



**Ultratech's  
Accreditations:**



0685



31040/SIT



C-1376



46390-2049



200093-0



SL2-IN-E-1119R

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Oakville, Ontario,  
Canada L6H 6G4

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Sep. 06, 2007

**TIMCO ENGINEERING INC.**

P.O. Box 370  
849 N.W. State Road 45  
Newberry, Florida  
USA 32669

**Subject: FCC Certification Application Testing under FCC PART 15,  
Subpart C - Unlicensed Low Power Transmitter operating in the  
frequency band 13.553-13.567 MHz.**

**Product: WORKABOUT PRO G2  
Model No.: 7527SBTAVXB  
FCC ID: TBO7527SBTAVXB**

Dear Sir/Madam

As appointed agent for Applied RFID Solutions Inc., we would like to submit the application for certification of the above product. Please review all required documents uploaded to your E-Filing web site.

**RF Exposure Requirements:**

The Model 7527SBTAVXB employs 3 different co-located radios as below:

- (1) 13.56 MHz Radio Module
- (2) Bluetooth radio (2.4 GHz), FCC ID: GM37525BTB
- (3) 802.11g radio (2.4 GHz), FCC ID: GM37527RA2041

The Bluetooth radio (2.4 GHz), FCC ID: GM37525BTB, and 802.11b/g radio (2.4 GHz), FCC ID: GM37527RA2041. Both of these transmitters are certified as co-located transmitters.

If you have any queries, please do not hesitate to contact us.

Yours truly,



Tri Minh Luu, P. Eng.,  
V.P., Engineering

Encl



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Sep. 06, 2007

**Applied RFID Solutions Inc.**  
201-6272 East Boulevard  
Vancouver, BC  
Canada, V6M 3V7

**Attn.: Mr. Avihu Nachmani**

**Subject: FCC Certification Application Testing under FCC PART 15,  
Subpart C - Unlicensed Low Power Transmitter operating in the  
frequency band 13.553-13.567 MHz.**

**Product: WORKABOUT PRO G2**  
**Model No.: 7527SBTAVXB**  
**FCC ID: TBO7527SBTAVXB**

Dear Mr. Nachmani,

The product sample, as provided by you, has been tested and found to comply with **FCC PART 15, Subpart C - Unlicensed Low Power Transmitter operating in the frequency band 13.553-13.567 MHz.**

**RF Exposure Requirements:**

The Model 7527SBTAVXB employs 3 different co-located radios as below:

- (4) 13.56 MHz Radio Module
- (5) Bluetooth radio (2.4 GHz), FCC ID: GM37525BTB
- (6) 802.11g radio (2.4 GHz), FCC ID: GM37527RA2041

The Bluetooth radio (2.4 GHz), FCC ID: GM37525BTB, and 802.11b/g radio (2.4 GHz), FCC ID: GM37527RA2041. Both of these transmitters are certified as co-located transmitters.

Enclosed you will find copies of the engineering report. If you have any queries, please do not hesitate to contact us.

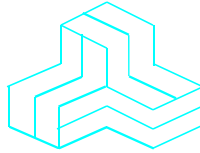
Yours truly,



Tri Minh Luu, P. Eng.,  
V.P., Engineering

Encl

# ENGINEERING TEST REPORT



**WORKABOUT PRO G2**  
**Model No.: 7527SBTAVXB**

**FCC ID: TBO7527SBTAVXB**

*Applicant:* **Applied RFID Solutions Inc.**  
201-6272 East Boulevard  
Vancouver, BC  
Canada, V6M 3V7

*In Accordance With*

**FEDERAL COMMUNICATIONS COMMISSION (FCC)**  
**PART 15, SUBPART C**  
**Unlicensed Low Power Transmitter**  
**operating in the band 13.553-13.567 MHz**

**UltraTech's File No.: TEK-594FCC15-225**

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



Date: Sep. 06, 2007

Report Prepared by: Tri Luu, P.Eng.

Tested by: Hung Trinh, RFI Test Technician

Issued Date: Sep. 06, 2007

Test Dates: Aug. 17-23, 2007

- *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

3000 Bristol Circle, Oakville, Ontario, Canada, L6H 6G4

Tel.: (905) 829-1570 Fax.: (905) 829-8050

Website: [www.ultratech-labs.com](http://www.ultratech-labs.com) Email: [vic@ultratech-labs.com](mailto:vic@ultratech-labs.com), Email: [tri.luu@sympatico.ca](mailto:tri.luu@sympatico.ca)



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SL2-IN-E-1119R

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## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

<b>Reference:</b>	FCC Part 15, Subpart C, Sec. 15.225 - Operation within the band 13.553-13.567 MHz.
<b>Title</b>	Telecommunication - Code of Federal Regulations, CFR 47, Part 15, Subpart C
<b>Purpose of Test:</b>	This report is covered test results for Certification compliance with FCC regulations for Unlicensed Low Power Transmitter operating in the 13.553-13.567 MHz band.
<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>	<ul style="list-style-type: none"><li>• Light-industry, Commercial</li><li>• Industry</li></ul>

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

None

### 1.3. NORMATIVE REFERENCES

Publication	YEAR	Title
FCC CFR Parts 0-19	2006	Code of Federal Regulations – Telecommunication
ANSI C63.4	2003	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
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 1. PERFORMANCE ASSESSMENT

### 1.1. CLIENT INFORMATION

<b>APPLICANT:</b>	
<b>Name:</b>	Applied RFID Solutions Inc.
<b>Address:</b>	201-6272 East Boulevard Vancouver, BC Canada, V6M 3V7
<b>Contact Person:</b>	Mr. Avihu Nachmani Phone #: 604-263-5529 Fax #: 604-263-9925 Email Address: avihu@applied-rfid.com

<b>MANUFACTURER:</b>	
<b>Name:</b>	Psion Teklogix Inc.
<b>Address:</b>	2100 Meadowvale Blvd. Mississauga, Ontario Canada, L5N 7J9
<b>Contact Person:</b>	Mr. Sada Dhawarkar Phone #: 905-812-6200 (x3358) Fax #: 905-812-6301 Email Address: sada.dhwarkar@psionteklogix.com

### 1.2. 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>	Psion Teklogix
<b>Product Name:</b>	WORKABOUT PRO G2
<b>Model Name or Number:</b>	7527SBTAVXB
<b>Part Number:</b>	N/A
<b>Serial Number:</b>	Preproduction
<b>Oscillators' Frequencies:</b>	13 MHz, 32.768 KHz, 6 MHz, 24.576 MHz, 13 MHz, 16 MHz
<b>CPU's Frequencies:</b>	520 MHz
<b>Power input source:</b>	3.7 VDC Battery

### 1.3. EUT'S TECHNICAL SPECIFICATIONS

<b>TRANSMITTER</b>	
<b>Equipment Type:</b>	▪ Portable
<b>Intended Operating Environment:</b>	▪ Commercial, light industry & heavy industry
<b>Power Supply Requirement:</b>	Battery 3.7 V
<b>Field Strength at 3 Meters:</b>	44.1 dB $\mu$ V/m @ 13.56 MHz
<b>Operating Frequency Range:</b>	13.553-13.567 MHz
<b>RF Output Impedance:</b>	50 Ohms
<b>Channel Spacing:</b>	Single channel
<b>Duty Cycle:</b>	N/A
<b>20 dB Bandwidth:</b>	3.47 kHz
<b>Modulation Type:</b>	ASK
<b>Emission Designation:</b>	3K47A1D
<b>Antenna Connector Type:</b>	• Integral, PCB type
<b>Antenna Description:</b>	Type: PCB Loop Antenna Antenna gain: -12 dBi In/Out Impedance: 50 Ohms

### 1.4. LIST OF EUT'S PORTS

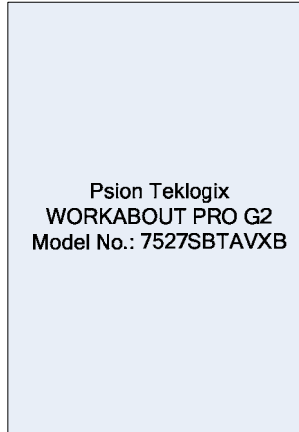
Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
1	LIF Port	1	12 Pin Pogo	N/A
2	Tether Port	1	18 Pin	N/A

### 1.5. ANCILLARY EQUIPMENT

N/A



## 1.6. GENERAL TEST SETUP



## EXHIBIT 2. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

### 2.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21°C
Humidity:	51%
Pressure:	102 kPa
Power input source:	Battery 3.7 V

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

<b>Operating Modes:</b>	Transmit RF signal
<b>Special Test Software:</b>	N/A
<b>Special Hardware Used:</b>	N/A
<b>Transmitter Test Antenna:</b>	The EUT is tested with the antenna fitted in a manner typical of normal intended use as an integral antenna equipment.

<b>Transmitter Test Signals:</b>	
<b>Frequencies:</b>	13.56 MHz

## EXHIBIT 3. SUMMARY OF TEST RESULTS

### 3.1. 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.

- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site 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 3-10 TDK Semi-Anechoic Chamber has been filed with FCC office (FCC File No.: 31040/SIT 1300B3) and Industry Canada office (Industry Canada File No.: IC2049-1). Last Date of Site Calibration: May 17, 2007.

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

FCC PARAGRAPH.	TEST REQUIREMENTS	COMPLIANCE (YES/NO)
15.203 & 15.204	The transmitter shall use a transmitting antenna that is an integral part of the device	Yes
	Power Limits & 20 dB Bandwidth	Yes
15.225(a)	Field Strength of Emissions inside and outside the permitted band 13.553-13.567 MHz	Yes
15.225(c)	Frequency Stability	Yes
15.107 & 15.207	Class B - AC Power Conducted Emissions on Tx, Rx and standby modes	N/A fro battery operated device
15.109(a)	Class B - Radiated Emissions from Unintentional Radiators	Yes. A separate test report will be provided upon request.

## **EXHIBIT 4. MEASUREMENTS, EXAMINATIONS & TEST DATA FOR EMC EMISSIONS**

### **4.1. 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.

### **4.2. 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.

### **4.3. 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.

#### 4.4. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

FCC Section	FCC Rules	
15.203	<p>Described how the EUT complies with the requirement that either its antenna is permanently attached, or that it employs a unique antenna connector, for every antenna proposed for use with the EUT.</p> <p>The exception is in those cases where EUT must be professionally installed. In order to demonstrate that professional installation is required, the following 3 points must be addressed:</p> <ul style="list-style-type: none"><li>• The application (or intended use) of the EUT</li><li>• The installation requirements of the EUT</li><li>• The method by which the EUT will be marketed</li></ul>	The antenna is permanently attached and enclosed inside the EUT's chassis.
15.204	<p>Provided the information for every antenna proposed for use with the EUT:</p> <p>(a) type (e.g. Yagi, patch, grid, dish, etc...), (b) manufacturer and model number (c) gain with reference to an isotropic radiator</p>	N/A

## 4.5. 20 DB BANDWIDTH @ FCC 15.407(A)

### 4.5.1. Limits

The 20 dB Bandwidth shall be less than 14 kHz [13.567 MHz – 15.553 MHz]

### 4.5.2. Method of Measurements

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

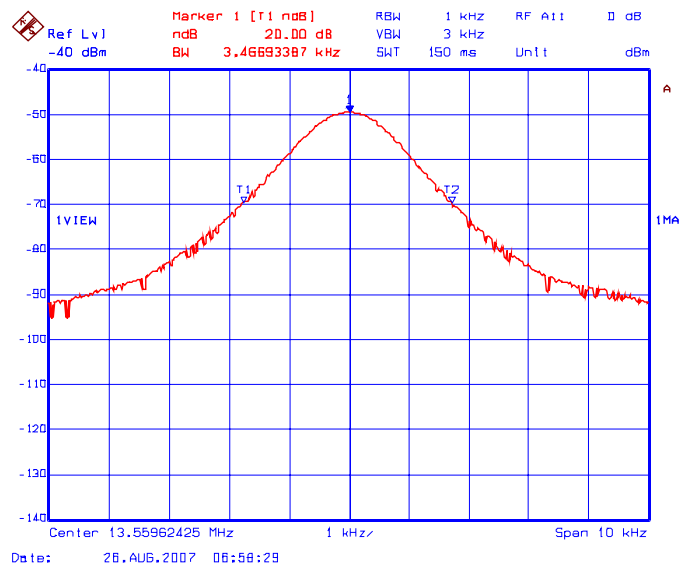
### 4.5.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schawrz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz with external mixer
Biconilog Antenna	EMCO	3142	10005	30 MHz to 2 GHz

### 4.5.4. Test Data

CHANNEL FREQUENCY (MHz)	20 dB Bandwidth (kHz)
13.56 MHz	3.47

**Plot #1: 20 dB Bandwidth Measurement**



## 4.6. FIELD STRENGTH OF EMISSIONS INSIDE & OUTSIDE THE PERMITTED BAND 13.553-13.567 MHZ @ 10 METERS, FCC 15.225(A)

### 4.6.1. Limits

- (a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

Alternative the limit of 47,544 microvolts/meter or 93.5 dBμV/m at 10 meters was used.

### Remarks:

#### FCC CFR 47, Part 15, Subpart C, Para. 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 CFR 47, Part 15, Subpart C, Para. 15.209(a) -- Field Strength Limits within Restricted Frequency Bands --

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/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

The alternative limits at the distance of 10 meters are used as below:

FREQUENCY (MHz)	FIELD STRENGTH LIMITS (microvolts/m)	FIELD STRENGTH LIMITS (dBμV/m)	DISTANCE (Meters)
0.009 - 0.490	7200 / F (KHz)	20*log [7200 / F (KHz)]	10
0.490 - 1.705	72,000 / F (KHz)	20*log[72,000 / F (KHz)]	10
1.705 - 30.0	90	39.1	10
30 - 88	30	29.5	10
88 - 216	45	33.1	10
216 - 960	60	35.6	10
Above 960	150	43.5	10

#### 4.6.2. Method of Measurements

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

Applies to harmonics/spurious that fall in the restricted bands listed in Section 15.205. the maximum permitted average field strength is listed in Section 15.209. A Pre-Amp and highpass filter are used for this measurement.

- For measurements from 9 KHz to 150 KHz, set RBW = 200 Hz, VBW  $\geq$  RBW, SWEEP=AUTO.
- For measurements from 150 KHz to 30 MHz, set RBW = 10 KHz, VBW  $\geq$  RBW, SWEEP=AUTO.
- For measurements from 30 MHz to 1 GHz, set RBW = 100 KHz, VBW  $\geq$  RBW, SWEEP=AUTO.
- For measurement above 1 GHz, set RBW = 1 MHz, VBW = 1 MHz, SWEEP=AUTO.

#### 4.6.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schawrz	FSEK20/B4/B2 1	834157/005	9 kHz – 40 GHz with external mixer
Active Loop Antenna	EMCO	6507	8906-1167	1 kHz – 30 MHz
Log Periodic/Bow-Tie Antenna	EMCO	3143	1029	20 - 1000 MHz

#### 4.6.4. Photographs of Test Setup

Refer to photos # 1, 2 and 3 in Annex 1 for photos of test setup.



4.6.5. Test Data

FREQUENCY (MHz)	RF LEVEL (dBµV/m)	EMI DETECTOR	ANTENNA PLANE (V/H)	LIMIT 15.209 (dBµV/m)	LIMIT MARGIN (dB)	PASS/ FAIL	Distance (m)
13.560	39.9	Peak	V	93.5	-53.6	PASS	10
13.560	44.1	Peak	H	93.5	-49.4	PASS	10
27.12	18.0	Peak	V	39.1	-21.1	PASS	10
27.12	21.4	Peak	H	39.1	-17.7	PASS	10
40.70	16.3	Peak	V	29.5	-13.2	PASS	10
162.72	20.9	Peak	V	33.1	-12.2	PASS	10
176.28	20.4	Peak	V	33.1	-12.7	PASS	10
189.84	21.1	Peak	V	33.1	-12.0	PASS	10
203.40	22.5	Peak	V	33.1	-10.6	PASS	10
203.40	16.4	Peak	H	33.1	-16.6	PASS	10
284.76	17.8	Peak	V	35.6	-17.7	PASS	10
298.32	23.1	Peak	H	35.6	-12.5	PASS	10
311.88	25.8	Peak	V	35.6	-9.7	PASS	10
311.88	19.8	Peak	H	35.6	-15.8	PASS	10
325.44	27.4	Peak	V	35.6	-8.2	PASS	10
379.68	27.5	Peak	V	35.6	-8.1	PASS	10
393.24	23.8	Peak	V	35.6	-11.8	PASS	10
393.24	22.0	Peak	H	35.6	-13.6	PASS	10
406.80	22.8	Peak	V	35.6	-12.8	PASS	10
420.36	24.9	Peak	V	35.6	-10.7	PASS	10
420.36	22.0	Peak	H	35.6	-13.6	PASS	10
433.90	27.8	Peak	V	35.6	-7.8	PASS	10
433.90	27.1	Peak	H	35.6	-8.5	PASS	10
447.48	29.9	Peak	V	35.6	-5.7	PASS	10
447.48	28.6	Peak	H	35.6	-7.0	PASS	10
461.04	33.5	Peak	V	35.6	-2.1	PASS	10
461.04	34.0	QP	H	35.6	-1.6	PASS	10
474.60	34.3	QP	V	35.6	-1.3	PASS	10
474.60	32.3	QP	H	35.6	-3.3	PASS	10
501.70	31.1	QP	V	35.6	-4.5	PASS	10
501.70	29.2	Peak	H	35.6	-6.4	PASS	10
528.84	25.2	Peak	V	35.6	-10.4	PASS	10
543.50	24.7	Peak	V	35.6	-10.9	PASS	10

The emissions were scanned from 10 kHz to 1 GHz and all emissions less 20 dB below the limits were recorded.

## 4.7. FREQUENCY STABILITY @ FCC §15.225(E)

### 4.7.1. Limits

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

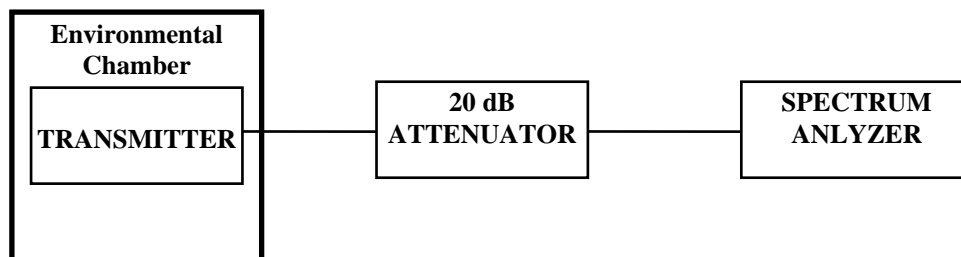
### 4.7.2. Method of Measurements

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

### 4.7.3. Test Equipment List

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range
Spectrum Analyzer/ EMI Receiver	Rohde & Schawrz	FSEK20/B4/B21	834157/005	9 kHz – 40 GHz with external mixer
Attenuator(s)	Bird	..	...	DC – 22 GHz
Temperature & Humidity Chamber	Tenney	T5	9723B	-40° to +60° C range

### 4.7.4. Test Arrangement



4.7.5. Test Data

<b>Frequency Band:</b>	13.553-13.567 MHz
<b>Center Frequency:</b>	13.56 MHz
<b>Frequency Tolerance Limit:</b>	Stay within the permitted bands
<b>Max. Frequency Tolerance Measured:</b>	± 0.1%
<b>Input Voltage Rating:</b>	3.7 Vdc

Ambient Temperature (°C)	Frequency Tolerance at Nominal Voltage 3.7 Vdc	Frequency Tolerance at Nominal Voltage 3.7 Vdc
	Hz	%
-30	-105	-0.0008
-20	-150	-0.0011
-10	-188	-0.0014
0	-263	-0.0019
+10	-304	-0.0022
<b>+20</b>	-210	-0.0016
+30	-180	-0.0013
+40	-256	-0.0019
+50	-316	-0.0023
+55	-376	-0.0028

## EXHIBIT 5. MEASUREMENT UNCERTAINTY

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

### 5.1. RADIATED EMISSION MEASUREMENT UNCERTAINTY

CONTRIBUTION (Radiated Emissions)	PROBABILITY DISTRIBUTION	UNCERTAINTY (+ dB)	
		3 m	10 m
Antenna Factor Calibration	Normal (k=2)	+1.0	+1.0
Cable Loss Calibration	Normal (k=2)	+0.3	+0.5
EMI Receiver specification	Rectangular	+1.5	+1.5
Antenna Directivity	Rectangular	+0.5	+0.5
Antenna factor variation with height	Rectangular	+2.0	+0.5
Antenna phase center variation	Rectangular	0.0	+0.2
Antenna factor frequency interpolation	Rectangular	+0.25	+0.25
Measurement distance variation	Rectangular	+0.6	+0.4
Site imperfections	Rectangular	+2.0	+2.0
Mismatch: Receiver VRC $\Gamma_1 = 0.2$ Antenna VRC $\Gamma_R = 0.67(Bi) 0.3 (Lp)$ Uncertainty limits $20\text{Log}(1+\Gamma_1\Gamma_R)$	U-Shaped	+1.1 -1.25	+0.5
System repeatability	Std. Deviation	+0.5	+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:

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

## EXHIBIT 6. MEASUREMENT METHODS

### 6.1. GENERAL TEST CONDITIONS

The following test conditions shall be applied throughout the tests covered in this report.

#### 6.1.1. Normal temperature and humidity

- Normal temperature: +15°C to +35°C
- Relative Humidity: +20% to 75%

The actual values during tests shall be recorded in the test report.

#### 6.1.2. Normal power source

##### 6.1.2.1. Mains Voltage

The nominal test voltage of the equipment to be connected to mains shall be the nominal mains voltage which is the declared voltage or any of the declared voltages for which the equipment was designed.

The frequency of test power source corresponding to the AC mains shall be between 59 Hz and 61 Hz.

##### 6.1.2.2. Battery Power Source.

For operation from battery power sources, the nominal test voltage shall be as declared by the equipment manufacturer. This shall be recorded in the test report.

#### 6.1.3. Operating Condition of Equipment under Test

- All tests were carried out while the equipment operated at the following frequencies:
  - The lowest operating frequency,
  - The middle operating frequency and
  - The highest operating frequency
- Modulation were applied using the Test Data sequence
- The transmitter was operated at the highest output power, or in the case the equipment able to operate at more than one power level, at the lowest and highest output powers

## 6.2. SPURIOUS EMISSIONS

For both conducted and radiated measurements, the spurious emissions were scanned from the lowest frequency generated by the EUT or 10 MHz whichever is lower to 10<sup>th</sup> harmonic of the highest frequency generated by the EUT.

- The radiated emission measurements were performed at the UltraTech's 3 Meter Open Field Test Site (OFTS) situated in the Town of Oakville, province of Ontario. The Attenuation Characteristics of OFTS have been filed to FCC, Industry Canada, ACA/Austel, NVLap and ITI.
- Radiated emissions measurements were made using the following test instruments:
  1. Calibrated EMCO BiconiLog antenna in the frequency range from 30 MHz to 2000 MHz.
  2. Calibrated Emco Horn antennas in the frequency range above 1000 MHz (1GHz - 40 GHz).
  3. The test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:
    - RBW = 100 kHz for  $f < 1\text{GHz}$  and RBW = 1 MHz for  $f \geq 1\text{GHz}$
    - VBW = RBW
    - Sweep = auto
    - Detector function = peak
    - Trace = max hold
    - Follows the guidelines in ANSI C63.4-1992 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc.. A pre-amp and highpass filter are required for this test, in order to provide the measuring system with sufficient sensitivity.
    - Allow the trace to stabilize.
    - The peak reading of the emission, after being corrected by the antenna correction factor, cable loss, pre-amp gain, etc.... is the peak field strength which comply with the limit specified in Section 15.35(b)

### Calculation of Field Strength:

The field strength is calculated by adding the calibrated antenna factor and cable factor, and subtracting the Amplifier gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

Where	FS	=	Field Strength
	RA	=	Receiver/Analyzer Reading
	AF	=	Antenna Factor
	CF	=	Cable Attenuation Factor
	AG	=	Amplifier Gain

Example: If a receiver reading of 60.0 dBuV is obtained, the antenna factor of 7.0 dB/m and cable factor of 1.0 dB are added, and the amplifier gain of 30 dB is subtracted. The actual field strength will be:

$$\text{Field Level} = 60 + 7.0 + 1.0 - 30 = 38.0 \text{ dBuV/m.}$$

$$\text{Field Level} = 10^{(38/20)} = 79.43 \text{ uV/m.}$$

- Submit this Test Data

- Now set the VBW to 10Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100ms, then the reading obtained may be further adjusted by a “duty cycle correction factor”, derived from  $10\log(\text{dwell time}/100\text{mS})$  in an effort to demonstrate compliance with the 15.209.
- Submit Test Data

### **Maximizing The Radiated Emissions:**

- The frequencies of emissions was first detected. Then the amplitude of the emissions was measured at the specified measurement distance using required antenna height, polarization, and detector characteristics.
- During this process, cables and peripheral devices were manipulated within the range of likely configuration.
- For each mode of operation required to be tested, the frequency spectrum was monitored. Variations in antenna heights (from 1 meter to 4 meters above the ground plane), antenna polarization (horizontal plane and vertical plane), cable placement and peripheral placement were explored to produce the highest amplitude signal relative to the limit.

The maximum radiated emission for a given mode of operation was found by using the following step-by-step procedure:

- Step1: Monitor the frequency range of interest at a fixed antenna height and EUT azimuth.
- Step2: Manipulate the system cables to produce highest amplitude signal relative to the limit. Note the amplitude and frequency of the suspect signal.
- Step3: Rotate the EUT 360 degrees to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, go back to the azimuth and repeat Step 2. Otherwise, orient the EUT azimuth to repeat the highest amplitude observation and proceed.
- Step4: Move the antenna over its full allowable range of travel (1 to 4 meters) to maximize the suspected highest amplitude signal. If the signal or another at a different frequency is observed to exceed the previously noted highest amplitude signal by 1 dB or more, return to Step 2 with the highest amplitude observation and proceed.
- Step5: Change the polarization of the antenna and repeat Step 2 through 4. Compare the resulting suspected highest amplitude signal with that found for the other polarization. Select and note the higher of the two signals. This signal is termed the highest observed signal with respect to the limit for this EUT operational mode.
- Step6: The effects of various modes of operation is examined. This is done by varying the equipment modes as steps 2 through 5 are being performed.
- Step7: After completing steps 1 through 6, record the final highest emission level, frequency, antenna polarization and detector mode of the measuring instrument.

### 6.3. 20 DB BANDWIDTH MEASUREMENTS

- Couple the RF output signal to the spectrum analyzer by means of direct connection or by a receiving antenna.
- The spectrum analyzer shall be set as follows:
  - Span: Minimum span to fully display the entire emission, approximately 3 x emission BW.
  - Resolution RBW: 1% to 3% of the approximate emission BW
  - Video VBW: 3 x RBW
  - EMI Detector: Peak
  - Sweep Time: Coupled or set to a slow rate
  - Trace: Max-hold
- Place the marker at both sides of the emission slope and at -20 dB down from the peak value.
- The difference of frequencies of 2 markers will be the 20 dB bandwidth
- Record and plot the test results.

### 6.4. FREQUENCY STABILITY

Refer to FCC @ 2.1055.

- (a) The frequency stability shall be measured with variation of ambient temperature as follows: From -30 to +50 centigrade except that specified in subparagraph (2) & (3) of this paragraph.
- (b) Frequency measurements shall be made at extremes of the specified temperature range and at intervals of not more than 10 centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short-term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stability circuitry need be subjected to the temperature variation test.
- (d) The frequency stability supply shall be measured with variation of primary supply voltage as follows:
  - (1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.
  - (2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.
  - (3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.
- (e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c) and (d) of this section. (For example, measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment).