

FCC PART 74



EMI MEASUREMENT AND TEST REPORT

For

Nady Systems, Inc.

6701 Shellmond Street
Emeryville, CA 94608 USA

FCC ID: BEK9E3UH4

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: Transmitter, Wireless Handheld Microphone
Test Engineer: Snell Leong / 	
Report No.: R0412035	
Report Date: 2004-12-29	
Reviewed By: Benjamin Jin / 	
Prepared By: Bay Area Compliance Laboratory Corporation 230 Commercial Street Sunnyvale, CA 94085 Tel: (408) 732-9162 Fax: (408) 732 9164	

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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *Nady Systems, Inc.*'s product, model no.: *UH-4* or the "EUT" as referred to this report is a transmitter, Wireless Handheld Microphone, which measures approximately 24cmL x 5.1cmW x 5.1cmH.

** The test data gathered are from typical production sample, serial number: CWF0238H, provided by the manufacturer.*

Objective

This report is prepared on behalf of *Nady Systems, Inc.* in accordance with Part 74 Subpart H of the Federal Communication Commissions rules.

The objective of the manufacturer is to determine compliance with FCC rules for peak output power, modulation characteristics, occupied bandwidth of emission, spurious emission, field strength of spurious radiation, frequency stability and line conduction.

Related Submittal(s)/Grant(s)

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.

Test Facility

The absorber lined chamber used by BACL Corp. 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 Corp. 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 test methods and procedures set forth in ANSI C63.4-2001& TIA/EIA-603.

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 200167-0). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22:2002, Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured for testing according to TIA/EIA-603.

The final qualification test was performed with the EUT operating at normal mode.

Block Diagram

Please refer to Exhibit D.

Equipment Modifications

No modifications were made to the EUT.

Configuration of Test System

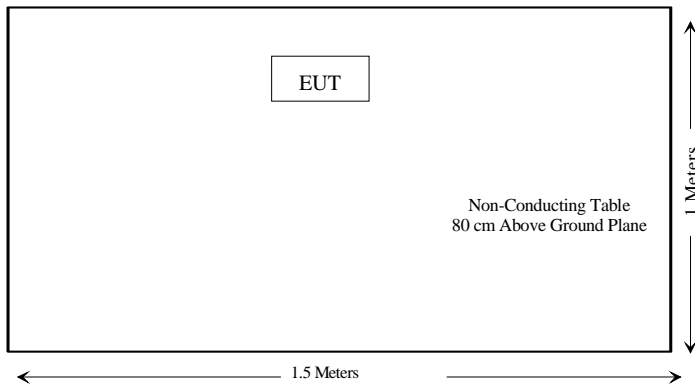


EUT

Test Setup Block Diagram

LISN 1

LISN 2



SUMMARY OF TEST RESULTS FOR FCC PART 15

FCC RULES	DESCRIPTION OF TEST	RESULT
§74.861(e)(1)(ii)	Output Power Measurement	Compliant
§74.861(e)(3)	Modulation Characteristics	Compliant
§74.861(e)(5)	Occupied Bandwidth Emission	Compliant
§74.861(e)(6)	Field Strength of Emission	Compliant
§15.209(f) & §15.33(a)	Spurious Emission at Antenna Port	Compliant
§74.86(e)(4)	Frequency Stability	Compliant

§74.861(e)(1)(ii) – OUTPUT POWER MEASUREMENT

Standard Applicable

According to §74.861(e)(1)(ii), for low power auxiliary station operating in the 614-806MHz band, the power of the measured unmodulated carrier power and the output of the transmitter power amplifier (antenna input power) may not exceed 250mW.

Test Procedure

The maximum peak output power was measured with a spectrum analyzer connected to the antenna terminal (conducted measurement) while EUT was operating in normal situation. Set RBW of spectrum analyzer to 100 kHz and VBW to 100 kHz.

Test equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	Spectrum Analyzer	8564E	3943A01781	2004-10-04

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

Environmental Conditions

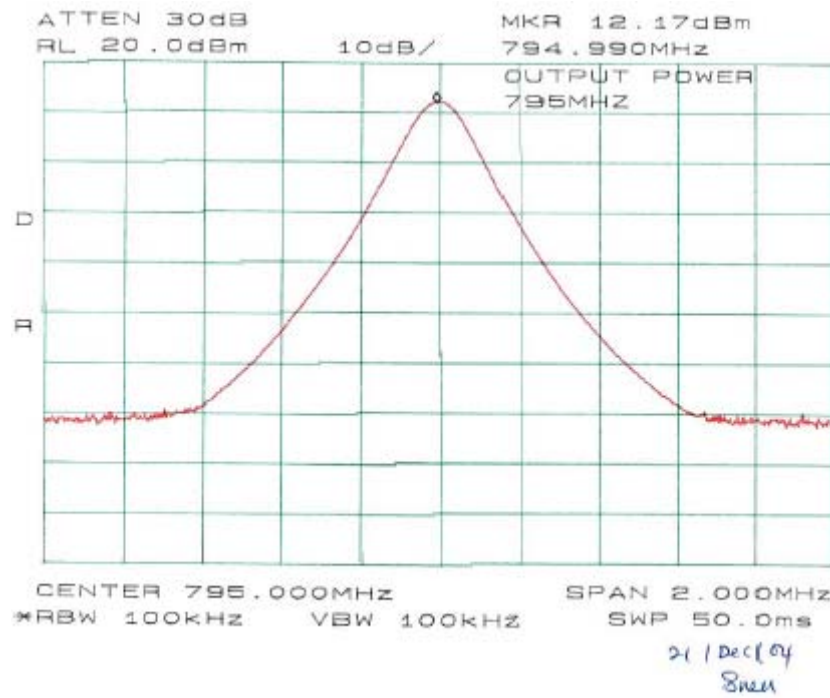
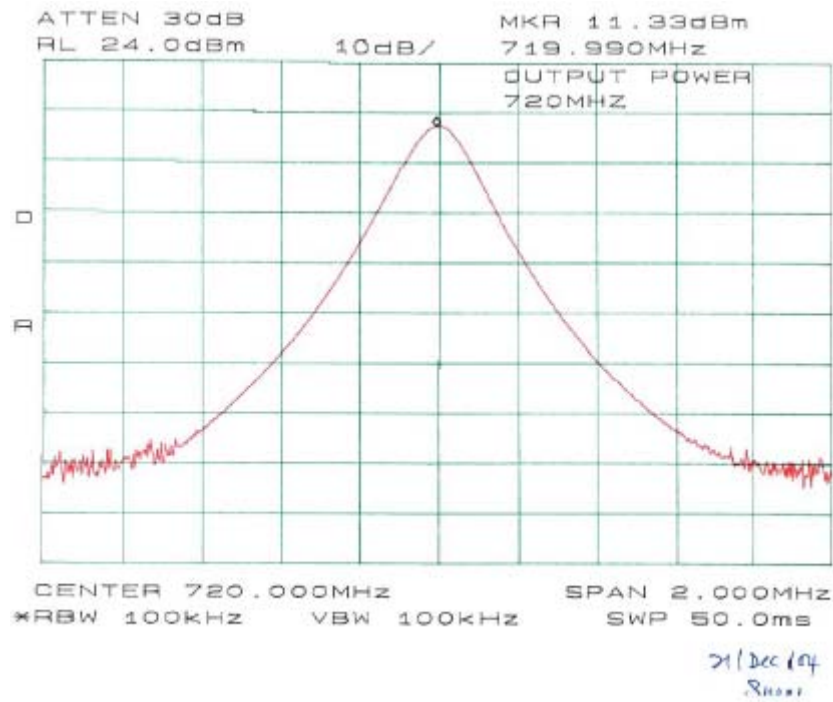
Temperature:	21° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

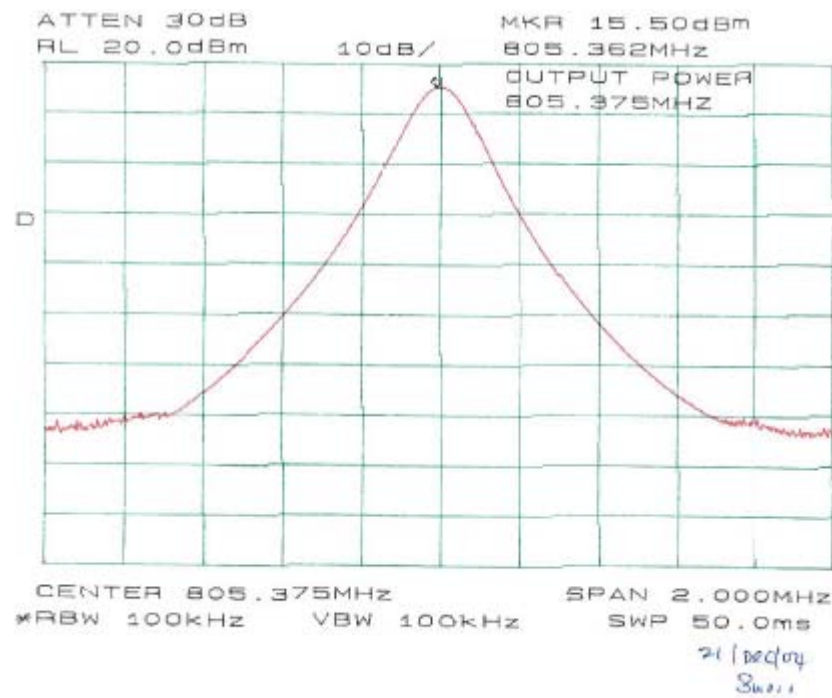
The testing was performed by Snell Leong on 2004-12-21.

Test Results

Channel	Spec Freq (MHz)	Peak Output Power (dBm)	Limit(dBm)	Margin dBm
Low	720.000	11.33	24	-12.67
Mid	795.000	12.17	24	-11.83
High	805.375	15.5	24	-8.5

The plot (s) of Maximum Output Peak Power was presented hereinafter as reference.





§74.861(e)(3) – MODULATION CHARACTERISTICS

Standard Applicable

According to FCC 2.1047 (a), for Voice Modulated Communication Equipment, the frequency response of the audio modulating circuit over a range of 100Hz to 5000Hz shall be measured. For equipment required to have an audio low-pass filter, the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be measured.

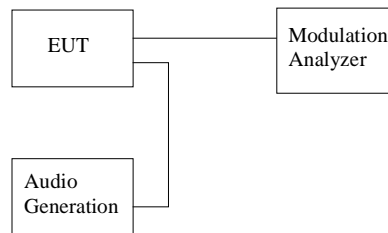
According to §74.861(e)(3), any form of modulation may be used. A maximum deviation of ± 75 kHz is permitted when frequency modulation is employed.

Test Procedure

Frequency response of audio circuits

- 1) Position the EUT as shown in figure 1

Figure 1
Modulation Characteristic
Measurement Configuration



- 2) Audio Frequency Response
 - a) RF output of EUT (transceiver) is connected to input of a FM deviation meter. (make sure not to overload the meter)
 - b) An audio signal generator is coupled into the external microphone jack of the EUT, or alternatively, the microphone element is removed, and generator output is connected to the microphone connector. (dummy microphone may be needed for some kind of EUT)
 - c) Frequency of audio signal is selected at 1KHz, and the audio signal input level is adjusted to obtain 20% of the maximum rated system deviation. The deviation is recorded as DEVref.
 - d) With the audio signal generator level unchanged, set the generator frequency respectively at 0.3-20KHz, and the EUT deviations are measured and recorded as DEVfreq.
 - e) Audio frequency response in dB is calculated as $20 \lg (\text{DEVfreq} / \text{DEVref})$.

Modulation Limit

- 1) Position the EUT as shown in figure 1, adjust the audio input frequency to 100 Hz and the input level from 0V to maximum permitted input voltage with recording each carrier frequency deviation responding to respective input level.
- 2) Repeat step 1 with changing the input frequency for 100, 300, 1000, 2500 and 3000 Hz in sequence.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Analyzer, Modulation	8901A	2026A00847	8/21/2004
Nanyan	Generator, Audio	NY2201	420	N/R
Tektronix	Oscilloscope	TDS220	B032444	12/3/2004
HP	Analyzer, Spectrum	8564E	3943A01781	10/4/2004

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

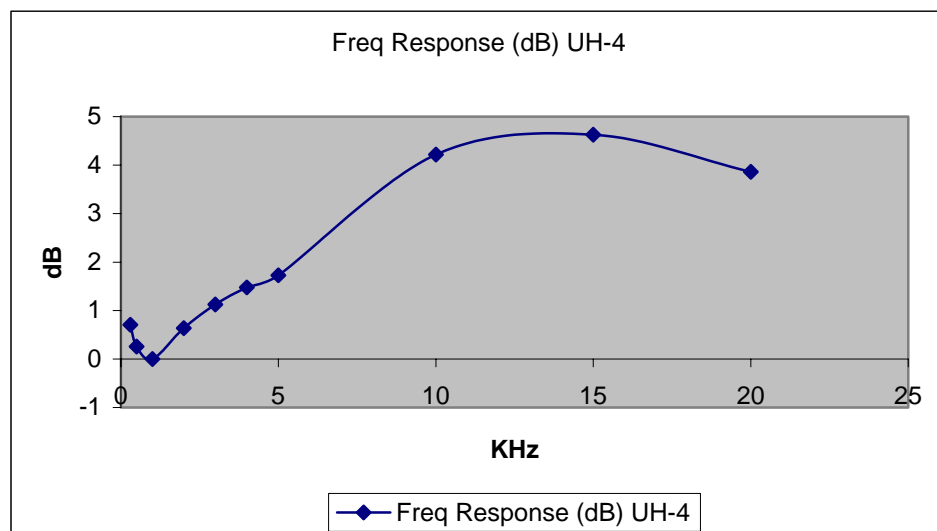
Environmental Conditions

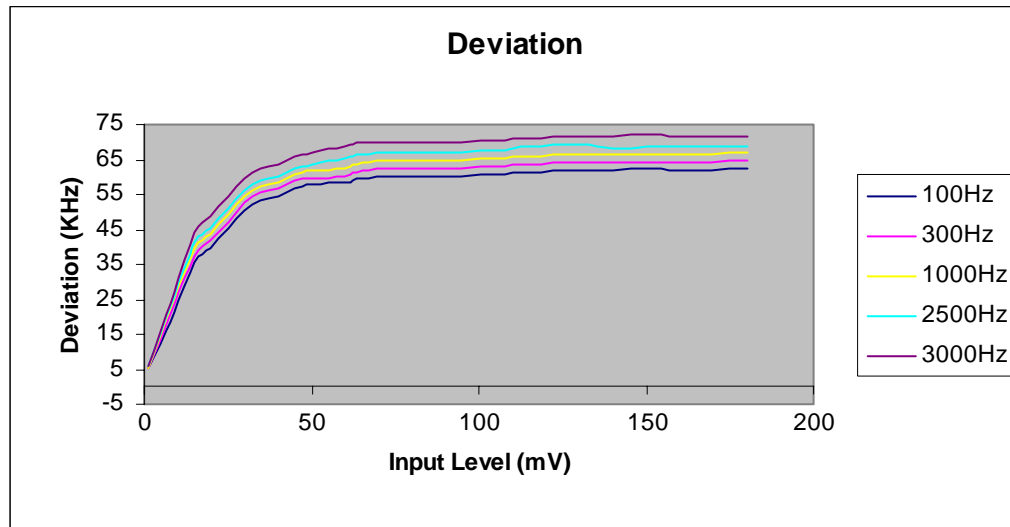
Temperature:	21° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

The testing was performed by Snell Leong on 2004-12-21.

Test Results

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





§74.861(e)(5) - OCCUPIED BANDWIDTH OF EMISSION

Standard Applicable

According to FCC 2.1049 (c) (1), for radiotelephone transmitter, other than single sideband or independent sideband transmitter, when modulated by a 2.5 kHz tone at an input level 16 dB greater than that necessary to produce 50 percent modulation.

According to §74.861(e)(5) & §74.861(e)(6), the operating bandwidth shall not exceed 200 kHz

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Install new batteries in the EUT. Turn on the EUT and set it to any one convenient frequency within its operating range.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Analyzer, Modulation	8901A	2026A00847	8/21/2004
Nanyan	Generator, Audio	NY2201	420	N/R
Tektronix	Oscilloscope	TDS220	B032444	12/3/2004
Agilent	Analyzer, Spectrum	8564E	3943A01781	10/4/2004

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

Environmental Conditions

Temperature:	21° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

The testing was performed by Snell Leong on 2004-12-21.

Test Results

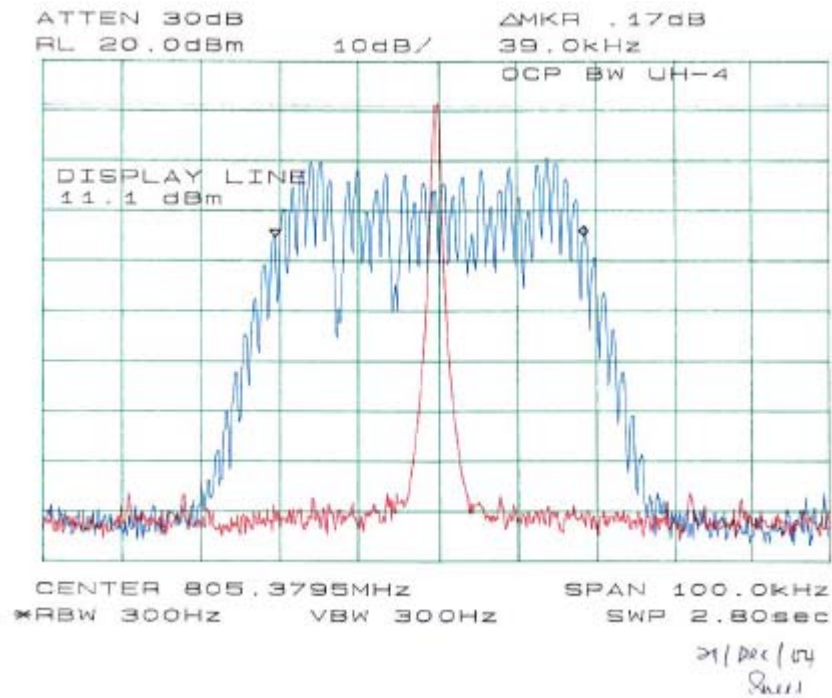
Spec Freq (MHz)	Occupied Bandwidth (KHz)	Limit (KHz)	Margin KHz
805.375	39	200	-161

Please refer the following plot.

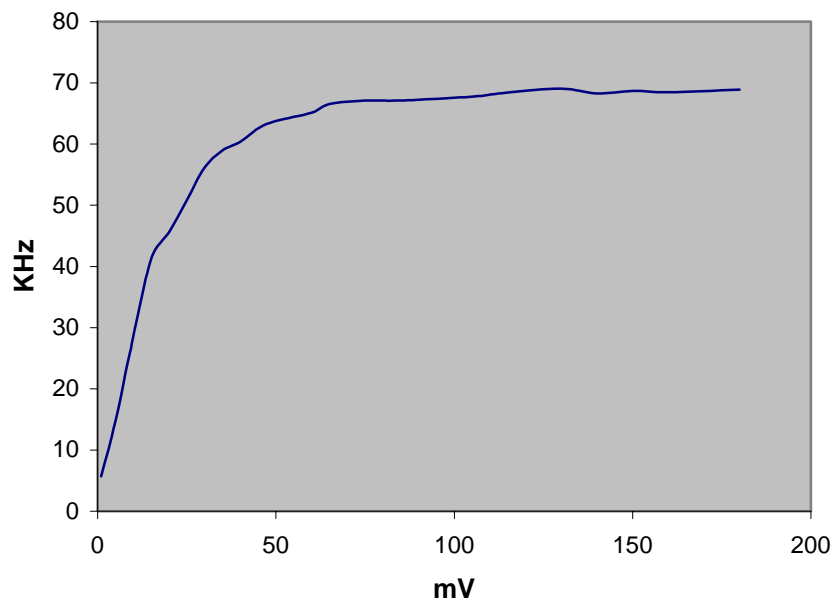
Emission Designator

$$2M + 2D = (2 \times 15 \text{ kHz}) + (2 \times 75 \text{ kHz}) = 180 \text{ KHz}$$

Please refer to the plots hereinafter.



2.5KHz Deviation Response



§74.861 (e)(6) – RADIATED SPURIOUS EMISSION

Standard Applicable

According to FCC2.1053, 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 FCC74.861 (e)(6), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:

1. on any frequency removed from the operating frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: at least 25 dB.
2. on any frequency removed from the operating frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: at least 35 dB.
3. on any frequency removed from the operating frequency by more than 250 percent up to and the authorized bandwidth shall be attenuated below the un-modulated carrier by at least 43 plus 10 Log (output power in watts)dB.

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 = $10 \lg (\text{TXpwr in Watts}/0.001)$ – the absolute level

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

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
A. H. Systems	Antenna, Horn, DRG	SAS-200/571	261	8/2/2004
HP	Amplifier, Pre	8447E	1937A01057	7/26/2004
HP	Amplifier, Pre, Microwave	8449B	3147A00400	6/14/2004
Agilent	Analyzer, Spectrum	8564E	3943A01781	10/4/2004
Rohde & Schwarz	Generator, Signal	SMIQ03	DE23746	7/3/2004
Com-Power	Antenna, Dipole	AD-1001	2229	9/26/2004

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

Environmental Conditions

Temperature:	21° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

The testing was performed by Snell Leong on 2004-12-21.

Test Results

Worst case reading:

-12.57dB at 795.00MHz

Primary scan Below 1GHz (795MHz)

Note: the test data for above 1GHz is measured without pre-amp

Indicated		Table	Test Antenna		Substituted		Antenna	Cable	Absolute	Limit	Margin
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Gain Correction	Loss dB	Level dBm	dBm	dB
795.00	114.17	90	1	v	795	12.2	0	0.77	11.43	24.0	-12.57
795.00	100.8	90	1.6	h	795	9.9	0	0.77	9.13	24.0	-14.87
1590.00	23.20	0	1.5	v	1590	-41	7.4	1.8	-35.4	-13.0	-22.4
2385.00	28.30	0	1.2	v	2385	-41.6	7.5	2.7	-36.8	-13.0	-23.8
1590.00	20.6	45	1	h	1590	-44.2	7.4	1.8	-38.6	-13.0	-25.6
397.50	67.33	230	1.2	v	397.5	-44	0	0.53	-44.53	-13.0	-31.53
2385.00	23.4	45	1	h	2385	-49.7	7.5	2.7	-44.9	-13.0	-31.9
397.50	62.67	0	1.5	h	397.5	-48	0	0.53	-48.53	-13.0	-35.53
927.50	41.80	0	2.1	v	927.5	-59	0	0.8	-59.8	-13.0	-46.8
927.50	39.20	0	2	h	927.5	-63.5	0	0.8	-64.3	-13.0	-51.3
132.50	49.5	180	1	h	132.5	-66	0	0.25	-66.25	-13.0	-53.25
132.50	42.50	60	1.5	v	132.5	-76	0	0.25	-76.25	-13.0	-63.25

Note : For below 1 GHz, the unit of Antenna gain is dBd, the corresponding measured power is ERP.
above 1 GHz, the unit of Antenna gain is dBi, the corresponding measured power is EIRP.

§2.1051 - SPURIOUS EMISSION AT ANTENNA TERMINAL

Standard Applicable

According to §2.1051, the radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

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 in figure 4 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.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Spectrum Analyzer	8564E	3943A01781	10/4/2004

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

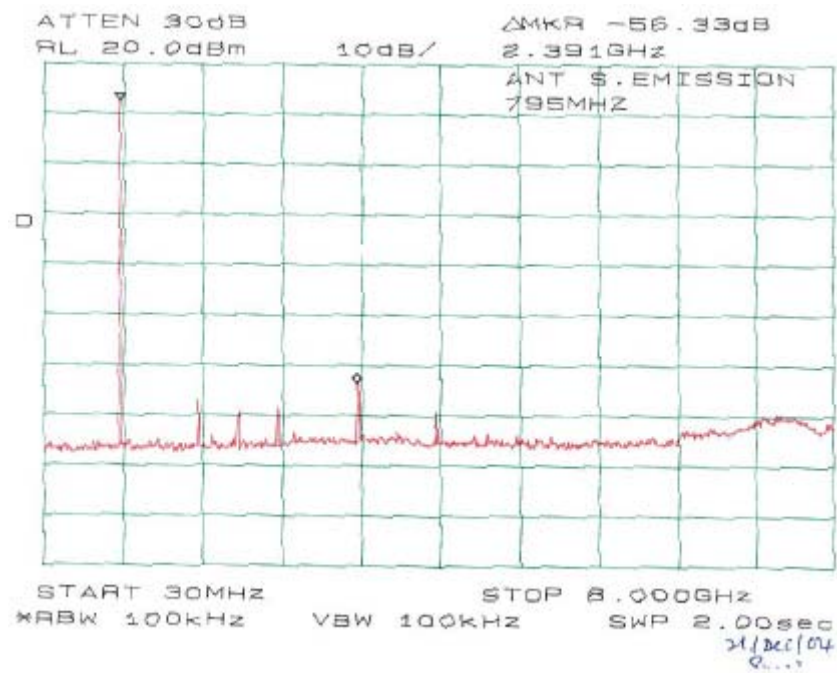
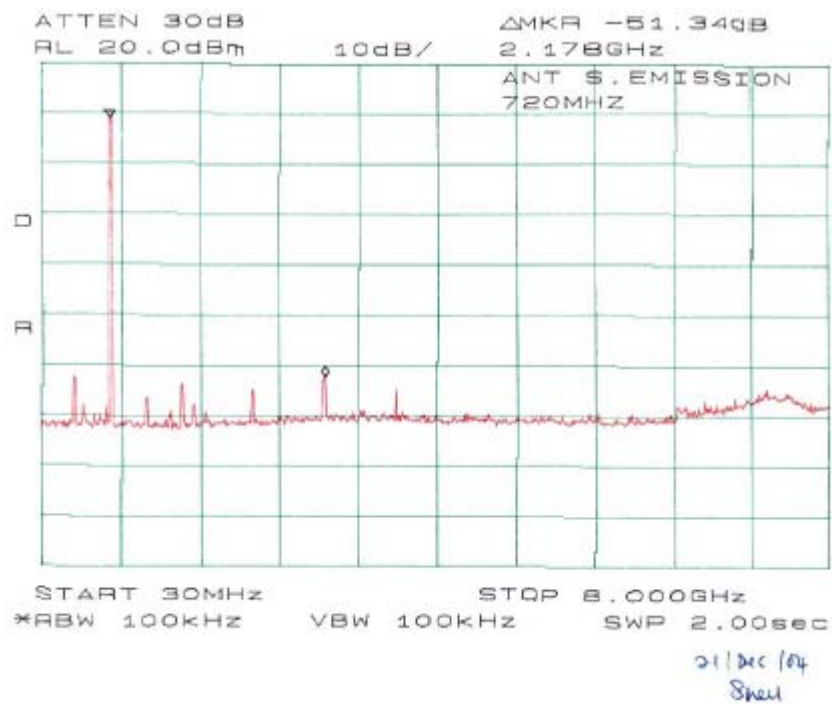
Environmental Conditions

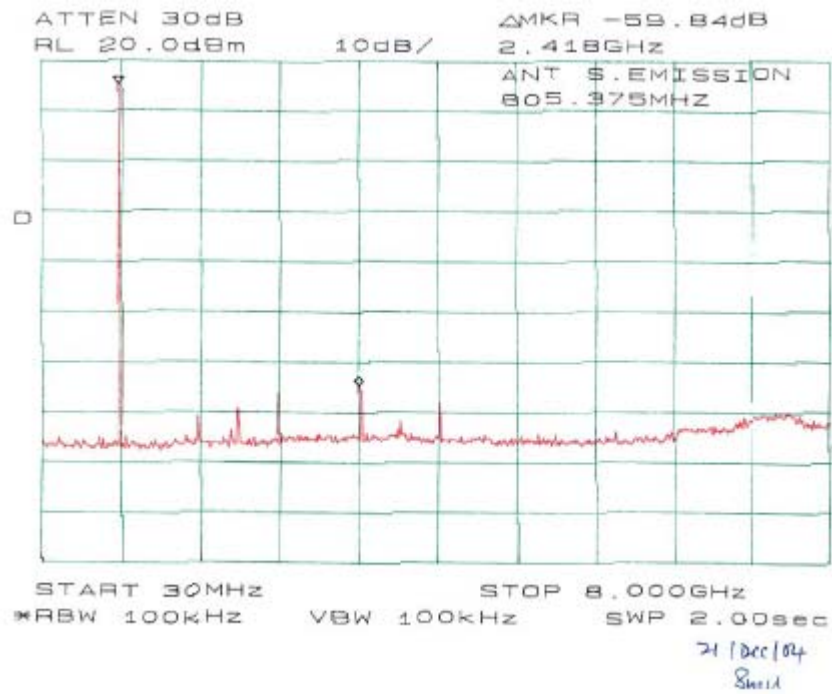
Temperature:	21° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

The testing was performed by Snell Leong on 2004-12-21.

Measurement Data

Please refer to the following plots.





§74.86(e)(4) - 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 74.861, the frequency tolerance of the transmitter shall be 0.005 percent.

Test Procedure

A) Frequency stability versus environmental temperature

1. Setup the configuration per figure 7 for frequencies measured at ambient temperature if it is with 15°C to 25°C . otherwise, an environmental chamber set for a temperature of 20°C shall be used. Install new batteries in the EUT.
2. Turn on EUT and set frequency counter center frequency to the right frequency needs to be measured, then set SA RBW to 30kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. Set the temperature of chamber to 50°C . Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10°C decreased per stage until the lowest temperature -30°C is measured, record all measurement frequencies.

B) Frequency stability versus input voltage

1. Setup the configuration per figure 7 for frequencies measured at ambient temperature if it is within 15°C to 25°C . otherwise, an environmental chamber set for a temperature of 20°C shall be used. Install new batteries in the EUT.
2. Set frequency counter center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. For battery operated only device, supply the EUT primary voltage at the battery operating end point which is specified by the manufactured and record the frequency.

Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
HP	Counter, Microwave Frequency	5342A	2232A06380	9/7/2004
Versa Tenn	Temperature Chamber	N/A	N/A	6/4/2004

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

Environmental Conditions

Temperature:	21° C
Relative Humidity:	40%
ATM Pressure:	1019 mbar

The testing was performed by Snell Leong on 2004-12-21.

Test Results**Low Supply Voltage - 6.8 V**

Channel	Spec Freq (MHz)	Measured Freq (MHz)	Freq Error (%)	Limit (%)
Low	720	720.000581	0.00008	0.005
Mid	795	795.001242	0.00016	0.005
High	805.375	805.377165	0.00027	0.005

Extreme Temperature -30C ~ 50C (Low Channel)

Temperature C	Spec Freq (MHz)	Measured Freq (MHz)	Freq Error (%)	Limit (%)
-30	720	720.002909	0.0004	0.0050
-20	720	720.002885	0.0004	0.0050
-10	720	720.003319	0.0005	0.0050
0	720	720.003767	0.0005	0.0050
10	720	720.003495	0.0005	0.0050
20	720	719.994572	-0.0008	0.0050
30	720	719.994216	-0.0008	0.0050
40	720	719.994144	-0.0008	0.0050
50	720	719.994049	-0.0008	0.0050

Extreme Temperature -30C ~ 50C (Mid Channel)

Temperature C	Spec Freq (MHz)	Measured Freq (MHz)	Freq Error (%)	Limit (%)
-30	795	795.013727	0.0017	0.0050
-20	795	795.013556	0.0017	0.0050
-10	795	795.013154	0.0017	0.0050
0	795	795.012452	0.0016	0.0050
10	795	795.009354	0.0012	0.0050
20	795	794.993805	-0.0008	0.0050
30	795	794.992982	-0.0009	0.0050
40	795	794.992956	-0.0009	0.0050
50	795	794.9929	-0.0009	0.0050

Extreme Temperature -30C ~ 50C (High Channel)

Temperature C	Spec Freq (MHz)	Measured Freq (MHz)	Freq Error (%)	Limit (%)
-30	805.375	805.38567	0.0013	0.0050
-20	805.375	805.385718	0.0013	0.0050
-10	805.375	805.386128	0.0014	0.0050
0	805.375	805.38623	0.0014	0.0050
10	805.375	805.374784	0.0000	0.0050
20	805.375	805.368771	-0.0008	0.0050
30	805.375	805.365489	-0.0012	0.0050
40	805.375	805.364974	-0.0012	0.0050
50	805.375	805.345761	-0.0036	0.0050