Project 16333-15

TX-14C
LRS Paging Transmitter
457.525 MHz

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

24 Aug 2015

Reviewed by

Larry Finn
Chief Technical Officer

Written by

Eric Lifsey
EMC Engineer

Revision History

Revision Number	Description	Date
00	Initial draft for review.	10 Aug 2015
01	Revised per review comments, final.	24 Aug 2015
01A	Delete IC ID references.	3 Sep 2015

Corrections

Where model is indicated as T14 or T14C the correct designation is TX-14C.

Table of Contents

Certificate of Compliance

Applicant	Device & Test Identification
Long Range Systems LLC (John Weber) 4550 Excel Parkway Suite 200 Addison TX 75001 Certificate Date: 24 Aug 2015	FCC ID: 2AB6OT14C Model(s): TX-14C Laboratory Project ID: 16333-15

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) FCC, RSS IC(Industry Canada)		
Parameter	**FCC**	**IC**
Conducted Output Power	90.210, 2.1046	RSS-119 Issue 12, 5.4
Emission Mask C	90.210(c), 2.1047	RSS-119 Issue 12, 5.8.3
Conducted Spurious/Harmonic Emissions at Antenna Terminals	90.210, 2.1051	RSS-119 Issue 12, 5.8; RSS-Gen Issue 4
Field Strength of Radiated Spurious/Harmonic Emissions Fundamental to 5 GHz	90.210, 15.209, 2.1053	RSS-119 Issue 12, 5.8
Transient Frequency Behavior	90.214, TIA/EIA-603C	RSS-119 Issue 12, 5.9
Frequency Stability	90.213, 2.1055	RSS-119 Issue 12, 5.3
Occupied Bandwidth, 20 dB, < 11.5 kHz	90.209, 2.1049	RSS-119 Issue 12, 5.5
Radiated Emissions 30 MHz – 5 GHz	15.109	RSS-Gen Issue 4, ICES-003
Exemption For Power ≤ 120 mW	90.217(b)	RSS-119 5.10
Mains Conducted Emissions, Class B	15.107	RSS-Gen Issue 4, ICES-003
Maximum Permissible Exposure		

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 requirements 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 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 unless specified otherwise in TIA/EIA-603.

1.2 EUT Description

The EUT transmits alert codes to other associated wireless devices at restaurants for seating or similar purposes in the establishment. The EUT is housed in a plastic enclosure with a small LCD display and integral keypad. It receives power from an internal rechargeable battery. The EUT employs an inductively-loaded quarter-wave antenna soldered directly to the circuit board and is located entirely inside the plastic enclosure.

Table 1.2.1 Equipment Under Test

Manufacturer & Description	Model	Serial #	Photo
Long Range Systems, LLC Paging transmitter	TX-14C	Sample Unit 4	 In Charger Base (left) and Not In Charger (right)

1.3 EUT Operation

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

Operating Frequency List
457.525 MHz (Including ±0.5 MHz as conventionally practiced.)

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.

2.0 Applicable Documents and Clauses

Table 2.0.1: Applicable Documents		
Document #	**Title/Description**	**Date**
47 CFR	FCC Part 90	
IC RSS	RSS-119 Issue 12	2015
IC RSS	RSS-Gen Issue 4	2014
ANSI C63.4	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment	2009
TIA/EIA-603C	Land Mobile FM or PM – Communications Equipment – Measurement and Performance Standards	2004

Table 2.0.2: Applicable Clauses		
Parameter	**FCC**	**IC**
Conducted Output Power	90.210, 2.1046	RSS-119 Issue 12, 5.4
Emission Mask C[1]	90.210(c), 2.1047	RSS-119 Issue 12, 5.8.3
Conducted Spurious/Harmonic Emissions at Antenna Terminals	90.210, 2.1051	RSS-119 Issue 12, 5.8; RSS-Gen Issue 4
Field Strength of Radiated Spurious/Harmonic Emissions Fundamental to 5 GHz	90.210, 15.209, 2.1053	RSS-119 Issue 12, 5.8
Transient Frequency Behavior[2]	90.214, TIA/EIA-603C	RSS-119 Issue 12, 5.9
Frequency Stability	90.213, 2.1055	RSS-119 Issue 12, 5.3
Occupied Bandwidth, 20 dB, < 11.5 kHz	90.209, 2.1049	RSS-119 Issue 12, 5.5
Radiated Emissions 30 MHz – 5 GHz	15.109	RSS-Gen Issue 4, ICES-003
Exemption For Power ≤ 120 mW[2]	90.217(b)	RSS-119 5.10
Mains Conducted Emissions, Class B[3]	15.107	RSS-Gen Issue 4, ICES-003
Maximum Permissible Exposure[4]	[4]	[4]

[1]Applies for equipment of this bandwidth and with transmit only functionality.
[2]Transmit power is below 120 mW which meets the requirement for exemption for this test.
[3]This device employs a charging accessory that generates and uses RF energy in the form of a switching power supply, such that 47 CFR, Part 15, applies. Therefore unintentional radiated and conducted emissions were measured to Part 15 limits.
[4]Exposure is reported in a separate supplement to this report.

3.0 Radiated Output Power

3.1 Procedure

The EUT contains an internal antenna and no external connector. The EUT is placed into continuous transmit mode without modulation and radiated emissions are measured. Field strength is recorded and converted by calculation to EIRP.

3.2 Criteria

Parameter	Section Reference	Date(s)
Conducted Output Power	90.210, 2.1046 | RSS-119 Issue 12, 5.4	17 Jul 2015

3.3 Results

The EUT satisfied the requirement. Tabular results are presented below.

Table 3.3.1 Power, Radiated			
Frequency (MHz)	**Polarity**	**Distance**	**Measured Level**
457.525	H	10 m	78.4 dBµV/m
457.525	V	10 m	74.3 dBµV/m

Table 3.3.2 Power of Maximum Radiated, Converted to EIRP		
Frequency (MHz)	**Calculated EIRP dBm**	**Calculated EIRP mW**
457.525	-6.37	0.23

4.0 Emission Mask

4.1 Procedure

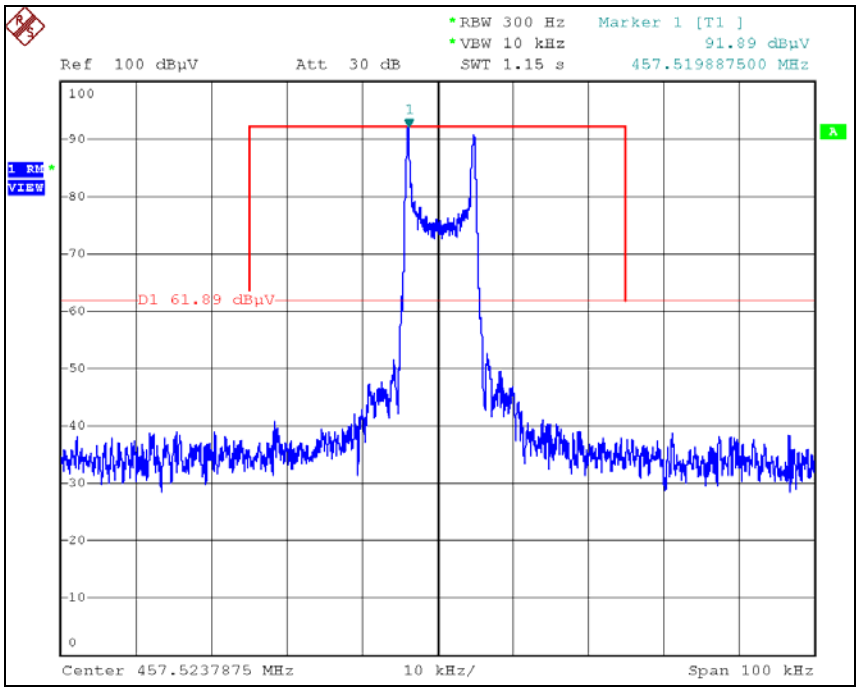
Emissions are measured with peak detector. The frequency span is the inner mask area including the fundamental and out to +/- 25 kHz from center frequency of signal. The mask was selected to match the emission bandwidth in use and transmitter-only device type.

4.2 Criteria

Guideline	Section Number	Date
Emissions at Antenna Terminals	90.210(c), 2.1047| RSS-119 Issue 12, 5.8.3	3 Jun 2015

4.3 Results

The emission measured within the mask as shown in the plot below. The EUT satisfied the requirement.



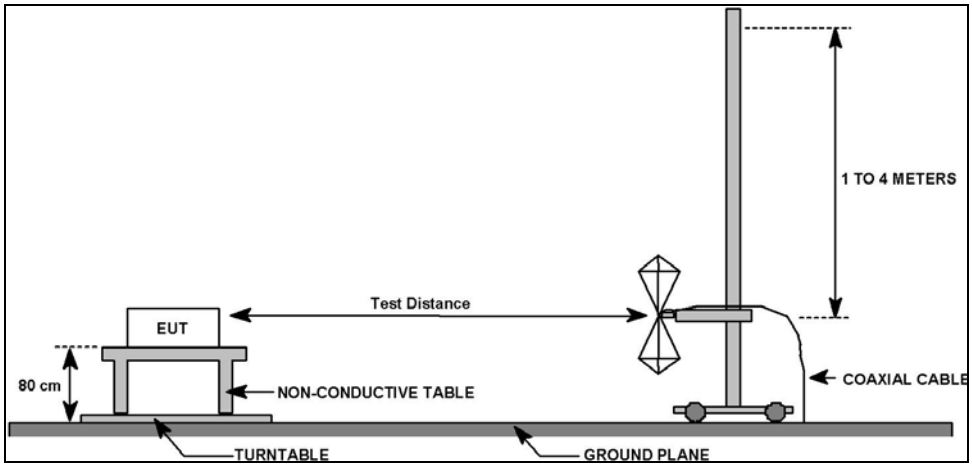
Modulated Emission with Superimposed Mask C

5.0 Field Strength of Radiated Spurious Emissions

5.1 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. The EUT was placed into transmit mode with the antenna removed and a resistive terminator substituted.

Spurious/harmonic emissions below 1 GHz were measured with quasi-peak detection at a distance of 10 meters. Spurious/harmonic emissions above 1 GHz peak 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 below.



Field Strength of Radiated Emissions Test Setup

5.2 Criteria

Clause Subject	Section Number	Date
Field Strength of Radiated Emissions 30 MHz to 5 GHz	90.210, 15.209, 2.1053| RSS-119 Issue 12, 5.8; RSS-Gen Issue 4	17 Jul 2015

5.3 Results

The EUT is hand-held which called for 3 measurement orientations in transmit mode.

All peak levels were found to be in excess of 10 dB below the limit.

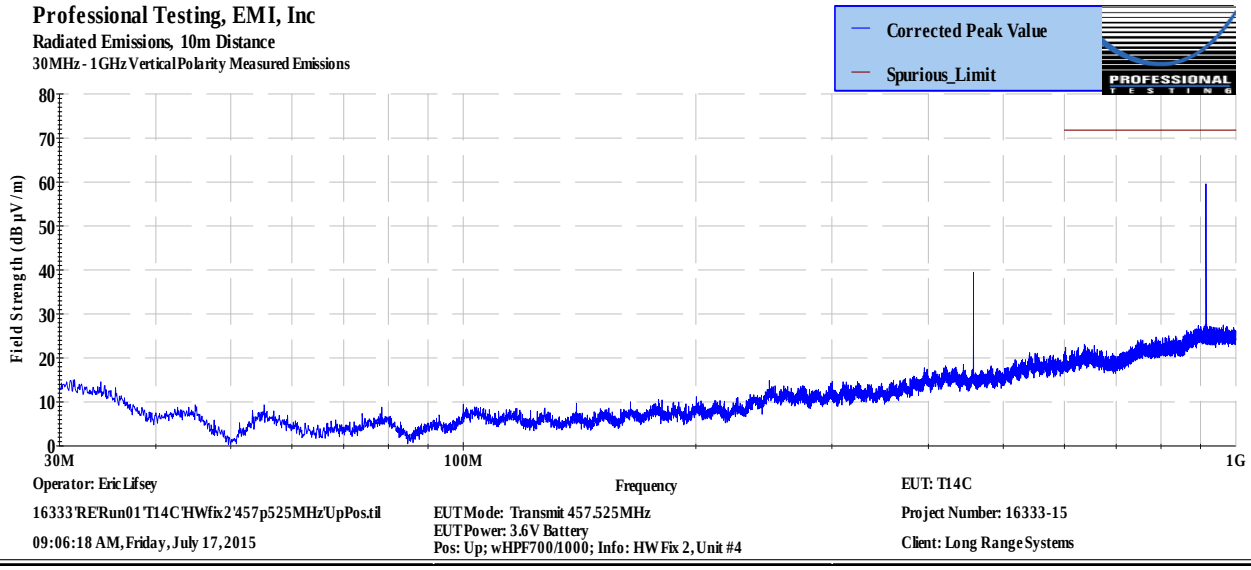
The EUT satisfied the requirement.

5.3.1 Transmit Mode

Table 5.3.1.1: Field Strength of Spurious Emissions, Upright, 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A	
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz		
			Transmit 457.525 MHz, Upright			

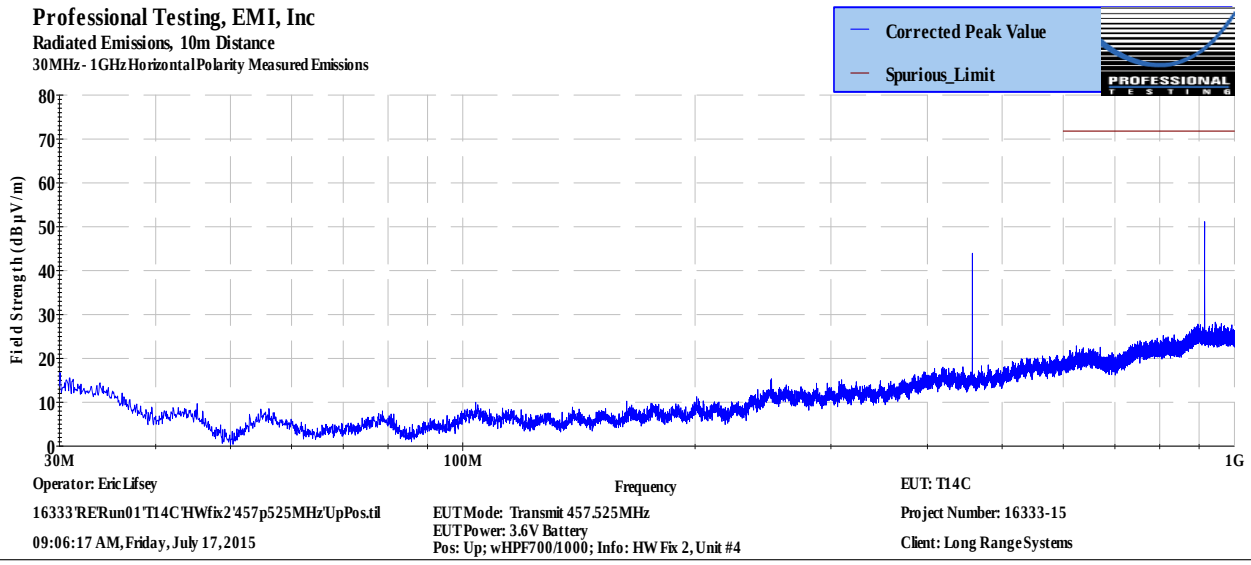


≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 5.3.1.2: Field Strength of Spurious Emissions, Upright, 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	**EUT Serial #:**	None
Customer:	Long Range Systems	**EUT Part #:**	Unit #4
Project Number:	16333-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	T14	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3.6 VDC	**EUT Power Frequency:**	0 N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	30MHz to 1GHz
		Transmit 457.525 MHz, Upright	

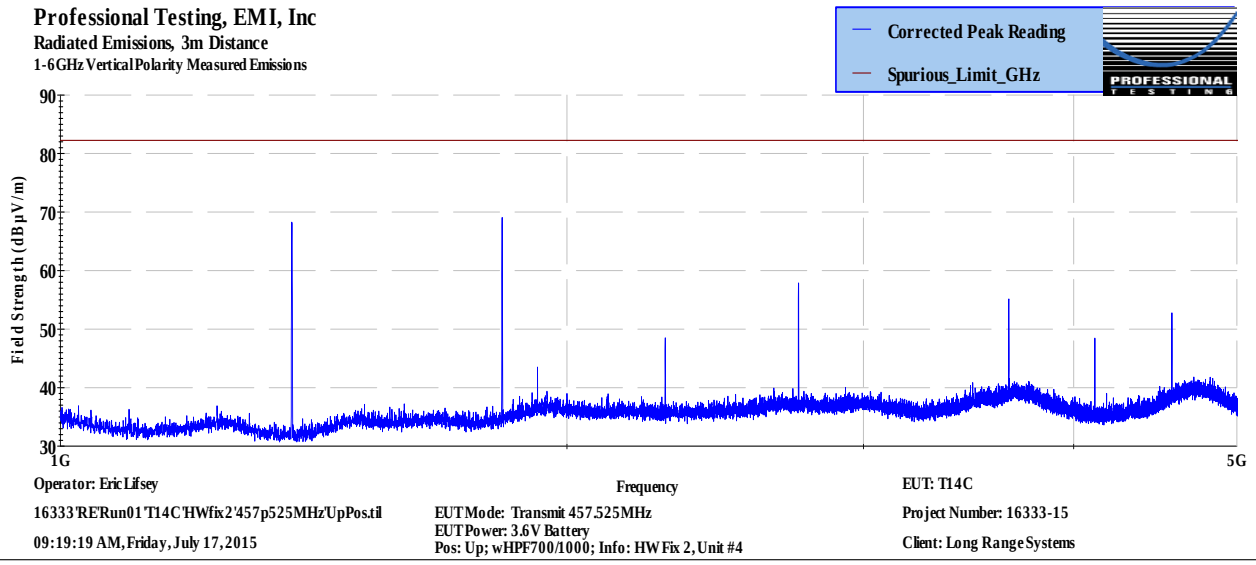


≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 5.3.1.3: Field Strength of Spurious Emissions, Upright, 1 GHz to 5 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A	
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz		
			Transmit 457.525 MHz, Upright			

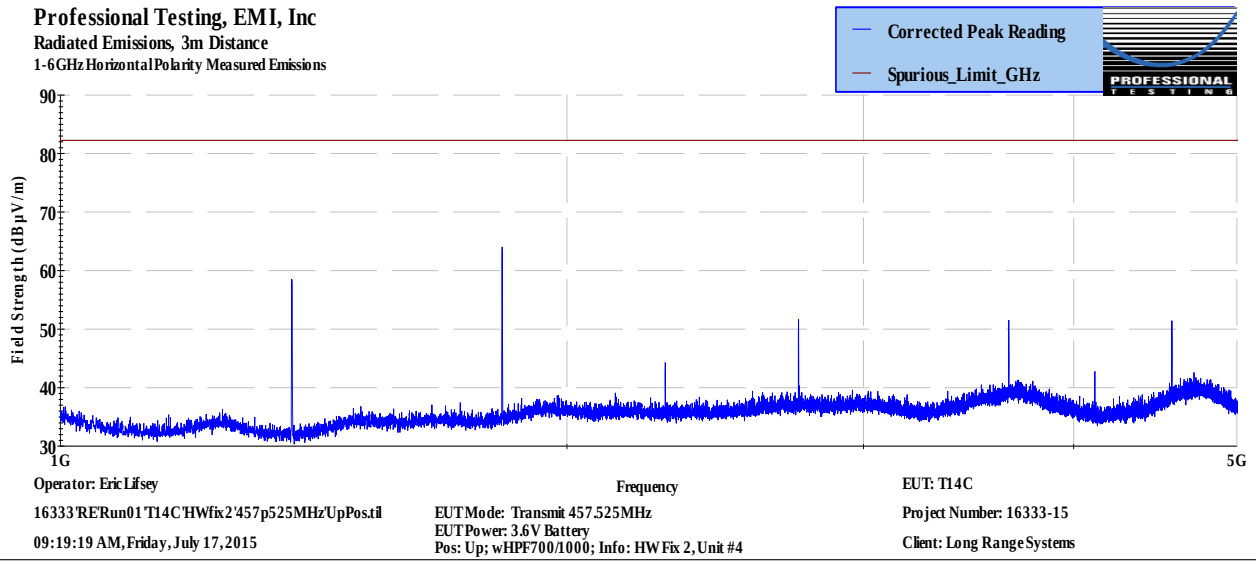


> 1GHz Vertical Antenna Polarity Measured Emissions

Table 5.3.1.4: Field Strength of Spurious Emissions, Upright, 1 GHz to 5 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A	
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz		
			Transmit 457.525 MHz, Upright			

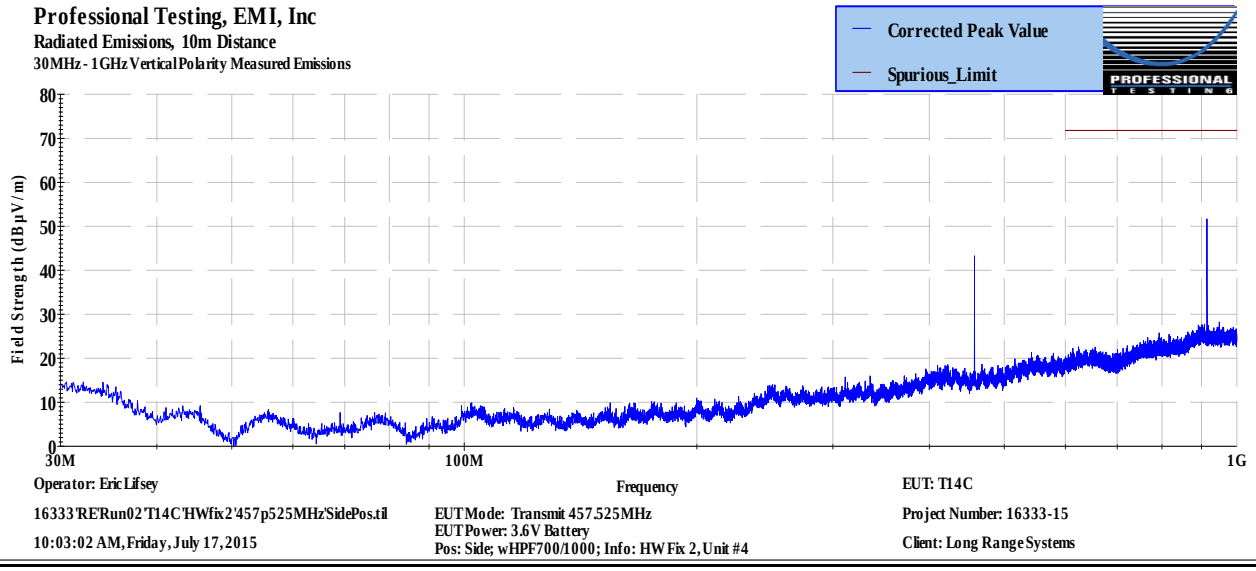


> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 5.3.1.5: Field Strength of Spurious Emissions, Side, 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A	
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz		
			Transmit 457.525 MHz, Side			

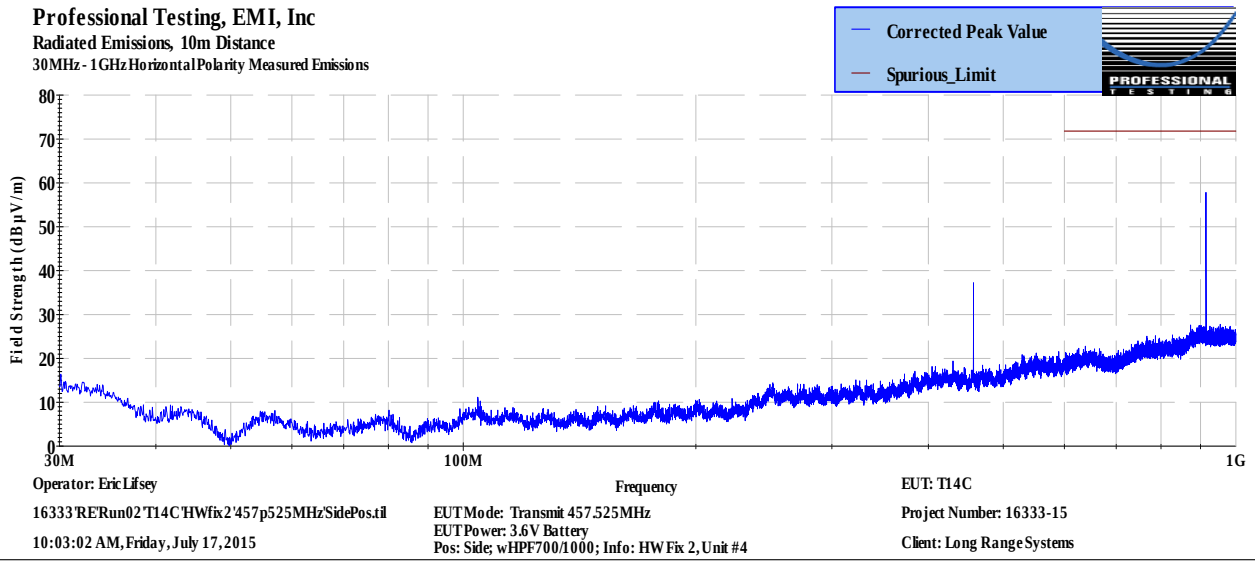


≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 5.3.1.6: Field Strength of Spurious Emissions, Side, 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1		
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A
Antenna Orientation:	Horizontal		Frequency Range:	30MHz to 1GHz	
			Transmit 457.525 MHz, Side		

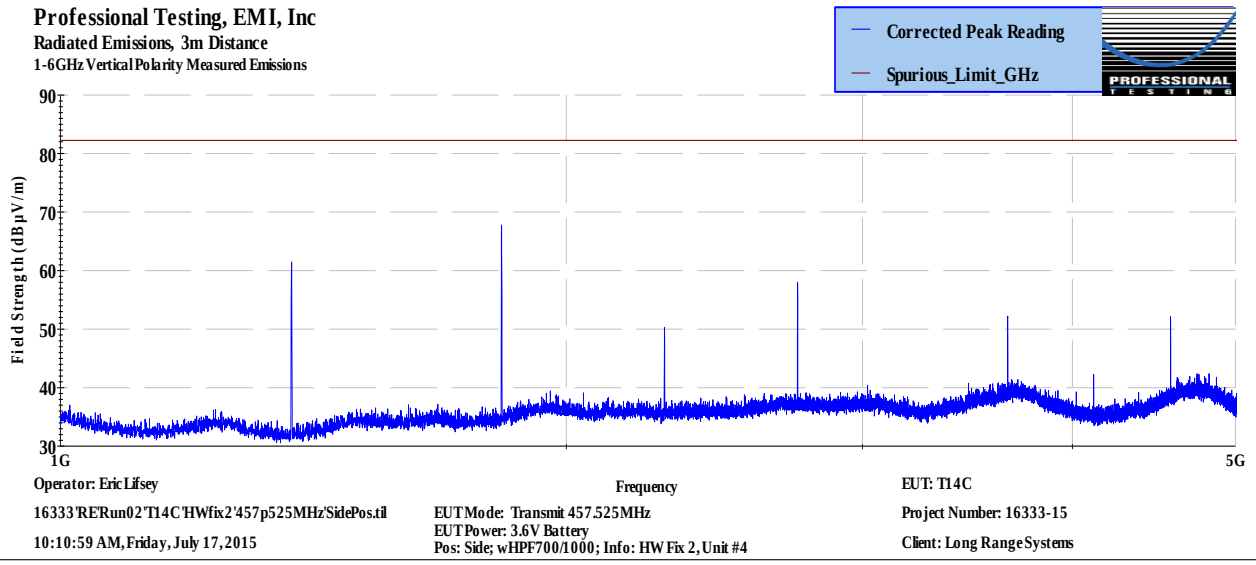


≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 5.3.1.7: Field Strength of Spurious Emissions, Side, 1 GHz to 5 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A	
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz		
			Transmit 457.525 MHz, Side			

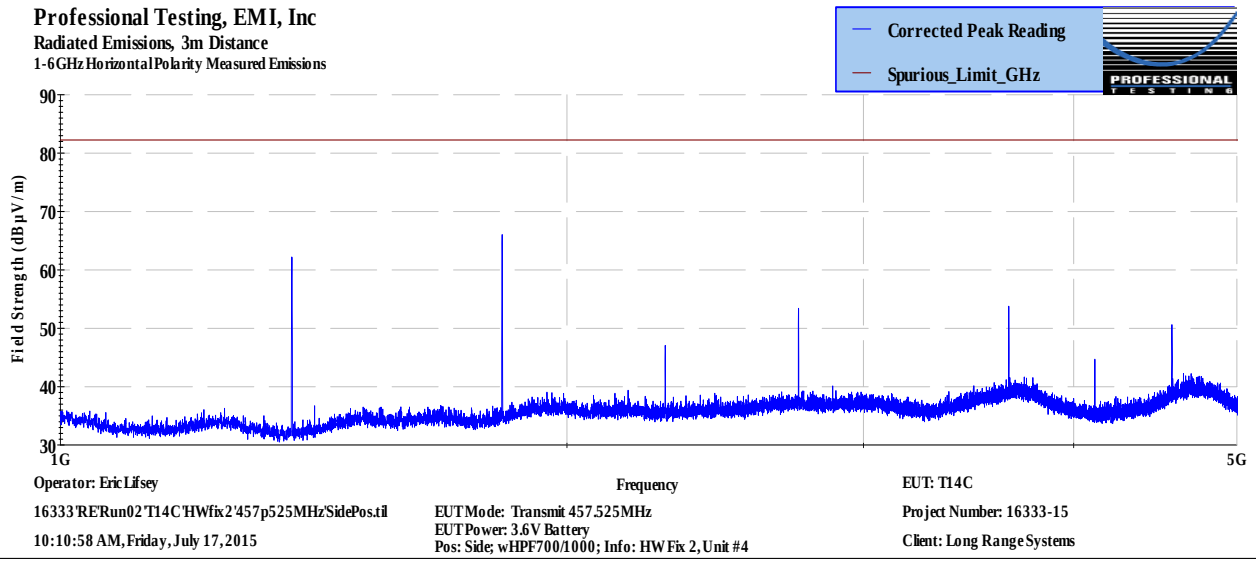


> 1GHz Vertical Antenna Polarity Measured Emissions

Table 5.3.1.8: Field Strength of Spurious Emissions, Side, 1 GHz to 5 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A	
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz		
			Transmit 457.525 MHz, Side			

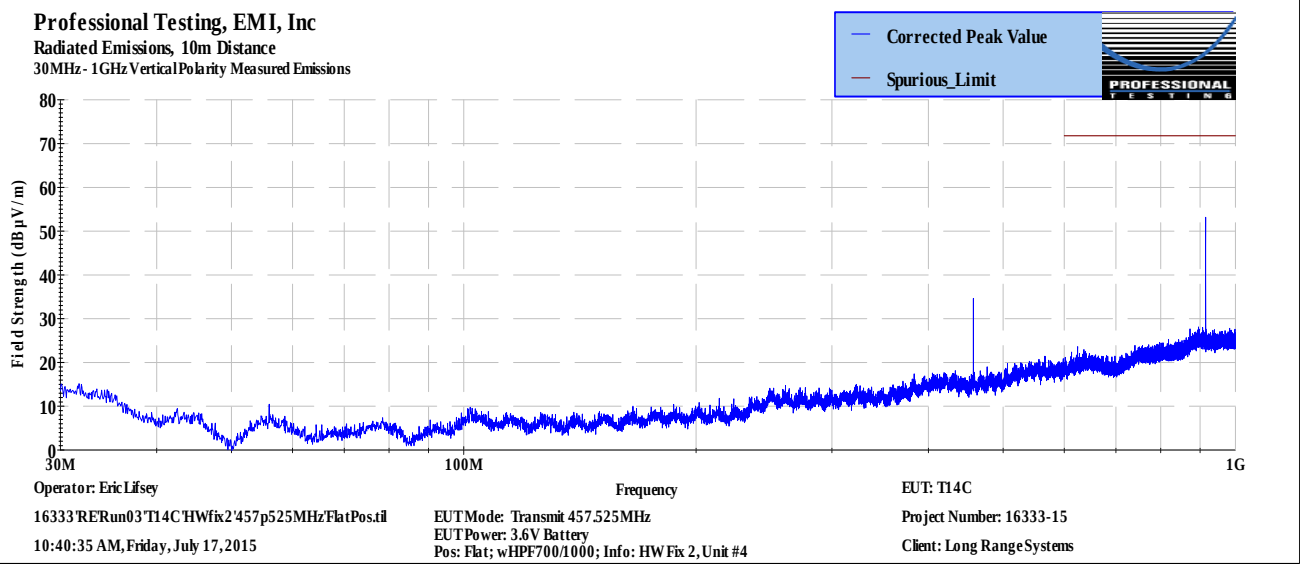


> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 5.3.1.9: Field Strength of Spurious Emissions, Flat, 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A	
Antenna Orientation:	Vertical		Frequency Range:	30MHz to 1GHz		
			Transmit 457.525 MHz, Flat			

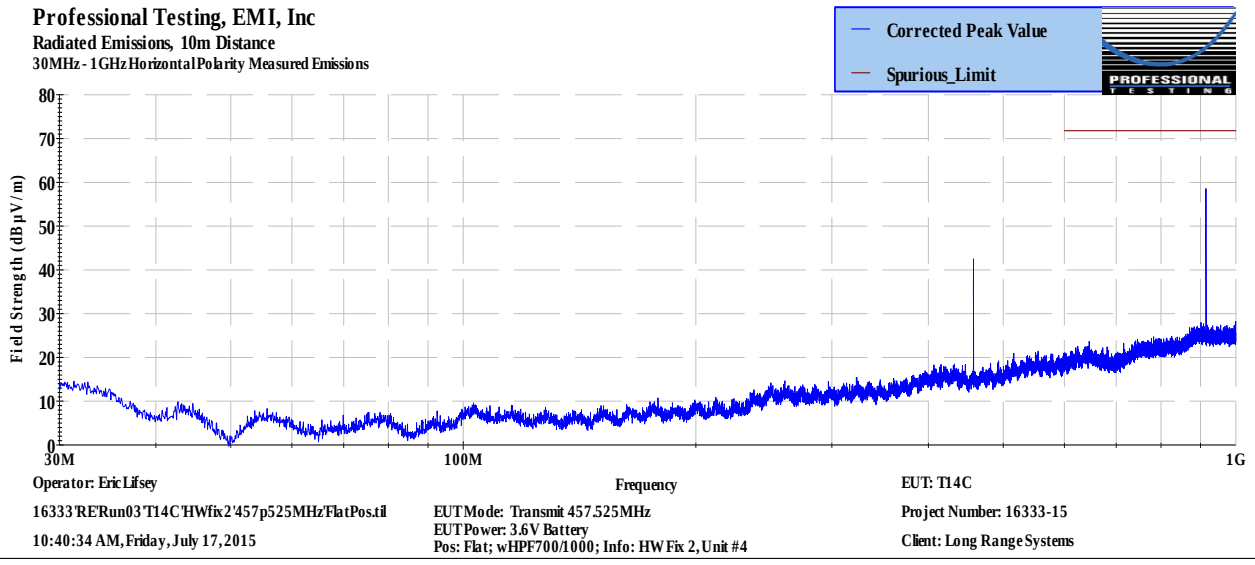


≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 5.3.1.10: Field Strength of Spurious Emissions, Flat, 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	**EUT Serial #:**	None
Customer:	Long Range Systems	**EUT Part #:**	Unit #4
Project Number:	16333-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	T14	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3.6 VDC	**EUT Power Frequency:**	0 N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	30MHz to 1GHz
		Transmit 457.525 MHz, Flat	

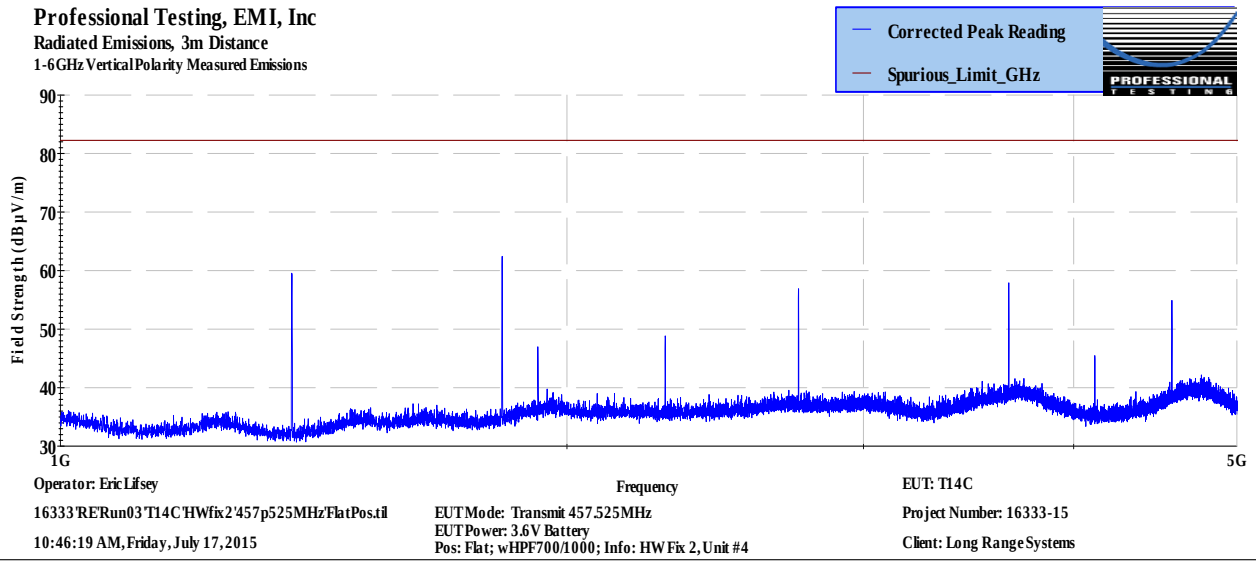


≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 5.3.1.11: Field Strength of Spurious Emissions, Flat, 1 GHz to 5 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A	
Antenna Orientation:	Vertical		Frequency Range:	Above 1GHz		
			Transmit 457.525 MHz, Flat			

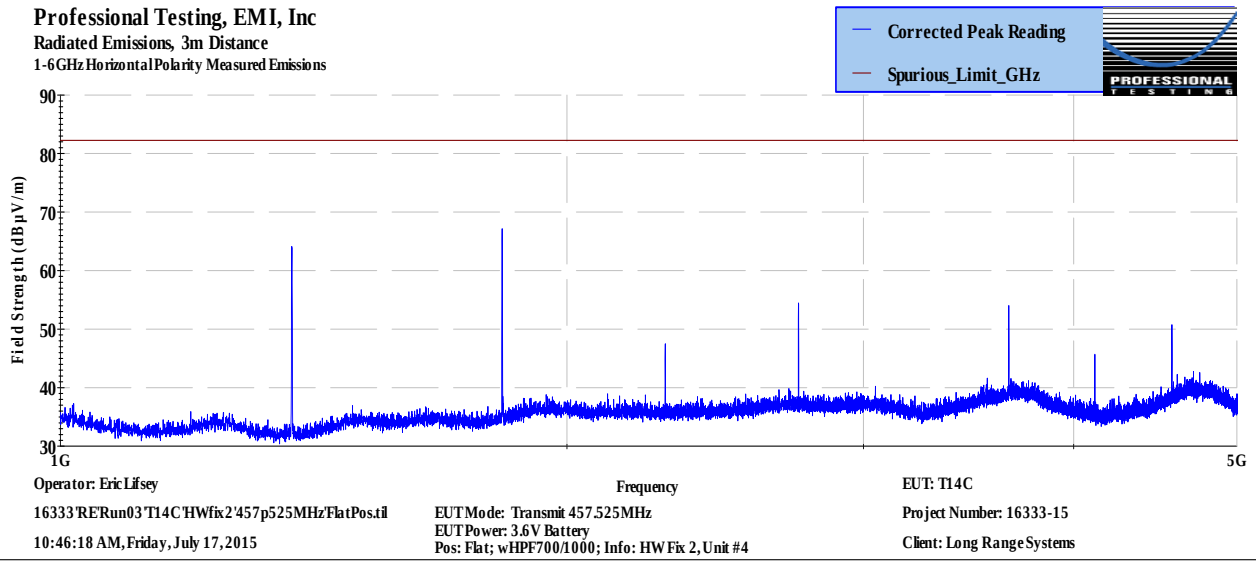


> 1GHz Vertical Antenna Polarity Measured Emissions

Table 5.3.1.12: Field Strength of Spurious Emissions, Flat, 1 GHz to 5 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 15.209 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Radiated Emissions Limits		
Section:	15.209		
Test Date(s):	7/17/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page:	1	of	1
EUT Line Voltage:	3.6	VDC	EUT Power Frequency:	0	N/A	
Antenna Orientation:	Horizontal		Frequency Range:	Above 1GHz		
			Transmit 457.525 MHz, Flat			



> 1GHz Horizontal Antenna Polarity Measured Emissions

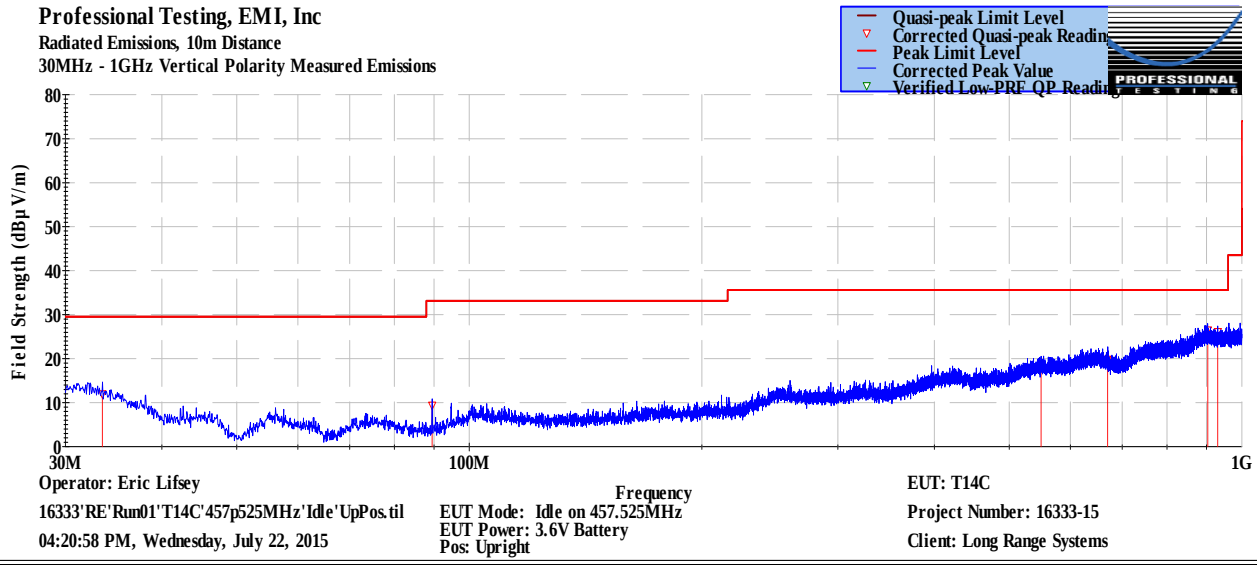
5.3.2 Idle Mode

Table 5.3.2.1: Field Strength of 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):	7/22/2015	EUT Serial #:	None
Customer:	Long Range Systems	EUT Part #:	Unit #4
Project Number:	16333-15	Test Technician:	Eric Lifsey
Purchase Order #:	NA	Supervisor:	Lisa Arndt
Equip. Under Test:	T14C	Witness' Name:	None

Radiated Emissions Test Results Data Sheet			Page: 1 of 1
EUT Line Voltage:	3.6 VDC	EUT Power Frequency:	0 N/A
Antenna Orientation:	Vertical	Frequency Range:	30MHz to 1GHz
		Idle, Upright	

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
33.4924	10	113	1.28	Quasi-peak	23.5	11.979	29.5	-17.5	Pass
89.5194	10	20	3.11	Quasi-peak	29	9.358	33.1	-23.7	Pass
549.854	10	294	2.78	Quasi-peak	22	18.666	35.6	-16.9	Pass
670.466	10	239	2.52	Quasi-peak	21.9	19.807	35.6	-15.8	Pass
903.585	10	213	2.31	Quasi-peak	21.2	26.452	35.6	-9.1	Pass
931.002	10	351	1.87	Quasi-peak	21.1	26.097	35.6	-9.5	Pass



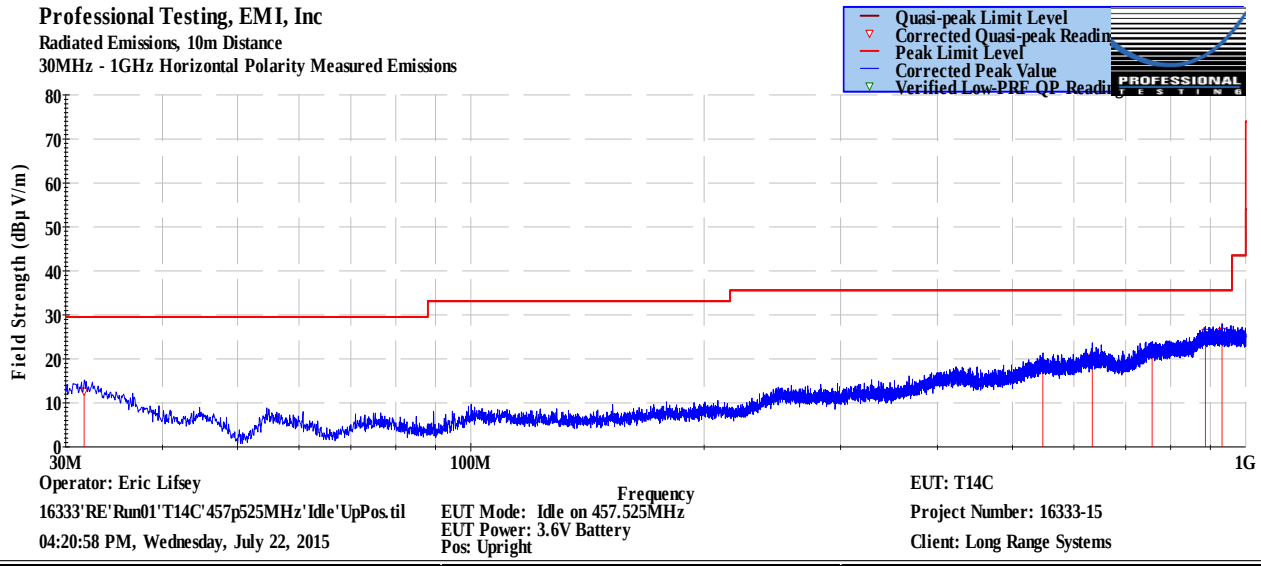
≤ 1GHz Vertical Antenna Polarity Measured Emissions

Table 5.3.2.2: Field Strength of 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):	7/22/2015	**EUT Serial #:**	None
Customer:	Long Range Systems	**EUT Part #:**	Unit #4
Project Number:	16333-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	T14C	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet				Page: 1 of 1
EUT Line Voltage:	3.6 VDC	**EUT Power Frequency:**	0 N/A	
Antenna Orientation:	Horizontal	**Frequency Range:**	30MHz to 1GHz	
		Idle, Upright		

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
31.6875	10	214	2.74	Quasi-peak	24.1	12.664	29.5	-16.8	Pass
547.168	10	94	1.39	Quasi-peak	22.1	18.582	35.6	-17.0	Pass
633.912	10	174	3.59	Quasi-peak	22	20.363	35.6	-15.2	Pass
757.218	10	290	1.27	Quasi-peak	21.6	22.534	35.6	-13.1	Pass
887.166	10	214	1.5	Quasi-peak	21.4	26	35.6	-9.6	Pass
932.027	10	81	1.5	Quasi-peak	21.2	26.217	35.6	-9.4	Pass



≤ 1GHz Horizontal Antenna Polarity Measured Emissions

Table 5.3.2.3: Field Strength of Spurious Emissions, 1 to 6 GHz, Vertical Polarity

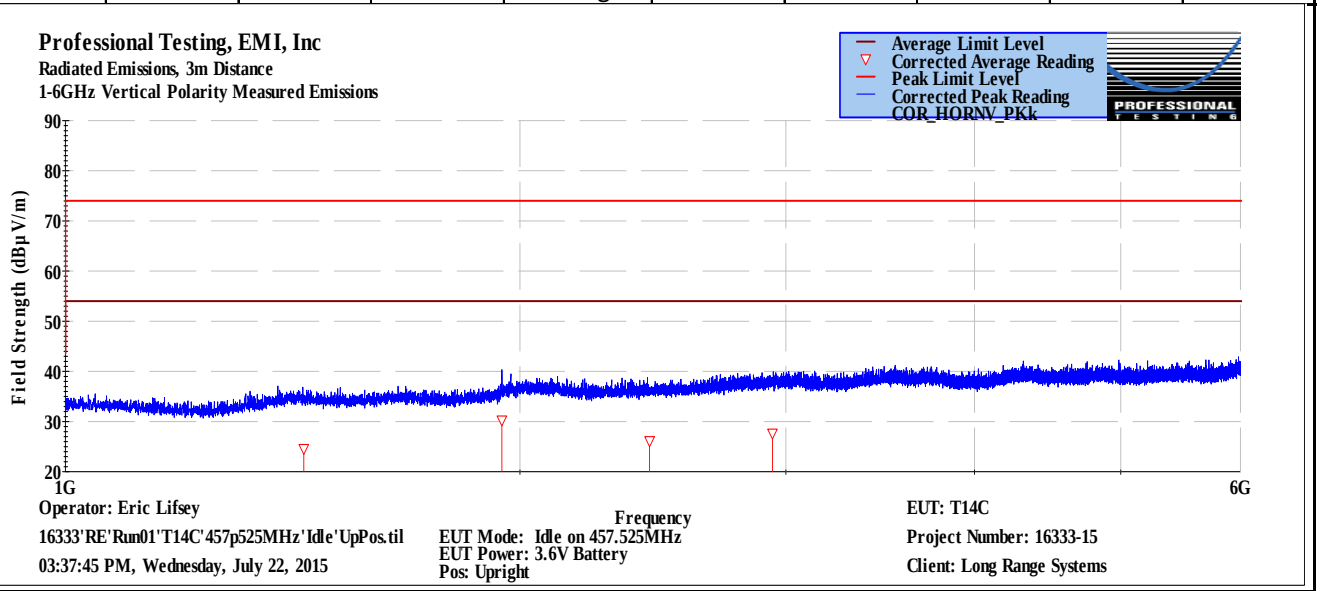
Professional Testing, EMI, Inc.

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):	7/22/2015	**EUT Serial #:**	None
Customer:	Long Range Systems	**EUT Part #:**	Unit #4
Project Number:	16333-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	T14C	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	3.6 VDC	**EUT Power Frequency:**	0 N/A
Antenna Orientation:	Vertical	**Frequency Range:**	Above 1GHz
		Idle, Upright	

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
1438.6	3	44	1	Average	36	24.587	54.0	-29.4	Pass
1945.97	3	61	1	Average	39.3	30.27	54.0	-23.7	Pass
2437.49	3	140	1	Average	34.6	26.12	54.0	-27.8	Pass
2939.64	3	205	1	Average	34.4	27.658	54.0	-26.3	Pass



> 1GHz Vertical Antenna Polarity Measured Emissions

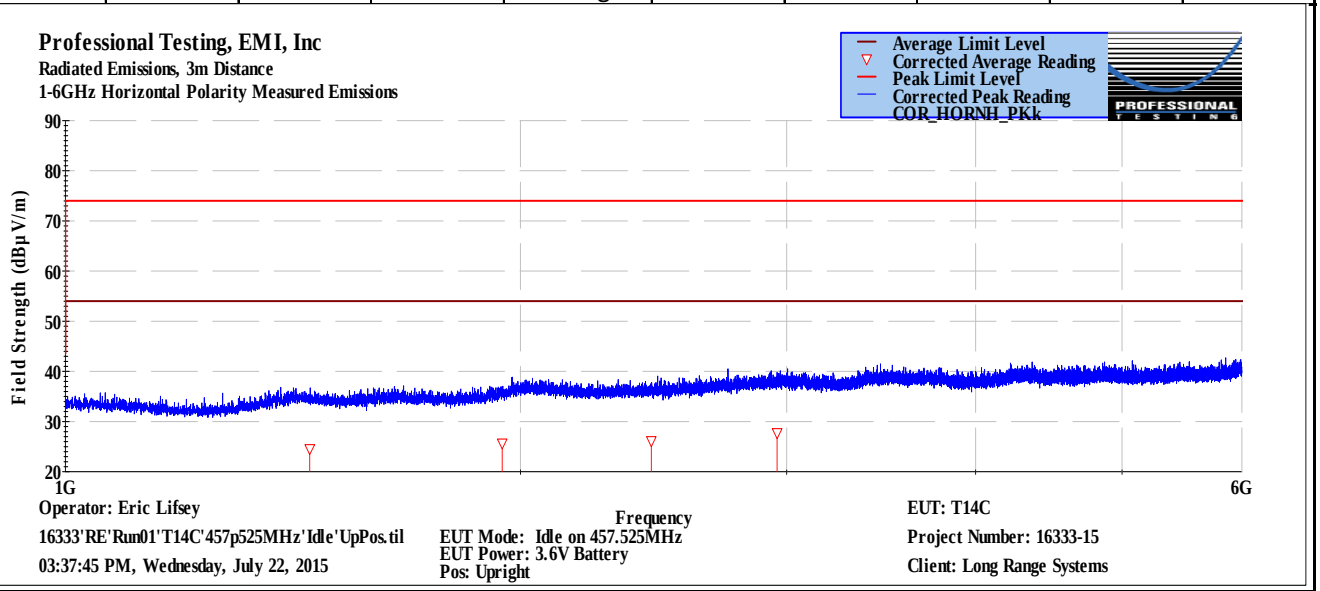
Table 5.3.2.4: Field Strength of Spurious Emissions, 1 to 6 GHz, Horizontal Polarity

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):	7/22/2015	**EUT Serial #:**	None
Customer:	Long Range Systems	**EUT Part #:**	Unit #4
Project Number:	16333-15	**Test Technician:**	Eric Lifsey
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	T14C	**Witness' Name:**	None

Radiated Emissions Test Results Data Sheet — **Page: 1 of 1**

EUT Line Voltage:	3.6 VDC	**EUT Power Frequency:**	0 N/A
Antenna Orientation:	Horizontal	**Frequency Range:**	Above 1GHz
		Idle, Upright	

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
1450.84	3	39	1	Average	36	24.57	54.0	-29.4	Pass
1945.06	3	177	1	Average	34.7	25.67	54.0	-28.3	Pass
2440.77	3	148	1	Average	34.6	26.128	54.0	-27.8	Pass
2956.83	3	30	1	Average	34.4	27.734	54.0	-26.2	Pass



> 1GHz Horizontal Antenna Polarity Measured Emissions

Table 7.3.13: 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	300	2	Multiple Sweeps

*Notes:
1. The settings above are specifically calculated for the E4440A series of spectrum analyzers, which have 8,000 data points per range.
2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 9-150 kHz.
3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.
4. The measurement receiver resolution bandwidth setting was 120 kHz for quasi-peak measurements from 30-1000 MHz.
5. The measurement receiver resolution bandwidth setting was 1 MHz for average measurements from 1-18 GHz.

6.0 Mains Conducted Emissions

6.1 Procedure

The EUT was placed on a non-conductive table 0.8 meters above the floor and 0.4 meters from the conductive reference plane (wall). The EUT is powered through a line impedance stabilization network (LISN) that provides a measurement tap and a termination approximating 50 Ohms in the measurement range of 150 kHz to 30 MHz. A spectrum analyzer is connected, in turn, to each mains line measurement tap and software is employed to measure the radio frequency noise generated by the EUT.

6.2 Criteria

Clause Subject	Section Number	Date
Mains Conducted Emissions, Class B	15.107 | RSS-Gen Issue 4, ICES-003	21 Jul 2015

6.3 Results

The EUT is inhibited from operating when in charge mode; and more than half of the keypad is not accessible when in the charger base.

The EUT satisfied the requirement. Tabular and plotted measurements appear below.

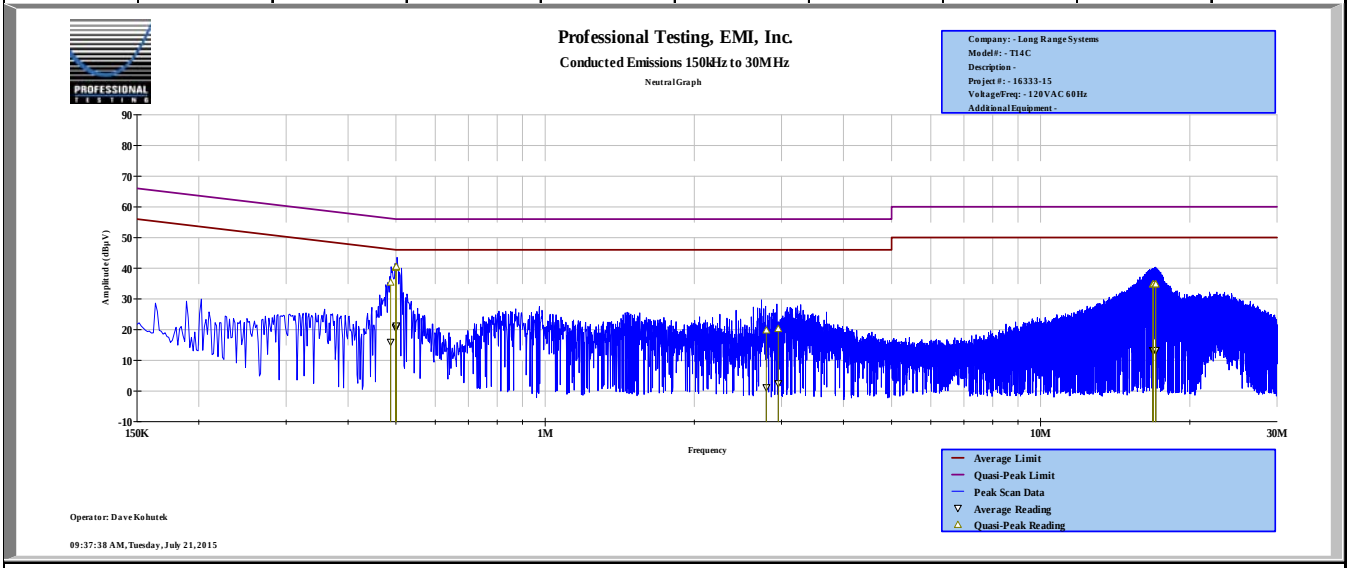
Table 8.3.1: Mains Conducted Emissions, Neutral Line

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2009: 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 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	7/21/2015	**EUT Serial #:**	None
Customer:	Long Range Systems	**EUT Part #:**	Unit #4
Project Number:	16333-15	**Test Technician:**	Dave Kohutek
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	T14C	**Witness' Name:**	None

Conducted Emissions Test Results Data Sheet - Neutral Lead **Page: 1 of 2**

EUT Line Voltage: 120 VAC **EUT Line Frequency:** 60 Hz

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.48752	38.2	35.3	56.2	-20.9	PASS	16	46.2	-30.2	PASS
0.499337	44.2	40.2	56	-15.8	PASS	20.6	46	-25.5	PASS
0.499686	43.4	40.2	56	-15.8	PASS	20.8	46	-25.2	PASS
0.500512	44.2	40.5	56	-15.5	PASS	21.3	46	-24.7	PASS
2.795	30.1	19.7	56	-36.3	PASS	1.2	46	-44.8	PASS
2.9542	29.8	20.2	56	-35.8	PASS	2.5	46	-43.5	PASS
16.8402	41	34.7	60	-25.3	PASS	13.3	50	-36.7	PASS
16.8945	41.1	34.8	60	-25.2	PASS	13.2	50	-36.8	PASS
17.0596	41.2	34.7	60	-25.3	PASS	13.2	50	-36.8	PASS
17.074	41.5	34.8	60	-25.2	PASS	13.3	50	-36.7	PASS



Measured Conducted Emissions - Neutral Lead

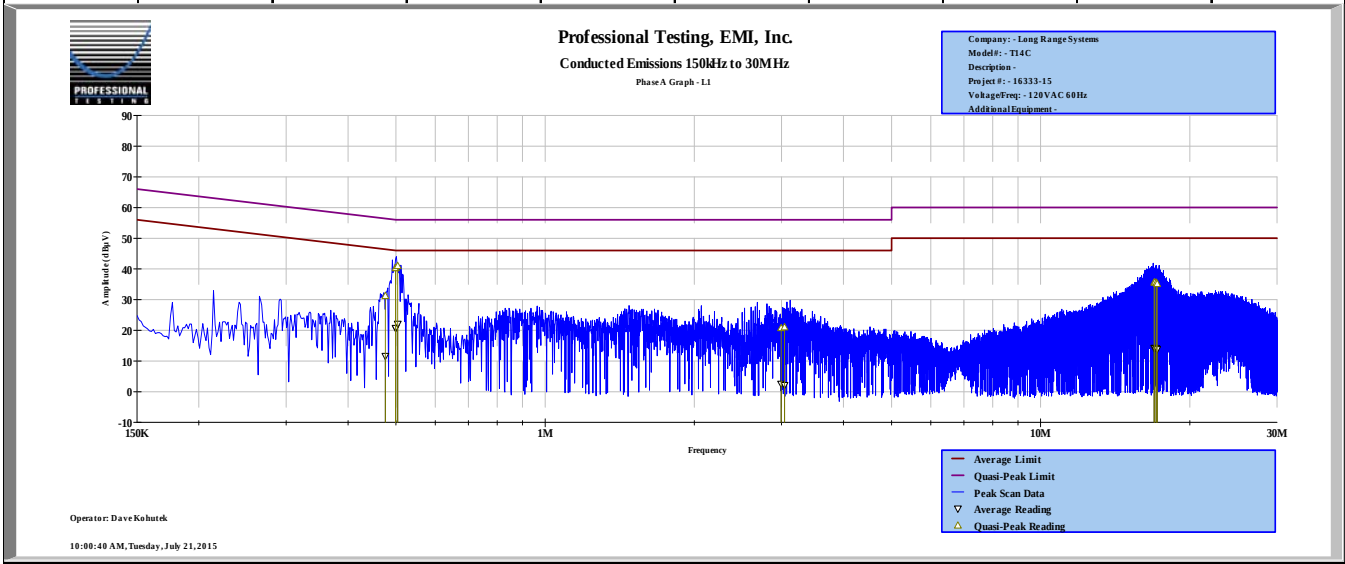
Table 8.3.2: Mains Conducted Emissions, Phase Line

Professional Testing, EMI, Inc.			
Test Method:	ANSI C63.4–2009: 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 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits		
Section:	15.207		
Test Date(s):	7/21/2015	**EUT Serial #:**	None
Customer:	Long Range Systems	**EUT Part #:**	Unit #4
Project Number:	16333-15	**Test Technician:**	Dave Kohutek
Purchase Order #:	NA	**Supervisor:**	Lisa Arndt
Equip. Under Test:	T14C	**Witness' Name:**	None

Conducted Emissions Test Results Data Sheet - Phase Lead (Line 1) **Page: 2 of 2**

EUT Line Voltage:	120	VAC	EUT Line Frequency:	60	Hz

Frequency Measured (MHz)	Peak Detector Reading (dBµV)	Quasi-peak Detector Reading (dBµV)	Quasi-peak Detector Limit (dBµV)	Quasi-peak Detector Margin (dB)	Quasi-peak Detector Test Results	Average Detector Reading (dBµV)	Average Detector Limit (dBµV)	Average Detector Margin (dB)	Average Detector Test Results
0.47585	35.6	31.2	56.4	-25.2	PASS	11.6	46.4	-34.8	PASS
0.49897	43.4	40.3	56	-15.7	PASS	20.7	46	-25.3	PASS
0.499098	44	40.2	56	-15.8	PASS	20.7	46	-25.3	PASS
0.504092	44.2	41	56	-15	PASS	22.1	46	-23.9	PASS
2.9934	30.6	20.7	56	-35.3	PASS	2.6	46	-43.4	PASS
3.0412	29.9	21	56	-35	PASS	2.1	46	-43.9	PASS
16.9539	41.9	35.6	60	-24.4	PASS	14.2	50	-35.8	PASS
17.0033	42.3	35.6	60	-24.4	PASS	14.2	50	-35.8	PASS
17.1232	42.2	35.5	60	-24.5	PASS	14.1	50	-35.9	PASS
17.1852	41.7	35.1	60	-24.9	PASS	13.8	50	-36.2	PASS



Measured Conducted Emissions - Phase Lead (Line 1)

Table 8.3.4: Mains Conducted Emissions, Measurement Bandwidths

Conducted Emissions Spectrum Analyzer Bandwidth and Measurement Time				
Frequency Band Start (MHz)	**Frequency Band Stop (MHz)**	**6 dB Bandwidth (kHz)**	**Number of Ranges Used**	**Measurement Time per Range**
0.01	0.15	0.3	7	Five 1 second sweeps
0.15	30	9	20	Five 1 second sweeps

*Notes:
1. The settings above are specifically calculated for the HP856X series of spectrum analyzers, which have 1,000 data points per range.
2. The measurement receiver resolution bandwidth setting was 300 Hz for quasi-peak measurements from 10-150 kHz.
3. The measurement receiver resolution bandwidth setting was 9 kHz for quasi-peak measurements from 0.15-30 MHz.

7.0 Frequency Stability

7.1 Procedure

The EUT is placed into a temperature chamber with a small dipole to pass the transmitted signal to a spectrum analyzer. On reaching each set point temperature, the EUT is allowed to soak at least 10 minutes without power applied. After soak time was satisfied, the EUT is powered on in transmit mode and the frequency is observed until it becomes stable; then the measurement of frequency is taken. The time required to become stable is also recorded.

Operating voltage stability was also measured for extremes of +/- 15% from nominal. In this case the power source is nominally 3.6 VDC.

7.2 Criteria

The operating frequency shall remain within +/- 25 kHz of the assigned channel. The measurement is performed for lowest, middle, and highest operating frequency.

7.3 Results

The EUT satisfied the requirement.

Table 9.3.2: Frequency Stability, Temperature

Date: 5 Jun 2015

Condition	Frequency		Deviation
Temperature (C)	Reference Center Frequency (MHz)	Measured Frequency (MHz)	Calculated Deviation (Hz)
-30	457.525000	457.524070	-930
-20	457.525000	457.526300	1300
-10	457.525000	457.527000	2000
0	457.525000	457.526690	1690
10	457.525000	457.525820	820
20	457.525000	457.524740	-260
30	457.525000	457.524270	-730
40	457.525000	457.523570	-1430
50	457.525000	457.523390	-1610

Table 9.3.3: Frequency Stability, Voltage

Date: 5 Jun 2015

Condition	Frequency			Deviation	Voltage
Voltage Extreme	Reference Frequency (MHz)	Measured Frequency (MHz)	Calculated Deviation (Hz)	Calculated Deviation (ppm)	Measured Voltage (V DC)
-15%	457.525000	457.525000000	0	0.000000000	3.06
Nominal	457.525000	457.525100000	100	0.218567291	3.60
+15%	457.525000	457.525200000	200	0.437134583	4.14

8.0 Transmit Transient

8.1 Procedure - Exempt

Transmit power under 120 mW exempts this test.

9.0 Emission Bandwidth

9.1 Procedure

The EUT antenna port is coupled through a power attenuator to a spectrum analyzer and then is placed into continuous transmit mode with modulation. The spectrum analyzer amplitude is offset to compensate for the attenuator calibrated power loss. The connection is direct and no cables are used. The modulated signal is then measured directly in a manner consistent with power measurement. Resolution bandwidth is typically ~1-3 percent of the bandwidth of ~12 kHz max where that range is 120 Hz to 360 Hz; 300 Hz RBW is selected for measurement.

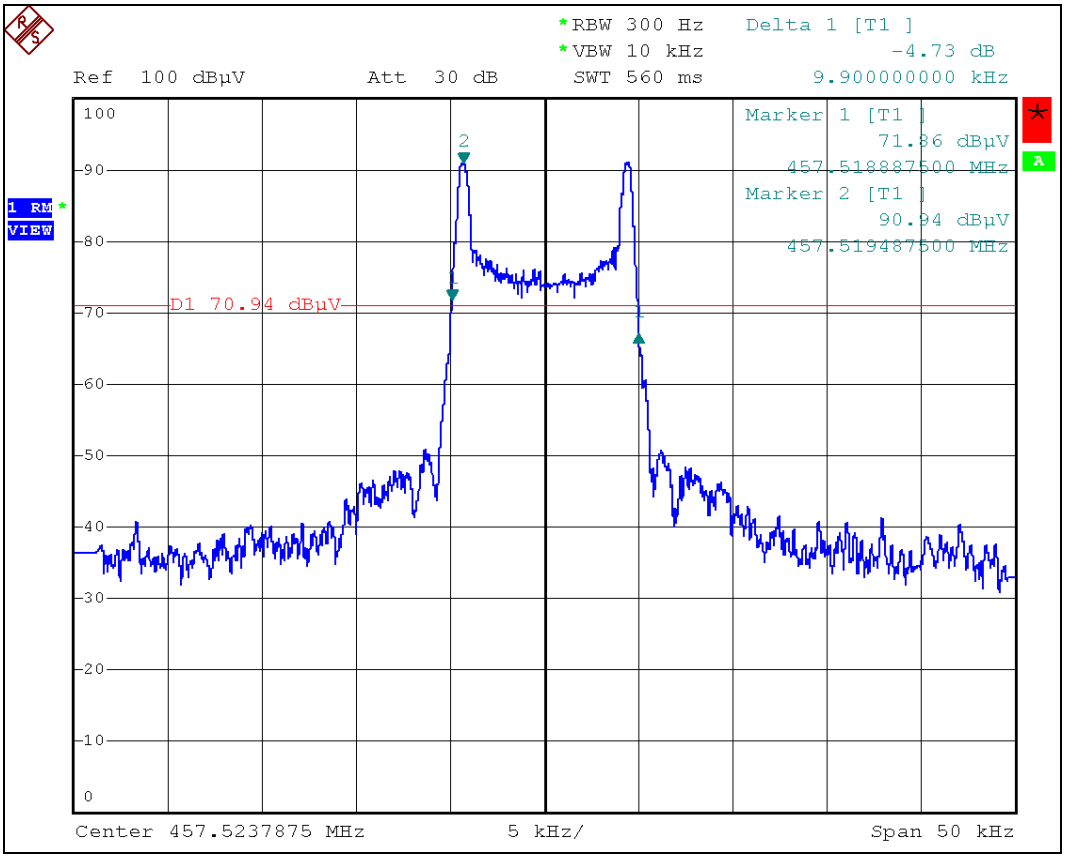
9.2 Criteria

Clause Requirement	Section Number	Date
90.210(c) Bandwidth < 12. 5 kHz	90.209, 2.1049 | RSS-119 Issue 12, 5.5	3 Jun 2015

9.3 Results

Table 9.3.2 Bandwidth	
Bandwidth Measurement Method	**Measured Bandwidth**
20 dB	9.9 kHz

The emission satisfies the bandwidth criteria. Plotted results appear below.



Low Channel; Bandwidth, 20 dB

10.0 Equipment Lists

10.1 Bandwidth

Table 10.1 Equipment List; Bandwidth				
Asset #	**Manufacturer**	**Model #**	**Description**	**Calibration Due**
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	29 Jan 2016

10.2 Frequency Stability

Table 10.2 Equipment List; Frequency Stability				
Asset #	**Manufacturer**	**Model #**	**Description**	**Calibration Due**
ALN-077	Rohde & Schwarz	FSP-30	Spectrum Analyzer	29 Jan 2016
2134	Tenny	TPS	Temperature Chamber	31 Oct 2015
C235	Unknown	RG type	Coaxial Cable, double shielded	CNR
1778	B&K	2408	DMM	20 Apr 2016
none	PTI	none	Sense Antenna, sleeve dipole	CNR

10.3 Radiated Spurious and Fundamental Power

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):	**7/17/2015**	**EUT Serial #:**	**None**
Customer:	**Long Range Systems**	**EUT Part #:**	**Unit #4**
Project Number:	**16333-15**	**Test Technician:**	**Eric Lifsey**
Purchase Order #:	**NA**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**T14**	**Witness' Name:**	**None**

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	2/5/2016
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	2/6/2016
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	9/29/2015
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	135454	1/25/2017
C027	PTI	None	Relay	none	N/A
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	3/13/2016
2004	Miteq	AFS44-00101800-2S-10P-44	Amplifier, 40dB, .1-18GHz	0	12/29/2015
C030	none	none	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	110313	2/25/2017

10.4 Radiated Spurious Idle Mode

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 15.109 - Code of Federal Regulations Part 47, Subpart B - Unintentional Radiators, Radiated Emissions Limits**		
Section:	**15.109**		
Test Date(s):	**7/22/2015**	**EUT Serial #:**	**None**
Customer:	**Long Range Systems**	**EUT Part #:**	**Unit #4**
Project Number:	**16333-15**	**Test Technician:**	**Eric Lifsey**
Purchase Order #:	**NA**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**T14C**	**Witness' Name:**	**None**

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	2/5/2016
1890	HP	8447F	Preamp/Amp, 9kHz-1300MHz, 28/25dB	3313A05298	2/6/2016
1937	Agilent	E4440A	Spectrum Analyzer, 3 Hz - 26.5 GHz	MY44303298	8/29/2015
1926	ETS-Lindgren	3142D	Antenna, Biconilog, 26 MHz - 6 GHz	135454	1/25/2017
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	3/13/2016
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	110313	2/25/2017

10.5 Mains Conducted Emissions

Professional Testing, EMI, Inc.			
Test Method:	**ANSI C63.4–2009: 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 15.207 - Code of Federal Regulations Part 47, Subpart C - Intentional Radiators, Conducted Emissions Limits**		
Section:	**15.207**		
Test Date(s):	**7/21/2015**	**EUT Serial #:**	**None**
Customer:	**Long Range Systems**	**EUT Part #:**	**Unit #4**
Project Number:	**16333-15**	**Test Technician:**	**Dave Kohutek**
Purchase Order #:	**NA**	**Supervisor:**	**Lisa Arndt**
Equip. Under Test:	**T14C**	**Witness' Name:**	**None**

Conducted Emissions Test Equipment List	
Tile! Software Version:	**4.1.A.0, April 14, 2009, 11:01:00PM**
Test Profile:	**Profile#: CE_2014_R3.TIL, dated May 1, 2014**

Asset #	Manufacturer	Model	Equipment Nomenclature	Serial Number	Calibration Due Date
1842	HP	8568B	Spectrum Analyzer	2732A03633	10/1/2015
2113	HP	85662A	Spec Anal Dsply for A/N 1842	2403A07470	N/A
0990	HP	85685A	RF Preselector	3010A01119	9/30/2016
1281	HP	85650A	Quasi Peak Adapter	2043A00063	N/A
1173	HP	6214B	Power Supply, DC, 12V 1A	2617A11110	N/A
1087	PTI	PTI-ALF3	Attenuator Limiter Filter	none	4/28/2016
C107	Pomona	RG-223	Cable 9 ft BNC RG-223 (black)	none	8/11/2015
C108	HP	11170 C	Cable 5 ft BNC (Grey)	none	8/11/2015
C109	HP	none	Cable 19 inch BNC (grey)	none	8/11/2015
1185	EMCO	3825/2	LISN, 10kHz-100MHz	1235	11/11/2015

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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