

August 08, 2022

Lat-Lon, LLC
Benjamin Jull
2300 S. Jason St.
Denver, CO 90223

Dear Mr. Jull,

Enclosed is the Wireless test report for compliance testing of the Lat-Lon X15500 as tested to the requirements of the

Title 47 of the CFR, Part 15 Subpart C

FCC Part §2.1053, §24.238(a), §27.53(a)(4), §27.53(c)(2), §27.53(f), §27.53(g)

ANSI C63.10: 2013 2009

RSS-GEN Issue 5, April 2018 + Amendment 1 (March 2019) + Amendment 2 (February 2021)

RSS-130 Issue 2 February 2019

RSS-133 Issue 6 January 2018

RSS-139 Issue 3 July 2015

Thank you for using the services of Eurofins Electrical and Electronic Testing NA, Inc. If you have any questions regarding these results or if Eurofins Electrical and Electronic Testing NA, Inc. can be of further service to you, please feel free to contact me.

Gary Chou

Documentation Department
Eurofins Electrical and Electronic Testing NA, Inc.

Reference: WIR117437-FCC_ISED-CO-LOCATION



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FCC/ ISED Test Report

Applicant name: Lat-Lon, LLC

Product: Lat-Lon, LLC

Report: WIR117437-FCC_ISED-CO-LOCATION

Applicant Address:

**2300 S. Jason St.
Denver, CO 90223**

Manufacturer Address:

**2300 S Jason St
Denver, CO 80223**

Prepared By:
Eurofins Electrical and Electronic Testing NA, Inc.
3162 Belick St.
Santa Clara CA, 95054

FCC/ ISED Test Report

Applicant name : Lat-Lon, LLC

Product: Lat-Lon X15500

Standard

47 CFR FCC Part 15, Subpart C (Section 15.247)

Part 22, Part 24, Part 27

RSS-GEN Issue 5, April 2018 + Amendment 1 (March 2019) + Amendment 2 (February 2021)

RSS-130 Issue 2 February 2019

RSS-133 Issue 6, January 2018

RSS-139 Issue 3 July 2015

ANSI C63.10: 2013 2009

Alberto Saldiver

Alberto Saldiver

Test Engineer, Wireless Laboratory

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

Gary Chou

Gary Chou

Wireless Engineering Manager, Wireless Laboratory

Report Status Sheet

Revision	Report Date	Reason for Revision
Ø	August 08, 2022	Initial Issue.

Table of Contents

I.	Executive Summary	1
	A. Executive Summary	1
II.	Equipment Information.....	2
	A. Overview.....	2
	B. References.....	4
	C. Test Site	4
	D. Measurement Uncertainty	5
	E. Modifications	6
	Modifications to EUT	6
	Modifications to Test Standard.....	6
	F. Disposition of EUT	6
III.	Electromagnetic Compatibility Criteria for Intentional Radiators.....	7
	A. Radiated Emission and Bandage Measurement	7

I. Executive Summary

A. Executive Summary

47 CFR FCC Part 15, Subpart C (Section 15.247) Part 22, Part 24, Part 27 RSS-GEN Issue 5, April 2018 + Amendment 1 (March 2019) + Amendment 2 (February 2021) RSS-130 Issue 2 February 2019 RSS-133 Issue 6, January 2018 RSS-139 Issue 3 July 2015 ANSI C63.10: 2013 2009			
Item	Test Item	Result	Remarks
1	Spurious Emission/ Unwanted Emissions Strength	PASS	Meet the requirement of limit.

Note:

1.Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

II. Equipment Information

A. Overview

EUT Summary Table

Model(s) Tested:	X15500		
EUT Specifications:	Primary Power: Battery/ Solar Voltage: 3.3 Vdc		
	Type of Modulations:	Cellular: LTE CAT-M	QPSK, 16QAM
		BLE	GFSK
		Zigbee	DSSS
	Operating Frequency :	LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz BLE : 2402 MHz~2480 MHz Zigbee : 2405 MHz~ 2475 MHz	
	Product:	Lat-Lon X15500	
	Brand:	Lat-Lon, LLC	
	FCC ID :	FCC ID report: W54-X15500m	
	ISED ID	ISED ID Report: 21325-X15500m	
Antenna Type:	Cellular:	Flexible PCB Antenna	
	BLE:	Chip Antenna	
	ZIGBEE:	Chip Antenna	
Antenna Gain:	Cellular	698 MHz -798 MHz : 3.5 dBi 1710 MHz - 2170 MHz : 3.8dBi 2300 MHz - 2400 MHz : 4.5 dBi 2500 MHz – 2690 MHz : 4.5 dBi	
	BLE	1.86 dBi	
	Zigbee	1.7 dBi	
Antenna Port:		Cellular: IPEX BLE: N/A ZIGBEE: N/A	
Analysis:	The results obtained relate only to the item(s) tested.		
Environmental Test Conditions:	Temperature: 15-35° C		
Environmental Test Conditions: Evaluated by:	Relative Humidity: 30-60%		
	Barometric Pressure: 860-1060 mbar		

	Alberto Saldiver
Date(s):	August 08, 2022

NOTE: The following modules can be chosen to be configured in the EUT.

	Model No.	FCC ID	ISED ID	Note
Cellular	ME910C1-NA	RI7LE910NAV2	5131A-ME910C1NA	-
BLE	BGM220P	QQQWGM160P	5123A-GM220P	-
ZigBee	ETERNA2	OWRCLEV6630B	5853A-ETERANA2	-

B. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A	Laptop	ACER	A315-51-533U	NXGNPAA0167300AA597600	-	-

Note: (Describe the outline of a simulator, if used for the tests, as a note under the table.)

Insert Cable Connections to/from EUT provided by test team.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
A	USB Cable	3	1.2	YES	0	From EUT to Laptop

Note: The core(s) is(are) originally attached to the cable(s).

General Description of Applied Standards

C. References

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

- o 47 CFR FCC Part 15, Subpart C (Section 15.247)
- o 47 CFR FCC Part 22, Part 24, Part 27
- o ANSI C63.10:2013
- o RSS-GEN Issue 5, April 2018 + Amendment 1 (March 2019) + Amendment 2 (February 2021)
- o RSS-130 Issue 2 February 2019
- o RSS-133 Issue 6, January 2018
- o RSS-139 Issue 3 July 2015

D. Test Site

All testing was performed at Eurofins Electrical and Electronic Testing NA, Inc., 3162 Belick St. Santa Clara, CA 95054. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Eurofins Electrical and Electronic Testing NA, Inc. has been accredited by the American Association for Laboratory Accreditation (A2LA) (Certificate #: 0591.02) in accordance with ISO/IEC 17025:2017.

Eurofins Electrical and Electronic Testing NA, Inc. is part of the Eurofins Electrical & Electronics (E&E) global compliance network.

E. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.32 dB	2	95%
RF Power Conducted Spurious Emissions	±2.25 dB	2	95%
RF Power Radiated Emissions	±3.01 dB	2	95%

Uncertainty Calculations Summary

F. Modifications**a) Modifications to EUT**

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

G. Disposition of EUT

The test sample including all support equipment (if any), submitted to the Electromagnetic Compatibility Lab for testing was returned to Lat-Lon, LLC upon completion of testing.

III. Electromagnetic Compatibility Criteria for Intentional Radiators

Radiated Emission and Bandage Measurement

Limits of Radiated Emission and Bandage Measurement:

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

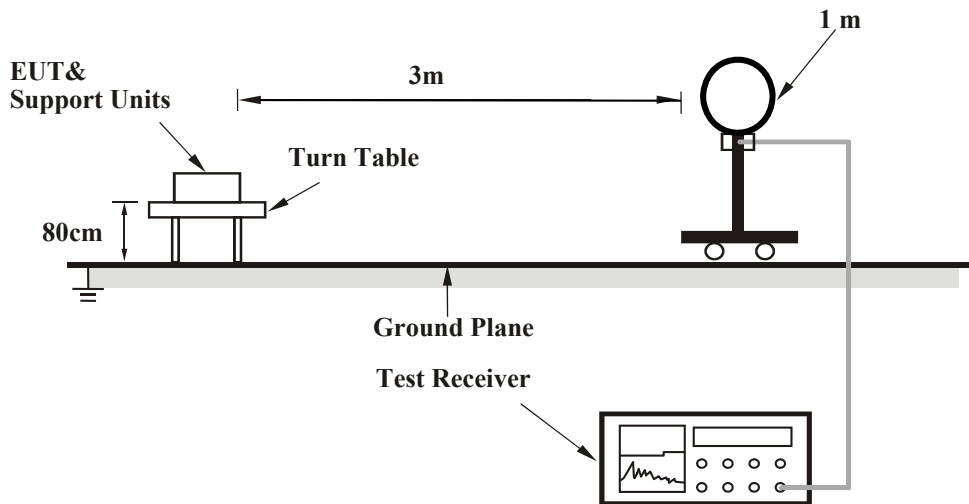
Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Test Procedures:

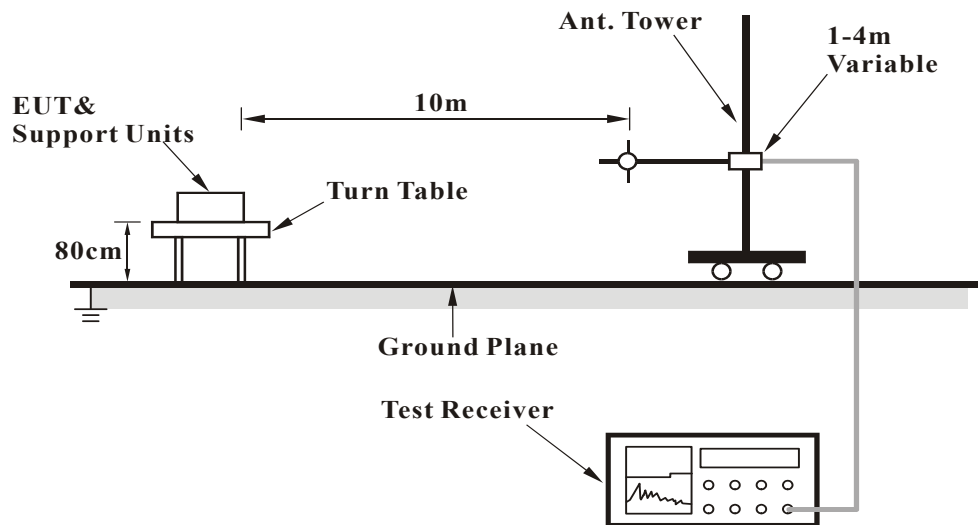
The transmitter was turned on. Measurements were performed of the low, mid and high Channels. The EUT was rotated orthogonally through all three axes. Plots shown are corrected for both antenna correction factor and distance and compared to a 3 m limit line. Only noise floor was measured above 18 GHz.

Test Setup

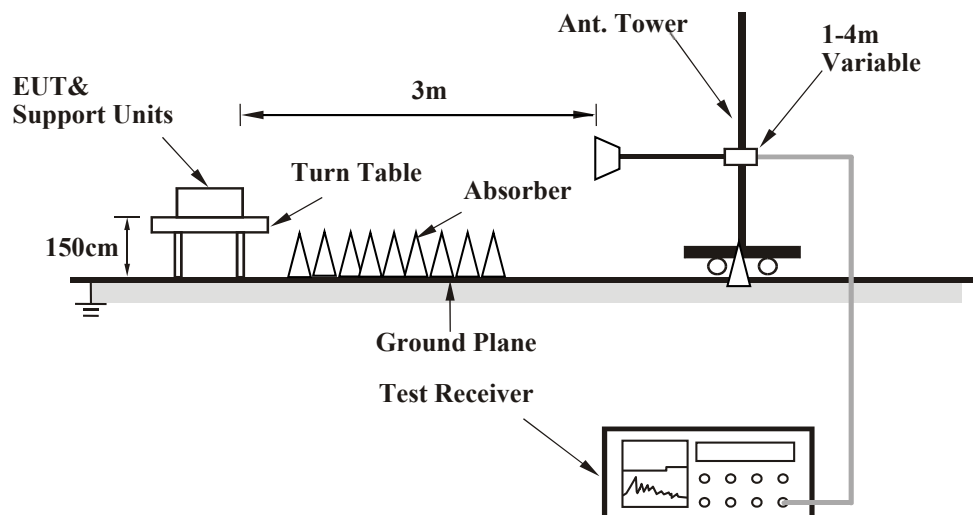
For Radiated Emission Below 30MHz



For Radiated emission 30 MHz to 1GHz



For Radiated emission 30 MHz to 1GHz



Test Results: The EUT was tested is **compliant** with Radiated Spurious Emissions Requirements.

Test Equipment List

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

Asset #	Equipment	Manufacturer	Model	Last Cal Date	Cal Due Date
1S2003	EMI Test Receiver	ROHDE & SCHWARZ	N9030B	10/08/2021	10/08/2022
1S2399	Turntable Controller	SUNOL SCIENCE	SC99V	Not Required	Not Required
1S2486	5 Meter Chamber Control Room	Panashield	5 Meter Control Room	Not Required	Not Required
1S2435	Horn Antenna	ETS-LINDGREN	3117	03/03/2021	03/09/2023
N/A	Preamplifier	EMC Instrument	EMC118A45SE	Note 1	Note 1
1S2668	Preamplifier	Sonoma Instrument	310N	Note 1	Note 1
1S2600	Antenna	TESEQ GmbH	D-12623	05/ 11/ 2021	05/ 11/ 2023
1S3983	Loop Antenna	ETS-LINDGREN	6512	10/ 14 /2021	10/ 14 /2023
Note 1: Verified by calibrated instrumentation at the time of testing					

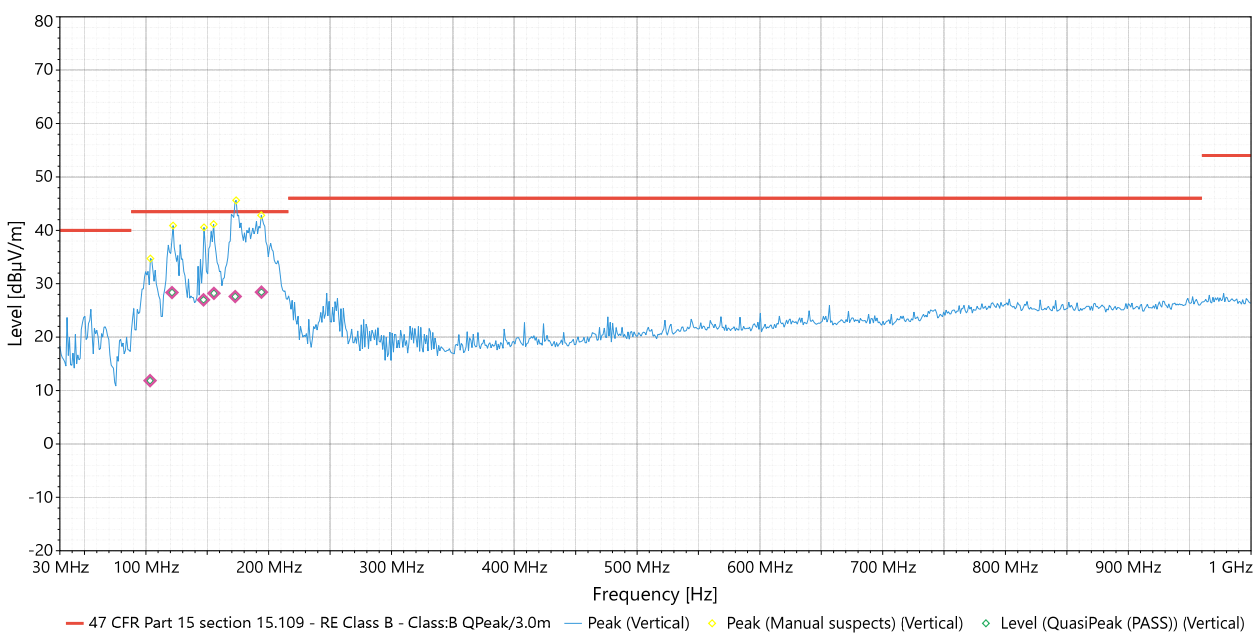
Test Engineer: Alberto Saldiver

Test Date(s): 08/08 /2022

Test Data

Radiated Emissions (30 MHz~1000 MHz)

EUT Test Condition		Measurement Detail	
Input Power	3.3 Vdc	Frequency Range	30MHz-1GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldiver
Test Mode	LTE, BLE and Zigbee transmit simultaneously		

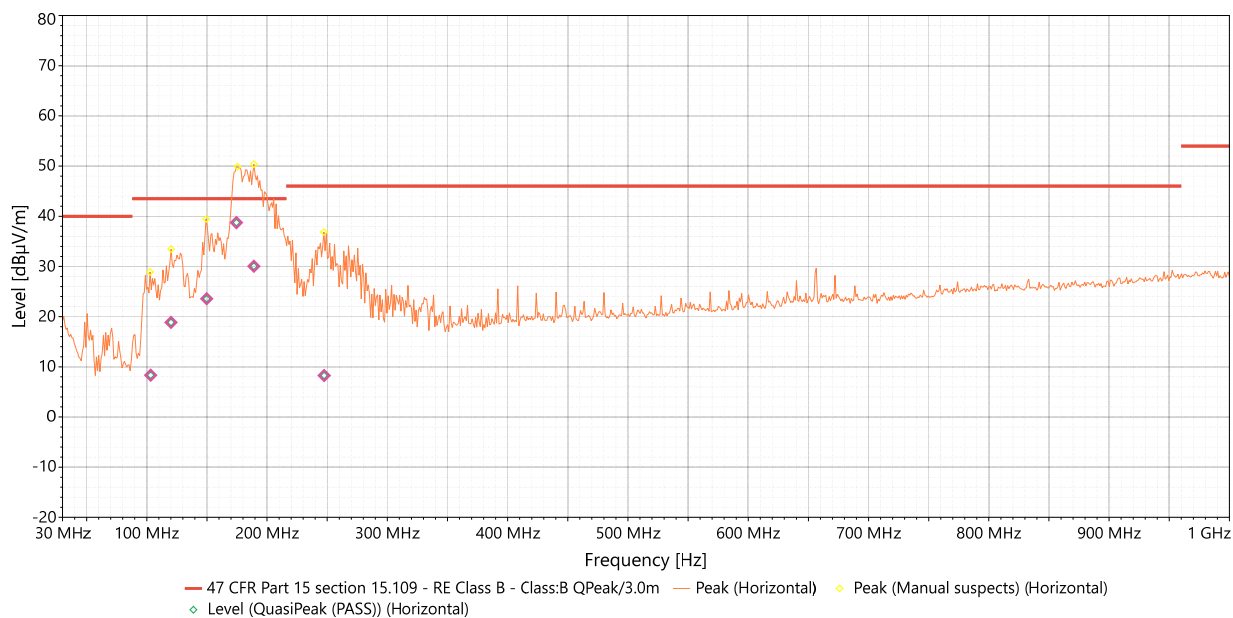


Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level Peak[dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Pass/Fail
1	103.456	Vertical	11.865	43.5	-31.635	1.08	98	-14.36	Pass
2	121.334	Vertical	28.352	43.5	-15.148	1.71	255	-13.67	Pass
3	146.95	Vertical	26.995	43.5	-16.505	1.2	245	-14.71	Pass
4	155.418	Vertical	28.2	43.5	-15.3	1.46	255	-15.39	Pass
5	172.768	Vertical	27.6	43.5	-15.9	1.46	61	-15.85	Pass
6	194.17	Vertical	28.428	43.5	-15.072	2.99	131	-16.1	Pass

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	3.3 Vdc	Frequency Range	30MHz-1GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldiver
Test Mode	LTE, BLE and Zigbee transmit simultaneously		



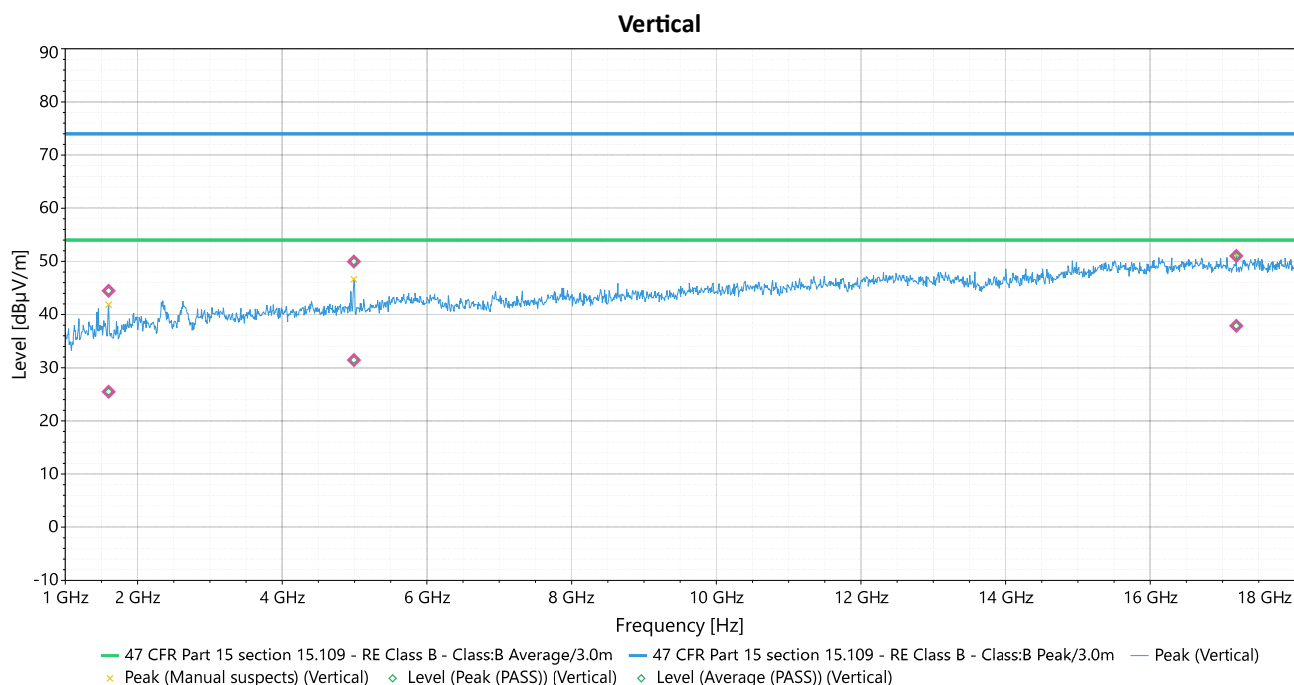
Antenna Polarity & Test Distance: Horizontal at 3m									
No.	Frequency (MHz)	Polarization	Level Peak[dB(uV/m)]	Limit Peak dB(uV/m)	Margin Peak [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Pass/Fail
1	103.254	Horizontal	8.33	43.5	-35.17	3.24	235	-15.32	Pass
2	120.114	Horizontal	18.852	43.5	-24.648	3.26	279	-14.65	Pass
3	149.79	Horizontal	23.561	43.5	-19.939	2.18	108	-15.69	Pass
4	174.528	Horizontal	38.727	43.5	-4.773	3.34	31	-16.64	Pass
5	189.008	Horizontal	30.039	43.5	-13.461	2.38	149	-16.68	Pass
6	247.472	Horizontal	8.253	46	-37.747	1.36	5	-13.39	Pass

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

Radiated Emissions (Above 1GHz)

EUT Test Condition		Measurement Detail	
Input Power	3.3 Vdc	Frequency Range	1GHz-18GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldiver
Test Mode	LTE, BLE and Zigbee transmit simultaneously		



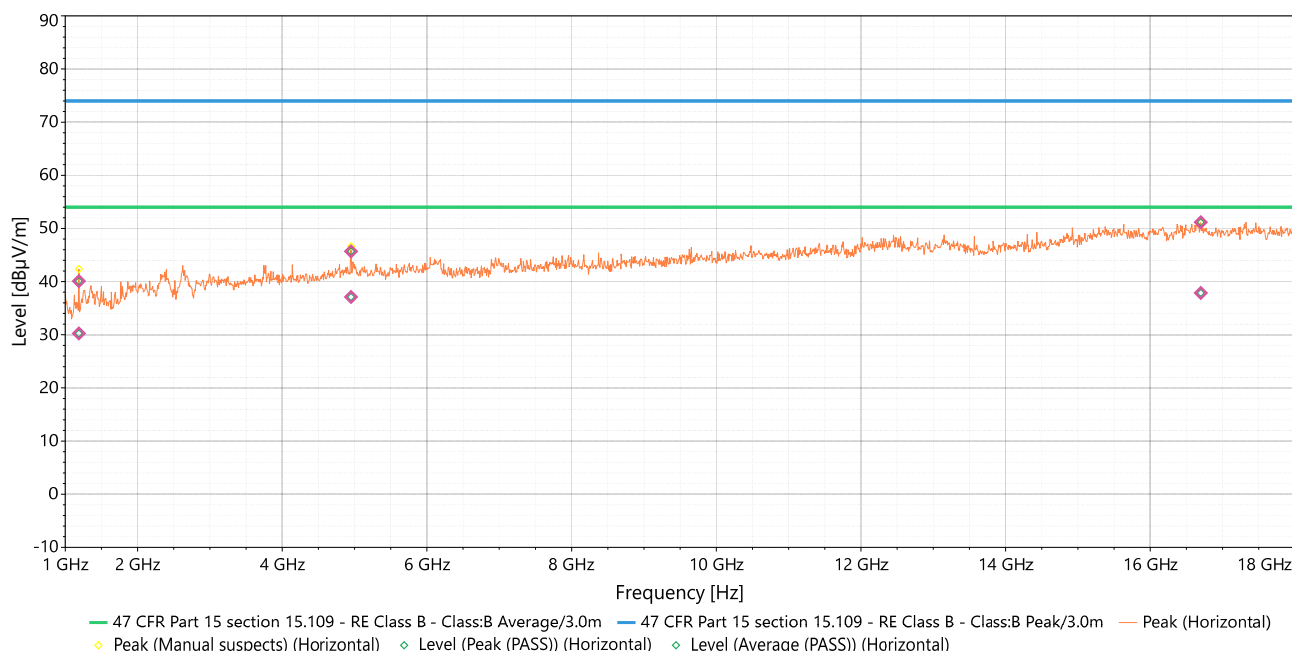
Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level [dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure type/ Result
1	1599.331	Vertical	44.46	74	-29.54	1	268	-4.76	Peak (PASS)
2	1599.331	Vertical	25.466	54	-28.534	1	268	-4.76	Average (PASS)
3	4990.751	Vertical	49.989	74	-24.011	1.77	269	0.76	Peak (PASS)
4	4990.751	Vertical	31.451	54	-22.549	1.77	269	0.76	Average (PASS)
5	17190.34	Vertical	51.026	74	-22.974	1.77	317	3.22	Peak (PASS)
6	17190.34	Vertical	37.874	54	-16.126	1.77	317	3.22	Average (PASS)

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

EUT Test Condition		Measurement Detail	
Input Power	3.3 Vdc	Frequency Range	1GHz-18GHz
Environmental Conditions	25 deg. C, 70% RH	Tested By	Alberto Saldiver
Test Mode	LTE, BLE and Zigbee transmit simultaneously		

Horizontal



Antenna Polarity & Test Distance: Vertical at 3m									
No.	Frequency (MHz)	Polarization	Level [dB(uV/m)]	Limit dB(uV/m)	Margin [dB]	Height (m)	Angle (Deg)	Factor [dB(1/m)]	Measure type/ Result
1	1187.03	Horizontal	40.097	74	-33.903	2.05	269	-5.56	Peak (PASS)
2	1187.03	Horizontal	30.246	54	-23.754	2.05	269	-5.56	Average (PASS)
3	4950.341	Horizontal	45.691	74	-28.309	2.62	269	1.34	Peak (PASS)
4	4950.341	Horizontal	37.096	54	-16.904	2.62	269	1.34	Average (PASS)
5	16699.45	Horizontal	51.166	74	-22.834	2.06	317	4.94	Peak (PASS)
6	16699.45	Horizontal	37.861	54	-16.139	2.06	317	4.94	Average (PASS)

REMARKS:

1. Level (dBuV) = Reading (dBuV) + Factor (dB(1/m)).
2. Factor (dB(1/m)) = Antenna Factor(AF) (dB(1/m)) + Cable Loss (dB) +Preamplifier
3. Margin value = Emission level – Limit value.
4. The emission levels of other frequencies were less than 20dB margin against the limit.

IV. Pictures of test Arrangements

Please see setup photo file

END OF REPORT