TEST REPORT

Product Name:	BLE module
HVIN:	MeshTek-H52E_V0.1
FCC ID:	2AEHU-MESHTEK-H52E
IC ID:	20059-MESHTEKH52E
Trademark:	MeshTek
Model Number:	MeshTek-H52E
Prepared For:	iLumi Solutions Inc.
Address:	1800 Preston Park Blvd, Plano, Texas 75093, United States
Manufacturer:	Shenzhen Holyiot Technologies Co.,Ltd
Address:	Room 309, Building 10, No.2 Industrial Zone, Guanlong Village, Xili Town, Nanshan District, Shenzhen, China
Prepared By:	Shenzhen HUAK Testing Technology Co., Ltd.
Address:	1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China
Sample Received Date:	Sep. 18, 2019
Sample tested Date:	Sep. 18, 2019 to Sep. 31, 2019
Issue Date:	Sep. 31, 2019
Report No.:	HK1909272442-E
Test Standards	FCC Part15.247 ANSI C63.10:2013 RSS-247 Issue 2
Test Results	PASS
Remark:	This is Bluetooth radio test report.

Compiled by:	Reviewed by:	Approved by:
(Gary Qian)	(Eden Hu)	(Jason Zhou)

The test report is effective only with both signature and specialized stamp. This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen HUAK Testing Technology Co., Ltd. this report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client.

TABLE OF CONTENT

(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
HK1909272442-E	Sep. 31, 2019	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

Test Item	Test Requirement	Test method	Result
AC Power Line Conducted Emission	47 CFR Part 15 Subpart C Section 15.207 RSS-GEN 8.8, RSS-247 3.1	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-247 5.5, RSS-GEN 8.9, RSS-GEN 8.10	ANSI C63.10-2013	PASS
Band edge and RF Conducted Spurious Emissions	47 CFR Part 15 Subpart C Section 15.247(d)/15.205(a) RSS-247 5.5	ANSI C63.10-2013	PASS
Conducted Peak Output Power	47 CFR Part 15 Subpart C Section 15.247 (b)(3) RSS-247 5.4 (b)	ANSI C63.10-2013	PASS
Bandwidth	47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 5.2 (a)	ANSI C63.10-2013	PASS
Power Spectral Density	47 CFR Part 15Subpart C Section 15.247 (e) RSS-247 5.2 (b)	ANSI C63.10-2013/ KDB 558074 D01v04	PASS
Antenna Requirement	47 CFR Part 15 Subpart C Section 15.203/15.247 (c) RSS-Gen.6.8	ANSI C63.10-2013	PASS

Remark:
Test according to ANSI C63.4-2014 & ANSI C63.10-2013.

3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Item	Uncertainty
Occupancy bandwidth	U=±54.3Hz
Conducted output power Above 1G	U=±1.0dB
Conducted output power below 1G	U=±0.9dB
Power Spectral Density , Conduction	U=±1.0dB
Conduction spurious emissions	U=±2.8dB
Out of band emission	U=±54Hz
3m camber Radiated spurious emission(30MHz-1GHz)	U=±4.3dB
3m chamber Radiated spurious emission(1GHz-18GHz)	U=±4.5dB
humidity uncertainty	U=±5.3%
Temperature uncertainty	U=±0.59℃
Supply voltages	U=±3%
Time	U=±5%

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):	MeshTek-H52E
Model Description:	BLE module
Bluetooth Version:	Bluetooth v4.0 with BLE
Hardware Version:	MeshTek-H52E_V0.1
Software Version:	V1.0

Operation Frequency:	Bluetooth: 2402-2480MHz
Max. RF output power:	Bluetooth: 19.31dBm
Type of Modulation:	Bluetooth: GFSK
Antenna installation:	Bluetooth: External antenna
Antenna Gain:	Bluetooth: 0dBi
Ratings:	DC 1.7V-3.6V
Test Power Supply:	DC 3.3V from USB

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
1	Laptop	DELL	Inspiron5570	JR4G1A00DPC	AE
2	AC Adaptor	DELL	HA45NM140	CN-00285K-CH200-88V-OEYC-A06	AE

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

CH No.	Frequency (MHz)	CH No.	Frequency (MHz)	CH No.	Frequency (MHz)	CH No.	Frequency (MHz)
0	2402	1	2404	2	2406	3	2408
4	2410	5	2412	6	2414	7	2416
8	2418	9	2420	10	2422	11	2424
12	2426	13	2428	14	2430	15	2432
16	2434	17	2436	18	2438	19	2440
20	2442	21	2444	22	2446	23	2448
24	2450	25	2452	26	2454	27	2456
28	2458	29	2460	30	2462	31	2464
32	2466	33	2468	34	2470	35	2472
36	2474	37	2476	38	2478	39	2480

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Low channel	Middle channel	High channel
Transmitting (GFSK)	2402MHz	2440MHz	2480MHz

During testing channel and power controlling software by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Test Software Version	Actions(nRFgo Studio V1.21.2.10)		
Frequency(MHz)	2402	2440	2480
Power Parameters(GFSK)	default	default	default

4.6 Test Environment

Humidity(%):	55
Atmospheric Pressure(kPa):	101.1
Normal Voltage(DC):	3.3
Normal Temperature(℃)	25
Low Temperature(℃)	0
High Temperature(℃)	40

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

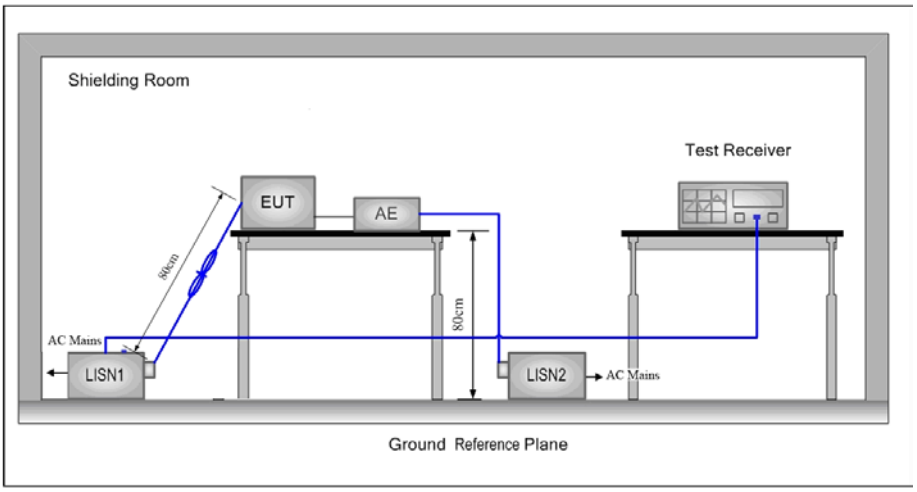
All measurement facilities used to collect the measurement data are located at 1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park, Fuhai Street, Bao'an District, Shenzhen City, China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	R&S	ENV216	HKE-002	Dec. 28, 2018	1 Year
2.	Receiver	R&S	ESCI 7	HKE-010	Dec. 28, 2018	1 Year
3.	RF automatic control unit	Tonscend	JS0806-2	HKE-060	Dec. 28, 2018	1 Year
4.	Spectrum analyzer	R&S	FSP40	HKE-025	Dec. 28, 2018	1 Year
5.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2018	1 Year
6.	Preamplifier	Schwarzbeck	BBV 9743	HKE-006	Dec. 28, 2018	1 Year
7.	EMI Test Receiver	Rohde & Schwarz	ESCI 7	HKE-010	Dec. 28, 2018	1 Year
8.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	HKE-012	Dec. 28, 2018	1 Year
9.	Loop Antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Dec. 28, 2018	1 Year
10.	Horn Antenna	Schewarzbeck	9120D	HKE-013	Dec. 28, 2018	1 Year
11.	Pre-amplifier	EMCI	EMC051845 SE	HKE-015	Dec. 28, 2018	1 Year
12.	Pre-amplifier	Agilent	83051A	HKE-016	Dec. 28, 2018	1 Year
13.	EMI Test Software EZ-EMC	Tonscend	JZOZtheBO T120-B Version	HKE-083	N/A	N/A
14.	RF Software	Micowave	MTS8000	Ver. 2.0.0.0	N/A	N/A
15.	Power Sensor	Agilent	E9300A	HKE-086	Dec. 28, 2018	1 Year
16.	Spectrum analyzer	Agilent	N9020A	HKE-048	Dec. 28, 2018	1 Year
17.	Signal generator	Agilent	N5182A	HKE-029	Dec. 28, 2018	1 Year
18.	Signal Generator	Agilent	83630A	HKE-028	Dec. 28, 2018	1 Year
19	Shielded room	Shiel Hong	4*3*3	HKE-039	Dec. 28, 2017	3 Year
20	Hf antenna	Schwarzbeck	LB-180400-KF	HKE-031	Dec. 28, 2018	1 Year

6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

6.3 Test procedure

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

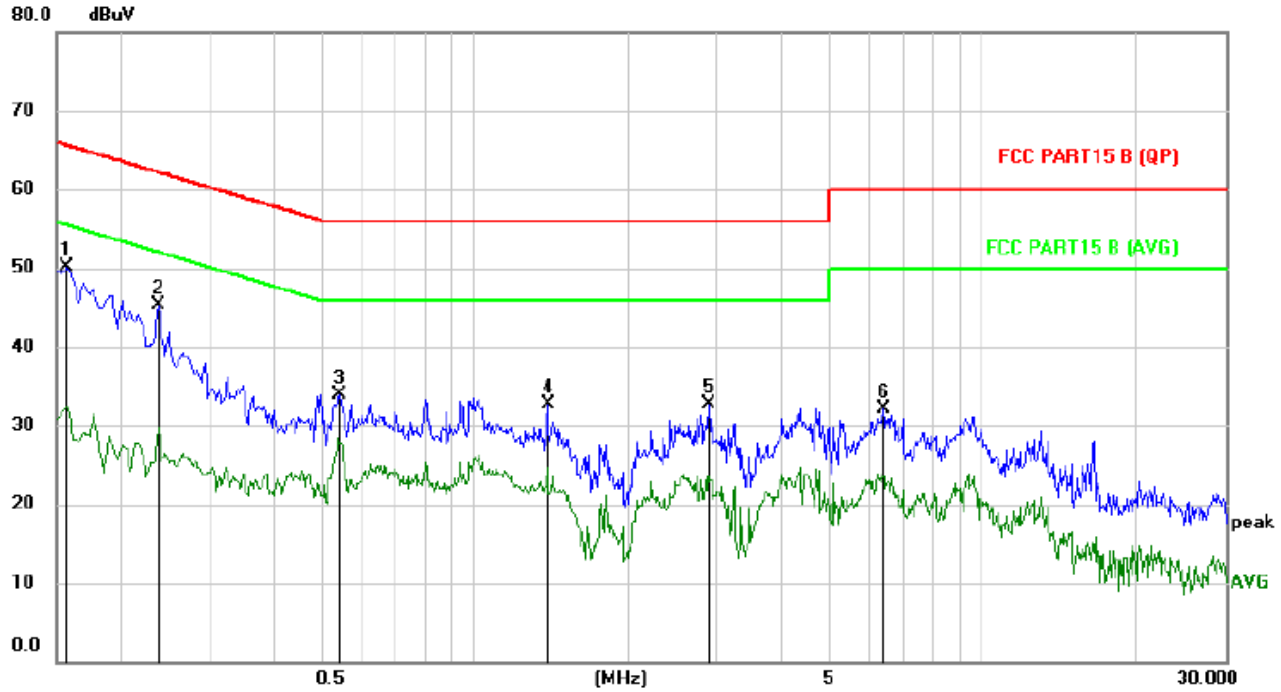
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference

plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

5) 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 on conducted measurement**.**

6.4 Test Result

Test Specification: Neutral

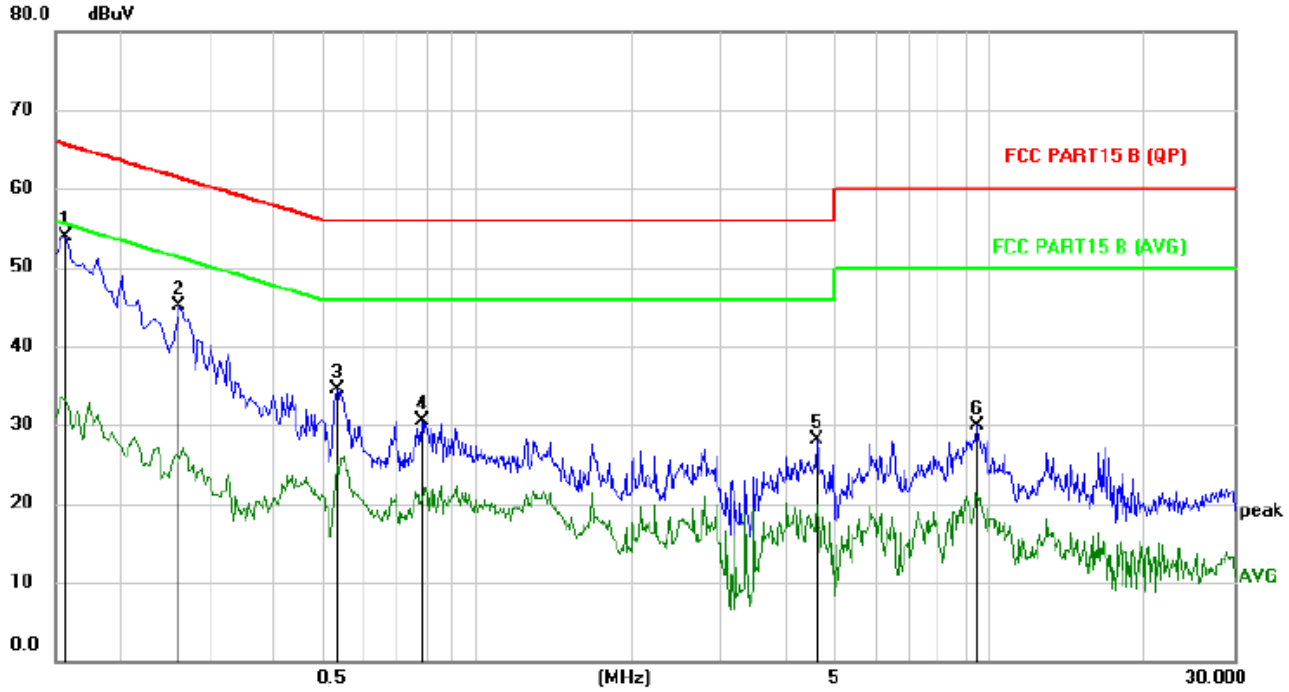


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1580	40.30	9.88	50.18	65.57	-15.39	peak	
2		0.2380	35.39	9.92	45.31	62.17	-16.86	peak	
3		0.5420	23.98	10.01	33.99	56.00	-22.01	peak	
4		1.3900	22.71	10.04	32.75	56.00	-23.25	peak	
5		2.8860	22.59	10.20	32.79	56.00	-23.21	peak	
6		6.3700	21.54	10.47	32.01	60.00	-27.99	peak	

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit

Test Specification: Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1580	44.02	9.88	53.90	65.57	-11.67	peak	
2		0.2620	35.26	9.90	45.16	61.37	-16.21	peak	
3		0.5340	24.41	10.00	34.41	56.00	-21.59	peak	
4		0.7820	20.35	10.06	30.41	56.00	-25.59	peak	
5		4.6220	17.75	10.39	28.14	56.00	-27.86	peak	
6		9.4700	19.26	10.57	29.83	60.00	-30.17	peak	

Remark:

Factor = Cable loss + LISN factor, Margin = Measurement – Limit

7. RADIATED SPURIOUS EMISSION

7.1 Block Diagram Of Test Setup

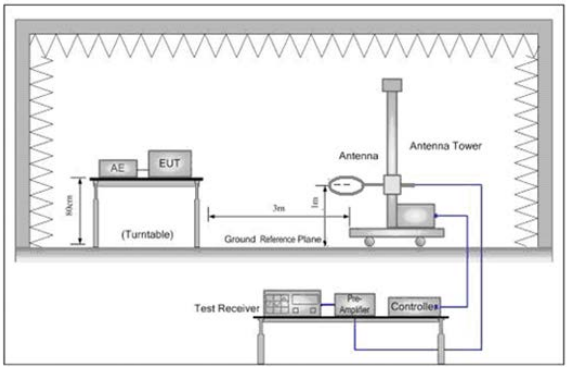


Figure 1. Below 30MHz

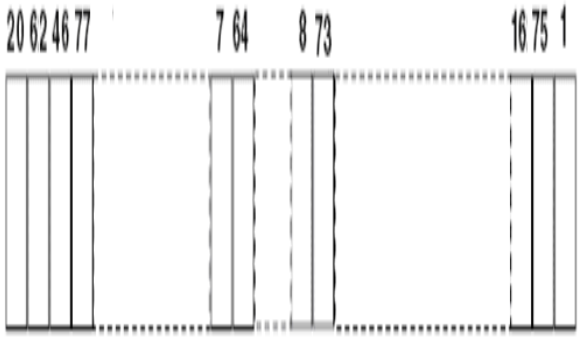


Figure 2. 30MHz to 1GHz

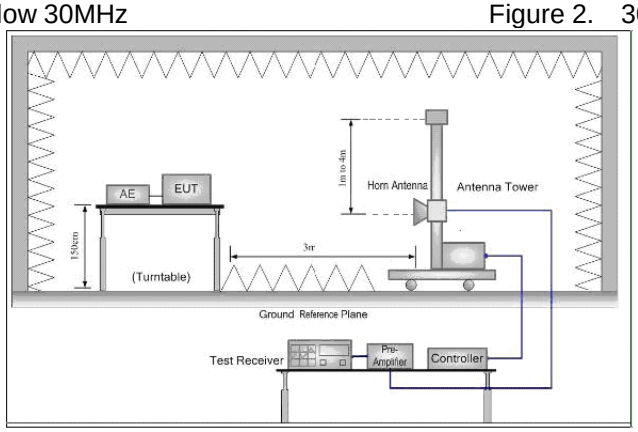


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F (kHz)	-	-	300
0.490MHz-1.705MHz	24000/F (kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

7.3 Test procedure

Below 1GHz test procedure as below:

a.The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.

b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c.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.

d.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 (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.

e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f.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.

Above 1GHz test procedure as below:

g.Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).

h.Test the EUT in the lowest channel ,the middle channel ,the Highest channel

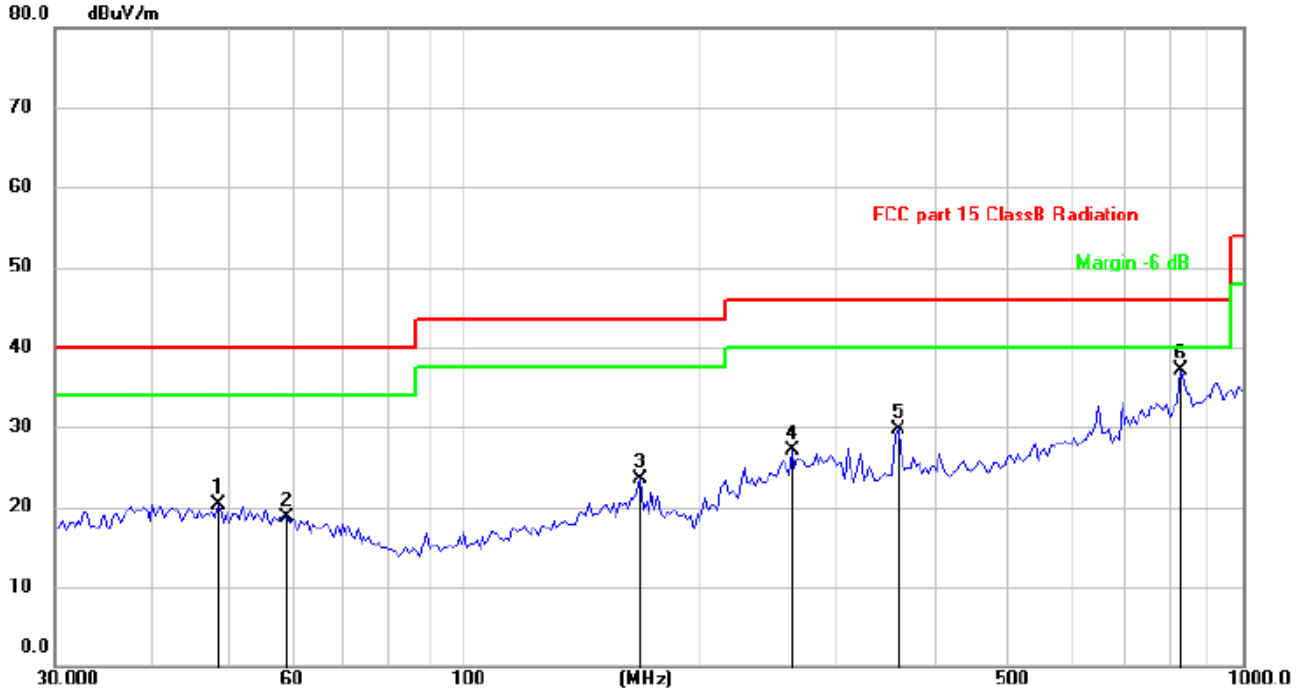
j.Repeat above procedures until all frequencies measured was complete.

Receiver set:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	100 kHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

7.4 Test Result

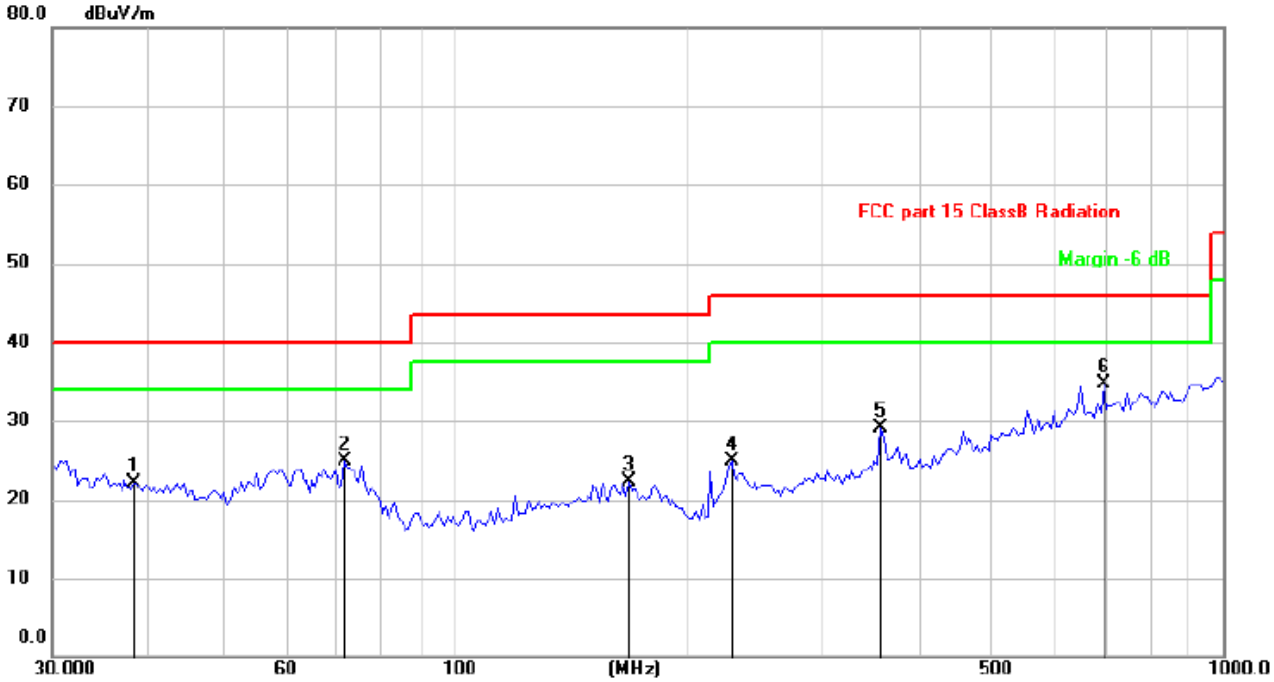
Below 1GHz Test Results:
Antenna polarity: H



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1		48.5865	26.88	-6.58	20.30	40.00	-19.70	peak	102	26	
2		59.4405	25.77	-7.12	18.65	40.00	-21.35	peak	105	59	
3		168.7093	29.75	-6.20	23.55	43.50	-19.95	peak	115	151	
4		263.8190	33.95	-6.86	27.09	46.00	-18.91	peak	106	69	
5		361.7137	33.53	-3.76	29.77	46.00	-16.23	peak	151	123	
6	*	831.8573	30.32	6.74	37.06	46.00	-8.94	peak	115	236	

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement – Limit

Antenna polarity: V



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector	cm	degree	Comment
1		38.3462	28.82	-6.68	22.14	40.00	-17.86	peak	112	12	
2		72.0841	34.18	-9.30	24.88	40.00	-15.12	peak	120	45	
3		168.7093	28.42	-6.20	22.22	43.50	-21.28	peak	104	231	
4		229.2930	34.36	-9.40	24.96	46.00	-21.04	peak	100	45	
5		358.5568	32.97	-3.85	29.12	46.00	-16.88	peak	125	164	
6	*	698.0795	30.43	4.35	34.78	46.00	-11.22	peak	115	21	

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement – Limit

Above 1 GHz Test Results:

CH Low (2402MHz)
Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	108.87	-5.84	103.03	114	-10.97	peak
2402	95.77	-5.84	89.93	94	-4.07	AVG
4804	56.56	-3.64	52.92	74	-21.08	peak
4804	47.65	-3.64	44.01	54	-9.99	AVG
7206	58.90	-0.95	57.95	74	-16.05	peak
7206	48.24	-0.95	47.29	54	-6.71	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2402	108.49	-5.84	102.65	114	-11.35	peak
2402	95.43	-5.84	89.59	94	-4.41	AVG
4804	56.36	-3.64	52.72	74	-21.28	peak
4804	47.04	-3.64	43.40	54	-10.60	AVG
7206	58.19	-0.95	57.24	74	-16.76	peak
7206	48.02	-0.95	47.07	54	-6.93	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH Middle (2440MHz)
Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2440	108.03	-5.71	102.32	114	-11.68	peak
2440	93.14	-5.71	87.43	94	-6.57	AVG
4880	55.94	-3.51	52.43	74	-21.57	peak
4880	46.82	-3.51	43.31	54	-10.69	AVG
7320	57.97	-0.82	57.15	74	-16.85	peak
7320	47.73	-0.82	46.91	54	-7.09	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2440	108.19	-5.71	102.48	114	-11.52	peak
2440	93.03	-5.71	87.32	94	-6.68	AVG
4880	55.99	-3.51	52.48	74	-21.52	peak
4880	46.95	-3.51	43.44	54	-10.56	AVG
7320	57.89	-0.82	57.07	74	-16.93	peak
7320	47.71	-0.82	46.89	54	-7.11	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

CH High (2480MHz)
Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	108.23	-5.65	102.58	114	-11.42	peak
2480	93.30	-5.65	87.65	94	-6.35	AVG
4960	56.13	-3.43	52.70	74	-21.30	peak
4960	47.30	-3.43	43.87	54	-10.13	AVG
7440	57.22	-0.75	56.47	74	-17.53	peak
7440	47.54	-0.75	46.79	54	-7.21	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2480	107.26	-5.65	101.61	114	-12.39	peak
2480	92.64	-5.65	86.99	94	-7.01	AVG
4960	56.12	-3.43	52.69	74	-21.31	peak
4960	47.43	-3.43	44.00	54	-10.00	AVG
7440	56.97	-0.75	56.22	74	-17.78	peak
7440	47.39	-0.75	46.64	54	-7.36	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Remark:
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2). All modes of GFSK were test at Low, Middle, and High channel, only the worst result of GFSK DH5 Low Channel was reported for below 1GHz test.
(3). For BT above 1GHz test all modes of GFSK were test at Low, Middle, and High channel, only the worst result of GFSK DH5 was reported.
(4). By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, and test data recorded in this report.
(5). Radiated emission test from 9kHz to 10th harmonic of fundamental was verified, and no emission found except system noise floor in 9kHz to 30MHz and not recorded in this report.

Restricted bands around fundamental frequency (Radiated)

Operation Mode: TX CH Low (2402MHz)
Horizontal (Worst case)

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310	55.34	-5.81	49.53	74	-24.47	peak
2310	/	-5.81	/	54	/	AVG
2390	54.52	-5.84	48.68	74	-25.32	peak
2390	/	-5.84	/	54	/	AVG
2400	52.63	-5.84	46.79	74	-27.21	peak
2400	/	-5.84	/	54	/	AVG

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2310	54.15	-5.81	48.34	74	-25.66	peak
2310	/	-5.81	/	54	/	AVG
2390	56.68	-5.84	50.84	74	-23.16	peak
2390	/	-5.84	/	54	/	AVG
2400	55.69	-5.84	49.85	74	-24.15	peak
2400	/	-5.84	/	54	/	AVG

Operation Mode: TX CH High (2480MHz)
Horizontal (Worst case)

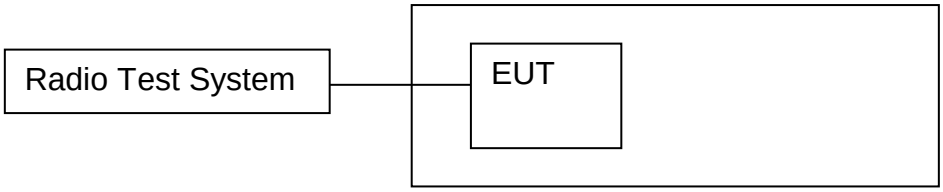
Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	56.26	-5.65	50.61	74	-23.39	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	53.48	-5.65	47.83	74	-26.17	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Vertical:

Frequency	Reading Result	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	
2483.50	54.26	-5.65	48.61	74	-25.39	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	52.48	-5.65	46.83	74	-27.17	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

8. BAND EDGE AND RF COUNDUCTED SPURIOUS EMISSIONS

8.1 Block Diagram Of Test Setup



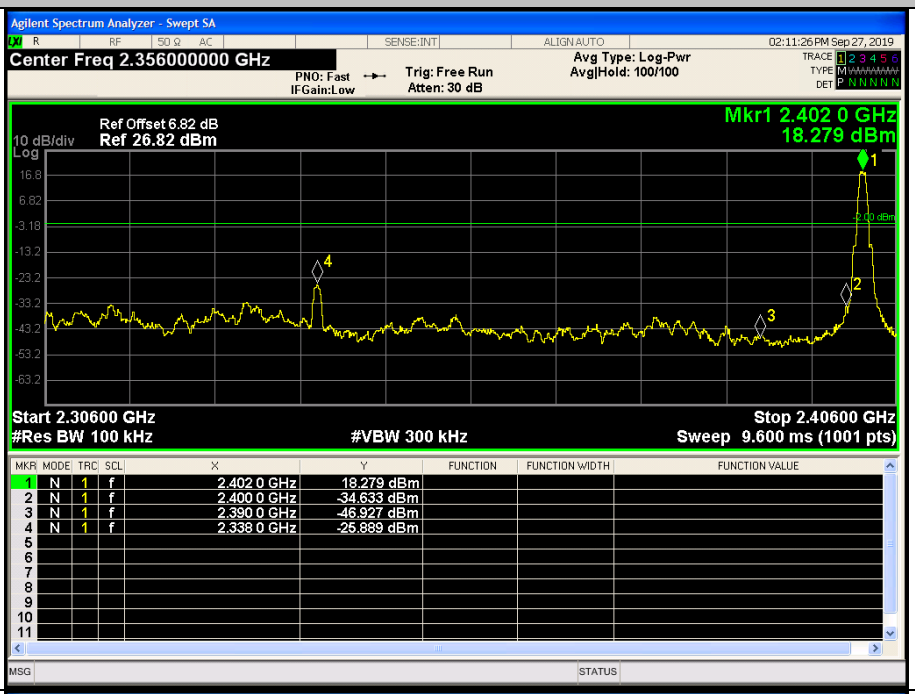
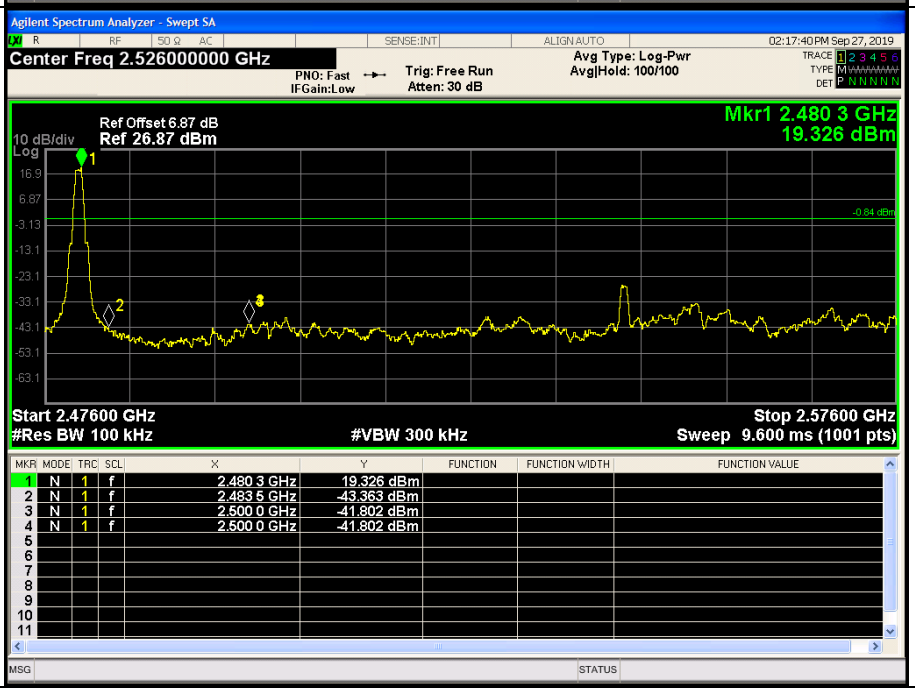
8.2 Limit

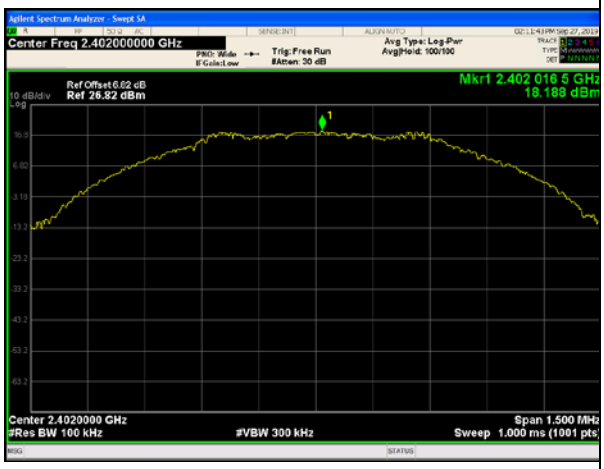
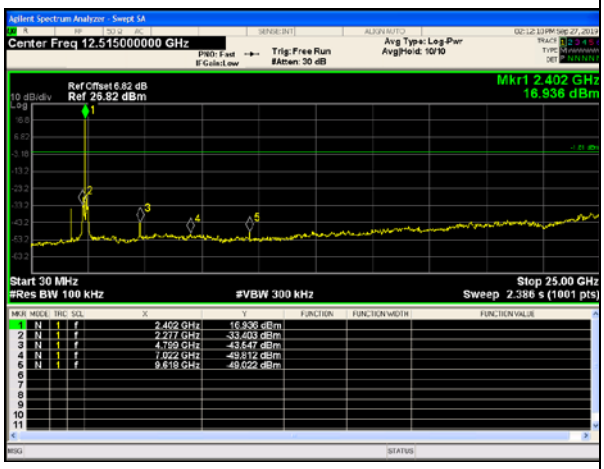
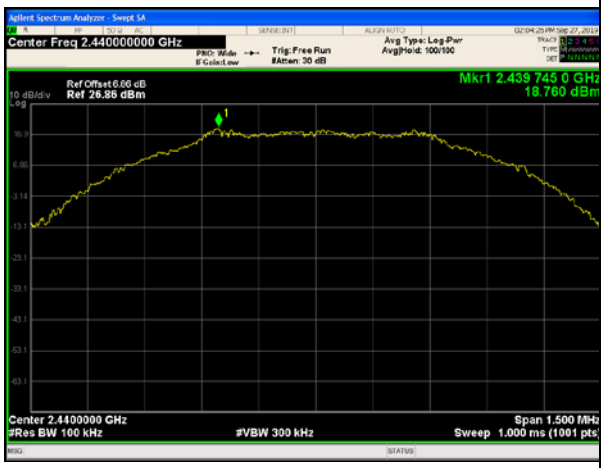
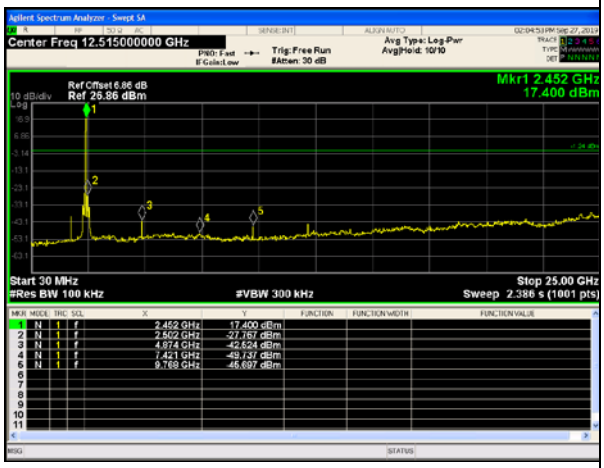
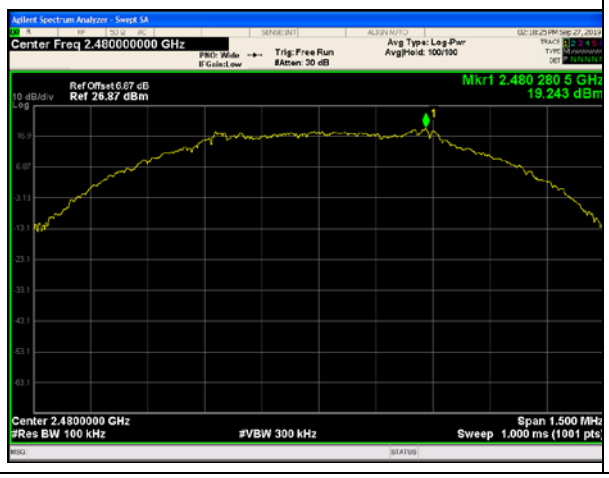
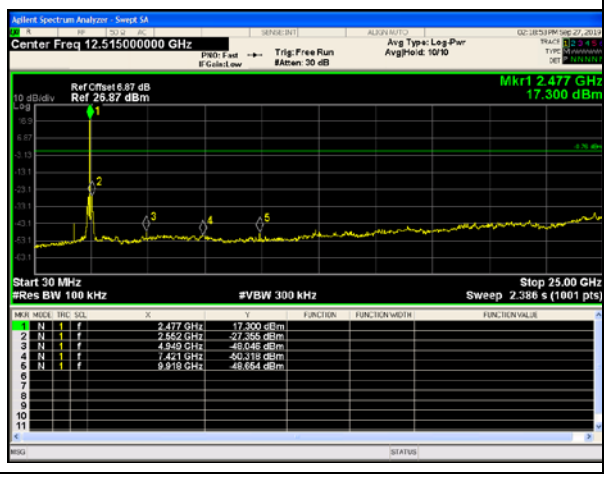
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) 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)).

8.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:
Blow 30MHz:
RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold
Above 30MHz:
RBW = 100KHz, VBW = 300KHz, Sweep = auto
Detector function = peak, Trace = max hold

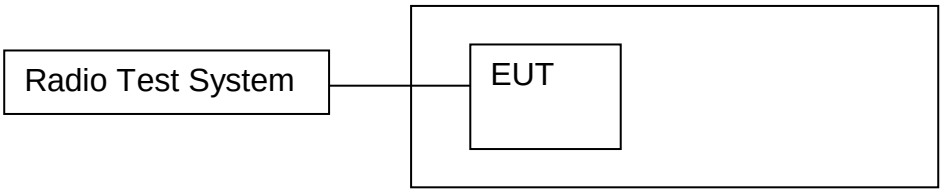
8.4 Test Result

BAND EDGE Graphs			
GFSK/LCH			
GFSK/HCH			

RF Conducted Spurious Emissions Graphs		
GFSK/LCH		
GFSK/MCH		
GFSK/HCH		

9. COUDUCTED MAX OUTPUT POWER

9.1 Block Diagram Of Test Setup



9.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(b)(3)	Conducted MAX Output Power	1 watt or 30dBm	2400-2483.5	PASS

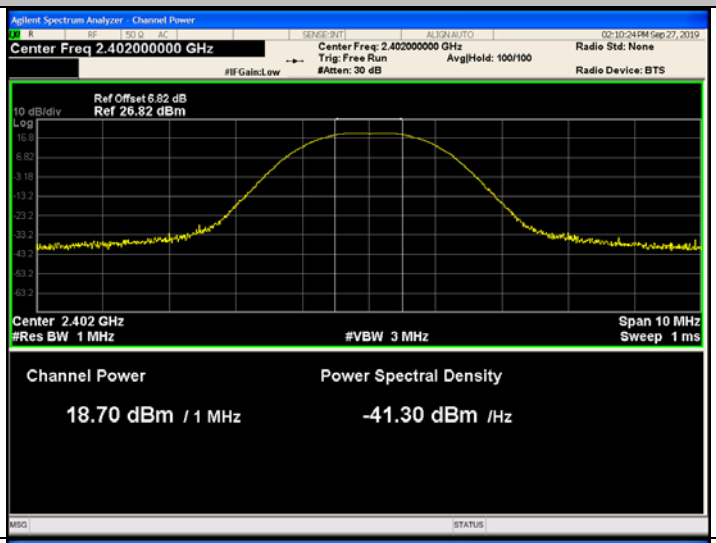
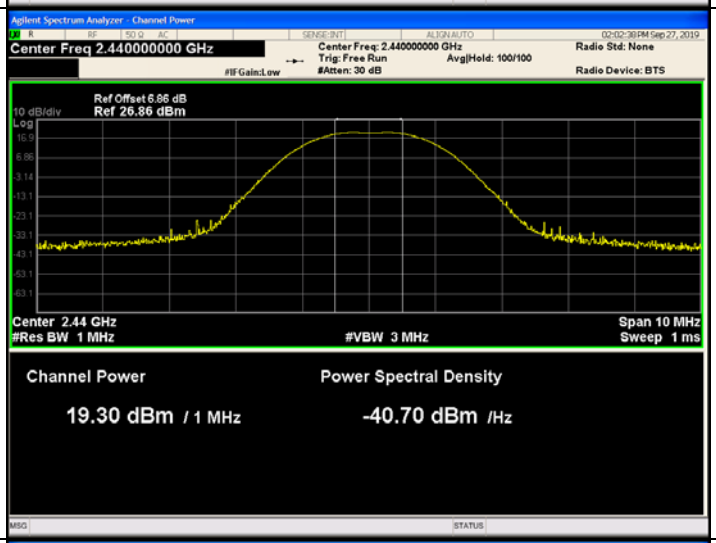
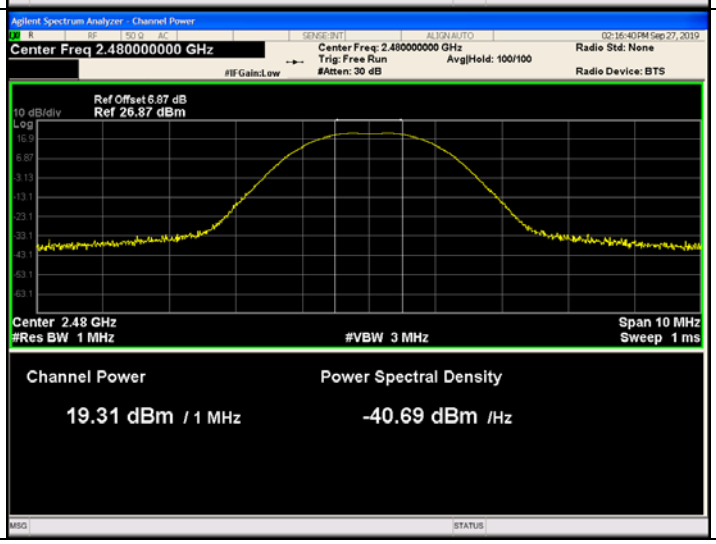
9.3 Test procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1MHz. VBW = 3MHz.
3. Keep the EUT in transmitting at lowest, middle and highest channel individually. Record the max value.

9.4 Test Result

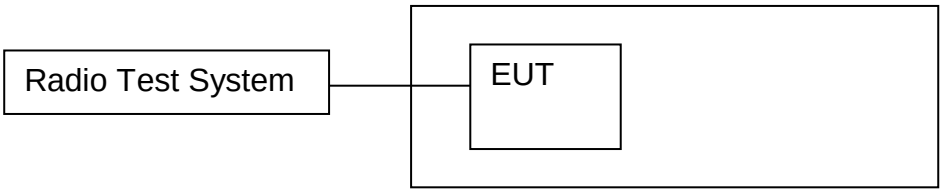
Mode	Channel.	Maximum Output Power [dBm]	Limit[dBm]	Verdict
GFSK	LCH	18.70	30	PASS
	MCH	19.30	30	PASS
	HCH	19.31	30	PASS

Test Graph:

Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

10. 6DB OCCUPIED BANDWIDTH

10.1 Block Diagram Of Test Setup



10.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247(a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

10.3 Test procedure

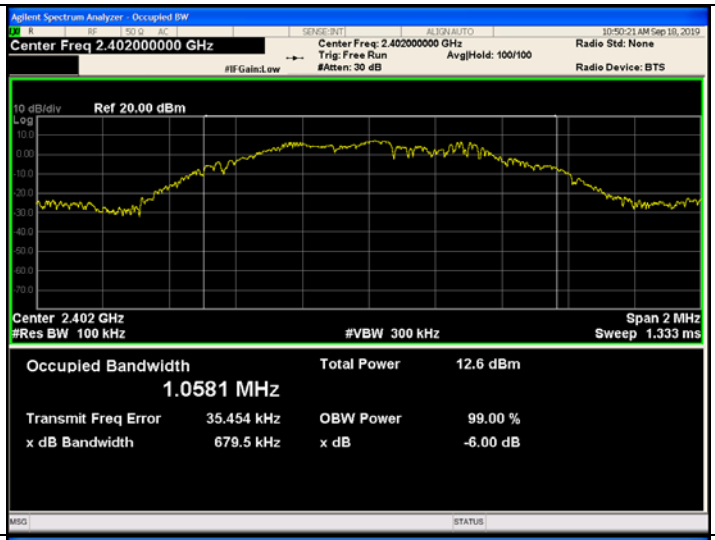
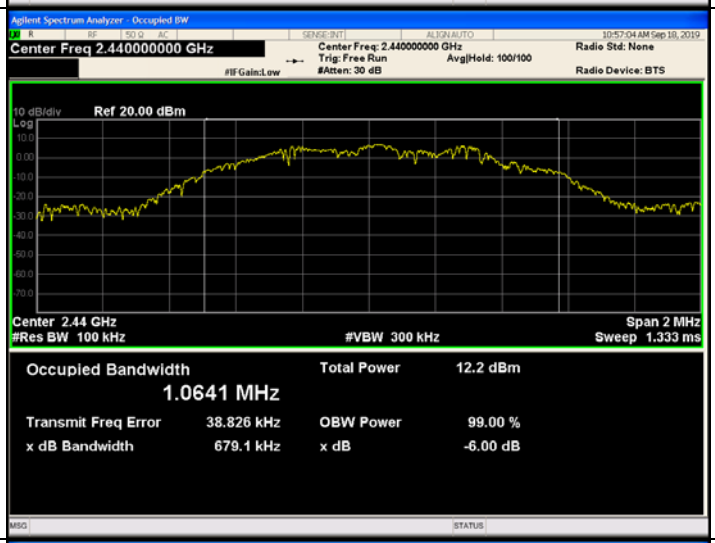
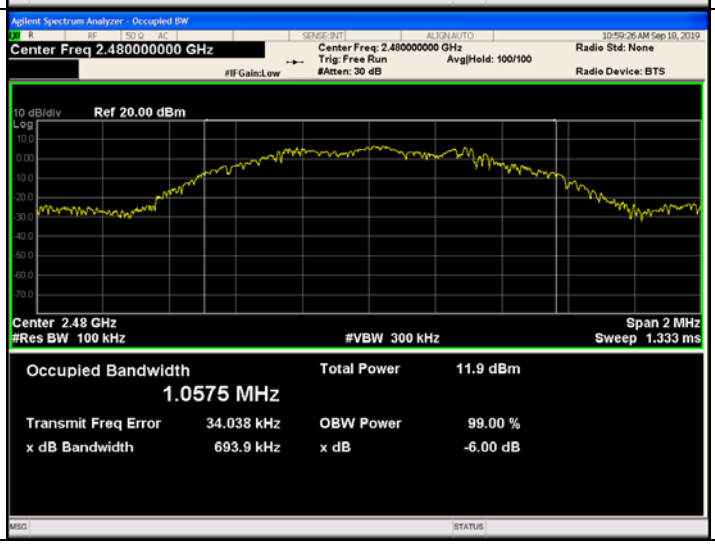
1. Rem1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

10.4 Test Result

Test Mode	Frequency	6dB Bandwidth (MHz)	Result
GFSK	Low channel	0.6795	**PASS**
	Mid channel	0.6791	**PASS**
	High channel	0.6939	**PASS**

Note: All modes of operation were Pre-scan and the worst-case emissions are reported.

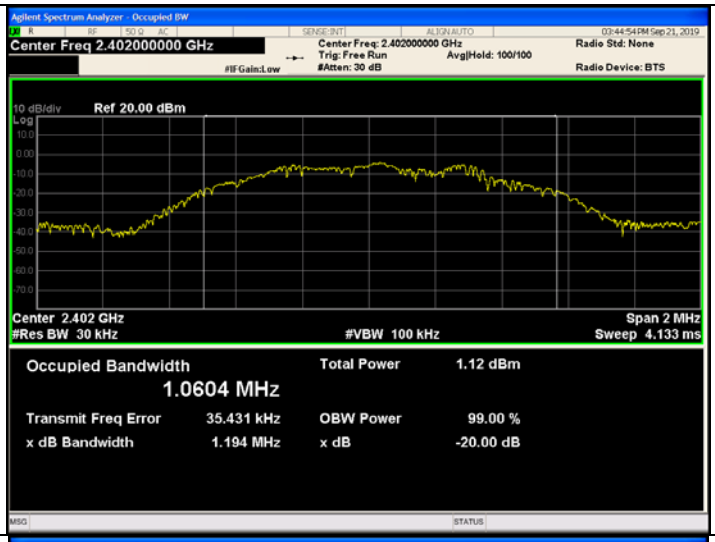
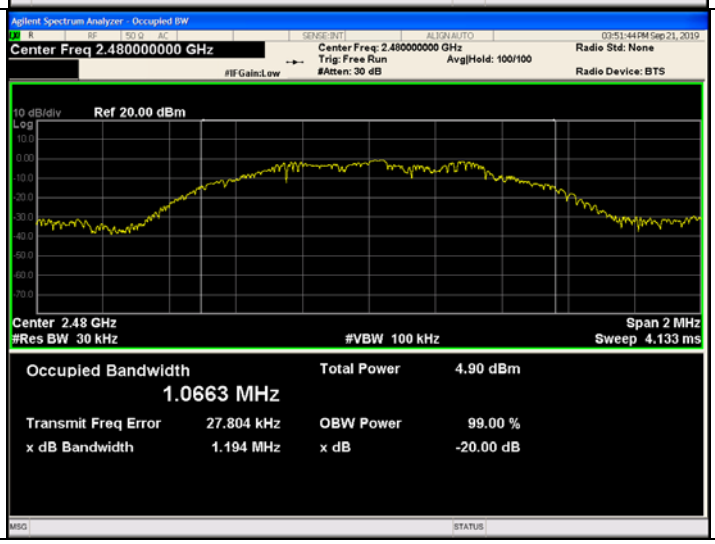
Test Graph:

GFSK Low channel		
GFSK Mid channel		
GFSK High channel		

Test Mode	Frequency	99% Bandwidth (MHz)	Result
GFSK	Low channel	1.0604	**PASS**
	Mid channel	1.0673	**PASS**
	High channel	1.0663	**PASS**

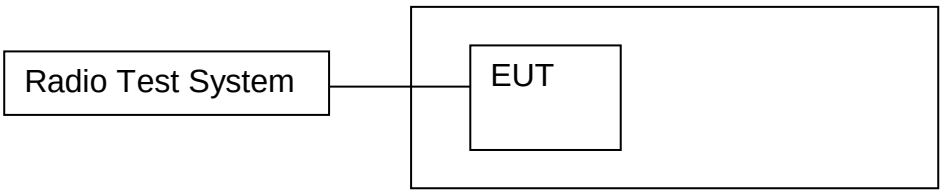
Note: All modes of operation were Pre-scan and the worst-case emissions are reported.

Test Graph:

GFSK Low channel		
GFSK Mid channel		
GFSK High channel		

11. POWER SPECTRAL DENSITY

11.1 Block Diagram Of Test Setup



11.2 Limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

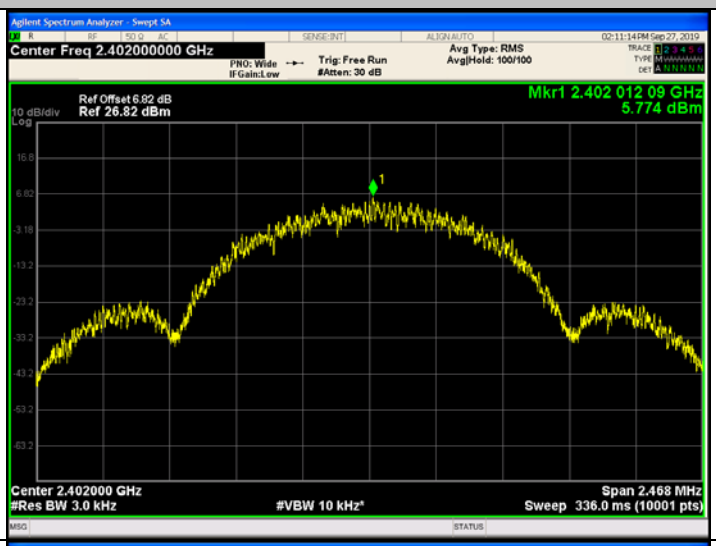
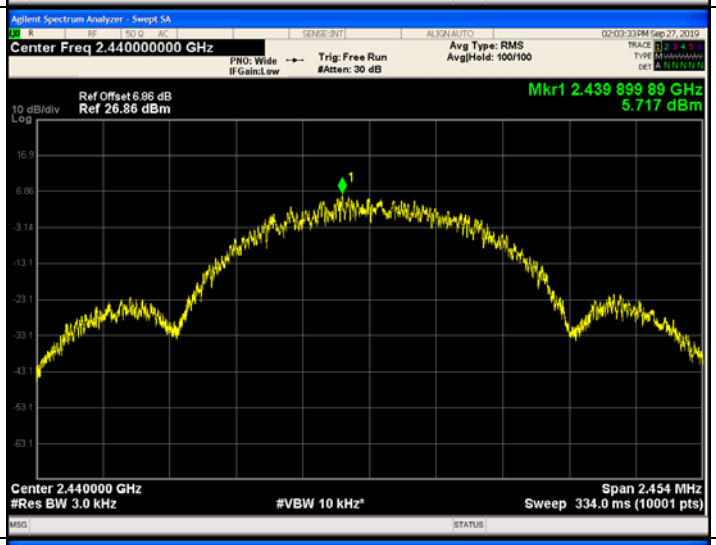
11.3 Test procedure

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 x RBW.
5. Detector = RMS.
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.

11.4 Test Result

Mode	Channel.	Carrier Frequency Separation [MHz]	Limit(dBm)	Verdict
GFSK	LCH	5.774	8	PASS
GFSK	MCH	5.717	8	PASS
GFSK	HCH	7.204	8	PASS

Test Graph

Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

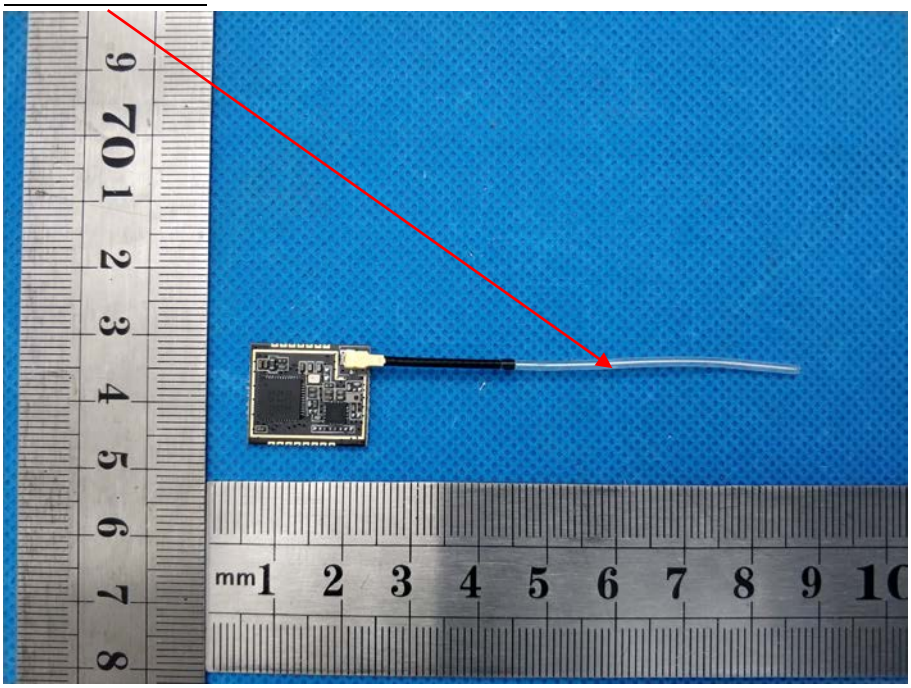
12. ANTENNA REQUIREMENT

15.203 requirement:
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.
15.247(b) (4) requirement:
The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is External Antenna. The best case gain of the antenna is 0dBi.

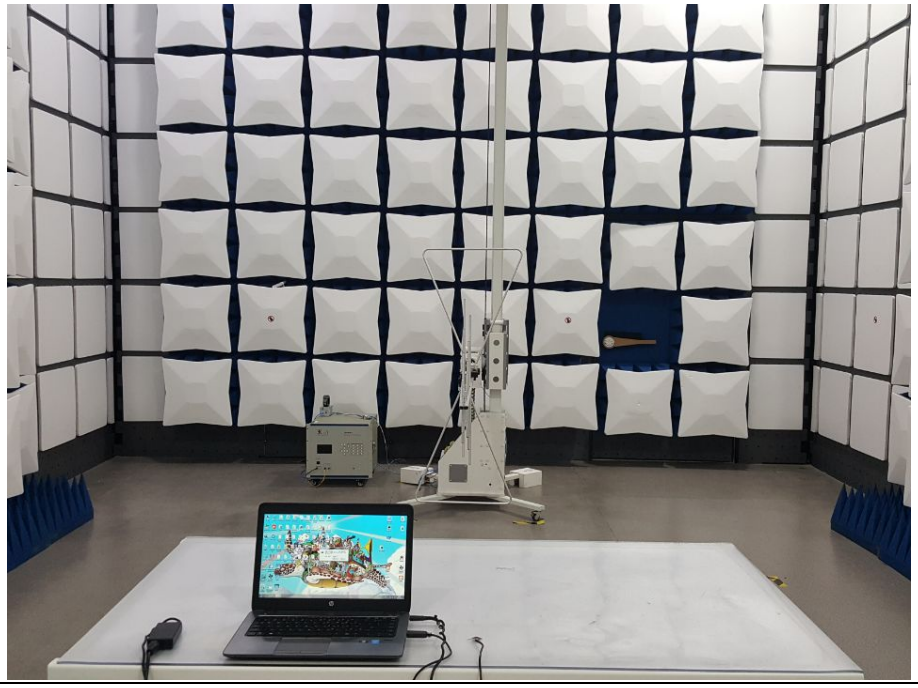
BT ANTENNA



13. EUT TEST SETUP PHOTOGRAPHS

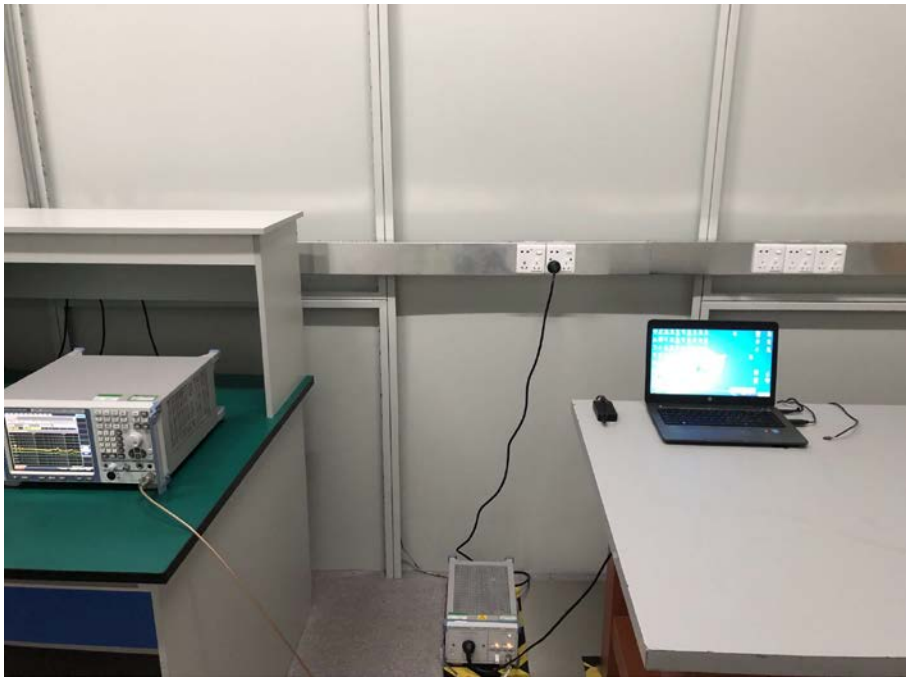
Radiated Emission

Below 1G



Above 1G

Conducted Emission



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