Application for Certification
For an RF Transmitter

ADD Eleco, Inc.
7207 Rio Flora Pl.
Downey, CA 90241

Product: Wireless Microphone

Model: AD200H

FCC ID: NHAAD200H

REPORT # RC054780/90103

This report was prepared in accordance with the requirements of the FCC Rules and Regulations Part 2, Subpart J, 2.981 through 2.1005, Part 74.801, 74.861 and other applicable sections of the rules as indicated herein.

Prepared By:

Jake Tynes

DNB Engineering, Inc.
3535 W. Commonwealth Ave.
Fullerton, CA 92833

15 FEBRUARY 2000

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Note:
The paragraph numbers in this report follow the application section numbers found in the FEDERAL COMMUNICATIONS COMMISSION Rules and Regulations, Part 2, Subpart J for Type Certification of electronic equipment.

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1.0 ADMINISTRATIVE DATA

1.1 Certifications and Qualifications

I certify that DNB Engineering, Inc conducted the tests performed in order to obtain the technical data presented in this application. Also, based on the results of the enclosed data, I have concluded that the equipment tested meets or exceeds the requirements of the Rules and Regulations governing this application.

1.2 Measurement Repeatability Information

The test data presented in this report has been acquired using the guidelines set forth in FCC Part 2.981 through 2.1005, and Part 90. The test results presented in this document are valid only for the equipment identified herein under the test conditions described. Repeatability of these test results will only be achieved with identical measurement conditions. These conditions include: The same test distance, EUT Height, Measurement Site Characteristics, and the same EUT System Components. The system must have the same Interconnecting Cables arranged in identical placement to that in the test set-up, with the system and/or EUT functioning in the identical mode of operation (i.e. software and so on) as on the date of the test. Any deviation from the test conditions and the environment on the date of the test may result in measurement repeatability difficulties.
All changes made to the EUT during the course of testing as identified in this test report must be incorporated into the EUT or identical models to ensure compliance with the FCC regulations.

Bryan Broaddus (Para. 1.1)
Manager, Test Dept.
DNB Engineering, Inc.
Tel. (714) 870-7781 FAX (714) 870-5081

2.983 (a) Request for Certification

Name of Applicant:		ADD Eleco, Inc. 7207 Rio Flora Pl. Downey, CA 90241
Applicant is:	X	Manufacturer
		Vendor
		Licensee
		Prospective Licensee
		Other
Name of Manufacturer:		ADD Eleco, Inc.

2.983 (b) Equipment Description

The EUT is a low power auxiliary station wireless microphone designed to operate within the 174 to 216 MHz (TV broadcast band).

Product: Wireless Microphone, Hand-Held

Model: AD200H

FCC ID: NHAAD200H

2.983 (c) Anticipated Production Quantity

	One Unit
X	Multiple Units

2.983 (d) Technical Description

The EUT is a hand-held wireless microphone that operates in the TV broadcast band between 174 and 216 MHz. The microphone requires a standard 9V transistor battery for operation. If the battery voltage drops below 6.2 Vdc, an LED battery level indicator next to the ON-OFF switch blinks to alert the user. The output power is 10 mW nominal into a 3 inch long flexible antenna.

2.983 (d) (1) Type of Emissions

F3E F: Frequency Modulation
3: A single channel containing analogue information
E: Telephony (including sound broadcasting)

2.983 (d) (2) Frequency Range

174 MHz to 216 MHz (crystal controlled, fixed, not selectable)

2.983 (d) (3) Operating Power Level

10 Milliwatts (nominal)

2.983 (d) (4) Maximum Power Allowed in Applicable Part(s) of the Rules

FCC rules:	Maximum Power:
Part 74.861 (e) (1) (i)	174 to 216 MHz: 50 mW

2.983 (d) (5) Final RF Transmitter Input Power

N/A

2.983 (d) (6) Function of all Active Circuit Devices

Please refer to block diagram (Figure 1) and schematic (Figure 2).

A. Preamplifier

U2 amplifies the microphone input signal 24 dB to 34 dB, depending on the setting of VR2.

B. Compressor and Pre-Emphasis

Pre-Emphasis is governed by C12, R5 and the 20K resistor built-into U1. U1A forms a compressor with a unity gain level of 0.775 volt.

C. Deviation Control

U1B functions as a voltage controlled amplifier, with VR1 controlling the output level and thus the frequency deviation.

D. FM Modulator and Tripler

Q4 functions as a voltage-controlled crystal oscillator with the collector tuned to three times the crystal frequency. The frequency determining components for this oscillator consists of L1, D1 and X1 in series.

E. First Band-Pass Filter

A band-pass filter formed by L4, C29, C37 and C40 is tuned to three times the crystal frequency.

F. RF Amplifier and Tripler

Q5 triples the output frequency of FM modulator (Q4) for a total of nine times the crystal frequency. Q5 also amplifies the signal to 10 dBm (10 mW into a 50 ohm load).

G. Second Band Pass Filter

A band pass filter formed by L5, C39 and C42 is tuned to nine times the crystal frequency.

H. Voltage Regulator and Low Battery Indicator

U5 serves as a voltage regulator and low battery indicator. If the battery voltage drops to 6.2 volts, D3 will blink until the battery is changed.

2.983 (d) (7) Circuit Diagram

See Figure 1. Block diagram provided in Figure 2.

2.983 (d) (8) Instruction Book

Refer to Appendix A.

2.983 (d) (9) Tune-Up Procedure

A. SW1 to OFF, VR1 to midrange and VR2 to midrange.

B. Solder a 50 ohm coaxial cable (RG174) to the antenna terminal.

C. Split this cable three ways to feed a spectrum analyzer, modulation analyzer and frequency counter.

D. On the modulation analyzer select 50 uS deemphasis, 15 kHz LPF, FM mode and connect its audio output to an audio analyzer for distortion measurement.

E. Solder a shielded cable to the preamplifier output.

F. Connect the other end of the shielded cable to an AC voltmeter.

G. Apply 9 volts to the battery terminals and switch SW1 on. Adjust C29, C33, C42 and L2 for maximum power.

H. Adjust L1 for the proper frequency (nine times the crystal frequency) and repeat step G.

I. Apply 30 mV of audio at 1 kHz to the microphone terminals. Adjust VR2 for 775 mV preamplifier output.

J. Adjust VR1 for 12 kHz deviation. Adjust L2 and C29 for minimum distortion and maximum power.

2.983 (d) (10) Description of Frequency Determining Circuitry

The frequency determining components for this oscillator consists of L1, D1 and X1 in series.

2.983 (d) (11) Description of Suppression Circuitry

Suppression circuitry consists of the two band-pass filters described in 2.983 (d) (6), E and G.

2.983 (d) (12) Description of Digital Modulation System

Not applicable.

FIGURE 1: EUT Circuit Diagram 2.983 (d) (7)

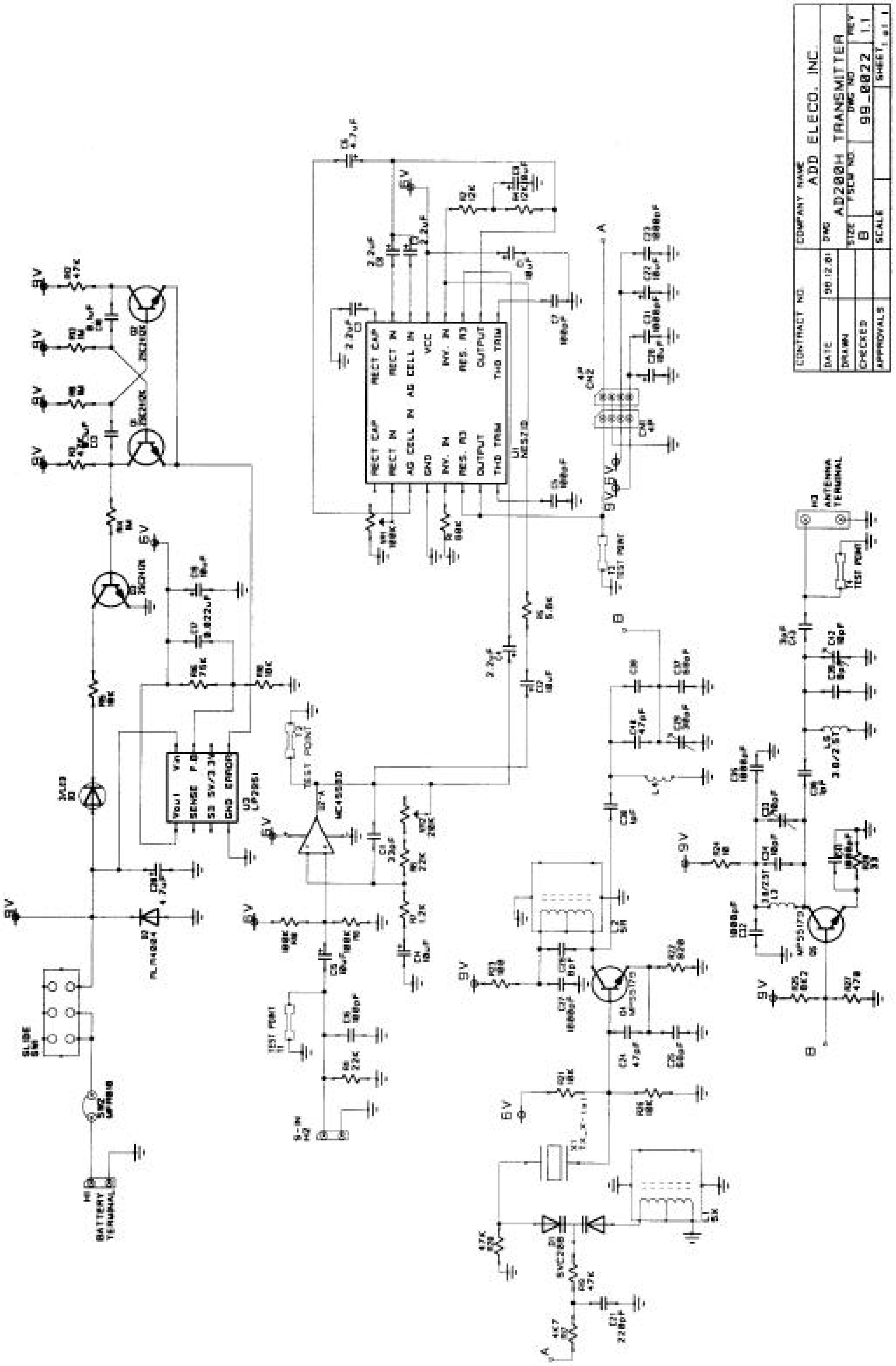
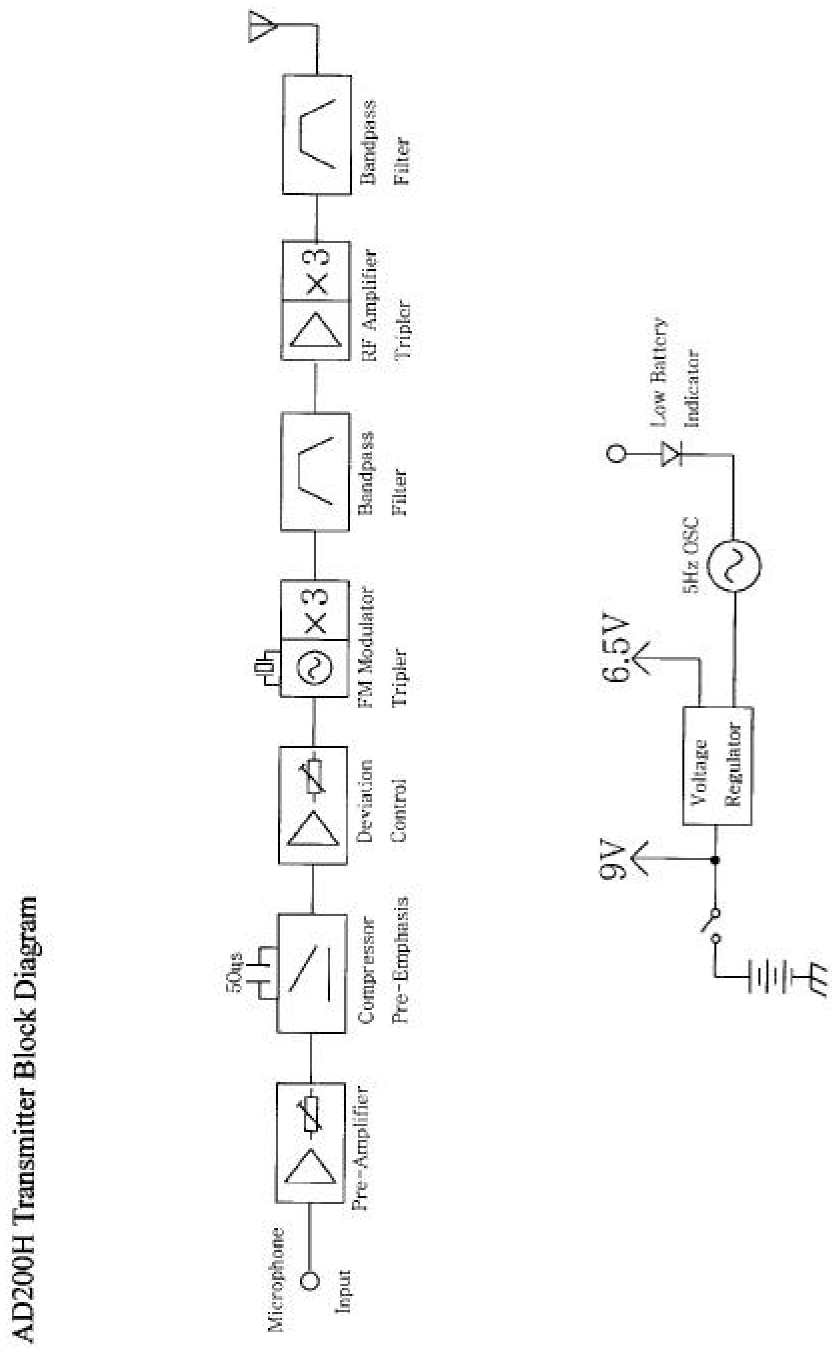


FIGURE 2: EUT Block Diagram 2.983 (d) (7)



2.983 (e) Test Data

Refer to 2.983 (e) (1) through 2.93 (e) (7).

2.983 (e) (1) Measurement of RF Power Output per 2.985 and 74.681

Requirement
Power output shall be measured at the RF output terminals when the EUT is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements.

The maximum power is 50 mW from 174 to 216 MHz.

Test Method

The block diagram for all conducted tests is provided in Figure 3.

Output Power is measured across a 50 ohm load with a directional coupler and a spectrum analyzer. A list of equipment used for all conducted tests is provided in Figure 4.

Test Results

Note: Prior to measuring the power output, the stock antenna was removed from the EUT and replaced with a cable and coaxial connector. The center conductor was connected to the RF output and the shield was connected to the EUT's ground plane. This was necessary to permit connecting the measuring apparatus to the RF output terminals. A similar cable was connected to the audio input terminals to permit external modulation. A test setup photograph for all conducted tests is provided in Figure 5.

The measured RF power into 50 ohms was verified to be 10mW (10 dBm).

A plot of the measured power is provided in Figure 6.

FIGURE 3: Block Diagram for All Conducted Tests

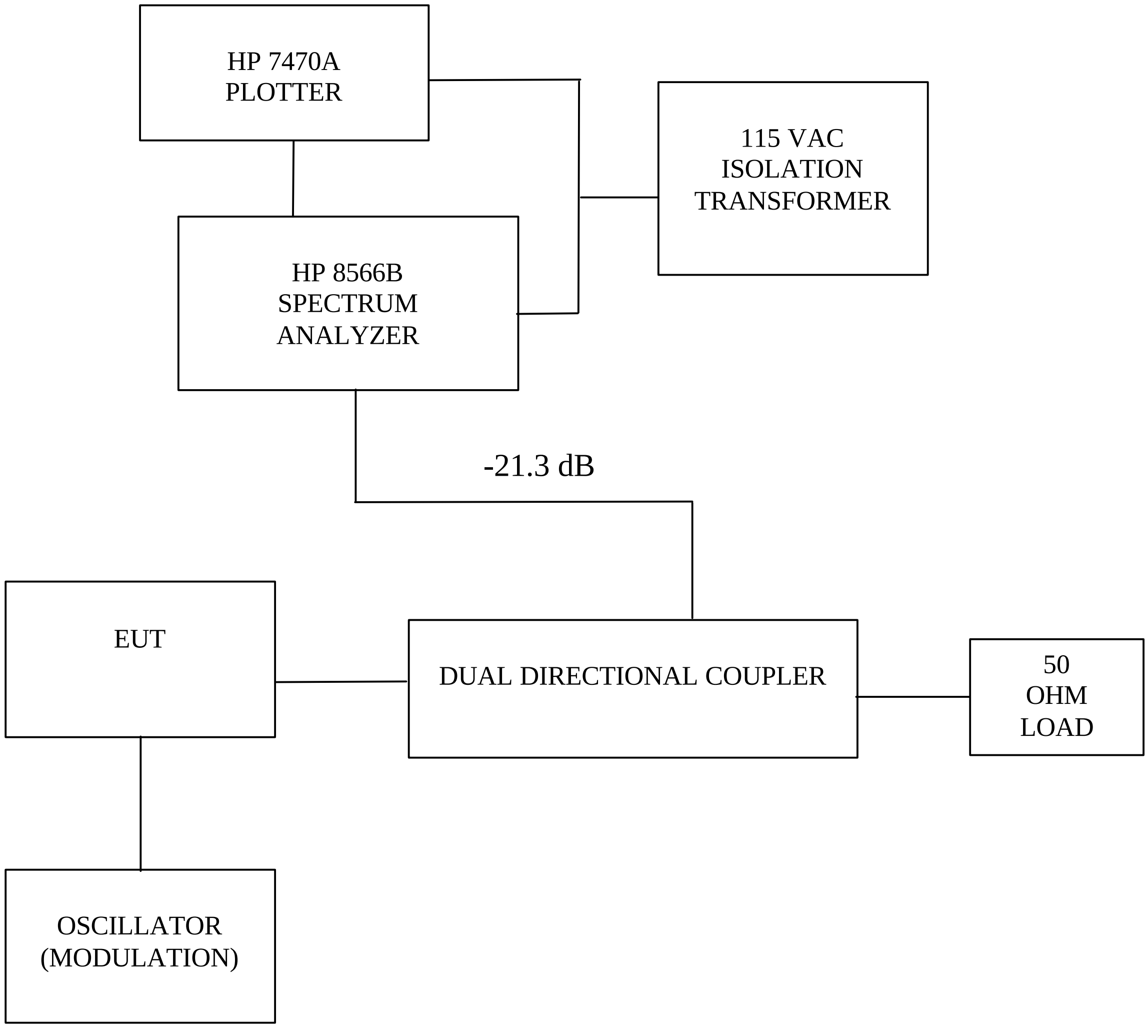


FIGURE 4: Equipment List

TEST EQUIPMENT LOG

Date: 2/9/00

EUT: Wireless Microphone

Serial #: N/A

Test Procedure: N/A

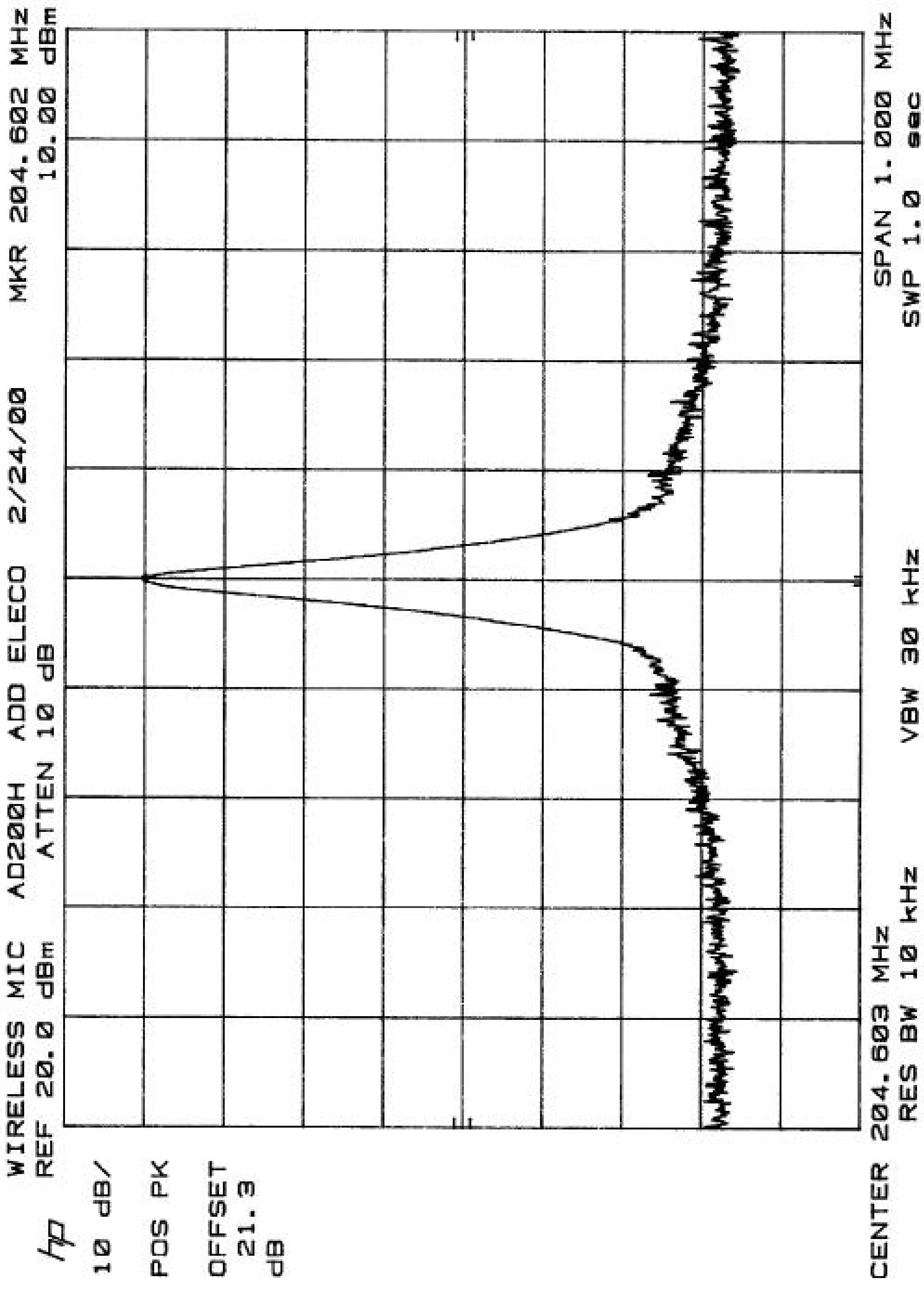
Part #: AD200H

Test Engineer: John Stanford

DESCRIPTION	MANUFACTURER	MODEL # / SERIAL #	CAL. DUE DATE
Spectrum Analyzer	HP	8566B / 970137-1, -2	2/20/00
Spectrum Analyzer	HP	8568B / 11403992180013, 14	8/6/00
Directional Coupler	HP	778D	Cal prior to test
Function Generator	HP	3312A	Reference
50 Ohm Load	Termaline	8164	N/A
50 Ohm Load	Termaline	8053	N/A
Oscilloscope	LeCroy	9400 / 85584	7/22/00
Plotter	HP	7470A	N/A

FIGURE 5: Test Setup Photo for All Conducted Tests

FIGURE 6: Plot of RF Power Output



2.983 (e) (2) Measurement of Modulation Characteristics per 2.987 and 74.861

Requirement

The requirement of this test is to produce a plot of Frequency (X-axis) vs. Deviation (kHz) for a wireless microphone. From the determined characteristics, a suitable modulation frequency and amplitude for the occuplied bandwidth measurement can be determined.

Test Method

The following equipment is required to perform this test:

1. Sound pressure meter (SPM)
2. Transducer (speaker) with a frequency response of 20 to 20 kHz
3. Audio oscillator, 20 Hz to 20 kHz
4. Audio amplifier, 20 Hz to 20 kHz
5. Oscilloscope and/or RMS voltmeter
6. Modulation monitor
7. Anechoic sound-proof room

Test Setup

To produce a frequency response curve (frequency vs. deviation), the non-linearities of the speaker must be nullified. This is accomplished by measuring the audio oscillator output level (Vp-p) necessary to produce a constant SPL of 86 dB at a constant distance (0.1 inches) from the transducer as measured on an SPM from 20 Hz to 20 kHz. Once this level is determined for the frequency range of interest, the same established drive levels is used with the sound pressure meter replaced with the wireless microphone under test.

A. Calibration

1. Arrange the test equipment per Figure 7 for calibration.

2. Turn on the SPM and calibrate the sound meter per operating instructions.

3. Place the speaker on the test bench.

4. Position the SPM in front of the reference speaker and align it with the center of the speaker cone.

5. Configure the sound pressure meter to the following settings:

    a. Meter range: lower
    b. Range: 45 – 125 dB
    c. Weighting network: Lin
    d. Meter function: Fast
    e. Ext Filter: Out

6. Turn on the audio oscillator and amplifier.

7. Set the frequency generator to 20 Hz and increase the test level until the SPM reads 86 dB.

8. Record the frequency and peak-to-peak voltage on the test data sheet.

9. Repeat every 10 Hz up to 100 Hz, every 100 Hz up to 1 kHz and every 1 kHz up to 20 KHz.

B. Test

1. Replace the SPM with the wireless microphone positioned at the same distance from the transducer and with the microphone aligned with the center of the speaker.

2. Connect the RF output from the wireless microphone to the modulation monitor.

3. Turn on the modulation monitor and set the mode to FM and (PK – PK)/2.

4. Turn on the wireless microphone.

5. Turn on the audio oscillator and amplifier.

6. Set the frequency and amplitude to the first calibration frequency established at 20 Hz.

7. Record the deviation (in kHz) on the test data sheet.

8. Repeat steps 6 and 7 at each calibration frequency from 20 Hz to 20 kHz.

C. Determination of suitable audio injection level

1. Determine the peak deviation frequency from the frequency response curve.

2. Disconnect the microphone and connect the audio oscillator (without the amplifier) directly to the microphone input.

.

3. While monitoring the output with an oscilloscope, increase the drive level until the maximum deviation level or 75 kHz is obtained, whichever is less

4. Record this drive level.

5. Decrease the drive level until the frequency deviation has decreased to one-half of the maximum attained in step 3. Record this level.

6. Increase this level by 16 dB and record. This frequency and amplitude level will be used for the occupied bandwidth test.

Test Results

Peak deviation of 11.1 kHz occurred at a modulation frequency of 13 kHz.

See Figure 11 and 12.

FIGURE 7: Block Diagram of Modulation Characteristics Test

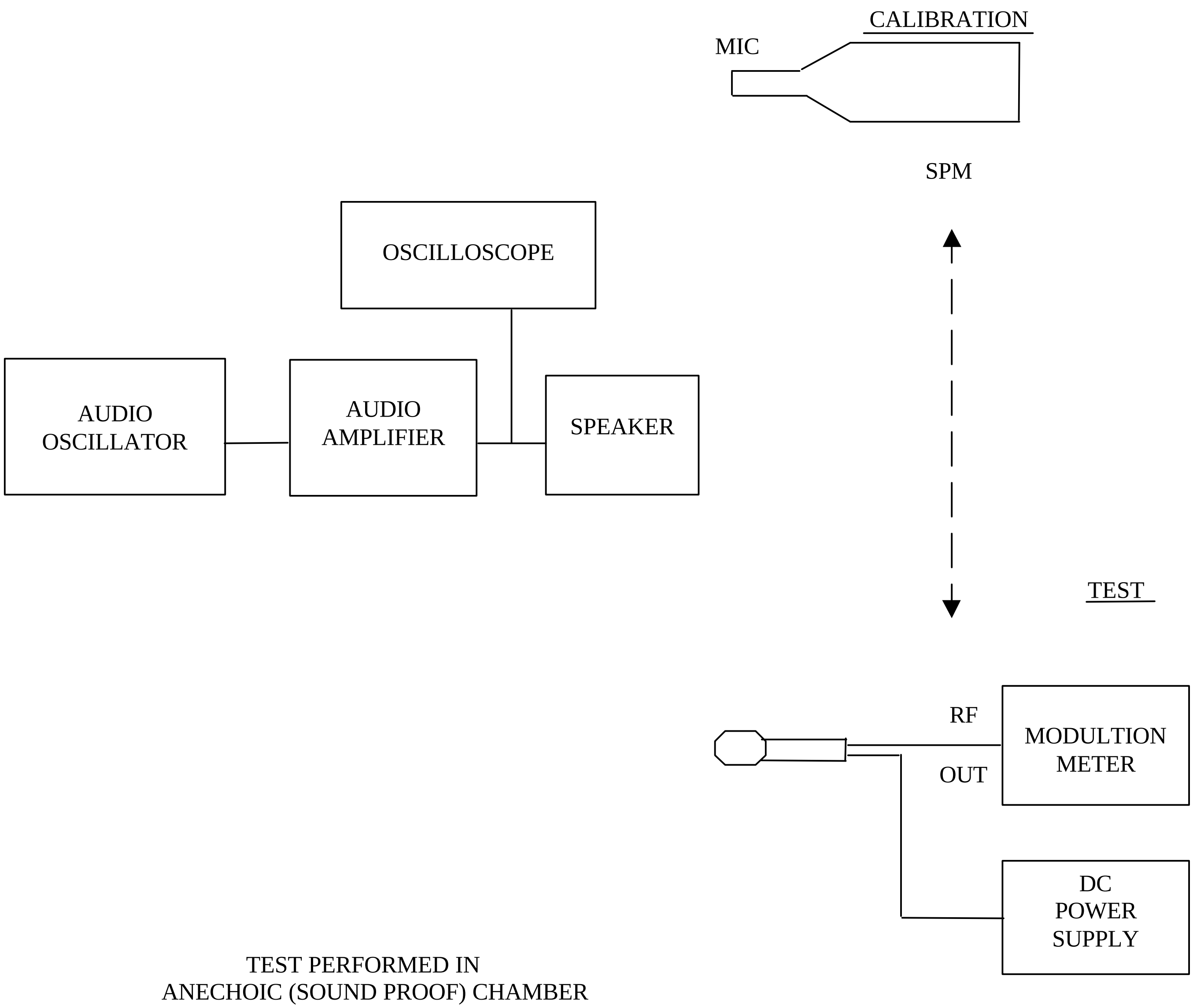


FIGURE 8: Test Equipment Log

TEST EQUIPMENT LOG

Date: 2/22/00

Test Procedure: N/A

EUT: Wireless Microphone

Part #: AD200H

Serial #: N/A

Test Engineer: John Stanford

DESCRIPTION	MANUFACTURER	MODEL # / SERIAL #	CAL. DUE DATE
Audio Amplifier	Bogen	MO-100A	Reference
Modulation Meter	Marconi	2305	Cal prior to test
Oscilloscope	Fluke	PM3084	2/26/00
Power Supply	HP	6216B	Reference
Signal Generator	HP	651B	Reference
Sound Pressure Meter	Bruel & Kjaer	2218	2/24/00
Speaker	N/A	8 ohm, 10W	Cal during test

FIGURE 9: Photo of Modulation Characteristics Calibration

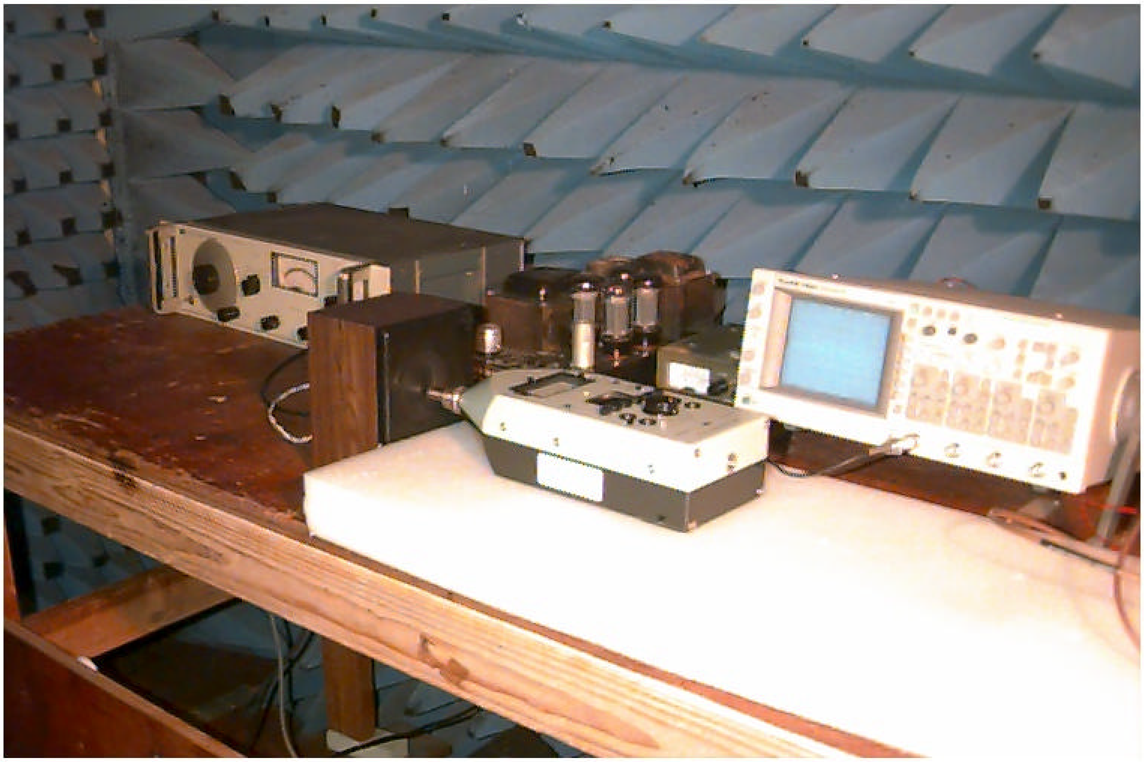


FIGURE 10: Photo of Modulation Characteristics Test

FIGURE 11: Test Data Sheet

TEST DATA SHEET

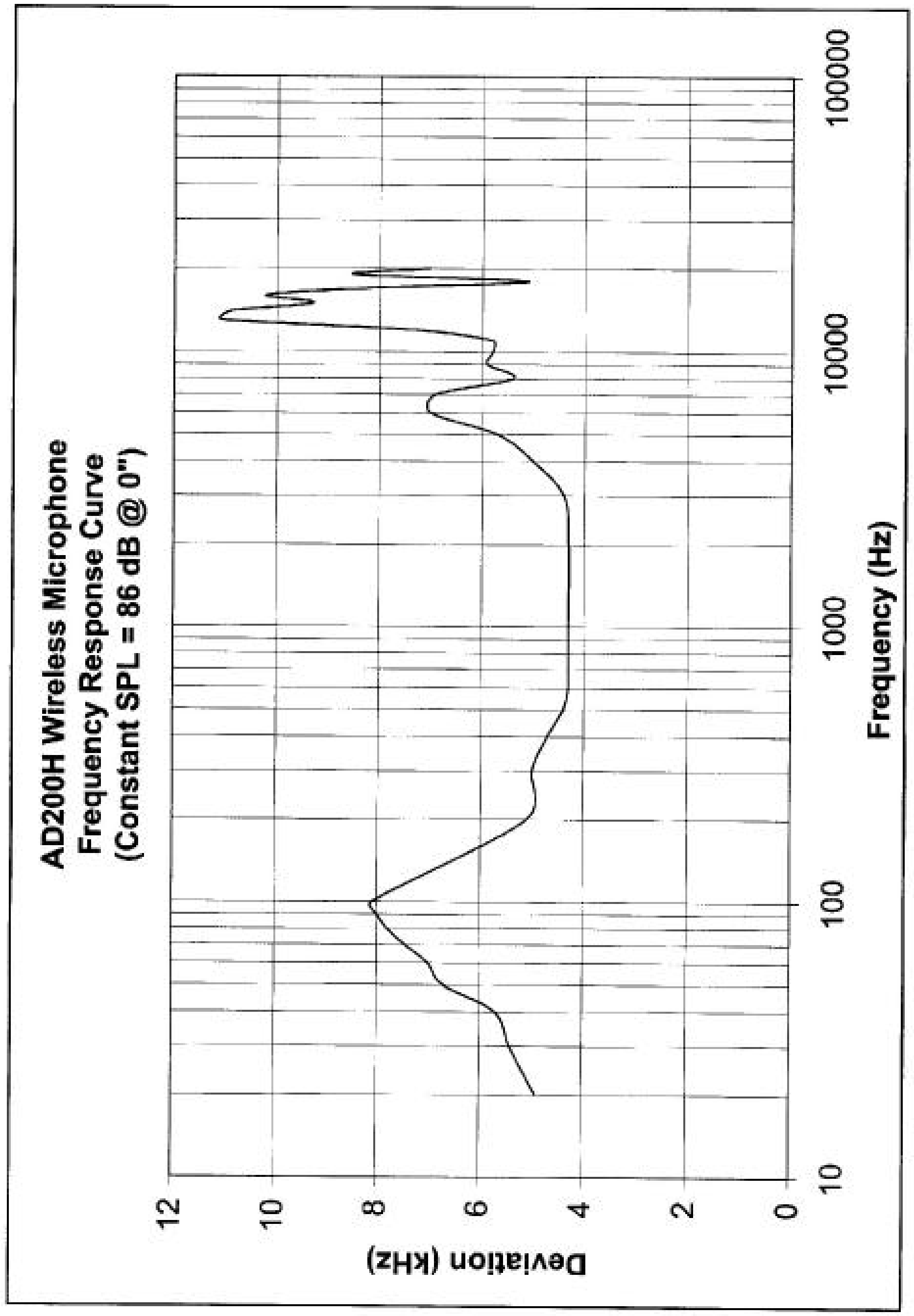
Date: 2/22/00

Unit Under Test: AD 200 H Wireless Mic

Constant Sound Pressure: 86 dB @ 0.1 inch Spacing

Frequency (Hz)	Transducer Drive (Vp-p)	Deviation (kHz)
20	2.49	4.9
30	2.05	5.4
40	1.50	5.7
50	1.16	6.7
60	1.10	7.0
70	0.930	7.5
80	0.845	7.8
90	0.880	8.0
100	0.880	8.1
200	0.183	5.1
300	0.148	5.0
400	0.178	4.7
500	0.200	4.4
600	0.216	4.3
700	0.199	4.3
800	0.198	4.3
900	0.194	4.3
1,000	0.248	4.3
2,000	0.524	4.3
3,000	0.545	4.4
4,000	0.672	5.0
5,000	0.926	5.7
6,000	0.836	7.0
7,000	4.34	6.9
8,000	1.12	5.4
9,000	3.43	5.9
10,000	2.54	5.8
11,000	3.18	5.8
12,000	15.7	7.3
13,000	47.0	11.1
14,000	32.9	10.9
15,000	16.5	9.3
16,000	22.3	10.2
17,000	9.7	8.1
18,000	4.8	5.1
19,000	11.2	8.5
20,000	25.9	7.0

FIGURE 12: Frequency Response Curve



2.983 (e) (3) Measurement of Occupied Bandwidth per 2.989 and 74.861

Requirement

The following requirements apply for occupied bandwith:

74.861 (e) (3) A maximum deviation of +/- 75 kHz is permitted when frequency modulation is used.

74.861 (e) (5) The operating bandwidth shall not exceed 200 kHz

74.861 (e) (6) The mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

(i) On any frequency >50% to 100% of authorized bandwidth: at least 25 dB.

(ii) On any frequency >100% to 250% of authorized bandwidth: at least 35 dB.

(iii) On any frequency >250% of authorized bandwidth: at least 43 + 10 $\log_{10}$ Po.

Test Method

Connect the equipment per Figure 3. From the frequency response curve of Figure 12, the worst-case modulation frequency that resulted in the maximum deviation was 13 kHz with a corresponding deviation of 11.1 kHz. The microphone was disconnected and replaced with an audio oscillator tuned to this same modulation frequency. An audio level of 228 mVp-p resulted in a maximum deviation of 75 kHz. The audio level was decreased to a level corresponding to a peak deviation of 37.5 kHz (50% modulation). This level was 85 mVp-p. An increase of 16 dB brought the desired drive level to 536 mVp-p. (Figure 13) The resulting deviation level remained at 75 kHz despite being higher that the amplitude required to achieve 75 kHz deviation. Audio limiting occurs at approximately 0.2 Vp-p.

Test Results

The spectrum bandwidth was well within the limits specified in the FCC Regulations as shown by the specified mask superimposed on the plot of the measured bandwidth shown in Figure 14.

FIGURE 13: Injected Audio Level

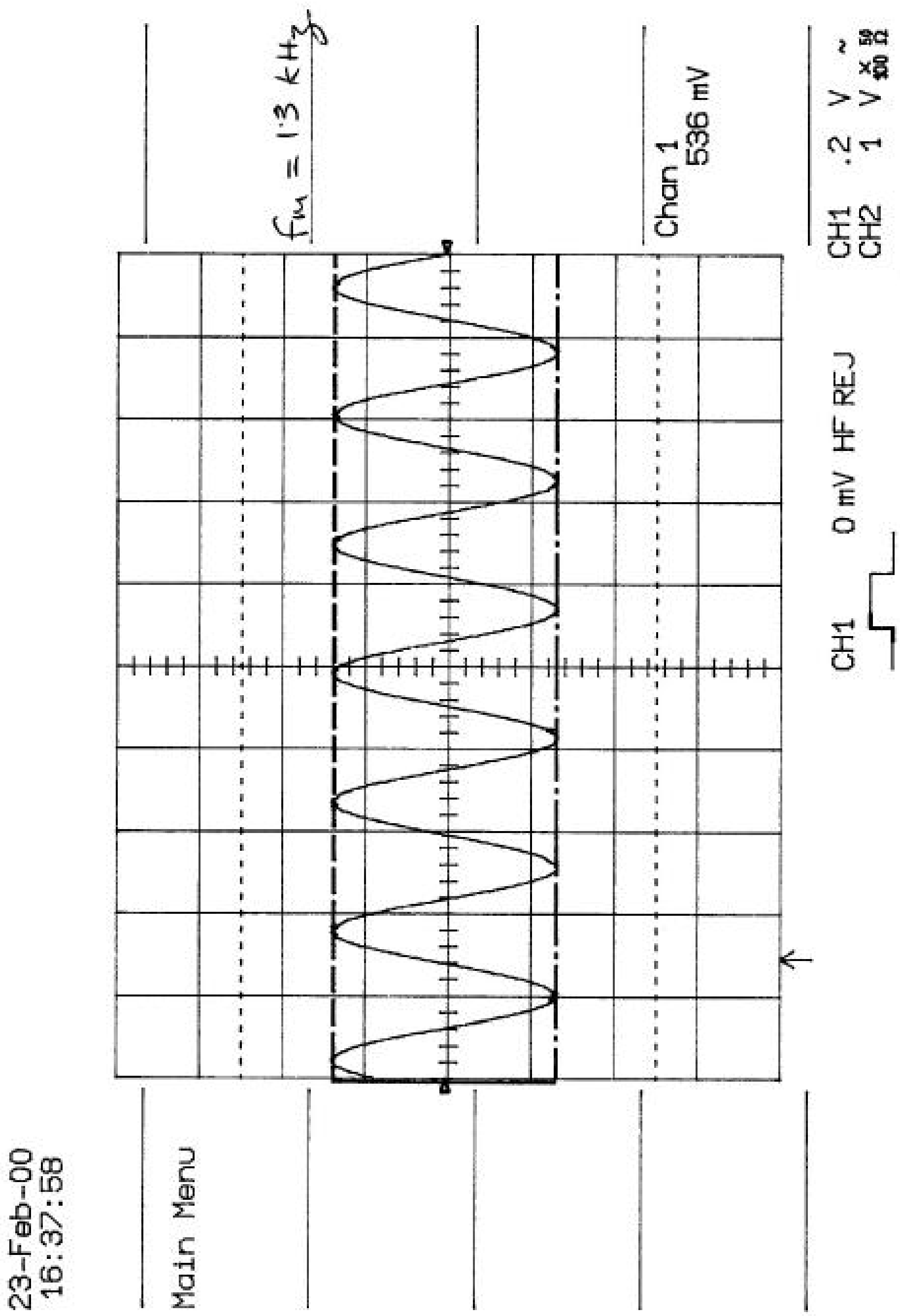
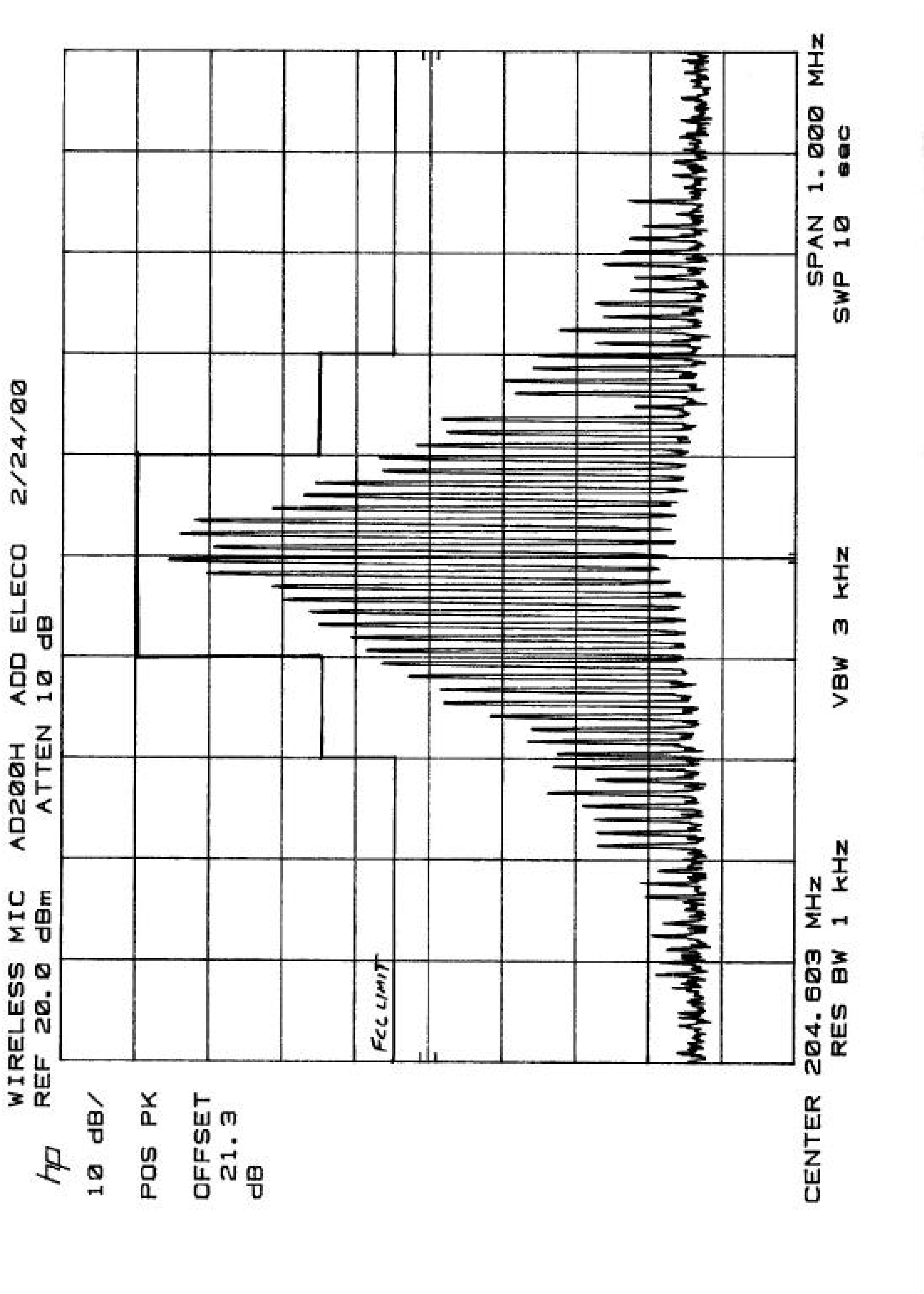


FIGURE 14: Plot of Occupied Bandwidth



2.983 (e) (4) Measurement of Antenna Conducted Spurious Emissions per 2.991 and 74.861

Requirement

Conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies which are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communication desired. The reduction in the level of these spurious emissions will not affect the quality of the information being transmitted. Conducted spurious emissions greater than 250% of the allocated bandwidth (200 kHz) shall be attenuated below the maximum level of the carrier frequency in accordance with the following formula:

Spurious attenuation in dB = $43 + 10 \log_{10} Po$

Where Po = Output in Watts measured in 2.983m (e) (1)

$= 43 + 10 \log_{10} (0.01)$

= 23 dBc (FCC limit)

Test Method

Connect the equipment as shown in Figure 3. Adjust the spectrum analyzer to display the conducted frequency spectrum. Scan the frequency spectrum from the lowest radio frequency generated in the equipment through the 10^{th} harmonic of the carrier frequency. Compare the carrier frequency amplitude to the amplitude of the individual emissions. Amplitudes shall be below the FCC limit.

Photograph of the test setup is provided in Figures 5.

Test Results

All spurious antenna conducted emissions were at least 23 dB below the carrier. The Figure 15 table summarizes the frequencies and amplitudes observed. Plots of the frequency spectrum are provided in Figures 16 through 18.

FIGURE 15: Highest Conducted Spurious Emissions

Table of Highest Conducted Spurious Emissions

Frequency (MHz)	Amplitude (dBm)	dBc
136.4	-35.9	-45.9
159.13	-35.8	-45.8
181.87	-29.5	-39.5
227.33	-20.6	-30.6
250.07	-36.0	-46.0
272.80	-38.0	-48.0
295.53	-42.0	-52.0
318.27	-49.0	-59.0
341.00	-41.0	-51.0
363.73	-46.0	-56.0
409.20	-46.0	-56.0
431.93	-50.0	-60.0
477.40	-51.0	-61.0

FIGURE 16: Plot of Conducted Spurious Emissions

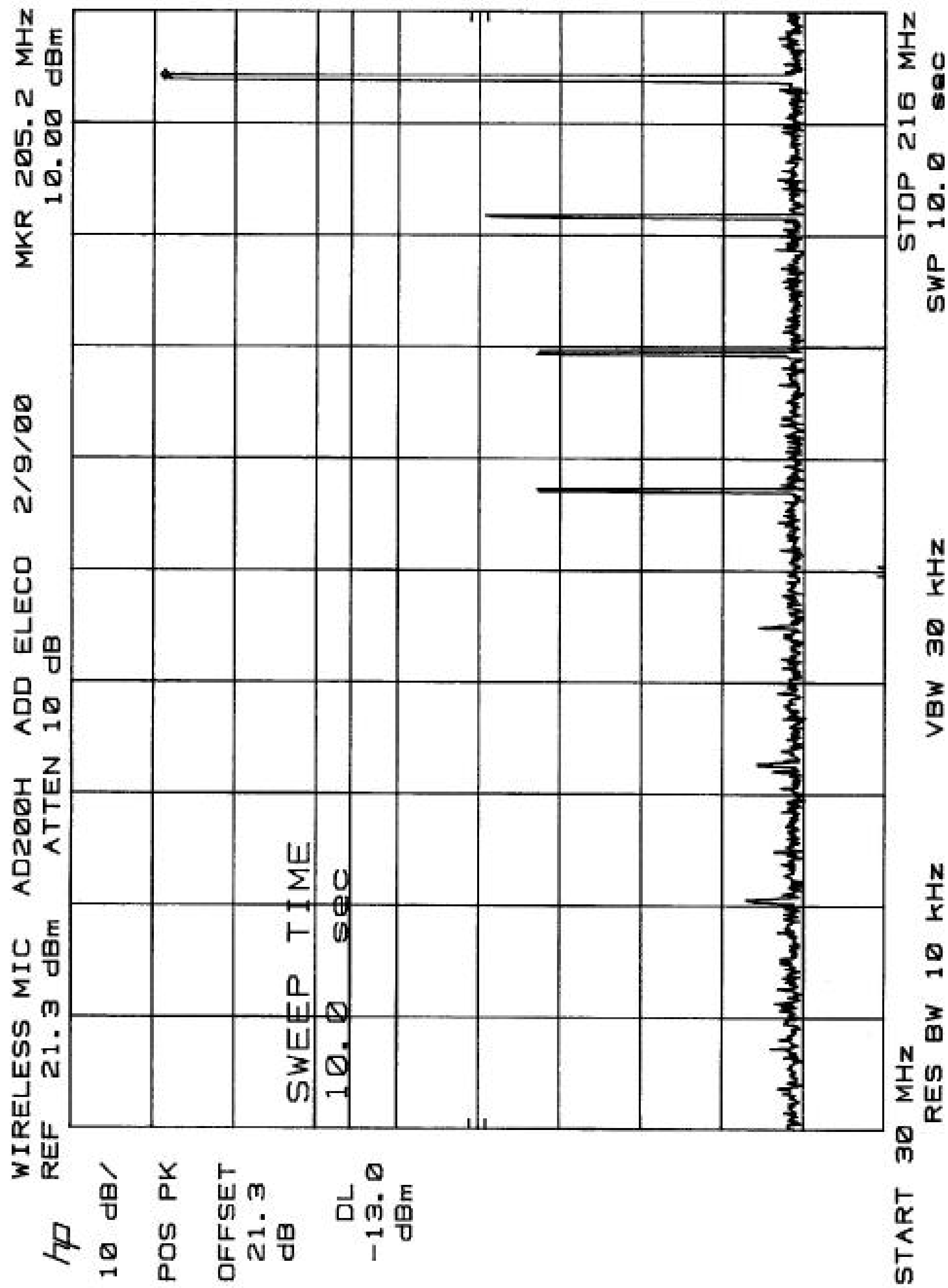


FIGURE 17: Plot of Conducted Spurious Emissions

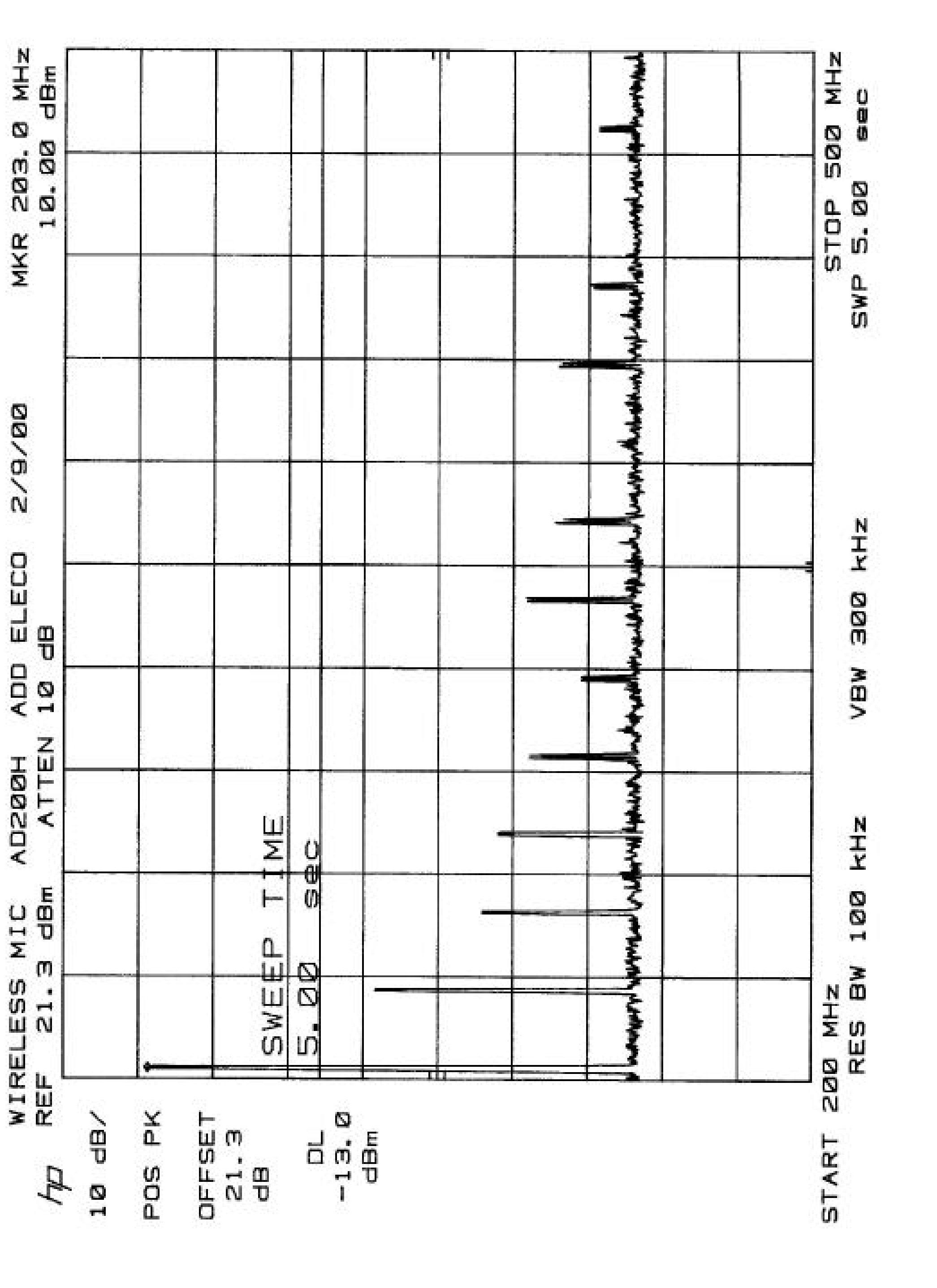
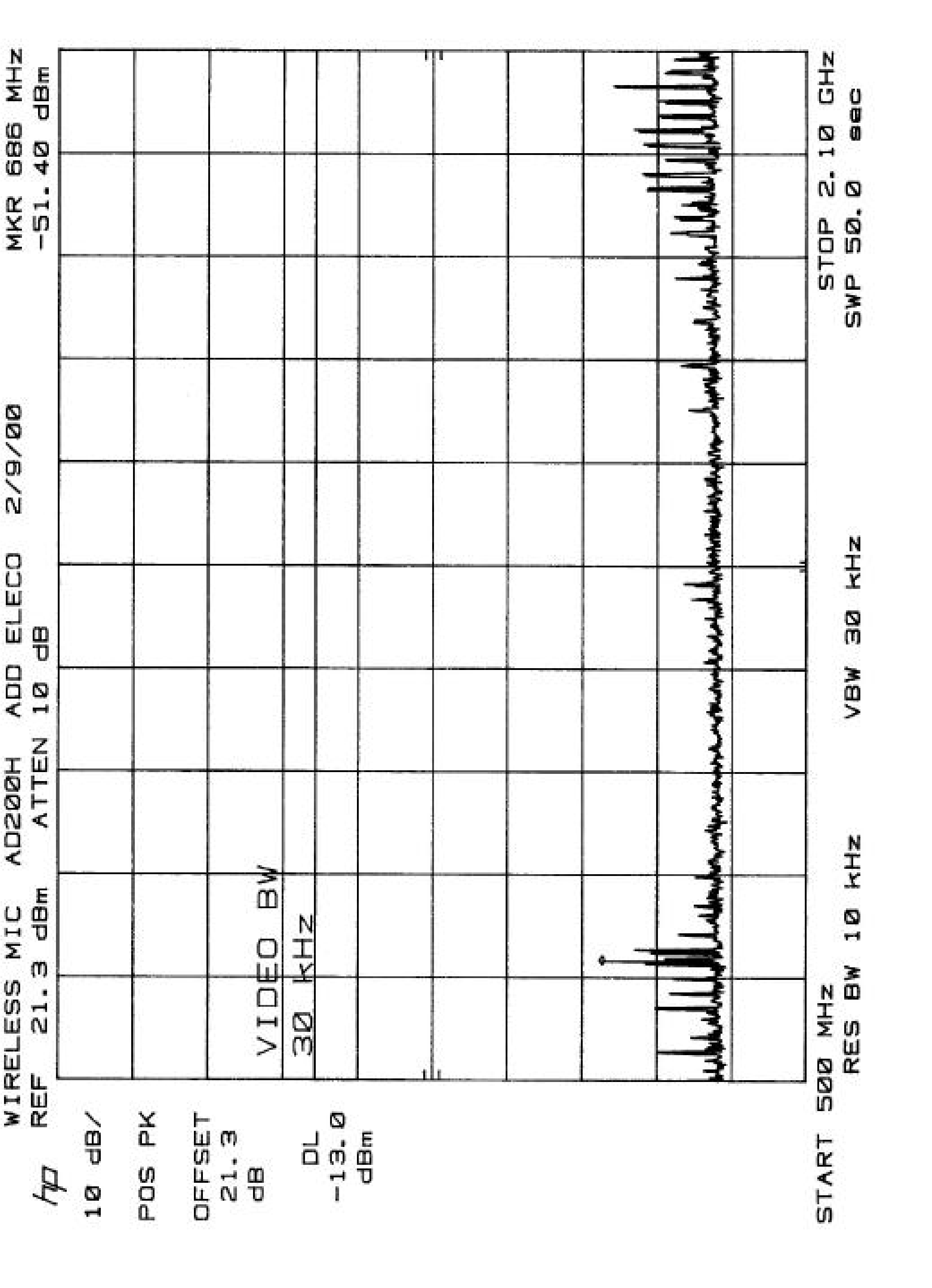


FIGURE 18: Plot of Conducted Spurious Emissions



2.983 (e) (5) Measurement of Radiated Spurious Emissions per 2.993 and 74.861

Requirement

Radiated spurious emissions are undesired emissions generated during the process of development of the fundamental frequency. Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or other intermediate circuit elements under normal conditions on installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission.

Radiated spurious emissions are measured from the EUT with the antenna port terminated into a 50 ohm non-radiating load resistor.

All emissions shall be attenuated by at least 43 + 10 log (Po) where Po is the measured power output or equivalent power delivered to a half-wave dipole antenna that produces the same signal levels as the EUT and associated antenna at the fundamental frequency (whichever is greater). Emissions up to and including the tenth harmonic of the fundamental shall be measured.

Modulation

No external modulation was used for the radiated spurious test. The frequency modulation did not affect conducted spurious emissions and the extra leads required to the signal generator were determined to not yield a representative radiated emissions test setup.

Test Method

The test setup is shown in Figure 19. The spurious signals are measured in a three-meter semi-anecholc room that meets the site attenuation requirements of ANSI C63.4. The equipment under test is placed on a non-metallic table 80 cm above a turntable. Support equipment is placed below the table. The receive antenna is mounted on an elevator platform that can be positioned between 1 and 4 meters. At each spurious emission frequency, the turntable and antenna positioner are adjusted to obtain the maximum signal level. Emissions are recorded for both horizontal and vertically polarized antennas. Equipment is positioned in a manner similar to its final installation.

For determining the equivalent transmitted power, the maximum signal level at the fundamental frequency was established. The EUT was then removed and substituted with a half-wave dipole adjusted to resonate at the same frequency as the EUT and orientated in the same polarization to produce maximum signal into the receive antenna. The output power applied to the dipole's connector required to obtain the same signal strength was then established. If this level was less than the measured power output, the measured power output level shall be used to calculate the FCC limit.

Test Results

The measured RF output power from the EUT was measured to be 10 mW as reported in 2.983 (e) (1). The equivalent power into a half-wave dipole requiired to generate the same measured signal level from the EUT (103.2 dBuV/m) was –7.6 dBm or 0.174 mW. The stock antenna has an equivalent gain of –17.6 dBd. Hence, the measured 10 mW power level was used to calculate the FCC limit.

The electric field at the fundamental frequency was calculated based on the accepted formula:

(1/3)*(R * P)^1/2 where:

R = 50 ohms
P = 0.01 Watts (10 mW)

This field level is 0.236 V/m or approximately 107.4 dBuV/m.

Hence, all spurious emissions to be compliant must be less than 84.4 dBuV/m.

All emissions recorded were less than 84.4 dBuV/m or 23 dBc (decibels below carrier level). No emissions below 30 MHz were noted that exceeded 43 dBc (20 dB below the permissable value of 23 dBc).

A list of test equipment used for the radiated spurious test is provided in Figure 20.

Photographs of the actual test setup are shown in Figures 21 through 24.

The complete data set is included on the attached EXCEL spreadsheet in Figure 25.

Plots of the peak emissions recorded between 30 MHz and 2100 MHz are provided in Figures 26 through 31.

FIGURE 19: RF Radiated Spurious Setup

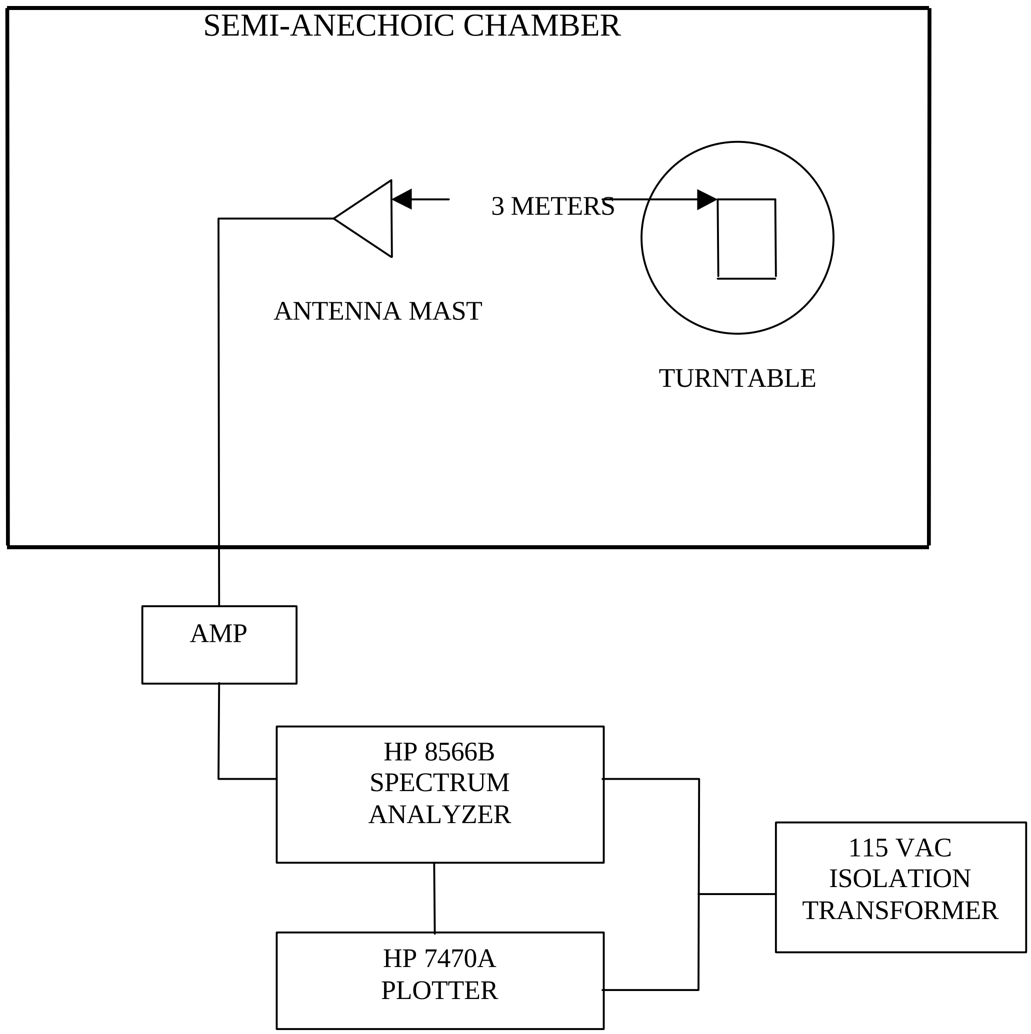


FIGURE 20: List of Radiated Spurious Test Equipment

TEST EQUIPMENT LOG

Date: 02/11/00

Test Procedure: Radiated Spurious Emissions

EUT: Wireless Microphone

Part #: AD200H

Serial #:

Test Engineer: John Stanford

DESCRIPTION	MANUFACTURER	MODEL # / SERIAL #	CAL. DUE DATE
Amplifier	MCL	ZFL-2000 (2 MHz to 2 GHz)	5/7/00
Antenna, ½ wave Dipole	Anritsu Electric Co., Ltd.	MP534A	Cal prior to test
Antenna, Biconical	A.H. Systems	SAS 200/540/528	07-14-00
Antenna, Log-Periodic	A.H. Systems	SAS 200/512/371	07-04-00
Non-Radiating Load	HP	50 ohms, 1 Watt	Cal prior to test
Signal Generator	Marconi	2024	Reference
Spectrum Analyzer	Hewlett Packard	8566B/11403990980007	05/15/00
Tower	EMCO	1050, 1196	Cal prior to use
Turntable	EMCO	1060C, 1017	Cal prior to use
Plotter	HP	7470A/	Reference

FIGURE 21: Photograph of Radiated Spurious Emission Setup

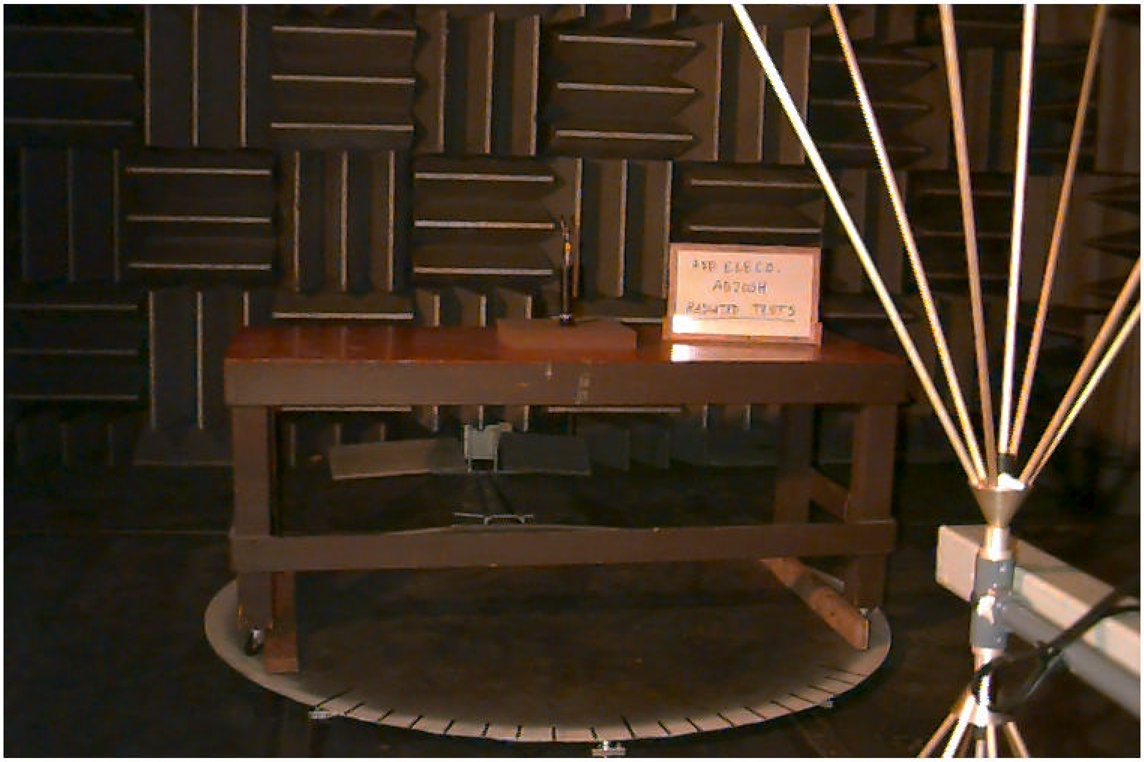


FIGURE 22: Photograph of Radiated Spurious Emission Setup

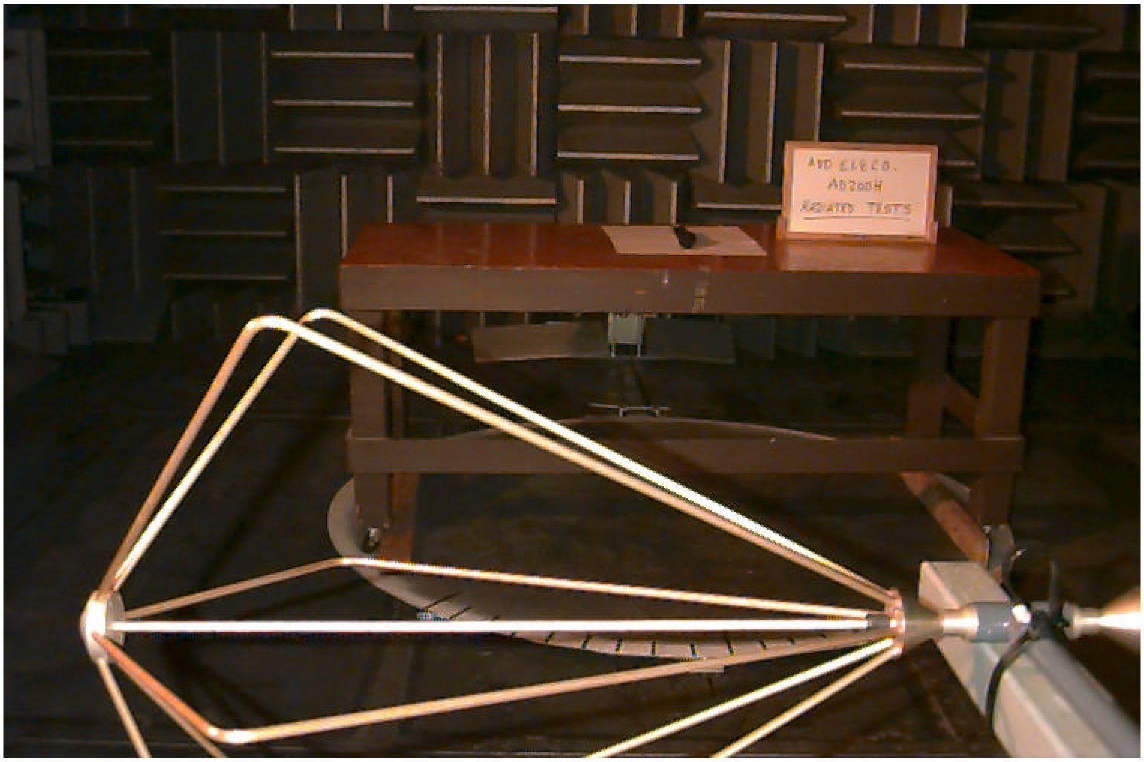


FIGURE 23: Photograph of Radiated Spurious Emission Setup

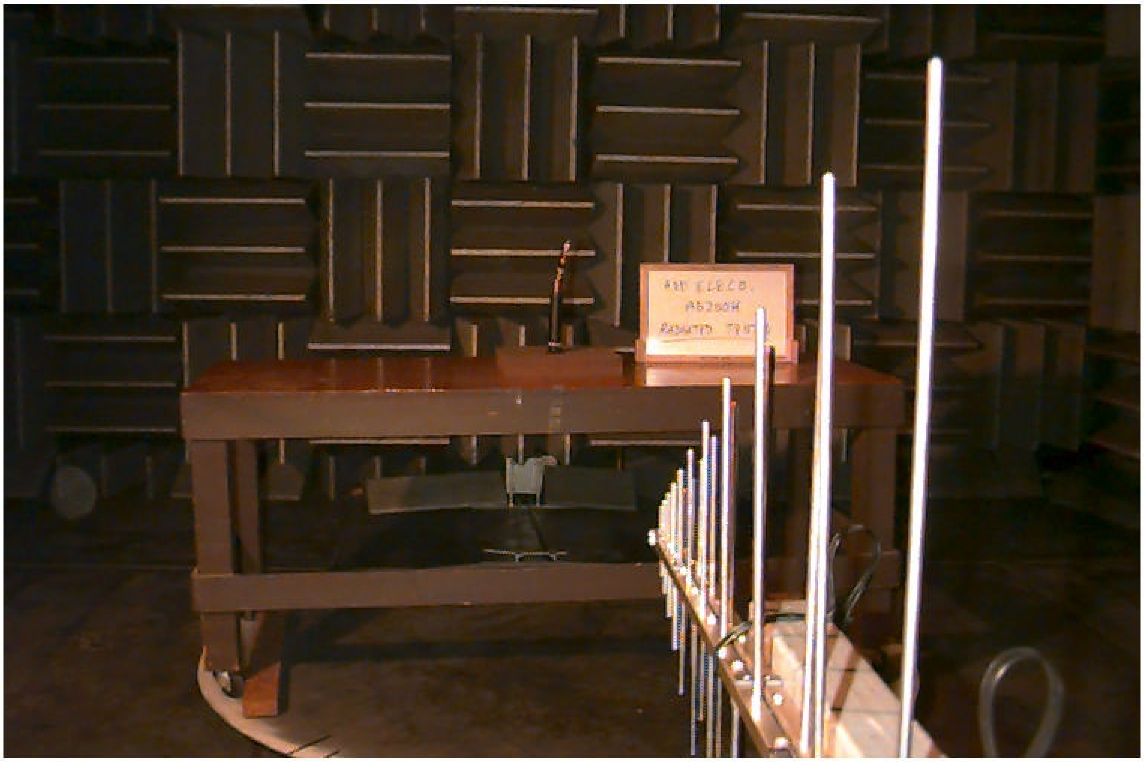


FIGURE 24: Photograph of Radiated Spurious Emission Setup

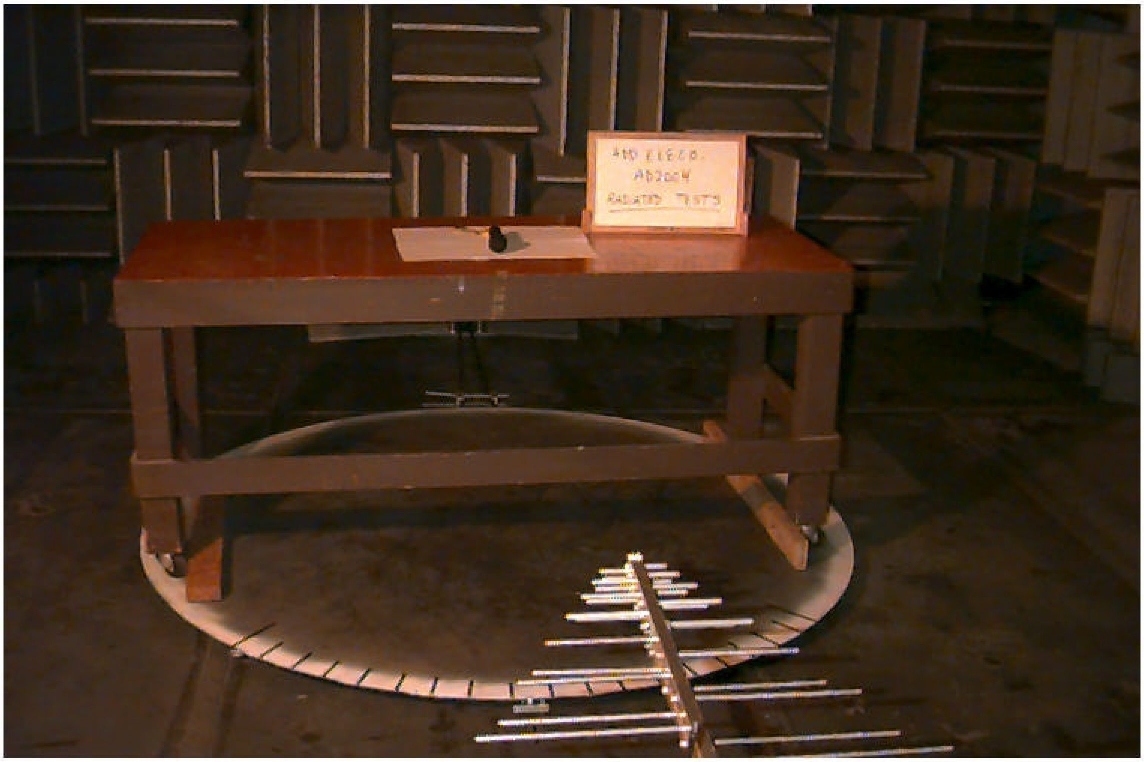


FIGURE 25: Radiated Spurious Emissions Test Data

Radiated Spurious		
Customer	Add Elecc	
Part #	AD200H	
Power out	0.01	Watts
Impedance	50	ohms
Field	0.24	V/m
Field	107.4	dBuV/m
Spurious dB down	23.00	dBc

		Position of EUT: Horizontal			Position of EUT: Vertical									
Type of Emission	Freq (MHz)	Horiz (dBuV)	Height (cm)	Az (deg)	Vert (dBuV)	Height (cm)	Az (deg)	Ant Factor (dB)	Coax loss (dB)	Amp Gain	Adj Horiz (dBuV/m)	Adj Vert (dBuV/m)	Horiz (dBc)	Vert (dBc)
S	68.2	22.2	126	248	26.6	100	0	9.2	0.8	22	10.2	14.6	97.2	92.8
S	90.93	16.1	183	51	12.8	100	0	9.1	0.8	22	4	0.7	103.4	106.7
S	136.4	26.2	134	230	17.3	100	0	11.9	1.1	22	17.2	8.3	90.2	99.1
S	159.13	23.1	186	210	18.4	100	0	12.5	1.2	22	14.6	10.1	92.6	97.3
S	181.87	26.4	165	270	22	100	0	13.7	1.3	22	19.4	15	88.0	92.4
F	204.60	80.2	100	90	71.6	225	0	11.3	1.3	22	70.8	62.2	36.6	45.2
S	227.33	58.9	100	90	50.5	196	0	11.2	1.4	22	49.5	41.1	57.9	66.3
S	250.07	52	100	90	43.7	180	0	12.2	1.5	22	43.7	35.4	63.7	72.0
S	272.80	58.9	117	77	51.9	163	0	12.6	1.6	22	51.1	44.1	56.3	63.3
S	295.53	55.9	100	80	52.3	159	0	13.4	1.7	22	49	45.4	58.4	62.0
S	318.27	49.6	100	77	50.1	151	0	14.4	1.7	22	43.7	44.2	63.7	63.2
S	341.00	59.9	100	274	63	143	0	15.2	1.7	22	54.8	57.9	52.6	49.5
S	363.73	54.2	100	274	61.3	133	0	15.5	1.8	22	49.5	56.6	57.9	50.8
S	386.47	42.6	100	274	45.4	127	0	15.8	1.8	22	38.2	41	69.2	66.4
H	409.20	54.1	100	274	50.1	118	0	16.3	1.8	22	50.2	46.2	57.2	61.2
S	431.93	53.4	100	275	44	100	0	16.7	1.9	22	50	40.6	57.4	66.8
S	477.40	46.8	196	290	39.4	100	0	17.6	2.1	22	44.5	37.1	62.9	70.3
S	591.07	47.2	144	294	38.6	134	0	19.3	2.2	22	46.7	38.1	60.7	69.3
H	613.80	50.3	139	291	39	132	0	19.5	2.5	22	50.3	39	57.1	68.4
S	772.93	43.3	103	299	30.5	148	0	21.7	2.9	22	45.9	33.1	61.5	74.3
S	795.67	40.1	100	302	23.5	145	0	21.5	3	22	42.6	26	64.8	81.4
H	818.40	43.6	100	300	31.3	135	0	22	3.1	22	46.7	34.4	60.7	73.0
S	841.13	47	100	301	36.1	138	0	22.2	3.2	22	50.4	39.5	57.0	67.9
S	863.87	37.7	100	302	28.7	118	0	22.5	3.2	22	41.4	32.4	66.0	75.0
S	886.60	33.9	100	301	31.2	118	0	23	3.3	22	38.2	35.5	69.2	71.9
S	909.33	28.9	107	293	36.9	112	0	22.9	3.4	22	34.2	41.2	73.2	66.2
H	1023.00	24.9	100	288	20.4	123	0	23.9	3.7	22	30.5	26	76.9	81.4
H	1227.60	18.9	169	286	21.35	153	0	26.4	4	22	27.3	29.75	80.1	77.7
H	1432.20	29.1	122	272	27.1	139	0	28.1	4.2	22	39.4	37.4	68.0	70.0
H	1636.80	26.8	101	270	20.1	125	0	29.7	4.9	22	39.2	32.7	68.2	74.7
H	1841.40	27.4	100	131	18.7	173	0	31.1	5.3	22	41.8	33.1	65.6	74.3
H	2046.00	27.8	100	222	22.2	244	0	29.5	5.7	22	41	35.4	66.4	72.0

F - Fundamental
S- Spurious (F+oscillartor)
H - Harmonic

FIGURE 26: Plot of Radiated Spurious Emissions

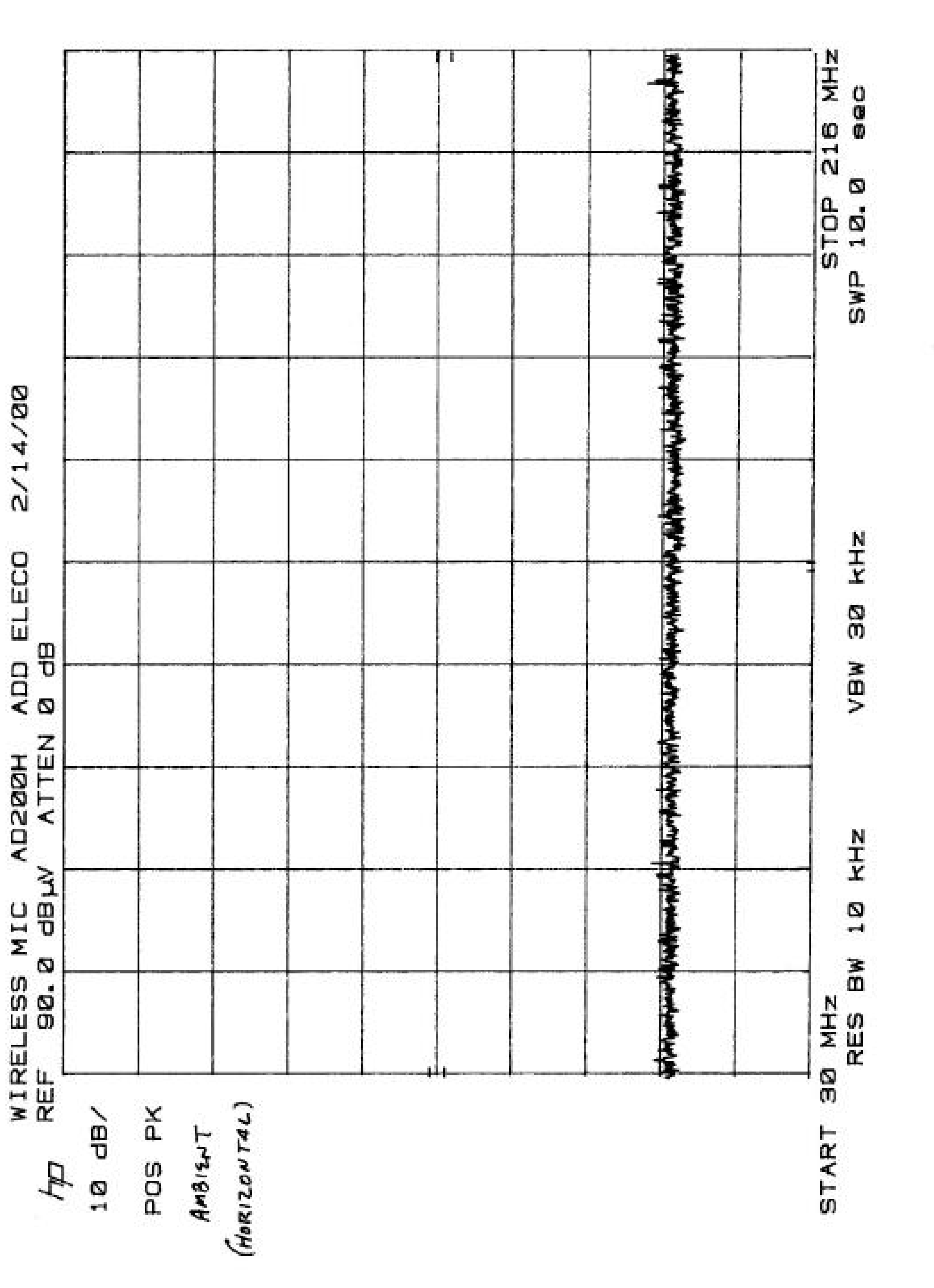


FIGURE 27: Plots of Radiated Spurious Emissions

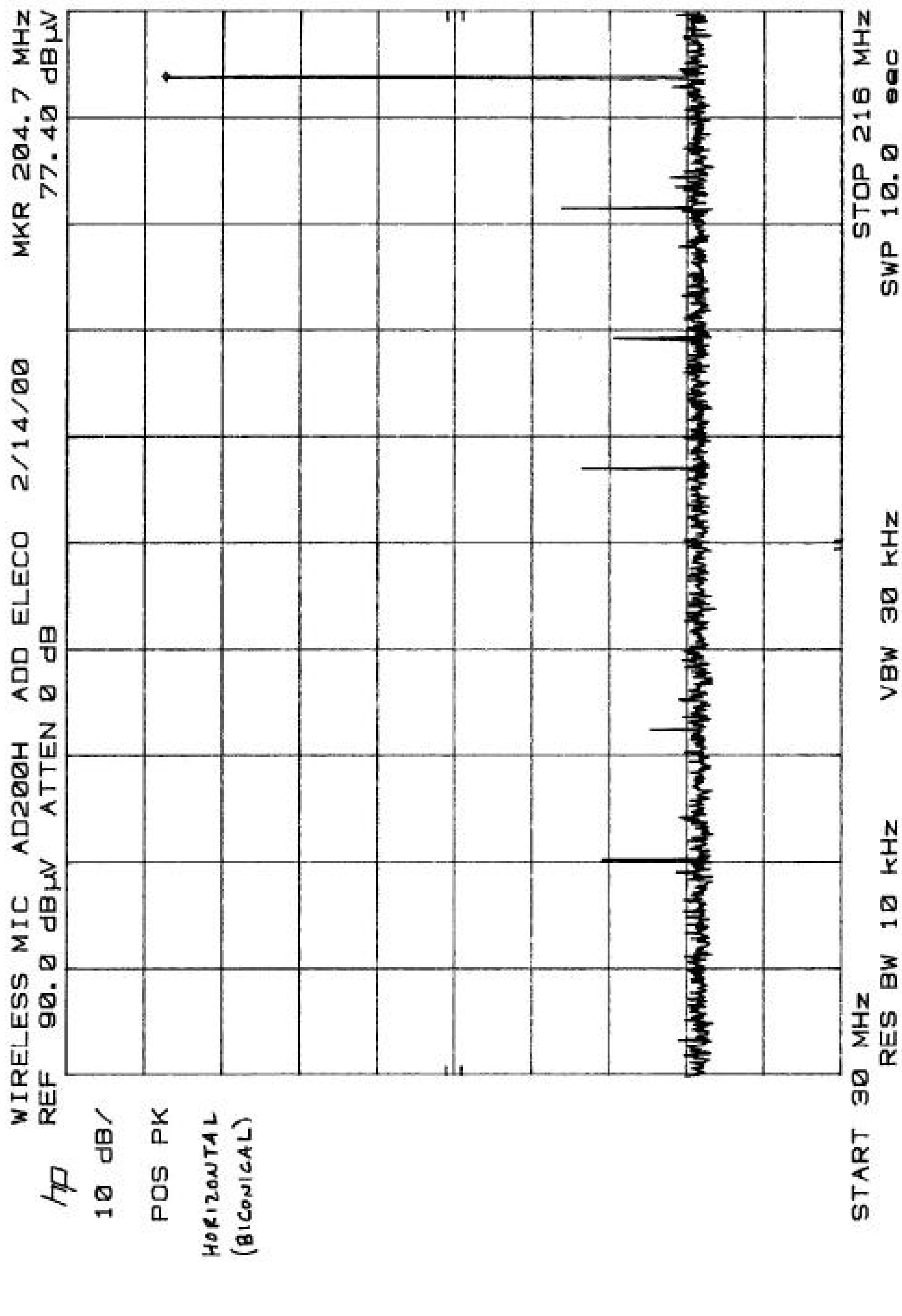


FIGURE 28: Plot of Radiated Spurious Emissions

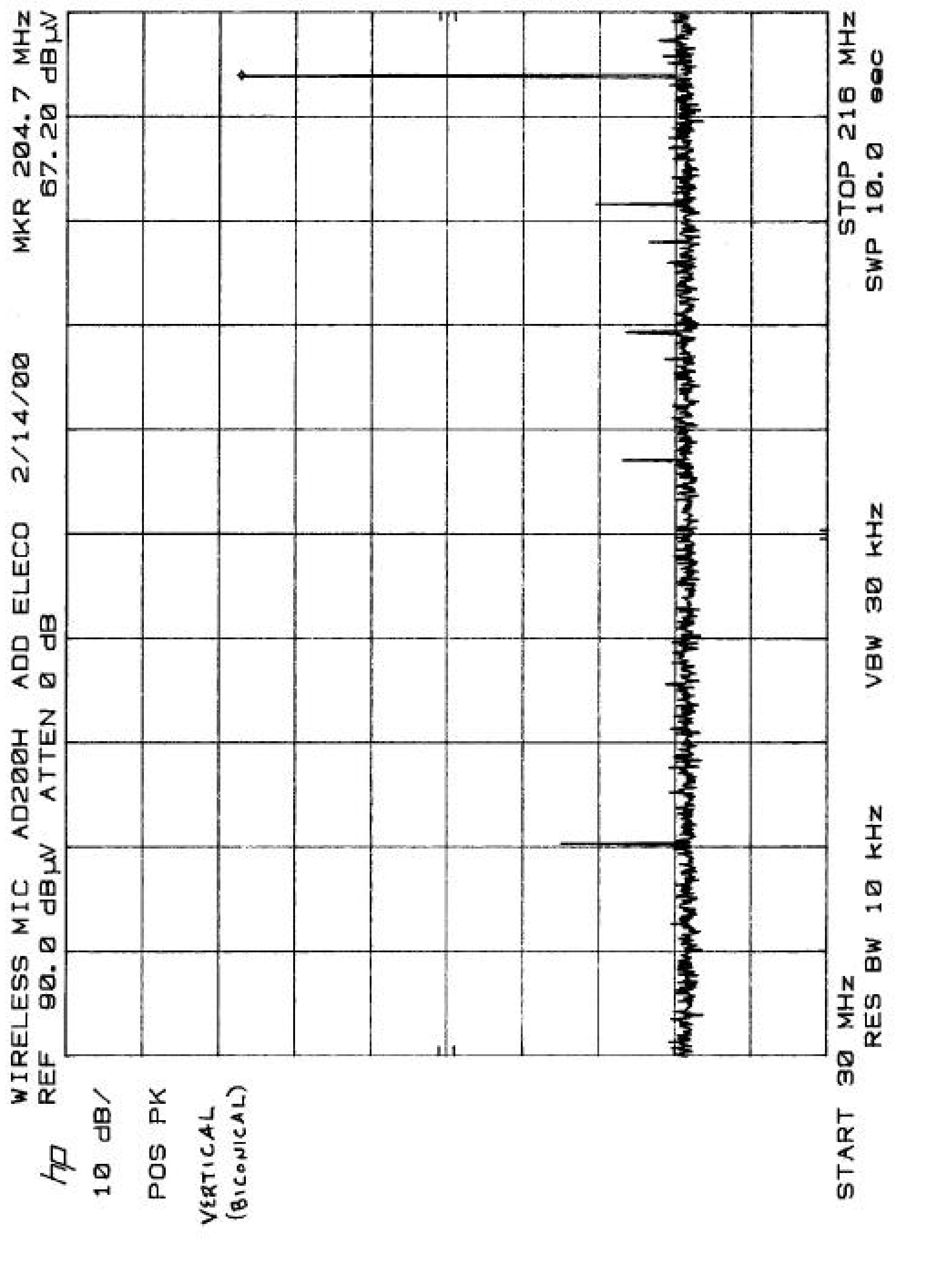


FIGURE 29: Plot of Radiated Spurious Emissions

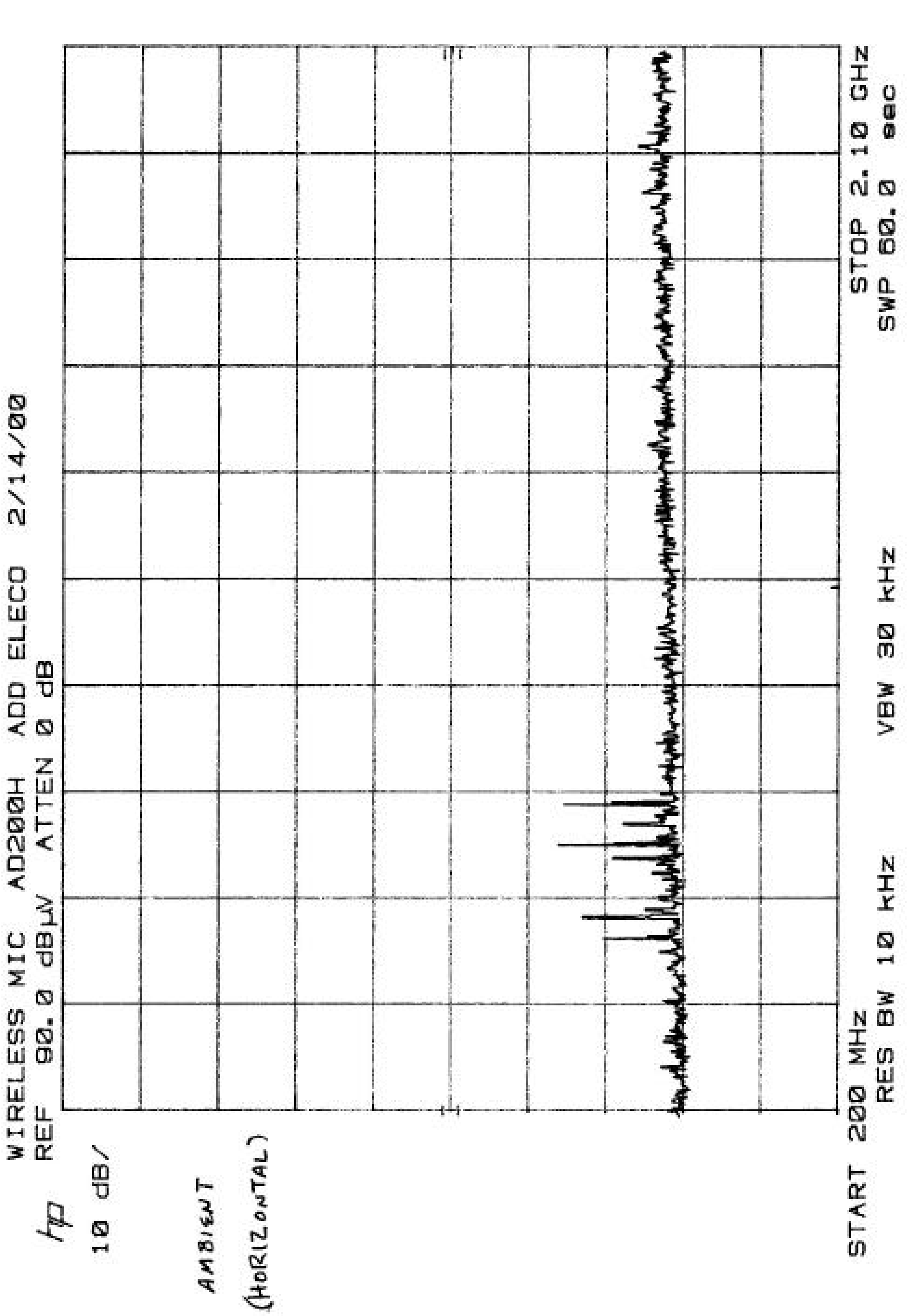


FIGURE 30: Plot of Radiated Spurious Emissions

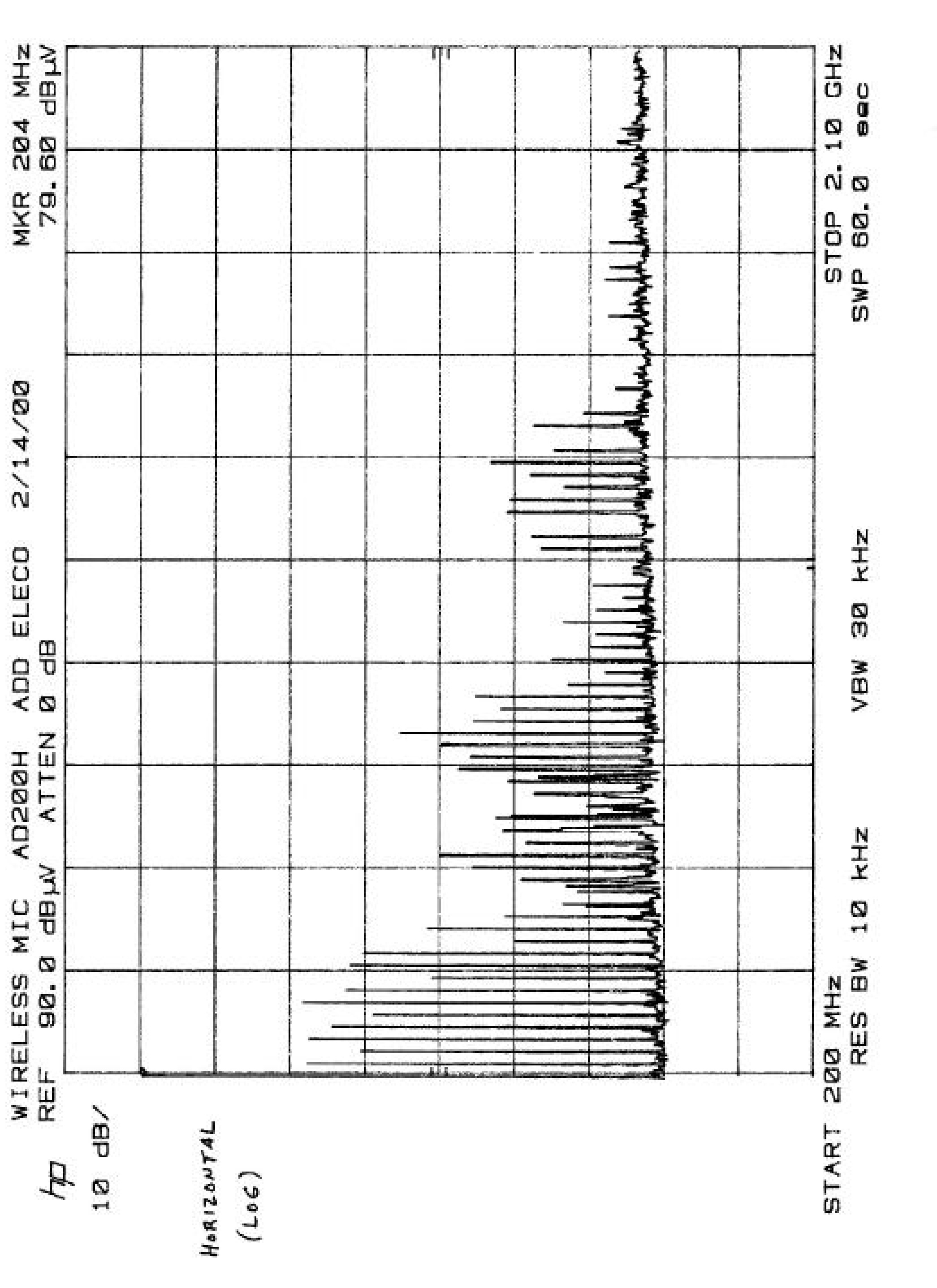
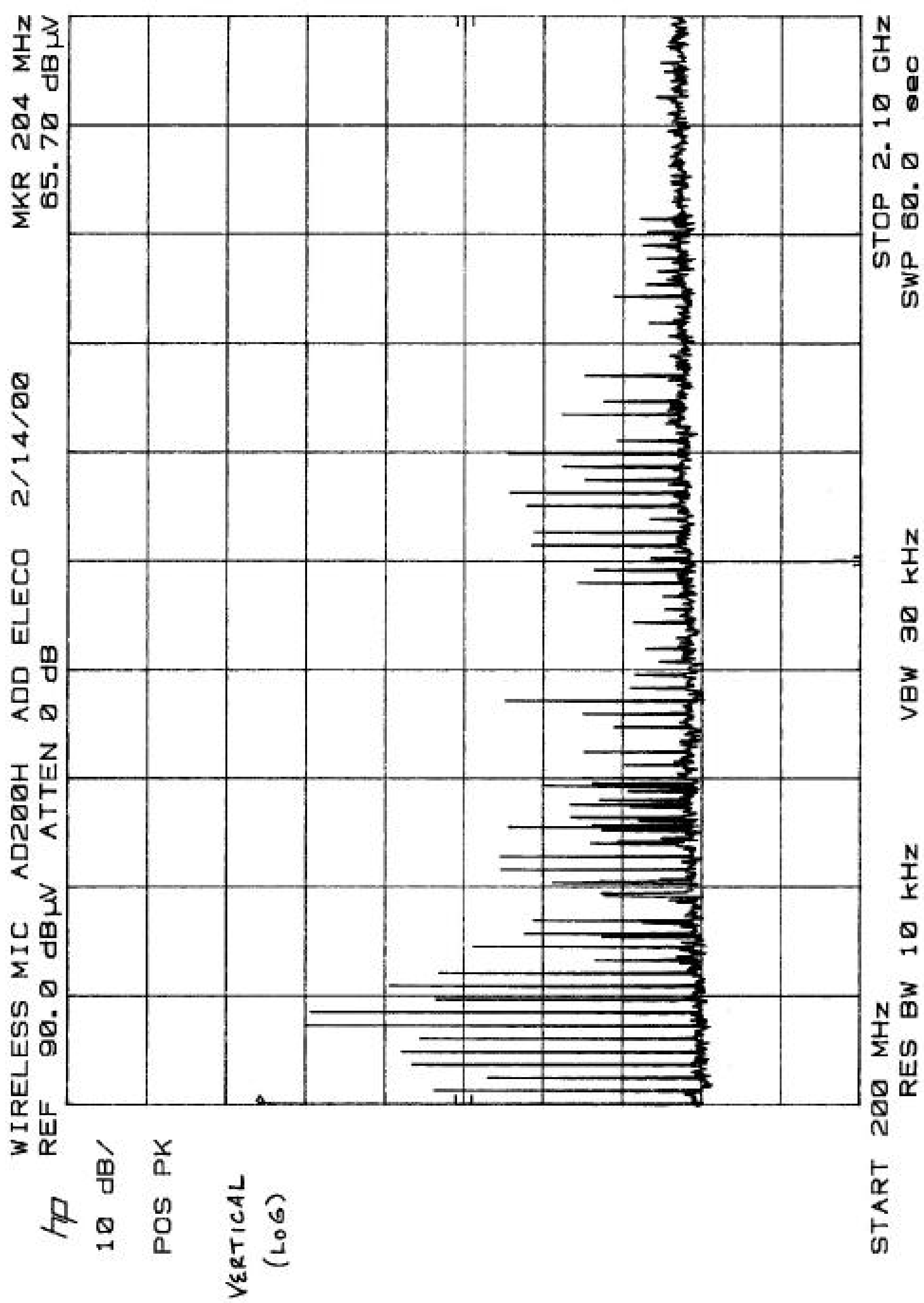


FIGURE 31: Plot of Radiated Spurious Emissions



2.983 (e) (6) Measurement of Frequency Stability per 2.995 and 74.861

Requirement

Frequency stability is a measure of the frequency determining components ability to remain stable over a prescribed temperature range. The EUT shall be subjected to a temperature range of –30 to +50 deg. C. The output frequency shall be monitored to determine if the nominal frequency changes by more than the required tolerance at temperature increments of 10 degrees C. The required frequency tolerance per part 74.861 (e) (4) is 0.005%. For hand-carrier, battery-operated equipment, the frequency stability shall also be characterized with the primary supply voltage reduced to the end-point specified by the manufacturer.

Test Method

The EUT and support equipment was arranged as described in Figure 32. The EUT was placed in a temperature chamber. The DC power leads and RF output cable were brought outside of the temperature chamber. The DC power to the EUT was connected to an adjustable DC power supply and the RF output cable was connected to a frequency counter, both placed outside of the temperature chamber. The EUT was not modulated during test. The frequency was monitored and recorded with a supply voltage of 9 Vdc from –30 to +50 degrees C. The test was repeated with a supply voltage of 6.2 Vdc (minimum operating voltage as specified by the manufacturer) from –30 to +50 degrees C. Photographs of the test setup are shown in Figures 33 and 34.

Test Results

The EUT did not exhibit frequency drift that exceeded 0.005% of the measured fundamental frequency characterized at 10 degrees C. Test results are provided in Figure 35 and 36.

FIGURE 32: Block Diagram of Frequency Stability Test

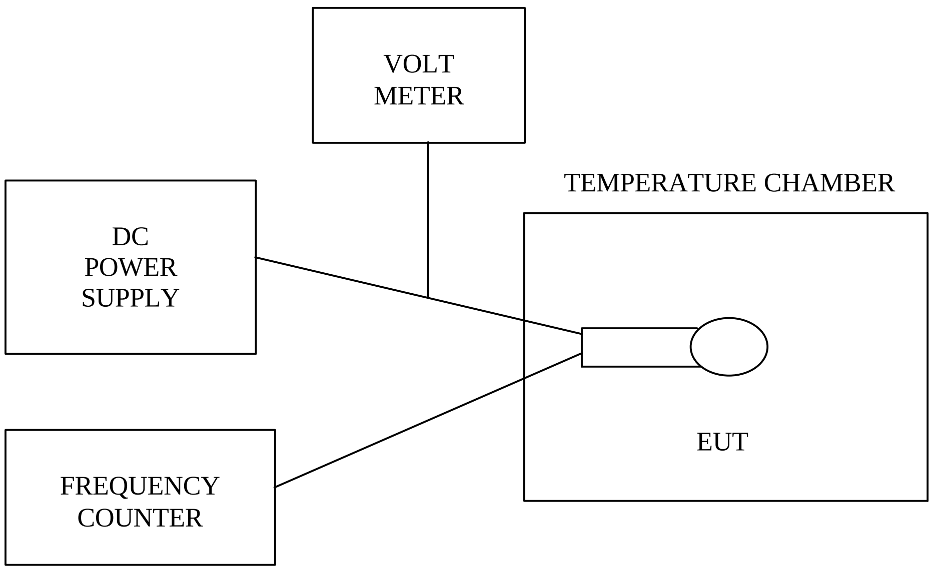


FIGURE 33: Photograph of Frequency Stability Test Setup

FIGURE 34: Photograph of Frequency Stability Test Setup

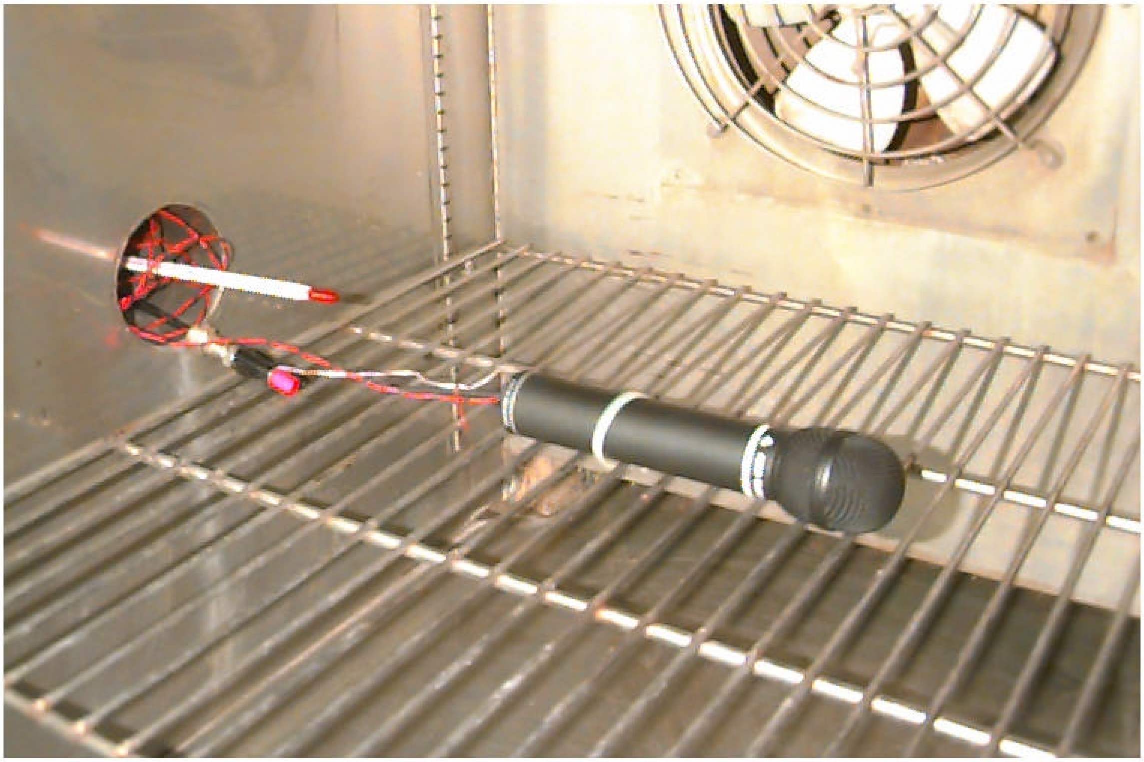


FIGURE 35: Frequency Stability Test Data Sheet

TEMPERATURE TEST DATA SHEET

DATE: FEBRUARY 17, 2000

ENGINEER: MICHAEL SPAULDING

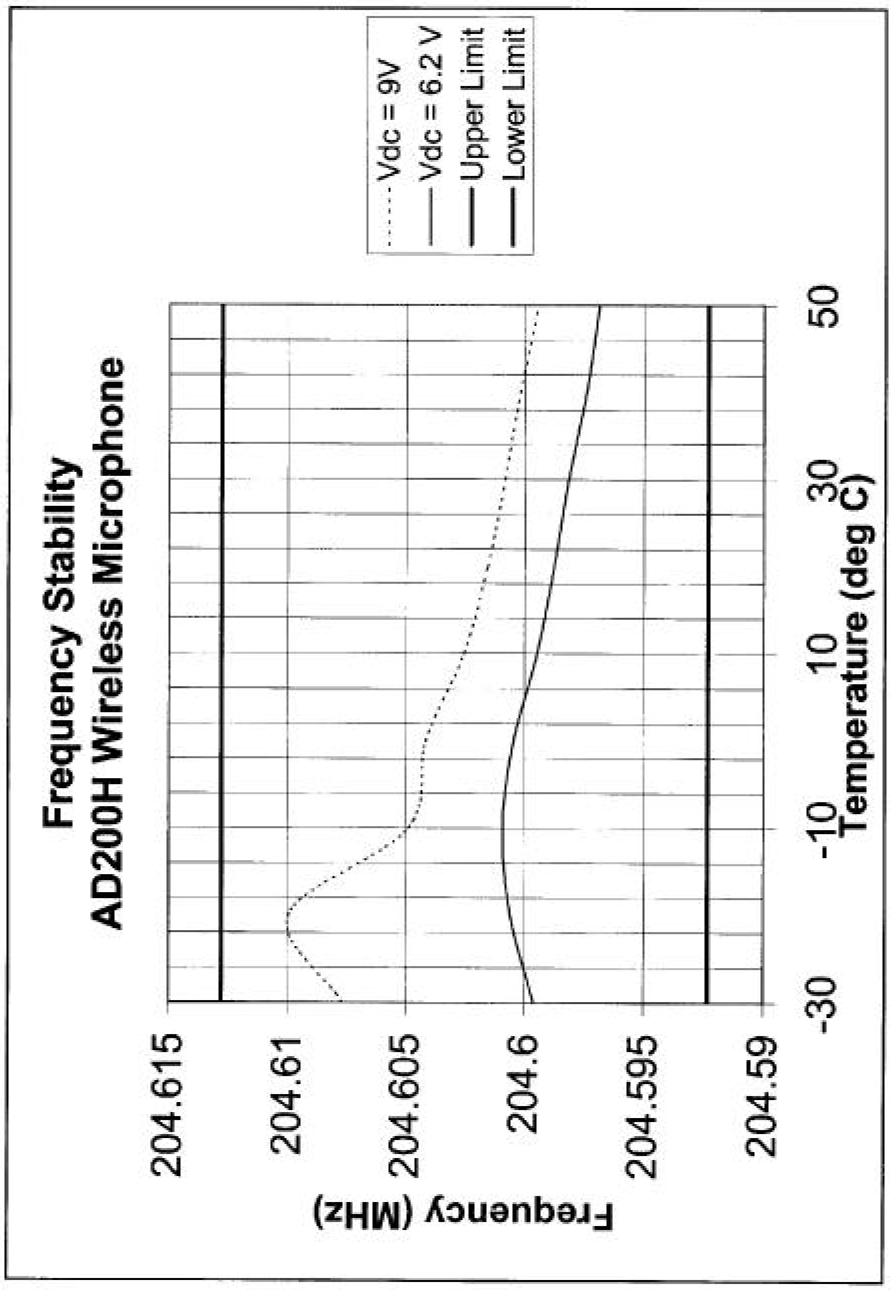
ITEM UNDER TEST: ADD ELECO AD200H

Time	Battery Voltage (Vdc)	TEMP (deg C)	FREQ (Hz)	Lower Limit (-0.005%)	Upper Limit (+0.005%)
11:20	9	20	204,601,550		
11:50	9	10	204,602,350		
13:40	9	0	204,604,170		
14:10	9	-10	204,604,890		
14:45	9	-20	204,609,940		
15:30	9	-30	204,607,660		
15:55	9	20	204,601,860		
16:20	9	30	204,600,830		
16:50	9	40	204,600,190		
17:25	9	50	204,599,430		
				F-10230 (204,591,320)	F+10230 (204,611,780)
8:20	6.2	20	204,598,760		
8:40	6.2	10	204,599,470		
9:30	6.2	0	204,600,460		
9:50	6.2	-10	204,600,920		
10:20	6.2	-20	204,600,580		
10:50	6.2	-30	204,599,590		
11:15	6.2	20	204,598,820		
11:35	6.2	30	204,598,150		
12:00	6.2	40	204,597,410		
12:50	6.2	50	204,596,880		

Notes:

1) Allow sufficient soak time at each temperature before recording frequency.

FIGURE 36: Frequency Stability Test Graph



2.983 (e) (7) Frequency Spectrum to be Investigated per 2.997

The Frequency was searched from the lowest radio frequency generated in the equipment through the 10^{th} harmonic of the carrier frequency

2.983 (f) FCC ID: Label

FCC ID: NHAAD200H

NOTES:
Label will be constructed of 0.02 inch aluminum as shown on the equipment with permanent adhesive. All information on the label will be etched or stamped. Both methods will exceed the expected lifetime of the equipment.

The label will be large enough to allow all information to be legible.

2.983 (g) Photographs and/or Drawings showing equipment construction techniques

Note: The Circuit Board shown in these photos has no components on the reverse side unless shown.

FIGURE 37: Wireless Microphone (Fully Assembled)

FIGURE 38: Switch Panel

FIGURE 39: Microphone Transmitter w/ Sleeves Removed A

FIGURE 40: Microphone Transmitter w/ Sleeves Removed B

FIGURE 41: Microphone Transmitter w/ Sleeves Removed C

FIGURE 42: Board Detail 1

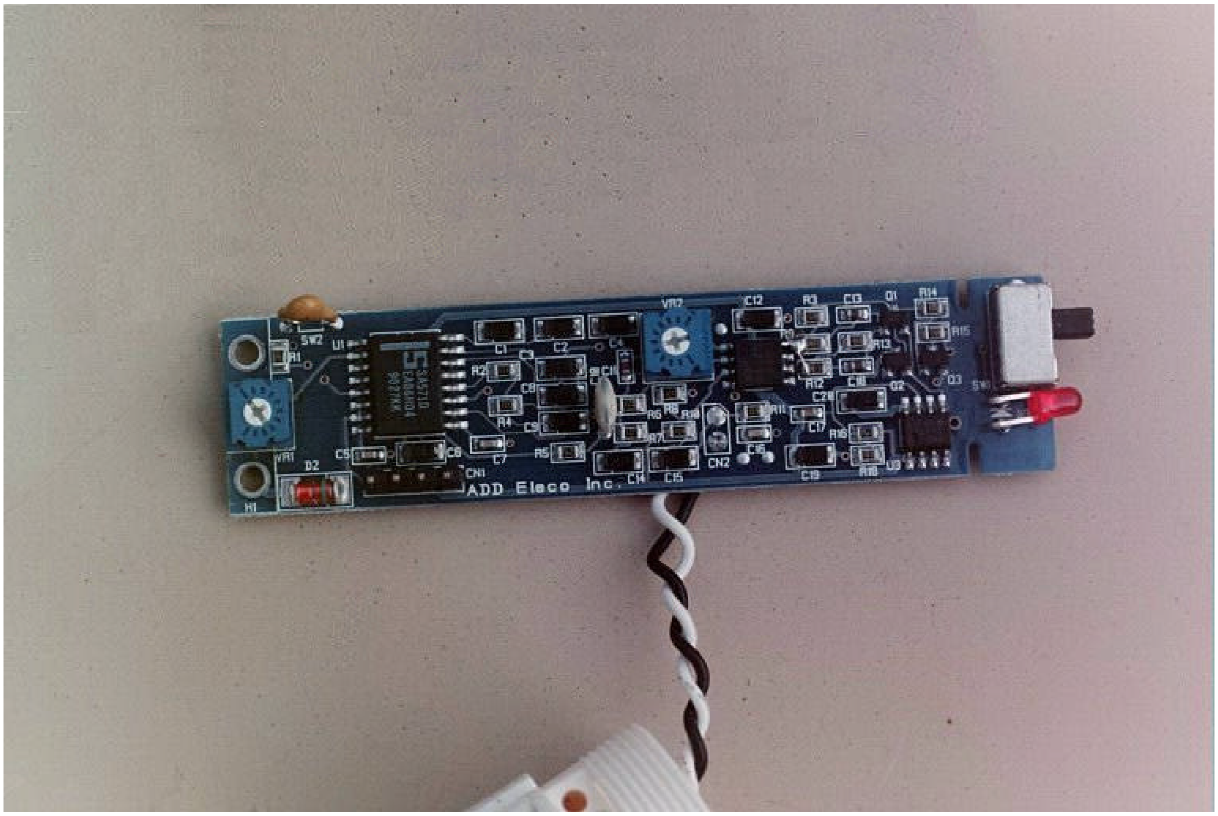


FIGURE 43: Board Detail 2

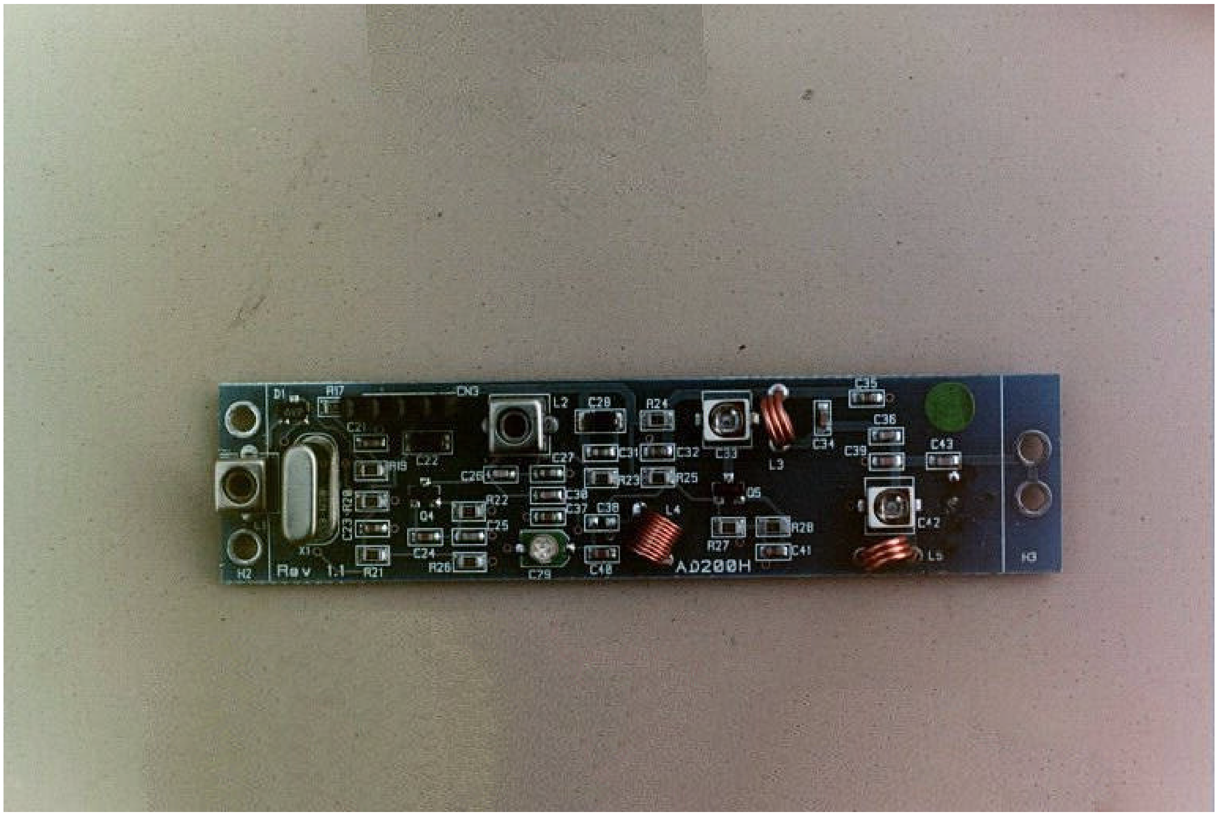


Figure 44: Microphone Pickup

APPENDIX A
INSTRUCTION MANUAL