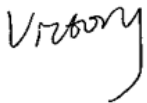


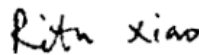
# TEST REPORT

Product Name: Zigbee  
FCC ID: 2AOE2-REX3M  
Trademark: N/A  
Model Number: REX3M  
Prepared For: Zhejiang Raying IoT Technology Co., Ltd.  
Address: 10F, North of Bld. No.10, Wellong Park, No.88 Jiangling Road, Binjiang District, Hangzhou, 310051 China  
Manufacturer: Zhejiang Raying IoT Technology Co., Ltd.  
Address: 10F, North of Bld. No.10, Wellong Park, No.88 Jiangling Road, Binjiang District, Hangzhou, 310051 China  
Prepared By: Shenzhen CTB Testing Technology Co., Ltd.  
Address: Floor 1&2, Building A, No. 26 of Xinxhe Road, Xinqiao Community, Xinqiao Street, Baoan District, Shenzhen, Guangdong China  
Sample Received Date: Mar. 20, 2020  
Sample tested Date: Mar. 20, 2020 to Mar. 31, 2020  
Issue Date: Mar. 31, 2020  
Report No.: CTB200330021RFX  
Test Standards: FCC Part15.247  
ANSI C63.10:2013  
Test Results: PASS  
Remark: This is Zigbee radio test report.

Compiled by:

Victory

Reviewed by:

Rita Xiao

Approved by:

Sherwin Qian/ Director

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.

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*(Note: N/A means not applicable)*



## 1. VERSION

Report No.	Issue Date	Description	Approved
CTB200330021RFX	Mar. 31, 2020	Original	Valid

## 2. TEST SUMMARY

The Product has been tested according to the following specifications:

Test Item	Test Requirement	Test method	Result
<b>AC Power Line Conducted Emission</b>	47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013	PASS
<b>Radiated Spurious emissions</b>	47 CFR Part 15 Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS
<b>Band edge and RF Conducted Spurious Emissions</b>	47 CFR Part 15 Subpart C Section 15.247(d)/15.205(a)	ANSI C63.10-2013	PASS
<b>Conducted Peak Output Power</b>	47 CFR Part 15 Subpart C Section 15.247 (b)(3)	ANSI C63.10-2013	PASS
<b>Bandwidth</b>	47 CFR Part 15 Subpart C Section 15.247 (a)(2)	ANSI C63.10-2013	PASS
<b>Power Spectral Density</b>	47 CFR Part 15 Subpart C Section 15.247 (e)	ANSI C63.10-2013/ KDB 558074 D01v04	PASS
<b>Antenna Requirement</b>	47 CFR Part 15 Subpart C Section 15.203/15.247 (c)	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	54.3kHz
Conducted output power Above 1G	0.9dB
Conducted output power below 1G	0.9dB
Power Spectral Density , Conduction	0.9dB
Conduction spurious emissions	2.0dB
Out of band emission	2.0dB
3m chamber Radiated spurious emission(30MHz-1GHz)	4.6dB
3m chamber Radiated spurious emission(1GHz-18GHz)	5.1dB
3m chamber Radiated spurious emission(18GHz-40GHz)	3.4dB
humidity uncertainty	5.5%
Temperature uncertainty	0.63°C
frequency	$1 \times 10^{-7}$
Conducted Emission (150KHz-30MHz)	3.2 dB
Radiated Emission(30MHz ~ 1000MHz)	4.8 dB
Radiated Emission(1GHz ~6GHz)	4.9 dB



## 4. PRODUCT INFORMATION AND TEST SETUP

### 4.1 Product Information

Model(s):	REX3M
Model Description:	N/A
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	Zigbee: 2405-2480MHz
Max. RF output power:	Zigbee: 1.475dBm
Type of Modulation:	Zigbee: O-QPSK
Antenna installation:	Zigbee: External antenna
Antenna Gain:	Zigbee:1.5dBi
Ratings:	DC 3.3V
Test Power Supply:	DC 3.3V

### 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-CH20 0-88V-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

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
11	2405MHz	15	2425MHz	19	2445MHz	23	2465MHz
12	2410MHz	16	2430MHz	20	2450MHz	24	2470MHz
13	2415MHz	17	2435MHz	21	2455MHz	25	2475MHz
14	2420MHz	18	2445MHz	22	2460MHz	26	2480MHz

#### 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)	2405MHz	2445MHz	2480MHz

#### 4.6 Test Environment

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



## 5. TEST FACILITY AND TEST INSTRUMENT USED

### 5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen 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	Type No.	Serial No.	Last calibration	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	Oct. 17, 2019	Oct. 16, 2020
2	Power Sensor	Agilent	U2021XA	MY56120032	Nov. 02, 2019	Nov. 01, 2020
3	Power Sensor	Agilent	U2021XA	MY56120034	Nov. 02, 2019	Nov. 01, 2020
4	Communication test set	R&S	CMW500	118735	Nov. 02, 2019	Nov. 01, 2020
5	Spectrum Analyzer	R&S	FSP40	100550	Nov. 02, 2019	Nov. 01, 2020
6	Signal Generator	Agilent	N5181A	MY49060920	Nov. 03, 2019	Nov. 02, 2020
7	Signal Generator	Agilent	N5182A	MY47420195	Nov. 03, 2019	Nov. 02, 2020
8	Communication test set	R&S	CMU200	119978	Nov. 02, 2019	Nov. 01, 2020
9	band rejection filter	Shenxiang	MSF2400-24 83.5MS-1154	20181015001	Nov. 02, 2019	Nov. 01, 2020
10	band rejection filter	Shenxiang	MSF5150-58 50MS-1155	20181015001	Nov. 02, 2019	Nov. 01, 2020
11	band rejection filter	Xingbo	XBLBQ-DZA 120	190821-1-1	Nov. 02, 2019	Nov. 01, 2020
12	BT&WI-FI Automatic test software	Microwave	MTS8310	Ver. 2.0.0.0	\	\
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	Nov. 02, 2019	Nov. 01, 2020
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	Nov. 02, 2019	Nov. 01, 2020
15	234G Automatic test software	Microwave	MTS8200	Ver. 2.0.0.0	\	\
16	966 chamber	C.R.T.	966 Room	966	Nov. 10, 2019	Nov. 09, 2020

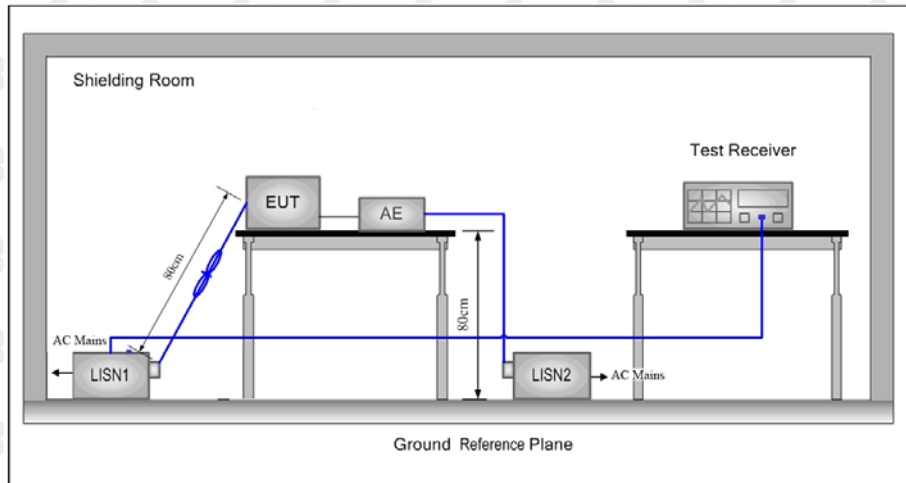
17	Receiver	R&S	ESPI	100362	Nov. 02, 2019	Nov. 01, 2020
18	Amplifier	HP	8447E	2945A02747	Nov. 03, 2019	Nov. 02, 2020
19	Amplifier	Agilent	8449B	3008A01838	Nov. 03, 2019	Nov. 02, 2020
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	869	Nov. 02, 2019	Nov. 01, 2020
21	Horn Antenna	Schwarzbeck	BBHA9120D	1911	Nov. 02, 2019	Nov. 01, 2020
22	Software	Fala	EZ-EMC	FA-03A2 RE	\	\
23	3-Loop Antenna	Daze	ZN30401	17014	Nov. 02, 2019	Nov. 01, 2020
24	loop antenna	ZHINAN	ZN30900A	/	Nov. 02, 2019	Nov. 01, 2020
25	Horn antenna	A/H/System	SAS-574	588	Nov. 02, 2019	Nov. 01, 2020
26	Amplifier	AEROFLEX	/	S/N/ 097	Nov. 02, 2019	Nov. 01, 2020

Conducted emissions Test						
	Equipment	Manufacturer	Model#	Serial#	Last Cal.	Next Cal.
27	AMN	ROHDE&SC HWARZ	ESH3-Z5	831551852	Nov. 02, 2019	Nov. 01, 2020
29	Pulse limiter	ROHDE&SC HWARZ	ESH3Z2	357881052	Nov. 02, 2019	Nov. 01, 2020
30	EMI TEST RECEIVER	ROHDE&SC HWARZ	ESCS30	834115/006	Nov. 02, 2019	Nov. 01, 2020
31	Coaxial cable	ZDECL	Z302S	18091904	Nov. 02, 2019	Nov. 01, 2020
32	ISN	TESEQ	NTFM8158	NTFM8158# 183	Nov. 02, 2019	Nov. 01, 2020
33	EMI TEST RECEIVER	ROHDE&SC HWARZ	ESCI	10428	Nov. 02, 2019	Nov. 01, 2020
34	Software	Fala	EZ-EMC	EMC-CON 3A1.1	\	\



## 6. AC POWER LINE CONDUCTED EMISSION

### 6.1 Block Diagram Of Test Setup



### 6.2 Limit

Frequency (MHz)	Maximum RF Line Voltage (dB $\mu$ V)			
	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 50 $\Omega$ /50 $\mu$ H + 5 $\Omega$  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

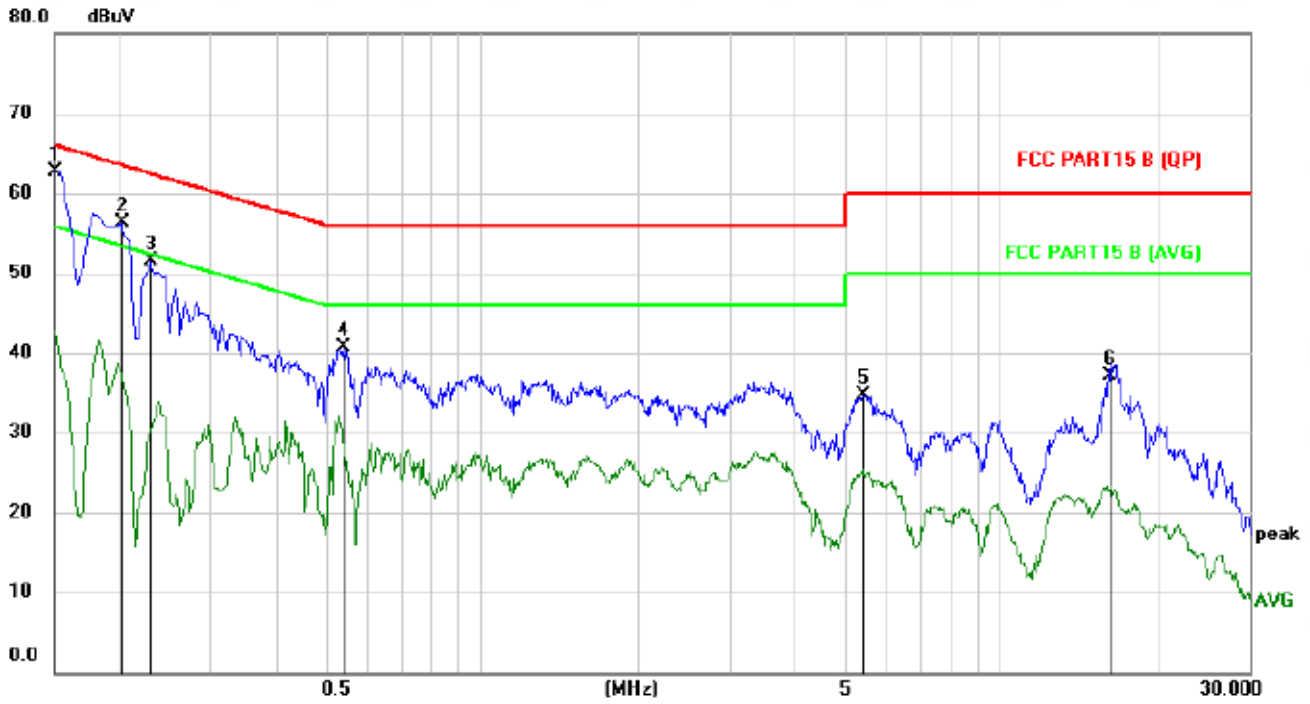


between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

- 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

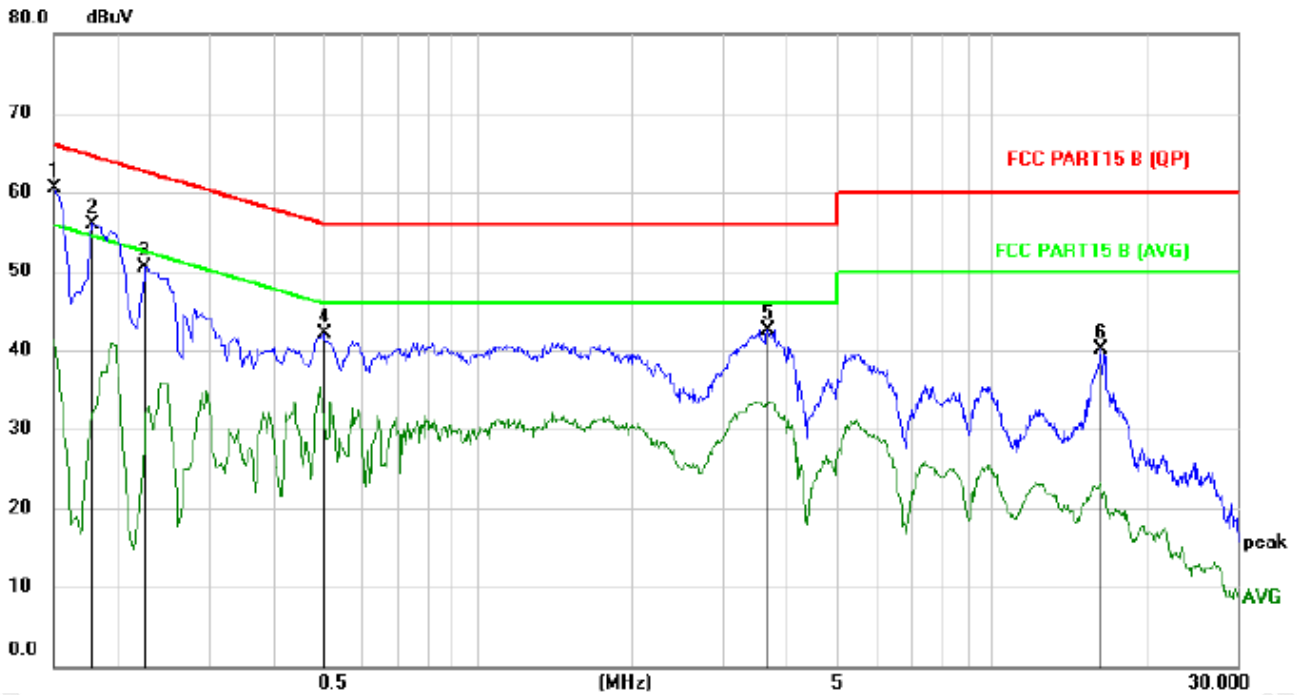


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	*	0.1500	52.69	10.08	62.77	66.00	-3.23	peak	
2		0.2020	46.10	10.12	56.22	63.53	-7.31	peak	
3		0.2300	41.32	10.13	51.45	62.45	-11.00	peak	
4		0.5420	30.40	10.23	40.63	56.00	-15.37	peak	
5		5.4180	24.21	10.52	34.73	60.00	-25.27	peak	
6		16.1380	26.49	10.71	37.20	60.00	-22.80	peak	

Remark:

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

Test Specification: Line



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1	*	0.1500	50.42	10.08	60.50	66.00	-5.50	peak	
2		0.1780	45.90	10.10	56.00	64.58	-8.58	peak	
3		0.2260	40.43	10.13	50.56	62.60	-12.04	peak	
4		0.5020	31.90	10.23	42.13	56.00	-13.87	peak	
5		3.6620	32.18	10.34	42.52	56.00	-13.48	peak	
6		16.2460	29.41	10.71	40.12	60.00	-19.88	peak	

Remark:

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



## 7. RADIATED SPURIOUS EMISSION

### 7.1 Block Diagram Of Test Setup

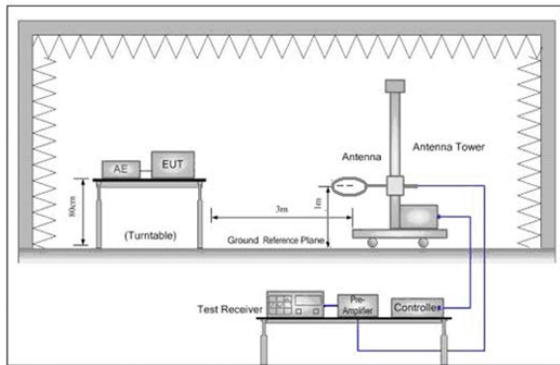


Figure 1. Below 30MHz

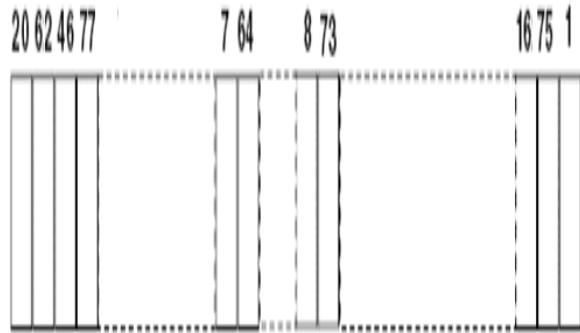


Figure 2. 30MHz to 1GHz

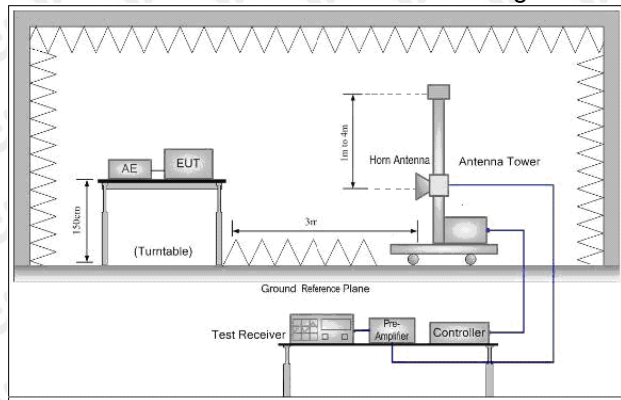


Figure 3. Above 1GHz

### 7.2 Limit

Spurious Emissions:

Frequency	Field strength (microvolt/meter)	Limit (dB $\mu$ V/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 chamber. 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:**

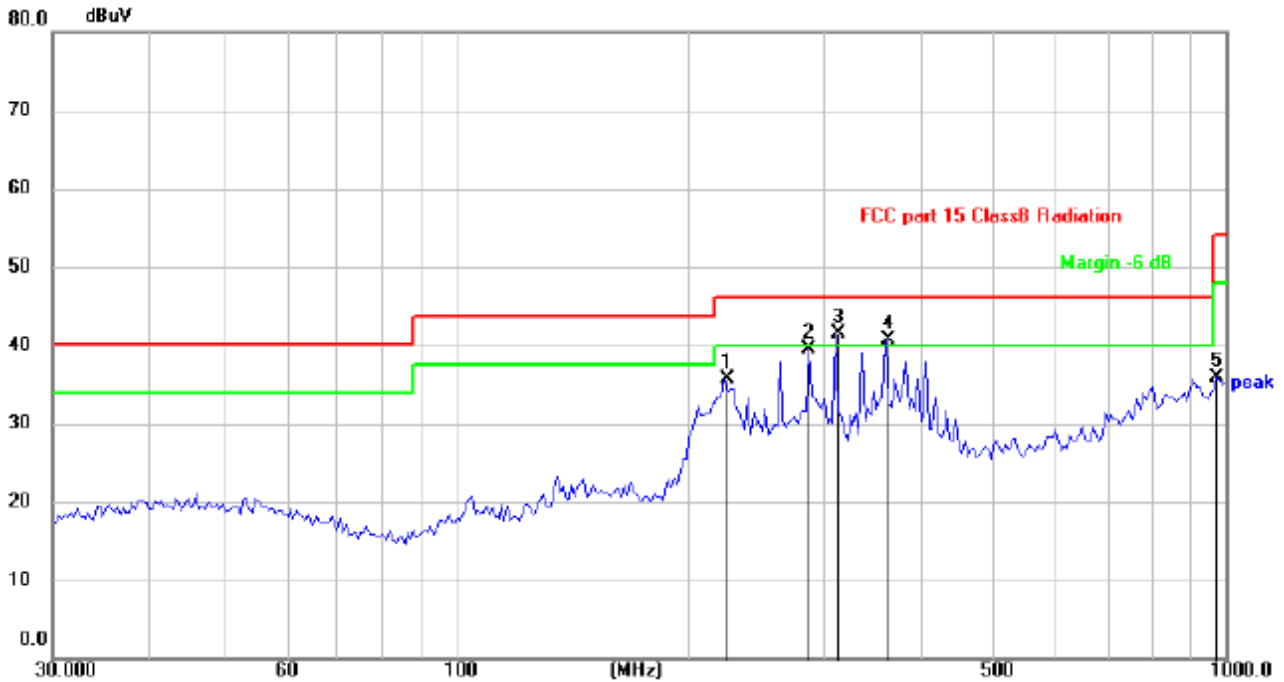
- g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter( Above 18GHz the distance is 1 meter and table is 1.5 meter).
- h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel
- j. 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	120 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

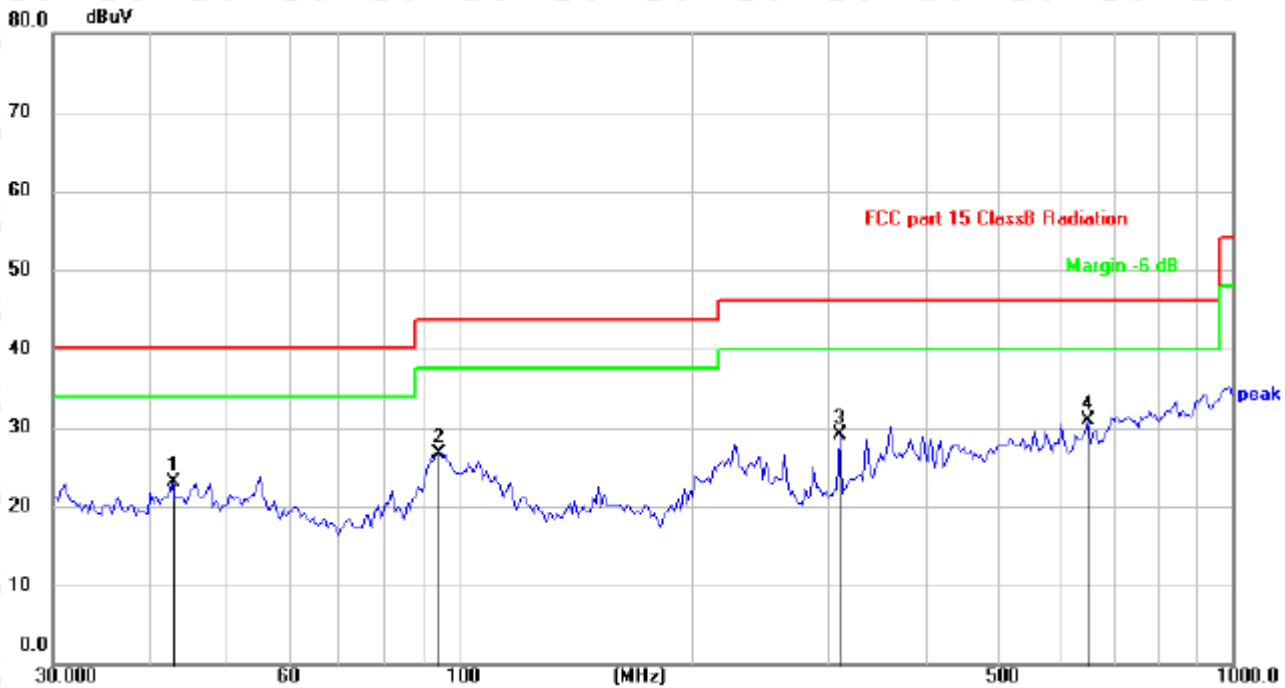


No.	Mk.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		223.3415	43.62	-7.88	35.74	46.00	-10.26	peak	
2		287.9904	45.02	-5.52	39.50	46.00	-6.50	peak	
3	*	311.6326	46.75	-5.29	41.46	46.00	-4.54	peak	
4	!	381.7139	44.16	-3.41	40.75	46.00	-5.25	peak	
5		974.0436	28.03	7.85	35.88	54.00	-18.12	peak	

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



Antenna polarity: V



No.	Mk.	Freq. MHz	Reading Level dBuV/m	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Margin dB	Detector	Comment
1		42.6000	28.85	-5.78	23.07	40.00	-16.93	peak	
2		94.5940	36.57	-9.90	26.67	43.50	-16.83	peak	
3		311.6325	34.35	-5.29	29.06	46.00	-16.94	peak	
4	*	650.7997	27.94	2.94	30.88	46.00	-15.12	peak	

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

## Above 1 GHz Test Results:

 CH Low (2405MHz)  
 Horizontal:

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
2405	109.03	-5.83	103.20	114	-10.80	peak
2405	94.35	-5.83	88.52	94	-5.48	AVG
4810	57.38	-3.62	53.76	74	-20.24	peak
4810	49.00	-3.62	45.38	54	-8.62	AVG
7215	59.53	-0.93	58.60	74	-15.40	peak
7215	48.14	-0.93	47.21	54	-6.79	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
2405	111.04	-5.83	105.21	114	-8.79	peak
2405	94.47	-5.83	88.64	94	-5.36	AVG
4810	58.04	-3.62	54.42	74	-19.58	peak
4810	48.93	-3.62	45.31	54	-8.69	AVG
7215	58.21	-0.93	57.28	74	-16.72	peak
7215	49.57	-0.93	48.64	54	-5.36	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

CH Middle (2445MHz)  
Horizontal:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dB $\mu$ V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	
2445	106.45	-5.69	100.76	114	-13.24	peak
2445	92.12	-5.69	86.43	94	-7.57	AVG
4890	55.29	-3.49	51.80	74	-22.20	peak
4890	46.96	-3.49	43.47	54	-10.53	AVG
7335	56.25	-0.81	55.44	74	-18.56	peak
7335	46.97	-0.81	46.16	54	-7.84	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dB $\mu$ V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	
2445	106.90	-5.69	101.21	114	-12.79	peak
2445	92.32	-5.69	86.63	94	-7.37	AVG
4890	54.66	-3.49	51.17	74	-22.83	peak
4890	46.01	-3.49	42.52	54	-11.48	AVG
7335	57.12	-0.81	56.31	74	-17.69	peak
7335	46.05	-0.81	45.24	54	-8.76	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.



CH High (2480MHz)  
Horizontal:

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
2480	106.92	-5.65	101.27	114	-12.73	peak
2480	91.47	-5.65	85.82	94	-8.18	AVG
4960	55.72	-3.43	52.29	74	-21.71	peak
4960	46.40	-3.43	42.97	54	-11.03	AVG
7440	55.94	-0.75	55.19	74	-18.81	peak
7440	45.97	-0.75	45.22	54	-8.78	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Meter Reading (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
2480	106.59	-5.65	100.94	114	-13.06	peak
2480	90.88	-5.65	85.23	94	-8.77	AVG
4960	55.46	-3.43	52.03	74	-21.97	peak
4960	47.24	-3.43	43.81	54	-10.19	AVG
7440	56.47	-0.75	55.72	74	-18.28	peak
7440	46.05	-0.75	45.30	54	-8.70	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 (2405MHz)  
Horizontal (Worst case)

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dB $\mu$ V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	
2310	54.48	-5.81	48.67	74	-25.33	peak
2310	/	-5.81	/	54	/	AVG
2390	53.19	-5.84	47.35	74	-26.65	peak
2390	/	-5.84	/	54	/	AVG
2400	53.33	-5.84	47.49	74	-26.51	peak
2400	/	-5.84	/	54	/	AVG

Vertical:

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dB $\mu$ V)	(dB)	(dB $\mu$ V/m)	(dB $\mu$ V/m)	(dB)	
2310	54.66	-5.81	48.85	74	-25.15	peak
2310	/	-5.81	/	54	/	AVG
2390	53.26	-5.84	47.42	74	-26.58	peak
2390	/	-5.84	/	54	/	AVG
2400	56.92	-5.84	51.08	74	-22.92	peak
2400	/	-5.84	/	54	/	AVG

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

Frequency (MHz)	Reading Result (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
2483.50	55.35	-5.65	49.70	74	-24.30	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	53.94	-5.65	48.29	74	-25.71	peak
2500.00	/	-5.65	/	54	/	AVG

Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:

Frequency (MHz)	Reading Result (dB $\mu$ V)	Factor (dB)	Emission Level (dB $\mu$ V/m)	Limits (dB $\mu$ V/m)	Margin (dB)	Detector Type
2483.50	56.35	-5.65	50.70	74	-23.30	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.46	-5.65	49.81	74	-24.19	peak
2500.00	/	-5.65	/	54	/	AVG

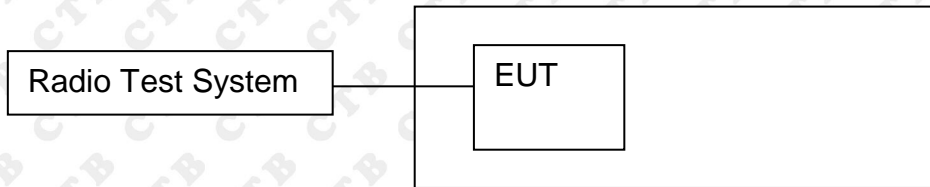
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.



## 8. BAND EDGE AND RF CONDUCTED SPURIOUS EMISSIONS

### 8.1 Block Diagram Of Test Setup



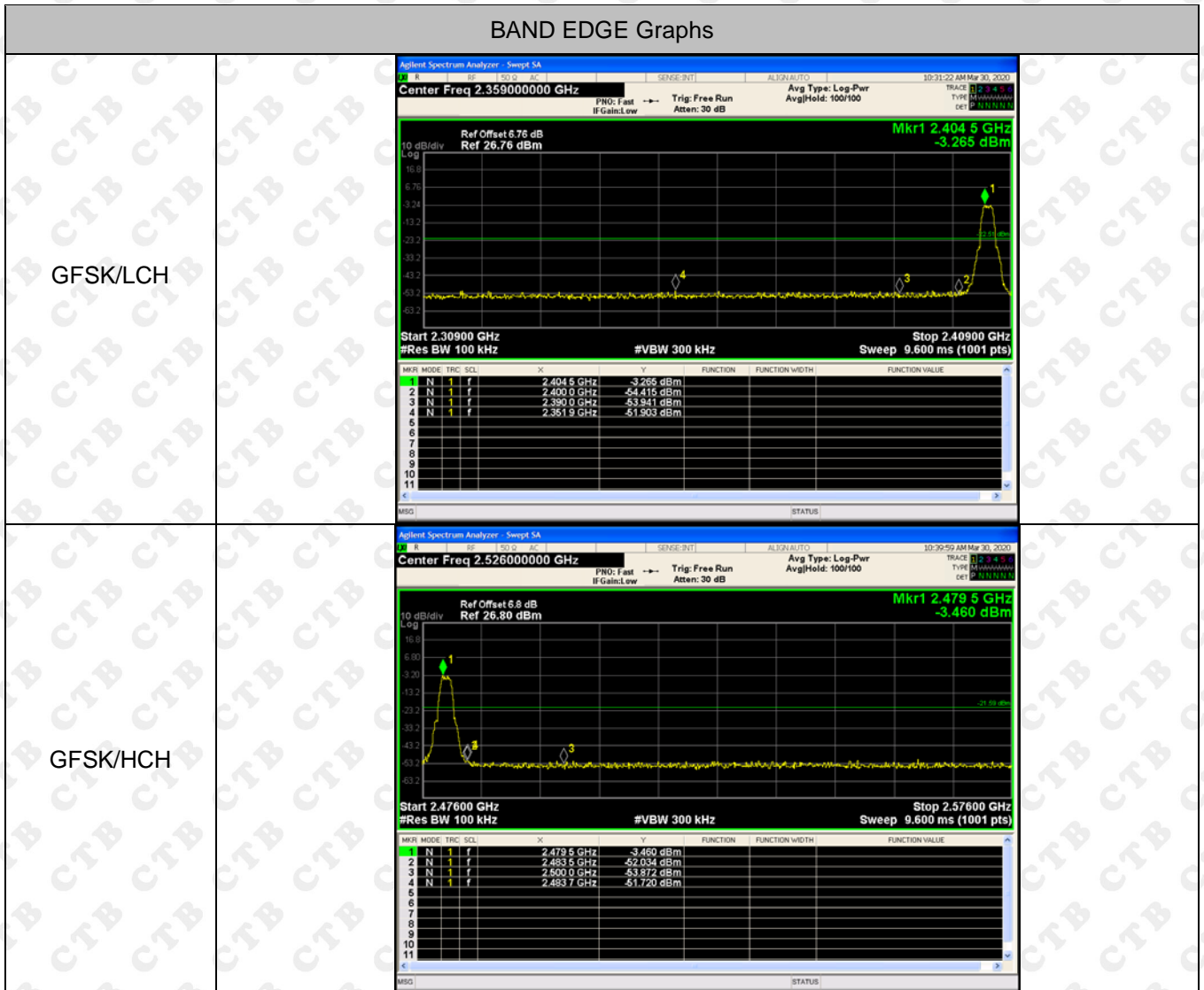
### 8.2 Limit

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

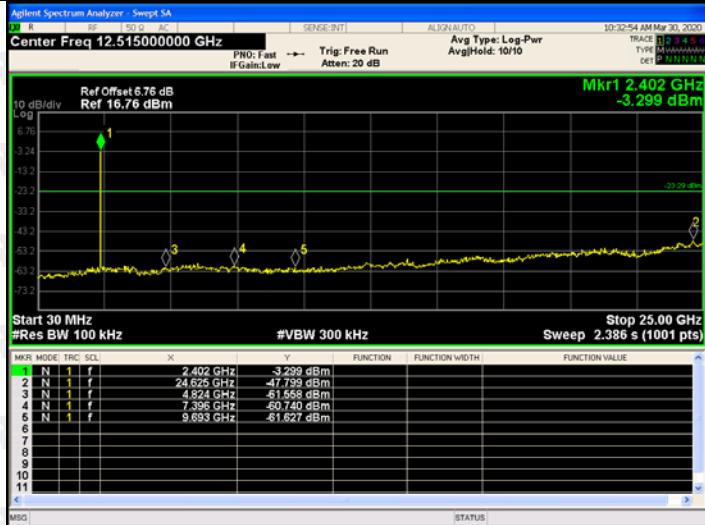
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer:  
Below 30MHz:  
RBW = 100kHz, VBW = 300kHz, Sweep = auto  
Detector function = peak, Trace = max hold  
Above 30MHz:  
RBW = 100KHz, VBW = 300KHz, Sweep = auto  
Detector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

### 8.4 Test Result

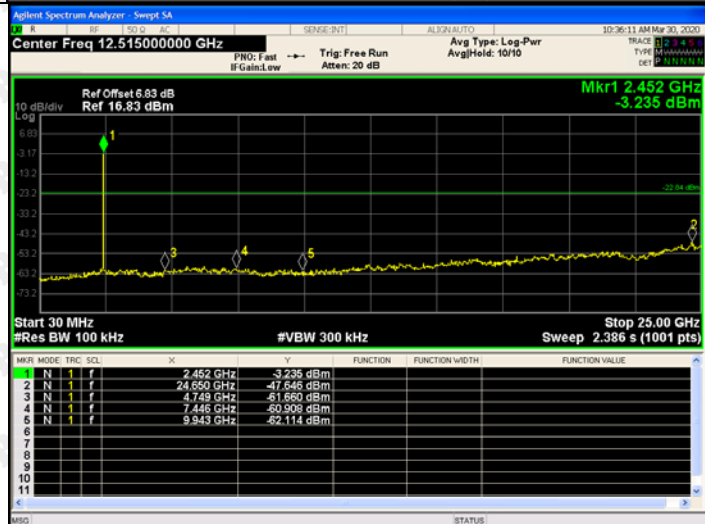


RF Conducted Spurious Emissions Graphs

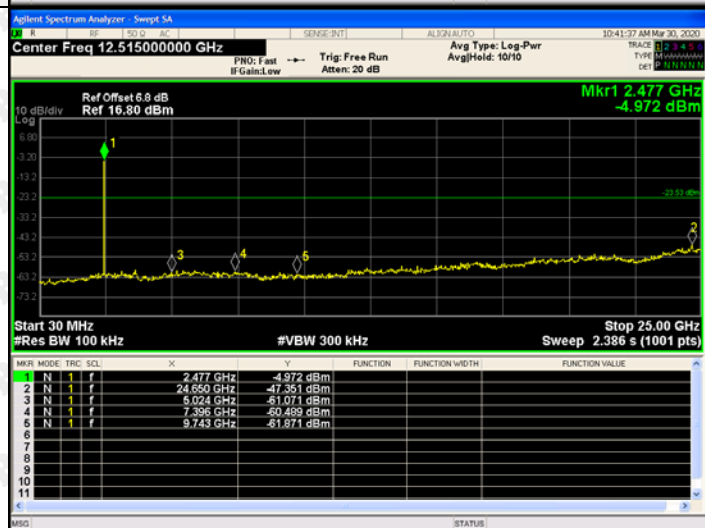
GFSK/LCH



GFSK/MCH



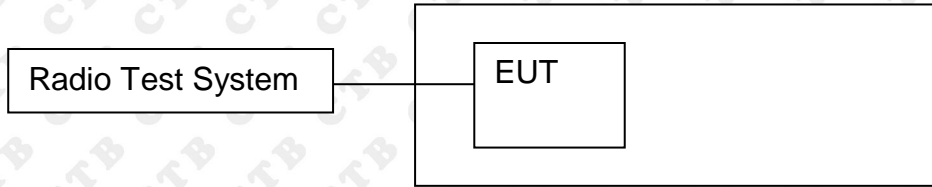
GFSK/HCH





## 9. COUDUCTED 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)	Peak 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. Channel power measurement. Sweep = auto; Detector Function = RMS.
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	1.310	30	PASS
	MCH	1.475	30	PASS
	HCH	0.555	30	PASS

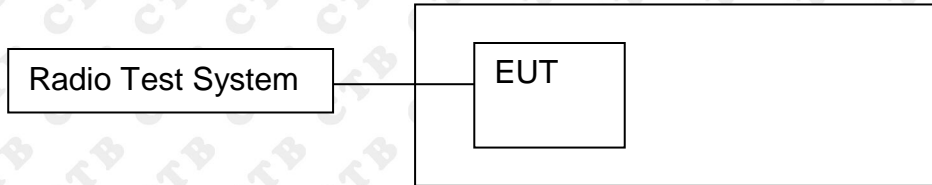
Test Graph:

Graphs	
GFSK/LCH	<p>Agilent Spectrum Analyzer - Swept SA          Marker 1 2.405230000000 GHz          Ref Offset: 6.76 dB          Ref: 26.76 dBm          Mkr1 2.405 23 GHz          1.310 dBm          Center: 2.405000 GHz          #Res BW 3.0 MHz          #VBW 3.0 MHz          Span 10.00 MHz          Sweep 1.000 ms (1001 pts)</p>
GFSK/MCH	<p>Agilent Spectrum Analyzer - Swept SA          Marker 1 2.444570000000 GHz          Ref Offset: 6.76 dB          Ref: 26.76 dBm          Mkr1 2.444 57 GHz          1.475 dBm          Center: 2.445000 GHz          #Res BW 3.0 MHz          #VBW 3.0 MHz          Span 10.00 MHz          Sweep 1.000 ms (1001 pts)</p>
GFSK/HCH	<p>Agilent Spectrum Analyzer - Swept SA          Marker 1 2.479340000000 GHz          Ref Offset: 6.76 dB          Ref: 26.76 dBm          Mkr1 2.479 34 GHz          0.555 dBm          Center: 2.480000 GHz          #Res BW 3.0 MHz          #VBW 3.0 MHz          Span 10.00 MHz          Sweep 1.000 ms (1001 pts)</p>



## 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	$\geq 500\text{KHz}$ (6dB bandwidth)	2400-2483.5	PASS

### 10.3 Test procedure

1. Rem1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW)  $\geq 3 \times$  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	1.5966	<b>PASS</b>
	Mid channel	1.6681	<b>PASS</b>
	High channel	1.5547	<b>PASS</b>

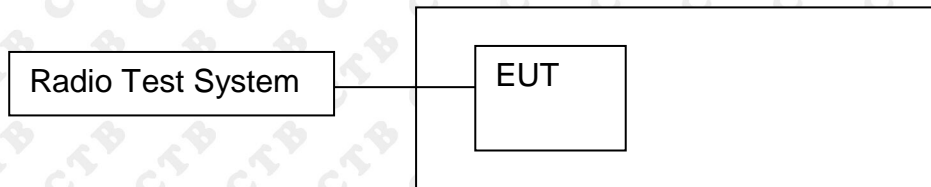
Note: All modes of operation were Pre-scan and the worst-case emissions are reported.

Test Graph:

<p>GFSK Low channel</p>	<p>Agilent Spectrum Analyzer - Occupied BW Center Freq 2.40500000 GHz Center Freq: 2.405000000 GHz Trig: Free Run #Atten: 30 dB AvgJHold: 100/100 Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref 20.00 dBm Center 2.405 GHz #Res BW 100 kHz #VBW 300 kHz Span 5 MHz Sweep 1.333 ms</p> <p>Occupied Bandwidth 2.2589 MHz Total Power 0.10 dBm Transmit Freq Error -748 Hz OBW Power 99.00 % x dB Bandwidth 1.597 MHz x dB -6.00 dB</p>	
<p>GFSK Mid channel</p>	<p>Agilent Spectrum Analyzer - Occupied BW Center Freq 2.44500000 GHz Center Freq: 2.445000000 GHz Trig: Free Run #Atten: 30 dB AvgJHold: 100/100 Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref 20.00 dBm Center 2.445 GHz #Res BW 100 kHz #VBW 300 kHz Span 5 MHz Sweep 1.333 ms</p> <p>Occupied Bandwidth 2.2641 MHz Total Power 0.24 dBm Transmit Freq Error -7.895 kHz OBW Power 99.00 % x dB Bandwidth 1.668 MHz x dB -6.00 dB</p>	
<p>GFSK High channel</p>	<p>Agilent Spectrum Analyzer - Occupied BW Center Freq 2.48000000 GHz Center Freq: 2.480000000 GHz Trig: Free Run #Atten: 30 dB AvgJHold: 100/100 Radio Std: None Radio Device: BTS</p> <p>10 dB/div Ref 20.00 dBm Center 2.48 GHz #Res BW 100 kHz #VBW 300 kHz Span 5 MHz Sweep 1.333 ms</p> <p>Occupied Bandwidth 2.2530 MHz Total Power -0.64 dBm Transmit Freq Error -1.414 kHz OBW Power 99.00 % x dB Bandwidth 1.555 MHz x dB -6.00 dB</p>	

## 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:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
4. Set the VBW  $\geq 3 \times \text{RBW}$ .
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.	Power Spectral Density (dBm/3KHz)	Limit(dBm/3KHz)	Verdict
GFSK	LCH	-11.43	8	PASS
GFSK	MCH	-11.317	8	PASS
GFSK	HCH	-12.253	8	PASS



Test Graph

Graphs	
GFSK/LCH	<p>Agilent Spectrum Analyzer - Swept SA          Center Freq 2.40500000 GHz          Ref Offset 6.76 dB          Ref 26.76 dBm          Mkr1 2.4054451 GHz          -11.430 dBm          Center 2.405000 GHz          #Res BW 3.0 kHz          #VBW 10 kHz*          Span 3.193 MHz          Sweep 434.7 ms (10001 pts)</p>
GFSK/MCH	<p>Agilent Spectrum Analyzer - Swept SA          Center Freq 2.44500000 GHz          Ref Offset 6.83 dB          Ref 26.83 dBm          Mkr1 2.4454454 GHz          -11.317 dBm          Center 2.445000 GHz          #Res BW 3.0 kHz          #VBW 10 kHz*          Span 3.336 MHz          Sweep 454.7 ms (10001 pts)</p>
GFSK/HCH	<p>Agilent Spectrum Analyzer - Swept SA          Center Freq 2.48000000 GHz          Ref Offset 6.8 dB          Ref 26.80 dBm          Mkr1 2.4804450 GHz          -12.253 dBm          Center 2.480000 GHz          #Res BW 3.0 kHz          #VBW 10 kHz*          Span 3.109 MHz          Sweep 423.3 ms (10001 pts)</p>

## 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.

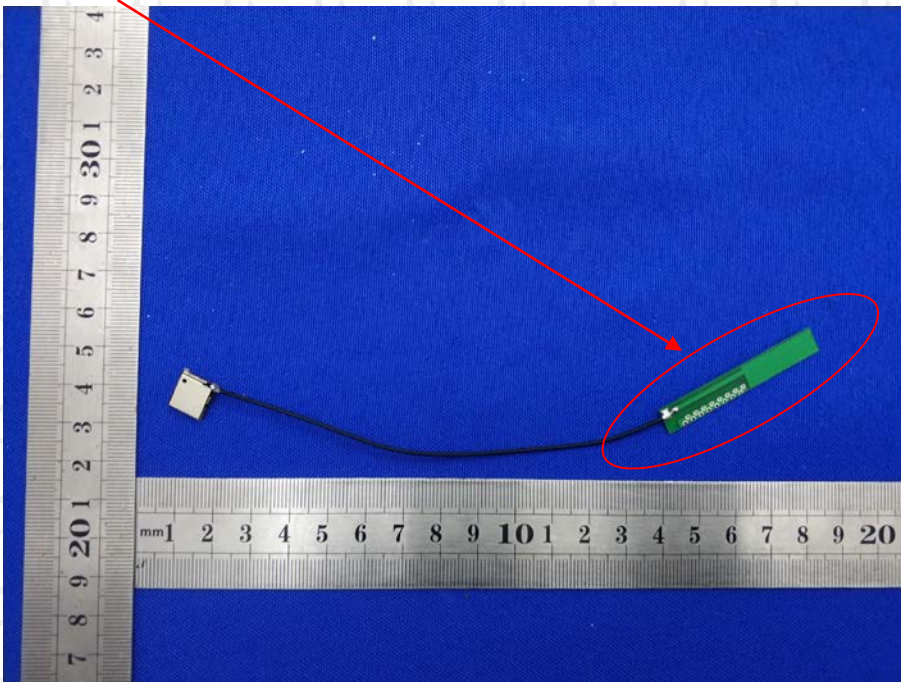
15.247(b) (4) requirement:

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 1.5dBi.

### ANTENNA

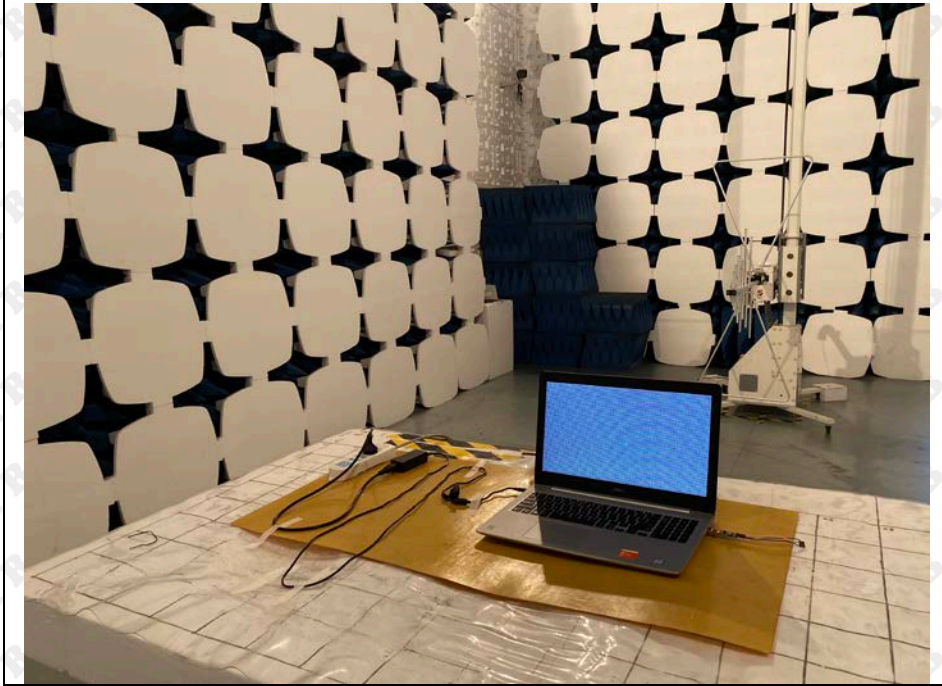




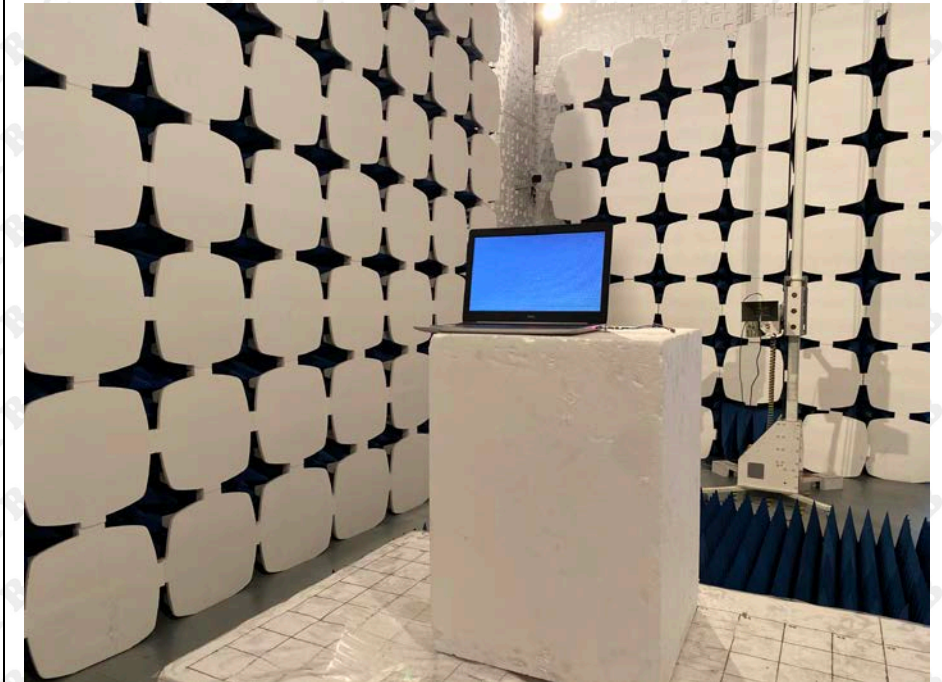
### 13. EUT TEST SETUP PHOTOGRAPHS

#### Radiated Emission

Below 1G

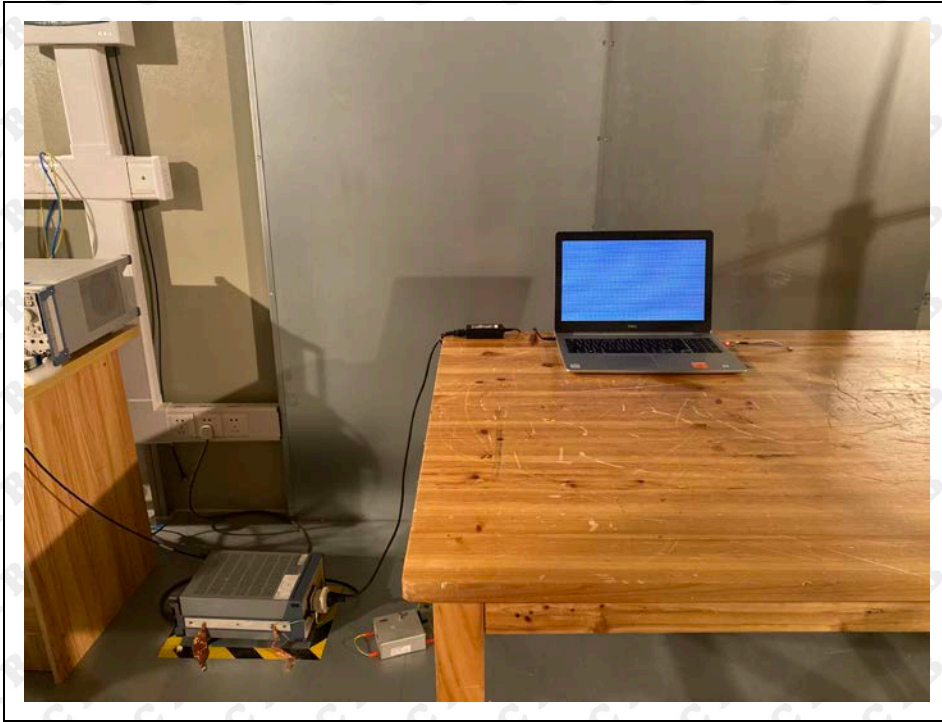


Above 1G





Conducted Emission



\*\*\*\*\* END OF REPORT \*\*\*\*\*