



FCC PART 90 TYPE APPROVALS
MEASUREMENT AND TEST REPORT
For
Comtek Communications Technology, Inc.

357 West 2700 South
Salt Lake City, UT 84115, USA

FCC ID: C6ZM175

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Product type: Person Communication Transmitter
Test Engineer: Oscar Au	
Report Number: R0708153	
Report Date: 2007-08-30	
Reviewed By: James Ma, Test Engineer	
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Note: This test report is for the customer shown above and their specific product only. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. This report **must not** be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

The report has been prepared on behalf of Comtek Communications Technology, Inc. and their product FCC ID: C6ZM175, or the EUT as referred to in the rest of this report. The EUT is a VHF Personal Communication Transmitter offering versatility for applications where one-way personal communications is required. This compact, personal transmitter is ideal for instructors and presenters who must communicate with persons some distance away or in a noisy environment..

Technical Specifications	
Frequency Band	72 - 76 MHz
Modulation Type	F3E
RF Output Power	40 milliWatts
Channel Spacing	20 kHz
Number of Channels	88
Power Supply	9 Volt battery
Antenna Type	Body induction microphone cord antenna

Mechanical Description

The Comtek Communications Technology, Inc. product is a VHF Transmitter of plastic construction, which measures approximately 90 mm L x 56 mmW x 25 mmH and weighs 0.14 kg.

** The test data gathered are from production sample, serial number: B1306 & B1307 provided by the manufacturer.*

EUT Photo



Additional Photo in Exhibit C

Objective

This Type approval report is prepared on behalf of *Comtek Communications Technology, Inc.* in accordance with 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 and 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 94089, 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.

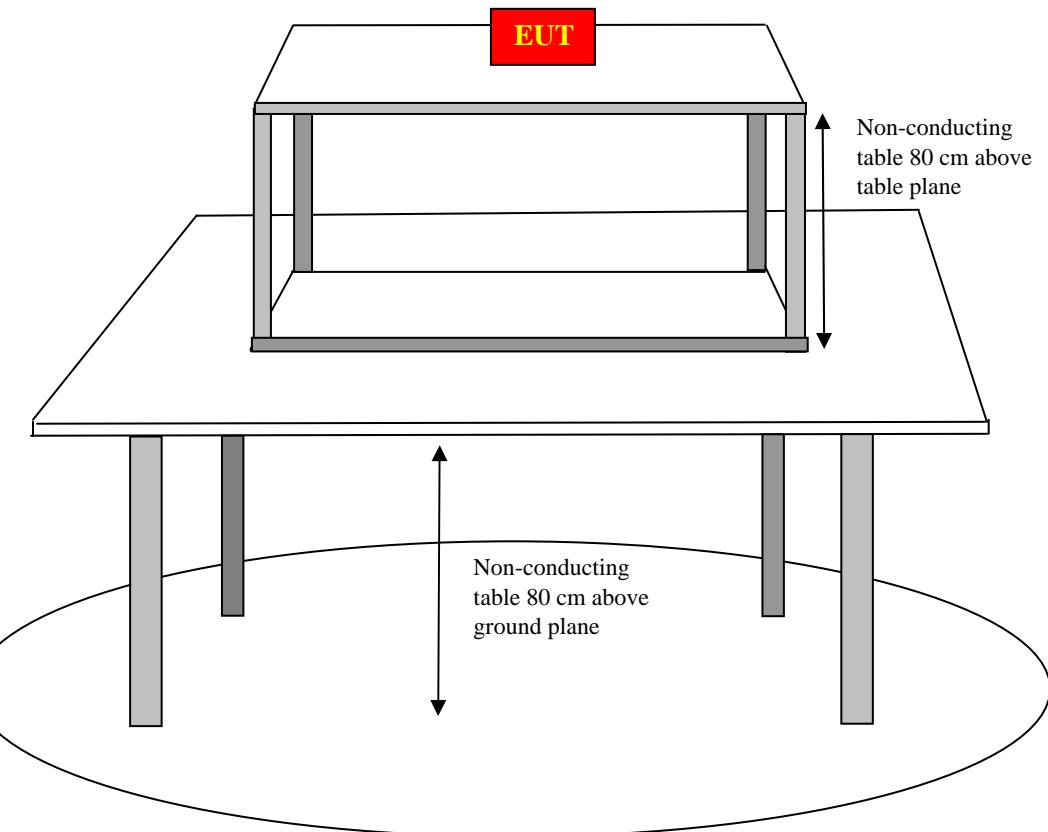
Equipment Modifications

No modifications were made to the EUT.

Power Supply and Line Filters

Manufacturer	Description	Model	Serial Number
Energizer	9V Alkaline battery	EN-22-6LR61-6AM6	N/A

Radiated Emission Test Setup Block Diagram



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
47 CFR §1.1310, 47 CFR §2.1093	RF Exposure	Compliant
47 CFR §2.1046, §90.205	RF Output Power	Compliant
47 CFR §2.1047, §90.207	Modulation characteristics	Compliant
47 CFR §2.1049, 47 CFR §90.209 47 CFR §90.210	Occupied Bandwidth, Emission Masks and Emission Limitation	Compliant
47 CFR §2.1051, 47 CFR §90.210	Spurious Emissions at Antenna Terminals	Compliant
47 CFR §2.1055, 47 CFR §90.213	Frequency stability	Compliant
47 CFR §2.1053, 47 CFR § 90.210	Field strength of spurious radiation,	Compliant

§1.1310 & §2.1093 - RF EXPOSURE**Applicable Standard**

According to FCC exclusion list, SAR evaluation is not required when the device or its antenna operates at less than 2.5 cm from a person's body and peak conducted output power not exceeds 790 mW at less than 76 MHz (based on general population and below the low threshold).

The output power of the EUT is 40 mW and is a body worn device operating at less than 2.5 cm from person's body; therefore SAR evaluation is not required.

Exposure category	<u>low threshold</u>	<u>high threshold</u>
general population	$(60/f_{GHz})$ mW, $d < 2.5$ cm $(120/f_{GHz})$ mW, $d \geq 2.5$ cm	$(900/f_{GHz})$ mW, $d < 20$ cm
occupational	$(375/f_{GHz})$ mW, $d < 2.5$ cm $(900/f_{GHz})$ mW, $d \geq 2.5$ cm	$(2250/f_{GHz})$ mW, $d < 20$ cm

§2.1046, and §90.205 - RF Output Power

Applicable Standard

According to FCC §2.1046, and §90.205(c) 72–76 MHz. The maximum effective radiated power (ERP) for stations operating on fixed frequencies is 300 watts. Stations operating on mobile-only frequencies are limited to one watt transmitter output power.

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:	45 %
ATM Pressure:	102.1 kPa

* The testing was performed by Oscar Au on 2007-08-28.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26
Sunol Sciences	30 - 3000 MHz	JB3	A020106-3 / S006628	2007-03-05
Com-Power	Antenna, Dipole	AD-100	2219	2007-04-26

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

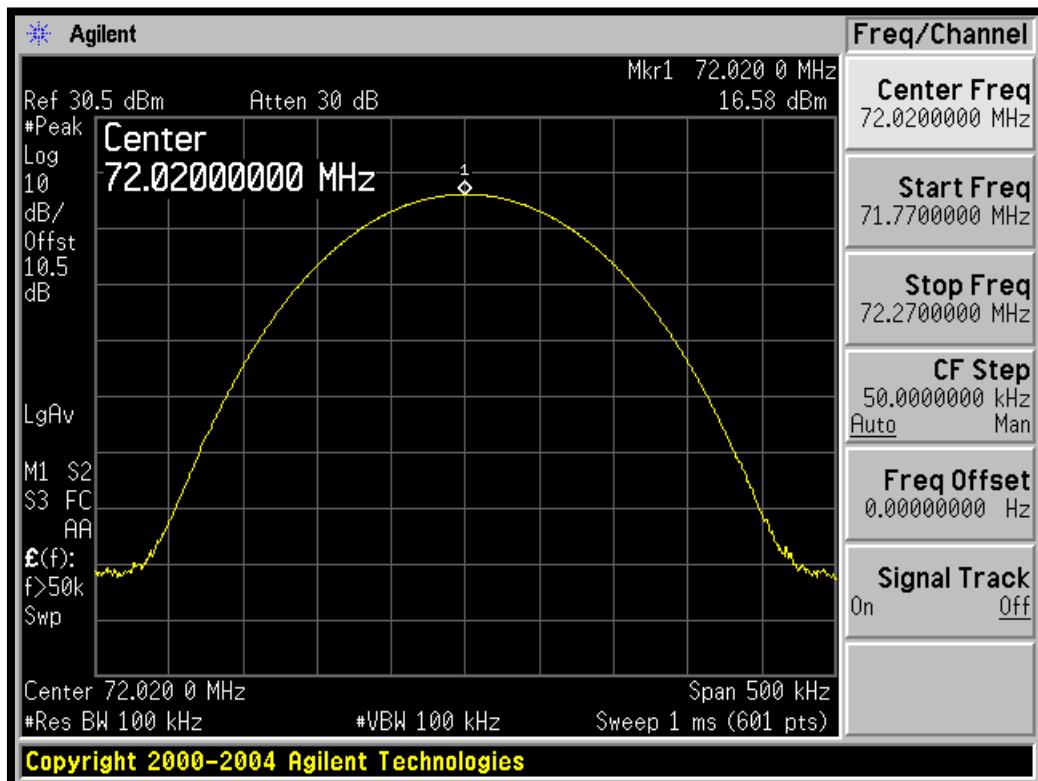
Test Result

Test Mode: Transmitting

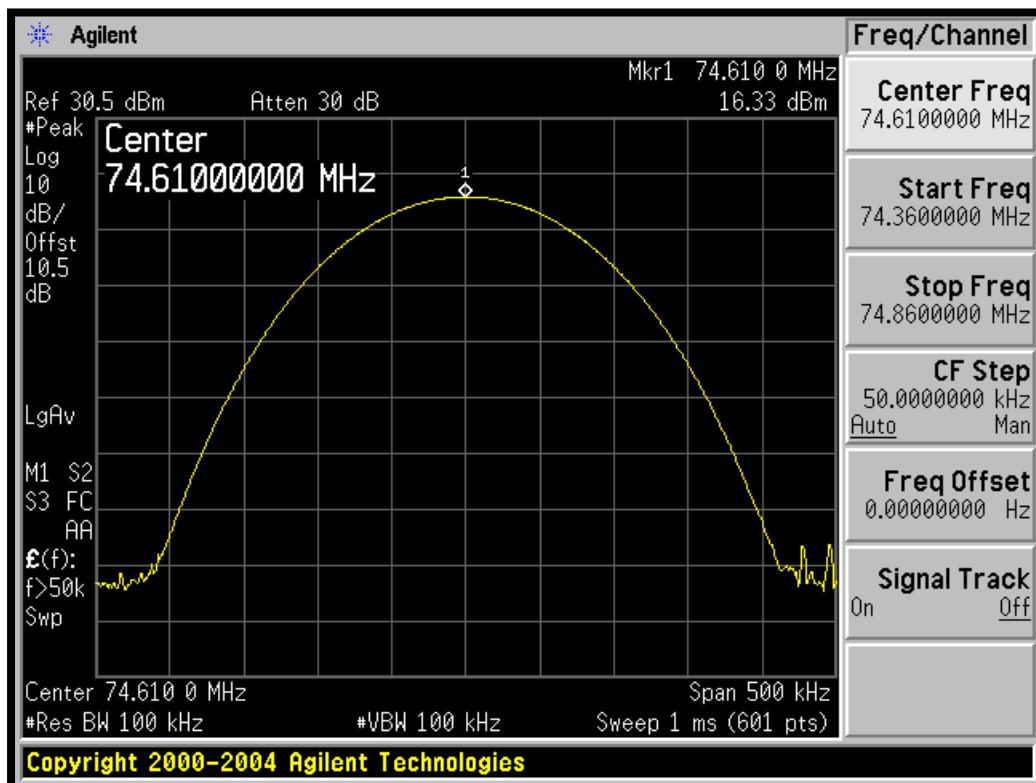
Antenna port conducted output power:

Frequency (MHz)	Output Power (dBm)	Output Power (mW)
72.02	16.58	45.50
74.61	16.33	42.95
75.98	15.86	38.55

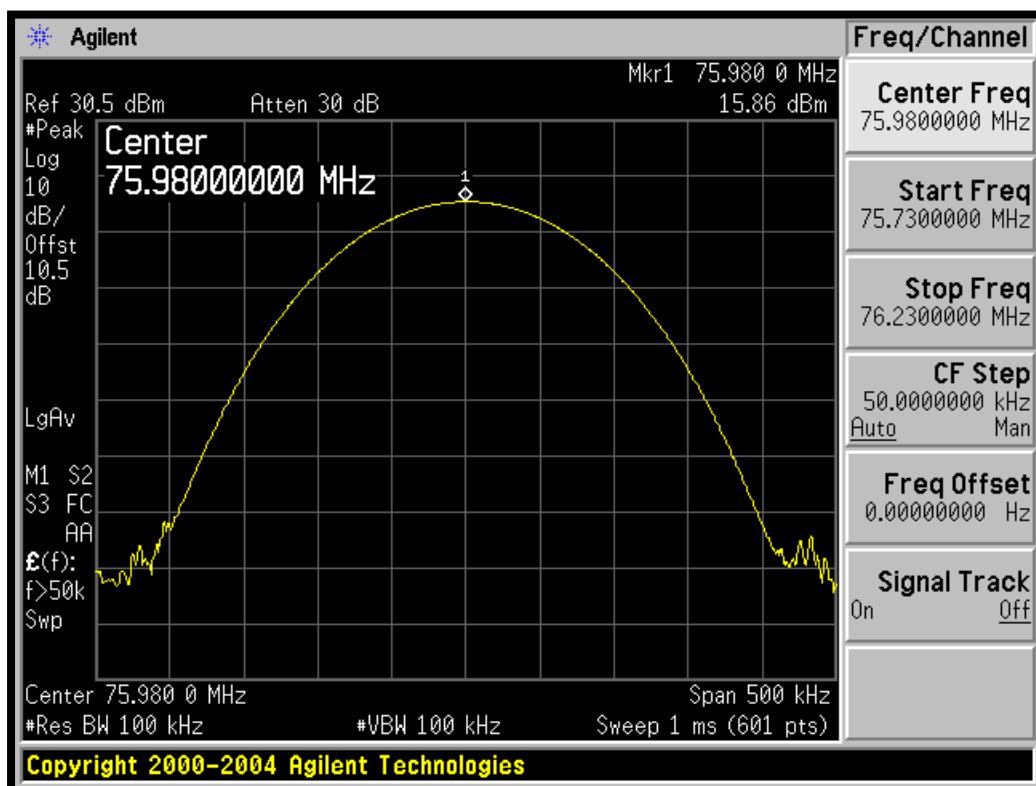
Low channel



Middle channel



High channel



ERP Power:

Indicated		Azimuth degrees	Test Antenna		Calculation				ERP in Watt (W)	
Frequency (MHz)	Amplitude (dBm)		Height (m)	Polar H/V	Freq. (MHz)	Path loss (dB)	Antenna Correction	Cable Loss (dB)		
72.02	-16.25	180	2.2	H	72.02	32	0	0.1	15.65	0.037
72.02	-20.83	255	2.5	V	72.02	32	0	0.1	11.07	0.013
74.61	-16.28	190	2.1	H	74.61	32	0	0.1	15.62	0.036
74.61	-21	295	2.9	V	74.61	32	0	0.1	10.9	0.012
75.98	-16.96	195	2.3	H	75.98	32	0	0.1	14.94	0.031
75.98	-21.51	265	2.5	V	75.98	32	0	0.1	10.39	0.011

§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:	43 %
ATM Pressure:	102.1 kPa

* The testing was performed by Oscar Au on 2007-08-28.

Test Equipment List and Details

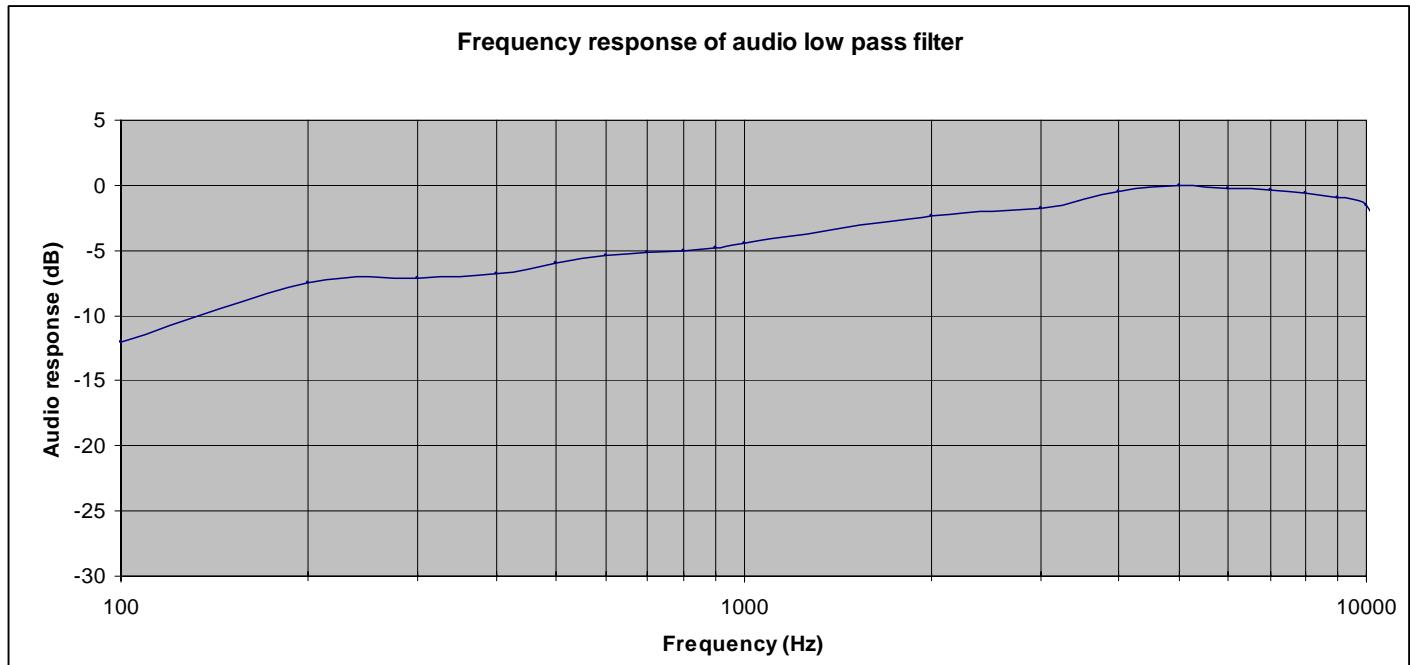
Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Function/ Arbitrary Waveform Generator	33220A	MY43004878	2007-06-07
HP	Modulation Analyzer	8901A	2026A00847	2006-01-17 (2 yrs)

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

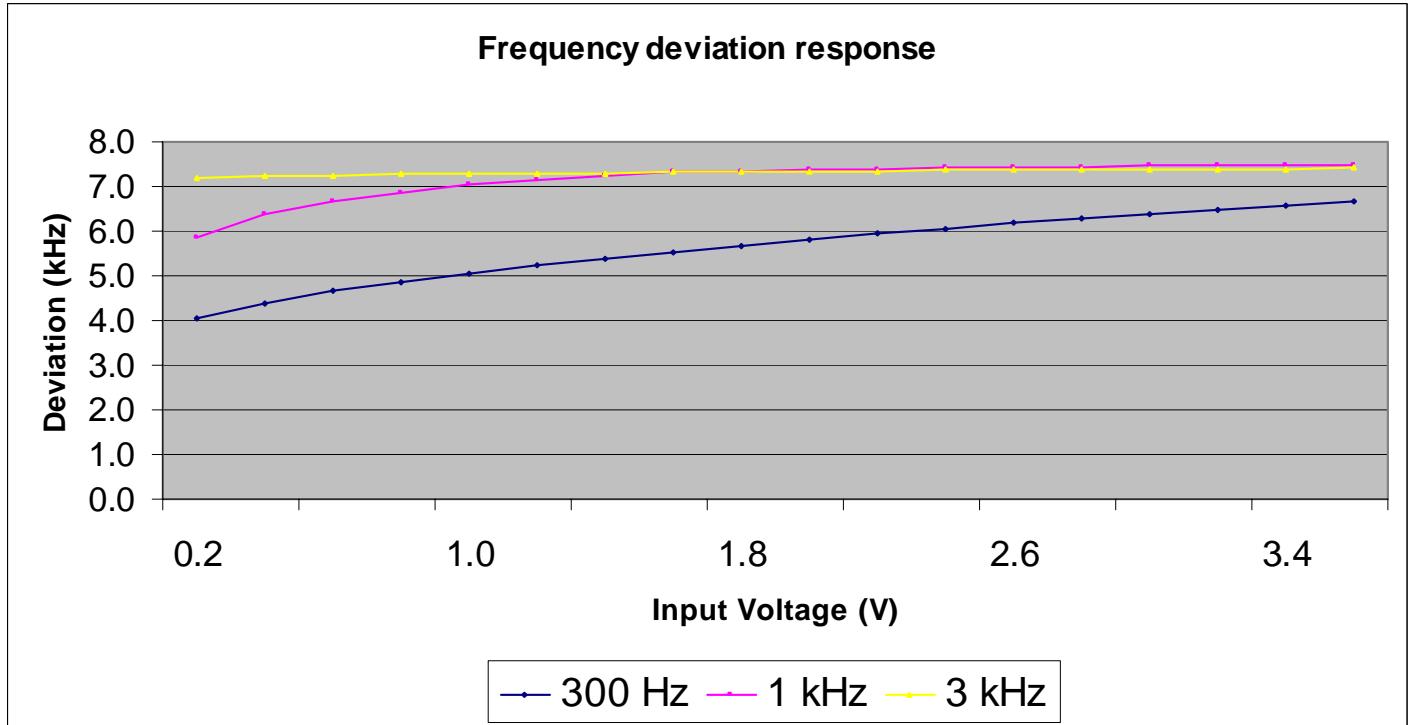
Test Result

Test Mode: Transmitting

Frequency response of low-pass filter



Modulation limiting:



§2.1049 and § 90.209(b) (5)/210 (b) – OCCUPIED BANDWIDTH, EMISSION MASKS & EMISSION LIMITATION

Applicable Standard

§90.209 (b) (5)

Operations in the 72-76 MHz range, channel spacing and authorized bandwidth is limited to 20 kHz.

§2.1049, §90.210 (b)

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:	22° C
Relative Humidity:	43 %
ATM Pressure:	102.1 kPa

* The testing was performed by Oscar Au on 2007-08-30.

Test Equipment List and Details

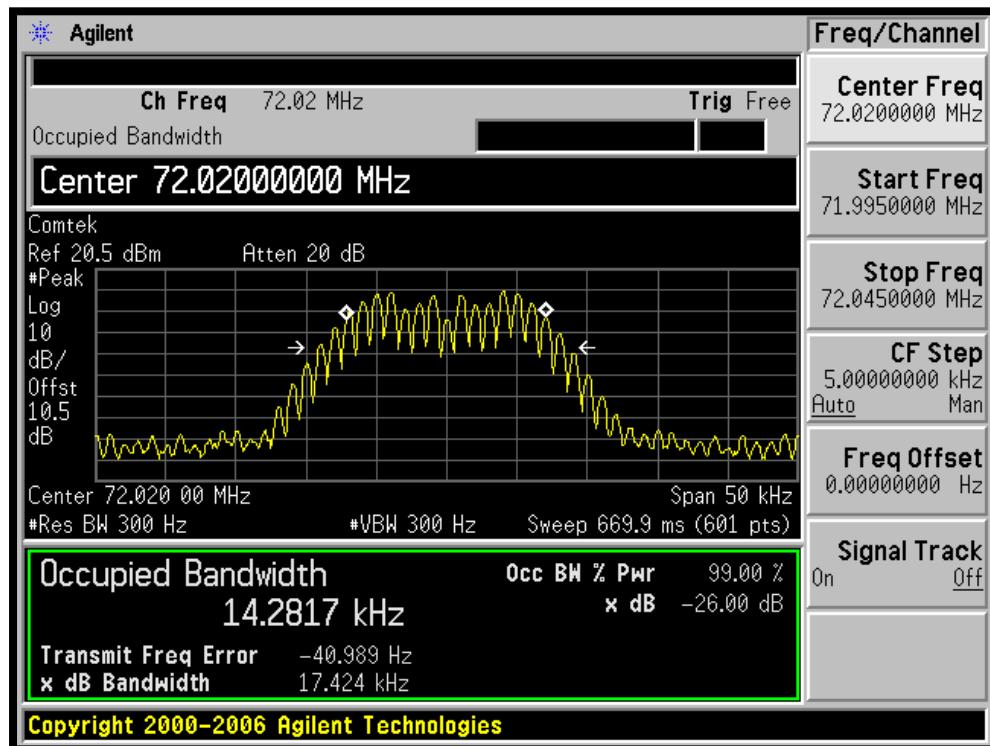
Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26
Agilent	Waveform generator	33220A	MY43004878	2007-06-07
R & S	Analyzer, Spectrum	ESCI3	100044	2007-02-19

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

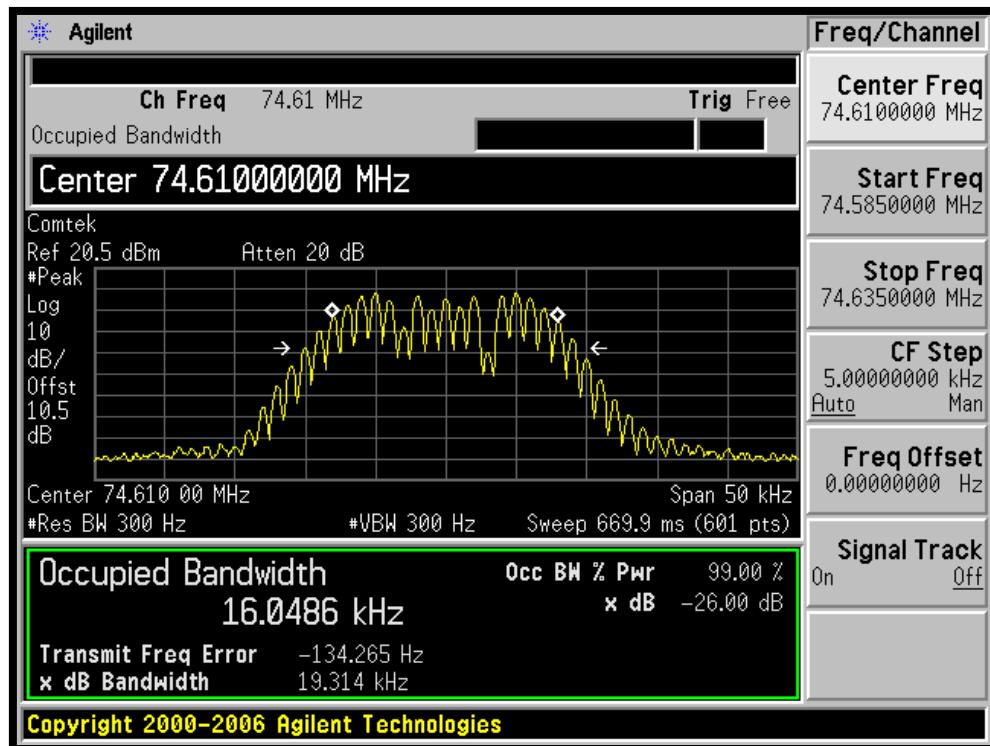
Test Result

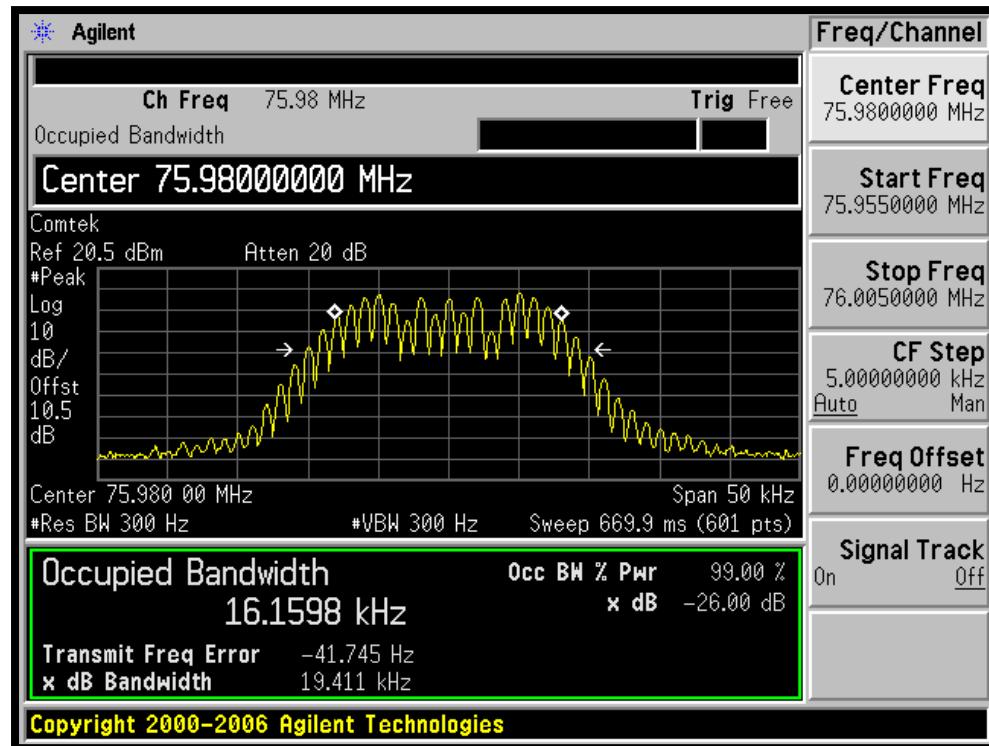
Please refer to the hereinafter plots.

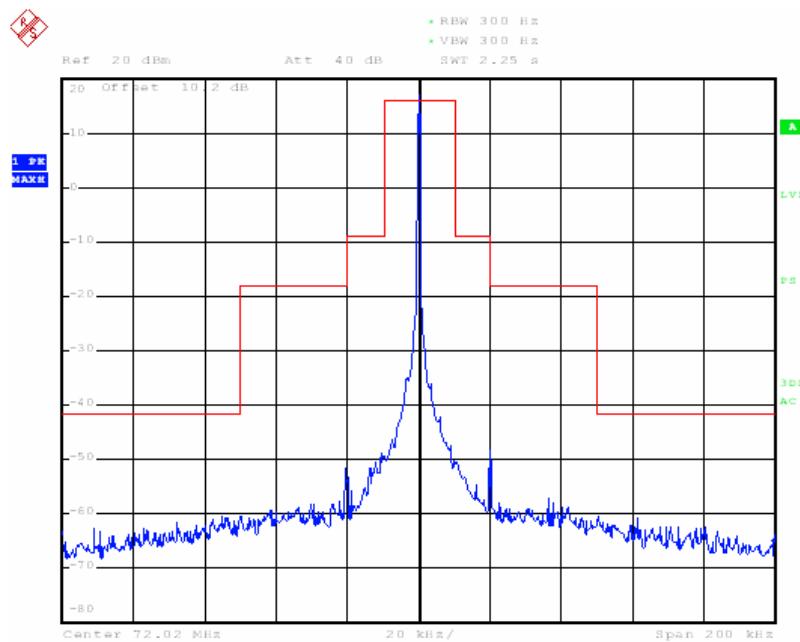
Low channel



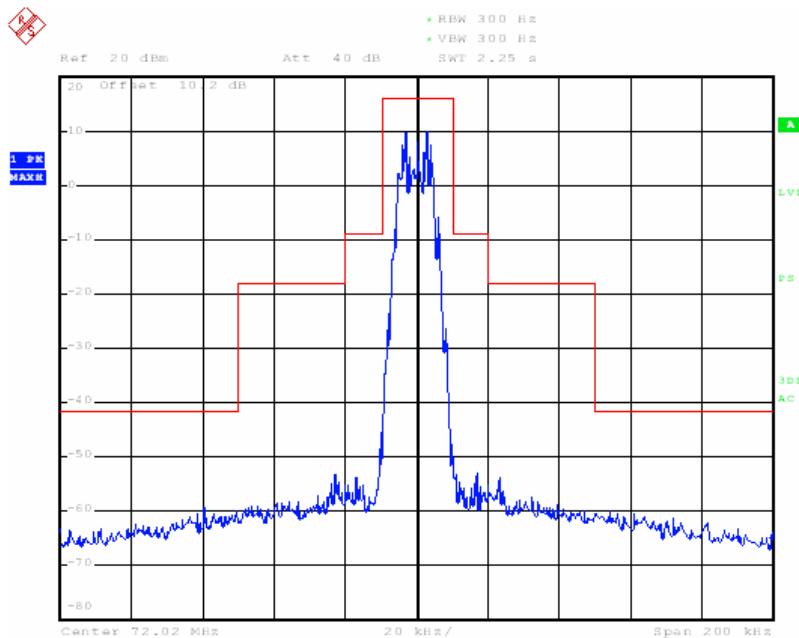
Mid channel



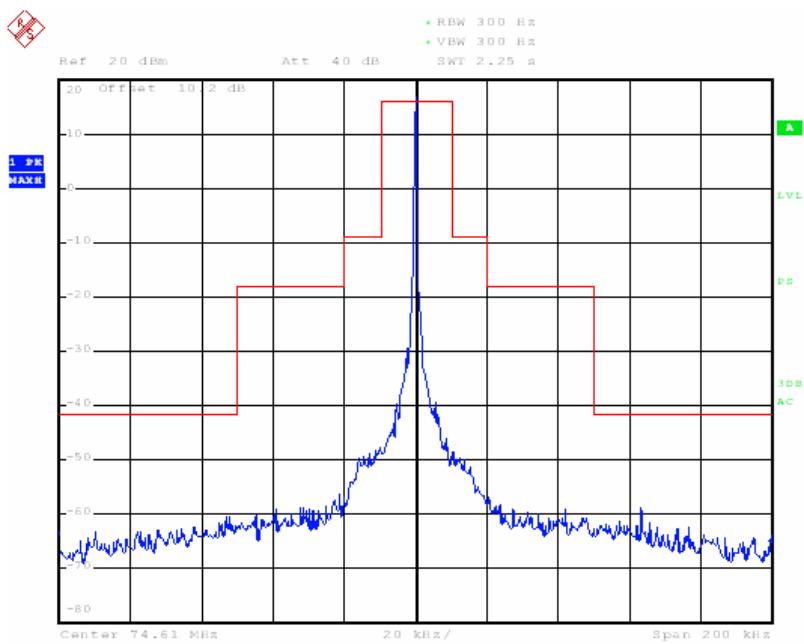
High Channel

Low channel - unmodulated

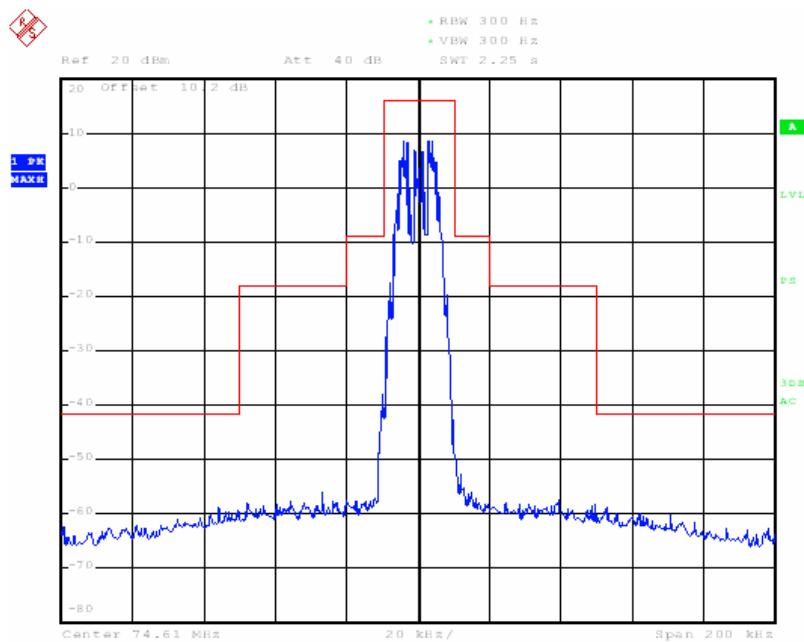
Date: 30.AUG.2007 11:39:47

Low channel - modulated

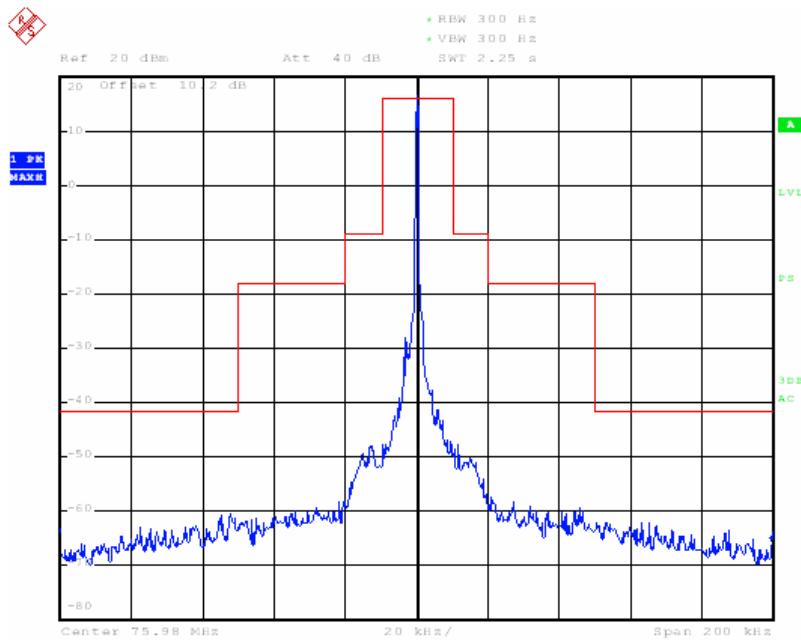
Date: 30.AUG.2007 11:38:41

Mid channel - unmodulated

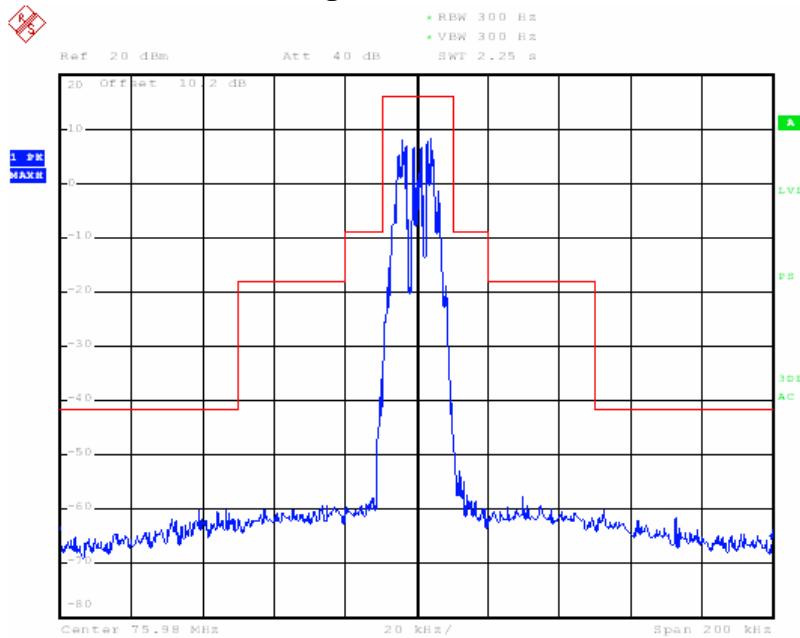
Date: 30.AUG.2007 11:28:50

Mid channel - modulated

Date: 30.AUG.2007 11:36:18

High channel - unmodulated

Date: 30.AUG.2007 11:27:40

High channel - modulated

Date: 30.AUG.2007 11:26:46

§2.1051 and §90.210 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

Applicable Standard

§90.210 Out of band emissions; the power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log (P)$.

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:	40 %
ATM Pressure:	102 kPa

* The testing was performed by Oscar Auon 2007-08-29.

Test Equipment List and Details

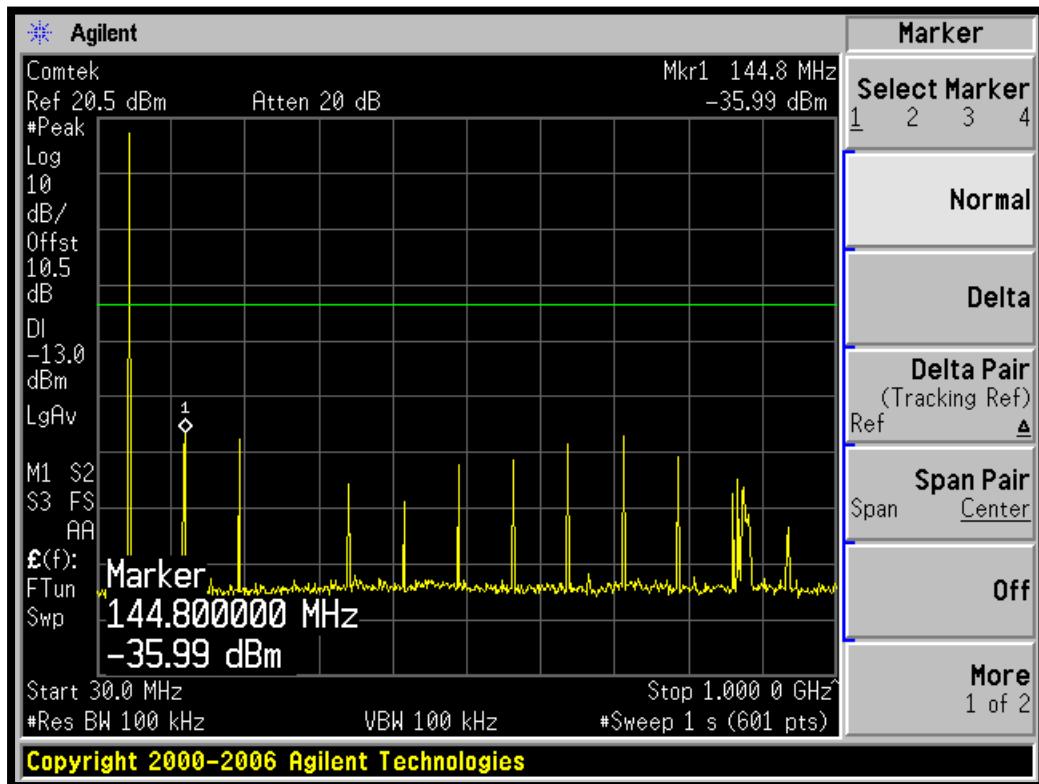
Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26

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

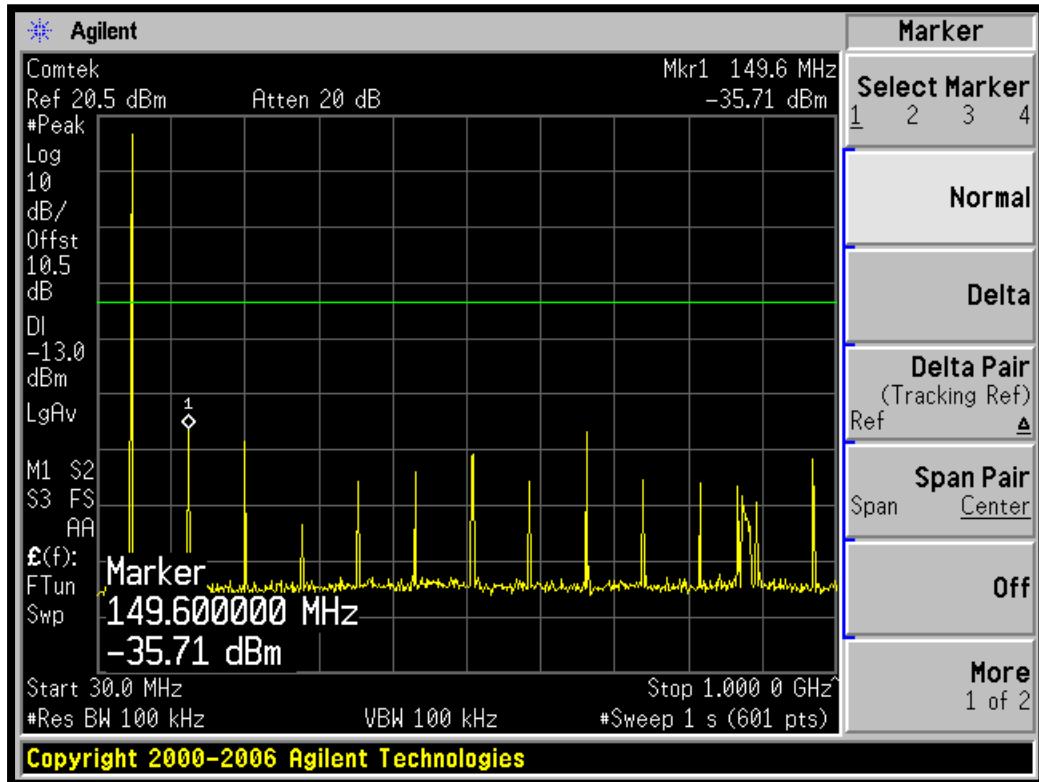
Test Results

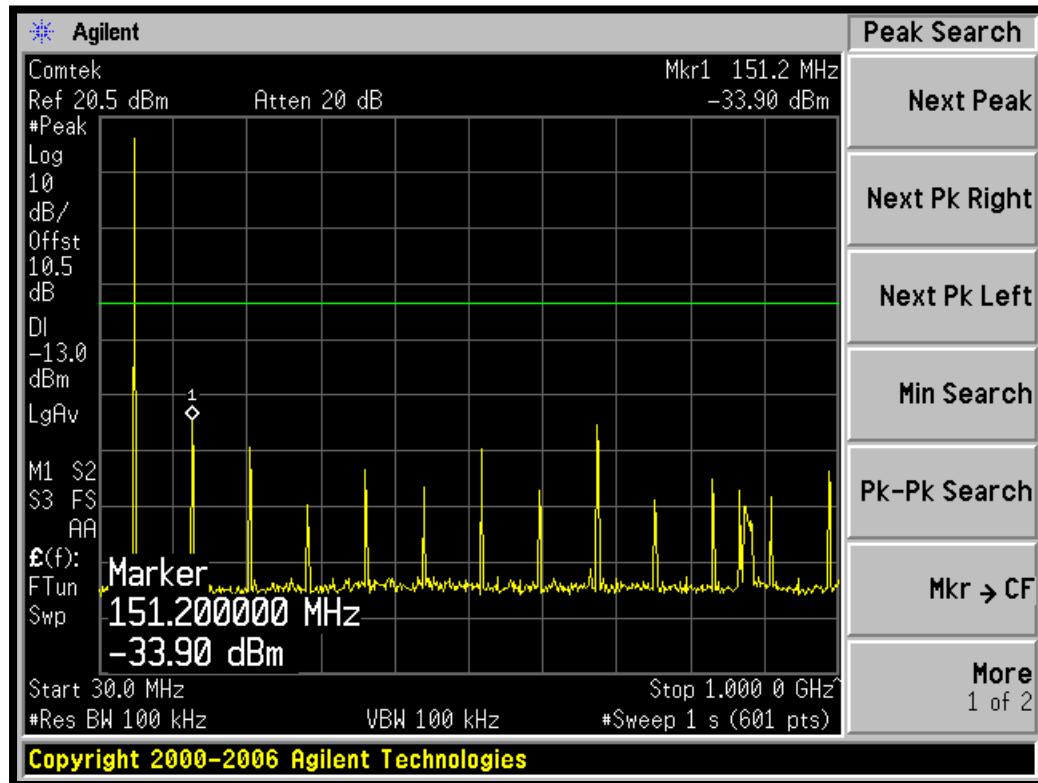
Please refer to the following plots.

Low channel



Mid channel



High channel

§2.1055 (d) and §90.213- FREQUENCY STABILITY

Applicable Standard

§2.1055 (d)

§90.213

For mobile station operating in frequency range 72 – 76 MHz, for output power < 2 watts, the limit is 50 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:	25° C
Relative Humidity:	40 %
ATM Pressure:	102 kPa

* The testing was performed by Oscar Auon 2007-08-29.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26
Tenney	Oven, Temperature	VersaTenn	12.222-193	2007-06-21
HP	DC Power Supply	6236B	2212-19	N/A

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

Test Result

74.61 MHz**Frequency vs. Temperature**

Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (PPM)	Limit (PPM)
Voltage (VDC)	Temperature (°C)				
9	50	74.61	74.6081	-25.466	50
9	40	74.61	74.6081	-25.466	50
9	30	74.61	74.6095	-6.702	50
9	20	74.61	74.6094	-8.042	50
9	10	74.61	74.6096	-5.361	50
9	0	74.61	74.6089	-14.743	50
9	-10	74.61	74.6092	-10.722	50
9	-20	74.61	74.6086	-18.764	50
9	-30	74.61	74.6085	-20.105	50

Frequency vs. Voltage

Condition		Reference Frequency (MHz)	Measured Frequency (MHz)	Frequency Error (PPM)	Limit (PPM)
Voltage (VDC)	Temperature (°C)				
6	20	74.61	74.6079	-28.146	50

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

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:	25° C
Relative Humidity:	40 %
ATM Pressure:	102 kPa

* The testing was performed by Oscar Au on 2007-08-31.

Test Equipment

Manufacturer	Description	Model	Serial Number	Calibration Date
Sunol Sciences	30 - 3000 MHz Antenna	JB3	A020106-3 / S006628	2007-03-05
Agilent	Analyzer, Spectrum	E4446A	US44300386	2007-04-26
Com-Power	Antenna, Dipole	AD-100	2219	2007-04-26
Rohde & Schwarz	Generator, Signal	SMIQ03	849192/0085	2006-10-18

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

Test Result

-27.3 dB at 298.44 MHz in the Horizontal polarization

Test Mode: Measured at 3 meters, 30 MHz –1GHz Tx

Middle Channel at High Power

Indicated		Azimuth degrees	Test Antenna		Substituted				Limit (dBm)	Margin (dB)	
Frequency (MHz)	Amplitude (dBuV)		Height (m)	Polar H/V	Freq. (MHz)	Level (dBm)	Antenna Correction	Cable Loss (dB)			
223.83	38.9	300	1	H	223.83	-45.4	0	0.2	-45.6	-13	-32.6
298.44	36.9	40	1.5	V	298.44	-47.5	0	0.3	-47.8	-13	-34.8
298.44	44.4	300	2	H	298.44	-40	0	0.3	-40.3	-13	-27.3
373.05	36.7	275	1.1	V	373.05	-49.1	0	0.4	-49.5	-13	-36.5
373.05	39.8	305	1.6	H	373.05	-46.2	0	0.4	-46.6	-13	-33.6
447.66	42.3	297	1.2	H	447.66	-44.4	0	0.5	-44.9	-13	-31.9
522.27	43	330	1.1	H	522.27	-44.3	0	0.5	-44.8	-13	-31.8
895.32	38.9	310	1.2	V	895.32	-44.3	0	0.8	-45.1	-13	-32.1