peaking for receiver INPUT 3
- how use a calibration table to calibrate receiver INPUT 3
- how to perform manual and automated measurements

When to Calibrate Your Receiver

Note

- To meet specified absolute amplitude accuracy, your receiver must be calibrated. For accurate calibration, ambient temperature must be 20 to 30 degrees centigrade. Your receiver must be stabilized at room temperature for at least two hours, to allow comb amplitude to stabilize.

Calibrate your HP 8572A microwave EMI receiver:

- at the start of each day
- after power is cycled on the RF preselector
- for each change in:
  - resolution bandwidth
  - frequency band
  - spectrum analyzer or preselector attenuation
  - logarithmic/linear scale
  - AMPTD CAL setting

In addition to these calibrations, you also should verify the performance of the HP 8572A microwave EMI receiver periodically.

Complete RF preselector comb characterization and all EMI receiver system performance tests every six months to be sure the EMI receiver system continues to meet its specifications. During performance testing, use the entire EMI receiver system (including all cables).

This periodic calibration requires extensive test equipment, and can be time consuming. For your convenience, calibration and performance verification is available through your local Hewlett-Packard service center.

Calibrating Receiver INPUT 1 and INPUT 2

Note

- Receiver INPUT 1 and receiver INPUT 2 are input 1 and input 2 on the HP 85685A RF preselector.

  When calibrating receiver INPUT 1 and receiver INPUT 2, complete the procedure for each new combination of frequency range, resolution bandwidth, logarithmic/linear scale, and attenuation settings.

To calibrate receiver INPUT 1 and receiver INPUT 2:

1. Connect the 100 MHz CAL OUTPUT on the spectrum analyzer to receiver INPUT 2 on the RF preselector.
2. On the quasi-peak adapter, select the bypass path by pressing the BYPASS key in the INSTR FUNCTION group. The LED above that key will light.
3. On the RF preselector, select the bypass path by pressing the ENABLE (•) key and the BYPASS (•) key; the BYPASS LED near receiver INPUT 2 will light.
4. Select the preamplifier bypass path by pressing the SWITCHES 0 (•) key on the attenuator/switch driver; the LED in that key will light.
5. Press (RECALL) (8) on the spectrum analyzer.
6. Adjust AMPTD CAL on the spectrum analyzer for -10 dBm ± 0.20 dB.
7. Press (RECALL) (9) on the spectrum analyzer.
8. Adjust FREQ ZERO on the spectrum analyzer for a maximum signal on the display.
9. Select the frequency range, resolution bandwidth, logarithmic/linear scale, and attenuator settings to be used for the desired measurement.
10. Select the quasi-peak adapter bandwidth for the measurement.
11. Connect the COMB GENERATOR OUTPUT on the RF preselector to the receiver input to be calibrated.
12. Execute the comb calibration sequence by pressing CAL SEQ (START) on the RF preselector.

If the start frequency is below 200 kHz, the spectrum analyzer will display the 100 kHz comb signal and you will be instructed to adjust AMPTD CAL on the spectrum analyzer for the displayed amplitude of the 100 kHz comb tooth to within ± 0.2 dB. If the 100 kHz calibration signal amplitude is within ± 0.2 dB of the desired value, no adjustment is necessary; the calibration sequence will continue automatically.

After adjusting AMPTD CAL to within ±0.2 dB, press CAL SEQ (START) on the RF preselector to continue the calibration routine. If the stop frequency is above 200 kHz, the calibration sequence is performed over the frequency span above 200 kHz.

The comb generator CAL SEQ LED flashes while the calibration sequence is running. When the calibration sequence ends, the CAL SEQ LED stays on, indicating that the system is calibrated over the current frequency range. If the receiver frequency is increased beyond the calibrated frequency range, the CAL SEQ LED turns off, to indicate an uncalibrated state.

Note

- The CAL SEQ LED does not turn off when settings other than start or stop frequency are changed. Therefore, it is possible for an uncalibrated state to exist for the current settings of resolution bandwidth, attenuation, or amplitude scale while the CAL SEQ LED is turned on. *Be sure the receiver is calibrated for the current instrument settings.*
- If you change resolution bandwidth, logarithmic/linear scale, or attenuation, or readjust AMPTD CAL, repeat steps 9 through 12 with the new settings.

Calibrating Receiver INPUT 3

Note

- Receiver INPUT 3 is the preamplifier input on the HP 8449B Opt H02 preamplifier.

  When calibrating receiver INPUT 3,

  - Complete the calibration procedure for frequency range, resolution bandwidth, logarithmic/linear scale, and attenuation settings.
  - Apply amplitude correction factors from the calibration table on page 1-10.
  - Execute a PRESEL PEAK (preselector peak) for each signal in preselected band 1 through band 4 (2 GHz to 22 GHz).

To calibrate receiver INPUT 3:

1. Connect the 100 MHz CAL OUTPUT on the spectrum analyzer to receiver INPUT 2.
2. On the RF preselector, select the bypass path by pressing the ENABLE (•) key and the BYPASS (•) key; the BYPASS LED near receiver INPUT 2 will light.
3. Select the preamplifier bypass path by pressing the SWITCHES 0 (•) key on the attenuator/switch driver; the LED in that key will light.
4. Press (RECALL) (8) on the spectrum analyzer.
5. Select the resolution bandwidth and logarithmic/linear scale settings for the measurement.
6. Adjust AMPTD CAL on the spectrum analyzer for -10 dBm ± 0.20 dB.
7. Press (RECALL) (9) on the spectrum analyzer.
8. Adjust FREQ ZERO on the spectrum analyzer for maximum trace amplitude.
9. Press the SWITCHES 0 (•) key on the attenuator/switch driver until the LED turns off.
10. Press (SHIFT) (PRESEL PEAK) on the spectrum analyzer.
11. To correct for receiver frequency response, subtract the gain factor from the displayed signal amplitude. See "Correcting Receiver INPUT 3 Using a Calibration Table").

Steps 1 through 6 perform a modified (RECALL) (8) amplitude adjustment through the bypass path. Pressing (SHIFT) (PRESEL PEAK) in step 10 will optimize 2 GHz to 22 GHz RF preselector filter tracking for best overall response. To obtain true signal amplitude, complete a (PRESEL PEAK) for each signal.

Note

- If you change resolution bandwidth, or logarithmic/linear scale settings, or readjust AMPTD CAL on the spectrum analyzer, repeat this procedure with the new settings.

Preselector Peaking for Receiver INPUT 3

To obtain the specified absolute amplitude accuracy for the 2 GHz to 22 GHz frequency bands, the tracking preselector must be peaked for each signal. If this is not done, displayed signals above 2 GHz are likely to be displayed as much as 5 dB to 7 dB lower. This discrepancy could cause amplitude errors of −0.7 to −1 dB, which becomes significant given the ±2 dB amplitude accuracy specification.

To determine the true amplitude of a signal, place the marker on the peak of the signal and press (PRESEL PEAK). The spectrum analyzer automatically fine tunes its preselector filter, using a digital-to-analog converter (DAC), for maximum signal amplitude, so the signal is not attenuated by the filter skirts.

Use the factory-default preselector DAC setting of 32 (obtained by executing (SHIFT) (PRESEL PEAK)) for best overall frequency response when viewing an entire swept frequency band.

Because the relative tuning of the preselector filter changes at different points in any given frequency span, the optimum preselector peak DAC value can differ by several DAC numbers, for different frequencies in a given frequency span, causing as much as 1 dB amplitude error. To avoid this, execute (PRESEL PEAK) at each frequency of interest.

Table 1-1. Frequency Bands

Frequency Band		Frequency Range	n	YTO Frequency Range
0	A[1]	0.0–2.5 GHz	1	3.62–6.12 GHz
1	B	2.0–5.8 GHz	1	2.32–6.12 GHz
2	C	5.8–12.5 GHz	2	2.74–6.09 GHz
3	D	12.5–18.6 GHz	3	4.06–6.09 GHz
4	E	18.6–22.0 GHz	4	4.57–5.42 GHz

1 Low Band (preselector peaking is not required).

Correcting Receiver INPUT 3 Using a Calibration Table

To obtain specified absolute amplitude accuracy for signals measured through receiver INPUT 3, apply the frequency-dependent correction factors to signal amplitude measurements. Because of the preamplifier gain, signals will be displayed on the receiver display at an amplitude higher than the actual signal amplitude.

Figure 1-1 is a sample calibration table. The calibration data corrects for preamplifier gain, preamplifier frequency response, and spectrum analyzer frequency response for both 0 dB and 10 dB spectrum analyzer attenuation after the receiver calibration routine has been completed. Calibration factors are provided every 50 MHz from 1.0 GHz to 22 GHz for each frequency band.

Calibration data is provided in two forms in the calibration table: gain in dB, and correction factor with a specific reference level offset.

HP 8572A CALIBRATION TABLE WITH 0 dB HP 8566B ATTENUATION

Model Number	Serial Number
HP 85650A	3145A01616
HP 85662A	3144A20461
HP 85660B	3138A07506
HP 11713A	2508A09477
HP 8449B (H02)	3008A00245
HP 85685A	31466A01315

Calibration Date: 11 Mar 1992
Reference level offset for manual calibration: -29.2 dB

Frequency Band 0

Frequency (GHz)	Gain (dB)	Correction Factor With -29.2 dB Reference Level Offset (dB)	Frequency (GHz)	Gain (dB)	Correction Factor With -29.2 dB Reference Level Offset (dB)
1.00	36.1	6.9	1.80	35.6	6.5
1.05	36.0	6.8	1.85	35.6	6.4
1.10	36.1	6.9	1.90	35.5	6.3
1.15	36.0	6.8	1.95	35.5	6.3
1.20	35.8	6.6	2.00	35.5	6.3
1.25	36.1	6.9	2.05	35.3	6.1
1.30	35.9	6.7	2.10	35.3	6.1
1.35	36.0	6.8	2.15	35.4	6.2
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.

Figure 1-1. Sample Calibration Table

Table 1-2. receiver INPUT 3 Frequency Bands

Frequency Band	Calibration Factor Frequency Range
0	1.00–2.50 GHz
1	2.00–5.80 GHz
2	5.60–12.50 GHz
3	12.30–18.60 GHz
4	18.40–22.00 GHz

Note

- Because spectrum analyzer bands overlap, correction factors are provided in both bands for the overlapping frequency points. Be sure to use the correction factor for the selected frequency band used in the measurement. Refer to Table 1-2.

  To determine the frequency band, press (SHIFT) (CONT). The "harmonic lock" number corresponding to the frequency band will be displayed. Press (SHIFT) (MKR/Δ --> STP SIZE) to return the spectrum analyzer to normal operation.

Manual Measurements Using Receiver INPUT 3

1. Calibrate receiver INPUT 3. Refer to "Calibrating Receiver INPUT 3".
2. Enter the reference level offset for manual calibration (from the calibration table).

   For example, to enter −29.2 dB press (SHIFT) (REFERENCE LEVEL) (2) (9) (.) (2) (−dBm). Notice that the correct reference level offset is displayed on the left side of the display.
3. Place the marker on the peak of the signal of interest and press (PRESEL PEAK).
4. To determine the actual signal power level, subtract the correction factor from the displayed amplitude reading (the correction factor usually will be less than 7 dB).
5. For frequencies not given in the table, interpolate between table values.

Because the actual amplitude of all signals always will be lower than the displayed amplitude, the correction factor acts as an additional guard band. If any signals are above or near the test limit, subtract the calibration factor from the displayed signal level to determine the correct signal amplitude. If you use the reference level offset, you will not need to apply the correction factor to signals several dB below the test limits, because the amplitude will be lower than the displayed amplitude.

Note

- Execute (PRESEL PEAK) for each signal in frequency band 1 through frequency band 4. You must select the RF preselector bypass path when performing measurements using receiver INPUT 3.

Note

- To determine the corrected signal level, subtract the gain from the measured signal amplitude.
- Be sure to calibrate your receiver before making this measurement. Follow all the amplitude accuracy considerations discusse in "When to Calibrate Your Receiver" at the beginning of this chapter.

Calibration data is supplied on two disks, for HP 9000 Series 200/300 controllers using the HP BASIC programming language (see *HP 8571A/8572A EMI Receiver 1 GHz to 22 GHz Calibration Data Manual*). Both the single-sided and the double-sided disk contain the same two files:

BDAT	for use with operation verification software.
Gain Table	provided as ASCII data in CITIfile data format. It can be used by the HP 85869A EMI Measurement Software with Revision A.03.00 or later.

A "Software Toolbox" disk containing utilities, example programs, documentation, and sample data files for CITIfile format is available; order HP part number 85103-10002.

Be sure to use the correction factor for the appropriate spectrum analyzer attenuation setting; data is provided for 0 dB and 10 dB attenuation.

To give you a general view of receiver response, the calibration data also is plotted on the display as a 20-point moving average. This graphic format shows correction factors for both 0 dB and 10 dB spectrum analyzer attenuation. Figure 1-2 is an example of this format. Use the calibration table, shown in Figure 1-1, to determine actual signal amplitude.

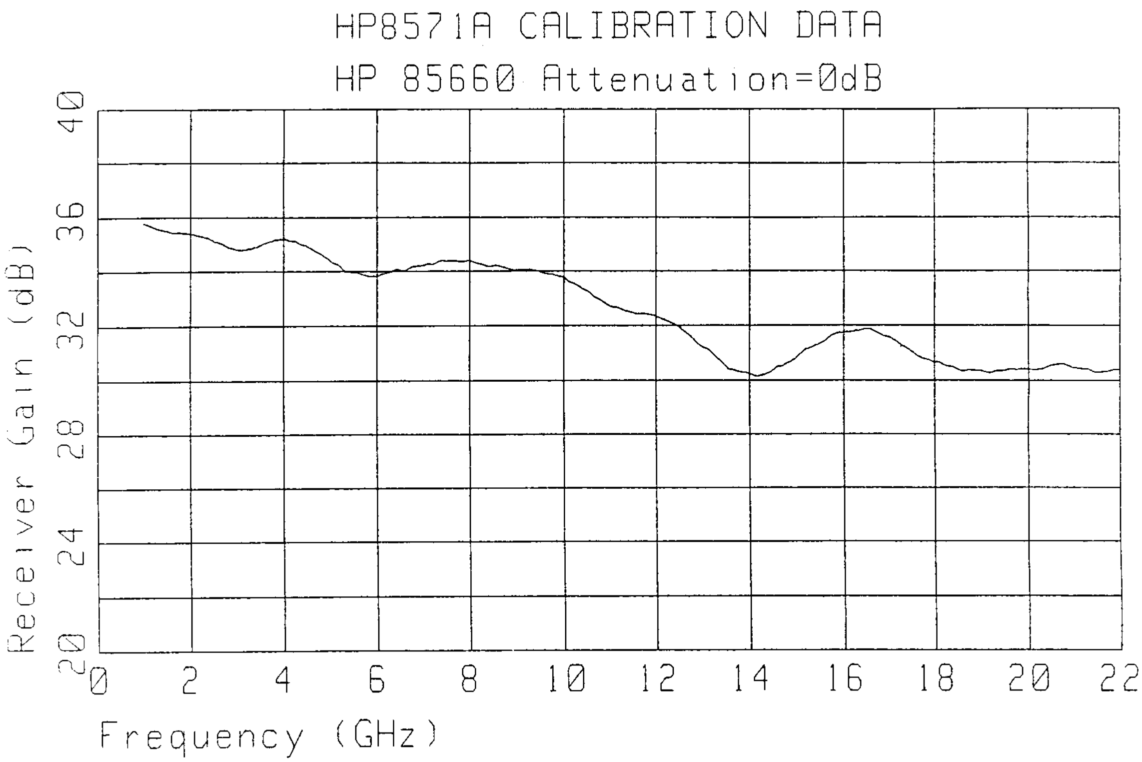


Figure 1-2. Calibration Data Graph

Spectrum Analyzer Corrected Mode

Warning **Do not use the spectrum analyzer corrected mode with the HP 8572A microwave EMI receiver.**

When corrected mode is on, CORR'D appears on the lower left side of the display. To turn off corrected mode, press (SHIFT) (STOP FREQ).

The calibration procedures in this chapter ensure the specified amplitude accuracy. There is no additional benefit from using the spectrum analyzer corrected mode.

2

Operation Verification

In this chapter, you will learn how to install the EMI receiver system operation verification test software, and how to perform all required and optional tests. The software is designed to provide a high level of confidence that the EMI receiver system meets its specifications without requiring excessive test equipment or test time.

Chapter 3, "Test Descriptions," describes each operation verification test in detail. Refer to that chapter for information regarding an individual test.

Note

- To perform the full range of operation verification tests, you will need *all* the test equipment listed in Table 2-1. The operation verification software directly supports only the recommended test equipment. If you use other models of test equipment, you may need to modify the operation verification program. For your convenience, calibration and performance verification are available through your local Hewlett-Packard service center.
- It takes about four hours to complete all the operation verification tests for the HP 8572A microwave EMI receiver.
- Because the program supports several input devices (keyboard or mouse), you may notice minor text differences in the menus and softkeys displayed on the screen.
- Before starting the tests, make backup copies of the operation verification software disks; store the backup disks in a safe place. If an original disk is damaged, or if program data is altered or lost, you will have this backup set. Operation verification software is sold in complete sets only; you cannot order an individual disk.

Step 1. Set up the hardware for operation verification testing

Operation verification software runs on HP 9000 Series 300 computers. The computer must have:

- A minimum of 2.5 to 4 megabytes of RAM, depending on the computer's display configuration.
- An HP-IB interface.
- A 3.5 inch double-sided flexible disk drive.

1. Connect the EMI receiver system to the computer connector.
   - □ If the computer has an HP 98624A HP-IB interface:
     a. Connect your EMI receiver system to HP-IB SELECT CODE 8.
     b. Check that the address switch on the HP 98624A HP-IB interface matches the HP-IB controller device address.
     c. If necessary, refer to the *HP 9000 Series 200/300 Peripheral Installation Guide, Volume 1.*
   - □ If the computer does not have an HP 98624A HP-IB interface:
     a. Connect the EMI receiver system to the connector marked HP-IB SELECT CODE 7.
2. Connect the HP-IB cables from the test equipment to the HP-IB SELECT CODE 7 connector on the computer.
3. Connect the HP-IB of the external disk drive to the computer connector labeled HP-IB SELECT CODE 7, using a 0.5 meter HP-IB cable (HP 10833D BNC 0.5 meter HP-IB cable, or similar cable).

   Occasionally, disk drives exhibit unpredictable behavior when sharing the HP-IB with instruments. If this occurs, connect the disk drive to a separate HP-IB interface.
4. Set the external test equipment and the EMI receiver system line switches to ON. Allow the equipment to warm up as specified for the operation verification tests.
5. Turn on the computer and the disk drive.

Step 2. Load the software

To run the operation verification test software, you must have a version of the BASIC programming language loaded on the computer. You also will need several specific binaries (BIN files—see below).

1. Load BASIC 5.13 or later, with the appropriate BIN files, on the HP 9000 Series 300 computer. If necessary, refer to an HP BASIC reference manual.

   These BIN files should be loaded:

CLOCK	EDIT	KBD
COMPLEX	ERR	MAT
CRTA	GRAPH	MS
CRTB	GRAPHX	PDEV‡
CRTX	HFS*	SRM†
CS80	HPIB	TRANS
DISC	IO	XREF‡

*Optional—required only for HFS (hierarchical file system) environment.

†Optional—required only for SRM (shared resource management) environment.

‡Optional—required only for Debug.

Caution

- Before starting the tests, make backup copies of the operation verification software disks; store the backup disks in a safe place. If an original disk is damaged, or if program data is altered or lost, you will have this backup set. Operation verification software is sold in complete sets only; you cannot order an individual disk.
- Make backup copies of all write-protected disks. Be sure to initialize the backup disks as follows:

  ```
  INITIALIZE ":,700,0",2,3.
  ```

  Format Option 3 must be used, but the MSVS and interleave factor are specific to your system.

- Assign the MASS STORAGE IS (MSI) to the drive you will use as the default drive.

  For example:

  ```
  MSI ":,700,0"
  ```

- Insert disk 1 into the disk drive.
- Type `LOAD "OPV",1` and press (ENTER).
- When prompted, remove disk 1 from the disk drive and insert disk 2.
- Press (CONTINUE).

Step 3. Select the EMI receiver system model

Note

- The Test Executive Program will guide you through the steps to set up your system for the operations verification tests.

The EMI operation verification software provides operation verification tests for the HP 8572A microwave EMI receiver. If your EMI receiver system is an Option 049, you will enter this information when you perform **"Step 4. Enter the EMI receiver system test information".**

```
=== SPECIFIC MODEL? ===
HP8571A
HP8572A
```

1. Use ⇩ and ⇧ to highlight HP 8572A.
2. Press ENTER to select the UUT. The computer will display a title page for the EMI receiver system operation verification test.
3. To continue, press any key on the computer except PAUSE.

Step 4. Enter the EMI receiver system test information

To make sure test records are as complete as possible, and that the correct tests are performed, you will need to enter information about the EMI receiver system.

```
============UUT: HP8572A============
SERIAL NUMBER
ADDRESS TYPE   HP-IB
ADDRESS        718
CONTROLLER
OPTIONS
TEMPERATURE     23.0 DEG C
HUMIDITY        50.0 %
LINE FREQUENCY 60 Hz
```

1. Use ⇧ and ⇩ to select SERIAL NUMBER. Press ENTER.
2. Type the complete ten-digit serial number for your EMI receiver system; press ENTER.
3. If other items in this list need to be changed, refer to these sections (at the end of this chapter) for instructions:
   - "Optional: Assigning the address type"
   - "Optional: Selecting the EMI receiver system address"
   - "Optional: Adding option 049"
   - "Optional: Modifying the temperature setting"
   - "Optional: Modifying the humidity setting"
   - "Optional: Selecting the line frequency"

Note

- You do not need to change the CONTROLLER setting for the HP 8572A microwave EMI receiver. If you select CONTROLLER, you will see the message It seems that a controller is not needed for this UUT. Press RETURN to continue with the setup procedure.

4. When the test information is correct, press CONTINUE.

Step 5. Choose the output destination for your test results

Reports of test results may be printed on the computer's printer, displayed on the computer's display, or not displayed. You must choose where you want to direct these reports.

```
Where should test reports be directed?  CRT
                                        PRINTER
                                        NO OUTPUT
```

1. Use (⇓) and (⇑) to select if you want the test reports displayed on the computer display (CRT), printed on the printer, or not output at all.
2. Press (ENTER).

Step 6. Select "Test all model numbers"

You must enter information for all equipment used in your EMI receiver system before performing any operation verification test.

```
============UUT: Selection============
Test all model numbers
Test only the mainframe/base unit
```

1. Select `Test all model numbers`.

   `Test only the mainframe/base unit` does not apply to the EMI receiver system.

2. Press (ENTER).

Step 7. Select equipment from the UUT Configuration menu

After you select `Test all model numbers` from the UUT Selection menu, you will see a display similar to this:

```
==========UUT: Configuration==========
BASE UNIT    HP8572A
UUT RF       HP85660B
UUT IF       HP85662A
UUT SW       HP11713A
UUT AMP      HP8449B(H02)
```

1. Use (⇑) and (⇓) to select a piece of equipment from the UUT Configuration menu.
2. Press (ENTER).

Step 8. Assign serial numbers to all equipment

Before you can begin performance verification testing, you must enter a serial number for each piece of equipment on the UUT Configuration menu. At this menu, you also will identify address type, address, and any options for each piece of equipment in the receiver under test.

```
==========UUT: Configuration==========
MODEL NUMBER      HP8572A
SERIAL NUMBER
ADDR TYPE          HP-IB
ADDRESS            718
OPTIONS
```

1. Use ⇓ and ⇑ to select SERIAL NUMBER.
2. Press (ENTER).
3. Enter the serial number of the instrument you selected in **"Step 7. Select equipment from the UUT Configuration menu".**
4. Press (ENTER).
5. If you need to change other receiver configuration on this list, use ⇑ and ⇓ to select the item to be changed; refer to these sections (at the end of this chapter) for instructions:
   - "Optional: Assigning the address type"
   - "Optional: Selecting the EMI receiver system address"
   - "Optional: Adding option 049"
6. When all the configuration information is correct, press (CONTINUE).

Step 9. Verify the test equipment

Note

- The Test Executive Program will take a few moments to check the equipment for the tests that need to be performed.

```
EQUIPMENT USED (MODEL/ADDRESS):
     HP436A    713
     HP8481D
     HP8482A
     HP8161A   712
     HP83830A  716
     HP3335A   704
     HP5316A   720
                    CONTINUE
                    PRINT
```

1. Verify that the model numbers and addresses match the equipment available for testing.
2. If the displayed test equipment model numbers and addresses match your test equipment model numbers and addresses, select CONTINUE, and press ENTER. Go on to **"Step 11. Run the operation verification tests".**
3. If the displayed test equipment model numbers and addresses *do not* match your test equipment, you must change your test equipment and addresses, or you must edit the display to the alternate equipment you are using:
   - To change your test equipment and its addresses to match the displayed test equipment and addresses:
     - □ Make the equipment changes to match the displayed models.
     - □ Select CONTINUE on the display.
     - □ Press ENTER.
     - □ Go on to **"Step 11. Run the operation verification tests".**
   - To change the displayed list of test equipment and addresses to match your test equipment:
     - □ Refer to "Optional: Changing the default equipment" at the end of this chapter.

       Table 2-1 in that section lists default and alternate models of supported test equipment. Only listed alternate models of each instrument may substitute for the default model number.

Step 10. Confirm the list of accessories

The screen will display a list of accessories used with the EMI receiver system for the operation verification tests.

```
=============== ACCESSORIES USED ===============

Semirigid coax cable type N (m) to N (m) HP 85685-20005
122 cm flexible coax cable BNC (m) to BNC (m) HP 10503A (3 required)
Flexible coax calibration cable type N (m) to N (m) HP 8120-4781
Adapter type N (m) to BNC (f) HP 1250-1535
91 cm flexible coax cable type N (m) to N (m) HP 8120-5140

                                                CONTINUE
                                                 PRINT
```

Select PRINT if you want a copy of this accessory list. Select CONTINUE to go on to the next step of the setup procedure.

Step 11. Run the operation verification tests

```
============== TEST LIST ==============
Calibrator Amplitude Accuracy
Log Fidelity
Linear Fidelity
Reference Level Switching Uncertainty
Receiver Calibration Input 1
Amplitude Accy. Input 1 (10 dB AT)
Amplitude Accy. Input 1 (10 dB AT), 20 Hz-9 kHz
Amplitude Accy. Input 1 (0 dB AT)
Amplitude Accy. Input 1 (0 dB AT), 20 Hz-9 kHz
Disp. Average Noise Input 1, 10 Hz RBW
Sensitivity Input 1, 20 Hz to 9 kHz
Residual Responses Input 1
Bandwidth Accuracy
Calibration Input 2
Pulse Response
Amplitude Accy. Input 2 (10 dB AT)
Amplitude Accy. Input 2 (0 dB AT)
Disp. Average Noise Input 2
Residual Responses Input 2
Amplitude Accy. Input 3
Disp. Average Noise Input 3, 10 Hz RBW
Residual Responses Input 3
```

HP 8572A microwave EMI receiver tests

The display shows the operation verification tests. The screen may not show all the tests; use (⇑) and (⇓) to view the entire list. These operation verification tests are organized in a specific sequence, designed to minimize changes in equipment setups.

1. Use (⇓) and (⇑) to select the first test.
2. Press (ENTER) to begin running the test.
3. Follow the on-screen instructions to set up the test equipment. Chapter 3 has illustrations of test setups and individual test descriptions.
4. Repeat steps 1, 2, and 3 until all operation verification tests are completed.
5. When you have completed the tests, or when you want to exit the program, press (CONTINUE).

```
Quit the Test Executive Program?  YES
                                   NO
```

6. Use the arrow keys to select YES or NO.
7. Press ENTER.

Optional: Installing the software on an SRM or HFS hard disk

The operation verification software may be installed on a shared resource manager (SRM) or hierarchical file structure (HFS) hard disk system. For information about creating directories and copying files, refer to the appropriate SRM or HFS hard disk manual.

To install the test software:

1. Create a directory to contain the operation verification program and its associated files.
2. Copy all operation verification program files from the two 3.5 inch disks to this directory.

Optional: Assigning the address type

```
============  UUT: HP8572A  ============

 SERIAL NUMBER   0000A00000
ADDRESS TYPE    HP-IB
 ADDRESS         718
 CONTROLLER
 OPTIONS
 TEMPERATURE     23.0 DEG C
 HUMIDITY        50.0 %
 LINE FREQUENCY 60 Hz
```

1. Press (ENTER). The display will offer address type options. You can select HP-IB, NONE, or OTHER as the address type. HP-IB is the default.

```
============  UUT: HP8572A  ============

 SERIAL NUMBER   0000A00000
ADDRESS TYPE  HP-IB
   HP-IB
    NONE
    OTHER
 TEMPERATURE     23.0 DEG C
 HUMIDITY        50.0 %
 LINE FREQUENCY 60 Hz
```

2. Use (⇓) and (⇑) to select the address type.
3. Press (ENTER).
4. Verify that the EMI receiver system address is correct. If the address information needs to be updated, refer to the following section, **"Optional: Selecting the EMI receiver system address".**

   When ADDRESS TYPE is selected, the address selection is reset.
5. If the ADDRESS information is correct, continue to step 3 of **"Step 4. Enter the EMI receiver system test information".**

Optional: Selecting the EMI receiver system address

The EMI receiver system factory-preset address is 718. If your receiver is set to an address other than 718, you may change this software to operate using your EMI receiver system's current address.

```
============UUT: HP8572A============
SERIAL NUMBER  0000A00000
ADDRESS TYPE   HP-IB
ADDRESS         718
CONTROLLER
OPTIONS
TEMPERATURE     23.0 DEG C
HUMIDITY        50.0 %
LINE FREQUENCY 60 Hz
```

1. Select ADDRESS, then press ENTER. The default address for the EMI receiver system is 718.
2. Use the arrow keys to change the display to the correct address.
   - Use ⇐ and ⇒ to move the cursor to the appropriate address digit.
   - Use ⇓ and ⇑ to change the number to the correct digit.
3. Press ENTER.
4. Return to step 3 of **"Step 4. Enter the EMI receiver system test information"** to continue.

Optional: Adding option 049

If you have an Option 049 EMI receiver system, enter the option information to ensure that your EMI receiver system is tested completely.

```
============UUT: HP8572A============
SERIAL NUMBER  0000A00000
ADDRESS TYPE   HP-IB
ADDRESS        718
CONTROLLER
OPTIONS
TEMPERATURE     23.0 DEG C
HUMIDITY        50.0 %
LINE FREQUENCY 60 Hz
```

1. Select OPTIONS, then press ENTER. The screen will display the option selections.

```
============UUT: HP8572A============
SERIAL NUMBER  0000A00000
ADDRESS TYPE   HP-IB
ADDRESS        718
CONTROLLER
OPTIONS
 ==========UUT OPTIONS===========
049   NO  Deletes the HP 8449B in HP 8571A/HP 8572A systems

LINE FREQUENCY 60 Hz
```

2. Press ENTER to change NO to YES. (Pressing ENTER again toggles YES back to NO.

   The HP 8449B Opt H02 preselector is deleted from your EMI receiver system configuration.
3. Press CONTINUE.
4. Return to step 3 of **"Step 4. Enter the EMI receiver system test information"** to continue.

Optional: Modifying the temperature setting

You may enter the ambient room temperature in which the EMI receiver system is operating. This temperature becomes part of the test record.

```
============= UUT: HP8572A ============
SERIAL NUMBER  0000A00000
ADDRESS TYPE   HP-IB
ADDRESS        718
CONTROLLER
OPTIONS
TEMPERATURE     23.0 DEG C
HUMIDITY        50.0 %
LINE FREQUENCY 60 Hz
```

1. Press (ENTER). The default temperature is 23.0 degrees celsius. Enter temperatures in celsius only.
2. Use the arrow keys to change to the correct temperature.
   - □ Use (⇐) and (⇒) to move the cursor to the digit to be changed.
   - □ Use (⇓) and (⇑) to change to the correct temperature.
3. Press (ENTER).
4. Return to step 3 of **"Step 4. Enter the EMI receiver system test information"** to continue.

Optional: Modifying the humidity setting

You may record the humidity of the area where the EMI receiver system is operating. This humidity setting becomes part of the test record.

```
============ UUT: HP8572A ============
SERIAL NUMBER  0000A00000
ADDRESS TYPE   HP-IB
ADDRESS        718
CONTROLLER
OPTIONS
TEMPERATURE     23.0 DEG C
HUMIDITY         50.0 %
LINE FREQUENCY 60 Hz
```

1. Select HUMIDITY, then press ENTER. The default humidity is 50 percent.
2. Use the arrow keys to change to the correct humidity.

   Use ⇐ and ⇒ to move the cursor to the column to be changed.

   Use ⇓ and ⇑ to change the digit to the correct number.
3. Press ENTER.
4. Return to step 3 of **"Step 4. Enter the EMI receiver system test information"** to continue.

Optional: Selecting the line frequency

You may record the line frequency the EMI receiver system is using to operate. This line frequency setting becomes part of the test record.

```
============ UUT: HP8572A ============
SERIAL NUMBER  0000A00000
ADDRESS TYPE   HP-IB
ADDRESS        718
CONTROLLER
OPTIONS
TEMPERATURE     23.0 DEG C
HUMIDITY        50.0 %
LINE FREQUENCY 60 Hz
```

1. Select LINE FREQUENCY, then press ENTER.

```
============ UUT: HP8572A ============
SERIAL NUMBER  0000A00000
ADDRESS TYPE   HP-IB
ADDRESS        718
CONTROLLER
OPTIONS
TEMPERATURE     23.0 DEG C
HUMIDITY        50.0 %
LINE FREQUENCY 60 Hz
   60 Hz
   50 Hz
  400 Hz
```

2. Use the arrow keys to select the line frequency that the EMI receiver system is using. The default line frequency is 60 Hertz.
3. Press ENTER.
4. Return to step 3 of **"Step 4. Enter the EMI receiver system test information"** to continue.

Optional: Changing the default equipment

If your test equipment model numbers and addresses are different from the default test equipment (displayed when you verified the test equipment), you must change the settings. Refer to **"Step 9. Verify the test equipment"**. This operation verification software supports only the equipment listed in Table 2-1. You must have BASIC 5.13 or later, with the appropriate binaries (BIN files) installed, to change these default settings.

The TSCRIPT file contains the default test equipment model numbers and addresses. In this procedure, you will edit, save, and run the TSCRIPT file.

Print the default equipment list

If you have a printer connected to your computer, you can print the default test equipment list. To print the list:

1. Use (⇓) and (⇑) to select `PRINT` on the display.
2. Press (ENTER).

Exit the operation verification software

3. Use (⇓) and (⇑) to select `CONTINUE` on the display.
4. Press (ENTER) to display the operation verification test menu.
5. Press (CONTINUE). You will be asked if you want to quit the Test Executive Program.
6. The default selection is `YES`. Press (ENTER) to exit the operation verification test software.

Load the default test equipment (TSCRIPT) file

7. Insert operation verification disk 1 in the default disk drive.
8. Type `GET "TSCRIPT"` and press (RETURN) (or the equivalent key). Wait for the asterisk in the lower right portion of the computer display to disappear.
9. Type `EDIT` and press (RETURN). Wait for the TSCRIPT file to appear on the computer display.

Edit the default test equipment list

10. Scroll to `CALIBRATION_STANDARDS(`. This section of the TSCRIPT file shows the default list of test equipment. The variable names with corresponding descriptions are shown in Table 2-2.

    Table 2-1 lists the supported test equipment you need to perform all the operation verification tests on the HP 8572A microwave EMI receiver. The equipment is grouped according to function; each group of equipment is separated by a horizontal line. At least one piece of test equipment must be selected from each group.

Table 2-1. Test Equipment

Default	Test Equipment	Model Number	Default Address
*	Power meter	HP 436A power meter	713
	Power meter	HP 437B power meter	713
	Power meter	HP 438A dual-channel power meter	713
*	Power sensor	HP 8481D N(m) power sensor	None
*	Power sensor	HP 8482A N(m) power sensor	None
*	Power sensor	HP 8484A N(m) power sensor	None
	Power sensor	HP 8485D APC-3.5 mm(m) power sensor	None
	Pulse generator	HP 8160A programmable pulse generator	712
*	Pulse generator	HP 8161A programmable pulse generator	712
	Pulse/Function generator	HP 8116A pulse/function generator	712
*	Synthesized sweeper	HP 83630A synthesized sweeper[1]	716
	Synthesized sweeper	HP 83640A synthesized sweeper[1]	716
	Synthesized sweeper	HP 83650A synthesized sweeper[1]	716
	Synthesized sweeper	HP 8340A synthesized sweeper	716
	Synthesized sweeper	HP 8340B synthesized sweeper	716
*	Synthesizer/Level generator	HP 3335A synthesizer/level generator	704
*	Universal counter	HP 5316A universal counter[2]	720
	Universal counter	HP 5316B universal counter[2]	720
* This is the factory-set default test instrument that the operation verification software identifies. This default instrument may be changed to any supported equipment shown in this table.			

1 When using an HP 8360 Series synthesized sweeper, you must select `Analyzr` under `Adrs Menu Programming Language`, for the operation verification software to communicate over the HP-IB.

2 You need this instrument only if you are using an HP 8116A pulse/function generator.

Table 2-2. Test Equipment Variable Names

Variable Name	Description
PM1	power meter 1
FC1	frequency counter 1
RFPS	RF power sensor
LRFPS	low RF power sensor
LG1	level generator
SYN1	synthesized source
FG1	function generator 1

11. Edit the default list of test equipment as needed. Table 2-2 gives the variable names for test instruments. Use this to identify the equipment defaults you want to change.

    For example, to substitute the HP 436A power meter for the HP 438A dual-channel power meter:

    - □ Scroll to the `PM1(HP436A)` line.
    - □ Position the cursor under the `6` and type `8`. The result should be `PM1(HP438A)`. Notice there is no space between `HP` and `438A`.

Note

- To substitute a HP 8116A pulse/function generator for an HP 8161A programmable pulse generator, scroll to the `FG1(HP8161A)` line and type `8116A` over `8161A`. The result should be `FG1(HP8116A)`.

  Then scroll to the `S_PULSE1("Power Meter"(PM1)` line. Under this line, find `"Universal Counter"(FC1)` and note the asterisk (comment character). Delete the asterisk in the `"Universal Counter"(FC1)` line.

---

12. Scroll to the `DEFAULT_ADDRESSES(` section of the file and edit the equipment addresses as you did in step 2 of this procedure.

    Valid addresses are 00 to 30. Valid select codes are 0 through 5, and 7 through 9. The default select code is 7. Do not set the equipment addresses to any addresses used by the unit under test (UUT).

Save the test equipment list edits and restart the operation& verification software

13. Press (Stop) (or the equivalent key), type `RE-SAVE "TSCRIPT"` , and press (Return) (or the equivalent key) to save the edited TSCRIPT file. Wait for the asterisk in the lower right portion of the computer screen to disappear.
14. Type `LOAD "C_TSCRIPT"` and press (Return). Wait for the asterisk in the lower right portion of the computer screen to disappear.

15. Type `RUN` and press (Return). When the message `TEST SCRIPT CONVERSION COMPLETED` appears on the computer screen, the operation verification software is ready to load and run.

16. Continue at the beginning of the operation verification software. Refer to **"Step 3. Select the EMI receiver system model".**

Optional: Entering power sensor calibration factors

The operation verification test program requires calibration factors for the power sensor. If the file containing calibration factors is in the default drive, the program will retrieve these factors automatically. If this program is not able to find calibration factors for the power sensor being used, a prompt appears on the computer display:

```
CAL FACTOR file for HP8485D (XXXX) was not found CREATE FILE
                                                 CHANGE DISK
                                                 ABORT
```

If there is a calibration factor file for your power sensor, select CHANGE DISK. The program will prompt you to insert the disk containing calibration factors into the default drive.

If you have not created a calibration factor file for your power sensor:

1. Align the selection window over CREATE FILE and press (Select) (or the equivalent key).

```
HP8485D (ID=XXXX) CAL FACTOR
------------------------------------------------------------
                            EDIT REFERENCE CAL FACTOR 100.00%
                            EDIT CAL FACTORS
                            EDIT FREQUENCY LIST
```

2. Highlight EDIT REFERENCE CAL FACTOR 100.00% and press (Select) (or the equivalent key).
3. Enter the REF CAL FACTOR printed on your power sensor. Use (⇐) and (⇒) to position the cursor under the appropriate field. Then, use (⇑) and (⇓) to change the value.
4. Press (Return) (or the equivalent key) to enter the reference calibration factor.
5. Highlight EDIT CAL FACTORS and press (Select). The list of frequencies with corresponding calibration factors appear on the computer screen.
6. Align the window over the frequency with the calibration factor that needs editing, then press (Select).
7. Use (⇐) and (⇒) to position the cursor under the appropriate field. Then, use (⇑) and (⇓) to change the value.

8. Press (Return) (or equivalent key) to enter the calibration factor.
9. Repeat steps 6 through 8 until all calibration factors are entered.
10. Press (Home) (or the equivalent key) to exit the CAL FACTOR display.
11. Highlight EDIT FREQUENCY LIST. The list of frequencies appears on the computer screen.
12. Place the selection bar where you want to add, insert, delete, or edit a frequency, then press (Select).
13. Highlight ADD, INSERT, DELETE, or EDIT, then press (Select).
14. Use the (⇐) and (⇒) to position the cursor under the appropriate field. Then use (⇑) and (⇓) to change the frequency.
15. Press (Home) to exit the FREQUENCY LIST display.

Note

- Frequencies are sorted in ascending order when you exit the FREQUENCY LIST display.

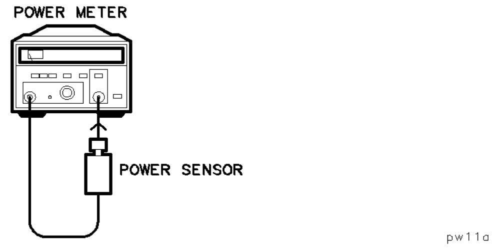
- Choose YES if you want to edit the calibration factors. If you want to store the modified calibration factor file, insert the disk to be used to store calibration data in the default drive.
- Choose NO to quit editing, and to go on to the next step.
- Press (CONTINUE) to exit the program.

3

Test Descriptions

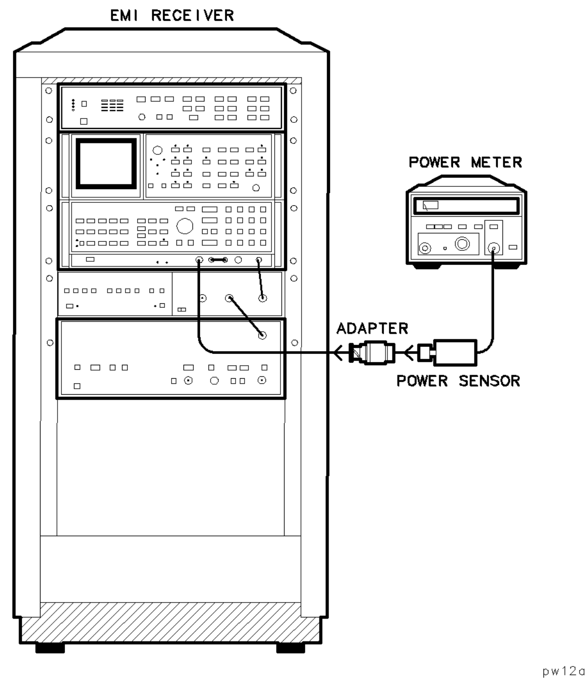
In this chapter, you'll find equipment setup diagrams, parts lists, and test descriptions for each operation verification test available for an HP 8572A microwave EMI receiver.

Calibrator Amplitude Accuracy



Recommended Equipment

power meter .... HP 436A power meter
power sensor .... HP 8482A N(m) power sensor



Recommended Equipment

power meter .... HP 436A power meter
power sensor .... HP 8482A N(m) power sensor
adapter .... HP 1250-0077 N(f) to BNC(m)

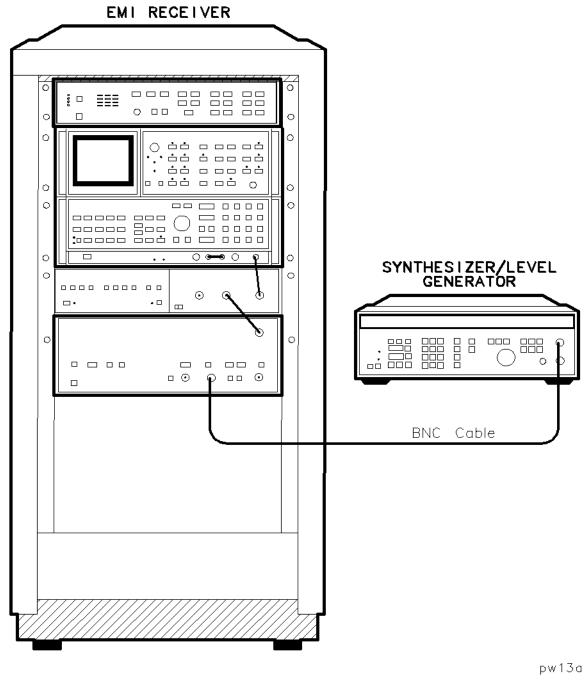
Purpose This test measures the 100 MHz calibrator of the EMI receiver system for amplitude accuracy.

Description "Calibrator Amplitude Accuracy" relies on the accuracy of the power meter and power sensor. First, the power meter is calibrated. Then the power sensor is connected to the 100 MHz calibrator output. The calibrator amplitude is measured and corrected using the calibration factor of the power sensor.

Note

- "Optional: Entering power sensor calibration factors," in chapter 2, discusses requirements for entering calibration factors for the power sensor being used.

Log Fidelity



Recommended Equipment

synthesizer/level generator . . HP 3335A synthesizer/level generator
cable . . . HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)

Purpose This test measures the relative on-screen log scale fidelity. Log scale fidelity is measured in the display CRT's upper nine divisions.

Note

- You must complete this test before you perform any amplitude accuracy test.

Description "Log Fidelity" relies on the attenuator accuracy of the HP 3335A synthesizer/level generator. Although log fidelity is not directly specified for the HP 8572A microwave EMI receiver, it is one of the contributors to absolute amplitude accuracy in log scale mode.

The unit under test is set for a reference level of +13 dBm and the resolution bandwidth or QPA (CISPR) bandwidth to be tested. The level-generator amplitude is adjusted to set the signal at the reference level.The difference between the level generator and marker amplitudes establishes a reference error at this point.

The level generator is stepped down in 2 dB increments until the signal is 70 dB below top screen or 10 dB above the displayed average noise, whichever is higher. The amplitude difference between the level generator and the displayed trace average is measured at each level generator step. The difference between the amplitude error at each level generator step and the reference error is the log fidelity of the EMI receiver system.

Test Settings

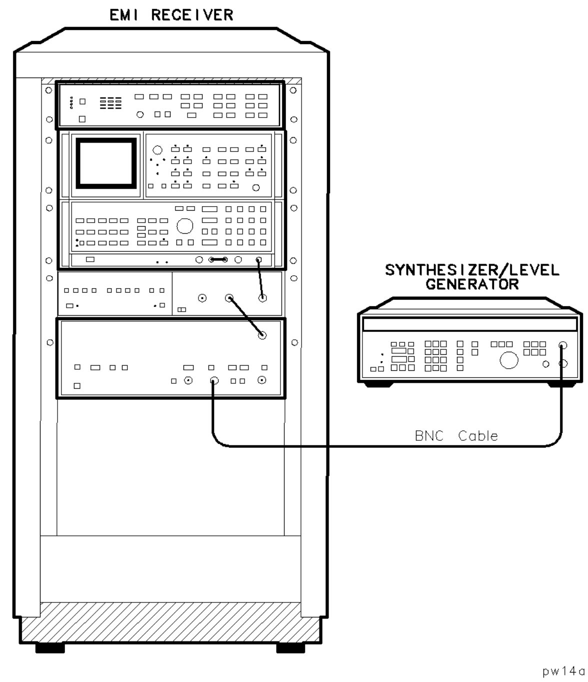
Function	Settings
RF FREQ	30 MHz
RFPS (atten)	43 dB
EMI receiver system (input)	receiver INPUT 1
SA (atten)	10 dB
QPA filter	200 Hz, 9 kHz, 120 kHz
RES BW	3 kHz, 10 kHz, 100 kHz, 1 MHz
Scale	Log 10 dB
REF LEVEL	13 dBm

Log fidelity for the EMI receiver system is tested to the following limits:

Log Fidelity Test Limits

Signal Level (dB below top screen)	Log Fidelity (dB)
0 dB	Reference
> 0 dB to ≤ 70 dB	± 0.60 dB

Linear Fidelity



Recommended Equipment

synthesizer/level generator .. HP 3335A synthesizer/level generator
cable ... HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)

Purpose This test measures the relative on-screen linear scale fidelity.

Note

- You must complete this test before you perform any amplitude accuracy test.

Description "Linear Fidelity" relies on the attenuator accuracy of the HP 3335A synthesizer/level generator and is measured in the display CRT's upper nine divisions. Although linear fidelity is not directly specified for the HP 8572A microwave EMI receiver, it is one of the contributors to absolute amplitude accuracy in linear scale mode.

The unit under test is set for a reference level of +13 dBm, and the resolution bandwidth or QPA (CISPR) bandwidth to be tested. The level generator amplitude is adjusted to set the signal at the reference level. The difference between the level generator and marker amplitudes establishes a reference error at this point.

The level generator is stepped down in 10% of full scale increments until the signal is nine divisions below the top of the screen. The amplitude difference between the level generator and the displayed trace average is measured at each level generator step. The difference between the amplitude error at each level generator step and the reference error is the linear fidelity of the EMI receiver system.

Test Settings

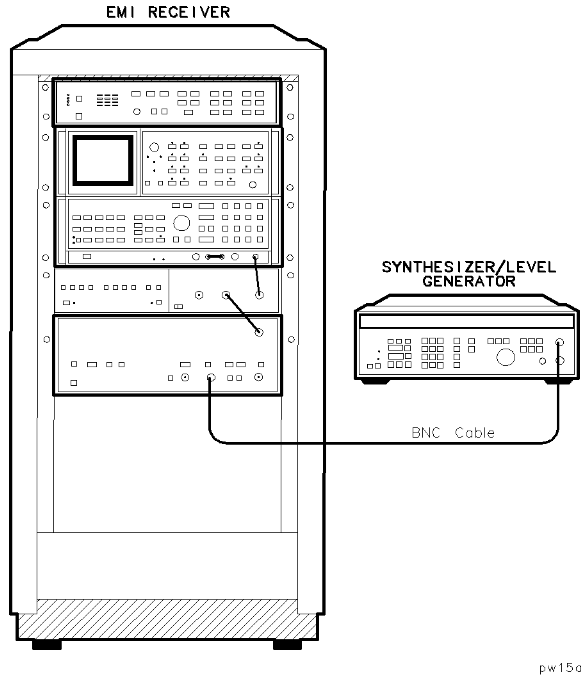
Function	Settings
RF FREQ	30 MHz
RFPS (atten)	43 dB
EMI receiver system (input)	receiver INPUT 1
SA (atten)	10 dB
QPA filter	200 Hz 9 kHz, 120 kHz
RES BW	10 Hz to 3 MHz (1, 3, 10 sequence)
Scale	Linear
REF LEVEL	120 dBμV

Linear fidelity for the EMI receiver system is tested to the following limits:

Linear Fidelity Test Limits

Signal Level (% of full scale)	Linear Fidelity (dB)
100 %	Reference
$\geq$10 % to <100 %	±3.0 %

Reference Level Switching Uncertainty



Recommended Equipment

synthesizer/level generator . . HP 3335A synthesizer/level generator
cable . . . HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)

Purpose This test measures reference level switching uncertainty.

Note

- You must complete this test before you perform any amplitude accuracy test.

Description "Reference Level Switching Uncertainty" relies on the attenuator accuracy of the HP 3335A synthesizer/level generator. Although Reference Level Switching Uncertainty is not directly specified for the HP 8572A microwave EMI receiver, it is one of the contributors to absolute amplitude accuracy.

The unit under test is set for a reference level of +13 dBm, and a resolution bandwidth or QPA (CISPR) bandwidth to be tested. The level-generator amplitude is adjusted to set the signal 2 dB below reference level. The difference between the level generator and marker amplitudes establishes a reference error at this point.

The level generator and EMI receiver system reference level are stepped down in 4 dB increments until the signal is −57 dBm or 10 dB above the displayed average noise, which ever is higher. The amplitude difference between the level generator and the displayed trace average is measured at each level generator step. The difference between the amplitude error at each level generator step and the reference error is the level switching uncertainty of the EMI receiver system.

Test Settings

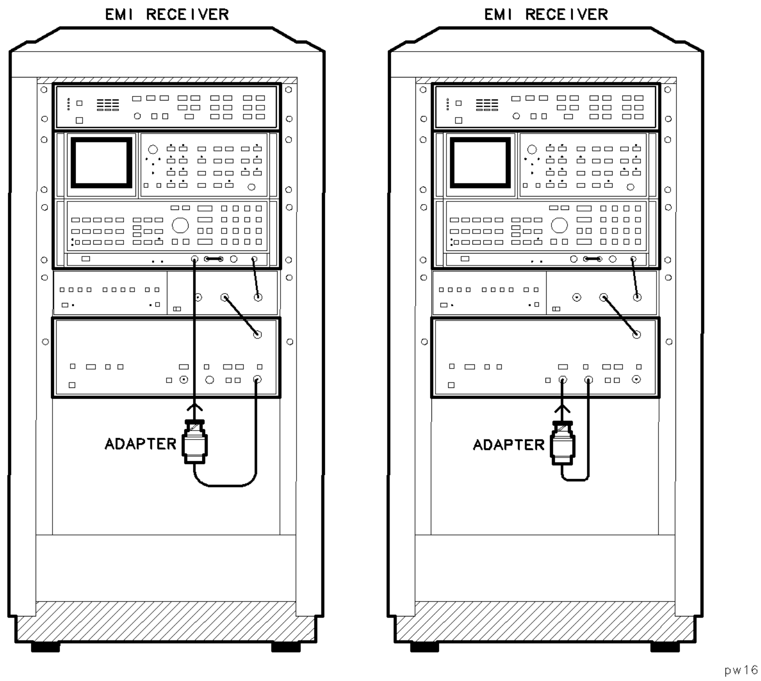
Function	Settings
RF FREQ	30 MHz
RFPS (atten)	43 dB
EMI receiver system (input)	receiver INPUT 1
SA (atten)	10 dB
QPA filter	200 Hz, 9 kHz, 120 kHz
RES BW	3 kHz, 10 kHz, 100 kHz, 1 MHz
Scale	Log 1 dB

Reference Level Switching Uncertainty for the EMI receiver system is tested to the following limits:

Reference Level Switching Uncertainty Test Limits

EMI receiver system Reference Level (dBm)	Reference Level Switching Uncertainty (dB)
+13 dBm	Reference
≥ -43 dBm to $< +13$ dBm	±0.50 dB
≥ -55 dBm to < -43 dBm	±0.80 dB

Receiver Calibration INPUT 1



Recommended Equipment

cable .... HP 8120-4781 61 cm (24 in) 50Ω coax N(m) to N(m)
adapter .... HP 1250-0077 N(f) to BNC(m)

Purpose This test calibrates receiver INPUT 1 of the EMI receiver system.

Description Two calibration routines are performed during "Receiver Calibration INPUT 1". The settings used during each of these two calibration routines are shown in the tables on the following pages.

Receiver Calibration INPUT 1 consists of two setups. The first setup calibrates the spectrum analyzer with the RF preselector in bypass mode. Recall-9 calibrates the spectrum analyzer's center frequency for narrow resolution bandwidths of 10 Hz through 1 kHz.

In the second setup, receiver INPUT 1 is calibrated at predetermined points for amplitude accuracy using the comb generator output. These points are chosen by the internal calibration sequence (CAL SEQ) in the RF preselector. receiver INPUT 1 is calibrated between 9 kHz and 50 MHz.

To make calibrated measurements with the EMI receiver system, CAL SEQ must be run for each set of EMI receiver system settings. This test runs CAL SEQ at the settings that will be used in subsequent tests. The resulting calibration factors are stored in the controller memory and loaded into the RF preselector when they are needed.

Test Settings

Settings for Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT), 20 Hz-9 kHz

Function	Settings (Manual)
RF FREQ	20 Hz to 9 kHz
RES BW	10 Hz
RFPS (atten)	0 dB
SA (atten)	10 dB or 0 dB
Scale	Log 2 dB

Settings for Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT)

Function	Band A (Manual)	Band B (Auto)	Band C (Auto)
RF FREQ	9 kHz to 150 kHz	200 kHz to 30 MHz	30 MHz to 50 MHz
QPA Filter	200 Hz	9 kHz	120 kHz
RES BW	3 kHz	100 kHz	1 MHz
RFPS (atten)	0 dB	0 dB	0 dB
SA (atten)	10 dB or 0 dB	10 dB or 0 dB	10 dB or 0 dB
Scale	Linear	Linear	Linear

Settings for Disp. Average Noise INPUT 1

Function	Band A (Manual)	Band B (Auto)	Band C (Auto)
RF FREQ	9 kHz to 150 kHz	200 kHz to 30 MHz	30 MHz to 50 MHz
QPA Filter	200 Hz	9 kHz	120 kHz
RES BW	3 kHz	100 kHz	1 MHz
RFPS (atten)	0 dB	0 dB	0 dB
SA (atten)	0 dB	0 dB	0 dB
Scale	Log 10 dB	Log 10 dB	Log 10 dB

Settings for Disp. Average Noise INPUT 1

Function	Settings (Manual)	Settings (Auto)
RF FREQ	9 kHz to 150 kHz	200 kHz to 50 MHz
QPA Filter	BYPASS	BYPASS
RES BW	10 kHz	10 kHz
RFPS (atten)	0 dB	0 dB
SA (atten)	0 dB	0 dB
Scale	Log 10 dB	Log 10 dB

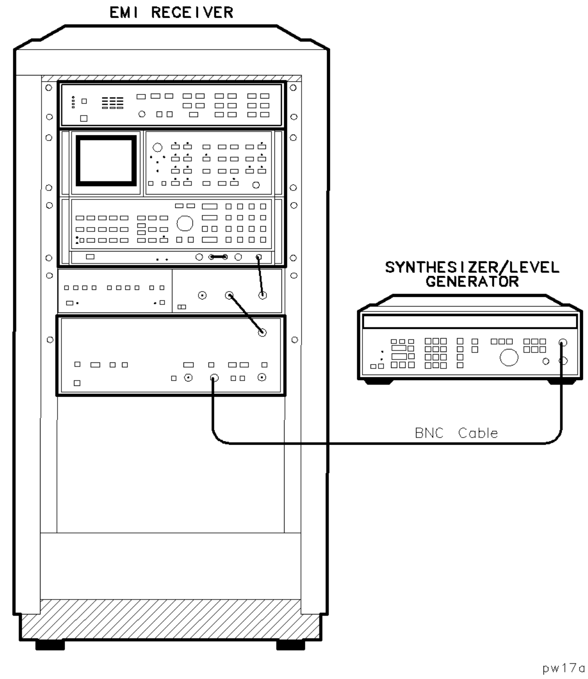
Settings for Sensitivity INPUT 1, 20 Hz to 9 kHz

Function	Settings (Manual)
RF FREQ	20 Hz to 9 kHz
QPA Filter	BYPASS
RES BW	10 kHz
RFPS (atten)	0 dB
SA (atten)	0 dB
Scale	Log 10 dB

Settings for Residual Responses INPUT 1

Function	Settings (Manual)	Settings (Auto)
RF FREQ	9 kHz to 150 kHz	200 kHz to 50 MHz
QPA Filter	BYPASS	BYPASS
RES BW	10 kHz	10 kHz
RFPS (atten)	0 dB	0 dB
SA (atten)	0 dB	0 dB
Scale	Log 10 dB	Log 10 dB

Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT), 20 Hz-9 kHz



Recommended Equipment

synthesizer/level generator . . HP 3335A synthesizer/level generator
cable . . . HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)

Purpose This test measures absolute amplitude accuracy through receiver INPUT 1.

Note

- Depending on the order in which you perform the operation verification tests, the software may invoke a calibration adjustment automatically, before running this test. Refer to "Receiver Calibration INPUT 1".
- To assure test accuracy, you must complete "Receiver Calibration INPUT 1", "Log Fidelity", "Linear Fidelity", and "Reference Level Switching Uncertainty" (20 Hz to 9 kHz) before you perform this test.

Description

"Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT), 20 Hz-9 kHz" relies on the amplitude accuracy of the HP 3335A synthesizer/level generator and is measured by injecting a reference power from the HP 3335A synthesizer/level generator directly into the system. Differences in the amplitude measured by the EMI receiver system are compared to the amplitude setting of the HP 3335A synthesizer/level generator. The amplitude accuracy of the EMI receiver system is the difference between the amplitude setting of the HP 3335A synthesizer/level generator and the EMI receiver system's measurement.

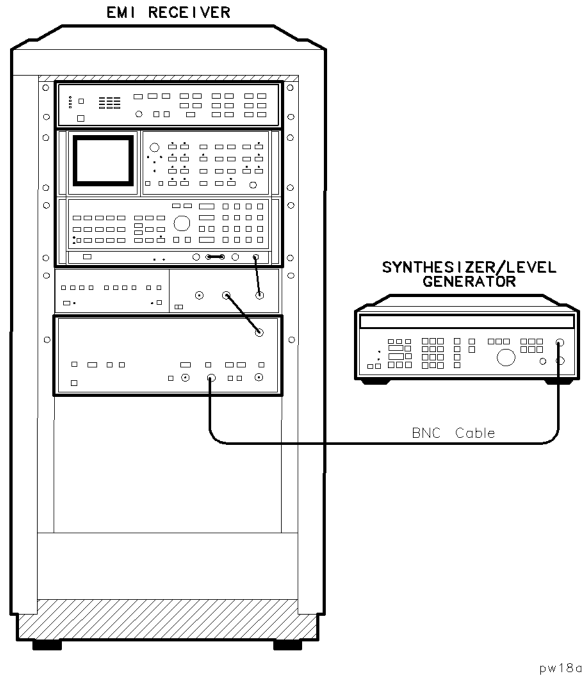
"Log Fidelity", "Linear Fidelity", "Reference Level Switching Uncertainty", and the accuracy of the EMI receiver system's internal calibration sequence contribute to the amplitude accuracy of the EMI receiver system in any valid setting. These error contributors are measured in separate tests.

Test Settings

Amplitude accuracy is tested at both 10 dB and 0 dB spectrum analyzer input attenuation. The settings used during this test are:

Function	Settings
RF FREQ	20 Hz to 9 kHz
RES BW	10 Hz
QPA filter	BYPASS
RFPS (atten)	0 dB
SA (atten)	10 dB or 0 dB
Scale	Log 1 dB

Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT)



Recommended Equipment

synthesizer/level generator . . HP 3335A synthesizer/level generator
cable . . . HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)

Purpose This test measures absolute amplitude accuracy through receiver INPUT 1.

Note

- Depending on the order in which you perform the operation verification tests, the software may invoke a calibration adjustment automatically, before running this test. Refer to "Receiver Calibration INPUT 1".
- To assure test accuracy, you must complete "Receiver Calibration INPUT 1", "Log Fidelity", "Linear Fidelity", and "Reference Level Switching Uncertainty" before you perform this test.

Description "Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT)" relies on the amplitude accuracy of the HP 3335A synthesizer/level generator and is measured by injecting a reference power from the HP 3335A synthesizer/level generator directly into the system. Differences in the amplitude measured by the EMI receiver system are compared to the amplitude setting of the HP 3335A synthesizer/level generator. The amplitude accuracy of the EMI receiver system is the difference between the amplitude setting of the HP 3335A synthesizer/level generator and the EMI receiver system's measurement.

"Log Fidelity", "Linear Fidelity", "Reference Level Switching Uncertainty", and the accuracy of the EMI receiver system's internal calibration sequence contribute to the amplitude accuracy of the EMI receiver system in any valid setting. These error contributors are measured in separate tests.

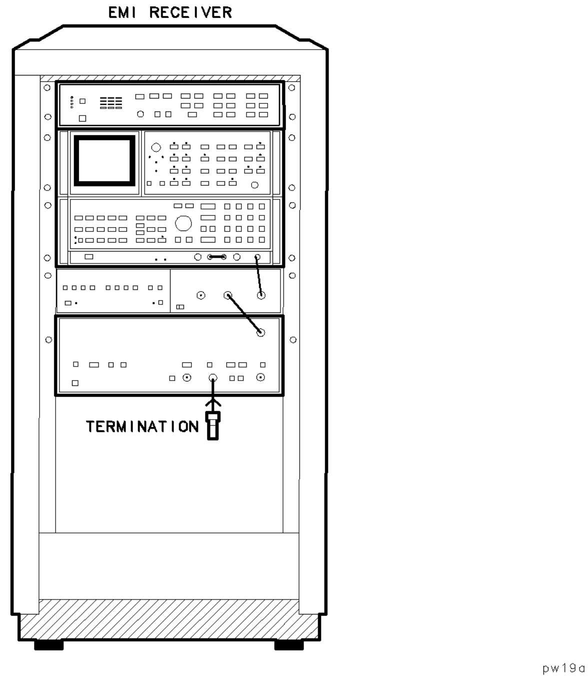
Test Settings

Amplitude accuracy is tested at both 10 dB and 0 dB spectrum analyzer input attenuation. The settings used during this test are:

Settings for Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT)

Function	Band A	Band B	Band C
RF FREQ	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 50 MHz
QPA filter	200 Hz	9 kHz	120 kHz
RES BW	3 kHz	100 kHz	1 MHz
RFPS (atten)	0 dB	0 dB	0 dB
SA (atten)	10 dB or 0 dB	10 dB or 0 dB	10 dB or 0 dB
Scale	Linear	Linear	Linear

Disp. Average Noise INPUT 1



Recommended Equipment

50Ω load .... HP 11593A 50Ω BNC(m) termination

Purpose This test measures the displayed average noise level through receiver INPUT 1.

Note

- Depending on the order in which you perform the operation verification tests, the software may invoke a calibration adjustment automatically, before running this test. Refer to "Receiver Calibration INPUT 1".
- To assure test accuracy, you must complete "Receiver Calibration INPUT 1" and "Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT)" before you perform this test.

Description "Disp. Average Noise INPUT 1" is measures the displayed average noise level of the EMI receiver system at selected frequency intervals between 9 kHz and 50 MHz through each RF preselector filter path. Measurements are made in linear mode through the QPA (CISPR) bandwidths, and in log mode in a 10 Hz spectrum analyzer resolution bandwidth. During these measurements, receiver INPUT 1 is terminated with a 50Ω load.

Test Settings

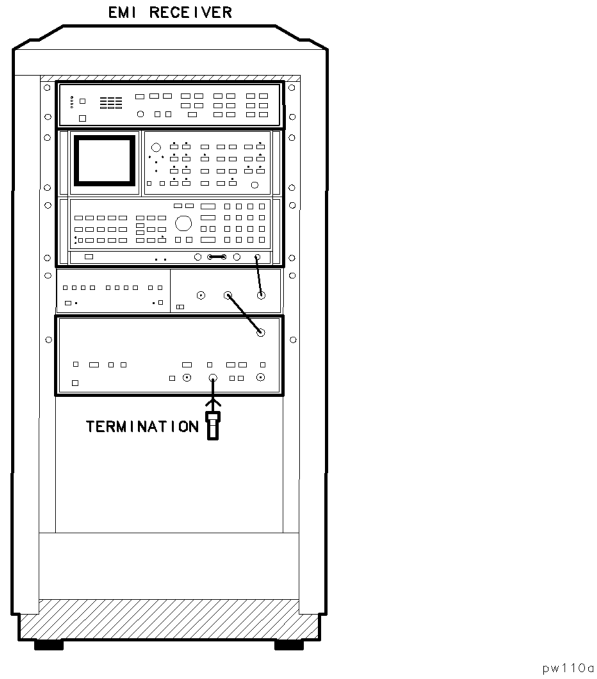
Settings for Disp. Average Noise INPUT 1, QPA Bandwidths

Function	Band A	Band B	Band C
RF FREQ	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 50 MHz
QPA Filter	200 Hz	9 kHz	120 kHz
RES BW	3 kHz	100 kHz	1 MHz
VID BW	3 kHz	100 kHz	1 MHz
RFPS (atten)	0 dB	0 dB	0 dB
SA (atten)	0 dB	0 dB	0 dB
Scale	Linear	Linear	Linear

Settings for Disp. Average Noise Input 1, 10 Hz RBW

Function	Settings
RF FREQ	9 kHz to 50 MHz
QPA Filter	BYPASS
RES BW	10 Hz
VID BW	1 Hz
RFPS (atten)	0 dB
SA (atten)	0 dB
Scale	Log 10 dB

Sensitivity INPUT 1, 20 Hz to 9 kHz



Recommended Equipment

50Ω load .... HP 11593A 50Ω BNC(m) termination

Purpose This test measures the sensitivity of receiver INPUT 1 from 20 Hz–9 kHz.

Note

- Depending on the order in which you perform the operation verification tests, the software may invoke a calibration adjustment automatically, before running this test. Refer to "Receiver Calibration INPUT 1".
- To assure test accuracy, you must complete "Receiver Calibration INPUT 1" and "Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT)" before you perform this test.

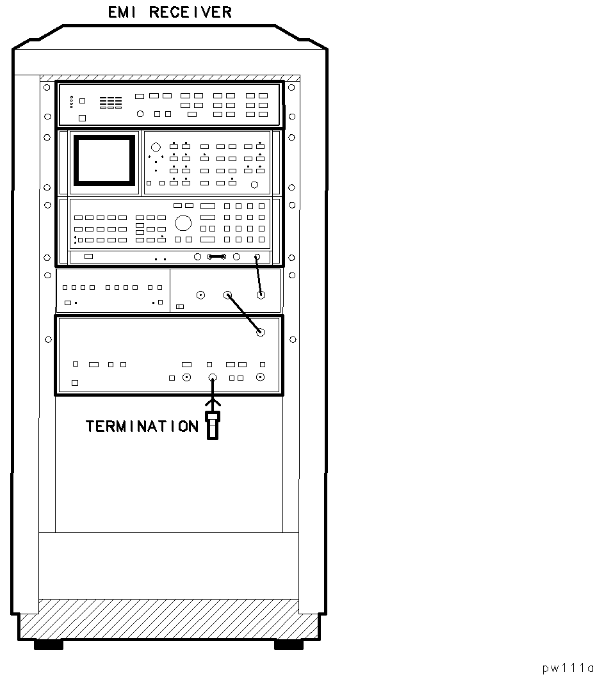
Description "Sensitivity INPUT 1, 20 Hz to 9 kHz" measures the sensitivity of the EMI receiver system at selected frequency intervals between 20 Hz and 9 kHz. Measurements are made in log mode with a 10 Hz resolution bandwidth. During these measurements, receiver INPUT 1 is terminated with a 50Ω load.

Test Settings

Settings for Sensitivity INPUT 1, 20 Hz to 9 kHz

Function	Settings
RF FREQ	20 Hz to 9 kHz
QPA filter	BYPASS
RES BW	10 Hz
VID BW	1 Hz
RFPS (atten)	0 dB
SA (atten)	0 dB
Scale	Log 10 dB

Residual Responses INPUT 1



Recommended Equipment

50Ω load .... HP 11593A 50Ω BNC(m) termination

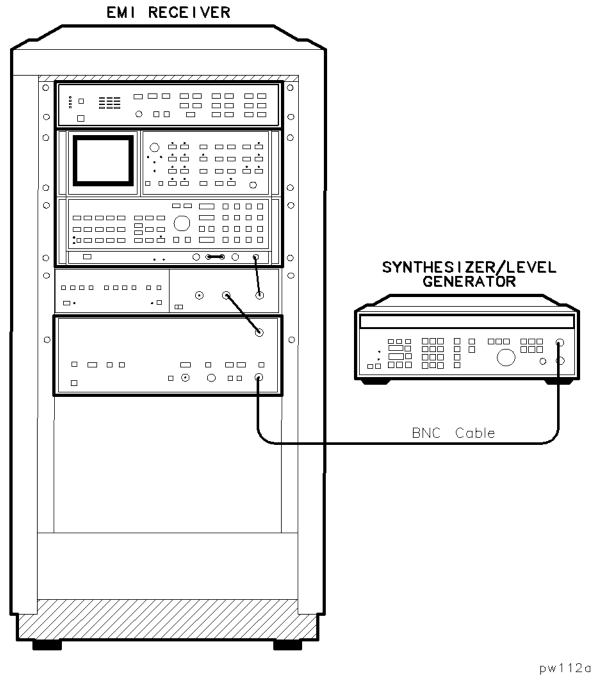
Purpose This test measures residual responses through receiver INPUT 1.

Note

- Depending on the order in which you perform the operation verification tests, the software may invoke a calibration adjustment automatically, before running this test. Refer to "Receiver Calibration INPUT 1".
- To assure test accuracy, you must complete "Receiver Calibration INPUT 1" and "Amplitude Accy. INPUT 1 (10 dB AT and 0 dB AT)" before you perform this test.

Description "Residual Responses INPUT 1" measures the EMI receiver system for residual responses between 9 kHz and 50 MHz. The measurements are made with both the RF preselector and spectrum analyzer in 0 dB input attenuation, receiver INPUT 1 terminated with a 50Ω load, and the quasi-peak adapter in bypass mode.

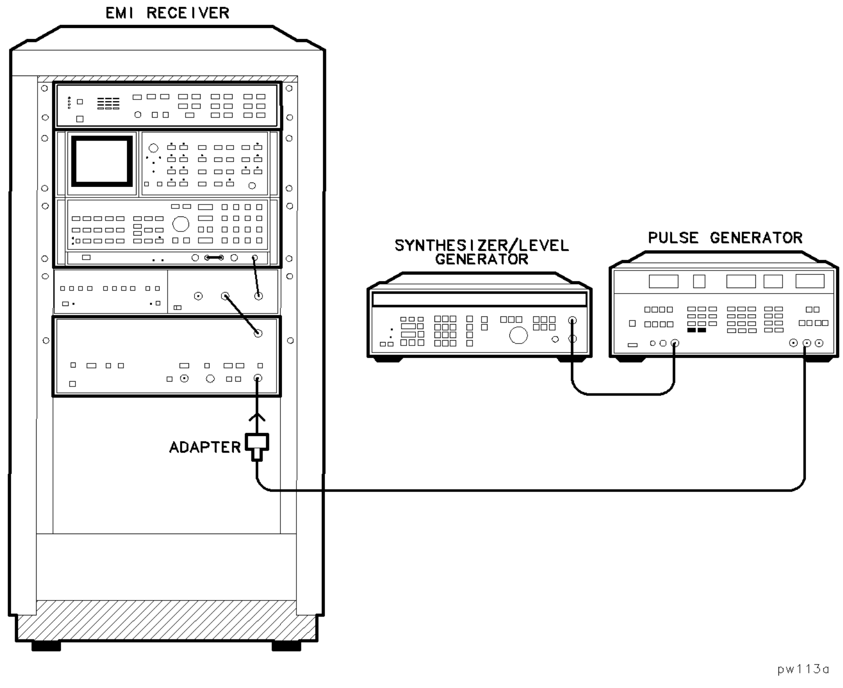
Bandwidth Accuracy



Bandwidth Accuracy, Setup 1

Recommended Equipment

synthesizer/level generator . . HP 3335A synthesizer/level generator
cable . . . HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)



Bandwidth Accuracy, Setup 2

Recommended Equipment

synthesizer/level generator .. HP 3335A synthesizer/level generator
pulse generator .... HP 8161A programmable pulse generator
cable ... HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
adapter .... HP 1250-0780 N(m) to BNC(f)

Purpose This test measures the bandwidth accuracy of the EMI receiver system.

Description Bandwidth Accuracy measures the 6 dB bandwidth and 60 dB bandwidth of the 10 Hz to 3 MHz resolution bandwidths in the receivers. The 6 dB bandwidth accuracy is specified only for the 10 Hz to 300 Hz resolution bandwidths. The impulse bandwidth is specified for the wider resolution bandwidths. However, the selectivity is specified for all bandwidths, so the 6 dB bandwidth is measured for all bandwidths.

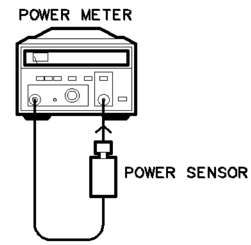
Resolution bandwidth settings of 10 Hz, 30 Hz, 100 Hz, and 300 Hz are specified as 6 dB bandwidths and are tested separately.

In the first setup, the 1 kHz to 3 MHz impulse bandwidths are measured in the EMI receiver system. The receiver's amplitude response to the same pulsed-RF signal is measured both in pulse mode and in line mode. Amplitude difference and pulse repetition frequency are measured by a frequency counter. A synthesizer is used to correct IF gain, log fidelity, and bandwidth switching errors in the amplitude response.

Then, the pulse generator output is connected directly to the receiver's input. The RF preselector must be put in bypass mode when testing impulse bandwidths of 300 kHz to 3 MHz. If this is not done, the bandwidth of the RF preselector will predominate, resulting in a narrower measured impulse bandwidth. These wider bandwidths are not used under 30 MHz, where the bandwidth of the RF preselector is wide enough not to affect the measurement.

The amplitude response corrections are then made. The synthesizer frequency is set to the original test frequency. The EMI receiver system is set as it was for the line-mode measurement and the synthesizer amplitude is adjusted to match the amplitude measured previously. The EMI receiver system is then set as it was for the pulse-mode measurement and the synthesizer amplitude is adjusted to match the amplitude measured previously. These two synthesizer amplitude settings are recorded and used in the calculation of the impulse bandwidth.

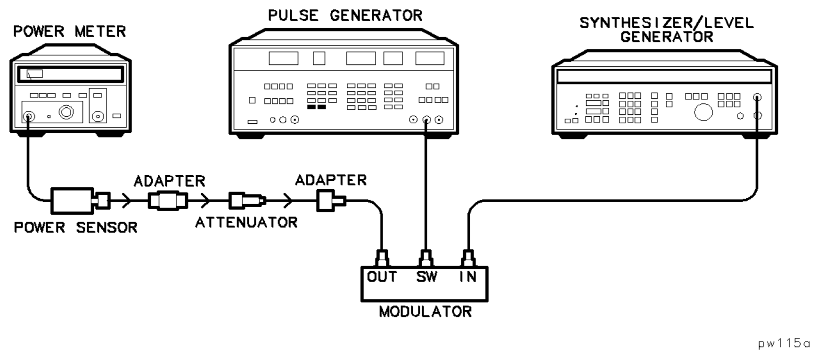
Pulse Response



Power Meter Calibration

Recommended Equipment

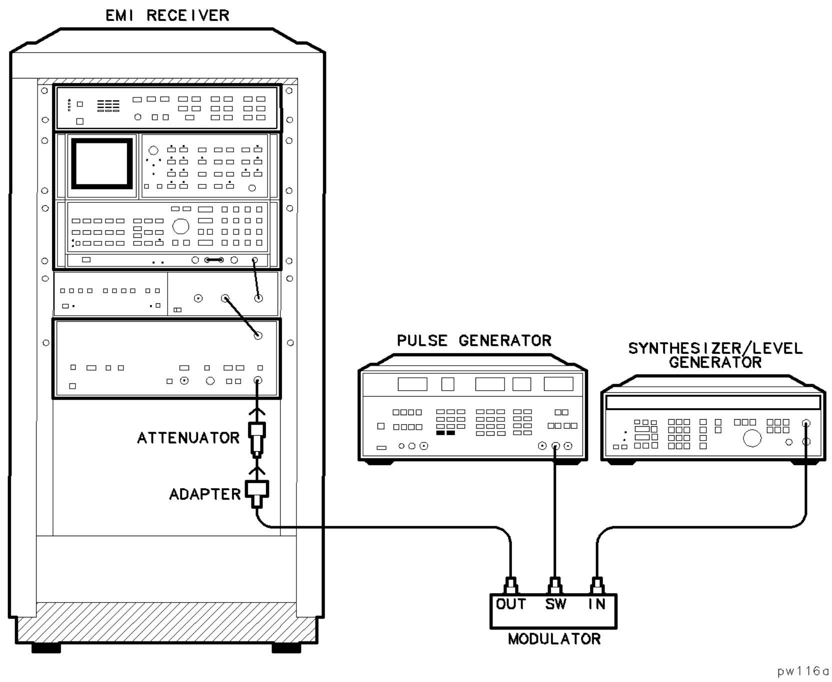
power meter .... HP 436A power meter
power sensor .... HP 8482A N(m) power sensor



Power Level Setup

Recommended Equipment

synthesizer/level generator . . HP 3335A synthesizer/level generator
pulse generator . . . . HP 8161A programmable pulse generator
power meter . . . . HP 436A power meter
power sensor . . . . HP 8482A N(m) power sensor
3 dB attenuator . . . . HP 8491A Option 003 coaxial fixed attenuator
modulator . . . . HP 0955-0533 solid-state switch, SPST (Modulator)
cables (3 required) . . HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
adapter . . . . HP 1250-0777 N(f) to N(f)
adapter . . . . HP 1250-0780 N(m) to BNC(f)



Pulse Response Measurement

Recommended Equipment

synthesizer/level generator . . HP 3335A synthesizer/level generator
pulse generator . . . . HP 8161A programmable pulse generator
3 dB attenuator . . . . HP 8491A Option 003 coaxial fixed attenuator
modulator . . . . HP 0955-0533 solid-state switch, SPST (Modulator)
cables (3 required) . . HP 10503A 122 cm (48 in) 50Ω coax BNC(m) to BNC(m)
adapter . . . . HP 1250-0777 N(f) to N(f)
adapter . . . . HP 1250-0780 N(m) to BNC(f)

Purpose This test measures the EMI receiver system's response to a pulsed RF input signal relative to that of a CW input signal and the system response as a function of pulse repetition frequency, according to CISPR* requirements.

Description "Pulse Response" is performed with a pulsed RF input signal rather than a video pulse, because the necessary equipment is readily available, easily calibrated, and flexible to use. Pulsed RF setup considerations and the relationship between the two techniques are explained in HP Application Note 150-2, and in CISPR Publication 16, Appendix Q.

The output of the HP 3335A synthesizer/level generator is modulated by the pulse generator using the pulse modulator to yield a pulsed RF signal. The system is tested, through each of the three 6 dB bandwidth filters of the HP 85650A quasi-peak adapter, with a pulse repetition frequency (PRF) corresponding to CISPR specifications.

Power Meter Calibration

The measurements start with a calibration of the power meter. If the power meter has been calibrated recently, the test skips this routine.

Input Amplitude Calibration

The pulse generator is set to dc bias the modulator in its ON state. The HP 3335A synthesizer/level generator's frequency is set and the amplitude is adjusted so that the power at the output of the 3 dB attenuator is −6.99 dBm (100 dBuV) as measured with the power sensor. This reference setting is used in the "Pulsed RF Signal" and "CW Measurement" sections to set input power appropriate for the unit under test. The 3 dB attenuator provides a controlled source match.

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* CISPR is the acronym for *Comité International Spécial des Perturbations Radioélectriques* (International Special Committee on Radio Interference) of the International Electrotechnical Commission. Publication 16, "CISPR Specification for Radio Interference Measuring Apparatus and Measurement Methods," stipulates performance requirements for radio interference measuring apparatus.

Isolation Check The power sensor is disconnected, the 3 dB attenuator is connected to the input of the unit under test, and the HP 85650A quasi-peak adapter is put into bypass mode. The input signal is measured with the EMI receiver system. The pulse generator is set to dc bias the modulator in its OFF state and the signal is measured again. The two readings are compared, to verify that the modulator's isolation is greater than 70 dBc. This ensures accuracy of the pulsed RF spectral intensity in low pulse repetition frequencies by limiting the carrier source feedthrough component.

Pulsed RF Signal The pulse generator is set to the desired pulse repetition frequency (PRF) and nominal pulse width. The HP 3335A synthesizer/level generator amplitude is set to yield the CISPR-specified spectral intensity of the main lobe at the input of the unit under test. The required setting for the HP 3335A synthesizer/level generator is determined from the CISPR-specified spectral intensity, the pulse width, and the reference setting determined above. If the HP 8116A pulse/function generator is used, the test measures the null spacing of the pulse spectrum to set the pulse width more accurately than the nominal value on the HP 8116A pulse/function generator.

Pulse Measurement

The HP 85650A quasi-peak adapter is set to normal mode and the detector is turned ON. Time is allowed for the detector to settle. The pulse modulated signal then is measured with the EMI receiver system. The pulse repetition frequency is varied to measure the pulse response at the CISPR specified pulse repetition frequencies.

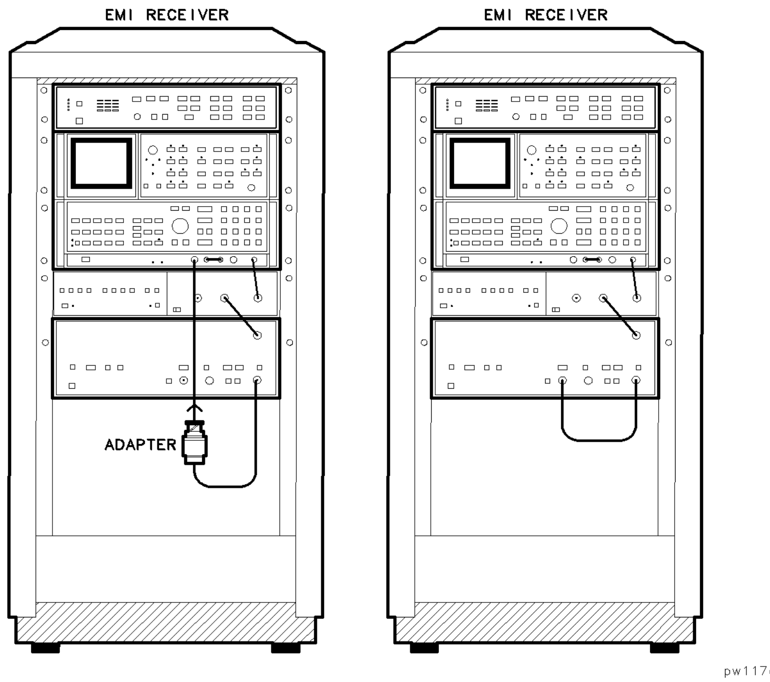
CW Measurement

The pulse generator is set to dc bias the modulator in its ON state. The HP 3335A synthesizer/level generator amplitude is set to yield 60 $dBuV$. The CW signal is measured with the EMI receiver system.

Power Sensor Calibration Factors

"Optional: Entering power sensor calibration factors" in Chapter 2 explains the requirements for entering calibration factors for the power sensor being used.

Calibration INPUT 2



Recommended Equipment

cable .... HP 8120-4781 61 cm (24 in) 50Ω coax N(m) to N(m)
adapter .... HP 1250-0077 N(f) to BNC(m)

Purpose This test calibrates receiver INPUT 2 of the EMI receiver system.

Description "Calibration INPUT 2" consists of two setups. The first setup calibrates the spectrum analyzer with the RF preselector in bypass mode. Recall-9 calibrates the spectrum analyzer's center frequency for narrow resolution bandwidths of 10 Hz through 1 kHz.

In the second setup, receiver INPUT 2 is calibrated at predetermined points for amplitude accuracy using the comb generator output. These points are chosen by the internal calibration sequence (CAL SEQ) in the RF preselector. receiver INPUT 2 is calibrated between 20 MHz and 2 GHz.

To make calibrated measurements with the EMI receiver system, CAL SEQ must be run for each set of EMI receiver system settings. This test runs CAL SEQ at the settings that will be used in subsequent tests. The resulting calibration factors are stored in the controller memory and loaded into the RF preselector when they are needed.

Test Settings

Settings for Amplitude Accy. INPUT 2 (10 dB AT and 0 dB AT)

Function	Band B (Auto)	Band C (Auto)	Band D (Auto)
RF FREQ	20 MHz to 30 MHz	30 MHz to 300 MHz	300 MHz to 2.0 GHz
QPA filter	9 kHz	120 kHz	120 kHz
RES BW	100 kHz	1 MHz	1 MHz
RFPS (atten)	0 dB	0 dB	0 dB
SA (atten)	10 dB or 0 dB	10 dB or 0 dB	10 dB or 0 dB
Scale	Linear	Linear	Linear

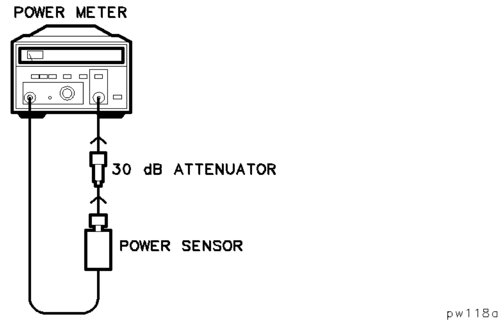
Settings for Disp. Average Noise Input 2, 10 Hz RBW

Function	Settings (Auto)
RF FREQ	20 MHz to 2.0 GHz
QPA filter	BYPASS
RES BW	30 kHz
RFPS (atten)	0 dB
SA (atten)	0 dB
Scale	Log 10 dB

Settings for Residual Responses INPUT 2

Function	Settings (Auto)
RF FREQ	20 MHz to 2.0 GHz
QPA filter	BYPASS
RES BW	30 kHz
RFPS (atten)	0 dB
SA (atten)	0 dB
Scale	Log 10 dB

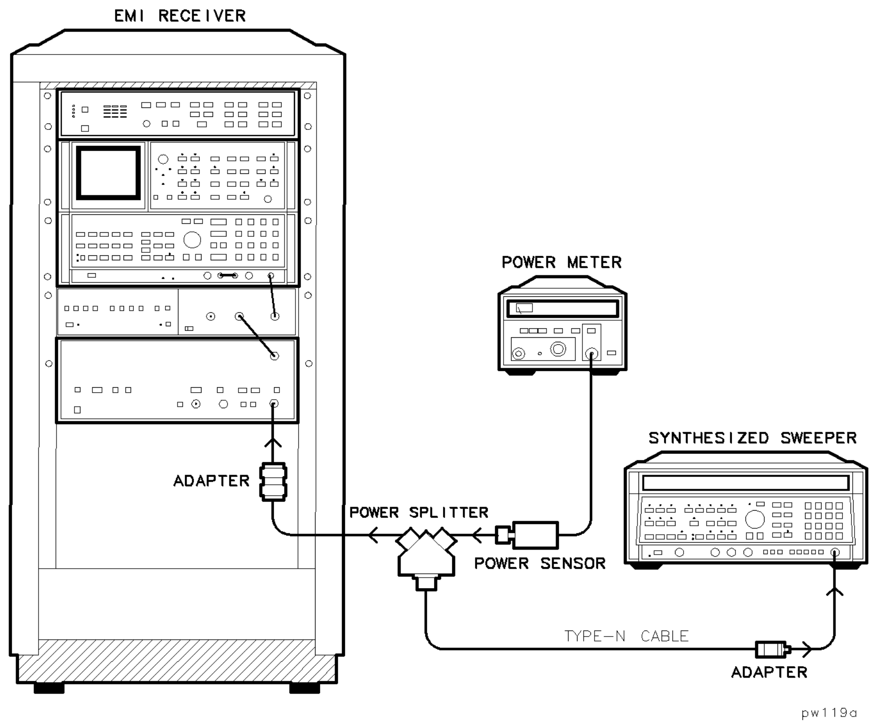
Amplitude Accy. INPUT 2 (10 dB AT and 0 dB AT)



Power Meter Calibration

Recommended Equipment

power meter .... HP 436A power meter
power sensor .... HP 8481D N(m) power sensor
attenuator ....HP 11708A APC-3.5 mm(f) to N(m) 30 dB fixed attenuator



Amplitude Accy. INPUT 2 (10 dB AT)

Recommended Equipment

synthesized sweeper .... HP 8360 Series synthesized sweeper
power meter .... HP 436A power meter
power sensor .... HP 8481D N(m) power sensor
power splitter .... HP 11667A power splitter
cable .... HP 8120-5140 91 cm (36 in) 50Ω N(m) to N(m)
adapter .... HP 1250-1745 APC-3.5(f) to N(f)
adapter .... HP 1250-1475 N(m) to N(m)

Purpose This test measures absolute amplitude accuracy through receiver INPUT 2.

Note

- To assure test accuracy, you must complete "Calibration INPUT 2", "Log Fidelity", "Linear Fidelity", and "Reference Level Switching Uncertainty" before you perform this test.

Description "Amplitude Accy. INPUT 2 (10 dB AT and 0 dB AT)" relies on the calibration accuracy of the HP 8481A N(m) power sensor. First, the power meter is calibrated. Then, a synthesized source is used as a signal source for this test. The signal is sent through a power splitter. One output is measured with a power sensor, and the other output is measured with receiver INPUT 2 through an HP 1250-1475 N(m) to N(m) adapter. The EMI receiver system amplitude response is compared to the power meter response. The difference between the corrected power meter response and the EMI receiver system measurement is the amplitude accuracy of the EMI receiver system.

"Log Fidelity", "Linear Fidelity", "Reference Level Switching Uncertainty", and the accuracy of the EMI receiver system's internal calibration sequence contribute to the amplitude accuracy of the EMI receiver system in any valid setting. These error contributors are measured in separate tests.

Amplitude accuracy is tested at both 10 dB and 0 dB spectrum analyzer input attenuation.

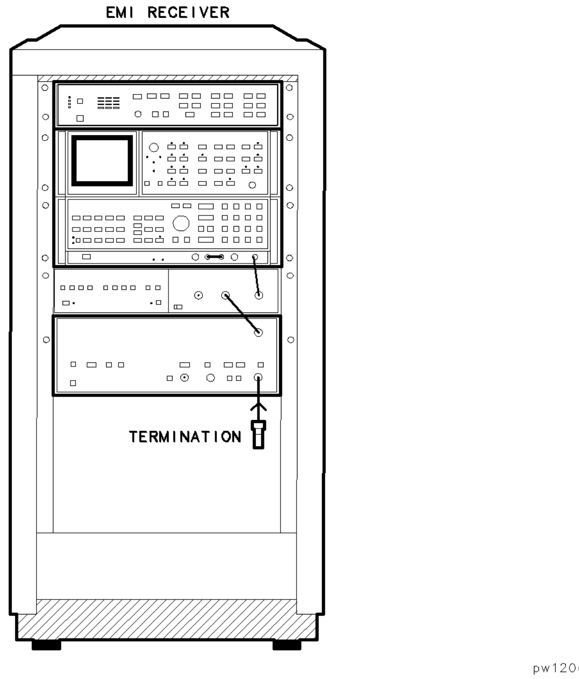
Note

- "Optional: Entering power sensor calibration factors," in chapter 2, lists requirements for entering calibration factors for the power sensor being used.

Test Settings

Function	Band B	Band C	Band D
RF FREQ	20 MHz to 30 MHz	30 MHz to 300 MHz	300 MHz to 2.0 GHz
QPA filter	9 kHz	120 kHz	120 kHz
RES BW	100 kHz	1 MHz	1 MHz
RFPS (atten)	0 dB	0 dB	0 dB
SA (atten)	10 dB or 0 dB	10 dB or 0 dB	10 dB or 0 dB
Scale	Linear	Linear	Linear

Disp. Average Noise INPUT 2



Recommended Equipment

50Ω load .... HP 908A 50Ω N(m) termination

Purpose This test measures the displayed average noise level through receiver INPUT 2.

Note

- To assure test accuracy, you must complete "Calibration INPUT 2" and "Amplitude Accy. INPUT 2 (10 dB AT and 0 dB AT)" before you perform this test.

Description During these measurements, receiver INPUT 2 is terminated with a 50Ω load, and measured for displayed average noise between 20 MHz and 2.0 GHz at selected frequency intervals through each RF preselector filter path. Measurements are made in linear mode through the QPA (CISPR) bandwidth, and in log mode in a 10 Hz resolution bandwidth.

Test Settings

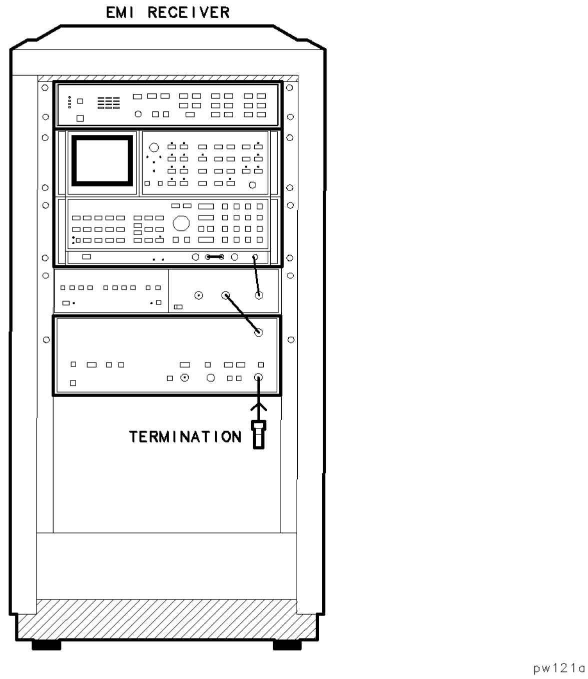
Settings for Disp. Average Noise INPUT 2, QPA Bandwidths

Function	Band B	Band C	Band D
RF FREQ	20 MHz to 30 MHz	30 MHz to 300 MHz	300 MHz to 2.0 GHz
QPA filter	9 kHz	120 kHz	120 kHz
RES BW	100 kHz	1 MHz	1 MHz
VID BW	100 kHz	1 MHz	1 MHz
RFPS (atten)	0 dB	0 dB	0 dB
SA (atten)	0 dB	0 dB	0 dB
Scale	Linear	Linear	Linear

Settings for Disp. Average Noise Input 2, 10 Hz RBW

Function	Settings
RF FREQ	20 MHz to 2.0 GHz
QPA filter	BYPASS
RES BW	10 Hz
VID BW	1 Hz
RFPS (atten)	0 dB
SA (atten)	0 dB
Scale	Log 10 dB

Residual Responses INPUT 2



Recommended Equipment

50Ω load .... HP 908A 50Ω N(m) termination

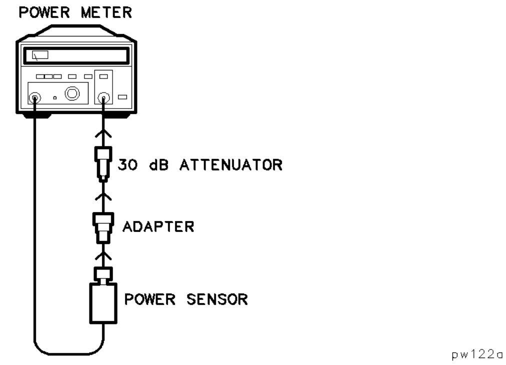
Purpose This test measures the residual responses through receiver INPUT 2 between 20 MHz and 100 MHz.

Note

- To assure test accuracy, you must complete "Calibration INPUT 2" and "Amplitude Accy. INPUT 2 (10 dB AT and 0 dB AT)" before you perform this test.

Description The measurements are made with both the RF preselector and the spectrum analyzer in 0 dB input attenuation; receiver INPUT 2 is terminated with a 50Ω load, and the quasi-peak adapter is in bypass mode.

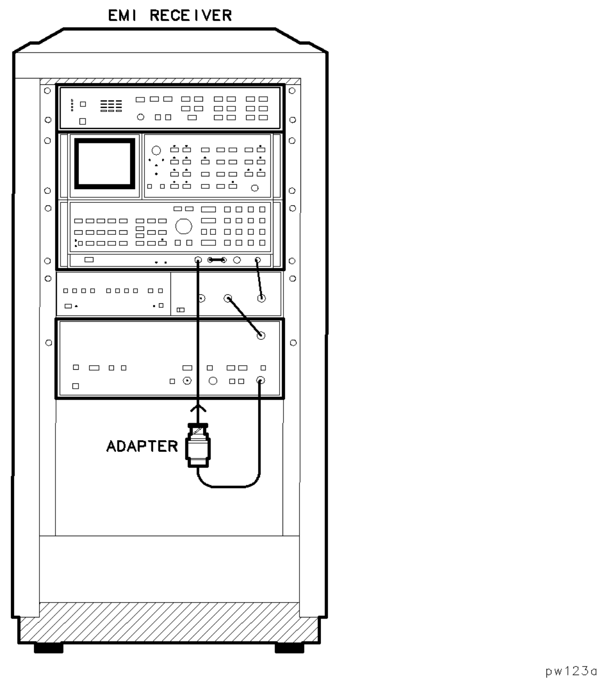
Amplitude Accy. INPUT 3



Power Meter Calibration

Recommended Equipment

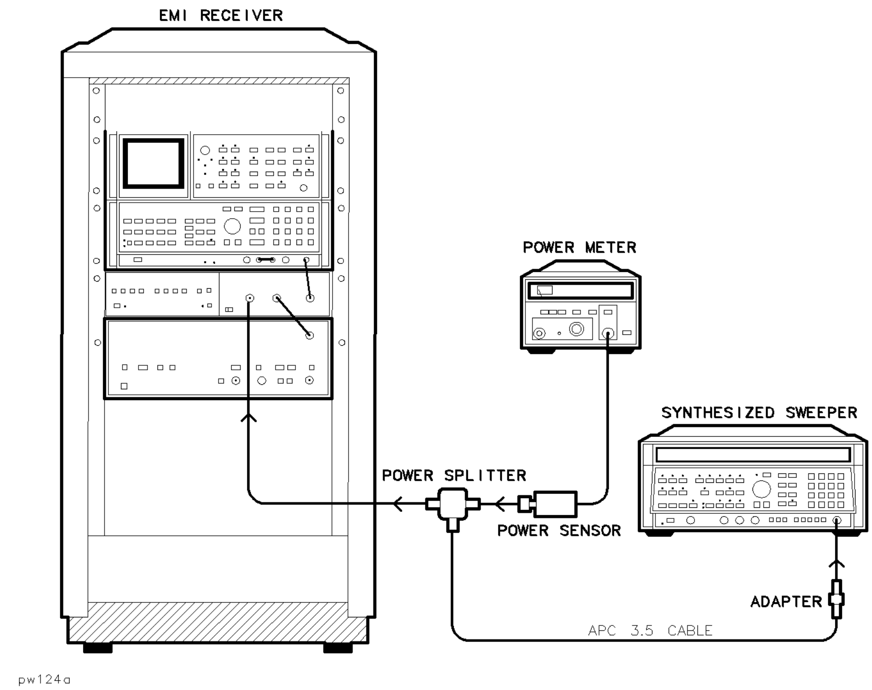
power meter .... HP 436A power meter
power sensor .... HP 8485D APC-3.5 mm(m) power sensor
attenuator .... HP 11708A APC-3.5 mm(f) to N(m) 30 dB fixed attenuator
adapter .... HP 08485-60005 APC 3.5(f) to N(m)



Amplitude Accy. INPUT 3

Recommended Equipment

cable .... HP 8120-4781 61 cm (24 in) 50Ω coax N(m) to N(m)
adapter .... HP 1250-0077 N(f) to BNC(m)



Amplitude Accy. INPUT 3

Recommended Equipment

synthesized sweeper .... HP 8360 Series synthesized sweeper
power meter .... HP 436A power meter
power sensor .... HP 8485D APC-3.5 mm(m) power sensor
power splitter .... HP 11667B power splitter
cable .... HP 8120-4921 91 cm (36 in) 50Ω APC-3.5 mm(m) to APC-3.5 mm(m)
adapter .... HP 1250-1749 APC-3.5(f) to APC-3.5(f)

Purpose This test measures absolute amplitude accuracy through receiver INPUT 3.

Note

- To assure test accuracy, you will need the amplitude characterization data (INPUT 3, 0 dB AT) in the *HP 8571A/8572A EMI Receiver 1 GHz to 22 GHz Calibration Data Manual.*
- You must complete "Log Fidelity", "Linear Fidelity", and "Reference Level Switching Uncertainty" before running this test.

Description "Amplitude Accy. INPUT 3" relies on the calibration accuracy of the HP 8481A N(m) power sensor. This test uses three setups. First, the power meter is calibrated.

The second setup calibrates the spectrum analyzer with the RF preselector in bypass mode using recall-8 on the spectrum analyzer. Recall-9 is used to calibrate the spectrum analyzer's center frequency for narrow resolution bandwidths of 10 Hz through 1 kHz.

The third setup uses a synthesized source as a signal source for the test. The signal is sent through a power splitter. One output is measured by receiver INPUT 3. The EMI receiver system amplitude response is corrected using the appropriate amplitude characterization data. The corrected power meter response is compared to the corrected EMI receiver system amplitude response. The difference between the corrected power meter response and the corrected EMI receiver system amplitude response is the amplitude accuracy of the EMI receiver system.

"Log Fidelity", "Linear Fidelity", "Reference Level Switching Uncertainty", and the accuracy of the EMI receiver system's internal calibration sequence contribute to the amplitude accuracy of the EMI receiver system in any valid setting. These error contributors are measured in separate tests.

Note

- "Optional: Entering power sensor calibration factors," in chapter 2, lists requirements for entering calibration factors for the power sensor being used.

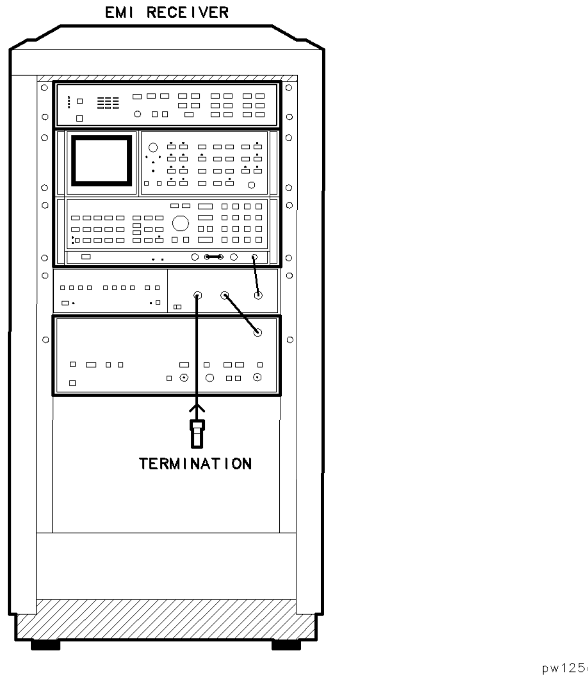
Test Settings

Amplitude accuracy is tested at both 10 dB and 0 dB spectrum analyzer input attenuation. The settings used during this test are:

Settings for Amplitude Accy. INPUT 3

Function	Settings
RF FREQ	1 GHz to 22 GHz
QPA filter	BYPASS
RES BW	1 MHz
RFPS	BYPASS
SA (atten)	10 dB or 0 dB
Scale	Log 1 dB

Disp. Average Noise INPUT 3, 10 Hz RBW



Recommended Equipment

50Ω load .... HP 909D Option 011 50Ω 3.5 mm(f) termination

Purpose This test measures the displayed average noise level through the receiver INPUT 3.

Note

- To assure test accuracy, you will need the amplitude characterization data (INPUT 3, 0 dB AT) in the *HP 8571A/8572A EMI Receiver 1 GHz to 22 GHz Calibration Data Manual*.
- You must complete "Amplitude Accy. INPUT 3" before you perform this test.

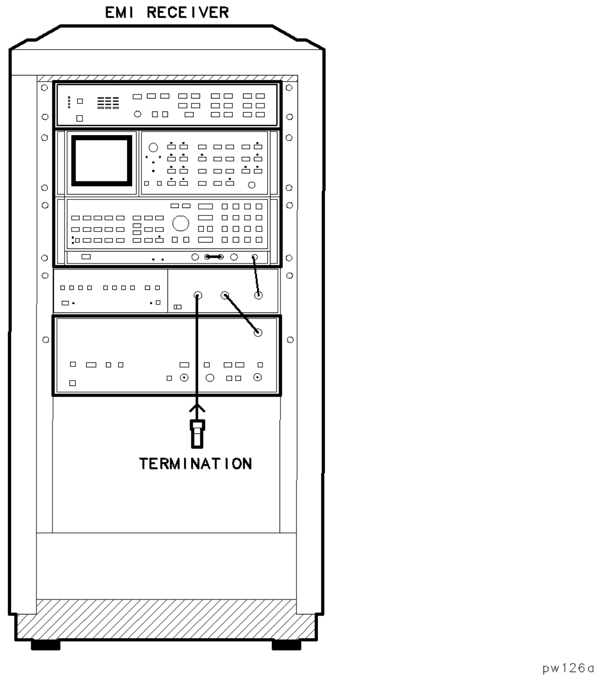
Description "Disp. Average Noise INPUT 3, 10 Hz RBW" measures the displayed average noise level of the EMI receiver system at selected frequency intervals between 1 GHz and 22 GHz. Measurements are made with the EMI receiver system in a 10 Hz resolution bandwidth and 0 dB input attenuation; receiver INPUT 3 is terminated with a 50Ω load, and the quasi-peak adapter is in bypass mode.

Test Settings

Settings for Disp. Average Noise INPUT 3, 10 Hz RBW

Function	Settings
RF FREQ	1 GHz to 22 GHz
QPA filter	BYPASS
RES BW	10 Hz
RFPS	BYPASS
SA (atten)	0 dB
Scale	Log 10 dB

Residual Responses INPUT 3



Recommended Equipment

50Ω load . . . . HP 909D Option 011 50Ω 3.5 mm(f) termination

Purpose This test measures the residual responses through receiver INPUT 3 between 1 GHz and 22 GHz.

Note

- To assure test accuracy, you will need the amplitude characterization data (INPUT 3, 0 dB AT) in the *HP 8571A/8572A EMI Receiver 1 GHz to 22 GHz Calibration Data Manual*.
- You must complete "Amplitude Accy. INPUT 3" before you perform this test.

Description The measurements are made with the spectrum analyzer in 0 dB input attenuation, receiver INPUT 3 terminated with a 50Ω load, and the quasi-peak adapter in bypass mode.

4

Making Typical Measurements

In this chapter, you'll find instructions for making typical measurements with the HP 8572A microwave EMI receiver:

- testing for overload
- testing narrowband and broadband signals
- making commercial compliance measurements
- performing MIL-STD 461 conducted emission tests
- performing MIL-STD 461 RE02 radiated emission tests
- making CISPR 22 measurements

Testing for Overload

In dealing with broadband signals such as pulses, the levels displayed on the CRT can represent only a small fraction of the total energy applied to the receiver's input. Therefore, while the level displayed on the CRT may appear within safety limits, the peak value actually applied may be beyond the 1 dB compression point. To avoid this error, analyze the signal response with the 3 dB linearity check overload test to determine if the receiver is overloaded. See Figure 4-1.

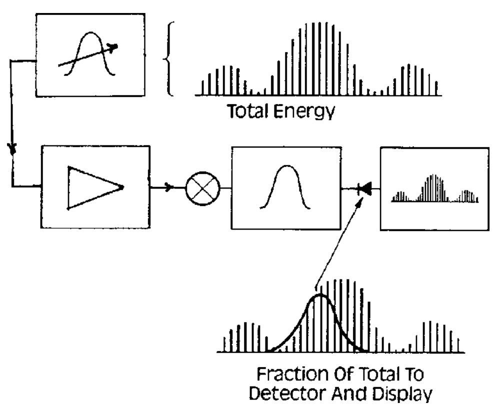


Figure 4-1. Testing for Overload

3 dB Linearity Check

Use the 3 dB linearity check key on the RF preselector to check for overload. Press the 3 dB LIN key and observe the amplitude level of the signals displayed on the spectrum analyzer. The change in the observed peak level of signals (at least 10 dB above the noise floor) should be less than 1 dB. If change in amplitude occurs, increase the RF preselector input attenuation by 10 dB and repeat the 3 dB test. Continue to add attenuation until the signals behave linearly. Use the least amount of attenuation necessary to cause linear signal-amplitude change.

Narrowband/Broadband Signals

The classification of a signal as narrowband or broadband depends on the signal's occupied frequency spectrum relative to the resolution bandwidth of the measuring receiver.

Narrowband Signals Emissions occupying a narrow frequency spectrum relative to the resolution bandwidth are defined as narrowband. A CW signal is an example of a narrowband signal. See Figure 4-2. Common measurement units for narrowband signals are dBμV (dB above 1 μV) and dBμV/m (field strength).

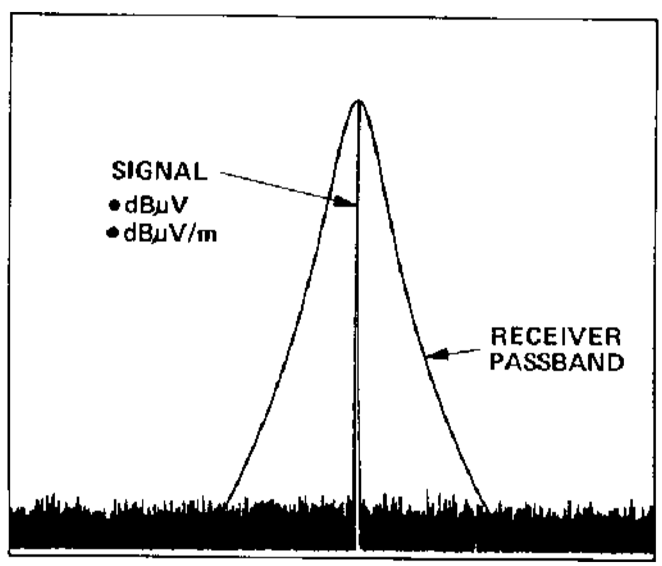


Figure 4-2. Narrowband Spectrum

Broadband Signals Emissions occupying a broad frequency spectrum relative to the resolution bandwidth are characterized as broadband. Sources of broadband signals can be impulse emissions from automobile ignitions systems, digital circuits, switching power supplies, and random noise. See Figure 4-3.

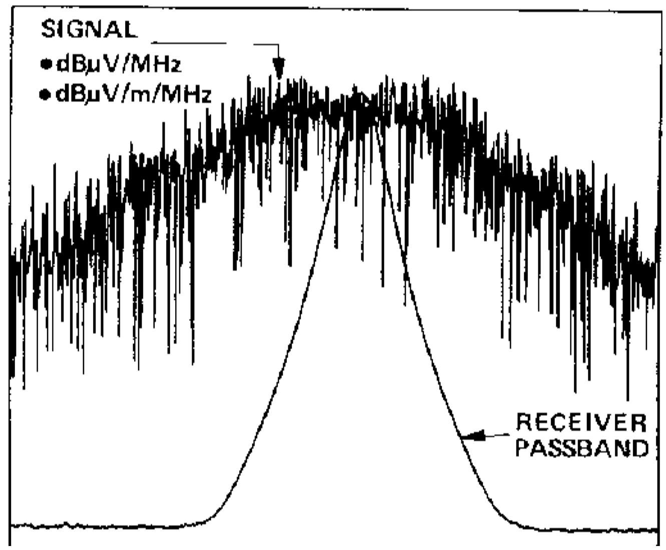


Figure 4-3. Broadband Spectrum

Broadband emissions measurement requires normalization to a reference bandwidth, for example, 1 MHz. Common broadband measurement units are dBμV/MHz and dBμV/m/MHz (field strength).

These easily-performed tests can determine if a signal is narrowband or broadband relative to the spectrum analyzer bandwidth:

Tuning Test Tune away $\pm\delta$BWi and observe changes in the signal's displayed amplitude.

PRF Test Use the sweeptime control (or span or resolution bandwidth) to determine if the signal is being displayed in line mode or pulse mode.

Peak vs. Average

Select a video bandwidth three to ten times narrower than the resolution bandwidth selected; observe smoothing of broadband signals.

Bandwidth Test

Increase or decrease the resolution bandwidth and observe amplitude changes of the signals. Changes in amplitude indicate that the signal is a broadband relative to the receiver bandwidth.

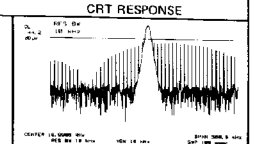
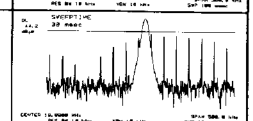
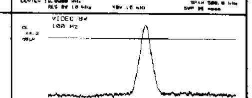
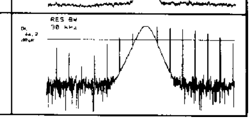
METHODS FOR NB AND BB ANALYSIS			
METHODS	NB	BB	CRT RESPONSE
TUNING TEST "TUNE" Δ BW_i	Δ AMPL $>$ 3dB	Δ AMPL $<$ 3dB	
PRF TEST Δ SWEEPTIME	NO Δ SPACING (LINE MODE)	SPACING (PULSE MODE)	
PEAK VS. AVG. DET Δ VIDEO BW	NO Δ AMPL	Δ AMPL	
BANDWIDTH TEST Δ RESOLUTION BW	NO Δ AMPL	Δ AMPL	

Figure 4-4. Methods for Narrowband and Broadband Analysis

Commercial Compliance Measurements

Detector Selection

The three commonly used detection modes for making EMC measurements are:

- Peak Detection
- Average Detection
- Quasi-Peak Detection

Peak Detection A peak measurement is the measured peak voltage referenced to the RMS value for a sinusoidal calibration signal. For peak detection on the EMI receiver, set the video bandwidth wider than the resolution bandwidth and place the analyzer in normal detection mode.

Average Detection After the incoming RF input has been mixed down to the IF (see Figure 4-5), filtered by the resolution bandwidth filters, and amplified logarithmically (dB) or linearly (volts), it reaches the envelope detector and video filter. Envelope detection finds the peak voltage of the signal. The video filter is a low-pass filter that integrates (averages) the higher frequency components (such as noise) at the output of the detector.

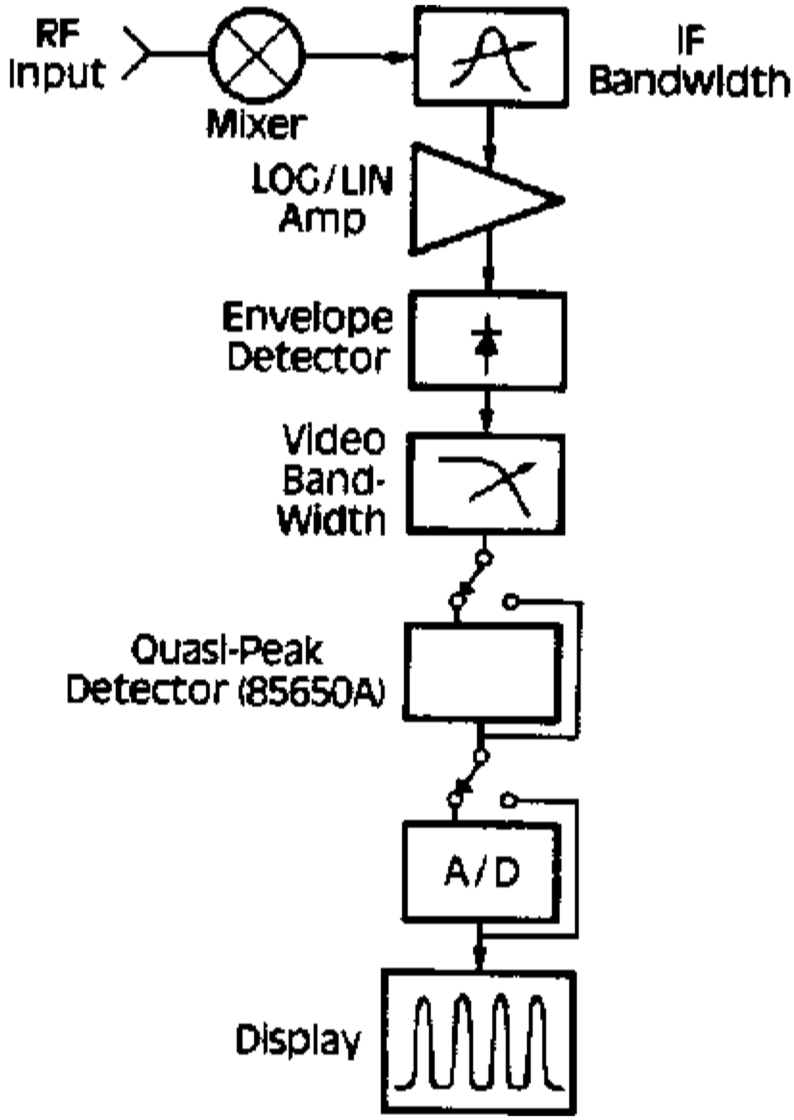


Figure 4-5. Signal Detection and Processing

For effective averaging, the bandwidth of the video filter must be smaller than the resolution bandwidth. The higher the ratio of resolution bandwidth to video bandwidth, the greater the averaging will be. See Figure 4-6.

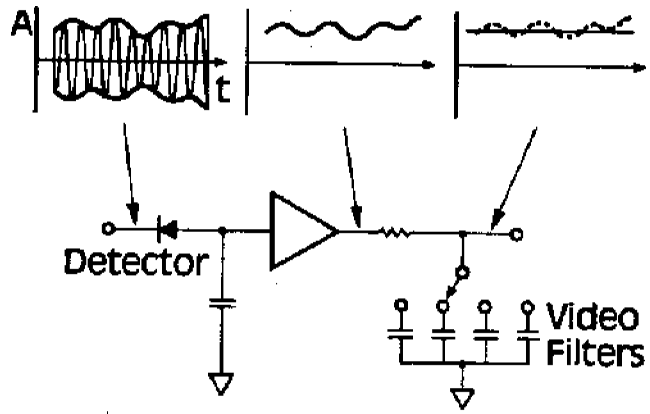


Figure 4-6. Average Detection Using Video Filtering

Because the video filter is in a series with the resolution bandwidth, filter sweep time is affected by the video bandwidth. Thus, narrow video bandwidths require long sweep times.

Quasi-Peak Detection

Many international EMI regulations based on CISPR standards permit use of a quasi-peak detector. The quasi-peak detector has three sets of charge and discharge time constants, depending on the frequency range selected. Because of these fast charge and slow discharge time constants, the output of the quasi-peak detector depends on the repetition rate of the broadband signal. See Figure 4-7.

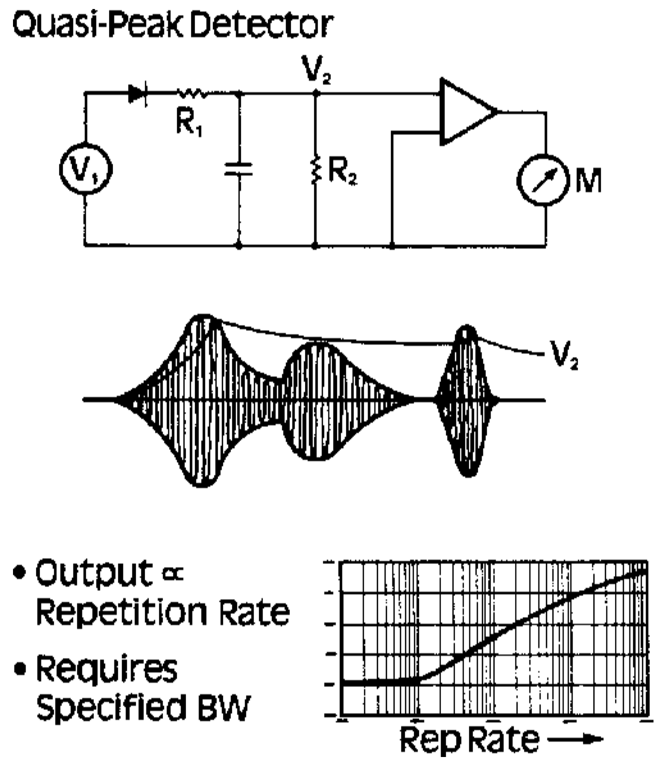


Figure 4-7. Quasi-Peak Detection

The time constant of the meter movement following the detector smooths the output, to obtain a single-valued reading. The quasi-peak value always will be less than or equal to the peak value of the signal. See Figure 4-8.

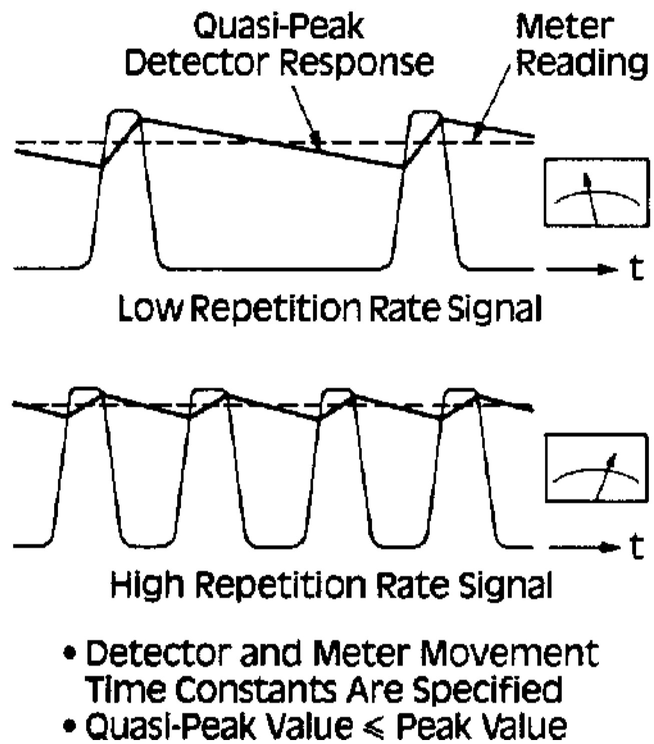


Figure 4-8. Quasi-Peak Detector Output

There should be no difference between peak and quasi-peak readings for CW signals. However, for broadband, pulsed type signals with low repetition rates, the difference can be significant. When making quasi-peak measurements, remember that substantially slower sweep rates are required for quasi-peak detection than for peak detection, because of the long time constants in the quasi-peak circuitry.

Measurement Examples

These examples show how to use the EMI receiver in manual mode, to perform an average measurement, and how to make peak and quasi-peak measurements, on both CW and broadband signals.

Example: Peak Measurement (CW Signal)

In this example, a 100 MHz signal will be used as the CW signal.

1. Connect the signal source to the correct receiver input (INPUT 2 for this example).
2. Adjust the reference level to bring the signal amplitude near the top of the display.
3. Set the correct quasi-peak bandwidth according to the frequency range being tested. Because the signal of interest in this example

is 100 MHz, press (.03-1 GHz) on the quasi-peak detector. This sets the quasi-peak bandwidth to 120 kHz.

4. Press the NORMAL key on the quasi-peak adapter.
5. Set the spectrum analyzer resolution and video bandwidths according to the table on the front of the quasi-peak adapter. For a 100 MHz signal, set the bandwidths to 1 MHz.

Note

- Making the spectrum analyzer's resolution bandwidth much greater than the quasi-peak bandwidth, the quasi-peak bandwidth becomes the limiting bandwidth in the IF. If the resolution bandwidth is less than the quasi-peak bandwidth, the resolution bandwidth becomes the limiting bandwidth in the IF and the special quasi-peak bandwidth filter would have no effect.

---

6. Set the spectrum analyzer center frequency to 100 MHz and the span to 1 MHz.
7. The table on the front of the quasi-peak adapter section shows the sweep time to use with quasi-peak detection OFF. With frequency in the 0.03 to 1 GHz band and span set to 1 MHz, the sweep time must be set to a value no faster than 1 ms.

   A sweep time faster than the value indicated on the table will cause an incorrect amplitude reading.
8. Press (SHIFT) C on the spectrum analyzer, to read amplitude in dBμV.
9. To select the preamplifier BYPASS path, press 0 (•) on the switch driver. The LED in the key will light.
10. Disconnect the signal source. Connect the preselector comb generator output to the input of the preselector section to be used in the measurement.
11. Set the spectrum analyzer start frequency to 30 MHz and stop frequency to 200 MHz (170 MHz span).

Note

Before calibrating the system:

- Make sure all equipment settings are correct. Do not change the resolution bandwidth, scale, attenuation, or input port after calibration. (The start and stop frequencies may be changed after calibration if the frequency range stays within the range at which the receiver was calibrated.)
- Manually set critical system parameters manually, such as resolution bandwidth. Parameters that are set manually will not change during the calibration routine; parameters that are still in the auto-coupled mode may change during the calibration routine.

---

12. Press CAL SEQ (START) on the preselector. Selected comb teeth are measured by the spectrum analyzer section. Any variation between the measured comb tooth amplitude and the value stored in the preselector section is corrected by an internal preselector section gain adjustment. The CAL SEQ LED flashes while the calibration routine runs.

Note

- After calibration, the CAL SEQ LED stays on, indicating that the system is calibrated over the current frequency range. If the frequency range is increased beyond the calibrated frequency range, the light turns off to indicate an uncalibrated state. However, the CAL SEQ light does *not* turn off when parameters other than the frequency range (start and stop frequency) are changed. Therefore, you may have an uncalibrated state while the CAL SEQ light is on.

  Be sure the receiver is calibrated for the *current* instrument settings.

---

13. Disconnect the preselector section's comb generator output and reconnect the signal source to receiver INPUT 2.

    Use the same cable during measurements that you used for calibration; the system has compensated for the loss in this cable. Remember to account for the losses in the calibration cable if you do not use that same during the actual measurement. Using other cables may introduce an amplitude error.

14. Set the spectrum analyzer span to 1 MHz and center frequency to 100 MHz.

15. Press (PEAK SEARCH) on the spectrum analyzer and read the marker amplitude on the display. If an antenna is connected to the system, the antenna factors would be added to the reading to give actual field strength reading. Refer to Figure 4-9.

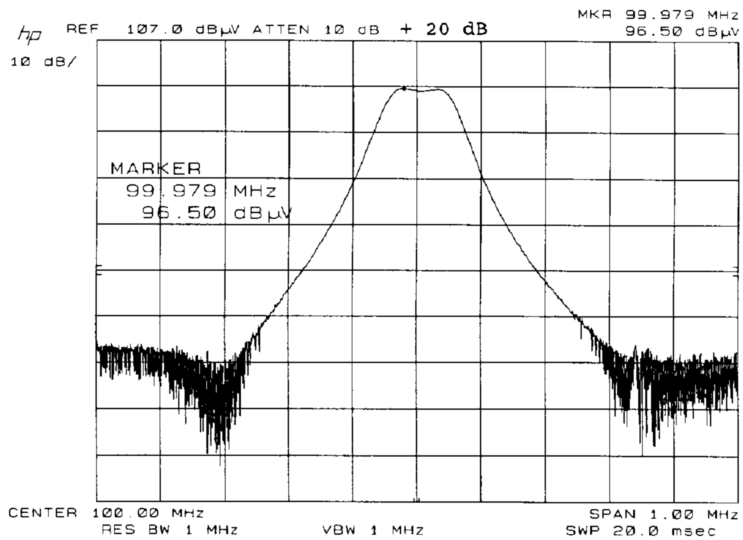


Figure 4-9. Peak Measurement of a CW Signal

16. Use the 3 dB attenuator in the preselector to check linearity for a gain compression or overload condition. The attenuator changes the gain by adding 3 dB of attenuation. If the amplitude changes on the display, suspect an overload or gain compression.

    If this test indicates an overload or gain compression:

    - Press (⇧) on the RF preselector to add 10 dB of attenuation.
    - Repeat the linearity check with the 3 dB attenuator. Add attenuation if necessary until the overload or gain compression is eliminated.
    - If the attenuation is increased, the receiver should be recalibrated with the new attenuator setting for best accuracy.

Example: Peak Measurement (Broadband Signal)

This measurement uses a pulse generator, and measures the 15 MHz-to-16 MHz region where conducted measurements are performed. The results are shown in Figure 4-10.

1. Press (INSTR PRESET) on the quasi-peak adapter and on the preselector.
2. Select receiver INPUT 1.
3. Press the 0 (●) key on the switch driver to select the preamplifier BYPASS path. The LED in the key will light.
4. Connect the signal source to receiver INPUT 1.

5. Set the EMI receiver as follows:

   (START FREQ) .... 15 MHz
   (STOP FREQ) .... 16 MHz
   (RES BW) .... 100 kHz
   (VIDEO BW) .... 100 kHz
   (SWEEP TIME) .... 100 ms
   QPA BW .... 9 kHz
   QPA .... NORMAL

6. Because the signal of interest is in the 0.15 to 30 MHz region, the 9 kHz quasi-peak bandwidth (QPA BW) is selected. Refer to the table on the front of the quasi-peak adapter, and set the spectrum analyzer resolution and video bandwidths to 100 kHz.
7. According to the table, sweep time with the quasi-peak detector in NORMAL (or off) is 100 ms/MHz. Because the selected span is 1 MHz, the sweep time for this measurement must be at least 100 ms.
8. To read amplitude in dBμV, press (SHIFT) C on the spectrum analyzer.
9. Adjust the reference level to bring the signal near the top of the display.
10. Disconnect the signal source. Connect the preselector comb generator output to the receiver input used in the measurement.

Note Before calibrating the system:

- Make sure all equipment settings are correct. Do not change the resolution bandwidth, scale, attenuation, or input port after calibration. (The start and stop frequencies may be changed after calibration if the frequency range stays within the range at which the receiver was calibrated.)
- Manually set critical system parameters manually, such as resolution bandwidth. Parameters that are set manually will not change during the calibration routine; parameters that are still in the auto-coupled mode may change during the calibration routine.

---

11. Press CAL SEQ (START) on the preselector. Selected comb teeth are measured by the spectrum analyzer section. Any variation between the measured comb tooth amplitude and the value stored in the preselector section is corrected by an internal preselector section gain adjustment. The CAL SEQ LED flashes while the calibration routine runs.

Note

- After calibration, the CAL SEQ LED stays on, indicating that the system is calibrated over the current frequency range. If the frequency range is increased beyond the calibrated frequency range, the light turns off to indicate an uncalibrated state. However, the CAL SEQ light does *not* turn off when parameters other than the frequency range (start and stop frequency) are changed. Therefore, you may have an uncalibrated state while the CAL SEQ light is on.

Be sure the receiver is calibrated for the *current* instrument settings.

---

12. Disconnect the preselector section's comb generator output and reconnect the signal source to receiver INPUT 1.

    Use the same cable during measurements that you used for calibration; the system has compensated for the loss in this cable. Remember to account for the losses in the calibration cable if you do not use that same during the actual measurement. Using other cables may introduce an amplitude error.

13. Press (MAX HOLD) on the spectrum analyzer. Allow the display to fill in.

14. Press (PEAK SEARCH) on the spectrum analyzer and read the marker amplitude on the display. Refer to Figure 4-10.

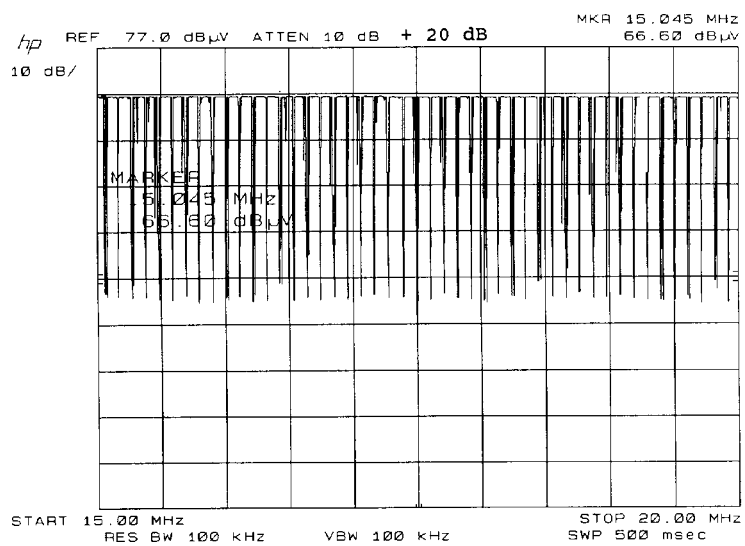


Figure 4-10. Peak Measurement of a Broadband Signal

Example: Microwave Peak Measurement (CW Signal)

This example makes peak or average measurements on a microwave signal in the 2 GHz to 22 GHz range.

1. Connect the 100 MHz calibration signal from the spectrum analyzer to receiver INPUT 2. Select receiver INPUT 2.

2. Select the preamplifier BYPASS path by pressing 0 (•) on the switch driver. The LED in the key will light.

3. Select the RF preselector BYPASS path by pressing the ENABLE key and the BYPASS key.

4. Select the resolution bandwidth for the measurement. For this example, use 1 MHz.
5. Select 0 dB or 10 dB spectrum analyzer attenuation.
6. Set the center frequency to 100 MHz and the span to 5 MHz. Press (PEAK SEARCH), and place a marker on the peak of the signal.
7. Select the vertical scale desired for the measurement. For measurements with the peak detector, the log scale is normally used. For average measurements, use the linear scale.
8. Adjust AMPTD CAL on the front panel of the spectrum analyzer until the marker reads -10.0 dBm.
9. Connect the signal source to the receiver INPUT 3.
10. Select receiver INPUT 3 by pressing the 0 (•) key on the switch driver. This input is selected when the 0 LED light is OFF.
11. Set resolution bandwidth and vertical scale to the same settings used for calibration.
12. Set spectrum analyzer attenuation to the same value used for calibration.
    - □ Select dBuV units using the KSC command.
    - □ Find the reference level offset on the EMI receiver's calibration chart. Enter this value in the receiver with (SHIFT) (REF LEVEL). Because this offset accounts for the gain of the preamplifier, use (-dBm) to make the resulting reference level offset a negative number.
13. Tune the receiver to the signal with (CENTER FREQUENCY) and (SPAN).
14. Use (PEAK SEARCH) to place a marker on the top of the signal to be measured.
15. Press (PRESEL PEAK) on the spectrum analyzer. The receiver automatically will select the optimum preselector DAC setting to give the maximum response.
    - □ If you are making an average measurement, set the vertical scale to LINEAR, and reduce the video bandwidth to 10 Hz.
16. Measure the signal amplitude using the marker.
17. Look up the measured frequency on the EMI receiver's calibration table. If necessary, interpolate between two points in the table to obtain the desired amplitude correction value.
18. Subtract the amplitude correction value from the marker reading obtained in step 16. This value corrects for the frequency response of the receiver.

Example: Quasi-Peak Measurement (CW Signal)

This example uses a 100 MHz signal as the CW signal.

1. Press INSTR PRESET on the quasi-peak adapter and on the preselector.
2. Connect the signal source to the correct receiver input (receiver INPUT 2 for this example).
3. To select the preamplifier BYPASS path, press 0 (•) on the switch driver. The LED in the key will light.
4. Set the quasi-peak bandwidth according to the frequency range being tested. Because the signal of interest is 100 MHz, press .03-1 GHz; this sets the quasi-peak bandwidth to 120 kHz.
5. Press the NORMAL key on the quasi-peak adapter.
6. Set the spectrum analyzer resolution and video bandwidths according to the table on the front of the quasi-peak adapter. For a 100 MHz signal, set the bandwidths to 1 MHz.

Note

- If you make the spectrum analyzer's resolution bandwidth much greater than the quasi-peak bandwidth, the quasi-peak bandwidth becomes the limiting bandwidth in the IF. If the resolution bandwidth is less than the quasi-peak bandwidth, the resolution bandwidth becomes the limiting bandwidth in the IF and the special quasi-peak bandwidth filter would have no effect.

---

7. Set the spectrum analyzer center frequency to 100 MHz and the span to 1 MHz.
8. Press the LIN key on the spectrum analyzer.
9. Change the reference level to bring the signal amplitude near the top of the display.
10. On the spectrum analyzer, press SHIFT C, to read the amplitude in dBμV.
11. Disconnect the signal source and connect the preselector section's comb generator output to the receiver input used in the measurement.

Note

Before calibrating the system:

- Make sure all equipment settings are correct. Do not change the resolution bandwidth, scale, attenuation, or input port after calibration. (The start and stop frequencies may be changed after calibration if the frequency range stays within the range at which the receiver was calibrated.)
- Manually set critical system parameters manually, such as resolution bandwidth. Parameters that are set manually will not change during the calibration routine; parameters that are still in the auto-coupled mode may change during the calibration routine.

---

12. Press CAL SEQ (START) on the preselector. Selected comb teeth are measured by the spectrum analyzer section. Any variation between the measured comb tooth amplitude and the value stored in the preselector section is corrected by an internal preselector section gain adjustment. The CAL SEQ LED flashes while the calibration routine is executing.

Note

- After calibration, the CAL SEQ LED stays on, indicating that the system is calibrated over the current frequency range. If the frequency range is increased beyond the calibrated frequency range, the light turns off to indicate an uncalibrated state. However, the CAL SEQ light does *not* turn off when parameters other than the frequency range (start and stop frequency) are changed. Therefore, you may have an uncalibrated state while the CAL SEQ light is on.

  Be sure the receiver is calibrated for the *current* instrument settings.

---

13. Disconnect the preselector section's comb generator output and reconnect the signal source to receiver INPUT 2.

    Use the same cable during measurements that you used for calibration; the system has compensated for the loss in this cable. Remember to account for the losses in the calibration cable if you do not use that same during the actual measurement. Using other cables may introduce an amplitude error.

14. On the quasi-peak adapter, press (ON) to start quasi-peak detection.

15. The table on the front of the quasi-peak adapter section shows the sweep time to use with quasi-peak detection ON. With frequency in the 0.03 to 1 GHz band and span set to 1 MHz, the sweep time must at least 20 seconds.

16. Press (PEAK SEARCH), on the spectrum analyzer section, and read the marker amplitude on the display. Refer to Figure 4-11.

    For CW signals, the peak and quasi-peak values are the same.

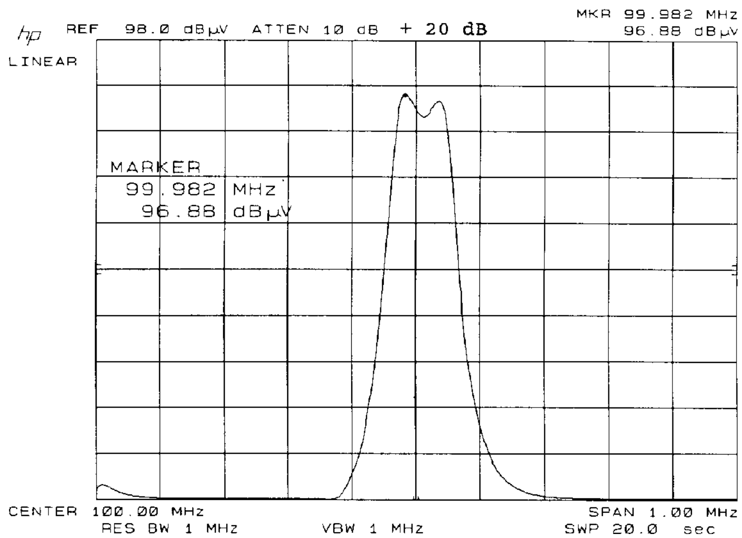


Figure 4-11. Quasi-Peak Measurement of a CW Signal

Example: Quasi-Peak Measurement (Broadband Signal)

This example uses a pulse generator as the broadband signal source.

1. Press (CLEAR WRITE) and the LIN key on the spectrum analyzer.
2. Change the reference level to bring the signal amplitude near the top of the display, to provide the best quasi-peak dynamic range for this measurement.
3. On the spectrum analyzer, press (SHIFT) C, to read amplitude in dBμV.
4. Disconnect the signal source. Connect the preselector section's COMB GENERATOR OUTPUT to the receiver input used in the measurement.

Note

Before calibrating the system:

- Make sure all equipment settings are correct. Do not change the resolution bandwidth, scale, attenuation, or input port after calibration. (The start and stop frequencies may be changed after calibration if the frequency range stays within the range at which the receiver was calibrated.)
- Manually set critical system parameters manually, such as resolution bandwidth. Parameters that are set manually will not change during the calibration routine; parameters that are still in the auto-coupled mode may change during the calibration routine.

---

5. Press CAL SEQ (START) on the preselector. Selected comb teeth are measured by the spectrum analyzer section. Any variation between the measured comb tooth amplitude and the value stored in the preselector section is corrected by an internal preselector section gain adjustment. The CAL SEQ LED flashes while the calibration routine runs.

Note

- After calibration, the CAL SEQ LED stays on, indicating that the system is calibrated over the current frequency range. If the frequency range is increased beyond the calibrated frequency range, the light turns off to indicate an uncalibrated state. However, the CAL SEQ light does *not* turn off when parameters other than the frequency range (start and stop frequency) are changed. Therefore, you may have an uncalibrated state while the CAL SEQ light is on.

  Be sure the receiver is calibrated for the *current* instrument settings.

---

6. Disconnect the preselector section's comb generator output and reconnect the signal source to receiver INPUT 1.

   Use the same cable during measurements that you used for calibration; the system has compensated for the loss in this cable. Remember to account for the losses in the calibration cable if you do not use that same during the actual measurement. Using other cables may introduce an amplitude error.

7. The table on the front of the quasi-peak adapter section shows the sweep time to use with quasi-peak detection ON. With a signal in the 0.03 to 1 GHz band and span set to 1 MHz, the sweep time must at least 200 seconds.

Note

An alternate method of receiver operation is the "fixed-tuned" mode. In this mode the span is set to 0 Hz, enabling the receiver to sweep at any speed, allowing the measurements can be performed quickly. While in fixed-tuned mode, the receiver measures only the frequency at which it is tuned (center frequency).

a. Find the frequency of the largest signal in the 15 MHz-to-16 MHz region by pressing (MAX HOLD) on the spectrum analyzer and allowing the display to fill in.

b. Press (PEAK SEARCH). Note the marker frequency.

c. Press (MKR -> CF). Tune the center frequency of the receiver to the marker frequency noted in the previous step.

d. Press (FREQUENCY SPAN) (0) (Hz) to set the receiver to zero span (time domain). The VOLUME control can be used to listen to the signal.

e. Set the sweep time to any desired speed and proceed to the next step in the measurement.

---

8. On the quasi-peak adapter, press (ON) to start the quasi-peak detector.

Note

- Though the peak values of the pulsed signals remain the same, as the repetition rate decreases the quasi-peak amplitude also decreases.
- Measurements will be accurate only if the signal of interest is above the first graticule from the bottom of the display. If the quasi-peak amplitude is below the first graticule, select (X10) on the quasi-peak adapter. This video amplifier boosts the signal by a factor of ten, allowing accurate measurements.
- If you use the quasi-peak adapter (X10) amplifier, subtract 20 dB from the marker amplitude shown on the display. Whenever a voltage is multiplied by a factor of ten, in terms of dB there is a 20 dB difference.

9. Press (MAX HOLD) on the spectrum analyzer and allow the receiver to sweep for several seconds.
10. Press (PEAK SEARCH) and read the marker amplitude on the display. Refer to Figure 4-12.

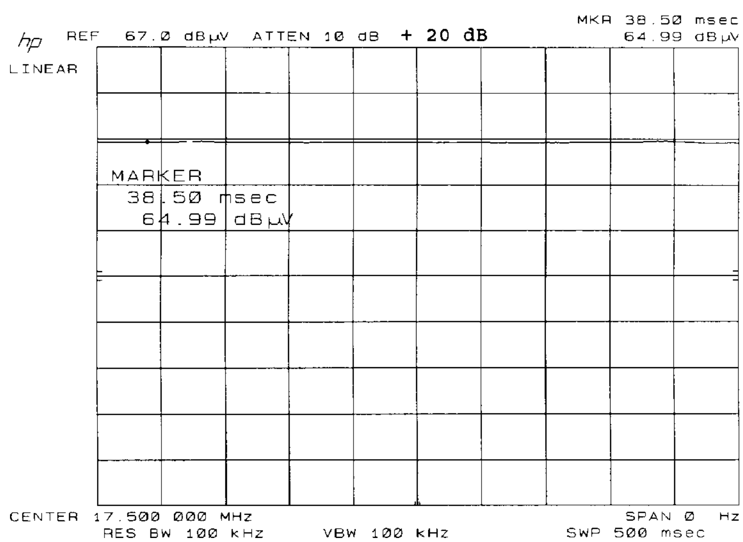


Figure 4-12. Quasi-Peak Measurement of a Broadband Signal

Example: Average Measurement (Broadband/Narrowband Signal)

This example makes an average measurement on a composite signal containing both narrowband and broadband signals, as shown in Figure 4-13.

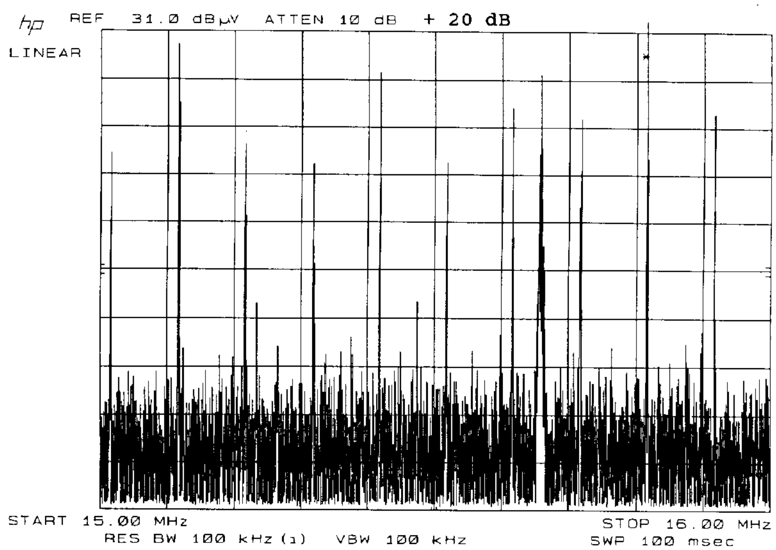


Figure 4-13. Composite Signal

1. Press (INSTR PRESET) on the quasi-peak adapter and on the preselector.
2. Select receiver INPUT 1.
3. Press the 0 (•) key on the switch driver to select the preamplifier BYPASS path. The LED in the key will light.
4. Connect the signal source to receiver INPUT 1.
5. Set the EMI receiver as follows:

(START FREQ)	15 MHz
(STOP FREQ)	16 MHz
(RES BW)	100 kHz
(VIDEO BW)	100 kHz
(SWEEP TIME)	100 ms
QPA BW	9 kHz
QPA	NORMAL
Amplitude scale	LIN

6. Because the signal of interest is in the 0.15 to 30 MHz region, the 9 kHz quasi-peak bandwidth (QPA BW) is selected. Refer to the table on the front of the quasi-peak adapter, and set the spectrum analyzer resolution and video bandwidths to 100 kHz.
7. According to the table, sweep time with the quasi-peak detector in NORMAL (or off) is 100 ms/MHz. Because the selected span is 1 MHz, the sweep time for this measurement must be at least 100 ms.

8. To read amplitude in dBμV, press (SHIFT) C on the spectrum analyzer.

9. Adjust the reference level to bring the signal near the top of the display.

10. Disconnect the signal source. Connect the preselector comb generator output to the receiver input used in the measurement.

Note

Before calibrating the system:

- Make sure all equipment settings are correct. Do not change the resolution bandwidth, scale, attenuation, or input port after calibration. (The start and stop frequencies may be changed after calibration if the frequency range stays within the range at which the receiver was calibrated.)
- Manually set critical system parameters manually, such as resolution bandwidth. Parameters that are set manually will not change during the calibration routine; parameters that are still in the auto-coupled mode may change during the calibration routine.

---

11. Press CAL SEQ (START) on the preselector. Selected comb teeth are measured by the spectrum analyzer section. Any variation between the measured comb tooth amplitude and the value stored in the preselector section is corrected by an internal preselector section gain adjustment. The CAL SEQ LED flashes while the calibration routine runs.

Note

- After calibration, the CAL SEQ LED stays on, indicating that the system is calibrated over the current frequency range. If the frequency range is increased beyond the calibrated frequency range, the light turns off to indicate an uncalibrated state. However, the CAL SEQ light does *not* turn off when parameters other than the frequency range (start and stop frequency) are changed. Therefore, you may have an uncalibrated state while the CAL SEQ light is on.

Be sure the receiver is calibrated for the *current* instrument settings.

---

12. Disconnect the preselector section's comb generator output and reconnect the signal source to receiver INPUT 1.

    Use the same cable during measurements that you used for calibration; the system has compensated for the loss in this cable. Remember to account for the losses in the calibration cable if you do not use that same during the actual measurement. Using other cables may introduce an amplitude error.

13. Press the (AUTO) key corresponding to the sweep time. This allows the sweep time to slow down automatically in the next step.

14. Reduce the video bandwidth. As the video bandwidth is reduced, the broadband signal amplitude will decrease while the narrowband signal amplitude remains unchanged. Continue to reduce the video bandwidth until the trace becomes smoothed and stops changing. Averaging occurs when the video bandwidth is smaller than the lowest pulse repetition frequency (PRF) of the signal being measured.

15. Press (PEAK SEARCH) on the spectrum analyzer and read the marker amplitude on the display. Refer to Figure 4-14.

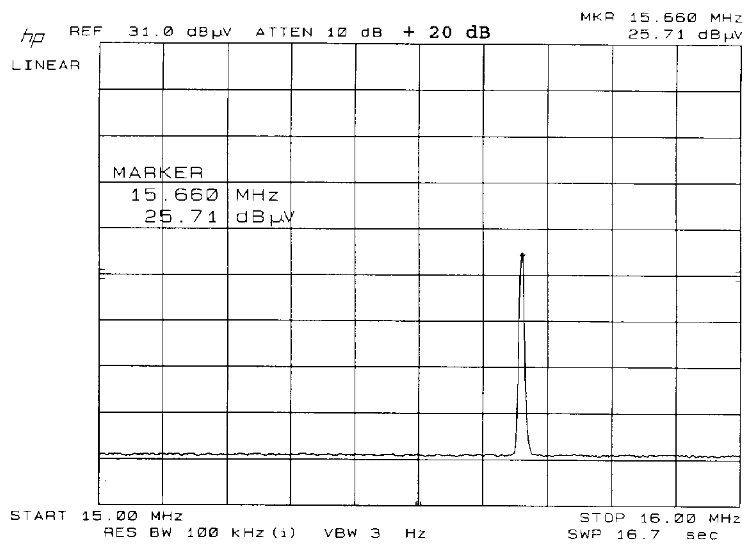


Figure 4-14. Average Measurement

CE03 (MIL-STD) Measurement

The MIL-STD 461 conducted emission test varies considerably from commercial conducted tests in terms of frequency range, test setup, transducer, and procedures.

Military conducted tests are performed in a shielded enclosure on a test bench with a copper or brass ground plane. The ground plane usually is bonded directly to the wall of the shielded enclosure. A major goal of the test setup is to isolate the EMI receiver and tested device from emissions caused by the power mains serving the enclosure. Isolation between the receiver and test sample is done by using separate phases of AC power for each, and by using an isolation transformer. For further isolation the receiver may be housed in a shielded anteroom area adjacent to the test sample room. The 10 μf feedthrough capacitors provide good isolation at high frequencies, but are less effective in the low frequency range to 10 kHz. See Figure 4-15.

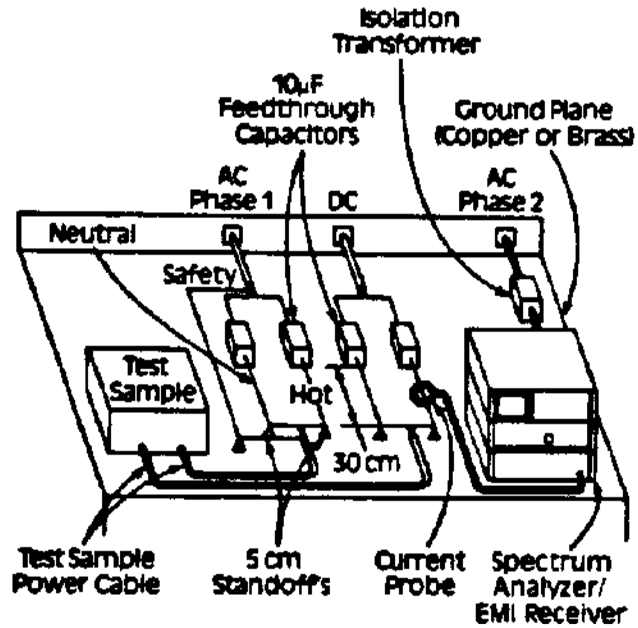


Figure 4-15. CE03 Power Lead Test Setup (Air Force and Navy)

Current probes are used as the transducer for most military conducted emission tests. The probe, which is clamped around the wire of interest, is exposed to the magnetic field produced by the current in the wire. The resulting output voltage of the probe is proportional to the current level, frequency, and probe characteristics such as permeability, cross-sectional area and number of turns.

To determine the current level associated with a particular voltage the transfer impedance (Z_T) of the probe must be known. By subtracting the transfer impedance (dBΩ) from the voltage (dBμV) measured on the receiver, the equivalent current (dBμA) can be calculated. As an alternate, a composite limit in dBμV may be determined by adding Z_T (dBΩ) to the limit (dBμA). Be careful not to exceed the current rating limitations of the probe as this could saturate the core of the probe and result in measurement errors. Matching transformers or inverse amplifiers may be employed to achieve a Z_T of 0 dBΩ over a wide frequency range. See Figure 4-16.

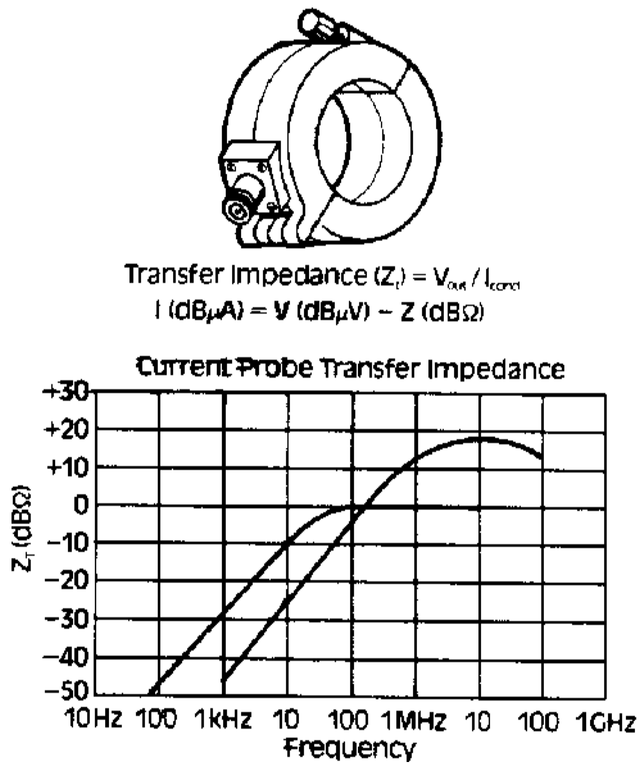


Figure 4-16. Current Probes as Transducers

Emissions may be defined as narrowband or broadband, relative to the bandwidth of the receiver. MIL-STD 461 generally has different limits for narrowband and broadband signals, requiring discrimination between the two and different measurement units.

A narrowband emission is by definition narrower than the receiver's bandwidth and its amplitude will not vary with bandwidth. The amplitude of a broadband emission, however, will vary with bandwidth and the measurement taken must be referred to a particular bandwidth. Thus, narrowband measurements are made in units of voltage, current, or field strength while broadband measurements are made in these same units referred to a bandwidth, usually 1 MHz. If broadband measurements are made in a bandwidth different from the reference bandwidth, a correction factor must be added to the measurement.

For coherent broadband signals, use a 20log correction factor. For incoherent (random) broadband signals, a 10log relationship is valid. Because it can be difficult to discriminate between coherent and incoherent signals, use of the 20log factor will ensure finding the worst case result. See Figure 4-17.

Narrowband Units: dBμV, dBμA, DBpT

Broadband Units: dBuV/MHz, dBuA/MHz

Bandwidth Correction

$$\text{Factor} = 20 \log \left(\frac{B_R}{B_I} \right)$$

B_R = Reference Bandwidth

B_I = Measuring Instrument Impulse Bandwidth

Example: 50 dBuV Measured in 10 kHz Impulse BW, Ref BW = 1 MHz

$$50 \text{ dBuV} + 20 \log \left(\frac{1 \text{ MHz}}{.01 \text{ MHz}} \right)$$

$$= 90 \text{ dBuV/MHz}$$

Figure 4-17. Bandwidth Correction Factor

RE02 (MIL-STD) Measurement

MIL-STD 461 RE02 is designed to measure radiated emissions. In many respects, it is similar to the CE03. This test measures interference radiating from a test device over a frequency range of 14 kHz to 10 GHz.

The RE02 setup shown in Figure 4-18 is for non-portable equipment that is permanently connected to a vehicle, system, or installation. For portable equipment such as hand tools, office machines, and manpack-operable equipment, the test sample is placed on a one-meter-high non-metallic test stand facing the antenna. The test is made in a shielded enclosure with the receiving antenna at least one meter away from all walls of the enclosure. The measurement equipment should be placed outside the enclosure or in a shielded anteroom to prevent this equipment from interfering with the measurement.

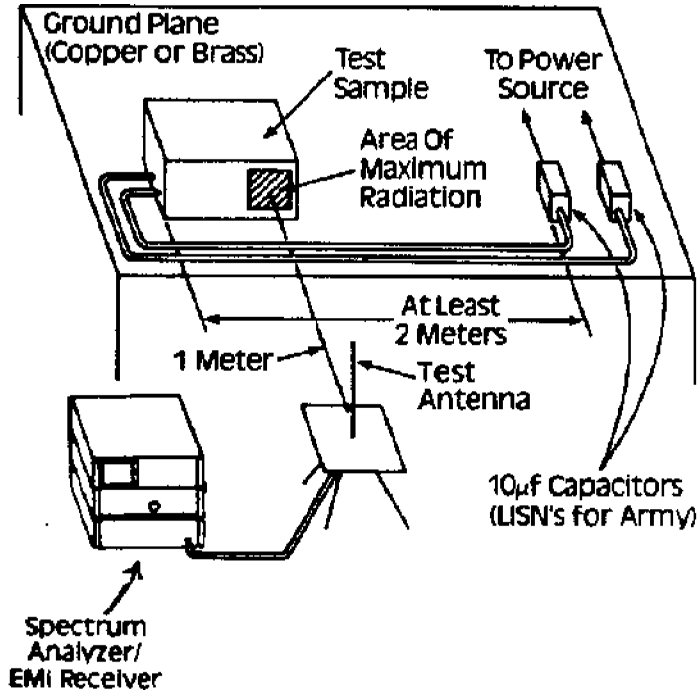


Figure 4-18. RE02 Test Setup

The RE02 requirements are applicable to radiated emissions from equipment and subsystems, cables, and interconnecting wiring. Emissions from antennas are not included. As with other tests, the intent of the procedure is to simulate the actual installation conditions of the equipment. RE02 limits and procedures are:

- Narrowband test: 14 kHz to 10 GHz.
- Broadband test: 14 kHz to 1 GHz.
- Does not apply to radiation from antennas.
- Vertical and horizontal polarization must be tested above 30 MHz.
- Probe with a loop to find the point of maximum emission and orient this point one meter from antenna.
- For large equipment or systems, the antenna should be moved to test a one-meter distance from various points.
- Typical antennas:

  14 kHz to 30 MHz (active rod) .... HP 11966B

  30 to 300 MHz (biconical) .... HP 11966C

  200 MHz to 2 GHz (double-ridged horn) .... HP 11966I

  1 to 18 GHz (double-ridged horn) .... HP 11966E

CISPR 22 Measurements

An advantage of using the EMI receiver for making EMI measurements is the receiver's quick-look/full-span capability. This allows you to identify problem areas quickly, then zoom in for further analysis.

Example: Conducted Emission Measurement

The first step in making a conducted emission measurement is to use peak detection to locate problem areas. The suggested settings for the quasi-peak adapter are:

INSTR FUNCTION .... NORMAL

FREQUENCY BAND .... 150 kHz–30 MHz

QUASI-PEAK DETECTOR .... (OFF)

If you observe emissions that exceed the regulatory limits at some frequencies, you may zoom in for further analysis. After you adjust the reference level and set the span and sweep time, turn on the quasi-peak detector.

(RES BW) .... 100 kHz

(VIDEO BW) .... 100 kHz

(START FREQ) .... lower frequency of regulatory limit

(450 kHz for the FCC, 150 kHz for VDE/CISPR)

(STOP FREQ) .... 30 MHz

(ATTEN) .... 10 dB

Receiver Input .... Input 1

(SWEEP TIME) .... ≥.1 sec/MHz x span

(for example, 3 seconds for a 30 MHz span)

If the amplitude is below the limit, then the equipment under test (EUT) passes the test.

Example: Radiated Emission Measurements

The procedure used to make radiated emission measurements depends on the nature of the test site. If you make measurements in a semi-anechoic enclosure or at a remote site where ambient signals are below the limits, you may use a quick-look/full-span procedure similar to the procedure used to make conducted measurements. If, on the other hand, you make measurements at an open site where numerous ambient signals are above the limits, then you must use one of these two procedures:

- Make preliminary measurements in a shielded enclosure where ambient signals are not present. Frequencies at which emissions are noted are then rechecked at an open site. (For CISPR measurements, a shielded enclosure can be used to locate emissions, but not to measure emission amplitudes.)

  or

- Select a relatively narrow span (for example, 1 MHz) then tune the center frequency, keeping track of emissions as they are observed. The relatively narrow span is required in order to distinguish between ambient and signals from the EUT.

  At open sites, ambient signals must be distinguished from signals emitted by the EUT.

  - Compile a list of ambient signals that are always or almost always present in a given environment. This allows some signals to be recognized as ambients based solely on the frequency of observation.
  - Sounds produced by emissions from a particular EUT may be unique and recognizable. Similarly, ambient signals can often be identified by sound alone. For this reason, a speaker is built into the quasi-peak adapter.

□ The appearance of signals provides a third clue about their origin. Ambient signals often have characteristic appearances, as do emission from many devices being tested. See Figure 4-19.

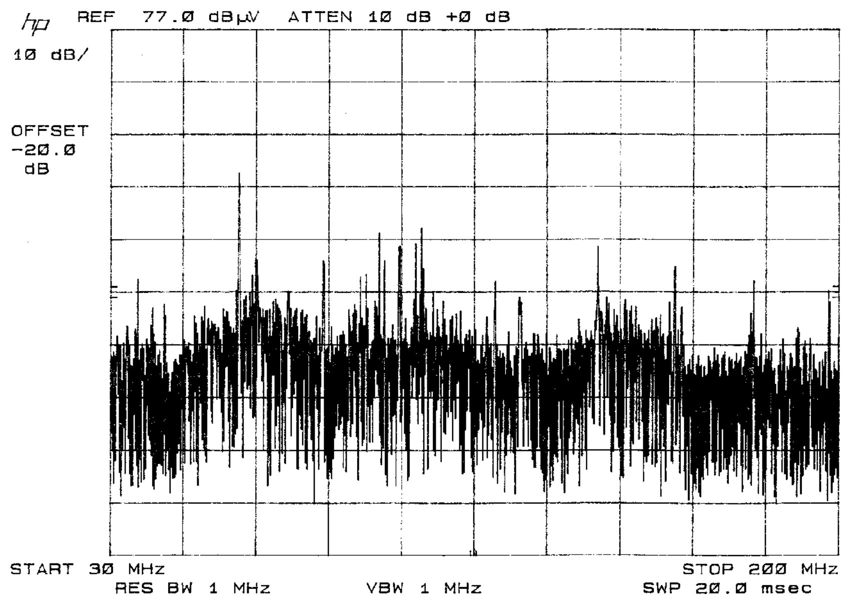


Figure 4-19. Characteristic Appearance of Radiated Emissions

□ The conclusive way to distinguish between ambient and emitted signals is to turn off the EUT. If the signals disappear, they were being emitted by the EUT. See Figure 4-20.

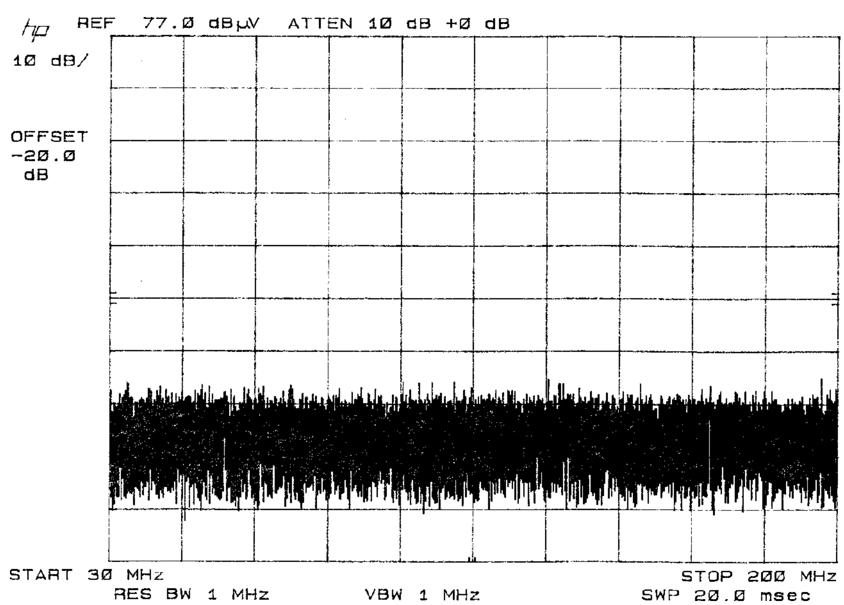


Figure 4-20. Equipment Under Test (EUT) Turned Off

As an additional complication in making radiated measurements, some regulatory test procedures require the EUT to be rotated azimuthally or that the antenna be raised and lowered to find the positions which yield the maximum emissions levels (as displayed on the receiver's CRT). This can be time consuming if these rotations and elevations must be made for emissions at a large number of frequencies. This is unavoidable at sites that have numerous ambients. At sites with a small number of ambients, however, the quick-look/full-span capability of the EMI receiver can greatly speed up measurements. The effect on emissions due to rotating the EUT or raising the antenna can be observed immediately. The MAX HOLD capability of the receiver is very useful for this work. Only those emissions which exceed the composite limit line need to be investigated further.

Example: Radiated Emissions

As with conducted emission measurements, radiated emission measurements are first made using peak detection.

INSTR FUNCTION .... NORMAL

FREQUENCY BAND ....03–1 GHz

QUASI-PEAK DETECTOR .... (OFF)

If you observe emissions that exceed the regulatory limits at some frequencies, you may zoom in for further analysis. After you adjust the reference level and set the span and sweep time, turn on the quasi-peak detector.

(RES BW) ....1 MHz

(VIDEO BW) ....1 MHz

Frequency Settings:

Full-span method

(START FREQ) ....Lower frequency limit of antenna

(STOP FREQ) ....Upper frequency limit of antenna

Narrow-span Method (for example, 1 MHz)

(CENTER FREQUENCY) ....Tuned between 30 MHz to 1 GHz

(ATTEN) .... 10 dB

Receiver Input ....Input 2

(SWEEP TIME) .... $\geq$.2 sec/GHz x span

(for example, 40 milliseconds for a 200 MHz span)

Add the appropriate antenna factor and any cable losses to the receiver's voltage reading. If the measured amplitude is less than or equal to the composite limit, the EUT passes. Otherwise the EUT fails.

5

Downloadable Program (DLP) Measurements

In this chapter, you'll learn how to perform EMI measurements with the HP 85867A downloadable program (DLP). This DLP is loaded into the memory of every HP 8572A EMI receiver.

Example: Quasi-peak measurements on broadband signals, using a DLP

Note

- Complete manual calibration over the desired frequency range before starting the DLP.
- The source used is a pulse generator in the 5 MHz range.
- In this example, only receiver INPUT 1 is calibrated (for CISPR band B). Separate calibration data can be stored for both INPUT 1 and INPUT 2 of the preselector section. This lets you calibrate the system over a wide frequency range. You may prefer to calibrate each input to correspond to a particular band before making measurements, because you then would not have to calibrate the system many times, over smaller frequency ranges.

1. Place the DLP overlay on the spectrum analyzer section numeric keypad.
2. Press (INSTR PRESET) on the quasi-peak adapter and on the preselector.
3. Press the INPUT 1 selection key on the preselector.
4. Place the preamplifier in BYPASS mode by pressing the switch driver 0 (•) key. The LED in the key will light.
5. Connect the signal source to receiver INPUT 1.
6. Set the receiver to these settings:

(START FREQ) .... 150 kHz
(STOP FREQ) .... 30 MHz
(REW BW) .... 100 kHz
(VIDEO BW) .... 100 kHz
QPA BW .... 9 kHz
QPA .... NORMAL
Scale .... LIN

Because the signal of interest is in the 0.15 to 30 MHz region (5 MHz), the 9 kHz quasi-peak bandwidth (QPA BW) is selected. According to the table on the front of the quasi-peak adapter, resolution and video bandwidths are 100 kHz.

7. To read amplitude in dBμV, press (SHIFT) C on the spectrum analyzer.
8. Adjust the reference level to bring the signal near the top of the display.
9. Disconnect the signal source. Connect the RF preselector comb generator output to receiver INPUT 1.

Note Before calibrating the system:

- Make sure all equipment settings are correct. Do not change resolution bandwidth, scale, attenuation, or input port after calibration. (The start and stop frequencies may be changed after calibration if the frequency range stays within the range at which the receiver was calibrated.)

  To ensure best amplitude accuracy when making measurements, recalibrate the system whenever you change a parameter.

- Manually set critical system parameters, such as resolution bandwidth. Parameters that are set manually will not change during the calibration routine; parameters that are still in the auto-coupled mode may change during the calibration routine.

- On the preselector, press CAL SEQ (START). The spectrum analyzer will measure selected comb teeth. Any variation between the measured comb tooth stored in the preselector section is corrected by an internal preselector section gain adjustment. The CAL SEQ LED flashes while the calibration routine runs.

Note

- After calibration, the CAL SEQ LED stays on, indicating that the system is calibrated over the current frequency range. If the frequency range is increased beyond the calibrated range, the light turns off, to indicate an uncalibrated state. However, the CAL SEQ light does *not* turn off when parameters other than the frequency range (start and stop frequency) are changed. Therefore, you may have an uncalibrated state while the CAL SEQ light is still on.

  Be sure the receiver is calibrated for the *current* instrument settings.

- Disconnect the preselector section's comb generator output and reconnect the signal source to Input 1 of the preselector section.

  Use the same cable during measurements that you used for calibration, because the system has compensated for the loss in this cable. Remember to account for the losses in the calibration cable if you do not use that same cable during the actual measurement. Using other cables may introduce an amplitude error.

- To start the DLP, press [SHIFT] [4] [Hz] on the spectrum analyzer. Notice that `EMI Receiver` appears in the upper left portion of the display, indicating that the DLP is activated. Refer to Figure 5-1.
- To select CISPR band B (150 kHz to 30 MHz), press [SHIFT] [2] [Hz].

  The resolution bandwidth on the display has changed from 100 kHz to 9 kHz.
- To select receiver INPUT 1, place the preamplifier in BYPASS mode by pressing the 0 [•] key on the switch driver. The LED in the key will light.
- Place a marker on the signal of interest.
- Press [SHIFT] [5] [Hz] to start the quasi-peak measurement.

Note

- The DLP automatically sets the equipment to the proper settings. For quasi-peak measurements, the receiver is switched to linear mode only during the measurement; after the measurement is completed, the receiver is switched back to log mode.
- The DLP places a marker on the measured signal, and displays the quasi-peak amplitude at the bottom of the display (directly under the measured signal). See Figure 5-1.
- [SHIFT] [1] [4] [Hz] clears all DLP markers.
- Access the list of all DLP functions by pressing [SHIFT] [9] [Hz].

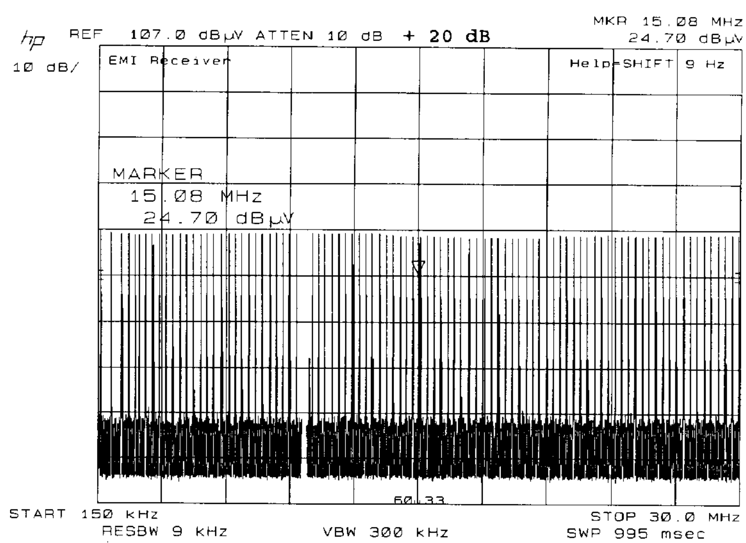


Figure 5-1. Quasi-Peak Measurement Using the HP 85867A DLP

- Position the marker on another signal, and perform another quasi-peak measurement. Up to six quasi-peak values can be measured.

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