

FCC Report (Bluetooth)

Applicant: FORM ELECTRONICS CO.,Ltd

Address of Applicant: 4F Bldg E, Junfeng Science&Technology Park, Lezhujiao, Xixiang, Bao'an Dist, Shenzhen, China

Manufacturer/Factory: FORM ELECTRONICS CO.,Ltd

Address of Manufacturer/Factory: 4F Bldg E, Junfeng Science&Technology Park, Lezhujiao, Xixiang, Bao'an Dist, Shenzhen, China

Equipment Under Test (EUT)

Product Name: Bluetooth Speaker

Model No.: FM0184, FM0164

FCC ID: 2AAL7-FM0184

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Date of sample receipt: June 20, 2018

Date of Test: June 21-26, 2018

Date of report issued: June 27, 2018

Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Robinson Lo

Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	June 27, 2018	Original

Prepared By:

Bill. Yuan
Project Engineer

Date:

June 27, 2018

Check By:

Andy. Wu
Reviewer

Date:

June 27, 2018

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4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Output Power	15.247 (b)(3)	Pass
Channel Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Spurious Emission	15.205/15.209	Pass

Pass: The EUT complies with the essential requirements in the standard.

Remark: Test according to ANSI C63.10:2013.

Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	$\pm 4.34\text{dB}$	(1)
Radiated Emission	30MHz ~ 1000MHz	$\pm 4.24\text{dB}$	(1)
Radiated Emission	1GHz ~ 26.5GHz	$\pm 4.68\text{dB}$	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	$\pm 3.45\text{dB}$	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 General Description of EUT

Product Name:	Bluetooth Speaker
Model No.:	FM0184, FM0164
Test Model No:	FM0184
<i>Remark: All above models are identical in the same PCB layout, interior structure and electrical circuits. The differences are color and model name for commercial purpose.</i>	
Serial No.:	FM0184-2018060026
Test sample(s) ID:	GTS201806000246-1
Sample(s) Status	Engineer sample
Hardware version:	FM0184-V0.3 2018-04-29
Software version:	US6988A_(J-023)(LACOSTE SPEAKER)_DIDI_20180518_v1.1
Operation Frequency:	2402MHz~2480MHz
Channel Numbers:	40
Channel Separation:	2MHz
Modulation Type:	GFSK
Antenna Type:	PCB Antenna
Antenna Gain:	0dBi(declare by applicant)
Power Supply:	Battery: 3.7V, 2000mAh

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	11	2422MHz	21	2442MHz	31	2462MHz
2	2404MHz	12	2424MHz	22	2444MHz	32	2464MHz
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
9	2418MHz	19	2438MHz	29	2458MHz	39	2478MHz
10	2420MHz	20	2440MHz	30	2460MHz	40	2480MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2402MHz
The middle channel	2440MHz
The Highest channel	2480MHz

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode
<i>Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i>	

5.3 Description of Support Units

None.

5.4 Test Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none">● FCC —Registration No.: 381383 Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383, January 08, 2018.● Industry Canada (IC) —Registration No.: 9079A-2 The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.

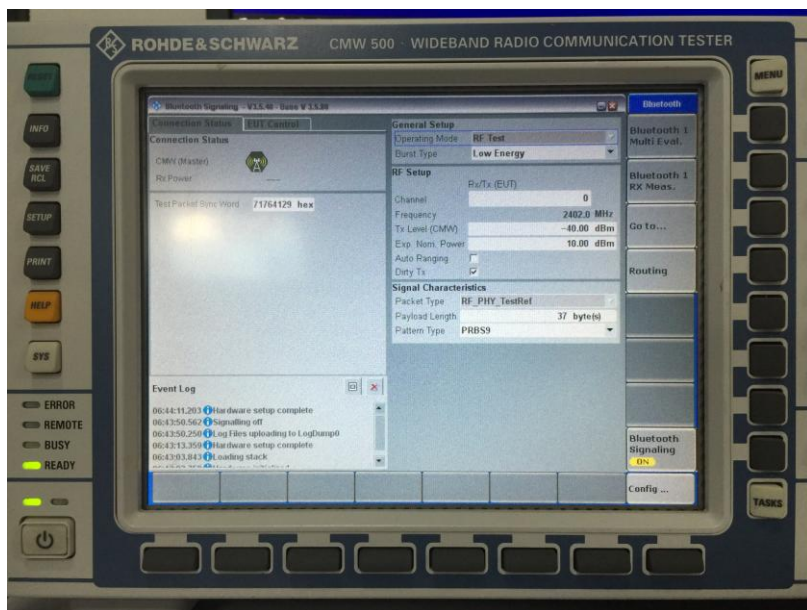
5.5 Test Location

All tests were performed at:
Global United Technology Services Co., Ltd. Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960

5.6 Additional Instructions

EUT Fixed Frequency Settings:

Power level setup			
Support Units	Description	Manufacturer	Model
	Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500
Mode	Channel	Frequency (MHz)	Level Set
GFSK	CH01	2402	TX level : Maximum
	CH20	2440	
	CH40	2480	



6 Test Instruments list

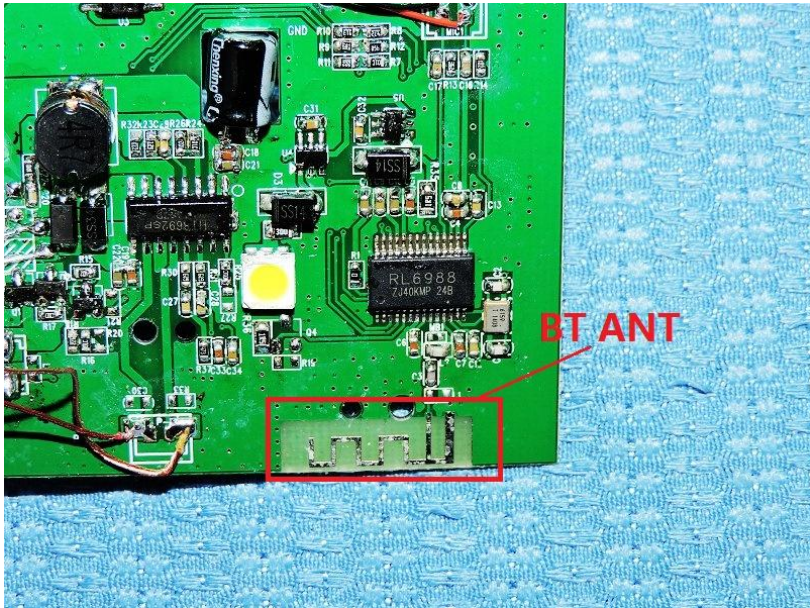
Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July 03 2015	July 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June 28 2017	June 27 2018
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June 28 2017	June 27 2018
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June 28 2017	June 27 2018
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 28 2017	June 27 2018
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	June 28 2017	June 27 2018
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	June 28 2017	June 27 2018
10	Coaxial Cable	GTS	N/A	GTS211	June 28 2017	June 27 2018
11	Coaxial cable	GTS	N/A	GTS210	June 28 2017	June 27 2018
12	Coaxial Cable	GTS	N/A	GTS212	June 28 2017	June 27 2018
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June 28 2017	June 27 2018
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June 28 2017	June 27 2018
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 28 2017	June 27 2018
16	Band filter	Amindeon	82346	GTS219	June 28 2017	June 27 2018
17	Power Meter	Anritsu	ML2495A	GTS540	June 28 2017	June 27 2018
18	Power Sensor	Anritsu	MA2411B	GTS541	June 28 2017	June 27 2018
19	Loop Antenna	ZHINAN	ZN30900A	GTS534	June 28 2017	June 27 2018

Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.16 2014	May.15 2019
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June 28 2017	June 27 2018
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June 28 2017	June 27 2018
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June 28 2017	June 27 2018
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June 28 2017	June 27 2018

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Barometer	ChangChun	DYM3	GTS257	June 28 2017	June 27 2018

7 Test results and Measurement Data

7.1 Antenna requirement

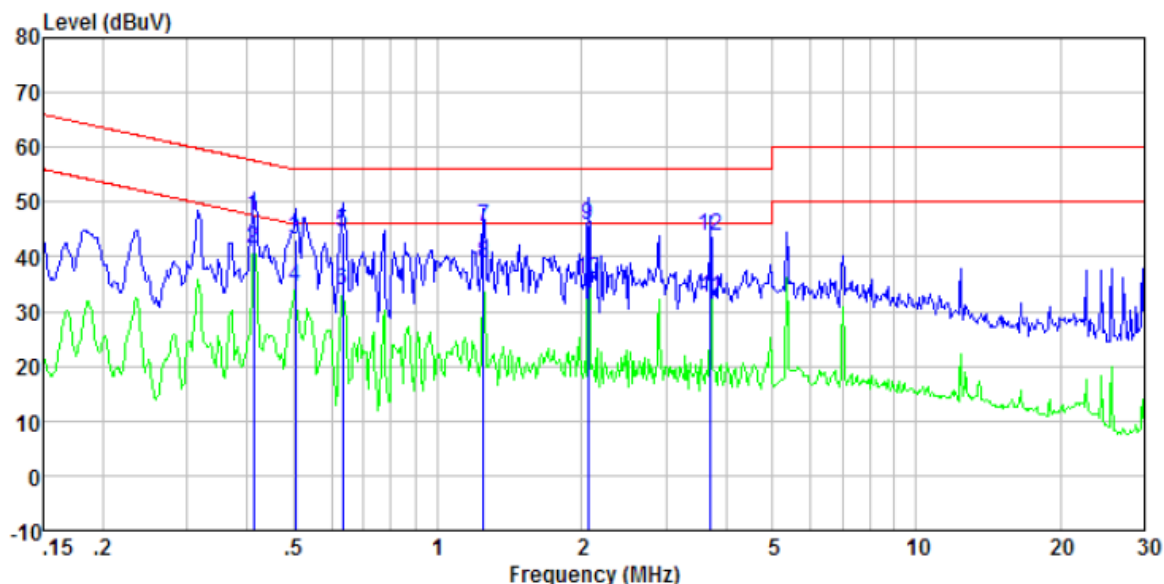
Standard requirement:	FCC Part15 C Section 15.203 /247(c)
<p>15.203 requirement:</p> <p>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that 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.</p> <p>15.247(c) (1)(i) requirement:</p> <p>(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 6dBi 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 6dBi.</p>	
E.U.T Antenna:	
<p><i>The antenna is PCB antenna, the best case gain of the antenna is 0dBi</i></p> 	

7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207														
Test Method:	ANSI C63.10:2013														
Test Frequency Range:	150KHz to 30MHz														
Class / Severity:	Class B														
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto														
Limit:	<table><tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr><tr><th>Quasi-peak</th><th>Average</th></tr><tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr><tr><td>0.5-5</td><td>56</td><td>46</td></tr><tr><td>5-30</td><td>60</td><td>50</td></tr></table> <p>* Decreases with the logarithm of the frequency.</p>	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
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													
Test setup:	<div><p>Reference Plane</p><p>40cm 80cm</p><p>LISN</p><p>AUX Equipment</p><p>E.U.T</p><p>Test table/Insulation plane</p><p>Filter</p><p>AC power</p><p>EMI Receiver</p><p>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p></div>														
Test procedure:	<ol style="list-style-type: none">1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.														
Test Instruments:	Refer to section 6.0 for details														
Test mode:	Refer to section 5.2 for details														
Test results:	Pass														

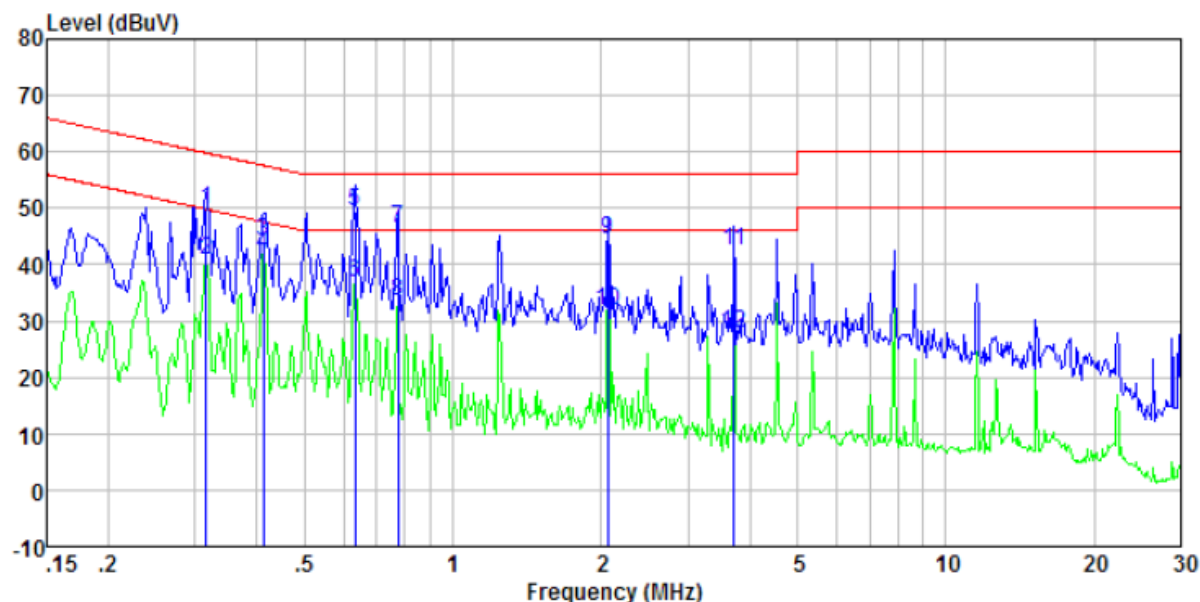
Measurement data

Mode:	TX mode	Test by:	Bill
Temp./Hum.(%RH):	26°C/56%RH	Probe:	Line



Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.41	47.08	0.35	0.11	47.54	57.59	-10.05	QP
0.41	41.02	0.35	0.11	41.48	47.59	-6.11	Average
0.50	42.80	0.31	0.11	43.22	56.00	-12.78	QP
0.50	33.94	0.31	0.11	34.36	46.00	-11.64	Average
0.63	44.04	0.28	0.12	44.44	56.00	-11.56	QP
0.63	33.37	0.28	0.12	33.77	46.00	-12.23	Average
1.25	45.08	0.20	0.16	45.44	56.00	-10.56	QP
1.25	38.33	0.20	0.16	38.69	46.00	-7.31	Average
2.07	45.34	0.20	0.18	45.72	56.00	-10.28	QP
2.07	35.36	0.20	0.18	35.74	46.00	-10.26	Average
3.72	32.19	0.20	0.18	32.57	56.00	-23.43	QP
3.72	43.29	0.20	0.18	43.67	46.00	-2.33	Average

Mode:	TX mode	Test by:	Bill
Temp./Hum.(%H):	26°C/56%RH	Probe:	Neutral

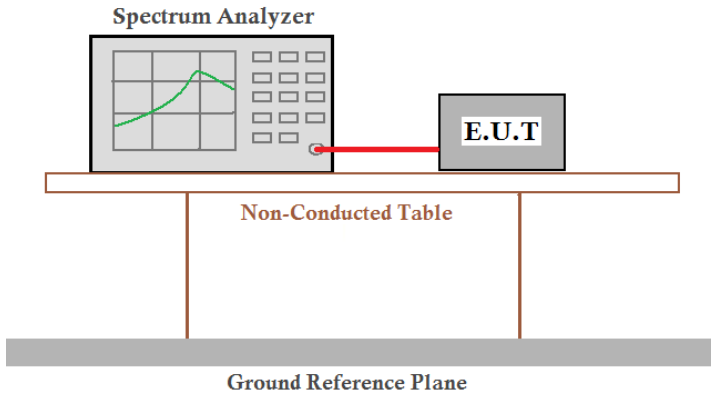


Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.32	49.45	0.39	0.10	49.94	59.80	-9.86	QP
0.32	40.27	0.39	0.10	40.76	49.80	-9.04	Average
0.41	43.80	0.35	0.11	44.26	57.59	-13.33	QP
0.41	41.35	0.35	0.11	41.81	47.59	-5.78	Average
0.63	48.94	0.28	0.12	49.34	56.00	-6.66	QP
0.63	36.54	0.28	0.12	36.94	46.00	-9.06	Average
0.78	46.21	0.24	0.14	46.59	56.00	-9.41	QP
0.78	33.04	0.24	0.14	33.42	46.00	-12.58	Average
2.07	44.17	0.20	0.18	44.55	56.00	-11.45	QP
2.07	31.31	0.20	0.18	31.69	46.00	-14.31	Average
3.72	42.09	0.20	0.18	42.47	56.00	-13.53	QP
3.72	27.36	0.20	0.18	27.74	46.00	-18.26	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

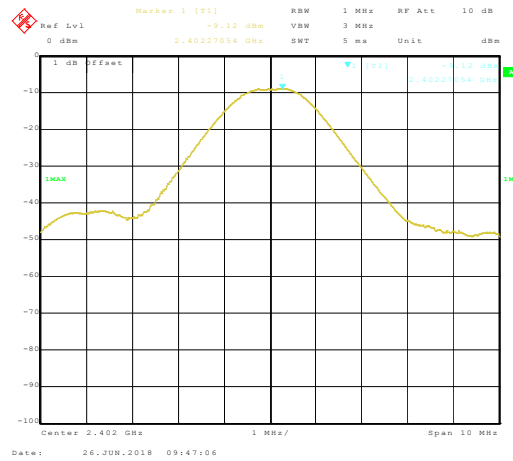
7.3 Conducted Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	30dBm
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

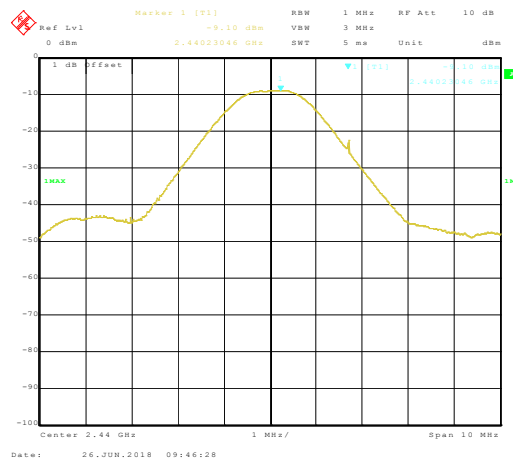
Measurement Data

Test channel	Peak Output Power (dBm)	Limit(dBm)	Result
Lowest	-9.12	30.00	Pass
Middle	-9.10		
Highest	-10.02		

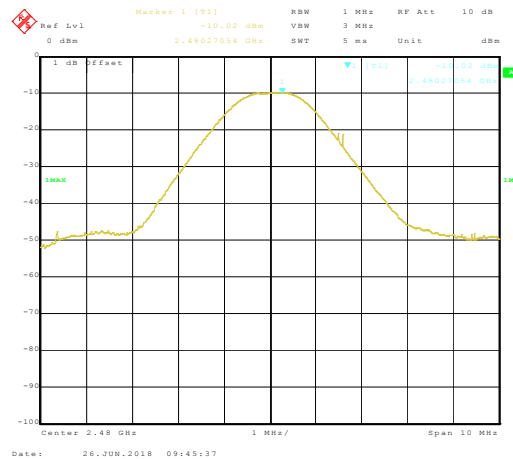
Test plot as follows:



Lowest channel

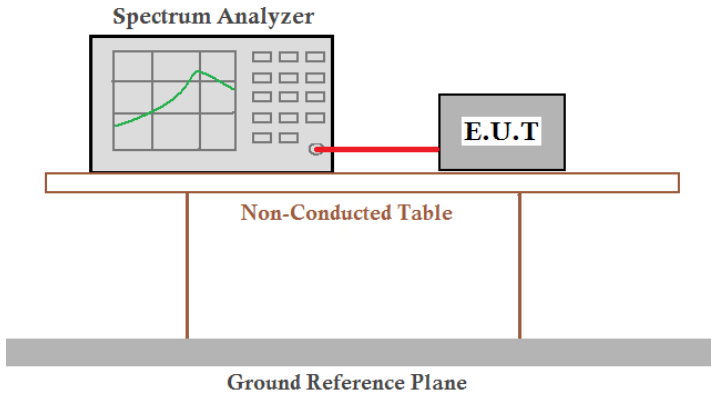


Middle channel



Highest channel

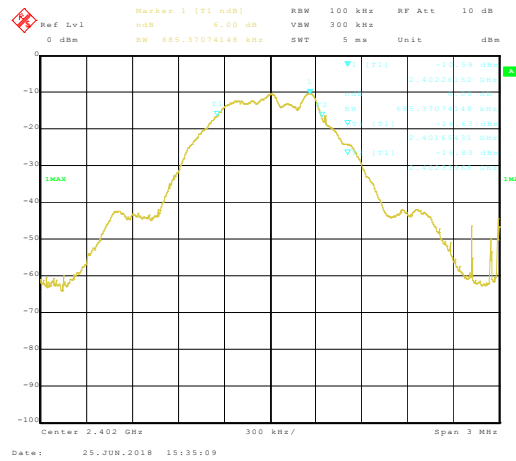
7.4 Channel Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	>500KHz
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

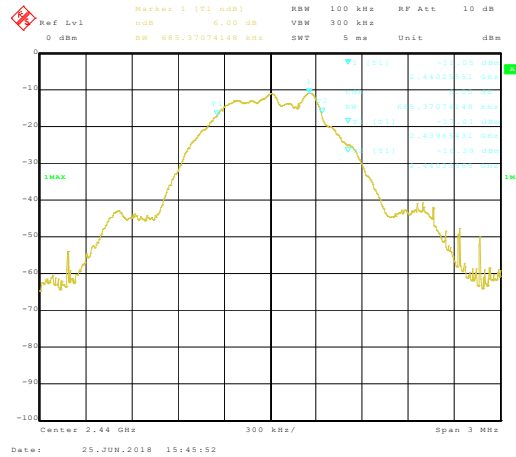
Measurement Data

Test channel	Channel Bandwidth (MHz)	Limit(KHz)	Result
Lowest	0.685	>500	Pass
Middle	0.685		
Highest	0.697		

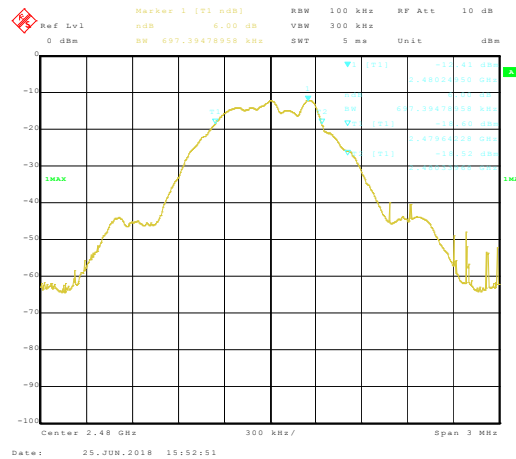
Test plot as follows:



Lowest channel

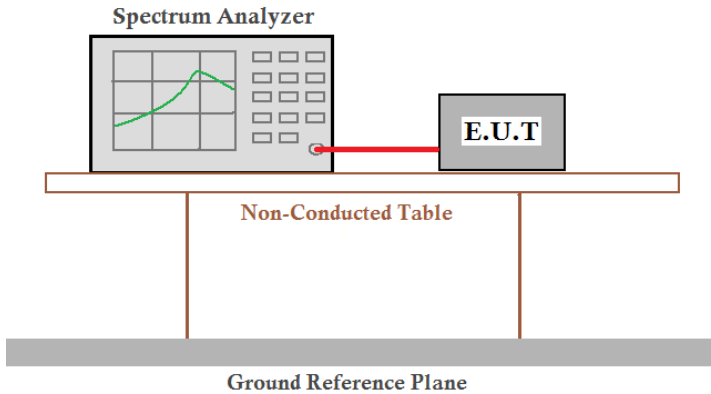


Middle channel



Highest channel

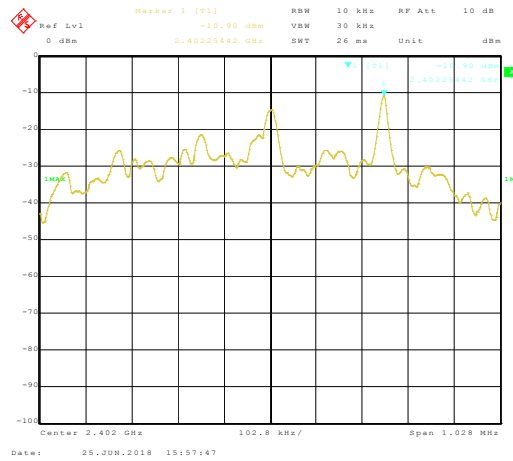
7.5 Power Spectral Density

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	8dBm/3kHz
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

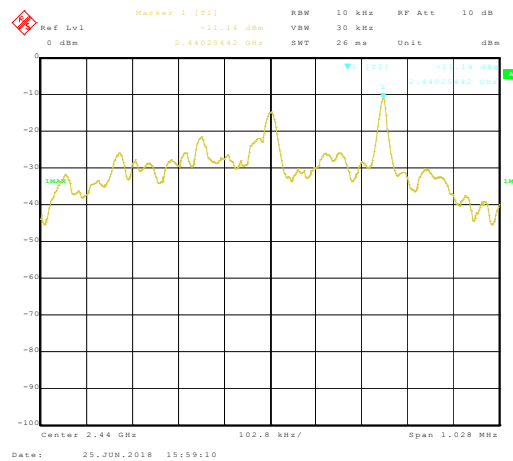
Measurement Data

Test channel	PK Power Spectral Density (dBm)	Limit(dBm/3kHz)	Result
Lowest	-10.90	8.00	Pass
Middle	-11.14		
Highest	-12.36		

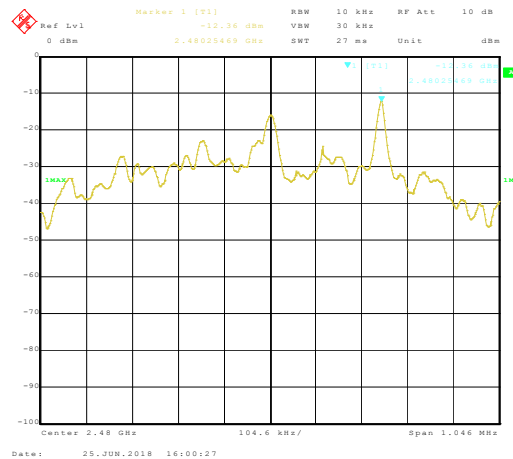
Test plot as follows:



Lowest channel



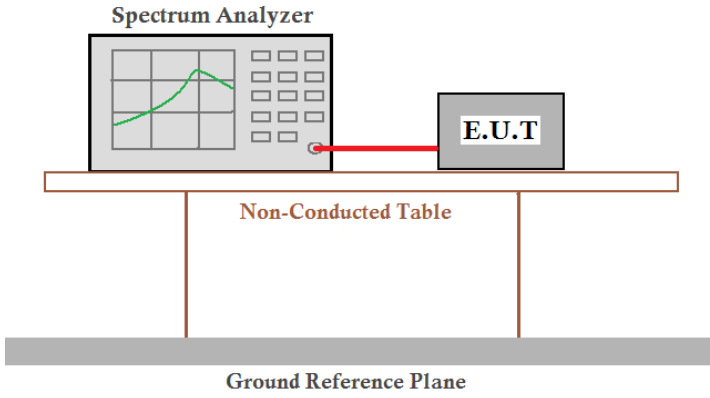
Middle channel



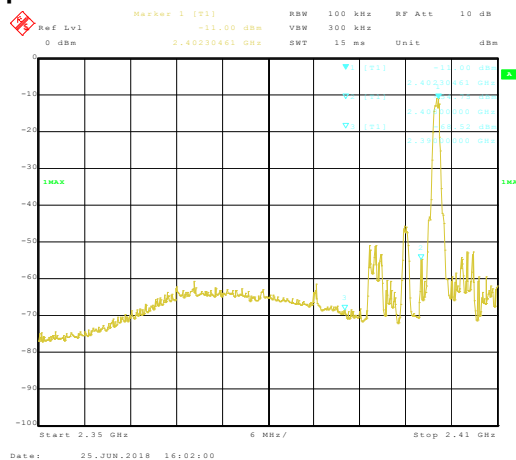
Highest channel

7.6 Band edges

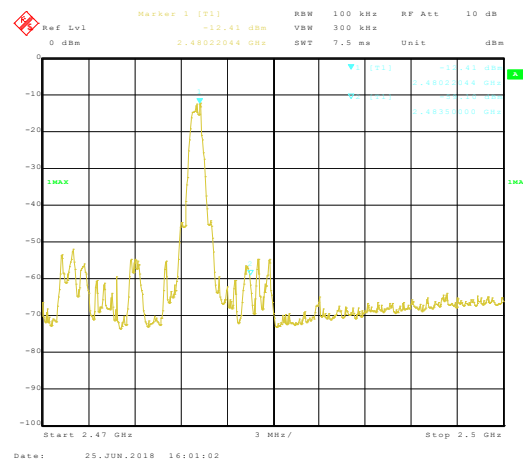
7.6.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	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 setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test) which is placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Test plot as follows:

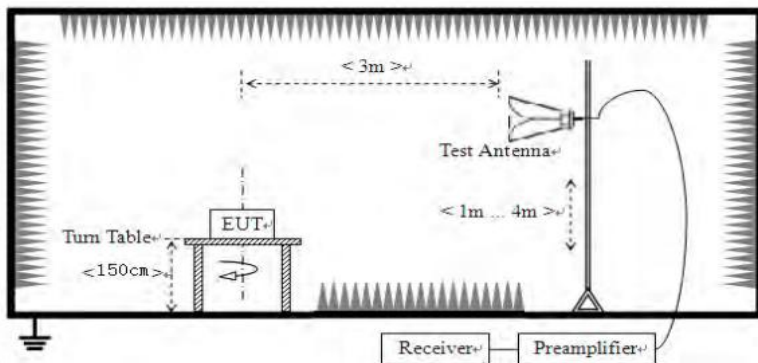


Lowest channel



Highest channel

7.6.2 Radiated Emission Method

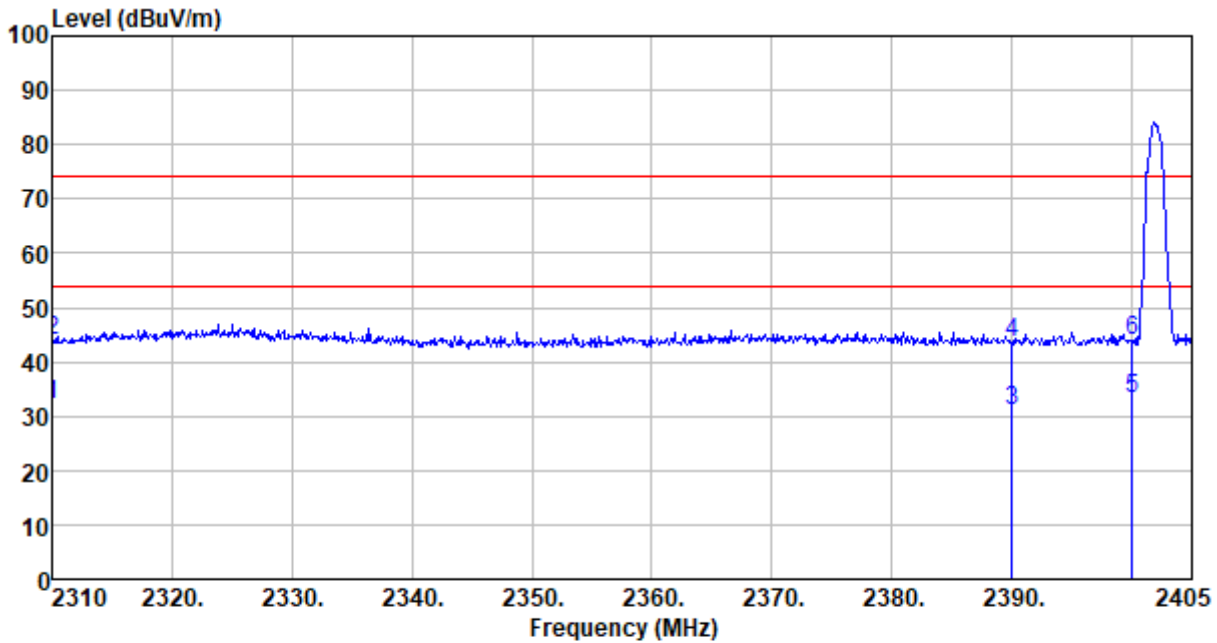
Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	Above 1GHz	Peak	1MHz	3MHz	Peak
		RMS	1MHz	3MHz	Average
Limit:	Frequency		Limit (dBuV/m @3m)		Value
	Above 1GHz		54.00		Average
			74.00		Peak
Test setup:					
Test Procedure:	<ol style="list-style-type: none">1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.7. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.				
Test Instruments:	Refer to section 6.0 for details				
Test mode:	Refer to section 5.2 for details				
Test results:	Pass				

Measurement data:

Remark: The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.

Test plot as follows:

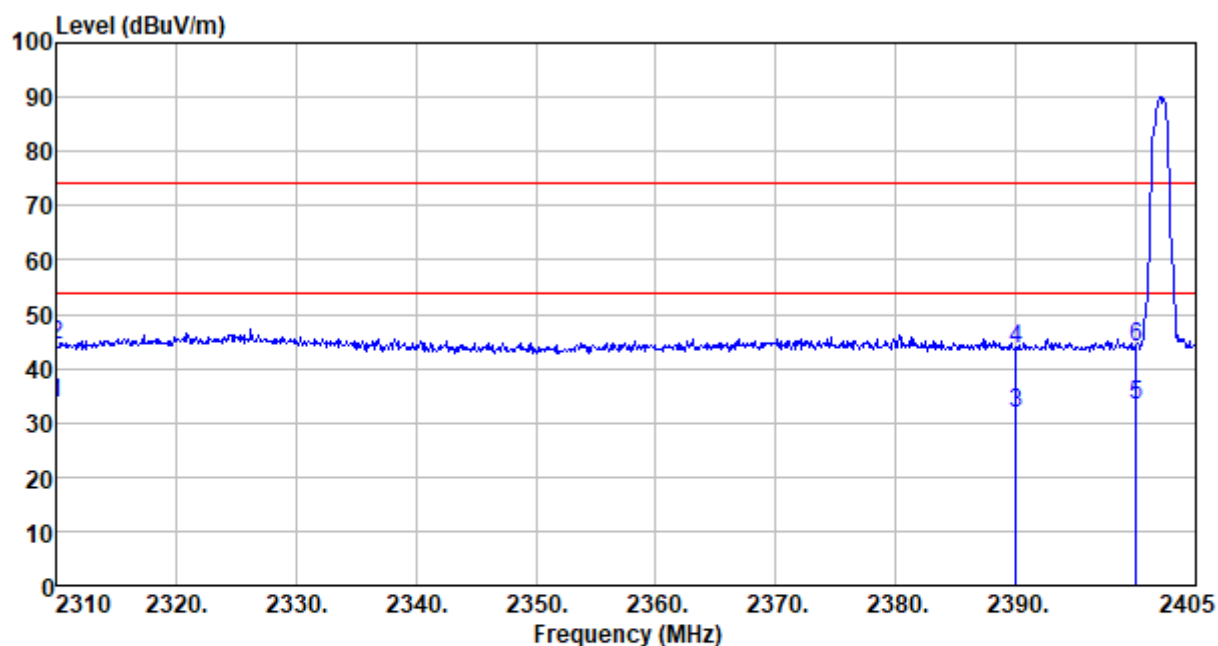
Test channel:	2402MHz	Polarization:	Horizontal
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Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2310.000	23.70	27.91	5.30	24.64	32.27	54.00	-21.73	Average
2310.000	35.16	27.91	5.30	24.64	43.73	74.00	-30.27	Peak
2390.000	22.69	27.59	5.38	24.71	30.95	54.00	-23.05	Average
2390.000	35.40	27.59	5.38	24.71	43.66	74.00	-30.34	Peak
2400.000	24.79	27.58	5.39	24.72	33.04	54.00	-20.96	Average
2400.000	35.82	27.58	5.39	24.72	44.07	74.00	-29.93	Peak

Test channel: 2402MHz

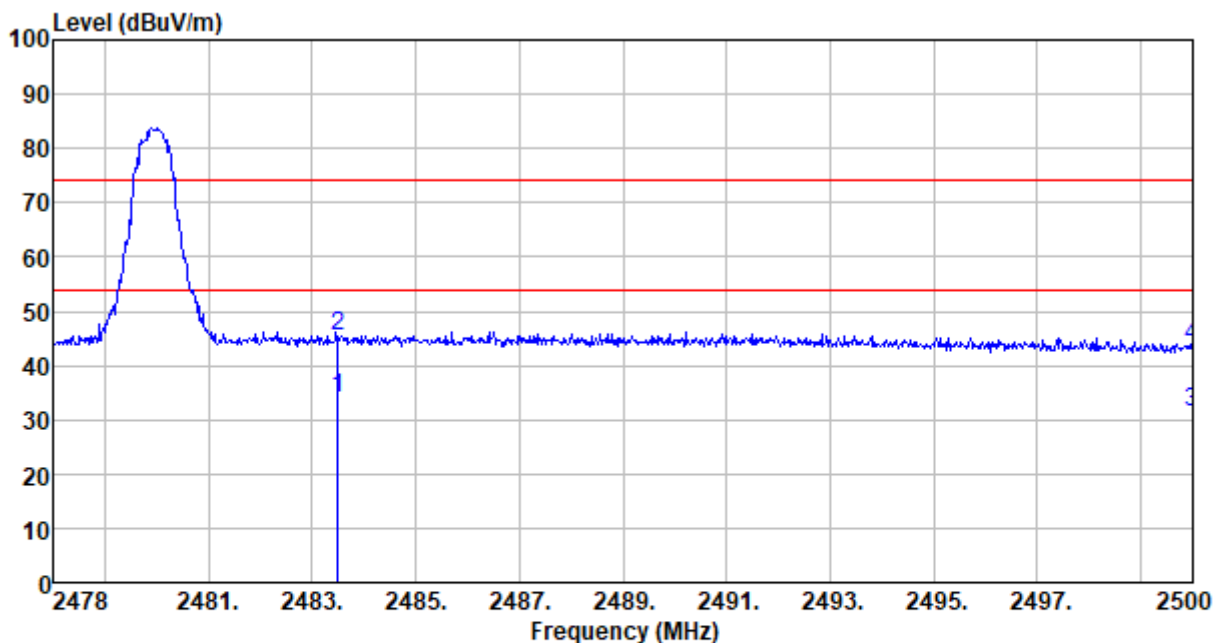
Polarization: Vertical



Freq MHz	Reading level dBUV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBUV	Limit level dBUV/m	Over limit dB	Remark
2310.000	24.91	27.91	5.30	24.64	33.48	54.00	-20.52	Average
2310.000	35.70	27.91	5.30	24.64	44.27	74.00	-29.73	Peak
2390.000	23.62	27.59	5.38	24.71	31.88	54.00	-22.12	Average
2390.000	35.28	27.59	5.38	24.71	43.54	74.00	-30.46	Peak
2400.000	24.78	27.58	5.39	24.72	33.03	54.00	-20.97	Average
2400.000	35.82	27.58	5.39	24.72	44.07	74.00	-29.93	Peak

Test channel: 2480MHz

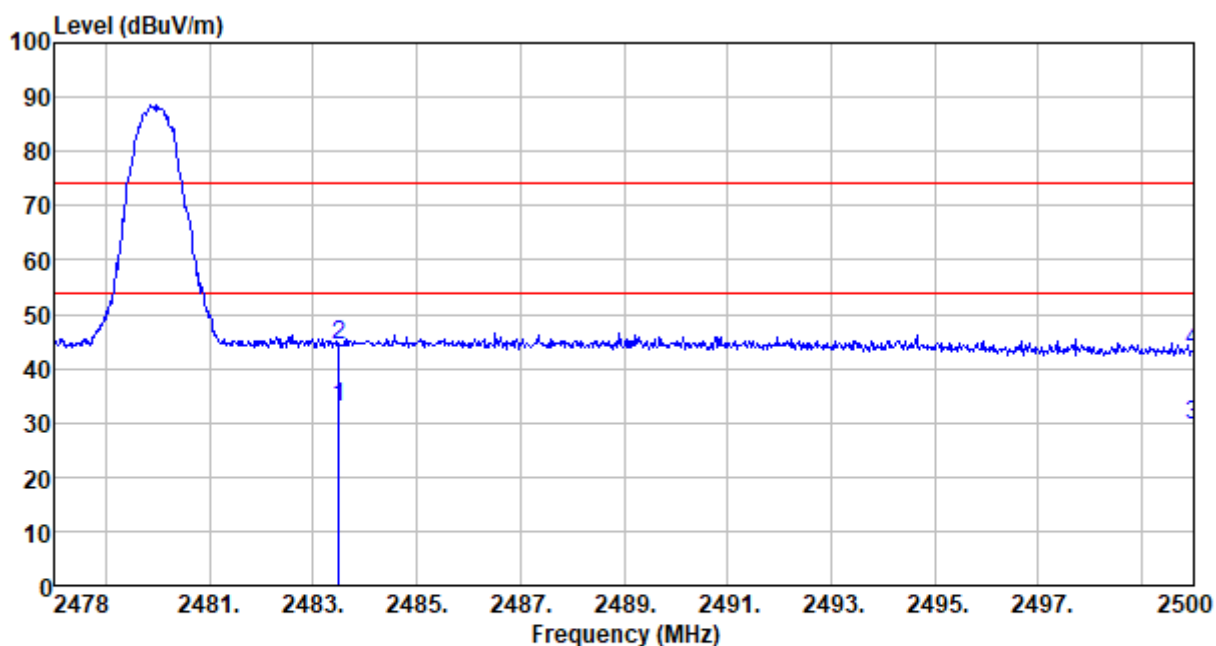
Polarization: Horizontal



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamplifier factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2483.500	25.77	27.53	5.47	24.80	33.97	54.00	-20.03	Average
2483.500	37.02	27.53	5.47	24.80	45.22	74.00	-28.78	Peak
2500.000	23.27	27.55	5.49	24.86	31.45	54.00	-22.55	Average
2500.000	35.30	27.55	5.49	24.86	43.48	74.00	-30.52	Peak

Test channel: 2480MHz

Polarization: Vertical



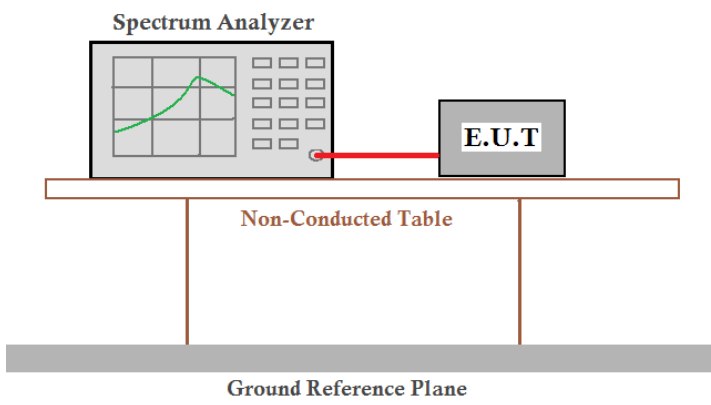
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2483.500	24.58	27.53	5.47	24.80	32.78	54.00	-21.22	Average
2483.500	36.16	27.53	5.47	24.80	44.36	74.00	-29.64	Peak
2500.000	21.36	27.55	5.49	24.86	29.54	54.00	-24.46	Average
2500.000	34.98	27.55	5.49	24.86	43.16	74.00	-30.84	Peak

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplicifier Factor

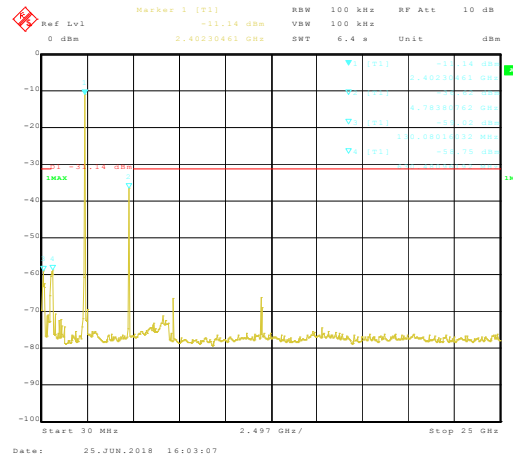
7.7 Spurious Emission

7.7.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	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 setup:	 <p>The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

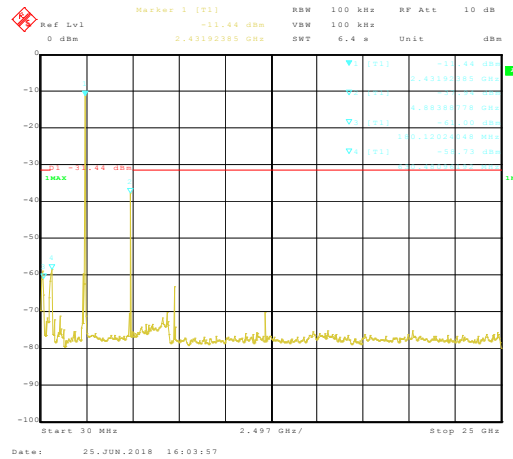
Test plot as follows:

Lowest channel



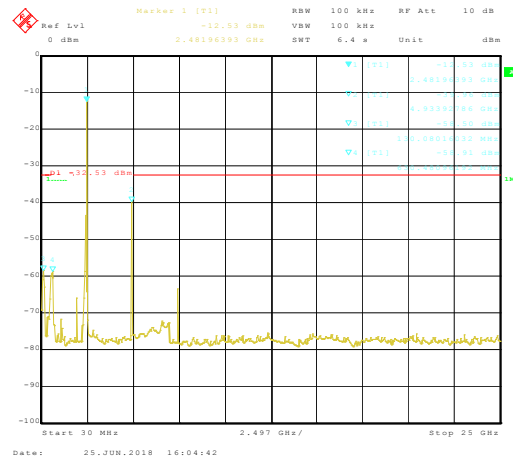
30MHz~25GHz

Middle channel



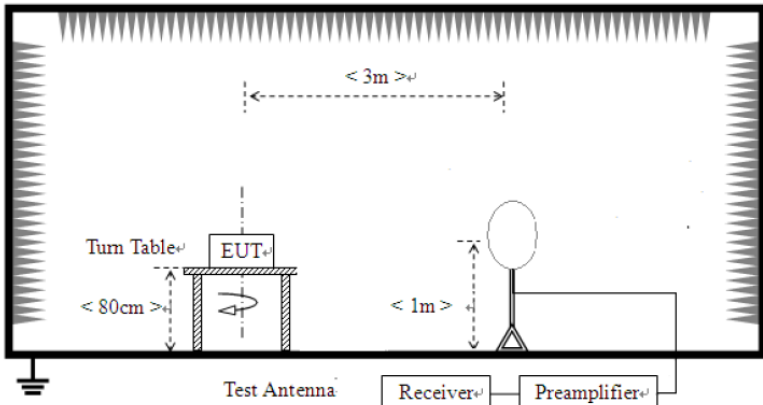
30MHz~25GHz

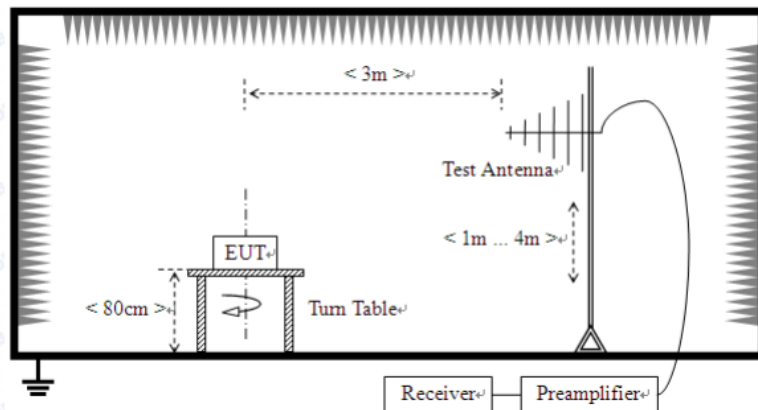
Highest channel



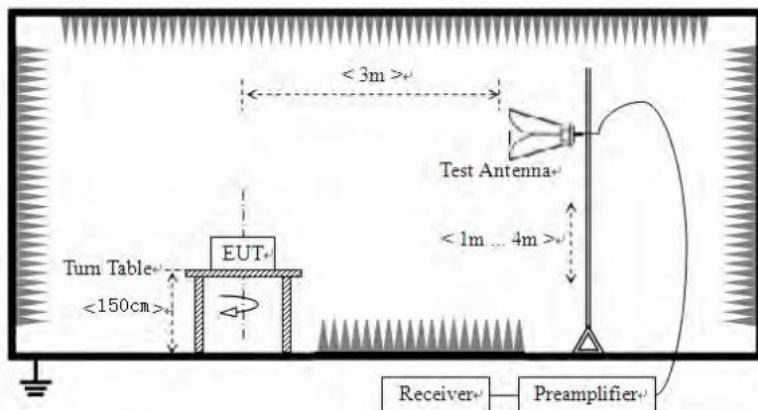
30MHz~25GHz

7.7.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9KHz-150KHz	PK/AV	200Hz	600Hz	PK/AV
	150KHz-30MHz	PK/AV/QP	9KHz	30KHz	PK/AV/QP
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		RMS	1MHz	3MHz	Average
Limit:	Frequency	Limit (uV/m)	Value	Measurement Distance	
	0.009MHz-0.490MHz	2400/F(KHz)	PK/AV	300m	
	0.490MHz-1.705MHz	24000/F(KHz)	QP	300m	
	1.705MHz-30MHz	30	QP	30m	
	30MHz-88MHz	100	QP	3m	
	88MHz-216MHz	150	QP		
	216MHz-960MHz	200	QP		
	960MHz-1GHz	500	QP		
	Above 1GHz	500	Average		
		5000	Peak		
Test setup:	Below 30MHz				
	<div></div>				
Test setup:	Below 1GHz				



Above 1GHz



Test Procedure:

1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the

	EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement data:*Remark:*

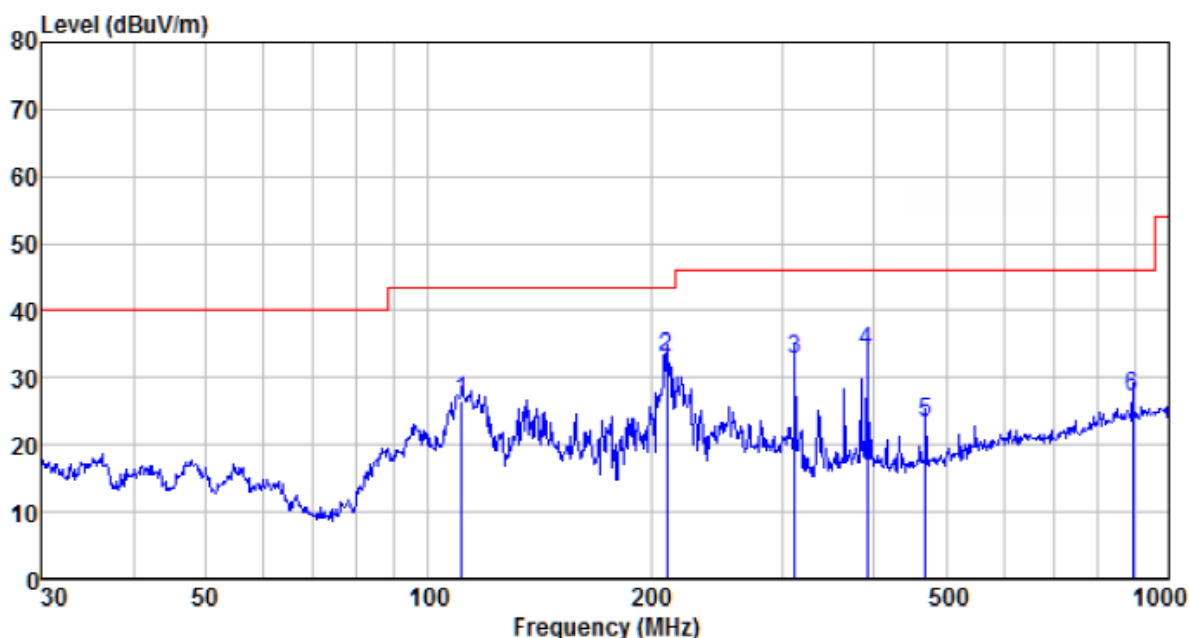
Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

■ 9kHz~30MHz

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

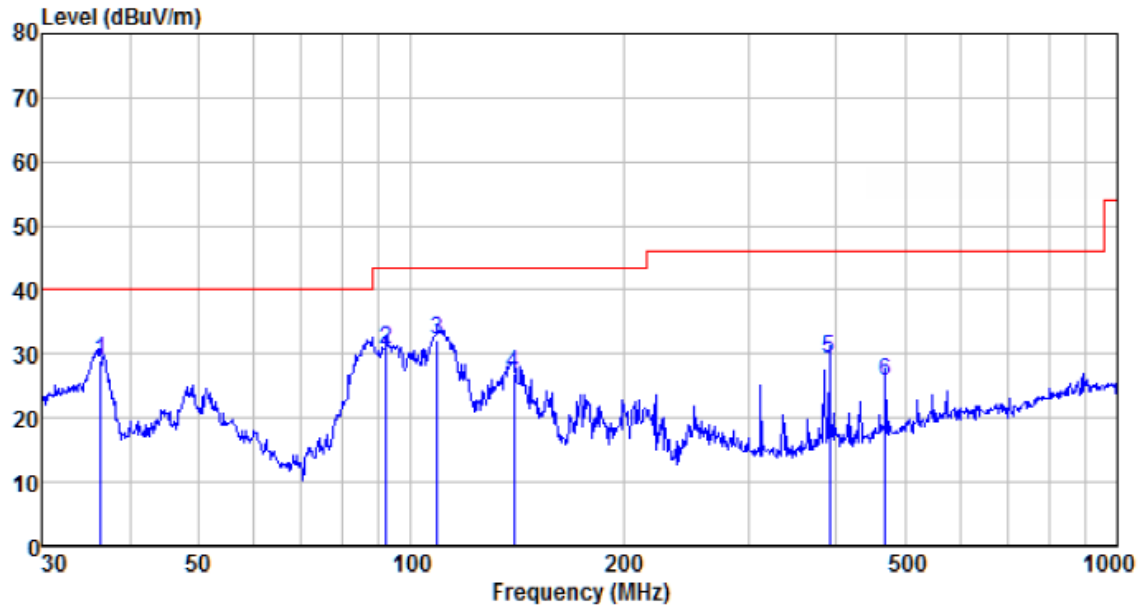
■ Below 1GHz

Mode:	TX mode	Test by:	Bill
Temp./Hum.(%RH):	26°C/56%RH	Polarization:	Horizontal



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
110.957	51.11	10.93	1.29	36.81	26.52	43.50	-16.98	QP
210.048	57.59	10.80	1.90	37.34	32.95	43.50	-10.55	QP
312.179	53.94	13.85	2.42	37.43	32.78	46.00	-13.22	QP
390.723	53.61	15.16	2.81	37.51	34.07	46.00	-11.93	QP
468.876	40.99	16.73	3.18	37.51	23.39	46.00	-22.61	QP
893.857	37.75	22.23	4.83	37.60	27.21	46.00	-18.79	QP

Mode:	TX mode	Test by:	Bill
Temp./Hum.(%RH):	26°C/56%RH	Polarization:	Vertical



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
36.381	52.08	11.58	0.62	35.45	28.83	40.00	-11.17	QP
92.139	55.18	11.04	1.13	36.66	30.69	43.50	-12.81	QP
109.029	56.48	11.20	1.27	36.80	32.15	43.50	-11.35	QP
139.851	55.05	7.45	1.50	37.02	26.98	43.50	-16.52	QP
390.723	48.79	15.16	2.81	37.51	29.25	46.00	-16.75	QP
468.876	43.32	16.73	3.18	37.51	25.72	46.00	-20.28	QP

■ Above 1GHz

Test channel:	Lowest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804.00	36.48	31.78	8.60	32.09	44.77	74.00	-29.23	Vertical
7206.00	31.28	36.15	11.65	32.00	47.08	74.00	-26.92	Vertical
9608.00	30.98	37.95	14.14	31.62	51.45	74.00	-22.55	Vertical
12010.00	*					74.00		Vertical
14412.00	*					74.00		Vertical
4804.00	40.60	31.78	8.60	32.09	48.89	74.00	-25.11	Horizontal
7206.00	32.96	36.15	11.65	32.00	48.76	74.00	-25.24	Horizontal
9608.00	30.32	37.95	14.14	31.62	50.79	74.00	-23.21	Horizontal
12010.00	*					74.00		Horizontal
14412.00	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4804.00	25.45	31.78	8.60	32.09	33.74	54.00	-20.26	Vertical
7206.00	20.06	36.15	11.65	32.00	35.86	54.00	-18.14	Vertical
9608.00	19.19	37.95	14.14	31.62	39.66	54.00	-14.34	Vertical
12010.00	*					54.00		Vertical
14412.00	*					54.00		Vertical
4804.00	29.59	31.78	8.60	32.09	37.88	54.00	-16.12	Horizontal
7206.00	22.18	36.15	11.65	32.00	37.98	54.00	-16.02	Horizontal
9608.00	18.85	37.95	14.14	31.62	39.32	54.00	-14.68	Horizontal
12010.00	*					54.00		Horizontal
14412.00	*					54.00		Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is the too weak instrument of signal is unable to test.

Test channel:	Middle
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Peak value:

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
4880.00	36.55	31.85	8.67	32.12	44.95	74.00	-29.05	Vertical
7320.00	31.33	36.37	11.72	31.89	47.53	74.00	-26.47	Vertical
9760.00	31.02	38.35	14.25	31.62	52.00	74.00	-22.00	Vertical
12200.00	*					74.00		Vertical
14640.00	*					74.00		Vertical
4880.00	40.68	31.85	8.67	32.12	49.08	74.00	-24.92	Horizontal
7320.00	33.02	36.37	11.72	31.89	49.22	74.00	-24.78	Horizontal
9760.00	30.37	38.35	14.25	31.62	51.35	74.00	-22.65	Horizontal
12200.00	*					74.00		Horizontal
14640.00	*					74.00		Horizontal

Average value:

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
4880.00	25.52	31.85	8.67	32.12	33.92	54.00	-20.08	Vertical
7320.00	20.11	36.37	11.72	31.89	36.31	54.00	-17.69	Vertical
9760.00	19.23	38.35	14.25	31.62	40.21	54.00	-13.79	Vertical
12200.00	*					54.00		Vertical
14640.00	*					54.00		Vertical
4880.00	29.66	31.85	8.67	32.12	38.06	54.00	-15.94	Horizontal
7320.00	22.23	36.37	11.72	31.89	38.43	54.00	-15.57	Horizontal
9760.00	18.90	38.35	14.25	31.62	39.88	54.00	-14.12	Horizontal
12200.00	*					54.00		Horizontal
14640.00	*					54.00		Horizontal

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *“*” means this data is too weak instrument of signal is unable to test.*

Test channel:	Highest
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Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	36.51	31.93	8.73	32.16	45.01	74.00	-28.99	Vertical
7440.00	31.31	36.59	11.79	31.78	47.91	74.00	-26.09	Vertical
9920.00	31.00	38.81	14.38	31.88	52.31	74.00	-21.69	Vertical
12400.00	*					74.00		Vertical
14880.00	*					74.00		Vertical
4960.00	40.64	31.93	8.73	32.16	49.14	74.00	-24.86	Horizontal
7440.00	32.99	36.59	11.79	31.78	49.59	74.00	-24.41	Horizontal
9920.00	30.35	38.81	14.38	31.88	51.66	74.00	-22.34	Horizontal
12400.00	*					74.00		Horizontal
14880.00	*					74.00		Horizontal

Average value:

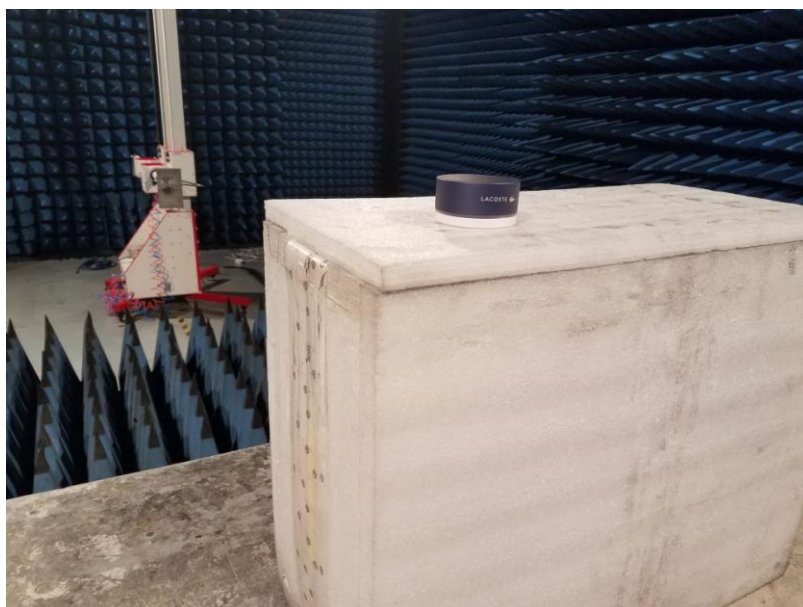
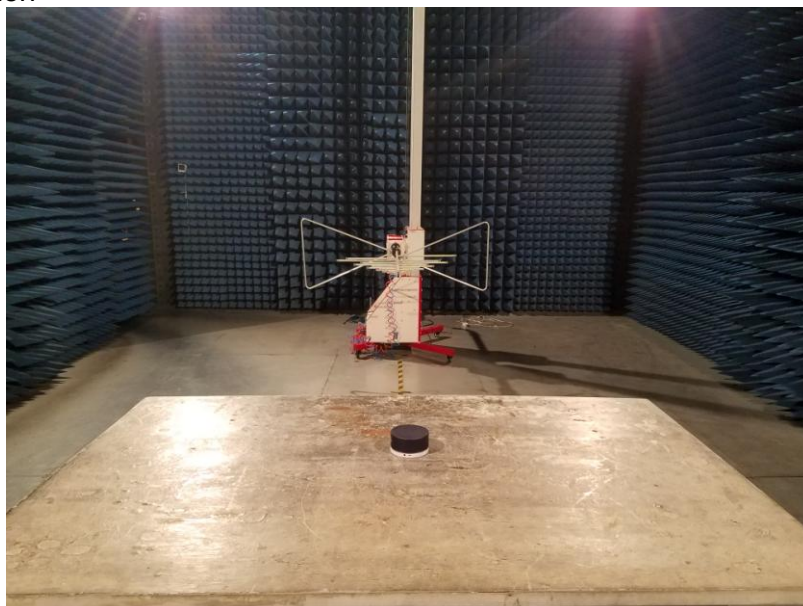
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamplifier Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	25.54	31.93	8.73	32.16	34.04	54.00	-19.96	Vertical
7440.00	20.12	36.59	11.79	31.78	36.72	54.00	-17.28	Vertical
9920.00	19.25	38.81	14.38	31.88	40.56	54.00	-13.44	Vertical
12400.00	*					54.00		Vertical
14880.00	*					54.00		Vertical
4960.00	29.69	31.93	8.73	32.16	38.19	54.00	-15.81	Horizontal
7440.00	22.25	36.59	11.79	31.78	38.85	54.00	-15.15	Horizontal
9920.00	18.92	38.81	14.38	31.88	40.23	54.00	-13.77	Horizontal
12400.00	*					54.00		Horizontal
14880.00	*					54.00		Horizontal

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “*”, means this data is too weak instrument of signal is unable to test.

8 Test Setup Photo

Radiated Emission



Conducted Emission



9 EUT Constructional Details

Reference to the test report No. GTS201806000246F01

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