MEASUREMENT/TECHNICAL REPORT

Chori America, Inc. Model WTX

FCC ID: K9R900040

APPLICATION FOR CERTIFICATION

RF Emission Measurements Performed For Determination of Compliance with the US Code of Federal Regulations Title 47, Chapter I, FCC Part 90.217 As Required for Certification for Intentional Radiators

Radiometrics Midwest Corporation Test Document RP-3924
Issue Date: 12-31-98
This report concerns: Original grant
Equipment type: UHF Transmitter
Transition Rules per 15.37 are not requested.

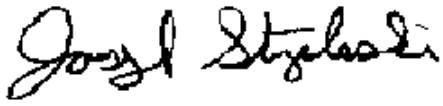
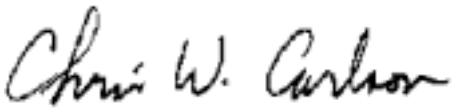
Tests Performed For	*Test Facility*
Chori America, Inc. One Penn Plaza Suite 5440 New York, NY 10119-5498	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446 Phone: (815) 293-0772 FAX: (815) 293-0820 radiomet@ix.netcom.com
Test Report Written By	*Test Report Approved By*
 Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	 Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

Table of Contents

1.0 General Information

1.1 Product Description

The Model WTX (referred to as the EUT in this report) is a 40 mW UHF Transmitter. The EUT is manufactured by Chori America, Inc. The EUT is battery powered and operates at 469.500 and 469.550 MHz. The EUT is designed to operate with a 20 kHz channel bandwidth.

1.2 Related Submittals

Chori America, Inc. is not submitting any other submittals related to the EUT.

The associated receiver is operated under FCC rules for unintentional radiators. It is subject to the FCC requirements pursuant to the Certification equipment authorization under Part 15 subpart B and has been previously approved as FCC ID: K9R900808.

1.3 Tested System Details

The FCC ID's for all equipment, plus descriptions of all cables used in the tested system which have grants, are:

Model Number Serial Number	FCC ID	Manufacturer & Description	Cable Descriptions
M/N: WTX (EUT)	K9R900040	Chori America, Inc. Transmitter	3 inch unshielded cable
M/N: MPL-M6E S/N: 7059005	N/A	Chori America, Inc. Spot D Tek III Receiver	None; Battery Operated

1.4 Test Methodology

The test procedures used are in accordance with the FCC part 90 rules. The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

1.5 Test Facility

The open area test site used to collect the radiated data is located on 8625 Helmar Road in Newark, Illinois. The open field test site has a metal ground screen. Details of the site characteristics are on file with the FCC. Conducted emission measurements and preliminary radiated emission scans were performed in shielded enclosure “A” at Radiometrics' Romeoville, Illinois EMI test lab. These sites have been fully described in a report and accepted by the FCC in a letter dated October 1, 1996 (31040/SIT 1300F2).

1.6 Test Equipment

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun.

The radiated emission measurements were performed with a spectrum analyzer. The bandwidths of the spectrum analyzers are adjusted to the correct bandwidths as specified by the FCC Rules. The bandwidth used from 450 kHz to 30 MHz is 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz a 1 MHz bandwidth is used. In order to increase the sensitivity of the spectrum analyzer, a preamplifier was used. The preamplifiers used had sufficient dynamic range that ensured that an overload condition was not present during the tests.

1.7 Test Specification Requirements

The electromagnetic emissions from the EUT must comply with the following requirements.

1.7.1 RF Power Output

The EUT shall not exceed the actual power necessary for satisfactory operation that is specified by the manufacturer to be 0.040 Watt or 40 milliwatts, with a tolerance of 20 Percent. In accordance with Paragraph 90.217, the maximum power output that will be authorized by the FCC for transmission is 120 milliwatts.

1.7.3 Occupied Bandwidth and Spurious Emissions

For equipment designed to operate with a 20 kHz channel bandwidth, the sum of the bandwidth occupied by the emitted signal plus the bandwidth required for frequency stability shall be adjusted so that any emission appearing on a frequency 40 kHz or more removed from the assigned frequency is attenuated at least 30 dB from the unmodulated carrier.

The occupied bandwidth of the emissions shall be measured at the RF output terminals of the transmitter. The frequency range of the measurement shall be 1 MHz to 5000 MHz.

The spurious emissions radiated from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation shall also be measured. The frequency range of the measurement shall be from 25 MHz to 5000 MHz. The amplitudes of the radiated emissions shall be attenuated in accordance with the requirements for occupied bandwidth as described above.

1.8 Test Procedures

The test procedures used are in accordance with FCC Part 90 and Measurement Procedure MP-1. The specific procedures are described below.

1.8.1 RF Power Output

The EUT was positioned on a nonconductive test stand. Power was supplied through its DC supply. The transmitter was keyed with no modulation. The RF output of the transmitter was connected directly to the RF input of a Power Meter.

1.8.2 Occupied Bandwidth

The occupied of the RF output was also measured using the 8566A spectrum analyzer. The bandwidth was measured using the peak detector function and a narrow resolution bandwidth. The output of the transmitter was connected to the spectrum analyzer with a six-inch, low loss SMA cable.

The spectrum analyzer display was digitized and plotted. Several views of the output spectrum in the range from 1 MHz to 5000 MHz were plotted to show compliance with the requirements set forth for spurious emissions at the terminals, as well as compliance with the occupied bandwidth limitations of the fundamental transmission. The bandwidth of the spectrum analyzer was set as required by FCC part 90.210.

1.8.4 Frequency Stability

Frequency stability was also measured using the 8566A spectrum analyzer. For this measurement, the analyzer was used as a frequency counter. The frequency of the transmitter was measured with an antenna close to the EUT. The resolution bandwidth of the analyzer was reduced to 10 Hz in order to accurately read the fundamental frequency.

The output frequency was measured while varying the input voltage to the EUT. Measurements were performed with the input voltage varied from the battery fully charged to the end point of battery operation.

The output frequency was also measured while varying the ambient temperature of the EUT. Measurements of the output frequency were performed with the ambient temperature varied over the range from -30 C to +50 C, at 10 degree increments. The EUT was placed in the temperature chamber during the test and the temperature was allowed to stabilize for 15 minutes at each temperature. The frequency was measured within 15 seconds of the initial keying of the transmitter at each temperature point.

1.8.5 Field Strength of Spurious Emissions

The field strength of the spurious was measured at Radiometrics' open field test site. The RF output of the transmitter was operated with its integral antenna. The transmitter was keyed with its standard modulation.

Emissions were measured at a test distance of 3 meters. The EUT was placed on top of the 0.8 meter high test stand.

The emission levels were maximized as described in this paragraph. The detected emission levels were maximized by rotating the EUT on all axis and by raising and lowering the antenna from 1 to 4 meters above the ground. The power cable position was also varied. Measurements were performed over the frequency range from 25 MHz to 5000 MHz.

2.0 System Test Configuration

2.1 Test System and Justification

in accordance with FCC rules, the tests were performed at one frequency since the EUT operates in over a 50 kHz band.

Proper operation was determined prior to the onset of tests. This is only configuration that will be installed in a normal operation. Wiring was consistent with manufacturer's recommendations. The system was configured for testing in a typical fashion (as a customer would normally use it).

2.2 EUT Test Configuration

The EUT was tested as a stand-alone device. The EUT was operated at full rated output into its standard antenna transmitting the data from the pipe locator. The modulation was disabled only when determining the amplitude of the unmodulated carrier

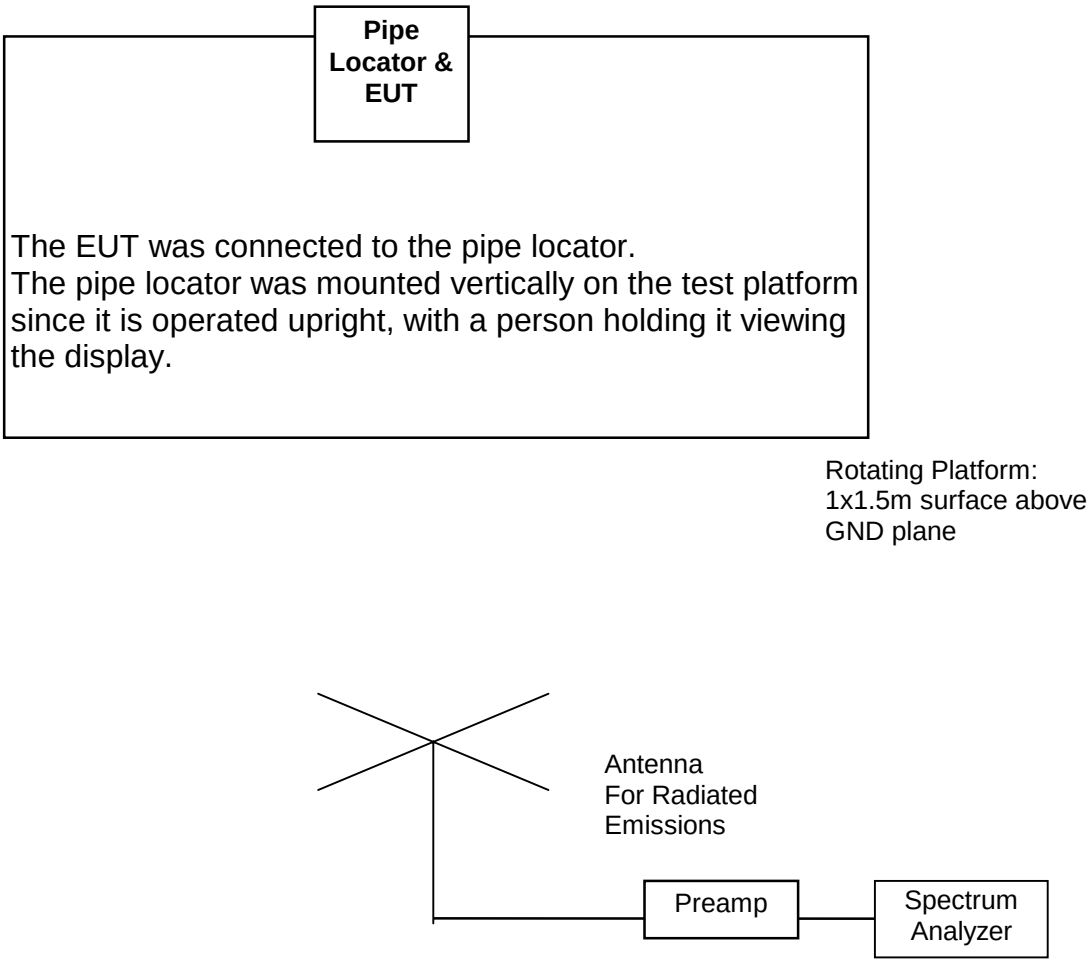
2.3 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

2.4 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

Figure 2.1 Configuration of Tested System



Radiated Emissions:
- LISN's not used
- AC outlet with low-pass filter at the base of the turntable
- No vertical conductive wall
- Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters

Notes:
- Not to Scale

Conducted Emissions:
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled
- Test platform is not rotated

3.0 Occupied Bandwidth Data

The occupied bandwidth of the RF output was measured using an HP8566A spectrum analyzer. The bandwidth was measured using the peak detector function and a narrow resolution bandwidth.

A broadband antenna was used to receive the modulated signal. The spectrum analyzer was set to the "MAX HOLD" mode to record the worst case of the modulation. The spectrum analyzer display was digitized and plotted. A limit was drawn on the plots based on the level of the modulated carrier. The plots of the occupied bandwidth for the EUT are supplied on the following page.

Figure 3.1 Occupied Bandwidth Plot

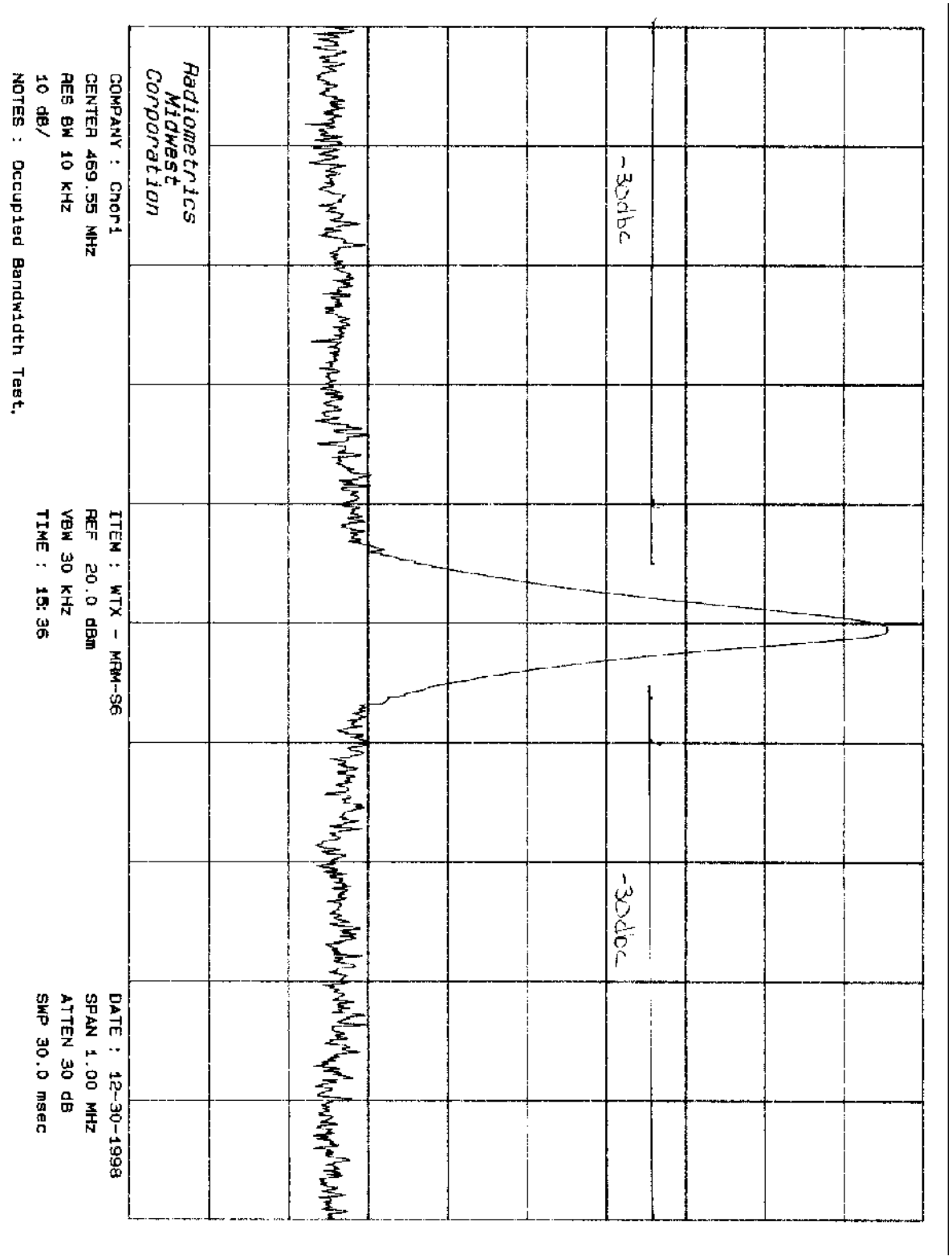


Figure 3.2 Occupied Bandwidth Plot

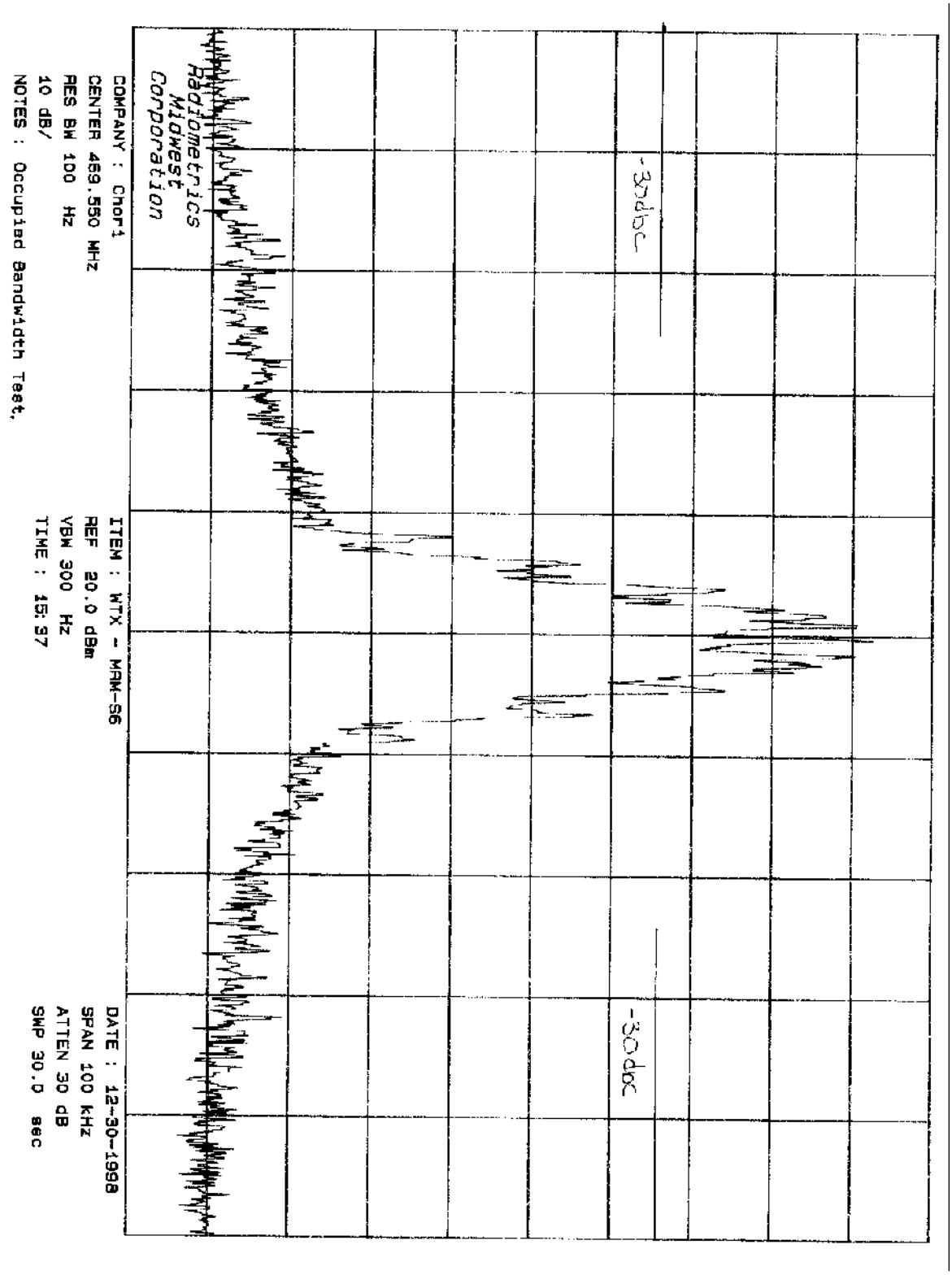


Figure 3.3 Occupied Bandwidth Plot

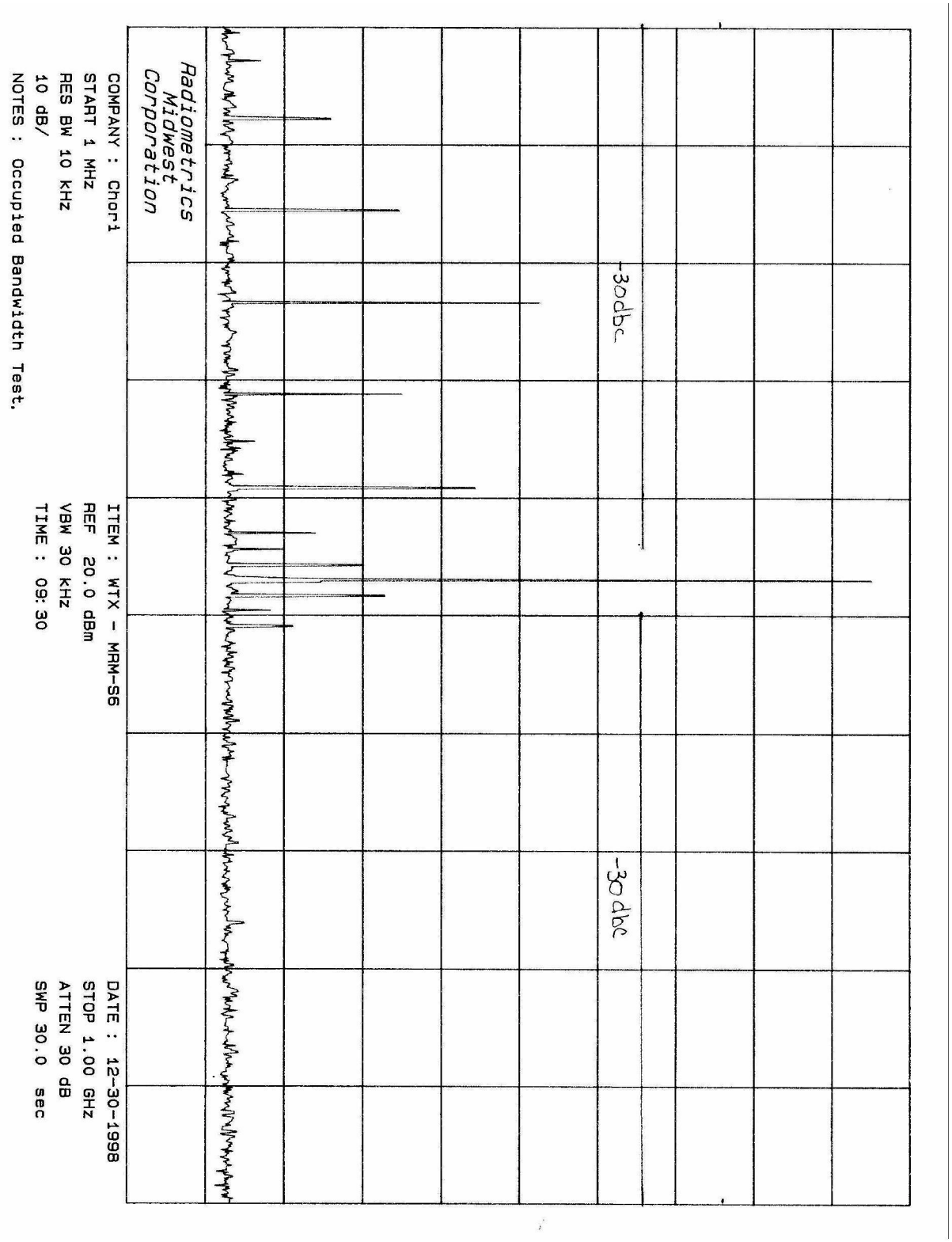


Figure 3.4 Occupied Bandwidth Plot

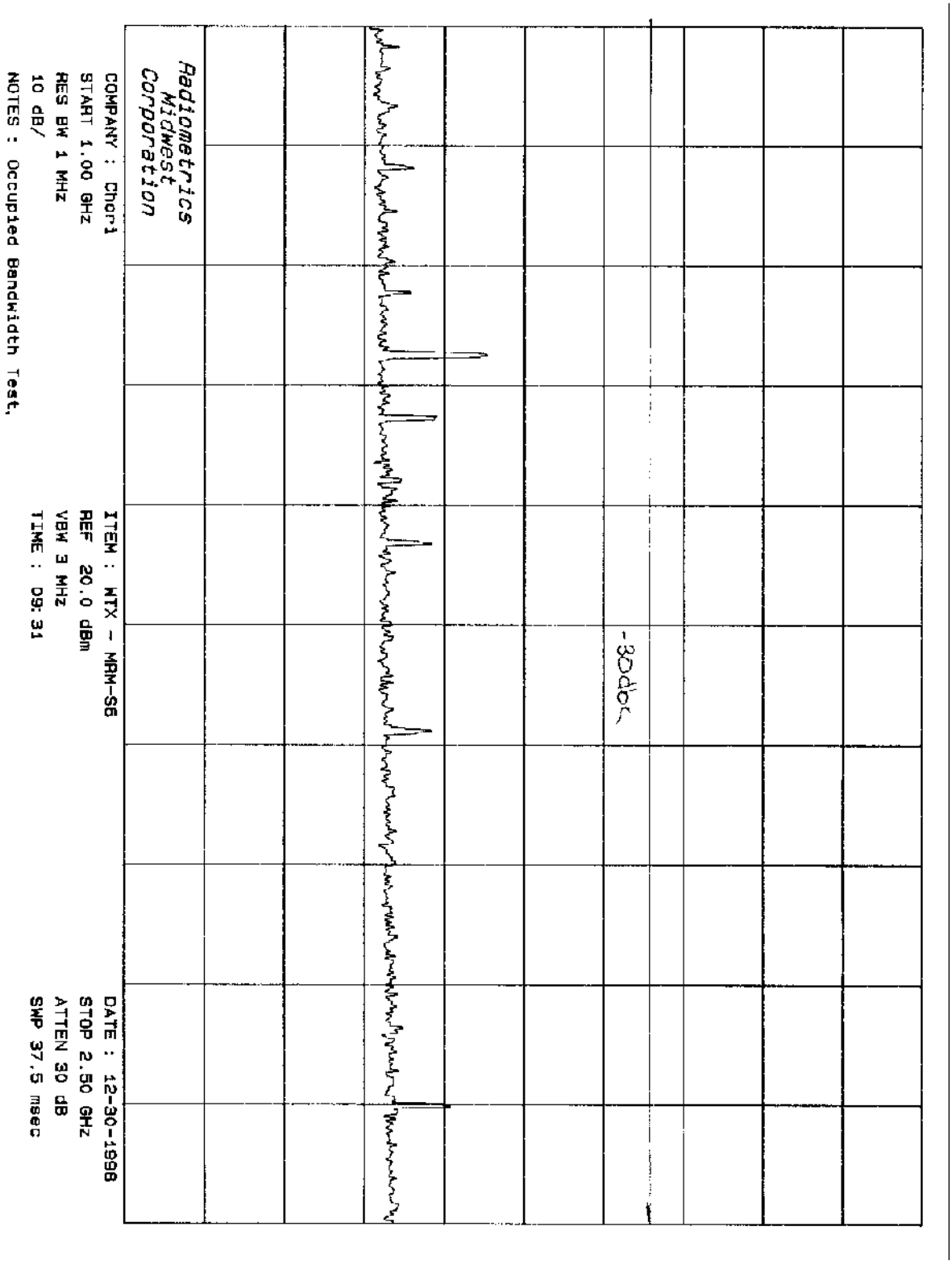
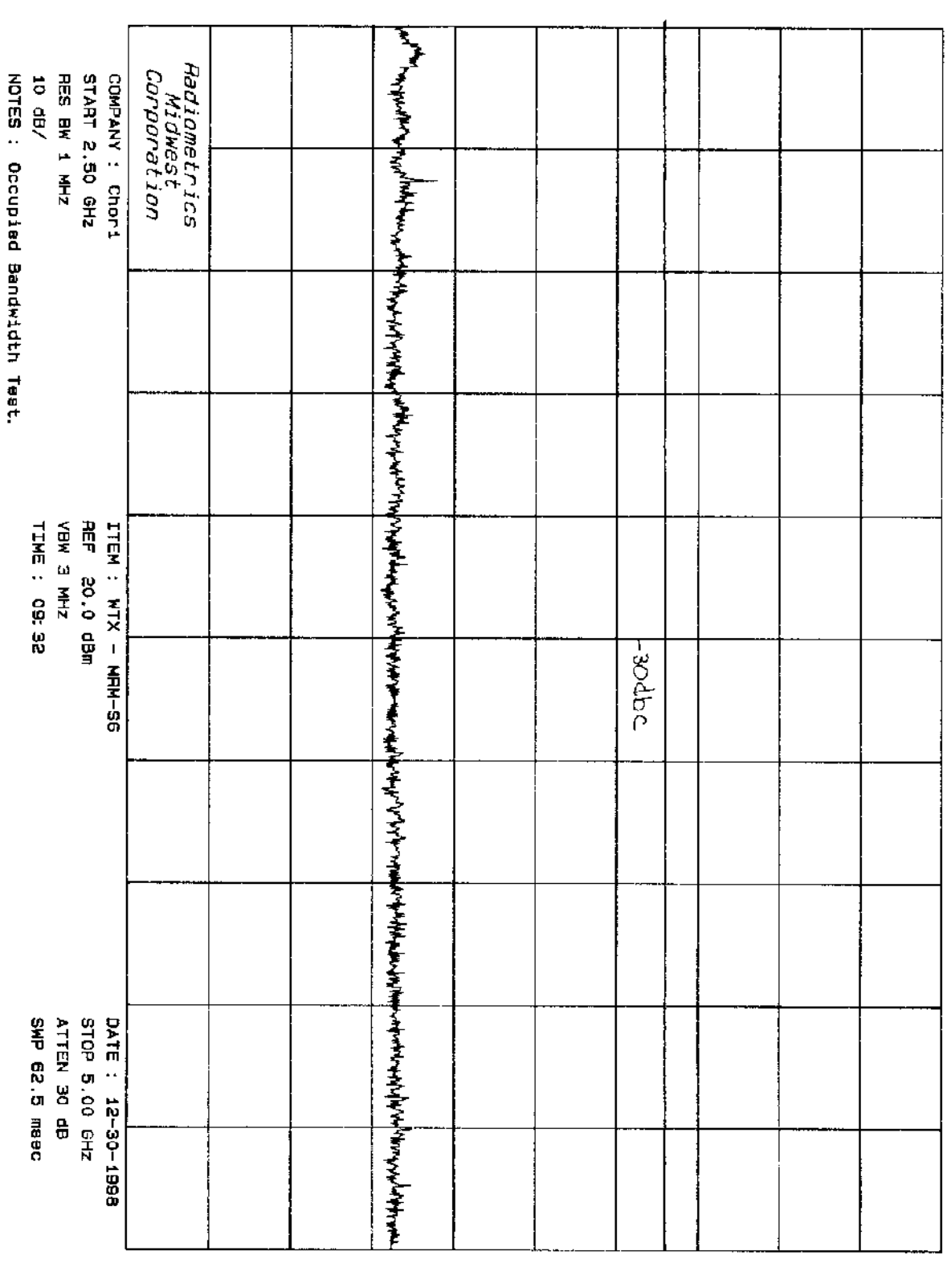


Figure 3.5 Occupied Bandwidth Plot



4.0 Radiated Emissions Data (Field Strength of Spurious Radiation)

The following table lists the highest measured emission frequencies, and measured levels and the limit. A sample calculation is given in paragraph 4.1.

Model : WTX
Test Date : 11-24-98
Test Distance : 3 Meters
Antennas Used : Biconical (30-200 MHz): Log-Periodic (200-1000 MHz)
: Horn (above 1000 MHz)
Notes : A low-loss coax cable was used above 1000 MHz.
: Corr. Factors = cable loss - preamp gain

Freq. MHz	Analyzer Reading dBuV*	Antenna Factor dB	Cable Loss dB	Field Strength of Signal dBuV/m	Limit Field Strength dBuV/m
469.5	87.8	16.8	3.9	108.5	#
78.3	40.9	7.9	1.4	50.3	78.5
156.5	34.3	15.2	2.2	51.7	78.5
234.8	48.4	11.4	3.0	62.8	78.5
704.3	41.8	20.6	5.0	67.4	78.5
939.0	47.6	22.9	5.8	76.3	78.5
1173.8	37.9	25.3	0.5	63.7	78.5
1408.5	46.3	25.7	0.6	72.6	78.5
1486.8	41.7	25.8	0.6	68.1	78.5
1643.3	36.9	26.7	0.7	64.3	78.5
1878.0	37.7	28.0	0.8	66.5	78.5
2347.5	42.1	29.5	0.8	72.4	78.5
2817.0	36.7	30.6	0.9	68.2	78.5
3286.5	33.6	31.9	1.0	66.5	78.5
3756.0	32.3	33.0	1.3	66.6	78.5

Level of unmodulated carrier

Judgment: Passed by 4.9 dB
The radiated emissions were scanned from 30 to 4700 MHz. The highest emissions are listed above.

Test Personnel: Joseph Strzelecki
Senior EMC Engineer

4.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG
Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Assume a receiver reading of 49.5 dBuV is obtained. The Antenna Factor of 8.1 and a Cable Factor of 1.7 is added. The Amplifier Gain of 23.3 dB is subtracted, giving a field strength of 36 dBuV/m. The 36 dBuV/m can be mathematically converted to its corresponding level in uV/m.

FS = 49.5 + 8.1 + 1.7 - 23.3 = 36.0 dBuV/m
Level in uV/m = Common Antilogarithm [(36 dBuV/m)/20] = 63.1 uV/m

5.0 RF Power Output Results

Test Description: RF Power Output; Paragraph 90.217

Received with power meter Signal Level dBm is 15.8

Note that 16.0 dB(m) = 40 mWatts

6.0 Frequency Stability

Test Description: Frequency Tolerance of Carrier Frequency Vs Temperature

Temperature Degrees C	Measured Frequency MHz	Frequency Deviation kHz
-30.0	469.49758	2.42
-20.0	469.49813	1.87
-10.0	469.49872	1.28
0.0	469.49910	0.90
10.0	469.50024	0.24
20.0	469.49955	0.45
30.0	469.49984	0.16
40.0	469.50018	0.18
50.0	469.50052	0.52

Test Description: Frequency Tolerance of Carrier Frequency Vs Input Voltage

Battery Input Voltage VDC	Measured Frequency MHz	Frequency Deviation kHz
7.00	469.49950	0.50
6.75	469.49947	0.53
6.50	469.49948	0.52
6.25	469.49947	0.53
6.00	469.49950	0.50
5.75	469.49951	0.49
5.50	469.49952	0.48
5.25	469.49953	0.47
5.00	469.49953	0.47
4.75	469.49954	0.46
4.50	469.49955	0.45
4.25	469.49956	0.44
4.00	469.49957	0.43
3.75	469.49957	0.43
3.50	469.49958	0.42

Note: The battery end point is 4.0 Volts.
Nominal Battery Voltage is 6.0 VDC

Test Result: The bandwidth required for frequency stability is 2.42 kHz

Test Personnel: Joseph Strzelecki
Senior EMC Engineer