FCC/ISED DTS RF TEST REPORT

Test Report Number……	**NSC-19042303-LC-RF-FCC-IC-BLE**
Applicant……	**Nortek Security & Control LLC**
Applicant Address……	**5919 Sea Otter Place, Carlsbad, CA 92010 USA**
Product Name……	Mobile Personal Emergency Reporting System
Model Number……	Libris 2.0
Family Product/Model……	N/A
FCC ID……	EF400167
ISED ID……	1078A-00167
Date of EUT received……	05/20/2019
Date of Test……	05/20/2019 – 05/28/2019
Report Issue Date……	05/31/2019
Test Standards……	**47CFR Part 15.247: 2019** **RSS-247 Issue 2.0: Feb 2017** **RSS-Gen Issue 5: Apr 2018**
Test Result……	Pass

Issued By:

Vista Laboratories

1261 Puerta Del Sol, San Clemente, CA 92673 USA

www.vista-compliance.com

Tested by:	**Approved By:**
Sherwin Lee/Test Engineer	**David Zhang/Technical Manager**

Laboratory Introduction

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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

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A2LA has accredited

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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	05/31/2019	Original release	N/A

1 General Information

1.1 Applicant

Applicant:	Nortek Security & Control LLC
Applicant address:	5919 Sea Otter Place, Carlsbad, CA 92010 USA
Manufacturer:	Nortek Security & Control LLC
Manufacturer Address:	5919 Sea Otter Place, Carlsbad, CA 92010 USA

1.2 Product information

Product Name	Mobile Personal Emergency Reporting System
Model Number	Libris 2.0
Serial Number	N/A
Frequency Band	2.4GHz Wi-Fi: 802.11b/g/n-20MHz: 2412-2462MHz 2.4GHz 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	802.11b: DSSS (CCK, DQPSK, DBPSK) 802.11g: OFDM-CCK (BPSK, QPSK, 16QAM, 64QAM) 802.11n: OFDM (BPSK, QPSK, 16QAM, 64QAM) BLE: GFSK QPSK (WCDMA), QPSK/16QAM (LTE Cat-1)
Equipment Class/ Category	DTS, PCB
Maximum output power	Wi-Fi: 18.68 dBm; BLE: 7.373 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	Wi-Fi/BLE: Internal antenna, 2.2 dBi Gain. WCDMA/LTE: PCB antenna, 4.0 dBi for 1700-2200MHz; 2.4 dBi for 700-900MHz
Clock Frequencies	N/A
Port/Connectors	Charging interface
Input Power	5VDC, 1.0A
Power Adapter Manu/Model	Shenzhen aquilstar / ASUC69a-050100
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	BLE, WLAN and WCDMA/LTE can transmit simultaneously
Additional Info	N/A

1.3 Test standard and method

Test standard	47CFR Part 15.247: 2019 RSS-247 Issue 2.0: Feb 2017 RSS-Gen Issue 5: Apr 2018
Test method	RSS-Gen Issue 5: Apr 2018 ANSI C63.10: 2013 558074 D01 15.247 Meas Guidance v05r02

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
RF conducted	Sherwin Lee	23.5°C / 58.2%/996 mbar	05/20/2019 – 05/24/2019
Radiated	Sherwin Lee	23.5°C / 58.2%/996 mbar	05/20/2019 – 05/24/2019

3 Modification of EUT

The EUT is an engineering test sample loaded with RF test firmware specifically designed to support the RF TX/RX measurement in different aspects. No modification on the hardware.

4 Test configuration and operation

4.1 EUT test configuration

EUT is powered by external PoE power supply or AC/DC power adapter. For RF conducted measurement, the original antenna is removed and connected to spectrum analyzer for measurement. The test command is used to set EUT to different transmission mode in terms of radio mode (WLAN, BLE), test channel, data rate, etc.

4.2 EUT test mode

Radio	Channel	Frequency (MHz)	Data Rate (Mbps)
BLE	0	2402	1
BLE	19	2440	1
BLE	39	2480	1

4.3 Supporting Equipment

Index	Description	Model	S/N	Brand	Remark
1	Laptop	G752V	F9N0CY758592398	ASUS	With test software
2	AC/DC adapter	ADP-180MB	N/A	ASUS	-

4.4 EUT setup diagram

4.5 EUT operation

EUT is pre-installed with test firmware. The test software on laptop is used to send the command to EUT to enable the continuous transmission at different channel and mode.

4.6 Test software

Index	Description	Remark
1	EMISoft Vasona 6.0049	EMC/Spurious emission test software used during testing
2	ESP_RF test tool v1.1.0	WLAN test software to enable test mode
3	nRFgo Studio 1.21.12.10	BLE test software to enable test mode

5 EUT and test setup pictures

5.1 EUT pictures

EUT Top View

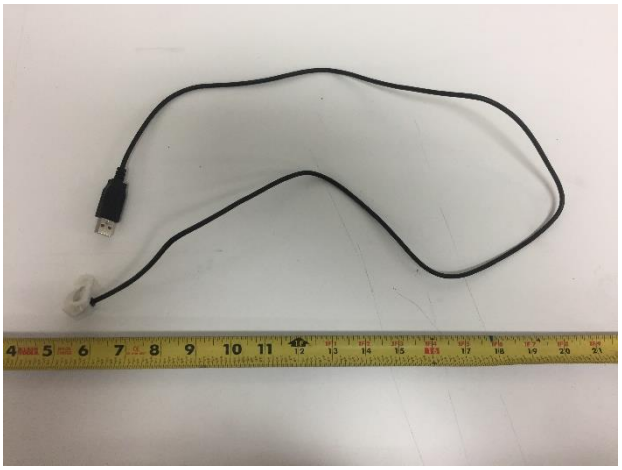
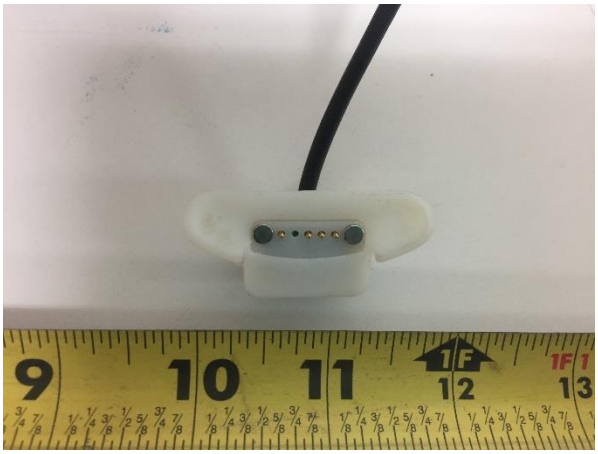
EUT Bottom View

EUT Front View

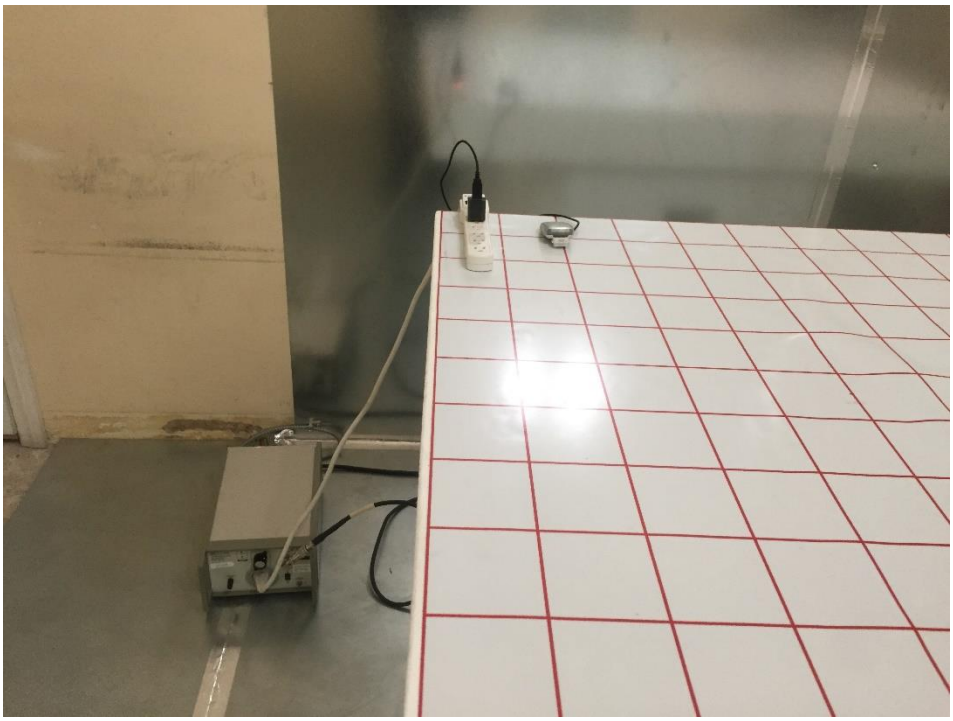
EUT Rear View

EUT Left Side View

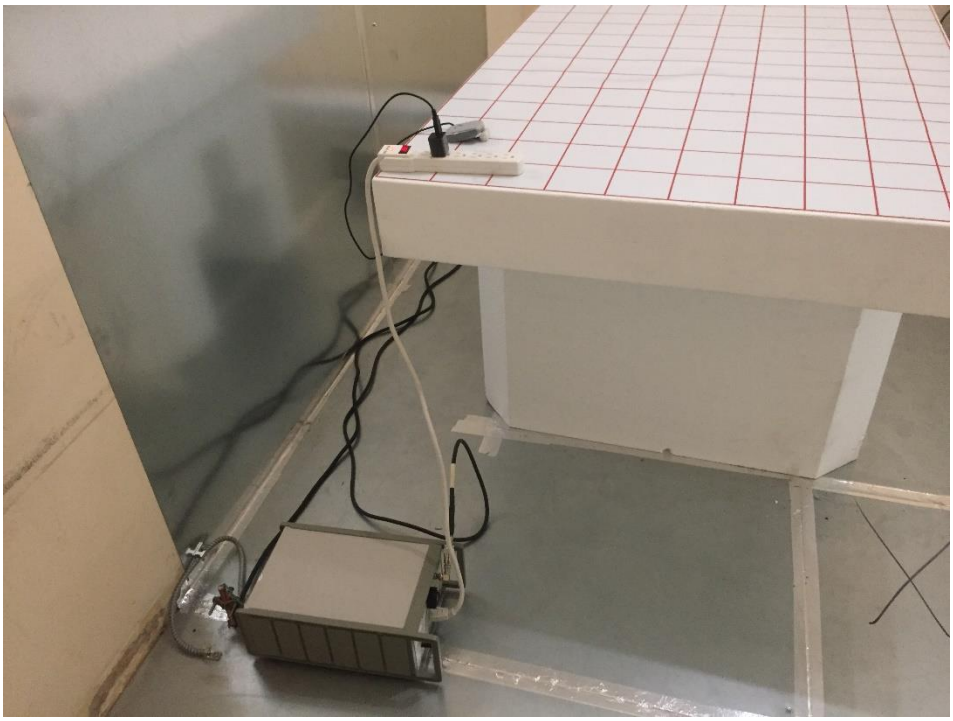
EUT Right Side View

	
Charging Cable/interface Top View	**Charging Cable/interface Front View**
	
Power Adapter Front View	**Power Adapter Rear View**

5.2 EUT test setup pictures

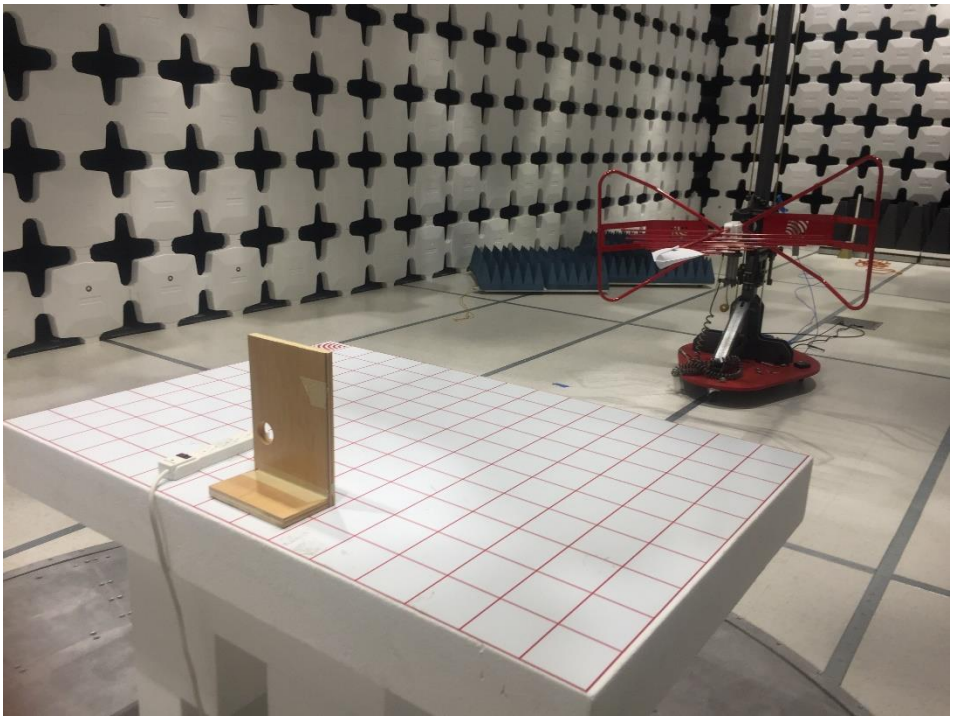


AC Line Conducted Emission setup – Front

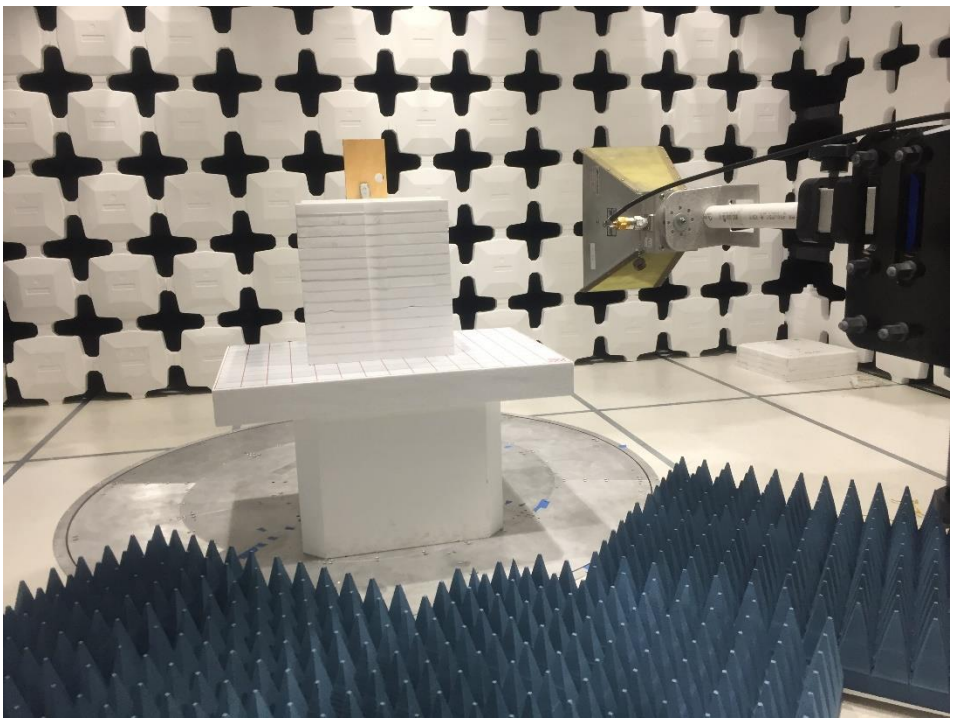


AC Line Conducted Emission setup – Rear

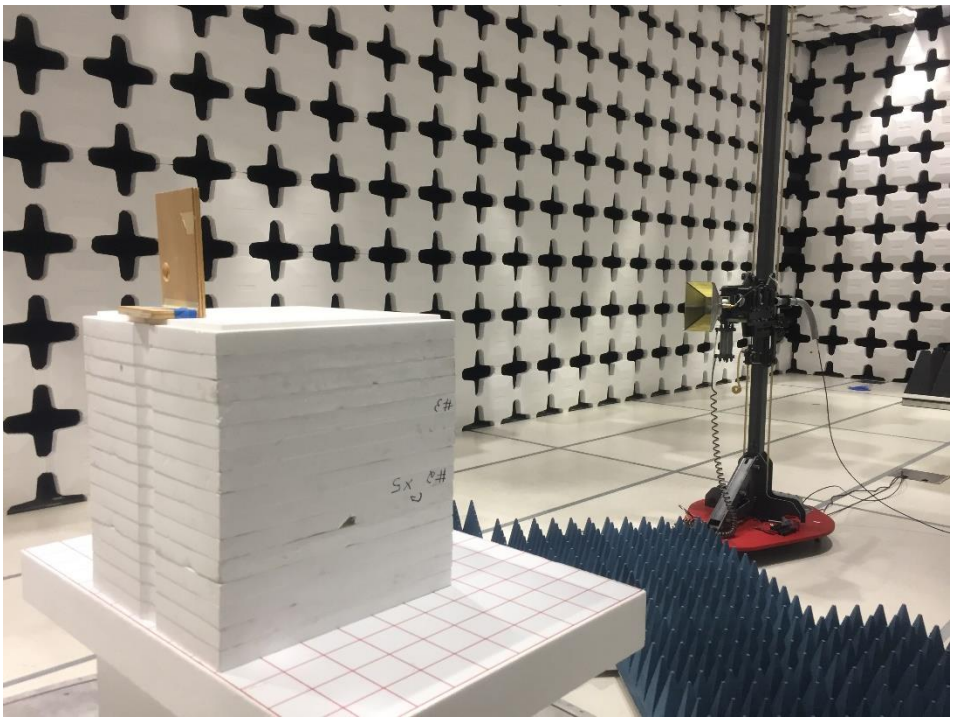
Radiated Emissions Below 1GHz setup – Front



Radiated Emissions Below 1GHz setup – Rear



Radiated Emissions Above 1GHz setup – Front



Radiated Emissions Above 1GHz setup – Rear

6 Test Summary

FCC Rules	ISED Rules	Test Item	Section	Verdict
§15.203	-	Antenna Requirement	8.1	Pass
§15.247 (a)(2)	RSS-247 §5.2	DTS (6 dB) Channel Bandwidth	8.2	Pass
-	RSS-Gen §6.7	Occupied Bandwidth	8.3	N/A
§15.247(b)(3)	RSS-247 §5.4	Conducted Maximum Output Power	8.4	Pass
§15.247(e)	RSS-247 §5.2	Power Spectral Density	8.5	Pass
§15.247(d)	RSS-247 §5.5	Conducted Band-Edge & Unwanted Emissions	8.6	Pass
§15.205, §15.209, §15.247(d)	RSS-247 §5.5	Radiated Emissions & Unwanted Emissions into Restricted Frequency Bands	8.7	Pass
-	RSS-Gen §7.3	Receiver Spurious Emission	N/A	N/A 1)
§15.207 (a)	RSS-Gen §8.8	AC Power Line Conducted Emissions	8.8	Pass

Note:

1) Testing covered the receive mode, and receiver spurious emissions are considered to be the same as transmitter.

7 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
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

8 Test summary and result

8.1 Antenna Requirement

8.1.1 Requirement

Per § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

8.1.2 Result

Analysis:

- EUT has one internal antenna which connect to the main board with unique spring loaded pins that contact the front case when the main board is installed and secured into the case. The internal antenna itself is glued to the front case and is not removable.

Conclusion:

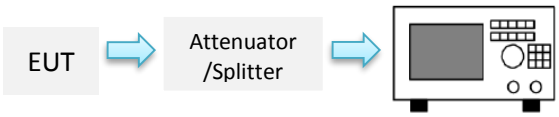
- EUT complies with antenna requirement in § 15.203.

8.2 DTS (6 dB) Bandwidth

8.2.1 Requirement

§ 15.247 (a)(2), RSS-247 §5.2
Systems using digital modulation techniques may operate in the 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz bands. The minimum 6 dB bandwidth shall be at least 500 KHz.

8.2.2 Test setup



8.2.3 Test Procedure

According to section 8.2, option 2, in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.8 of ANSI C63.10-2013:

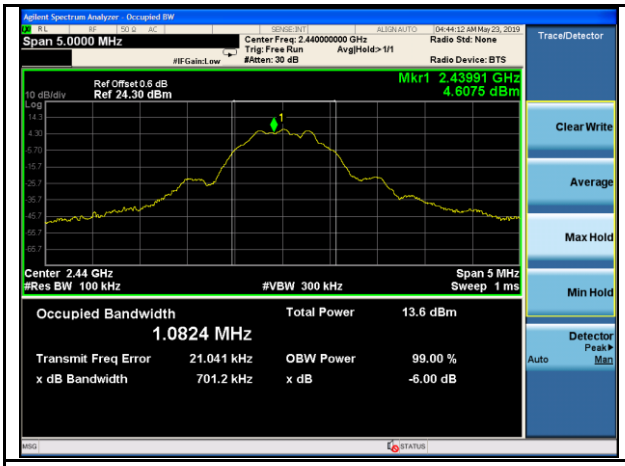
The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Use automatic bandwidth measurement capability on instrument to obtain BW result.

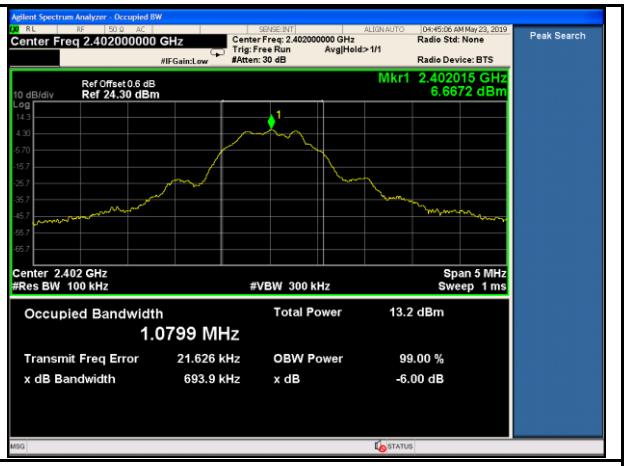
8.2.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Bandwidth (KHz)	Minimum Bandwidth (KHz)	Result
BLE	2402	1	701.2	500	Pass
BLE	2440	1	693.9	500	Pass
BLE	2480	1	693.3	500	Pass

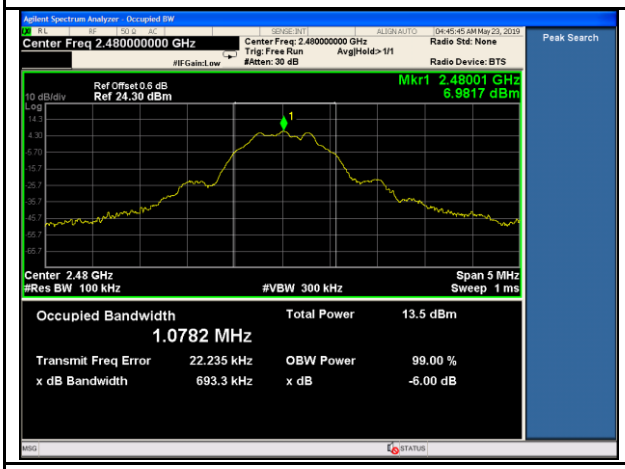
8.2.5 Test Plots



BLE-6 dB BW-Low



BLE-6 dB BW-Mid



BLE-6 dB BW-High

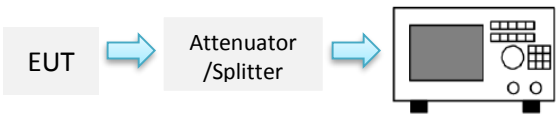
8.3 Occupied Bandwidth (99%)

8.3.1 Requirement

RSS-Gen §6.7

The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

8.3.2 Test setup



8.3.3 Test Procedure

According to section RSS-Gen §6.7

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW ≥ 3 × RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

1. Set RBW = 1% to 5% of the actual occupied BW.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Span = large enough to capture all products of the modulation process
7. Allow the trace to stabilize.
8. Use automatic bandwidth measurement capability on instrument to obtain BW result.

8.3.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured 99% OBW (KHz)	Limit (KHz)	Result
BLE	2402	1	1082.4	N/A	N/A
BLE	2440	1	1079.9	N/A	N/A
BLE	2480	1	1078.2	N/A	N/A

8.4 Maximum Output Power

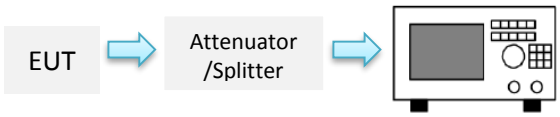
8.4.1 Requirement

§ 15.247 (b)(3), RSS-247 §5.4

or systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: the maximum output power is 1 Watt.

If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

8.4.2 Test setup



8.4.3 Test Procedure

For BLE, power measurement is according to subclause 11.9.1.1 of ANSI C63.10-2013:

1. Set the RBW ≥ DTS bandwidth
2. Set VBW ≥ 3 X RBW.
2. Set SPAN ≥ 3 X RBW.
3. Sweep time = auto couple.
4. Detector = peak.
5. Trace mode = max hold
6. Allow trace to fully stabilize.
7. Use peak marker function to determine the peak amplitude level.

8.4.4 Test Result

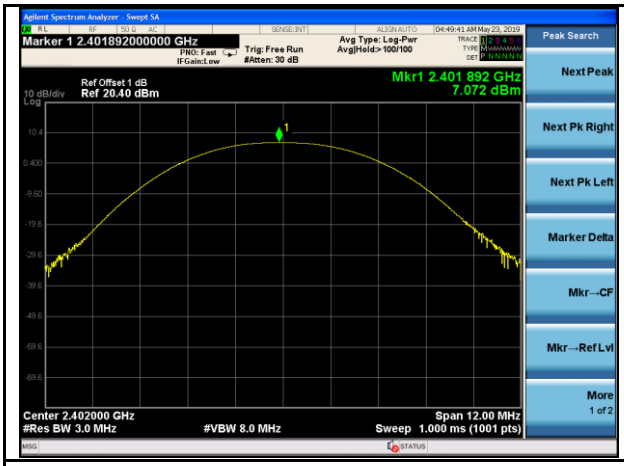
Conducted Output Power

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured Output Power (dBm)	Max Output Power (dBm)	Result
BLE	2402	1	7.072	30	Pass
BLE	2440	1	7.373	30	Pass
BLE	2480	1	7.373	30	Pass

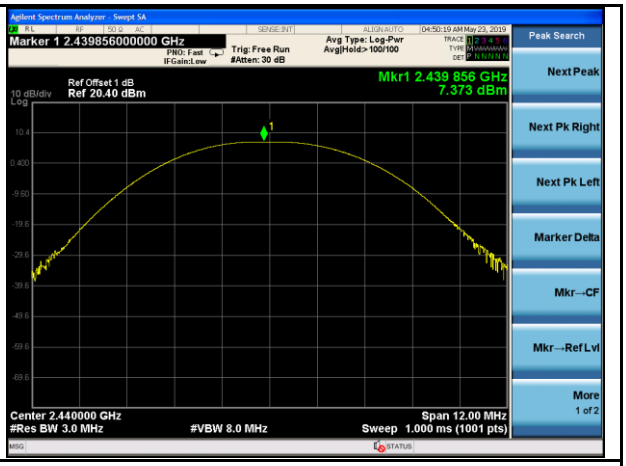
Max e.i.r.p

Radio	Data rate	Test Frequency (MHz)	Measured Output Power (dBm)	Antenna Gain (dBi)	Max e.i.r.p (dBm)	Limit	Result
BLE	1Mbps	2402	7.072	2.2	9.272	36	Pass
	1Mbps	2440	7.373	2.2	9.573	36	Pass
	1Mbps	2480	7.373	2.2	9.573	36	Pass

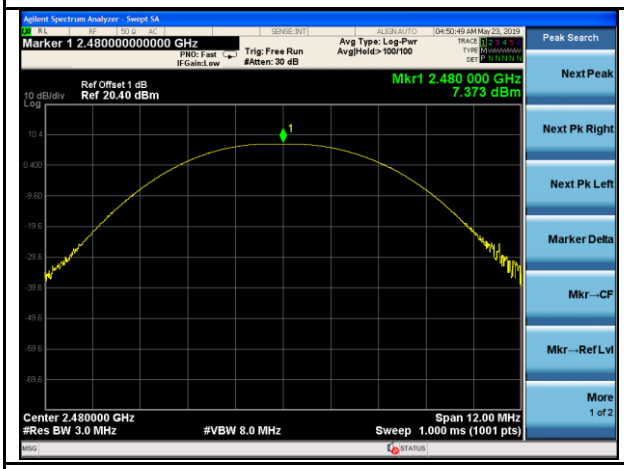
8.4.5 Test Plots



BLE-PWR-Low



BLE-PWR-Mid



BLE-PWR-High

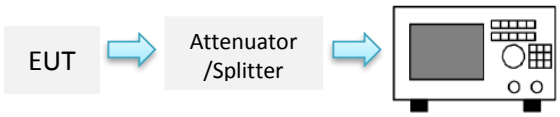
8.5 Power Spectral Density

8.5.1 Requirement

§ 15.247 (e), RSS-247 §5.2

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power is used to determine the power spectral density.

8.5.2 Test setup



8.5.3 Test Procedure

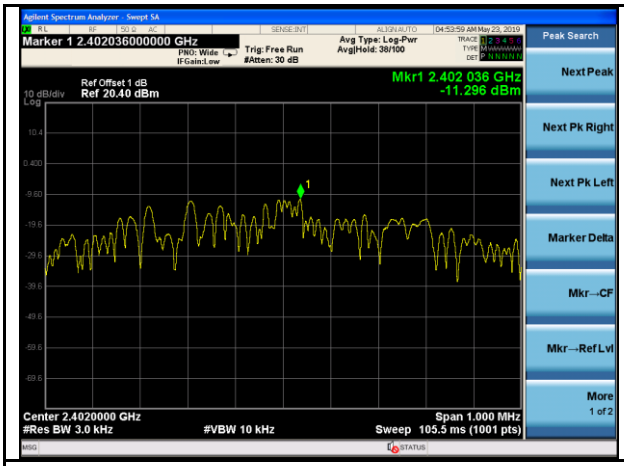
For BLE, PSD measurement is according to section 8.4 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.10.2 PKPSD of ANSI C63.10-2013:

1. Set analyser centre frequency to DTS channel centre frequency.
2. Set the span to 1.5 X DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

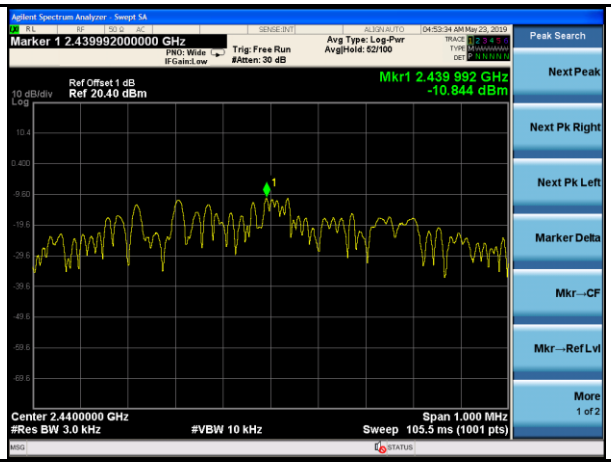
8.5.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Data rate	Measured PSD (dBm/3KHz)	Max PSD (dBm/3KHz)	Result
BLE	2402	1	-11.296	8	Pass
BLE	2440	1	-10.844	8	Pass
BLE	2480	1	-10.771	8	Pass

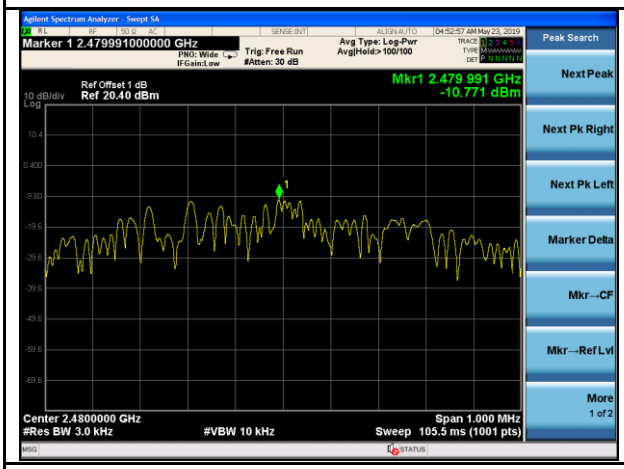
8.5.5 Test Plots



BLE-PSD-Low



BLE-PSD-Mid



BLE-PSD-High

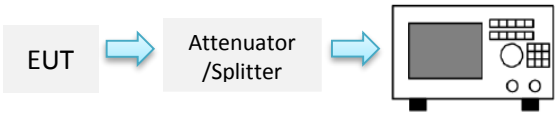
8.6 Conducted Band-Edge & Unwanted Emissions Measurement

8.6.1 Requirement

§ 15.247 (d), RSS-247 §5.5

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.

8.6.2 Test setup



8.6.3 Test Procedure

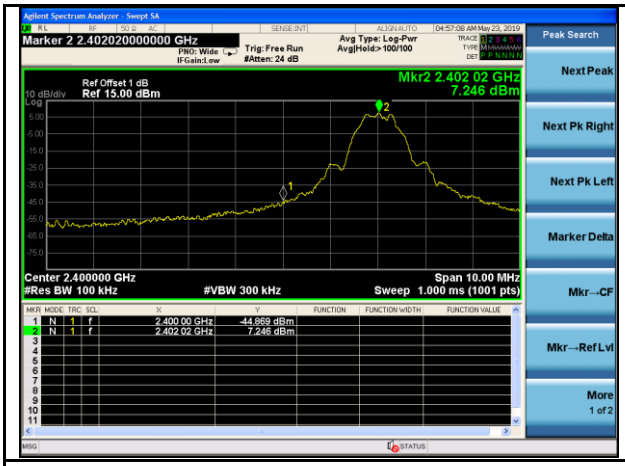
According to section 8.5 Emission level measurement, in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.11.3 in ANSI C63.10-2013:

1. Set the centre frequency and span to encompass frequency range to be measured.
2. Set the RBW = 100 kHz.
3. Set the VBW ≥ 3 X RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

8.6.4 Test Result

See test plots

8.6.5 Test Plots

	
BLE-Band Edge-Low	**BLE-Band Edge-High**

BLE-Out Of Band Emission-Low

BLE-Out Of Band Emission-Mid

BLE-Out Of Band Emission-High

8.7 Radiated Band-Edge & Spurious Emissions into Restricted Frequency Bands

8.7.1 Requirement

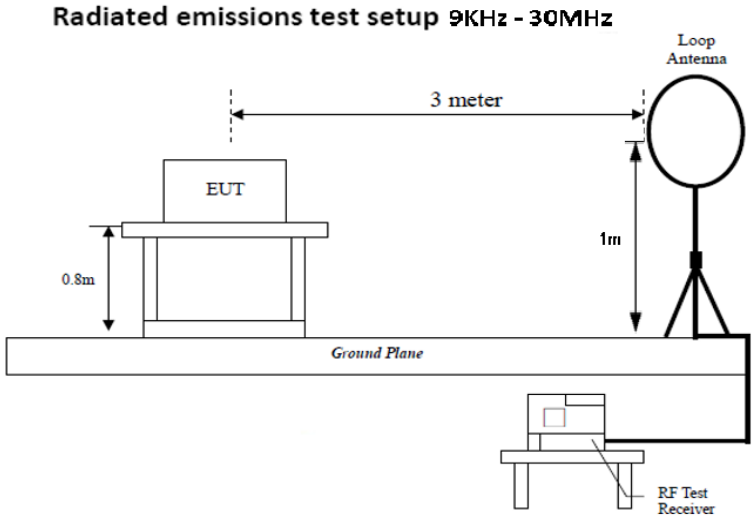
§ 15.247 (d), RSS-247 §5.5

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.

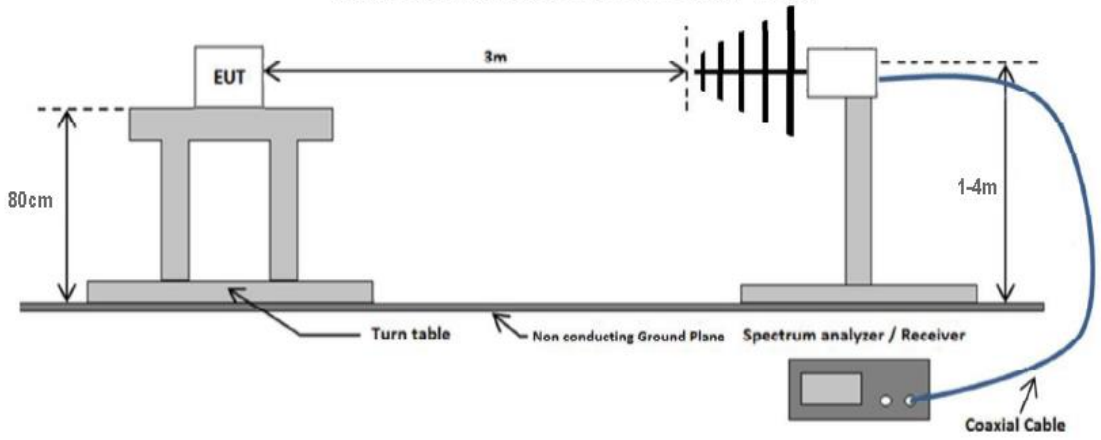
Attenuation below the general limits specified in §15.209(a) and RSS-Gen is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

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

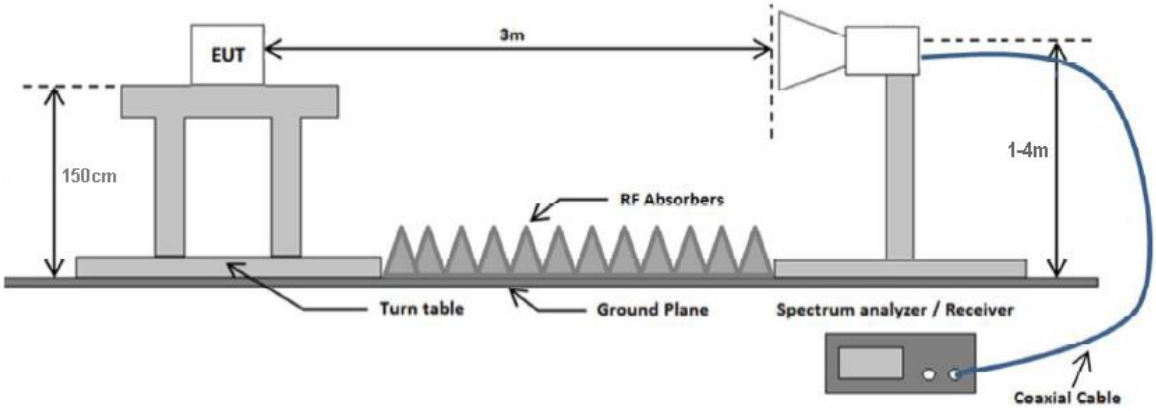
8.7.2 Test setup



Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



8.7.3 ***Test Procedure***

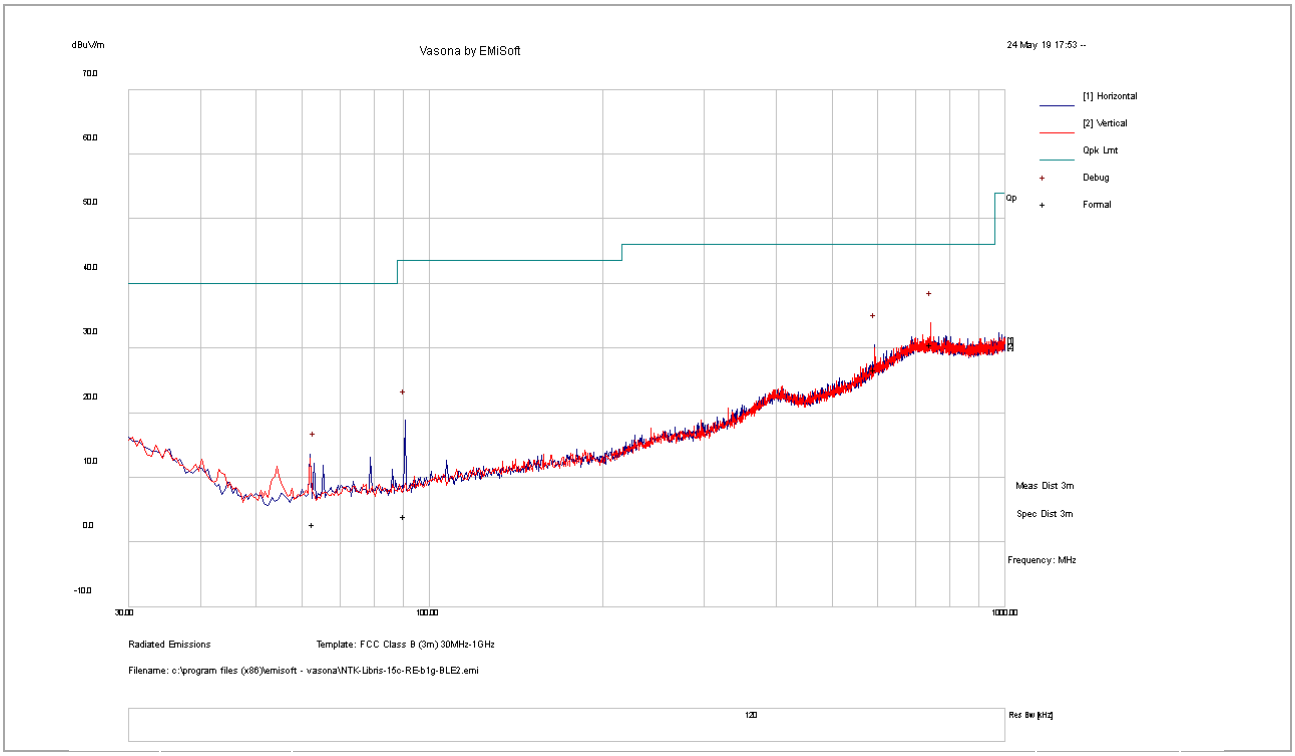
According to section 8.6 in KDB 558074 D01 DTS Meas Guidance v05r02 and subclause 11.12.2.7 Radiated spurious emission measurements in ANSI C62.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 was followed. Boresight antenna mast was 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.

8.7.4 Test Result

30-1000MHz test result

Test Standard:	**15.209, RSS-247**	**Mode:**	**BLE**
Frequency Range:	**30-1000MHz**	**Test Date:**	**05/24/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
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
741.74	29.93	7.28	-6.58	30.63	QP	V	100	5	46	-15.37
593.43	29.74	7.10	-10.08	26.76	QP	H	238	47	46	-19.24
90.58	25.16	3.45	-24.55	4.07	QP	H	290	250	44	-39.43
62.91	24.28	3.05	-24.53	2.79	QP	H	309	332	40	-37.21

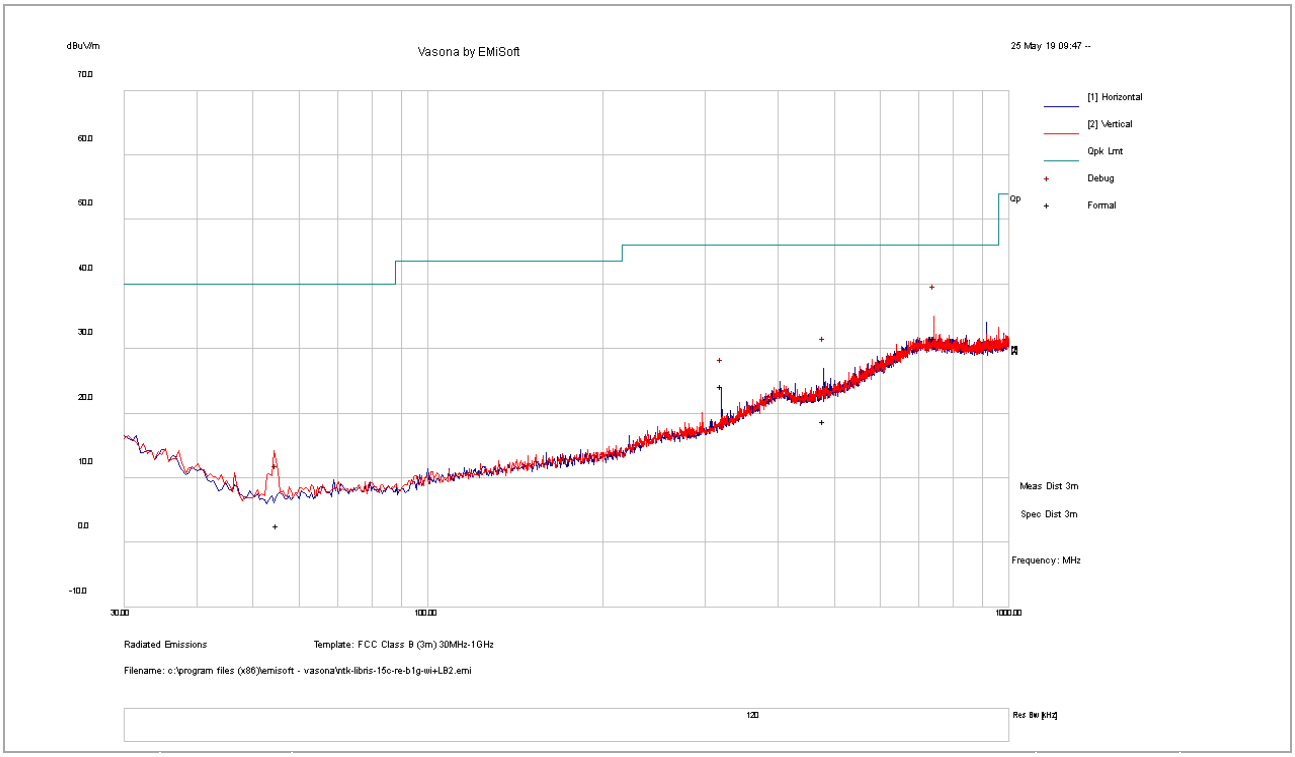
Note:

1) For below 1GHz, all different channel and modes were verified but only the worst case result under mid channel is shown here.
2) For below 30MHz, no outstanding noise is found other than the noise floor.

30-1000MHz test result for WLAN, BLE & Cellular radio simultaneous transmission

30-1000MHz test result

Test Standard:	**15.209, RSS-247**	**Mode:**	**BLE, WLAN, LTE**
Frequency Range:	**30-1000MHz**	**Test Date:**	**05/24/2019**
Antenna Type/Polarity:	**Bi-Log/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
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
741.78	30.96	7.28	-6.58	31.66	QP	V	400	336	46	-14.34
480.07	25.99	6.13	-13.26	18.86	QP	H	102	95	46	-27.14
320.00	35.98	5.83	-17.64	24.18	QP	H	100	308	46	-21.82
54.95	24.51	2.90	-24.73	2.68	QP	H	134	248	40	-37.32

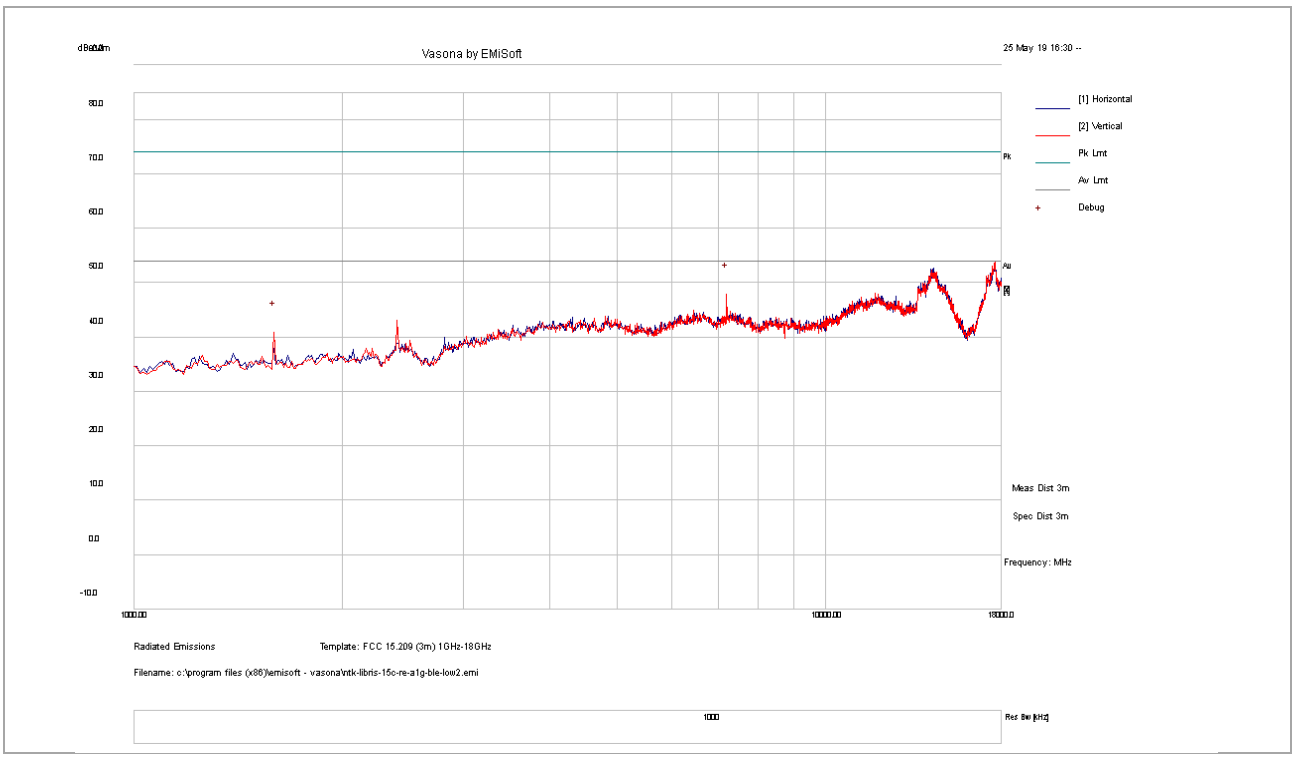
Note:

1) For below 1GHz, all different channel and modes were verified but only the worst case result under mid channel is shown here.

2) For below 30MHz, no outstanding noise is found other than the noise floor.

1GHz – 18GHz test result

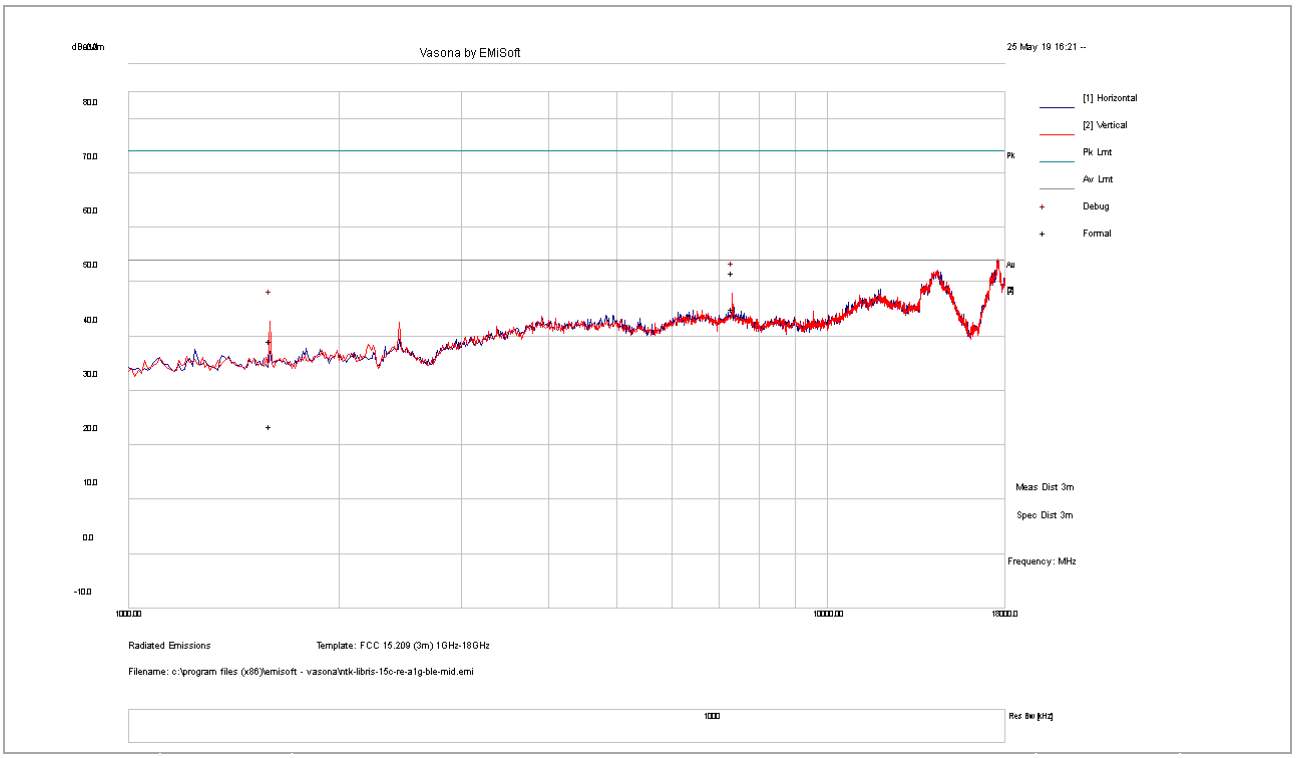
Test Standard:	**15.209, RSS-247**	**Mode:**	**BLE-2402MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**05/24/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7205.00	19.73	16.45	11.67	47.86	PK	V	355	185	74	-26.14
1595.00	33.40	10.73	-3.37	40.77	PK	H	241	5	74	-33.23
7205.00	14.39	16.45	11.67	42.52	AV	V	355	185	54	-11.48
1595.00	28.06	10.73	-3.37	35.43	AV	H	241	5	54	-18.57

1GHz – 18GHz test result

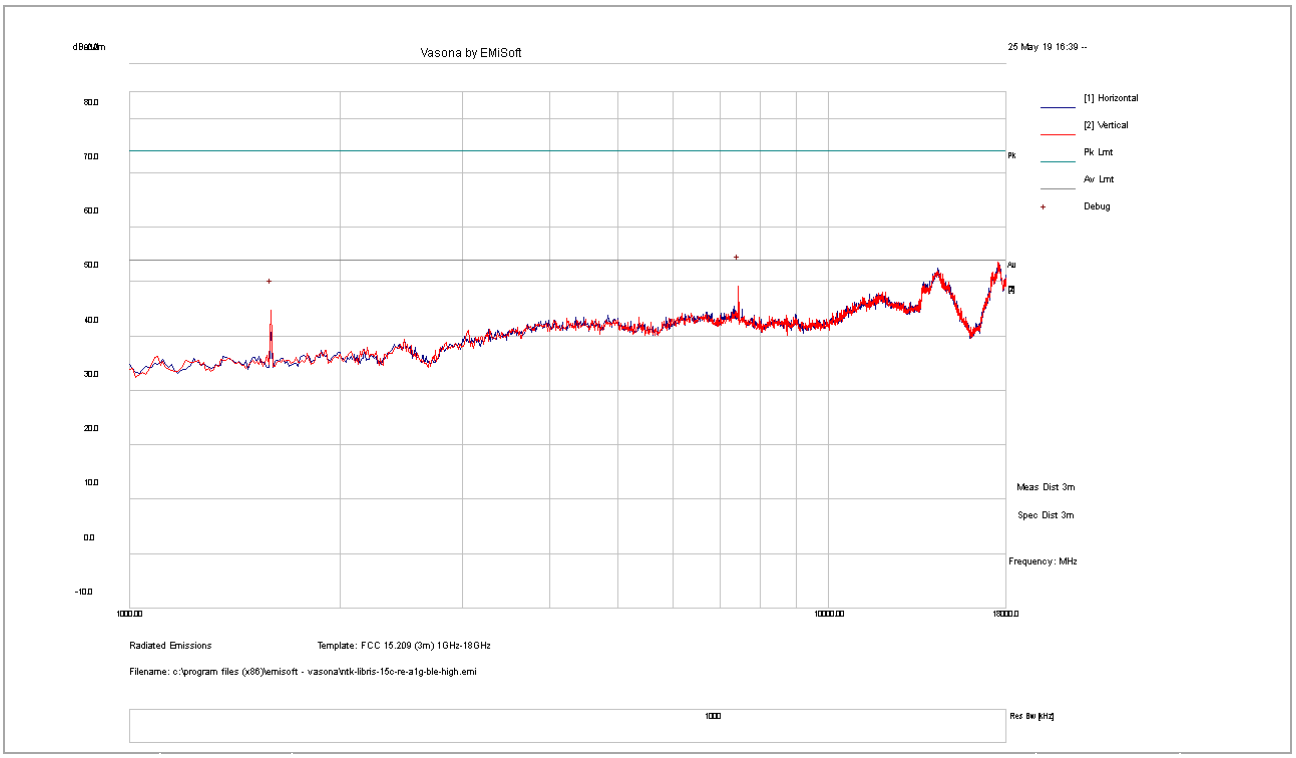
Test Standard:	**15.209, RSS-247**	**Mode:**	**BLE-2440MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**05/24/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7319.97	23.40	16.67	11.70	51.77	PK	V	176	220	74	-22.23
1593.42	31.87	10.74	-3.38	39.22	PK	V	282	282	74	-34.78
7319.97	16.61	16.67	11.70	44.98	AV	V	176	220	54	-9.02
1593.42	16.18	10.74	-3.38	23.54	AV	V	282	282	54	-30.47

1GHz – 18GHz test result

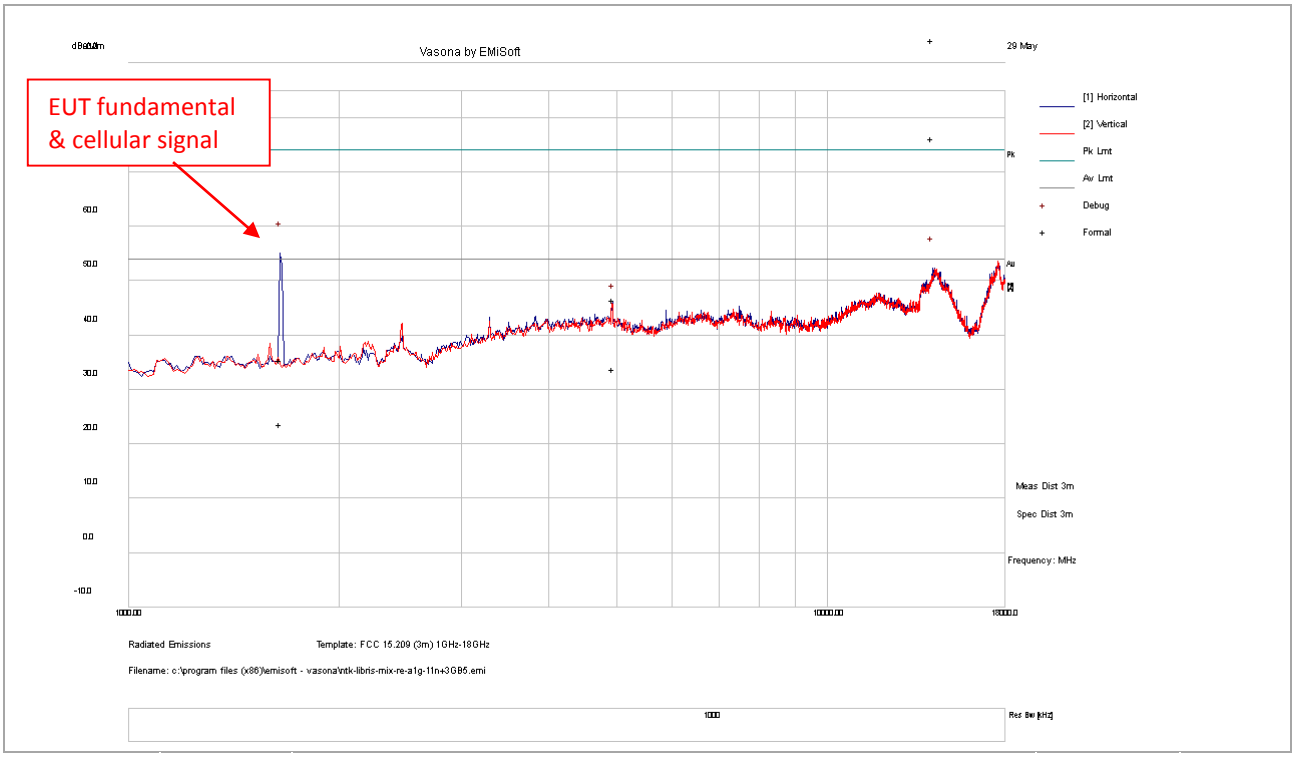
Test Standard:	**15.209, RSS-247**	**Mode:**	**BLE-2480MHz**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**02/28/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
7438.75	20.73	16.90	11.53	49.16	PK	V	346	154	74	-24.84
1595.00	37.28	10.73	-3.37	44.65	PK	V	326	28	74	-29.35
7438.75	15.39	16.90	11.53	43.82	AV	V	346	154	54	-10.18
1595.00	31.94	10.73	-3.37	39.31	AV	V	326	28	54	-14.69

Above 1GHz test result for WLAN, BLE & Cellular radio simultaneous transmission

Test Standard:	**15.209, RSS-247**	**Mode:**	**BLE, WLAN and WCDMA**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**05/24/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**

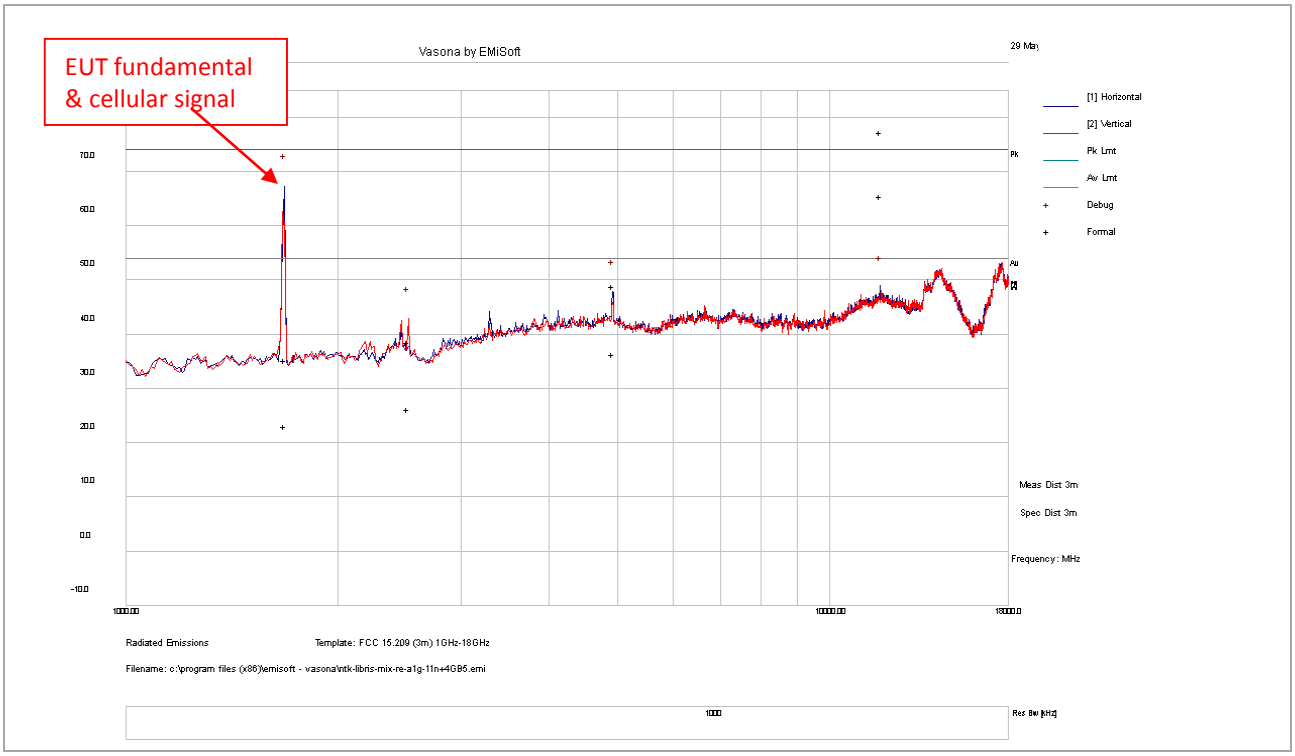


Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
1648.34	28.11	10.66	-3.34	35.44	PK	H	328	315	74	-38.56
4939.22	22.95	13.38	10.19	46.52	PK	V	128	63	74	-27.48
1648.34	16.25	10.66	-3.34	23.58	AV	H	328	315	54	-30.42
4939.22	10.27	13.38	10.19	33.84	AV	V	128	63	54	-20.16

Note:
EUT is capable of transmitting simultaneously in WLAN, BLE and cellular mode. Additional evaluation has been performed and found no change in the result when both WLAN, BLE and cellular transmissions are enabled.

Above 1GHz test result for WLAN, BLE & Cellular radio simultaneous transmission

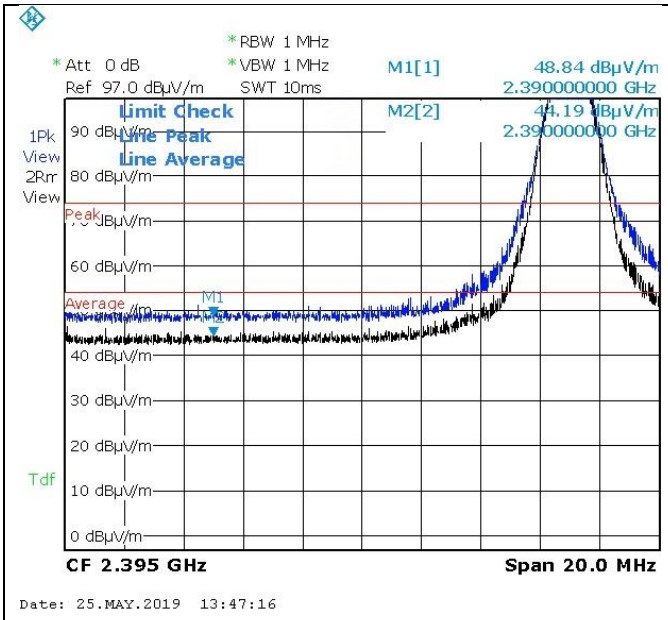
Test Standard:	**15.209, RSS-247**	**Mode:**	**BLE, WLAN and LTE**
Frequency Range:	**1GHz-18GHz**	**Test Date:**	**05/24/2019**
Antenna Type/Polarity:	**Horn/Hor & Ver**	**Test Personnel:**	**Sherwin Lee**
Remark:	**N/A**	**Test Result:**	**Pass**



Frequency MHz	Raw dB	Cable dB	AF dB	Level dBuV/m	Det	Pol deg	Height cm	Table deg	Limit dBuV/m	Margin dB
1681.72	27.83	10.62	-3.18	35.27	PK	H	288	44	74	-38.73
4919.99	25.23	13.38	10.24	48.85	PK	H	120	186	74	-25.15
2517.48	27.16	10.84	0.67	38.67	PK	V	304	271	74	-35.33
1681.72	15.76	10.62	-3.18	23.20	AV	H	288	44	54	-30.80
4919.99	12.70	13.38	10.24	36.31	AV	H	120	186	54	-17.69
2517.48	14.70	10.84	0.67	26.21	AV	V	304	271	54	-27.79

Note:
EUT is capable of transmitting simultaneously in WLAN, BLE and cellular mode. Additional evaluation has been performed and found no change in the result when both WLAN, BLE and cellular transmissions are enabled.

Restricted Band Measurement Plots:

<table>
<tr>
<td> 
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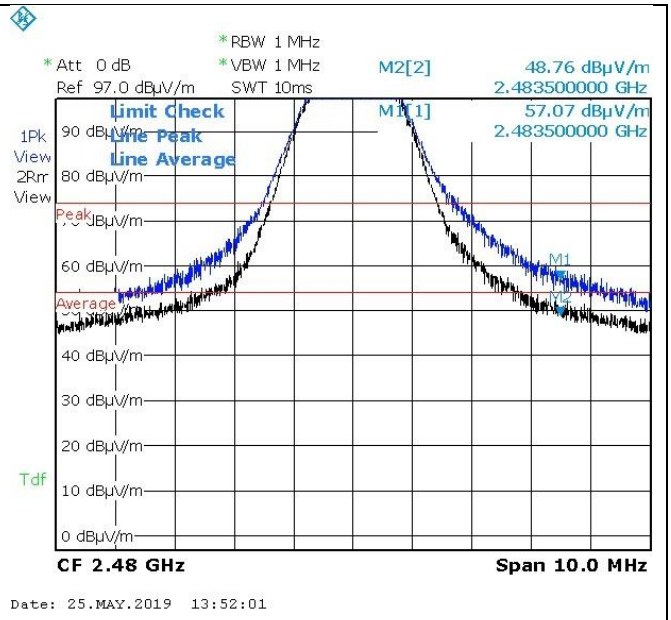
<td> 
</td>
</tr>
<tr>
<td>BLE 2402M-Low</td>
<td>BLE 2480M-High</td>
</tr>
</table>

8.8 Conducted Emissions

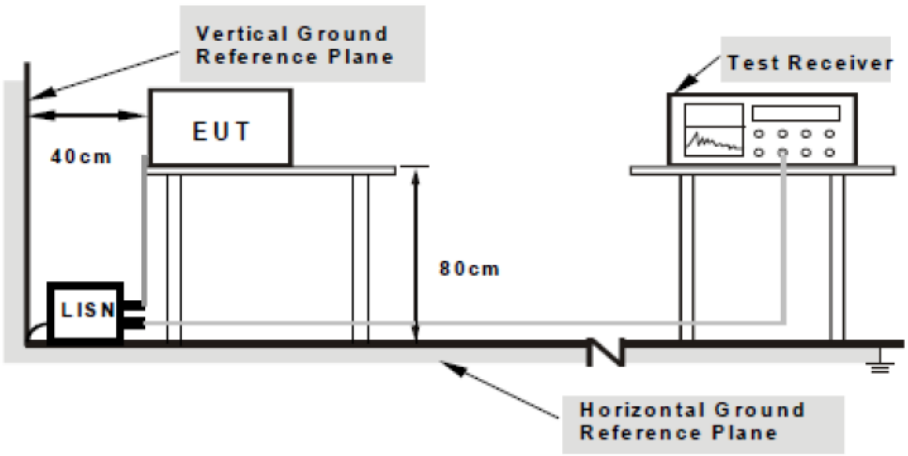
8.8.1 Requirement

Per RSS-Gen §8.8, an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Limits for Conducted Emissions at the Mains Ports

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
Class B devices	0.15 – 0.5	66 – 56	56 – 46
	0.5 – 5	56	46
	5 - 30	60	50
NOTE 1 The lower limit shall apply at the transition frequencies.			

8.8.2 Test setup



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

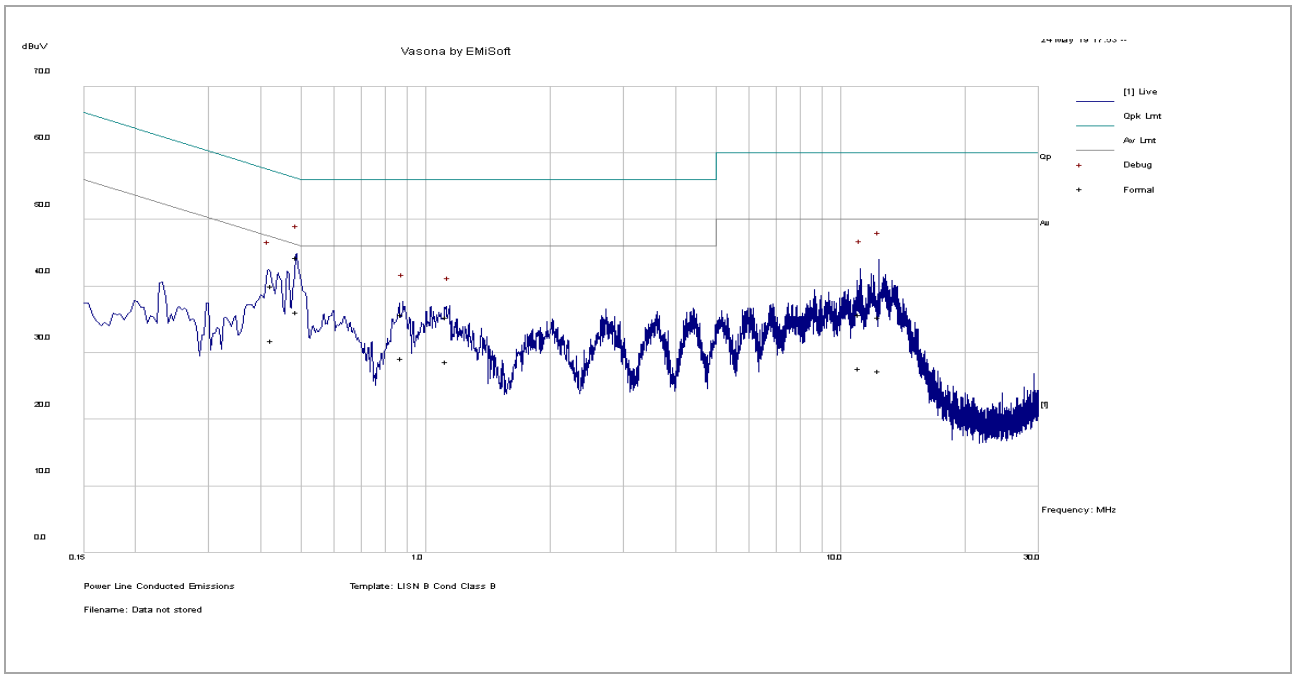
8.8.3 Test Procedure

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment was powered separately from another main supply.
5. The EUT was switched on and allowed to warm up to its normal operating condition.
6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
7. High peaks, relative to the limit line, were then selected.
8. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made
9. All possible modes of operation were investigated. Only the worst case emissions were measured and reported. All other emissions were relatively insignificant.

8.8.4 Test Result

Live Line

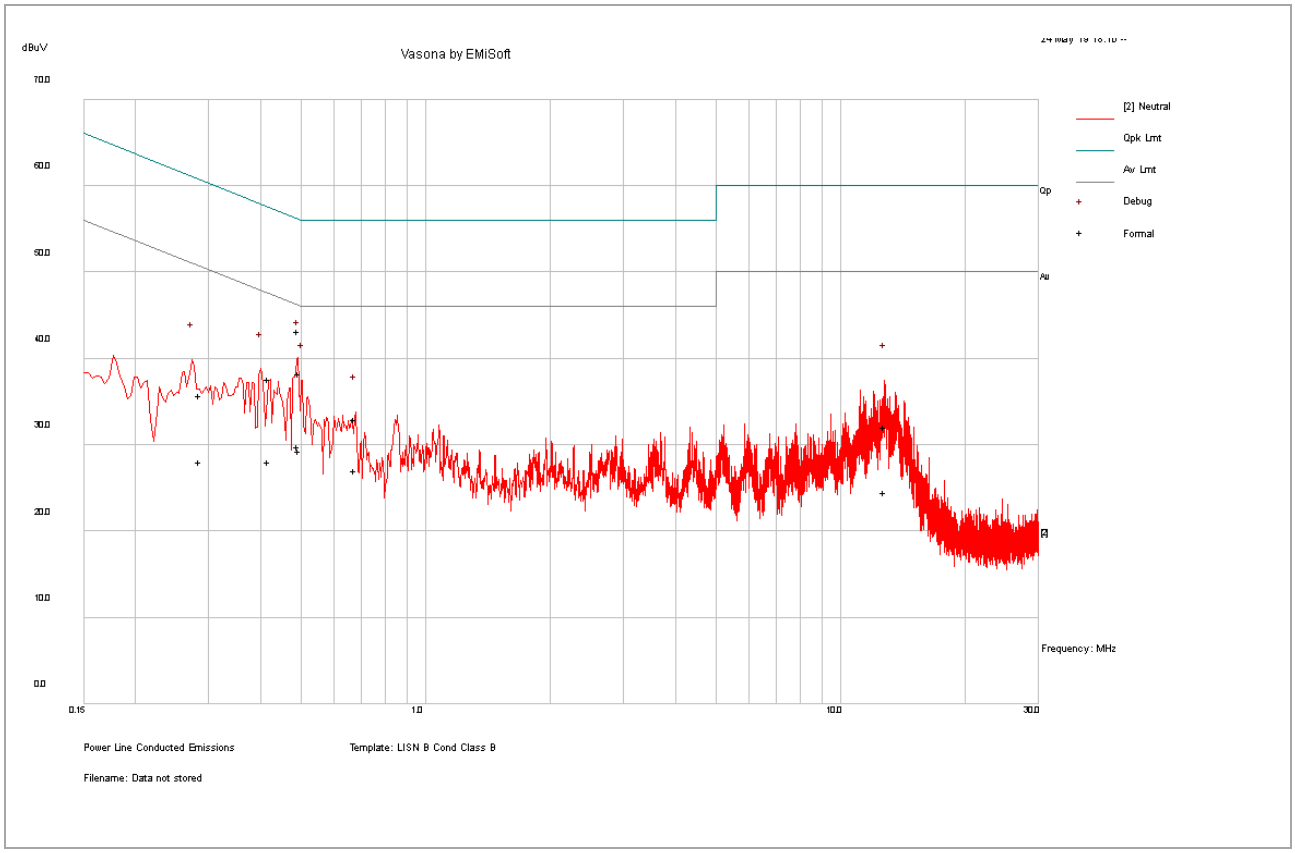
Test Standard:	**15.207, RSS-Gen**	**Mode:**	**Line**
Frequency Range:	**0.15-30MHz**	**Test Date:**	**05/24/2019**
Antenna Type/Polarity:	**N/A**	**Test Personnel:**	**Sherwin Lee**
Remark:	**120VAC, 60Hz**	**Test Result:**	**Pass**



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV/m)	Meas. Type	Line	Limit (dBuV/m)	Margin (dB)	Pass /Fail
0.49	33.81	10.39	0.11	44.31	QP	Live	56.14	-11.84	Pass
0.43	29.51	10.38	0.12	40.00	QP	Live	57.35	-17.34	Pass
12.36	24.28	10.82	0.27	35.36	QP	Live	60.00	-24.64	Pass
11.14	24.65	10.79	0.25	35.70	QP	Live	60.00	-24.30	Pass
0.88	25.10	10.52	0.10	35.72	QP	Live	56.00	-20.28	Pass
1.12	24.69	10.56	0.10	35.34	QP	Live	56.00	-20.66	Pass
0.49	25.63	10.39	0.11	36.13	AV	Live	46.14	-10.02	Pass
0.43	21.35	10.38	0.12	31.84	AV	Live	47.35	-15.50	Pass
12.36	16.24	10.82	0.27	27.33	AV	Live	50.00	-22.67	Pass
11.14	16.59	10.79	0.25	27.64	AV	Live	50.00	-22.36	Pass
0.88	18.58	10.52	0.10	29.19	AV	Live	46.00	-16.81	Pass
1.12	17.99	10.56	0.10	28.64	AV	Live	46.00	-17.36	Pass

Neutral Line

Test Standard:	**15.207, RSS-Gen**	**Mode:**	**Neutral**
Frequency Range:	**0.15-30MHz**	**Test Date:**	**05/24/2019**
Antenna Type/Polarity:	**N/A**	**Test Personnel:**	**Sherwin Lee**
Remark:	**120VAC, 60Hz**	**Test Result:**	**Pass**



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV/m)	Meas. Type	Line	Limit (dBuV/m)	Margin (dB)	Pass /Fail
0.49	32.71	10.39	0.11	43.20	QP	Neutral	56.13	-12.93	Pass
0.49	27.69	10.39	0.11	38.18	QP	Neutral	56.09	-17.91	Pass
0.42	27.16	10.38	0.11	37.65	QP	Neutral	57.49	-19.85	Pass
0.29	25.28	10.35	0.14	35.76	QP	Neutral	60.66	-24.89	Pass
0.67	22.44	10.46	0.11	33.00	QP	Neutral	56.00	-23.00	Pass
12.75	20.95	10.82	0.27	32.04	QP	Neutral	60.00	-27.96	Pass
0.49	19.29	10.39	0.11	29.78	AV	Neutral	46.13	-16.35	Pass
0.49	18.75	10.39	0.11	29.24	AV	Neutral	46.09	-16.85	Pass
0.42	17.50	10.38	0.11	27.99	AV	Neutral	47.49	-19.50	Pass
0.29	17.54	10.35	0.14	28.03	AV	Neutral	50.66	-22.63	Pass
0.67	16.51	10.46	0.11	27.07	AV	Neutral	46.00	-18.93	Pass
12.75	13.47	10.82	0.27	24.57	AV	Neutral	50.00	-25.43	Pass

9 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