

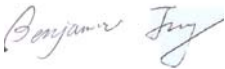
FCC PART 95 EMI MEASUREMENT AND TEST REPORT

For

Midland Radio Corporation

1120 Clay Street
North Kansas City, MO 64116

FCC ID: MMA77321

This Report Concerns: ☒ Original Report	Equipment Type: Transceiver, CB Radio with Weather Alert
Test Engineer: Ming Jin / 	
Report Number: R0503081	
Report Date: 2005-04-04	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Midland Radio Corporation* 's product, FCC ID: *MMA77321*, Model: *77-321* or the "EUT" as referred to in this report is a transceiver, CB radio with weather alert. The EUT was composed of two parts, the radio part, which measures approximately 155mmL x 90mmW x 20mmH and the head unit part, which measures approximately 250mmL x 212mmW x 65mmH.

The EUT operates at the frequency range of 26.965 – 27.405 MHz, maximum output power 3.98W, frequency tolerance 0.0007% and emission designator 6K00A3E.

** The test data gathered are from production sample, serial number: #1, provided by the manufacturer.*

Objective

This report is prepared on behalf of *Midland Radio Corporation* in accordance with Part 95 Subpart D and Subpart E of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for effective radiated power, modulation characteristics, occupied bandwidth, radiated spurious emissions, AC line conducted emissions and frequency stability.

Related Grant/Submission

No Related Submittals.

Test Methodology

Measurements contained in this report were also conducted with TIA/EIA 603A, Telecommunications Industry Association Land Mobile AM 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.

Test Facility

The Open Area Test site used by BACL 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 BACL 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 C63.4-2003.

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, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200367-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

SYSTEM TEST CONFIGURATION

Justification

The EUT was tested according to TIA/EIA 603A to represent the worst-case results during the final qualification test.

EUT Test Configuration

The EUT was powered and fully operated by pushing buttons on the headset which controls the CB radio.

Special Accessories

As shown in following test block diagram setup, interface cable used for compliance testing is shielded as normally supplied by customer and its respective support equipment manufacturers.

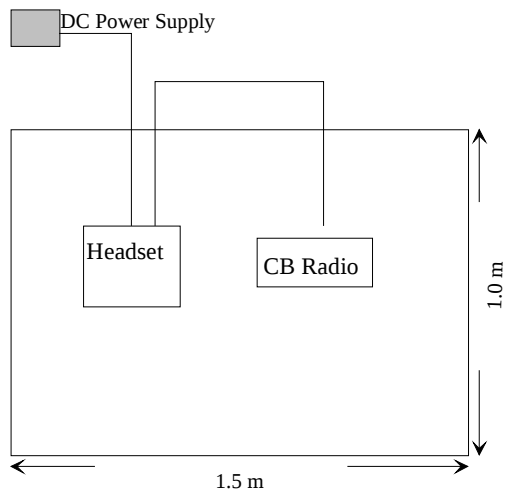
Schematics / Block Diagram

Please refer to Appendix D.

Equipment Modifications

No modifications were made to the EUT.

Test Setup Block Diagram



REQUIREMENTS OF PROVISIONS

Results reported relate only to the product tested, serial number: #1.

FCC Rules	Rules Description	Requirement	Result
2.1046 95.639 (c) (1)	Conducted Output Power	4W	Complied
2.1047 95.637 (d) 95.637 (c)	Modulation Characteristics A3E analog device Audio Frequency Response Modulation Limiting Over Modulation Transient Response	85% < Amplitude Modulation < 100%	Complied
2.1049 95.633 (a)	Occupied Bandwidth	8KHz	Complied
§2.1053 §95.635(b)(1) §95.635(b)(3) §95.635(b)(8) §95.635(b)(9)	Spurious Radiation	Worst Case < -23dBm	Complied
95.635(a) 2.1053 (a)	Spurious Emission at Antenna Port	Complied	Complied
2.1055 95.625 (b)	Frequency Stability Vs. Temperature Vs. Voltage	< 0.005%	Complied

§2.1046 and § 95.639 (c)(1) – CONDUCTED OUTPUT POWER

Provision Applicable

Per FCC §2.1046 and FCC § 95.639 (c)(1), no CB transmitter, under any condition of modulation, shall exceed 4W Carrier power when transmitting emission type A3E or A1D.

Test Procedure

1. Place the EUT on a bench and set it in transmitting mode.
2. Connect a low loss RF cable from the antenna port to an attenuator .
3. Connect a low loss RF cable from the antenna port to a spectrum analyzer.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8564E	3943A01781	2004-10-04
Hewlett Packard	Plotter	HP7470A	N/A	N/A

* **Statement of Traceability:** **BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Environmental Conditions

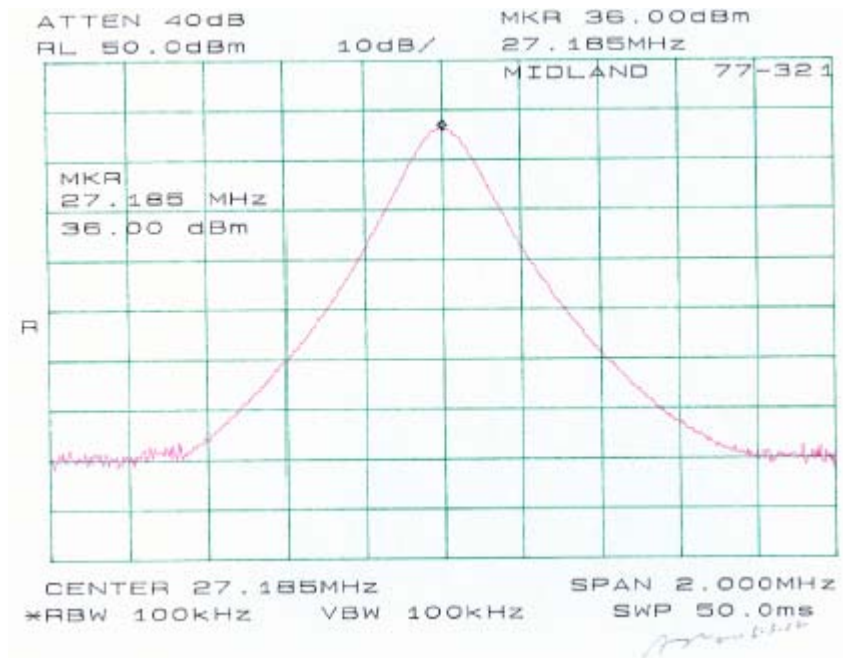
Temperature:	25 ° C
Relative Humidity:	38%
ATM Pressure:	1032 mbar

The testing was performed by Ming Jin on 2005-03-25.

Test Results

Frequency (MHz)	Output power (W)	Limit (W)
27.185	3.98	4

Please refer to the following plots.



§2.1047, §95.631(c), and § 95.637(c) - MODULATION CHARACTERISTICS

Standard Applicable

Per FCC § 2.1047, §95.631(c), and §95.637 (c), when emission type A3E is transmitted, the modulation must be greater than 85% but most not exceed 100%. Simultaneous amplitude modulation and frequency or phase modulation of a transmitter are not permitted.

Test Procedure

Audio Frequency Response

The RF output of the transceiver was connected to the input of an AM modulation analyzer 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.

The audio signal input level was adjusted to obtain 50% of modulation at 1 kHz, and recorded as AM_{ref}. With the audio signal generator level unchanged, set the generator frequency between 100 Hz to 5000 Hz. The transmitter modulation (AM_{freq}) were measured and the audio frequency response was calculated as

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

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

$$LEV_{\text{FREQ}} - LEV_{\text{REF}}$$

Modulation Limiting

With the same setup as the above, at three different modulating frequencies, the output level of the audio generator was varied and the AM in % was recorded.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8564E	3943A01781	2004-10-04
HP	Modulation Analyzer	8901A	2026A00847	2004-08-19
Nanyan	Audio Generator	NY2201	000420	Not Required

*** Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

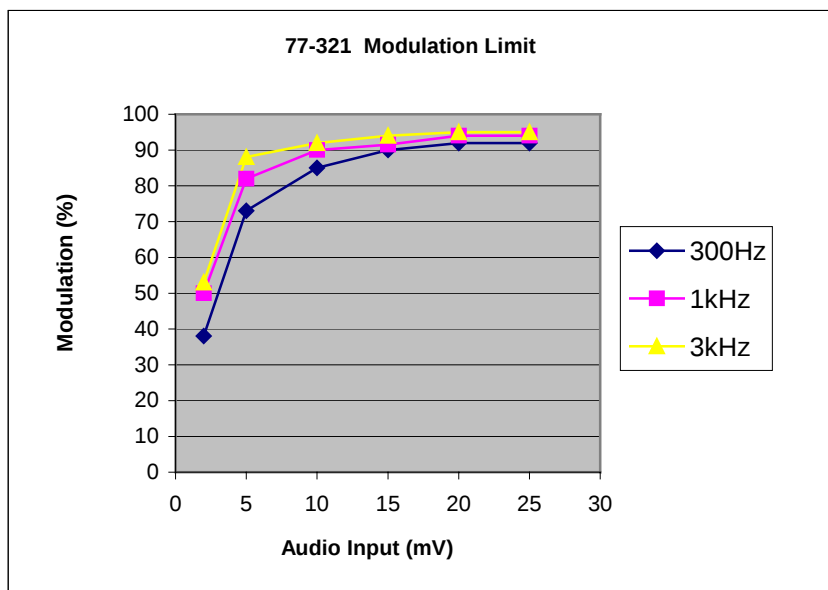
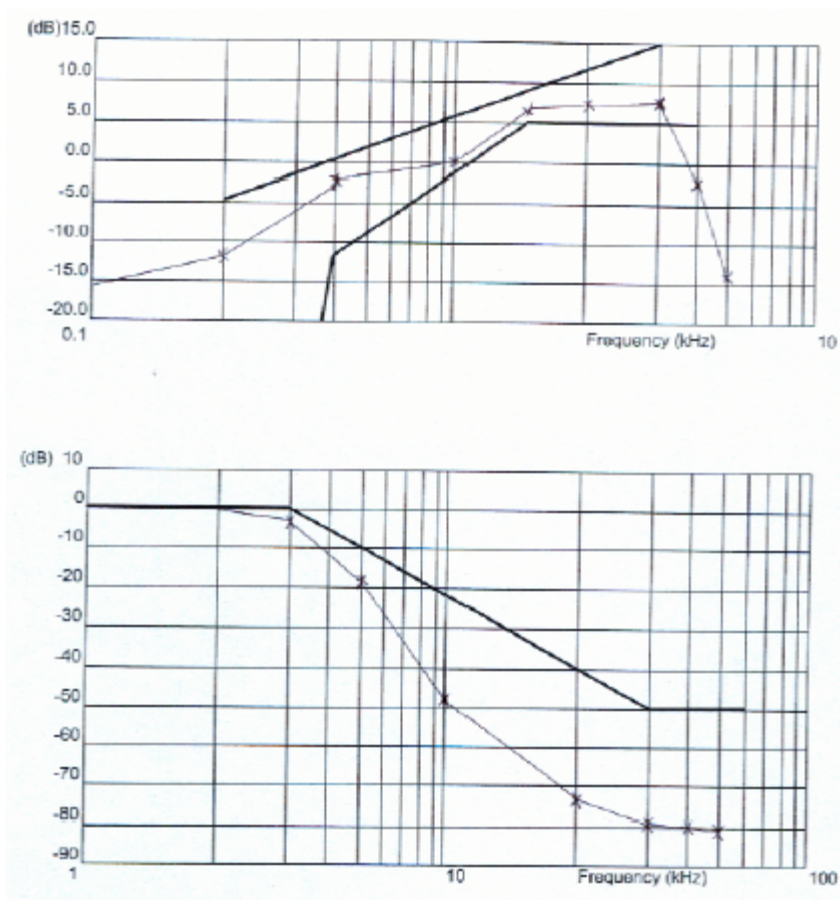
Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	38%
ATM Pressure:	1032 mbar

The testing was performed by Ming Jin on 2005-03-25.

Test Results

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



§2.1049 and § 95.633(a) - OCCUPIED BANDWIDTH OF EMISSION

Standard Applicable

Per FCC §2.1049 and FCC §95.633 (a), the authorized bandwidth for emission type A3E transmitted is 8 kHz.

Test Procedure

The antenna was disconnected from the transmitter and the short cable was connected to the transmitter RF output.

The RF output was connected to the input of the spectrum analyzer through sufficient attenuation.

With the transmitter keyed, the level of the unmodulated carrier was set to the full scale reference line of the spectrum analyzer. This is used as a 0dB reference for emission mask measurements.

The transmitter was then modulated with a 2500 Hz tone at an input level 16 dB greater than the necessary to produce 50% modulation. The resolution bandwidth of the spectrum analyzer was set up to 300 Hz and the spectrum of the transmitting signal was recorded. This spectrum was compared to the required emission mask.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Due Date
Agilent	Spectrum Analyzer	8564E	3943A01781	2004-10-04
Nanyan	Audio Generator	NY2201	000420	Not Required

* **Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	38%
ATM Pressure:	1032 mbar

The testing was performed by Ming Jin on 2005-03-25.

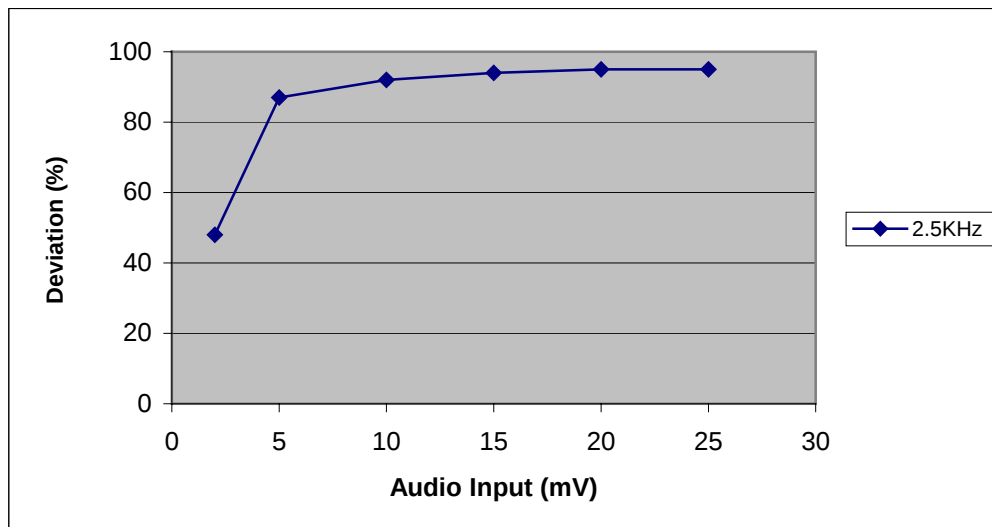
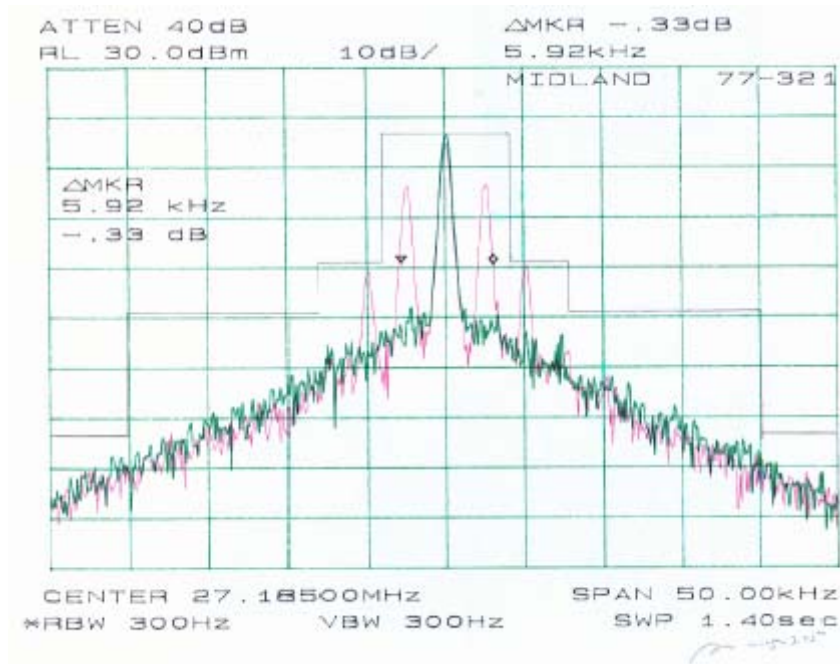
Test Results

According to part 2.202 (e)(g), the calculation for Emission Designator is as following:

$2M = 6K00A3E$, where

M= Maximum modulation Frequency in hertz

Please refer the following curve and plots.



§2.1053, §95.635(b)(1), §95.635(b)(3), §95.635(b)(8) and §95.635(b)(9) - RADIATED EMISSION

Standard Applicable

According to FCC §2.1053, measurements shall be made to detect spurious emission that may be radiated directly from the cabinet, control circuits, power leads, or intermediated circuit elements under normal condition of installation and operation. Information submitted shall include the relative radiated power of spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from a halfwave dipole antenna.

According to FCC §95.635(b)(1), at least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.

According to FCC §95.635(b)(3), at least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.

According to FCC §95.635(b)(8), at least $53 + 10 \log_{10}(T)$ dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

According to FCC §95.635(b)(9), at least 60 dB on any frequency twice or greater than twice the fundamental frequency.

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.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
EMCO	Antenna, Log-Periodic	3146	2101	2005-03-05
EMCO	Antenna, Biconical	3110B	9309-1165	2004-10-01
HP	Amplifier, Pre	8447D	2944A10187	2004-8-25
R&S	Receiver, EMI Test	ESCI 1166.5950K03	100044	2004-09-29
Com-Power	Antenna, Dipole	AD-100	2219	2004-09-26
R&S	Generator, Signal	SMIQ03	DE23746	2004-07-03
Wisewave	Antenna, Horn, Std	ARH-2823-02	10555-02	2004-12-13

* **Statement of Traceability: BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	38%
ATM Pressure:	1032 mbar

The testing was performed by Ming Jin on 2005-03-25.

Test Result

Worst Case readings:

-19.5 dB at 81.555 MHz in the Vertical polarization

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
27.185	0	0	0	v	27.185	0	v	0	0	0		
27.185	0	0	0	h	27.185	0	h	0	0	0		
81.555	39.9	0	1.8	v	81.555	-42.4	v	0	0.1	-42.5	-24	-18.5
81.555	38.7	90	2.1	h	81.555	-43.6	h	0	0.1	-43.7	-24	-19.7
54.370	38.5	180	1.5	v	54.370	-45.3	v	0	0.1	-45.4	-24	-21.4
54.370	34.6	210	2.2	h	54.370	-49.8	h	0	0.1	-49.9	-24	-25.9
108.74	30.1	160	1.5	v	108.74	-50.6	v	0	0.2	-50.8	-24	-26.8
108.74	28.7	30	2.2	h	108.74	-52.7	h	0	0.2	-52.9	-24	-28.9

Note: No preamplifier used.

§95.635(b)(1), §95.635(b)(3), §95.635(b)(8), and §95.635(b)(9) - SPURIOUS EMISSION AT ANTENNA PORT

Standard Applicable

Per FCC §95.635 (b)(1), at least 25 dB (decibels) on any frequency removed from the center of the authorized bandwidth by more than 50% up to and including 100% of the authorized bandwidth.

Per FCC §95.635 (b)(3), at least 35 dB on any frequency removed from the center of the authorized bandwidth by more than 100% up to and including 250% of the authorized bandwidth.

Per FCC §95.635 (b)(8), at least $53 + 10 \log_{10}(T)$ dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

Per FCC §95.635 (b)(9), at least 60dB on any frequency twice or greater than twice the fundamental frequency.

Measurement Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set the SA on Max-Hold Mode, and then keep the EUT in transmitting mode. Record all the signals from each channel until each one has been recorded.
4. Set the SA on View mode and then plot the result on SA screen.
5. Repeat above procedures until all frequencies measured were complete.
6. Spurious attenuation limits in dB = $53 + 10\log_{10}(\text{power out in Watts})$

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Analyzer, Spectrum	8565EC	3946A00131	8/6/2004

*** Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

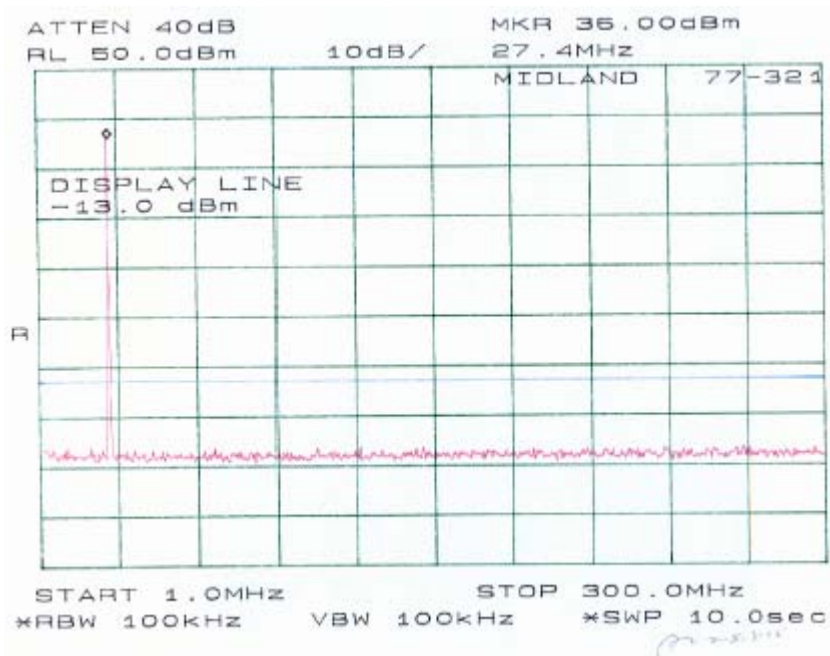
Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	38%
ATM Pressure:	1032 mbar

The testing was performed by Ming Jin on 2005-03-25.

Test Result

Please refer to the following plot(s).



§2.1055(a)(1), and §95.625(b) - FREQUENCY STABILITY MEASUREMENT**Standard Applicable**

According to FCC §2.1055(a)(1), the frequency stability shall be measure with variation of ambient temperature from -30°C to $+50^{\circ}\text{C}$, and according to FCC 2.1055(d)(2), the frequency stability shall be measured with reducing primary supply voltage to the battery operating end point which is specified by the manufacturer.

According to FCC §95.625 (b), each CB transmitter must be maintained within a frequency tolerance of 0.005%.

Test Procedure**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.

Frequency Stability versus Input Voltage

At room temperature ($25\pm 5^{\circ}\text{C}$), 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.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	DC Power Supply	6236B	2003A05705	N/A
Tenney	Oven, Temperature	VersaTenn	12.222-193	6/4/2004
HP	Counter, Microwave Frequency	5342A	2232A06380	9/7/2004

*** Statement of Traceability:** **BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Environmental Conditions

Temperature:	25 ° C
Relative Humidity:	38%
ATM Pressure:	1032 mbar

The testing was performed by Ming Jin on 2005-03-25.

Test Results

Reference Frequency : 27.1850 MHz, Limit : 0.005%			
Temperature C	Power supplied Vdc	Frequency Measure with Time Elapsed	
		MCF (MHz)	Error %
50	12.75	27.1848	-0.0007
40	12.75	27.1848	-0.0007
30	12.75	27.1849	-0.0004
20	12.75	27.1851	0.0004
10	12.75	27.1851	0.0004
0	12.75	27.1851	0.0004
-10	12.75	27.1852	0.0007
-20	12.75	27.1852	0.0007
-30	12.75	27.1853	0.0007

Reference Frequency : 27.1850 MHz, Limit : 0.005%		
Power supplied Vdc	Frequency Measure with Time Elapsed	
	Frequency (MHz)	Error %
9	27.1851	0.0004
16	27.1851	0.0004