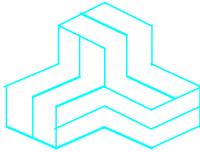


# ENGINEERING TEST REPORT



## Buoyant Operating Spa System (B.O.S.S.) MODEL NO.: in.te601

**FCC ID: PTT-TE601**

*Applicant:*

**Gecko Electronics Inc.**  
450, des Canetons  
Quebec, QC  
Canada, G2E 5W6

*Tested in Accordance With*

**FCC Part 15, Subpart C, Section 15.249**  
**Low Power Transmitters**  
**Operating in the Frequency Band 902 - 928 MHz**

**UltraTech's File No.: GEK-003F15C249**

This Test report is Issued under the Authority of  
Tri M. Luu, Professional Engineer,  
Vice President of Engineering  
UltraTech Group of Labs

Date: March 29, 2005



Report Prepared by: Dan Huynh

Tested by: Mr. Hung Trinh, EMC/RFI Technician

Issued Date: March 29, 2005

Test Dates: March 12, 2005

- The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
- This report must not be used by the client to claim product endorsement by NVLAP or any agency of the US Government.*

## UltraTech

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## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

<b>Reference:</b>	FCC Part 15, Subpart C, Section 15.249
<b>Title:</b>	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
<b>Purpose of Test:</b>	To gain FCC Certification Authorization for Low Power Licensed-Exempt Transmitters operating in the Frequency Band 902 - 928 MHz.
<b>Test Procedures:</b>	Both conducted and radiated emissions measurements were conducted in accordance with American National Standards Institute ANSI C63.4 - American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
<b>Environmental Classification:</b>	Commercial, industrial or business environment residential

### 1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

### 1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC CFR Parts 0-19	2005	Code of Federal Regulations – Telecommunication
ANSI C63.4	2004	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
FCC Public Notice DA 00-1407	2000	Part 15 Unlicensed Modular Transmitter Approval
CISPR 22 +A1 EN 55022	2003-04-10 2004-10-14 2003	Limits and Methods of Measurements of Radio Disturbance Characteristics of Information Technology Equipment
CISPR 16-1-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-2-1	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-1: Conducted disturbance measurement
CISPR 16-2-3	2003	Specification for radio disturbance and immunity measuring apparatus and methods. Part 2-3: Radiated disturbance measurement

## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

APPLICANT	
<b>Name:</b>	Gecko Electronics Inc.
<b>Address:</b>	450, des Canetons Quebec, QC Canada G2E 5W6
<b>Contact Person:</b>	Benoit Laflamme Phone #: (418) 872-4411 Fax #: (418) 872-6305 Email Address: blaflamme@gecko-electronic.com

MANUFACTURER	
<b>Name:</b>	Gecko Electronics Inc.
<b>Address:</b>	450, des Canetons Quebec, QC Canada G2E 5W6
<b>Contact Person:</b>	Benoit Laflamme Phone #: (418) 872-4411 Fax #: (418) 872-6305 Email Address: blaflamme@gecko-electronic.com

### 2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

<b>Brand Name:</b>	Gecko Electronics Inc.
<b>Product Name:</b>	Buoyant Operating Spa System (B.O.S.S.)
<b>Model Name or Number:</b>	in.te601
<b>Serial Number:</b>	Test Sample
<b>Type of Equipment:</b>	Low Power Communication Device Transmitter
<b>Input Power Supply Type:</b>	AC Mains
<b>Primary User Functions of EUT:</b>	Provide data communication link through air.

## 2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
<b>Equipment Type:</b>	Base station (fixed use)
<b>Intended Operating Environment:</b>	Residential Commercial, light industry & heavy industry
<b>Power Supply Requirement:</b>	120 VAC 60 Hz
<b>RF Output Power Rating:</b>	92.97 Peak dB $\mu$ V/m
<b>Operating Frequency Range:</b>	915.8818 – 916.6190 MHz
<b>RF Output Impedance:</b>	50 Ohms
<b>20 dB Bandwidth:</b>	156.31 kHz
<b>Modulation Type:</b>	FSK
<b>Emission Designation:</b>	F1D
<b>Oscillator Frequencies:</b>	14.7456 MHz
<b>Antenna Connector Type:</b>	Integral, permanently attached
<b>Antenna Description:</b>	Manufacturer: Linx Type: Helical Model: ANT-916-HETH (THROUGH-HOLE 916 MHz) Frequency Range: 910-920 MHz In/Out Impedance: 50 Ohms Gain: estimated to -6 dBi

## 2.4. LIST OF EUT'S PORTS

None.

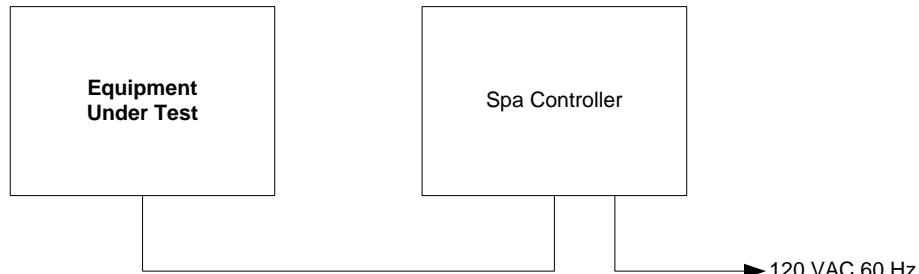
## 2.5. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

Ancillary Equipment # 1	
Description:	Remote Control
Brand name:	Gecko
Model Name or Number:	in.k702
Serial Number:	Test Sample
Connected to EUT's Port:	N/A

<b>Ancillary Equipment # 2</b>	
Description:	Spa Controller
Brand name:	Gecko
Model Name or Number:	--
Serial Number:	Test Sample
Connected to EUT's Port:	Series Connector on PCB

## 2.6. GENERAL TEST SETUP



## EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

### 3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	120 VAC 60 Hz

### 3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

<b>Operating Modes:</b>	EUT was configured to transmit continuously for emissions measurements.
<b>Special Test Software:</b>	None
<b>Special Hardware Used:</b>	None
<b>Transmitter Test Antenna:</b>	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment.

<b>Transmitter Test Signals:</b>	
<b>Frequency Band(s):</b>	915.8818 – 916.6190 MHz
<b>Test Frequency(ies):</b>	915.8818 MHz
<b>Transmitter Wanted Output Test Signals:</b>	
• RF Power Output (measured maximum output power):	92.97 Peak dB $\mu$ V/m
• Normal Test Modulation:	FSK
• Modulating signal source:	Internal

## EXHIBIT 4. SUMMARY OF TEST RESULTS

### 4.1. LOCATION OF TESTS

- All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.
- AC Powerline Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario.
- The above sites have been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville Open Field Test Site has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049). Last Date of Site Calibration: Jan. 10, 2005

### 4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.107(a) & 15.207	AC Power Conducted Emissions	Yes
--	20 dB Bandwidth	Yes
15.249(a), 15.209, 15.205	Transmitter Radiated Emissions, Harmonic Emissions	Yes

### 4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

## **EXHIBIT 5. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS**

### **5.1. TEST PROCEDURES**

This section contains test results only. Details of test methods and procedures can be found in ANSI C63.4 and ULTR-P001-2004.

### **5.2. MEASUREMENT UNCERTAINTIES**

The measurement uncertainties stated were calculated in accordance with requirements of UKAS Document LAB 34 with a confidence level of 95%. Please refer to Exhibit 6 for Measurement Uncertainties.

### **5.3. MEASUREMENT EQUIPMENT USED**

The measurement equipment used complied with the requirements of the Standards referenced in the Methods & Procedures ANSI C63.4 and CISPR 16-1.

### **5.4. ESSENTIAL/PRIMARY FUNCTIONS AS DECLARED BY THE MANUFACTURER**

The EUT is part of a 915 MHz RF remote control system. It sends commands and data via RF to a battery powered remote unit. It receives commands from the remote control via an InfraRed link only (no RF). The in.te601 also communicates via a serial link (I2C) with Gecko's spa controllers. The interface unit is powered from the spa controller.

## 5.5. AC POWERLINE CONDUCTED EMISSIONS [47 CFR 15.107(a) & 15.207]

### 5.5.1. Limits

The equipment shall meet the limits of the following table:

Test Frequency Range (MHz)	Class B Limits		Measuring Bandwidth
	Quasi-Peak (dB $\mu$ V)	Average (dB $\mu$ V)	
0.15 to 0.5	66 to 56*	56 to 46*	RBW = 9 kHz VBW $\geq$ 9 kHz for QP VBW = 1 Hz for Average
0.5 to 5	56	46	RBW = 9 kHz VBW $\geq$ 9 kHz for QP VBW = 1 Hz for Average
5 to 30	60	50	RBW = 9 kHz VBW $\geq$ 9 kHz for QP VBW = 1 Hz for Average

\* Decreasing linearly with logarithm of frequency.

### 5.5.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

### 5.5.3. Test Equipment List

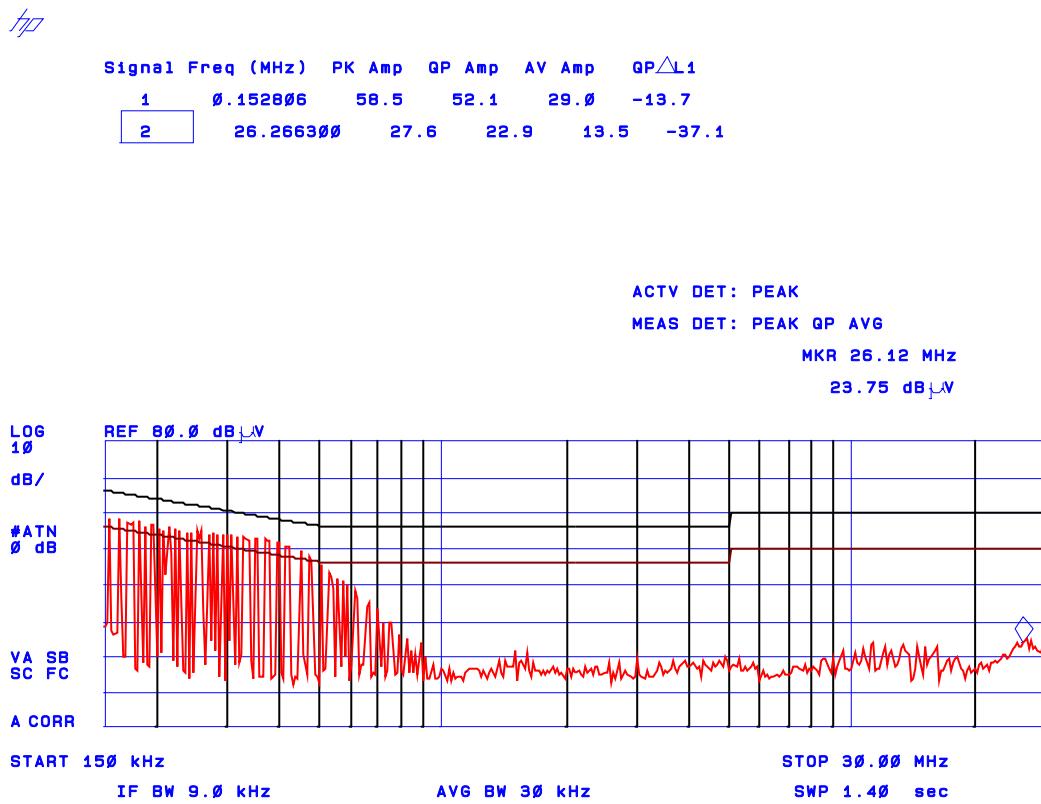
Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Hewlett Packard	HP 8593EM	3412A00103	9 kHz – 26.5 GHz
Transient Limiter	Hewlett Packard	11947A	310701998	9 kHz – 200 MHz 10 dB attenuation
L.I.S.N.	EMCO	3825/2	89071531	9 kHz – 200 MHz 50 Ohms / 50 $\mu$ H
24'x16'x8' RF Shielded Chamber	RF Shielding	--	--	--

#### 5.5.4. Test Data

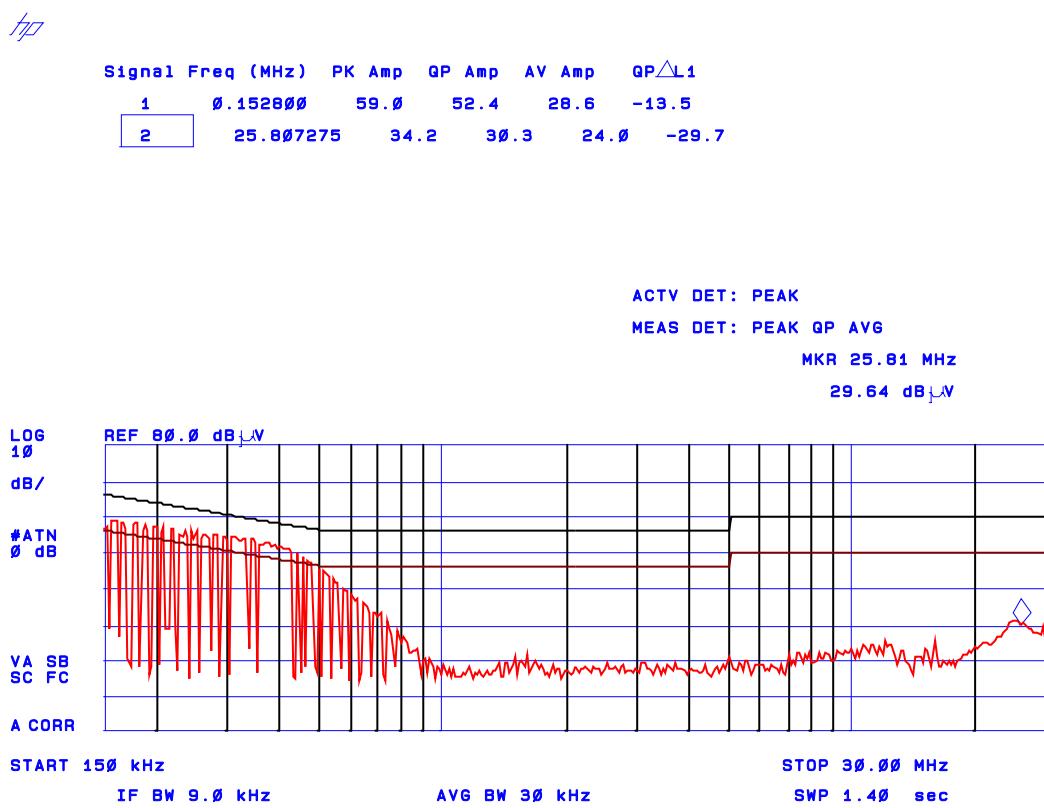
Frequency (MHz)	RF Level (dB $\mu$ V)	Receiver Detector (QP/AVG)	QP Limit (dB $\mu$ V)	AVG Limit (dB $\mu$ V)	Margin (dB)	Pass/Fail	Line Tested (L1/L2)
0.152806	52.1	QP	65.8	55.8	-13.7	Pass	L1
0.152806	29.0	AVG	65.8	55.8	-26.8	Pass	L1
26.266300	22.9	QP	60.0	50.0	-37.1	Pass	L1
26.266300	13.5	AVG	60.0	50.0	-36.5	Pass	L1
<hr/>							
0.152800	52.4	QP	65.8	55.8	-13.4	Pass	L2
0.152800	28.6	AVG	65.8	55.8	-27.2	Pass	L2
25.807275	30.3	QP	60.0	50.0	-29.7	Pass	L2
25.807275	24.0	AVG	60.0	50.0	-26.0	Pass	L2

See the following plots (1 & 2) for actual measurement plots

Plot 1: AC Power Line Conducted Emissions  
Line Tested: Line 1  
Line Voltage: 120VAC 60 Hz



Plot 2: AC Power Line Conducted Emissions  
Line Tested: Line 2  
Line Voltage: 120VAC 60 Hz



## 5.6. 20 dB BANDWIDTH

### 5.6.1. Limits

No limit. Test is performed for information only.

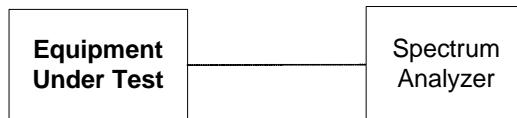
### 5.6.2. Method of Measurements

The transmitter output was loosely coupled to the spectrum analyzer through a receiving antenna and the bandwidth of bandwidth of the fundamental frequency was measured with the spectrum analyzer with the resolution bandwidth of the spectrum analyzer set per ANSI 63.4

### 5.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz- 40 GHz
Log Periodic	EMCO	3148	23845	200 MHz – 2 GHz

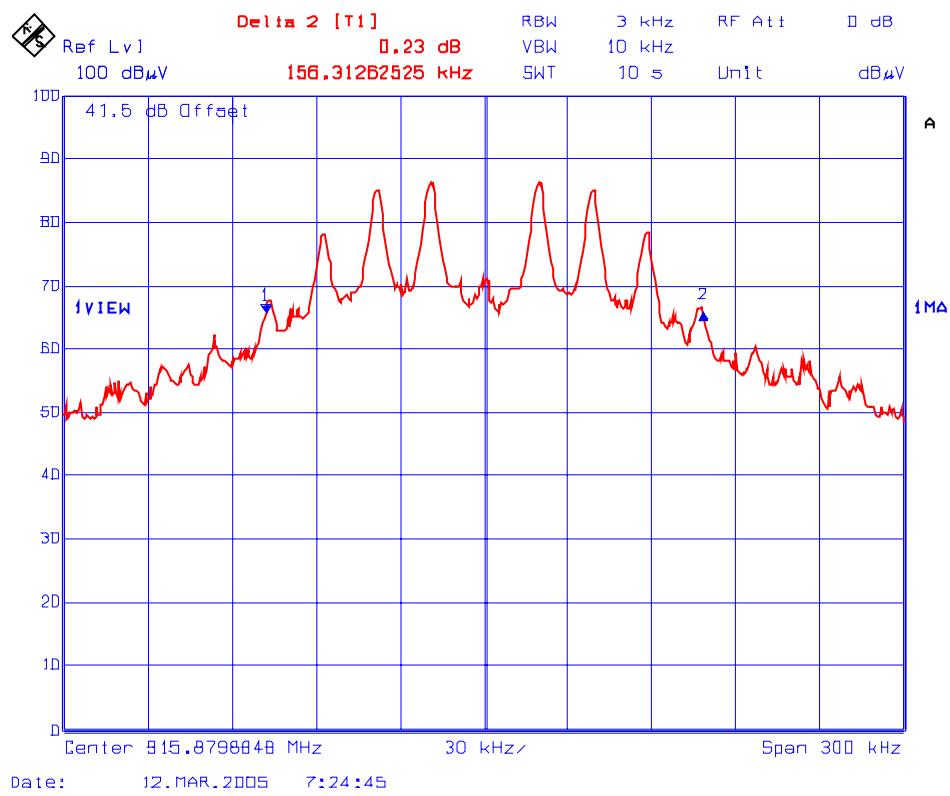
### 5.6.4. Test Arrangement



### 5.6.5. Test Data

Channel Frequency (MHz)	20 dB Bandwidth (kHz)
915.8818	156.31

Plot 3: 20 dB Bandwidth  
Test Frequency: 915.8818 MHz



**ULTRATECH GROUP OF LABS**  
3000 Bristol Circle, Oakville, Ontario, Canada L6H 6G4  
Tel.: 905-829-1570, Fax.: 905-829-8050

**File #: GEK-003F15C249**  
**March 29, 2005**

All test results contained in this engineering test report are traceable to National Institute of Standards and Technology (NIST)

## 5.7. FUNDAMENTAL FIELD STRENGTH AND HARMONIC EMISSIONS (RADIATED @ 3 METERS) [47 CFR 15.249(a), 15.209 & 15.205]

### 5.7.1. Limits

- The Field Strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency (MHz)	Field Strength of Fundamental (mV/m)	Field Strength of Harmonics (μV/m)
902 - 928	50	500

- The fundamental frequency shall not fall within any restricted frequency band specified in 15.205. All rf other emissions that fall in the restricted bands shall not exceed the general radiated emission limits specified in 15.209(a).

FCC 47 CFR 15.205(a)  
 -- Restricted Frequency Bands --

MHz	MHz	MHz	GHz
0.090 - 0.110	162.0125 - 167.17	2310 - 2390	9.3 - 9.5
0.49 – 0.51	167.72 - 173.2	2483.5 - 2500	10.6 - 12.7
2.1735 - 2.1905	240 - 285	2655 - 2900	13.25 - 13.4
8.362 - 8.366	322 - 335.4	3260 - 3267	14.47 - 14.5
13.36 - 13.41	399.9 - 410	3332 - 3339	14.35 - 16.2
25.5 – 25.67	608 - 614	3345.8 - 3358	17.7 - 21.4
37.5 – 38.25	960 - 1240	3600 - 4400	22.01 - 23.12
73 - 75.4	1300 - 1427	4500 - 5250	23.6 - 24.0
108 – 121.94	1435 - 1626.5	5350 - 5460	31.2 - 31.8
123 – 138	1660 - 1710	7250 - 7750	36.43 - 36.5
149.9 – 150.05	1718.8 - 1722.2	8025 - 8500	Above 38.6
156.7 – 156.9	2200 – 2300	9000 - 9200	

FCC 47 CFR 15.209(a)  
 -- Field Strength Limits within Restricted Frequency Bands --

Frequency (MHz)	Field Strength Limits (μV/m)	Distance (Meters)
0.009 - 0.490	2,400 / F (KHz)	300
0.490 - 1.705	24,000 / F (KHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

### 5.7.2. Method of Measurements

Refer to Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4 for measurement methods

### 5.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schwarz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz with external mixer
Microwave Amplifier	Hewlett Packard	HP 83017A		1 GHz to 26.5 GHz
Biconilog Antenna	EMCO	3143	1029	20 MHz to 2 GHz
Horn Antenna	EMCO	3155	9701-5061	1 GHz – 18 GHz

### 5.7.4. Test Data

Frequency (MHz)	Peak E-Field @3m (dB $\mu$ V/m)	Average E-Field @3m (dB $\mu$ V/m)	Antenna Plane (H/V)	Field Strength Limit of Fundamental/Harmonic (dB $\mu$ V/m)	Field Strength Limit of § 15.209 (dB $\mu$ V/m)	Margin (dB)
915.8818	91.81	--	V	94.0	--	-2.2
915.8818	92.97	--	H	94.0	--	-1.0
1831.7636	49.64	47.12	V	54.0	54.0	-6.9
1831.7636	48.20	44.88	H	54.0	54.0	-9.1
2747.6454	51.31	47.66	V	54.0	54.0	-6.3
2747.6454	53.51	50.02	H	54.0	54.0	-4.0
3663.5272	48.16	36.30	V	54.0	54.0	-17.7
3663.5272	49.26	39.52	H	54.0	54.0	-14.5

The emissions were scanned from 30 MHz to 10 GHz and all emissions within 20 dB below the limits were recorded.

## EXHIBIT 6. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of NIST Technical Note 1297 and LAB 34

### 6.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Line Conducted)	PROBABILITY DISTRIBUTION	UNCERTAINTY (dB)	
		9-150 kHz	0.15-30 MHz
EMI Receiver specification	Rectangular	$\pm 1.5$	$\pm 1.5$
LISN coupling specification	Rectangular	$\pm 1.5$	$\pm 1.5$
Cable and Input Transient Limiter calibration	Normal (k=2)	$\pm 0.3$	$\pm 0.5$
Mismatch: Receiver VRC $\Gamma_1 = 0.03$ LISN VRC $\Gamma_R = 0.8(9 \text{ kHz}) 0.2 (30 \text{ MHz})$ Uncertainty limits $20\text{Log}(1+\Gamma_1\Gamma_R)$	U-Shaped	$\pm 0.2$	$\pm 0.3$
System repeatability	Std. deviation	$\pm 0.2$	$\pm 0.05$
Repeatability of EUT	--	--	--
Combined standard uncertainty	Normal	$\pm 1.25$	$\pm 1.30$
Expanded uncertainty U	Normal (k=2)	$\pm 2.50$	$\pm 2.60$

Sample Calculation for Measurement Accuracy in 450 kHz to 30 MHz Band:

$$u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)} = \pm \sqrt{(1.5^2 + 1.5^2)/3 + (0.5/2)^2 + (0.05/2)^2 + 0.35^2} = \pm 1.30 \text{ dB}$$

$$U = 2u_c(y) = \pm 2.6 \text{ dB}$$

## 6.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY ( $\pm$ dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	$\pm 1.0$	$\pm 1.0$
Cable Loss Calibration	Normal (k=2)	$\pm 0.3$	$\pm 0.5$
EMI Receiver specification	Rectangular	$\pm 1.5$	$\pm 1.5$
Antenna Directivity	Rectangular	$\pm 0.5$	$\pm 0.5$
Antenna factor variation with height	Rectangular	$\pm 2.0$	$\pm 0.5$
Antenna phase center variation	Rectangular	0.0	$\pm 0.2$
Antenna factor frequency interpolation	Rectangular	$\pm 0.25$	$\pm 0.25$
Measurement distance variation	Rectangular	$\pm 0.6$	$\pm 0.4$
Site imperfections	Rectangular	$\pm 2.0$	$\pm 2.0$
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67(Bi)$ 0.3 (Lp) Uncertainty limits $20\log(1+\Gamma_1\Gamma_R)$	U-Shaped	$+1.1$  $-1.25$	$\pm 0.5$
System repeatability	Std. Deviation	$\pm 0.5$	$\pm 0.5$
Repeatability of EUT		-	-
Combined standard uncertainty	Normal	+2.19 / -2.21	+1.74 / -1.72
Expanded uncertainty U	Normal (k=2)	+4.38 / -4.42	+3.48 / -3.44

Calculation for maximum uncertainty when 3m biconical antenna including a factor of k = 2 is used:

$$U = 2u_c(y) = 2x(+2.19) = +4.38 \text{ dB} \quad \text{And} \quad U = 2u_c(y) = 2x(-2.21) = -4.42 \text{ dB}$$