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February 18, 2015

John Weber  
Long Range Systems, LLC  
4550 Excel Parkway Suite 200  
Addison TX 75001

Dear John:

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for Long Range Systems, LLC. Enclosed is the Wireless Certification Report for the TT-SIL-Z pager. This report can be used to demonstrate compliance with the wireless regulatory requirements for wireless devices in North America.

If you have any questions, please contact me.

Sincerely,

Jeffrey A. Lenk  
President

Attachment

Project 16693-15

**TT-SIL-Z**  
**Wireless Pager**  
**2.4 GHz Zigbee Section**  
**Receive Mode Radiated Emissions**  
  
**Wireless Certification Report**

Prepared for:

Long Range Systems, LLC  
4550 Excel Parkway Suite 200  
Addison TX 75001

By

Professional Testing (EMI), Inc.  
1601 North A.W. Grimes Blvd., Suite B  
Round Rock, Texas 78665

February 18, 2015

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Reviewed by



Larry Finn  
Chief Technical Officer

Written by



Eric Lifsey  
EMC Engineer

**Revision History**

Revision Number	Description	Date
00	Initial Release	February 18, 2015
01	Revised/final per reviewer comments.	February 18, 2015

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### NOTICE:

(1) This Report must not be used to claim product endorsement, by NVLAP, NIST, the FCC or any other Agency. This report also does not warrant certification by NVLAP or NIST.

(2) This report shall not be reproduced except in full, without the written approval of Professional Testing (EMI), Inc.

(3) The significance of this report is dependent on the representative character of the test sample submitted for evaluation and the results apply only in reference to the sample tested. The manufacturer must continuously implement the changes shown herein to attain and maintain the required degree of compliance.



# Certificate of Compliance

Applicant	Device & Test Identification
Long Range Systems LLC (John Weber) 4550 Excel Parkway Suite 200 Addison TX 75001 Certificate Date: February 18, 2015	FCC ID: 2AB6OTRACKER Industry Canada ID: 5501A-TRACKER Model(s): TT-SIL-Z Laboratory Project ID: 16693-15

The device model(s) listed above were tested utilizing the following documents and found to be in compliance with the required criteria.

47 CFR (USA), IC (Industry Canada)	
Section Reference FCC   IC	Parameter
15.209   RSS-210 Issue 8	Spurious Emissions, Receive Mode

I, Eric Lifsey, for Professional Testing (EMI), Inc., being familiar with the above rules and test procedures have reviewed the test setup, measured data, and this report. I believe them to be true and accurate.

Eric Lifsey  
EMC Engineer

This report has been reviewed and accepted by the Applicant. The undersigned is responsible for ensuring that this device will continue to comply with the rules listed above.

---

Representative of Applicant

## 1.0 Introduction

### 1.1 Scope

This report describes the extent to which the equipment under test (EUT) conformed to the intentional radiator requirements of North America.

Professional Testing (EMI), Inc., (PTI) follows the guidelines of National Institute of Standards and Technology (NIST) for all uncertainty calculations, estimates, and expressions thereof for electromagnetic compatibility testing. The procedures of ANSI C63.4: 2009 were used for making all radiated enclosure and mains emission measurements.

### 1.2 EUT Description

This device is a wireless pager for restaurant use in paging patrons for service. The Zigbee device in this report is one part of a two-part composite wireless device. The Zigbee 2.4 GHz section was previously tested and certified for FCC; this report augments the FCC report by adding receive mode spurious emission test results for IC. The pager includes a 13.56 MHz RFID type radio which was tested separately.

**Table 1.2.1: Equipment Under Test**

Manufacturer	Model	Serial #	Description
Long Range Systems LLC	TT-SIL-Z	19	Wireless pager, Zigbee section

The device is composed of an approximately square circuit board in a rigid plastic case approximately 10 x 12 cm in size and ~1.5 cm in height. It is designed such that it presents as a drink coaster.

In operation the pager is alerted by a signal from a base unit. It then flashes a set of LED indicators and vibrates to get the patrons attention. The Zigbee 2.4 GHz functionality communicates with a base unit such as a TX-7470 or similar.



**EUT Photograph**

### 1.3 EUT Operation

The EUT was exercised in a manner consistent with normal operations.

### 1.4 Modifications to Equipment

No modifications were made to the EUT during the performance of the test program.

### 1.5 Test Site

Measurements were made at the PTI semi-anechoic facility designated Site 45 (FCC 459644, IC 3036B-1) in Austin, Texas. The site is registered with the FCC under Section 2.948 and Industry Canada per RSS-GEN, and is subsequently confirmed by laboratory accreditation (NVLAP). The test site is located at 11400 Burnet Road, Austin, Texas 78758, while the main office is located at 1601 North A.W. Grimes Boulevard, Suite B, Round Rock, Texas, 78665.

### 1.6 Radiated Measurements

Radiated levels are determined as follows:

<b>Raw Measured Level + Antenna Factor + Cable Losses – Amplifier Gain = Corrected Level</b>
--

Additionally, measurement distance extrapolation factors are applied and documented where used.

## 2.0 Applicable Documents and Clauses

Table 2.0.1: Applicable Documents	
Document	Title/Description
47 CFR (USA)	Part 15 – Section 15.225
ANSI C63.4 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment
RSS-Gen Issue 4	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 8	Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

Table 2.0.2: Applicable Clauses	
47 CFR (USA), IC (Industry Canada)	
Section Reference FCC   IC	Parameter
15.209   RSS-210 Issue 8	Spurious Emissions Receive Mode

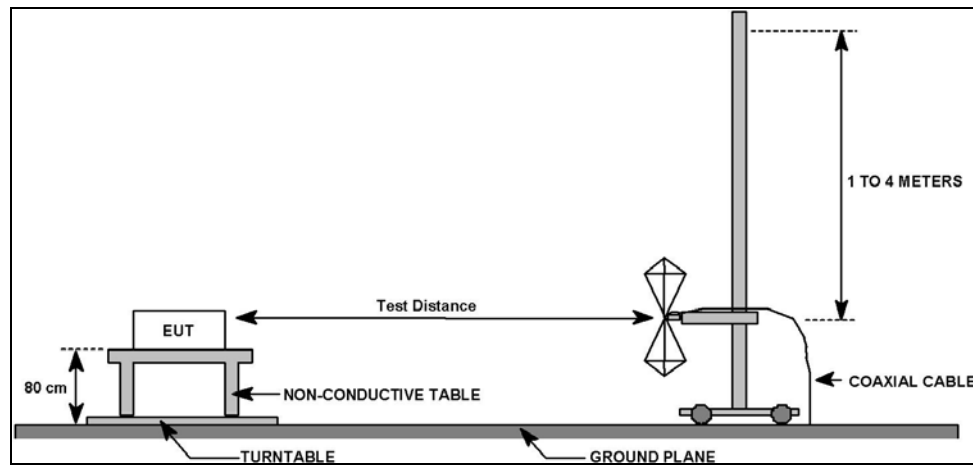


### 3.0 Radiated Spurious Emissions

#### 3.1 Test Procedure

The EUT was placed on a non-conductive table 0.8 meters above the ground plane. The table was centered on a rotating turntable. Emissions were measured at a distance of 10 meters below 1 GHz and at 3 meters above 1 GHz.

A diagram showing the test setup is given in the figure below.



**Field Strength of Spurious Emissions Test Setup**

#### 3.2 Test Criteria

Section Number FCC   IC	Clause Subject	Date
15.209   RSS-210	Field Strength of Radiated Spurious/Harmonic Emissions Receive Mode	2015-01-07

#### 3.3 Test Results

Peak detection was employed. Quasi-Peak detection was used if peaks exceeded the limits.

Note that the lowest flat limit line in the plots below can be disregarded. The data was taken and shared for other regulatory limits.

The EUT satisfied the criteria. Recorded data is presented below.

Table 3.3.1: Radiated Spurious Emissions, 30 MHz to 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.									
In accordance with:		Industry Canada - ICES-003 Issue 5, August 2012 - Spectrum Management and Telecommunications, Interference-Causing Equipment Standard, Information Technology Equipment (ITE) – Limits and methods of measurement							
Section:									
Test Date(s):		1/7/2015			EUT Serial #:		0		
Customer:		Long Range Systems			EUT Part #:		TT-SIL-Z		
Project Number:		16297-15, 16693-15			Test Technician:		Eric Lifsey		
Purchase Order #:		NA			Supervisor:		Lisa Arndt		
Equip. Under Test:		Table Tracker TT-SIL-Z			Witness' Name:		NA		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
EUT Line Voltage:		12		VDC		EUT Power Frequency:		0 N/A	
Antenna Orientation:		Vertical			Frequency Range:		30MHz to 1GHz		
EUT Mode of Operation:					Receive Mode				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
56.957	10	36	3.81	Quasi-peak	33.9	13.521	29.5	-16.0	Pass
60.0005	10	5	3.85	Quasi-peak	38.9	18.124	29.5	-11.4	Pass
65.0624	10	31	2.31	Quasi-peak	36.6	15.585	29.5	-13.9	Pass
874.734	10	29	3.8	Quasi-peak	22.7	24.196	35.5	-11.3	Pass
892.009	10	16	1.79	Quasi-peak	22.7	24.537	35.5	-11.0	Pass
931.439	10	46	3.08	Quasi-peak	23.1	25.185	35.5	-10.3	Pass

Professional Testing, EMI, Inc

Radiated Emissions, 10m Distance

30MHz - 1GHz Vertical Polarity Measured Emissions

— Quasi-peak Limit Level

— Corrected Quasi-peak Reading

— Peak Limit Level

— Corrected Peak Value

— Verified Low-PRE OP Reading

— Limit - ETSI300440 - RecMode

Operator: Eric Lifsey

16297TC300440'RERecModeLPRF4d

03:37:18 PM, Wednesday, January 07, 2015

EUT Mode: Receive

EUT Power: Battery, charging

EUT: Table Tracker TT-SIL-Z

Project Number: 16297-15

Client: Long Range Systems

≤ 1GHz Vertical Antenna Polarity Measured Emissions

≤ 1GHz Vertical Antenna Polarity Measured Emissions

**Table 3.3.2: Radiated Spurious Emissions, 30 MHz to 1 GHz, Horizontal Polarity**

Professional Testing, EMI, Inc.									
<b>In accordance with:</b>		Industry Canada - ICES-003 Issue 5, August 2012 - Spectrum Management and Telecommunications, Interference-Causing Equipment Standard, Information Technology Equipment (ITE) – Limits and methods of measurement							
<b>Section:</b>									
<b>Test Date(s):</b>		1/7/2015			<b>EUT Serial #:</b>		0		
<b>Customer:</b>		Long Range Systems			<b>EUT Part #:</b>		TT-SIL-Z		
<b>Project Number:</b>		16297-15, 16693-15			<b>Test Technician:</b>		Eric Lifsey		
<b>Purchase Order #:</b>		NA			<b>Supervisor:</b>		Lisa Arndt		
<b>Equip. Under Test:</b>		Table Tracker TT-SIL-Z			<b>Witness' Name:</b>		NA		
Radiated Emissions Test Results Data Sheet							Page: 1 of 1		
<b>EUT Line Voltage:</b>		12 VDC			<b>EUT Power Frequency:</b>		0 N/A		
<b>Antenna Orientation:</b>		Horizontal			<b>Frequency Range:</b>		30MHz to 1GHz		
<b>EUT Mode of Operation:</b>					<b>Receive Mode</b>				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
35.9117	10	159	1.41	Quasi-peak	23.3	9.524	29.5	-20.0	Pass
38.5673	10	201	2.04	Quasi-peak	23.5	8.326	29.5	-21.2	Pass
76.9297	10	61	3.56	Quasi-peak	30.2	8.98	29.5	-20.5	Pass
889.079	10	260	2.87	Quasi-peak	22.7	24.484	35.5	-11.0	Pass
947.927	10	109	2.63	Quasi-peak	22.5	24.897	35.5	-10.6	Pass
982.628	10	173	1.76	Quasi-peak	22.4	25.183	43.5	-18.3	Pass

**Professional Testing, EMI, Inc**  
Radiated Emissions, 10m Distance  
30MHz - 1GHz Horizontal Polarity Measured Emissions

Operator: Eric Lifsey  
16297TC300440RERecModeLPRF.ttl  
03:37:18 PM, Wednesday, January 07, 2015

Frequency

EUT: Table Tracker TT-SIL-Z  
Project Number: 16297-15  
Client: Long Range Systems

**PROFESSIONAL TESTING**

**≤ 1GHz Horizontal Antenna Polarity Measured Emissions**

**Table 3.3.3: Radiated Spurious Emissions, 1 to 13 GHz, Vertical Polarity**

Professional Testing, EMI, Inc.									
<b>In accordance with:</b>		Industry Canada - ICES-003 Issue 5, August 2012 - Spectrum Management and Telecommunications, Interference-Causing Equipment Standard, Information Technology Equipment (ITE) – Limits and methods of measurement							
<b>Section:</b>									
<b>Test Date(s):</b>		1/7/2015			<b>EUT Serial #:</b>		0		
<b>Customer:</b>		Long Range Systems			<b>EUT Part #:</b>		TT-SIL-Z		
<b>Project Number:</b>		16297-15, 16693-15			<b>Test Technician:</b>		Eric Lifsey		
<b>Purchase Order #:</b>		NA			<b>Supervisor:</b>		Lisa Arndt		
<b>Equip. Under Test:</b>		Table Tracker TT-SIL-Z			<b>Witness' Name:</b>		NA		
<b>Radiated Emissions Test Results Data Sheet</b>							Page: 1 of 1		
<b>EUT Line Voltage:</b>		12 VDC		<b>EUT Power Frequency:</b>		0 N/A			
<b>Antenna Orientation:</b>		Vertical			<b>Frequency Range:</b>		Above 1GHz		
<b>EUT Mode of Operation:</b>					<b>Receive Mode</b>				
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
1743.93	3	117	1	Average	36.5	24.779	54.0	-29.2	Pass
2110.86	3	34	1	Average	37.1	27.036	54.0	-26.9	Pass
2789.34	3	69	1	Average	36.6	28.327	54.0	-25.6	Pass
3371.41	3	191	1	Average	36.8	28.58	54.0	-25.4	Pass
4192.65	3	170	1	Average	36.2	29.807	54.0	-24.2	Pass
4893.35	3	52	1	Average	35.5	29.748	54.0	-24.2	Pass
7891.45	3	33	1	Average	30.3	34.145	54.0	-19.8	Pass
8789.24	3	105	1	Average	29.1	34.532	54.0	-19.4	Pass
11464.6	3	318	1	Average	29.5	38.187	54.0	-15.8	Pass
11725.2	3	176	1	Average	29.8	37.642	54.0	-16.3	Pass
11996.7	3	155	1	Average	29.7	37.697	54.0	-16.3	Pass
12628.5	3	351	1	Average	29.7	37.959	54.0	-16.0	Pass

**Professional Testing, EMI, Inc**  
Radiated Emissions, 3m Distance  
1-18GHz Vertical Polarity Measured Emissions

— Average Limit Level  
 ▽ Corrected Average Reading  
 — Peak Limit Level  
 — Corrected Peak Reading  
 — Limit ETSI300440 RecMode

Operator: Eric Lifsey  
 16297 TC300440 RE RecMode LPRF.ttl  
 04:35:39 PM, Wednesday, January 07, 2015

EUT Mode: Receive  
 EUT Power: Battery, charging

EUT: Table Tracker TT-SIL-Z  
 Project Number: 16297-15  
 Client: Long Range Systems

**> 1GHz Vertical Antenna Polarity Measured Emissions**

Table 3.3.4: Radiated Spurious Emissions, 1 to 13 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.									
In accordance with:		Industry Canada - ICES-003 Issue 5, August 2012 - Spectrum Management and Telecommunications, Interference-Causing Equipment Standard, Information Technology Equipment (ITE) – Limits and methods of measurement							
Section:									
Test Date(s):	1/7/2015	EUT Serial #:	0						
Customer:	Long Range Systems	EUT Part #:	TT-SIL-Z						
Project Number:	16297-15, 16693-15	Test Technician:	Eric Lifsey						
Purchase Order #:	NA	Supervisor:	Lisa Arndt						
Equip. Under Test:	Table Tracker TT-SIL-Z	Witness' Name:	NA						
Radiated Emissions Test Results Data Sheet								Page: 1 of 1	
EUT Line Voltage:		12	VDC	EUT Power Frequency:		0	N/A		
Antenna Orientation:		Horizontal		Frequency Range:		Above 1GHz			
EUT Mode of Operation:				Receive Mode					
Frequency Measured (MHz)	Test Distance (Meters)	EUT Direction (Degrees)	Antenna Height (Meters)	Detector Function	Recorded Amplitude (dBμV)	Corrected Level (dBμV/m)	Limit Level (dBμV/m)	Margin (dB)	Test Results
1700.4	3	266	1	Average	36.9	24.94	54.0	-29.0	Pass
2093.57	3	213	1	Average	36.9	26.815	54.0	-27.1	Pass
2308.79	3	116	1	Average	36.5	27.005	54.0	-27.0	Pass
3282.93	3	351	1	Average	36.5	28.211	54.0	-25.7	Pass
4855.35	3	340	1	Average	35.7	29.938	54.0	-24.0	Pass
6022.05	3	213	1	Average	33.7	31.013	54.0	-22.9	Pass
6739.68	3	104	1	Average	32	31.63	54.0	-22.3	Pass
7777.65	3	138	1	Average	30.2	34.074	54.0	-19.9	Pass
8825.16	3	255	1	Average	29.2	34.472	54.0	-19.5	Pass
11034.8	3	3	1	Average	29.4	36.87	54.0	-17.1	Pass
11488.5	3	315	1	Average	29.6	38.353	54.0	-15.6	Pass
12344.2	3	255	1	Average	29.8	37.725	54.0	-16.2	Pass

**Professional Testing, EMI, Inc**

Radiated Emissions, 3m Distance

1-18GHz Horizontal Polarity Measured Emissions


— Average Limit Level

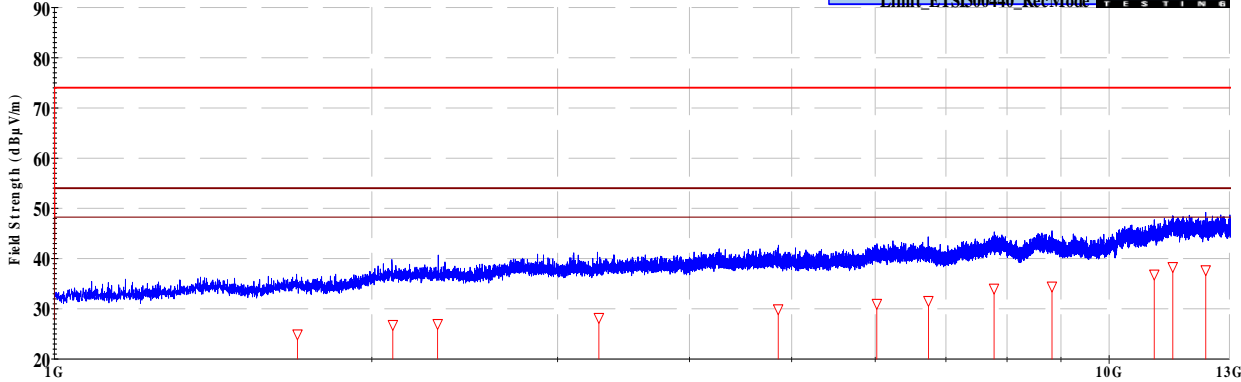
— Corrected Average Reading

— Peak Limit Level

— Corrected Peak Reading

— Limit ETSI300440 RecMode





Operator: Eric Lifsey

16297 TC300440 RE RecMode LPRF.ttl

04:35:39 PM, Wednesday, January 07, 2015

EUT Mode: Receive

EUT Power: Battery, charging

EUT: Table Tracker TT-SIL-Z

Project Number: 16297-15

Client: Long Range Systems

**> 1GHz Horizontal Antenna Polarity Measured Emissions**

## 4.0 Equipment Lists

### 4.1 Radiated Spurious Emissions 30 MHz to 1 GHz

Professional Testing, EMI, Inc.					
In accordance with:		Industry Canada - ICES-003 Issue 5, August 2012 - Spectrum Management and Telecommunications, Interference-Causing Equipment Standard, Information Technology			
Section:					
Test Date(s):	1/7/2015	EUT Serial #:	0		
Customer:	Long Range Systems	EUT Part #:	TT-SIL-Z		
Project Number:	16297-15, 16693-15	Test Technician:	Eric Lifsey		
Purchase Order #:	NA	Supervisor:	Lisa Arndt		
Equip. Under Test:	Table Tracker TT-SIL-Z	Witness' Name:	NA		
Radiated Emissions Test Equipment List					
Tile! Software Version:		4.2.A, May 23, 2010, 08:38:52 AM			
Test Profile:		Radiated Emissions_Profile Version October 12, 2011			
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Braden	N/A	TDK 10M Chamber, NSA < 1 GHz	DAC-012915-005	1/29/2015
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	1/22/2015
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	3/29/2015
2172	ETS-Lindgren	3142C	Antenna, Biconilog, 26 MHz-3GHz	49383	12/5/2015
C027	N/A	RG214	Cable Coax, N-N, 25m	none	10/22/2015
1327	EMCO	1050	Controller, Antenna Mast	none	N/A
0942	EMCO	11968D	Turntable, 4ft.	9510-1835	N/A
1969	HP	11713A	Attenuator/Switch Driver	3748A04113	N/A
1509B	Braden	N/A	TDK 10M Chamber, VSWR > 1 GHz	DAC-012915-005	1/16/2015
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	12/29/2015
C030	N/A	0	Cable Coax, N-N, 30m	none	10/10/2015
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	00110313	1/21/2015

## 5.0 Measurement Bandwidth

Radiated Emissions Spectrum Analyzer Bandwidth and Measurement Time - Peak Scan				
Frequency Band Start (MHz)	Frequency Band Stop (MHz)	6 dB Bandwidth (kHz)	Number of Ranges Used	Measurement Time per Range
0.009	0.15	0.3	2	Multiple Sweeps
0.15	30	9	6	Multiple Sweeps
30	1000	120	2	Multiple 800 mS Sweeps
1000	6000	1000	2	Multiple Sweeps
6000	18000	1000	2	Multiple Sweeps
18000	26500	1000	2	Multiple Sweeps
<p>*Notes:</p> <ol style="list-style-type: none"> <li>1. The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range.</li> <li>2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz.</li> <li>3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.</li> <li>4. The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz.</li> <li>5. The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz.</li> </ol>				

## Appendix: Policy, Rationale, and Evaluation of EMC Measurement Uncertainty

All uncertainty calculations, estimates and expressions thereof shall be in accordance with NIST policy. Since PTI operates in accordance with NIST (NVLAP) Handbook 150-11: 2007, all instrumentation having an effect on the accuracy or validity of tests shall be periodically calibrated or verified traceable to national standards by a competent calibration laboratory. The certificates of calibration or verification on this instrumentation shall include estimates of uncertainty as required by NIST Handbook 150-11.

### Rationale and Summary of Expanded Uncertainty.

Each piece of instrumentation at PTI that is used in making measurements for determining conformance to a standard (or limit), shall be assessed to evaluate its contribution to the overall uncertainty of the measurement in which it is used. The assessment of each item will be based on either a type A evaluation or a type B evaluation. Most of the evaluations will be type B, since they will be based on the manufacturer's statements or specifications of the calibration tolerances, or uncertainty will be stated along with a brief rationale for the type of evaluation and the resulting stated uncertainties.

The individual uncertainties included in the combined standard uncertainty for a specific test result will depend on the configuration in which the item of instrumentation is used. The combination will always be based on the law of propagation of uncertainty. Any systematic effects will be accommodated by including their uncertainties, in the calculation of the combined standard uncertainty; except that if the direction and amount of the systematic effect cannot be determined and separated from its uncertainty, the whole effect will be treated as uncertainty and combined along with the other elements of the test setup.

Type A evaluations of standard uncertainty will usually be based on calculating the standard deviation of the mean of a series of independent observations, but may be based on a least-squares curve fit or the analysis of variance for unusual situations. Type B evaluations of standard uncertainty will usually be based on manufacturer's specifications, data provided in calibration reports, and experience. The type of probability distribution used (normal, rectangular, a priori, or u-shaped) will be stated for each Type B evaluation.

In the evaluation of the uncertainty of each type of measurement, the uncertainty caused by the operator will be estimated. One notable operator contribution to measurement uncertainty is the manipulation of cables to maximize the measured values of radiated emissions. The operator contribution to measurement uncertainty is evaluated by having several operators independently repeat the same test. This results in a Type A evaluation of operator-contributed measurement uncertainty.

A summary of the expanded uncertainties of PTI measurements is shown as Table 1. These are the worst-case uncertainties considering all operative influence factors.

Summary of Measurement Uncertainties for Site 45			
Type of Measurement	Frequency Range	Meas. Dist.	Expanded Uncertainty U, dB (k=2)
Mains Conducted Emissions	150 kHz to 30 MHz	N/A	2.9
Telecom Conducted Emissions	150 kHz to 30 MHz	N/A	2.8
Radiated Emissions	30 to 1,000 MHz	10 m	4.8
	1 to 18 GHz	3 m	5.7



## **End of Report**

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