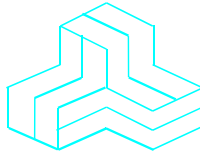


# ENGINEERING TEST REPORT



**Postal RFID Active Tag**

**Model: PT40**

**FCC ID: PQG-PT40**

*Applicant:*

**Lyngsoe Systems Ltd.**

5570 Kennedy Road, Unit B  
Mississauga, Ontario  
Canada L4Z 2A9

**In Accordance With  
Federal Communications Commission (FCC)  
Part 15, Subpart C, Section 15.231  
Low Power Transmitter & Momentarily Operation (433.92 MHz)**

**UltraTech's File No.: LYI-095F15C231**

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

Date: May 7, 2012

Report Prepared by: Dan Huynh

Tested by: Mr. Wei Wu

Issued Date: May 7, 2012

Test Dates: April 17, 2012

- 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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FCC

91038



1309



46390-2049



NvLap Lab Code 200093-0



SL2-IN-E-1119R



Korea KCC-RRL  
CA2049

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May 7, 2012

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## EXHIBIT 1. INTRODUCTION

### 1.1. SCOPE

<b>Reference:</b>	FCC Part 15, Subpart C, Section 15.231
<b>Title:</b>	Code of Federal Regulations (CFR), Title 47, Telecommunication - Part 15
<b>Purpose of Test:</b>	To gain FCC Equipment Certification for section 15.231 - Momentarily Operation at 433.92 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

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

None.

### 1.3. NORMATIVE REFERENCES

Publication	Year	Title
FCC 47 CFR 15	2011	Code of Federal Regulations, Title 47 – Telecommunication, Part 15 - Radio Frequency Devices
ANSI C63.4	2009	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 EN 55022	2008-09, Edition 6.0 2006	Information Technology Equipment - Radio Disturbance Characteristics - Limits and Methods of Measurement
CISPR 16-1-1 +A1 +A2	2006 2006 2007	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-1: Measuring Apparatus
CISPR 16-1-2 +A1 +A2	2003 2004 2006	Specification for radio disturbance and immunity measuring apparatus and methods. Part 1-2: Conducted disturbances

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## EXHIBIT 2. PERFORMANCE ASSESSMENT

### 2.1. CLIENT INFORMATION

APPLICANT	
<b>Name:</b>	Lyngsoe Systems Ltd.
<b>Address:</b>	5570 Kennedy Road, Unit B Mississauga, Ontario Canada L4Z 2A9
<b>Contact Person:</b>	Donald Ferguson Phone #: 905-501-1533 Fax #: 905-501-1538 Email Address: dfe@lyngsoesystems.com

MANUFACTURER	
<b>Name:</b>	Lyngsoe Systems Ltd.
<b>Address:</b>	5570 Kennedy Road, Unit B Mississauga, Ontario Canada L4Z 2A9
<b>Contact Person:</b>	Donald Ferguson Phone #: 905 501 1533 Fax #: 905-501-1538 Email Address: dfe@lyngsoesystems.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>	Lyngsoe Systems Ltd.
<b>Product Name:</b>	Postal RFID Active Tag
<b>Model Name or Number:</b>	PT40
<b>Serial Number:</b>	Test sample
<b>Type of Equipment:</b>	Momentarily operated device
<b>Input Power Supply Type:</b>	Integral 3V Battery
<b>Primary User Functions of EUT:</b>	Used in the Automatic Mail Quality Measurements for International Post Corporation and for national posts including Canada Post.

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### 2.3. EUT'S TECHNICAL SPECIFICATIONS

TRANSMITTER	
Equipment Type:	Portable
Intended Operating Environment:	Commercial, light industry & heavy industry
Power Supply Requirement:	Integral 3V battery
RF Output Power Rating:	79.33 dBμV/m peak at 3m distance
Operating Frequency Range:	433.92 MHz
Duty Cycle:	18.7 %
20 dB Bandwidth:	43.89 kHz
Modulation Type:	FSK
Oscillator Frequencies:	18.080 MHz
Antenna Connector Type:	Integral
Antenna Description:	Manufacturer: Lyngsoe Systems Type: PCB trace Model: N/A Frequency Range: 433.92 MHz Gain: -19.4 dBi
RECEIVER	
Equipment Type:	Portable
Power Supply Requirement:	Integral 3V battery
Operating Frequency Range:	125 kHz
RF Output Impedance:	n/a
Intermediate Frequency(ies):	None
Oscillator Frequency(ies):	None

### 2.4. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
No interface port				

### 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:

No ancillary equipment.

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## 2.6. TEST SETUP BLOCK DIAGRAM

Stand-alone Device



## 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:	3V battery

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

<b>Operating Modes:</b>	The EUT was configured for continuous transmission for the duration of testing.
<b>Special Test Software:</b>	N/A
<b>Special Hardware Used:</b>	N/A
<b>Transmitter Test Antenna:</b>	The EUT was 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>	433.92 MHz
<b>Test Frequency(ies):</b>	433.92 MHz
<b>RF Power Output:</b>	79.33 dBµV/m peak at 3m distance
<b>Normal Test Modulation:</b>	FSK
<b>Modulating Signal Source:</b>	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 Power Line 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 3-10 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.: 91038) and Industry Canada office (Industry Canada File No.: 2049A-3). Expiry Date: 2014-04-04.

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

FCC Section(s)	Test Requirements	Compliance (Yes/No)
15.203	Antenna Requirement	Yes*
15.231(a)	Provisions of FCC 15.231	Yes
15.231(b) 15.209	Transmitter Radiated Emissions - Fundamental, Harmonic and Spurious Emissions	Yes
15.231(c)	20 dB Bandwidth	Yes
15.231(d)	Frequency Tolerance for Devices Operating within the Frequency Band 40.66-40.70 MHz	Not applicable
15.207(a)	AC Powerline Conducted Emissions	Not applicable for battery operated device.

\* The EUT complies with the requirement; it employs a PCB trace antenna.

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

None.

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## EXHIBIT 5. TEST DATA

### 5.1. PROVISIONS FOR PERIODIC TRANSMITTERS [47 CFR 15.231(a)]

FCC Rules	FCC Provisions	Analysis on Compliance
15.231(a)	The intentional radiator restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal.	The EUT transmission contains a fixed recognition code only, it does not transmit data.
15.231(a)(1)	A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	N/A
15.231(a)(2)	A transmitter activated automatically shall cease transmission within 5 seconds after activation.	The length of transmission is limited to less than 5 seconds through internal software.
15.231(a)(3)	Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.	Transmission is activated when the EUT passes through a disturbance field generated at entry gates in Post Offices or facilities where statistical measurement of the flow of goods requires automatic measurement. Presentation of the EUT in the disturbance field is unpredictable. It varies with the processing flow of the mail and seeding. The EUT is seeded into the mail randomly to permit the statistical measurement of mail flow efficiency.
15.231(a)(4)	Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.	N/A
15.231(a)(5)	Transmission of set-up information for security systems may exceed the transmission duration limits in paragraphs (a)(1) and (a)(2) of this section, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.	N/A

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## 5.2. TRANSMITTER RADIATED EMISSIONS [47 CFR §§ 15.231(b), 15.209 & 15.205]

### 5.2.1. Limit(s)

**47 CFR 15.231(b) Field Strength Limits**

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66-40.70.	2,250	225
70-130	1,250	125
130-174	1,250 to 3,750 <sup>1</sup>	125 to 375 <sup>1</sup>
174-260	3,750	375
260-470	3,750 to 12,500 <sup>1</sup>	375 to 1,250 <sup>1</sup>
Above 470	12,500	1,250

<sup>1</sup> Linear interpolations with frequency F in MHz:

For 130-174 MHz: FS (microvolts/m) = (56.82 x F) - 6136

For 260-470 MHz: FS (microvolts/m) = (41.67 x F) - 7083.

- (1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.
- (2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

**47 CFR 15.205(a) Restricted bands of operation**

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
<sup>1</sup> 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	( <sup>2</sup> )
13.36-13.41.			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

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- (3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

**47 CFR 15.209(a) General Field Strength Limits**

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/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
** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54–72 MHz, 76– 88 MHz, 174–216 MHz or 470–806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§ 15.231 and 15.241.		

### 5.2.2. Method of Measurements

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

### 5.2.3. Test Data

#### Remarks:

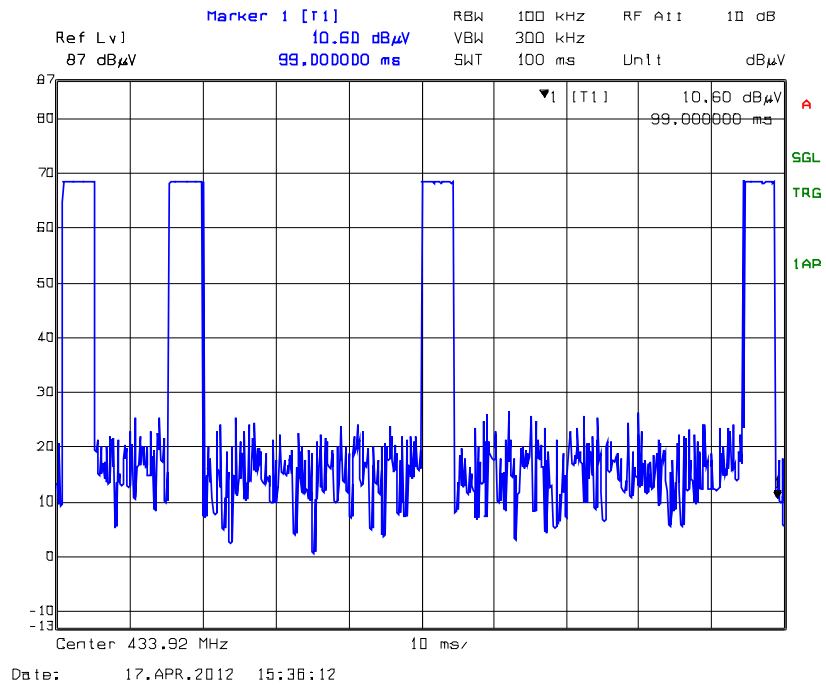
- The measuring receiver shall be tuned over the frequency range of 30 MHz to the 10<sup>th</sup> harmonic of the highest fundamental frequency.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- For portable transmitter, EUT shall be placed in three different orthogonal positions for searching maximum field strength level.
- In the restricted band per FCC 15.205: § 15.209 (a) limits applied
- Outside the restricted band per FCC 15.205: § 15.231 (b) limits or § 15.209 (a) applied, whichever allows higher field strength emission.
- Section 15.231(b) field strength limit of the fundamental at 433.92 MHz =  $20 \log [(41.67 \times 433.92) - 7083] = 80.8 \text{ dB}\mu\text{V/m}$
- Spurious emissions limit is 20 dB below fundamental limit.
- Duty Cycle: measured maximum duty cycle is 18.7 %.
- The peak-average correction factor was obtained from the duty cycle calculation (see plots 5.2.3.1 and 5.2.3.2 for detail).

$$\text{Duty cycle correction factor} = 20 \cdot \log (T_{\text{ON}}/100 \text{ ms}) = 20 \cdot \log (4 \cdot 4.687375 \text{ ms}/100 \text{ ms}) = -14.54 \text{ dB}$$

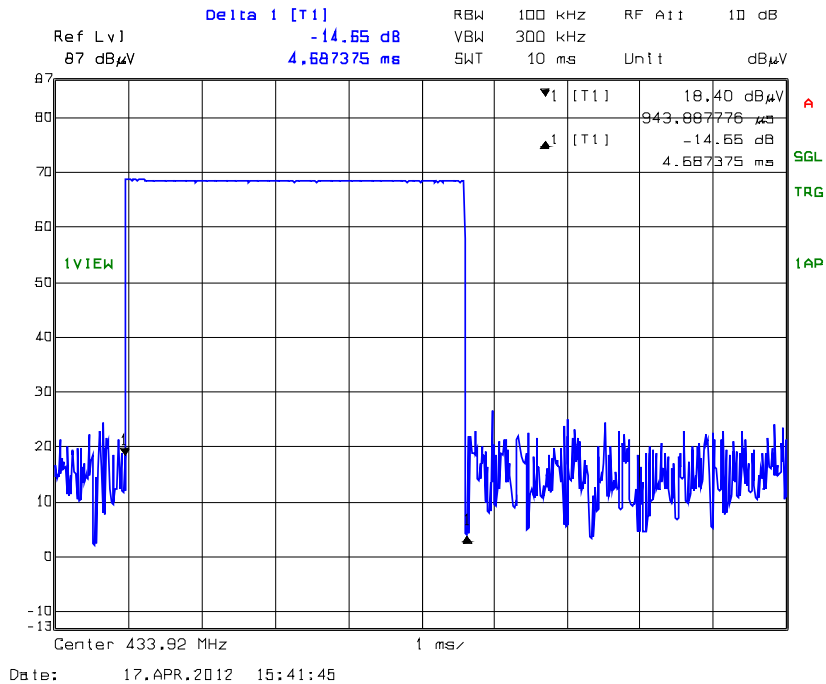
Frequency (MHz)	Peak E-Field @ 3m (dBμV/m)	Average E-Field @ 3m (dBμV/m)	Antenna Plane (H/V)	§ 15.231 (b) Limits @ 3m (dBμV/m)	§ 15.209 (a) Limits @ 3m (dBμV/m)	Margin (dB)	Pass/Fail
433.92	78.67	64.13	V	80.8	--	-16.7	Pass
433.92	79.33	64.79	H	80.8	--	-16.0	Pass
1301.76	49.15	34.61	H	60.8	54.0	-19.4	Pass*
2169.60	57.12	42.58	H	60.8	54.0	-18.2	Pass

\* Emissions within the restricted bands.

Plot 5.2.3.1. Duty Cycle in 100 ms (pulse train)



Plot 5.2.3.2. Duty Cycle (pulse length is 4.687375 ms)



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### 5.3. 20 dB BANDWIDTH [47 CFR 15.231(c)]

#### 5.3.1. Limit(s)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

#### 5.3.2. Method of Measurements

The measurements were performed in accordance with Ultratech Test Procedures, File # ULTR P001-2004 and ANSI C63.4.

#### 5.3.3. Test Data

Channel Frequency (MHz)	20 dB Bandwidth (kHz)	Maximum Bandwidth Limit (kHz)
433.92	43.89	1084.8

See the following plot for details.

**Plot 5.3.3.1. 20 dB Bandwidth**  
Fc: 433.92 MHz



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## EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSEK	834157/005	9 KHz – 40 GHz	28 Jul 2012
Environment Chamber	Envirotronics	SSH32C	11994847-S-11059	-60 to 177 °C	11 Aug 2012
RF Synthesized signal Generator	HP	8648C	3343U00391	100K-3200M Hz AM/ FM/ PM	14 Dec 2012
Power supply	Tenma	72-7295	490300297	1-40V DC 5A	Cal on use
Horn antenna	ETS-LINDGREN	3117	119425	1-18GHz	02 Apr 2013
Preamplifier	Hewlett Packard	8449B	3008A00769	1-26.5GHz	01 Feb 2013
High Pass Filter	Mini Circuit	SHP 600		Cut off 560 MHz	Cal on use
Attenuator	Aeroflex/Weinschel	23-20-34	BH7876	DC-18 GHz	Cal on use
Antenna	ETS	93148	1101	200-2000 MHz	02 Apr 2013
Preamplifier	COM-POWER	PA-103	161243	10-1000MHz	11 Dec 2012
Dipole Antenna	EMCO	3121C 3121-DB4	8907-434	400-1000MHz	06 Jan 2013
Spectrum Analyzer	Rohde & Schwarz	ESU40	100037	20 Hz – 40 GHz	19 Mar 2013
Biconi-Log Antenna	EMCO	3142C	00034792	26 – 3000 MHz	26 Apr 2012
Pre-Amplifier	AH System	PAM-0118	225	20 MHz – 18 GHz	16 Mar 2013
Horn Antenna	EMCO	3115	5061	1 – 18 GHz	25 Jan 2013

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## EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

### 7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (150 kHz – 30 MHz):	Measured	Limit
$u_c$	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 1.57$	$\pm 1.8$
$U$	Expanded uncertainty U: $U = 2u_c(y)$	$\pm 3.14$	$\pm 3.6$

### 7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	Measured	Limit
$u_c$	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 2.15$	$\pm 2.6$
$U$	Expanded uncertainty U: $U = 2u_c(y)$	$\pm 4.30$	$\pm 5.2$

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	Measured	Limit
$u_c$	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 2.39$	$\pm 2.6$
$U$	Expanded uncertainty U: $U = 2u_c(y)$	$\pm 4.78$	$\pm 5.2$

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	Measured	Limit
$u_c$	Combined standard uncertainty: $u_c(y) = \sqrt{\sum_{i=1}^m u_i^2(y)}$	$\pm 1.87$	Under consideration
$U$	Expanded uncertainty U: $U = 2u_c(y)$	$\pm 3.75$	Under consideration

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File #: LYI-095F15C231  
May 7, 2012

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