Zhejiang Kezheng Electronic Product Inspection
Building 5, No. 316, Jianghong South Road Binjiang District, Hangzhou 310052, China
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TEST REPORT

Certificate Number 4749.01

Report No.....:	**2019-9049**
FCC ID·····:	**2AR6M-WBSMB**
Applicant.....:	ShenZhen LiCheng Technology Co.,Ltd.
Address.....:	Xinghe World Phase I, Bantian Street, Longgang District, Shenzhen, Guangdong, China
Manufacturer.....:	Shenzhen Lixin Technology Co., Ltd.
Address.....:	Tongyi Industrial Park, No. 351, Jihua Road, Longgang District, Shenzhen, China
Product Name.....:	**Barcode Scanner**
Trade Mark.....:	inateck
Model/Type reference.....:	P7
Listed Model(s).....:	P6S,P7S,P8,P8S,BCST-61,BCST-63,BCST-71,BCST-73
Standard.....:	**FCC CFR Title 47 Part 15 Subpart C Section 15.247**
Date of Receipt.....:	Jul.7, 2019
Date of Test Date.....:	Jul.7, 2019-Aug.20, 2019
Date of issue.....:	Aug.20, 2019
Test result.....:	**Pass**

Compiled by: (Printed name+signature)	Liu Wei	Liu Wei
Supervised by: (Printed name+signature)	Chen Yiyun	Chen Yiyun
Approved by: (Printed name+signature)	Wang Weixiong	Wang Weixiong

Testing Laboratory Name.....:	**Zhejiang Kezheng Electronic Product Inspection**
Address.....:	Building 5, No. 316, Jianghong South Road Binjiang District, Hangzhou 310052, China

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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

FCC Rules Part 15.247: Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.

1.2. Report version

Revised No.	Date of issue	Description
01	Aug.20, 2019	Original

1.3. Test Description

FCC Part 15 Subpart C(15.247)			
Test Item	Standard Section	Result	Test Engineer
	FCC		
Antenna Requirement	15.203	Pass	John Xie
Conducted Emission	15.207	Pass	John Xie
Restricted Bands	15.205	Pass	John Xie
Hopping Channel Separation	15.247(a)(1)	Pass	John Xie
Dwell Time	15.247(a)(1)	Pass	John Xie
Peak Output Power	15.247(b)(1)	Pass	John Xie
Number of Hopping Frequency	15.247(b)(1)	Pass	John Xie
Band Edge Emissions	15.247(d)	Pass	John Xie
Radiated Spurious Emission	15.247(c)&15.209	Pass	John Xie
99% Occupied Bandwidth & 20dB Bandwidth	15.247(a)	Pass	John Xie
Pseudorandom Frequency Hopping Sequence	15.247 (a)(1)	Pass	John Xie

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

1.4. Measurement Uncertainty

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

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.42 dB	(1)
Transmitter power Radiated	2.14 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.20 dB	(1)
Radiated Emissions 30~1000MHz	4.70 dB	(1)
Radiated Emissions 1~18GHz	5.00 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)
Occupied Bandwidth	2.80 dB	(1)

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

1.5. Environmental conditions

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

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

2. GENERAL INFORMATION

2.1. Client Information

Applicant:	ShenZhen LiCheng Technology Co.,Ltd.
Address:	Xinghe World Phase I, Bantian Street, Longgang District, Shenzhen, Guangdong, China
Manufacturer:	Shenzhen Lixin Technology Co., Ltd.
Address:	Tongyi Industrial Park, No. 351, Jihua Road, Longgang District, Shenzhen, China

2.2. General Description of EUT

Product Name:	Barcode Scanner
Model/Type reference:	P7
Marketing Name:	inateck
Listed Model(s):	P6S,P7S,P8,P8S,BCST-61,BCST-63,BCST-71,BCST-73
Model Difference:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is model name.
Power Source:	DC 5V output from the PC
Power supply(Battery):	DC3.6Vdc 2600mAh from Li-ion Battery
Hardware version:	V1.0
Software version:	V0.0.9
BT3.0	
Modulation:	GFSK
Operation frequency:	2402MHz~2480MHz
Max Peak Output Power:	-6.14dBm
Channel number:	79
Channel separation:	1MHz
Antenna type:	spring antenna
Antenna gain:	1.0dBi

2.3. Operation state

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. BT EDR, 79 channels are provided to the EUT. Channels 00/39/78 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)
00	**2402**
01	2403
⋮	⋮
38	2440
39	**2441**
40	2442
⋮	⋮
77	2479
78	**2480**

Note: The display in grey were the channel selected for testing.

Test mode

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

2.4. Measurement Instruments List

Tonscend JS0806-2 Test system					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
1	Spectrum Analyzer	R&S	FSV40-N	101798	Sept. 09, 2020
2	Vector Signal Generator	Agilent	N5182A	MY50142520	Sept. 09, 2020
3	Analog Signal Generator	HP	83752A	3344A00337	Sept. 09, 2020
4	Power Sensor	Agilent	E9304A	MY50390009	Sept. 09, 2020
5	Power Sensor	Agilent	E9300A	MY41498315	Sept. 09, 2020
6	Wideband Radio Communication Tester	R&S	CMU200	115297	Sept. 09, 2020
7	Climate Chamber	Angul	AGNH80L	1903042120	Sept. 09, 2020
8	Dual Output DC Power Supply	Agilent	E3646A	MY40009992	Sept. 09, 2020
9	RF Control Unit	Tonscend	JS0806-2	/	Sept. 09, 2020

Transmitter spurious emissions & Receiver spurious emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	EMI Test Receiver	R&S	ESR	102525	Sept. 09, 2020
2	High Pass Filter	Chengdu E-Microwave	OHF-3-18-S	0E01901038	Sept. 09, 2020
3	High Pass Filter	Chengdu E-Microwave	OHF-6.5-18-S	0E01901039	Sept. 09, 2020
4	Spectrum Analyzer	HP	8593E	3831U02087	Sept. 09, 2020
5	Ultra-Broadband logarithmic period Antenna	Schwarzbeck	VULB 9163	01230	Sept. 09, 2020
6	Loop Antenna	Beijin ZHINAN	ZN30900C	18050	Sept. 09, 2020
7	Horn Antenna	R&S	Sep-60	69483	Sept. 09, 2020
8	Spectrum Analyzer	R&S	FSV40-N	101798	Sept. 09, 2020
9	Horn Antenna	Schwarzbeck	BBHA 9120 D	2023	Sept. 09, 2020
10	Pre-Amplifier	Schwarzbeck	BBV 9745	9745#129	Sept. 09, 2020
11	Pre-Amplifier	EMCI	EMC051835SE	980662	Sept. 09, 2020
12	Power Meter	Agilent	E4419B	GB41293710	Sept. 09, 2020

Note:
1)The Cal. Interval was one year.
2)The cable loss has calculated in test result which connection between each test instruments.

2.5. Test Software

Software name	Model	Version
Conducted emission Measurement Software	EZ-EMC	EMC-Con 3A1.1
Radiated emission Measurement Software	EZ-EMC	FA-03A.2.RE
Bluetooth and WIFI Test System	JS1120-3	2.5.77.0418

3. TEST ITEM AND RESULTS

3.1. Antenna requirement

Requirement

FCC CFR Title 47 Part 15 Subpart C Section 15.203:

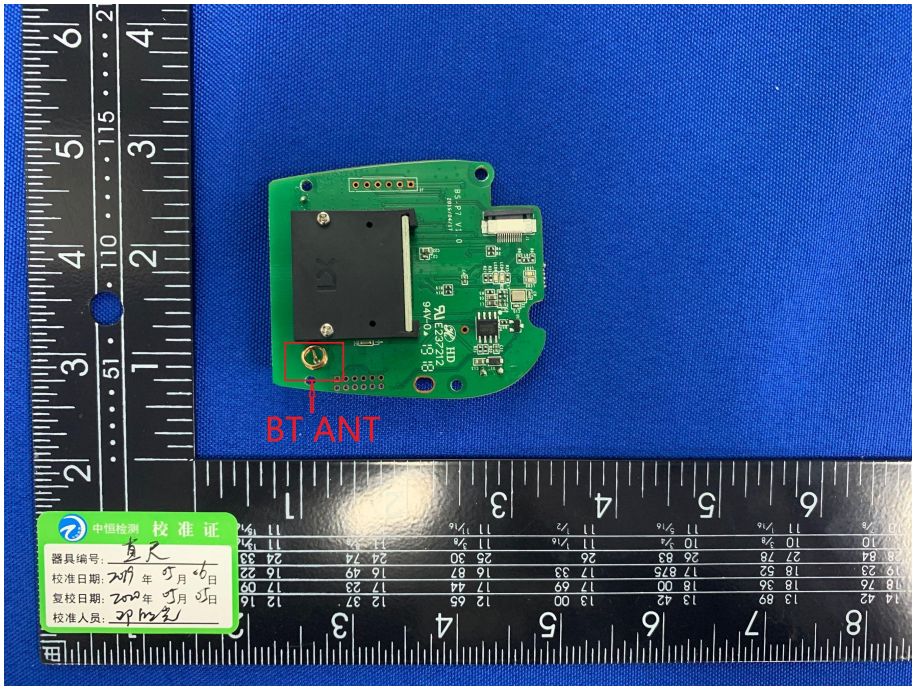
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

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

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

Test Result

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



3.2. Conducted Emission

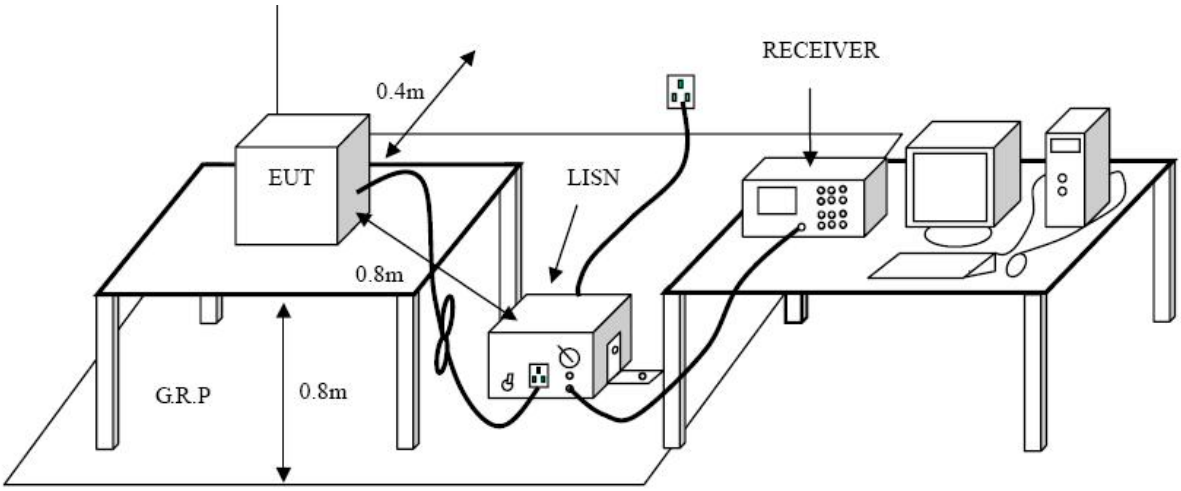
Limit

Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dBμV)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Notes:
(1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequencies.
(3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Test Configuration



Test Procedure

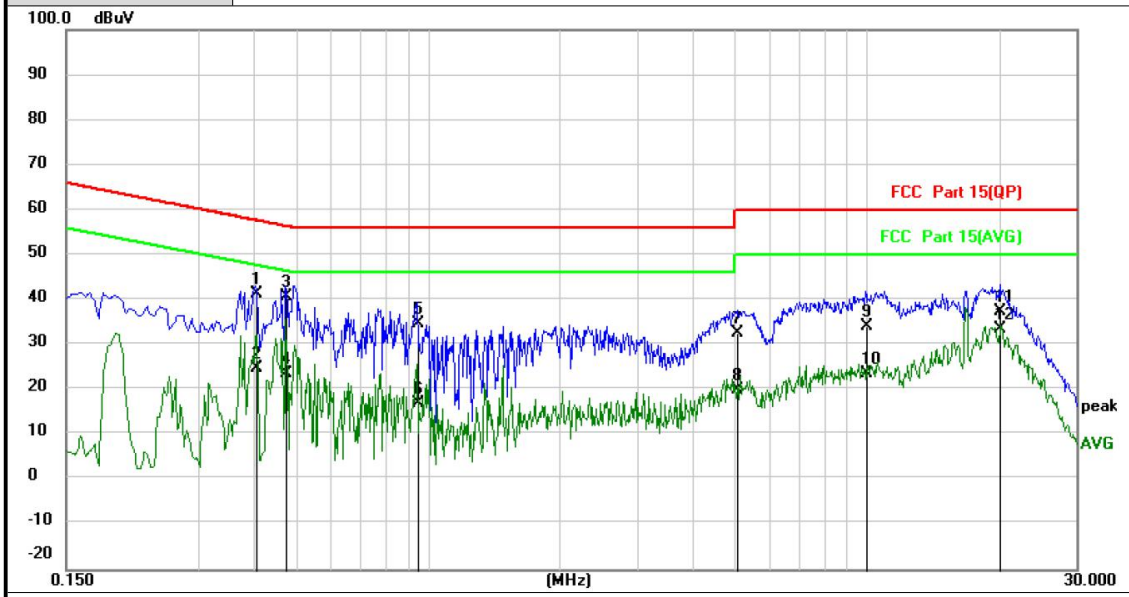
1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from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

Test Mode:

Please refer to the clause 2.3.

Test Results

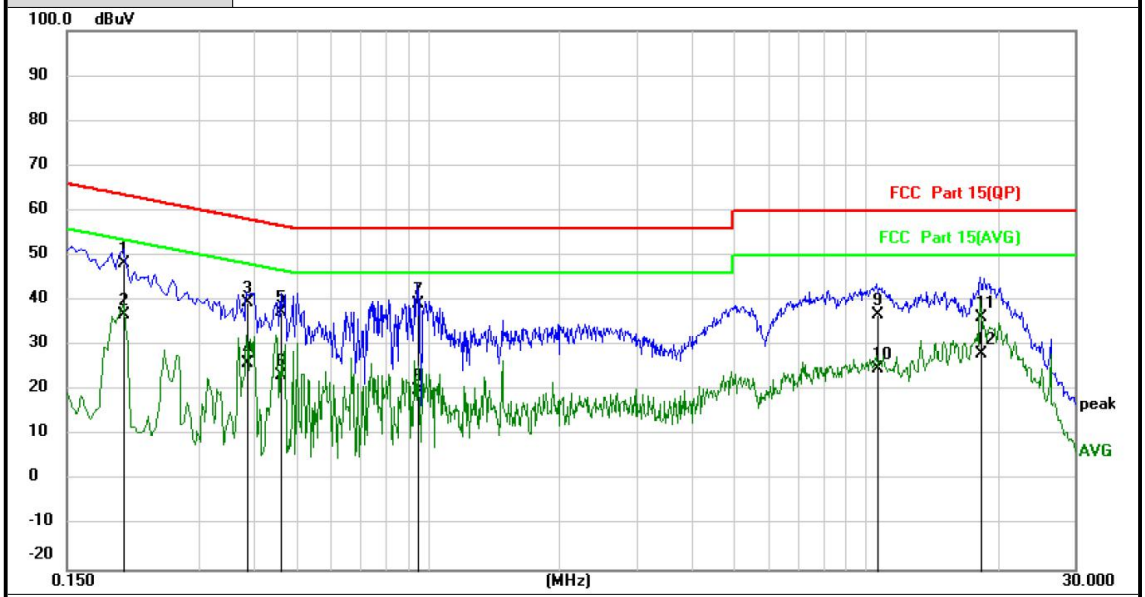
Test Voltage:	AC 120V/60 Hz
Terminal:	Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.4060	30.81	10.40	41.21	57.73	-16.52	QP
2		0.4060	14.31	10.40	24.71	47.73	-23.02	AVG
3	*	0.4740	30.47	10.41	40.88	56.44	-15.56	QP
4		0.4740	13.28	10.41	23.69	46.44	-22.75	AVG
5		0.9460	24.39	10.42	34.81	56.00	-21.19	QP
6		0.9460	6.69	10.42	17.11	46.00	-28.89	AVG
7		5.0620	22.04	10.62	32.66	60.00	-27.34	QP
8		5.0620	9.58	10.62	20.20	50.00	-29.80	AVG
9		9.9340	23.55	10.69	34.24	60.00	-25.76	QP
10		9.9340	13.06	10.69	23.75	50.00	-26.25	AVG
11		20.0980	26.54	11.02	37.56	60.00	-22.44	QP
12		20.0980	22.63	11.02	33.65	50.00	-16.35	AVG

Remarks:
1.Measurement = Reading Level+ Correct Factor
2.Over = Measurement -Limit

Test Voltage:	AC 120V/60 Hz
Terminal:	Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1	*	0.2020	37.99	10.39	48.38	63.53	-15.15	QP
2		0.2020	26.55	10.39	36.94	53.53	-16.59	AVG
3		0.3860	29.27	10.40	39.67	58.15	-18.48	QP
4		0.3860	15.58	10.40	25.98	48.15	-22.17	AVG
5		0.4620	26.90	10.41	37.31	56.66	-19.35	QP
6		0.4620	12.83	10.41	23.24	46.66	-23.42	AVG
7		0.9460	28.88	10.42	39.30	56.00	-16.70	QP
8		0.9460	9.77	10.42	20.19	46.00	-25.81	AVG
9		10.5820	26.17	10.71	36.88	60.00	-23.12	QP
10		10.5820	14.03	10.71	24.74	50.00	-25.26	AVG
11		18.2420	25.19	10.96	36.15	60.00	-23.85	QP
12		18.2420	17.19	10.96	28.15	50.00	-21.85	AVG

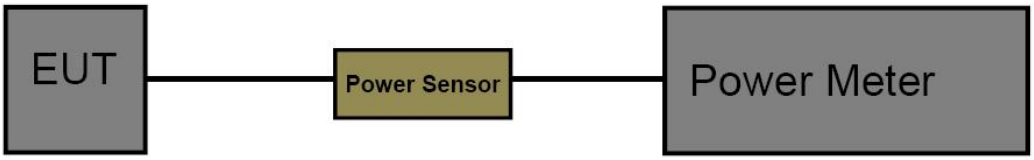
Remarks:
1.Measurement = Reading Level+ Correct Factor
2.Over = Measurement -Limit

3.3. Peak Output Power

Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125mW(21dBm)	2400~2483.5

Test Configuration



Test Procedure

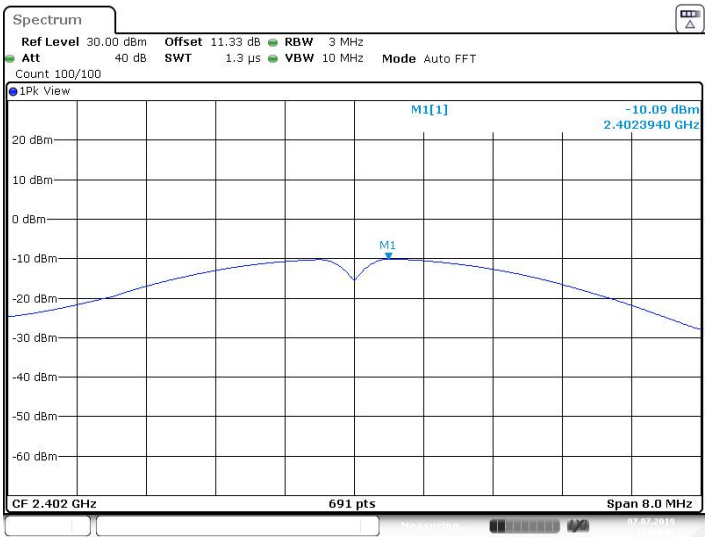
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz.
   RBW=3 MHz, VBW=3 MHz for bandwidth more than 1MHz.

Test Mode

Please refer to the clause 2.3

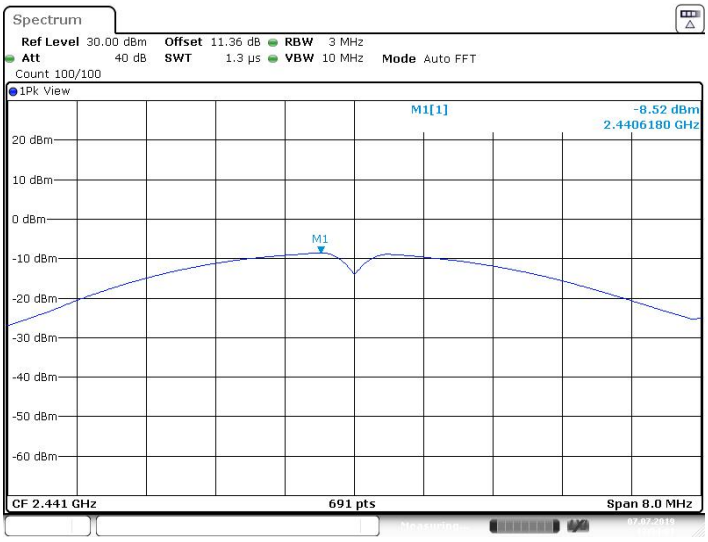
Test Result

Test Mode:	GFSK Mode	
Channel frequency (MHz)	**Test Result (dBm)**	**Limit (dBm)**
2402	-10.09	**30**
2441	-8.52	
2480	-6.14	
GFSK Mode		
2402 MHz		



GFSK Mode

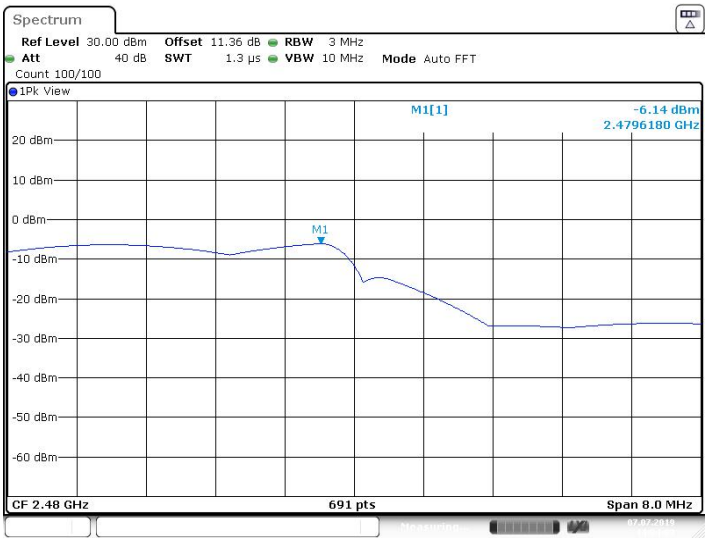
2441 MHz



Date: 7.JUL.2019 13:54:02

GFSK Mode

2480 MHz



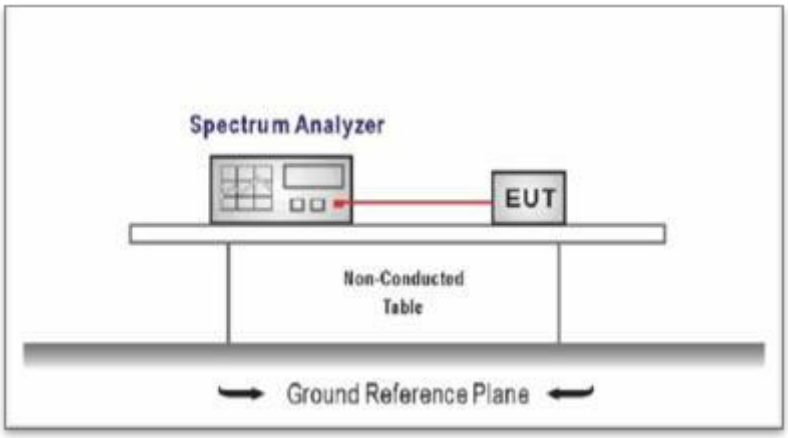
Date: 7.JUL.2019 14:04:03

3.4. 99% Occupied Bandwidth & 20dB Bandwidth

Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	<=1 MHz (20dB bandwidth)	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:

   20dB Bandwidth
   (1) Set RBW = 100 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

   99% Occupied Bandwidth
   (1) Set RBW = 20 kHz.
   (2) Set the video bandwidth (VBW) =100 kHz.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

   NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

Test Mode

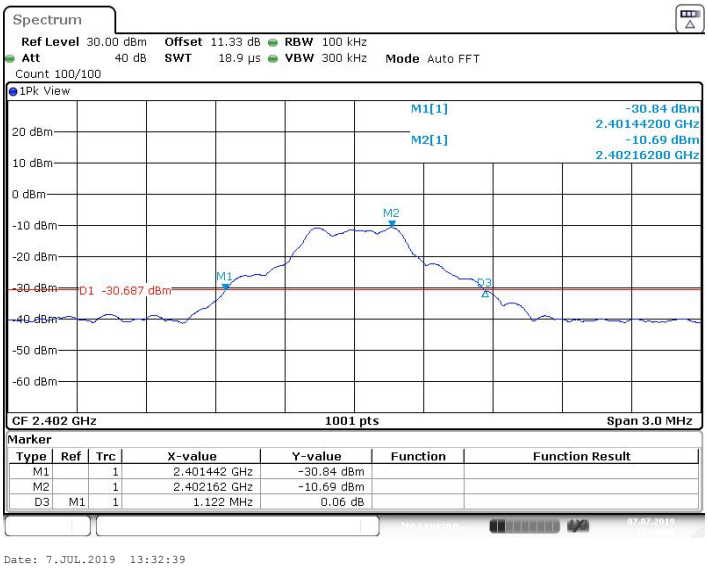
Please refer to the clause 2.3.

Test Results

Test Mode:	GFSK Mode			
Channel frequency (MHz)	20dB Bandwidth [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	1.122	2401.442	2402.564	PASS
2441	1.113	2440.457	2441.570	PASS
2480	1.113	2479.448	2480.561	PASS

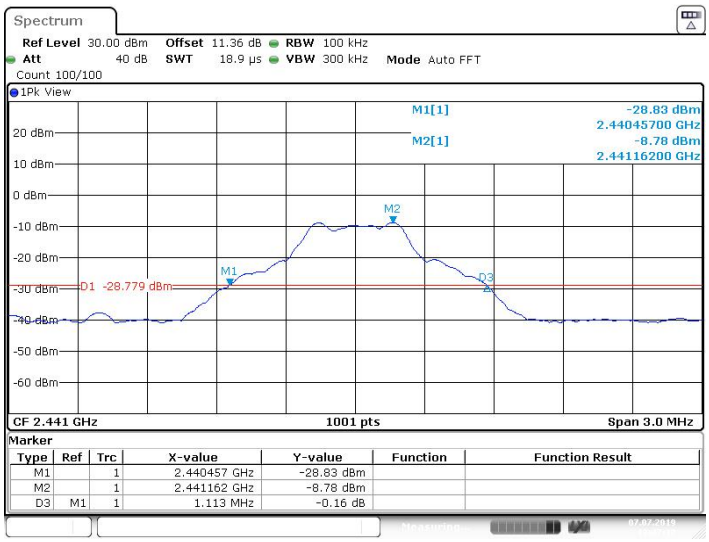
GFSK Mode

2402 MHz



GFSK Mode

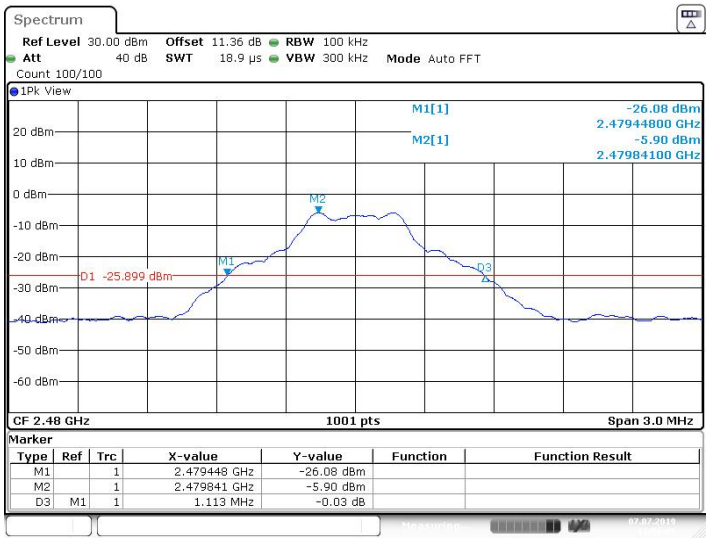
2441 MHz



Date: 7.JUL.2019 13:47:12

GFSK Mode

2480 MHz

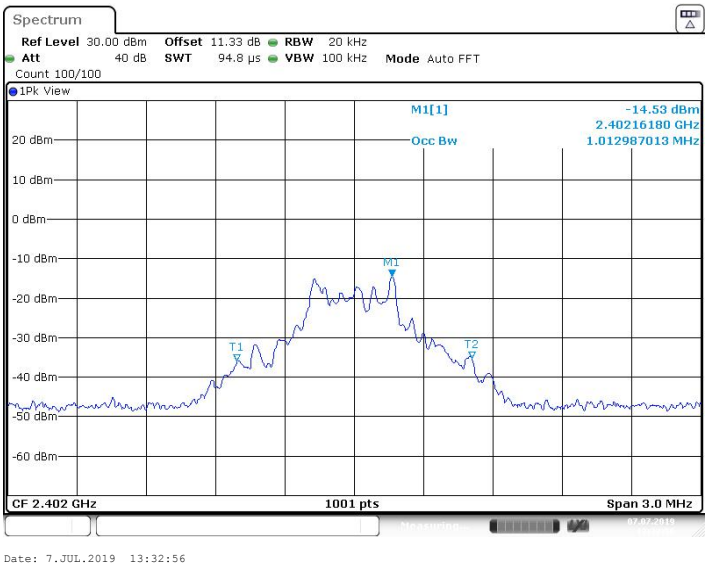


Date: 7.JUL.2019 13:56:05

Test Mode:	GFSK Mode			
Channel frequency (MHz)	99% OCB [MHz]	FL[MHz]	FH[MHz]	Verdict
2402	1.013	2401.494	2402.506	PASS
2441	0.959	2440.520	2441.480	PASS
2480	0.887	2479.559	2480.447	PASS

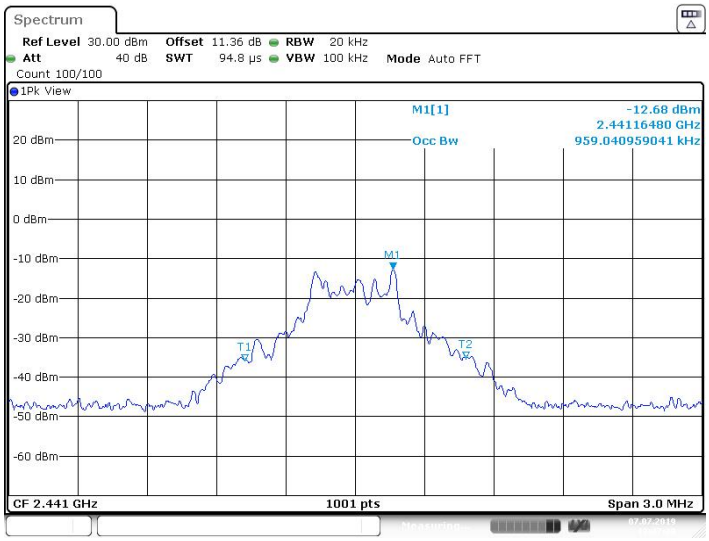
GFSK Mode

2402 MHz



GFSK Mode

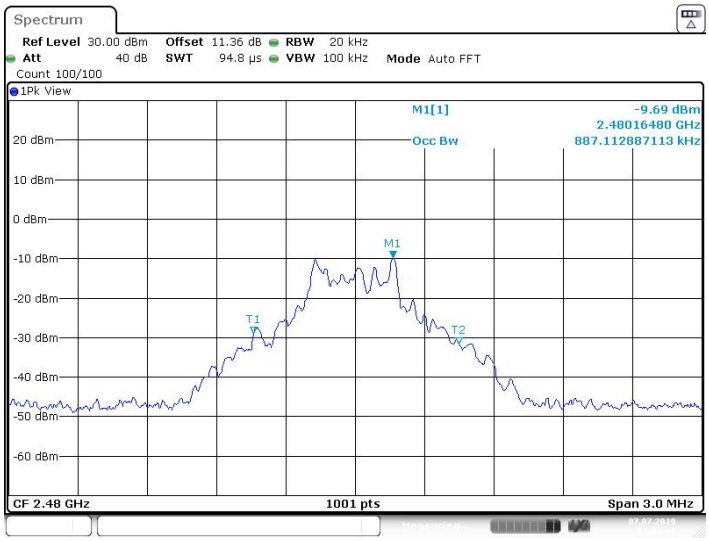
2441 MHz



Date: 7.JUL.2019 13:47:29

GFSK Mode

2480 MHz



Date: 7.JUL.2019 13:56:21

3.5. Carrier Frequencies Separation

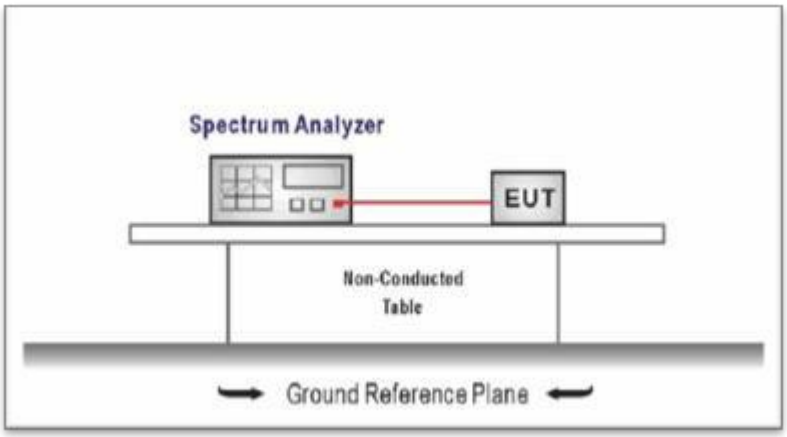
LIMIT

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

frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

Test Item	Limit	Frequency Range(MHz)
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Set RBW = 100 kHz.
   (2) Set the video bandwidth (VBW) ≥ 3 RBW.
   (3) Detector = Peak.
   (4) Trace mode = Max hold.
   (5) Sweep = Auto couple.

NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

Test Mode

Please refer to the clause 2.3.

Test Results

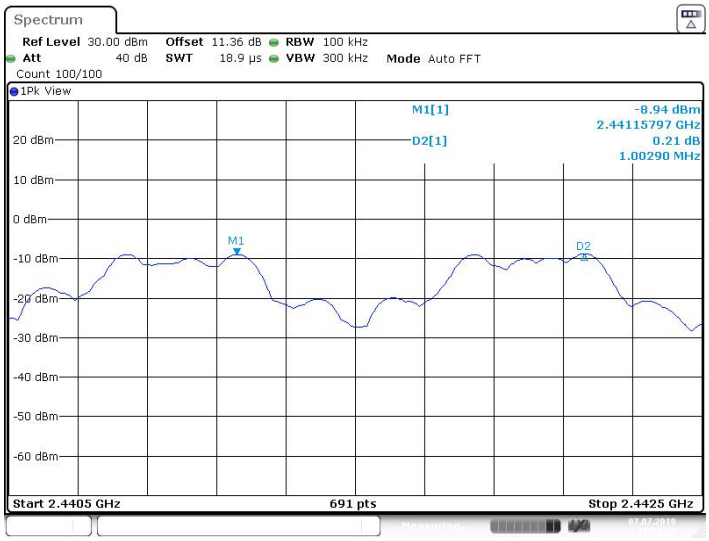
Test Mode:	GFSK Hopping Mode		
Channel frequency (MHz)	Result[MHz]	Limit[MHz]	Verdict
2402	0.771	>=0.748	PASS
2441	1.003	>=0.742	PASS
2480	1.000	>=0.742	PASS

GFSK Hopping Mode

2402 MHz

GFSK Hopping Mode

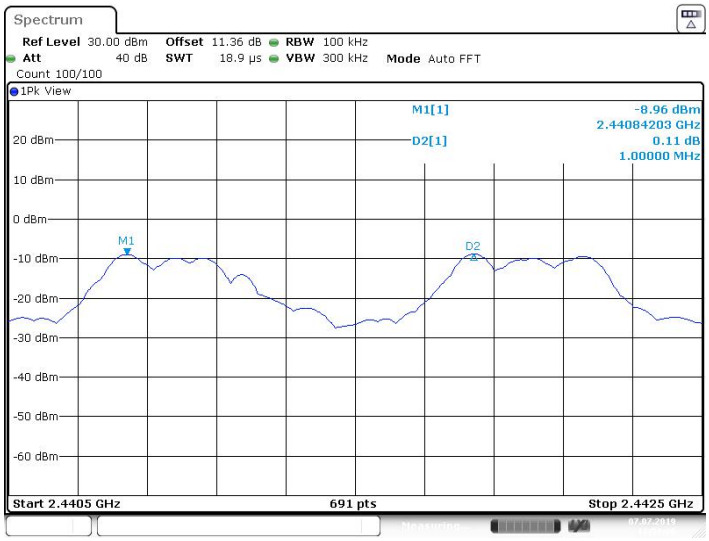
2441 MHz



Date: 7.JUL.2019 13:51:12

GFSK Hopping Mode

2480 MHz



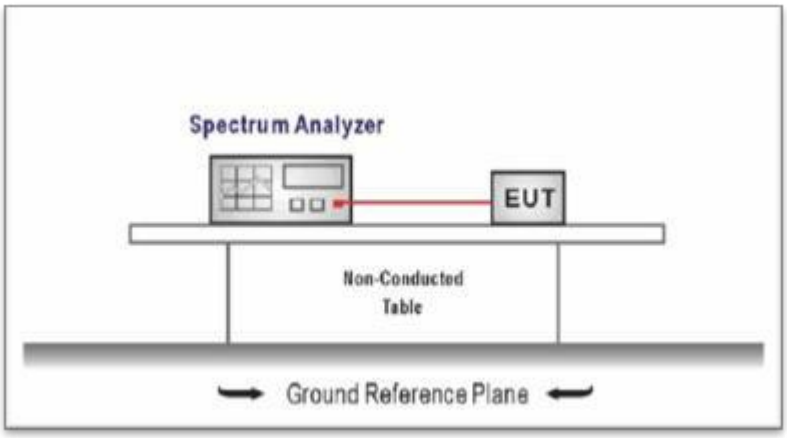
Date: 7.JUL.2019 13:59:26

3.6. Number of Hopping Channel

Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

Test Configuration



Test Procedure

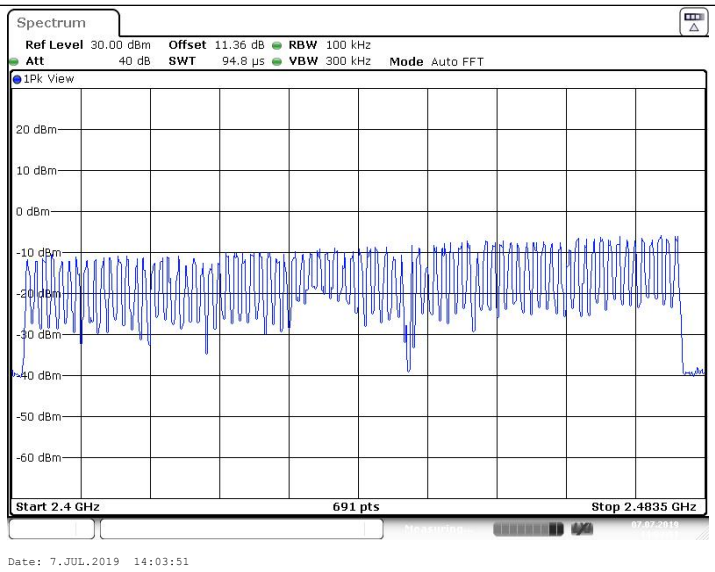
1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Peak Detector: RBW=100 kHz, VBW⩾RBW, Sweep time= Auto.

Test Mode

Please refer to the clause 2.3.

Test Result

Test Mode:	GFSK Hopping Mode		
Frequency Range	**Test Mode**	**Quantity of Hopping Channel**	**Limit**
2402MHz~2483.5MHz	Hop	79	**>15**
GFSK Mode			

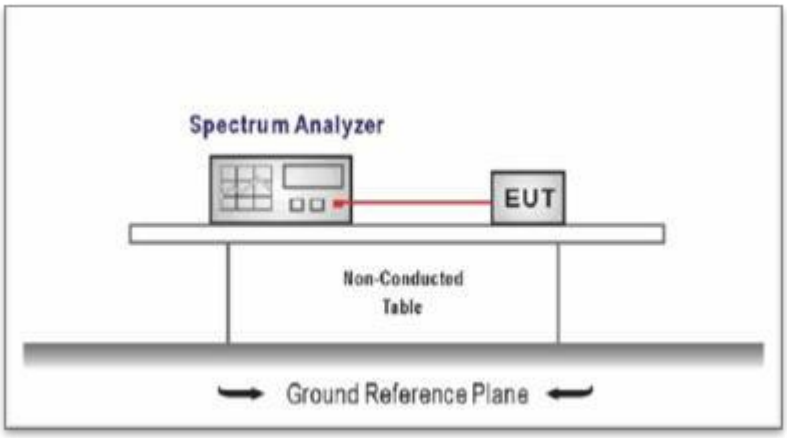


3.7. Dwell Time

Limit

Section	Test Item	Limit
15.247(a)(1)	Average Time of Occupancy	0.4 sec

Test Configuration



Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
   (1) Spectrum Setting: RBW=1MHz, VBW⩾RBW.
   (2) Use video trigger with the trigger level set to enable triggering only on full pulses.
   (3) Sweep Time is more than once pulse time.
   (4) Set the center frequency on any frequency would be measure and set the frequency span to zero.
   (5) Measure the maximum time duration of one single pulse.
   (6) Set the EUT for packet transmitting.

Test Mode

Please refer to the clause 2.3

Test Result

Note:

1.We have tested all mode at high,middle and low channel,and recoreded worst case at low channel.

2.Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2-DH1, 3-DH1

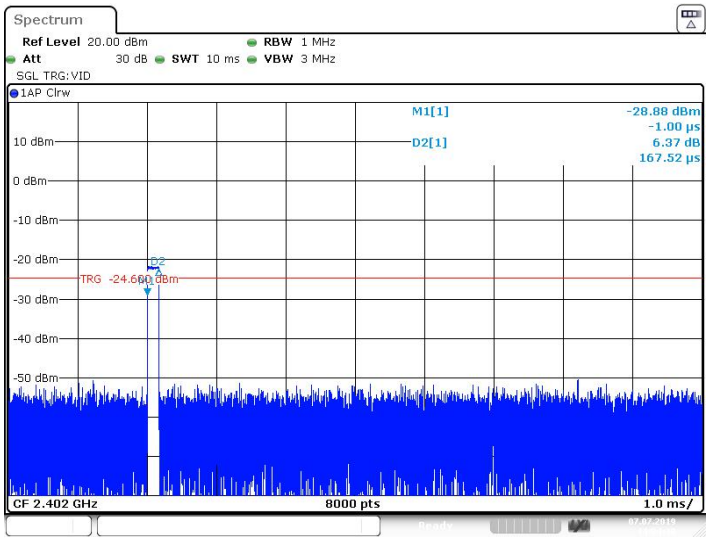
Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2-DH3, 3-DH3

Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2-DH5, 3-DH5

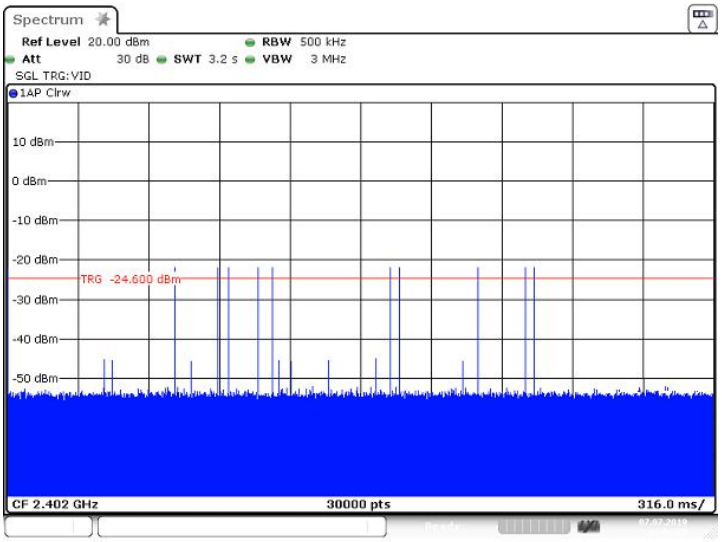
Test Mode:	GFSK Hopping Mode					
Test Mode	**Channel (MHz)**	**Pulse Time (ms)**	**Total of Dwell (ms)**	**Period Time (s)**	**Limit (ms)**	**Result**
1DH5	2402	0.17	18.13	31.60	**400**	**PASS**
1DH5 Total of Dwell= Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second						

GFSK Hopping Mode 1DH5

2402 MHz



Date: 7.JUL.2019 14:04:38



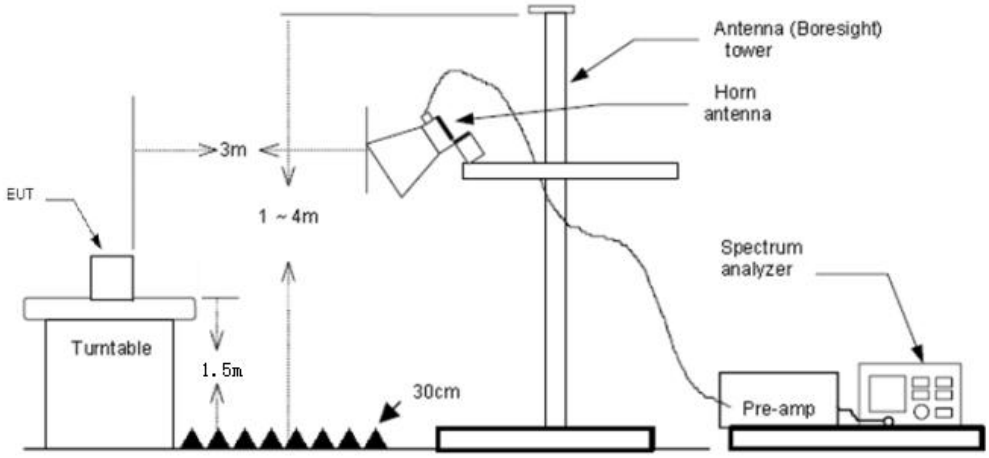
Date: 7.JUL.2019 14:04:55

3.8. Band Edge Emissions(Radiated)

Limit

Restricted Frequency Band (MHz)	(dBuV/m)(at 3m)	
	Peak	Average
2310 ~2390	74	54
2483.5 ~2500	74	54
Note: All restriction bands have been tested, only the worst case is reported.		

Test Configuration



Test Procedure

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

Test Mode

Please refer to the clause 2.3.

Test Results

Note:

Measurement = Reading level + Correct Factor

Correct Factor=Antenna Factor + Cable Loss -Preamplifier Factor

GFSK					CH00				
Frequency (MHz)	Reading Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Measurement (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization	Test value
2310	49.41	26.82	3.78	44.62	35.39	74	-38.61	Vertical	Peak
2390	45.36	27.26	3.89	44.86	31.65	74	-42.35	Vertical	
2310	46.49	26.82	3.78	44.62	32.47	54	-21.53	Vertical	Average
2390	41.38	27.26	3.89	44.86	27.67	54	-26.33	Vertical	
2310	48.10	26.82	3.78	44.62	34.08	74	-39.92	Horizontal	Peak
2390	46.86	27.26	3.89	44.86	33.15	74	-40.85	Horizontal	
2310	45.59	26.82	3.78	44.62	31.57	54	-22.43	Horizontal	Average
2390	43.48	27.26	3.89	44.86	29.77	54	-24.23	Horizontal	

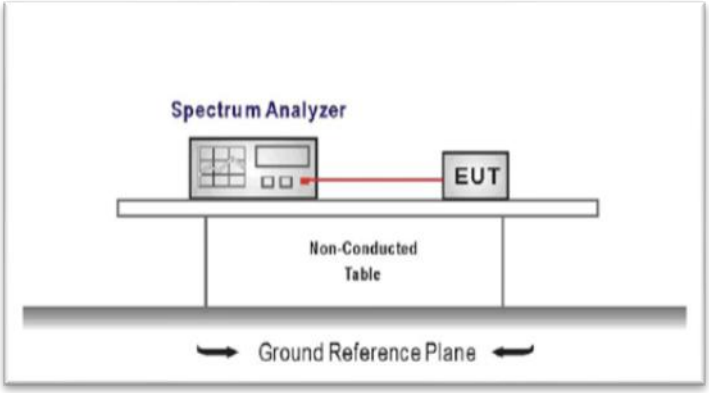
GFSK					CH78				
Frequency (MHz)	Reading Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Measurement (dBuV/m)	Limit Line (dBuV/m)	Margin (dB)	Polarization	Test value
2483.50	52.65	27.46	3.92	44.96	38.63	74	-35.37	Vertical	Peak
2500.00	49.44	27.98	4.17	45.02	35.73	74	-38.27	Vertical	
2483.50	49.21	27.46	3.92	44.96	35.19	54	-18.81	Vertical	Average
2500.00	46.32	27.98	4.17	45.02	32.61	54	-21.39	Vertical	
2483.50	53.98	27.46	3.92	44.96	39.96	74	-34.04	Horizontal	Peak
2500.00	48.61	27.98	4.17	45.02	34.9	74	-39.10	Horizontal	
2483.50	50.64	27.46	3.92	44.96	36.62	54	-17.38	Horizontal	Average
2500.00	45.15	27.98	4.17	45.02	31.44	54	-22.56	Horizontal	

3.9. Band Edge and Spurious Emission (conducted)

LIMIT

FCC CFR Title 47 Part 15 Subpart C Section15.247 (d):
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

TEST CONFIGURATION



TEST PROCEDURE

1.The transmitter output was connected to the spectrum analyzer through an attenuator, the pathloss was compensated to the results for each measurement.

2.Set to the maximum power setting and enable the EUT transmit continuously

3.Use the following spectrum analyzer settings:

RBW= 100 KHz, VBW≥RBW
Sweep = auto, Detector function = peak, Trace = max hold

4.Measure and record the results in the test report.

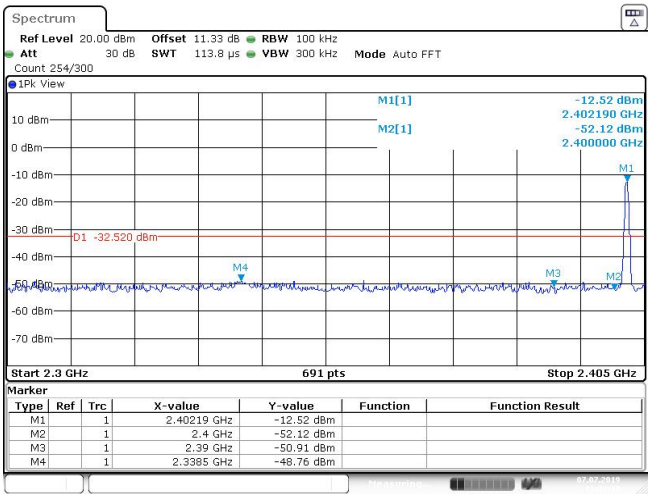
TEST MODE:

Please refer to the clause 2.3.

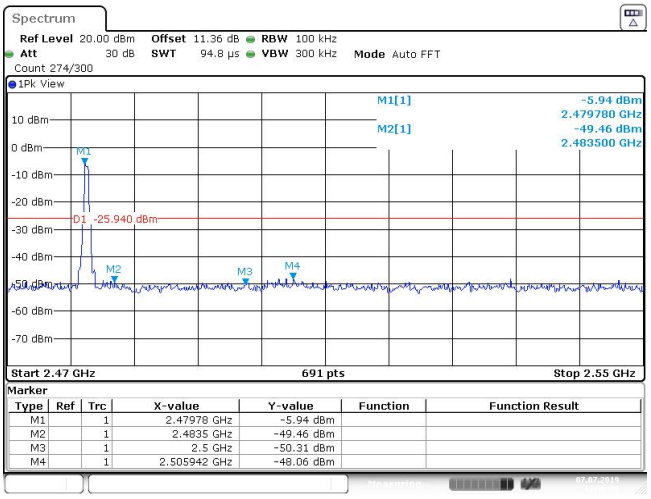
TEST RESULTS

GFSK

CH00-Bandedge

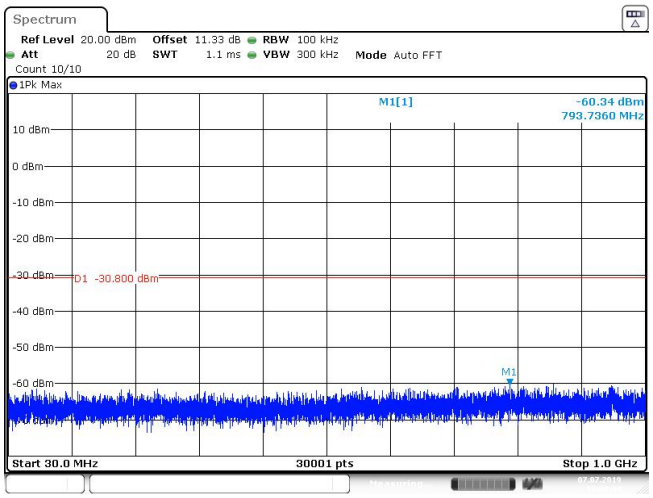


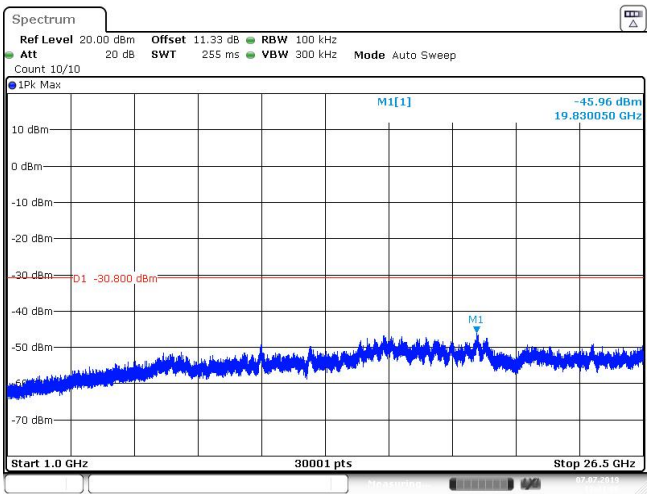
CH78-Bandedge



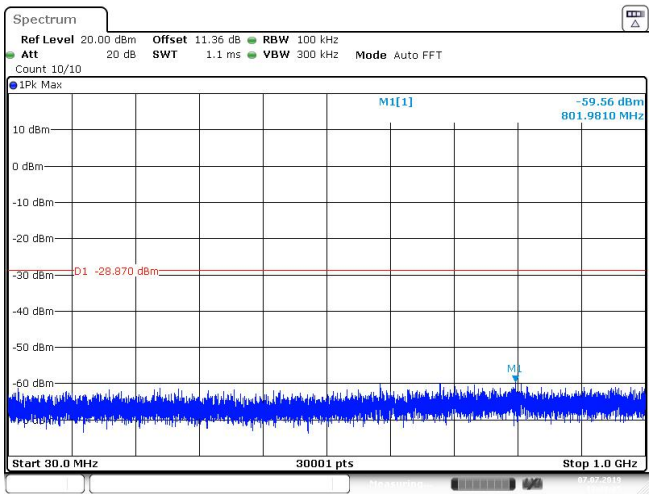
GFSK

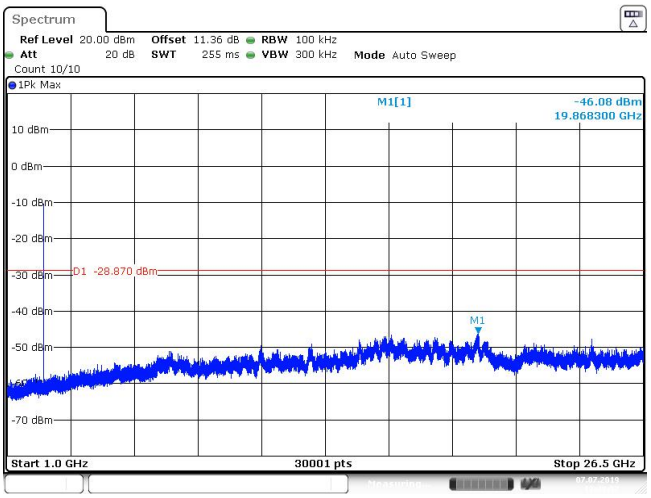
CH00-SE



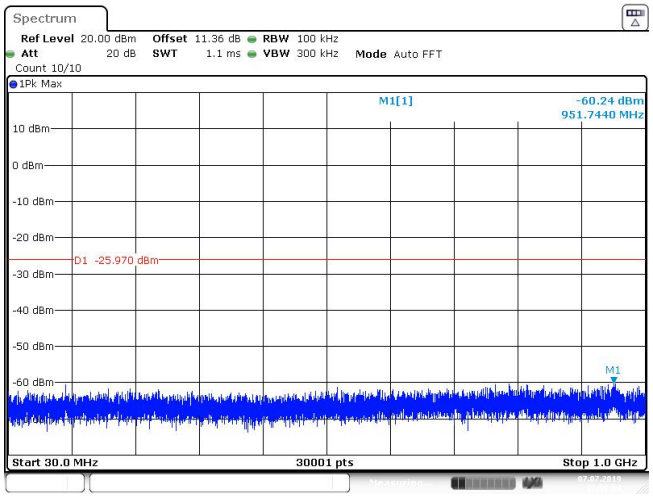


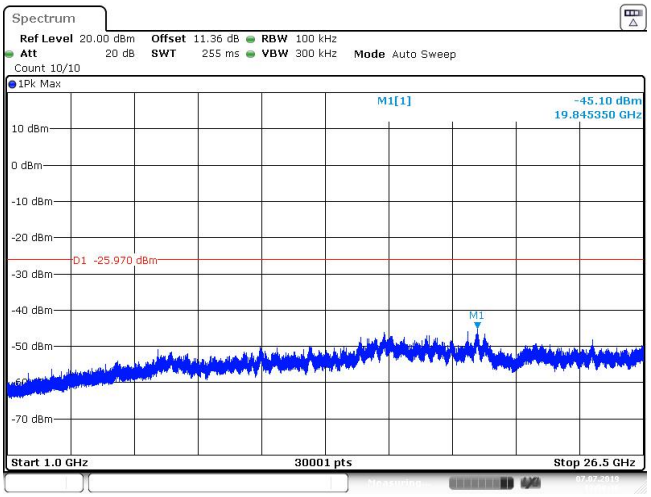
CH39-SE





CH78-SE





3.10. Radiated Spurious Emissions

Limit

Radiated Emission Limits (9 kHz~1000 MHz)

Frequency (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Radiated Emission Limit (Above 1000MHz)

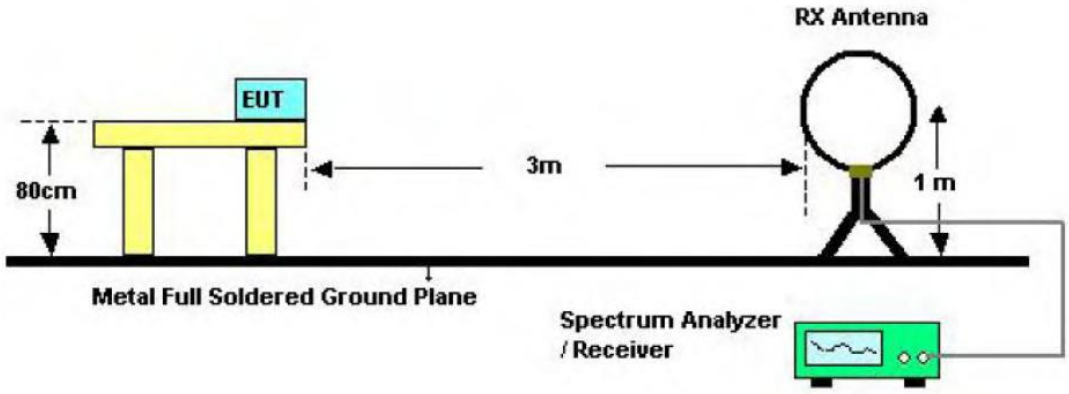
Frequency (MHz)	Distance Meters(at 3m)	
	Peak	Average
Above 1000	74	54

Note:

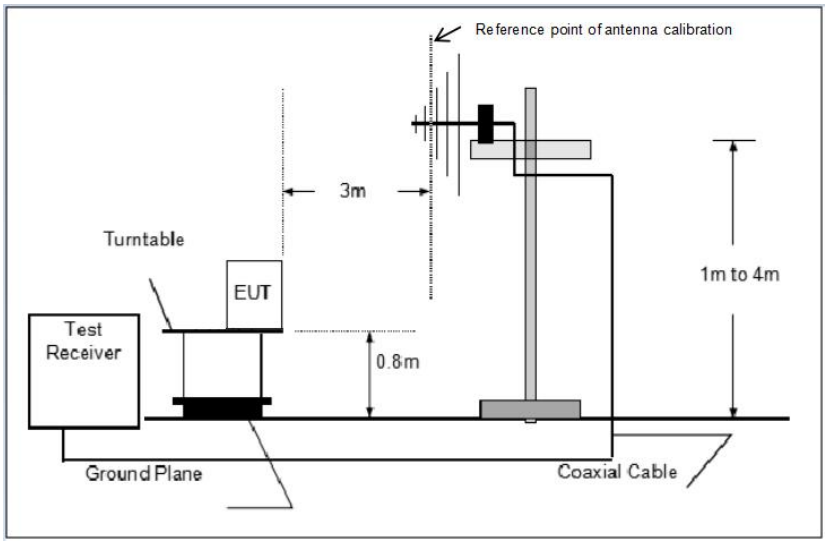
(1) The tighter limit applies at the band edges.

(2) Emission Level (dBuV/m)=20log Emission Level (uV/m).

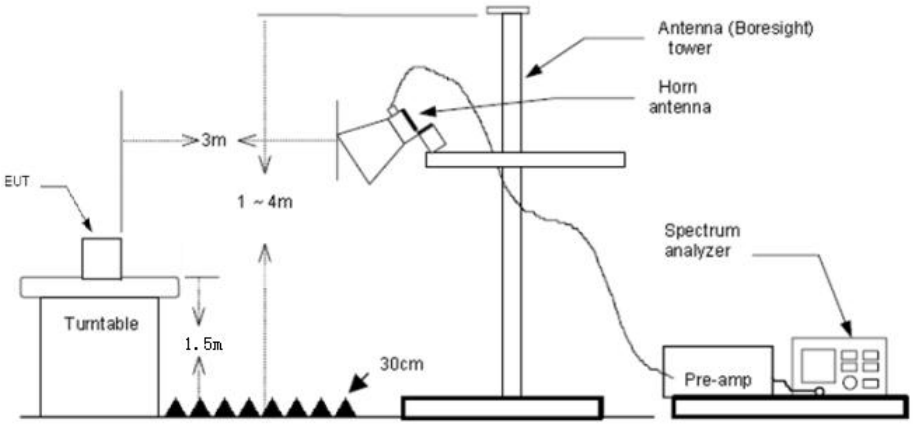
Test Configuration



Below 30MHz Test Setup



Below 1000MHz Test Setup



Above 1GHz Test Setup

Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings

   (1) Span shall wide enough to fully capture the emission being measured;

   (2) Below 1 GHz:

   RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;

   If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

   (3) From 1 GHz to 10th harmonic:

   RBW=1MHz, VBW=3MHz Peak detector for Peak value.

   RBW=1MHz, VBW=10Hz RMS detector for Average value.

Test Mode

Please refer to the clause 2.3.

Test Result

9 KHz~30 MHz and 18GHz~25GHz

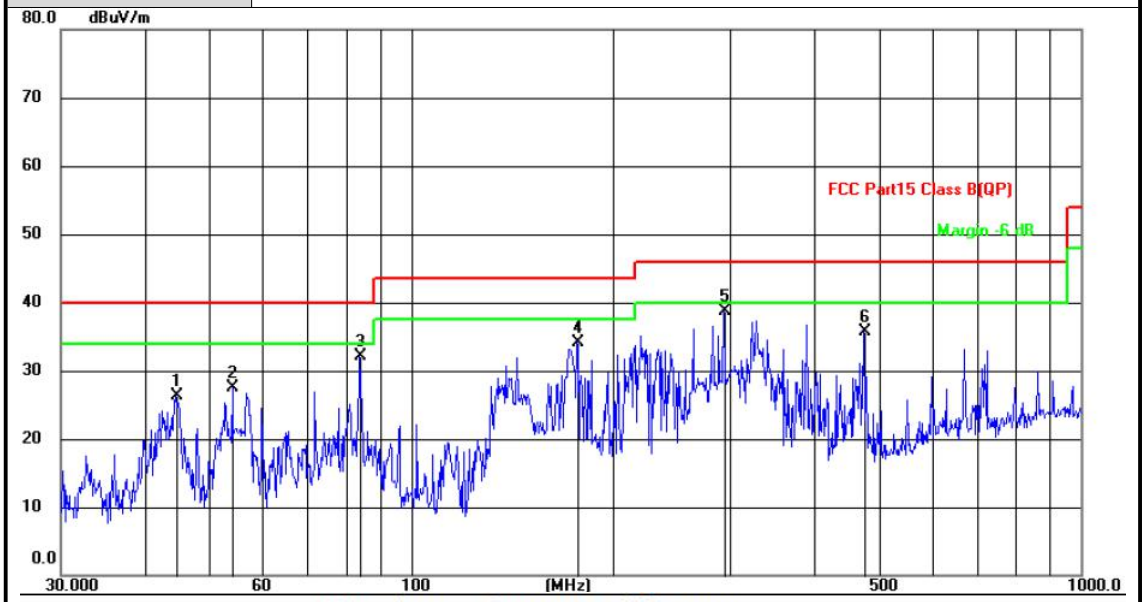
From 9 KHz~30 MHz and 18GHz~25GHz: Conclusion: PASS

Note:

1) Measurement = Reading level + Correct Factor
   Correct Factor=Antenna Factor + Cable Loss -Preamplifier Factor
2) The peak level is lower than average limit(54 dBuV/m), this data is the too weak instrument of signal is unable to test.
3) The emission levels of other frequencies are very lower than the limit and not show in test report.
4) The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

30MHz-1GHz

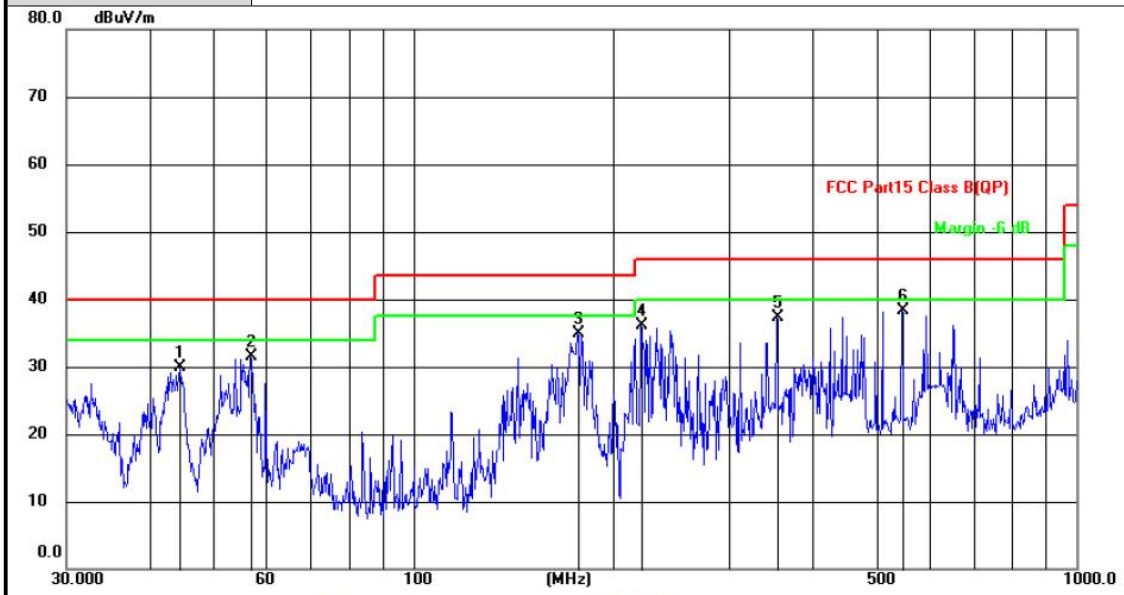
Ant. Pol.	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		44.7276	41.55	-15.19	26.36	40.00	-13.64	QP
2		54.0900	42.32	-14.86	27.46	40.00	-12.54	QP
3		83.9037	51.38	-19.26	32.12	40.00	-7.88	QP
4		177.1982	52.91	-18.83	34.08	43.50	-9.42	QP
5	*	293.9075	52.97	-14.35	38.62	46.00	-7.38	QP
6		474.0008	45.72	-10.09	35.63	46.00	-10.37	QP

Measurement = Reading level + Correct Factor

Ant. Pol.	Vertical

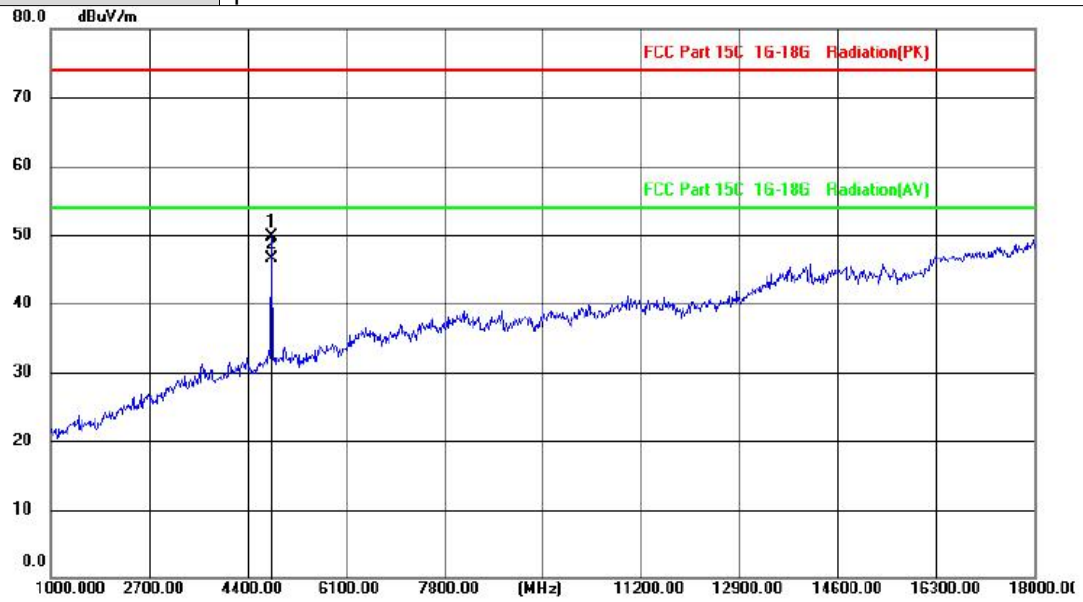


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		44.5867	45.18	-15.21	29.97	40.00	-10.03	QP
2		56.9112	46.79	-15.24	31.55	40.00	-8.45	QP
3		177.1982	53.83	-18.83	35.00	43.50	-8.50	QP
4		220.6945	52.19	-16.14	36.05	46.00	-9.95	QP
5		353.9347	49.28	-12.06	37.22	46.00	-8.78	QP
6	*	546.1390	47.68	-9.36	38.32	46.00	-7.68	QP

Measurement = Reading level + Correct Factor

Adobe 1GHz

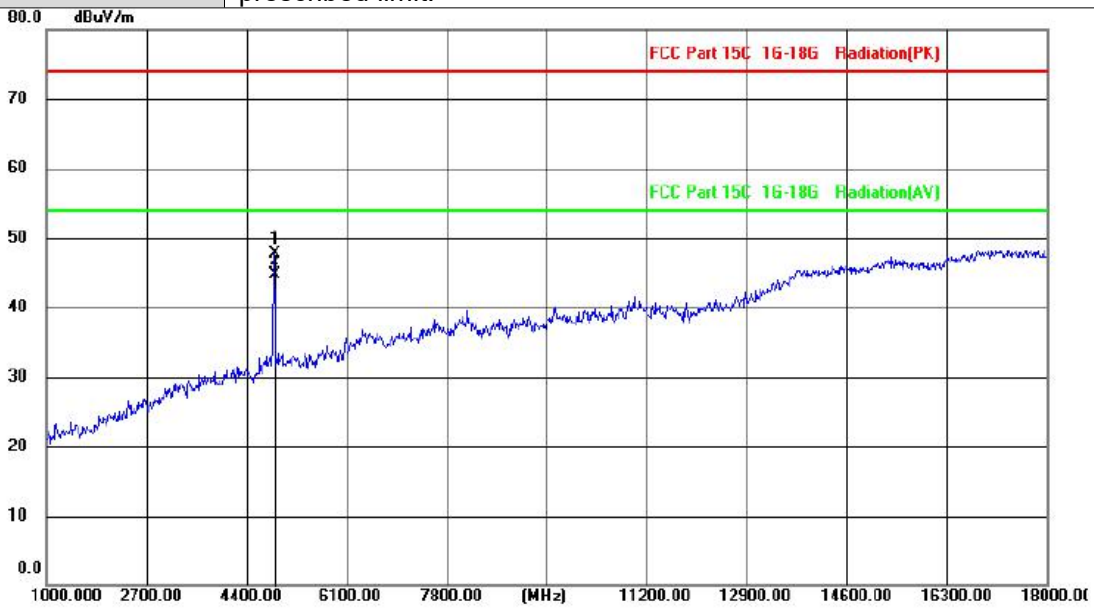
Ant. Pol.	Horizontal
Test Mode:	TX GFSK Mode 2402MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4803.300	54.42	-4.63	49.79	74.00	-24.21	peak
2	*	4803.300	51.23	-4.63	46.60	54.00	-7.40	AVG

Measurement = Reading level + Correct Factor

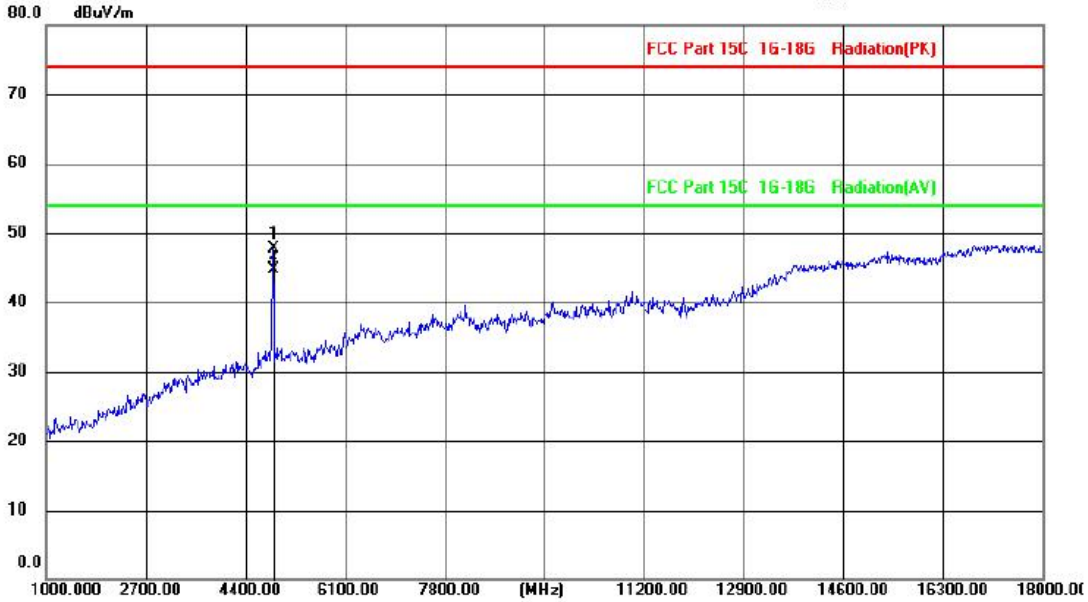
Ant. Pol.	Vertical
Test Mode:	TX GFSK Mode 2402MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4803.300	54.42	-4.63	49.79	74.00	-24.21	peak
2	*	4803.300	51.23	-4.63	46.60	54.00	-7.40	AVG

Measurement = Reading level + Correct Factor

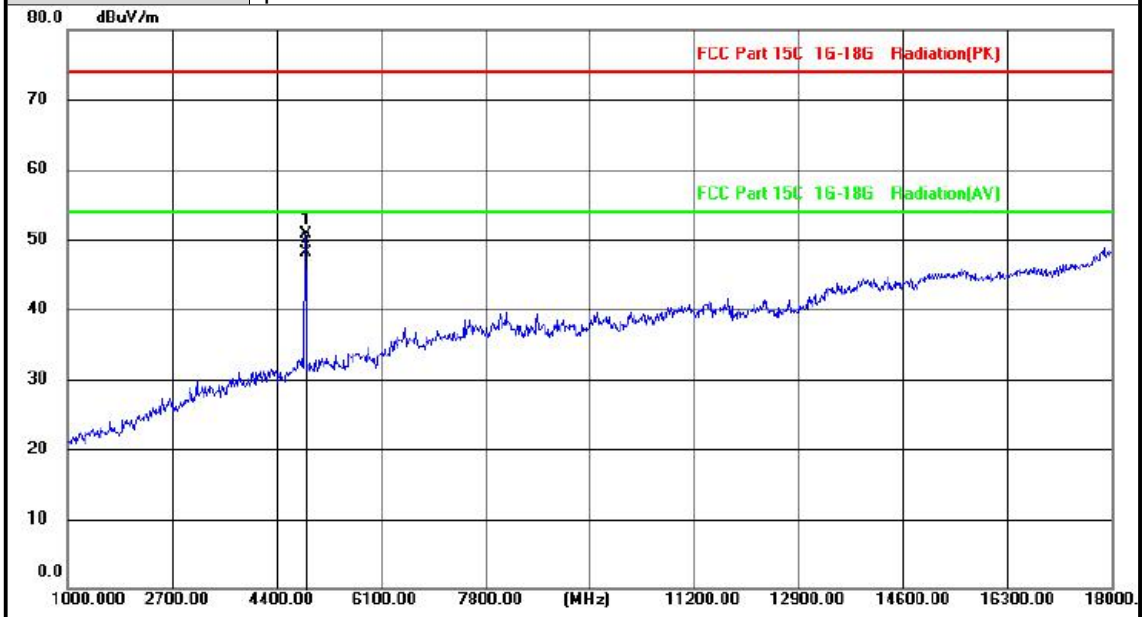
Ant. Pol.	Horizontal
Test Mode:	TX GFSK Mode 2441MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4884.300	52.16	-4.45	47.71	74.00	-26.29	peak
2	*	4884.300	49.12	-4.45	44.67	54.00	-9.33	AVG

Measurement = Reading level + Correct Factor

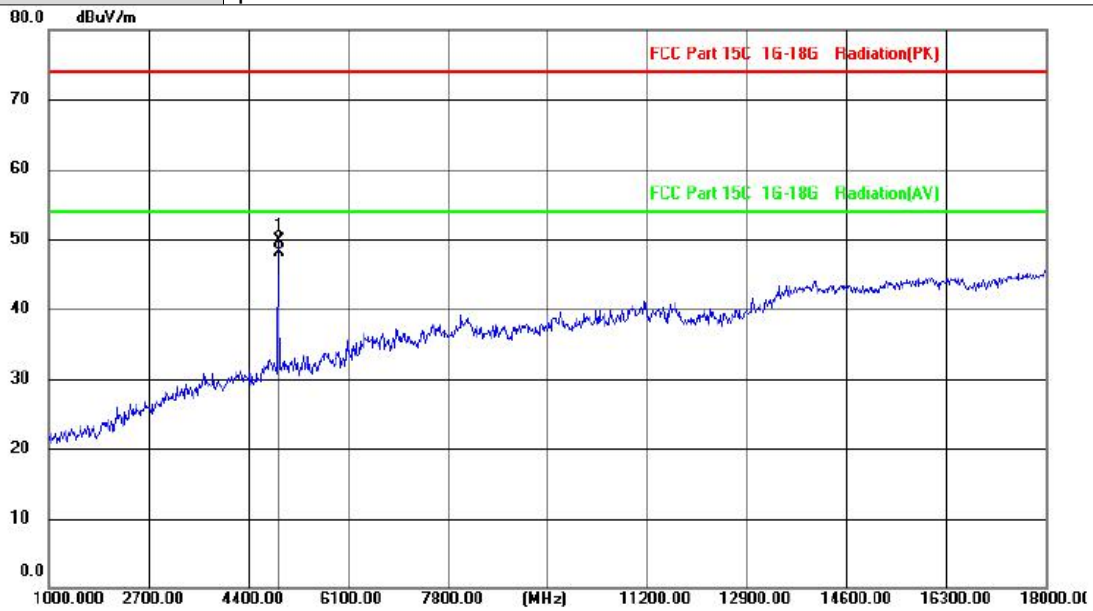
Ant. Pol.	Vertical
Test Mode:	TX GFSK Mode 2441MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4884.300	55.07	-4.45	50.62	74.00	-23.38	peak
2	*	4884.300	52.61	-4.45	48.16	54.00	-5.84	AVG

Measurement = Reading level + Correct Factor

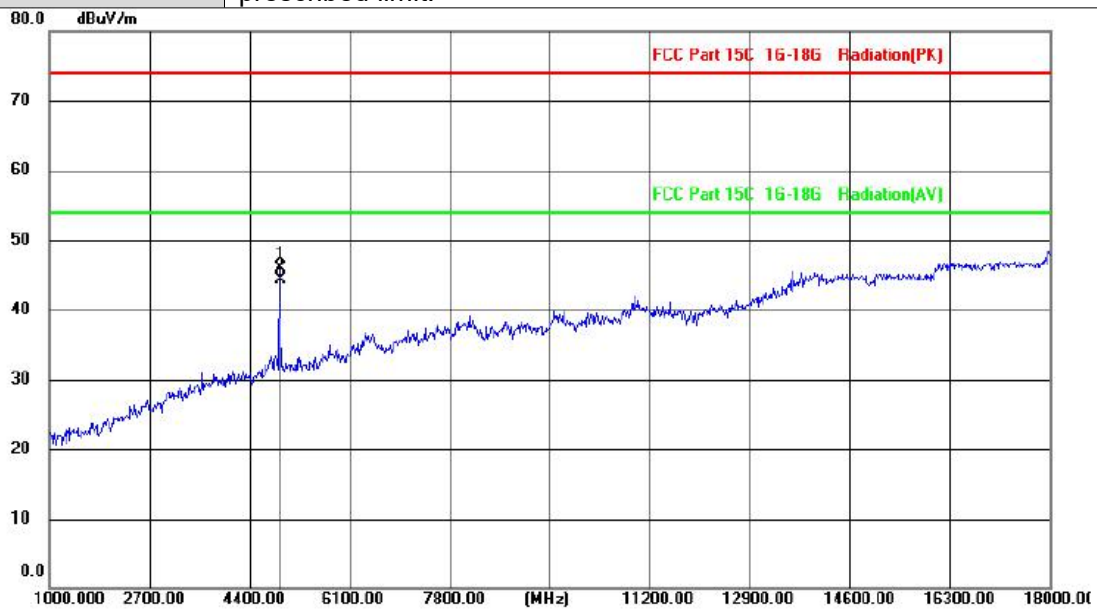
Ant. Pol.	Horizontal
Test Mode:	TX GFSK Mode 2480MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4993.600	54.01	-4.33	49.68	74.00	-24.32	peak
2	*	4993.600	52.38	-4.33	48.05	54.00	-5.95	AVG

Measurement = Reading level + Correct Factor

Ant. Pol.	Vertical
Test Mode:	TX GFSK Mode 2480MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		4993.600	50.25	-4.33	45.92	74.00	-28.08	peak
2	*	4993.600	48.56	-4.33	44.23	54.00	-9.77	AVG

Measurement = Reading level + Correct Factor

3.11. Pseudorandom Frequency Hopping Sequence

LIMIT

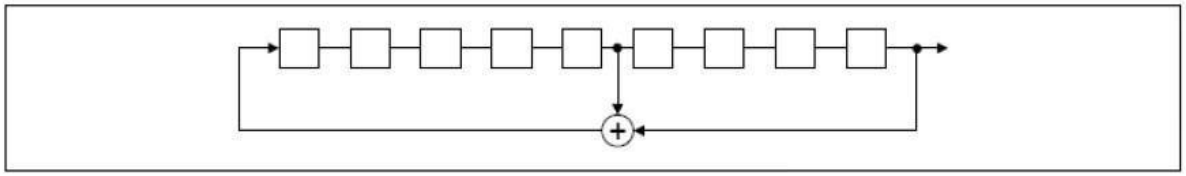
FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, 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 pseudo randomly 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 hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

TEST RESULTS

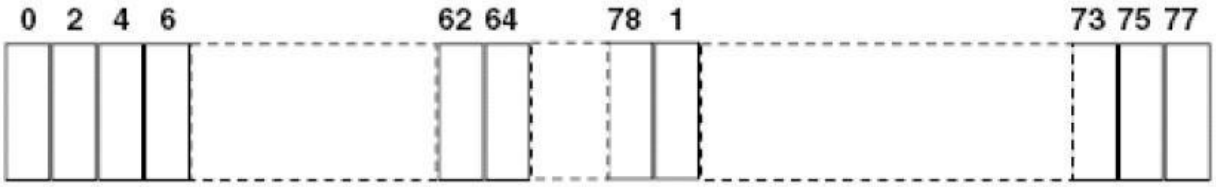
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the friststage.The sequence begins with the frist one of 9 consecutive ones, for example: the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.

The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

4. EUT TEST PHOTOS

Reference to the document No.: Test Photos.

5. PHOTOGRAPHS OF EUT CONSTRUCTIONAL

Reference to the document No.: External Photos and Internal Photos.

**********THE END**********