



TEST REPORT

Report Reference No...... : **TRE1709011501** R/C.....: 17710

FCC ID..... : **AMW70001**

Applicant's name..... : **Uniden America Corporation**

Address.....: 3001 Gateway Drive Suite 130, Irving, Texas, United States

Manufacturer.....: Uniden America Corporation

Address.....: 3001 Gateway Drive Suite 130, Irving, Texas, United States

Test item description : **FLOATING VHF MARINE RADIO**

Trade Mark: UNIDEN, West Marine

Model/Type reference.....: MHS335BT

Listed Model(s): VHF470B, VHF470G

Standard : **FCC CFR Title 47 Part 15 Subpart C Section 15.247**

Date of receipt of test sample.....: Sept. 15, 2017

Date of testing.....: Sept. 18, 2017 – Oct. 16, 2017

Date of issue.....: Oct. 16, 2017

Result.....: **PASS**

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Testing Laboratory Name : **Shenzhen Huatongwei International Inspection Co., Ltd.**

Address.....: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

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The test report merely correspond to the test sample.

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1. TEST STANDARDS AND REPORT VERSION

1.1. Test Standards

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

[ANSI C63.10:2013](#): American National Standard for Testing Unlicensed Wireless Devices

[KDB 558074 D01 DTS Meas Guidance v04](#): Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating under §15.247

1.2. Report version

Version No.	Date of issue	Description
00	Oct. 16, 2017	Original

2. TEST DESCRIPTION

Test Item	FCC Rule	Result	Test Engineer
Antenna requirement	15.203/15.247(c)	Pass	William Wang
Line Conducted Emissions (AC Main)	15.207	Pass	William Wang
Conducted Peak Output Power	15.247(b)(3)	Pass	William Wang
Power Spectral Density	15.247(e)	Pass	William Wang
6dB Bandwidth	15.247(a)(2)	Pass	William Wang
Restricted band	15.247(d)/15.205	Pass	William Wang
Spurious Emissions	15.247(d)/15.209	Pass	William Wang

Note: The measurement uncertainty is not included in the test result.

3. SUMMARY

3.1. Client Information

Applicant:	Uniden America Corporation
Address:	3001 Gateway Drive Suite 130, Irving, Texas, United States
Manufacturer:	Uniden America Corporation
Address:	3001 Gateway Drive Suite 130, Irving, Texas, United States

3.2. Product Description

Name of EUT:	FLOATING VHF MARINE RADIO
Trade Mark:	UNIDEN, West Marine
Model No.:	MHS335BT
Listed Model(s):	VHF470B, VHF470G
Power supply:	DC 7.4V from re-charge Lion battery DC 6.0V from dry battery
Adapter information:	Model:SAW12-120-1000UD Input:100-240Va.c.,50/60Hz,0.3A Output: 12Vd.c., 1000mA
Hardware version:	V1.2
Software version:	V1.78
Bluetooth	
Version:	Supported BT4.0+BLE
Modulation:	GFSK
Operation frequency:	2402MHz~2480MHz
Channel number:	40
Channel separation:	2MHz
Antenna type:	Integral Antenna
Antenna gain:	1.dBi

Note:

Pre-scan the test voltage 7.4V and 6.0V, only show the worst test result at 7.4V.

3.3. Operation state

➤ Test frequency list

According to section 15.31(m), regards to the operating frequency range over 10 MHz, must select three channel which were tested. the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, please see the above gray bottom.

Channel	Frequency (MHz)
00	2402
01	2404
⋮	⋮
19	2440
⋮	⋮
38	2478
39	2480

➤ Test mode

For RF test items
The engineering test program was provided and enabled to make EUT continuous transmit (duty cycle>98%).
For AC power line conducted emissions:
The EUT was set to connect with the Bluetooth instrument under large package sizes transmission.
For RF test axis
EUT in each of three orthogonal axis emissions had been tested ,but only the worst case (X axis) data Recorded in the report.

3.4. EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

/	Manufacturer:	/
	Model No.:	/
/	Manufacturer:	/
	Model No.:	/

3.5. Modifications

No modifications were implemented to meet testing criteria.

4. TEST ENVIRONMENT

4.1. Address of the test laboratory

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.

Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

4.2. Test Facility

CNAS-Lab Code: L1225

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 3902.01

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 762235

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files.

IC-Registration No.:5377B-1

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No.: 5377B-1.

ACA

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

4.3. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

4.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors in calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report according to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the Shenzhen Huatongwei International Inspection Co., Ltd. quality system according to ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Here after the best measurement capability for Shenzhen Huatongwei International Inspection Co., Ltd. is reported:

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.57 dB	(1)
Transmitter power Radiated	2.20 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.39 dB	(1)
Radiated Emissions 30~1000MHz	4.24 dB	(1)
Radiated Emissions 1~18GHz	5.16 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

4.5. Equipments Used during the Test

Conducted Emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Artificial Mains	Rohde&Schwarz	ESH2-Z5	100028	2016/11/13
2	EMI Test Receiver	Rohde&Schwarz	ESCI3	100038	2016/11/13
3	Pulse Limiter	Rohde&Schwarz	ESHSZ2	100044	2016/11/13
4	EMI Test Software	Rohde&Schwarz	ES-K1 V1.71	-	-

Radiated Emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	EMI test receiver	Rohde&Schwarz	ESI 26	100009	2016/11/13
2	Loop Antenna	Rohde&Schwarz	HFH2-Z2	100020	2016/11/13
3	Ultra-Broadband Antenna	ShwarzBeck	VULB9163	538	2016/11/13
4	Horn antenna	ShwarzBeck	9120D	1011	2016/11/13
5	Horn Antenna	SCHWARZBECK	BBHA9170	25841	2016/11/13
6	Amplifier	Sonoma	310N	E009-13	2016/11/13
7	JS Amplifier	Rohde&Schwarz	JS4-00101800-28-5A	F201504	2016/11/13
8	Amplifier	Compliance Direction systems	PAP1-4060	120	2016/11/13
9	High pass filter	Compliance Direction systems	BSU-6	34202	2016/11/13
10	EMI test Software	Rohde&Schwarz	ESK1	-	-
11	EMI test Software	Audix	E3	-	-
12	TURNTABLE	MATURO	TT2.0	-	-
13	ANTENNA MAST	MATURO	TAM-4.0-P	-	-

RF Conducted methods					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Last Cal.
1	Spectrum Analyzer	Rohde&Schwarz	FSP	1164.4391.40	2016/11/13
2	MXA Signal Analyzer	Agilent Technologies	N9020A	MY5050187	2016/11/13

The Cal.Interval was one year.

5. TEST CONDITIONS AND RESULTS

5.1. Antenna Requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 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, 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.

FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 1.8dBi.

TEST RESULTS

Passed Not Applicable

The directional gain of the antenna less than 6dBi, please refer to the below antenna photo.



5.2. Conducted Emissions (AC Main)

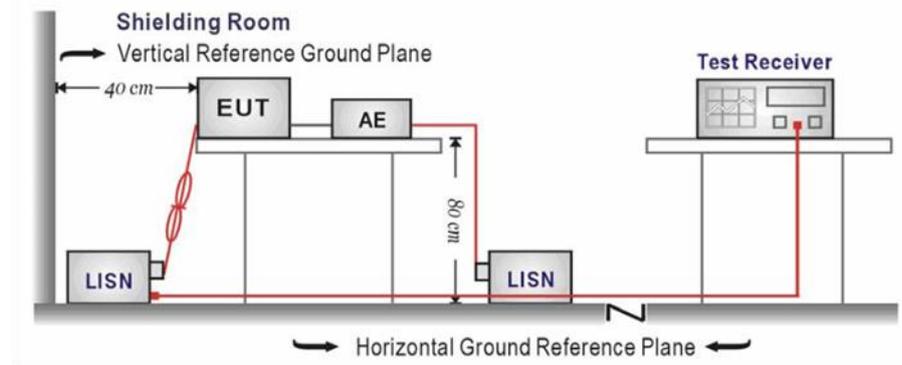
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment.
4. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
5. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
6. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
7. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
8. During the above scans, the emissions were maximized by cable manipulation.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

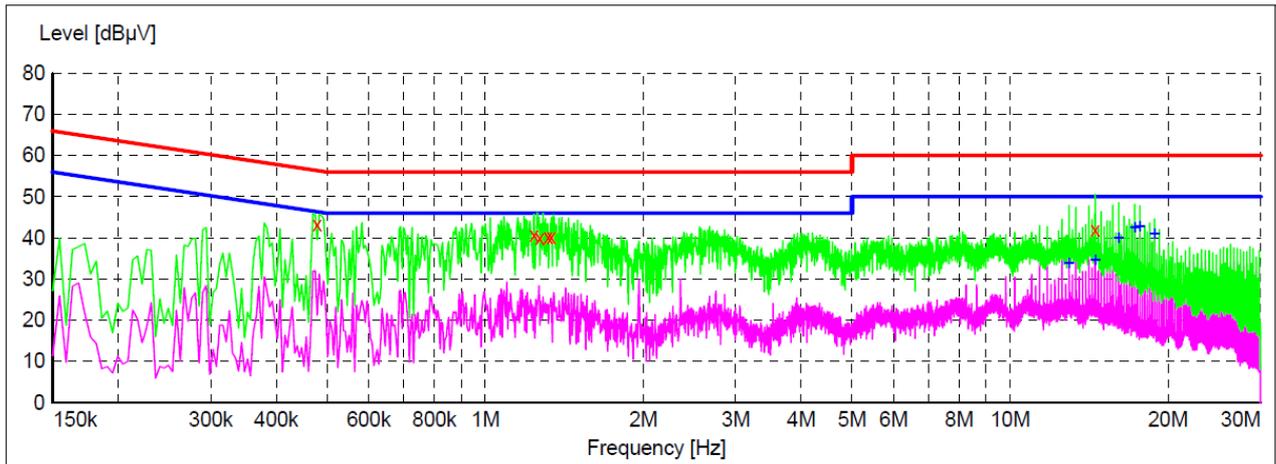
Passed Not Applicable

Note:

- 1) Transd = Cable lose + Pulse Limiter Factor + Artificial Mains Factor
- 2) Margin = Limit - Level

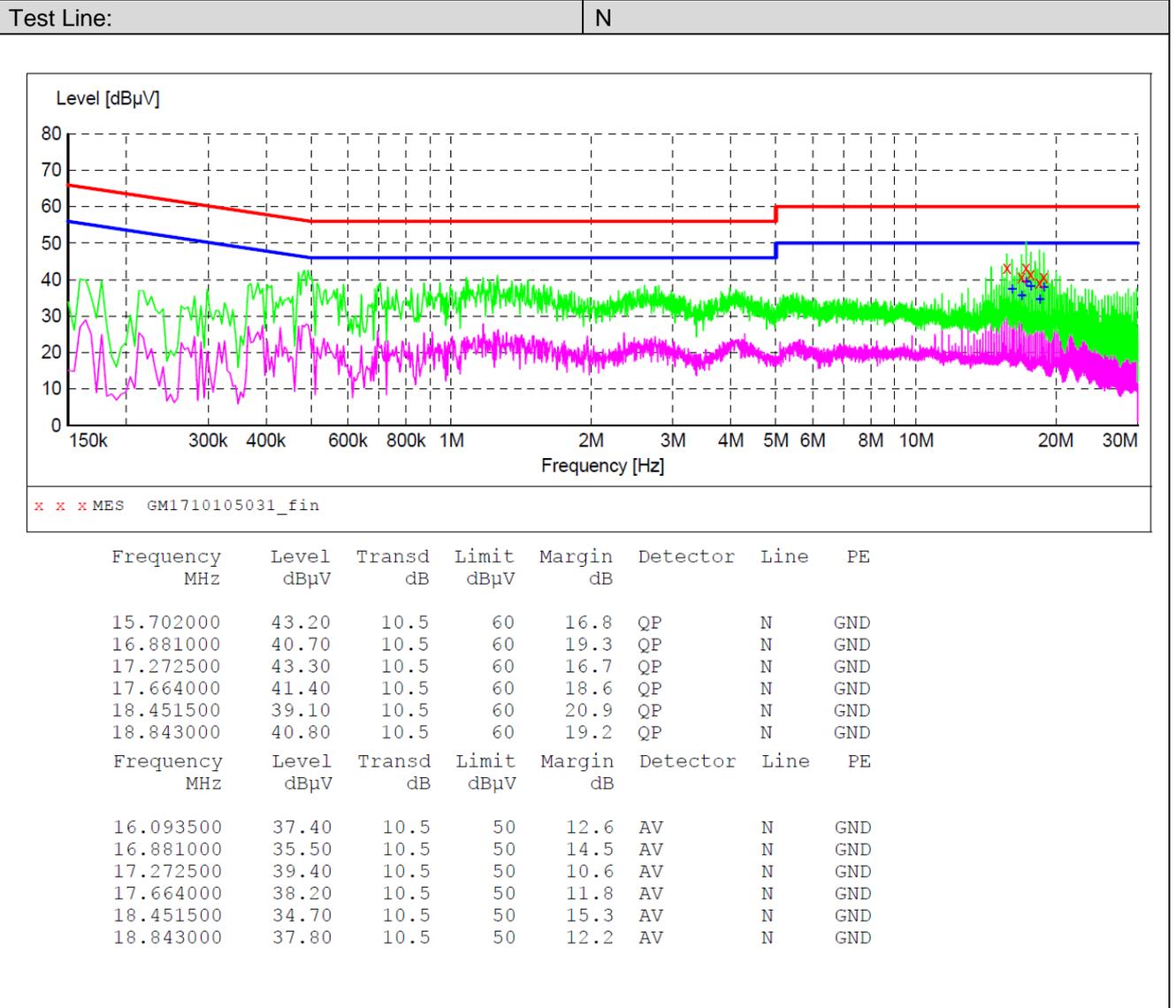
Test Line:

L



x x x MES GM1710105032_fin

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.478500	43.20	10.2	56	13.2	QP	L1	GND
1.239000	40.80	10.2	56	15.2	QP	L1	GND
1.270500	40.00	10.2	56	16.0	QP	L1	GND
1.320000	40.30	10.2	56	15.7	QP	L1	GND
1.338000	40.10	10.2	56	15.9	QP	L1	GND
14.532000	42.00	10.5	60	18.0	QP	L1	GND
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
12.957000	33.90	10.5	50	16.1	AV	L1	GND
14.532000	34.70	10.5	50	15.3	AV	L1	GND
16.098000	40.00	10.5	50	10.0	AV	L1	GND
17.277000	42.40	10.5	50	7.6	AV	L1	GND
17.668500	42.80	10.5	50	7.2	AV	L1	GND
18.847500	41.00	10.5	50	9.0	AV	L1	GND

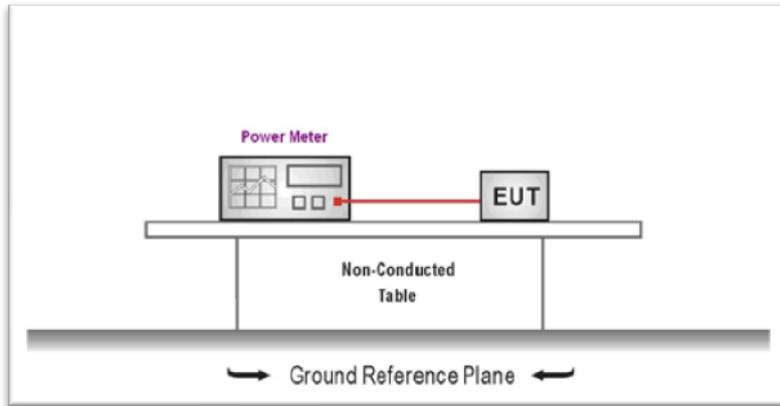


5.3. Conducted Peak Output Power

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (b)(3): **30 dBm**

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was tested according to ANSI C63.10: 2013 and KDB 558074 D01 for compliance to FCC 47 CFR 15.247 requirements.
2. The maximum peak conducted output power may be measured using a broadband peak RF power meter.
3. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.
4. Record the measurement data.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

Passed **Not Applicable**

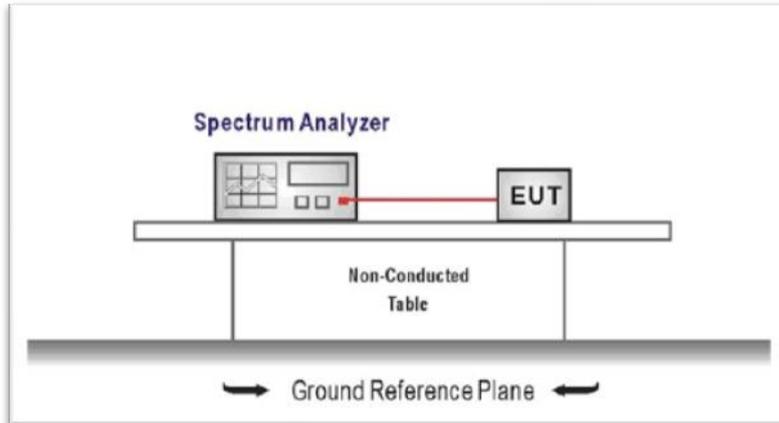
Type	Channel	Output power (dBm)	Limit (dBm)	Result
BT-BLE	00	-11.954	≤30.00	Pass
	19	-11.989		
	39	-12.672		

5.4. Power Spectral Density

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (e): 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.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input,
2. Configure the spectrum analyzer as shown below:
 Center frequency=DTS channel center frequency
 Span =1.5 times the DTS bandwidth
 RBW = 3 kHz ≤ RBW ≤ 100 kHz, VBW ≥ 3 × RBW
 Sweep time = auto couple
 Detector = peak
 Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter wave form on the spectrum analyzer.
4. Use the peak marker function to determine the maximum amplitude level within the RBW.
5. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

Passed Not Applicable

Type	Channel	Power Spectral Density(dBm/RBW)	Limit (dBm/RBW)	Result
BT-BLE	00	-26.039	≤8.00	Pass
	19	-24.459		
	39	-25.071		

Test plot as follows:

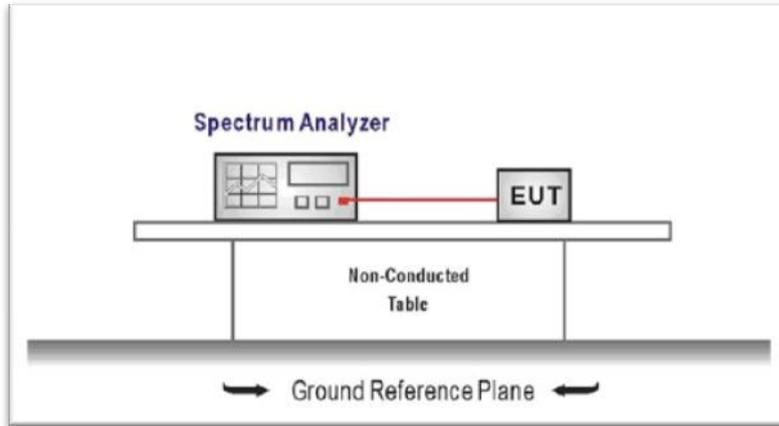
<p>CH00</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.40200000 GHz</p> <p>Start Freq 2.401500000 GHz</p> <p>Stop Freq 2.402500000 GHz</p> <p>CF Step 100.000 kHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH19</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.44000000 GHz</p> <p>Start Freq 2.439500000 GHz</p> <p>Stop Freq 2.440500000 GHz</p> <p>CF Step 100.000 kHz Auto Man</p> <p>Freq Offset 0 Hz</p>
<p>CH39</p>		<p>Frequency</p> <p>Auto Tune</p> <p>Center Freq 2.48000000 GHz</p> <p>Start Freq 2.479500000 GHz</p> <p>Stop Freq 2.480500000 GHz</p> <p>CF Step 100.000 kHz Auto Man</p> <p>Freq Offset 0 Hz</p>

5.5. 6dB bandwidth

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(2):For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Configure the spectrum analyzer as shown below (enter all losses between the transmitter output and the spectrum analyzer).
 Center Frequency =DTS channel center frequency
 Span=2 x DTS bandwidth
 RBW = 100 kHz, VBW ≥ 3 × RBW
 Sweep time= auto couple
 Detector = Peak
 Trace mode = max hold
3. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
4. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission, and record the pertinent measurements.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

Passed **Not Applicable**

Type	Channel	6dB Bandwidth(kHz)	Limit (kHz)	Result
BT-BLE	00	0.6640	≥500	Pass
	19	0.5293		
	39	0.6797		

Test plot as follows:

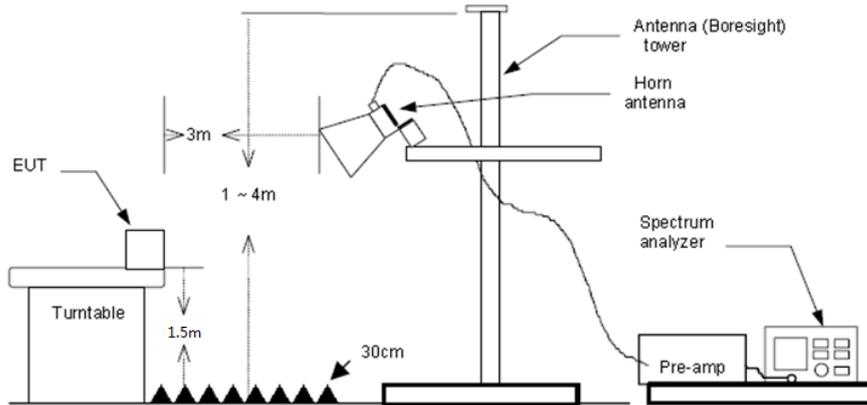
CH00	 <p>Agilent Spectrum Analyzer - Occupied BW Center Freq 2.40200000 GHz Center Freq: 2.40200000 GHz Trig: Free Run #IFGain: Low #Atten: 20 dB Avg/Hold: 10/10 Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref Offset 1 dB Ref 11.00 dBm</p> <p>Center 2.402 GHz #Res BW 100 kHz #VBW 300 kHz Span 2 MHz Sweep 1.067 ms</p> <p>Occupied Bandwidth 1.0385 MHz Total Power -5.45 dBm Transmit Freq Error 45.860 kHz OBW Power 99.00 % x dB Bandwidth 664.0 kHz x dB -6.00 dB</p> <p>Frequency Center Freq 2.40200000 GHz CF Step 200.000 kHz Freq Offset 0 Hz</p>	
CH19	 <p>Agilent Spectrum Analyzer - Occupied BW Center Freq 2.44000000 GHz Center Freq: 2.44000000 GHz Trig: Free Run #IFGain: Low #Atten: 20 dB Avg/Hold: 10/10 Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref Offset 1 dB Ref 11.00 dBm</p> <p>Center 2.44 GHz #Res BW 100 kHz #VBW 300 kHz Span 2 MHz Sweep 1.067 ms</p> <p>Occupied Bandwidth 1.0213 MHz Total Power -9.42 dBm Transmit Freq Error 61.471 kHz OBW Power 99.00 % x dB Bandwidth 529.3 kHz x dB -6.00 dB</p> <p>Frequency Center Freq 2.44000000 GHz CF Step 200.000 kHz Freq Offset 0 Hz</p>	
CH39	 <p>Agilent Spectrum Analyzer - Occupied BW Center Freq 2.48000000 GHz Center Freq: 2.48000000 GHz Trig: Free Run #IFGain: Low #Atten: 20 dB Avg/Hold: 10/10 Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref Offset 1 dB Ref 11.00 dBm</p> <p>Center 2.48 GHz #Res BW 100 kHz #VBW 300 kHz Span 2 MHz Sweep 1.067 ms</p> <p>Occupied Bandwidth 1.0434 MHz Total Power -6.41 dBm Transmit Freq Error 51.149 kHz OBW Power 99.00 % x dB Bandwidth 679.7 kHz x dB -6.00 dB</p> <p>Frequency Center Freq 2.48000000 GHz CF Step 200.000 kHz Freq Offset 0 Hz</p>	

5.6. Restricted band

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d):In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, Radiated Emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the Radiated Emissions limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:
 RBW=1MHz, VBW=3MHz Peak detector for Peak value.
 RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

Passed **Not Applicable**

Note:

- 1) Final level= Read level + Antenna Factor+ Cable Loss- Preamp Factor
- 2) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.

CH00									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2310.00	35.28	28.05	6.62	37.65	32.30	74.00	-41.70	Vertical	Peak
2390.03	34.52	27.65	6.75	37.87	31.05	74.00	-42.95	Vertical	Peak
2310.00	29.52	28.05	6.62	37.65	26.54	74.00	-47.46	Horizontal	Peak
2390.03	27.22	27.65	6.75	37.87	23.75	74.00	-50.25	Horizontal	Peak
2310.00	29.68	28.05	6.62	37.65	26.70	54.00	-27.30	Vertical	Average
2390.03	28.52	27.65	6.75	37.87	25.05	54.00	-28.95	Vertical	Average
2310.00	23.65	28.05	6.62	37.65	20.67	54.00	-33.33	Horizontal	Average
2390.03	23.22	27.65	6.75	37.87	19.75	54.00	-34.25	Horizontal	Average

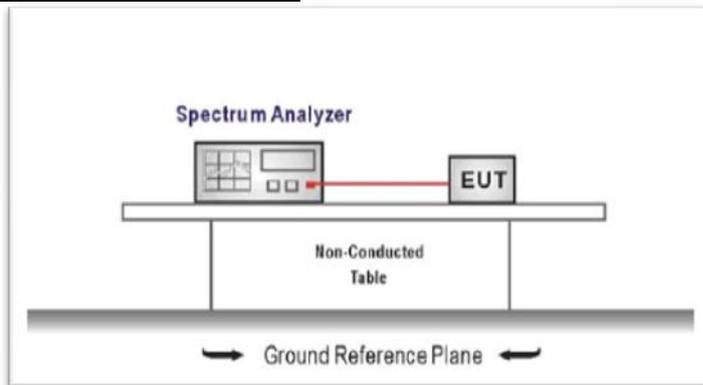
CH39									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
2483.50	35.67	27.26	6.83	37.87	31.89	74.00	-42.11	Vertical	Peak
2500.00	35.90	27.20	6.84	37.87	32.07	74.00	-41.93	Vertical	Peak
2483.50	35.64	27.26	6.83	37.87	31.86	74.00	-42.14	Horizontal	Peak
2500.00	37.91	27.20	6.84	37.87	34.08	74.00	-39.92	Horizontal	Peak
2483.50	28.26	27.26	6.83	37.87	24.48	54.00	-29.52	Vertical	Average
2500.00	28.34	27.20	6.84	37.87	24.51	54.00	-29.49	Vertical	Average
2483.50	28.84	27.26	6.83	37.87	25.06	54.00	-28.94	Horizontal	Average
2500.00	28.17	27.20	6.84	37.87	24.34	54.00	-29.66	Horizontal	Average

5.7. Band edge and Spurious Emissions (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

TEST CONFIGURATION



TEST PROCEDURE

1. Connect the antenna port(s) to the spectrum analyzer input.
2. Establish a reference level by using the following procedure
Center frequency=DTS channel center frequency
The span = 1.5 times the DTS bandwidth.
RBW = 100 kHz, VBW $\geq 3 \times$ RBW
Detector = peak, Sweep time = auto couple, Trace mode = max hold
Allow trace to fully stabilize
Use the peak marker function to determine the maximum PSD level

Note that the channel found to contain the maximum PSD level can be used to establish the reference level.

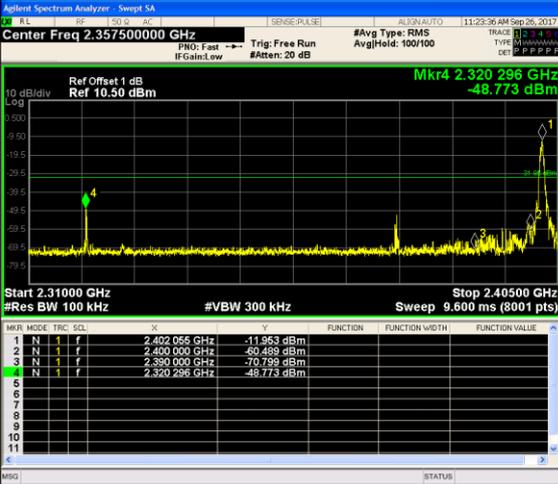
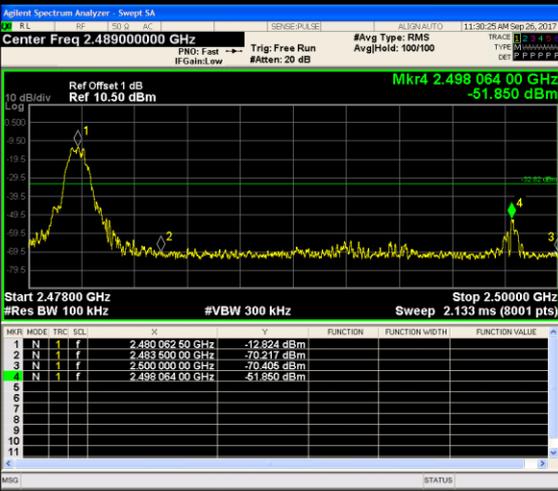
3. Emission level measurement
Set the center frequency and span to encompass frequency range to be measured
RBW = 100 kHz, VBW $\geq 3 \times$ RBW
Detector = peak, Sweep time = auto couple, Trace mode = max hold
Allow trace to fully stabilize
Use the peak marker function to determine the maximum amplitude level.
4. Place the radio in continuous transmit mode, allow the trace to stabilize, view the transmitter waveform on the spectrum analyzer.
5. Ensure that the amplitude of all unwanted emission outside of the authorized frequency band excluding restricted frequency bands) are attenuated by at least the minimum requirements specified (at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz). Report the three highest emission relative to the limit.

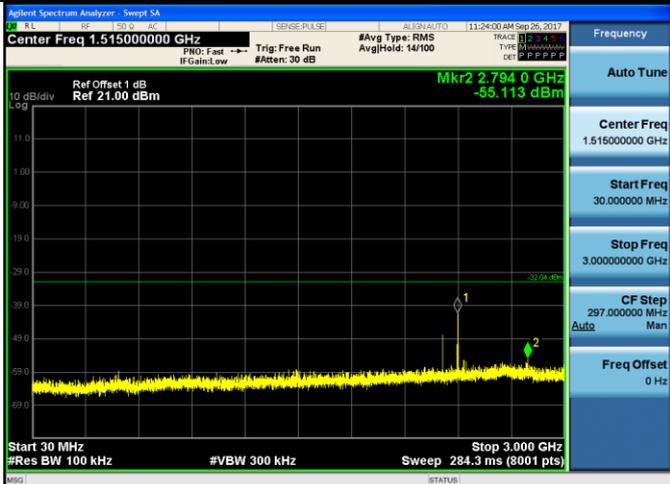
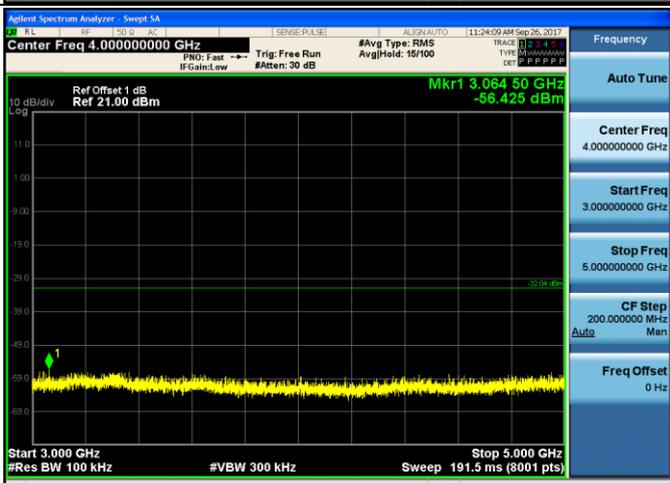
TEST MODE:

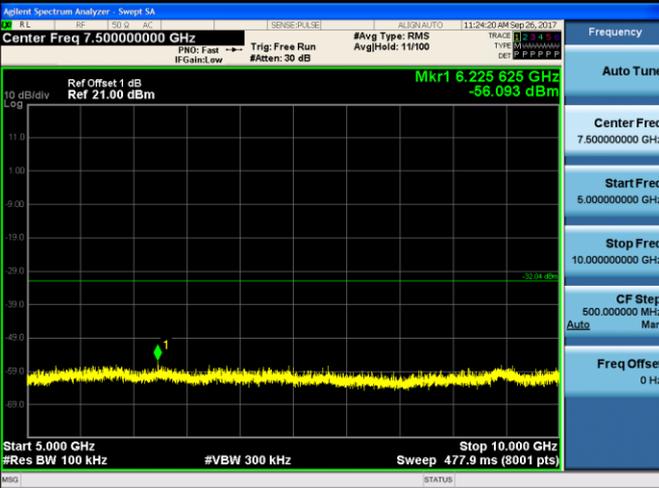
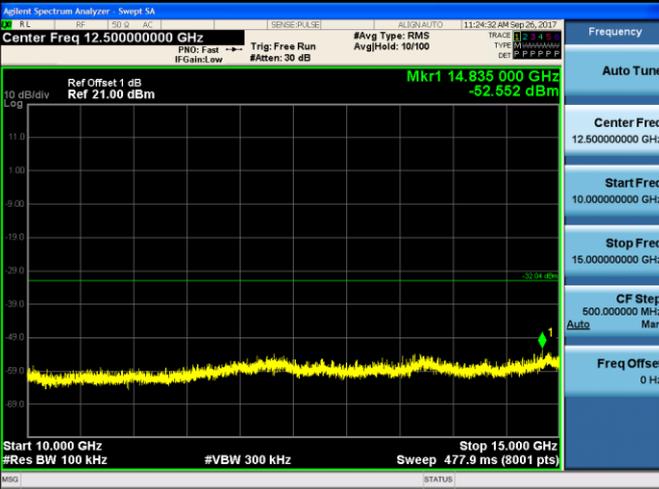
Please refer to the clause 3.3

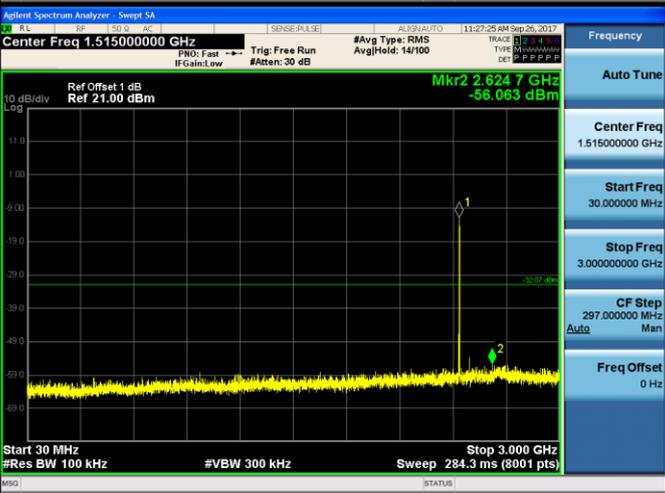
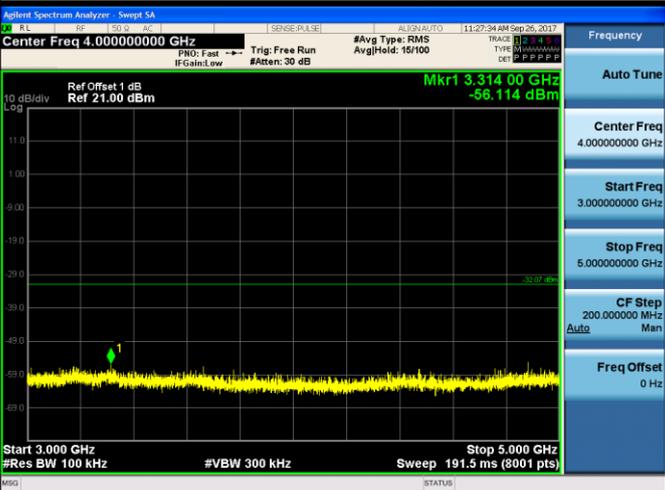
TEST RESULTS

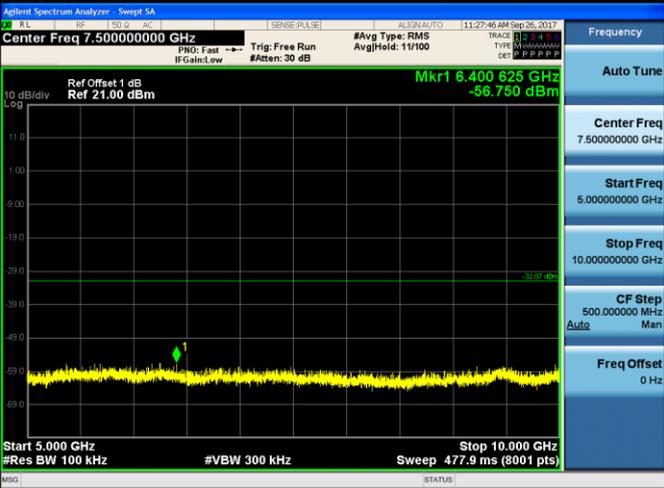
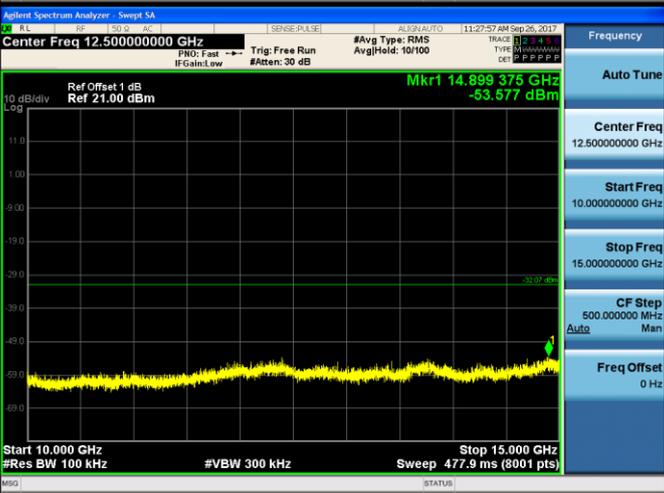
Passed Not Applicable

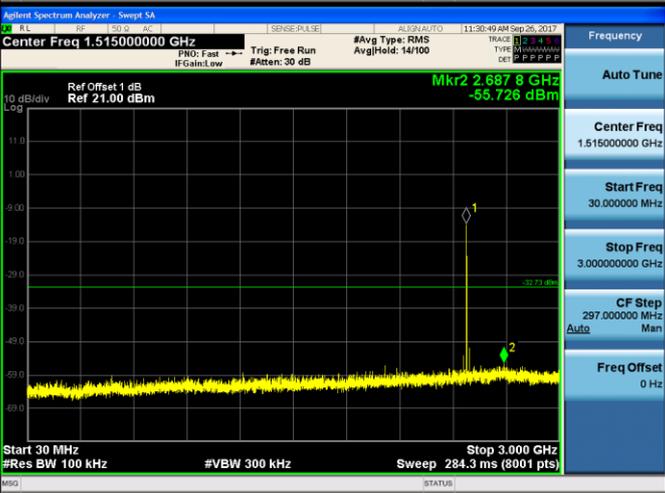
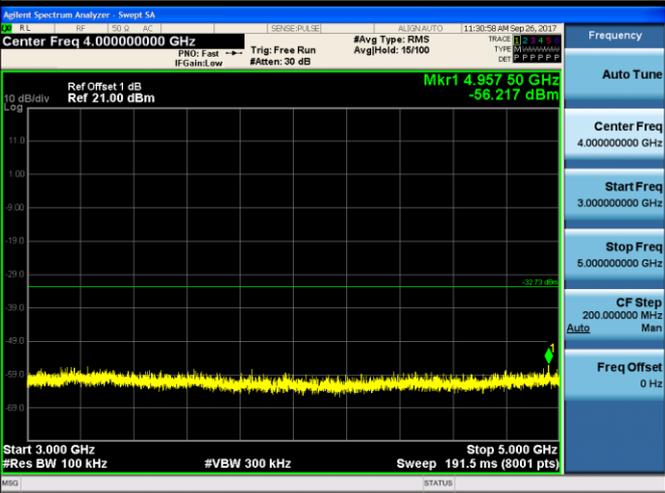
Test Item:	Band edge																																													
CH00	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.357500000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr4 2.320 296 GHz -48.773 dBm</p> <p>Start 2.31000 GHz #Res BW 100 kHz</p> <p>Stop 2.40500 GHz #VBW 300 kHz Sweep 9.600 ms (8001 pts)</p> <table border="1"> <thead> <tr> <th>MKR</th> <th>MODE</th> <th>TRC</th> <th>SCL</th> <th>X</th> <th>Y</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>N</td> <td>1</td> <td>f</td> <td>2.402 056 GHz</td> <td>-11.963 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>N</td> <td>1</td> <td>f</td> <td>2.400 000 GHz</td> <td>-60.489 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>N</td> <td>1</td> <td>f</td> <td>2.300 000 GHz</td> <td>-70.199 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>N</td> <td>1</td> <td>f</td> <td>2.320 296 GHz</td> <td>-48.773 dBm</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2.402 056 GHz	-11.963 dBm				2	N	1	f	2.400 000 GHz	-60.489 dBm				3	N	1	f	2.300 000 GHz	-70.199 dBm				4	N	1	f	2.320 296 GHz	-48.773 dBm			
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4	N	1	f	2.320 296 GHz	-48.773 dBm																																									
CH39	 <p>Agilent Spectrum Analyzer - Sweep SA</p> <p>Center Freq 2.489000000 GHz</p> <p>Ref Offset 1 dB Ref 10.50 dBm</p> <p>Mkr4 2.498 064 00 GHz -51.850 dBm</p> <p>Start 2.47800 GHz #Res BW 100 kHz</p> <p>Stop 2.50000 GHz #VBW 300 kHz Sweep 2.133 ms (8001 pts)</p> <table border="1"> <thead> <tr> <th>MKR</th> <th>MODE</th> <th>TRC</th> <th>SCL</th> <th>X</th> <th>Y</th> <th>FUNCTION</th> <th>FUNCTION WIDTH</th> <th>FUNCTION VALUE</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>N</td> <td>1</td> <td>f</td> <td>2.480 062 50 GHz</td> <td>-12.524 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>2</td> <td>N</td> <td>1</td> <td>f</td> <td>2.493 500 00 GHz</td> <td>-70.217 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>3</td> <td>N</td> <td>1</td> <td>f</td> <td>2.500 000 00 GHz</td> <td>-70.495 dBm</td> <td></td> <td></td> <td></td> </tr> <tr> <td>4</td> <td>N</td> <td>1</td> <td>f</td> <td>2.498 064 00 GHz</td> <td>-51.850 dBm</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	1	N	1	f	2.480 062 50 GHz	-12.524 dBm				2	N	1	f	2.493 500 00 GHz	-70.217 dBm				3	N	1	f	2.500 000 00 GHz	-70.495 dBm				4	N	1	f	2.498 064 00 GHz	-51.850 dBm			
MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE																																						
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3	N	1	f	2.500 000 00 GHz	-70.495 dBm																																									
4	N	1	f	2.498 064 00 GHz	-51.850 dBm																																									

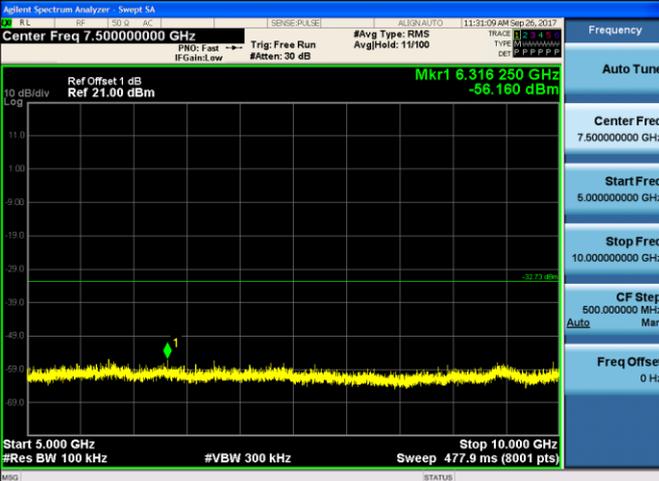
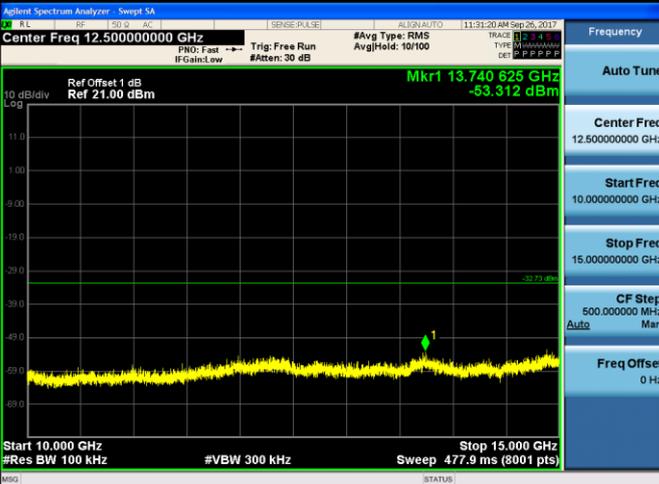
Test Item:	SE
<p>CH00 Reference level</p>	
<p>CH00 30MHz~3GHz</p>	
<p>CH00 3GHz~5GHz</p>	

<p>CH00 5GHz~10GHz</p>	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 7.500000000 GHz #Avg Type: RMS AvgHold: 11/100 Ref Offset 1 dB Ref 21.00 dBm Mkr1 6.225 625 GHz -56.093 dBm Start 5.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 477.9 ms (8001 pts)</p>	<p>Frequency Auto Tune Center Freq 7.500000000 GHz Start Freq 5.000000000 GHz Stop Freq 10.000000000 GHz CF Step 500.000000 MHz Auto Man Freq Offset 0 Hz</p>
<p>CH00 10GHz~15GHz</p>	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 12.500000000 GHz #Avg Type: RMS AvgHold: 10/100 Ref Offset 1 dB Ref 21.00 dBm Mkr1 14.835 000 GHz -52.552 dBm Start 10.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 477.9 ms (8001 pts)</p>	<p>Frequency Auto Tune Center Freq 12.500000000 GHz Start Freq 10.000000000 GHz Stop Freq 15.000000000 GHz CF Step 500.000000 MHz Auto Man Freq Offset 0 Hz</p>
<p>CH00 15GHz~25GHz</p>	 <p>Agilent Spectrum Analyzer - Sweep SA Center Freq 20.000000000 GHz #Avg Type: RMS AvgHold: 5/100 Ref Offset 1 dB Ref 23.00 dBm Mkr1 24.323 75 GHz -44.035 dBm Start 15.000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 955.7 ms (8001 pts)</p>	<p>Frequency Auto Tune Center Freq 20.000000000 GHz Start Freq 15.000000000 GHz Stop Freq 25.000000000 GHz CF Step 1.000000000 GHz Auto Man Freq Offset 0 Hz</p>

<p>CH19 Reference level</p>		
<p>CH19 30MHz~3GHz</p>		
<p>CH19 3GHz~5GHz</p>		

<p>CH19 5GHz~10GHz</p>		
<p>CH19 10GHz~15GHz</p>		
<p>CH19 15GHz~25GHz</p>		

<p>CH39 Reference level</p>		
<p>CH39 30MHz~3GHz</p>		
<p>CH39 3GHz~5GHz</p>		

<p>CH39 5GHz~10GHz</p>		
<p>CH39 10GHz~15GHz</p>		
<p>CH39 15GHz~25GHz</p>		

5.8. Spurious Emissions (radiated)

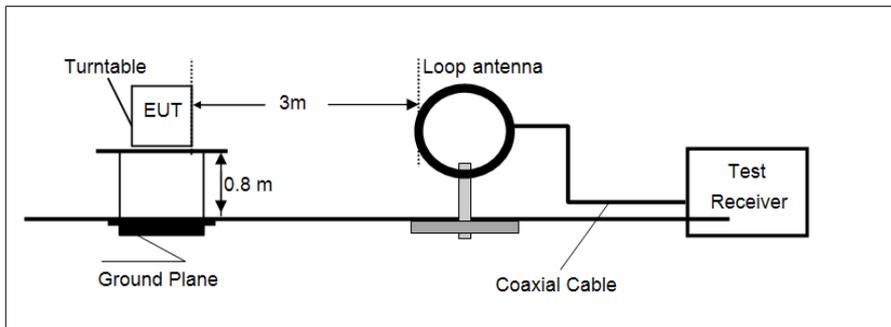
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.209

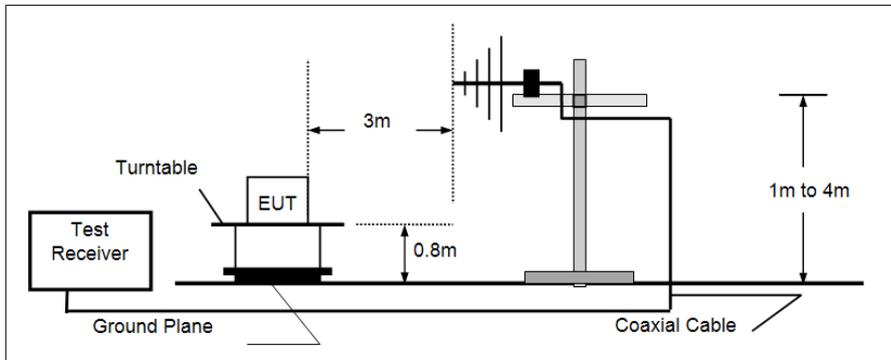
Frequency	Limit (dBuV/m @3m)	Value
30MHz~88MHz	40.00	Quasi-peak
88MHz~216MHz	43.50	Quasi-peak
216MHz~960MHz	46.00	Quasi-peak
960MHz~1GHz	54.00	Quasi-peak
Above 1GHz	54.00	Average
	74.00	Peak

TEST CONFIGURATION

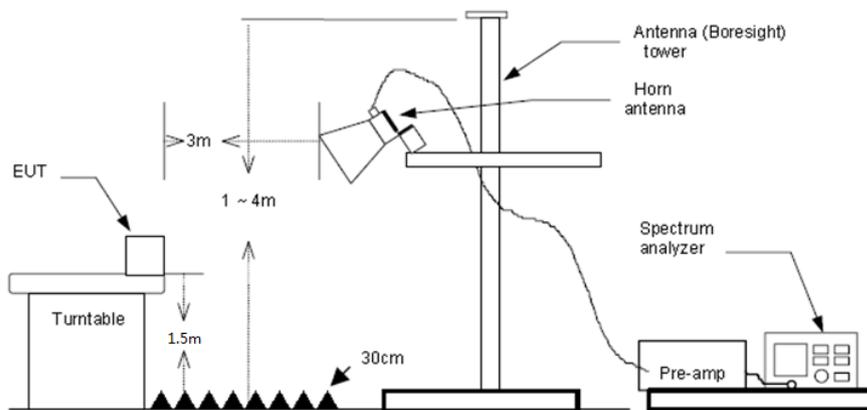
- 9 kHz ~ 30 MHz



- 30 MHz ~ 1 GHz



- Above 1 GHz



TEST PROCEDURE

1. The EUT was setup and tested according to ANSI C63.10:2013 for compliance to FCC 47CFR 15.247 requirements.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. Use the following spectrum analyzer settings
 - (1) Span shall wide enough to fully capture the emission being measured;
 - (2) Below 1 GHz, RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
 - (3) Above 1GHz, RBW=1MHz, VBW=3MHz Peak detector for Peak value.
RBW=1MHz, VBW=3MHz RMS detector for Average value.

TEST MODE:

Please refer to the clause 3.3

TEST RESULTS

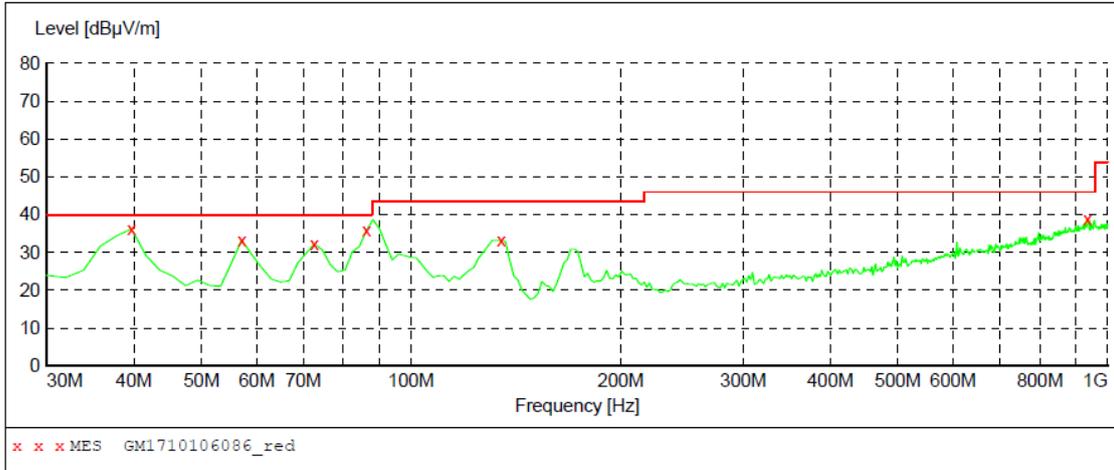
Passed **Not Applicable**

Note:

- 1) Above 1GHz Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
 - 2) The emission levels of other frequencies are very lower than the limit and not show in test report.
- **9 kHz ~ 30 MHz**
The EUT was pre-scanned the frequency band (9 kHz ~ 30 MHz), found the radiated level lower than the limit, so don't show on the report.
- **30 MHz ~ 1000 MHz**
Have pre-scan all modulation mode, found the BT-BLE mode CH39 which it was worst case, so only the worst case's data on the test report.

➤ 30 MHz ~ 1 GHz

Polarization: Vertical

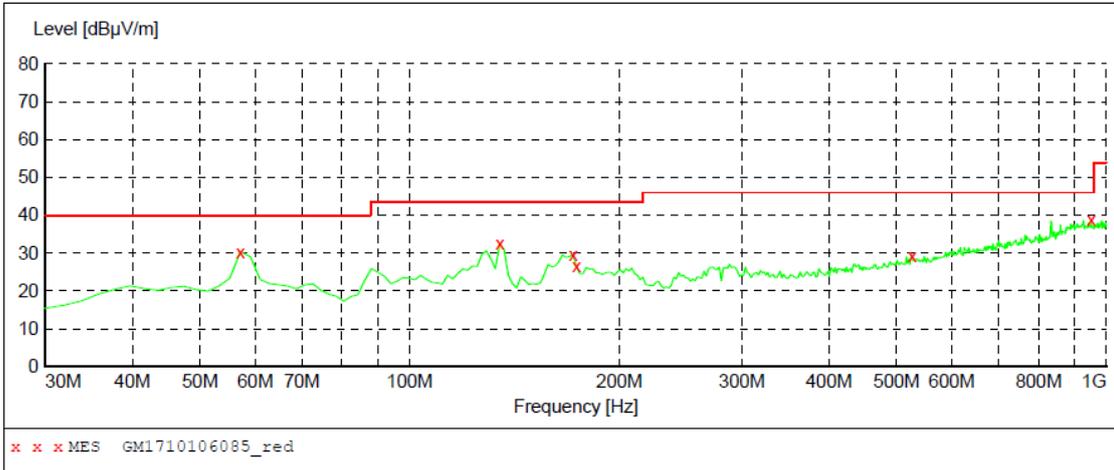


MEASUREMENT RESULT: "GM1710106086_red"

10/10/2017 8:46PM

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
39.700000	36.30	-10.1	40.0	3.7	---	100.0	306.00	VERTICAL
57.160000	33.30	-9.4	40.0	6.7	---	100.0	279.00	VERTICAL
72.680000	32.30	-14.1	40.0	7.7	---	100.0	131.00	VERTICAL
86.260000	35.70	-14.1	40.0	4.3	---	100.0	211.00	VERTICAL
134.760000	33.20	-13.7	43.5	10.3	---	100.0	227.00	VERTICAL
935.980000	38.90	7.1	46.0	7.1	---	100.0	267.00	VERTICAL

Polarization: Horizontal



MEASUREMENT RESULT: "GM1710106085_red"

10/10/2017 8:39PM

Frequency MHz	Level dBuV/m	Transd dB	Limit dBuV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
57.160000	30.30	-9.4	40.0	9.7	---	300.0	177.00	HORIZONTAL
134.760000	32.50	-13.7	43.5	11.0	---	300.0	0.00	HORIZONTAL
171.620000	29.70	-12.9	43.5	13.8	---	300.0	56.00	HORIZONTAL
173.560000	26.60	-12.8	43.5	16.9	---	300.0	56.00	HORIZONTAL
526.640000	29.20	-1.2	46.0	16.8	---	300.0	125.00	HORIZONTAL
951.500000	38.70	7.3	46.0	7.3	---	100.0	320.00	HORIZONTAL

➤ Above 1 GHz

CH00									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1589.29	44.05	24.99	5.54	36.71	37.87	74.00	-36.13	Vertical	Peak
2987.92	46.32	28.59	7.47	38.24	44.14	74.00	-29.86	Vertical	Peak
4809.50	42.86	31.58	9.55	36.93	47.06	74.00	-26.94	Vertical	Peak
8747.72	33.73	37.80	13.05	34.34	50.24	74.00	-23.76	Vertical	Peak
1659.57	46.27	25.08	5.69	36.85	40.19	74.00	-33.81	Horizontal	Peak
2995.54	45.95	28.60	7.48	38.23	43.80	74.00	-30.20	Horizontal	Peak
4809.50	44.16	31.58	9.55	36.93	48.36	74.00	-25.64	Horizontal	Peak
7063.69	32.85	35.49	11.85	34.88	45.31	74.00	-28.69	Horizontal	Peak

CH19									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1993.40	40.15	26.24	6.26	37.29	35.36	74.00	-38.64	Vertical	Peak
2995.54	44.60	28.60	7.48	38.23	42.45	74.00	-31.55	Vertical	Peak
4883.52	43.29	31.43	9.59	36.73	47.58	74.00	-26.42	Vertical	Peak
6974.36	36.02	35.15	11.82	34.82	48.17	74.00	-25.83	Vertical	Peak
1593.34	46.94	24.96	5.55	36.71	40.74	74.00	-33.26	Horizontal	Peak
2995.54	45.49	28.60	7.48	38.23	43.34	74.00	-30.66	Horizontal	Peak
4883.52	42.42	31.43	9.59	36.73	46.71	74.00	-27.29	Horizontal	Peak
8002.06	33.55	37.10	12.30	34.53	48.42	74.00	-25.58	Horizontal	Peak

CH39									
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization	Test value
1746.25	49.93	25.29	5.86	37.03	44.05	74.00	-29.95	Vertical	Peak
2124.37	46.94	26.90	6.38	37.32	42.90	74.00	-31.10	Vertical	Peak
2987.92	50.42	28.59	7.47	38.24	48.24	74.00	-25.76	Vertical	Peak
4983.99	44.57	31.48	9.66	36.44	49.27	74.00	-24.73	Vertical	Peak
1659.57	42.25	25.08	5.69	36.85	36.17	74.00	-37.83	Horizontal	Peak
3168.08	37.28	28.80	7.68	38.20	35.56	74.00	-38.44	Horizontal	Peak
4958.68	38.99	31.46	9.64	36.52	43.57	74.00	-30.43	Horizontal	Peak
6594.52	32.74	34.19	11.35	35.36	42.92	74.00	-31.08	Horizontal	Peak

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The peak level is lower than average limit (54 dBuV/m), this data is the too weak instrument of signal is unable to test.
3. The emission levels of other frequencies are very lower than the limit and not show in test report.

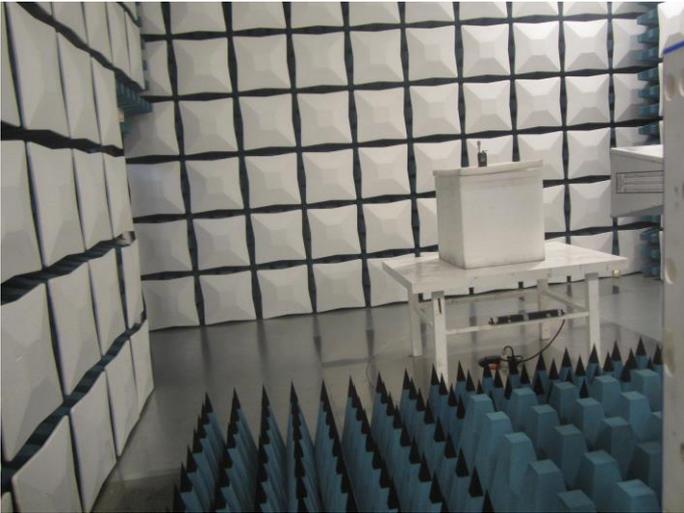
6. Test Setup Photos of the EUT

Conducted Emissions (AC Mains)



Radiated Emissions





7. External and Internal Photos of the EUT

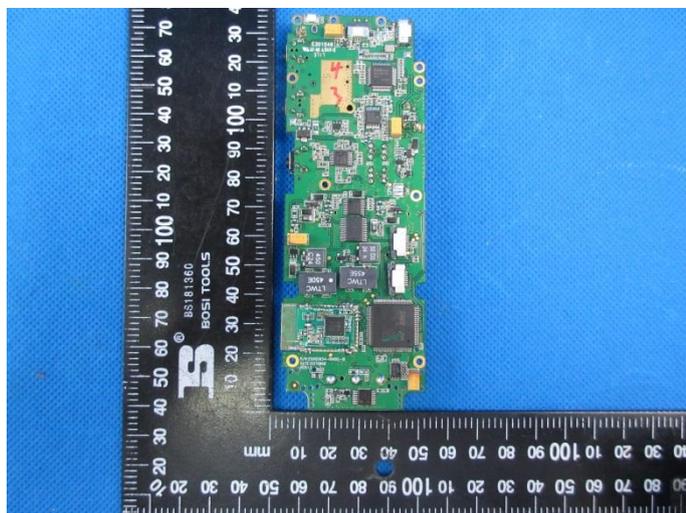
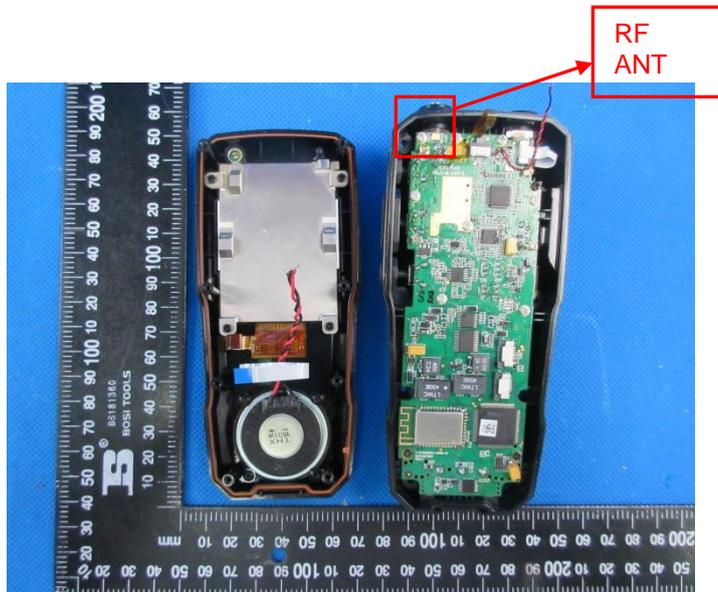
External Photos of the EUT

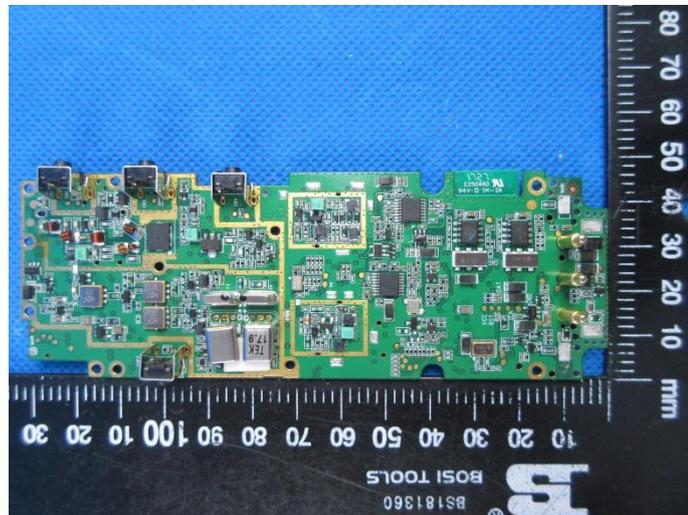


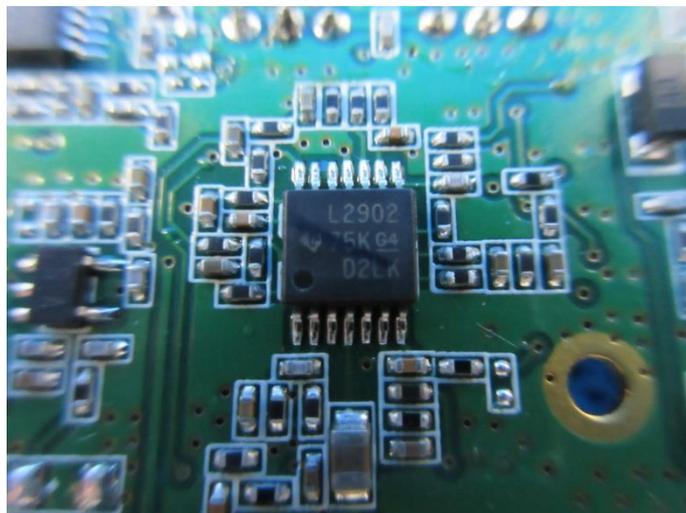
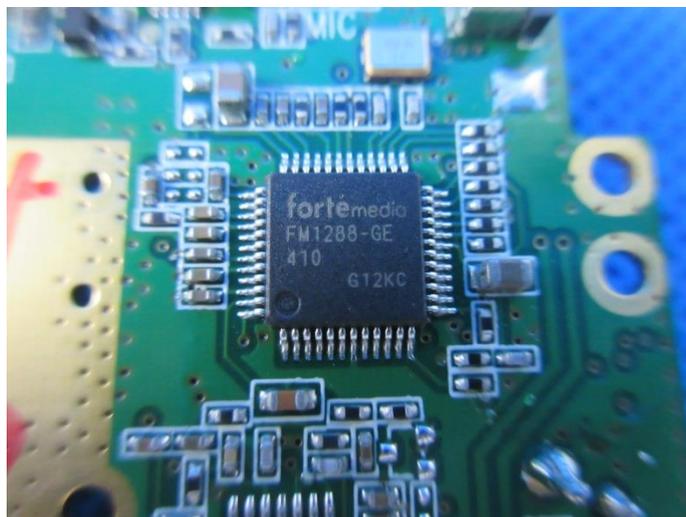


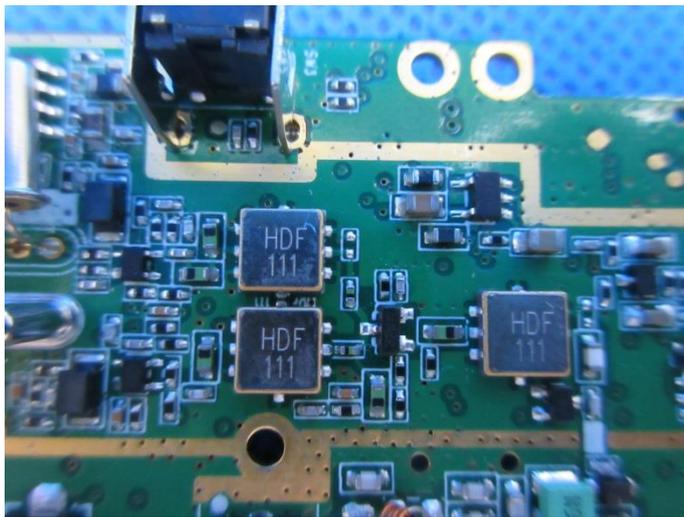
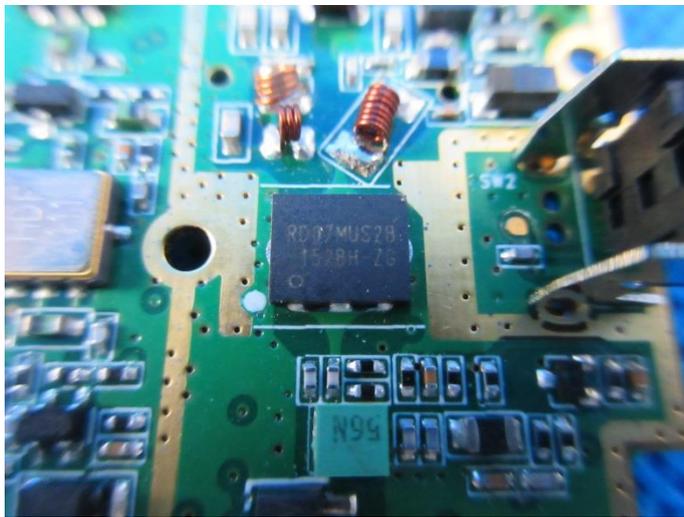


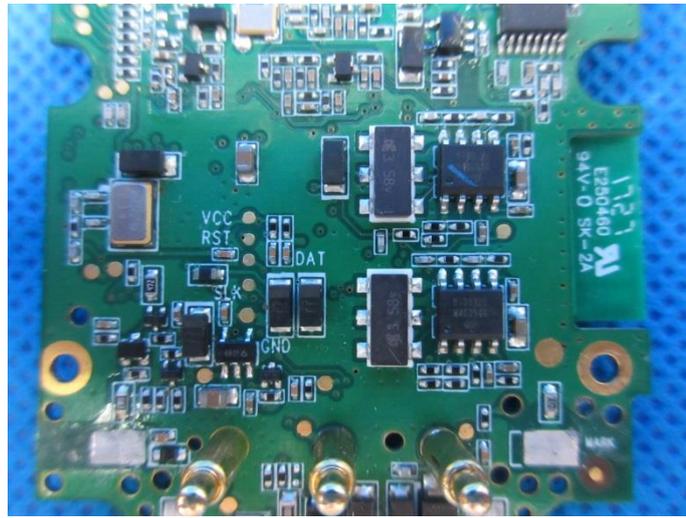
Internal Photos of the EUT











-----End of Report-----