Making Measurements with the HP 11757B Multipath Fading Simulator

SERIAL NUMBERS

Attached to the rear panel of the instrument is a serial number plate. The serial number is in the form: 0000A00000. The first four digits and the letter are the serial number prefix. The last five digits are the suffix. The prefix is the same for identical instruments; it changes only when a configuration change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument.

This manual applies to instruments with serial numbers prefixed 3108A and above.

HP Part No. 11757-90050

5301 Stevens Creek Blvd., Santa Clara, California 95052
Printed in USA

By internet, phone, or fax, get assistance with all your test and measurement needs.

Table 1-1 Contacting Agilent

Online assistance: `www.agilent.com/find/assist`

United States
(tel) 1 800 452 4844

Latin America
(tel) (305) 269 7500
(fax) (305) 269 7599

Canada
(tel) 1 877 894 4414
(fax) (905) 282-6495

Europe
(tel) (+31) 20 547 2323
(fax) (+31) 20 547 2390

New Zealand
(tel) 0 800 738 378
(fax) (+64) 4 495 8950

Japan
(tel) (+81) 426 56 7832
(fax) (+81) 426 56 7840

Australia
(tel) 1 800 629 485
(fax) (+61) 3 9210 5947

Asia Call Center Numbers

Country	Phone Number	Fax Number
Singapore	1-800-375-8100	(65) 836-0252
Malaysia	1-800-828-848	1-800-801664
Philippines	(632) 8426802 1-800-16510170 (PLDT Subscriber Only)	(632) 8426809 1-800-16510288 (PLDT Subscriber Only)
Thailand	(088) 226-008 (outside Bangkok) (662) 661-3999 (within Bangkok)	(66) 1-661-3714
Hong Kong	800-930-871	(852) 2506 9233
Taiwan	0800-047-866	(886) 2 25456723
People's Republic of China	800-810-0189 (preferred) 10800-650-0021	10800-650-0121
India	1-600-11-2929	000-800-650-1101

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Digital Radio Testing

This guide contains detailed instructions for performing digital radio tests with the HP 11757B Multipath Fading Simulator. The tests detailed in this chapter include:

- Static M-Curve Measurement
- Dynamic M-Curve Measurement
- Dynamic S-Curve Measurement
- Hysteresis M-Curve Measurement
- Recovery Time Test
- Bit Error Rate Test

Note

If you have an option 001 HP 11757B Multipath Fading Simulator, this guide does not apply to your instrument. Use the Operating and Programming Reference.

BERT

The tests detailed in this guide use a Bit Error Rate Test Sets (BERT) to supply and receive data, and count errors. There are other alternatives. Some digital radio systems have their own internal error checking scheme with an error pulse output. This will allow elimination of the BERT. Another possibility is simply using the Alarm Output of the radio, and simplifying tests to lock/out-of-lock transition measurements.

Connecting the HP 11757B to a BERT

The HP 11757B can work with many different types of Bit Error Rate Test Sets (BERT). However, not all BERT operate the same way and it is important for you to understand how to correctly interface different types of BERTs to the HP 11757B.

Triggering

The (RADIO SETUP) key can be used to adjust the triggering of the ERROR PULSE INPUT and ALARM INPUT connectors to coincide with the BERT you are using. The ERROR PULSE INPUT line can be terminated in ECL/75Ω, TTL/75Ω, or TTL/ 10kΩ. In addition, an ERROR PULSE INPUT variable threshold can be selected instead of ECL or TTL thresholds. ERROR PULSE INPUT variable threshold is only available in serial prefixes 3235A and above. The HP 11757B will always trigger on the rising edge of signals applied to the ERROR PULSE INPUT connector.

The ALARM INPUT connector is always terminated in TTL/10kΩ. However, the edge (positive or negative going) that the Fader triggers on can be chosen by you. Select the one that works with your BERT.

Error Pulse Signals during Out-of-Lock Situations

It is very important to understand what kind of "ERROR PULSE" signal your BERT puts out when the radio is out-of-lock. Ideally, when the radio is out-of-lock, the BERT will put out a very fast stream of pulses indicating a very high Bit Error Rate (BER). If this is the case with your BERT, all you need do for BER Criteria measurements is connect the "ERROR PULSE" of your BERT to the ERROR PULSE INPUT connector on the front panel of the Fader.

On the other hand, some BERTs turn off their "ERROR PULSE" signal when an out-of-lock state is detected. If this is the case with your BERT, you not only need

to connect the "ERROR PULSE" of the BERT to the ERROR PULSE INPUT of the Fader, you must also connect an Alarm line from either your radio or your BERT to the ALARM INPUT line of the Fader. This is because when no errors are present on the ERROR PULSE INPUT line, the Fader cannot tell the difference between an out-of-lock situation and one were the bit error rate is truly zero. The Fader needs the ALARM INPUT line to determine which of these situations is occurring.

Static M-Curve Measurement

Equipment Setup

1. The basic setup for all measurements involves interrupting the IF path of the digital radio with a fading simulator. If a Bit Error Rate Tester (BERT) is used, connect the appropriate data channels. In the figure below, the DS3 data out from the BERT is connected to the DS3 input of the transmitter, and the BASEBAND output of the receiver to the DS3 data input of the BERT. DS3 is used only as an example; if your radio requires another data format, use a BERT that produces it. The ERROR OUTPUT of the BERT is connected to the ERROR PULSE INPUT of the Fader. This input can be set to match the impedance of the BERT.

Note

Some digital radios have their own error outputs and internal data checking schemes that limit the need for a BERT. See the manual for your radio if you wish to connect the ERROR PULSE INPUT of the Fader directly to the radio. There may be a connection that must be made between two ports of the radio system for this to work.

2. The RF output of the transmitter is connected to the RF input of the receiver. Appropriate attenuation is used to protect the RF input of the receiver. Check the manual of the receiver and the transmitter to insure safe levels for the receiver input.
3. The Alarm Output on the receiver can be connected to the Alarm Input on the Fader. This connection is only needed for recovery tests, and tests where no BERT is available and you want to use the ALARM INPUT to indicate failure.

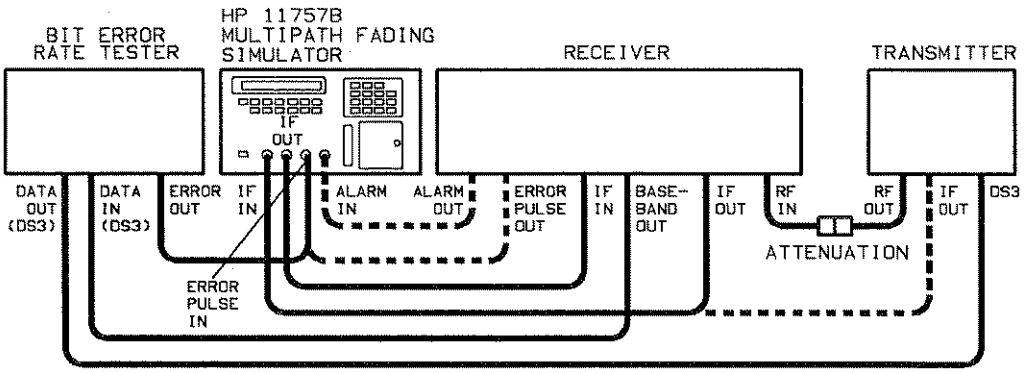

Figure 1-1. Static M-Curve Measurement Test Setup

4. Connect the Fader, BERT and Digital Radio as shown in figure 1-1.
5. Press (MEAS TYPE). Use the (▲) key until the display shows **STATIC**, then press (ENTER).

Radio Setup

1. Press (RADIO SETUP).
2. The first item displayed reads **0 BIT RATE**. Press (ENTER) to see what the bit rate is set to. The preset value is 44.7 MHz (DS3). If you want to set another bit rate use the arrow or data keys and press (ENTER).
3. The display then reads **1 ERROR TERM**. Press (ENTER) to find the present setting. Use the (▲) key to toggle to the termination appropriate for your BERT, then press (ENTER).
4. The display then reads **1.1 ERROR THR**. Press (ENTER) to see what the variable error threshold is set to. If you want to set a different threshold use the arrow or data keys. Choose a threshold setting (combined with the ERROR TERM setting) that is appropriate for your BERT, then press (ENTER).

Error pulse input variable threshold is only available in serial prefixes 3235A and above.

5. The display next reads **2 ALARM POL**. You will not need to set this unless you are planning to use the ALARM INPUT for this test. Press the (▲) key to advance to the next feature.

6. The display should read **3 SCALE FACT**. The PRESET scale factor is 1.0, and this should only be changed if your BERT's error output is sending out error pulses at a rate other than it is detecting them. For instance, if the error output of your BERT is sending one pulse for every four errors, set the scale factor to four. To set the SCALE FACTOR press (ENTER) when **3 SCALE FACT** is displayed, then use the (▲) arrow key to display the factor your want, then press (ENTER) again.

7. The display should now read 4 **AGC ON/OFF**. AGC (Automatic Gain Control) maintains the power level of the spectrum sent through the Fader. You may want the power level to remain constant even though a notch is sweeping through the band. If you are interrupting the digital radio after its own internal ALC or AGC circuitry, you may have to use the Fader's internal AGC circuitry to prevent non-fade effects from distorting measurement results. Press (ENTER), then use the (▲) key to display AGC ON if AGC OFF is displayed. Press (ENTER) to exit.

8. The display should now read **5 AGC FREQ**. If the AGC is ON, you should ensure that you have the proper AGC center frequency set. Press (ENTER) and the display will change "**AGC FRQ 070.0**" or whatever frequency may have been set previously. Use the arrow or data keys to set the desired frequency, then press (ENTER).

9. The display should now read "**6 AGC BW**". This allows you to set the bandwidth to distribute the

AGC power over. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a value. Use a value close to the radio's channel bandwidth, then press (ENTER).

10. The display should now read "**7 WAIT TIME**". This allows you to set the wait time after every notch movement. This wait allows your radio some settling time before a Bit Error Rate measurement is made by the Fader. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
11. The display should now read "**8 MAX SLEW**". This allows you to set the notch's maximum slew rate during measurements. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
12. The display should now read "**9 SYMBL TIME**". This allows you to set the symbol time of your radio. You will not need to set this unless you are planning to perform a CCIR DFM calculation. The radio setup is now complete. CCIR DFM is only available in serial prefixes 3215A and above.

Measurement Setup

1. Press (MEAS SETUP). This will access a series of parameters to enter to set the Fader up for a measurement.
2. The first item displayed under (MEAS SETUP) is "**0 DATA PTS**". This specifies the number of linearly spaced frequencies to calculate and measure in the band you have selected. Press (ENTER) to access, then use the arrow or data keys to enter a value, then press (ENTER) to get the next parameter. 11 is a good value to enter to keep the measurement time down.
3. The second and third items will be "**1 STRT FRQ**" and "**2 STOP FRQ**". These access the start and stop

frequencies for the notch. Press (ENTER) to access STRT FR, then use the arrow or data keys to set a value in MHz (use 45 for this example), then press (ENTER). The display should show **2 STOP FRQ**. Press (ENTER) and set a value using data or arrow keys (95 for this example), then press (ENTER).

4. The next two items displayed are "**3 START RATE**" and "**4 STOP RATE**". These parameters are used for S-Curve measurements and will be ignored when making M-Curve measurements. Press (▼) until the display reads "**5 ERROR BITS**".

5. **ERROR BITS** determines the number of errors that are counted before a final bit error rate calculation is made. You may enter powers of 2 from 2 to 15 (4 , 8, . . . , 32768). Press (ENTER) to access and use the (▲) arrow key to get 2^{11}, which equals 2048. Press (ENTER).

6. The next displayed item is "**6 PHASE**". Press (ENTER) and use the (▲) arrow key to toggle between the three options: **MIN, NON-MIN and BOTH**. When both is displayed, press (ENTER).

7. The Fader will then display "**7 CRITERIA**", which indicates the decision criteria for drawing an M-Curve. Press (ENTER) and use the (▲) arrow key to toggle through the options: ALARM, 1E-3, 3E-4, 1E-4, 3E-5, 1E-5 and 1E-6. Unless you have opted to use the ALARM INPUT to make the measurement, select one of the other criteria and press (ENTER).

8. The display will then read "**8 SPEED**". This applies only to Dynamic M-Curve, and will be ignored for Static M-Curve measurements. Press (▼) to move to the next feature.

9. The display will now read "**9 DEVIATION**". This applies only to Dynamic M-Curve, and will be

ignored for Static M-Curve measurements. Press ▼ to move to the next feature.

10. The display should then read "**10 EDGE ZOOM**". This feature increases measurement resolution near the edges of the measurement, but will only be activated if you have specified at least 15 data points (we specified just 11 earlier in this example). Use the ▼ key to move to the next feature.
11. The display will now read "**11 MK SEARCH**". This algorithm will initiate worst case searches during the measurement. For a full description see MK SEARCH in the Local and Remote Reference Manual. Since this feature can increase measurement time press ENTER to ensure that it is set to OFF, then press ENTER again.
12. The display will now read "**12 DFM TYPE**". This allows selection of the type of DFM calculation performed. For a full description see MEAS in the Local Reference. The measurement setup is now complete. DFM TYPE is only available in serial prefixes 3215A and above.

Measurement

You are now ready to make the actual measurement. Press MEAS. The display will indicate that the measurement is in progress. When the measurement has finished, the display will return to normal. If you press the PRESET/LOCAL key on the Fader front panel during the measurement, the measurement will be interrupted and stop.

Printing Results

1. After the measurement has been completed, you can print the results. First, set the printer destination. Press SHIFT MEAS (PRINTER), then use the ▲ arrow key to select between **1 DEST** and **2 PRINT**. Press ENTER on **1 DEST** to set the destination. Use ▲ to select between **EXTERN** and **INTERN**.

Press (ENTER) on **INTERN** to set the printout for the internal thermal printer.

Note

Once the destination has been set, you do not need to reset it before every printing. **NONE** is the PRESET setting.

2. Next, print the parameters. Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **PRVIEW**, the press (ENTER). The printer will print the parameters you used to make the measurement.
3. Next, print the data (graphic results). Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **DATA**, then press (ENTER). The printer will now print the results.

Dynamic M-Curve Measurement

Equipment Setup

1. The basic setup for all measurements involves interrupting the IF path of the digital radio with a fading simulator. If a Bit Error Rate Tester (BERT) is used, connect the appropriate data channels. In the figure below, the DS3 data out from the BERT is connected to the DS3 input of the transmitter, and the BASEBAND output of the receiver to the DS3 data input of the BERT. The ERROR OUTPUT of the BERT is connected to the ERROR PULSE INPUT of the Fader. This input can be set to match the impedance of the BERT.

Note

Some digital radios have their own error outputs and internal data checking schemes that limit the need for a BERT. See the manual for your radio if you wish to connect the ERROR PULSE INPUT of the Fader directly to the radio. There may be a connection that must be made between two ports of the radio system for this to work.

2. The RF output of the transmitter is connected to the RF input of the receiver. Appropriate attenuation is used to protect the RF input of the receiver. Check the manual of the receiver and the transmitter to insure safe levels for the receiver input.
3. The Alarm Output on the receiver can be connected to the Alarm Input on the Fader. This connection is only needed for recovery tests, and tests where no BERT is available and you want to use the ALARM INPUT to indicate failure.

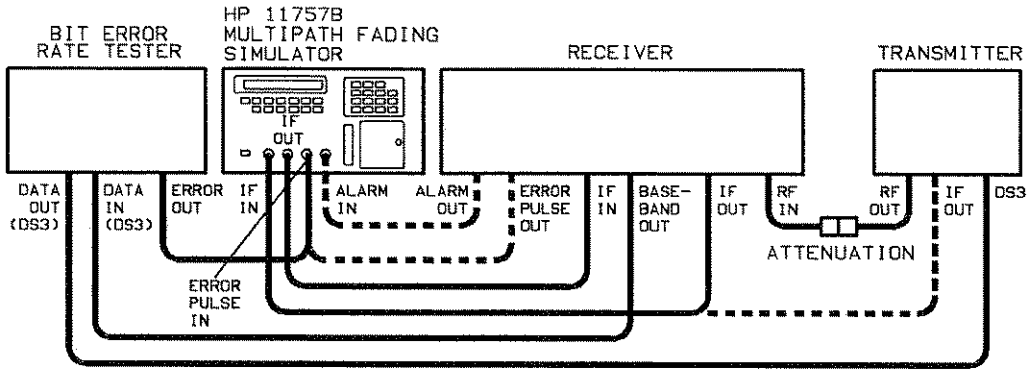

Figure 1-2. Dynamic M-Curve Measurement Test Setup

4. Connect the Fader, BERT and Digital Radio as shown in figure 1-2.
5. Press (MEAS TYPE). Use the (▲) key until the display shows **DYNM M**, then press (ENTER).

Radio Setup

1. Press (RADIO SETUP).
2. The first item displayed reads **0 BIT RATE**. Press (ENTER) to see what the bit rate is set to. The preset value is 44.7 MHz (DS3). If you want to set another bit rate use the arrow or data keys and press (ENTER).
3. The display then reads **1 ERROR TERM**. Press (ENTER) to find the present setting. Use the (▲) key to toggle to the termination appropriate for your BERT, then press (ENTER).
4. The display then reads **1.1 ERROR THR**. Press (ENTER) to see what the variable error threshold is set to. If you want to set a different threshold use the arrow or data keys. Choose a threshold setting (combined with the ERROR TERM setting) that is appropriate for your BERT, then press (ENTER).

Error pulse input variable threshold is only available in serial prefixes 3235A and above.

5. The display next reads **2 ALARM POL**. You will not need to set this unless you are planning to use the ALARM INPUT for this test. Press the (▼) key to advance to the next feature.

6. The display should read **3 SCALE FACT**. The PRESET scale factor is 1, and this should only be changed if your BERT's error output is sending out error pulses at a rate other than it is detecting them. For instance, if the error output of your BERT is sending one pulse for every four errors, set the scale factor to four. To set the scale factor press (ENTER) when **3 SCALE FACT** is displayed, then use the (▲) arrow key to display the factor your want, then press (ENTER) again.

7. The display should now read **4 AGC ON/OFF**. AGC (Automatic Gain Control) maintains the power level of the spectrum sent through the Fader. You may want the power level to remain constant even though a notch is sweeping through the band. If you are interrupting the digital radio after its own internal ALC or AGC circuitry, you may have to use the Fader's internal AGC circuitry to prevent non-fade effects from distorting measurement results. Press (ENTER), then use the (▲) key to display AGC ON if AGC OFF is displayed. Press (ENTER) to exit.

8. The display should now read **5 AGC FREQ**. If the AGC is ON, you should ensure that you have the proper AGC center frequency set. Press (ENTER) and the display will change "**AGC FRQ 070.0**" or whatever frequency may have been set previously. Use the arrow or data keys to set the desired frequency, then press (ENTER).

9. The display should now read "**6 AGC BW**". This allows you to set the bandwidth to distribute the

AGC power over. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a value. Use a value close to the radio's channel bandwidth, then press (ENTER).

10. The display should now read "**7 WAIT TIME**". This allows you to set the wait time after every notch movement. This wait allows your radio some settling time before a Bit Error Rate measurement is made by the Fader. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
11. The display should now read "**8 MAX SLEW**". This allows you to set the notch's maximum slew rate during measurements. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
12. The display should now read "**9 SYMBL TIME**". This allows you to set the symbol time of your radio. You will not need to set this unless you are planning to perform a CCIR DFM calculation. The radio setup is now complete. CCIR DFM is only available in serial prefixes 3215A and above.

Measurement Setup

1. Press (MEAS SETUP). This will access a series of parameters to enter to set the Fader up for a measurement.
2. The first item displayed under (MEAS SETUP) is "**0 DATA PTS**". This specifies the number of linearly spaced frequencies to calculate and measure in the band you have selected. Press (ENTER) to access, then use the arrow or data keys to enter a value, then press (ENTER) to get the next parameter. 11 is a good value to enter to keep the measurement time down.
3. The second and third items will be "**1 STRT FRQ**" and "**2 STOP FRQ**". These access the start and stop

frequencies for the notch. Press (ENTER) to access STRT FRQ, then use the arrow or data keys to set a value in MHz (use 50 for this example), then press (ENTER). The display should show **2 STOP FRQ**. Press (ENTER) and set a value using data or arrow keys (95 for this example), then press (ENTER).

4. The next two items displayed are "**3 START RATE**" and "**4 STOP RATE**". These parameters are used for S-Curve measurements and will be ignored when making M-Curve measurements. Press (▼) until the display reads "**5 ERROR BITS**".

5. **ERROR BITS** determines the number of errors that are counted before a final bit error rate calculation is made. You may enter powers of 2 from 2 to 15 (4 , 8, ... , 32768). Press (ENTER) to access and use the (▲) arrow key to get 2^{11}, which equals 2048. Press (ENTER).

6. The next displayed item is "**PHASE**". Press (ENTER) and use the (▲) arrow key to select between the three options: **MIN, NON-MIN and BOTH**. When both is displayed, press (ENTER).

7. The Fader will then display "**CRITERIA**", which indicates the decision criteria for drawing an M-Curve. Press (ENTER) and use the (▲) arrow key to toggle through the options: ALARM, 1E-3, 3E-4, 1E-4, 3E-5, 1E-5 and 1E-6. Unless you have opted to use the ALARM INPUT to make the measurement, select one of the other criteria and press (ENTER).

8. The display will then read "**8 SPEED**". This parameter determines the peak frequency per second at which the notch oscillations will take place for Dynamic M-Curve measurements. Press (ENTER) to access. Speed is entered in megahertz per second. The PRESET is 300 MHz per second. Use the (▼) arrow key to toggle between the allowable values: 10,

30, 100, 300, 600 and 1200 MHz per second. Choose a value and press (ENTER). Refer to figure 1-3.

9. The display will now read "**9 DEVIATION**". This refers to the maximum deviation of frequency the notch will take as it makes a measurement. See figure below. Use the arrow or data keys to select a value (±1, ±2, ±4, ±6, ±10 and ±20 MHz). Do not set a value that will cause the starting or stopping frequency for your measurement to exceed allowable bounds. For instance, if you set the start frequency at 45 MHz, and set the deviation at ±20 MHz, an error message will result (45 − 20 = 25, and 25 MHz is below the minimum frequency for Fader). There is a guardband of ±4 MHz that should be used to prevent errors. The formula for calculating acceptable deviation values is:

   START FREQ −(|DEVIATION|+4 MHz)≥40 MHz

   STOP FREQ +(|DEVIATION|+4 MHz)≤100 MHz

   Use the arrow keys to set ±5 MHz, then press (ENTER).

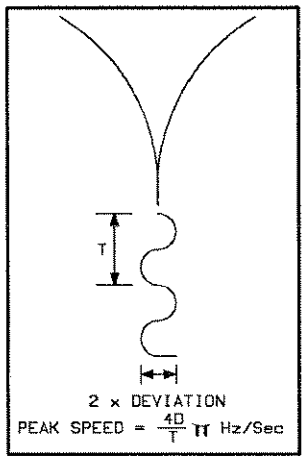

Figure 1-3. Speed and Deviation

10. The display should then read "**10 EDGE ZOOM**". This feature increases measurement resolution near the edges of the measurement, but should only be activated if you have specified at least 15 data points (we specified just 11 earlier in this example). Use the [▼] key to move to the next feature.
11. The display will now read "**11 MK SEARCH**". This algorithm will initiate worst case searches during the measurement. For a full description see MK SEARCH in the Local and Remote Reference Manual. Since this feature can increase measurement time press [ENTER] to ensure that it is set to OFF, then press [ENTER] again.
12. The display will now read "**12 DFM TYPE**". This allows selection of the type of DFM calculation performed. For a full description see MEAS in the Local Reference. The measurement setup is now complete. DFM TYPE is only available in serial prefixes 3215A and above.

Measurement

You are now ready to make the actual measurement. Press (MEAS). The display will indicate that the measurement is in progress. When the measurement has finished, the display will return to normal. If you press the (PRESET/LOCAL) key on the Fader front panel during the measurement, the measurement will be interrupted and stop.

Printing Results

1. After the measurement has been completed, you can print the results. First, set the printer destination. Press (SHIFT) (MEAS) (PRINTER), then use the (▲) arrow key to select between **1 DEST** and **2 PRINT**. Press (ENTER) on **1 DEST** to set the destination. Use (▲) to select between **EXTERN** and **INTERN**. Press (ENTER) on **INTERN** to set the printout for the internal thermal printer.

Note

Once the destination has been set, you do not need to reset it before every printing. NONE is the PRESET setting.

2. Next, print the parameters. Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **PRVIEW**, the press (ENTER). The printer will print the parameters you used to make the measurement.
3. Next, print the data (graphic results). Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **DATA**, then press (ENTER). The printer will now print the results.

Dynamic S-Curve Measurement

Equipment Setup

1. The basic setup for all measurements involves interrupting the IF path of the digital radio with a fading simulator. If a Bit Error Rate Tester (BERT) is used, connect the appropriate data channels. In the figure below, the DS3 data out from the BERT is connected to the DS3 input of the transmitter, and the BASEBAND output of the receiver to the DS3 data input of the BERT. The ERROR OUTPUT of the BERT is connected to the ERROR PULSE INPUT of the Fader. This input can be set to match the impedance of the BERT.

Note

Some digital radios have their own error outputs and internal data checking schemes that limit the need for a BERT. See the manual for your radio if you wish to connect the ERROR PULSE INPUT of the Fader directly to the radio. There may be a connection that must be made between two ports of the radio system for this to work.

2. The RF output of the transmitter is connected to the RF input of the receiver. Appropriate attenuation is used to protect the RF input of the receiver. Check the manual of the receiver and the transmitter to insure safe levels for the receiver input.
3. The Alarm Output on the receiver can be connected to the Alarm Input on the Fader. This connection is only needed for recovery tests, and tests where no BERT is available and you want to use the ALARM INPUT to indicate failure.

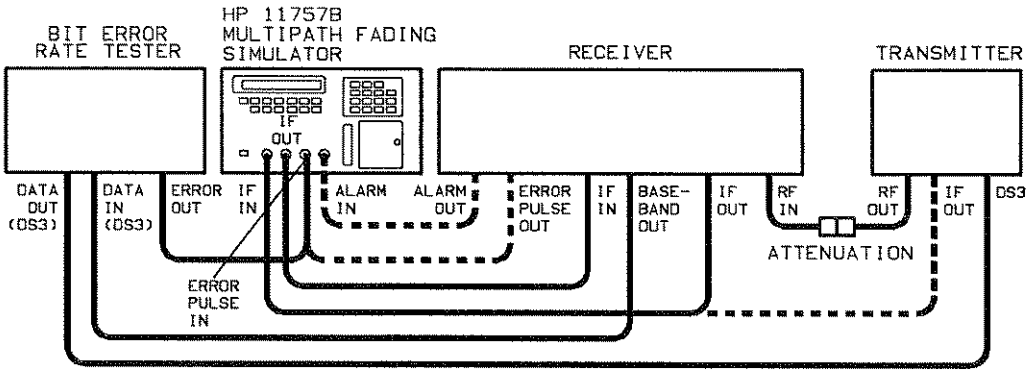

Figure 1-4. S-Curve Measurement Test Setup

4. Connect the Fader, BERT and Digital Radio as shown in figure 1-4.
5. Press (MEAS TYPE). Use the (▲) key until the display shows **DYNM S**, then press (ENTER).

Radio Setup

1. Press (RADIO SETUP).
2. The first item displayed reads **0 BIT RATE**. Press (ENTER) to see what the bit rate is set to. The preset value is 44.7 MHz (DS3). If you want to set another bit rate use the arrow or data keys and press (ENTER).
3. The display then reads **1 ERROR TERM**. Press (ENTER) to find the present setting. Use the (▲) key to toggle to the termination appropriate for your BERT, then press (ENTER).
4. The display then reads **1.1 ERROR THR**. Press (ENTER) to see what the variable error threshold is set to. If you want to set a different threshold use the arrow or data keys. Choose a threshold setting (combined with the ERROR TERM setting) that is appropriate for your BERT, then press (ENTER).

Error pulse input variable threshold is only available in serial prefixes 3235A and above.

5. The display next reads **2 ALARM POL**. You will not need to set this unless you are planning to use the ALARM INPUT for this test. Press the (▼) key to advance to the next feature.

6. The display should read **3 SCALE FACT**. The PRESET scale factor is 1, and this should only be changed if your BERT's error output is sending out error pulses at a rate other than it is detecting them. For instance, if the error output of your BERT is sending one pulse for every four errors, set the scale factor to four. To set the scale factor press (ENTER) when **3 SCALE FACT** is displayed, then use the (▲) arrow key to display the factor your want, then press (ENTER) again.

7. The display should now read 4 **AGC ON/OFF**. AGC (Automatic Gain Control) maintains the power level of the spectrum sent through the Fader. You may want the power level to remain constant even though a notch is sweeping through the band. If you are interrupting the digital radio after its own internal ALC or AGC circuitry, you may have to use the Fader's internal AGC circuitry to prevent non-fade effects from distorting measurement results. Press (ENTER), then use the (▲) key to display AGC ON if AGC OFF is displayed. Press (ENTER) to exit.

8. The display should now read **5 AGC FREQ**. If the AGC is ON, you should ensure that you have the proper AGC center frequency set. Press (ENTER) and the display will change "**AGC FRQ 070.0**" or whatever frequency may have been set previously. Use the arrow or data keys to set the desired frequency, then press (ENTER).

9. The display should now read "**6 AGC BW**". This allows you to set the bandwidth to distribute the

AGC power over. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a value. Use a value close to the radio's channel bandwidth, then press (ENTER).

10. The display should now read "**7 WAIT TIME**". This allows you to set the wait time after every notch movement. This wait allows your radio some settling time before a Bit Error Rate measurement is made by the Fader. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
11. The display should now read "**8 MAX SLEW**". This allows you to set the notch's maximum slew rate during measurements. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
12. The display should now read "**9 SYMBL TIME**". This feature is not available for Dynamic S-Curve measurements. The radio setup is now complete.

Measurement Setup

1. Press (MEAS SETUP). This will access a series of parameters to enter to set the Fader up for a measurement.
2. The first item displayed under (MEAS SETUP) is "**0 DATA PTS**". This specifies the number of linearly spaced rates to calculate and measure in the band you have selected. Press (ENTER) to access, then use the arrow or data keys to enter a value, then press (ENTER) to get the next parameter. 11 is a good value to enter to keep the measurement time down.
3. The second and third items will be "**1 STRT FRQ**" and "**2 STOP FRQ**". These access the start and stop frequencies for the notch. Press (ENTER) to access STRT FR, then use the arrow or data keys to set a value in MHz (use 45 for this example), then press

(ENTER). The display should show **2 STOP FRQ**. Press (ENTER) and set a value using data or arrow keys (95 for this example), then press (ENTER).

4. The next two items displayed are "**3 START RATE**" and "**4 STOP RATE**". These parameters are used for S-Curve measurements. The start rate and stop rate refer to the range of rates at which the notch sweeps throughout the measurement. The range of values is 1 MHz per second to $\frac{|StartFreq-StopFreq|}{.01}$ MHz per second. The Fader will linearly distribute rates from your start rate to your stop rate using the number of data points selected. If you selected 11 data points, the measurement will use 11 different rates from your start rate to your stop rate. Press (ENTER) to access the start rate. Use the arrow or data keys to set the value at 5 MHz per second. Then press (ENTER) to move to 4 **STOP RATE**. Press (ENTER) again to access and set the rate to 2000 MHz per second, the press (ENTER).

5. The next parameter, **ERROR BITS**, determines the number of errors that are counted before a final bit error rate calculation is made. You may enter powers of 2 from 2 to 15 (4 , 8, . . . , 32768). Press (ENTER) to access and use the (▲) arrow key to get 2^{11}, which equals 2048. Press (ENTER).

6. The next displayed item is "**PHASE**". Press (ENTER) and use the (▲) arrow key to select between the three options: **MIN, NON-MIN and BOTH**. When both is displayed, press (ENTER).

7. The Fader will then display "**CRITERIA**", which indicates the decision criteria for drawing an M-Curve. Press (ENTER) and use the (▲) arrow key to toggle through the options: ALARM, 1E-3, 3E-4, 1E-4, 3E-5, 1E-5 and 1E-6. Unless you have opted to use the ALARM INPUT to make the measurement, select one of the other criteria and press (ENTER).

8. The display will then read "**8 SPEED**". This parameter determines the peak frequency per second at which the notch oscillations will take place for Dynamic M-Curve measurements. It does not apply to S-Curve Measurements. Press (▼).
9. The display will now read "**9 DEVIATION**". This applies only to Dynamic M-Curve Measurements. Press (▼).
10. The display should then read "**10 EDGE ZOOM**". This feature is not useful for S-Curve measurements and will be ignored. Press (▼).
11. The display will now read "**11 MK SEARCH**". This feature is not available for Dynamic S-Curve measurements.
12. The display will now read "**12 DFM TYPE**". This feature is not available for Dynamic S-Curve measurements. The measurement setup is now complete.

Measurement

You are now ready to make the actual measurement. Press (MEAS). The display will indicate that the measurement is in progress. When the measurement has finished, the display will return to normal. If you press the (PRESET/LOCAL) key on the Fader front panel during the measurement, the measurement will be interrupted and stop.

Printing Results

1. After the measurement has been completed, you can print the results. First, set the printer destination. Press (SHIFT) (MEAS) (PRINTER), then use the (▲) arrow key to select between **1 DEST** and **2 PRINT**. Press (ENTER) on **1 DEST** to set the destination. Use (▲) to select between **EXTERN** and **INTERN**. Press (ENTER) on **INTERN** to set the printout for the internal thermal printer.

Note

Once the destination has been set, you do not need to reset it before every printing. NONE is the PRESET setting.

2. Next, print the parameters. Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **PRVIEW**, the press (ENTER). The printer will print the parameters you used to make the measurement.
3. Next, print the data (graphic results). Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **DATA**, then press (ENTER). The printer will now print the results.

Hysteresis M-Curve Measurement

Note

The Hysteresis M-Curve measurement uses the same parameters and setup as the Static M-Curve Test.

Equipment Setup

1. The basic setup for all measurements involves interrupting the IF path of the digital radio with a fading simulator. If a Bit Error Rate Tester (BERT) is used, connect the appropriate data channels. In the figure below, the DS3 data out from the BERT is connected to the DS3 input of the transmitter, and the BASEBAND output of the receiver to the DS3 data input of the BERT. The ERROR OUTPUT of the BERT is connected to the ERROR PULSE INPUT of the Fader. This input can be set to match the impedance of the BERT.

Note

Some digital radios have their own error outputs and internal data checking schemes that limit the need for a BERT. See the manual for your radio if you wish to connect the ERROR PULSE INPUT of the Fader directly to the radio. There may be a connection that must be made between two ports of the radio system for this to work.

2. The RF output of the transmitter is connected to the RF input of the receiver. Appropriate attenuation is used to protect the RF input of the receiver. Check the manual of the receiver and the transmitter to insure safe levels for the receiver input.
3. The Alarm Output on the receiver can be connected to the Alarm Input on the Fader. This connection is only needed for recovery tests, and tests where no

BERT is available and you want to use the ALARM INPUT to indicate failure.

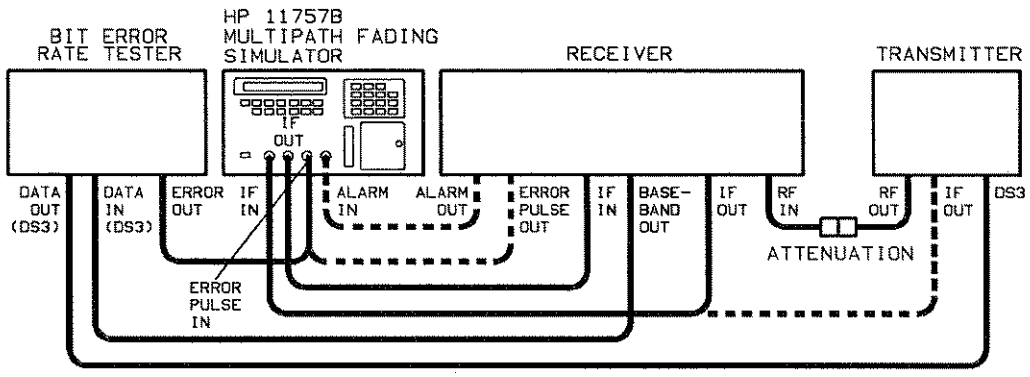

Figure 1-5. Hysteresis Measurement

4. Connect the Fader, BERT and Digital Radio as shown in figure 1-5.
5. Press (MEAS TYPE). Use the (▲) key until the display shows **HYSTER**, then press (ENTER).

Radio Setup

1. Press (RADIO SETUP).
2. The first item displayed reads **0 BIT RATE**. Press (ENTER) to see what the bit rate is set to. The preset value is 44.7 MHz (DS3). If you want to set another bit rate use the arrow or data keys and press (ENTER).
3. The display then reads **1 ERROR TERM**. Press (ENTER) to find the present setting. Use the (▲) key to toggle to the termination appropriate for your BERT, then press (ENTER).
4. The display then reads **1.1 ERROR THR**. Press (ENTER) to see what the variable error threshold is set to. If you want to set a different threshold use

the arrow or data keys. Choose a threshold setting (combined with the ERROR TERM setting) that is appropriate for your BERT, then press (ENTER). Error pulse input variable threshold is only available in serial prefixes 3235A and above.

5. The display next reads **2 ALARM POL**. You will not need to set this unless you are planning to use the ALARM INPUT for this test. Press the (▼) key to advance to the next feature.

6. The display should read **3 SCALE FACT**. The PRESET scale factor is 1.0, and this should only be changed if your BERT's error output is sending out error pulses at a rate other than it is detecting them. For instance, if the error output of your BERT is sending one pulse for every four errors, set the scale factor to four. To set the scale factor press (ENTER) when **3 SCALE FACT** is displayed, then use the (▲) arrow key to display the factor your want, then press (ENTER) again.

7. The display should now read **4 AGC ON/OFF**. AGC (Automatic Gain Control) maintains the power level of the spectrum sent through the Fader. You may want the power level to remain constant even though a notch is sweeping through the band. If you are interrupting the digital radio after its own internal ALC or AGC circuitry, you may have to use the Fader's internal AGC circuitry to prevent non-fade effects from distorting measurement results. Press (ENTER), then use the (▲) key to display AGC ON if AGC OFF is displayed. Press (ENTER) to exit.

8. The display should now read **5 AGC FREQ**. If the AGC is ON, you should ensure that you have the proper AGC center frequency set. Press (ENTER) and the display will change "**AGC FRQ 070.0**" or whatever frequency may have been set previously.

Use the arrow or data keys to set the desired frequency, then press (ENTER).

9. The display should now read "**6 AGC BW**". This allows you to set the bandwidth to distribute the AGC power over. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a value. Use a value close to the radio's channel bandwidth, then press (ENTER).
10. The display should now read "**7 WAIT TIME**". This allows you to set the wait time after every notch movement. This wait allows your radio some settling time before a Bit Error Rate measurement is made by the Fader. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
11. The display should now read "**8 MAX SLEW**". This allows you to set the notch's maximum slew rate during measurements. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
12. The display should now read "**9 SYMBL TIME**". This allows you to set the symbol time of your radio. You will not need to set this unless you are planning to perform a CCIR DFM calculation. The radio setup is now complete. CCIR DFM is only available in serial prefixes 3215A and above.

Measurement Setup

1. Press (MEAS SETUP). This will access a series of parameters to enter to set the Fader up for a measurement.
2. The first item displayed under (MEAS SETUP) is "**0 DATA PTS**". This specifies the number of linearly spaced frequencies to calculate and measure in the band you have selected. Press (ENTER) to access, then use the arrow or data keys to enter a value, then

press (ENTER) to get the next parameter. 11 is a good value to enter to keep the measurement time down.

3. The second and third items will be "**1 STRT FRQ**" and "**2 STOP FRQ**". These access the start and stop frequencies for the notch. Press (ENTER) to access STRT FRQ, then use the arrow or data keys to set a value in MHz (use 45 for this example), then press (ENTER). The display should show **2 STOP FRQ**. Press (ENTER) and set a value using data or arrow keys (95 for this example), then press (ENTER).

4. The next two items displayed are "**3 START RATE**" and "**4 STOP RATE**". These parameters are used for S-Curve measurements and will be ignored when making Hysteresis M-Curve measurements. Press (▼) until the display reads "**5 ERROR BITS**".

5. **ERROR BITS** determines the number of errors that are counted before a final bit error rate calculation is made. You may enter powers of 2 from 2 to 15 (4 , 8, . . . , 32768). Press (ENTER) to access and use the (▲) arrow key to get 2^{11}, which equals 2048. Press (ENTER).

6. The next displayed item is "**PHASE**". The Hysteresis M-Curve measurement uses BOTH phases. You do not need to select a phase because the instrument will always choose BOTH. Use the (▼) key to move to **CRITERIA**.

7. The Fader will then display "**CRITERIA**", which indicates the decision criteria for drawing an M-Curve. Press (ENTER) and use the (▲) arrow key to toggle through the options: ALARM, 1E-3, 3E-4, 1E-4, 3E-5, 1E-5 and 1E-6. Unless you have opted to use the ALARM INPUT to make the measurement, select one of the other criteria and press (ENTER).

8. The display will then read "**8 SPEED**". This applies only to Dynamic M-Curve, and will be ignored for

Hysteresis M-Curve measurements. Press (▼) to move to the next feature.

9. The display will now read "**9 DEVIATION**". This applies only to Dynamic M-Curve, and will be ignored for Hysteresis M-Curve measurements. Press (▼) to move to the next feature.
10. The display should then read "**10 EDGE ZOOM**". This feature increases measurement resolution near the edges of the measurement, but will only be activated if you have specified at least 15 data points (we specified just 11 earlier in this example). Use the (▼) key to move to the next feature.
11. The display will now read "**11 MK SEARCH**". This algorithm will initiate worst case searches during the measurement. For a full description see MK SEARCH in the Local and Remote Reference Manual. Since this feature can increase measurement time press (ENTER) to ensure that it is set to OFF, then press (ENTER) again.
12. The display will now read "**12 DFM TYPE**". This allows selection of the type of DFM calculation performed. For a full description see MEAS in the Local Reference. The measurement setup is now complete. DFM TYPE is only available in serial prefixes 3215A and above.

Measurement

You are now ready to make the actual measurement. Press (MEAS). The display will indicate that the measurement is in progress. When the measurement has finished, the display will return to normal. If you press the (PRESET/LOCAL) key on the Fader front panel during the measurement, the measurement will be interrupted and stop.

Printing Results

1. After the measurement has been completed, you can print the results. First, set the printer destination. Press (SHIFT) (MEAS) (PRINTER), then use the (▲) arrow key to select between **1 DEST**, **2 PRINT** and **NONE**. Press (ENTER) on **1 DEST** to set the destination. Use (▲) to select between **EXTERN** and **INTERN**. Press (ENTER) on **INTERN** to set the printout for the internal thermal printer.

Note

Once the destination has been set, you do not need to reset it before every printing. NONE is the PRESET setting.

2. Next, print the parameters. Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **PRVIEW**, the press (ENTER). The printer will print the parameters you used to make the measurement.
3. Next, print the data (graphic results). Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **DATA**, then press (ENTER). The printer will now print the results.

Recovery Time Test

In the recovery time test the Fader breaks the IF path of the digital radio and then measures the time the radio takes to recover lock. The time the radio is out of lock is measured at the ALARM INPUT of the Fader.

There are two variations on this test that you may want to try. You can measure the time it takes to recover when a notch is in the IF path after a break in lock. You may also measure the time it takes to recover to a specified bit error rate (requires Bit Error Rate Tester). The procedure that follows covers all three variations. The BERT is only required for return to bit error rate testing.

Note

Some radios have their own internal error checking scheme. This would eliminate the need for a BERT in bit error rate checking.

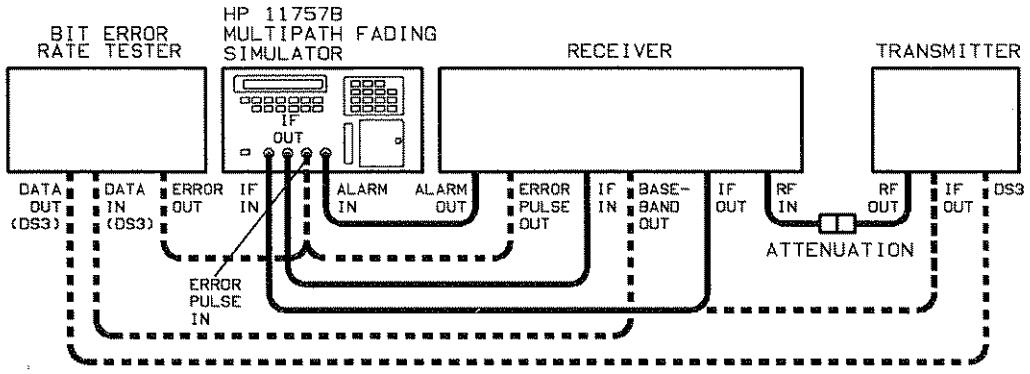

Figure 1-6. Recovery Time Test Setup

Equipment Setup

1. Connect the Fader, Digital Radio, and BERT if used as shown in figure 1-6.
2. Press (MEAS TYPE). Use the (▲) key until the display shows **RECVRY**, then press (ENTER).

Radio Setup

1. Press (RADIO SETUP).
2. The first item displayed reads **0 BIT RATE**. This need only be entered if you are using a BERT to measure recovery time to a bit error rate. Press (ENTER) to see what the bit rate is set to. The preset value is 44.7 MHz (DS3). If you want to set another bit rate use the arrow or data keys and press (ENTER).
3. The display then reads **1 ERROR TERM**. Press (ENTER) to find the present setting. Use the (▲) key to toggle to the termination appropriate for your BERT, then press (ENTER).
4. The display then reads **1.1 ERROR THR**. Press (ENTER) to see what the variable error threshold is set to. If you want to set a different threshold use the arrow or data keys. Choose a threshold setting (combined with the ERROR TERM setting) that is appropriate for your BERT, then press (ENTER). Error pulse input variable threshold is only available in serial prefixes 3235A and above.
5. The display next reads **2 ALARM POL**. Press (ENTER) to display the current setting. Use the (▲) key to toggle between positive and negative edge polarity triggering. You may need to refer to the ALARM OUTPUT of your radio, or the manual for your radio to find out which polarity to use. Select the polarity and press (ENTER).
6. The display should read **3 SCALE FACT**. This is not needed unless you are using a BERT for recovery to a bit error rate, and the BERT does not put out a pulse for each error it detects. For instance, if the

error output of your BERT is sending one pulse for every four errors, set the scale factor to four. To set the scale factor press (ENTER) when **3 SCALE FACT** is displayed, then use the (▲) arrow key to display the factor your want, then press (ENTER) again.

7. The display should now read **4 AGC ON/OFF**. You do not need to use AGC or set anything in the next three steps unless you intend to have a notch in the band before the start of a test. If you are not using a notch, go to **Measurement Setup**. AGC (Automatic Gain Control) maintains the power level of the spectrum sent through the Fader. You want the power level to remain constant even though a notch is sweeping through the band. If you are interrupting the digital radio after its own internal ALC or AGC circuitry, you may have to use the Fader's internal AGC circuitry to prevent non-fade effects from distorting measurement results. Press (ENTER), then use the (▲) key to display AGC ON if AGC OFF is displayed. Press (ENTER) to exit.
8. The display should now read **5 AGC FREQ**. If the AGC is ON, you should ensure that you have the proper AGC center frequency set. Press (ENTER) and the display will change "**AGC FRQ 070.0**" or whatever frequency may have been set previously. Use the arrow or data keys to set the desired frequency, then press (ENTER).
9. The display should no read "**6 AGC BW**". This allows you to set the bandwidth to distribute the AGC power over. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a value. Use a value close to the radio's channel bandwidth, then press (ENTER). The radio setup is now complete.

Measurement Setup

1. Press (MEAS SETUP). This will access a series of parameters to enter to set the Fader up for a measurement.
2. Use the (▼) to display "**CRITERIA**", which can be used with the recovery test to measure the time it takes to recover to a specified bit error rate. This is not needed if you are simply using the ALARM INPUT to measure recovery time. Press (ENTER) and use the (▲) arrow key to toggle through the options: ALARM, 1E-3, 3E-4, 1E-4, 3E-5, 1E-5 and 1E-6. Unless you have opted to use the ALARM INPUT to make the measurement, select one of the other criteria and press (ENTER).
3. If you want to test recovery time when a notch exists in the IF path (or some other path), press (NOTCH FREQ) and use the arrow or data keys to set the notch frequency you want to test at. Then press (NOTCH DEPTH) and use the arrow or data keys to set the depth you want to test at.

Note

If you set a depth too deep and have set a bit error rate criteria for recovery, the radio may not recover. Make sure that the notch depth and frequency you have chosen for recovery test is one that would pass on the Static M-Curve test for the criteria you have set.

Measurement

You are now ready to make the actual measurement. Press (MEAS). The Fader display will show the recovery time.

Printing Results

You cannot print the data in this test. However, you can print the parameters.

1. After the measurement has been completed, you can print the parameters. First, set the printer destination. Press (SHIFT) (MEAS) (PRINTER), then use the (▲) arrow key to select between **1 DEST** and **2 PRINT**. Press (ENTER) on **1 DEST** to set the destination. Use (▲) to select between **EXTERN** and **INTERN**. Press (ENTER) on **INTERN** to set the printout for the internal thermal printer.

Note

Once the destination has been set, you do not need to reset it before every printing. NONE is the PRESET setting.

2. Next, print the parameters. Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **PRVIEW**, the press (ENTER). The printer will print the parameters you used to make the measurement.

Bit Error Rate Test

In the bit error rate test the Fader monitors the ERROR PULSE INPUT and measures the bit error rate for approximately 1 second. When started using the (MEAS) key, this test runs continuously until the (PRESET/LOCAL) key is pressed.

Note

Some radios have their own internal error checking scheme. This would eliminate the need for a BERT in bit error rate checking.

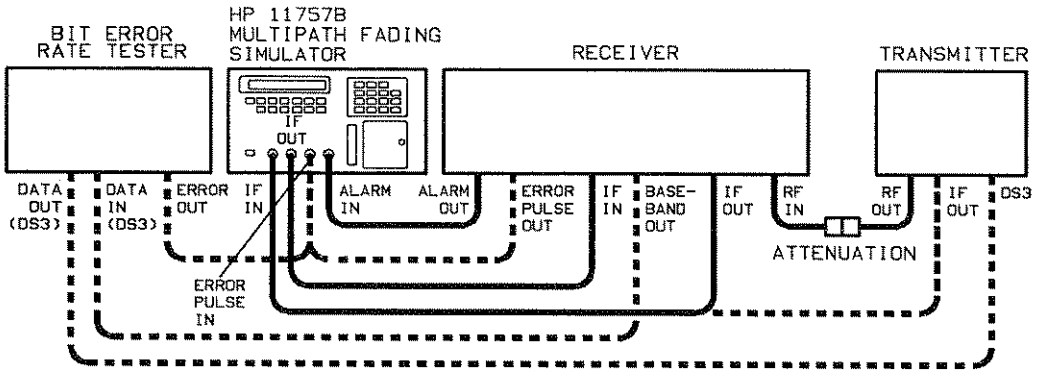

Figure 1-7. Bit Error Rate Test Setup

Equipment Setup

1. Connect the Fader, Digital Radio, and BERT if used as shown in figure 1-7.
2. Press (MEAS TYPE). Use the (▲) key until the display shows **BER**, then press (ENTER).

Radio Setup

1. Press (RADIO SETUP).
2. The first item displayed reads **0 BIT RATE**. This need only be entered if you are using a BERT to measure recovery time to a bit error rate. Press (ENTER) to see what the bit rate is set to. The preset value is 44.7 MHz (DS3). If you want to set another bit rate use the arrow or data keys and press (ENTER).
3. The display then reads **1 ERROR TERM**. Press (ENTER) to find the present setting. Use the (▲) key to toggle to the termination appropriate for your BERT, then press (ENTER).
4. The display then reads **1.1 ERROR THR**. Press (ENTER) to see what the variable error threshold is set to. If you want to set a different threshold use the arrow or data keys. Choose a threshold setting (combined with the ERROR TERM setting) that is appropriate for your BERT, then press (ENTER). Error pulse input variable threshold is only available in serial prefixes 3235A and above.
5. The display next reads **2 ALARM POL**. You will not need to set this for this test. Press the (▲) key to advance to the next feature.
6. The display should read **3 SCALE FACT**. The PRESET scale factor is 1.0, and this should only be changed if your BERT's error output is sending out error pulses at a rate other than it is detecting them. For instance, if the error output of your BERT is sending one pulse for every four errors, set the scale factor to four. To set the SCALE FACTOR press (ENTER) when **3 SCALE FACT** is displayed, then use the (▲) arrow key to display the factor your want, then press (ENTER) again.
7. The display should now read 4 **AGC ON/OFF**. AGC (Automatic Gain Control) maintains the power level

of the spectrum sent through the Fader. You may want the power level to remain constant even though you have a notch. If you are interrupting the digital radio after its own internal ALC or AGC circuitry, you may have to use the Fader's internal AGC circuitry to prevent non-fade effects from distorting measurement results. Press (ENTER), then use the (▲) key to display AGC ON if AGC OFF is displayed. Press (ENTER) to exit.

8. The display should now read **5 AGC FREQ**. If the AGC is ON, you should ensure that you have the proper AGC center frequency set. Press (ENTER) and the display will change "**AGC FRQ 070.0**" or whatever frequency may have been set previously. Use the arrow or data keys to set the desired frequency, then press (ENTER).
9. The display should now read "**6 AGC BW**". This allows you to set the bandwidth to distribute the AGC power over. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a value. Use a value close to the radio's channel bandwidth, then press (ENTER).
10. The display should now read "**7 WAIT TIME**". This allows you to set the wait time after every notch movement. This wait allows your radio some settling time before a Bit Error Rate measurement is made by the Fader. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
11. The display should now read "**8 MAX SLEW**". This allows you to set the notch's maximum slew rate during measurements. Press (ENTER) to see what value this is set to. Use the arrow or data entry keys to set a new value if desired, then press (ENTER).
12. If you want to test bit error rate when a notch exists in the IF path (or some other path), press

(NOTCH FREQ) and use the arrow or data keys to set the notch frequency you want to test at. Then press (NOTCH DEPTH) and use the arrow or data keys to set the depth you want to test at.

Measurement

You are now ready to make the actual measurement. Press (MEAS). The Fader display will show the bit error rate approximately every 1 second.

Printing Results

You cannot print the data in this test. However, you can print the parameters.

1. After the measurement has been completed, you can print the parameters. First, set the printer destination. Press (SHIFT) (MEAS) (PRINTER), then use the (▲) arrow key to select between **1 DEST** and **2 PRINT**. Press (ENTER) on **1 DEST** to set the destination. Use (▲) to select between **EXTERN** and **INTERN**. Press (ENTER) on **INTERN** to set the printout for the internal thermal printer.

Note

Once the destination has been set, you do not need to reset it before every printing. NONE is the PRESET setting.

2. Next, print the parameters. Press (SHIFT) (MEAS), then toggle the (▲) key to get **2 PRINT**. Press (ENTER). Use the (▲) key to display **PRVIEW**, the press (ENTER). The printer will print the parameters you used to make the measurement.