

FCC PART 90
EMI MEASUREMENT AND TEST REPORT

For

GMT INDUSTRIAL LTD.

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HONGKONG.

FCC ID: BSYKS395

2004-01-21

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: Cordless Microphone System
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Test Date: 2003-12-23	
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GENERAL INFORMATION

Product Description for Equipment Under Test (EUT)

The *GMT INDUSTRIAL LTD.*'s Model: *KS-395* or the "EUT" as referred to in this report is a cordless microphone system, transmitter part, which measures approximately 9.7"L x 2.25"W x 2.25"H. The EUT has one channel at frequency of 171.045MHz and maximum output power of 13.50 dBm.

* *The test data gathered are from production sample, serial number: 0011, provided by the manufacturer.*

Objective

This report is prepared on behalf of *GMT INDUSTRIAL LTD.* in accordance with Part 90 Subpart A Subpart I and Subpart K of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for effective radiated power, modulation characteristics, occupied bandwidth, radiated spurious emissions, and frequency stability.

Related Grant/Submission

No Related Submittals.

Test Methodology

Measurements contained in this report were also conducted with TIA/EIA Standard 603, Telecommunications Industry Association Land Mobile FM or PM Communications Equipment Measurement and Performance Standards.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167-0.

SYSTEM TEST CONFIGURATION

Justification

The EUT was tested under typical operating modes to represent the worst-case results during the final qualification test.

Special Accessories

As shown in section 2.7, interface cable used for compliance testing is shielded as normally supplied by customer and its respective support equipment manufacturers.

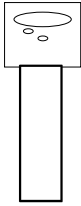
Schematics / Block Diagram

Please refer to Appendix D.

Equipment Modifications

No modification was made by BACL Corp. to make sure the EUT to comply with the applicable limits.

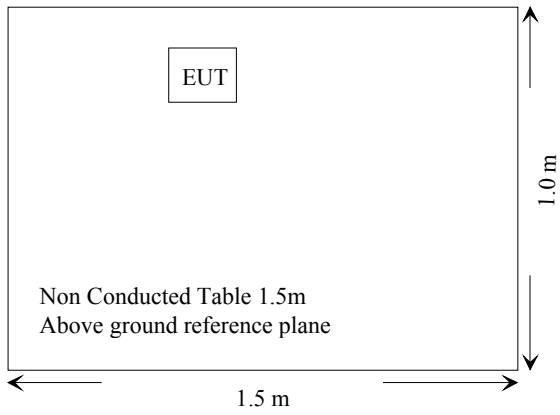
Configuration of Test System



Test Setup Block Diagram

LISN 1

LISN 2



REQUIREMENTS OF PROVISIONS

Requirements and Test Summary

FCC Rules	Rules Description	Result
2.1046 90.265 (b)	RF Output Power	Complied
2.1047 90.265 (b)	Modulation Characteristics	Complied
2.1049 90.265 (b)	Occupied Bandwidth	Complied
2.1053 90.210 (b)	Radiated Spurious Emission	Complied
2.1051 90.210 (b)	Spurious Emission at Antenna Port	Complied
2.1055 90.265 (b)(3)	Frequency Stability Vs. Temperature Vs. Voltage	Complied
90.214	Transient Frequency Behavior	Complied

Labeling Requirement

Each equipment for which a type acceptance applications is filed on or after May 1, 1981, shall bear an identification plate or label pursuant to §2.295 (Identification of Equipment) and §2.926 (FCC identifier)

In August 1996 the Federal Communications Commissions (FCC) adopted RF exposure guidelines with safety levels for hand-held wireless devices.

Generally users manual contains a RF exposure statement to indicate compliance with FCC requirements.

The users manual should also contain required information and instruction pursuant to 95.653.

§2.1046 and §90.265(b)(2) - CONDUCTED OUTPUT POWER

Provision Applicable

Per FCC §2.1046 and §90.265(b)(2): the output power shall not exceed 50mW.

Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuator.

Test Equipment

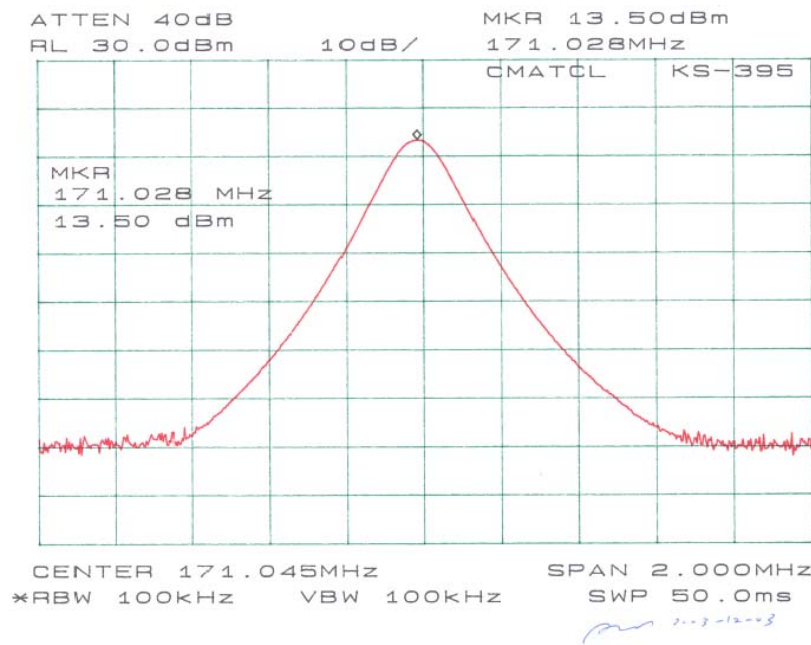
Manufacturer	Description	Model	Serial Number	Cal. Due Date
Hewlett Packard	Spectrum Analyzer	HP8565C	06042	2004-05-03
Hewlett Packard	Plotter	HP7470A	N/A	N/A

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

Test Results

Frequency	Output Power in dBm	Output Power in W
171.028	13.50	0.0224

Please refer to the following plots.



§2.1047, §90.265(b) and §90.210 (b) - MODULATION CHARACTERISTICS

Provision Applicable

Per FCC § 2.1047, § 90.265(b), and §90.210(b), modulation is required to report.

Test Procedure

Audio Frequency Response

The RF output of the transceiver was connected to the input of a FM deviation meter through sufficient attenuation so as not to overload the meter or distort the reading. An audio signal generator was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed the generator output was connected to the microphone connectors.

The audio signal input level was adjusted to obtain 20% of the maximum rated system deviation at 1 kHz, and recorded as DEVREF. With the audio signal generator level unchanged, set the generator frequency between 100 Hz to 5000 Hz. The transmitter deviations (DEVFREQ) were measured and the audio frequency response was calculated as

$$20\log_{10} [\text{DEV}_{\text{FREQ}} / \text{DEV}_{\text{REF}}]$$

Audio Low-Pass Filter Response

An audio signal generator and an audio spectrum analyzer were connected to the input and output of the post limiter low pass filter respectively. The audio signal generator frequency was set between 1000 Hz and the upper low pass filter limit. The audio frequency response at test frequency was calculated as

$$\text{LEV}_{\text{FREQ}} - \text{LEV}_{\text{REF}}$$

Modulation Limiting

With the same setup as section 5.2.1 above, at three different modulating frequencies, the output level of the audio generator was varied and the FM deviation level was recorded.

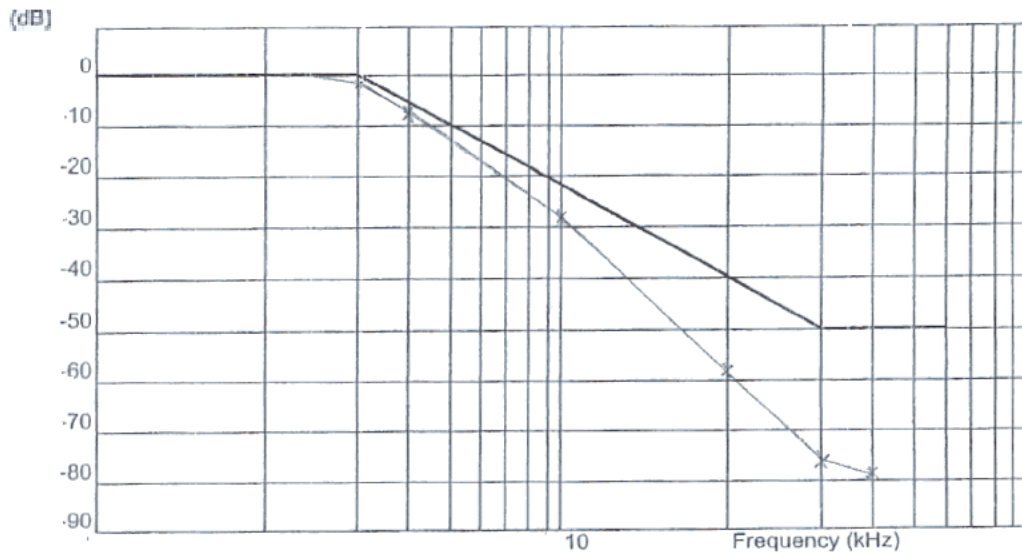
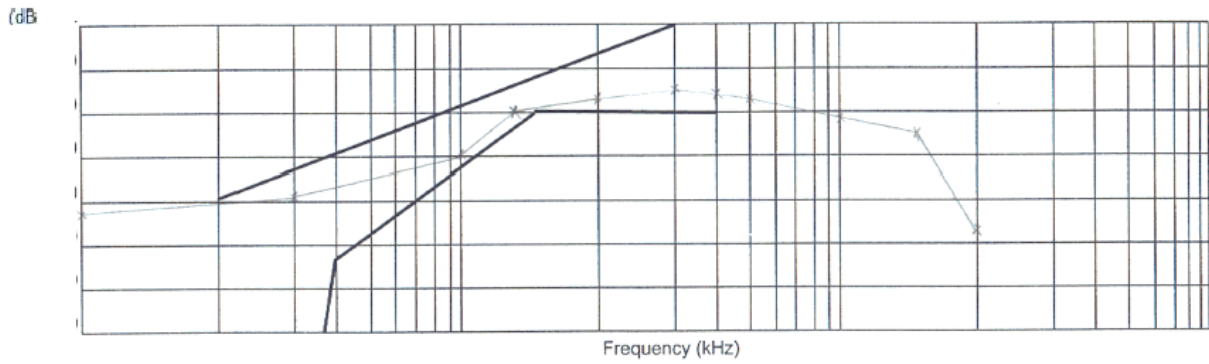
Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	DRG Spectrum Analyzer	8565EC	3946A00131	2003-06-30
Hewlett Packard	Modulation Analyzer	8901A	2026A00847	2003-08-09

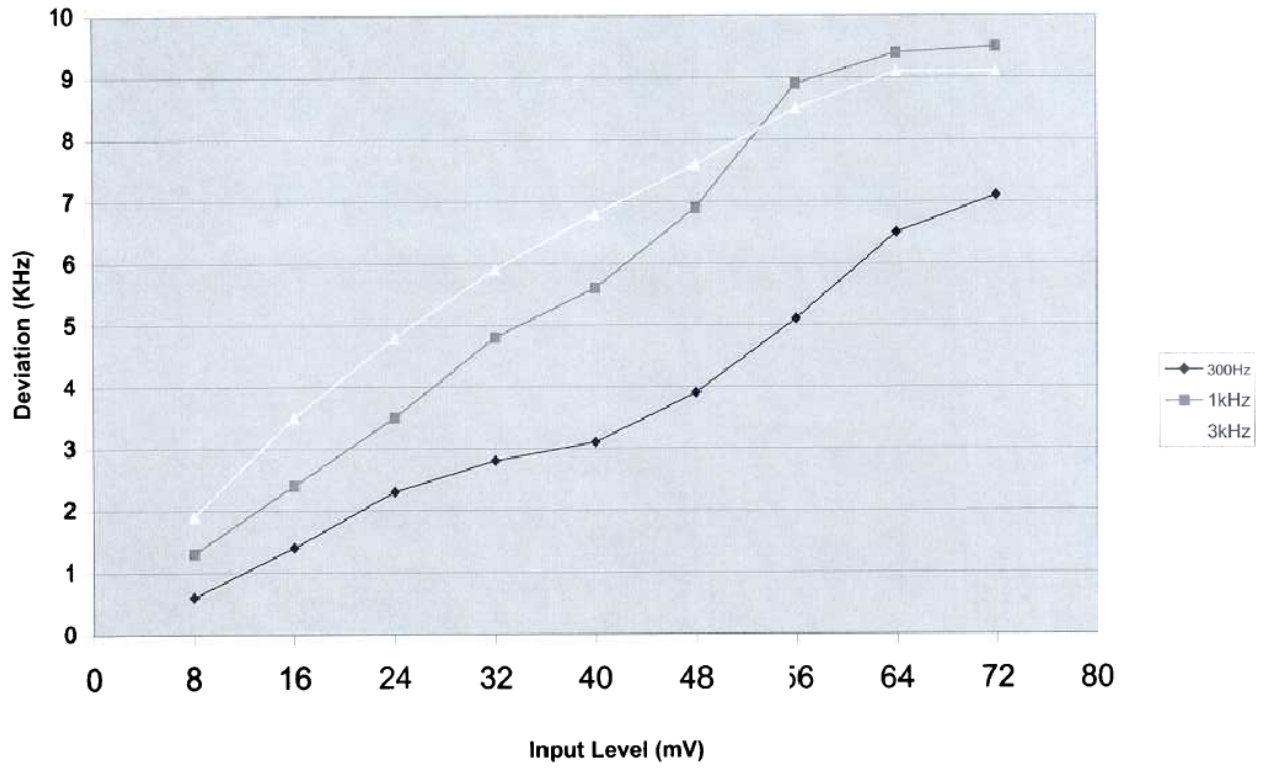
* **Statement of Traceability: BA CL Corp.** certifies that all calibrations have been performed in accordance to NVLAP requirements, traceable to the NIST.

Test Results

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



KS-395 Modulation Limiting



§2.1049, §90.265(b)(1), and §90.210 (b) - OCCUPIED BANDWIDTH OF EMISSION

Provision Applicable

Per FCC §2.1049, §90.265(b)(1), and §90.210 (b), the emission bandwidth shall not exceed 54KHz.

For any frequency removed from the center of the assigned channel by more than 50 percent up to and including 100 percent of the authorized bandwidth, at least 25 dB.

On any frequency removed from the center of the assigned channel by more than 100 percent up to and including 250 percent, at least 35 dB.

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

$$43 + 10 \log(P)_{dB}$$

Test Procedure

The transmitter was modulated with a 2500Hz tone at an input level 16 dB greater than the necessary to produce 50% of rated system deviation. The resolution bandwidth of the spectrum analyzer was set up to 300 Hz and the spectrum of the transmitting signal was recorded. This spectrum was compared to the required emission mask.

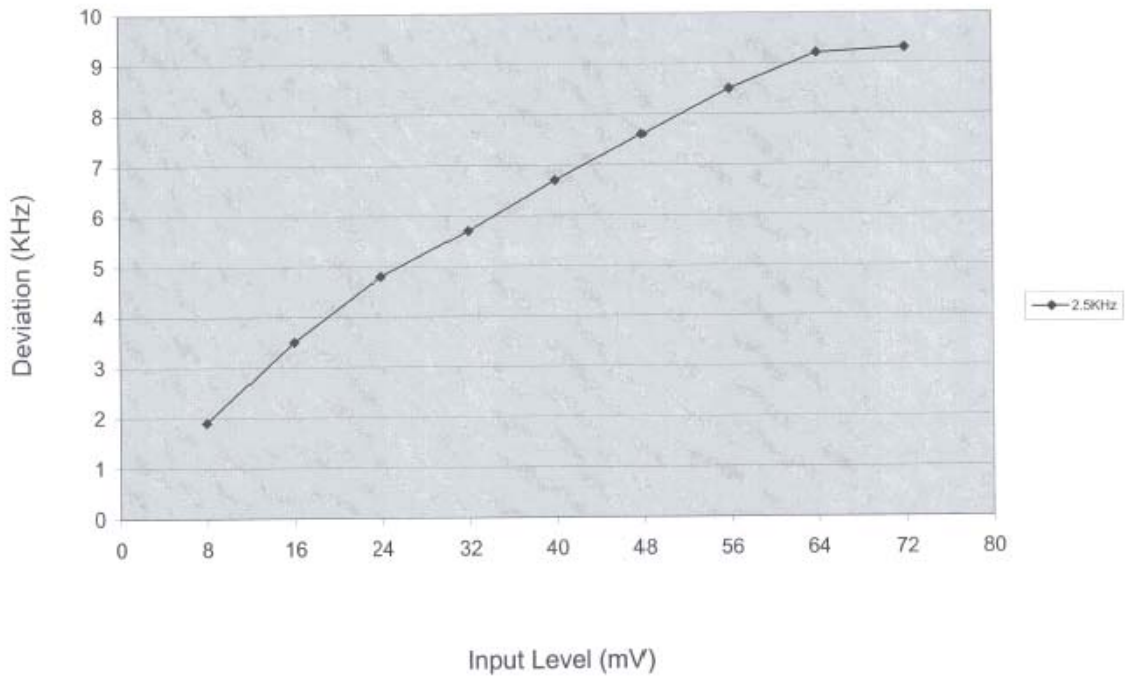
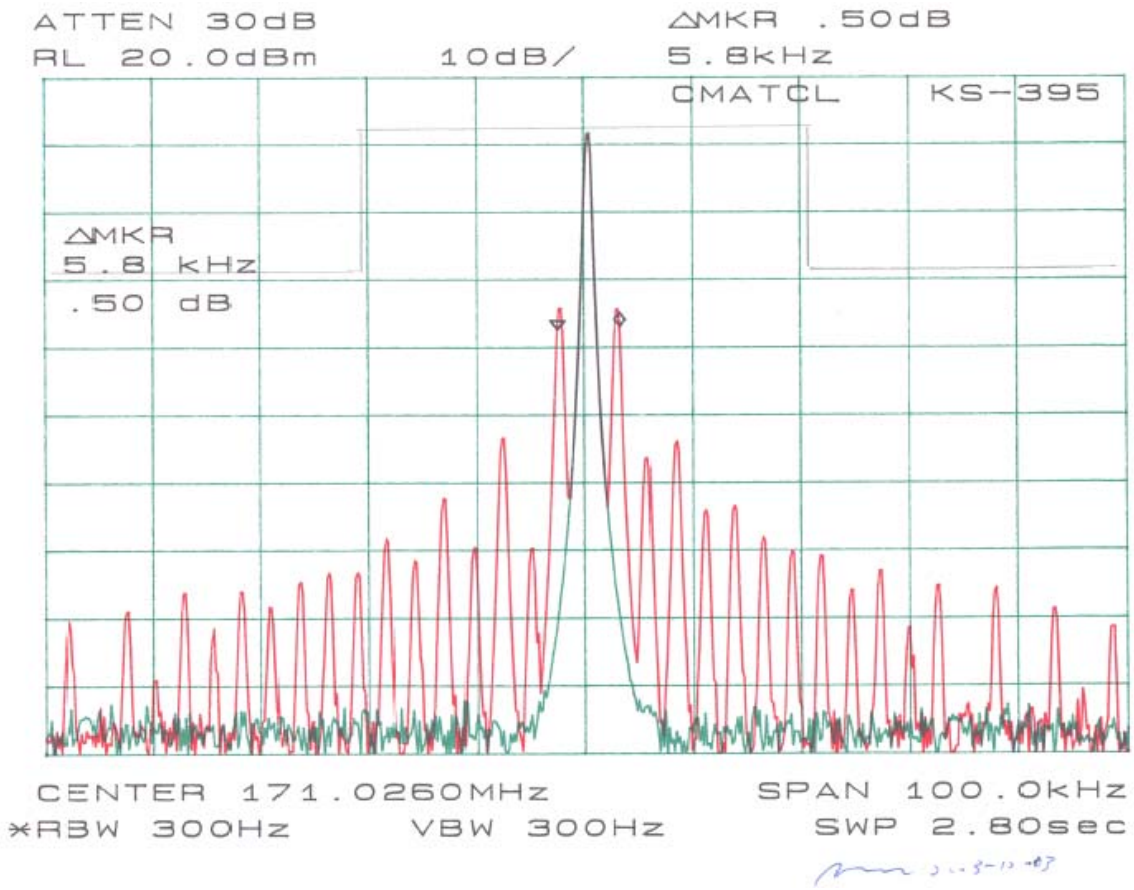
Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	DRG Spectrum Analyzer	8565EC	3946A00131	2003-06-30
Hewlett Packard	Plotter	HP7470A	N/A	N/A
NAAYAN	Audio Generator	NY2201	00042	N/A

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

Test Results

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



§2.1051 and §90.210(b) - RADIATED SPURIOUS EMISSION

Provision Applicable

Per FCC §2.1051 and FCC §90.210(b)

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

$$43 + 10 \log(P) \text{ dB}$$

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	Serial Number	Cal. Date
EMCO	Biconical Antennas	3110B	9603-2315	2003-10-11
EMCO	Log-Periodic Antenna	3148	0004-1155	2003-10-11
A.H. System	Horn Antenna	SAS-200/571	2455-261	2003-08-02
Agilent	DRG Spectrum Analyzer	8565EC	3946A00131	2003-06-30
Rohde & Schwarz	Signal Generator	SMIQ03	DE237467	2003-07-03

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

Test Result

-3.1 dB at 342.09 MHz

EUT					Generator							Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC	
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss DB	Level dBm	Limit dBm	Margin DB	
171.045	78.3	310	2.3	v	171.045	8.4	v	0	0.1	8.3			
171.045	69.2	210	2.1	h	171.045	3.8	h	0	0.1	3.7			
342.09	59.7	90	2.5	v	342.09	-15.8	v	0	0.3	-16.1	-13	-3.1	
342.09	43.6	30	2.2	h	342.09	-34.8	h	0	0.3	-35.1	-13	-22.1	
513.135	38.9	15	2.4	v	513.135	-36.4	v	0	0.5	-36.9	-13	-23.9	
513.135	36.7	0	1.5	h	513.135	-41.2	h	0	0.5	-41.7	-13	-28.7	

Result: Pass

Test was performed in three orthogonal plane.

§2.1051 and §90.210(b) - SPURIOUS EMISSION AT ANTENNA TERMINAL

Standard Applicable

Per FCC §2.1051 and FCC §90.210(b)

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

$$43 + 10 \log(P) \text{ dB}$$

Measurement 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.

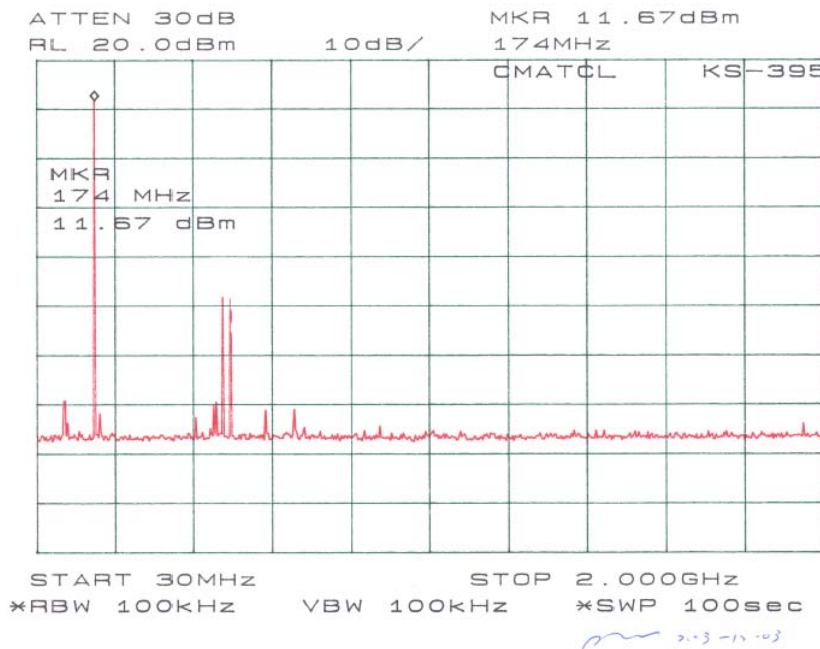
Test Equipment

Manufacturer	Description	Model No.	Serial No.	Calibration Date
Agilent	DRG Spectrum Analyzer	8565EC	3946A00131	2003-06-30

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

Test Result

Please refer to following plots.



§90.265(b)(3) - FREQUENCY STABILITY MEASUREMENT

Provision Applicable

According to §90.265(b)(3), the frequency stability of the wireless microphones shall limit the total emission to within $\pm 32.5\text{KHz}$ of the assigned frequency.

Test Procedure

Frequency stability versus environmental temperature

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber.

After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.

Frequency Stability versus Input Voltage

At room temperature ($25\pm 5^\circ\text{C}$), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Tenney	Temperature Chamber -50° to $+100^\circ\text{C}$	Versa	12.222-193	2003-04-23
Agilent	DRG Spectrum Analyzer	8565EC	3946A00131	2003-06-30

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

Test Results

Assigned Frequency: 171.045 MHz, Limit: total emission within +/- 32.5KHz of the assigned freq.		
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed Total emission within KHz
50	9	-29.5
40	9	-28.3
30	9	-27.4
20	9	-26.9
10	9	-26.1
0	9	-25.3
-10	9	-24.4
-20	9	-23.6
-30	9	-22.8

Frequency Stability Versus Input Voltage

Assigned Frequency: 171.045 MHz, Limit: total emission within +/- 32.5KHz of the assigned frequency	
Power Supplied (Vdc)	Frequency Measure with Time Elapsed Total Emission Within KHz
6.3	-27.3

Battery end point: 6.3Vdc

Conclusion: The EUT complied with the applicable Frequency Stability Limits.

§90.214 - TRANSIENT FREQUENCY BEHAVIOUR OF THE TRANSMITTER

Standard Applicable

§90.214

Test Procedure

TIA/EIA-603.2.219

Test Equipment

Manufacturer	Description	Model	Serial Number	Cal. Date
Tektronix	Oscilloscope	TDS7104	B020557	2003-10-09
NAA YAN	Audio Generator	NY2201	00042	N/A
HP	Modulation Analyzer	8901A	2026A00847	2003-08-09

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

Test Results

Please refer to the following plots.

