FCC PART 90 TYPE APPROVAL

EMI MEASUREMENT AND TEST REPORT

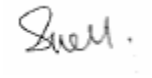
For

Commtech Wireless Pty Ltd

30 Hector Street Osborne Park, Perth. Western Australia 6017

FCC ID: T5GPT5

This Report Concerns:	Product name:
☒ Original Report	PT5 UHF Transmitter, PT5 VHF Transmitter

Test Engineer:	Taylor Tsai 
Report No.:	R0603082
Report Date:	2006-04-04
Reviewed By:	Snell Leong 
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)

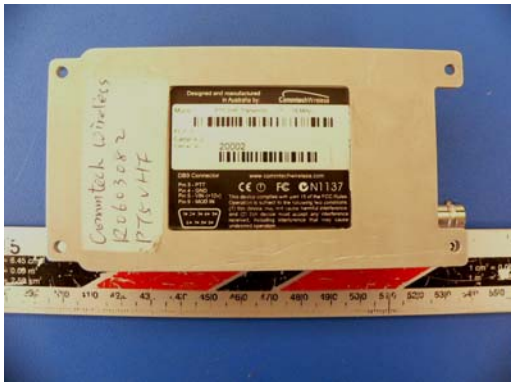
The *Commtech Wireless* Pty Ltd product, FCC ID: *T5GPT5* or the "EUT" as referred to in this report is a Paging Transmitter.

Approximately measured is: 30.0 mm L x 62.0 mmW x 118 mmH.

** The test data gathered are from production sample, serial number: 20002/20001, Revision: Rev 1 provided by the manufacturer.*

EUT Photo

PT5-UHF



PT5-VHF

Objective

This Type approval report is prepared on behalf of *Commtech Wireless* in accordance with Part 2, 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 90 – Private Land Mobile Radio Service

Applicable Standards: TIA EIA 137-A, TIA EIA 98-C, TIA603-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 Laboratory 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 230 Commercial Street , 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 has the reports on file and is listed under FCC registration number: 90464 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 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/EIA-603C.

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	0.3	PC Serial Port/Function Generator BNC output port	EUT Serial connector/ BNC
PT5 Audio test cable	0.3	PC Serial Port Function Generator BNC output port	EUT Serial connector/BNC

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, §90.209	Occupied Bandwidth	Compliant
§2.1051, §90.210	Spurious Emissions AT Antenna Terminals	Compliant
§ 2.1055 § 90.213	Frequency stability	Compliant
§ 90.214	Transient Frequency Behavior	Compliant
§2.1053, §90.210	Spurious Emissions	Compliant*

** The test data was within the measurement of uncertainty.*

§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:

R B/W	Video B/W
100 kHz	300 kHz

Environmental Conditions

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

** The testing was performed by Taylor Tsai on 2006-3-28.*

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Aglient	Spectrum Analyzer	8565EC	06042	2006-01-11

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

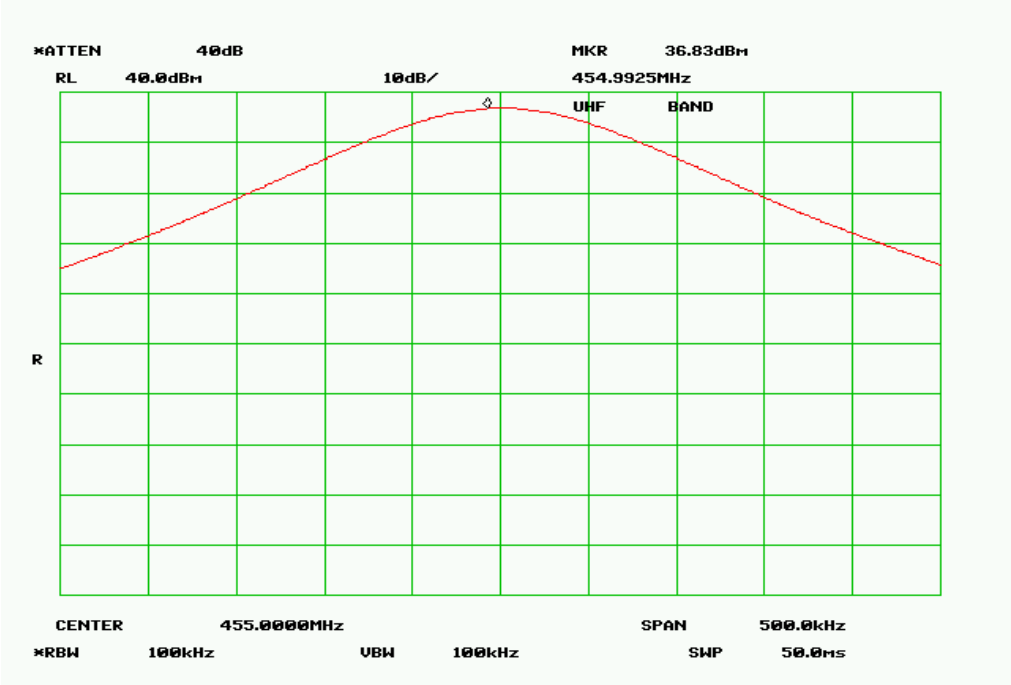
Test Result

Test Mode: Transmitting

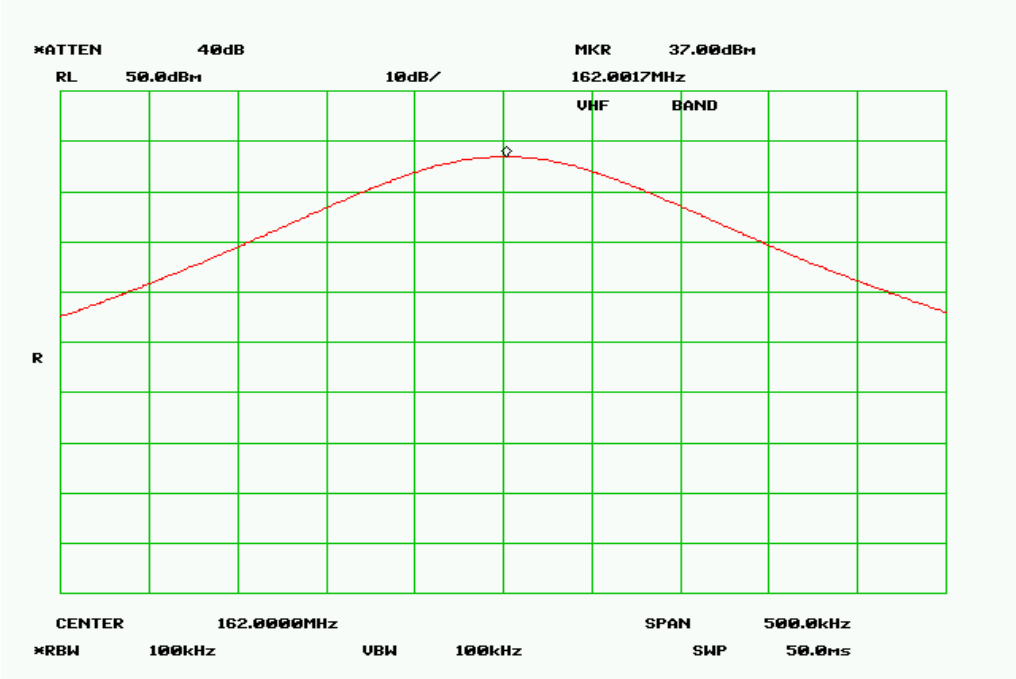
Frequency Spacing (kHz)	Frequency (MHz)	Output Power in dBm	Output Power in W
UHF (25KHz)	454.9925	36.83	4.81
VHF (25KHz)	162.0017	37.00	5.01
UHF (12.5KHz)	455.0017	36.78	4.76
VHF (12.5KHz)	162.0017	36.97	4.98

Note: The power output may depend on the intended use of the EUT. For all tests, the EUT was set to maximum conditions.

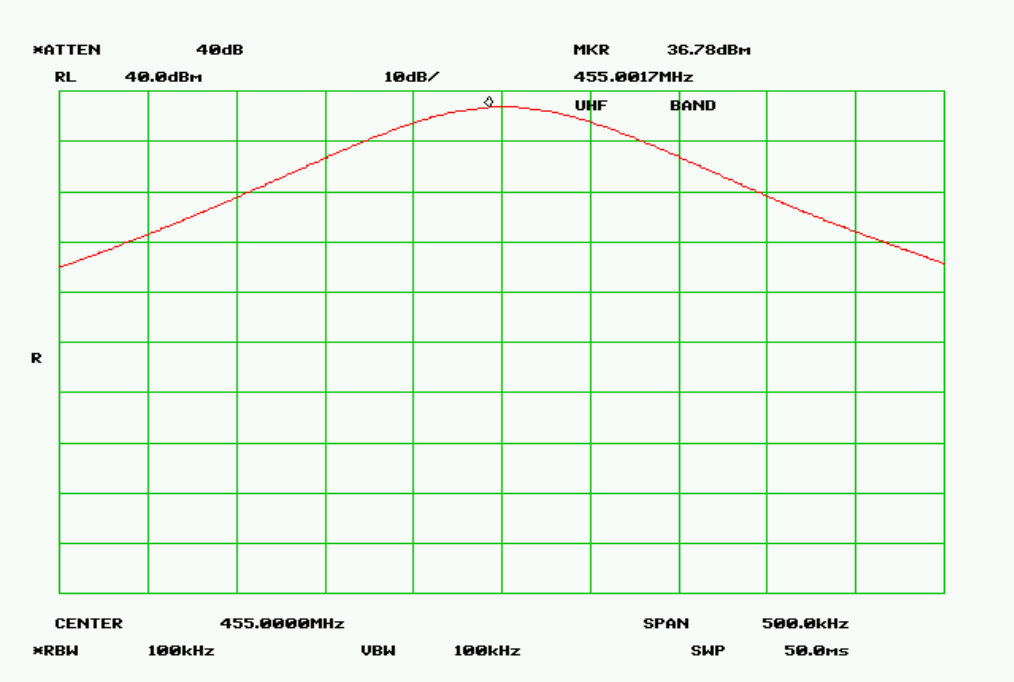
Conducted Output Power for UHF (25 KHz)



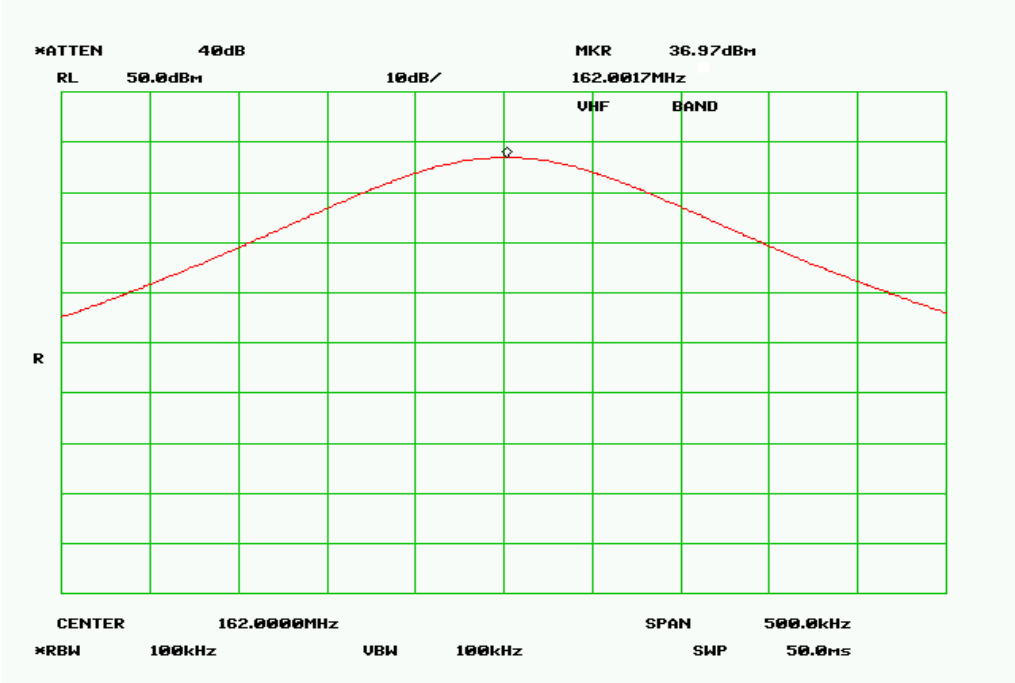
Conducted Output Power for VHF (25 KHz)



Conducted Output Power for UHF (12.5 KHz)



Conducted Output Power for VHF (12.5 KHz)



§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 2.2.3

Environmental Conditions

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

** The testing was performed by Taylor Tsai on 2006-3-28.*

Test Equipment List and Details

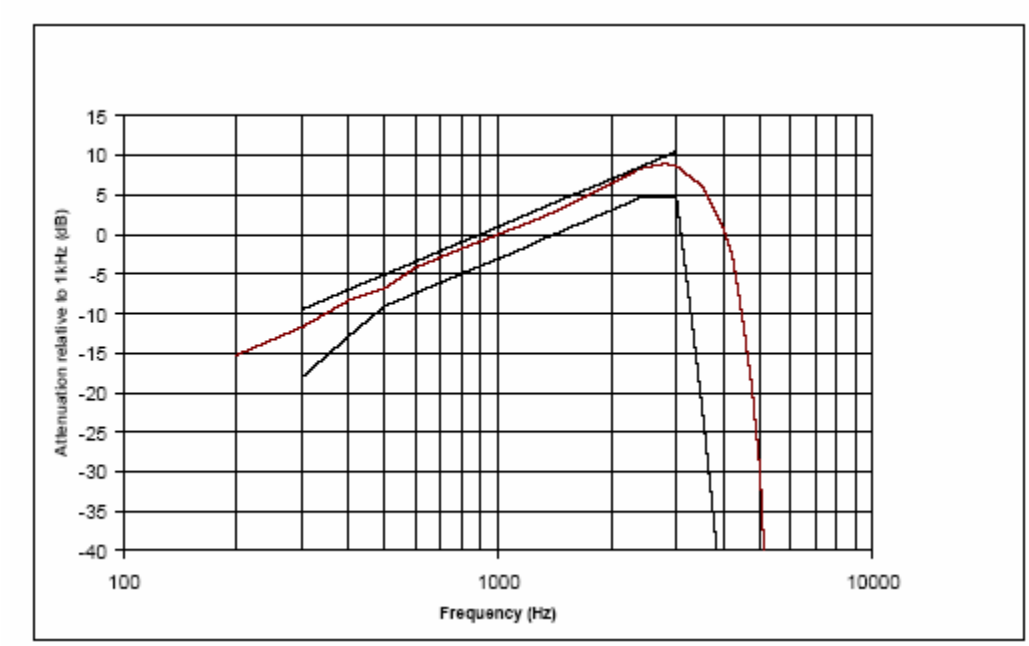
Manufacturer	Description	Model	Serial Number	Cal. Date
Aglient	Function/Arbitrary Waveform Generator	33220A	33220A	2005-05-18
HP	Modulation Analyzer	8901A	2026A00847	2006-01-17

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

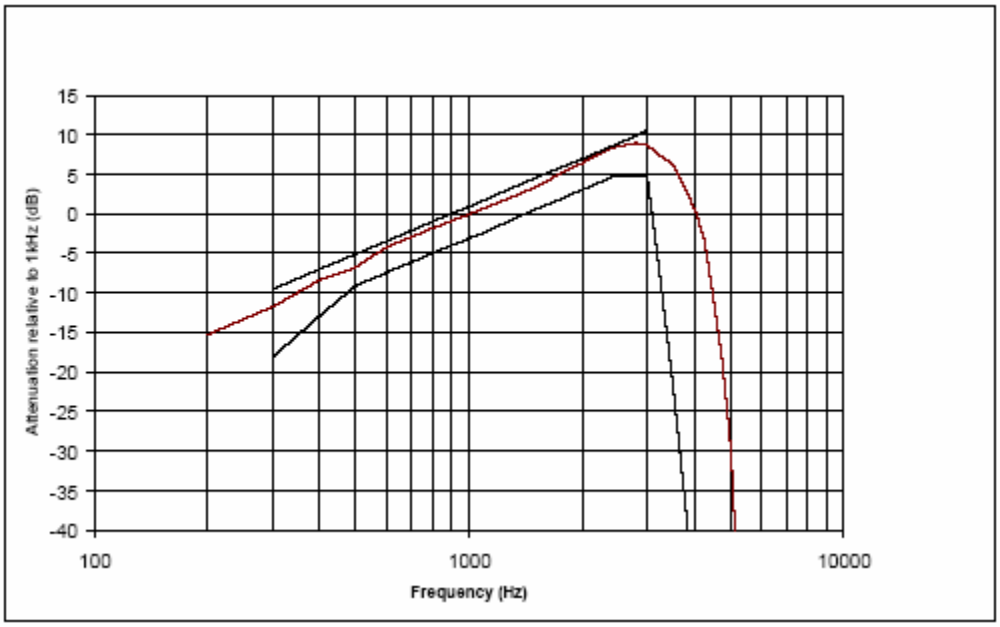
Test Result

Test Mode: Transmitting

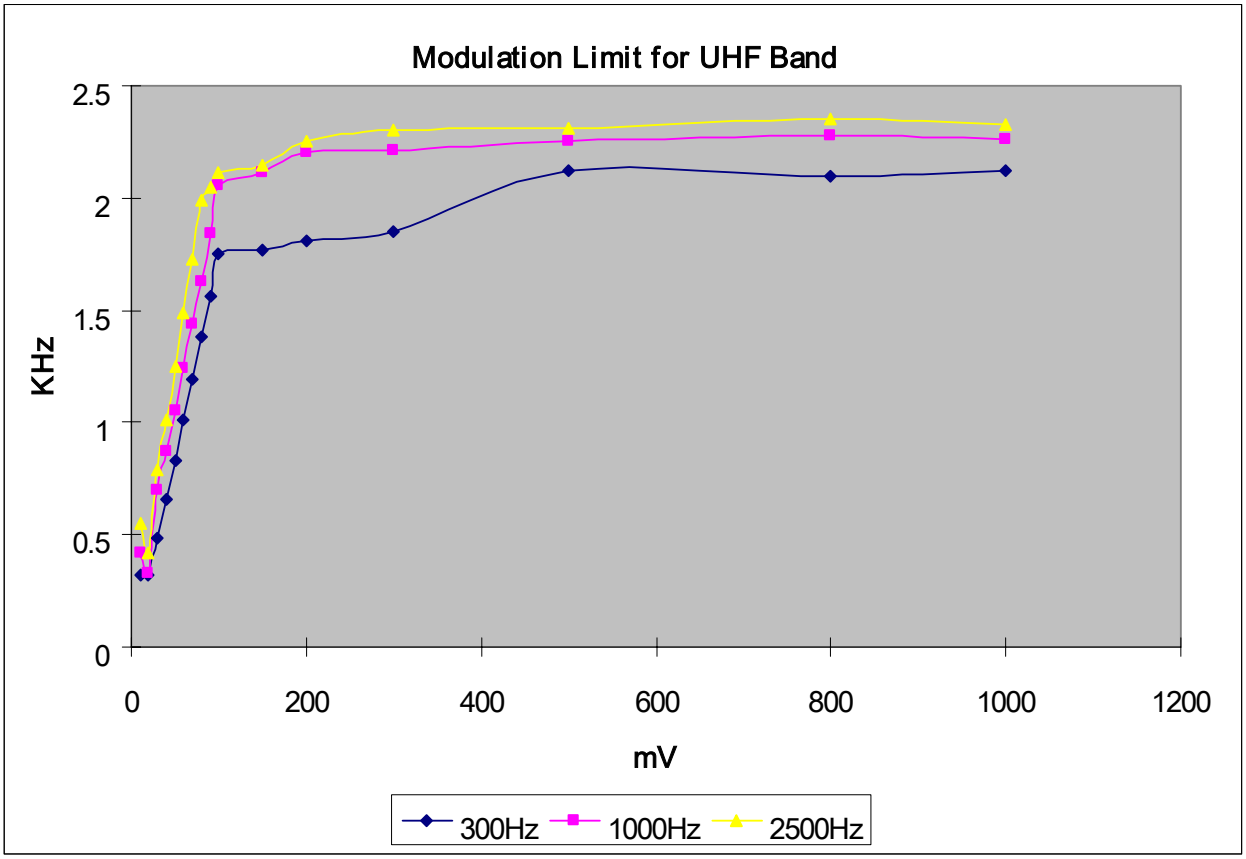
Audio Frequency Response for PT5-UHF Band (12.5 KHz Channel Spacing)



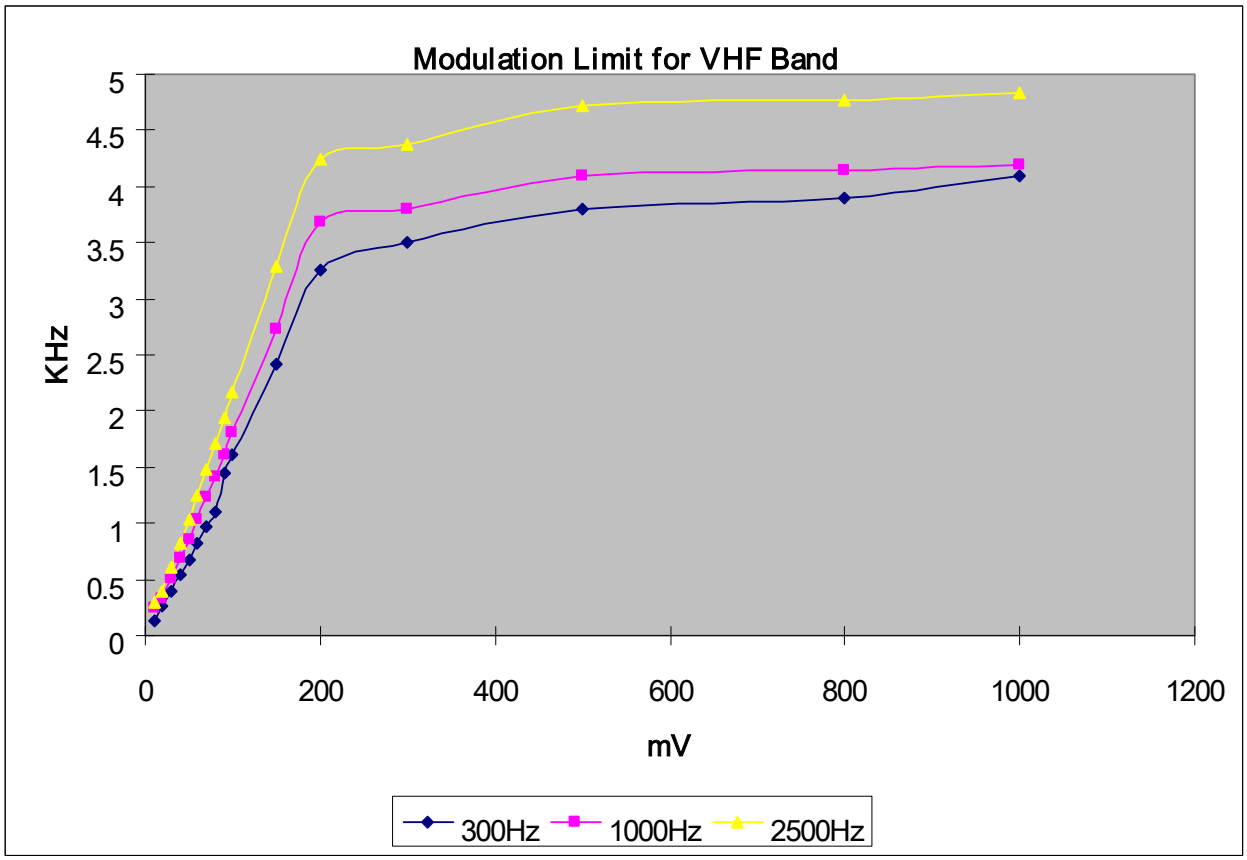
Audio Frequency Response for PT5-UHF Band (25 KHz Channel Spacing)



Modulation Limit For *PT5-UHF, channel separation = 12.5Khz*



Modulation Limit For *PT5-VHF , channel separation = 25Khz*



§2.1049, 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 5.625kHz 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 5.626kHz but no more than 12.5kHz, at least 7.27 (f_d –2.88kHz) 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+10logP=50+10log(3.96)=55.56dB

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 300Hz 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 300 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 Taylor Tsai on 2006-3-28.*

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2006-03-06

*** 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

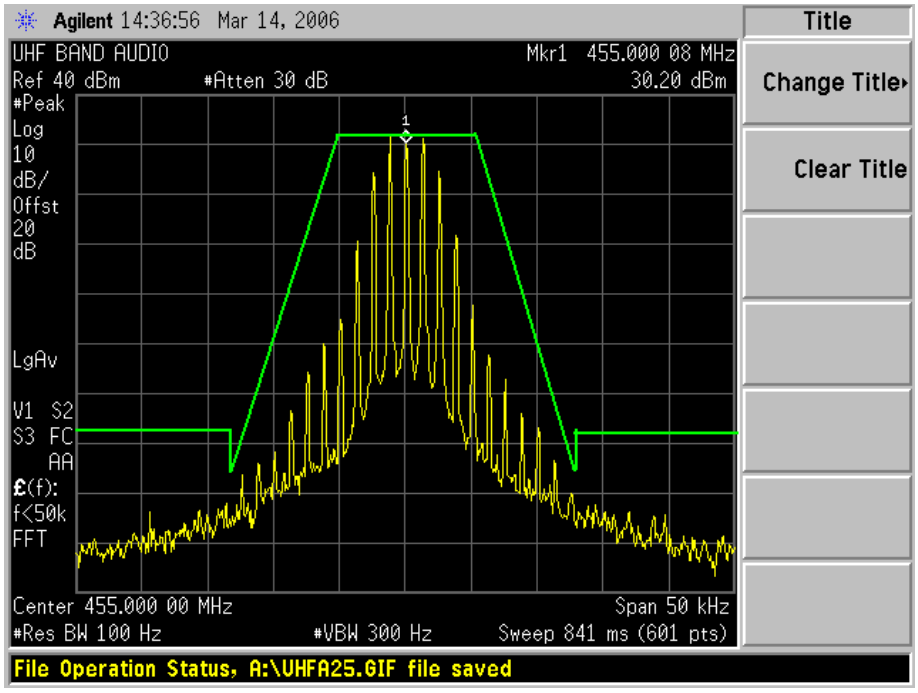
Please refer to the hereinafter plots.

Emission Designator:

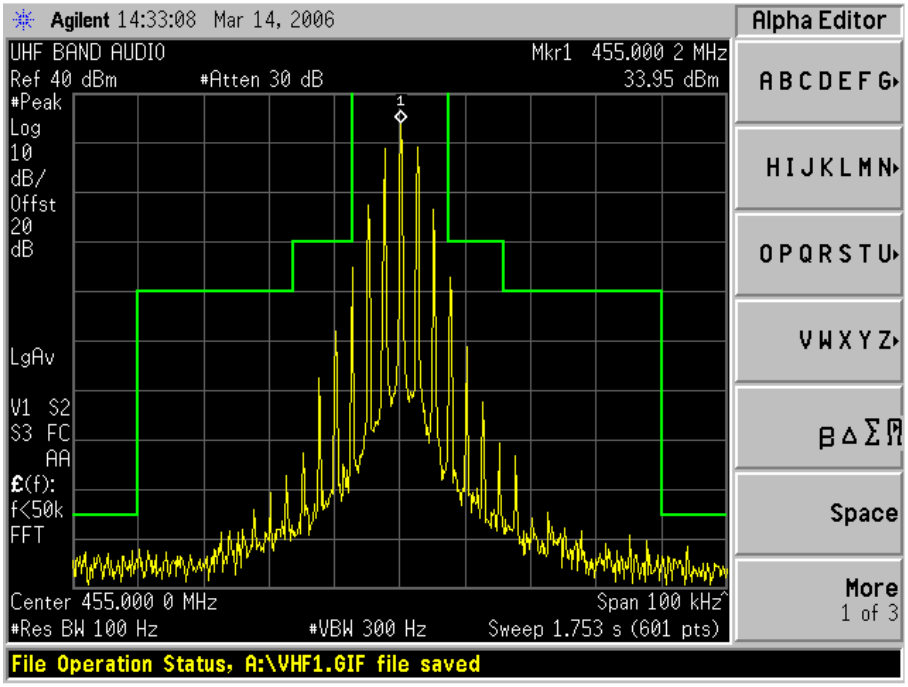
For 12.5 KHz Channel Spacing: 2M+2D = 2x3+2x2.5 => 11K0F1D, 11K0F3D, 11K0F3E

For 25 KHz Channel Spacing: 2M+2D = 2x3+2x5 => 16K0F1D, 16K0F3D, 16K0F3E

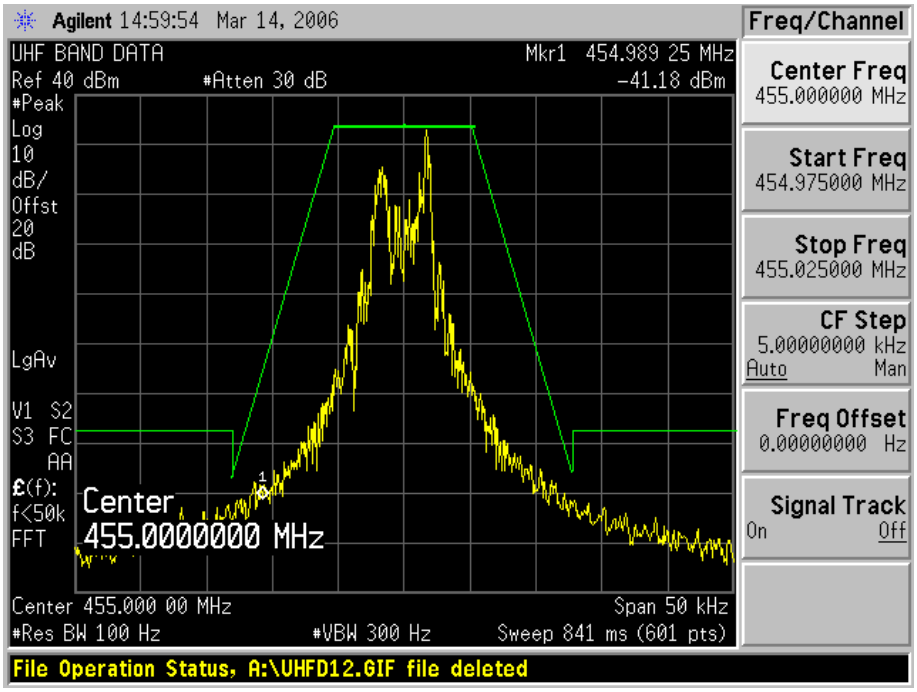
For PT5- UHF Audio 12.5 kHz



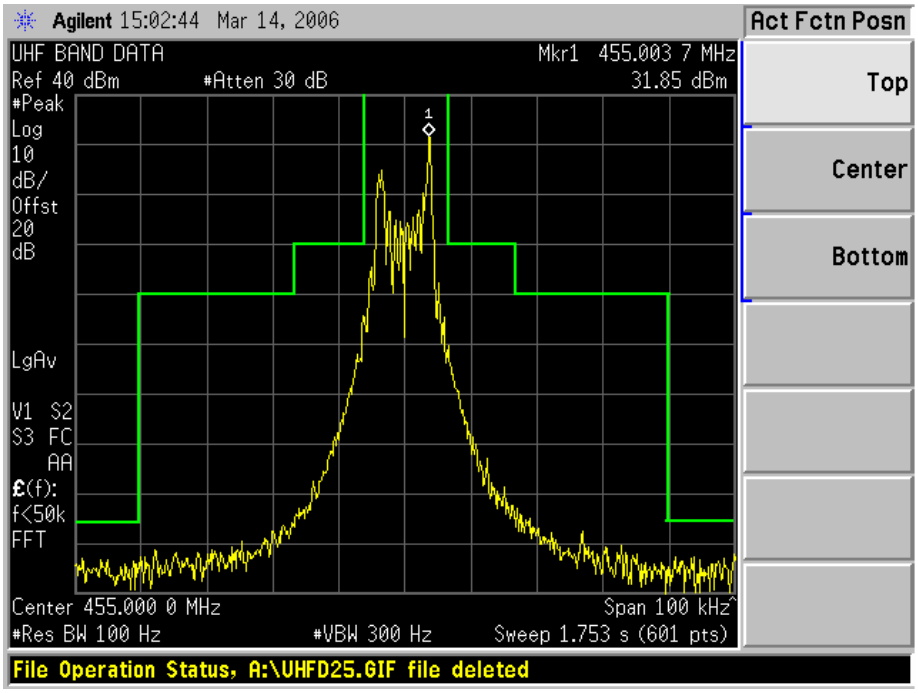
For PT5- UHF Audio 25 kHz



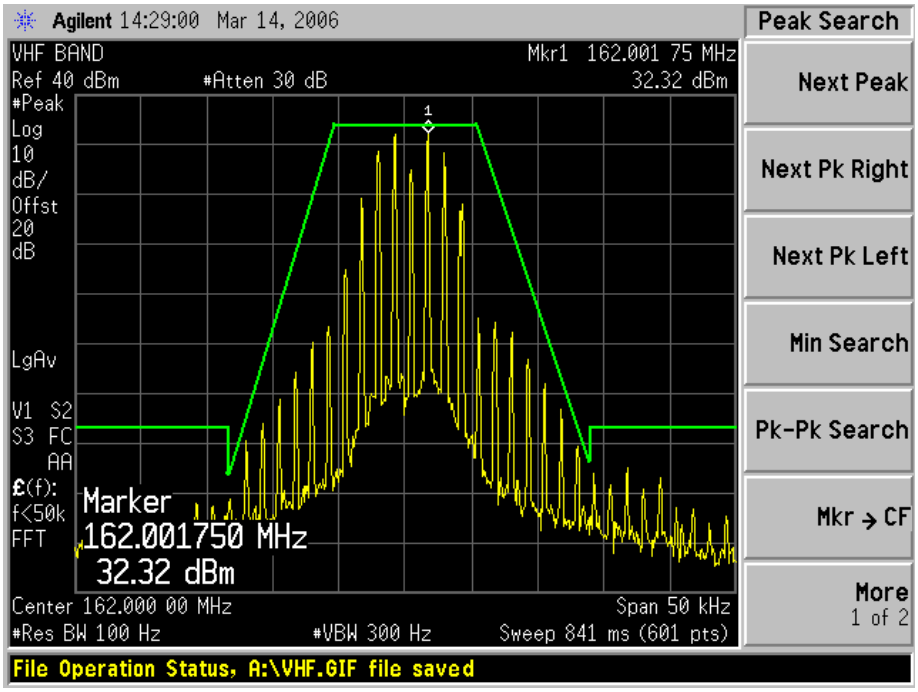
For PT5- UHF Data 12.5 kHz



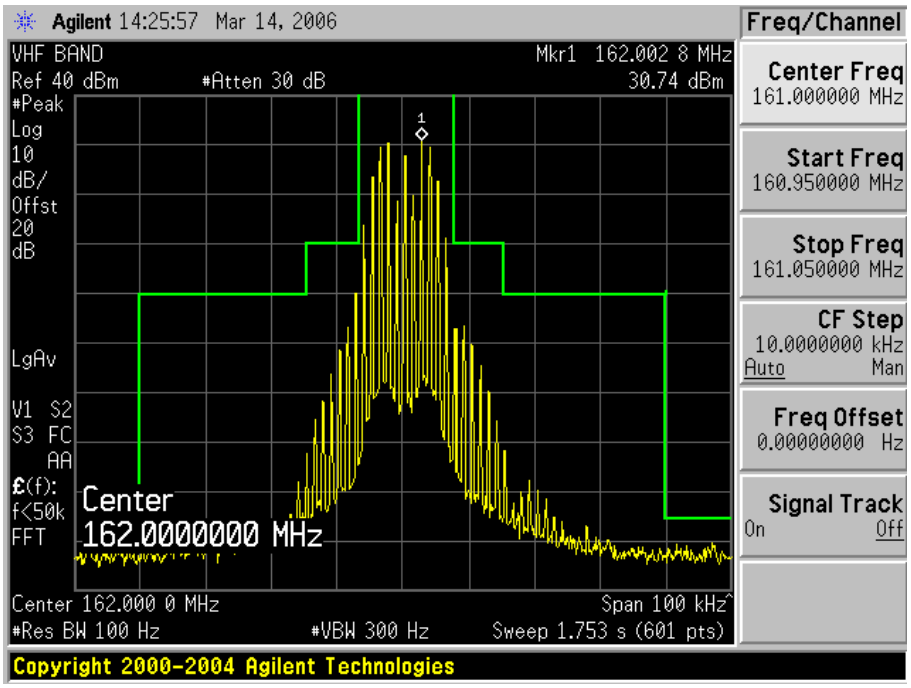
For PT5- UHF Data 25 kHz



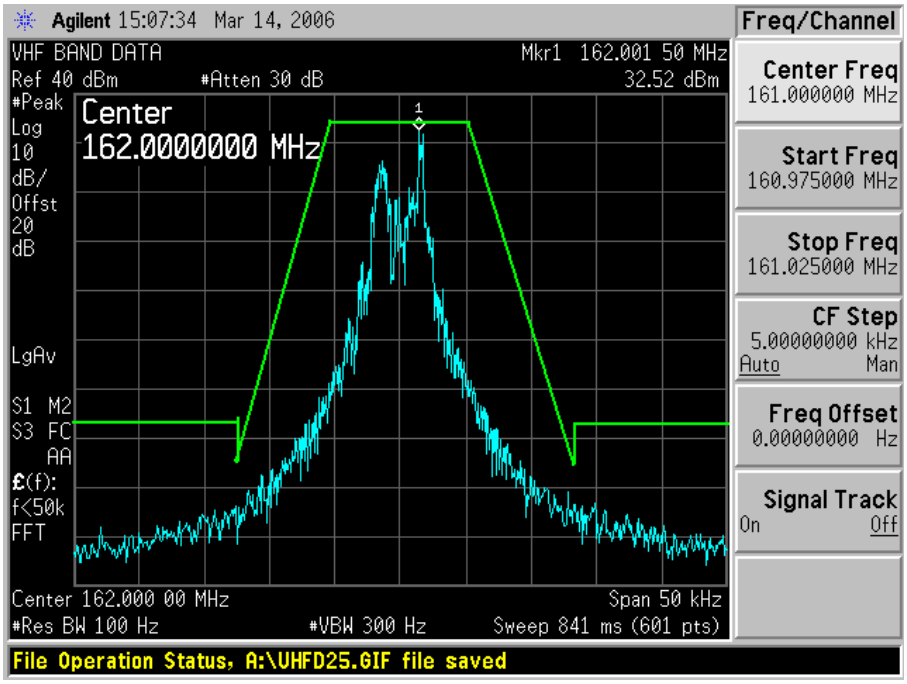
For PT5- VHF Audio 12.5 kHz



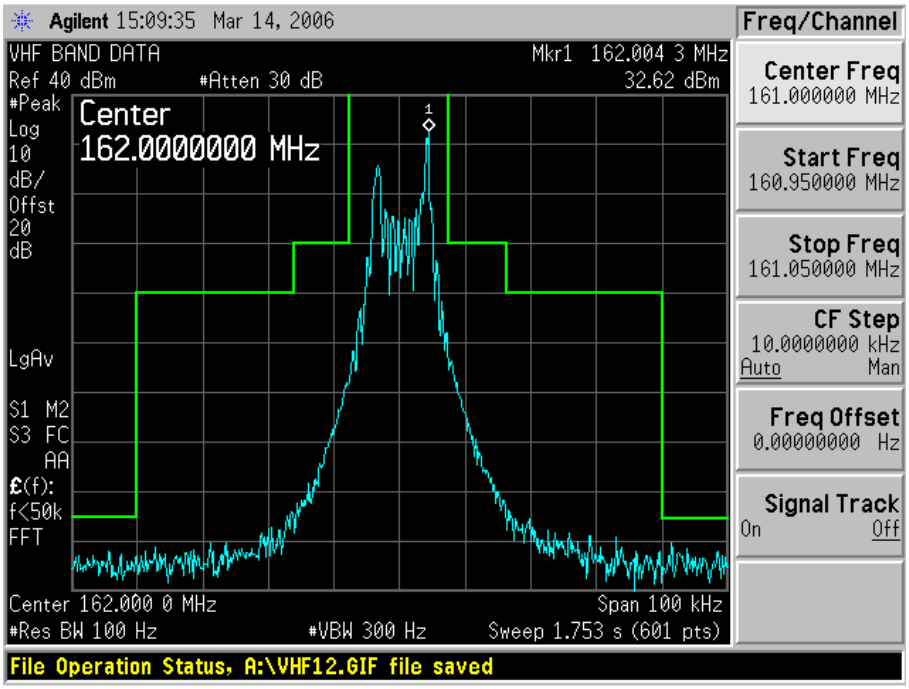
For PT5- VHF Audio 25 kHz



For PT5- VHF Data 12.5 kHz



For PT5- VHF Data 25 kHz



§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=50+10log (3.96) =55.56dB

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

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

43+10logP=43+10log (3.93) =48.94dB

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 Taylor Tsai on 2006-3-28.*

Test Equipment List and Details

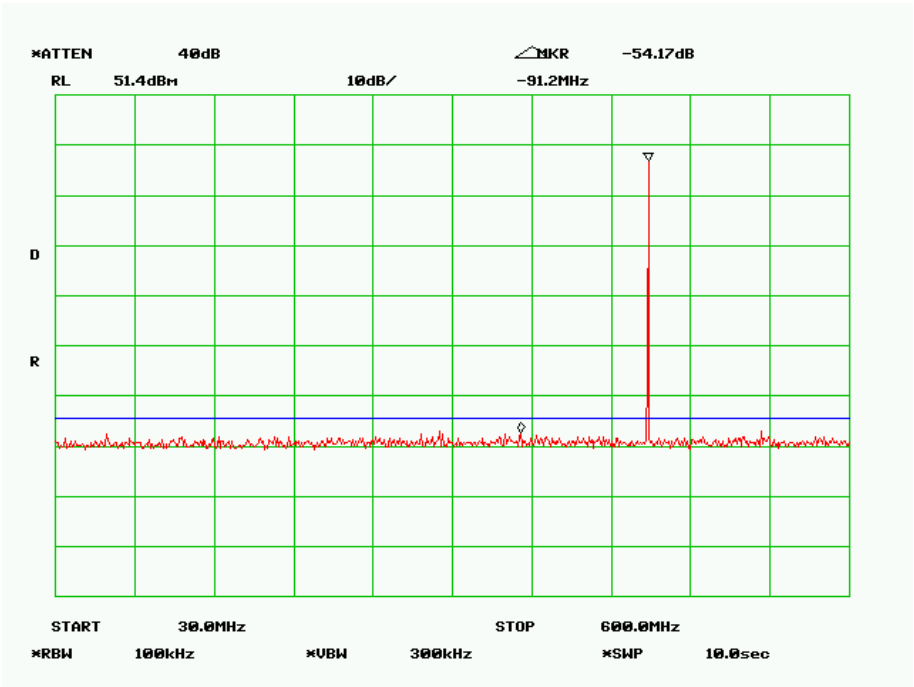
Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2006-03-06
Aglient	Spectrum Analyzer	8565EC	06042	2006-01-11

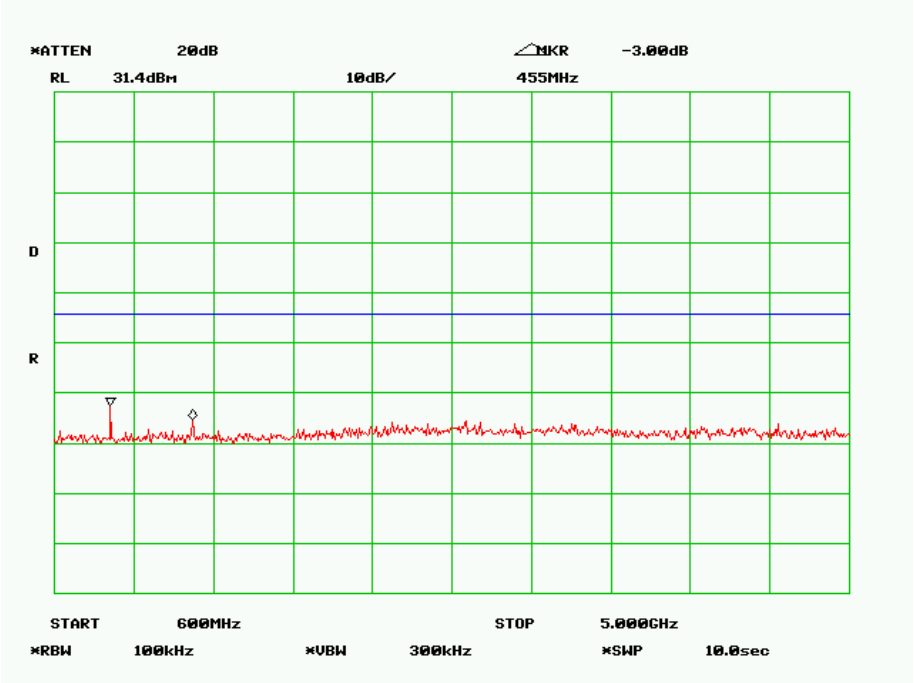
*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Results

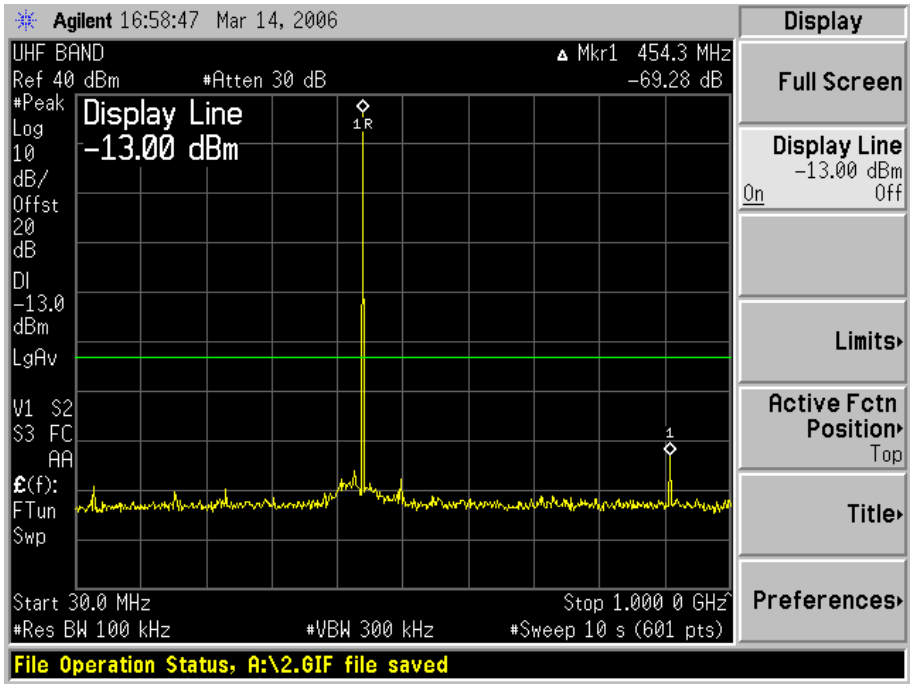
Test Mode: Transmitting Using Conducted measuring method

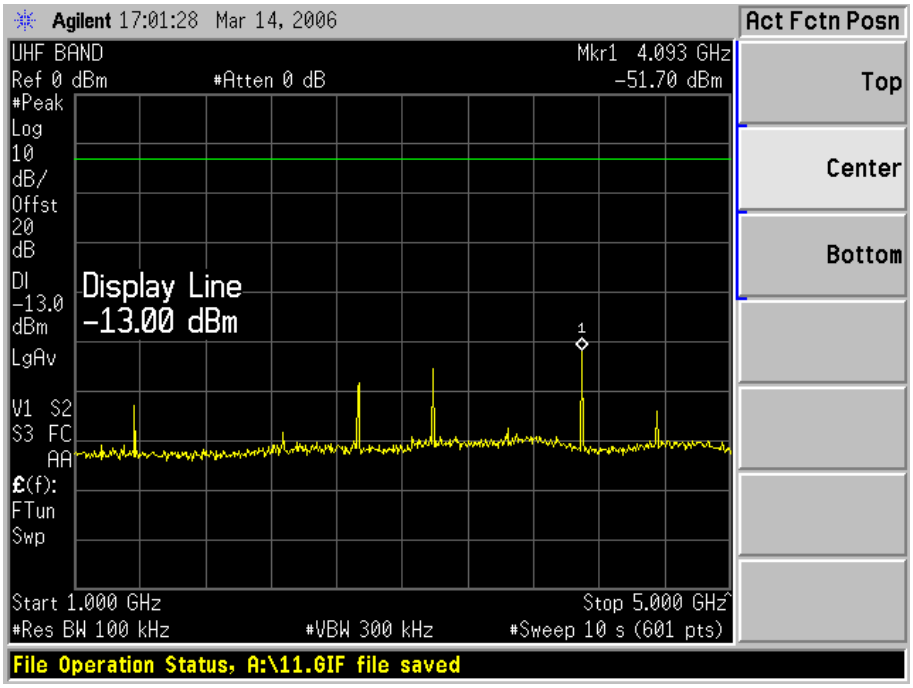
For PT5- UHF 12.5 kHz Channel Bandwidth:



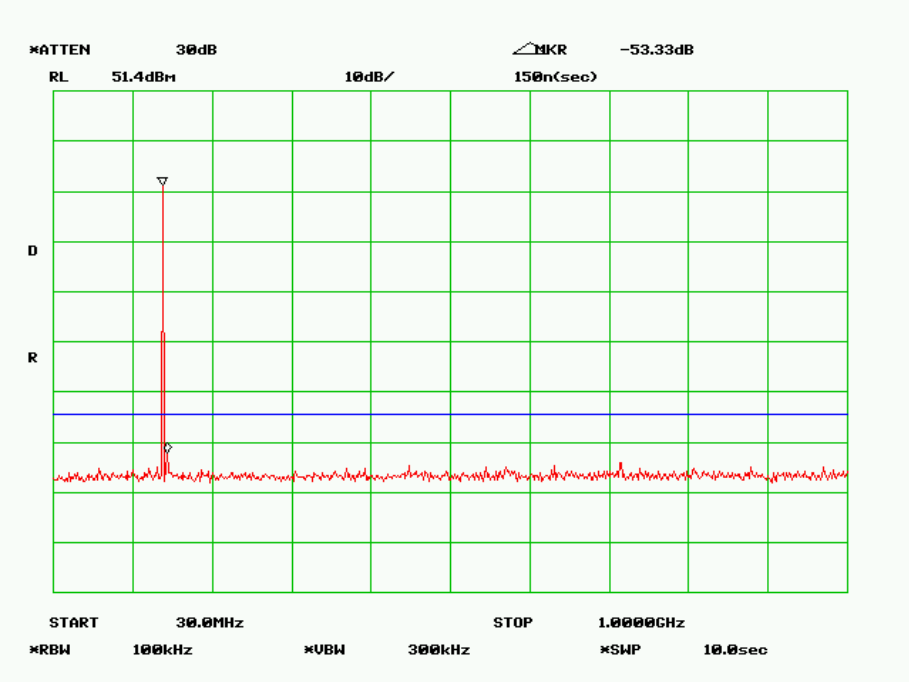


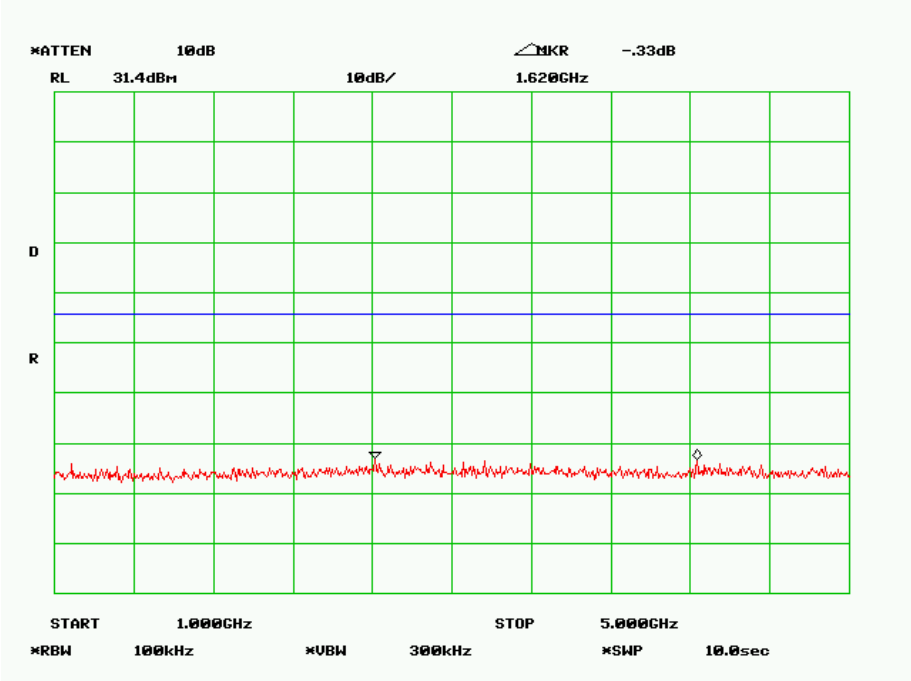
For PT5- UHF 25 kHz Channel Bandwidth:



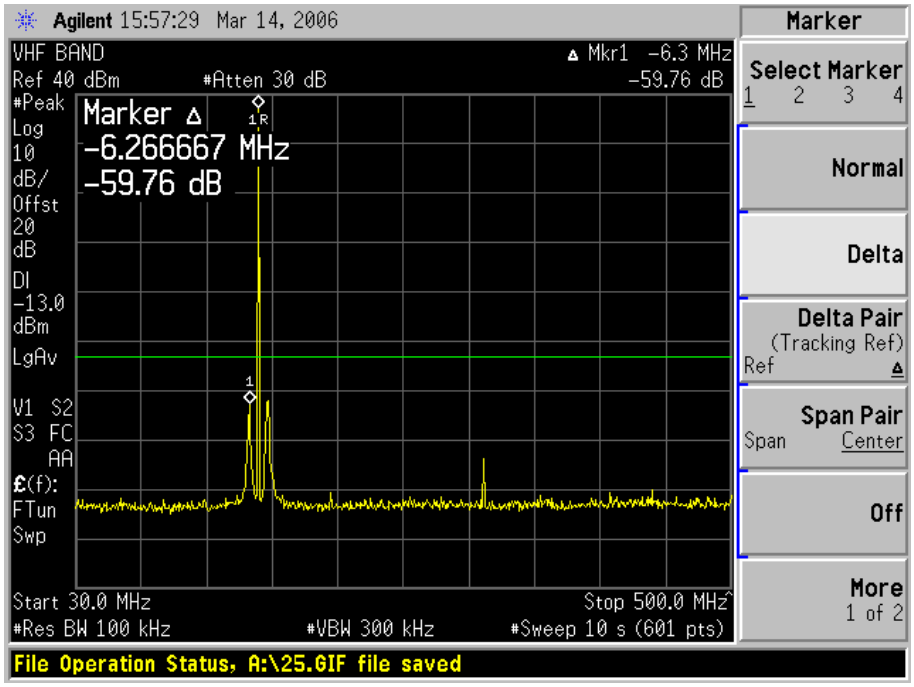


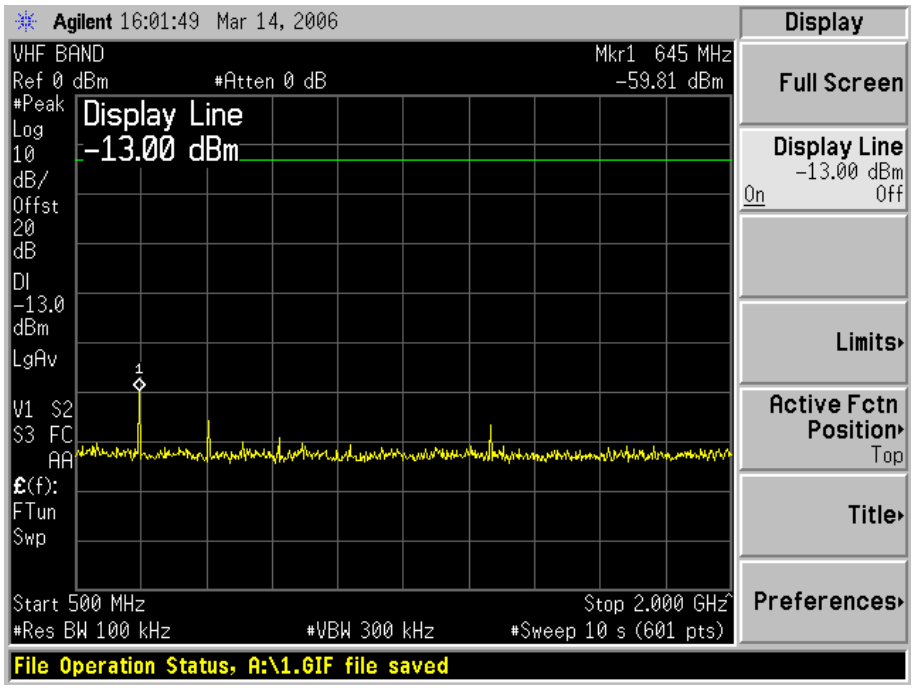
For PT5- VHF 12.5 kHz Channel Bandwidth:





For PT5- VHF 25 kHz Channel Bandwidth:





§2.1055 (d) 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 115% 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 Taylor Tsai on 2006-3-28.*

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Agilent	Spectrum Analyzer	E4446A	US44300386	2006-03-06
Tenney	Ove, 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 PT5- UHF Band

Condition		Ref Frequency	Measured Freq	Frequency Error	Limit
Voltage (v)	**Temperature (C)**	**MHz**	**MHz**	**ppm**	**ppm**
120	60	455.000000	454.999885	0.25	±5.00
120	50	455.000000	454.999801	0.44	±5.00
120	40	455.000000	455.000138	0.30	±5.00
120	30	455.000000	455.000411	0.90	±5.00
120	20	455.000000	455.000452	0.99	±5.00
120	10	455.000000	455.000479	1.05	±5.00
120	0	455.000000	455.00044	0.97	±5.00
120	-10	455.000000	455.000341	0.75	±5.00
120	-20	455.000000	455.000365	0.80	±5.00
120	-30	455.000000	455.000375	0.82	±5.00
138	60	455.000000	454.999876	0.27	±5.00
102	-30	455.000000	455.000306	0.67	±5.00
138	60	455.000000	454.999895	0.23	±5.00
102	-30	455.000000	455.000358	0.79	±5.00

For PT5- VHF Band

Condition		Ref Frequency	Measured Frequency	Frequency Error	Limit
Voltage (v)	**Temperature (C)**	**MHz**	**MHz**	**ppm**	**PPM**
120	60	162.000000	162.00025	1.61	±5.00
120	50	162.000000	162.000196	1.26	±5.00
120	40	162.000000	162.000205	1.32	±5.00
120	30	162.000000	162.000189	1.22	±5.00
120	20	162.000000	162.000165	1.06	±5.00
120	10	162.000000	162.000138	0.89	±5.00
120	0	162.000000	162.000326	2.10	±5.00
120	-10	162.000000	162.000355	2.29	±5.00
120	-20	162.000000	162.000425	2.74	±5.00
120	-30	162.000000	162.000436	2.81	±5.00
138	60	162.000000	162.000256	1.65	±5.00
102	-30	162.000000	162.000442	2.85	±5.00
138	60	162.000000	162.000241	1.55	±5.00
102	-30	162.000000	162.000439	2.83	±5.00

§90.214 - TRANSIENT FREQUENCY BEHAVIOR

Applicable Standard

§90.214

Test Procedure

TIA/EIA-603 2.2.19

Environmental Conditions

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

** The testing was performed by Taylor Tsai on 2006-3-28.*

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Cal. Date
Aglient	Function/Arbitrary Waveform Generator	33220A	33220A	2005-05-18
HP	Modulation Analyzer	8901A	2026A00847	2006-01-17
Tektronix	Digital Phosphor Oscilloscope	TDS7104	B020557	2006-02-15
HP	Spectrum Analyzer	8566B	3026A20081	2005-08-31
HP	Qusai-Peak Adapter	85650A	2430A00350	2005-09-01

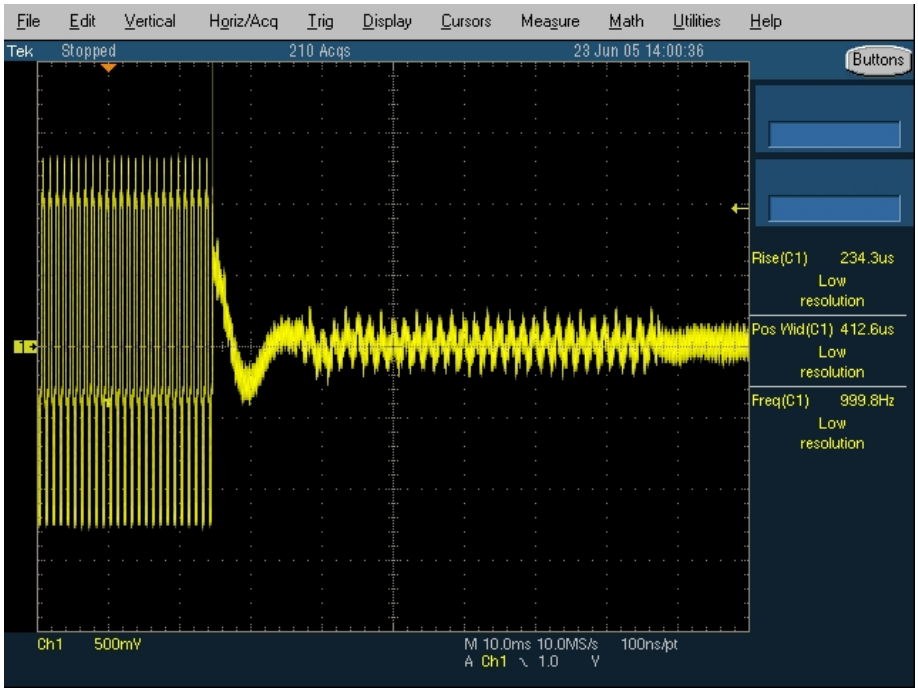
*** Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

Test Result

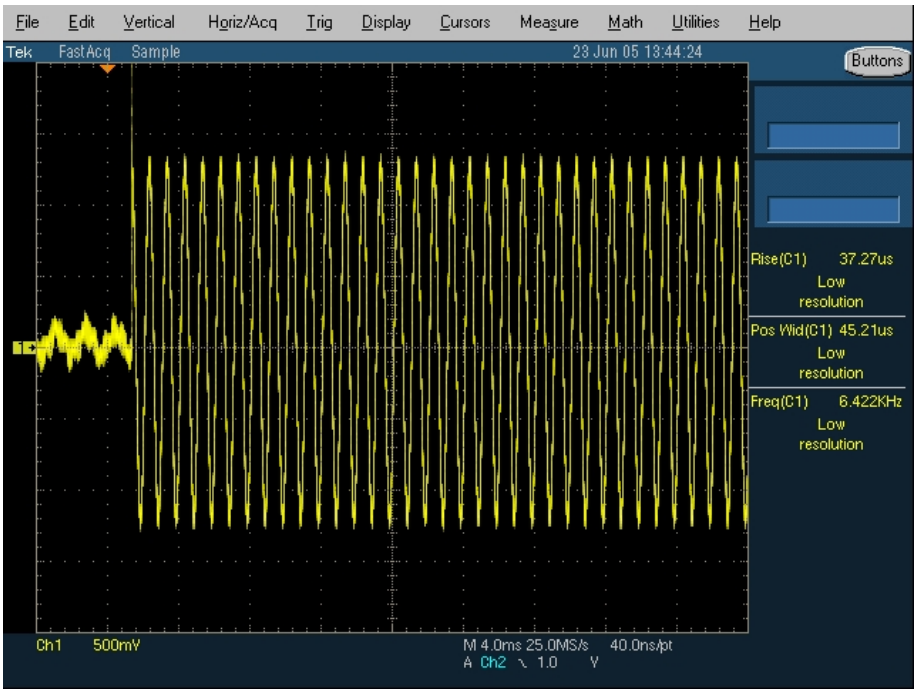
Test Mode: Transmitting

For PT5- UHF 12.5 kHz

Turn on

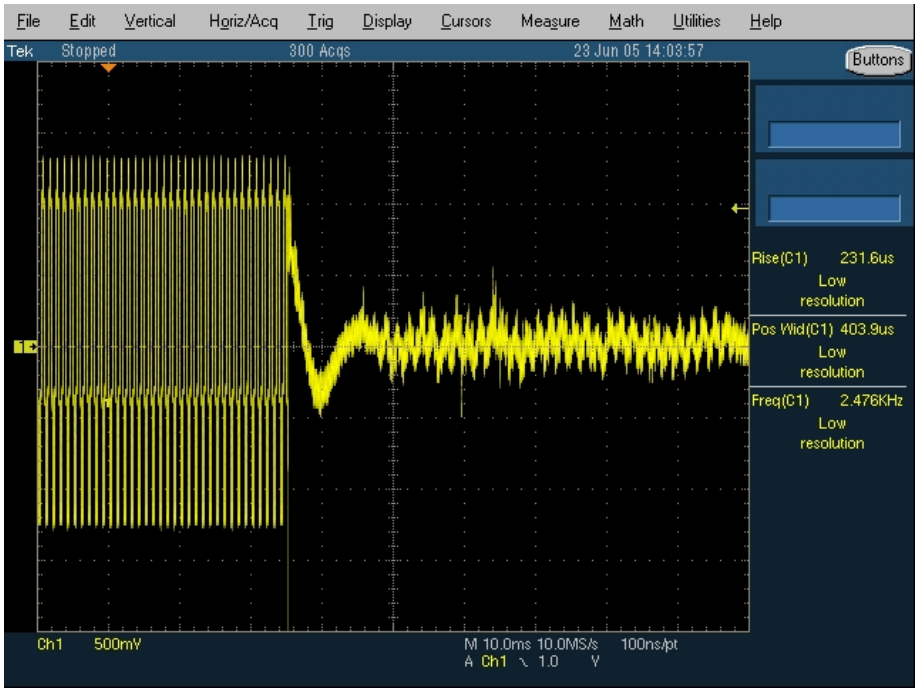


Turn off

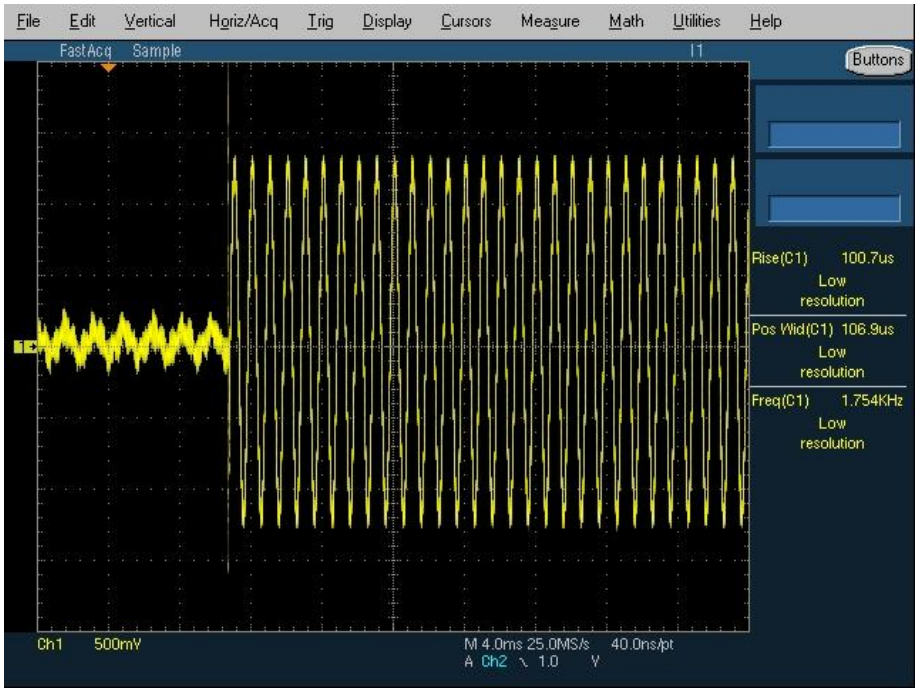


For PT5- UHF 25 kHz

Turn on

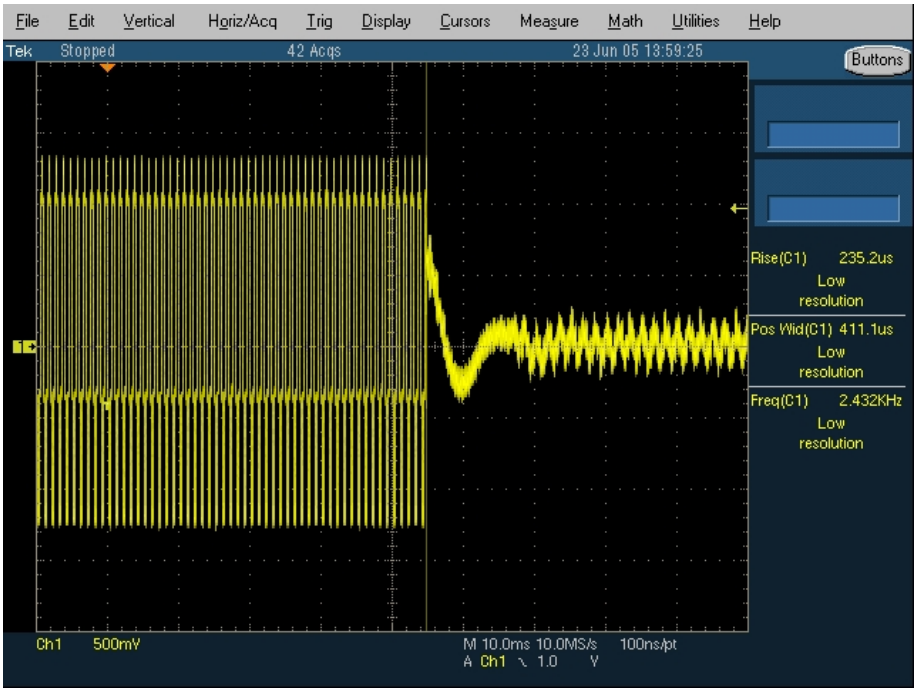


Turn off

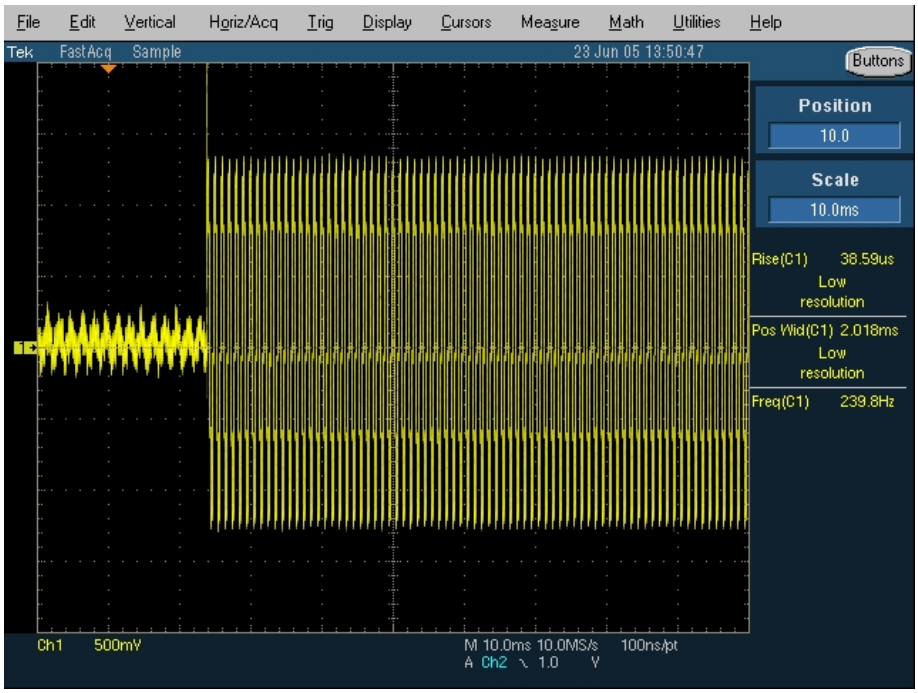


For PT5- VHF 12.5 kHz

Turn on

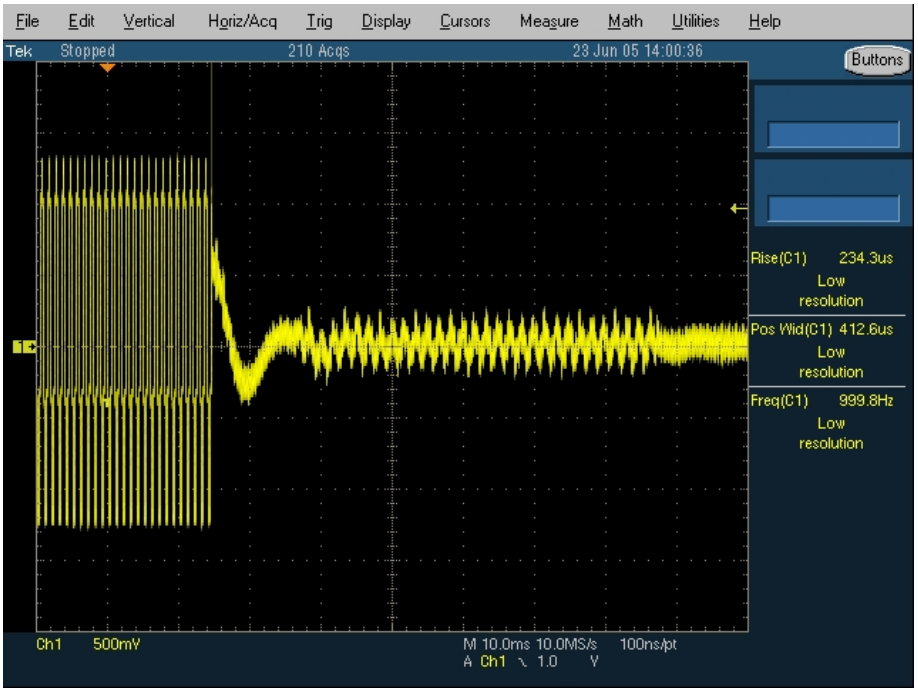


Turn off

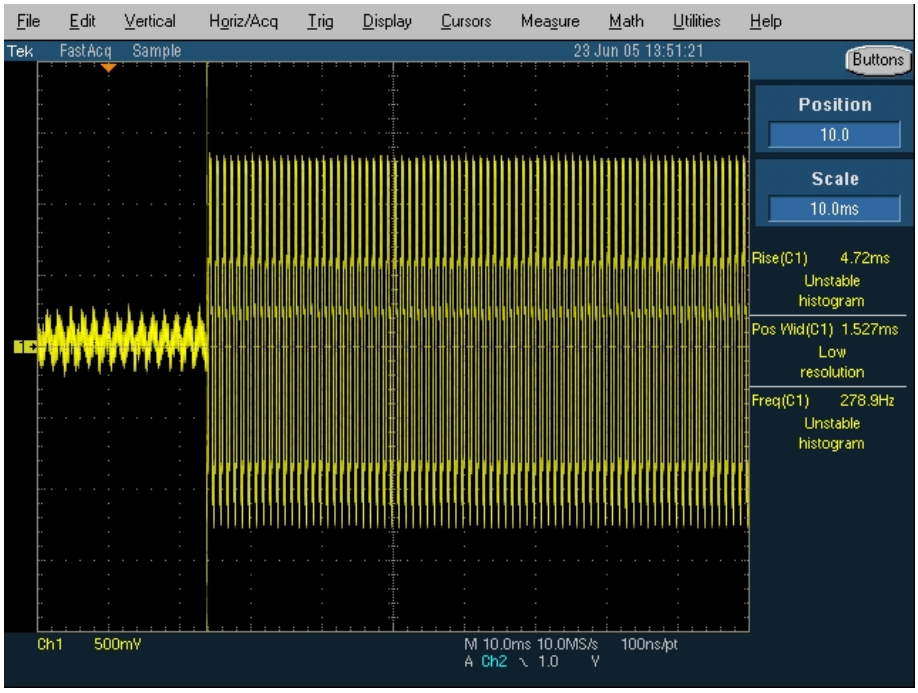


For PT5- VHF 25 kHz

Turn on



Turn off



§2.1053 and §90.210 - RADIATED SPURIOUS EMISSION

Applicable Standard

§2.1053 and §90.210(g)

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

Environmental Conditions

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

** The testing was performed by Taylor Tsai on 2006-3-28.*

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
HP	Amplifier, Pre, Microwave	8449B	3147A00400	2005-08-10
HP	Generator, Signal	83650B	3614A00276	2005-05-10
A.R.A.	Antenna, Horn	DRG-118/A	1132	2005-08-17
Sunol Sciences	Antenna	JB1	A013105-3	2006-03-15
A.R.A.	Antenna, Horn	DRG-118/A	1132	2005-08-17
Agilent	Spectrum Analyzer	E4446A	US44300386	2006-03-06

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

Test Result

*-1.4dB at 1364.98MHz, for UHF **
-17.6dB at 321.98MHz, for VHF

**Test data are within the measurement uncertainty ±4.0dB.*

Test Mode: Transmission Using substitution measuring method

UHF transmits at 455 MHZ

Freq. (MHz)	Measured Ampl. (dBuV/m)	Angle	Height Meter	Polar	SG Level dBm	Ant. Gain dB	Cable Loss dB	abs. Ampl dBm	Limit dBm	Margin
1364.98	39.90	245.25	1.7	H	-19.40	6.3	1.27	-14.4	-13	-1.4
1364.98	38.50	141.75	1.71	V	-20.35	6.3	1.27	-15.3	-13	-2.3
909.98	42.10	107.5	1.04	V	-65.5	6.6	0.83	-59.8	-13	-46.8
909.95	38.80	218	1.53	H	-60.1	6.6	0.83	-54.3	-13	-41.3

VHF transmits at 162 MHz

Freq. (MHz)	Measured Ampl. (dBuV/m)	Angle	Height Meter	Polar	SG Level dBm	Ant. Gain dB	Cable Loss dB	abs. Ampl dBm	Limit dBm	Margin
321.98	53.9	207	1.38	H	-29.80	0	0.84	-30.6	-13	-17.6
321.98	50.8	256.25	1.94	V	-31.80	0	0.84	-32.6	-13	-19.6
482.98	40.1	278.25	2.06	V	-37.00	0	0.83	-37.8	-13	-24.8
482.98	39.4	237	1.6	H	-37.60	0	0.83	-38.4	-13	-25.4