FCC/ISED RF TEST REPORT

Vista Labs
TEST • CERTIFY • COMPLY

Test Report Number……	**GLS-19051002-LC-FCC-IC**
Applicant……	**Mobilogix, Inc.**
Applicant Address……	**5500 Trabuco Road, Suite 150, Irvine, CA 92620**
Product Name……	ATD310
Product Brand……	Mobilogix
Model Number……	ATD310S
Family Product/Model……	N/A
FCC ID……	2AH4HATD310S
ISED ID……	21385-ATD310S
Date of EUT received……	05/15/2019
Date of Test……	05/15/2019 – 05/17/2019
Report Issue Date……	05/20/2019
Test Standards……	**47CFR Part 15 Subpart B: 2019** **ICES-003 Issue 6: April 2019** **47CFR Part 22: 2019** **47CFR Part 24: 2019** **47CFR Part 27: 2019** **RSS-130 Issue 2: Feb 2019** **RSS-132 Issue 3: Jan 2013** **RSS-133 Issue 6: Jan 2018** **RSS-139 Issue 3: Jul 2015**
Test Result……	Pass

Issued By:

Vista Laboratories

1261 Puerta Del Sol, San Clemente, CA 92673 USA

www.vista-compliance.com

Tested by:	**Approved By:**
David Zhang/Test Engineer	**Sherwin Lee/Engineering Reviewer**

Laboratory Introduction

Vista Labs is an A2LA accredited 17025 compliant regulatory compliance testing laboratories (Cert. number: 4848-01) strategically located in Orange County, providing services in the electrical and telecommunication industries. Vista labs is also recognized testing facility for Australia (ACMA), Chinese Taipei (BSMI), Chinese Taipei (NCC), Hong Kong (OFCA), Israel (MOC), Korea (RRA), Singapore (IMDA), Vietnam (MIC), etc.

Our comprehensive testing services include safety testing, EMC emission and susceptibility testing, RF and wireless testing (including DFS).
As your partner, Vista investigates appropriate test standards, develops test plans, performs troubleshooting & failure analysis, reviews documentation, and provides test reports for a complete compliance testing and certification package.

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A2LA has accredited

VISTA LABORATORIES, INC.

San Clemente, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (*refer to joint ISO-ILAC-IAF Communiqué dated April 2017*).

Presented this 21st day of June 2018.

President and CEO
For the Accreditation Council
Certificate Number 4848.01
Valid to July 31, 2020

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

17025 Product Testing Accreditation Certificate

Accredited Product Certification Body

A2LA has accredited

VISTA LABORATORIES, INC.

San Clemente, CA

This product certification body is accredited in accordance with the recognized International Standard ISO/IEC 17065:2012 *Requirements for bodies certifying products, processes and services*. This product certification body also meets the A2LA R308 – Specific Requirements – ISO-IEC 17065 – Telecommunication Certification Body Accreditation Program and R322 – Specific Requirements – Notified Body Accreditation Requirements. This accreditation demonstrates technical competence for a defined scope and the operation of a management system.

Presented this 1st day of October 2018.

President and CEO
For the Accreditation Council
Certificate Number 4848.02
Valid to July 31, 2020

For the product certification schemes to which this accreditation applies, please refer to the organization's Product Certification Scope of Accreditation.

17065 Product Certification Accreditation Certificate

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REVISION HISTORY

Revision	Issue Date	Description	Note
Original	05/23/2019	Original release	N/A

1 General Information

1.1 Applicant

Applicant:	Mobilogix, Inc.
Applicant address:	5500 Trabuco Road, Suite 150, Irvine, CA 92620
Manufacturer:	Mobilogix, Inc.
Manufacturer Address:	5500 Trabuco Road, Suite 150, Irvine, CA 92620

1.2 Product information

Product Name	ATD310
Model Number	ATD310S
Family Model Number	N/A
Serial Number	N/A
Frequency Band	BLE: 2402-2480MHz WCDMA Band II: 1852.4 – 1907.6 MHz WCDMA Band IV: 1712.4 – 1752.6 MHz WCDMA Band V: 826.4 – 846.6 MHz LTE Cat-1 Band 2: 1850.7-1909.3MHz LTE Cat-1 Band 4: 1710.7-1754.3MHz LTE Cat-1 Band 5: 824.7-848.3MHz LTE Cat-1 Band 12: 699.7-715.3MHz LTE Cat-1 Band 13: 779.5-784.5MHz
Type of modulation	GFSK (BLE), QPSK (WCDMA), QPSK/16QAM (LTE Cat-1)
Equipment Class/ Category	DTS (BLE), PCB (LTE Cat-1)
Maximum output power	BLE: 3.35 dBm WCDMA Band II: 24.00 dBm WCDMA Band IV: 24.11 dBm WCDMA Band V: 21.81 dBm LTE Cat-1 Band 2: 26.29 dBm LTE Cat-1 Band 4: 25.23 dBm LTE Cat-1 Band 5: 22.07 dBm LTE Cat-1 Band 12: 19.44 dBm LTE Cat-1 Band 13: 22.55 dBm
Antenna Information	BLE: Chip antenna, 2.0 dBi Gain. WCDMA/LTE: PCB antenna, 0.6 dBi for 1700-2000MHz; 2.4 dBi for 600-850MHz.
Clock Frequencies	N/A
Port/Connectors	N/A
Input Power	3.7VDC (battery powered)
Power Adapter Manu/Model	N/A
Power Adapter SN	N/A
Hardware version	N/A
Software version	1.6.0
Simultaneous Transmission	BLE and WCDMA/LTE can transmit simultaneously
Additional Info	N/A

1.3 Test standard and method

Test standard	47CFR Part 15 Subpart B: 2019 ICES-003 Issue 6: April 2019 47CFR Part 22: 2019 47CFR Part 24: 2019 47CFR Part 27: 2019 RSS-130 Issue 2: Feb 2019 RSS-132 Issue 3: Jan 2013 RSS-133 Issue 6: Jan 2018 RSS-139 Issue 3: Jul 2015 SRSP-510 Issue 5: Feb 2009 RSS-Gen Issue 5: Apr 2018
Test method	ANSI C63.26: 2015 KDB 971168 D01 Power Meas License Digital Systems v03r01 KDB 412172 D01 Determining ERP and EIRP v01r01

1.4 Test Purpose and statement

The purpose of this test report is intended to demonstrate the compliance of product listed in section 1.2, received from company listed in section 1.1, to the requirements of standard and method listed in section 1.3. Based on our test results, we conclude that the product tested complies with the requirements of the standards indicated.

2 Test site information

Lab performing tests	**Vista Laboratories**
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www. Vista-compliance.com

Test condition	Test Engineer	Test Environment	Test Date
Radiated	David Zhang	21.5°C / 58.2%/996 mbar	05/15/2019 – 05/17/2019

3 Modification of EUT

N/A

4 Test configuration and operation

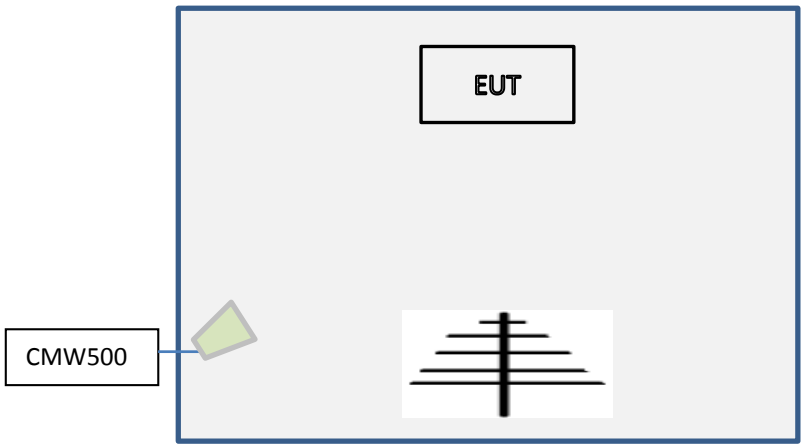
4.1 EUT test configuration

The cellular radio of EUT is connected to and controlled by CMW500, the base station emulator, communicate continuously in different modulation, test channel and data rate. The radio of BLE is set to transmit continuously by using mobile application.

4.2 Supporting Equipment

Index	Description	Model	S/N	Brand	Remark
-	-	-	-	-	-

4.3 EUT setup diagram



4.4 EUT operation

The radio can be set to transmit continuously in different modulation, test channel and data rate.

4.5 Test software

Index	Description	Remark
1	EMISoft Vasona 6.0049	EMC/Spurious emission test software used during testing
2	Nordic nRF Toolbox	Enable BLE continuous transmission

5 Test Summary

FCC Rules	ISED Rules	Test Item	Section	Verdict
15.109	ICES-003	Radiated Emission (unintentional)	8.1	Pass
15.247, 15.209	RSS-247, RSS-Gen	Radiated Spurious Emissions into Restricted Frequency Bands (intentional)	8.2	Pass
2.1046 22.917 (a), 24.238 (a), 27.53 (f), (g), (h), (c)(2) and (5)	RSS-130(4.7.1) and (4.7.2) RSS-132 (5.5) RSS-133 (6.5) RSS-139 (6.6) SRSP-510(5.1.2)	Field Strength of Spurious Radiation (licensed band)	8.3	Pass

6 Uncertainly of Measurement

Test item	Measurement Uncertainty (dB)
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB

7 Test summary and result

7.1 Radiated Emission (unintentional)

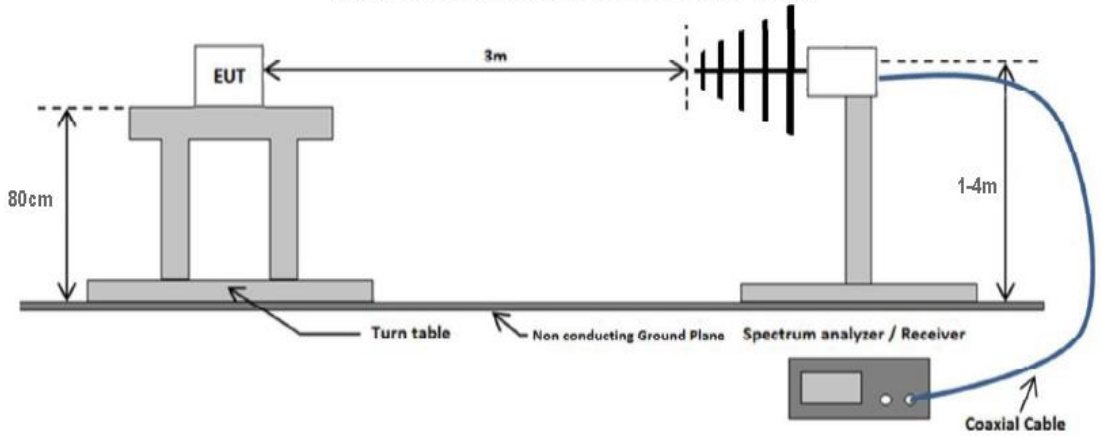
7.1.1 Requirement

Per § 15.109 (a), except for Class A digital device, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

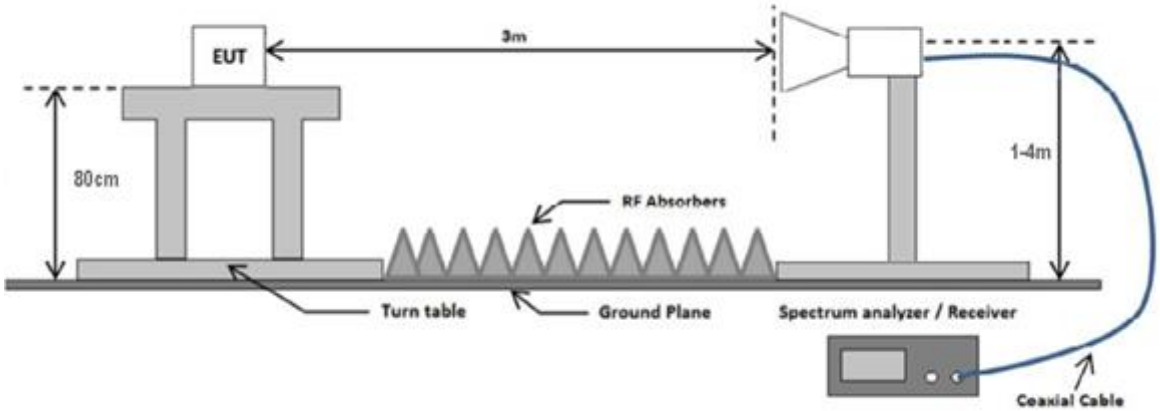
Frequency range (MHz)	Field Strength (µV/m)
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

7.1.2 Test setup

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



7.1.3 Test Procedure

The procedure is according to ANSI C63.4: 2014. The following are the steps.

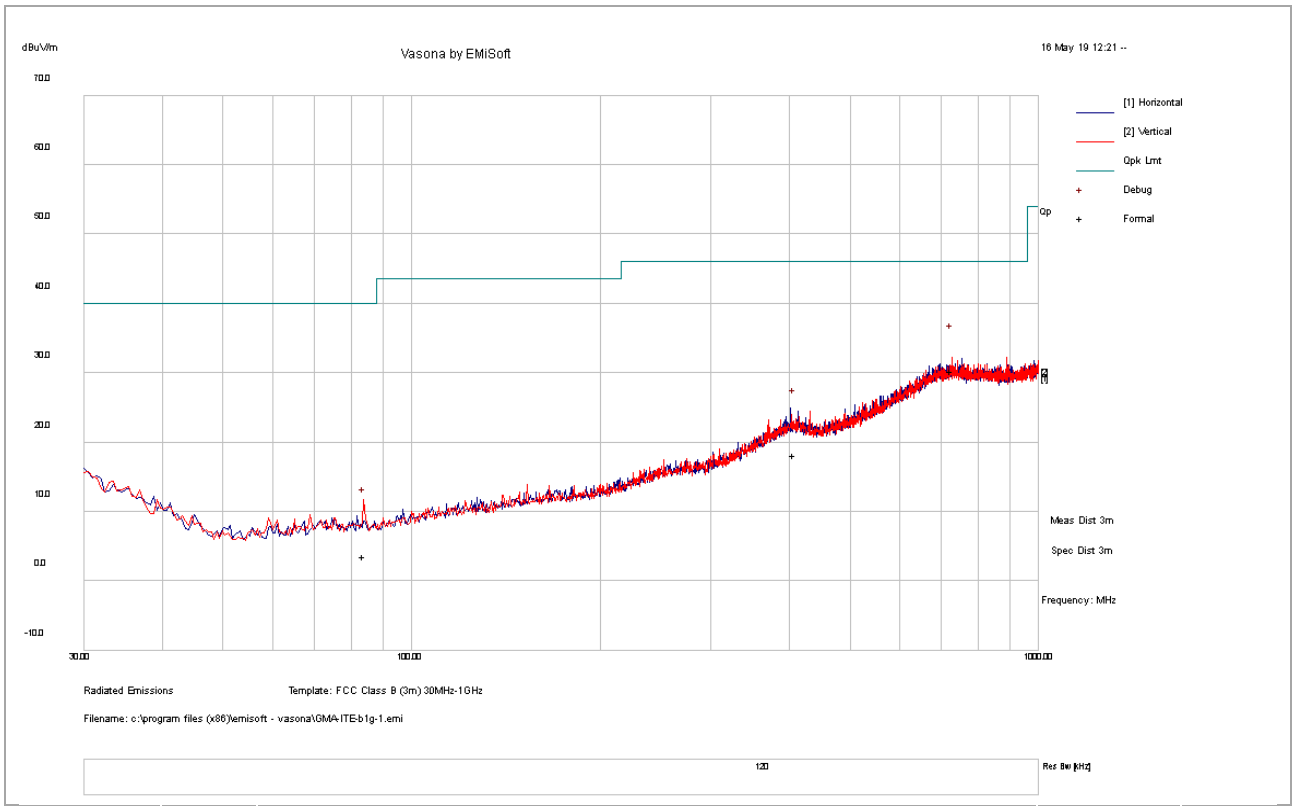
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency below 1GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak measurement at frequency above 1GHz.

   The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz with Peak detection for Average Measurement as below at frequency above 1GHz.
5. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

7.1.4 Test Result

30-1000MHz test result under FCC Part 15B

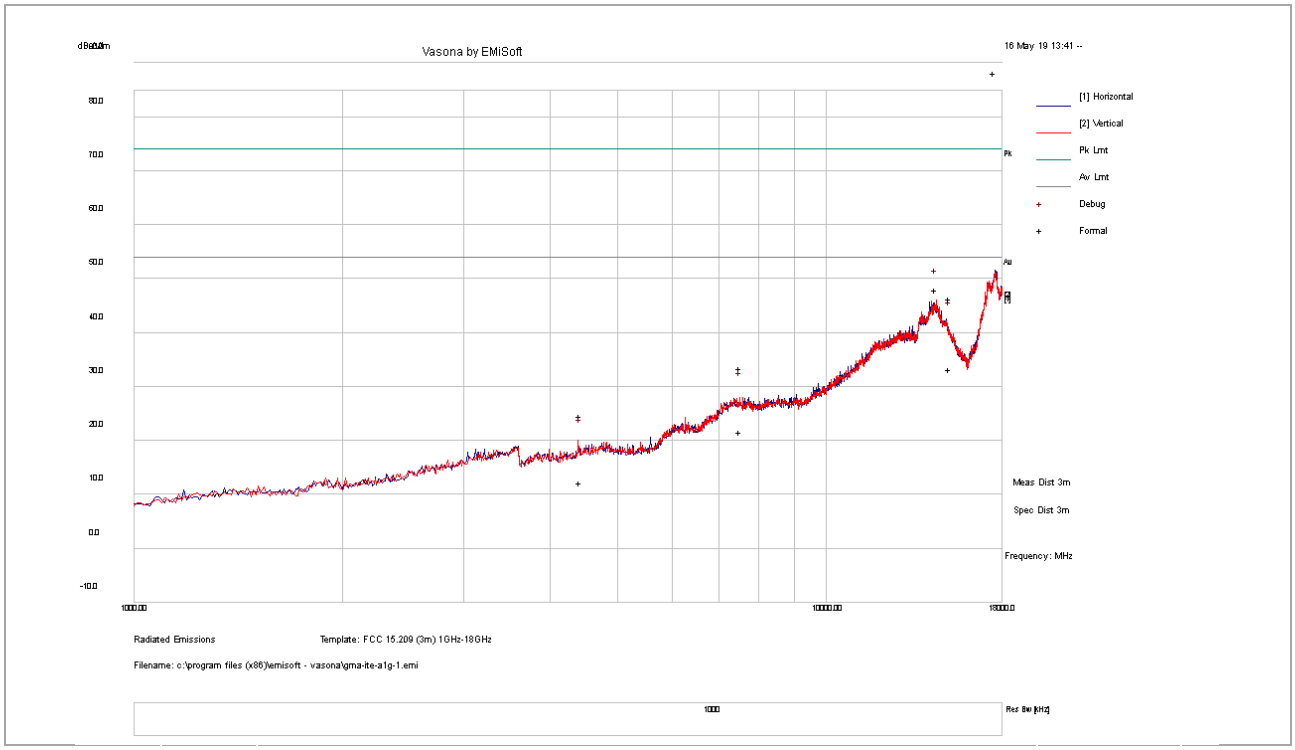
Test Standard:	**47CFR 15.109**	**Mode:**	**N/A**
Frequency Range:	**30-1000MHz**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
83.77	24.79	3.37	-24.61	3.54	QP	H	171	180	40	-36.46
406.98	25.38	6.35	-13.53	18.19	QP	H	132	75	46	-27.81
726.04	29.61	7.29	-6.52	30.38	QP	V	109	46	46	-15.62

Above 1GHz Test Result under FCC Part 15B

Test Standard:	**47CFR 15.109**	**Mode:**	**N/A**
Frequency Range:	**1000-18000MHz**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
4410.15	17.70	13.19	-6.38	24.51	PK	V	325	113	74	-49.49
7510.37	16.74	17.02	-0.41	33.35	PK	V	126	222	74	-40.65
14428.59	32.09	22.82	7.34	62.25	PK	V	223	0	74	-11.75
15111.35	19.14	24.42	2.73	46.29	PK	H	128	187	74	-27.71
4410.15	5.51	13.19	-6.38	12.31	AV	V	325	113	54	-41.69
7510.37	5.05	17.02	-0.41	21.65	AV	V	126	222	54	-32.35
14428.59	17.79	22.82	7.34	47.95	AV	V	223	0	54	-6.06
15111.35	6.19	24.42	2.73	33.34	AV	H	128	187	54	-20.66

7.2 Radiated Spurious Emissions into Restricted Frequency Bands

7.2.1 Requirement

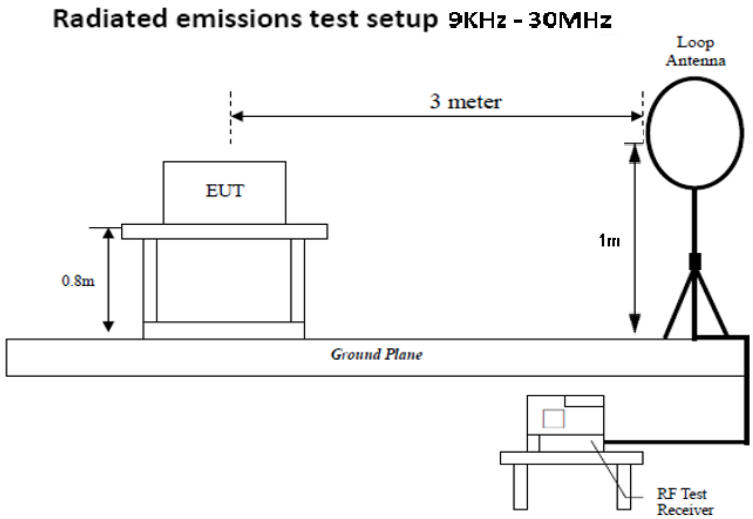
§ 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

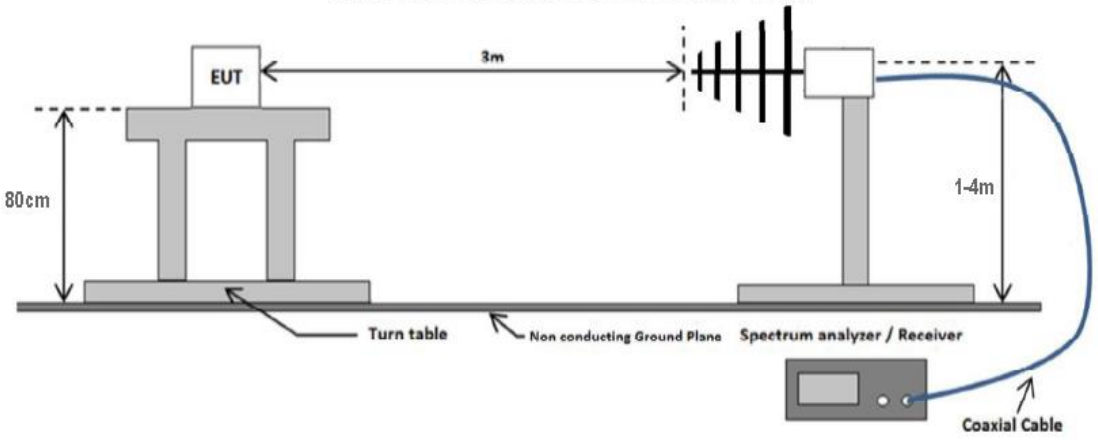
Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

Frequency range (MHz)	Field Strength (µV/m)
0.009~0.490	2400/F(KHz)
0.490~1.705	24000/F(KHz)
1.705~30.0	30
30 – 88	100
88 – 216	150
216 960	200
Above 960	500

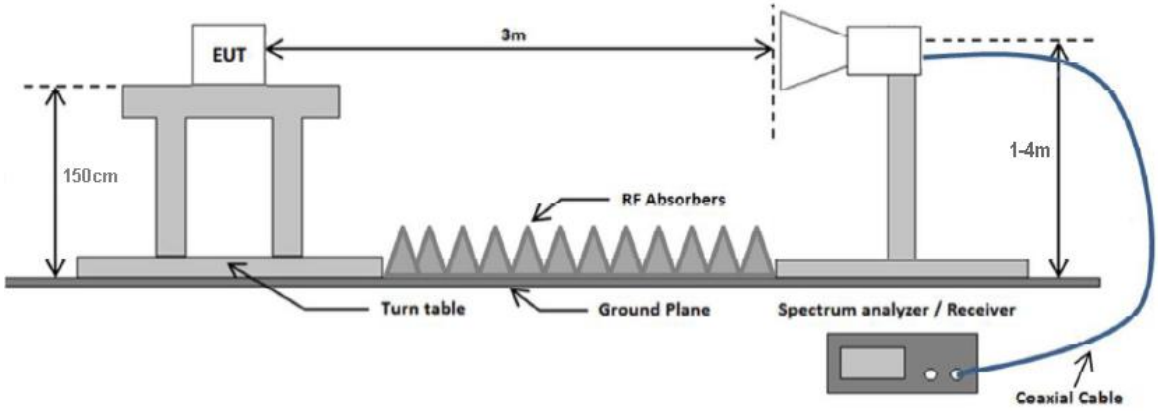
7.2.2 Test setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



7.2.3 ***Test Procedure***

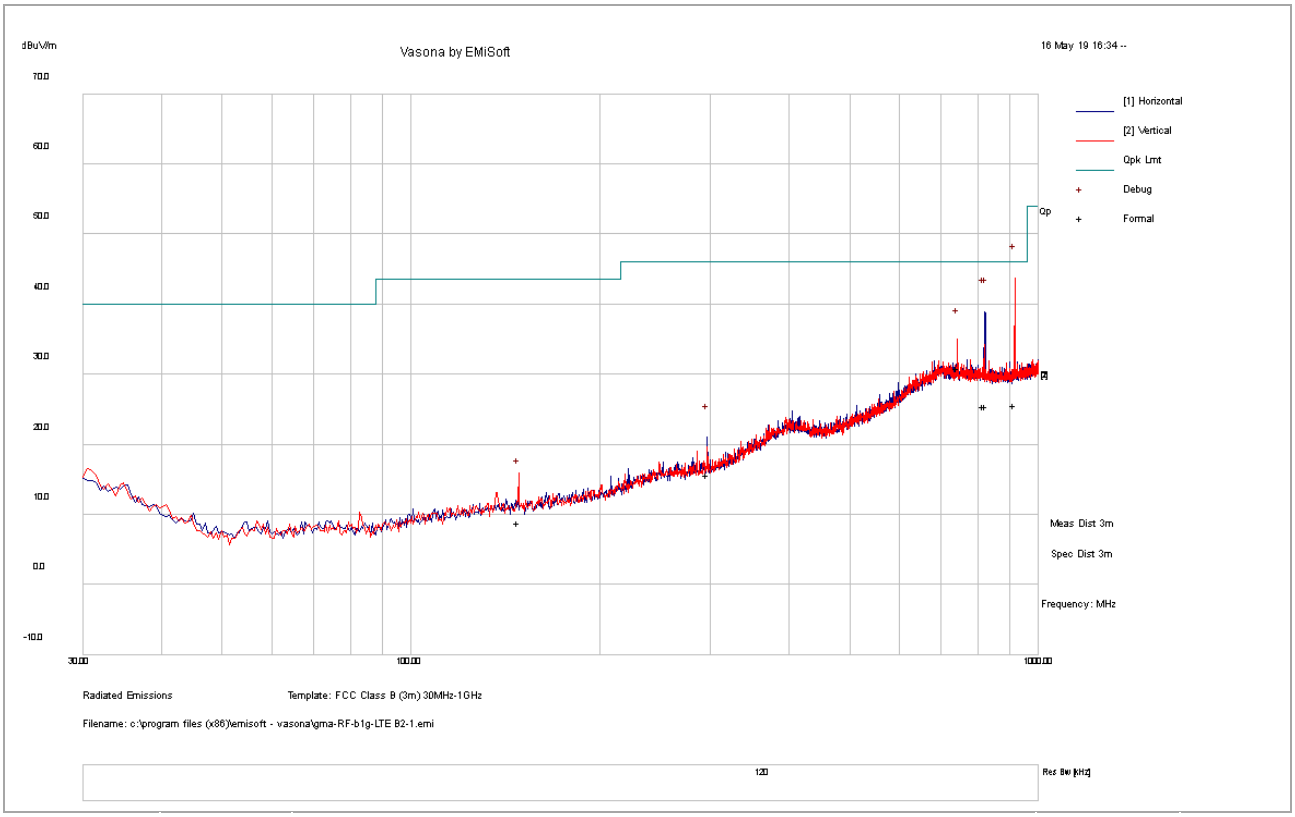
According to section 8.6 in KDB 558074 D01 DTS Meas Guidance v05r01 and subclause 11.12.2.7 Radiated spurious emission measurements in ANSI C62.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 was followed. Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

7.2.4 Test Result

30-1000MHz test result under FCC Part 15C

Test Standard:	**15.209**	**Mode:**	**BLE 2440MHz + LTE B2**
Frequency Range:	**30-1000MHz**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**



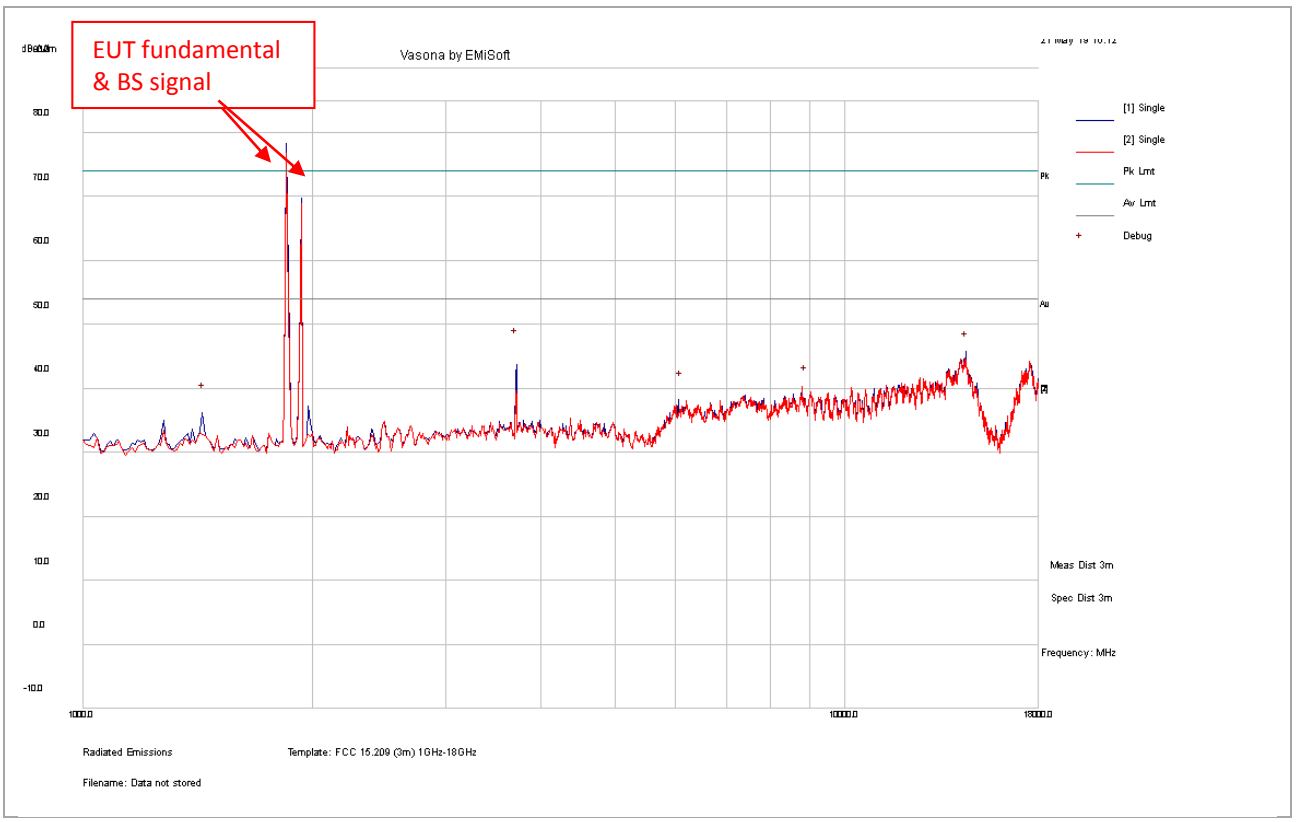
Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
148.30	27.27	4.23	-22.55	8.94	QP	H	103	260	43.50	-34.56
296.67	28.85	5.65	-18.76	15.75	QP	H	308	265	46.00	-30.25
741.75	30.15	7.28	-6.58	30.85	QP	H	235	102	46.00	-15.15
819.68	25.05	7.32	-6.86	25.51	QP	H	226	357	46.00	-20.49
823.70	25.09	7.33	-6.88	25.55	QP	H	189	110	46.00	-20.45
915.96	25.02	7.67	-7.06	25.64	QP	V	318	227	46.00	-20.36

Note:

1) For below 1GHz, all different channel and modes were verified but only the worst case result is shown here.
2) No outstanding result was found for below 30MHz other than ambient noise floor.
3) EUT was tested in 3 orientations.

1GHz – 18GHz test result under FCC Part 15C

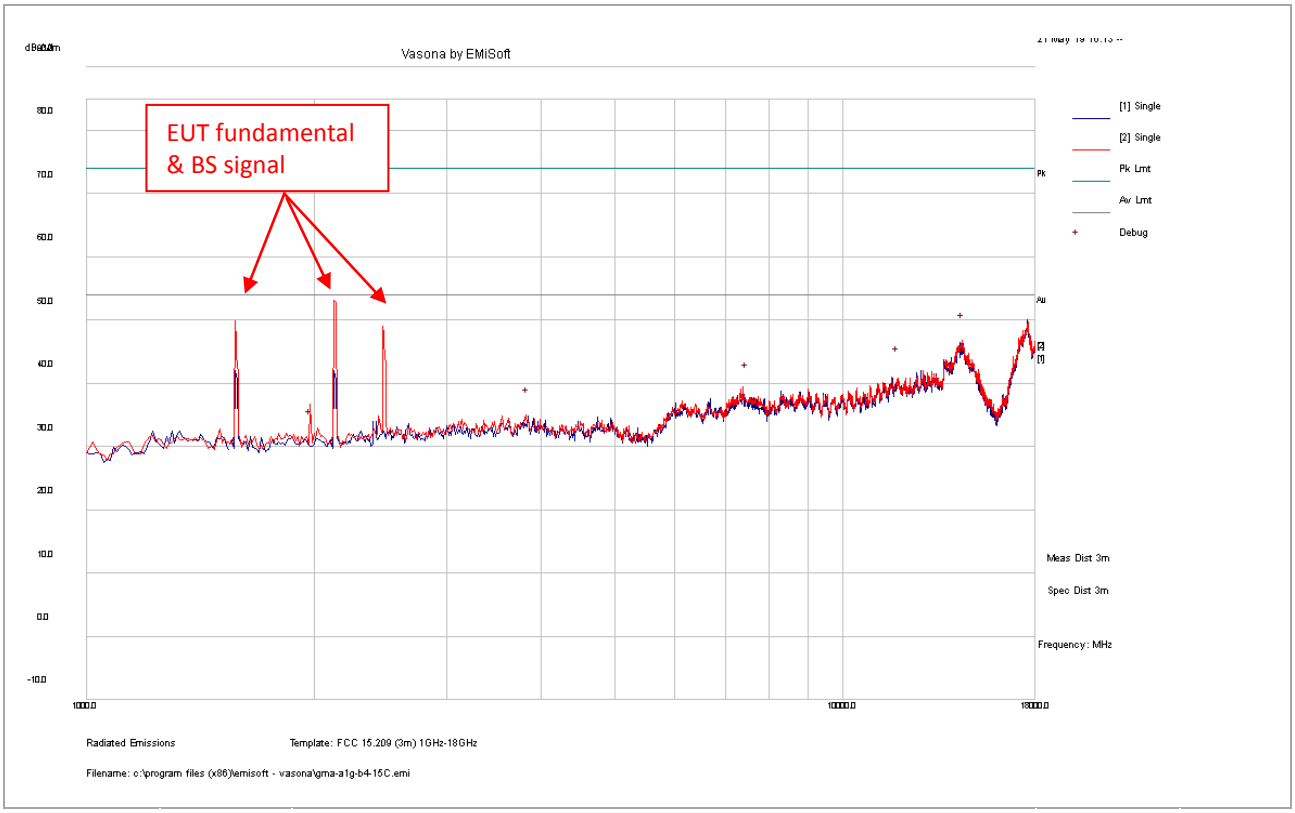
Test Standard:	**15.209**	**Mode:**	**BLE 2440MHz + LTE B2**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
1439.34	42.22	4.36	-11.67	34.92	PK	H	162	132	54	-19.08
3708.40	44.24	6.12	-6.82	43.54	PK	H	173	82	54	-10.46
6115.45	31.53	7.87	-2.50	36.90	PK	H	208	17	54	-17.10
8891.73	27.61	9.93	0.23	37.77	PK	V	221	109	54	-16.23
14491.96	20.63	14.86	7.63	43.12	PK	V	184	92	54	-10.88

1GHz – 18GHz test result under FCC Part 15C

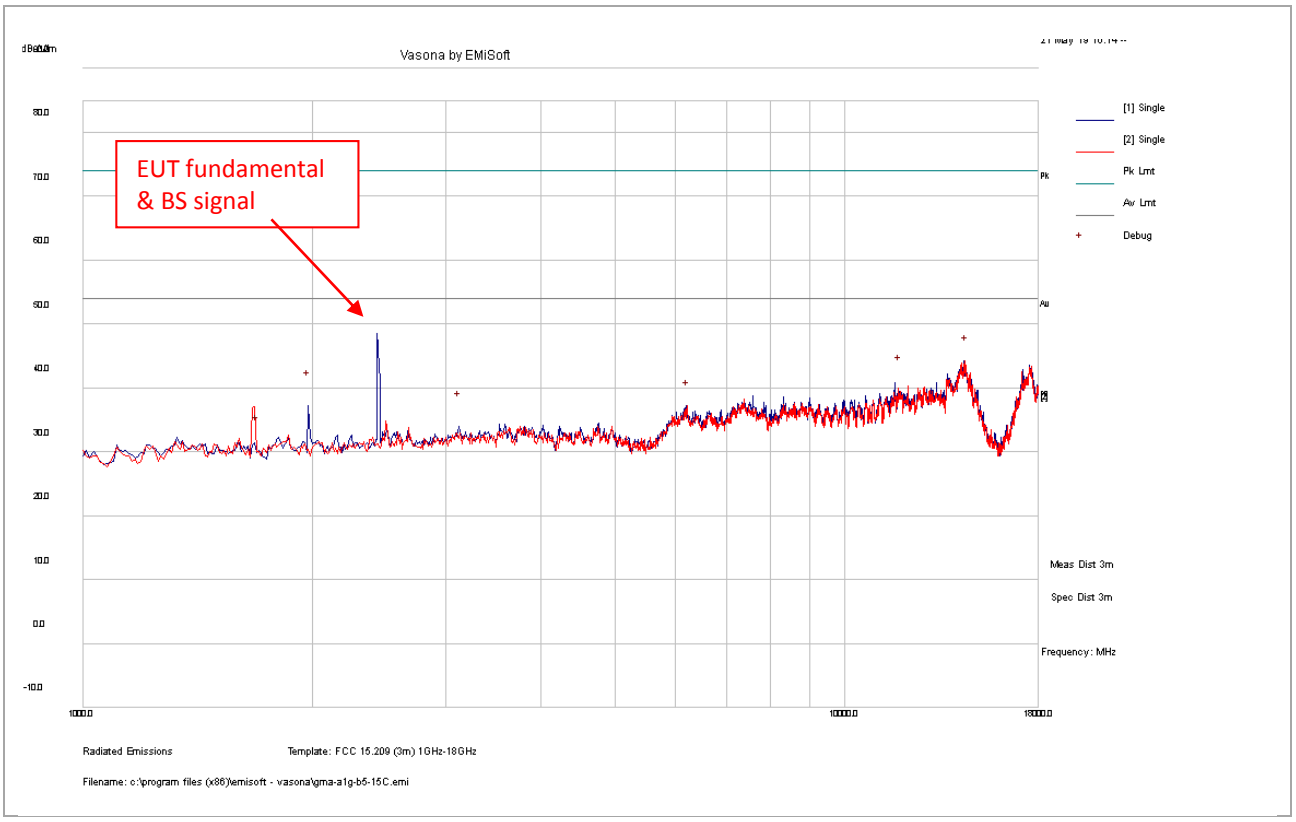
Test Standard:	**15.209**	**Mode:**	**BLE 2440MHz + LTE B4**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
1977.30	36.25	4.44	-10.59	30.11	PK	V	112	98	54	-23.89
3828.90	33.49	6.24	-6.20	33.54	PK	H	183	19	54	-20.46
7465.21	28.84	9.72	-1.15	37.41	PK	V	209	331	54	-16.59
11820.35	24.07	13.27	2.70	40.04	PK	V	192	261	54	-13.96
14408.43	22.48	14.66	8.17	45.31	PK	H	227	74	54	-8.69

1GHz – 18GHz test result under FCC Part 15C

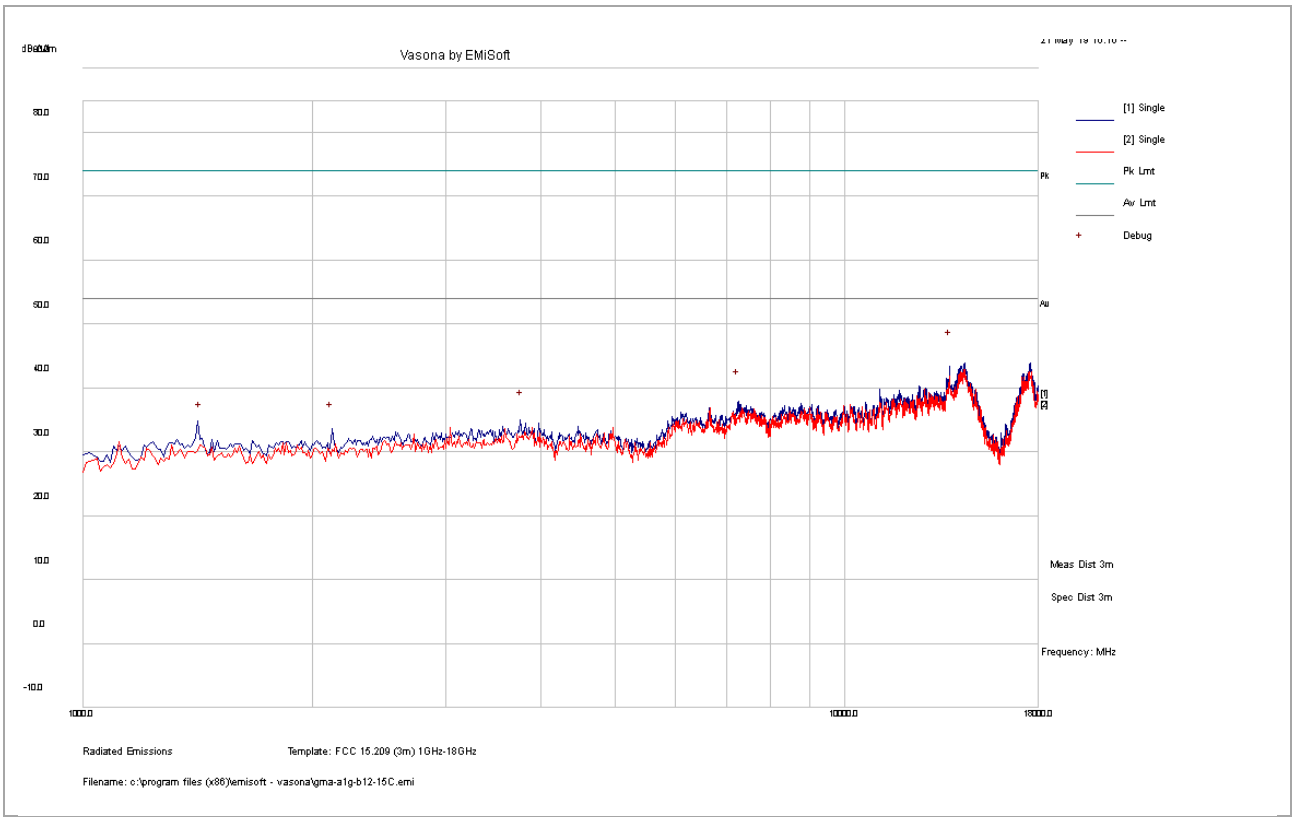
Test Standard:	**15.209**	**Mode:**	**BLE 2440MHz + LTE B5**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
1692.23	37.43	4.45	-11.94	29.94	PK	V	181	118	54	-24.06
1978.28	43.03	4.44	-10.59	36.89	PK	V	147	108	54	-17.11
3118.53	36.08	5.50	-7.89	33.69	PK	H	306	360	54	-20.31
6222.43	30.12	7.87	-2.58	35.41	PK	V	181	118	54	-18.59
11820.35	23.25	13.27	2.70	39.22	PK	V	147	108	54	-14.78
14450.13	19.66	14.76	7.92	42.34	PK	H	306	360	54	-11.66

1GHz – 18GHz test result under FCC Part 15C

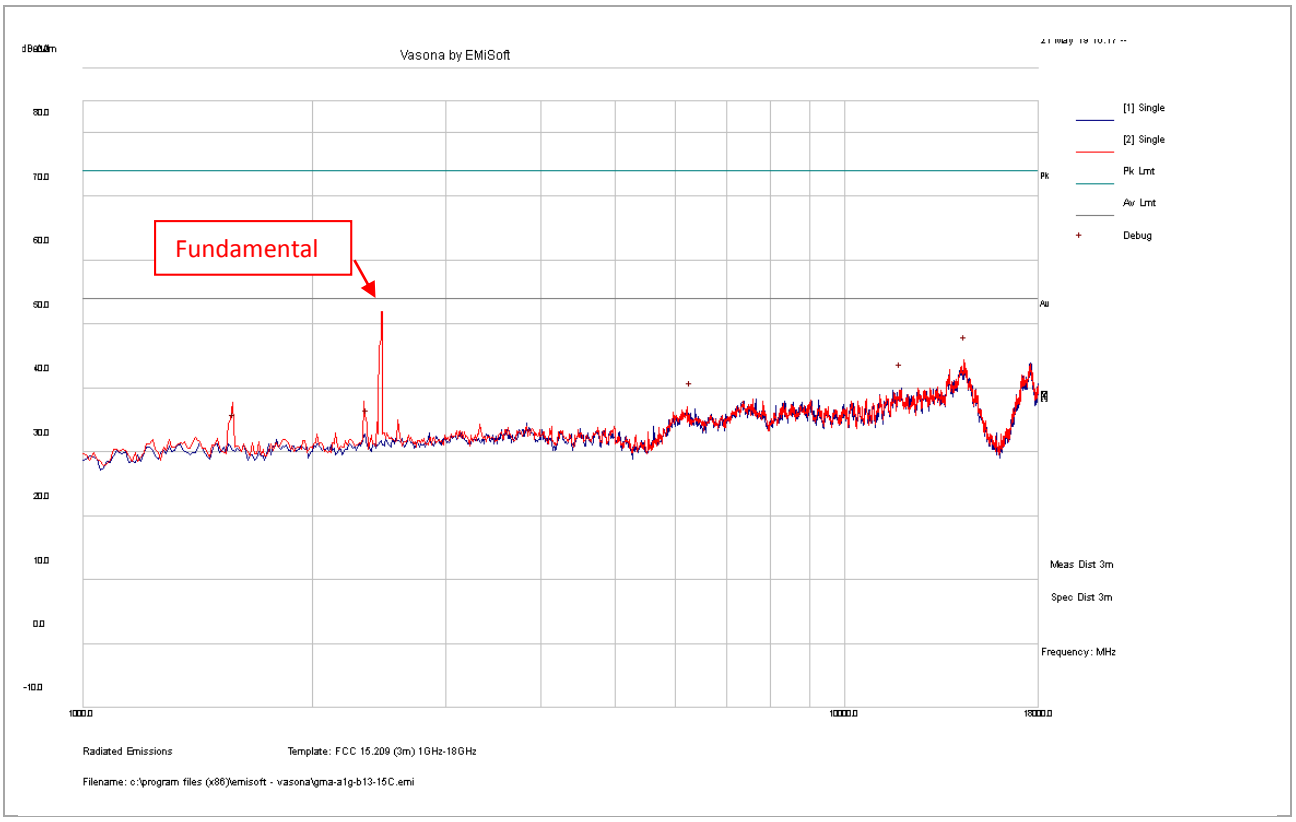
Test Standard:	**15.209**	**Mode:**	**BLE 2440MHz + LTE B12**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
1424.86	39.19	4.34	-11.59	31.94	PK	V	178	98	54	-22.06
2117.11	38.11	4.56	-10.69	31.98	PK	V	209	96	54	-22.02
3763.07	34.19	6.18	-6.57	33.80	PK	H	257	340	54	-20.20
7263.02	29.05	9.30	-1.28	37.08	PK	V	178	98	54	-16.92
13760.97	24.31	13.56	5.35	43.22	PK	V	209	96	54	-10.78

1GHz – 18GHz test result under FCC Part 15C

Test Standard:	**15.209**	**Mode:**	**BLE 2440MHz + LTE B13**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
1578.82	37.51	4.45	-11.83	30.14	PK	V	253	93	54	-23.86
2362.89	36.13	4.80	-10.00	30.93	PK	H	352	81	54	-23.07
6285.70	29.92	7.87	-2.65	35.13	PK	V	169	110	54	-18.87
11854.57	22.11	13.30	2.66	38.07	PK	V	253	93	54	-15.93
14408.43	19.55	14.66	8.17	42.38	PK	H	352	81	54	-11.62

18GHz – 25GHz test result

Note: no substantial emission is found other than the noise floor.
Different modes have been verified.

7.3 Field Strength of Spurious Radiation

7.3.1 Requirement

§ 2.1051,22.917(a), 24.238(a), 27.53 (f), (g), (h) and (c)(2) and (5)

RSS-130(4.7.1) and (4.7.2), RSS-132(5.5), RSS-133(6.5), RSS-139(6.6)

FCC 47 CFR Part 22, Clause 22.917 (a) and FCC 47 CFR Part 24, Clause 24.238 (a)

(a)Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

FCC 47 CFR Part 27, Clause 27.53 (c)(2) and (5)

(c) For operations in the 746-758 MHz band and the 776-788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(2) On any frequency outside the 776-788 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;

(5) Compliance with the provisions of paragraphs (c)(1) and (c)(2) of this section is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. However, in the 100 kHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least 30 kHz may be employed;

FCC 47 CFR Part 27, Clause 27.53 (f)

(f) For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

FCC 47 CFR Part 27, Clause 27.53 (g)

(g) For operations in the 600 MHz band and the 698-746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed.

FCC 47 CFR Part 27, Clause 27.53 (h)

(h) AWS emission limits — (1) General protection levels. Except as otherwise specified below, for operations in the 1695-1710 MHz, 1710-1755 MHz, 1755-1780 MHz, 1915-1920 MHz, 1995-2000 MHz, 2000-2020 MHz, 2110-2155 MHz, 2155-2180 MHz, and 2180-2200 bands, the power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least 43 + 10 log10 (P) dB.

(3) Measurement procedure. (i) Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

RSS-130, Clause 4.7.1 and 4.7.2

The unwanted emissions in any 100 kHz bandwidth on any frequency outside the low frequency edge and the high frequency edge of each frequency block range(s), shall be attenuated below the transmitter power, P (dBW), by at least 43 + 10 log10 p (watts), dB. However, in the 100 kHz band immediately outside of the equipment's frequency block range, a resolution bandwidth of 30 kHz may be employed.

In addition to the limit outlined in section 4.7.1 above, equipment operating in the frequency bands 746- 756 MHz and 777-787 MHz shall also comply with the following restrictions:

a) The power of any unwanted emissions in any 6.25 kHz bandwidth for all frequencies between 763-775 MHz and 793-806 MHz shall be attenuated below the transmitter power, P (dBW), by at least:

(i) 76 + 10 log10 p (watts), dB, for base and fixed equipment, and

(ii) 65 + 10 log10 p (watts), dB, for mobile and portable equipment.

b) The e.i.r.p. in the band 1559-1610 MHz shall not exceed -70 dBW/MHz for wideband signal and 80 dBW for discrete emission with bandwidth less than 700 Hz.

RSS-132, Clause 5.5

Mobile and base station equipment shall comply with the limits in (i) and (ii) below.

(i) In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts).

(ii) After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

RSS-133, Clause 6.5.1

Equipment shall comply with the limits in (i) and (ii) below.

(i) In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts).

(ii) After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10 p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

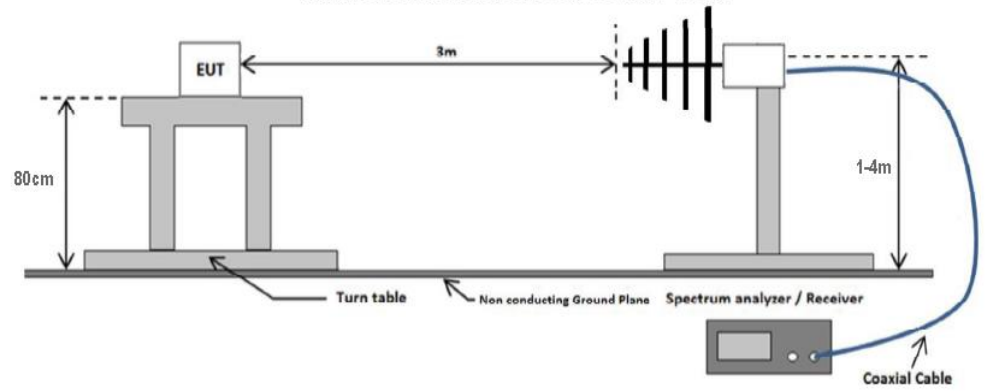
RSS-139, Clause 6.6

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

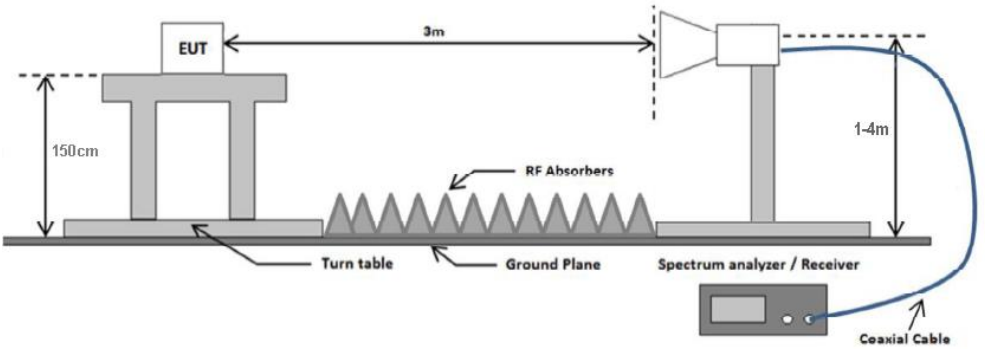
(ii) After the first 1.0 MHz outside the equipment's smallest operating frequency block, which can contain the equipment's occupied bandwidth, the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in dBW) by at least 43 + 10 log10 p (watts) dB.

7.3.2 Test setup

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



7.3.3 Test Procedure

ANSI C63.26: 2015 section 5.5

KDB 971168 D01 Power Meas License Digital Systems v03r01 section 7

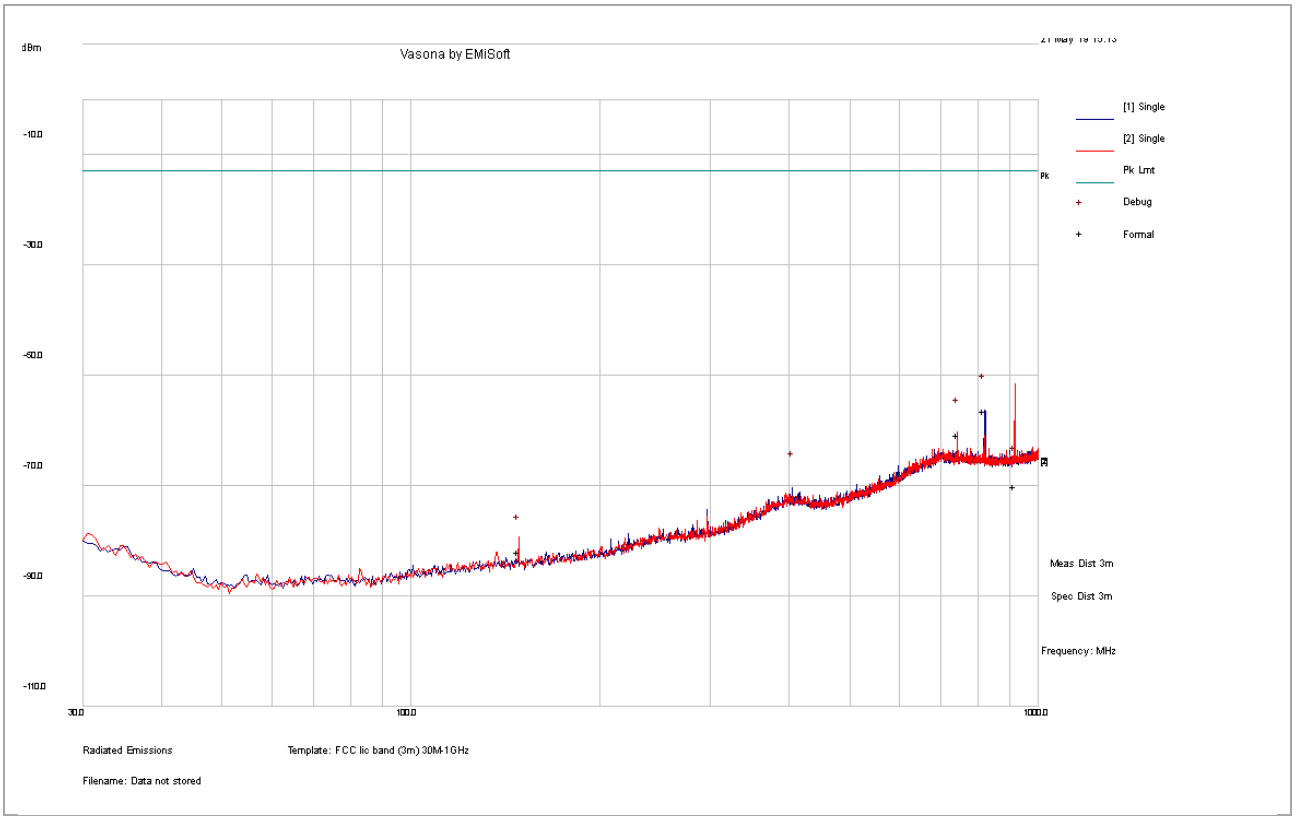
Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.

4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Remove the transmitter and replace it with a substitution antenna (the antenna should be half-wavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter.
8. Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained.
9. Steps 2 - 8 were repeated for the next frequency point, until all selected frequency points were measured

7.3.4 Test Result

Test Standard:	**Part 24E & RSS 133**	**Mode:**	**BLE 2440MHz + LTE B2**
Frequency Range:	**30-1000MHz**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**

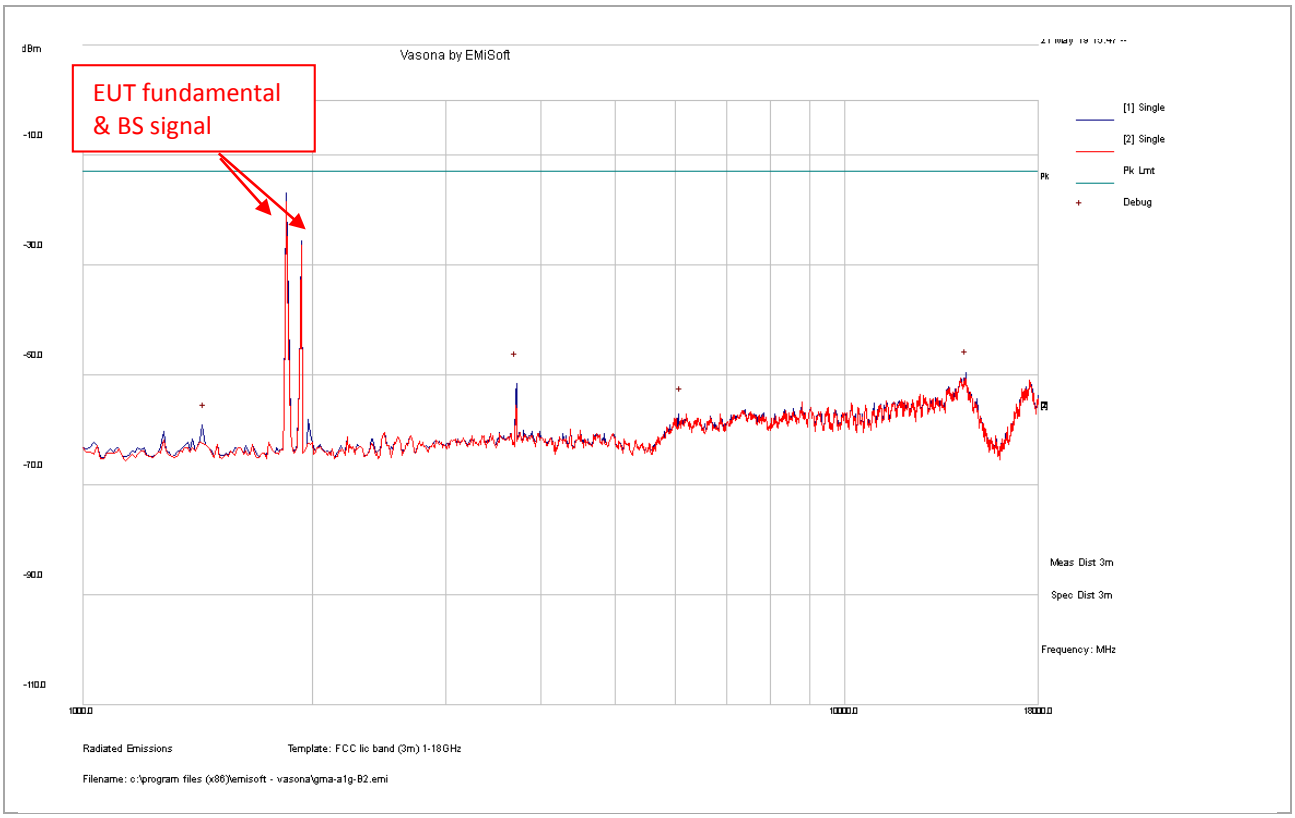


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
148.30	-67.96	4.23	-22.55	-86.29	RMS	H	103	260	-13	-73.29
296.67	-66.38	5.65	-18.76	-79.48	RMS	H	308	265	-13	-66.48
741.75	-65.08	7.28	-6.58	-64.38	RMS	H	235	102	-13	-51.38
819.68	-70.18	7.32	-6.86	-69.72	RMS	H	226	357	-13	-56.72
823.70	-70.14	7.33	-6.88	-69.68	RMS	H	189	110	-13	-56.68
915.96	-70.21	7.67	-7.06	-69.59	RMS	V	318	227	-13	-56.59

Note:

1) All different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 24E & RSS 133**	**Mode:**	**BLE 2440MHz + LTE B2**
Frequency Range:	**1GHz -18GH**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**

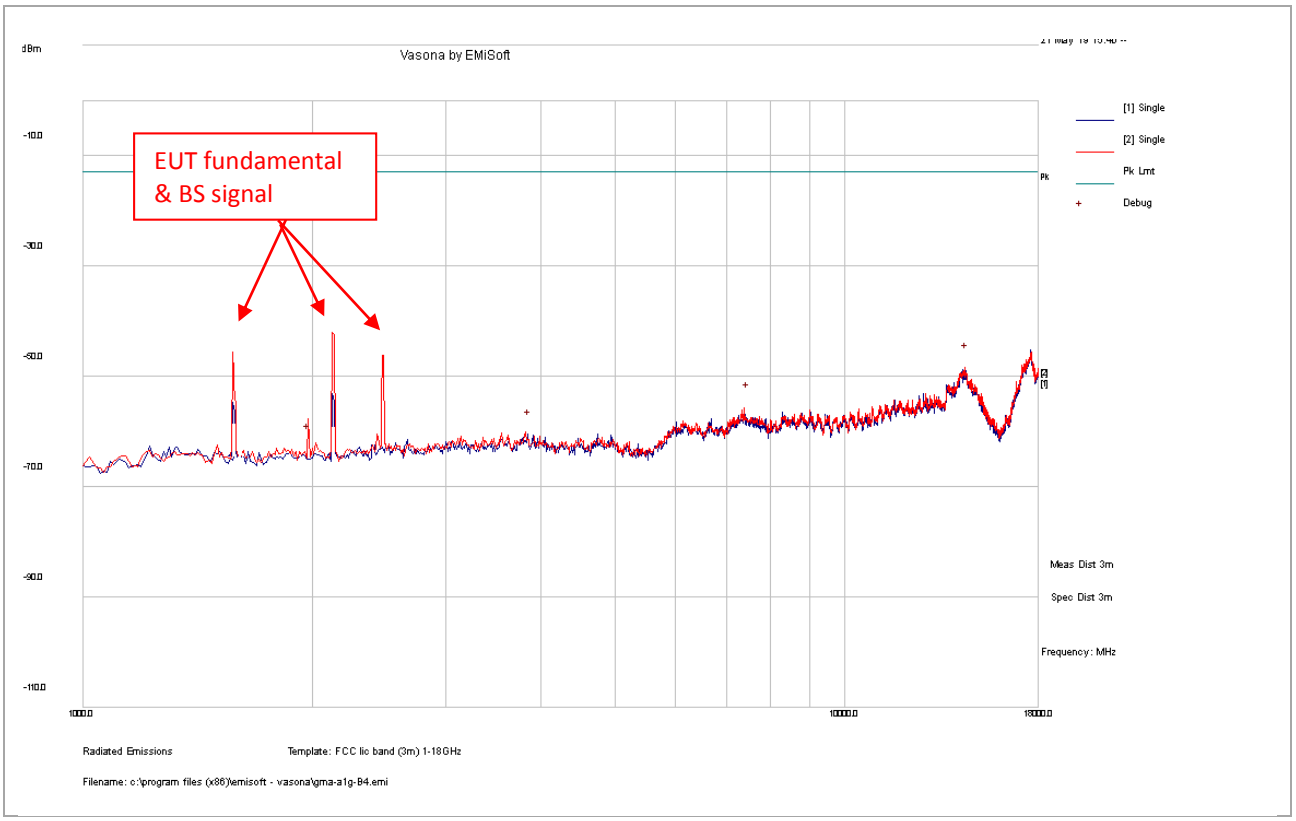


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
1443.51	-54.44	4.37	-11.69	-61.76	RMS	H	162	132	-13	-48.76
3703.72	-51.73	6.11	-6.84	-52.46	RMS	H	179	82	-13	-39.46
6097.80	-64.21	7.87	-2.52	-58.86	RMS	H	192	88	-13	-45.86
10244.59	-68.43	11.6	1.12	-55.71	RMS	V	182	109	-13	-42.71
14491.96	-74.6	14.86	7.63	-52.11	RMS	V	167	118	-13	-39.11

Note:

1) All different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 27 & RSS 139**	**Mode:**	**BLE 2440MHz + LTE B4**
Frequency Range:	**1GHz -18GH**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**

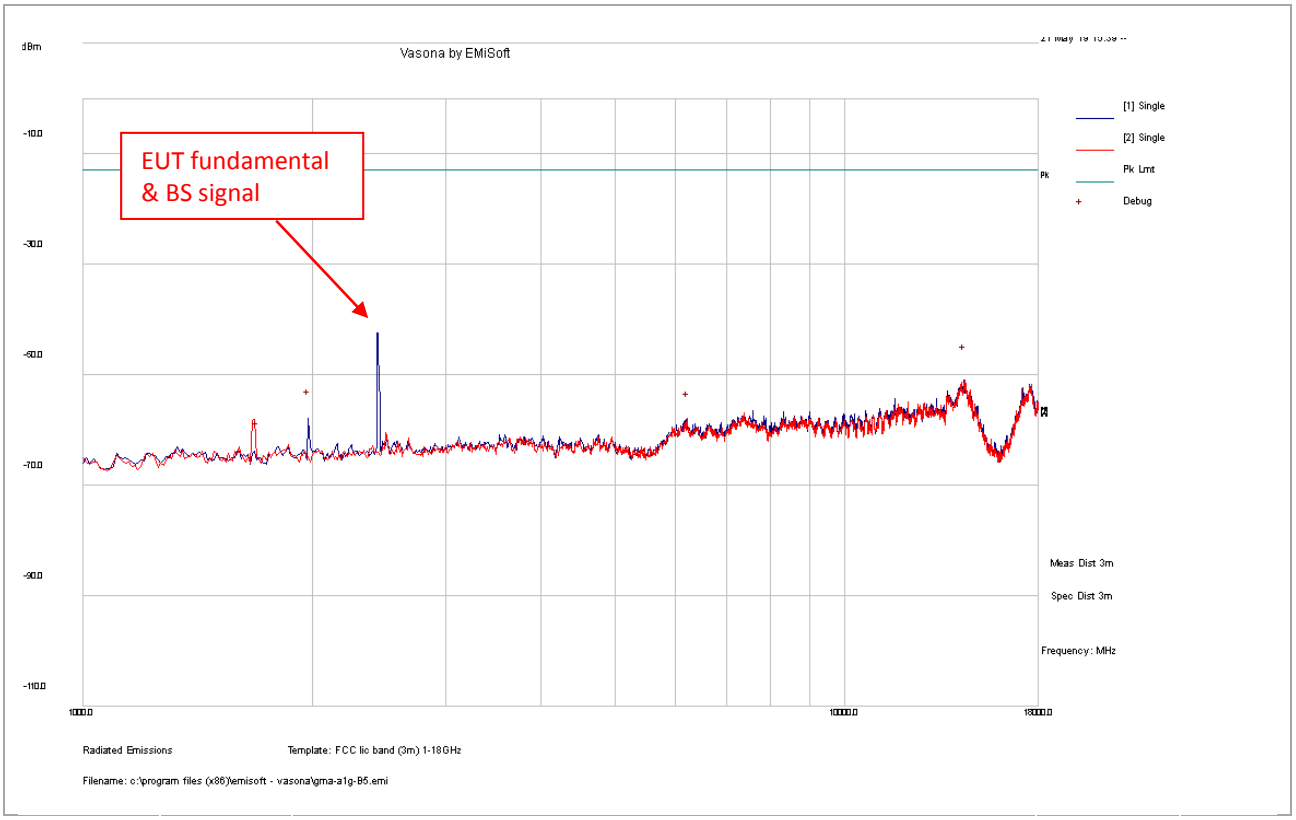


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
1989.55	-58.94	4.44	-10.59	-65.09	RMS	V	101	143	-13	-52.09
3862.25	-62.92	6.28	-6.1	-62.75	RMS	H	204	113	-13	-49.75
7465.21	-66.39	9.72	-1.15	-57.82	RMS	V	326	41	-13	-44.82
14491.96	-73.27	14.86	7.63	-50.78	RMS	V	101	143	-13	-37.78

Note:

1) All different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 22 & RSS 132**	**Mode:**	**BLE 2440MHz + LTE B5**
Frequency Range:	**1GHz -18GH**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**

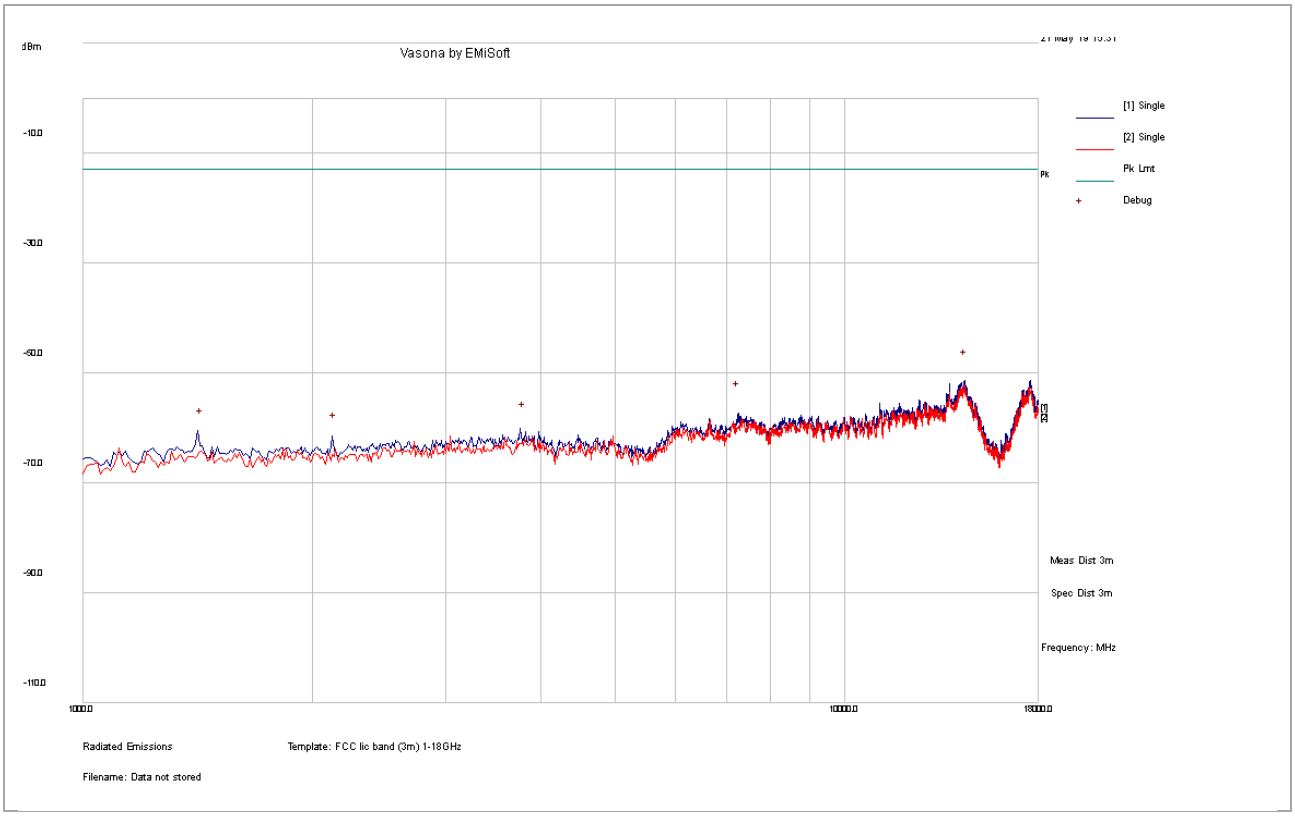


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
1692.23	-57.80	4.45	-11.94	-65.29	RMS	V	169	110	-13	-52.29
1975.23	-53.41	4.44	-10.58	-59.55	RMS	V	253	93	-13	-46.55
6222.43	-65.11	7.87	-2.58	-59.82	RMS	H	352	81	-13	-46.82
14366.84	-74.23	14.56	8.33	-51.34	RMS	V	169	110	-13	-38.34

Note:

1) All different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 27 & RSS 130**	**Mode:**	**BLE 2440MHz + LTE B12**
Frequency Range:	**1GHz -18GH**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**

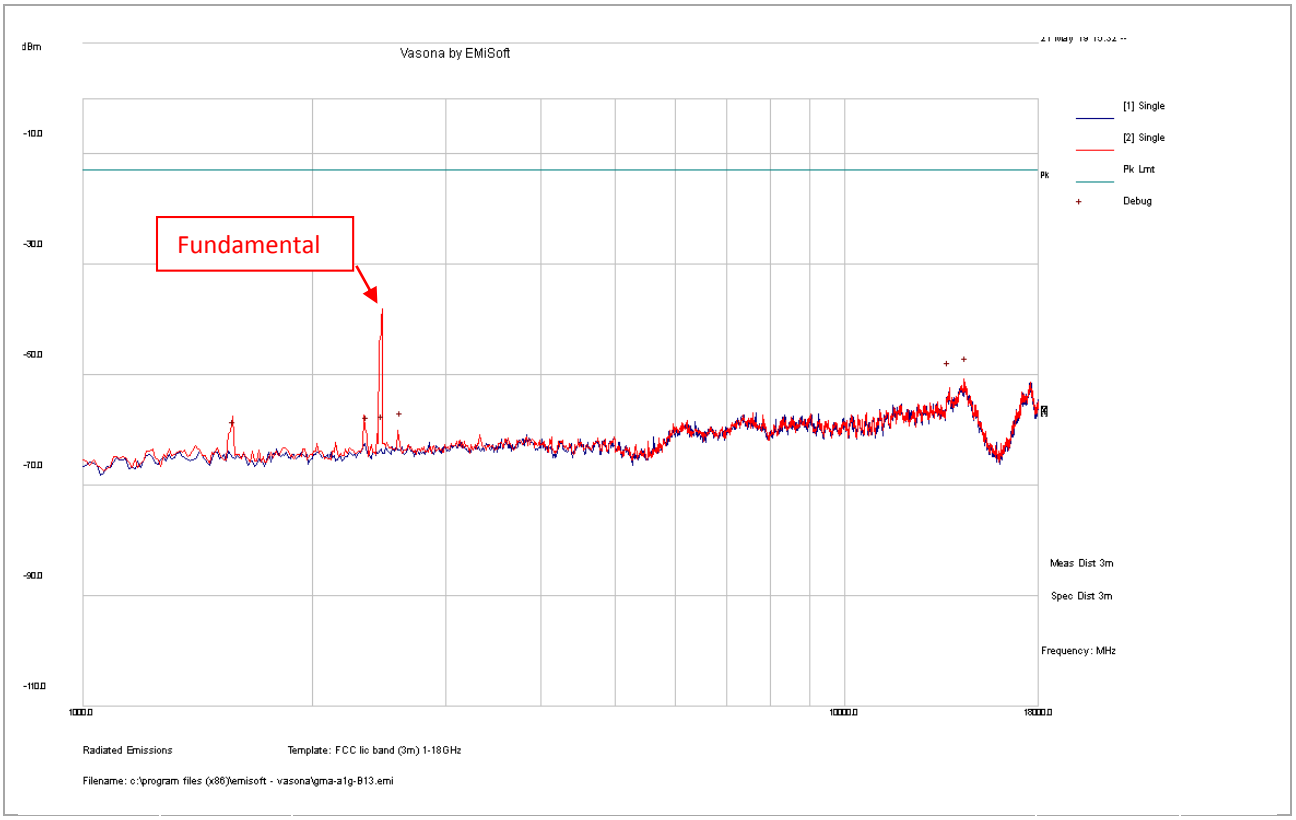


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
1428.98	-56.02	4.35	-11.61	-63.28	RMS	V	155	116	-13	-50.28
2138.64	-58.07	4.58	-10.62	-64.11	RMS	V	251	98	-13	-51.11
3790.36	-61.94	6.20	-6.38	-62.11	RMS	H	214	5	-13	-49.11
7242.05	-66.33	9.26	-1.31	-58.38	RMS	V	155	116	-13	-45.38
14408.43	-75.33	14.66	8.17	-52.50	RMS	V	251	98	-13	-39.50

Note:

1) All different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

Test Standard:	**Part 27 & RSS 130**	**Mode:**	**BLE 2440MHz + LTE B13**
Frequency Range:	**1GHz -18GH**	**Test Date:**	**05/15/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**David Zhang**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBm	Det	Pol deg	Height cm	Table deg	Limit dBm	Margin dB
1578.82	-57.72	4.45	-11.83	-65.09	RMS	H	192	13	-13	-52.09
2362.89	-59.10	4.80	-10.00	-64.30	RMS	V	273	182	-13	-51.30
2474.73	-59.42	4.89	-9.54	-64.07	RMS	H	141	98	-13	-51.07
2618.22	-59.48	5.03	-8.99	-63.44	RMS	H	112	109	-13	-50.44
13717.56	-73.15	13.54	5.21	-54.40	RMS	V	308	188	-13	-41.40
14450.13	-76.12	14.76	7.92	-53.44	RMS	H	187	221	-13	-40.44

Note:

1) All different channel and modes were verified but only the worst case result is shown here.
2) All different modes have been verified and the worst case result is presented here.
3) EUT was tested in 3 orientations.
4) Final substitution measurement is not necessary as margin is over 20 dB.

18GHz – 25GHz test result

Note: no substantial emission is found other than the noise floor.
Different modes have been verified.

8 Test instrument list

Equipment	Manufacturer	Model	Serial Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	5/11/2019	5/11/2020
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	5/4/2019	5/4/2020
EMC Test Receiver	R&S	ESL6	100230	5/7/2019	5/7/2020
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/2019	5/4/2020
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2018	11/15/2019
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/2/2019	5/2/2020
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	5/2/2019	5/2/2020
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	5/10/2019	5/10/2020
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/10/2019	5/10/2020
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/9/2019	5/9/2020
RF Attenuator	Pasternack	PE7005-3	VL061	5/10/2019	5/10/2020
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	5/10/2019	5/10/2020
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	5/9/2019	5/9/2020
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	5/10/2019	5/10/2020
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	5/10/2019	5/10/2020
RE test cable (>18GHz)	Sucoflex	104	344903/4	5/10/2019	5/10/2020
Pulse limiter	Com-Power	LIT-930A	531727	5/15/2019	5/15/2020
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	5/10/2019	5/10/2020
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	5/9/2019	5/9/2020