EXHIBIT 3 : FCC 2.1033(c) (TEST DATA) AND FCC 2.1041 (MEASUREMENT PROCEDURES)

INTRODUCTION TO TRANSMITTER MEASUREMENTS, Part 2.1033(c)(14)

Exhibits 4 through 9 on the following pages present the required measured transmitter performance data for Parts 2.1046 through 2.1057.

CERTIFICATION OF TEST DATA, Part 2.911(d)

Please see page 3-2 for the test supervisor's statement

MEASUREMENT PROCEDURES EMPLOYED, Parts 2.947 and 2.1041

Specific measurement procedures and test setup diagrams are presented along with the resultant data for each of the tests prescribed by Parts 2.1046 through 2.1057

TEST EQUIPMENT LIST, Part 2.947(d)

The equipment used for the transmitter tests is listed on page 3-3.

STATEMENT OF TEST SUPERVISOR

This is to certify that the undersigned supervised the technical tests included in this report and to the best of my knowledge the data and facts are correct.

The engineering qualifications of the undersigned are as follows:

1. A.B degree in mathematics from Harvard University and M.S. degree in electrical engineering from Massachusetts Institute of Technology

2. Over 18 years professional experience in communications equipment and system design with the following organizations: MIT-Lincoln Laboratory, Proxim, Inc., and SEA, Inc.

Should you require further information regarding this application, please contact me at (425) 771-2182, extension 128. For your greater convenience the SEA Inc. WATS line number is 1-800-426-1330 and our FAX number is (206) 771-2650.

Signed,

Jim Elder Date

Marine Engineering Manager

SEA, Inc of Delaware

(signed copy provided as separate attachment)

FCC PART 2.947 MEASUREMENT PROCEDURE

It is required than applicants submit "A detailed description of the measurement procedure actually used". In this report, specific detailed descriptions of the measurement procedures actually used have been made a part of each specific test section. Diagrams and text relating to each specific test have been labeled with the corresponding test number as well as FCC 2.947. An additional requirement of FCC 2.947 is a listing of the test equipment used. This list appears below.

TEST EQUIPMENT LIST (FCC 2.947)

ITEM	DESCRIPTION	MODEL
1.	Spectrum Analyzer	Hewlett-Packard 8568B
2.	Spectrum Analyzer	Hewlett-Packard 8553B
3.	Audio Oscillators (2)	Hewlett-Packard HP204D
4.	Audio Step Attenuator	HP350A
5.	Distortion Analyzer	Hewlett-Packard 334A
6.	Frequency Counter	Hewlett-Packard 5384A
7.	Precision Time Base	Hewlett-Packard 58503A
8.	Crystal Time Base	Hewlett-Packard 105A
9.	RF Voltmeter	Hewlett-Packard 410B
10.	AF Voltmeter	Hewlett-Packard 400E
11.	RF Signal Generator	Hewlett-Packard 8644A
12.	DC Power Supply	Hewlett-Packard 6269A
13.	Computer (HPIB)	Hewlett-Packard 87XM
14.	X-Y Plotter	Hewlett-Packard 7470A
15.	Oscilloscope	Tektronics 2465A
16.	Oscilloscope	Tektronics 465B
17.	RF Dummy Load	Bird Model 8325
18.	RF Wattmeter	Bird Model 43 W/Elements
19.	RF Signal Generator	Farnell PSG1000
20.	Multimeter	Fluke Model 8024A
21.	RF Signal Generators (2)	Fluke Model 6080A
22.	Environmental Chamber	Tenney Jr. #TJR-16
23.	Calibrated Loop (2)	Meguro-Donpa Sokki K.K. Model MLA-1001B
24.	MF Dummy Load	SEA Inc Model 10-200
25.	MF Antenna Coupler	SEA 1635
26.	Field Measurement Site	Norse Labs site, Issaquah, Washington
27.	Dipole Antenna Set	Compliance Design Inc. Roberts Dipole Set
28.	Battery Charger	Newmar PT-24-35CE
30.	DC Power Supply (2)	12 Volt Secondary Battery
31.	RF Dummy Load	Bird Model 8135

EXHIBIT 4 : FCC 2.1046 (RF POWER OUTPUT)

FCC 2.1046(b)(1)(2) R.F. POWER OUTPUT MEASUREMENTS

FCC 2.947 MEASUREMENT PROCEDURE EMPLOYED

RF POWER OUTPUT TEST:

The transceiver (SEA 245) and the associated test equipment was set up as shown in Figure 4.1 (Page 4-2). The transceiver was then operated on a series of test frequencies in accordance with the procedure set forth in the Instruction Manual.

In the J3E and R3E modes, the test signal consisted of two equal tones of 400 Hz and 1800 Hz. In the H3E mode test, the test signal consisted of the reinserted carrier and a single 1500 Hz tone.

Initially, the transmitter was operated in the 2K80J3E mode on the 12 MHz test frequency. Using the calibrated spectrum analyzer, the audio tones were adjusted to provide two equal RF tones in the output signal and the transmitter ALC was adjusted to set the output power to 150 watts PEP. (All cables and attenuators are calibrated). The transmitter was then operated on the various test frequencies and the RF output levels measured by both spectrum analyzer and wattmeter measurements were then recorded.

For the H3E measurement on 2182.0 kHz, the audio test signal was readjusted to a single 1500 Hz tone and the reinserted carrier was then adjusted to provide a good two-tone envelope output. The spectrum analyzer and the wattmeter measurements were then recorded.

One extra measurement was made to provide the data on operation of the transceiver in the R3E mode (2K80R3E). For this measurement, the transceiver was first adjusted with the standard two-tone signal for normal operation in the J3E mode at 150 watts PEP. The 400 and 1800 Hz oscillators were then disconnected and the carrier reinserted at the -16 dB (below PEP) level. The two-tone signal was then restored AT THE PREVIOUSLY ADJUSTED LEVEL. Output power readings were made and recorded as noted above.

The results of the above series of tests are recorded in Table 4.1 on Page 4-3 of this report.

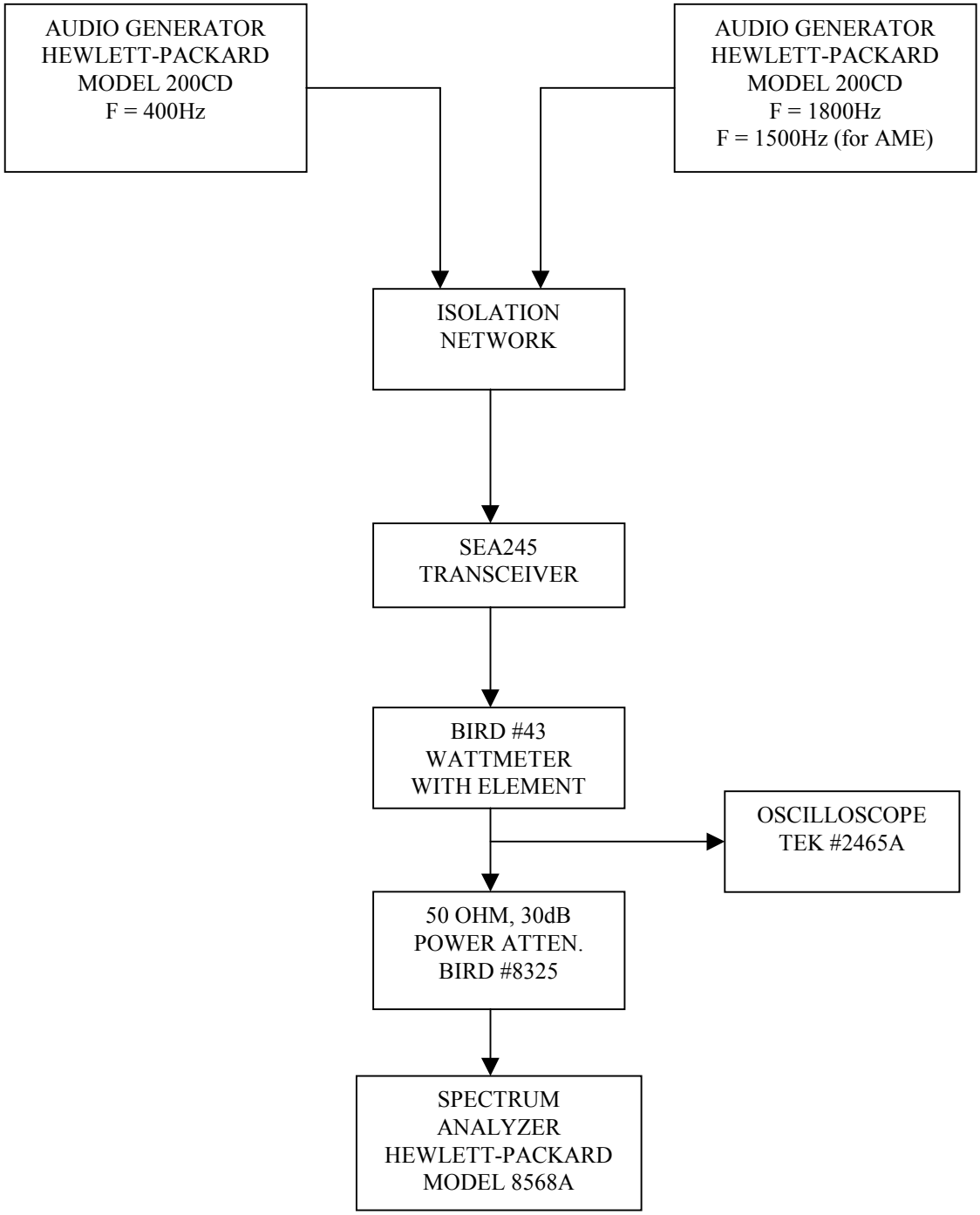

FIGURE 4.1 TEST SETUP FOR THE POWER OUTPUT TEST IN ACCORDANCE WITH SECTION 2.1046 (b) (1) (2)

TABLE 4.1 POWER OUTPUT TEST DATA

FREQ. (kHz)	MODE	WATT METER	SPECTRUM ANALYZER	CALCULATED PEP WATTS
1619.0	2K80J3E	68 W	15.6 dBW	145 W PEP
2182.0	2K80J3E	70 W	15.7 dBW	148 W PEP
2182.0	2K80H3E	70 W	15.7 dBW	148 W PEP
4125.0	2K80J3E	75 W	15.7 dBW	148 W PEP
6215.0	2K80J3E	75 W	15.6 dBW	145 W PEP
8204.0	2K80R3E	60 W	150 W *	150 W PEP
8291.0	2K80J3E	76 W	15.7 dBW	148 W PEP
12290.0	2K80J3E	78 W	15.8 dBW	151 W PEP
16420.0	2K80J3E	79 W	15.7 dBW	148 W PEP
18840.0	2K80J3E	79 W	15.7 dBW	148 W PEP
22159.0	2K80J3E	80 W	15.8 dBW	151 W PEP
25100.0	2K80J3E	79 W	15.8 dBW	151 W PEP

NOTE:

The wattmeter used for the above listed readings was a Bird Model 43 "Thruline" equipped with a type 250H plug and a 30 μA meter movement. The Frequency response of the 250H plug is nominally 2 to 30 MHz with ±5% accuracy (±12 Watts) and optimum calibration accuracy at mid-frequency (16 MHz).

In the above series of tests, the power level of the transmitter output was adjusted to 150 watts PEP by inspection of the spectrum analyzer. All cables and attenuators are calibrated. The spectrum analyzer readings shown above represent the power in each tone adjusted for cable and attenuator loss. Peak envelope power is computed by adding 6 dB. The wattmeter readings serve as an alternative measurement technique. Note that the presence of intermodulation distortion and (in the case of the R3E measurement) carrier cause the wattmeter reading to vary somewhat from the calculated conversion factor. In this case peak envelope power was measured by inspection of the signal on an oscilloscope rather than a spectrum analyzer.

EXHIBIT 5 : FCC 2.1047 (MODULATION CHARACTERISTICS)

Part 2.1047(a)(c) MODULATION CHARACTERISTICS

Part 2.947 Measurement Procedure Employed

FCC Part 2.1047(a) Audio Response Test:

The transceiver and associated test equipment was set up as shown in Figure 5.1 (Page 5-2). The transceiver was initially tuned up on the desired test frequency in the 2K80J3E mode with the ALC circuitry disabled. The audio oscillator was initially set to a frequency of 1000Hz and the output level was recorded. This level was kept constant throughout the test. The RF level resulting from the audio signal was recorded and taken as the 0 dB datum level for the audio response curve. Data was recorded for at least 10 frequencies from 100 to 5000 Hz. Figure 5.2 (Page 5-3) shows these results.

FCC Part 2.1047(c) Modulation Limiter Test:

The transceiver and associated test equipment was set up as shown in Figure 5.3 (Page 5-4).

Figure 5.4 (Page 5-5) shows the schematic diagram of the AF signal generator isolation network used to combine the two audio oscillators for two-tone tests.

For the J3E mode the test signal was the standard two-tone audio test signal. The level of the test signal was adjusted until a good "two-tone" envelope was observed at the RF load. The level of the combined tones was varied from 5 mV to 450 mV (39 dB) while monitoring the RF output power. Figure 5.5 (Page 5-6) shows the resulting data plotted as a curve.

The second test illustrates the ALC performance in the H3E mode. The test signal in this mode consists of the re-inserted carrier at -6 dB below rated PEP and a single audio tone at 1500 Hz. The level of the audio tone was varied from 5 mV to 450 mV (39 dB) while monitoring the RF output power. Figure 5.6 (Page 5-7) shows the resulting data plotted as a curve.

A third test illustrates the ALC performance in the R3E mode. The test signal in this mode consists of the standard two-tone audio test signal with the carrier re-inserted at -16 dB below rated PEP. The level of the audio tone was varied from 5 mV to 450 mV (39 dB) while monitoring the output power. Figure 5.7 (Page 5-8 shows the resulting data plotted as a curve.

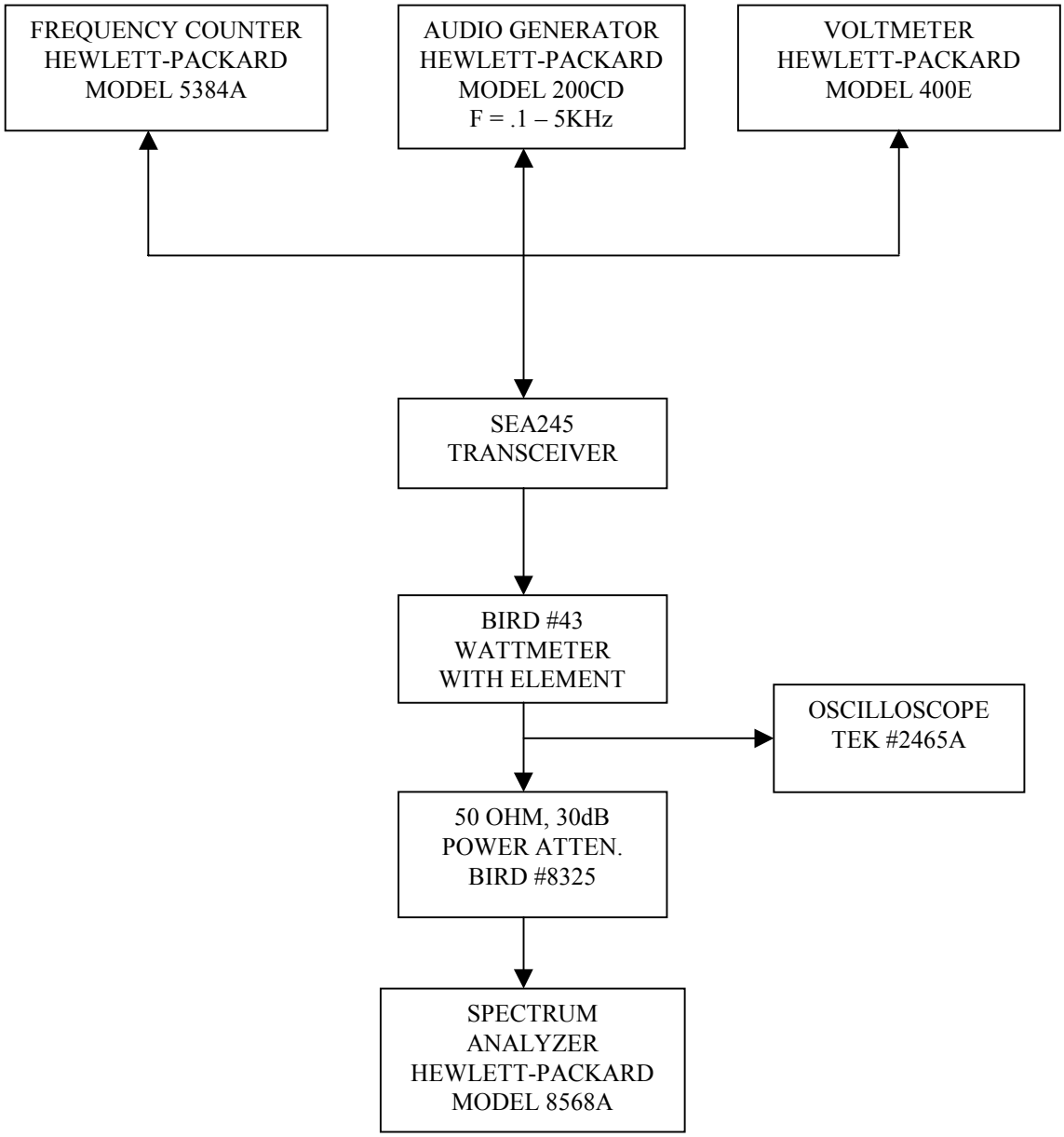

FIGURE 5.1 TEST SETUP FOR THE AUDIO RESPONSE TEST IN ACCORDANCE WITH SECTION 2.1047 (a)

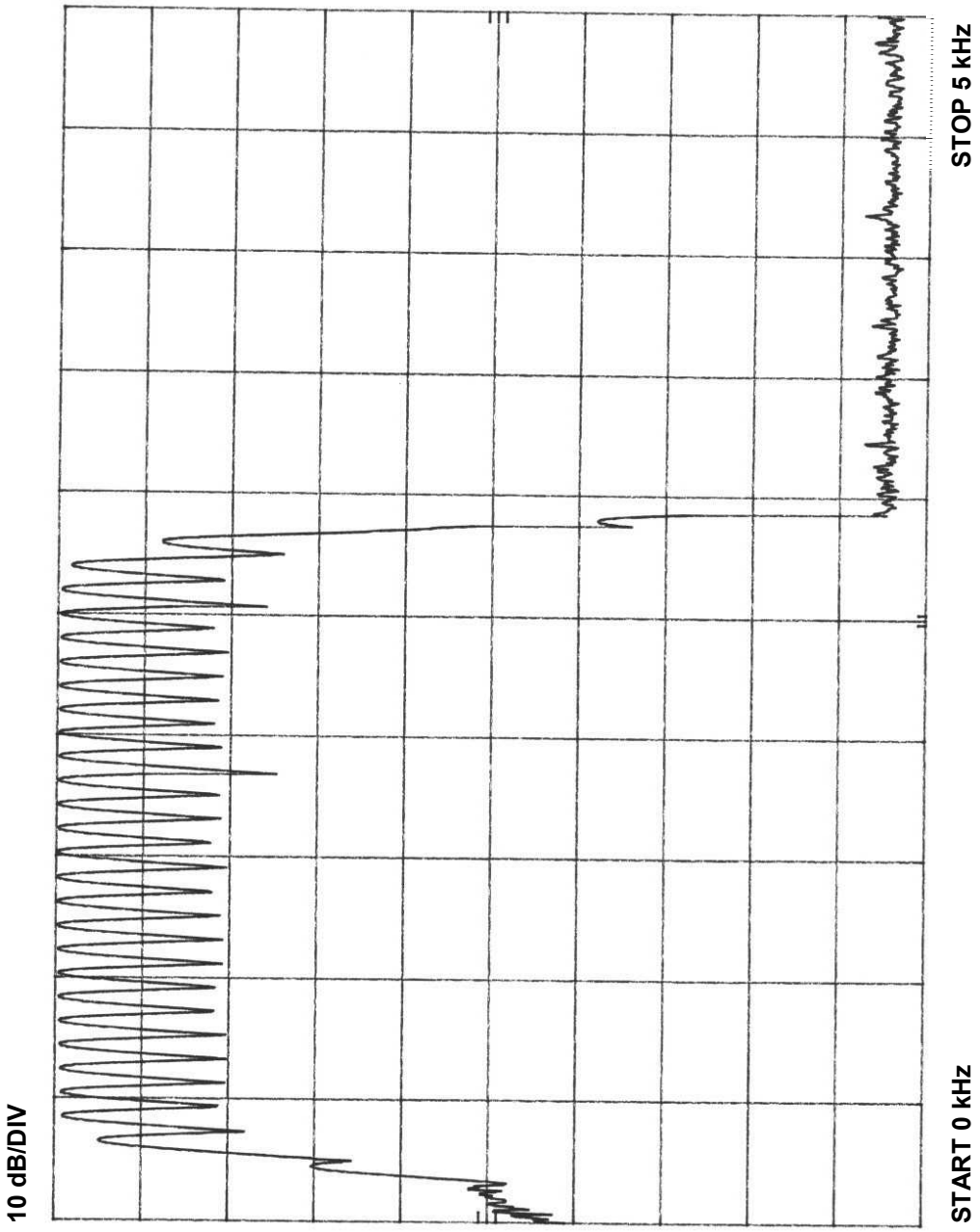

FIGURE 5.2 AUDIO RESPONSE CURVE

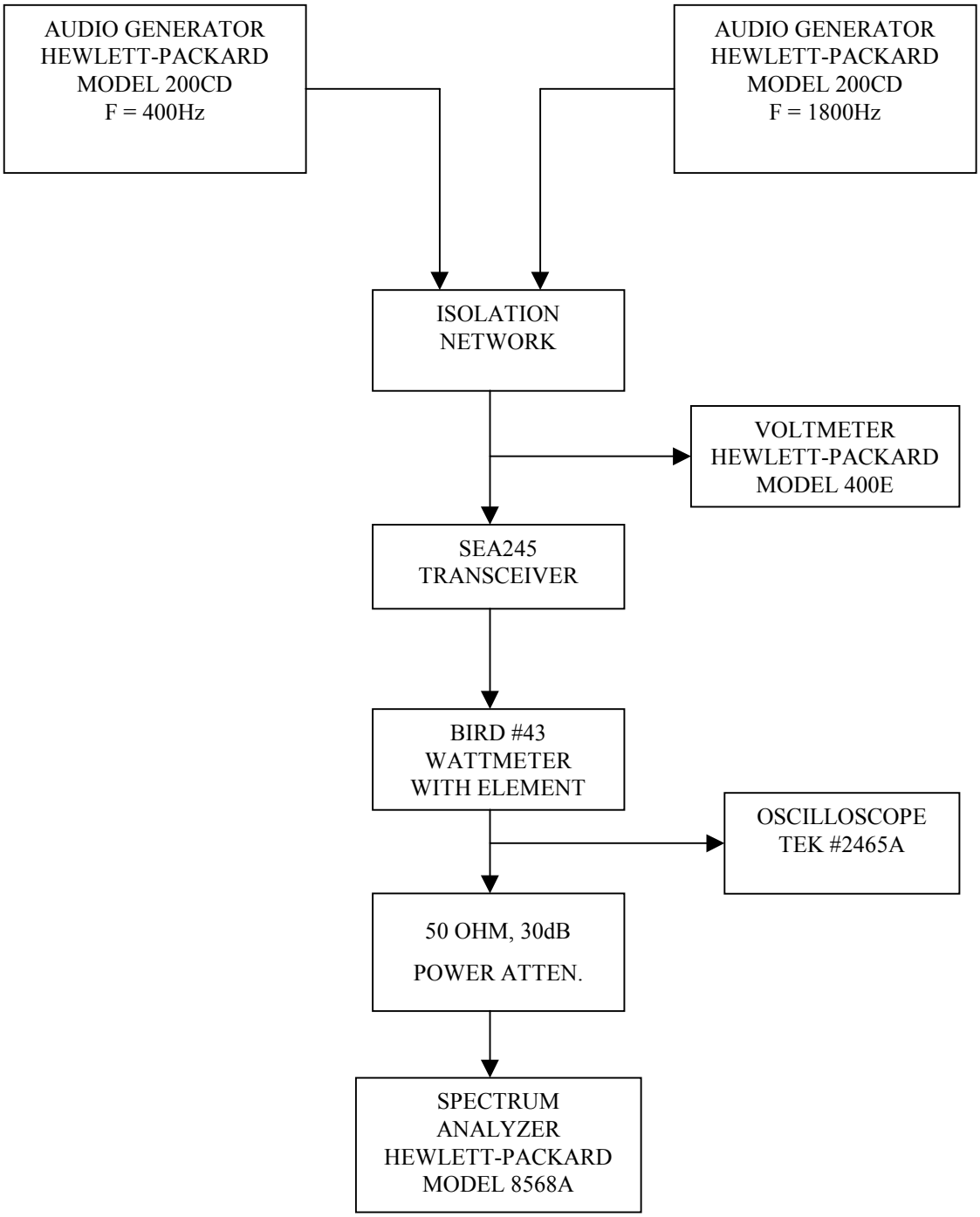

FIGURE 5.3 TEST SETUP FOR THE MODULATION LIMITER TEST IN ACCORDANCE WITH SECTION 2.1047 (c)

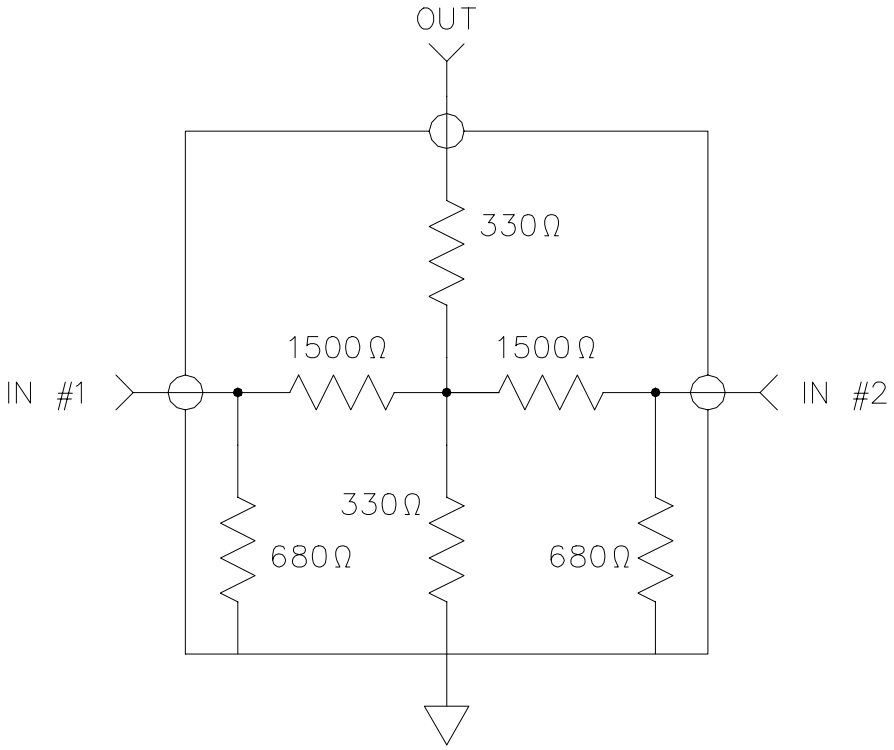

FIGURE 5.4 AUDIO ISOLATION NETWORK SCHEMATIC DIAGRAM

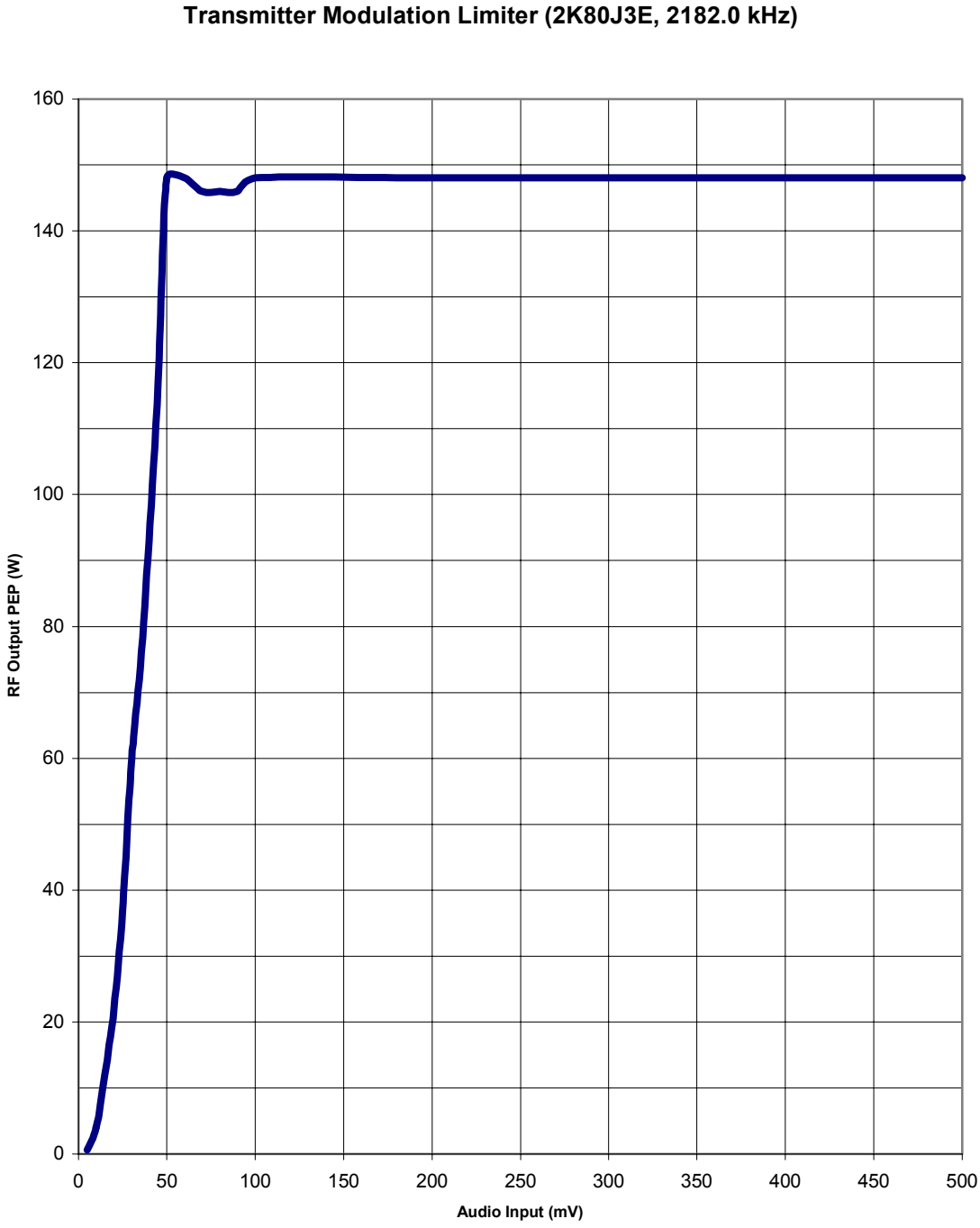

FIGURE 5.5 ALC TEST DATA IN J3E MODE

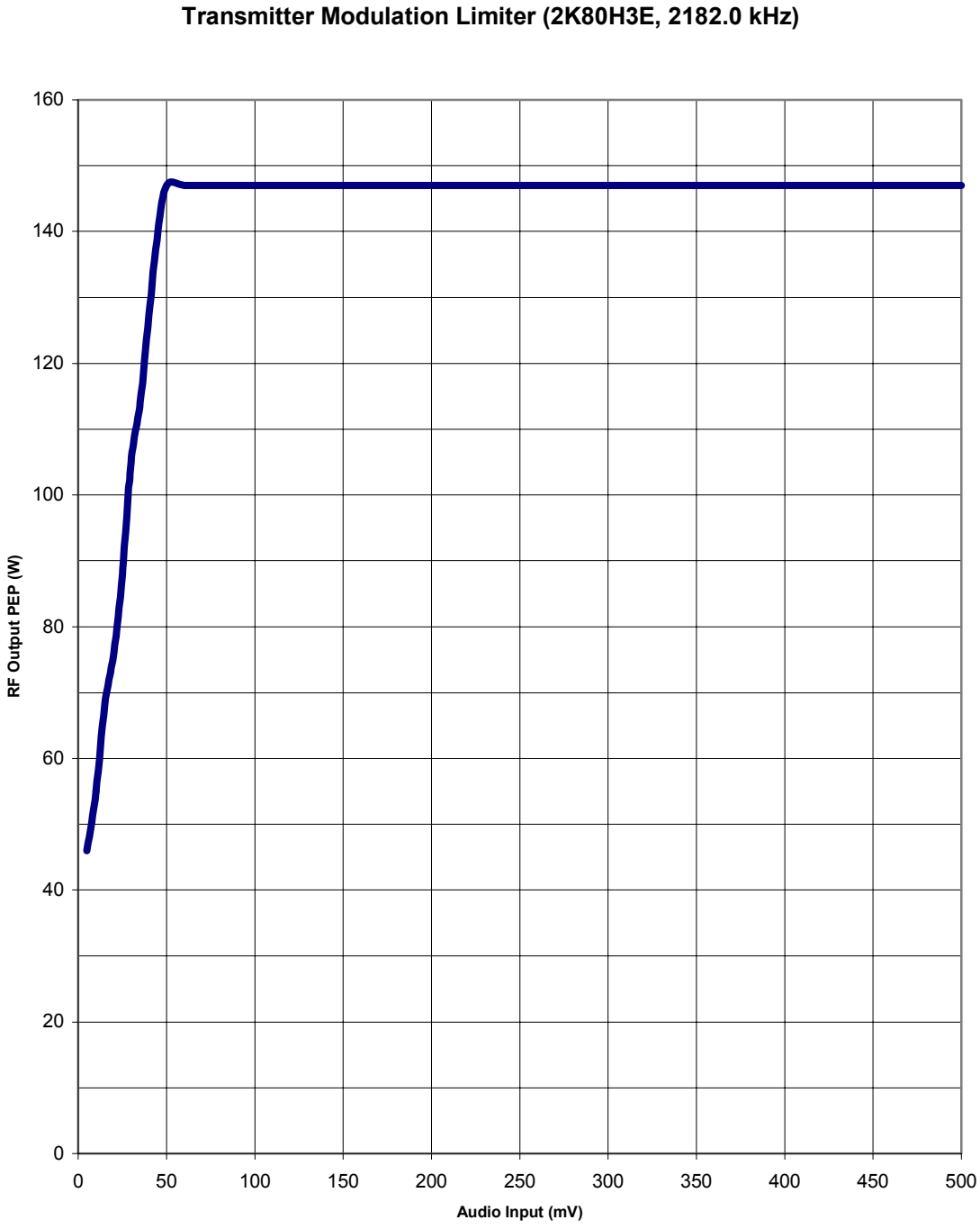

FIGURE 5.6 ALC TEST DATA IN H3E MODE

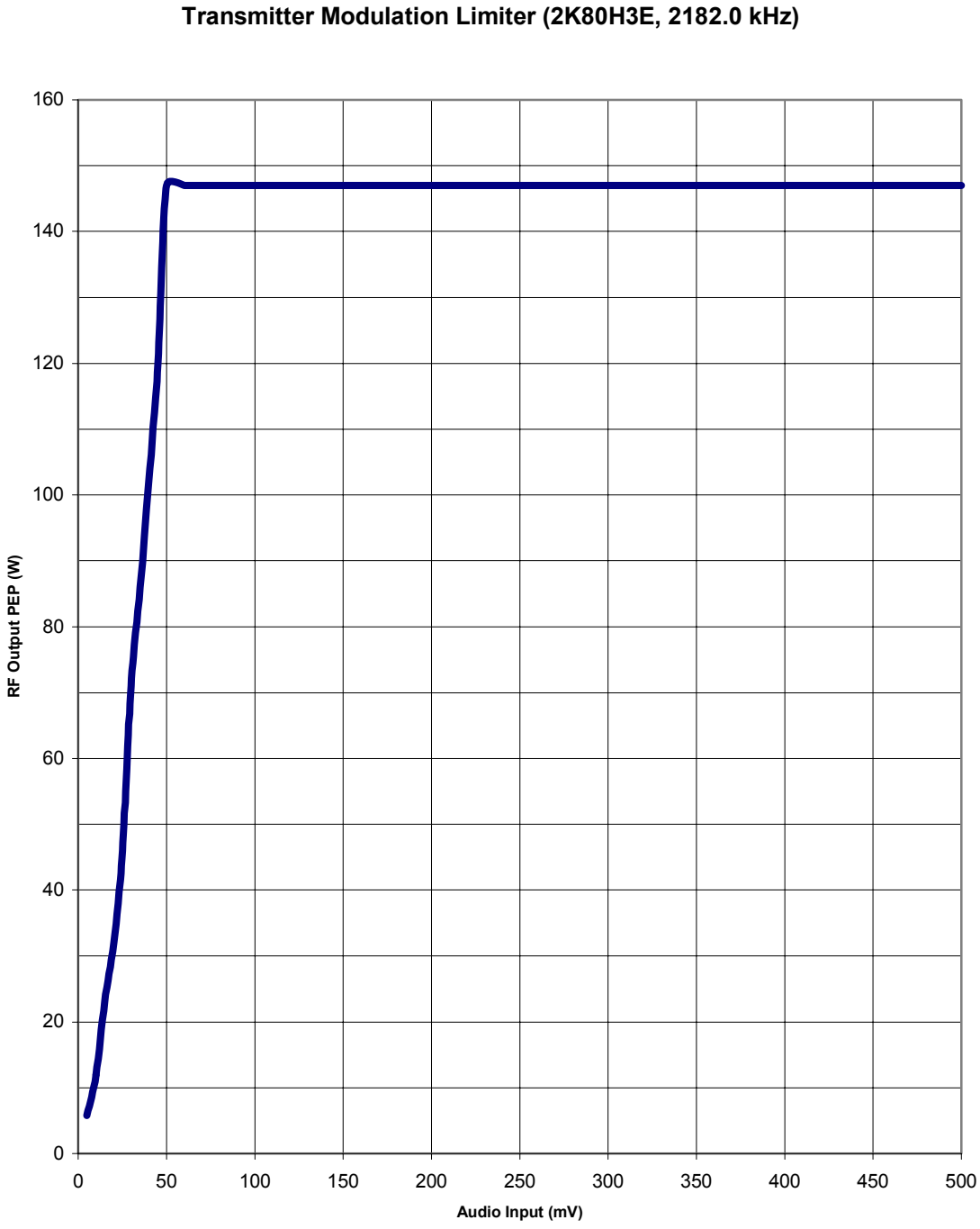

FIGURE 5.7 ALC TEST DATA IN R3E MODE

EXHIBIT 6 : FCC 2.1049 (OCCUPIED BANDWIDTH)

Part 2.1049(c), 80.211(f) Bandwidth Occupied Measurement

Part 2.947 Measurement Procedure Employed

Bandwidth Occupied Test:

The transceiver and the associated test equipment were set up as shown in Figure 6.1 (Page 6-2). In accordance with FCC Parts 80.219 (Special requirements for narrow-band direct printing (NB-DP) equipment) and 80.225 (Requirements for selective calling equipment), the FSK generator was set to deliver 1700 Hz ± 5 Hz with ± 85 Hz shift. (Total frequency shift of 170 Hz. Transmission rate was set to 100 baud with a MARK-SPACE ratio of 1:1, MARK (stop) frequency being the LOWER frequency emitted and SPACE (start) frequency being the UPPER frequency.

The FSK generator used for these tests is the internal DSC generator included in the SEA 245. DSC and NB-DP use the same modulation format. The SEA 245 uses a digital numerically controlled sine wave oscillator algorithm implemented in a digital signal processor for tone generation. The digital signals are converted to precise analog tones by an 18-bit digital to analog converter.

On each marine band from 2 to 25 MHz the transmitter output level on a single 1615 Hz tone was adjusted to 150 watts. The DSC dot pattern generator was energized and the resultant 280HJ2B emission was measured.

The results of the above tests are documented in the following figures:

2187.5 kHz	Figures 6.2, Page 6-3
4207.5 kHz	Figures 6.3, Page 6-4
6312.0 kHz	Figures 6.4, Page 6-5
8414.5 kHz	Figures 6.5, Page 6-6
12577.0 kHz	Figures 6.6, Page 6-7
16804.5 kHz	Figures 6.7, Page 6-8
22284.5 kHz	Figures 6.8, Page 6-9
25173.0 kHz	Figures 6.9, Page 6-10

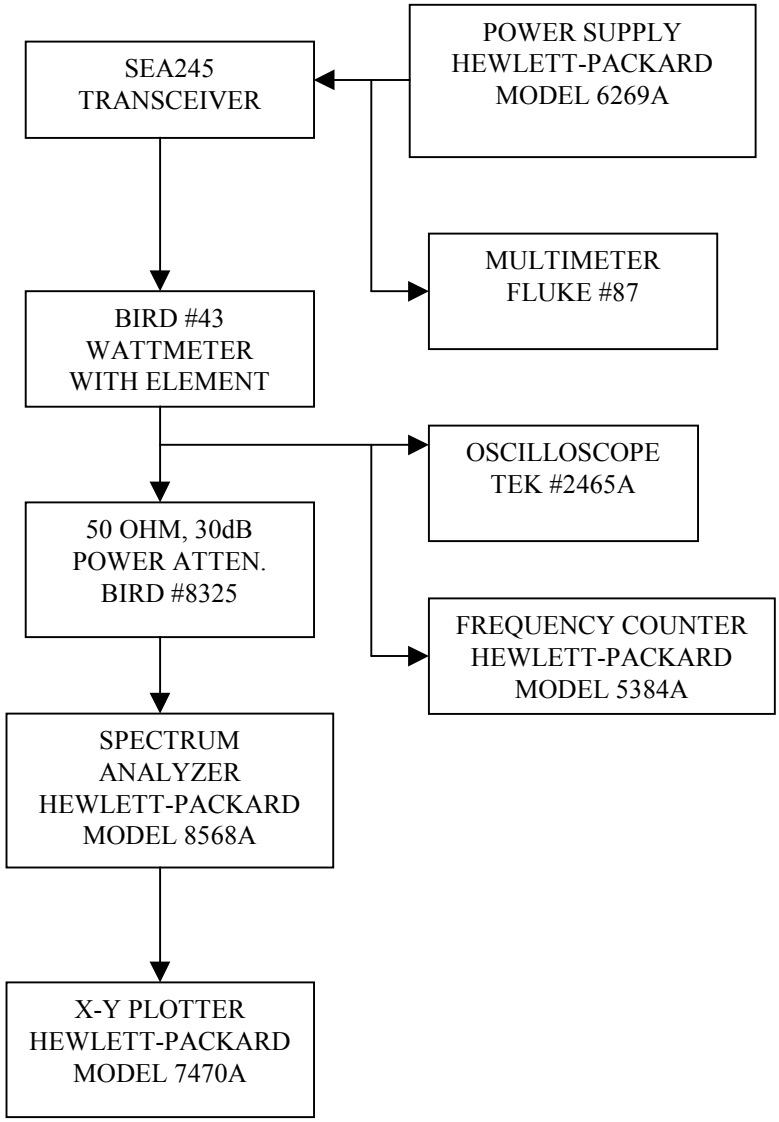

FIGURE 6.1 OCCUPIED BANDWIDTH TEST SETUP FOR NBDP IN ACCORDANCE WITH SECTION 2.1049 (c)

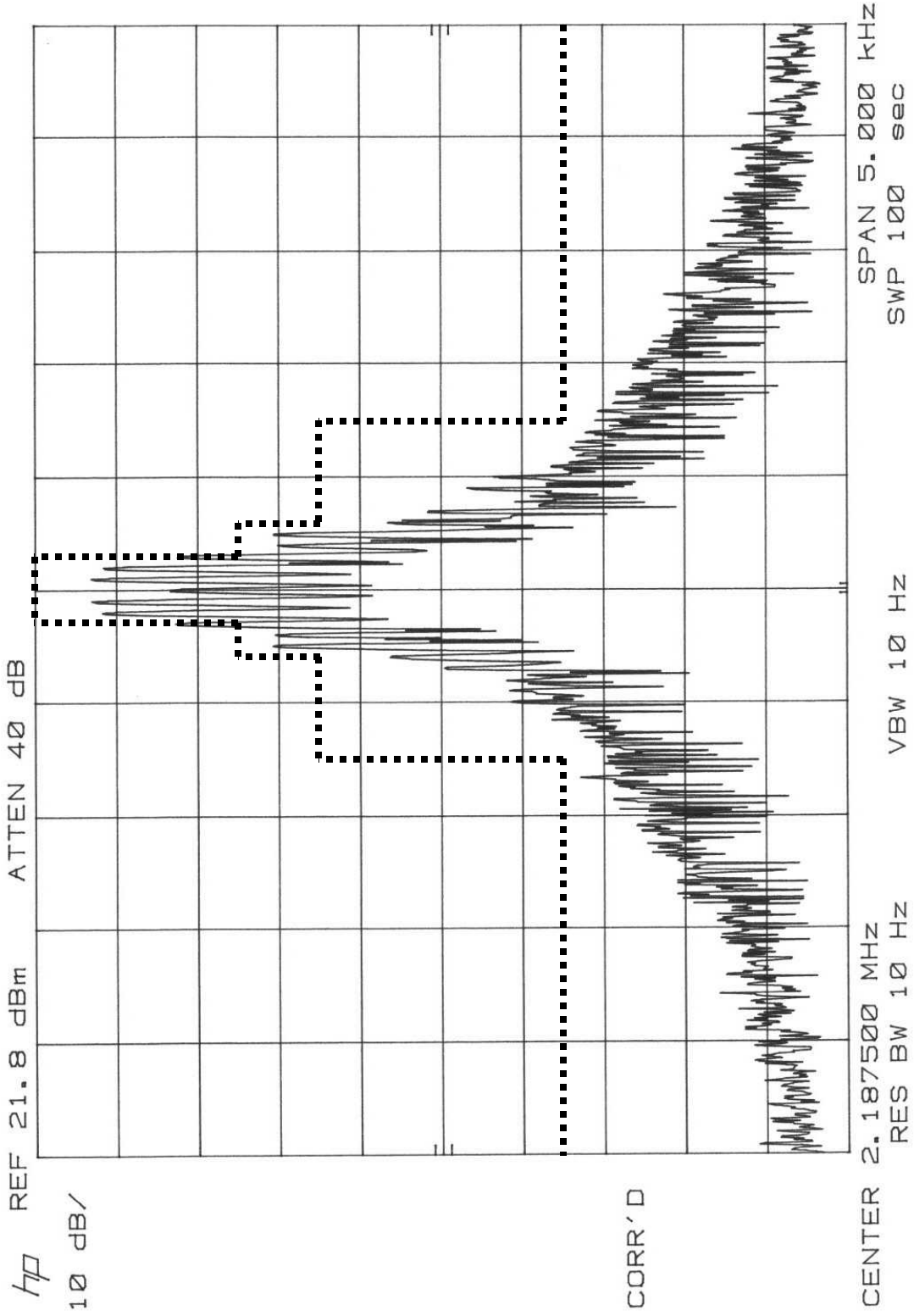

FIGURE 6.2 OCCUPIED BANDWIDTH TEST DATA (F_0 = 2187.5 kHz)

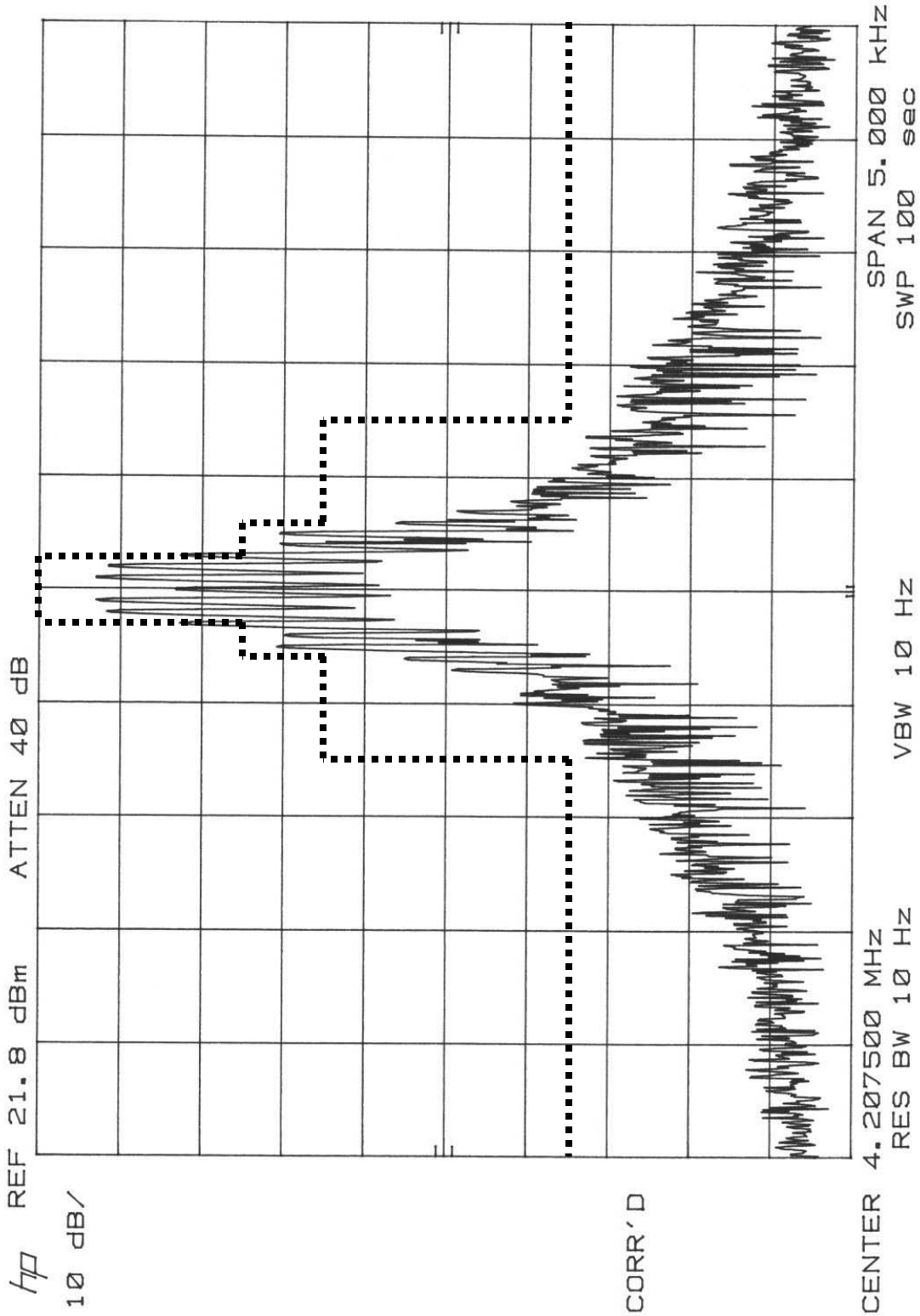

FIGURE 6.3 OCCUPIED BANDWIDTH TEST DATA (F_0 = 4207.5 kHz)

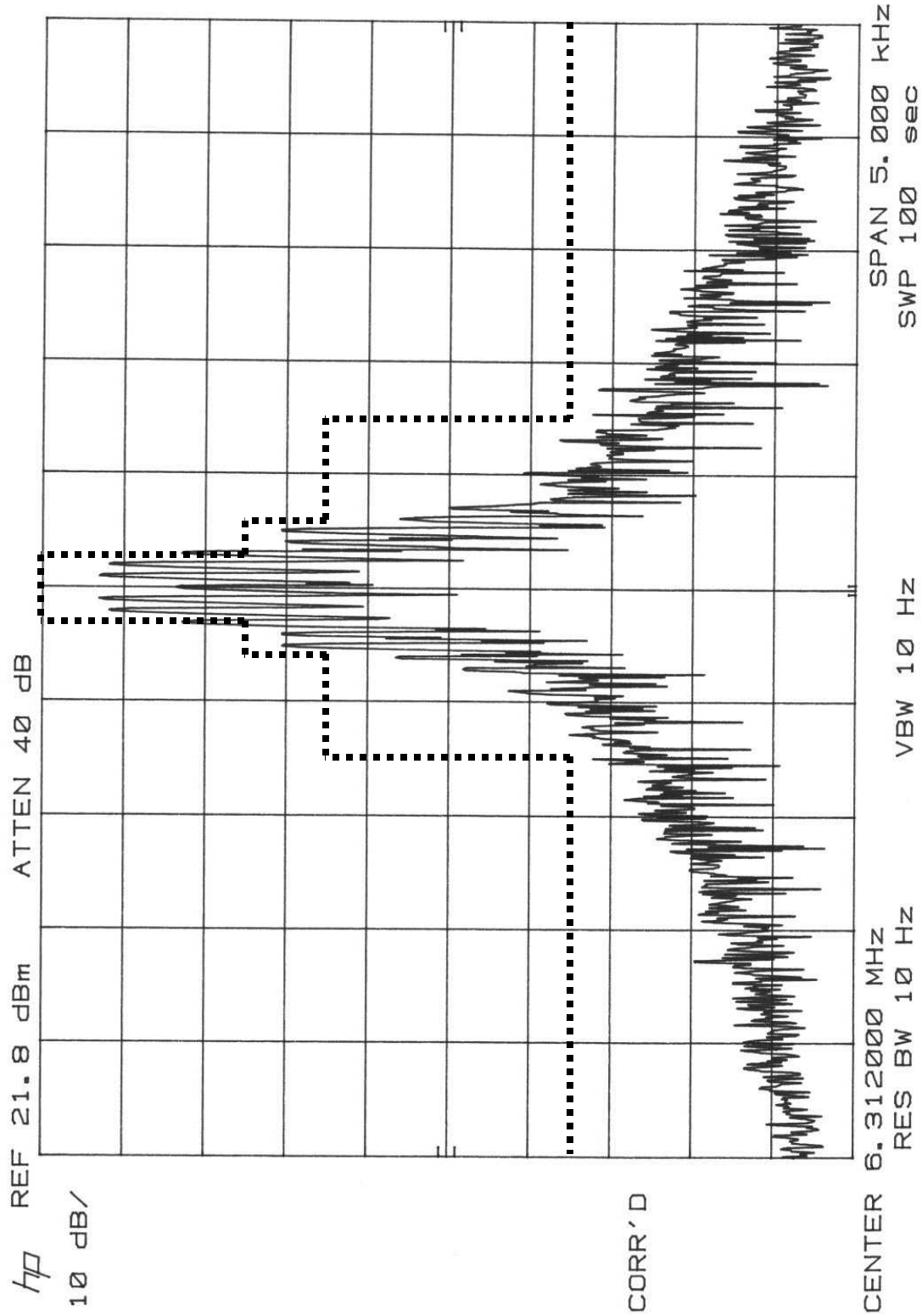

FIGURE 6.4 OCCUPIED BANDWIDTH TEST DATA (F_0 = 6312.0 kHz)

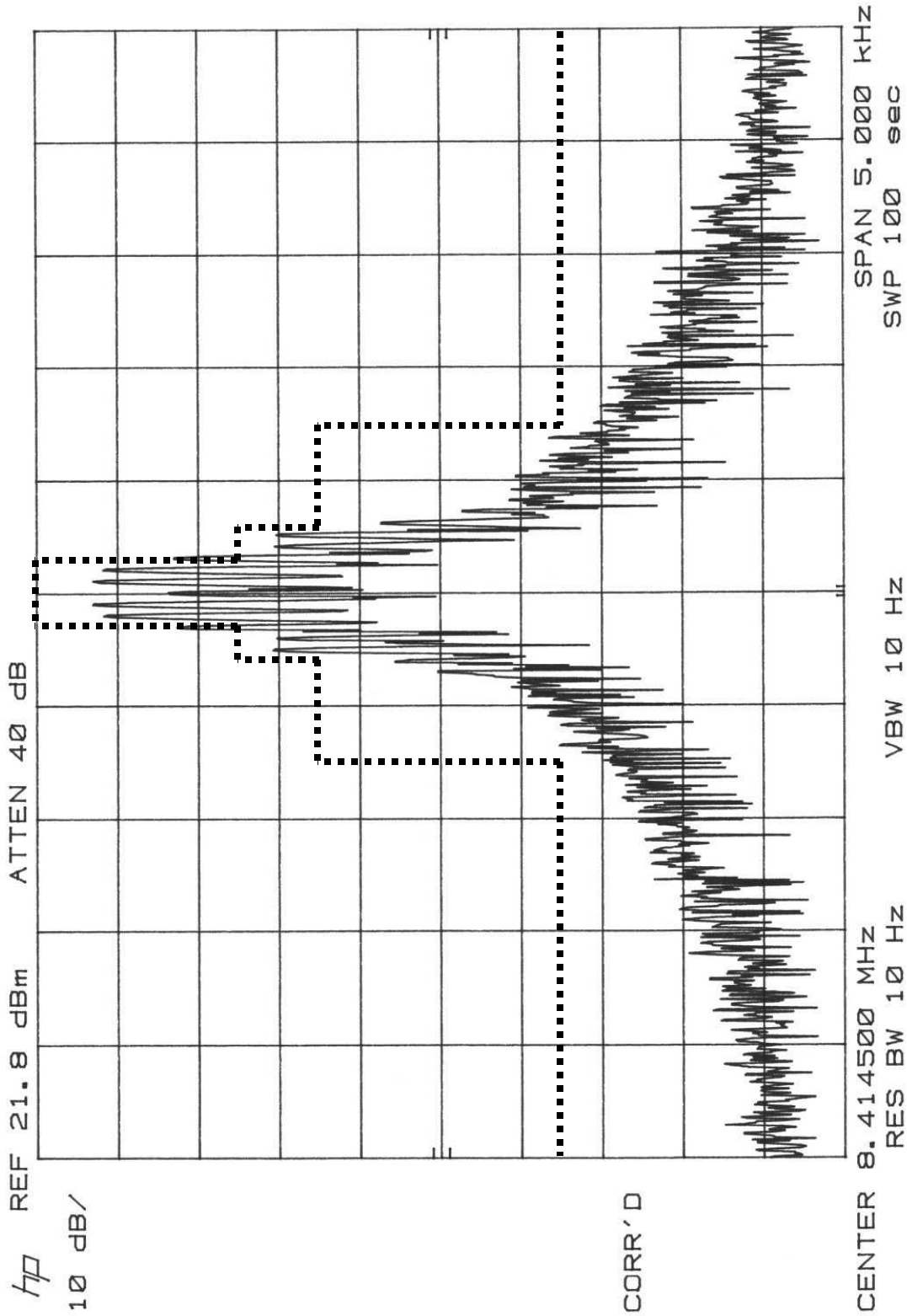

FIGURE 6.5 OCCUPIED BANDWIDTH TEST DATA (F_0 = 8414.5 kHz)

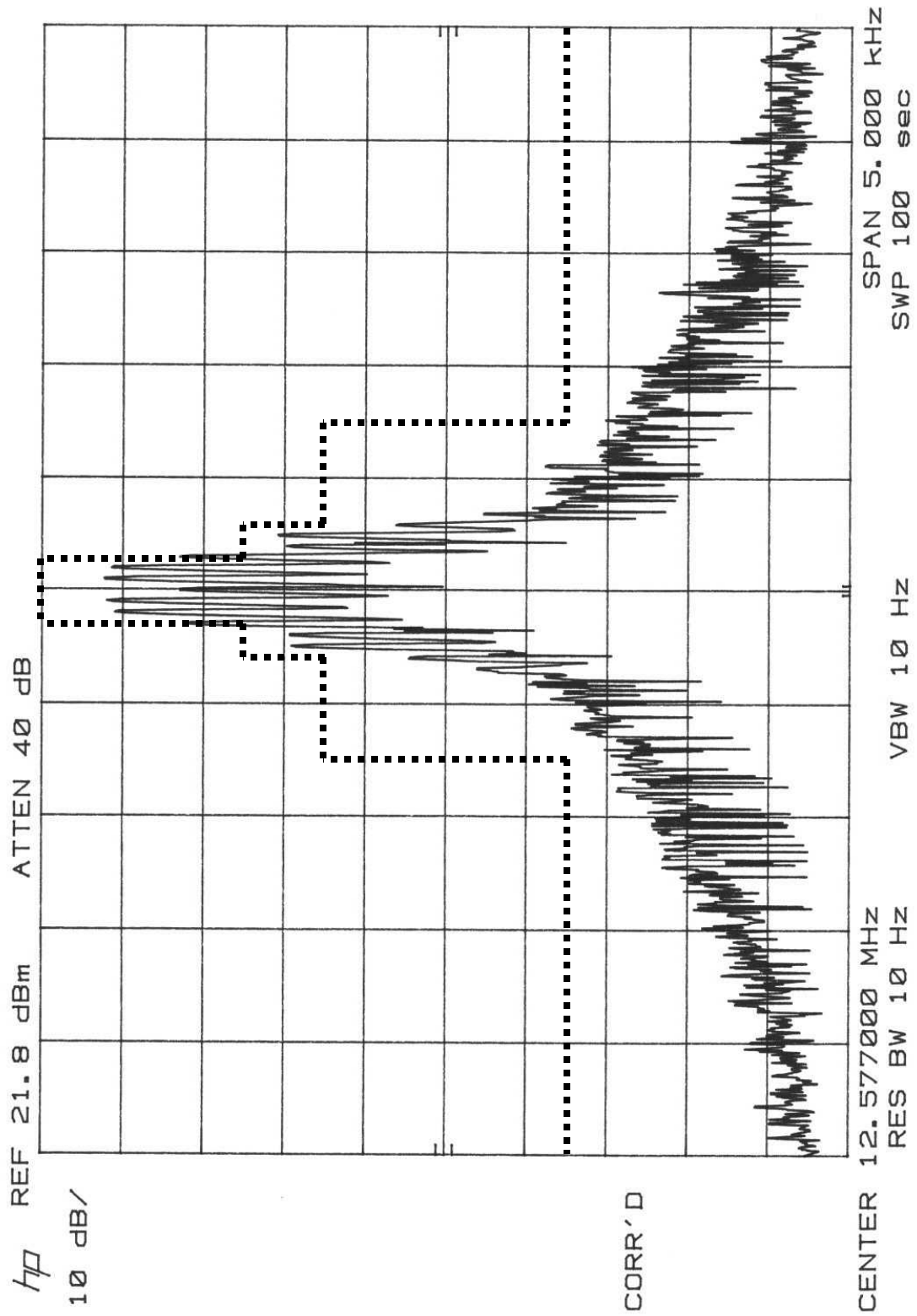

FIGURE 6.6 OCCUPIED BANDWIDTH TEST DATA (F_0 = 12577.0 kHz)

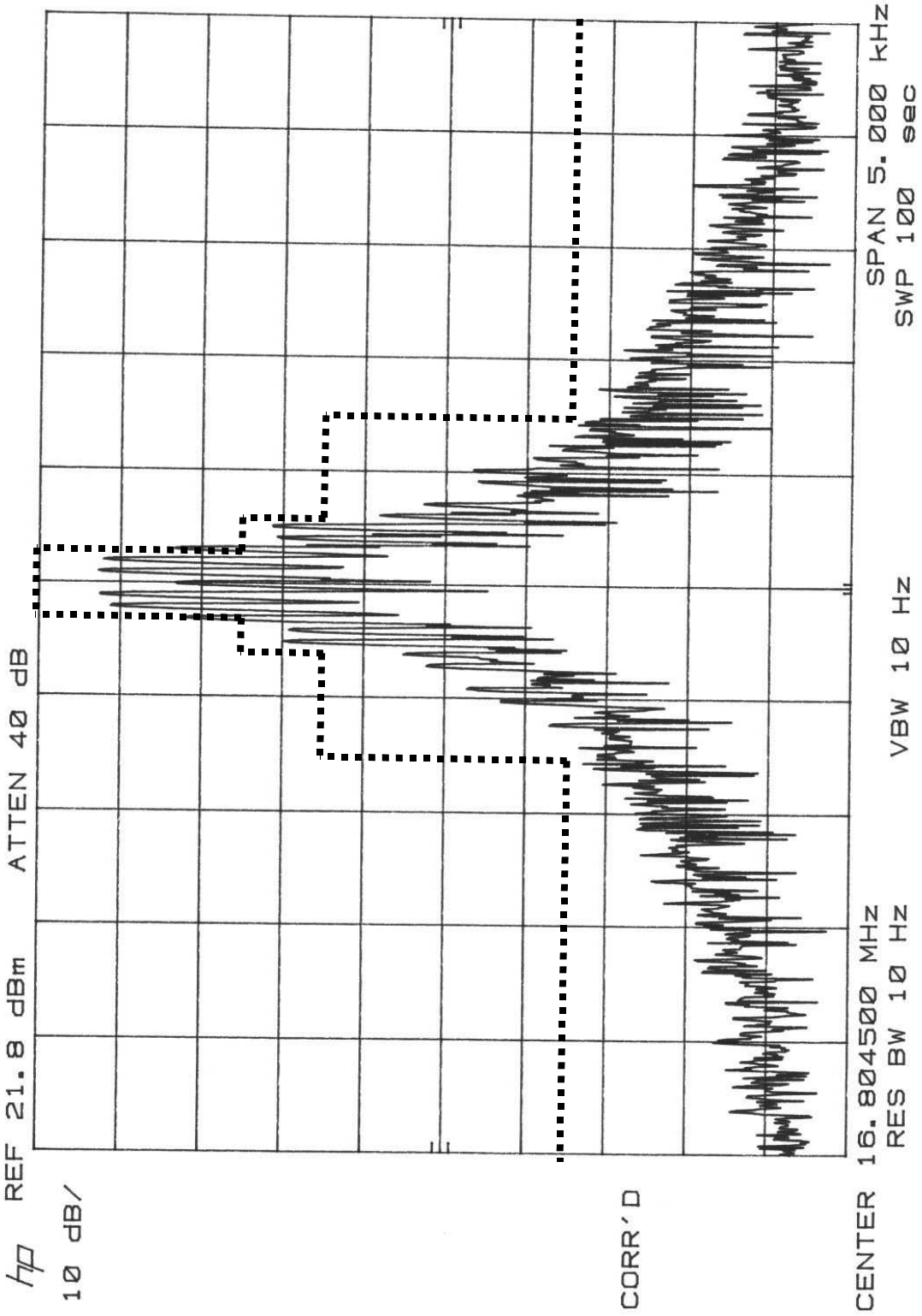

FIGURE 6.7 OCCUPIED BANDWIDTH TEST DATA (F_0 = 16804.5 kHz)

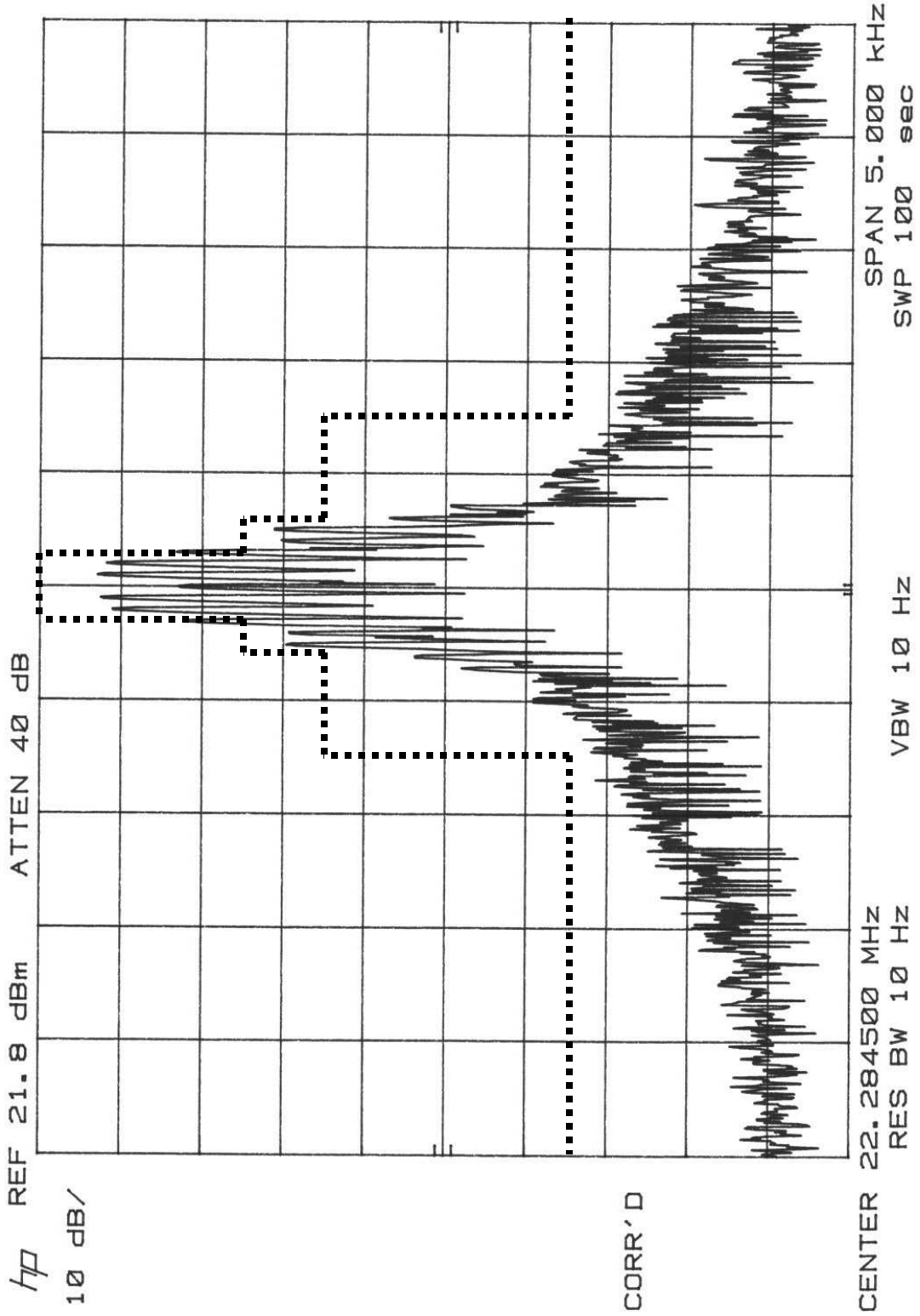

FIGURE 6.8 OCCUPIED BANDWIDTH TEST DATA (F_0 = 22284.5 kHz)

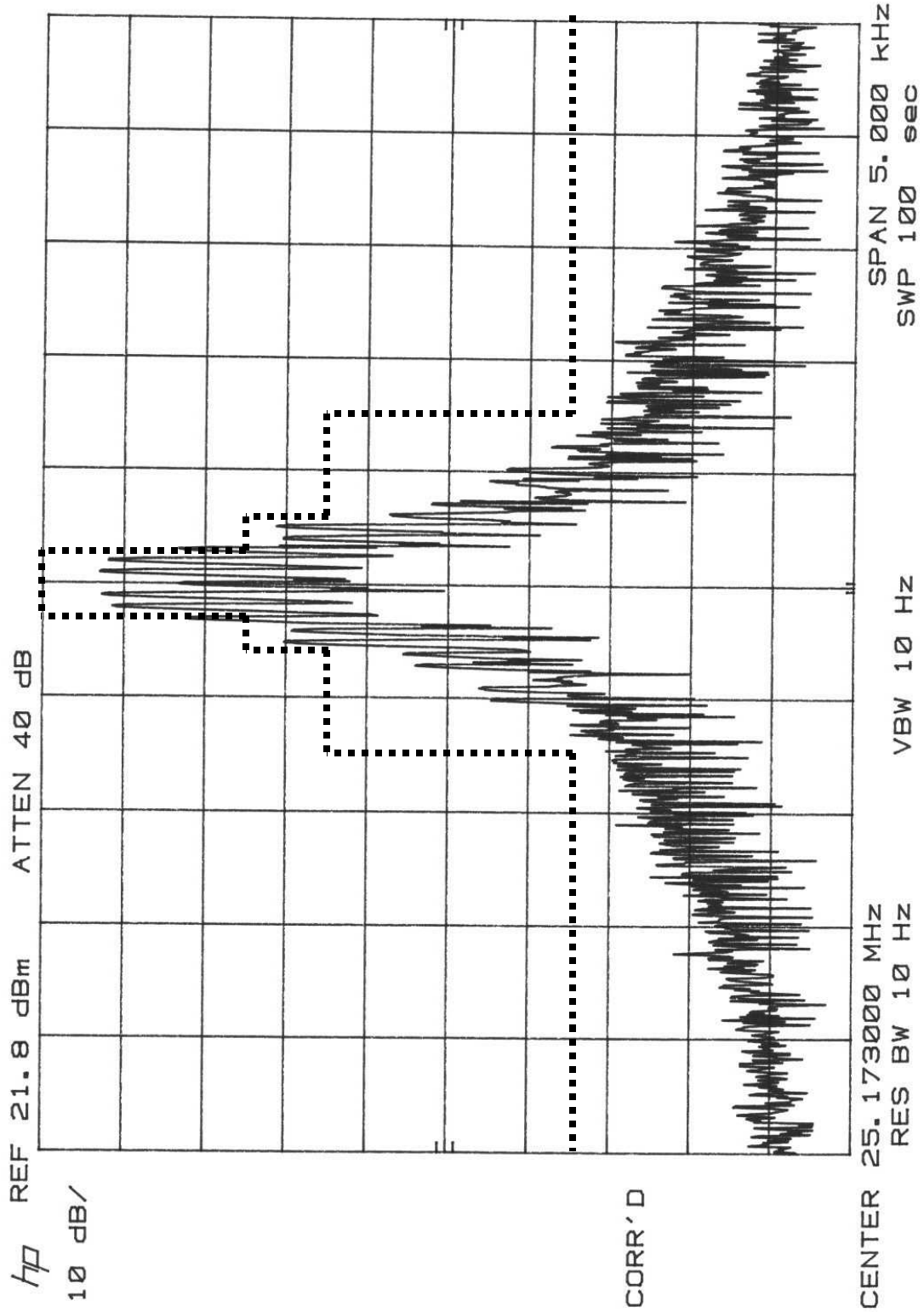

FIGURE 6.9 OCCUPIED BANDWIDTH TEST DATA (F_0 = 25173.0 kHz)