TEST REPORT

Product	:	Handy Tracker
Trade mark	:	TRC
Model/Type reference	:	RC2-STD-HDTK02
Serial Number	:	N/A
Report Number	:	EED32L00330301
FCC ID	:	2AVJS-RC2-STD
Date of Issue:	:	Sep. 27, 2020
Test Standards	:	47 CFR Part 15 Subpart C
Test result	:	PASS

Prepared for:

TRCare, Inc.
1060 East Meadow Circle, Palo Alto, California 94303, USA

Prepared by:

Centre Testing International Group Co., Ltd.
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Compiled by:	Smile Zhong	Reviewed by:	Jok Yang
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Approved by:	Sam Chuang	Date:	Sep. 27, 2020
	Sam Chuang		

Check No.:3096363801

2 Version

Version No.	Date	Description
00	Sep. 27, 2020	Original

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10-2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10-2013	PASS
Conducted Peak Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(1)	ANSI C63.10-2013	PASS
20dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Carrier Frequencies Separation	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Hopping Channel Number	47 CFR Part 15, Subpart C Section 15.247 (b)	ANSI C63.10-2013	PASS
Dwell Time	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Pseudorandom Frequency Hopping Sequence	47 CFR Part 15, Subpart C Section 15.247(b)(4)&TCB Exclusion List (7 July 2002)	ANSI C63.10-2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS

Remark:
Test according to ANSI C63.4-2014 & ANSI C63.10-2013.
Company Name and Address shown on Report, the sample(s) and sample Information was/ were provide d by the applicant who should be responsible for the authenticity which CTI hasn't verified.

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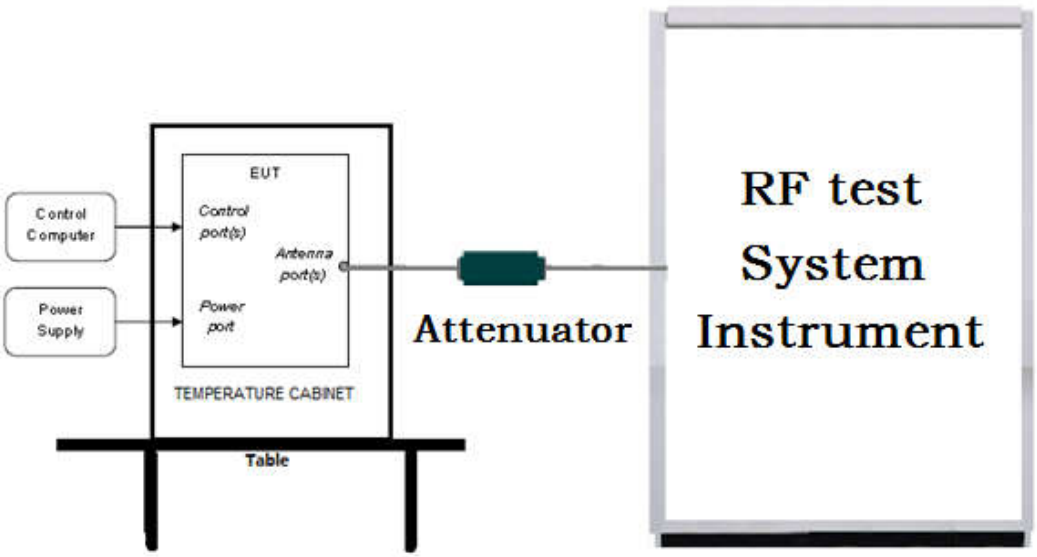
5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

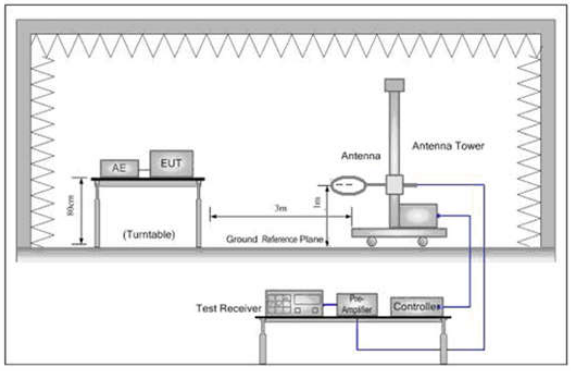


Figure 1. Below 30MHz

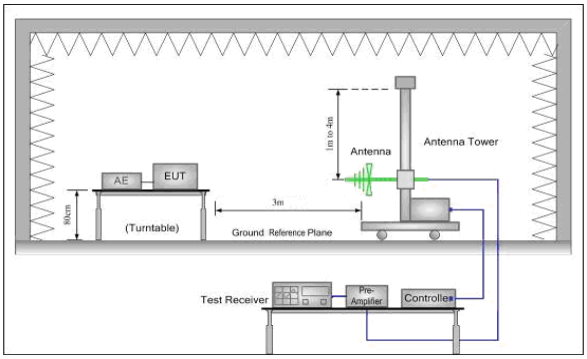


Figure 2. 30MHz to 1GHz

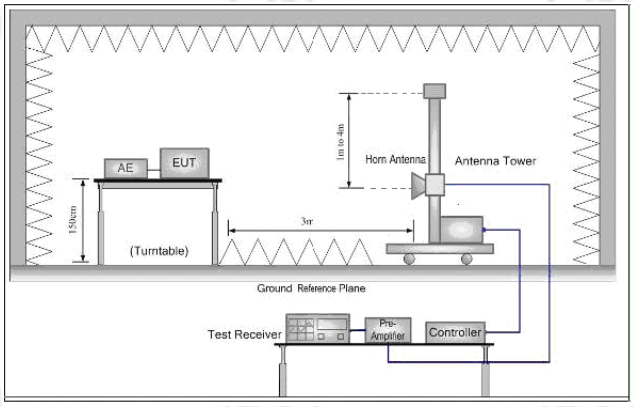
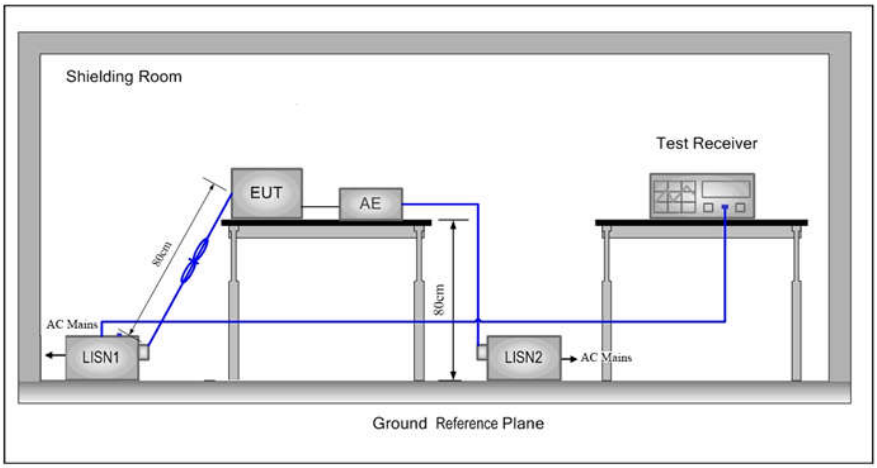


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment:	
Temperature:	24.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	1010mbar

5.3 Test Condition

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
GFSK	2404MHz ~2480 MHz	2402MHz	2442MHz	2480MHz

6 General Information

6.1 Client Information

Applicant:	TRCare, Inc.
Address of Applicant:	1060 East Meadow Circle, Palo Alto, California 94303, USA
Manufacturer:	SHENZHEN SIGMAWIT TECHNOLOGY CO., LTD.
Address of Manufacturer:	11th floor, Lingyun Building, DingXin Industrial Area, Honglang North 2nd Road, Bao'an, ShenZhen, China
Factory:	SHENZHEN SIGMAWIT TECHNOLOGY CO., LTD.
Address of Factory:	11th floor, Lingyun Building, DingXin Industrial Area, Honglang North 2nd Road, Bao'an, ShenZhen, China

6.2 General Description of EUT

Product Name:	Handy Tracker	
Model No.(EUT):	RC2-STD-HDTK02	
Add Mode No.:	N/A	
Trade mark:	TRC	
EUT Supports Radios application	DSS	
Power Supply:	Adapter:	Input: AC 100V-240V 50-60Hz 0.4A Output: DC 5.0V 1000mA
	Battery:	DC3.7V 350 mA (Li-on Rechargeable Battery)
Sample Received Date:	Aug. 01, 2020	
Sample tested Date:	Aug. 01, 2020 to Sep. 24, 2020	

6.3 Product Specification subjective to this standard

Operation Frequency:	2404MHz~2480MHz
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK
Number of Channel:	16
Hopping Channel Type:	Adaptive Frequency Hopping systems
Sample Type:	Portable production
Test Power Grade:	Default
Test Software of EUT:	XCOM V2.2.exe (manufacturer declare)
Antenna Type:	PCB Antenna
Antenna Gain:	0 dBi
Test Voltage:	120V/60Hz

Operation Frequency each of channel

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2404MHz	5	2425MHz	9	2445MHz	13	2465MHz
2	2410MHz	6	2430MHz	10	2450MHz	14	2470MHz
3	2415MHz	7	2435MHz	11	2455MHz	15	2473MHz
4	2420MHz	8	2442MHz	12	2460MHz	16	2480MHz

6.4 Description of Support Units

The EUT has been tested with associated equipment below.

Associated equipment name		Manufacturer	Model	S/N serial number	Certification	Supplied by
AE1	Notebook	HP	HSTNN-Q9SC	/	CE & FCC	CTI

6.5 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd
Building C, Hongwei Industrial Park Block 70, Bao'an District, Shenzhen, China
Telephone: +86 (0) 755 33683668 Fax:+86 (0) 755 33683385
No tests were sub-contracted.
FCC Designation No.: CN1164

6.6 Deviation from Standards

None.

6.7 Abnormalities from Standard Conditions

None.

6.8 Other Information Requested by the Customer

None.

6.9 Measurement Uncertainty(95% confidence levels, k=2)

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.9×10^{-8}
2	RF power, conducted	0.46dB (30MHz-1GHz)
		0.55dB (1GHz-18GHz)
3	Radiated Spurious emission test	4.3dB (30MHz-1GHz)
		4.5dB (1GHz-12.75GHz)
4	Conduction emission	3.5dB (9kHz to 150kHz)
		3.1dB (150kHz to 30MHz)
5	Temperature test	0.64°C
6	Humidity test	3.8%
7	DC power voltages	0.026%

7 Equipment List

RF test system					
Equipment	**Manufacturer**	**Mode No.**	**Serial Number**	**Cal. Date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Spectrum Analyzer	Keysight	N9010A	MY54510339	02-17-2020	02-16-2021
Spectrum Analyzer	R&S	FSV40	101200	09-02-2020	09-01-2021
Signal Generator	Keysight	N5182B	MY53051549	02-17-2020	02-16-2021
Temperature/ Humidity Indicator	biaozhi	HM10	1804186	06-29-2020	06-28-2021
High-pass filter	Sinoscite	FL3CX03WG18N M12-0398-002	---	---	---
High-pass filter	MICRO-TRONICS	SPA-F-63029-4	---	---	---
DC Power	Keysight	E3642A	MY56376072	02-17-2020	02-16-2021
PC-1	Lenovo	R4960d	---	---	---
BT&WI-FI Automatic control	R&S	OSP120	101374	02-17-2020	02-16-2021
RF control unit	JS Tonscend	JS0806-2	158060006	02-17-2020	02-16-2021
BT&WI-FI Automatic test software	JS Tonscend	JS1120-3	---	---	---

Conducted disturbance Test					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Receiver	R&S	ESCI	100435	04-28-2020	04-27-2021
Temperature/ Humidity Indicator	Defu	TH128	/	---	---
LISN	R&S	ENV216	100098	03-05-2020	03-04-2021
Barometer	changchun	DYM3	1188	---	---

3M Semi/full-anechoic Chamber					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
3M Chamber & Accessory Equipment	TDK	SAC-3	---	05-24-2019	05-23-2022
TRILOG Broadband Antenna	Schwarzbeck	VULB9163	9163-618	05-16-2020	05-15-2021
Loop Antenna	Schwarzbeck	FMZB 1519B	1519B-076	04-25-2018	04-24-2021
Receiver	R&S	ESCI7	100938-003	10-21-2019	10-20-2020
Multi device Controller	maturo	NCD/070/107 11112	---	---	---
Temperature/ Humidity Indicator	Shanghai qixiang	HM10	1804298	06-29-2020	06-28-2021
Cable line	Fulai(7M)	SF106	5219/6A	---	---
Cable line	Fulai(6M)	SF106	5220/6A	---	---
Cable line	Fulai(3M)	SF106	5216/6A	---	---
Cable line	Fulai(3M)	SF106	5217/6A	---	---

3M full-anechoic Chamber					
Equipment	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
RSE Automatic test software	JS Tonscend	JS36-RSE	10166	---	---
Receiver	Keysight	N9038A	MY57290136	03-05-2020	03-04-2021
Spectrum Analyzer	Keysight	N9020B	MY57111112	03-05-2020	03-04-2021
Spectrum Analyzer	Keysight	N9030B	MY57140871	03-05-2020	03-04-2021
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-1148	04-25-2018	04-24-2021
Horn Antenna	Schwarzbeck	BBHA 9170	9170-832	04-25-2018	04-24-2021
Horn Antenna	ETS-LINDGREN	3117	00057407	07-10-2018	07-09-2021
Preamplifier	EMCI	EMC184055SE	980596	05-20-2020	05-19-2021
Preamplifier	EMCI	EMC001330	980563	04-22-2020	04-21-2021
Preamplifier	JS Tonscend	980380	EMC051845 SE	01-09-2020	01-08-2021
Temperature/ Humidity Indicator	biaozhi	GM1360	EE1186631	04-27-2020	04-26-2021
Fully Anechoic Chamber	TDK	FAC-3	---	01-17-2018	01-16-2021
Filter bank	JS Tonscend	JS0806-F	188060094	04-10-2018	04-09-2021
Cable line	Times	SFT205-NMSM-2.50M	394812-0001	---	---
Cable line	Times	SFT205-NMSM-2.50M	394812-0002	---	---
Cable line	Times	SFT205-NMSM-2.50M	394812-0003	---	---
Cable line	Times	SFT205-NMSM-2.50M	393495-0001	---	---
Cable line	Times	EMC104-NMNM-1000	SN160710	---	---
Cable line	Times	SFT205-NMSM-3.00M	394813-0001	---	---
Cable line	Times	SFT205-NMNM-1.50M	381964-0001	---	---
Cable line	Times	SFT205-NMSM-7.00M	394815-0001	---	---
Cable line	Times	HF160-KMKM-3.00M	393493-0001	---	---

8 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC Part15C	Subpart C-Intentional Radiators
2	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices

Test Results List:

Test requirement	Test method	Test item	Verdict	Note
Part15C Section 15.247 (a)(1)	ANSI 63.10	20dB Occupied Bandwidth	PASS	Appendix A)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Carrier Frequencies Separation	PASS	Appendix B)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Dwell Time	PASS	Appendix C)
Part15C Section 15.247 (b)	ANSI 63.10	Hopping Channel Number	PASS	Appendix D)
Part15C Section 15.247 (b)(1)	ANSI 63.10	Conducted Peak Output Power	PASS	Appendix E)
Part15C Section 15.247(d)	ANSI 63.10	Band-edge for RF Conducted Emissions	PASS	Appendix F)
Part15C Section 15.247(d)	ANSI 63.10	RF Conducted Spurious Emissions	PASS	Appendix G)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Pseudorandom Frequency Hopping Sequence	PASS	Appendix H)
Part15C Section 15.203/15.247 (c)	ANSI 63.10	Antenna Requirement	PASS	Appendix I)
Part15C Section 15.207	ANSI 63.10	AC Power Line Conducted Emission	PASS	Appendix J)
Part15C Section 15.205/15.209	ANSI 63.10	Restricted bands around fundamental frequency (Radiated) Emission)	PASS	Appendix K)
Part15C Section 15.205/15.209	ANSI 63.10	Radiated Spurious Emissions	PASS	Appendix L)

Appendix A): 20dB Occupied Bandwidth

Test Limit

According to §15.247(a) (1),

20 dB Bandwidth : For reporting purposes only.

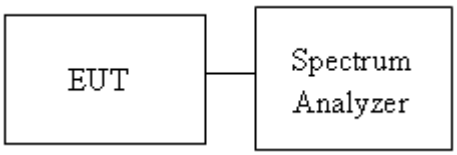
Occupied Bandwidth(99%) : For reporting purposes only.

Test Procedure

Test method Refer as Section 8.1 and ANSI C63.10: 2013 clause 7.8.7,

1. The EUT RF output connected to the spectrum analyzer by RF cable.
2. Setting maximum power transmit of EUT
3. SA set RBW =30kHz, VBW = 100kHz and Detector = Peak, to measurement 20dB Bandwidth.
4. SA set RBW = 1% ~ 5% OBW, VBW = three times the RBW and Detector = Peak, to measurement 99% Bandwidth.
5. Measure and record the result of 20 dB Bandwidth and 99% Bandwidth. in the test report.
6.

Test Setup



Test Result

Occupied Bandwidth(99%)

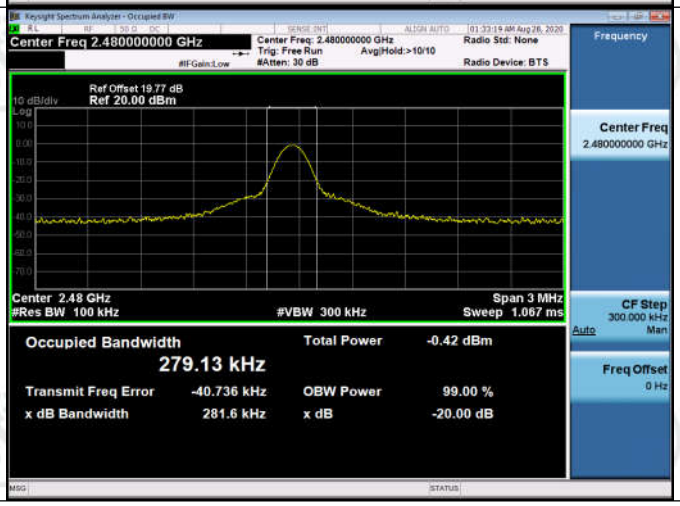
Mode	Channel.	99% OBW [MHz]	Verdict
GFSK	LCH	0.26880	PASS
GFSK	MCH	0.27155	PASS
GFSK	HCH	0.27913	PASS

20 dB Bandwidth

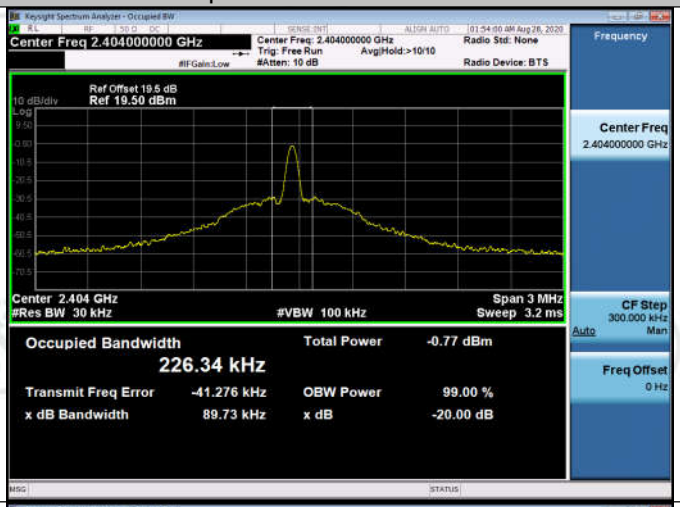
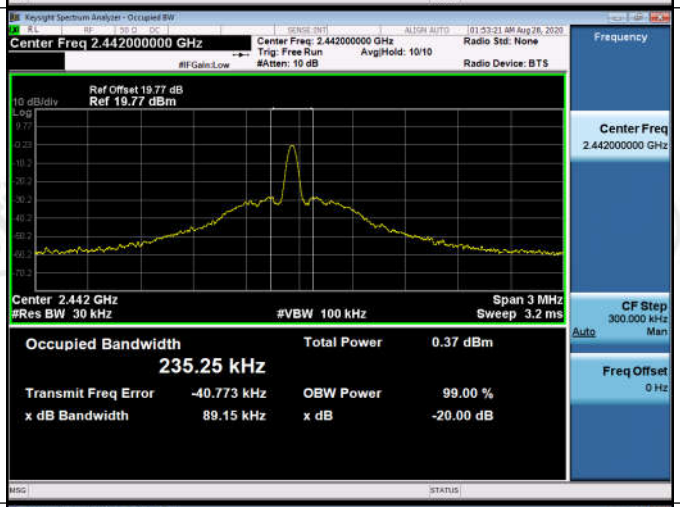
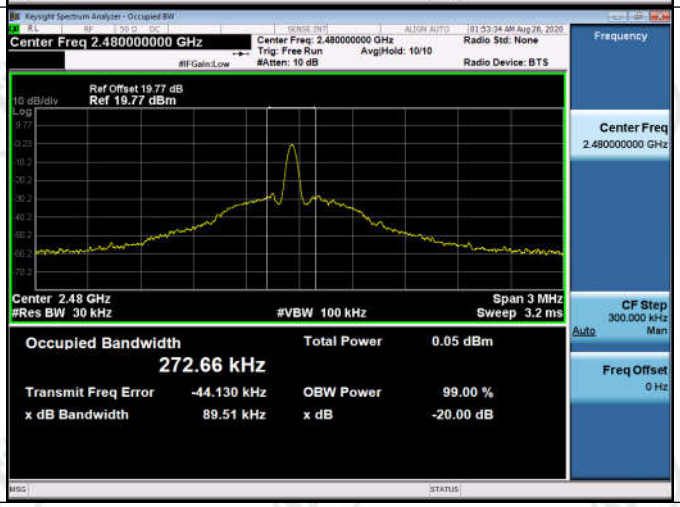
Mode	Channel.	20 dB Bandwidth [MHz]	Verdict
GFSK	LCH	0.0897	PASS
GFSK	MCH	0.0891	PASS
GFSK	HCH	0.0895	PASS

Test Graph

Occupied Bandwidth(99%)

Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

20 dB Bandwidth

	Graphs
GFSK/LCH	
GFSK/MCH	
GFSK/HCH	

Appendix B): Carrier Frequency Separation

Test Limit

According to §15.247(a)(1),

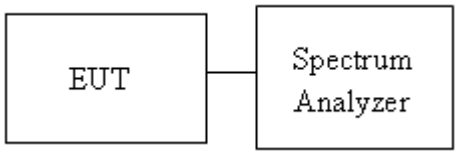
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Limit	> two-thirds of the 20 dB bandwidth

Test Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = 300kHz, Sweep = auto. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency

Test Setup



Result Table

Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	6.003	PASS
GFSK	MCH	3.698	PASS
GFSK	HCH	7.000	PASS

Test Graph

Graphs	
GFSK/LCH	
GFSK/MCH	
GFSK/HCH	

Appendix C): Dwell Time

Test Limit

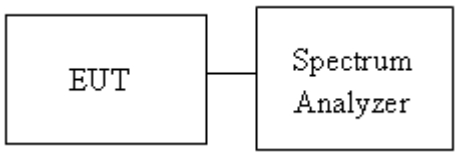
According to §15.247(a)(1)(iii),

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

Test Procedure

1. EUT RF output port connected to the SA by RF cable.
2. Set center frequency of spectrum analyzer = operating frequency.

Test Setup



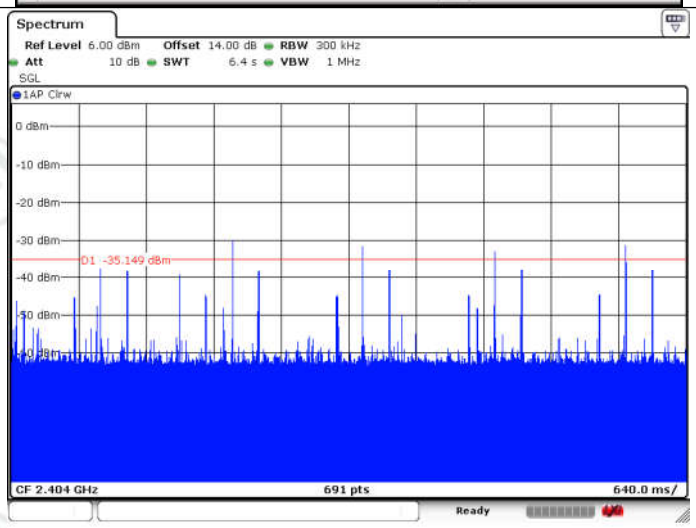
Result Table

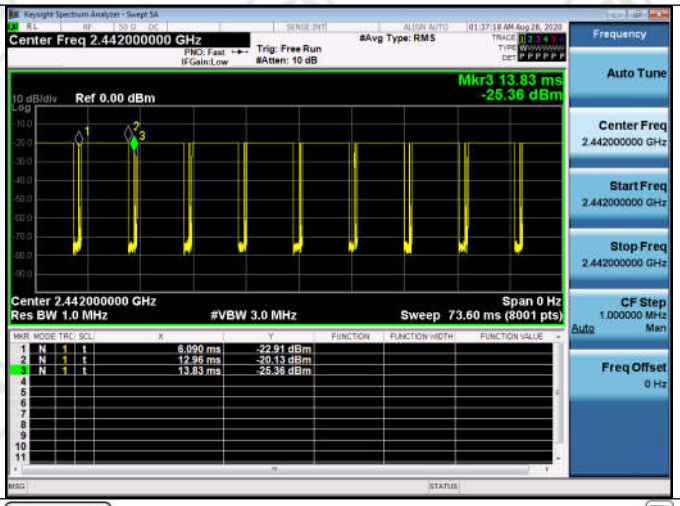
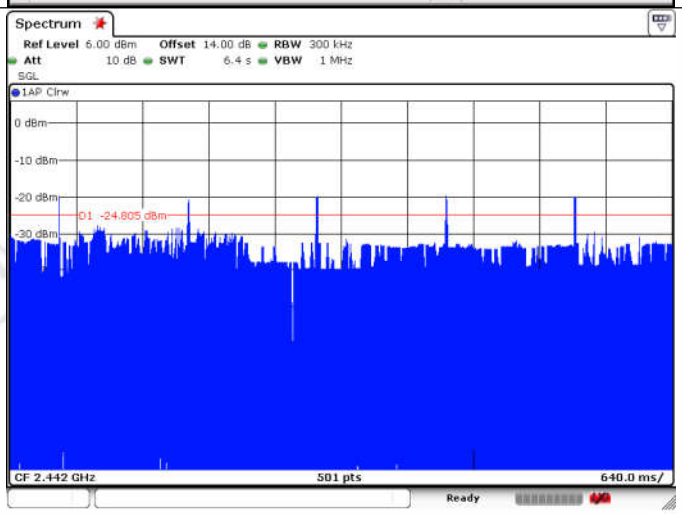
Mode	Channel	Sweep time [s]	Burst Width [ms]	Total Hops[pc]	Dwell Time[s]	Verdict
GFSK	LCH	6.4	6.863	4	0.027	PASS
GFSK	MCH	6.4	6.870	5	0.034	PASS
GFSK	HCH	6.4	6.870	5	0.034	PASS

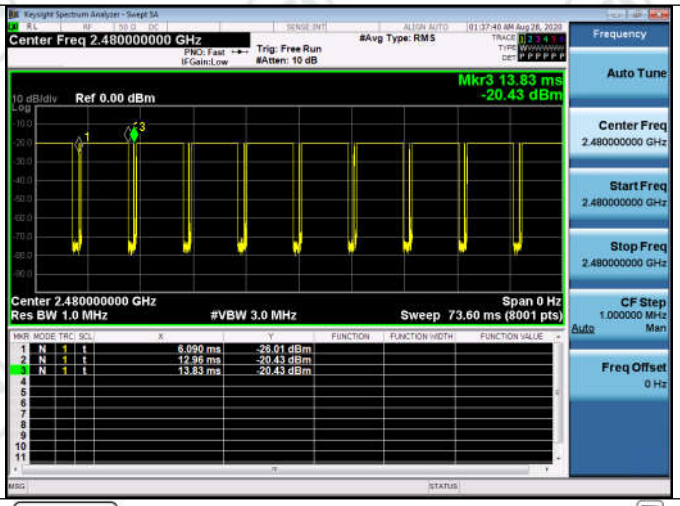
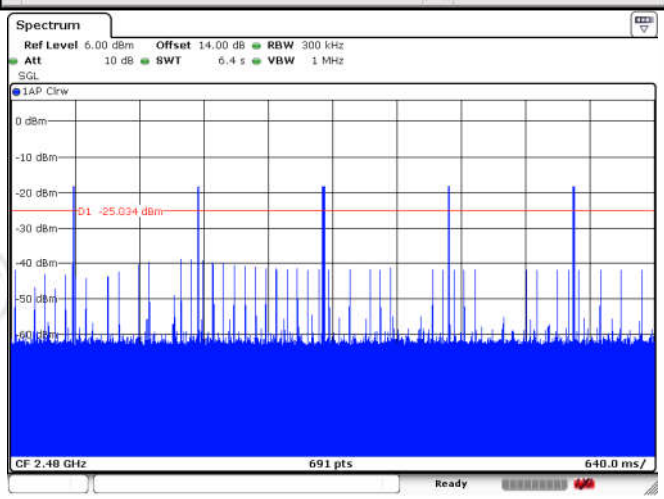
Remark: Sweep time=0.4s*channel No.=6.4s

Dwell time=Burst width*Total Hops

Test Graph

Graphs	
GFSK /LCH (Frequency fix mode)	
GFSK /LCH (Frequency hopping mode)	

GFSK /MCH (Frequency fix mode)	
GFSK /MCH (Frequency hopping mode)	

GFSK /HCH (Frequency fix mode)	
GFSK /HCH (Frequency hopping mode)	

Appendix D): Hopping Channel Number

Test Limit

According to §15.247(a)(1)(iii)

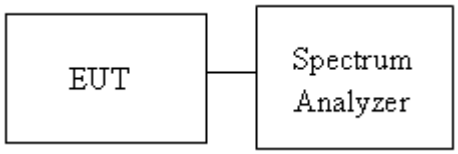
Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test Procedure

Test method Refer as ANSI C63.10: 2013 clause 7.8.3

1. Place the EUT on the table and set it in transmitting mode.
2. EUT RF output port connected to the SA by RF cable.
3. Set spectrum analyzer Start Freq. = 2400 MHz, Stop Freq. = 2483.5 MHz, RBW =100KHz, VBW = 300KHz.
4. Max hold, view and count how many channel in the band.

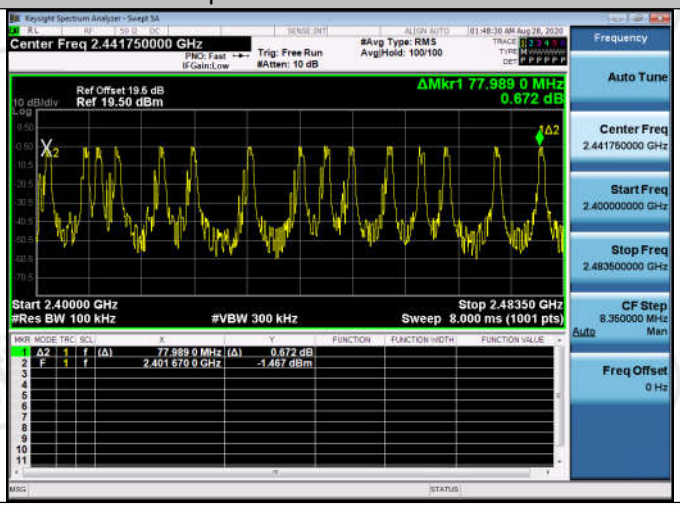
Test Setup



Result Table

Mode	Channel.	Number of Hopping Channel	Verdict
GFSK	Hop	79	PASS
π/4DQPSK	Hop	79	PASS
8DPSK	Hop	79	PASS

Test Graph

Graphs			
GFSK/Hop			

Appendix E): Conducted Peak Output Power

Test Limit

According to §15.247(b)(1).

Peak output power：

FCC

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

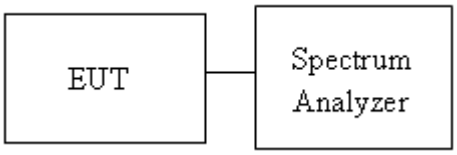
Limit	☒ Antenna not exceed 6 dBi：21dBm ☐ Antenna with DG greater than 6 dBi：21dBm [Limit = 30 – (DG – 6)]

Average output power：For reporting purposes only.

Test Procedure

1. The EUT RF output connected to the power meter by RF cable.
2. Setting maximum power transmit of EUT.
3. The path loss was compensated to the results for each measurement.
4. Measure and record the result of Peak output power and Average output power. in the test report.

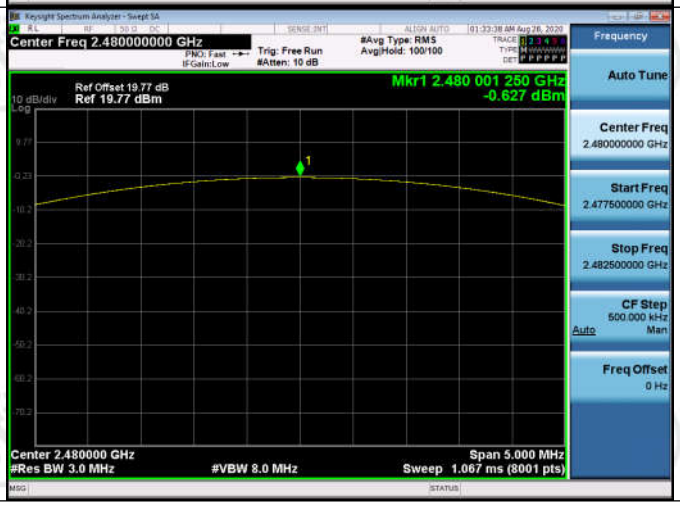
Test Setup



Result Table

Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	-1.465	PASS
GFSK	MCH	-0.316	PASS
GFSK	HCH	-0.627	PASS

Test Graph

Graphs			
GFSK/LCH			
GFSK/MCH			
GFSK/HCH			

Appendix F): Band-edge for RF Conducted Emissions

Test Limit

According to §15.247(d),

Limit	-20 dBc

.

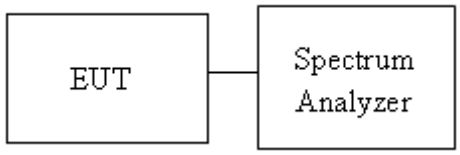
Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.

2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.

3. The Band Edge at 2.4GHz and 2.4835GHz are investigated with normal hopping mode.

Test Setup

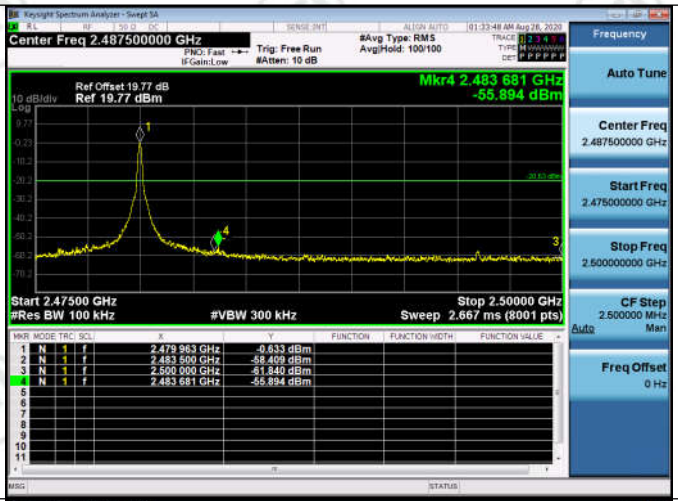


Result Table

Mode	Channel	Carrier Frequency [MHz]	Carrier Power [dBm]	Frequency Hopping	Max Spurious Level [dBm]	Limit [dBm]	Verdict
GFSK	LCH	2404	-1.459	Off	-58.786	-21.46	PASS
			-1.112	On	-55.425	-21.11	PASS
GFSK	HCH	2480	-0.633	Off	-55.894	-20.63	PASS
			-0.631	On	-51.049	-20.63	PASS

Test Graph

Graphs			
GFSK/LCH/No Hop			
GFSK/LCH/Hop			

GFSK/HCH/No Hop			
GFSK/HCH/Hop			

Appendix G): RF Conducted Spurious Emissions

Test Limit

According to §15.247(d),

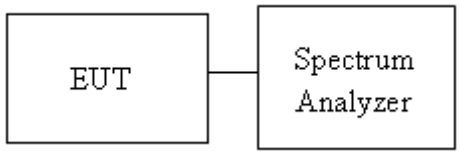
Limit	-20 dBc

Test Procedure

1. EUT RF output port connected to the SA by RF cable, and the path loss was compensated to result.

2. SA setting, RBW=100kHz, VBW=300kHz, Detector=Peak, Trace mode = max hold, SWT = Auto.

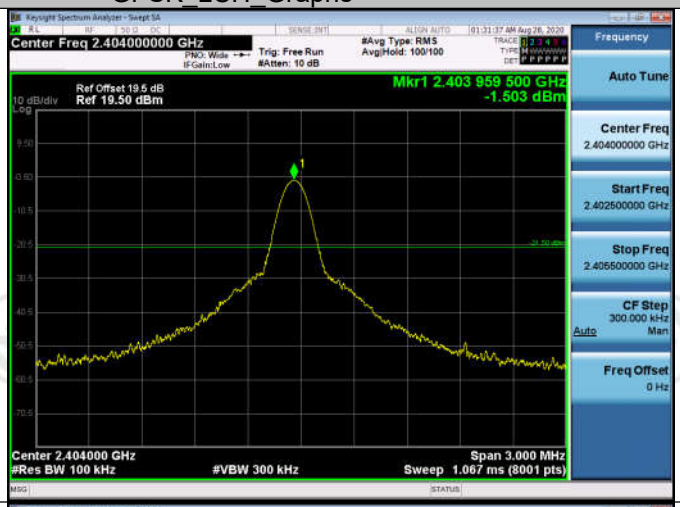
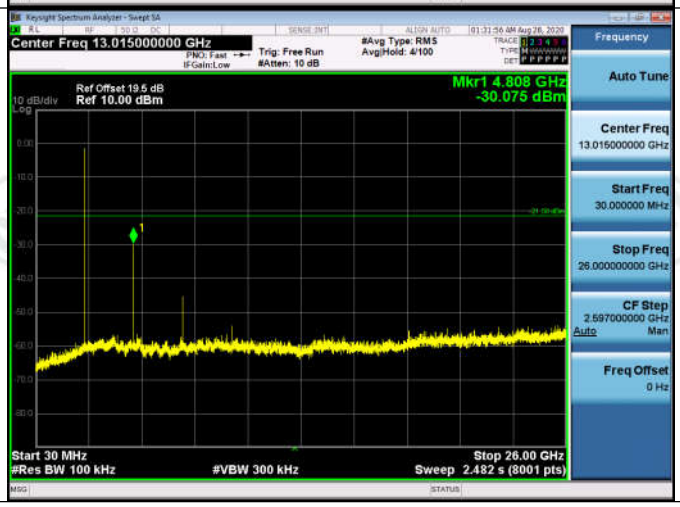
Test Setup

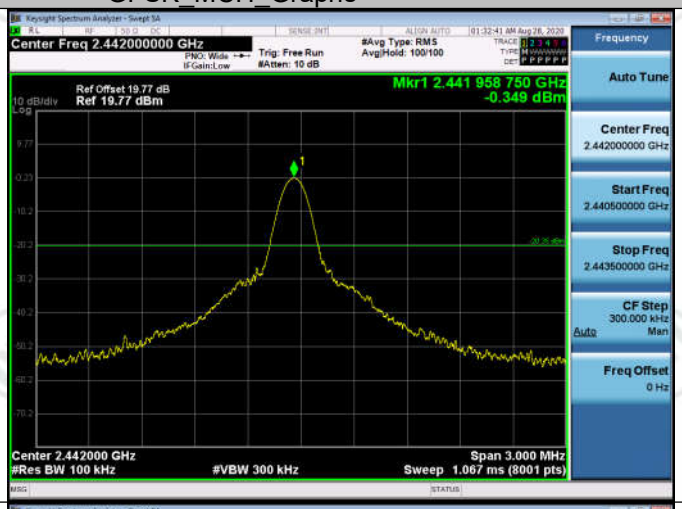
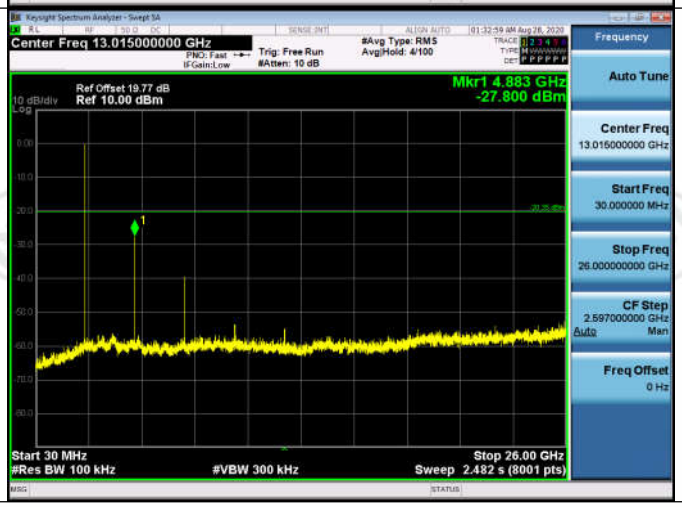


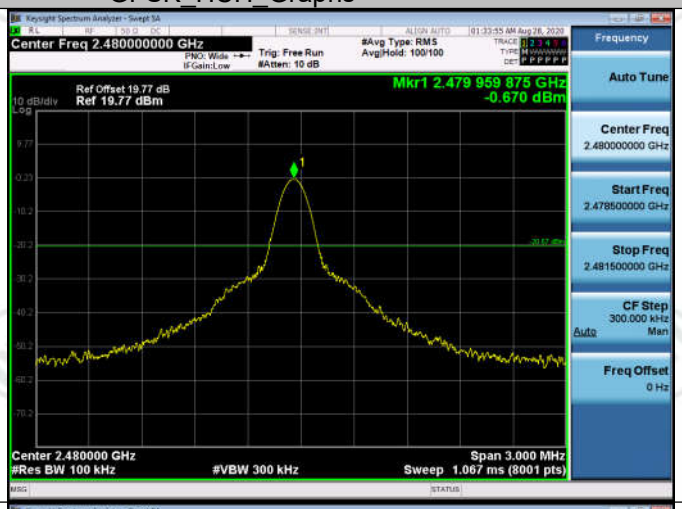
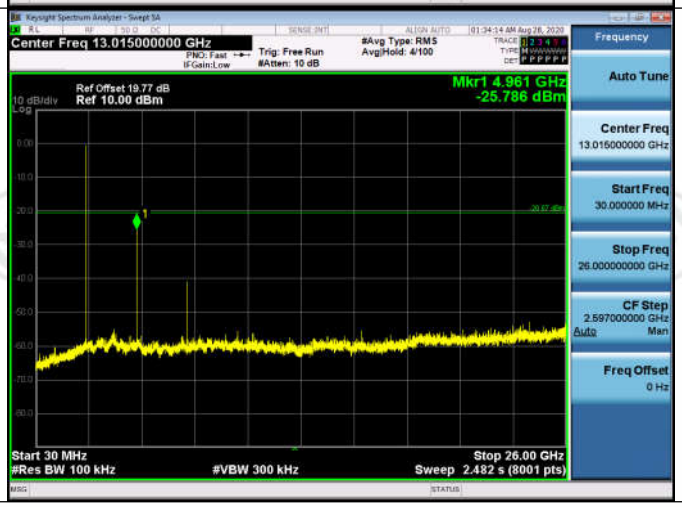
Result Table

Mode	Channel	Pref [dBm]	Puw[dBm]	Verdict
GFSK	LCH	-1.503	<Limit	PASS
GFSK	MCH	-0.349	<Limit	PASS
GFSK	HCH	-0.67	<Limit	PASS

Test Graph

GFSK_LCH_Graphs			
Pref			
Puw			

GFSK_MCH_Graphs			
Pref			
Puw			

GFSK_HCH_Graphs			
Pref			
Puw			

Appendix H) Pseudorandom Frequency Hopping Sequence

Test Requirement:	47 CFR Part 15**C Section 15.247 (a)(1) requirement:**

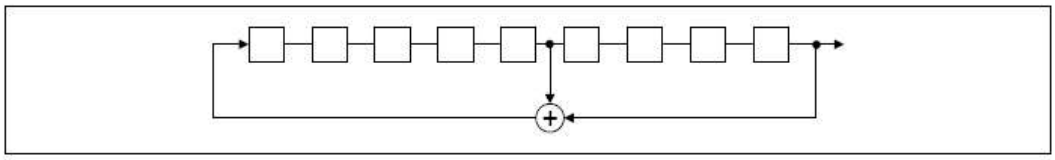
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively. Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

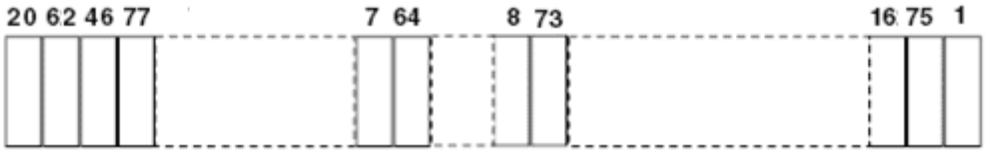
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 2^9 -1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

Appendix I) 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 integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.

Appendix J) AC Power Line Conducted Emission

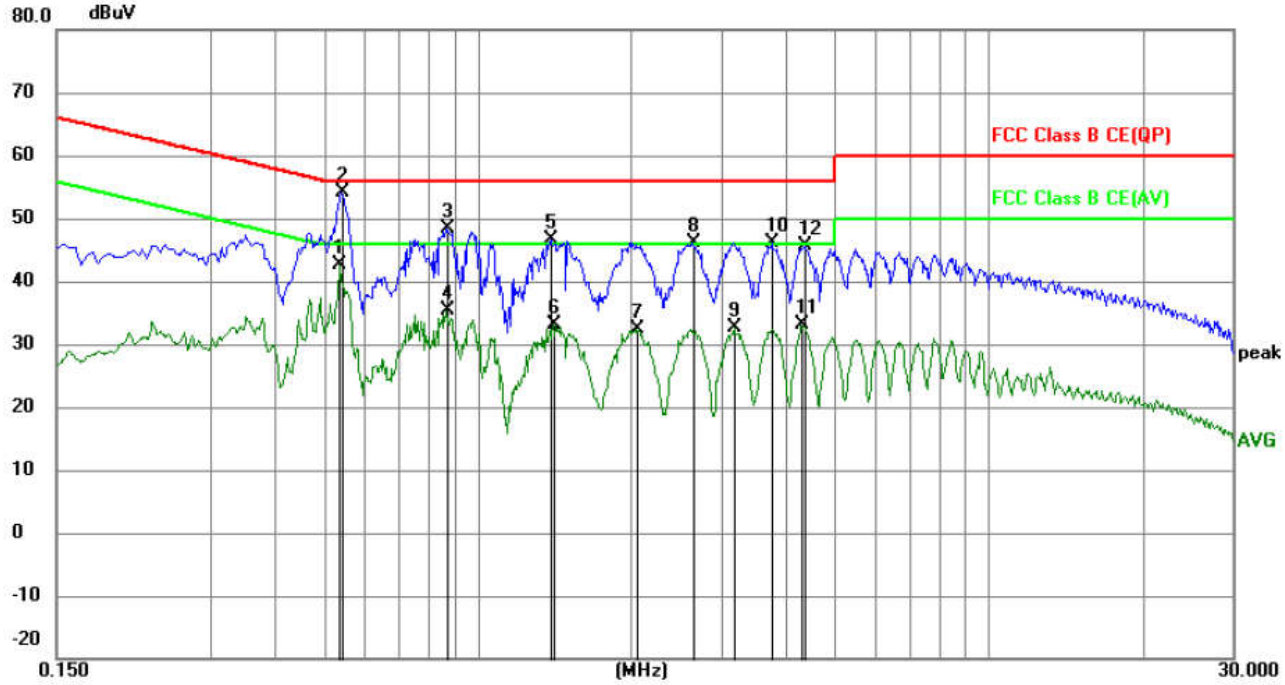
<table>
<tr><td>Test Procedure:</td><td>Test frequency range :150KHz-30MHz
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. 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.</td></tr>
<tr><td>Limit:</td><td>
<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>
* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.
NOTE : The lower limit is applicable at the transition frequency</td></tr>
</table>

Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

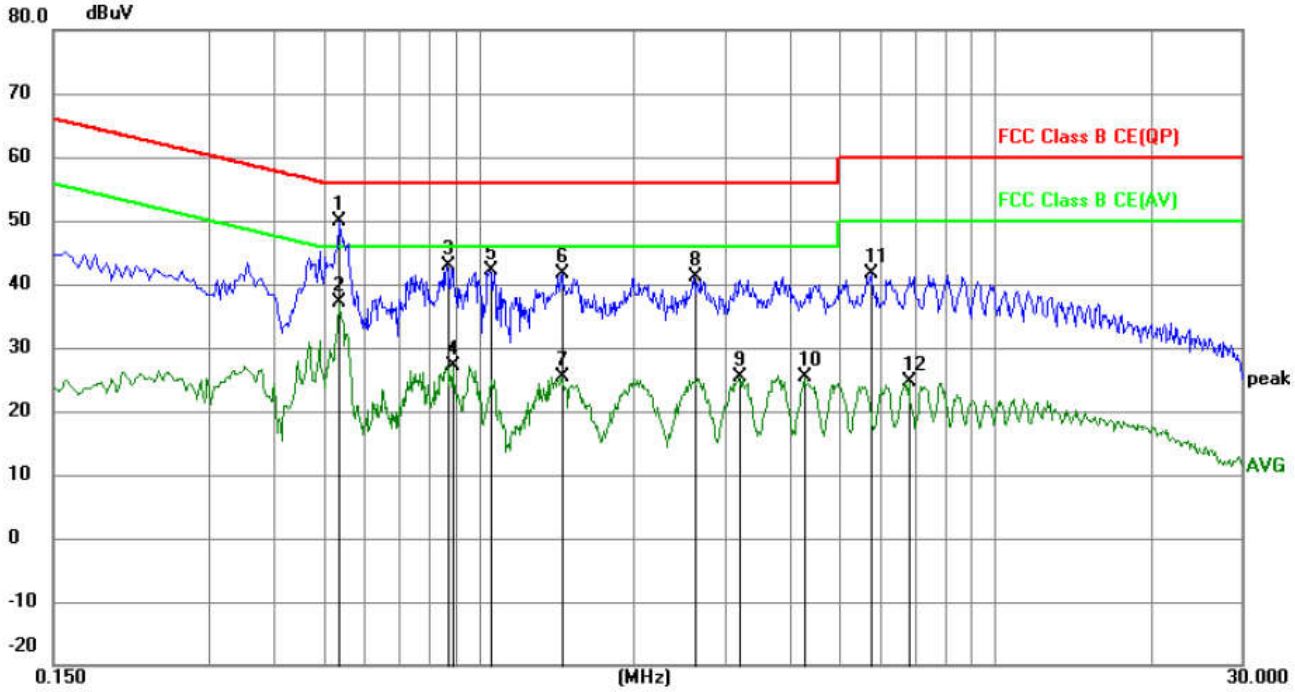
Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1		0.5370	32.58	9.99	42.57	46.00	-3.43	AVG	
2	*	0.5415	44.11	10.00	54.11	56.00	-1.89	QP	
3		0.8700	38.45	9.85	48.30	56.00	-7.70	QP	
4		0.8700	25.62	9.85	35.47	46.00	-10.53	AVG	
5		1.3920	36.78	9.81	46.59	56.00	-9.41	QP	
6		1.4100	23.44	9.81	33.25	46.00	-12.75	AVG	
7		2.0490	22.71	9.79	32.50	46.00	-13.50	AVG	
8		2.6430	36.41	9.79	46.20	56.00	-9.80	QP	
9		3.1829	22.83	9.79	32.62	46.00	-13.38	AVG	
10		3.7770	36.34	9.78	46.12	56.00	-9.88	QP	
11		4.3034	23.30	9.78	33.08	46.00	-12.92	AVG	
12		4.3620	35.94	9.78	45.72	56.00	-10.28	QP	

Neutral line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.5370	39.92	9.99	49.91	56.00	-6.09	QP	
2		0.5370	27.17	9.99	37.16	46.00	-8.84	AVG	
3		0.8700	33.11	9.85	42.96	56.00	-13.04	QP	
4		0.8925	17.34	9.85	27.19	46.00	-18.81	AVG	
5		1.0500	32.28	9.83	42.11	56.00	-13.89	QP	
6		1.4505	31.76	9.81	41.57	56.00	-14.43	QP	
7		1.4505	15.57	9.81	25.38	46.00	-20.62	AVG	
8		2.6160	31.39	9.79	41.18	56.00	-14.82	QP	
9		3.1965	15.62	9.79	25.41	46.00	-20.59	AVG	
10		4.2900	15.49	9.78	25.27	46.00	-20.73	AVG	
11		5.7480	31.77	9.78	41.55	60.00	-18.45	QP	
12		6.8235	14.80	9.79	24.59	50.00	-25.41	AVG	

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level =Receiver Reading + LISN Factor + Cable Loss.

Appendix K) Restricted bands around fundamental frequency (Radiated)

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Quasi-peak	120 kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

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 and the rotatable 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. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel

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 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
h. b. Test the EUT in the lowest channel , the Highest channel
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
j. Repeat above procedures until all frequencies measured was complete.

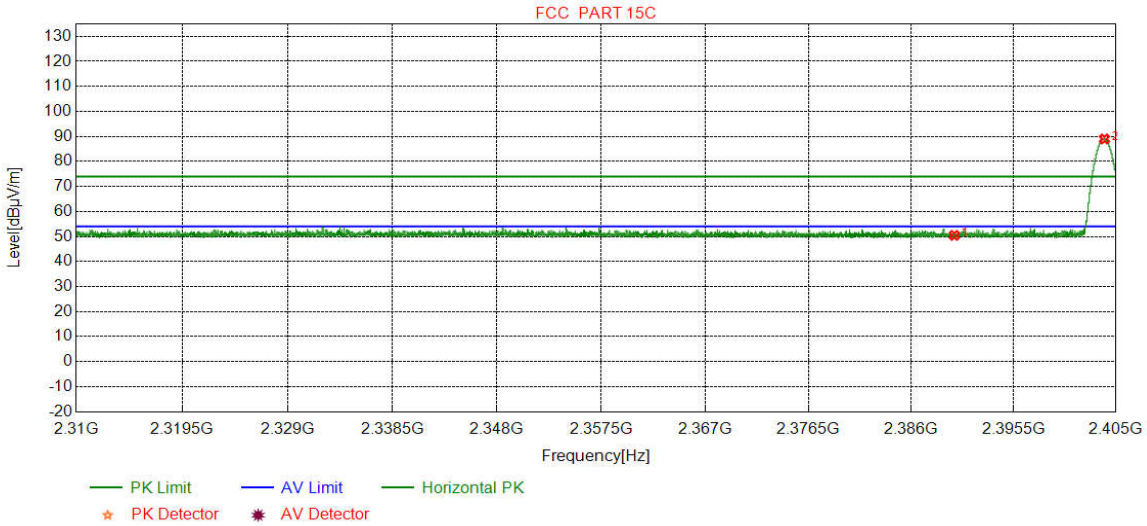
Limit:

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test plot as follows:

Mode:	GFSK transmitting	Channel:	2404MHz
Remark:	PK		

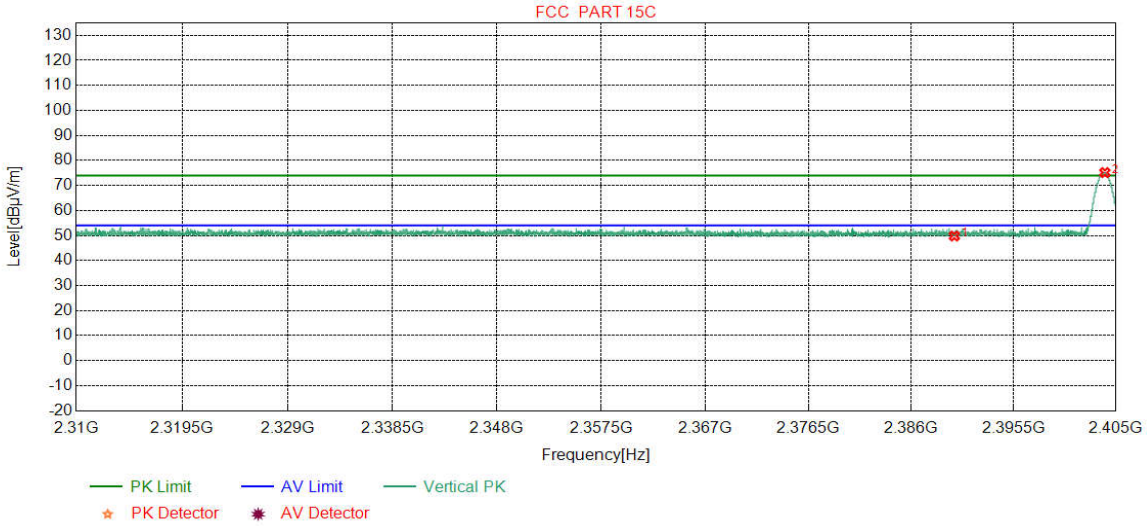
Test Graph



Suspected List											
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	2390.0000	32.25	13.37	-43.12	47.95	50.45	74.00	23.55	Pass	Horizontal	Peak
2	2403.9423	32.27	13.32	-43.13	86.52	88.98	74.00	-14.98	Pass	Horizontal	Peak

Mode:	GFSK transmitting	Channel:	2404MHz
Remark:	PK		

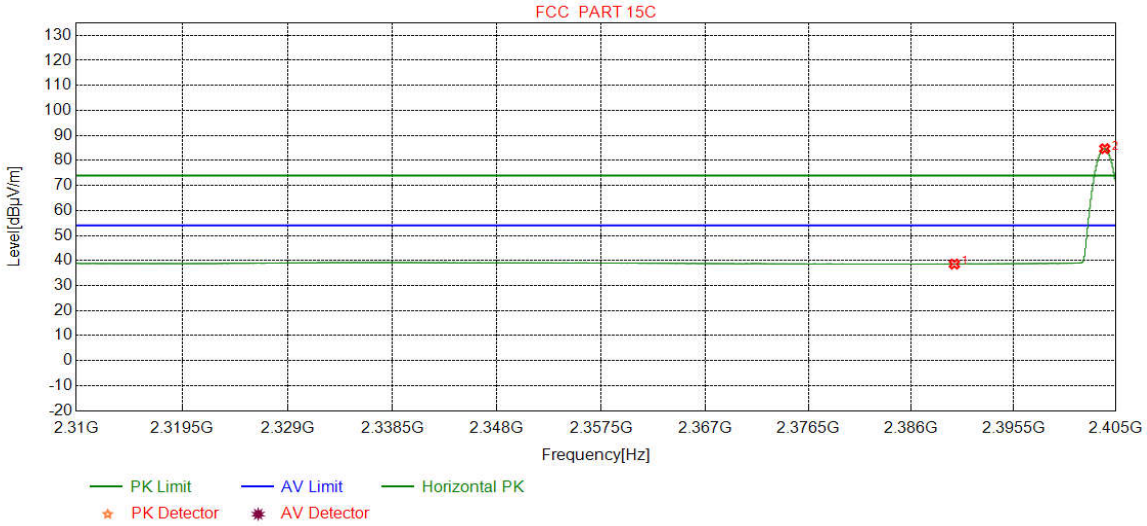
Test Graph



Suspected List											
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	2390.0000	32.25	13.37	-43.12	47.29	49.79	74.00	24.21	Pass	Vertical	Peak
2	2403.9866	32.27	13.32	-43.13	72.69	75.15	74.00	-1.15	Pass	Vertical	Peak

Mode:	GFSK transmitting	Channel:	2404MHz
Remark:	AV		

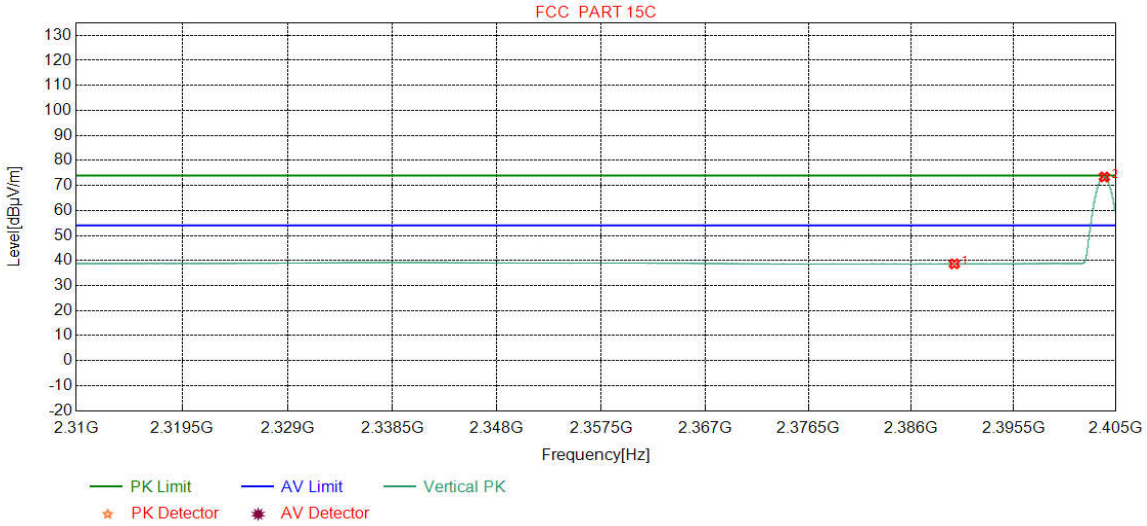
Test Graph



Suspected List											
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	2390.0000	32.25	13.37	-43.12	36.08	38.58	54.00	15.42	Pass	Horizontal	Average
2	2403.9739	32.27	13.32	-43.13	82.23	84.69	54.00	-30.69	Pass	Horizontal	Average

Mode:	GFSK transmitting	Channel:	2404MHz
Remark:	AV		

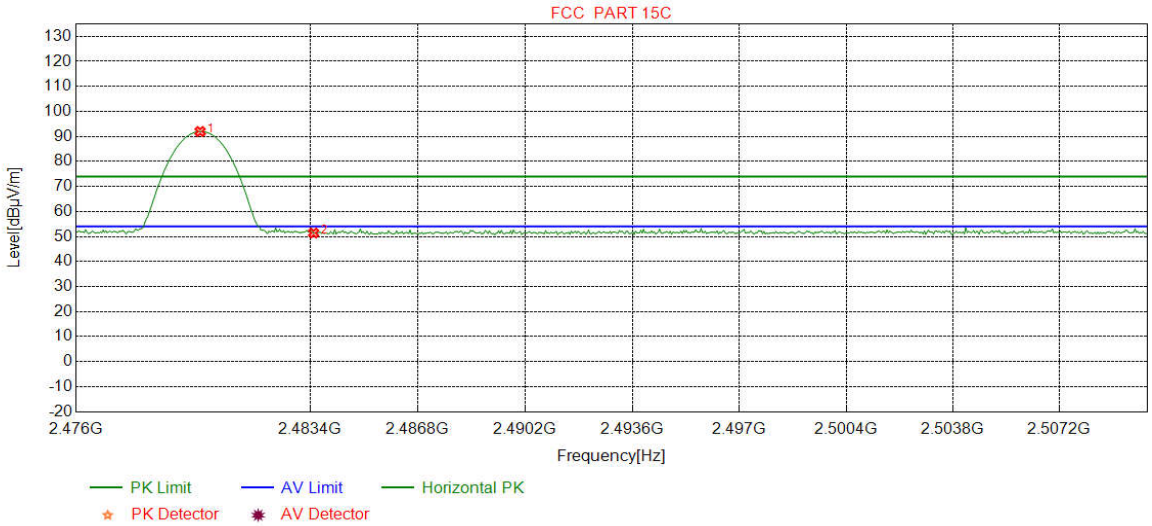
Test Graph



Suspected List											
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	2390.0000	32.25	13.37	-43.12	36.17	38.67	54.00	15.33	Pass	Vertical	Average
2	2403.9296	32.27	13.32	-43.13	70.94	73.40	54.00	-19.40	Pass	Vertical	Average

Mode:	GFSK transmitting	Channel:	2480MHz
Remark:	PK		

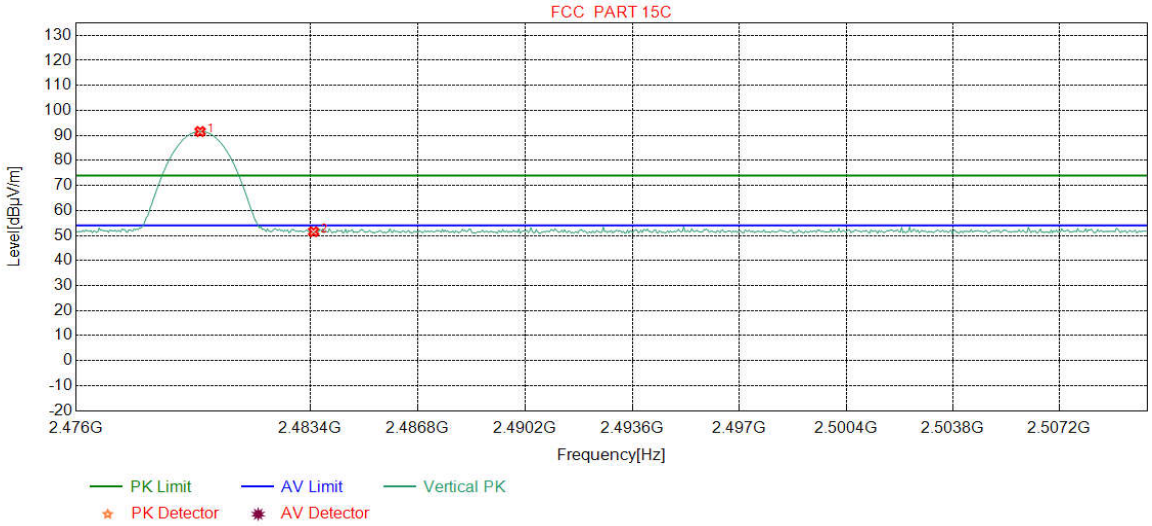
Test Graph



Suspected List											
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	2479.9149	32.37	13.39	-43.10	89.31	91.97	74.00	-17.97	Pass	Horizontal	Peak
2	2483.5000	32.38	13.38	-43.11	48.75	51.40	74.00	22.60	Pass	Horizontal	Peak

Mode:	GFSK transmitting	Channel:	2480MHz
Remark:	PK		

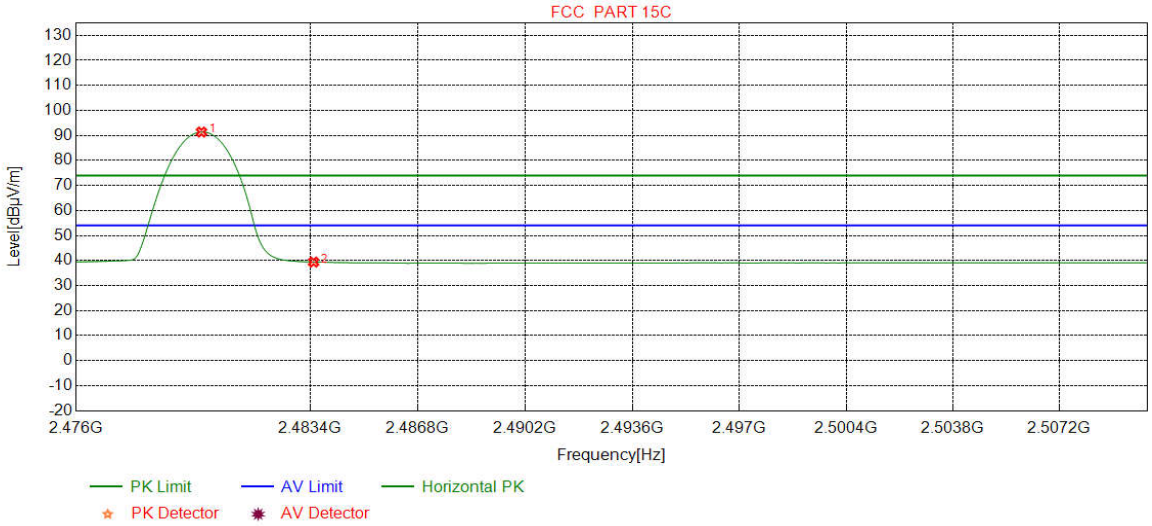
Test Graph



Suspected List											
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	2479.9149	32.37	13.39	-43.10	88.89	91.55	74.00	-17.55	Pass	Vertical	Peak
2	2483.5000	32.38	13.38	-43.11	48.87	51.52	74.00	22.48	Pass	Vertical	Peak

Mode:	GFSK transmitting	Channel:	2480MHz
Remark:	AV		

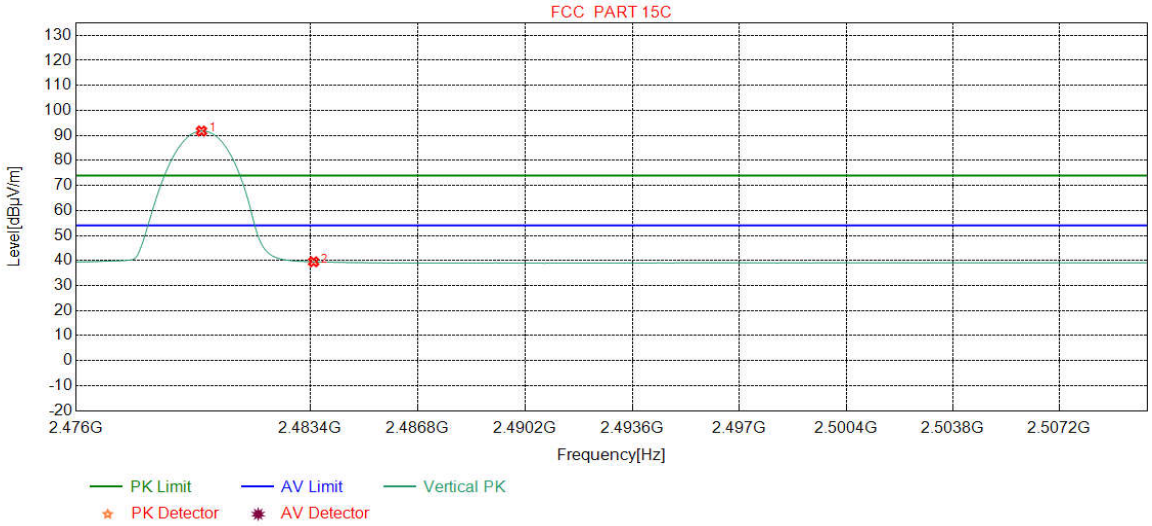
Test Graph



Suspected List											
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	2479.9574	32.37	13.39	-43.10	88.70	91.36	54.00	-37.36	Pass	Horizontal	Average
2	2483.5000	32.38	13.38	-43.11	36.73	39.38	54.00	14.62	Pass	Horizontal	Average

Mode:	GFSK transmitting	Channel:	2480MHz
Remark:	AV		

Test Graph



Suspected List											
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	2479.9574	32.37	13.39	-43.10	89.09	91.75	54.00	-37.75	Pass	Vertical	Average
2	2483.5000	32.38	13.38	-43.11	36.85	39.50	54.00	14.50	Pass	Vertical	Average

Note:
The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading - Correct Factor

Correct Factor = Preamplifier Factor– Antenna Factor–Cable Factor

Appendix L) Radiated Spurious Emissions

Receiver Setup:

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

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 rotatable 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 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).
h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
j. Repeat above procedures until all frequencies measured was complete.

Limit:

Frequency	Field strength (microvolt/meter)	Limit (dBuV/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.

Radiated Spurious Emissions test Data:

Radiated Emission below 1GHz

Mode:	GFSK Transmitting	Channel:	2442MHz

NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	96.1606	10.39	1.13	-31.98	52.31	31.85	43.50	11.65	Pass	H	PK
2	240.2200	11.95	1.84	-31.90	58.21	40.10	46.00	5.90	Pass	H	PK
3	288.4338	12.97	2.02	-31.89	58.71	41.81	46.00	4.19	Pass	H	PK
4	384.5705	15.06	2.33	-31.85	54.22	39.76	46.00	6.24	Pass	H	PK
5	432.6873	15.92	2.46	-31.84	53.19	39.73	46.00	6.27	Pass	H	PK
6	600.0290	19.00	2.96	-31.50	42.87	33.33	46.00	12.67	Pass	H	PK
7	96.1606	10.39	1.13	-31.98	43.58	23.12	43.50	20.38	Pass	V	PK
8	216.2586	11.32	1.75	-31.95	46.28	27.40	46.00	18.60	Pass	V	PK
9	240.4140	11.95	1.84	-31.90	50.05	31.94	46.00	14.06	Pass	V	PK
10	288.3368	12.97	2.02	-31.89	53.15	36.25	46.00	9.75	Pass	V	PK
11	432.4932	15.92	2.46	-31.84	43.12	29.66	46.00	16.34	Pass	V	PK
12	600.0290	19.00	2.96	-31.50	43.14	33.60	46.00	12.40	Pass	V	PK

Transmitter Emission above 1GHz

Mode:	GFSK Transmitting							Channel:	2404MHz		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1999.2999	31.70	3.47	-43.20	52.04	44.01	74.00	29.99	Pass	H	PK
2	3937.0625	33.75	4.34	-43.01	49.91	44.99	74.00	29.01	Pass	H	PK
3	4808.1205	34.50	4.56	-42.80	52.18	48.44	74.00	25.56	Pass	H	PK
4	6918.2612	36.07	5.85	-42.25	49.46	49.13	74.00	24.87	Pass	H	PK
5	9152.4102	37.67	6.45	-42.03	49.57	51.66	74.00	22.34	Pass	H	PK
6	10447.496	38.43	7.03	-42.01	49.18	52.63	74.00	21.37	Pass	H	PK
7	1597.2597	29.04	3.07	-42.91	53.56	42.76	74.00	31.24	Pass	H	PK
8	2589.1589	32.54	4.10	-43.10	51.86	45.40	74.00	28.60	Pass	V	PK
9	3786.0524	33.63	4.36	-43.04	49.83	44.78	74.00	29.22	Pass	V	PK
10	4808.1205	34.50	4.56	-42.80	53.33	49.59	74.00	24.41	Pass	V	PK
11	7215.2810	36.32	5.81	-42.16	48.44	48.41	74.00	25.59	Pass	V	PK
12	9109.4073	37.68	6.44	-42.02	49.51	51.61	74.00	22.39	Pass	V	PK

Mode:	GFSK Transmitting							Channel:	2442MHz		
NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1990.6991	31.64	3.46	-43.18	52.40	44.32	74.00	29.68	Pass	H	PK
2	3047.0031	33.22	4.84	-43.11	51.55	46.50	74.00	27.50	Pass	H	PK
3	5043.1362	34.54	4.87	-42.78	50.70	47.33	74.00	26.67	Pass	H	PK
4	6460.2307	35.89	5.51	-42.51	49.49	48.38	74.00	25.62	Pass	H	PK
5	7744.3163	36.50	6.24	-42.14	49.19	49.79	74.00	24.21	Pass	H	PK
6	9162.4108	37.67	6.45	-42.04	49.40	51.48	74.00	22.52	Pass	H	PK
7	1798.4798	30.37	3.32	-42.71	55.54	46.52	74.00	27.48	Pass	V	PK
8	3189.0126	33.28	4.63	-43.10	51.60	46.41	74.00	27.59	Pass	V	PK
9	4884.1256	34.50	4.82	-42.80	52.02	48.54	74.00	25.46	Pass	V	PK
10	6031.2021	35.81	5.26	-42.60	49.37	47.84	74.00	26.16	Pass	V	PK
11	7802.3202	36.48	6.09	-42.16	49.80	50.21	74.00	23.79	Pass	V	PK
12	9297.4198	37.64	6.64	-42.06	49.51	51.73	74.00	22.27	Pass	V	PK

Mode:	GFSK Transmitting	Channel:	2480MHz

NO	Freq. [MHz]	Ant Factor [dB]	Cable loss [dB]	Pream gain [dB]	Reading [dBμV]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Result	Polarity	Remark
1	1991.6992	31.65	3.46	-43.18	51.13	43.06	74.00	30.94	Pass	H	PK
2	4470.0980	34.46	4.75	-42.81	50.60	47.00	74.00	27.00	Pass	H	PK
3	4959.1306	34.50	4.82	-42.80	51.28	47.80	74.00	26.20	Pass	H	PK
4	6368.2245	35.87	5.41	-42.53	49.98	48.73	74.00	25.27	Pass	H	PK
5	7200.2800	36.30	5.82	-42.16	48.04	48.00	74.00	26.00	Pass	H	PK
6	9166.4111	37.67	6.45	-42.04	50.02	52.10	74.00	21.90	Pass	H	PK
7	1422.4422	28.32	2.92	-42.77	51.35	39.82	74.00	34.18	Pass	V	PK
8	1800.0800	30.38	3.32	-42.71	55.94	46.93	74.00	27.07	Pass	V	PK
9	3186.0124	33.27	4.63	-43.10	51.30	46.10	74.00	27.90	Pass	V	PK
10	4960.1307	34.50	4.82	-42.80	52.70	49.22	74.00	24.78	Pass	V	PK
11	6915.2610	36.07	5.86	-42.26	49.60	49.27	74.00	24.73	Pass	V	PK
12	9308.4206	37.64	6.63	-42.06	49.05	51.26	74.00	22.74	Pass	V	PK

Note:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading -Correct Factor

Correct Factor = Preamplifier Factor– Antenna Factor–Cable Factor

2) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.