

FCC PART 22, 74, 90 TYPE APPROVALS

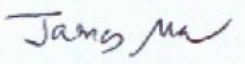
MEASUREMENT AND TEST REPORT

For

Headline Systems, INC.

Misung Bldg., Guro-Dong 612-6, Guro-Gu, Seoul, Korea, 152-865

FCC ID: USIHL-100V2
Model: HLD-100V2

This Report Concerns: <input checked="" type="checkbox"/> Original Report		Product type: VHF Data Radio Transceiver
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Report Number:	R07022710	
Report Date:	2007-03-13	
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The report has been prepared on behalf of Headline Systems, INC. and their product FCC ID: U5IHLD-100V2, model: HLD-100V2 or the EUT as referred to in the rest of this report. The EUT is a VHF Data Radio Transceiver that operates under FCC Parts 22, 74, and 90.

Specifications	
Frequency Band	148-174 MHz
Modulation Type	F3D, D3E
RF Output Power	1 - 5 Watts
Channel Spacing	25 kHz / 12.5 kHz
Number of Channels	16
Power Supply	12 VDC
Frequency Deviation	Peak ± 5 kHz (25 kHz Channel Spacing) Peak ± 2.5 kHz (12.5 kHz Channel Spacing)
Antenna Type	External Omnidirectional Antenna with reverse polarity connection type, 1 dBi Gain

Mechanical Description

The Headline Systems INC's product, model: HLD-100V2 or the "EUT" as referred to in this report is a VHF Data Radio Transceiver of metallic construction, which measures approximately 101.6 mm L x 63.5 mmW x 38.1 mmH and weighs 120g.

** The test data gathered are from production sample, serial number: 000005 Revision: Rev 1 provided by the manufacturer.*

EUT Photo



Additional Photo in Exhibit C

Objective

This Type approval report is prepared on behalf of *Headline Systems, INC.* in accordance with Part 22, Part 74 and Part 90 of the Federal Communication Commissions rules.

Related Submittal(s)/Grant(s)

No related submittal(s).

Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 22 – Public Mobile Services, Part 74 – Experimental Radio, Auxillary, Special Broadcast and other Program Distributional Services, Part 90 – Private Land Mobile Radio Service

Applicable Standards: TIA-603-C and ANSI 63.4-2003, American National Standard for Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed by Bay Area Compliance Laboratories Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Test site used by BACL Corp. to collect radiated and conducted emission measurement data is located at 1274 Anvilwood Ave, Sunnyvale, California 94085, 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 C63.4-2003& TIA/EIA-603.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and is listed under FCC registration number: 90464 and VCCI Registration Number: 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 current scope of accreditations is attached hereinafter and can also be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

SYSTEM TEST CONFIGURATION

Justification

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

The EUT was tested in the normal (native) operating mode to represent *worst-case* results during the final qualification test.

Equipment Modifications

No modifications were made to the EUT.

Power Supply and Line Filters

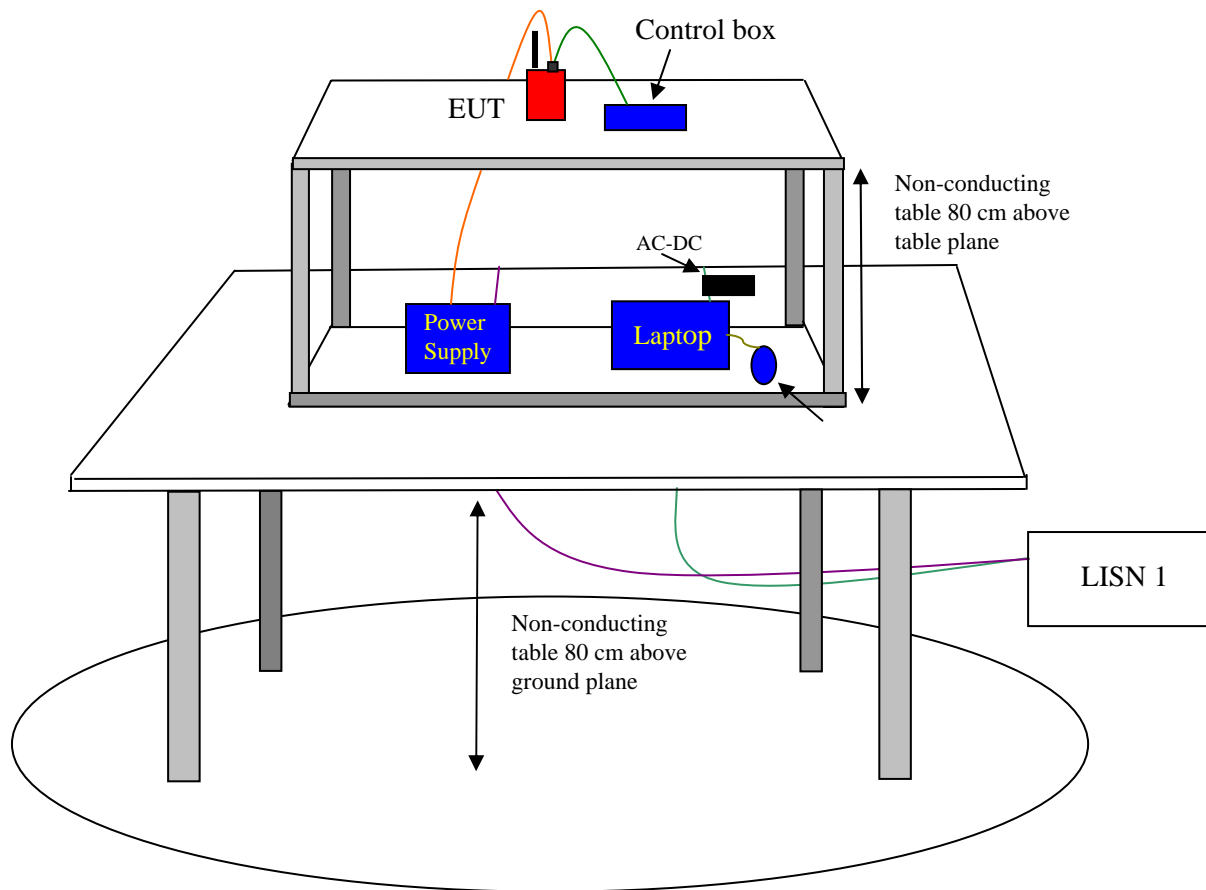
Manufacturer	Description	Model	Serial Number
Sceptre	I.T.E. power supply	AD2512B	0553WSC12

Local Support Equipment

Manufacturer	Description	Model	Serial Number
Sceptre	I.T.E. power supply	AD2512B	0553WSC12

Interface Ports and Cabling

Cable Description	Length (M)	From	To
PT5 Data test cable	0.5	PC Serial Port/Function Generator BNC output port	EUT Serial connector/ BNC
PT5 Audio test cable	0.5	PC Serial Port Function Generator BNC output port	EUT Serial connector/BNC

Radiated Emission Test Setup Block Diagram

SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§1.1310, §2.1091	RF Exposure	Compliant
§2.1046, §90.205	Conducted Output Power	Compliant
§2.1047 §90.207	Modulation Characteristic	Compliant
§2.1049, §22.359, §74.124, §90.209	Occupied Bandwidth and Emission Limitation	Compliant
§2.1051	Spurious Emissions at Antenna Terminals	Compliant
§2.1055, §22.355, §74.1261, § 90.213	Frequency stability	Compliant
§2.1053, § 90.210	Field strength of spurious radiation, Emission Masks	Compliant
§ 90.214	Transient Frequency Behavior	Compliant

§1.1310 and §2.1091 - RF EXPOSURE

According to §1.1307, 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 §2.1091 RF exposure is calculated.

Limits for Maximum Permissible 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				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

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

VHF:

Maximum peak output power at antenna input terminal (dBm): 36.85 (dBm)

Maximum peak output power at antenna input terminal (mW): 4842 (mW)

Predication distance (cm): 50 (cm)

Predication frequency (MHz): 160 (MHz)

Antenna Gain, typical (dBi): 1 (dBi)

Maximum Antenna Gain (numeric): 1.26 (numeric)

Power density at predication frequency at 50 cm (mW/cm²): 0.194 (mW/cm²)

MPE limit for uncontrolled exposure at predication frequency (mW/cm²): 0.200 (mW/cm²)

Test Result

The EUT is a mobile device. For VHF, the worst power density level at 50 cm for the maximum output power is 0.194 mW/cm², which is below the uncontrolled limit of 0.200 mW/cm².

§2.1046, and §90.205 - CONDUCTED OUTPUT POWER

Applicable Standard

According to FCC §2.1046, and §90.205, maximum ERP is dependent upon the station's antenna HAAT and required service area.

Test Procedure

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

Spectrum Analyzer Setting:

RBW	Video BW
100 kHz	300 kHz

Environmental Conditions

Temperature:	23° C
Relative Humidity:	32%
ATM Pressure:	1009mbar

** The testing was performed by James Ma on 2007-03-12.*

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Aglient	Spectrum Analyzer	E4446A	US44300386	2006-03-16

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

Test Result

Test Mode: Transmitting

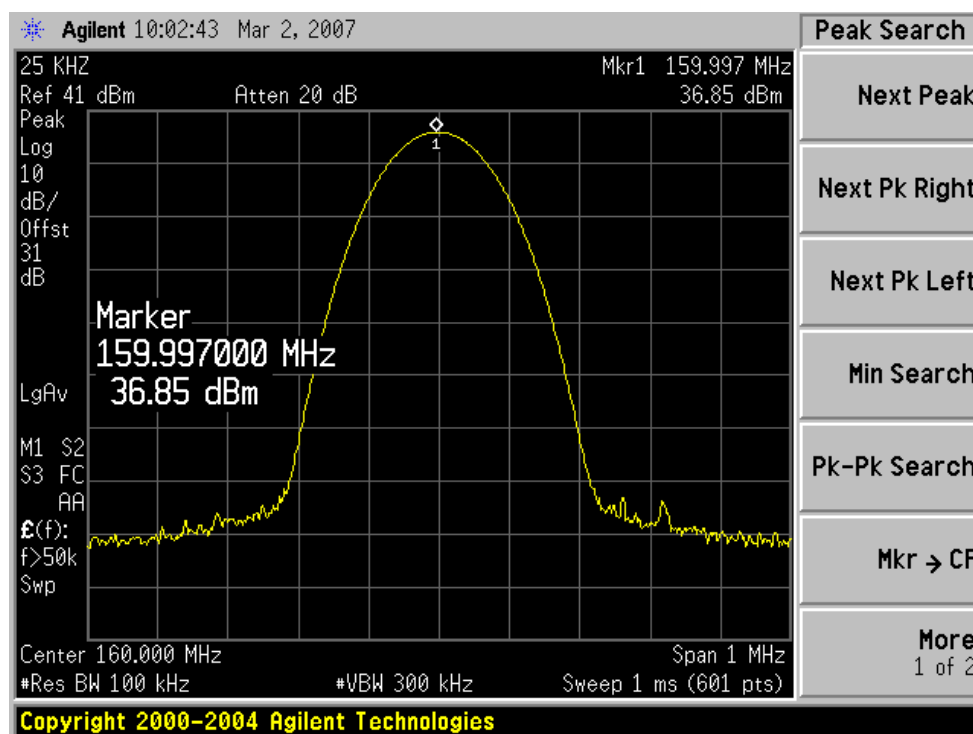
High Power

Frequency Spacing (kHz)	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)
VHF (25KHz)	159.997	36.85	4.842
VHF (12.5KHz)	159.997	36.82	4.808

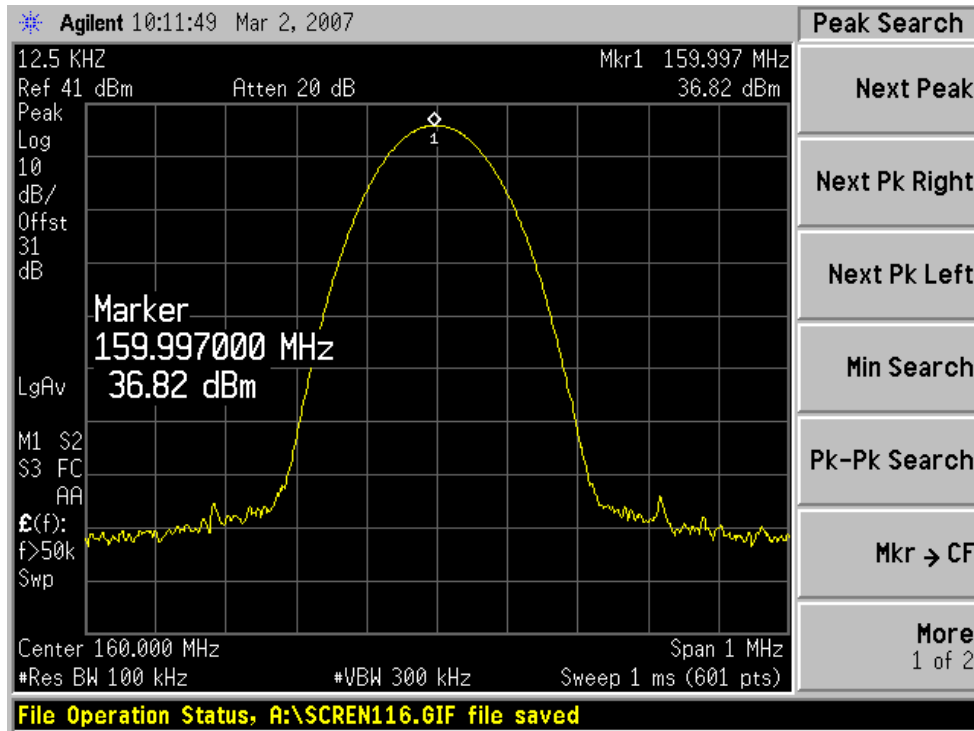
Low Power

Frequency Spacing (kHz)	Frequency (MHz)	Output Power (dBm)	Output Power (Watt)
VHF (25KHz)	159.997	30.92	1.236
VHF (12.5KHz)	159.997	30.95	1.245

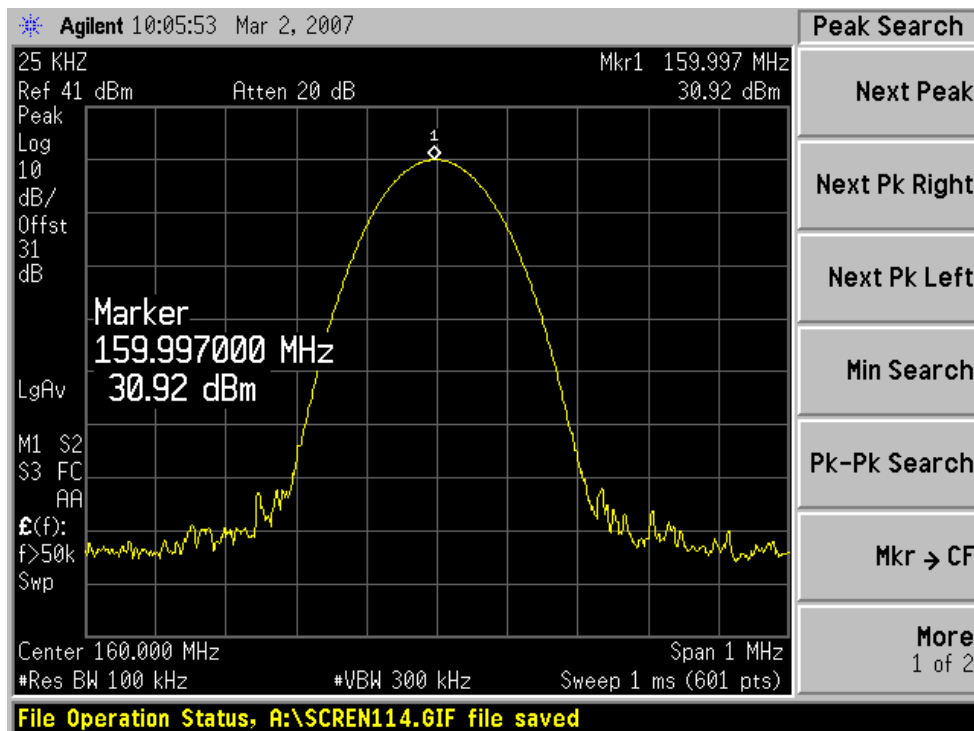
Conducted Output Power for VHF (25 KHz) High Power



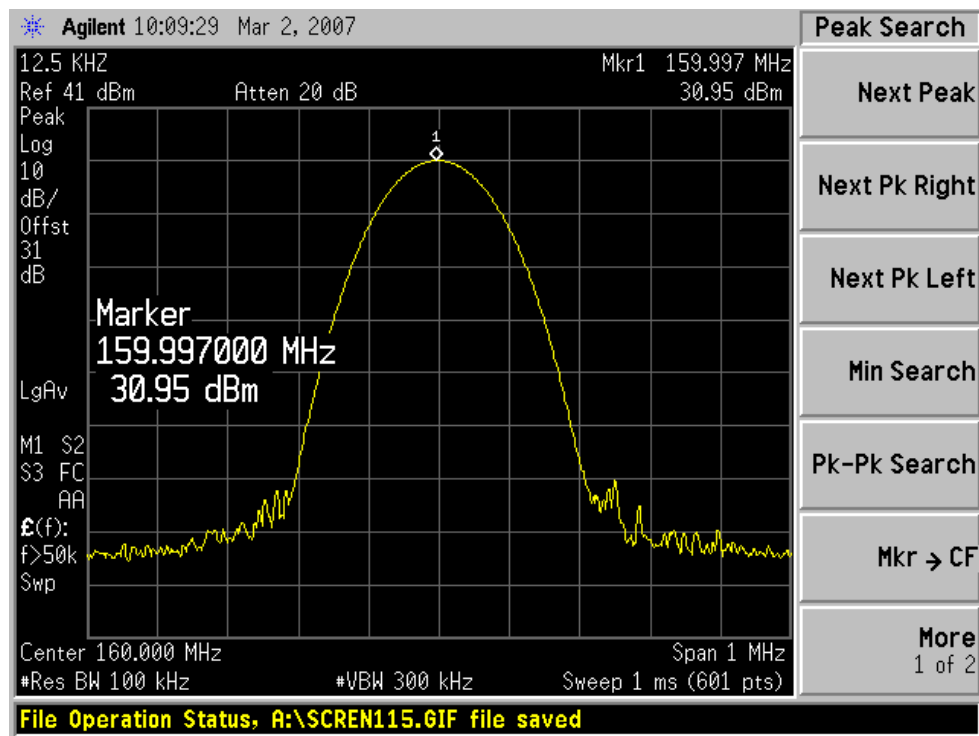
Conducted Output Power for VHF (12.5 KHz) High Power



Conducted Output Power for UHF (25 KHz) Low Power



Conducted Output Power for VHF (12.5 KHz) Low Power



§2.1047, and §90.207 - MODULATION CHARACTERISTIC

Applicable Standard

§2.1047 & §90.207:

- (a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
- (b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

Test Procedure

Test Method: TIA/EIA-603-C 2.2.3

Environmental Conditions

Temperature:	23° C
Relative Humidity:	32%
ATM Pressure:	1009mbar

** The testing was performed by James Ma on 2007-03-12.*

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Function Arbitrary Waveform Generator	33220A	MY43004878	2005-05-18 (2 yrs)
HP	Modulation Analyzer	8901A	2026A00847	2006-01-17 (2 yrs)

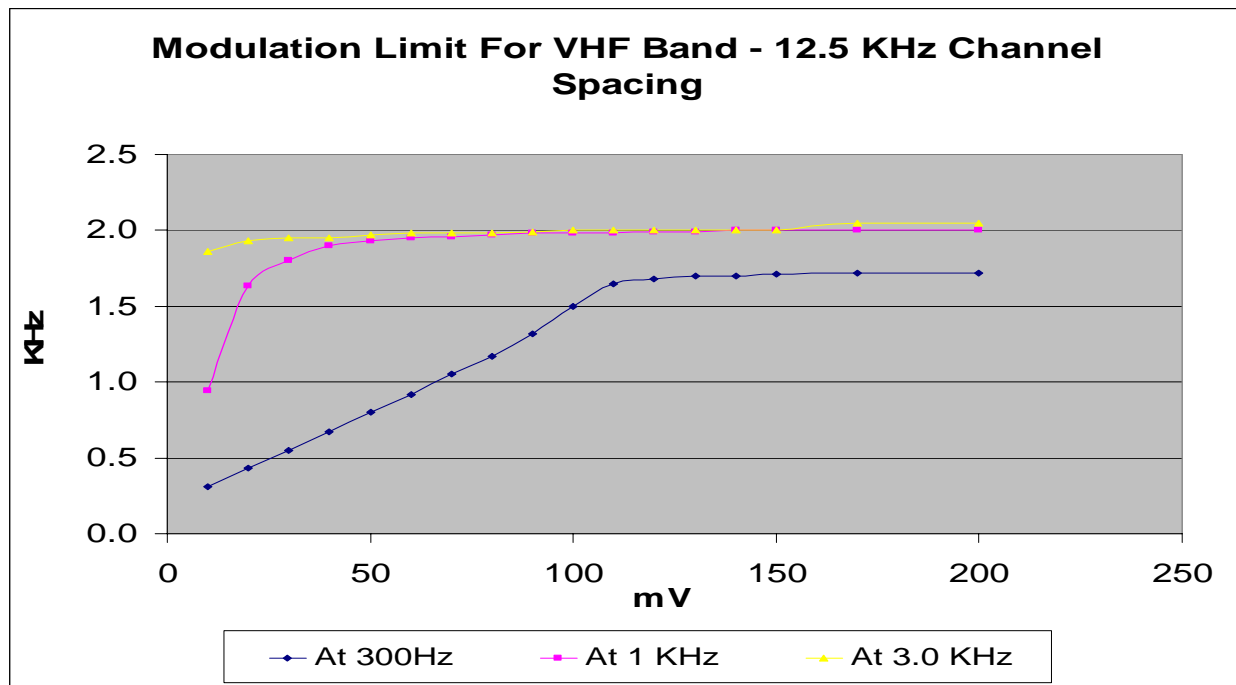
*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Result

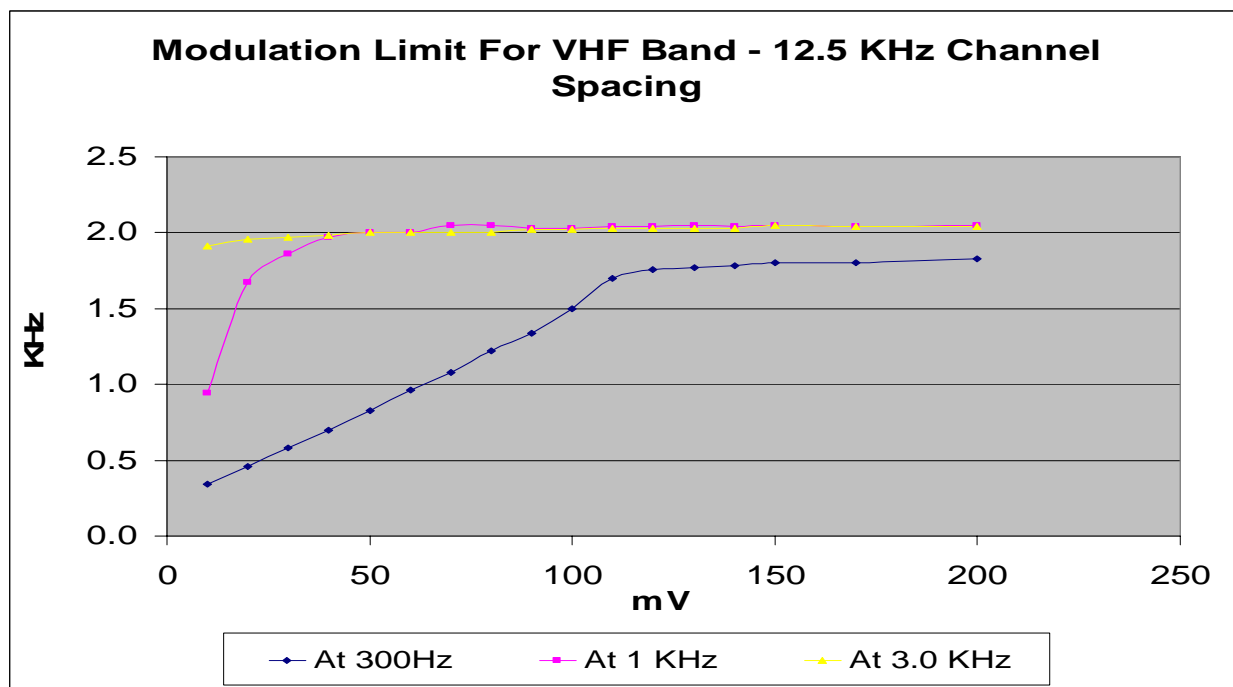
Test Mode: Transmitting

Modulation Limit for *HLD – 100V2 - VHF*

High Power

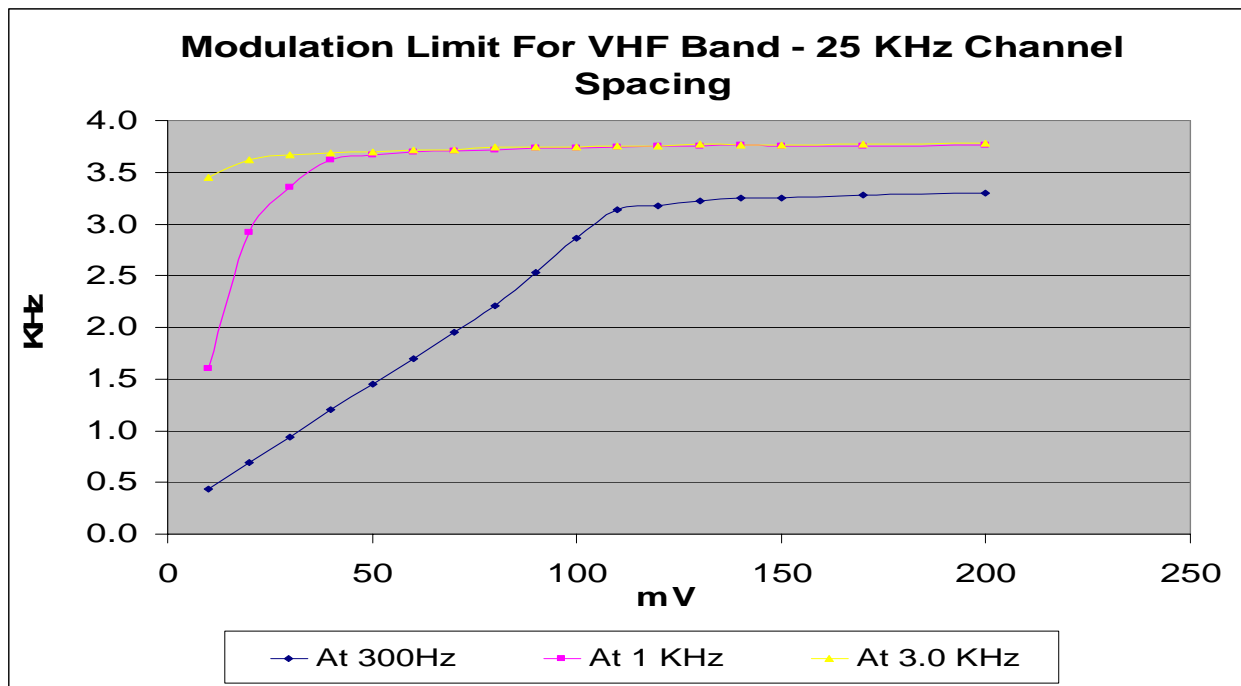


Low Power

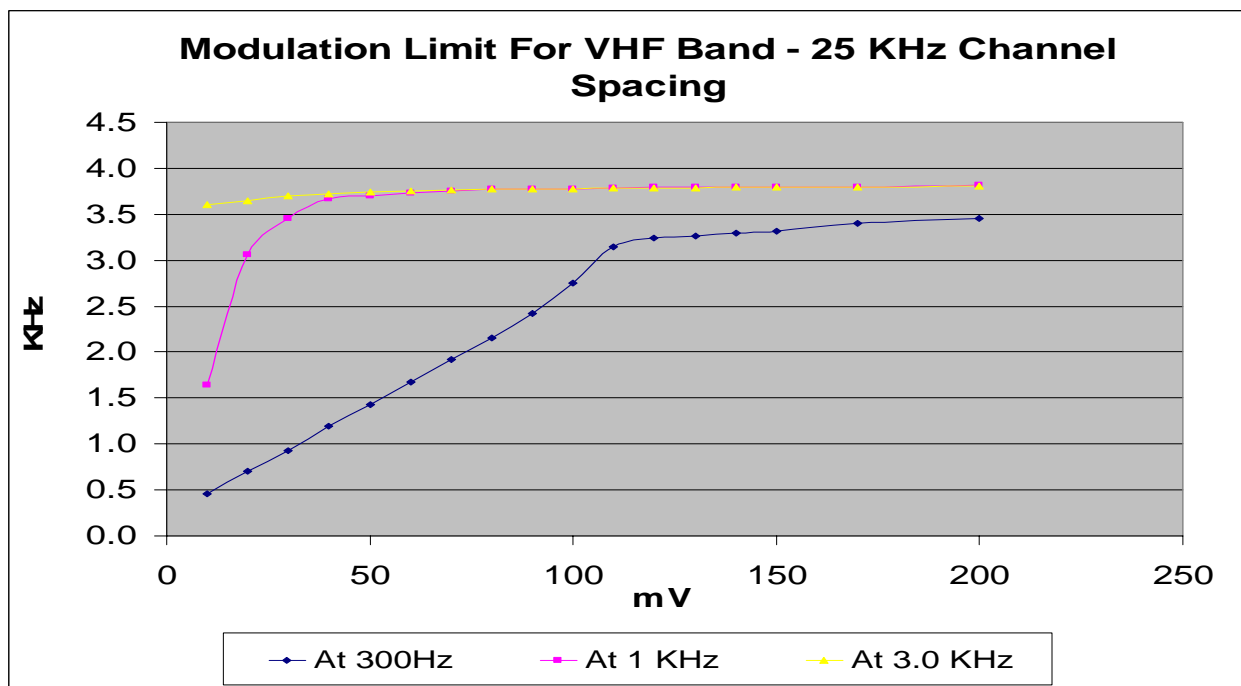


Modulation Limit for *HLD – 100V2 - VHF*

High Power



Low Power



§2.1049, §22.359, §74.1236, and § 90.209/210– OCCUPIED BANDWIDTH & EMISSION LIMITATION

Applicable Standard

§90.209

Operations using equipment using a 25 kHz bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized an 11.25 kHz bandwidth.

§2.1049, §90.210

Emission Mask D—12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

- 1) For any frequency removed from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 , 0dB.
- 2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625kHz but no more than 12.5kHz, at least $7.27 (f_d - 2.88\text{kHz})$ dB.
- 3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5kHz at least:

$50 + 10\log P = 50 + 10\log (P)$ or 70 dB, whichever is the lesser attenuation.

Emission Mask B. For transmitters that are equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:

- 1) On any frequency removed from the assigned frequency by more than 50 percent, but not more than 100 percent of the authorized bandwidth: At least 25 dB.
- 2) On any frequency removed from the assigned frequency by more than 100 percent, but not more than 250 percent of the authorized bandwidth: At least 35 dB.
- 3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least $43 + \log (P)$ dB.

The resolution bandwidth was 100Hz or greater for measuring up to 250kHz from the edge of the authorized frequency segment, and 30kHz or greater for measuring more than 250kHz from the authorized frequency segment.

Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 100 Hz and the spectrum was recorded in the frequency band ± 50 KHz from the carrier frequency.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	32%
ATM Pressure:	1009mbar

** The testing was performed by James Ma on 2007-03-12.*

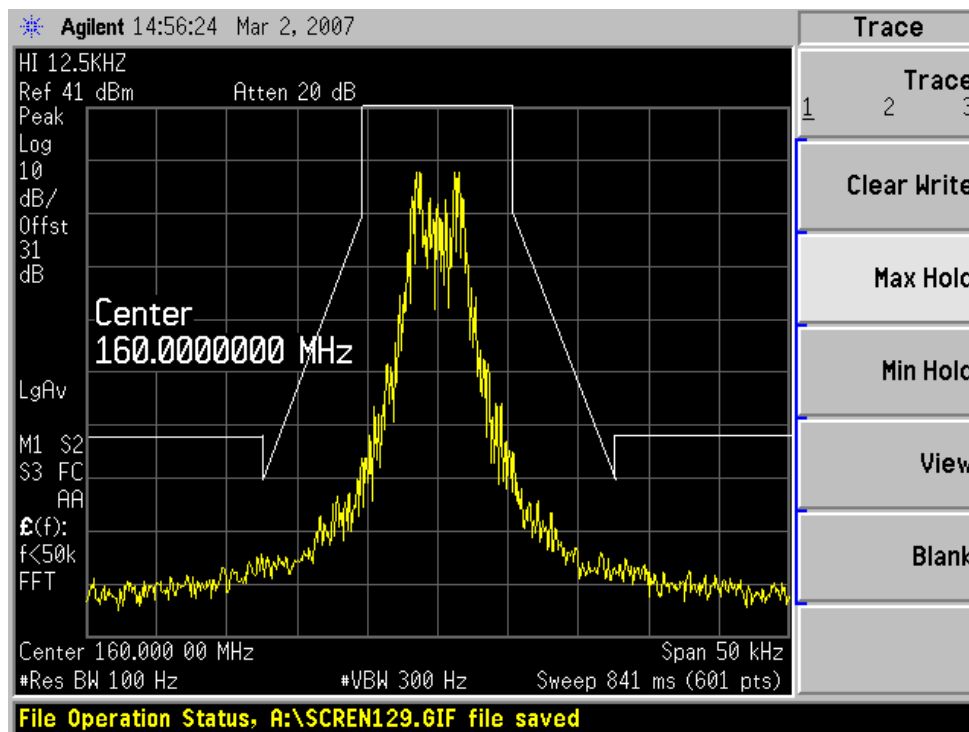
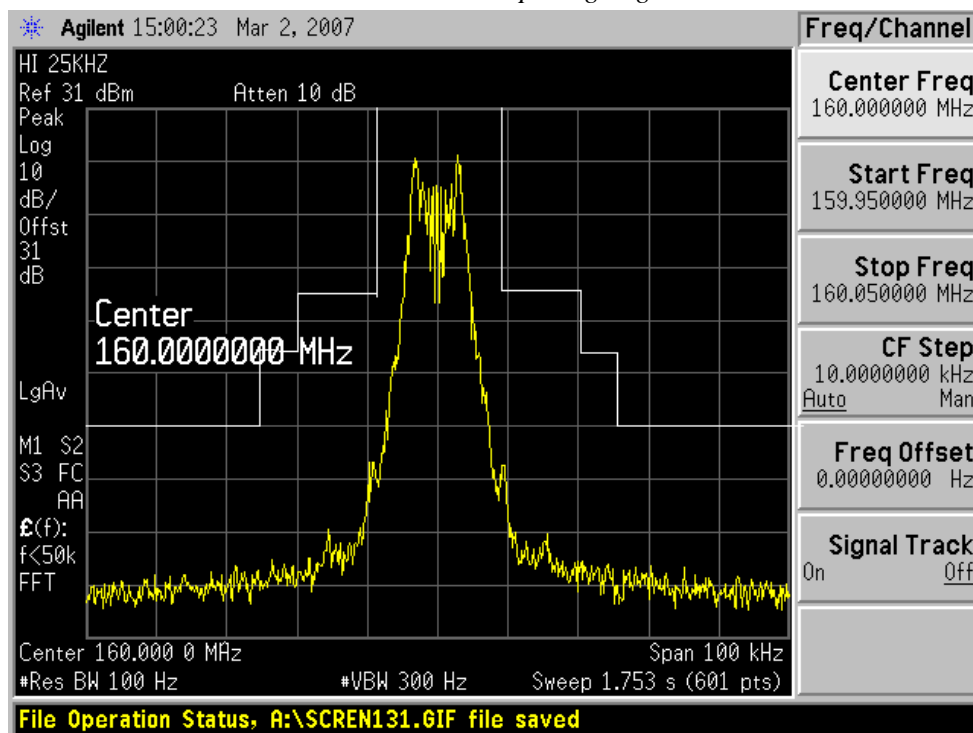
Test Equipment List and Details

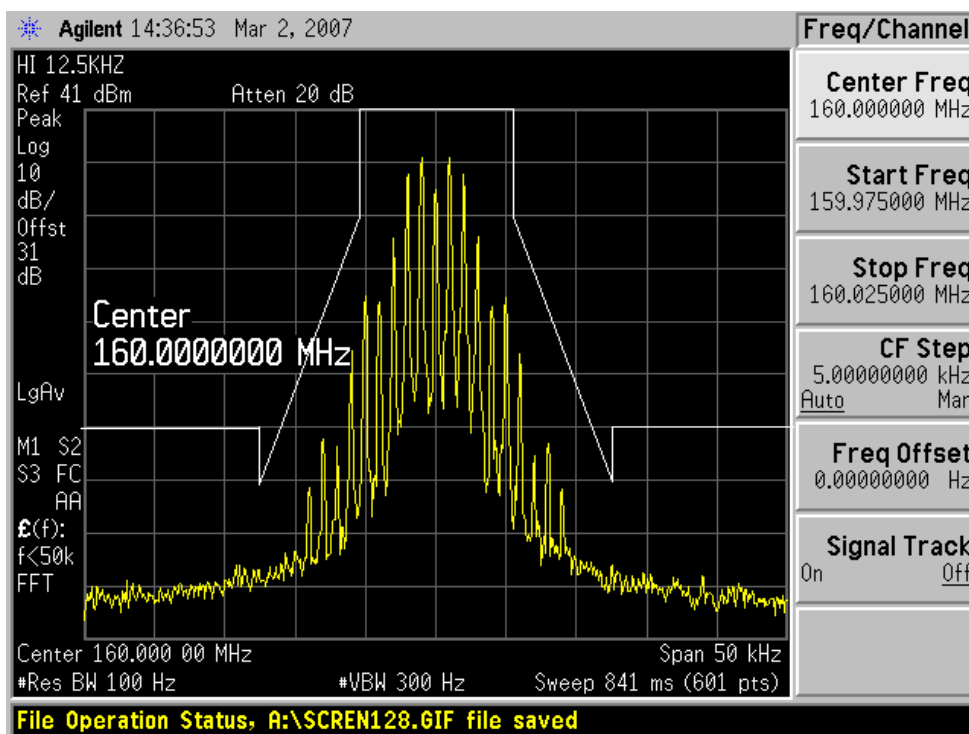
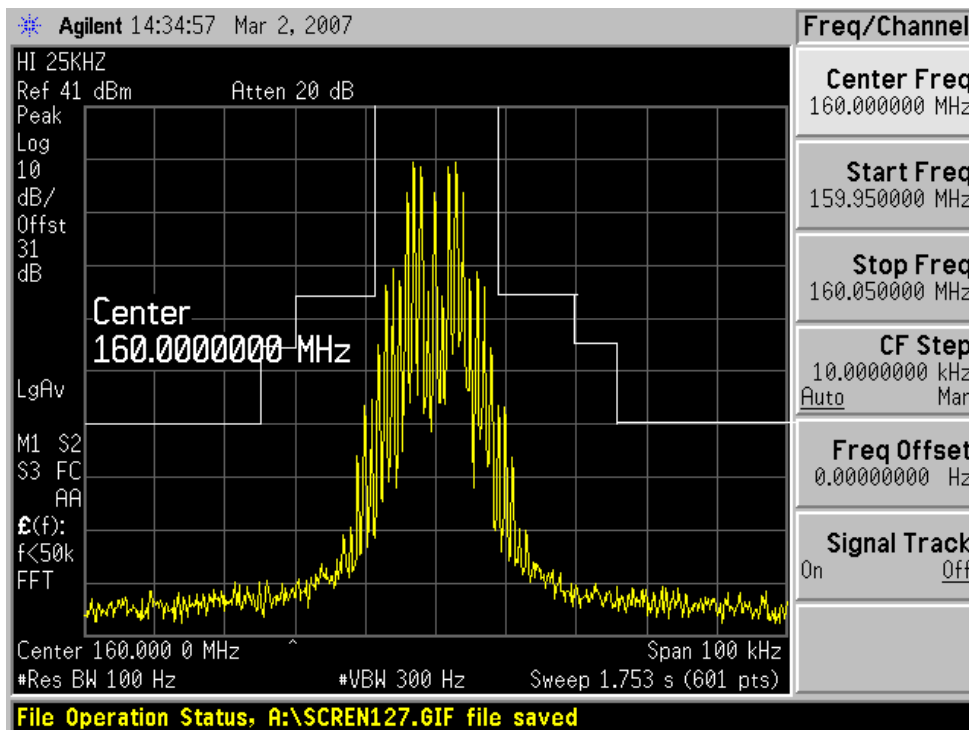
Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2006-03-16

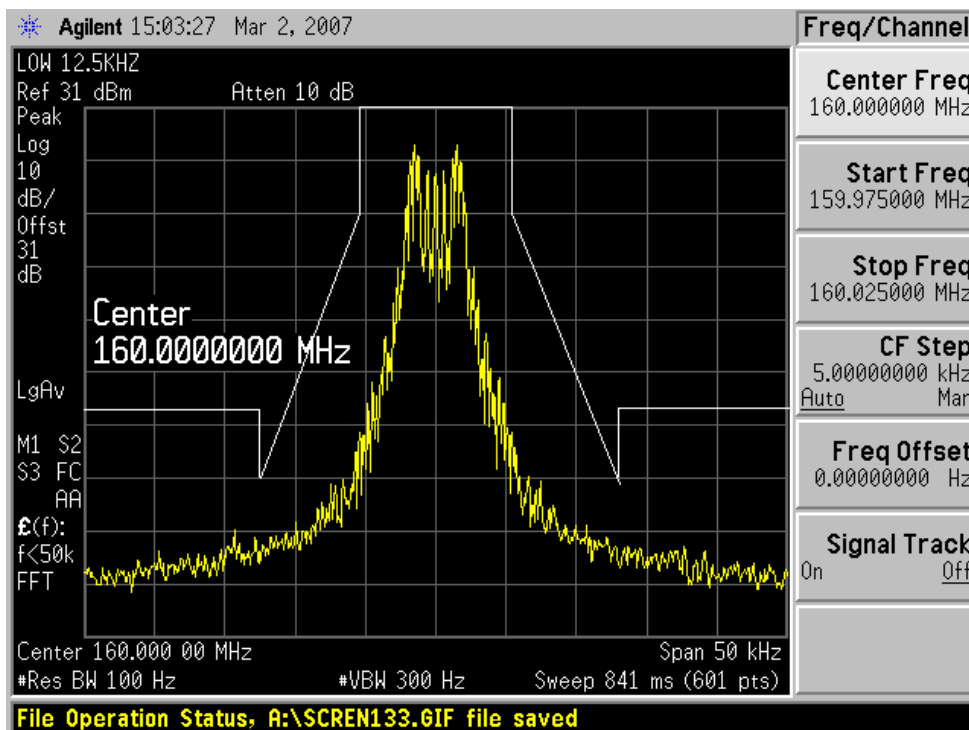
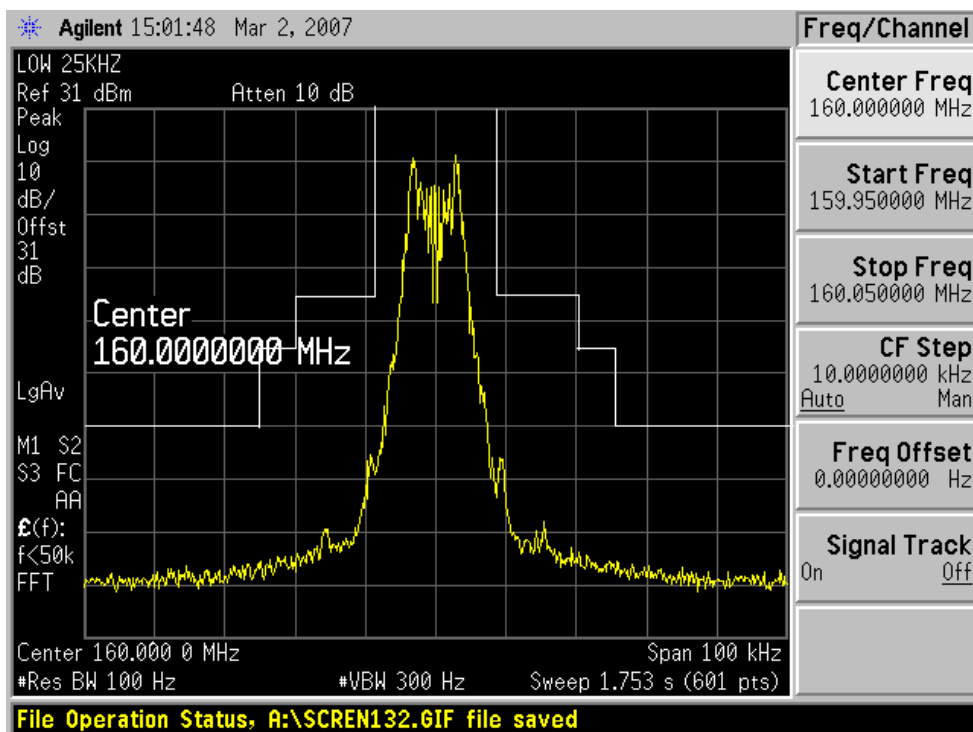
*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

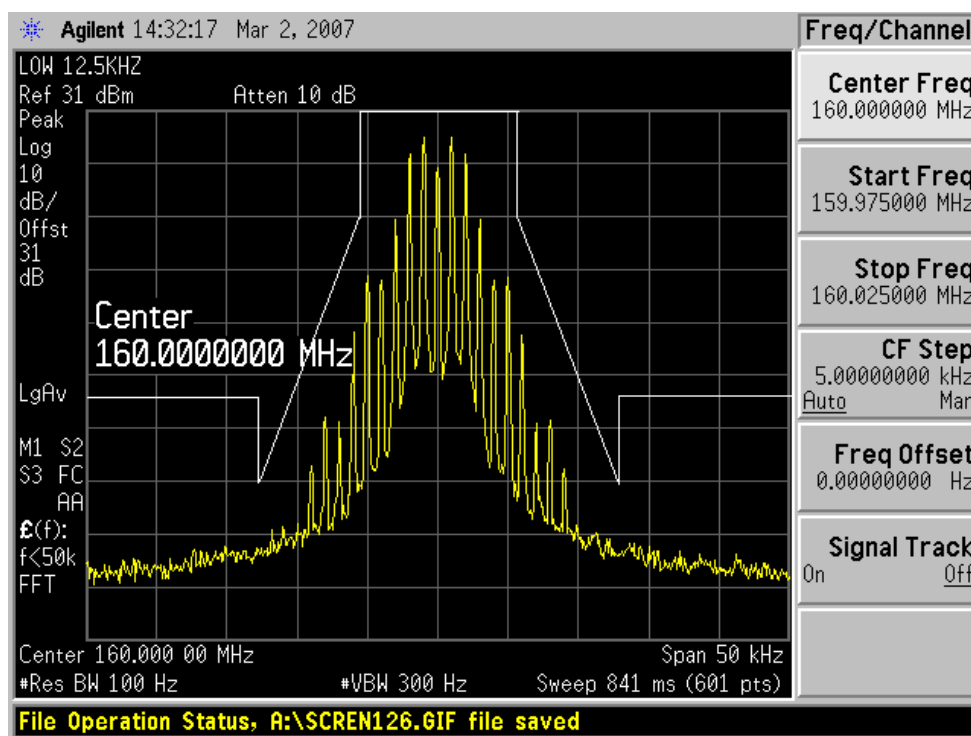
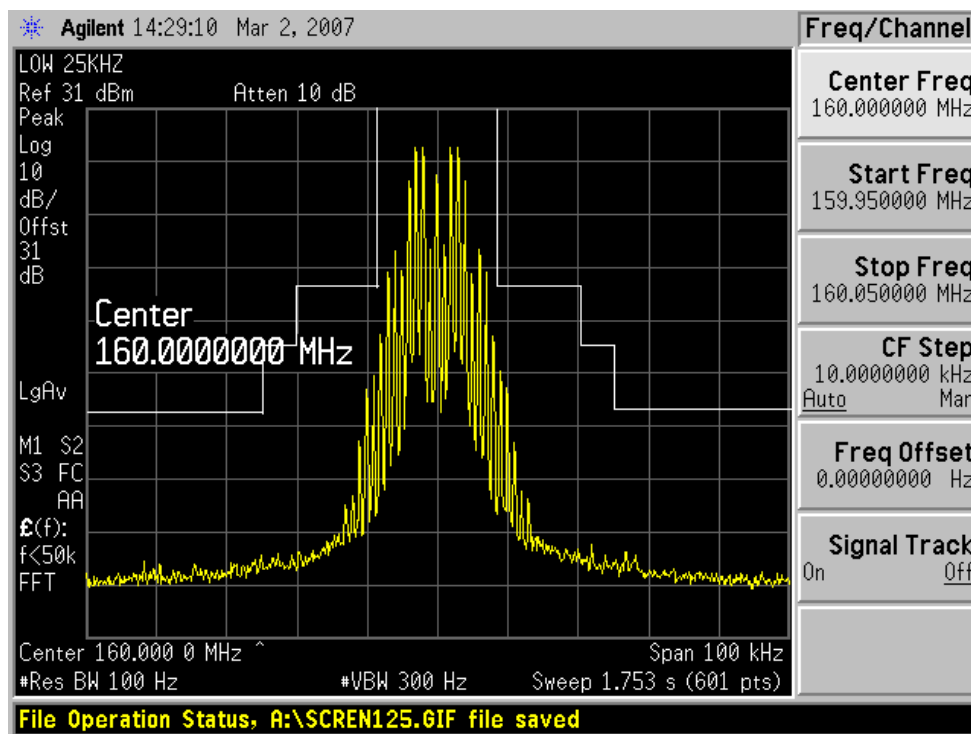
Test Result

Please refer to the hereinafter plots.

High Power*Data 12.5 kHz Channel Spacing High Power**Data 25 kHz Channel Spacing High Power*

Audio 12.5 kHz Channel spacing High Power*Audio 25 kHz Channel spacing High Power*

Low Power*Data 12.5 kHz Channel spacing Low Power**Data 25 kHz Channel spacing Low Power*

Audio 12.5 KHz Channel spacing Low Power*Audio 25 KHz Channel spacing Low Power*

§2.1051 and §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

§90.210 (12.5 kHz bandwidth only)

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5kHz at least:

50+10logP or 70 dB

§2.1051 and §90.210 (25 kHz bandwidth and 20 kHz bandwidth)

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

43+10log (P)

Test 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 10th harmonic.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	32%
ATM Pressure:	1009mbar

* The testing was performed by James Ma on 2007-03-12.

Test Equipment List and Details

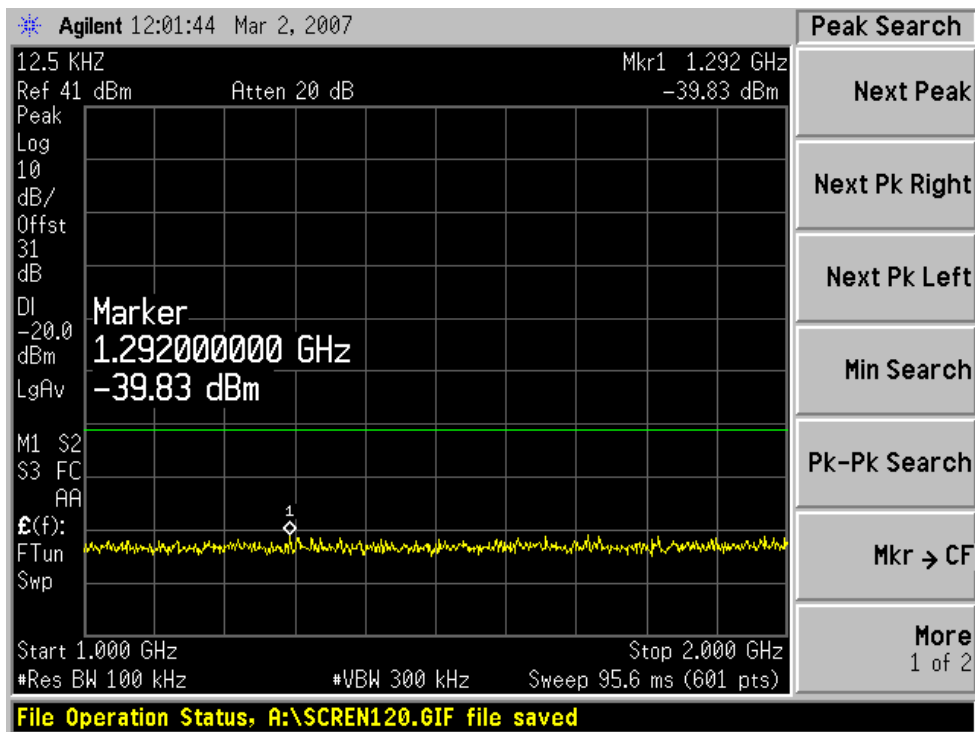
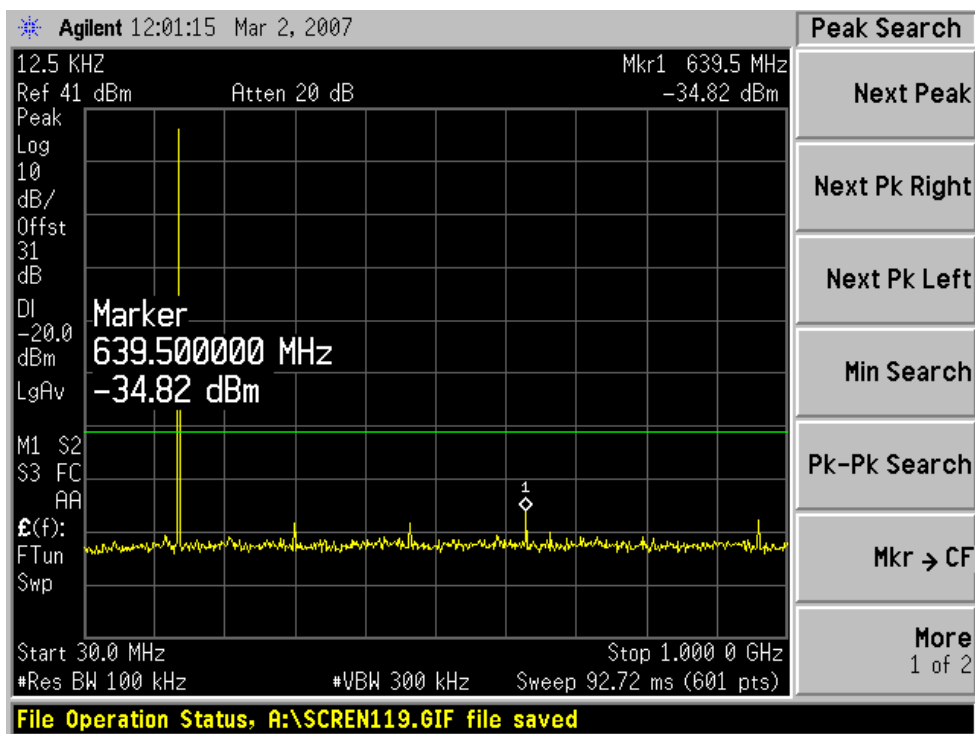
Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2006-03-16

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

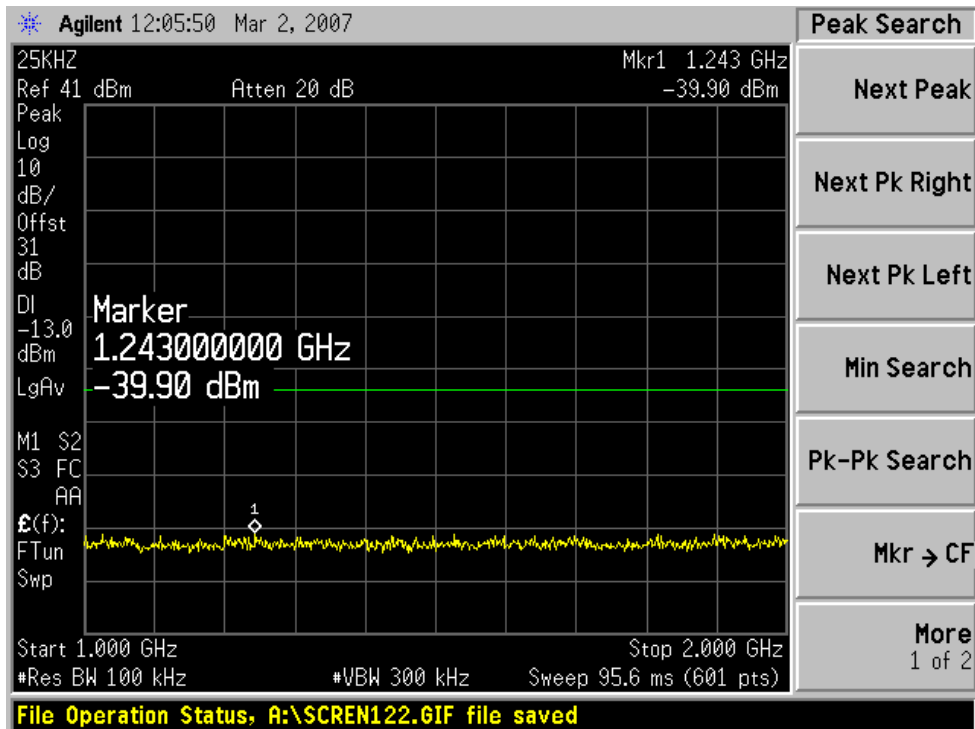
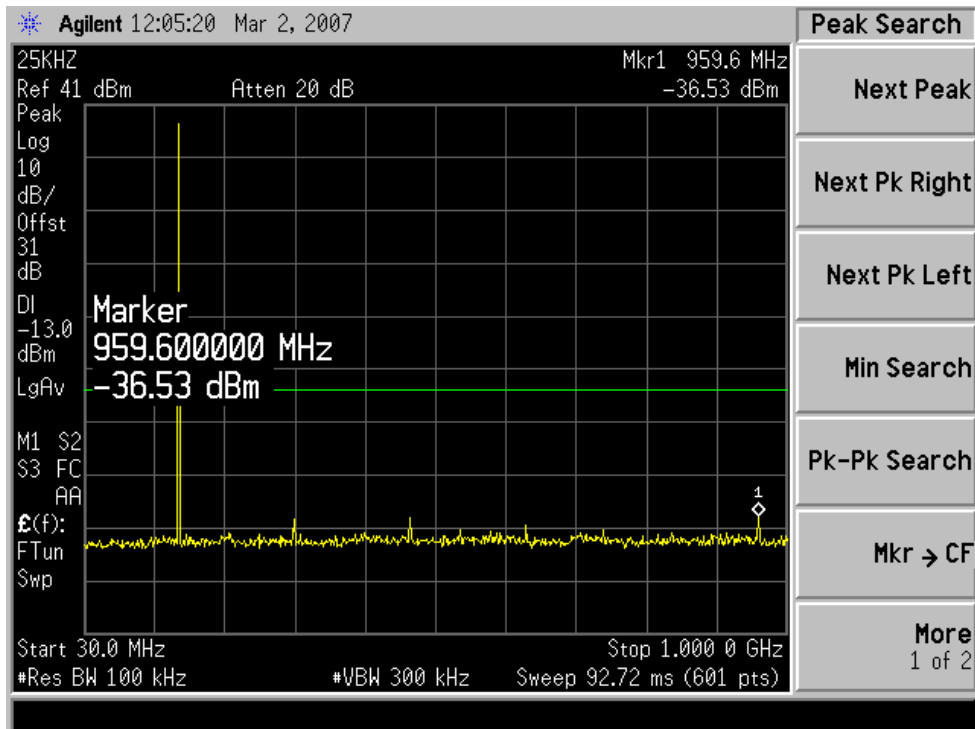
Test Results

Test Mode: Transmitting Using Conducted measuring method

For VHF 12.5 kHz Channel Bandwidth:



For VHF 25 kHz Channel Bandwidth:



§2.1055 (d), §22.355, §74.1261 (b) and §90.213- FREQUENCY STABILITY**Applicable Standard**

§2.1055 (d)

§90.213

For output power > 2 watts, the limit is 5.0 ppm.

Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to the Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable DC power supply Source. The voltage was set to 110% of the nominal value and was then decreased until the transmitter light no longer illuminated; i.e., the end point. The output frequency was recorded for each voltage.

Environmental Conditions

Temperature:	23° C
Relative Humidity:	32%
ATM Pressure:	1009mbar

** The testing was performed by James Ma on 2007-03-12.*

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2006-03-16
Tenney	Oven, Temperature	Versa Tenn	12.431-8	2006-06-27

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

Test Result

Test Mode: Transmitting

*For VHF Band***Frequency vs. Temperature**

Condition		Reference Frequency (kHz)	Measured Frequency (kHz)	Frequency Error (PPM)	Limit (PPM)
Voltage (VDC)	Temperature (°C)				
12.0	60	160000.000	160000.089	0.5563	5.00
12.0	50	160000.000	160000.072	0.4500	5.00
12.0	40	160000.000	160000.055	0.3437	5.00
12.0	30	160000.000	160000.063	0.3937	5.00
12.0	10	160000.000	160000.071	0.4437	5.00
12.0	0	160000.000	160000.079	0.4937	5.00
12.0	-10	160000.000	160000.108	0.6750	5.00
12.0	-20	160000.000	160000.136	0.8500	5.00
12.0	-30	160000.000	160000.182	1.1375	5.00

Frequency vs. Voltage

Condition		Reference Frequency (kHz)	Measured Frequency (kHz)	Frequency Error (PPM)	Limit (PPM)
Voltage (VDC)	Temperature (°C)				
13.2	20	160000.000	160000.051	0.3188	5.00
10.8	20	160000.000	160000.045	0.2813	5.00

§2.1053 and §90.210 (b) (d) - FIELD STRENGTH OF SPURIOUS RADIATION, EMISSION MASKS

Applicable Standard

§2.1053 (a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. and §90.210(b),(d): Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

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

Environmental Conditions

Temperature:	23° C
Relative Humidity:	32%
ATM Pressure:	1009mbar

** The testing was performed by James Ma on 2007-03-12.*

Test Equipment

Manufacturer	Description	Model	Serial Number	Calibration Date
HP	Generator, Signal	8648C	3426A01345	2006-10-10
ComPower	Antenna, Dipole 400-1000 MHz	AD-100	122	NR
Sunol Sciences	Antenna	JB1	A013105-3	2006-03-15
Agilent	Spectrum Analyzer	E4446A	US44300386	2006-03-16

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

Test Result

-6.3 dB at 320 MHz in the Horizontal polarization

Test Mode: Transmission Using substitution measuring method

Indicated		Azimuth	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	Amplitude dBuV	degrees	Height (m)	Polar H/V	Frequency MHz	Level dBm	Antenna Correction	Cable Loss (dB)	Absolute Level (dBm)		
320.0	49.3	120	1.5	H	320.0	-18.9	0	0.4	-19.3	-13	-6.3
320.0	48.2	0	1.8	V	320.0	-20.1	0	0.4	-20.5	-13	-7.5
480.0	32.0	0	1.5	V	480.0	-35.4	0	0.5	-35.9	-13	-22.9
480.0	31.5	55	1.6	H	480.0	-36.8	0	0.5	-37.3	-13	-24.3
640.0	29.5	100	2.3	H	640.0	-36.7	0	0.6	-37.3	-13	-24.3
640.0	29.6	190	1.1	V	640.0	-36.9	0	0.6	-37.5	-13	-24.5
148.7	27.4	200	2.4	V	148.7	-39.4	0	0.2	-39.6	-13	-26.6
148.7	27.2	70	1.6	H	148.7	-40.0	0	0.2	-40.2	-13	-27.2

Note: measured at 3 meters and without Power amplifier

§90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

§90.214: Transmitters designed to operate in the 150–174 MHz and 421–512 MHz frequency bands must maintain transient frequencies within the maximum frequency difference limits during the time intervals indicated:

Time intervals ^{1,2}	Maximum frequency difference ³	All equipment
		150 to 174 MHz
Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels		
t ₁ ⁴	±25.0 kHz	5.0 ms
t ₂	±12.5 kHz	20.0 ms
t ₃ ⁴	±25.0 kHz	5.0 ms
Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels		
t ₁ ⁴	±12.5 kHz	5.0 ms
t ₂	±6.25 kHz	20.0 ms
t ₃ ⁴	±12.5 kHz	5.0 ms

Test Procedure

TIA/EIA-603-C 2.2.19

Environmental Conditions

Temperature:	23° C
Relative Humidity:	32%
ATM Pressure:	1009mbar

* The testing was performed by James Ma on 2007-03-12.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
HP	Modulation Analyzer	8901A	2026A00847	2006-01-17 (2 Yrs)
Tektronix	Digital Phosphor Oscilloscope	TDS7104	B020557	2006-02-15 (2 Yrs)
Agilent	Spectrum Analyzer	E4446A	US44300386	2006-03-16
HP	Signal Generator	8648C	3426A01345	2006-08-22

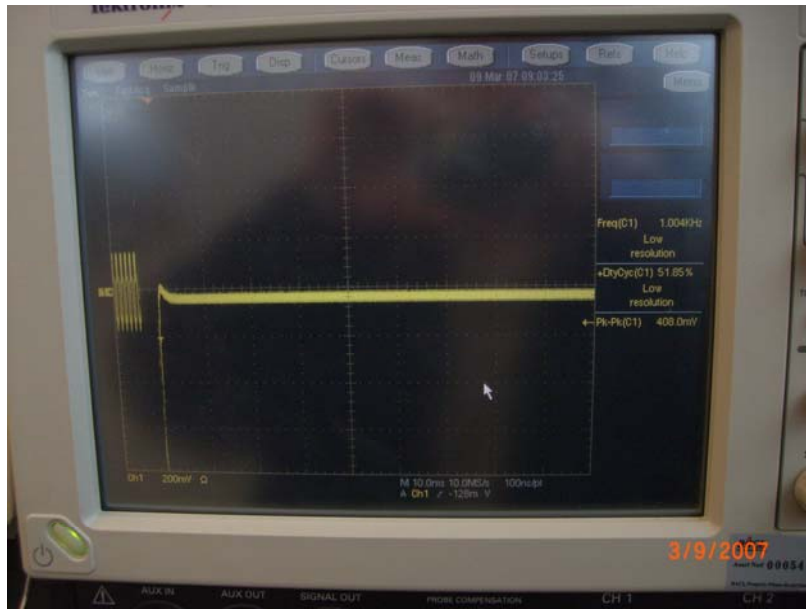
* **Statement of Traceability:** BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Result

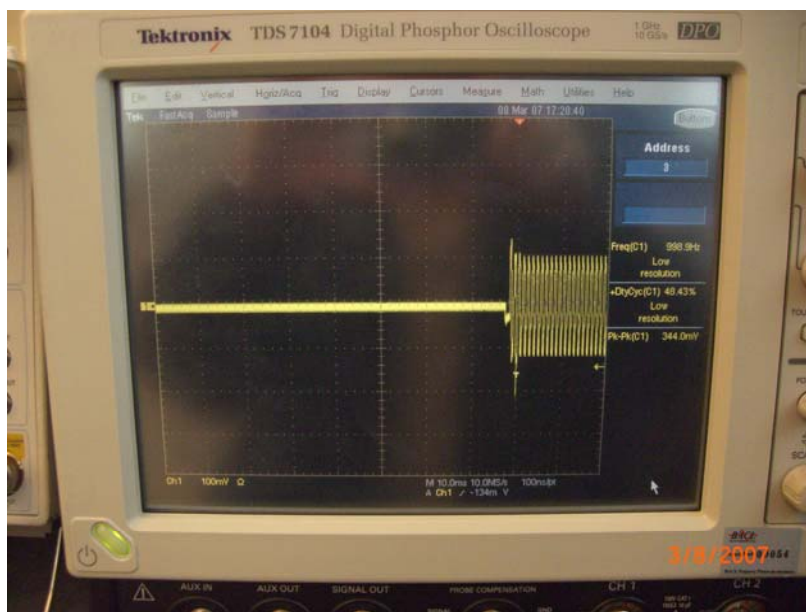
Please refer to the following plots

VHF 12.5 kHz Channel Spacing

On:

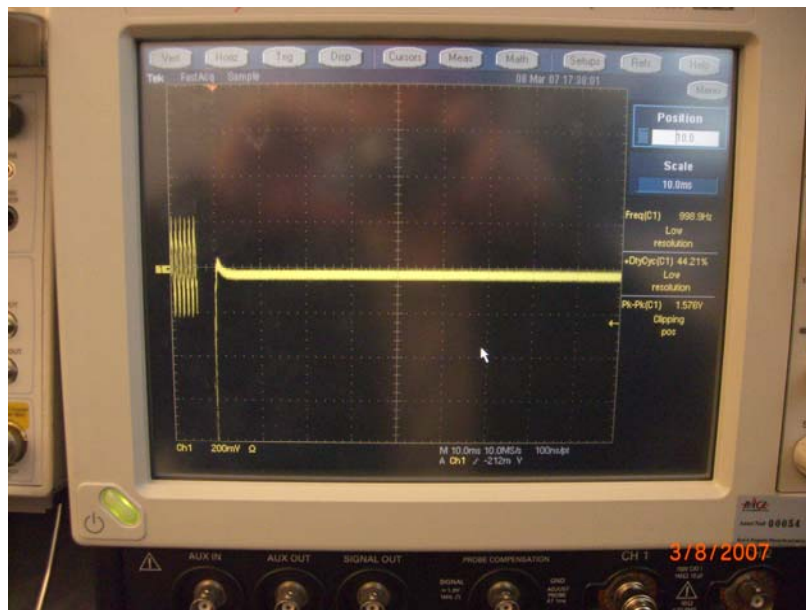


Off:



VHF 25 kHz Channel Spacing

On:



Off:

