FCC PART 90
EMI MEASUREMENT AND TEST REPORT

For

Midland Radio Corporation

1120 Clay Street
North Kansas City, MO 64116

FCC ID: MMA714110B

2003-06-05

This Report Concerns:	Equipment Type:
☒ Original Report	LAND MOBILE RADIO

Test Engineer:	Ming Jing /
Report Number:	R0305195
Test Date:	2003-06-03
Reviewed By:	Hans Mellberg /
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *Midland Radio Corporation's* Model: *71-4110B* or the "EUT" as referred to in this report is a land mobile radio which measures approximately 16.5"L x 19.2"W x 3.2"H. The EUT is comprised of separate module all housed within on 2RU equipment cabinet. The receiver, transmitter, and PA unit are each enclosed within their own die-cast housing. Each one is then mounted directly on the large upper heatsink. A microprocessor-controlled interface module controls the channel selection, LCD Display, timers, interfaces, and signaling features.

** The test data gathered are from typical production samples provided by the manufacturer.*

1.2 Objective

This report is prepared on behalf of *Midland Radio Corporation.* in accordance with Part 90 Subpart A, and Subpart I of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for effective radiated power, modulation characteristics, occupied bandwidth, radiated spurious emissions, and frequency stability.

1.3 Related Grant/Submission

No Related Submittals.

1.4 Test Methodology

Measurements contained in this report were also conducted with TIA/EIA Standard 603, Telecommunications Industry Association Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Date
HP	Spectrum Analyzer	8568B	2517A01610	2003-10-30
HP	Spectrum Analyzer	8593A	29190A00242	2004-05-01
HP	Amplifier	8447E	1937A01054	2004-05-01
HP	Quasi-Peak Adapter	85650A	2521A00718	2004-05-01
Com-Power	Biconical Antenna	AB-100	14012	2004-05-01
Com-Power	LISN	LI-200	12005	2004-03-28
Com-Power	LISN	LI-200	12008	2004-03-28
Com-Power	Log Periodic Antenna	AL-100	16091	2004-05-01
Com-Power	Log Periodic Antenna	AB-900	15049	2004-05-01
Rohde & Schwarz	EMI Test Receiver	ESPI	1147 8007 07	2003-12-03
HP	Spectrum Analyzer (9KHz – 40GHz)	8564E	08303	2003-08-01
HP	Spectrum Analyzer (9KHz – 50GHz)	8565EC	06042	2004-05-03
HP	Amplifier (1-26.5GHz)	8449B	3147A00400	2004-03-14
A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2004-05-31
KIKUSUI	Voltmeter	PL2303W	N/A	2003-07-28
Electro Impulse	1000W Attenuator	AX-1000-30	N/A	2003-07-29
Rohde & Schwarz	Generator	SMIQ03	N/A	2003-07-05
Terfronix	Storage Scope	TDS7104	N/A	2003-10-31
Versa	Temperature Chamber	DPSG-PI	124318	2004-04-23
HP	Plotter	7470A	N/A	Not Required

*** Statement of Traceability:** Bay Area Compliance Laboratory Corp. certifies that all calibration has been performed using suitable standards traceable to NATIONAL INSTITUTE of STANDARDS and TECHNOLOGY. (NIST)

1.7 Local Support Equipment

Manufacturer	Description	Model	Serial Number	FCC ID
Condor	DC Power Supply	GPFC250	None	None

1.8 External I/O Cabling List and Details

Cable Description	Length (M)	From	To
BNC Cable	1.0	RF output port / EUT	Input port / Attenuator
BNC Cable	1.0	Output port/Attenuator	Attenuator

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was tested under typical operating modes to represent the worst-case results during the final qualification test.

2.2 EUT Test Configuration

The EUT was powered and fully operated by pushing PTT (Push To Talk) button and then change the channel to Low, Middle, and High by selecting the keypad on the EUT.

2.3 Special Accessories

As shown in section 2.7, interface cable used for compliance testing is shielded as normally supplied by customer and its respective support equipment manufacturers.

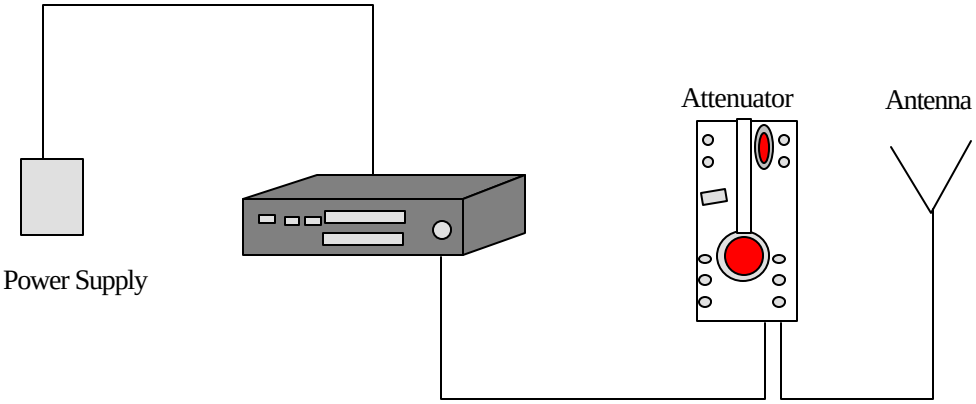
2.4 Schematics / Block Diagram

Please refer to Appendix D.

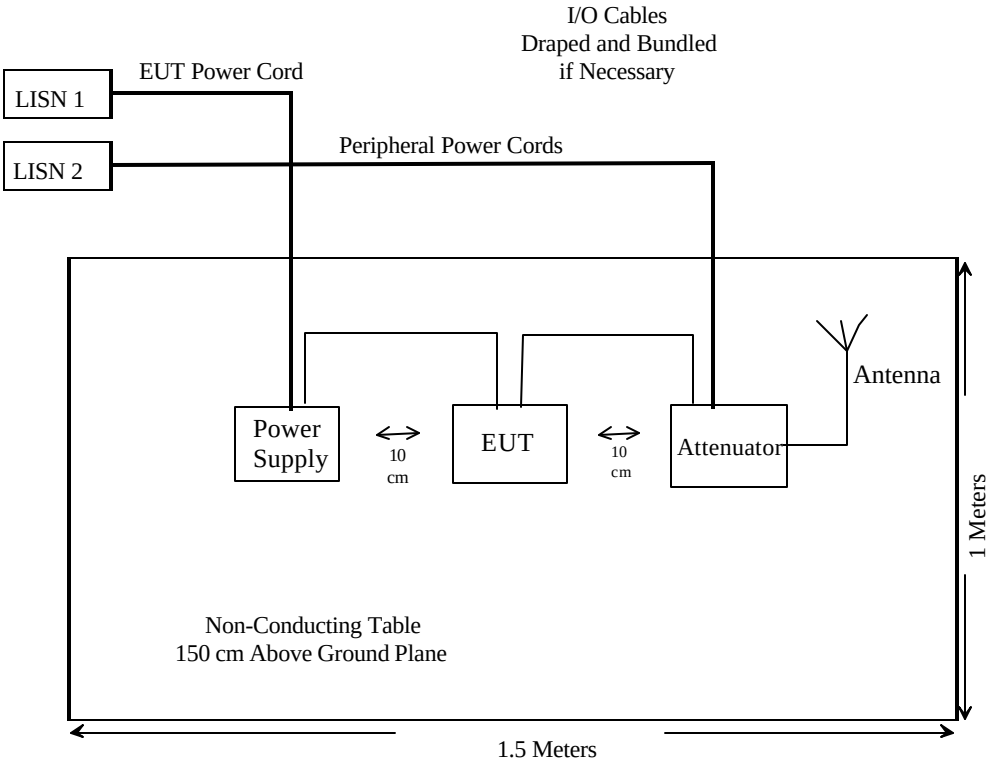
2.5 Equipment Modifications

No modification was made by BACL Corp. to make sure the EUT to comply with the applicable limits.

2.6 Configuration of Test System



2.7 Test Setup Block Diagram



3 - REQUIREMENTS OF PROVISIONS

3.1 Requirements and Test Summary

FCC Rules	Rules Description	Result
2.1046 90.205 (b)	RF Output Power	Complied
2.1047 90.207 90.210 (b)	Modulation Characteristics	Complied
2.1049 90.209 (b)(5) 90.210 (b)	Occupied Bandwidth	Complied
2.1053 90.210 (b)	Radiated Spurious Emission	Complied
2.1051 90.210 (b)	Spurious Emission at Antenna Port	Complied
2.1055 90.213	Frequency Stability Vs. Temperature Vs. Voltage	Complied
15.107	AC Line Conducted Emission	N/A

3.2 Labeling Requirement

Each equipment for which a type acceptance applications is filed on or after May 1, 1981, shall bear an identification plate or label pursuant to §2.295 (Identification of Equipment) and §2.926 (FCC identifier)

In August 1996 the Federal Communications Commissions (FCC) adopted RF exposure guidelines with safety levels for hand-held wireless devices.

Generally users manual contains a RF exposure statement to indicate compliance with FCC requirements.

The users manual should also contain required information and instruction pursuant to 95.653.

4 – CONDUCTED OUTPUT POWER

4.1 Provision Applicable

Per FCC §2.1046, §90.205(h)(i)(p)(q) and §90.309: the maximum transmitter output power depends on HAAT and service area radius.

4.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuator.

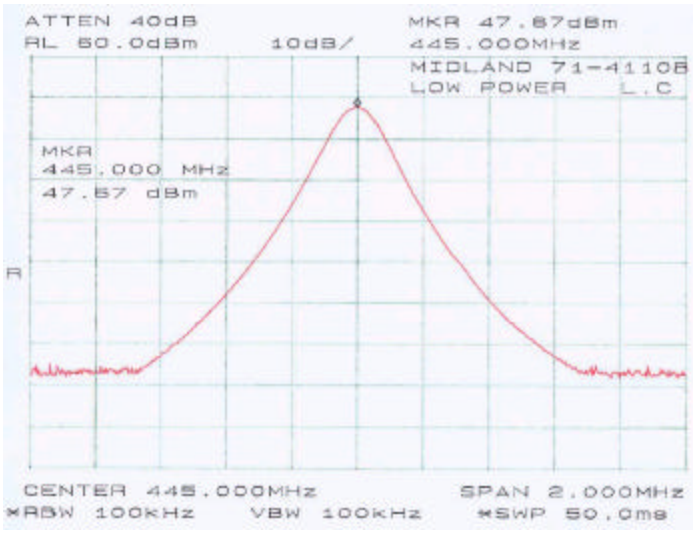
4.3 Test Equipment

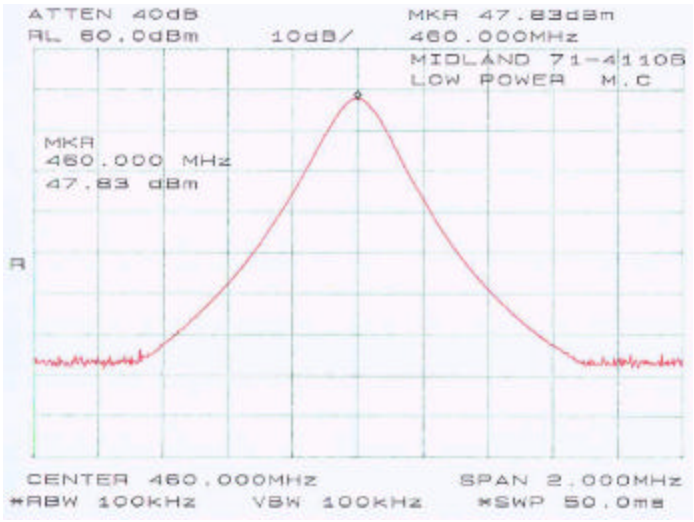
Hewlett Packard HP8564E Spectrum Analyzer, Calibration Due Date: 2003-08-01
Electro Impulse AX-1000-30 1000W Attenuator, Calibration Due Date: 2003-07-29

4.4 Test Results

Transmitter	Channel	Frequency	Output Power in dBm	Output Power in W
Low Power	Low	445.0	47.67	58.479
	Middle	460.0	47.83	60.673
	High	475.0	47.50	56.234
High Power	Low	445.0	50.33	107.894
	Middle	460.0	50.50	112.201
	High	475.0	49.83	96.161

Please refer to the following plots.


ATTEN 40dB
RL 60.0dBm
10dB/
MKR 47.67dBm
445.000MHz
MIDLAND 71-4110B
LOW POWER L.C
MKR
445.000 MHz
47.67 dBm
R
CENTER 445.000MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms


ATTEN 40dB
RL 60.0dBm
10dB/
MKR 47.83dBm
460.000MHz
MIDLAND 71-4110B
LOW POWER M.C
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VBW 100kHz
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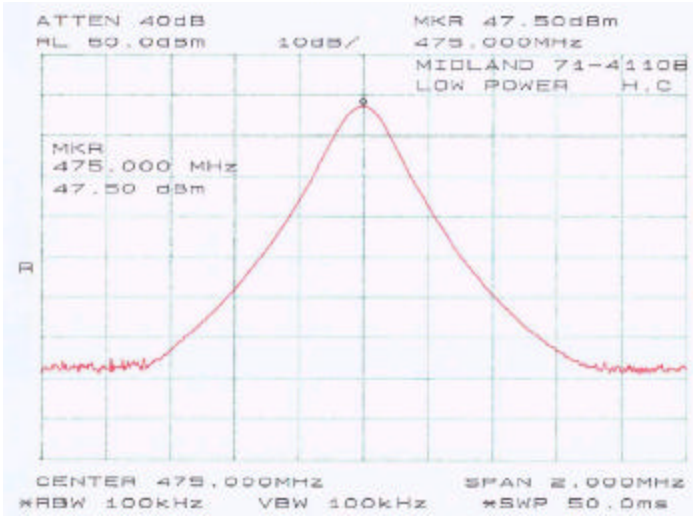
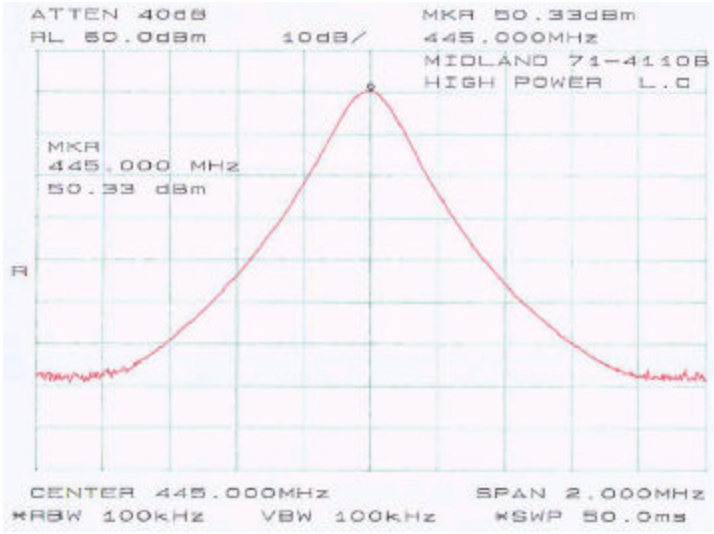
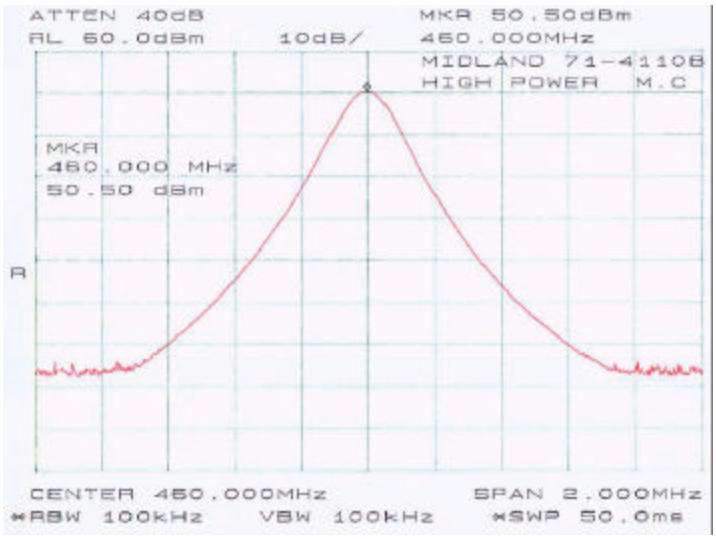
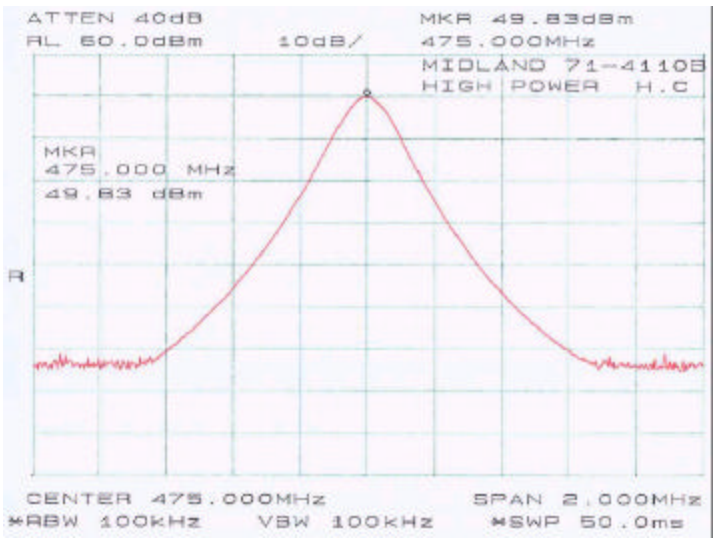

ATTEN 40dB
RL 60.0dBm
10dB/
MKR 47.50dBm
475.000MHz
MIDLAND 71-4110B
LOW POWER H.C
MKR
475.000 MHz
47.50 dBm
R
CENTER 475.000MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms


ATTEN 40dB
RL 50.0dBm
10dB/
MKR 50.33dBm
445.000MHz
MIDLAND 71-4110B
HIGH POWER L.C
MKR
445.000 MHz
50.33 dBm
R
CENTER 445.000MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms


ATTEN 40dB
RL 50.0dBm
10dB/
MKR 50.50dBm
460.000MHz
MIDLAND 71-4110B
HIGH POWER M.C
MKR
460.000 MHz
50.50 dBm
R
CENTER 460.000MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms


ATTEN 40dB
RL 50.0dBm
10dB/
MKR 49.83dBm
475.000MHz
MIDLAND 71-4110B
HIGH POWER H.C
MKR
475.000 MHz
49.83 dBm
R
CENTER 475.000MHz
SPAN 2.000MHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0ms

5 - MODULATION CHARACTERISTICS

5.1 Provision Applicable

Per FCC § 2.1047, § 90.207, and §90.210(b), modulation is required to report.

5.2 Test Procedure

5.2.1 Audio Frequency Response

The RF output of the transceiver was connected to the input of a FM deviation meter through sufficient attenuation so as not to overload the meter or distort the reading. An audio signal generator was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed the generator output was connected to the microphone connectors.

The audio signal input level was adjusted to obtain 20% of the maximum rated system deviation at 1 kHz, and recorded as DEVREF. With the audio signal generator level unchanged, set the generator frequency between 100 Hz to 5000 Hz. The transmitter deviations (DEVFREQ) were measured and the audio frequency response was calculated as

$$20\log_{10}[DEV_{FREQ} / DEV_{REF}]$$

5.2.2 Audio Low-Pass Filter Response

An audio signal generator and an audio spectrum analyzer were connected to the input and output of the post limiter low pass filter respectively. The audio signal generator frequency was set between 1000 Hz and the upper low pass filter limit. The audio frequency response at test frequency was calculated as

$$LEV_{FREQ} - LEV_{REF}$$

5.2.3 Modulation Limiting

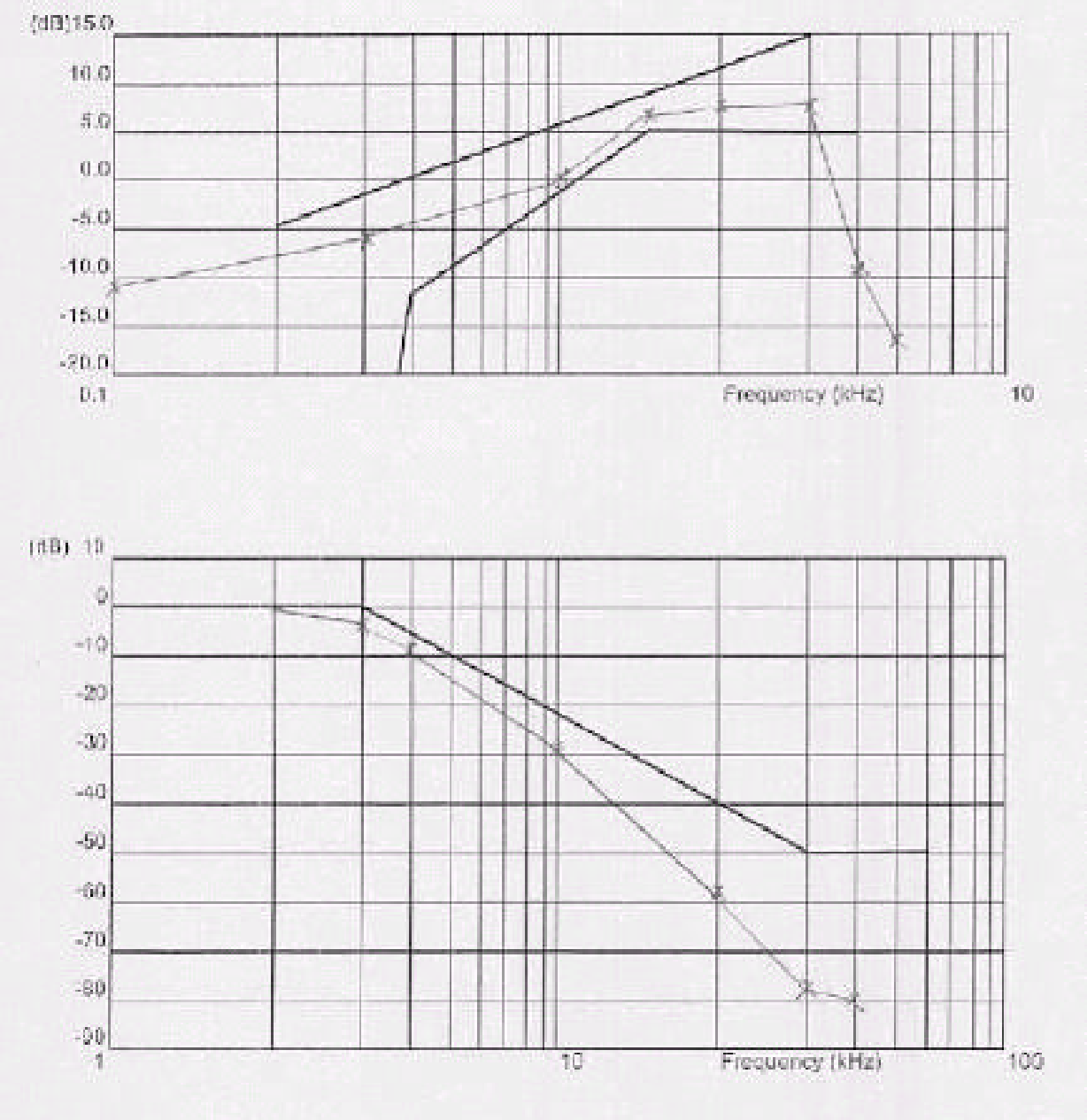
With the same setup as section 5.2.1 above, at three different modulating frequencies, the output level of the audio generator was varied and the FM deviation level was recorded.

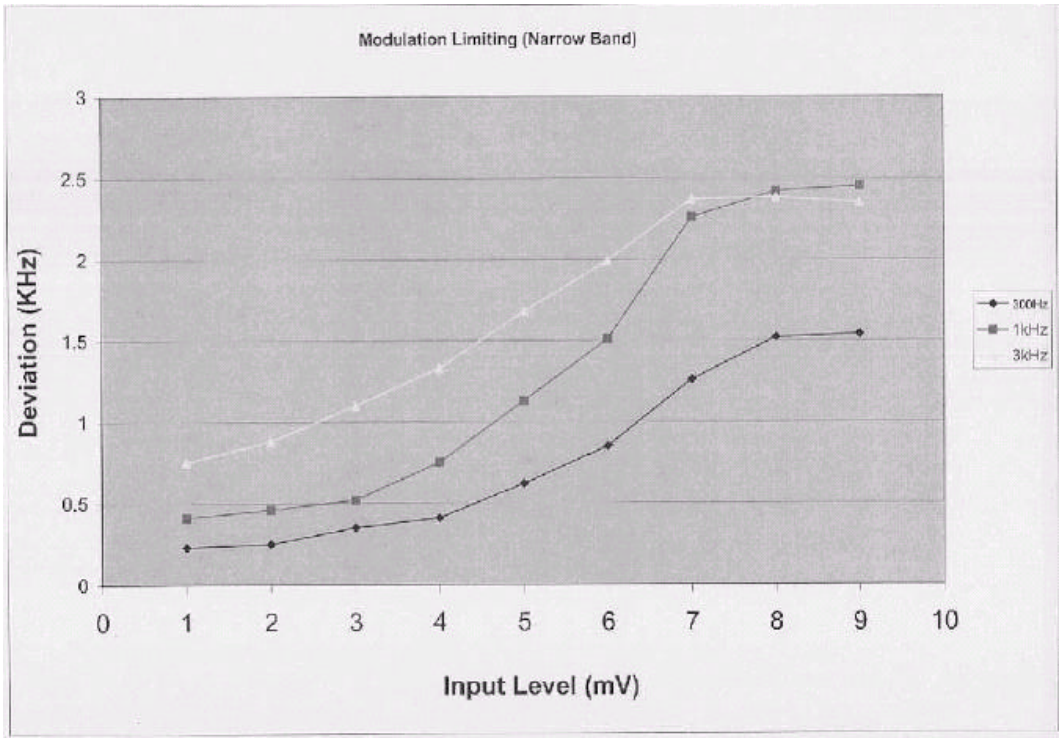
5.3 Test Equipment

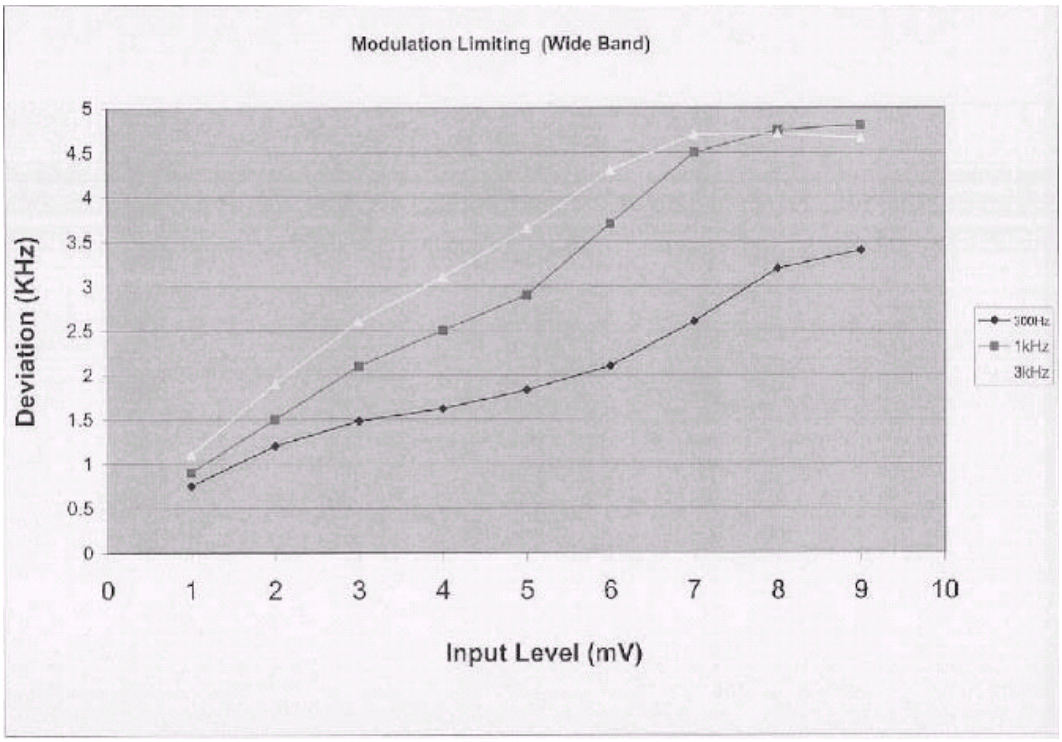
Hewlett Packard HP8564E Spectrum Analyzer, Cal. Due Date: 2003-08-01
Hewlett Packard HP 7470A Plotter, Cal. Due Date: Not Required
Hewlett Packard HP8901A Modulation Analyzer, Cal. Due Date: 2003-10-18
Terfronix TDS7104 Storage Scope, Cal. Due Date: 2003-10-31
Nan Yan NY2201 Audio Generator

5.4 Test Results

The plot(s) of modulation characteristic is presented hereinafter as reference.


(dB) 15.0
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
0.1
Frequency (kHz)
10
(dB) 10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1
10
Frequency (kHz)
100


Modulation Limiting (Narrow Band)
Deviation (KHz)
Input Level (mV)
300Hz
1kHz
3kHz


Modulation Limiting (Wide Band)
Deviation (KHz)
Input Level (mV)
300Hz
1kHz
3kHz

6 - OCCUPIED BANDWIDTH OF EMISSION

6.1 Provision Applicable

Per FCC §2.1049, §90.209(b)(5), and §90.210 (b), the authorized bandwidth is 20kHz for operating band within 25-50 MHz.

For any frequency removed from the center of the assigned channel by more than 50 percent up to and including 100 percent of the authorized bandwidth, at least 25 dB.

On any frequency removed from the center of the assigned channel by more than 100 percent up to and including 250 percent, at least 35 dB.

On any frequency removed from the center of the assigned channel by more than 250 percent at least:

43 + 10 log(P)_dB

6.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation. The RBW of the spectrum analyzer was set at 300Hz, and the spectrum was recorded in ± 50KHz from the carrier Frequency.

6.3 Test Equipment

Hewlett Packard HP8564E Spectrum Analyzer, Cal. Due Date: 2003-08-01
Nan Yan NY2201 Audio Generator
Hewlett Packard HP8901A Modulation Analyzer, Cal. Due Date: 2003-10-18

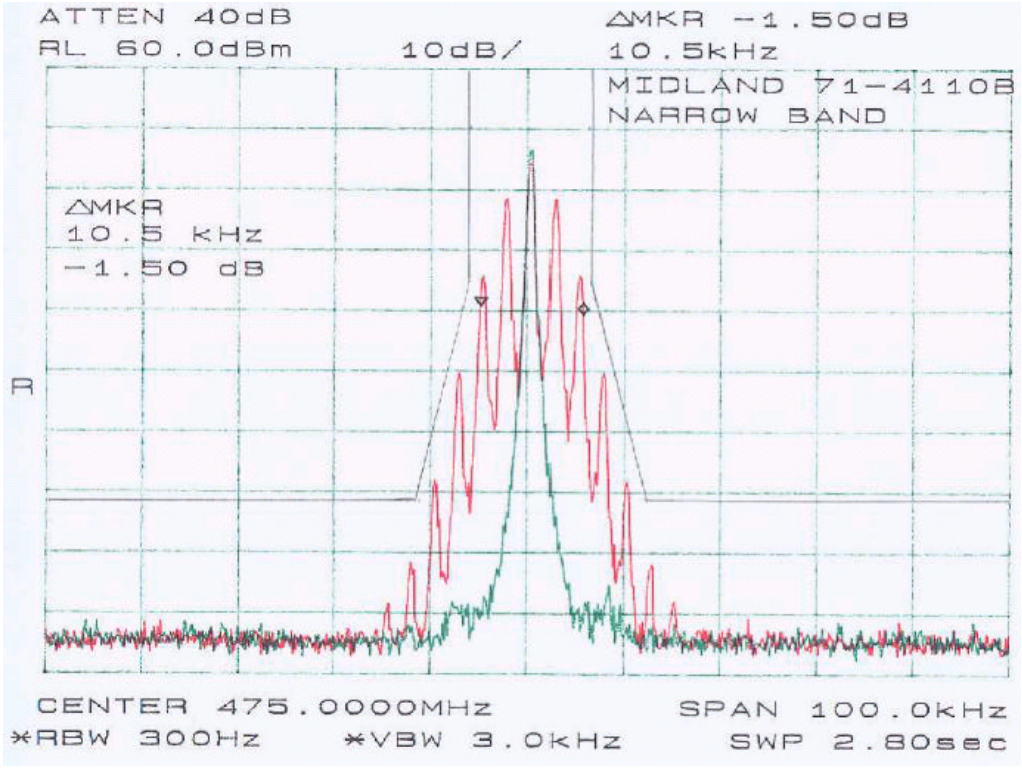
6.4 Test Results

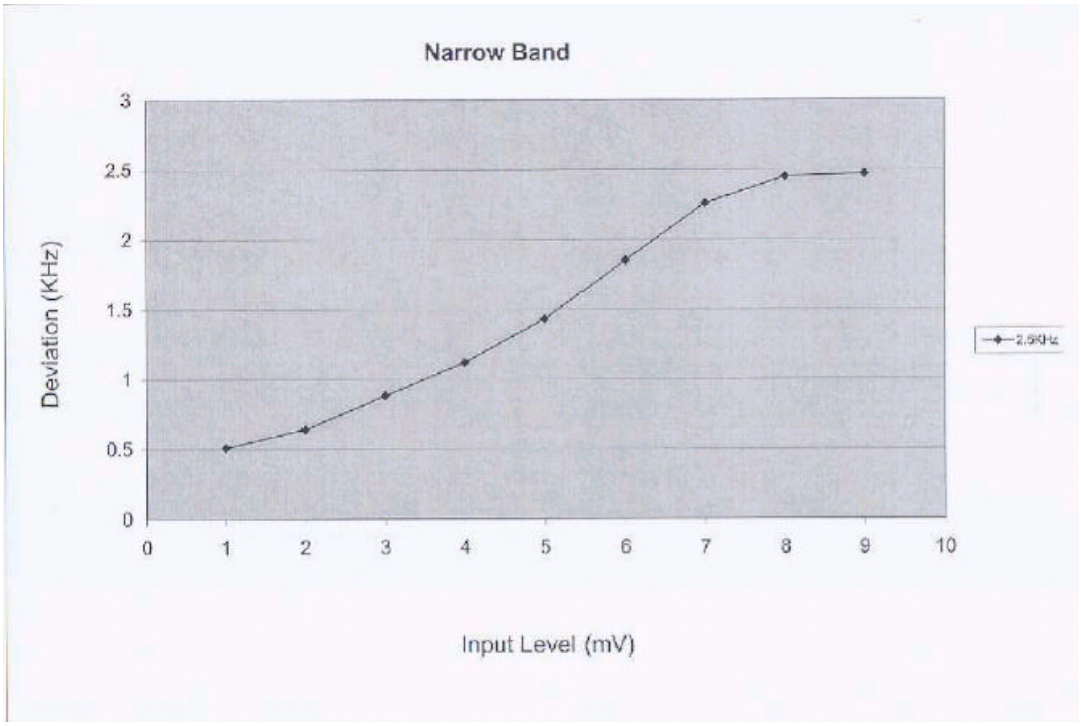
Test Result: Pass
Please refer the following curve and plots.

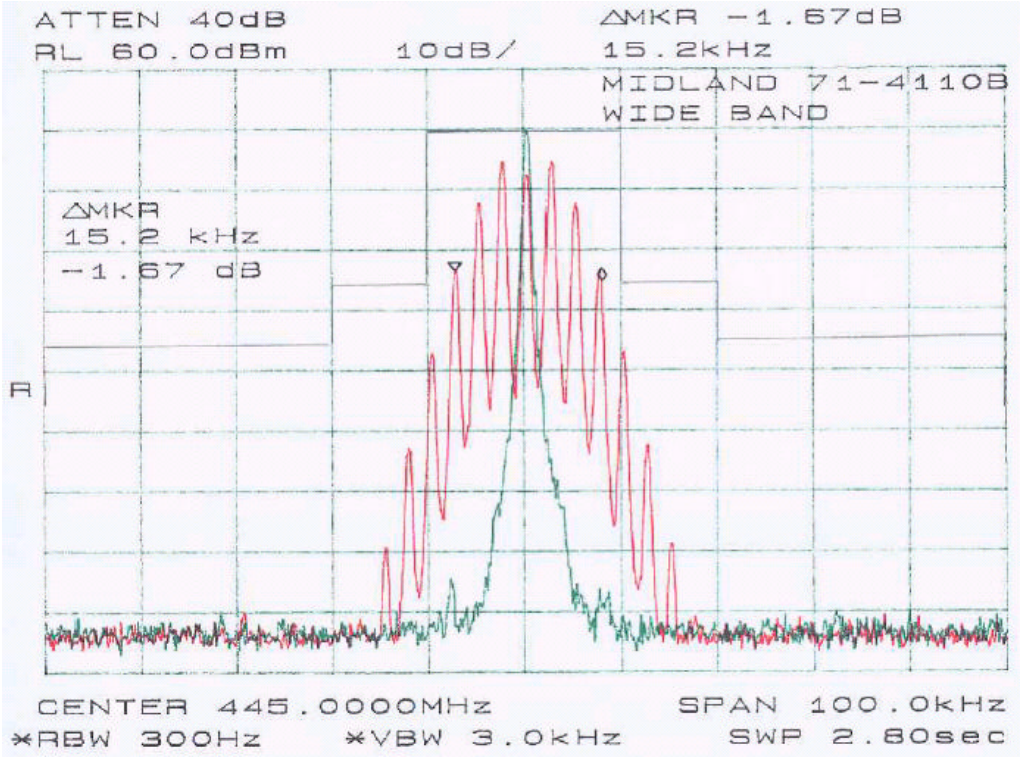
6.5 Emission Designator

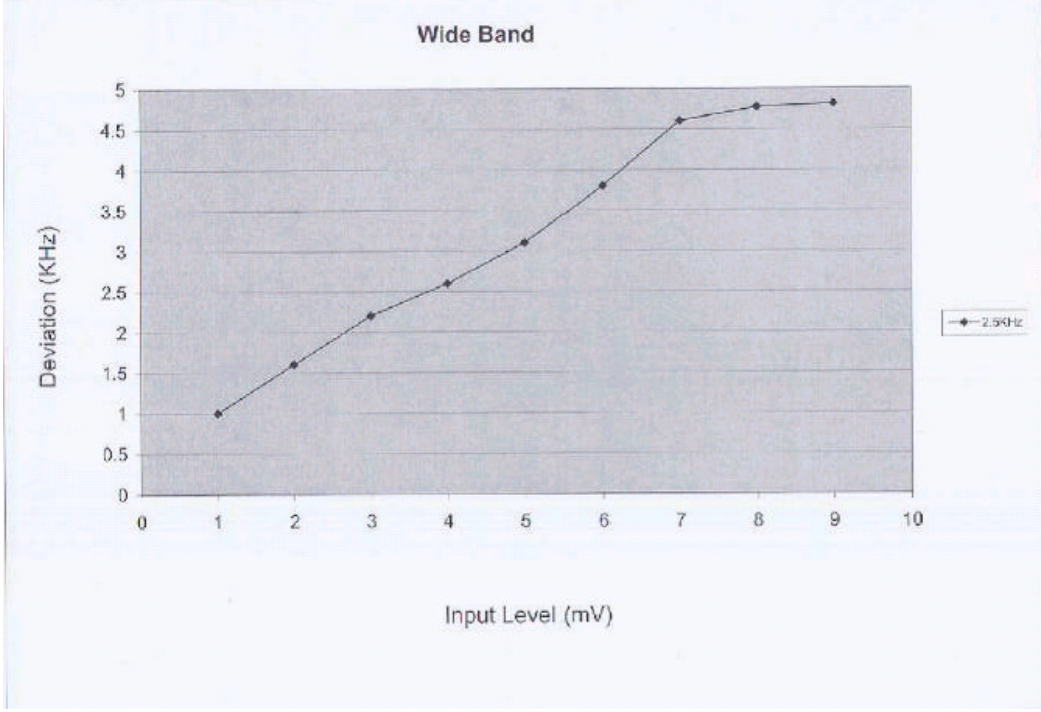
Narrow Band: 2M + 2D = (2 x 3 kHz) + (2 x 2.5 kHz) = 11K0F3E

Wide Band: 2M + 2D = (2 x 3 kHz) + (2 x 5.0 kHz) = 16K0F3E


ATTEN 40dB
RL 60.0dBm
10dB/
ΔMKR -1.50dB
10.5kHz
MIDLAND 71-4110B
NARROW BAND
ΔMKR
10.5 kHz
-1.50 dB
CENTER 475.0000MHz
SPAN 100.0kHz
*RBW 300Hz
*VBW 3.0kHz
SWP 2.80sec


Narrow Band
Deviation (KHz)
Input Level (mV)
0
0.5
1
1.5
2
2.5
3
0
1
2
3
4
5
6
7
8
9
10
2.5KHz


ATTEN 40dB
RL 60.0dBm
10dB/
ΔMKR -1.67dB
15.2kHz
MIDLAND 71-4110B
WIDE BAND
ΔMKR
15.2 kHz
-1.67 dB
A
CENTER 445.0000MHz
SPAN 100.0kHz
*RBW 300Hz
*VBW 3.0kHz
SWP 2.80sec


Wide Band
Deviation (KHz)
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5
6
7
8
9
10
Input Level (mV)
2.5KHz

7 - RADIATED SPURIOUS EMISSION

7.1 Provision Applicable

Per FCC §2.1051and FCC §90.210(b)

On any frequency removed from the center of the assigned channel by more than 250 percent at least:

43 + 10 log(P) dB

7.2 Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. The test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = 10 lg (TXpwr in Watts/0.001) – the absolute level

Spurious attenuation limit in dB = 43 + 10 Log_{10} (power out in Watts)

7.3 Test Equipment

Com-Power AL-100 Antenna, Cal. Due Date: 2004-05-01
Com-Power AB-100 Antenna, Cal. Due Date: 2004-05-01
Com-Power AB-900 Antenna, Cal. Due Date: 2004-05-01
HP 8564E Spectrum Analyzer, Cal. Due Date: 2003-08-01
A.H.System SAS-200 Antenna, Cal. Due Date: 2004-05-31
HP 8449B Preamplifiers, Cal. Due Date: 2004-03-14
Rohde & Schwarz SICQ03 Generator, Cal. Due Date: 2003-07-05

7.4 Test Result

Low Frequency: -31 dB at 1335 MHz
Middle Frequency: -31 dB 920 MHz
High Frequency: -31.2 dB at 1425 MHz

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss DB	Level dBm	Limit dBm	Margin DB
Low Frequency												
445	95.6	310	2.1	v	445	39.5	v	0	0.1	39.4		
445	101.4	280	2.5	h	445	41.3	h	0	0.1	41.2		
1335	43.8	15	1.5	h	1335	-43.7	h	0	0.3	-44	-13	-31
890	45.7	90	1.5	h	890	-44.2	h	0	0.1	-44.3	-13	-31.3
1335	40.6	0	1.7	v	1335	-45.1	v	0	0.3	-45.4	-13	-32.4
1780	39.7	210	1.8	h	1780	-45.3	h	0	0.3	-45.6	-13	-32.6
890	42.1	120	1.5	v	890	-45.6	v	0	0.1	-45.7	-13	-32.7
1780	36.2	230	1.5	v	1780	-46.8	v	0	0.3	-47.1	-13	-34.1
Middle Frequency												
460	96.5	30	1.2	v	460	40.3	v	0	0.1	40.2		
460	103.1	210	1.5	h	460	43.9	h	0	0.1	43.8		
920	46.3	15	1.2	h	920	-43.9	h	0	0.1	-44	-13	-31
1380	44.1	150	2	h	1380	-44.5	h	0	0.3	-44.8	-13	-31.8
920	42.5	0	1.5	v	920	-44.8	v	0	0.1	-44.9	-13	-31.9
1380	41.1	90	1.5	v	1380	-45.6	v	0	0.3	-45.9	-13	-32.9
1840	39.5	120	1.8	h	1840	-45.7	h	0	0.3	-46	-13	-33
1840	36.4	60	1.5	v	1840	-46.2	v	0	0.3	-46.5	-13	-33.5
High Frequency												
475	93.1	240	2	v	475	38.7	v	0	0.1	38.6		
475	96.2	290	2.5	h	475	40.5	h	0	0.1	40.4		
1425	43.2	130	2	h	1425	-43.9	h	0	0.3	-44.2	-13	-31.2
950	45.3	15	1.6	h	950	-44.9	h	0	0.1	-45	-13	-32
950	41.6	0	1.8	v	950	-45.5	v	0	0.1	-45.6	-13	-32.6
1425	40.1	110	1.5	v	1425	-45.3	v	0	0.3	-45.6	-13	-32.6
1900	38.7	310	1.2	h	1900	-45.5	h	0	0.3	-45.8	-13	-32.8
1900	36.1	270	1.5	v	1900	-46.3	v	0	0.3	-46.6	-13	-33.6

Result: Pass

Please refer the hereinafter plots for more information.

8 - SPURIOUS EMISSION AT ANTENNA TERMINAL

8.1 Standard Applicable

Per FCC §2.1051and FCC §90.210(b)

On any frequency removed from the center of the assigned channel by more than 250 percent at least:

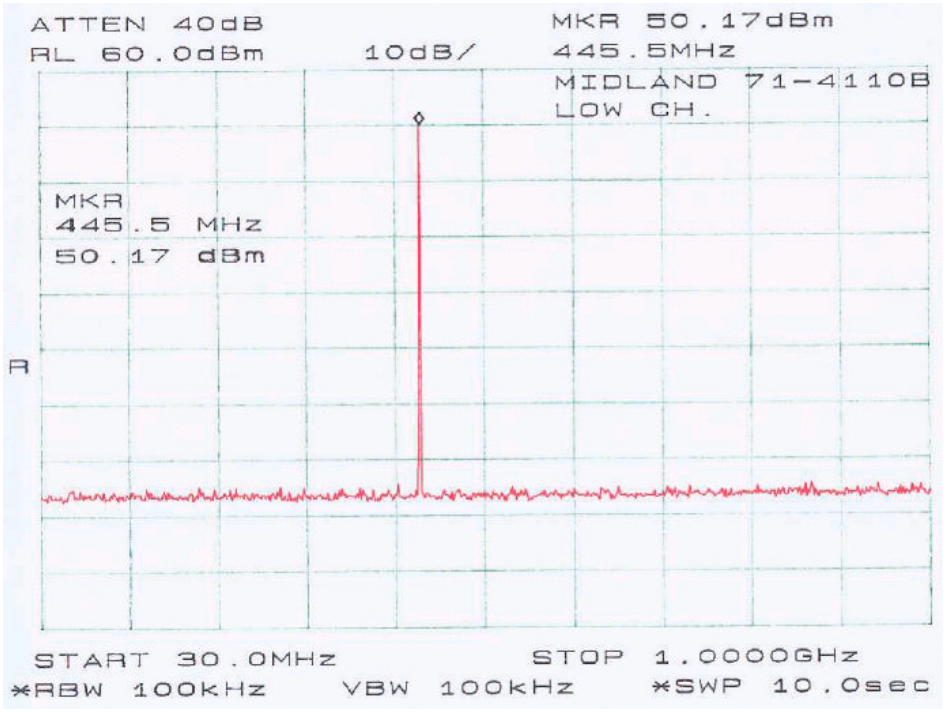
43 + 10 log(P) dB

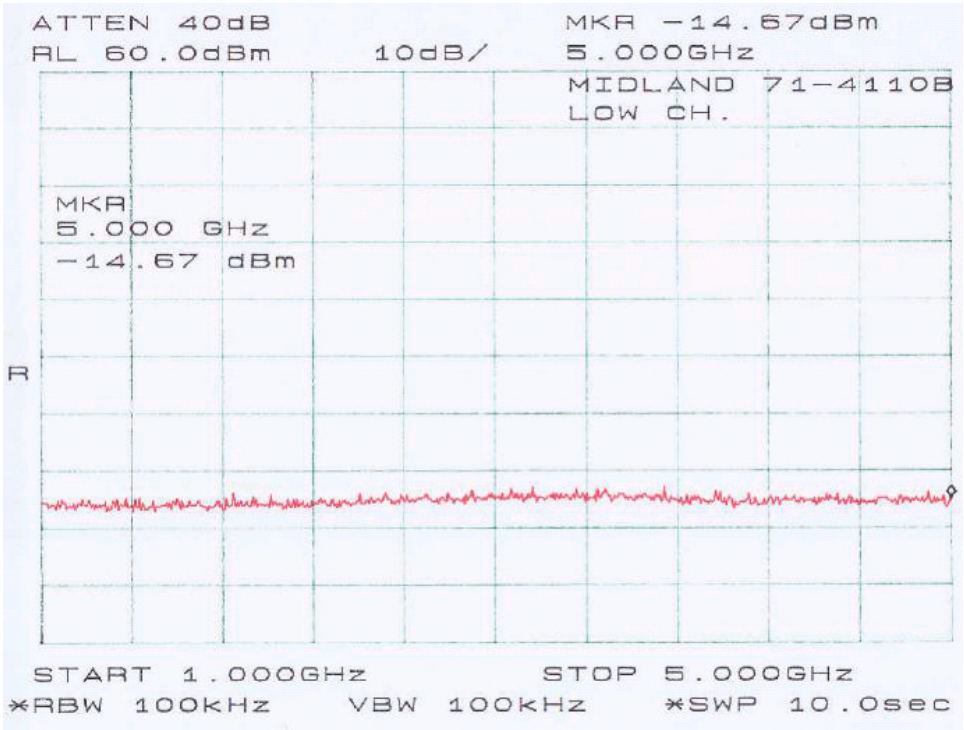
8.2 Measurement Procedure

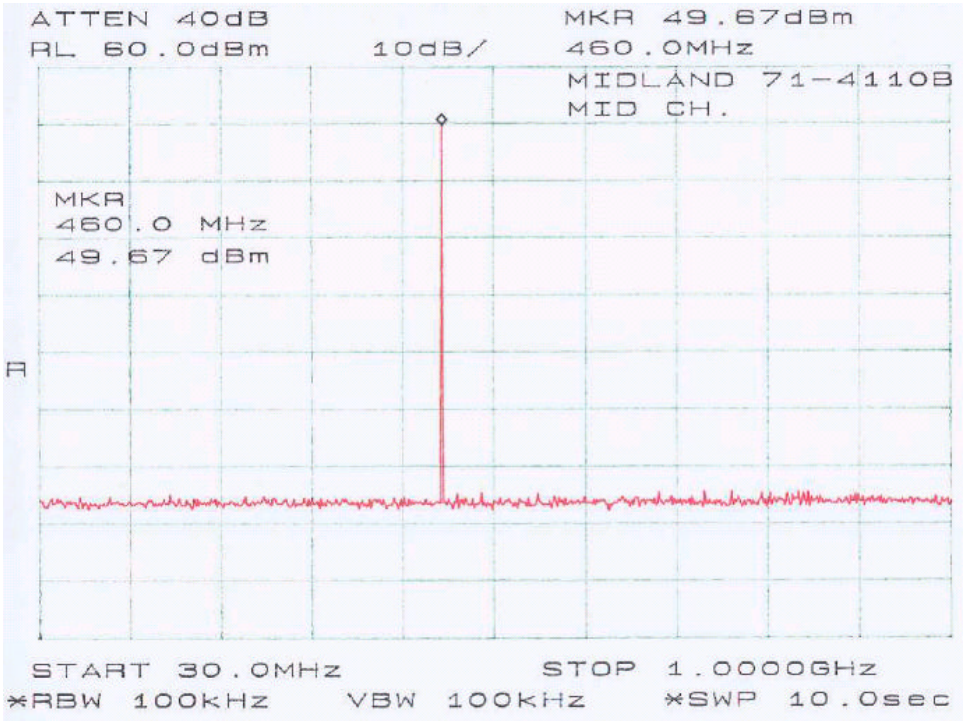
The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

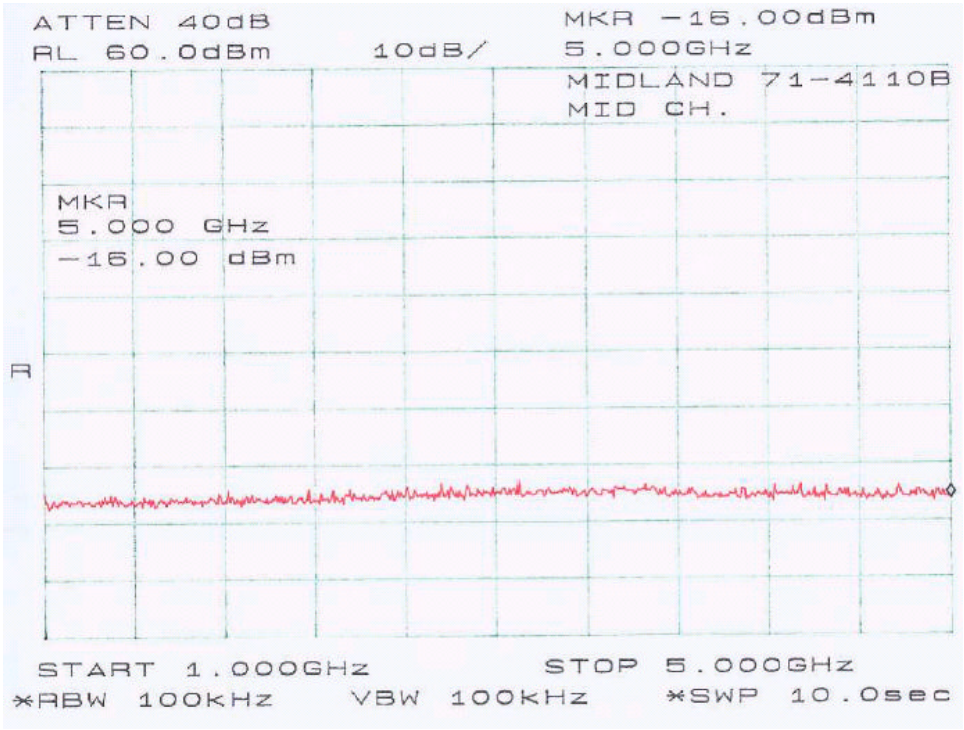
8.3 Test Result

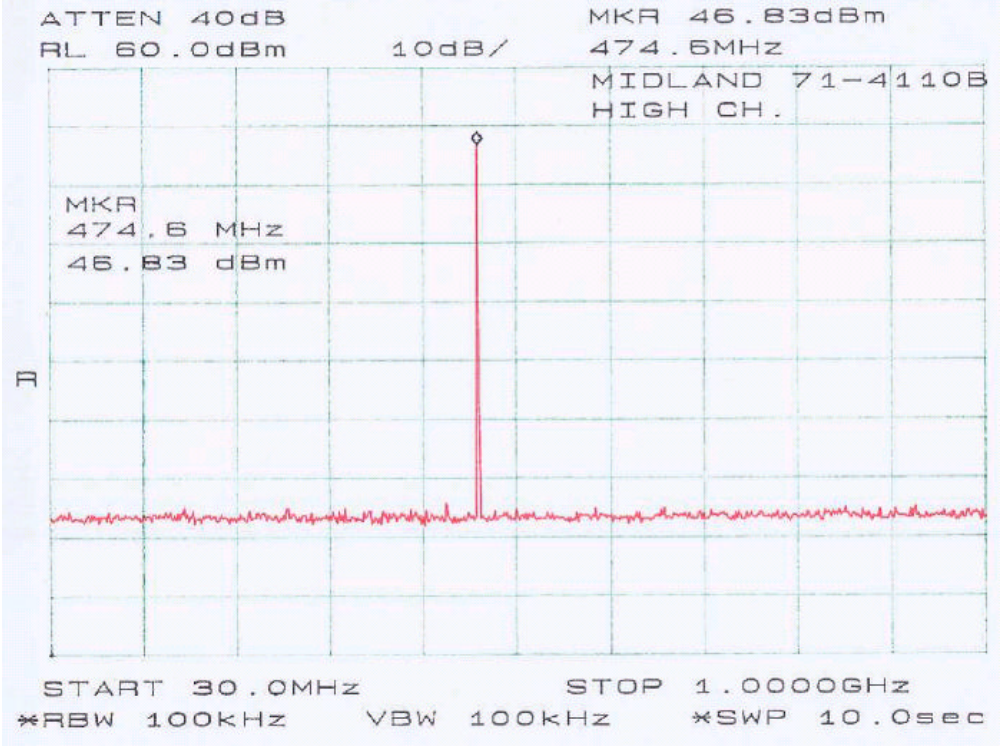
Please refer to following plots.

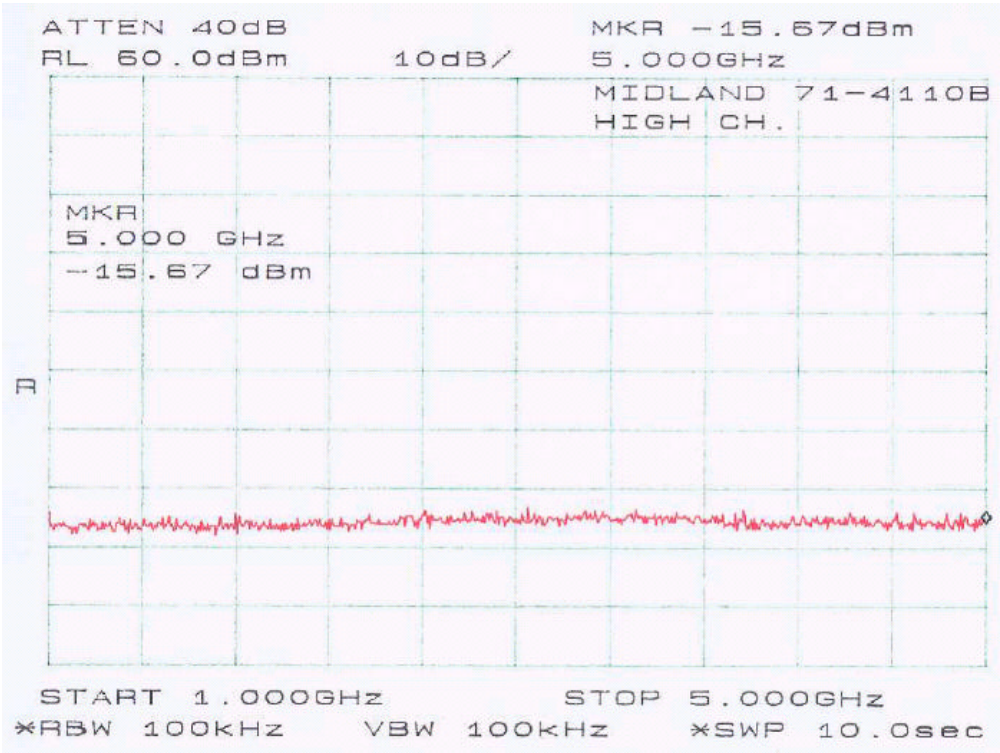

ATTEN 40dB
RL 60.0dBm
10dB/
MKR 50.17dBm
445.5MHz
MIDLAND 71-4110B
LOW CH.
MKR
445.5 MHz
50.17 dBm
R
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 60.0dBm
10dB/
MKR -14.67dBm
5.000GHz
MIDLAND 71-4110B
LOW CH.
MKR
5.000 GHz
-14.67 dBm
R
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 60.0dBm
10dB/
MKR 49.67dBm
460.0MHz
MIDLAND 71-4110B
MID CH.
MKR
460.0 MHz
49.67 dBm
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 60.0dBm
10dB/
MKR -16.00dBm
5.000GHz
MIDLAND 71-4110B
MID CH.
MKR
5.000 GHz
-16.00 dBm
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 60.0dBm
10dB/
MKR 46.83dBm
474.6MHz
MIDLAND 71-4110B
HIGH CH.
MKR
474.6 MHz
46.83 dBm
A
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec


ATTEN 40dB
RL 60.0dBm
10dB/
MKR -15.67dBm
5.000GHz
MIDLAND 71-4110B
HIGH CH.
MKR
5.000 GHz
-15.67 dBm
A
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 10.0sec

9 - AC LINE CONDUCTED EMISSIONS

Not applicable because of DC power supply.

10 - FREQUENCY STABILITY MEASUREMENT

10.1 Provision Applicable

According to §90.213, for operating band within 25-50MHz and output power > 2 watts, the frequency stability limit is 20 ppm.

10.2 Test Procedure

10.2.1 Frequency stability versus environmental temperature

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

10.2.2 Frequency Stability versus Input Voltage

At room temperature (25±5°C), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.

10.3 Test Equipment

Temperature Chamber, -50°C to +100°C
Hewlett Packard HP8568B Spectrum Analyzer, Cal. Due Date: 2003-10-30
Hewlett Packard HP 7470A Plotter, Cal. Due Date: Not Required

10.4 Test Results

Reference Frequency: 445.0000 MHz, Limit: 2.5 ppm			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
60	13.6	445.0007	1.6
50	13.6	445.0007	1.6
40	13.6	445.0002	0.4
30	13.6	445.0002	0.4
20	13.6	445.0000	0
10	13.6	445.0000	0
0	13.6	444.9998	-0.4
-10	13.6	444.9998	-0.4
-20	13.6	444.9995	-1.1
-30	13.6	444.9995	-1.1

Frequency Stability Versus Input Voltage

Reference Frequency: 445.0000 MHz, Limit: 25 ppm						
Power Supplied (Vdc)	Frequency Measure with Time Elapsed					
	2 Minutes		5 Minutes		10 Minutes	
	MHz	ppm	MHz	ppm	MHz	ppm
15.6	445.0000	0	445.0000	0	445.0001	0.2
13.6	445.0000	0	445.0000	0	445.0000	0
11.5	445.0000	0	444.9998	-0.4	444.9998	-0.4

Conclusion: The EUT complied with the applicable Frequency Stability Limits.

11 - RF EXPOSURE

According to §15.247(b)(4) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §1.1310 and §2.1093 RF exposure is calculated.

Limits for Maximum Permissive Exposure (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for Occupational Population/Controlled Exposure				
0.3-3.0	614	1.63	*(100)	6
3.0-30	1824/f	4.89/f	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
300-1500	/	/	f/300	6
1500-100,000	/	/	5	6

f = frequency in MHz
* = Plane-wave equivalent power density

MPE Prediction

Predication of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

Maximum peak output power at antenna input terminal: 50.5 (dBm)
Maximum peak output power at antenna input terminal: 112200 (mW)
Prediction distance: 600 (cm)
Predication frequency: 450 (MHz)
Antenna Gain (typical): 16 (dBi)
antenna gain: 39.8 (numeric)
Power density at predication frequency at 20 cm: 0.99 (mW/cm^2)

MPE limit for uncontrolled exposure at prediction frequency: 1.5 (mW/cm^2)

Test Result

The EUT is defined as a mobile device since the predicted power density level at 600 cm is 0.99 mW/cm^2. This is below the controlled exposure limit of 1.5mW/cm^2 at 450 MHz.