1601 North A.W. Grimes Blvd., Suite B
Round Rock, TX 78665
e-mail: info@ptitest.com
(512) 244-3371 Fax: (512) 244-1846

June 17, 2013

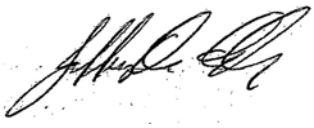
Cody Lohse
Dyno Pro, LLC
8500 Clinton Rd, Unit 1104A
Brooklyn, OH 44144

Dear Cody:

Thank you for allowing Professional Testing (EMI), Inc. an opportunity to perform testing for Dyno Pro, LLC. Enclosed is the Wireless Certification Report for the Dyno V1. This report can be used to demonstrate compliance with FCC requirements for wireless devices in the United States.

If you have any questions, please contact me.

Sincerely,



Jeffrey A. Lenk
President

Attachment

Project 14280-10

Dyno V1

Wireless Certification Report

Prepared for:

Dyno Pro, LLC

By

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

June 17, 2013

Reviewed by	Written by
	
Larry Finn Product Development Engineer	Eric Lifsey Test Engineer

Revision History

Revision Number	Description	Date
01	Initial Release	June 17, 2013

Table of Contents

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.

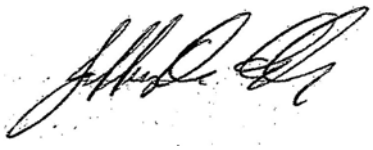
Certificate of Compliance

Applicant:	Dyno Pro, LLC
Applicant's Address:	8500 Clinton Rd, Unit 1104A Brooklyn, OH 44144
FCC ID:	R3W-V1P12
Model:	Dyno V1
Project Number:	14280-10

The **Dyno V1** by **Dyno Pro, LLC**, was tested utilizing the following documents and found to be in compliance with the required criteria on the indicated test date.

47 CFR (USA), IC (Industry Canada)		
Section Reference	Parameter	Date
15.249(a), RSS-210 Issue 8	Fundamental Field Strength Limit 50 mV/m	2013-02-11
15.209, RSS-210 Issue 8	Harmonic & Spurious Emissions	2013-02-11
15.203, RSS-Gen Issue 3	Antenna Requirements	2013-06-07
RSS-210 Issue 8	Bandwidth	2013-03-07
2.1091	Maximum Permissible Exposure	2013-06-07

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



Jeffrey A. Lenk
President

This report has been reviewed and accepted by Dyno Pro, LLC. The undersigned is responsible for ensuring that the Dyno V1 by Dyno Pro, LLC, will continue to comply with the applicable rules.

_____
Representative of Dyno Pro, LLC

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 the United States.

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

The EUT is the **Dyno V1** by **Dyno Pro, LLC**. This device measures the torque on a bicycle frame as a means to measure cyclist performance. It relays that data by wireless means using the single-frequency of 2456.8 MHz, modulated using GMSK. The system as tested consisted of the following:

Table 1.2.1: Equipment Under Test

Manufacturer	Model	Serial #	Description
Dyno Pro, LLC	Dyno V1	V1P12	Wireless torque meter

The device is composed of three sections: two parallel circuit boards, a rechargeable battery, and a torque sensor. As installed, the torque sensor slides in first, followed by the battery, then by the circuit board assembly. The battery is charged using a USB power-only connection to any USB compliant power source.

1.3 EUT Operation

The EUT was exercised in a manner consistent with normal operations. It was tested installed in its intended location inside the hollow axle of a bicycle pedal assembly as shown below.

Photograph 1.3.1: EUT Installed in Axle

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 RS-212, 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.

2.0 Applicable Documents and Clauses

This device operates on frequencies assigned to the Iridium satellite communication services, as such 47 CFR and relevant part(s) applies as shown below.

Table 2.0.1: Applicable Documents

Document #	Title/Description
47 CFR (USA)	Part 15 – Section 15.249
IC (Canada)	RSS-210 Issue 8, RSS-102 Issue 4, RSS-Gen Issue 3
ANSI C63.4 2009	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment

Table 2.0.2: Applicable Clauses

Clause Subject	Section References	Required?	Result
Radiated Output Power	15.249, RSS210 A2.9(a)	Yes	Pass
Occupied Bandwidth, 20 dB	2.1049, RSS210-Gen 4.6.3	No, Yes	Informational
Field Strength of Radiated Spurious/Harmonic Emissions (30 MHz to 25 GHz)	15.249, 15.209, RSS-210 A2.9(a) and (b)	Yes	Pass
Antenna Construction	15.203, RSS-Gen 7.1.2	Yes	Pass
Maximum Permissible Exposure	2.1091, FCC 447498 D01 General RF Exposure Guidance v05, RSS-102	Yes	Pass

3.0 Fundamental Field Strength

Radiated peak output power measurements were made on the EUT.

3.1 Test Procedure

EUT is placed on a non-conductive surface 80 cm above a reference plane and measurements of emissions are made to find maximum emission level.

3.2 Test Criteria

Section Reference	Parameter	Date(s)
15.249, RSS210 A2.9(a)	Radiated Output Power, 50 mV/m @ 3 m Restated as 93.98 dBµV/m @ 3 m Or 103.52 dBµV/m @ 1 m	2013-02-11

3.3 Test Results

The EUT was found to be in compliance with the applicable criteria. The maximum emission is presented below and compared to the limit.

Field Strength of Fundamental, 1 Meter Measurement Distance

Frequency GHz	EUT Direction degrees	Antenna Polarity	Antenna Height meters	Measured Level dBµV	Amplifier Gain dB	Antenna Factor dB/m	Cable Loss dB	Corrected Level (Measured Peak Level) dBµV/m	Detector Mode
2.4568	77	H	1	90.97	32.0	28.2	2.05	89.02	Peak

Resolution Bandwidth 1 MHz

Limit at 1 meter dBµV/m	Corrected Level (Measured Peak Level) dBµV/m	Margin dB
103.52	89.02	-14.5

For application filing purposes the 3 meter field strength is determined below:

89.02 dBµV/m – 9.54 dB = **79.48 dBµV/m**

4.0 Transmitter Duty Cycle

Measurements of transmitter on time and intervals between transmissions were made to determine the duty cycle factor.

4.1 Test Procedure

EUT is placed into normal transmit operation to observe and record transmitter time domain performance.

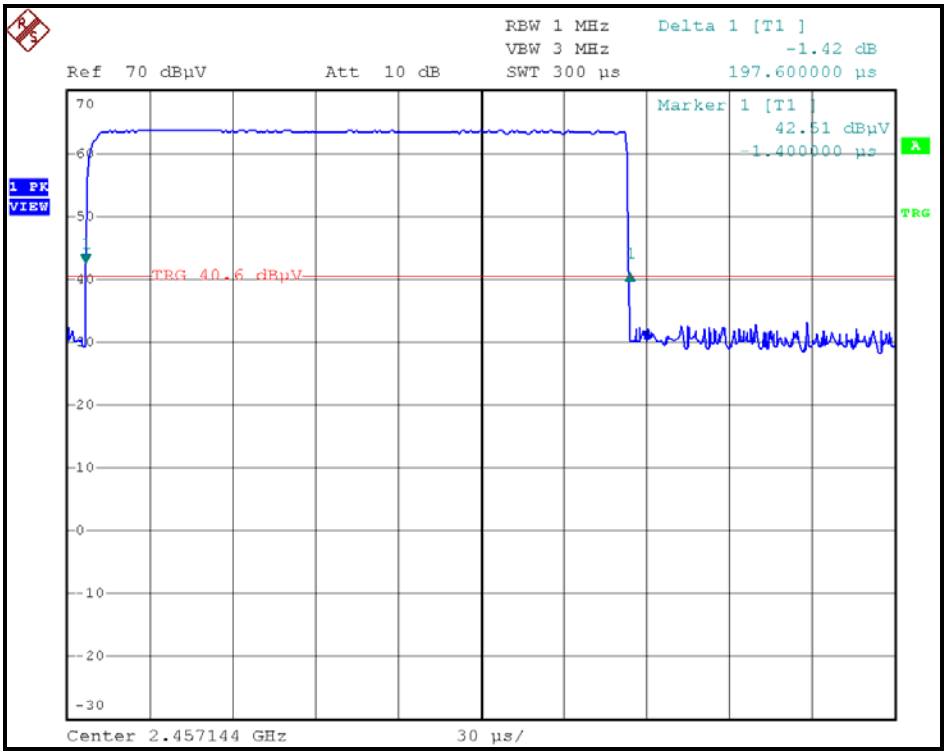
4.2 Test Criteria

Measurement is based on intervals not to exceed 100 msec. Maximum transmitter on time is divided by the lesser of 100 msec or the actual measured minimum transmitter interval time. The result is converted to dB and applied as needed to peak measurements of transmitter artifacts to determine average power. This is not a pass/fail measurement.

4.3 Test Results

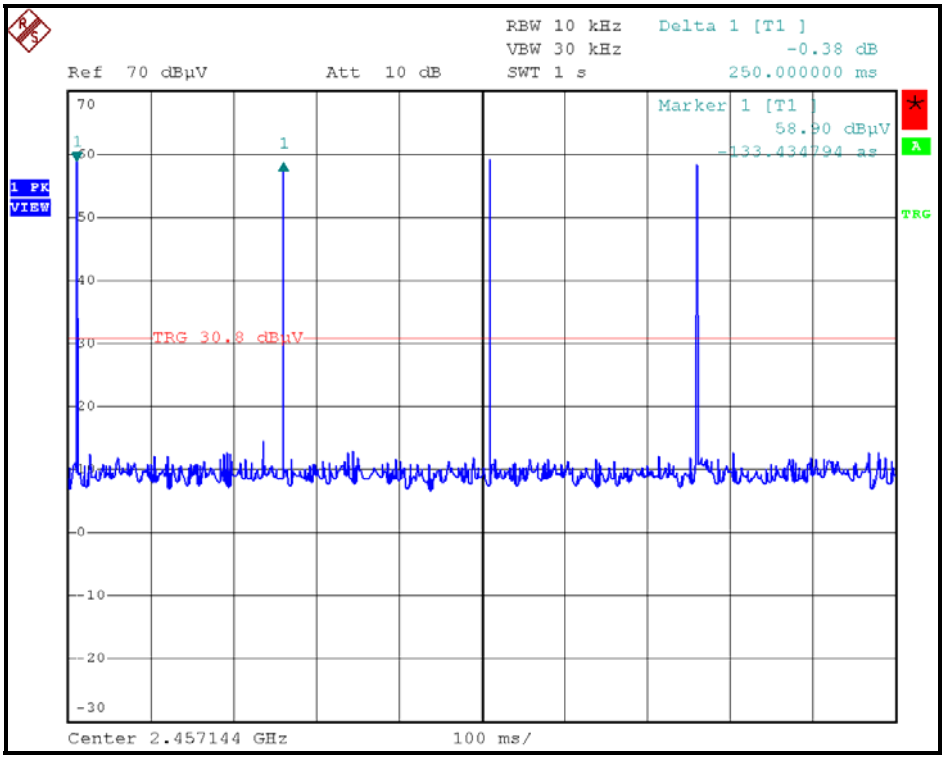
Measurements were performed on March 7, 2013 with the following results.

Plot 4.3.1 Transmit On Time



Measured maximum transmit time: 0.1976 msec

Plot 4.3.2 Transmit Interval Time



Measured minimum transmit interval time: 250 msec (Allowed 100 msec.)

Table 4.3.1 Duty Cycle Factor Result

Measured On Time (msec)	Measured Time Interval (msec)	Duty Cycle Factor Calculation	Result (dB)	Duty Cycle Factor Allowed (dB)
0.1976	250 msec (100 msec allowed)	= 20 * Log_{10} (0.1976 msec / 100 msec)	-54.08	-20

5.0 Occupied Bandwidth

Occupied bandwidth measurement was made on the EUT.

5.1 Test Procedure

The EUT is configured for best signal/power and the bandwidth then is measured. A recording of the results is included.

5.2 Test Criteria

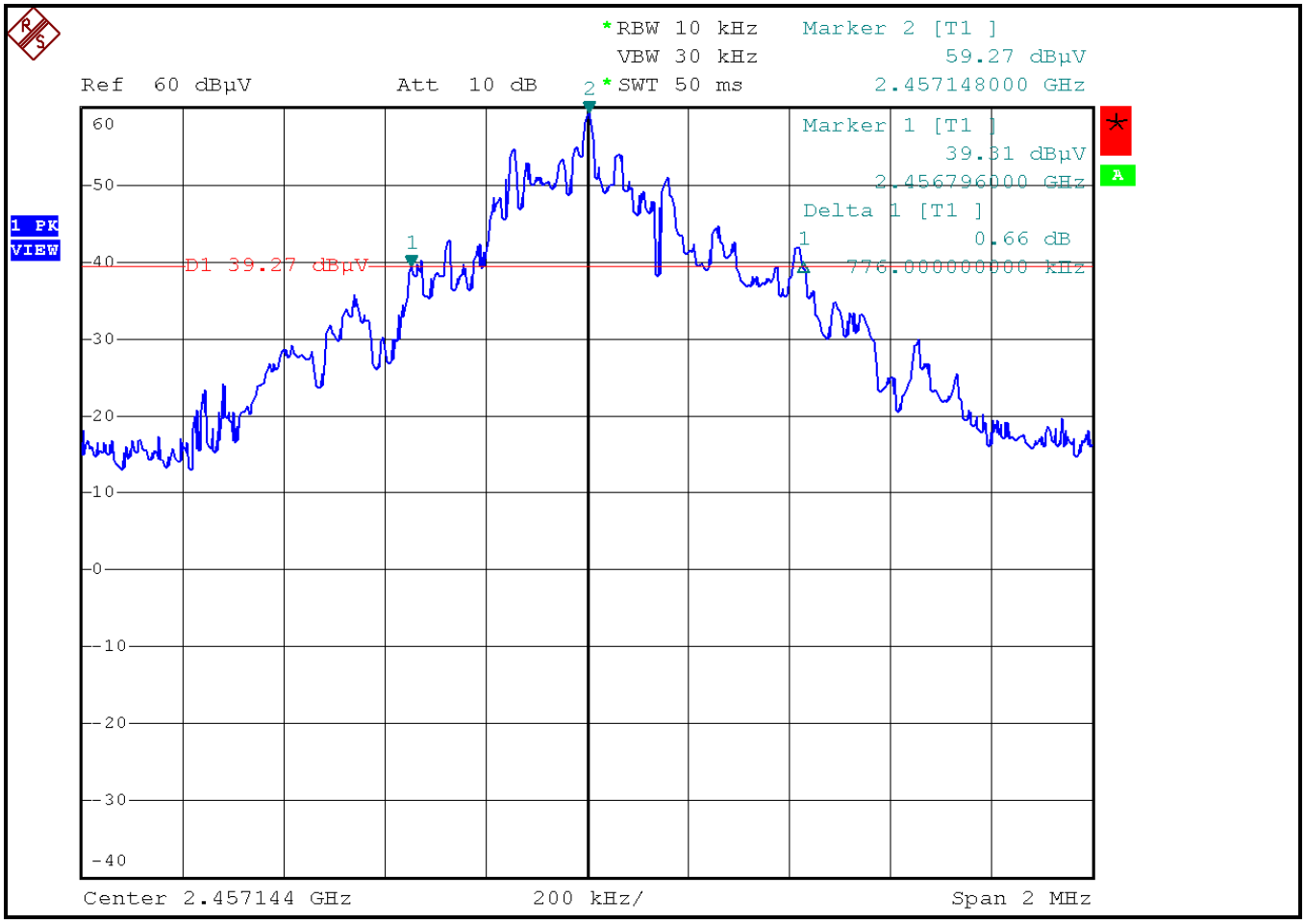
Section Reference	Parameter	Date(s)
2.1049, RSS210-Gen 4.6.3	Bandwidth, 20 dB	2013-03-07

5.3 Test Results

EUT was found to be in compliance with applicable requirements.

Measured BW (kHz)
776.0

5.3.1 Bandwidth Plot



6.0 Radiated Spurious Emissions Below 1 GHz

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to 47 CFR, Part 15.

6.1 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 at a distance of 10 meters from the measurement antenna.

Spurious/harmonic emissions below 1 GHz were measured with average and peak detection with a resolution bandwidth of 1 MHz and measured at a distance of 3 meters. Average detection was used to determine compliance of the EUT if the peak did not meet the average limit. Non-harmonic emissions must satisfy the average limit and the peak limit (20 dB above average). A diagram showing the test setup is given as Figure 5.1.1.

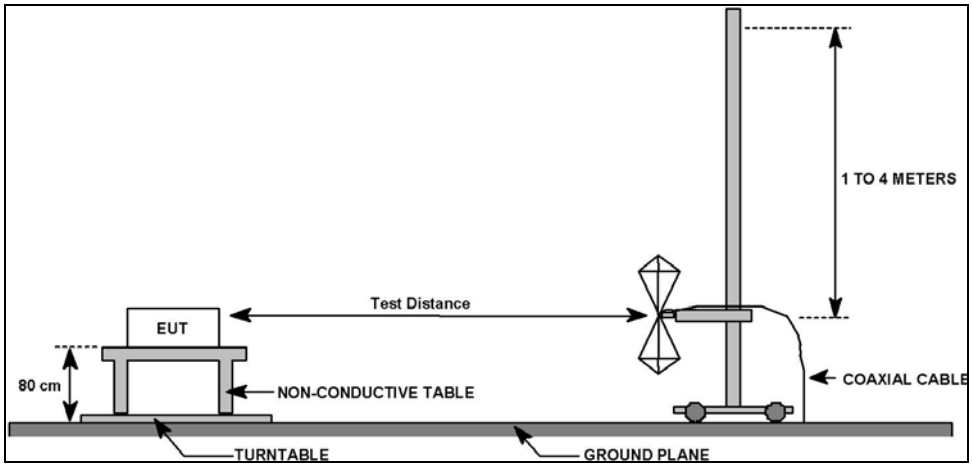


Figure 5.1.1: Field Strength of Spurious Emissions Test Setup

6.2 Test Criteria

Clause Subject	Section Number	Required?
Field Strength of Radiated Spurious/Harmonic Emissions	15.249, 15.209, RSS-210 A2.9(a) and (b)	Yes

6.3 Test Results

Table 5.3.1: Radiated Spurious Emissions, Below 1 GHz, Vertical Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	2/11/2013	EUT Serial #:	0
Customer:	DYNO	EUT Part #:	0
Project Number:	14280-10	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Rob McCollough
Equip. Under Test:	0	Witness' Name:	Kent Britain

Radiated Emissions Test Results Data Sheet								Page:	1	of	1
EUT Line Voltage:	DC	VDC		EUT Power Frequency:	0	N/A					
Antenna Orientation:	Vertical			Frequency Range:	30MHz to 1GHz						
EUT Mode of Operation:											
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		
44.5195	10	318	1.53	Quasi-peak	23.1	5.48	29.5	-24.0	Pass		
60.0142	10	289	2.34	Quasi-peak	23.3	2.451	29.5	-27.0	Pass		
80.2142	10	155	3.96	Quasi-peak	23.6	2.414	29.5	-27.1	Pass		
105.864	10	342	3.49	Quasi-peak	23.1	3.935	33.1	-29.2	Pass		
150.278	10	86	3.44	Quasi-peak	23	4.481	33.1	-28.6	Pass		
215.12	10	342	2.57	Quasi-peak	22.6	7.986	33.1	-25.1	Pass		

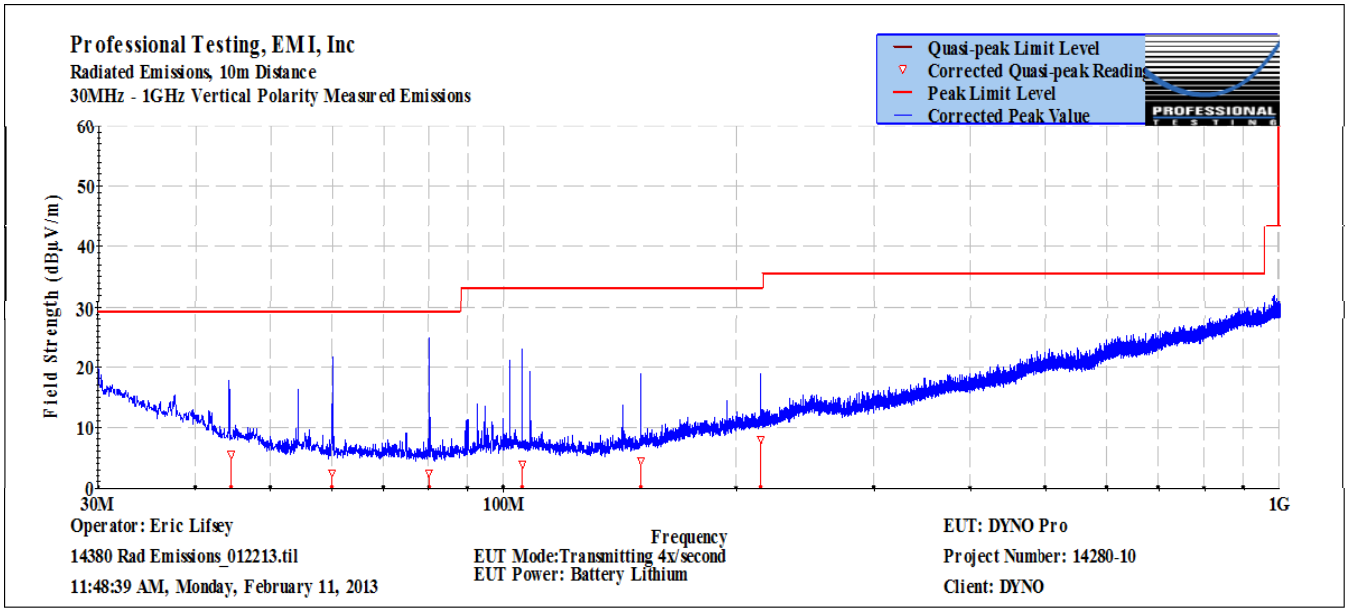
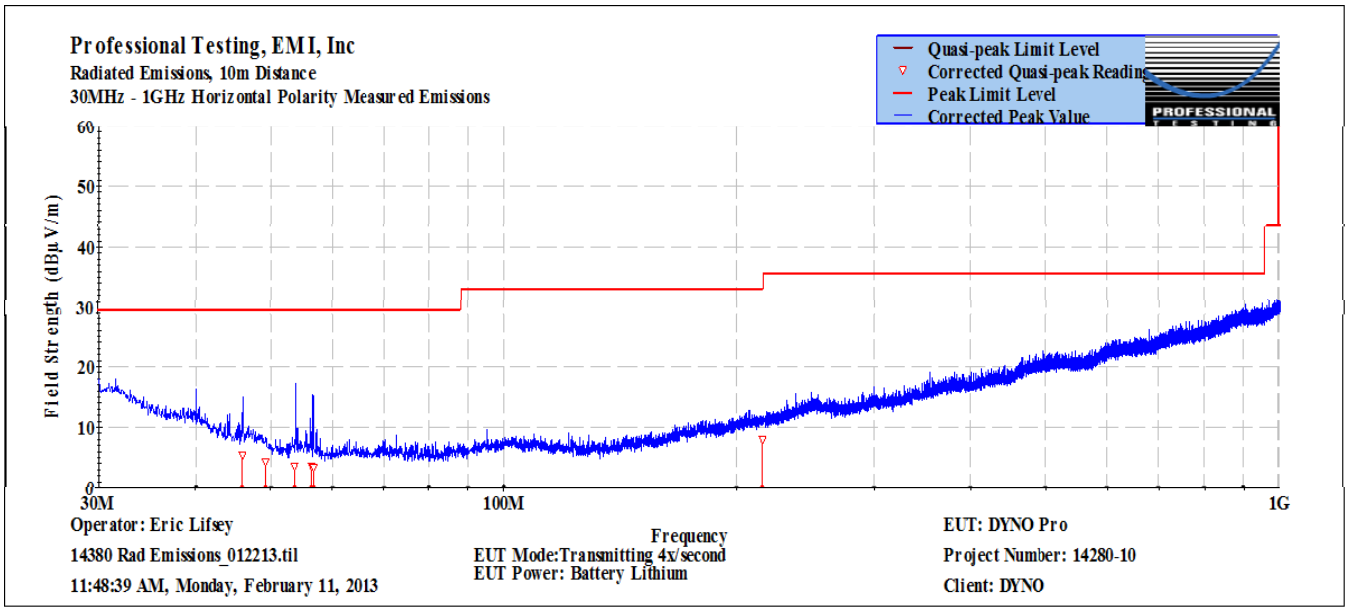


Table 5.3.2: Radiated Spurious Emissions, Below 1 GHz, Horizontal Polarity

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference, see §15.38).		
In accordance with:	FCC Part 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits		
Section:	15.109		
Test Date(s):	2/11/2013	EUT Serial #:	0
Customer:	DYNO	EUT Part #:	0
Project Number:	14280-10	Test Technician:	Eric Lifsey
Purchase Order #:	0	Supervisor:	Rob McCollough
Equip. Under Test:	0	Witness' Name:	Kent Britain

Radiated Emissions Test Results Data Sheet									Page: 1 of 1
EUT Line Voltage:	DC	VDC			EUT Power Frequency:	0	N/A		
Antenna Orientation:	Horizontal				Frequency Range:	30MHz to 1GHz			
EUT Mode of Operation:									
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
45.9132	10	332	3.74	Quasi-peak	23.7	5.5	29.5	-24.0	Pass
49.149	10	242	1.04	Quasi-peak	23.7	4.3	29.5	-25.2	Pass
53.5765	10	354	3.61	Quasi-peak	23.8	3.6	29.5	-25.9	Pass
56.3607	10	315	3.55	Quasi-peak	24	3.5	29.5	-26.0	Pass
56.667	10	357	3.95	Quasi-peak	23.8	3.4	29.5	-26.1	Pass
215.837	10	333	3.01	Quasi-peak	22.5	7.9	33.1	-25.2	Pass



7.0 Radiated Spurious Emissions Above 1 GHz

Out of band spurious/harmonic emissions measurements were performed on the EUT to determine compliance to 47 CFR, Part 15.

7.1 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 at a distance of 10 meters from the measurement antenna.

Harmonic emissions above 1 GHz peak were measured with peak detection, a resolution bandwidth of 1 MHz, and at a distance of 1 meter. If peak measurements exceeded average limits, the peak limit was applicable and duty cycle factor was then applied for average level calculation. Emissions were investigated up to the 10th harmonic of the transmitter fundamental.

Non-harmonic spurious emissions must satisfy the average limit and the peak limit (20 dB above average). A diagram showing the test setup is given as Figure 5.1.1.

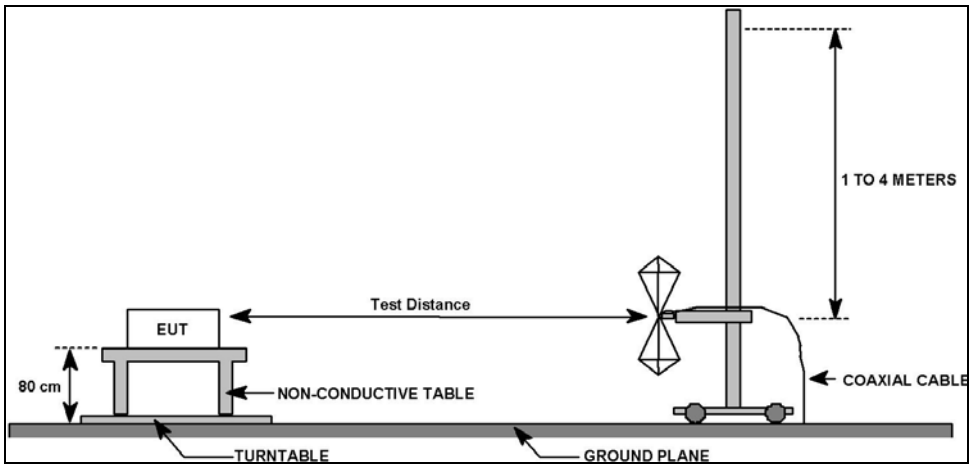


Figure 5.1.1: Field Strength of Spurious Emissions Test Setup

7.2 Test Criteria

Clause Subject	Section Number	Required?	Result
Field Strength of Radiated Spurious/Harmonic Emissions	15.249, 15.209	Yes	Pass

7.3 Test Results

Table 6.3.1: Radiated Spurious Emissions, 1 to 25 GHz, Vertical Polarity

Professional Testing (EMI), Inc.

Radiated Emissions Measured Indoors, 1 Meters Distance, Antenna Polarized Vertical

V 2.X

Client:	DYNO	Preamp:	1		
Test Date:	February 11, 2013	EUT:	DYNO Pro		
Voltage:	Battery Powered	Serial #:	None		
Frequency:	n/a	Project #:	14280		
Technician:	Eric Lifsey	Test Type:	FCC 15.249 RSS 210+310	Class:	B

Corrected Level = Recorded Level - Amplifier Gain + Antenna Factor + Cable Loss

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Duty Cycle Factor (dB)	Corrected Level (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Detector Function
4.9136	0	1	47.3	31.3	34.4	3.46	-20.00	33.8	63.54	-29.7	Peak
7.3704	0	1	60.6	31.5	37.2	4.61	-20.00	50.9	63.54	-12.6	Peak

Resolution Bandwidth 1 MHz

Table 6.3.2: Radiated Spurious Emissions, 1 to 25 GHz, Horizontal Polarity

Professional Testing (EMI), Inc.

Radiated Emissions Measured Indoors, 1 Meters Distance, Antenna Polarized Horizontal

V 2.X

Client:	DYNO	Preamp:	1		
Test Date:	February 11, 2013	EUT:	DYNO Pro		
Voltage:	Battery Powered	Serial #:	None		
Frequency:	n/a	Project #:	14280		
Technician:	Eric Lifsey	Test Type:	FCC 15.249 RSS 210+310	Class:	B

Corrected Level = Recorded Level - Amplifier Gain + Antenna Factor + Cable Loss

Frequency (GHz)	EUT Direction (degrees)	Antenna Elevation (Meters)	Recorded Level (dBuV)	Amplifier Gain (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Duty Cycle Factor (dB)	Corrected Level (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Detector Function
7.3704	0	1	64.5	31.5	37.2	4.61	-20.00	54.8	63.54	-8.7	Peak

Resolution Bandwidth 1 MHz

8.0 Antenna Construction Requirements

The design was investigated for meeting the antenna construction requirements of the applicable rules.

8.1 Test Procedure

A direct examination of the antenna construction is performed and compared to rule criteria that prevents wireless device antennas from being modified by end users in ways that would void their authorization to use the device.

8.2 Test Criteria

Clause Subject	Section Number	Required?
Antenna Construction	15.203, RSS-Gen 7.1.2	Yes

8.3 Test Results

Antenna specifications are referenced here:

Antenna Manufacturer and Model	Specifications	
Fractus P/N: FR05-S1-N-0-102 SMD Package Style	**Frequency range** **Average Efficiency** **Radiation Pattern** **Peak Gain** **VSWR** **Weight (approx.)** **Impedance** **Dimensions (L x W x H)**	2.4 GHz - 2.5 GHz 72.0 % Omnidirectional 1.7 dB < 2:1 0.1 g 50 Ω 7.0 mm x 3.0 mm x 2.0 mm
Source: http://www.fractus.com/		

The antenna is internal only to the device.

The antenna is a soldered-on component on the transmitter circuit board.

Antenna gain is given by manufacturer as 1.7 dBi.

There is no antenna connector.

The design meets the requirements of the rules.

9.0 Equipment Lists

9.1 Equipment for Spurious Radiated Emissions Below 1 GHz

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2003: "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" (incorporated by reference,**		
In accordance with:	**FCC Part 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits**		
Section:	**15.209**		
Test Date(s):	**2/15/2013**	**EUT Serial #:**	**0**
Customer:	**Universal Repeater**	**EUT Part #:**	**0**
Project Number:	**14426-10**	**Test Technician:**	**Eric Lifsey**
Purchase Order #:	**0**	**Supervisor:**	**Rob McCollough**
Equip. Under Test:	**SatMAX**	**Witness' Name:**	**Charlie Thompson**

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**

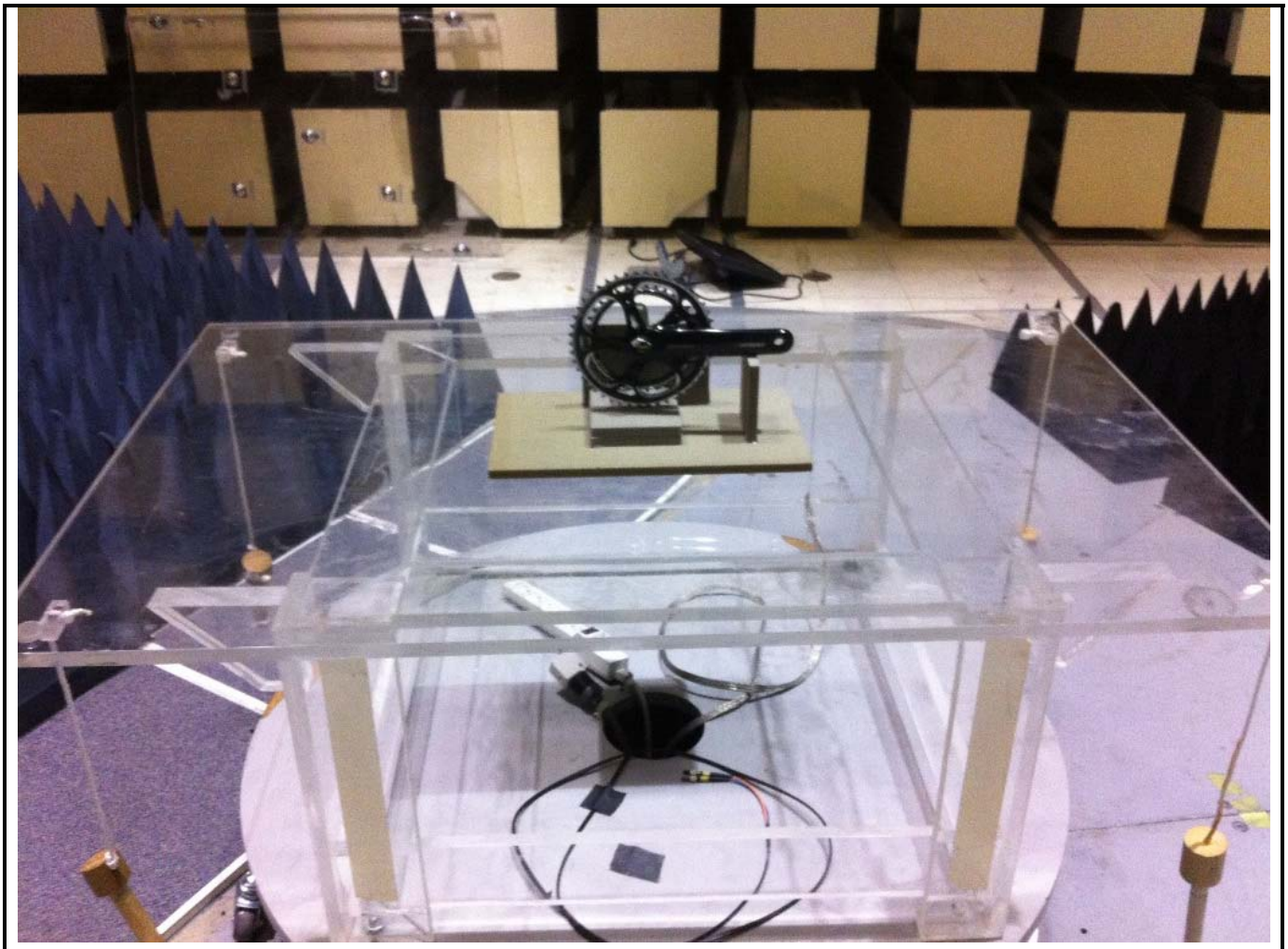
Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1509A	Narda	3022	Coupler, Bi-Directional 1-4GHz	40063	N/A
1780	ETS-Lindgren	3117	Antenna, Double Ridged Guide Horn, 1 - 18 GHz	00110313	2/4/2014
1930	Agilent	E4440A-239	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY45304903	6/19/2013
1325	EMCO	1050	Controller, Antenna Mast	9003-1461	N/A
C027	N/A	LMR-400	Cable Coax, N-N, 0.6m	none	11/1/2013
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	HP	8491B-003	Attenuator, N, 3dB	21897	N/A
1594	Miteq	AFS44-00102650	Amplifier, 1-26.5GHz, 42dB	none	10/15/2013
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	11/26/2013
C030	N/A	LMR-400	Cable Coax, N-N, 2.5m	none	N/A

9.2 Equipment for Fundamental and Radiated Spurious Emissions Above 1 GHz

The following equipment was used to measure radiated output power, timings, bandwidth, and radiated spurious emissions.

Asset #	Manufacturer	Model #	Description	Calibration Due
0582	EMCO	3115	Ridge Guide Antenna	2014-02-14
1594	Agilent	83017A	Microwave Preamplifier (preamp 1)	2014-09-24
1342	Rohde & Schwarz	FSP	Spectrum Analyzer	2015-01-29
C059	Pasternack		Cable	2014-02-06
C249	Pasternack		Cable	2014-02-06
C250	Pasternack		Cable	2014-02-06
1542	AH Systems	SAS-572	Horn Antenna, Standard Gain, 20 dB	Not Required

9.3 Setup Photographs



Radiated Tests Below 1 GHz

Radiated Tests Above 1 GHz

10.0 Maximum Permissible Exposure Evaluation

The results of power measurement and intended use/proximity are compared against the requirements for safety of RF exposure.

10.1 Criteria

Section Reference	Date
2.1091, FCC 447498 D01 General RF Exposure Guidance v05, RSS-102	June 7, 2013

10.2 Procedure

Using measurement of peak power and intended application, determine the permissible exposure level or whether additional exposure tests (SAR) are indicated. Justify conclusion for selected exposure area and separation distance.

10.3 Results

Antenna for this device is a component on a small two-PCB circuit assembly that resides inside the hollow axle of the pedal crankshaft. The assembly receives power from a rechargeable battery. Recharging is done by connecting a USB cable. When the USB cable is connected the device stops radiating a signal and the user cannot mount the bicycle to operate the pedals. The USB cable is only employed for charging and has no data connection.

RF emission is from one end of the hollow axle. The component antenna is set back from the opening such that user contact is not possible. When the user is operating the exercise bicycle, the upper ankle passes in front of the device once per rotation. Distance between user and antenna is maintained by the fixed thickness of the axle arm with more added variably by the user's ankle bone and consequential care needed to avoid the usually painful bone impingement to the axle arm.

As the device is clearly low power, a separation distance of 5 mm was selected as a highly pessimistic value. Power is determine here from the measured field strength at 1 meter and antenna gain applied to determine ERP. The ERP is compared to the referenced table threshold value.

Measured Field Strength	At Distance	Calculated Source Power	Chip Antenna Gain	Calculated ERP
89.02 dBµV/m*	1 m	0.0266 mW	1.7 dBi	0.0393 mW

*This is the peak measurement. Application of the duty cycle factor would reduce it another 20 dB.

FCC 447498 D01 General RF Exposure Guidance v05; Appendix A, Table Page 25, SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm	Distance Selected Column	Operating Frequency Row	SAR Exclusion Threshold From Table
For Operating Frequency: 2.4568 GHz	5 mm	2450 MHz	10 mW

The power at the antenna itself is below the SAR Exclusion Threshold, it therefore meets the criteria for exclusion from SAR testing.

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.

1. 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.

Table 1: 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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