FCC PART 95
EMI MEASUREMENT AND TEST REPORT

For

Columbia Telecommunications Group Inc.

174 Milbar Blvd.
Farmingdale, NY 11735

FCC ID: GAFFRS22-NL

2004-01-29

This Report Concerns:	Equipment Type:
☒ Original Report	22 Channel 2-Way Radio

Test Engineer:	Ling Zhang /
Report Number:	R0312013
Test Date:	2003-12-01
Reviewed By:	Ming Jing /
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Columbia Telecommunications Group Inc.'s product, FCC ID: GAFFRS22-NL,* or the "EUT" as referred to in this report is 22 channel 2-way radio which is measured approximately 3.6"L x 2.4"W x 1.0"H.

** The test data gathered are from production sample, serial number: B0001, provided by the manufacturer.*

Objective

This report is prepared on behalf of *Columbia Telecommunications Group Inc.* in accordance with Part 95 Subpart A, Subpart B 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 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.

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 C63.4-2001.

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, IEC/CISPR 22: 1998, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

SYSTEM TEST CONFIGURATION

Justification

The EUT was tested according to ANSI C63.4-2001 to represent the worst-case results during the final qualification test.

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 using up and down buttons.

Special Accessories

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

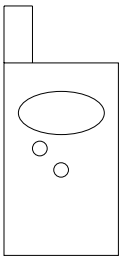
Schematics / Block Diagram

Please refer to Appendix D.

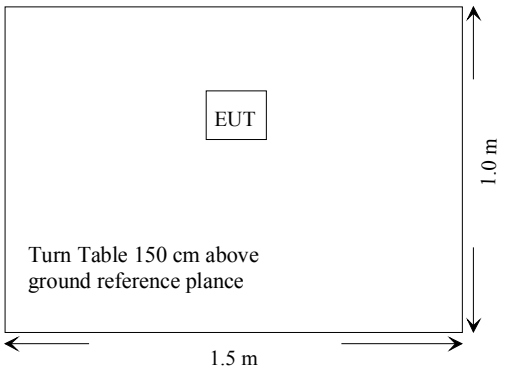
Equipment Modifications

No modifications were made to the EUT.

Configuration of Test System



Test Setup Block Diagram



REQUIREMENTS OF PROVISIONS

Test Summary

FCC Rules	Rules Description	Requirement	Result
2.1046 95.639 (a) (1) 95.639 (d)	Effective Radiated Power	0.5W for FRS	Complied
		50 W for GMRS	
2.1047 95.631 (d) 95.637 (a) 95.637 (b)	Modulation Characteristics F3E analogy voice Peak Frequency Deviation Audio Frequency Response Over Modulation	Deviation < 2.5 kHz for FRS	Complied
		Deviation < 5 kHz for GMRS	
2.1049 95.633 (a) 95.633 (c)	Occupied Bandwidth	12.5 kHz for FRS	Complied
		20 kHz for GMRS	
2.1053 15.109 (a)	Field Strength of Spurious Radiation	Worst Case < 48dB	Complied
95.635 (b)(1) 95.635 (b)(3) 95.635(b)(7)	Spurious Emission	Complied	Complied
2.1055 95.621 (b) 95.627 (b)	Frequency Stability Vs. Temperature Vs. Voltage	Deviation < 5 ppm for GMRS	Complied
		Deviation < 2.5 ppm for FRS	

§2.1046, §95.639(d), and §95.639 (a)(1) - EFFECTIVE RADIATED POWER

Standard Applicable

Per FCC §2.1046 and FCC § 95.639 (a) (1), no GMRS unit, under any condition of modulation, shall exceed 50W Carrier Power (average TP during one unmodulated RF cycle) when transmission type A1D, F1D, .G1D, A3E, F3E or G3E.

Per FCC §2.1046 and FCC § 95.639 (d), no FRS unit, under any condition of modulation, shall exceed 0.500W effective radiated power (ERP).

Test Procedure

1. On a test site, the EUT shall be placed at 1.5m height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the quasi-peak detector is used for the measurement.
4. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then the rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a tuned dipole (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring received, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.

16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Rohde & Schwarz	Signal Generator	SMIQ03	1125.5555.03	2003-07-10
Rohde & Schwarz	I/O Modulation Generator	AMIQ	1110.2003.02	2003-07-10
HP	Spectrum Analyzer	8564E	08303	2003-08-20
Com-Power	Log Periodic Antenna	AL-100	16091	2003-05-01
Com-Power	Biconical Antenna	AB-100	14012	2003-11-02
A.H.System	Horn Antenna (700MHz-18GHz)	SAS-200/571	261	2003-05-30

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

Environmental Conditions

Temperature:	14^0 C
Relative Humidity:	48%
ATM Pressure:	1012

Test Results

FREQUENCY (MHZ)	SUBSTITUTION READING (dBm)	SUBSTITUTION ANTENNA GAIN	SUBSTITUTION CALBE LOSS (dbm)	EIRP (dBm)
562.5625	25.9	0	0.1	25.8
467.7125	25.6	0	0.1	25.5
462.7250	25.5	0	0.1	25.4

Sample calculation:

Absolute level = substitution reading + antenna gain - cable loss

For example:

25.9 + 0 – 0.1 = 25.8

The measured output power showed as follows:

Low Channel (Channel 1): 25.8 dBm at 462.5625 MHz
High Channel (Channel 14): 25.5 dBm at 467.7125 MHz
Channel (Channel 22): 25.4 dBm at 462.725 MHz

§2.1047, §95.631(d), §95.637(a), and § 95.637(b) - MODULATION CHARACTERISTICS

Standard Applicable

Per FCC § 2.1047 and FCC §95.637 (a), a GMRS transmitter that transmits emission types F3E must not exceed a peak frequency deviation of plus or minus 5 kHz. A FRS unit that transits emission type F3E must not exceed a peak frequency deviation of plus or minus 2.5 kHz, and the audio frequency response must not exceed 3.125 kHz.

Test Procedure

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

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

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

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

Modulation Limiting

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

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Spectrum Analyzer	8564E	08303	2003-08-20
HP	Modulation Analyzer	8901A	2026A00847	2003-08-19
Nanyan	Audio Generator	NY2201	000420	Not Required

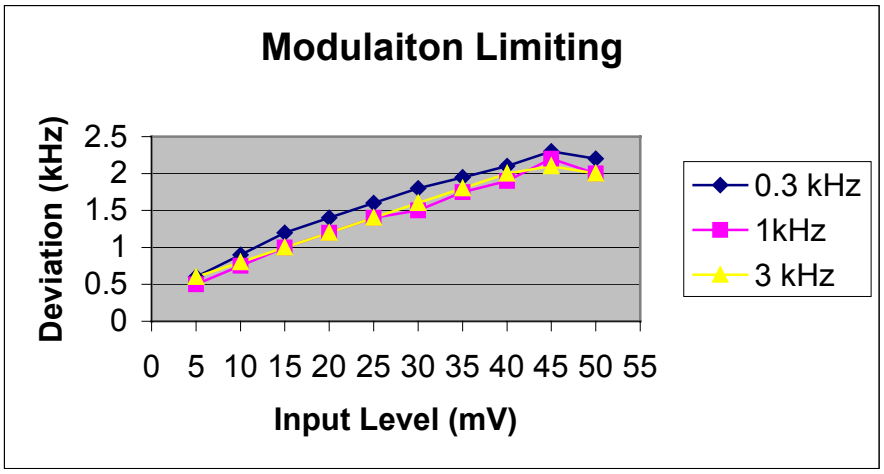
*** Statement of Traceability: BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

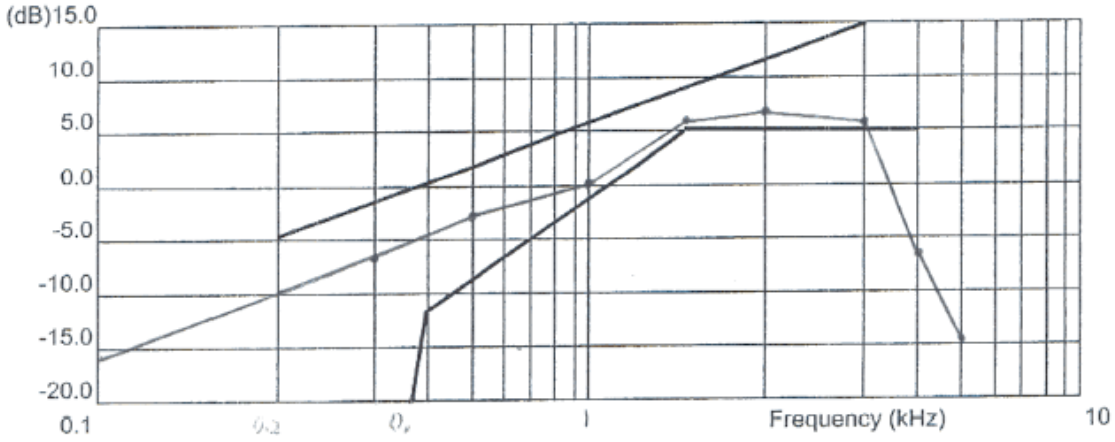
Environmental Conditions

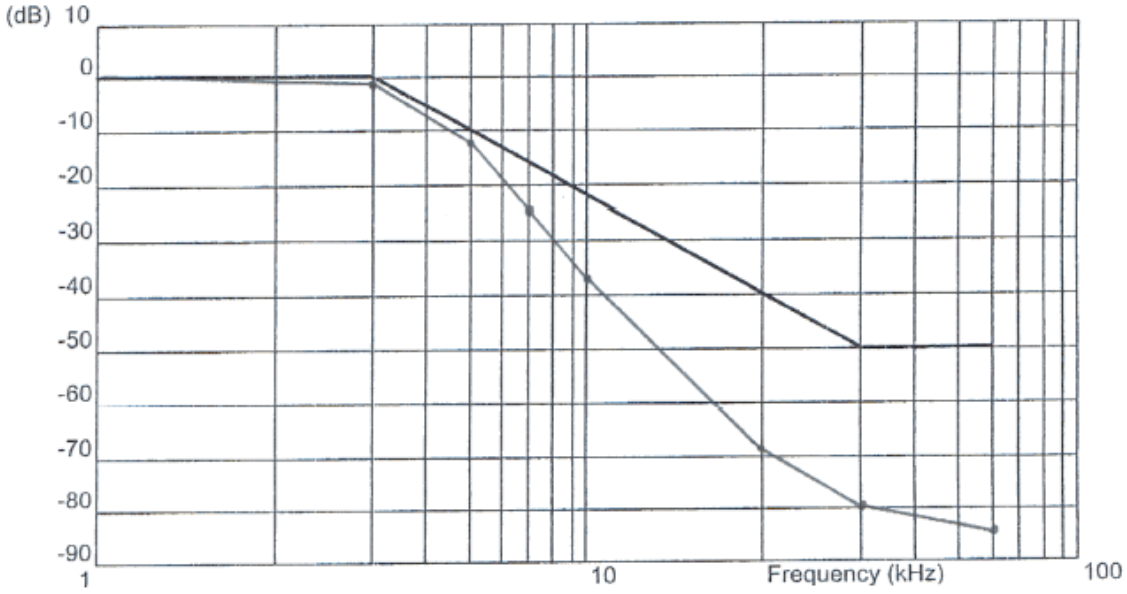
Temperature:	14^0 C
Relative Humidity:	48%
ATM Pressure:	1012

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
1
Frequency (kHz)
10


(dB) 10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
1
10
Frequency (kHz)
100

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

Standard Applicable

Per FCC §2.1049 and FCC §95.633 (a), the authorized bandwidth for emission type F3E transmitted is 20 kHz.

Per FCC §2.1049 and FCC §95.633 (c), the authorized bandwidth for emission type F3E transmitted by a FRS unit is 12.5 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.

The resolution bandwidth of the spectrum analyzer was set up at least 10 times higher than the authorized bandwidth of the transmitter. 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 20 dB greater than the necessary to produce 50% of rated system deviation. 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. Date
HP	Spectrum Analyzer	8564E	08303	2003-08-20
Nanyan	Audio Generator	NY2201	000420	Not Required

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

Environmental Conditions

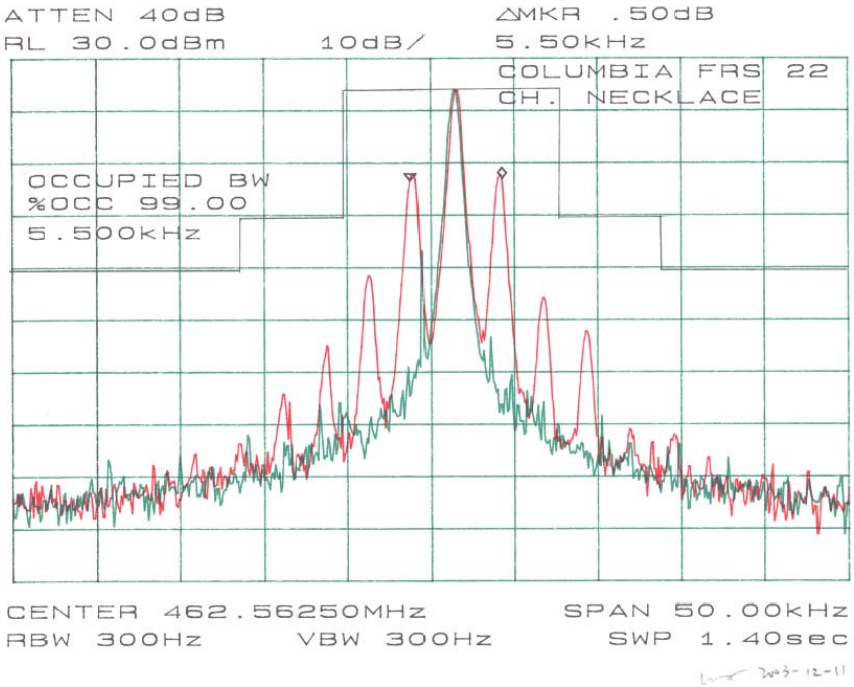
Temperature:	14^0 C
Relative Humidity:	48%
ATM Pressure:	1012

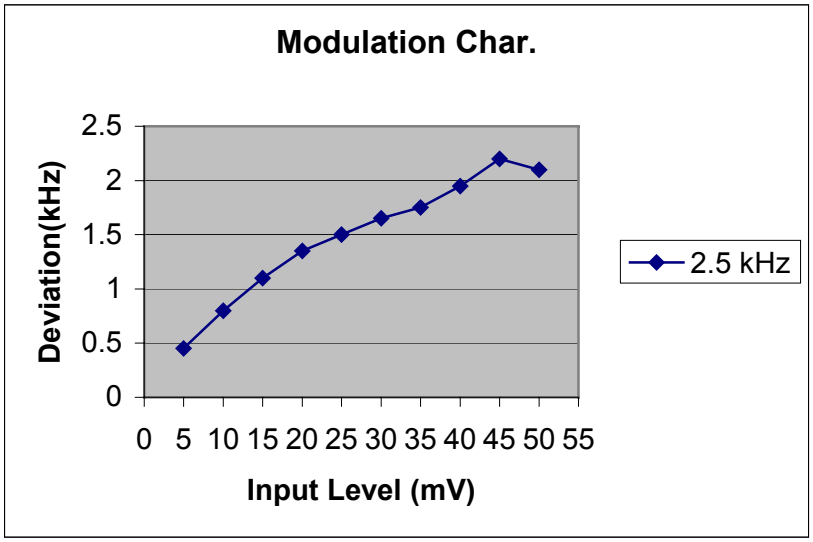
Test Results

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

Emission Designator

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


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR .50dB
5.50kHz
COLUMBIA FRS 22
CH. NECKLACE
OCCUPIED BW
%OCC 99.00
5.500kHz
CENTER 462.56250MHz
SPAN 50.00kHz
RBW 300Hz
VBW 300Hz
SWP 1.40sec


Modulation Char.
Deviation(kHz)
2.5
2
1.5
1
0.5
0
0 5 10 15 20 25 30 35 40 45 50 55
Input Level (mV)
2.5 kHz

§2.1053 and §15.109(a) - RADIATED SPURIOUS 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.

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)

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Com-Power	Biconical Antennas	CDI B100/200/300	14012	2003-05-01
Com-Power	Bi-logcon Antenna	3110B	9603-2315	2003-10-11
A.H. System	Horn Antenna	SAS-200	2455	2003-08-02
Hewlett Packard	Spectrum Analyzer	HP8565EC	06042	2003-05-03
Rohde & Schwarz	Generator	SMIQ03	1048004	2003-08-01

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

Environmental Conditions

Temperature:	14^0 C
Relative Humidity:	48%
ATM Pressure:	1012

Test Result

Low Frequency: -14.5 dBm at 925.125 MHz
High Frequency: -14.4 dBm at 1403.1375 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 DBm
CHANNEL 1, LOW FREQUENCY AT 462.5625 MHZ												
462.5625	92.67	180	2.2	V	462.5625	24.1	V	0	0.1	24.0		
462.5625	94.83	120	1.5	H	462.5625	25.9	H	0	0.1	25.8		
925.1250	44.83	180	1.5	H	925.1250	-27.2	H	0	0.3	-27.5	-13	-14.5
1387.6875	40.50	90	1.5	V	1387.6880	-30.8	V	3.6	0.5	-27.7	-13	-14.7
1387.6875	39.50	180	2.0	H	1387.6880	-31.5	H	3.6	0.5	-28.4	-13	-15.4
925.1250	41.67	90	1.7	V	925.1250	-30.1	V	0	0.3	-30.4	-13	-17.4
1850.2500	32.67	60	1.5	V	1850.2500	-35.7	V	4.2	0.7	-32.2	-13	-19.2
1850.250	33.33	0	1.8	H	1850.2500	-36.3	H	4.2	0.7	-32.8	-13	-19.8
CHANNEL 14, HIGH FREQUENCY AT 467.7125 MHZ												
467.7125	91.80	30	1.80	V	467.7125	23.5	V	0	0.1	23.4		
467.7125	94.50	0	1.50	H	467.7125	25.6	H	0	0.1	25.5		
1403.1375	40.33	90	2.00	V	1403.1380	-30.5	V	3.6	0.5	-27.4	-13	-14.4
935.4250	43.67	90	1.70	H	935.4250	-28.0	H	0	0.3	-28.3	-13	-15.3
935.4250	42.00	45	1.70	V	935.4250	-29.8	V	0	0.3	-30.1	-13	-17.1
1403.1375	37.50	100	2.50	H	1403.1380	-33.2	H	3.6	0.5	-30.1	-13	-17.1
1870.8500	34.33	45	1.50	V	1870.8500	-37.2	V	4.2	0.7	-33.7	-13	-20.7
1870.8500	34.00	180	2.10	H	1870.8500	-37.5	H	4.2	0.7	-34.0	-13	-21.0
CHANNEL 22, FREQUENCY AT 462.725 MHZ												
462.7250	91.50	0	2.50	V	462.725	23.3	V	0	0.1	23.2		
462.7250	94.33	120	2.00	H	462.725	25.5	H	0	0.1	25.4		
1388.1750	40.50	180	2.00	V	1388.175	-30.3	V	3.6	0.5	-27.2	-13	-14.2
925.4500	43.00	170	1.50	H	925.45	-29.0	H	0	0.3	-29.3	-13	-16.3
925.4500	42.50	90	1.80	V	925.45	-29.6	V	0	0.3	-29.9	-13	-16.9
1388.1750	37.17	90	1.80	H	1388.175	-33.5	H	3.6	0.5	-30.4	-13	-17.4
1850.9000	35.00	200	2.00	V	1850.9	-36.7	V	4.2	0.7	-33.2	-13	-20.2
1850.9000	34.50	120	2.20	H	1850.9	-37.1	H	4.2	0.7	-33.6	-13	-20.6

Note: No Preamplifier Used.

§95.635(b)(1), §95.635(b)(3), and §95.635(b)(7) - SPURIOUS EMISSION

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)(7), at least $43 \pm 10 \log_{10}$ (T) dB on any frequency removed from the center of the authorized bandwidth by more than 250%.

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 = $43 + 10\text{Log}_{10}$(power out in Watts)

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Spectrum Analyzer	8564E	08303	2003-08-20
Nanyan	Audio Generator	NY2201	000420	Not Required

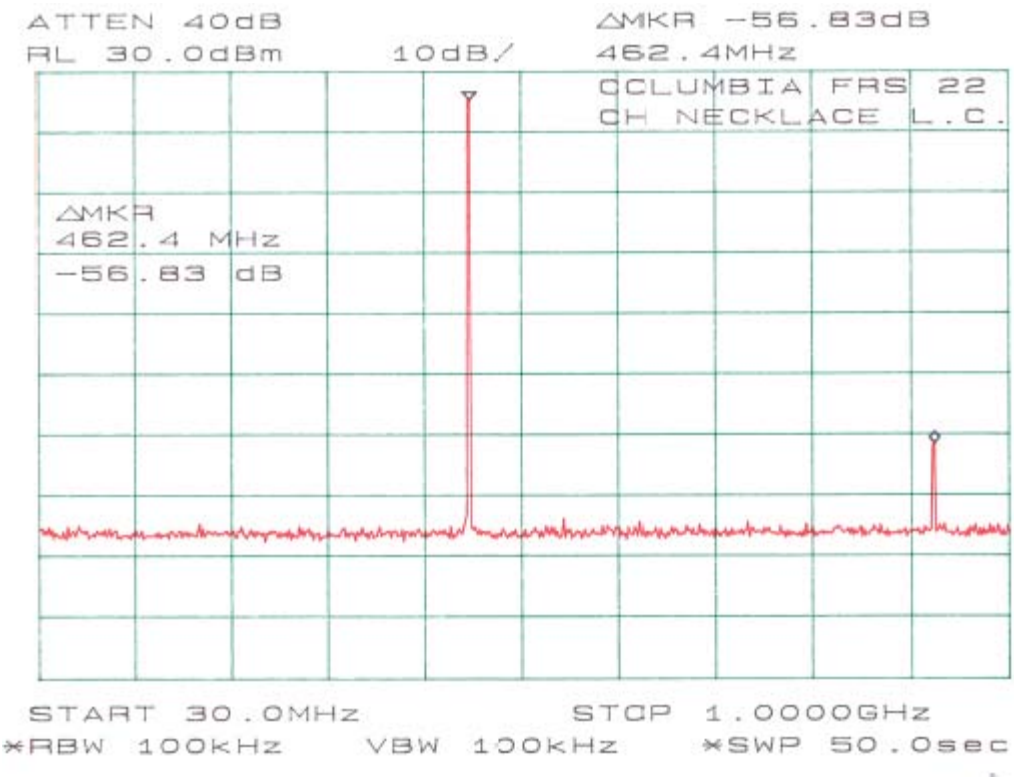
*** Statement of Traceability: BACL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

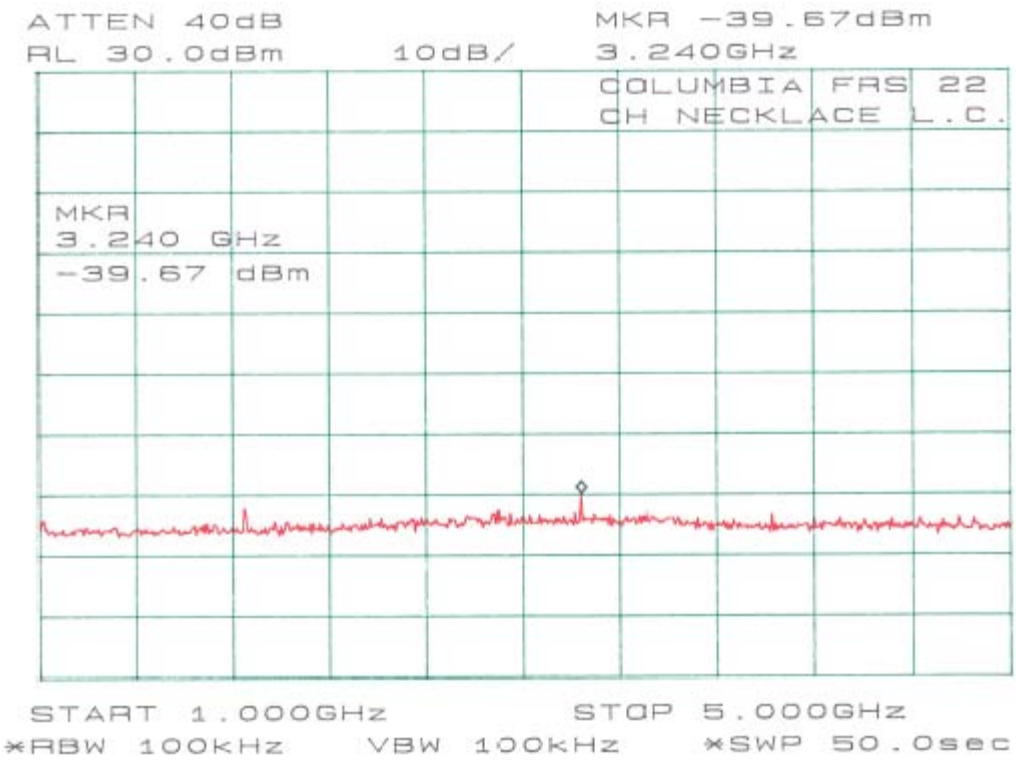
Environmental Conditions

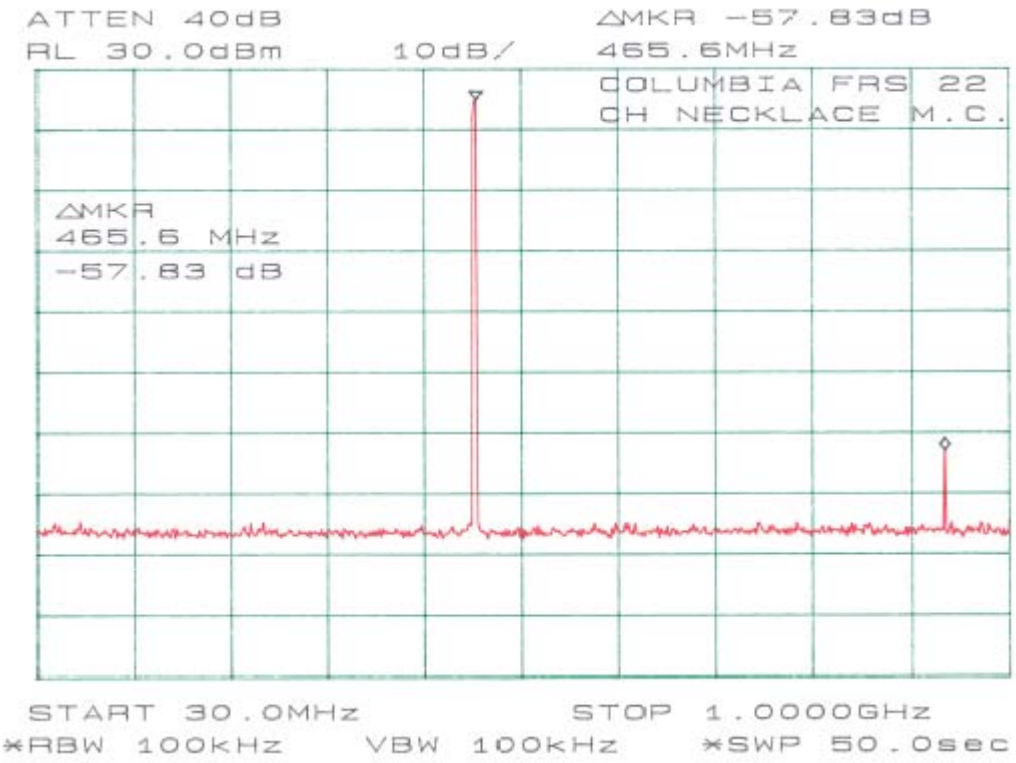
Temperature:	14^0 C
Relative Humidity:	48%
ATM Pressure:	1012

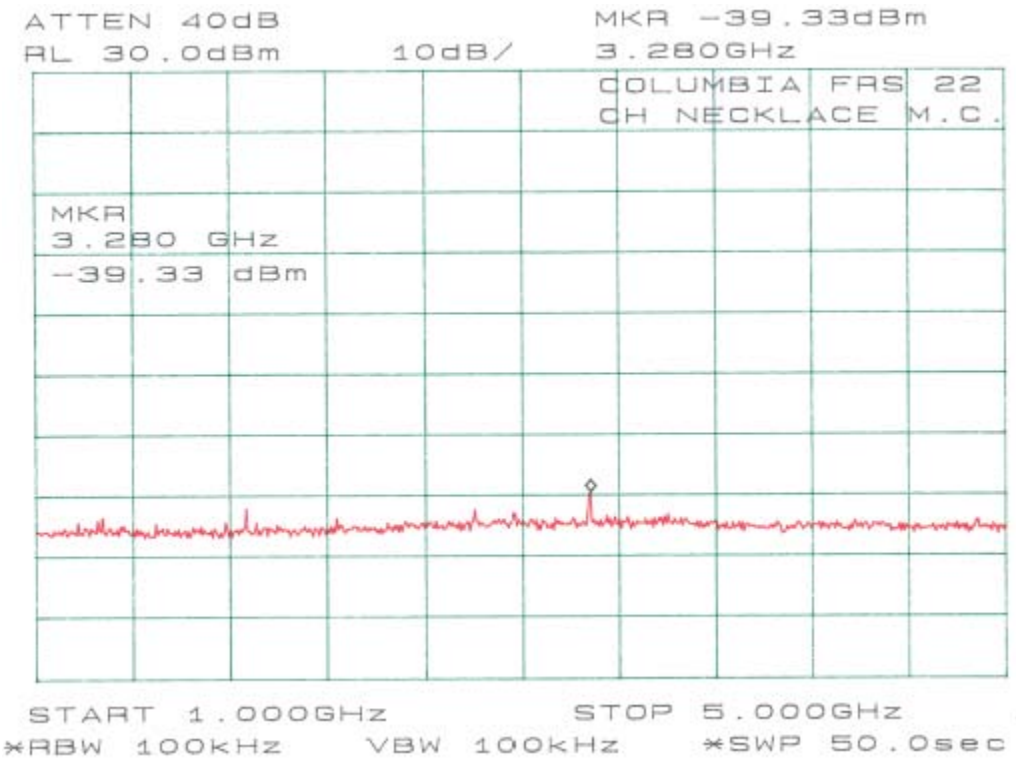
Test Result

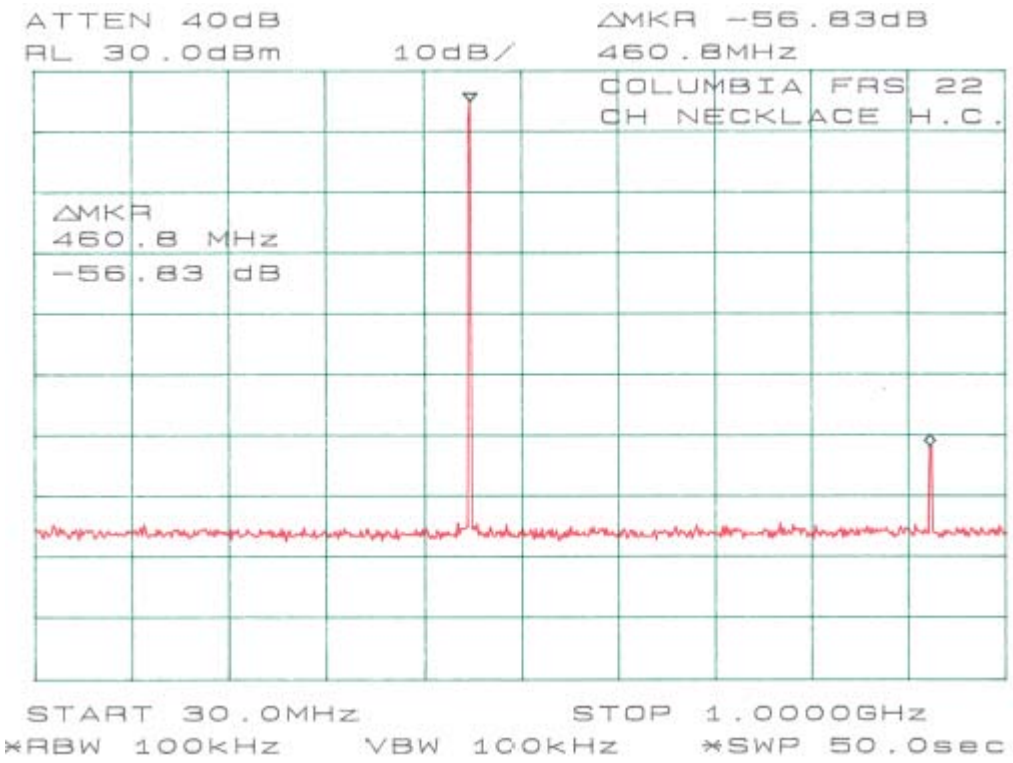
Please refer to the following plot(s).

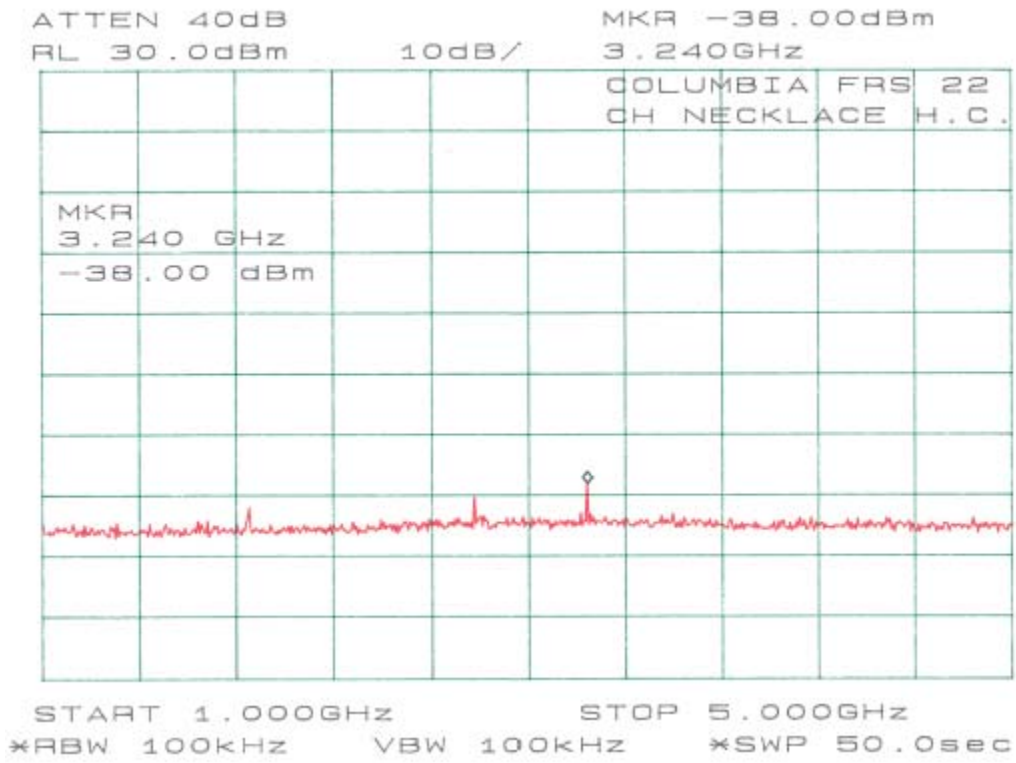

ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -56.83dB
462.4MHz
COLUMBIA FRS 22
CH NECKLACE L.C.
ΔMKR
462.4 MHz
-56.83 dB
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -39.67dBm
3.240GHz
COLUMBIA FRS 22
CH NECKLACE L.C.
MKR
3.240 GHz
-39.67 dBm
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -57.83dB
465.6MHz
COLUMBIA FRS 22
CH NECKLACE M.C.
ΔMKR
465.6 MHz
-57.83 dB
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -39.33dBm
3.280GHz
COLUMBIA FRS 22
CH NECKLACE M.C.
MKR
3.280 GHz
-39.33 dBm
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
ΔMKR -56.83dB
460.8MHz
COLUMBIA FRS 22
CH NECKLACE H.C.
ΔMKR
460.8 MHz
-56.83 dB
START 30.0MHz
STOP 1.0000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0sec


ATTEN 40dB
RL 30.0dBm
10dB/
MKR -38.00dBm
3.240GHz
COLUMBIA FRS 22
CH NECKLACE H.C.
MKR
3.240 GHz
-38.00 dBm
START 1.000GHz
STOP 5.000GHz
*RBW 100kHz
VBW 100kHz
*SWP 50.0sec

§2.1055, §95.621(b), and §95.627(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 –30ºC to +50ºC, 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 §95.621 (a), the GMRS transmitter channel frequencies (reference frequencies from which the carrier frequency, suppressed or otherwise, may not deviate by more than the specified frequency to tolerance) are 462.5500, 462.5625, 462.5750, 462.5875, 462.6000, 462.6125, 462.6250, 462.6375, 462.6500, 462.6625, 462.6750, 462.6875, 462.7000, 462.7125, 462.7250, 467.5500, 467.5750, 467.6000, 467.6250, 467.6500, 467.6750, 467.7000 and 467.7250.

According to FCC §95.621 (b), each GMRS transmitter for mobile station, small base station and control station operation must be maintained within a frequency tolerance of 0.0005%. Each GMRS transmitter for base station (except small base), mobile rely station or fixed station operation must be maintained within a frequency tolerance of 0.00025%.

According to FCC §95.627, each FRS unit must be maintained within a frequency tolerance of 0.00025%.

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±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.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Due Date
HP	Spectrum Analyzer	8564E	08303	2004-08-20
Tenny	Temperature Chamber	Versa	4581	2003-04-23

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

Environmental Conditions

Temperature:	14^0 C
Relative Humidity:	48%
ATM Pressure:	1012

Test Results

Reference Frequency: 462.5625 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
60	4.5	462.5623	-0.43
50	4.5	462.56233	-0.37
40	4.5	462.56238	-0.26
30	4.5	462.56245	-0.11
20	4.5	462.56280	0.65
10	4.5	462.56300	1.08
0	4.5	462.56331	1.75
-10	4.5	462.56345	2.05
-20	4.5	462.56358	2.33
-30	4.5	462.56362	2.42

Frequency Stability Versus Input Voltage

Reference Frequency: 462.5625 MHz, Limit: 2.5ppm			
Power Supplied (Vdc)	Environment Temperature (^{0}C)	MHz	ppm
3.8Vdc	25	462.5629	0.78

End Point = 3.8 V