SGS-CSTC Standards Technical Services Co., Ltd.
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TEST REPORT

The following sample(s) was/were submitted and identified on behalf of the client as:

Application No.:	GZEM1610006811AV
Applicant:	BRIGHT INDUSTRIES COMPANY LIMITED
Manufacturer:	Dong Guan Jia Sheng Lighting Technology Co., Ltd.
Factory:	Dong Guan Jia Sheng Lighting Technology Co., Ltd.
FCC ID:	2AJ8KB0029RA
Product Description:	Low Voltage Outdoor Speaker
Model No.:	B0029RA
Trade Mark:	Hampton Bay
Standards:	CFR 47 FCC PART 15 Subpart C: 2015 section 15.247
Date of Receipt:	2016-10-25
Date of Test:	2016-12-05 to 2016-12-07
Date of Issue:	2016-12-26
Test Result :	**Pass***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:

Vicky Liu
Manager

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2016-12-26		Original Report

Authorized for issue by:				
Tested By		Vico.Cui **(Vico Cui) /Project Engineer**		2016-12-05 to 2016-12-07 **Date**
Prepared By		Millie Li **(Millie Li) / Clerk**		2016-12-24 **Date**
Checked By		Ricky Liu **(Ricky Liu) / Reviewer**		2016-12-26 **Date**

3 Test Summary

Test	Test Requirement	Test method	Result
Antenna Requirement	FCC PART 15 C section 15.247 (c) and Section 15.203	FCC PART 15 C section 15.247 (c) and Section 15.203	PASS
Occupied Bandwidth	FCC PART 15 C section 15.247 (a)(1)	ANSI C63.10: Clause 6.9.2	PASS
Carrier Frequencies Separated	FCC PART 15 C section 15.247(a)(1)	ANSI C63.10: Clause 7.8.2	PASS
Hopping Channel Number	FCC PART 15 C section 15.247(a)(1)(iii)	ANSI C63.10: Clause 7.8.3	PASS
Dwell Time	FCC PART 15 C section 15.247(a)(1)(iii)	ANSI C63.10: Clause 7.8.4	PASS
Pseudorandom Frequency Hopping Sequence	FCC PART 15 C section 15.247(a)(1)	FCC PART 15 C section 15.247(a)(1)	PASS
Maximum Peak Output Power	FCC PART 15 C section 15.247(b)(1)	ANSI C63.10: Clause 7.8.5	PASS
Unwanted Emission (30 MHz to 25 GHz)	FCC PART 15 C section 15.247(d)	ANSI C63.10: Clause 7.8.8	PASS
Radiated Spurious Emissions	FCC PART 15 C Section 15.209 and 15.205	ANSI C63.10:	PASS
Radiated Emissions which fall in the restricted bands	FCC PART 15 C section 15.247(d)	ANSI C63.10: Clause 6.3, 6.5 and 6.6	PASS
Band Edges Measurement	FCC PART 15 C section 15.247 (d) &15.205	ANSI C63.10: Clause 6.10	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207	ANSI C63.10: Clause 6.2	PASS

Remark:

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

ANSI C63.10: the detail version is ANSI C63.10:2013 in the whole report.

DA 00-705 was used as a guideline in preparing this Test Report.

Conducted testing use a direct connection between the antenna port of the device and the spectrum analyzer, may through suitable attenuator, all the attenuation in the conducted RF path, include cable loss or external attenuation will be offset to the spectrum analyzer during testing. Detailed offset value, please refer to the corresponding test plot.

4 Contents

5 General Information

5.1 Client Information

Applicant:	BRIGHT INDUSTRIES COMPANY LIMITED
Address of Applicant:	UNIT 16 17F GOLDEN ERA PLAZA NO 39-55 SAI YEE STREET MONG KOK HONG KONG
Manufacturer:	Dong Guan Jia Sheng Lighting Technology Co., Ltd.
Address of Manufacturer:	Shutian Manage District, Humen Town, Dongguan City, China, 523929
Factory:	Dong Guan Jia Sheng Lighting Technology Co., Ltd.
Address of Factory:	Shutian Manage District, Humen Town, Dongguan City, China, 523929

5.2 General Description of E.U.T.

Product Description:	Low Voltage Outdoor Speaker
Model No.:	B0029RA

5.3 Details of E.U.T.

Operating Frequency	2402 MHz to 2480 MHz
Type of Modulation:	GFSK, (π/4)DQPSK, 8DPSK
Number of Channels	79 Channels
Channel Separation:	1 MHz
Test Software of EUT:	BlueTest 3 Version 2.4.8(manufacturer declare)
Antenna Type	Integral
Antenna gain:	3.5 dBi
Specialty:	Bluetooth 4.1 single mode
Function:	Outdoor Speaker with BT function to transmit and receive audio signal
Power Supply:	DC 3.7V (internal rechargeable battery operated) AC/DC 12V for charging
Power Cord:	N/A

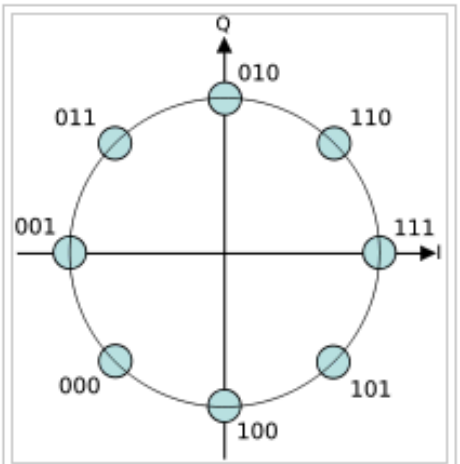
5.4 Modulation configure

Modulation	Packet	Packet Type	Packet Size
GFSK	DH1	4	24
	DH3	11	183
	DH5	15	339
(π/4)DQPSK	2DH1	20	54
	2DH3	26	367
	2DH5	30	379
8DPSK	3DH1	24	83
	3DH3	27	552
	3DH5	31	1021

Remark:

Modulation 8-DPSK

The modulation 8 PSK works with 8 phases between 0 and 2*pi (0 and 360 degrees), it can be seeing bellow in the circle.



Constellation diagram for 8-PSK with Gray coding.

Normal mode: the Bluetooth has been tested on the Modulation of GFSK;

EDR mode: the Bluetooth has been tested on the Modulation of (π/4)DQPSK and 8DPSK, compliance test and record the worst case on 8DPSK.

5.5 Description of Support Units

The EUT has been tested with following support units as bellowing.

Description	Manufacturer	Model No.	SN/Certificate NO
NoteBook	IBM	T30	S/N78-3VMLX 06/01
BT test board	SGS EMC	RF 07	RF 07
DC Power supply (EMC 0009)	Instek	PS-3030	L9905E037.34

Using the special software and development board we can enter the product for engineer mode then we can control the EUT to select the wanted channel for test. The test board and PC are only to configure the engineer mode and not used to final test

5.6 Deviation from Standards

Biconical and log periodic antennas were used instead of dipole antennas.

5.7 Abnormalities from Standard Conditions

None.

5.8 Other Information Requested by the Customer

None.

5.9 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou Branch EMC Laboratory,
198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663
Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

5.10 Measurement Uncertainty

No.	Item	Measurement uncertainty
1	Conducted emission	1.02dB(9kHz to 150kHz)
		1.05dB(150kHz to 30MHz)
2	Radiated emission	5.06dB(30MHz to 1GHz)
		5.06dB(1GHz to 26GHz)

5.11 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **NVLAP (Lab Code: 200611-0)**

  SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

  The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.

- **ACMA**

  SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our NVLAP accreditation.

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

  Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

  SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

- **FCC (Registration No.: 282399)**

  SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 282399, May 31, 2002.

- **Industry Canada (Registration No.: 4620B-1)**

  The 3m/10m Alternate Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd., has been registered by Certification and Engineering of Industry Canada for radio equipment testing with Registration No. 4620B-1.

- **VCCI (Registration No.: R-2460, C-2584, G-449 and T-1179)**

  The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co. Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2460, C-2584，G-449 and T-1179 respectively.

- **CBTL (Lab Code: TL129)**

  SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, the Basic Rules, IECEE 01 and Rules of procedure IECEE 02, and the relevant IECEE CB-Scheme Operational documents.

6 Equipment List

RE in Chamber						
No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. date (YYYY-MM-DD)	Cal.Due date (YYYY-MM-DD)
EMC0525	Compact Semi-Anechoic Chamber	ChangZhou ZhongYu	N/A	N/A	2016-12-04	2019-12-03
EMC0522	EMI Test Receiver	Rohde & Schwarz	ESIB26	100283	2016-02-01	2017-01-31
EMC0056	EMI Test Receiver	Rohde & Schwarz	ESCI	100236	2016-02-01	2017-01-31
EMC0528	RI High frequency Cable	SGS	20 m	N/A	2016-04-19	2018-04-18
EMC2025	Trilog Broadband Antenna 30-1000MHz	SCHWARZBECK MESS-ELEKTRONIK	VULB 9160	9160-3372	2016-09-08	2019-09-07
SEM003-18	Trilog Broadband Antenna 25-2000MHz	SCHWARZBECK MESS-ELEKTRONIK	VULB 9168	665	2016-06-29	2019-06-28
EMC0524	Bi-log Type Antenna	Schaffner -Chase	CBL6112B	2966	2016-09-08	2019-09-07
EMC0519	Bilog Type Antenna	Schaffner -Chase	CBL6143	5070	2014-05-04	2017-05-03
EMC2026	Horn Antenna 1-18GHz	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120D	9120D-841	2016-09-09	2019-09-08
EMC0521	1-26.5 GHz Pre-Amplifier	Agilent	8449B	3008A01649	2016-01-25	2017-01-24
EMC2065	Amplifier	HP	8447F	N/A	2016-07-04	2017-07-03
EMC2086	PRE AMPLIFIER MH648A	ANRITSU CORP	MH648A	N/A	2016-12-02	2017-12-01
EMC2063	Pre-amplifier 1GHz-26GHz	Compliance Direction Systems Lnc.	PAP-1G26-48	6279.628	2016-12-02	2017-12-01
EMC0523	Active Loop Antenna	EMCO	6502	42963	2016-02-27	2018-02-26
EMC2041	Broad-Band Horn Antenna (14)15-26.5(40)GHz	SCHWARZBECK MESS-ELEKTRONI	BBHA 9170	9170-375	2014-05-26	2017-05-25
EMC2079	High Pass Filter(915MHz)	FSY MICROWAVE	HM1465-9SS	009	2016-01-25	2017-01-24
EMC2069	2.4GHz Filter	Micro-Tronics	BRM 50702	149	2016-01-25	2017-01-24
EMC0530	10m Semi-Anechoic Chamber	ETS	N/A	N/A	2016-04-30	2018-04-29

General used equipment						
No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. date (YYYY-MM-DD)	Cal.Due date (YYYY-MM-DD)
EMC0006	DMM	Fluke	73	70681569	2016-09-01	2017-08-31
EMC0007	DMM	Fluke	73	70671122	2016-08-22	2017-08-21

7 Test Results

7.1 E.U.T. test conditions

Test Voltage:	DC 3.7V (battery operated) AC/DC 12V for charging
Temperature:	20.0 -25.0 °C
Humidity:	38-50 % RH
Atmospheric Pressure:	1000 -1010 mbar
Requirements:	**15.31(e):** For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery. **15.32:** Power supplies and CPU boards used with personal computers and for which separate authorizations are required to be obtained shall be tested as follows: Testing shall be in accordance with the procedures specified in Section 15.31 of this part.
Test frequencies and frequency range:	According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table: According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

EUT channels and frequencies list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	27	2429	54	2456
1	2403	28	2430	55	2457
2	2404	29	2431	56	2458
3	2405	30	2432	57	2459
4	2406	31	2433	58	2460
5	2407	32	2434	59	2461
6	2408	33	2435	60	2462
7	2409	34	2436	61	2463
8	2410	35	2437	62	2464
9	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454	/	/
26	2428	53	2455	/	/

Using the special software and development board we can enter the product for engineer mode then we can control the EUT to select the wanted channel for test as above list.

Test frequencies are the lowest channel: 0 channel(2402 MHz), middle channel: 39 channel(2441 MHz) and highest channel: 78 channel(2480 MHz)

7.2 Antenna Requirement

Standard requirement

15.203 requirement:

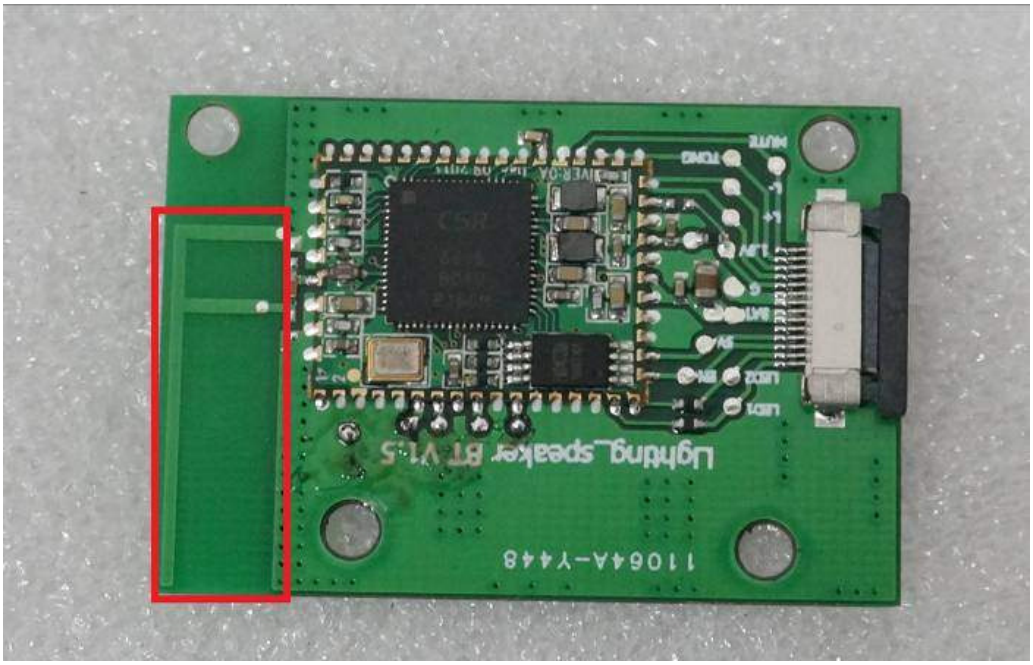
For intentional device. According to 15.203. an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz bands that are used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi 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 6 dBi.

EUT Antenna

The antenna is integrated PCB antenna and no consideration of replacement. The maximum gain of the antenna is 3.5 dBi.



Test result: The unit does meet the FCC requirements.

7.3 Occupied Bandwidth

Test Requirement: FCC Part 15 C section 15.247

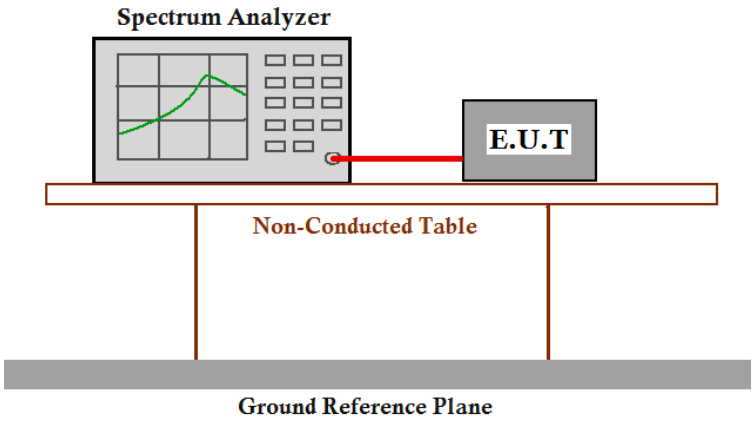
(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies 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.

Test Method: ANSI C63.10: Clause 6.9.2

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data package and modulation type. Compliance test in normal mode GFSK modulation type (DH5) and EDR mode 8DPSK modulation type (3DH5) as the worst case was found.

Test the EUT in B/O mode.

Test Configuration:



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: Span = approximately 2 to 5 times the 20dB bandwidth, centring on a hopping channel;
3. Set the spectrum analyzer: RBW:1% ~5% of the 20dB bandwidth ,VBW >=3 RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and -20 dB points bandwidth.

Test result:

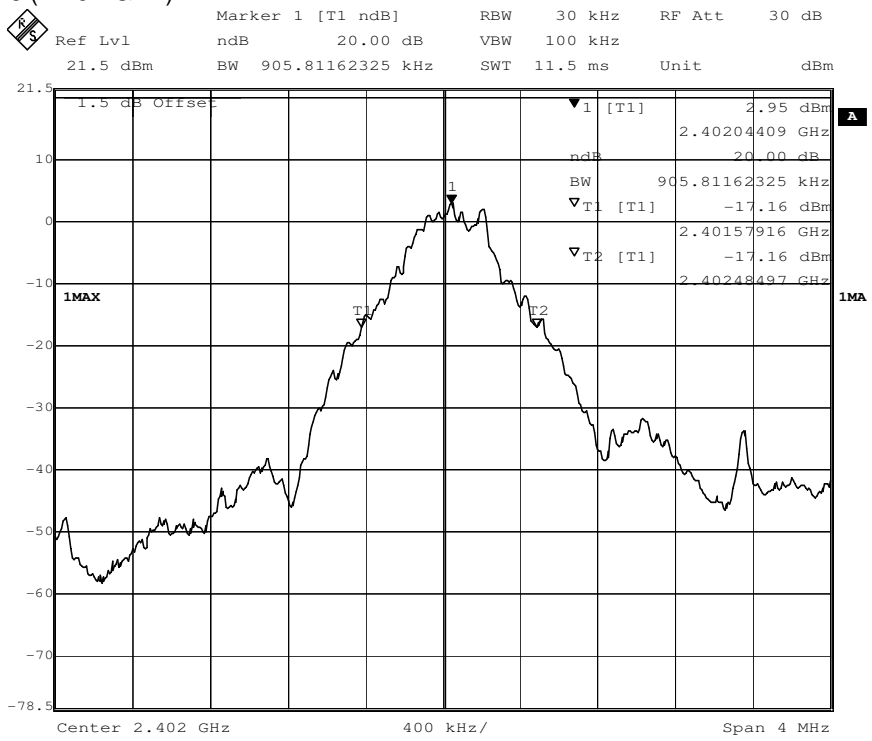
GFSK modulation type (DH5) mode:

Test Channel	Bandwidth(MHz)	2/3 bandwidth (MHz)
Lowest	0.905	0.6033
Middle	0.897	0.5980
Highest	0.889	0.5927

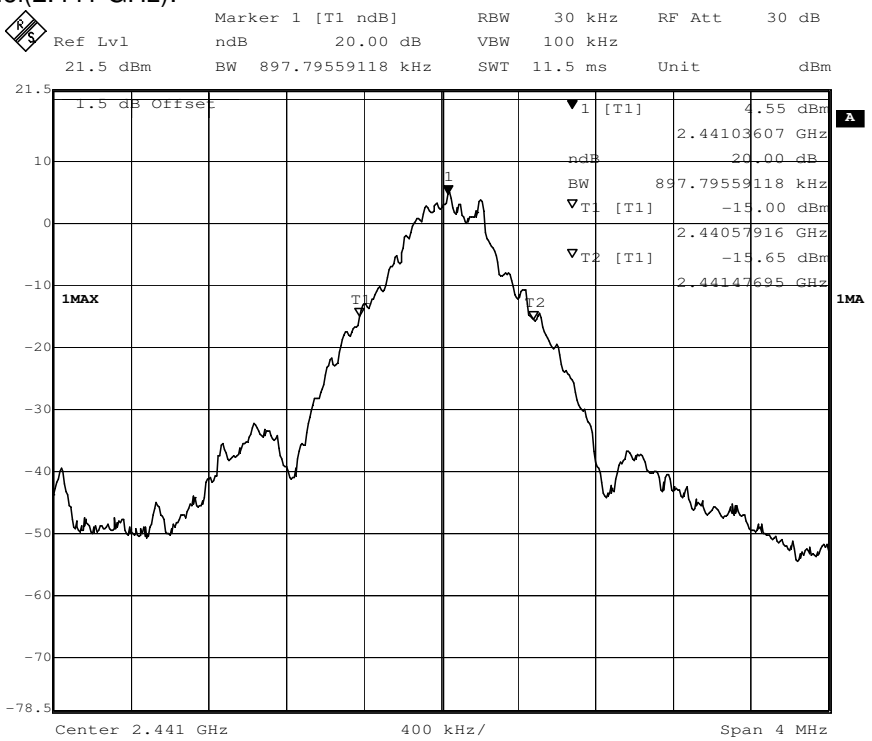
8DPSK modulation type (3DH5) mode:

Test Channel	Bandwidth (MHz)	2/3 bandwidth (MHz)
Lowest	1.242	0.8280
Middle	1.266	0.8440
Highest	1.274	0.8493

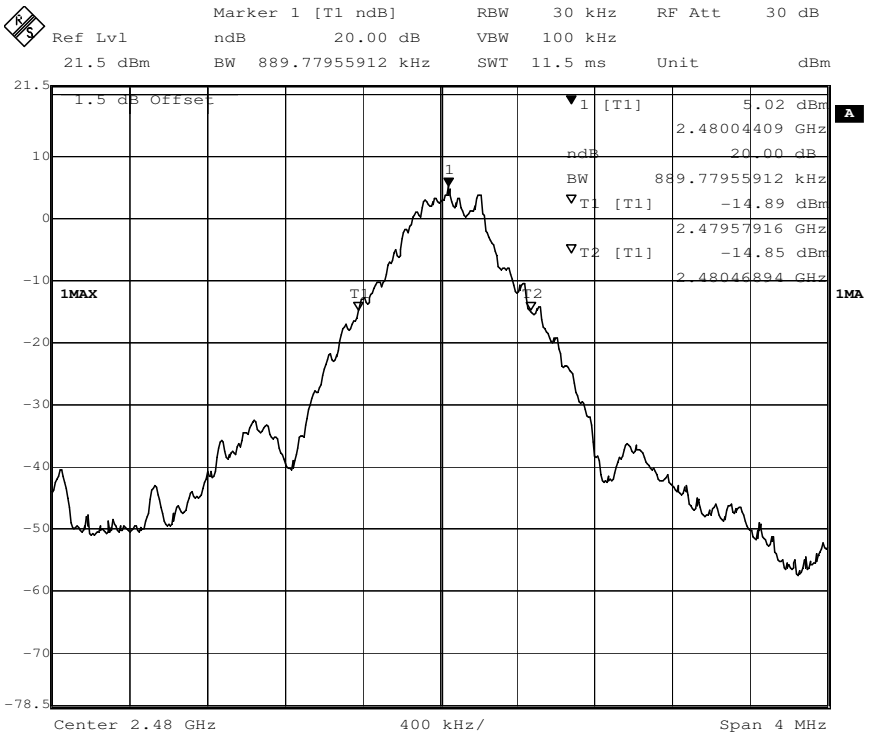
Result plot as follows:
GFSK modulation type mode (DH5):
Lowest Channel(2.402 GHz):



Middle Channel(2.441 GHz):

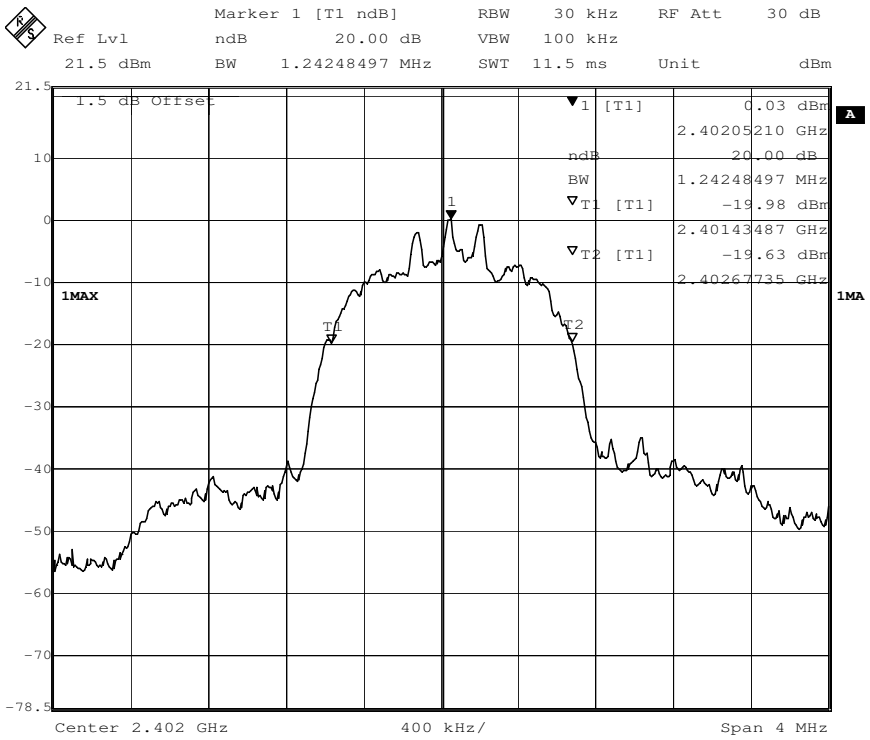


Highest Channel(2.480 GHz):

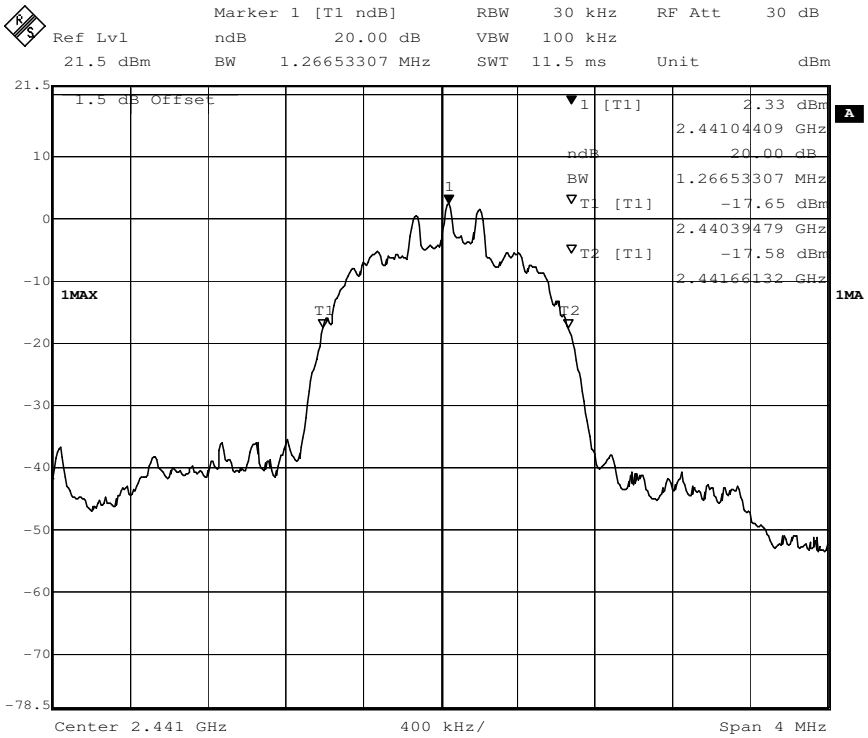


8DPSK modulation type mode (3DH5):

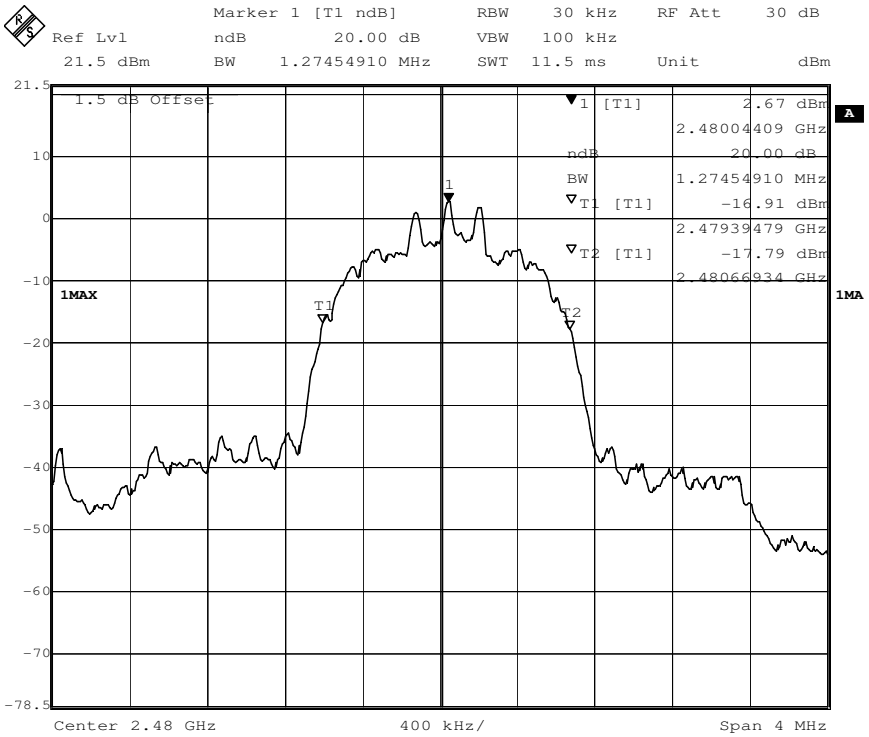
Lowest Channel(2.402 GHz):



Middle Channel(2.441 GHz):



Highest Channel(2.480 GHz):



7.4 Carrier Frequencies Separated

Test Requirement: FCC Part 15 C section 15.247

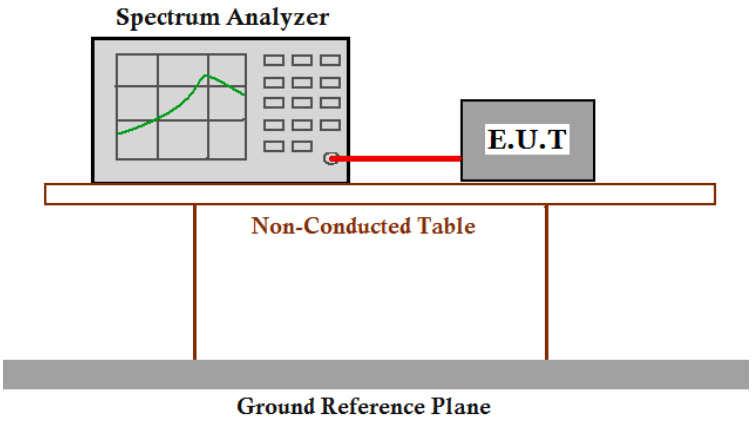
(a),(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies 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.

Test Method: ANSI C63.10: Clause 7.8.2

Test Status: Pre-test the EUT in hopping mode with different data packet and modulation type. Compliance test in normal mode GFSK modulation type (DH5) as the worst case was found.

Test the EUT in B/O mode.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW >= 1% of the span, VBW >= RBW, Sweep = auto; Detector Function = Peak. Trace = Max, hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

Test result:

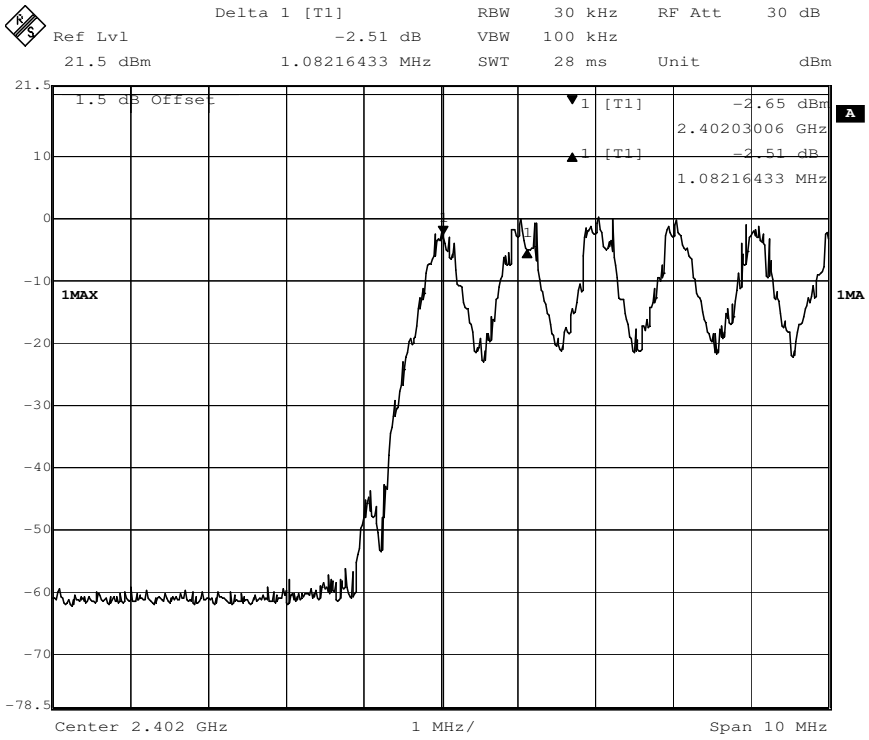
Test Channel	Carrier Frequencies Separated	Limit①	Pass/Fail
Lower Channels (channel 0 and channel 1)	1.082MHz	0.8280	Pass
Middle Channels (channel 39 and channel 40)	1.002MHz	0.8440	Pass
Upper Channels (channel 77 and channel 78)	1.022MHz	0.8493	Pass

Remark:

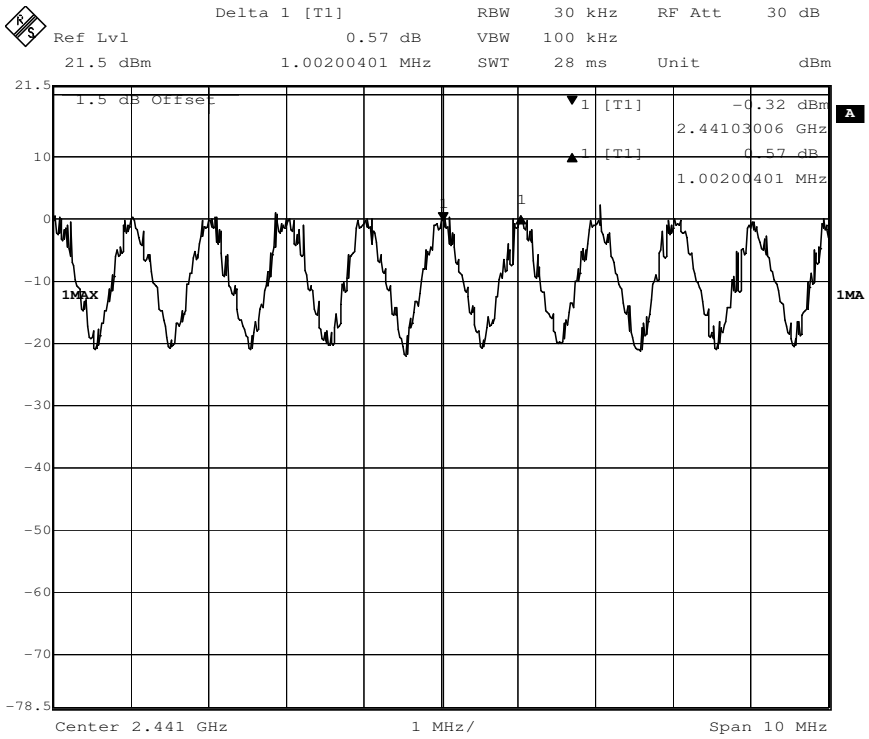
① The limit is two-thirds of the 20dB bandwidth EDR(3DH5) mode due to the transmission power is less than 0.125 W shown on section 7.8 of this report.

Result plot as follows:

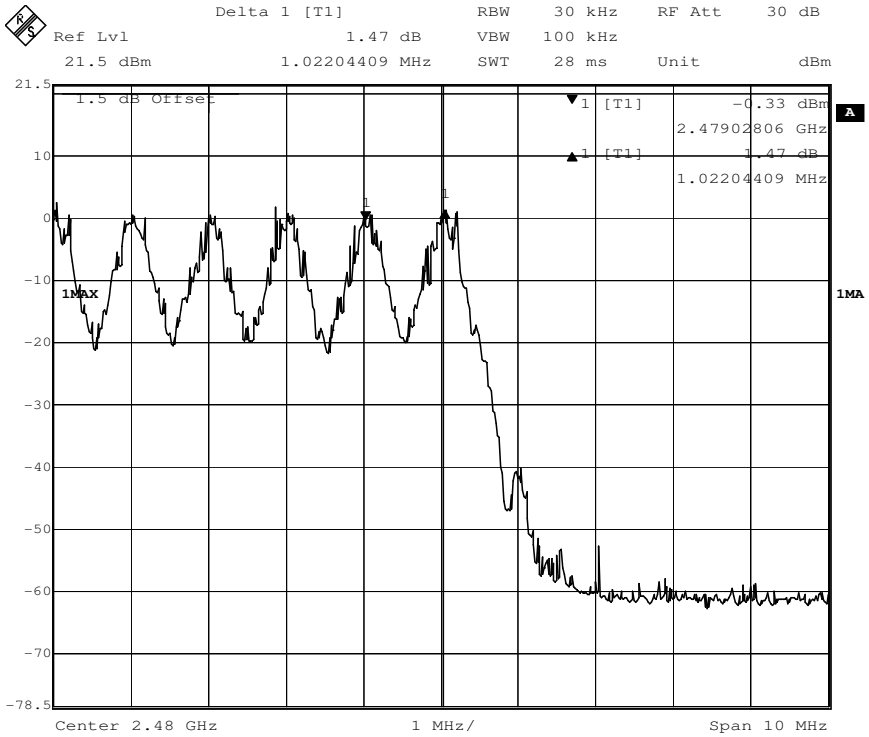
Lowest Channels: **Carrier Frequencies Separated**



Middle Channels: **Carrier Frequencies Separated**



Highest Channels: **Carrier Frequencies Separated**



Test result: The unit does meet the FCC requirements.

7.5 Hopping Channel Number

Test Requirement: FCC Part15 C section 15.247

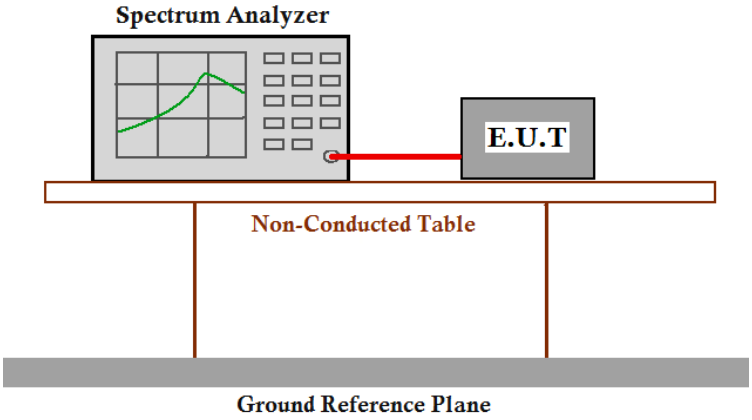
(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test Method: ANSI C63.10: Clause 7.8.3

Test Status: Pre-test the EUT in hopping mode with different data packet and modulation type. Compliance test in hopping with normal mode GFSK modulation type (DH5) as the worst case was found.

Test the EUT in B/O mode.

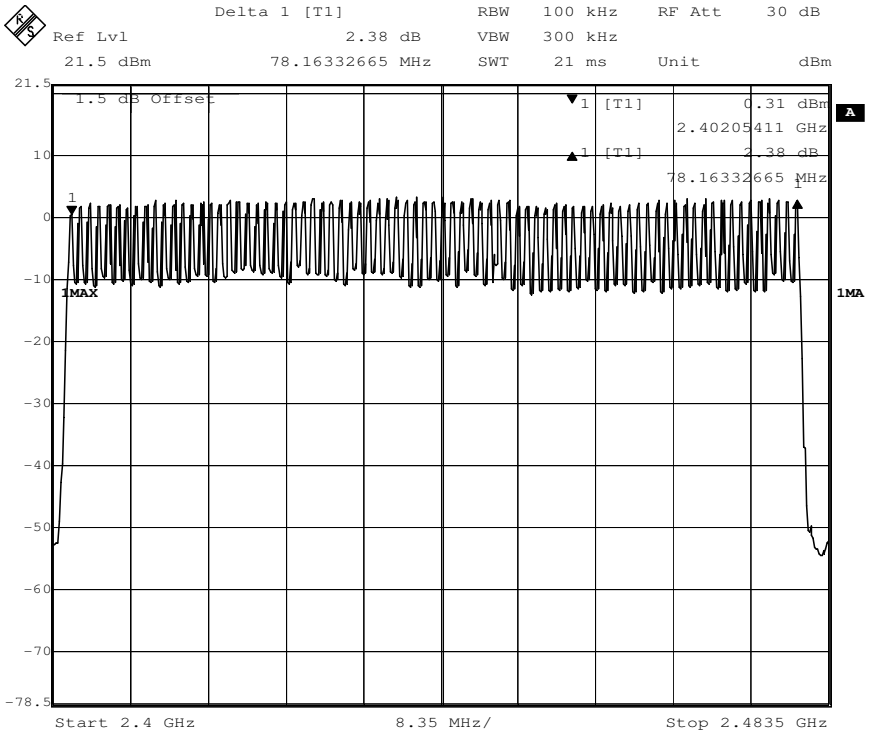
Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 100 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: start frequency = 2400 MHz. stop frequency = 2483.5 MHz. Submit the test result graph.

Test result: Total channels are 79 channels.



Test result: The unit does meet the FCC requirements.

7.6 Dwell Time

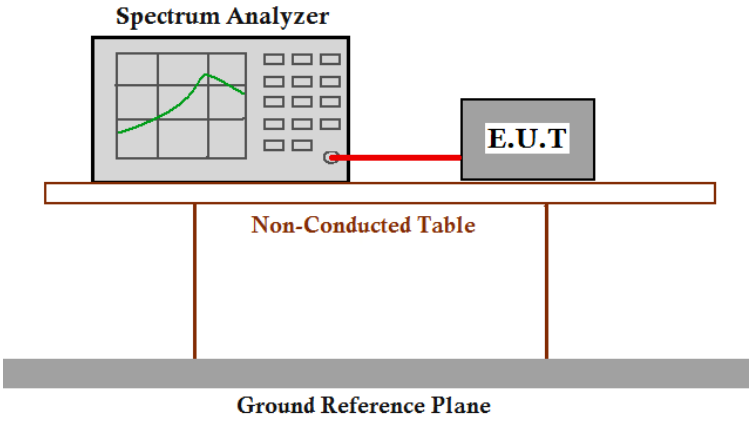
Test Requirement: FCC Part 15 C section 15.247

(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

Test Method: ANSI C63.10: Clause 7.8.4

Test Status: Test the EUT in hopping mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet. Compliance test in hopping mode with EDR mode and 8DPSK modulation type (3DH1, 3DH3 and 3DH5) as the worst case was found.
Test the EUT in B/O mode.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. centered on a hopping channel;
3. Set RBW = 1 MHz and VBW = 1 MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Detector Function = Peak. Trace = Max hold;
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). Repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.

Test Result:

The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

1. Channel 0: 2.402GHz										
3DH1 time slot	=	0.430	(ms)	*	32	*	(31.6/3.16)	=	137.600	ms
3DH3 time slot	=	1.683	(ms)	*	16	*	(31.6/3.16)	=	269.280	ms
3DH5 time slot	=	2.945	(ms)	*	11	*	(31.6/3.16)	=	323.950	ms
2. Channel 39: 2.441GHz										
3DH1 time slot	=	0.440	(ms)	*	33	*	(31.6/3.16)	=	145.200	ms
3DH3 time slot	=	1.693	(ms)	*	16	*	(31.6/3.16)	=	270.880	ms
3DH5 time slot	=	2.945	(ms)	*	11	*	(31.6/3.16)	=	323.950	ms
3. Channel 78: 2.480GHz										
3DH1 time slot	=	0.440	(ms)	*	32	*	(31.6/3.16)	=	140.800	ms
3DH3 time slot	=	1.693	(ms)	*	16	*	(31.6/3.16)	=	270.880	ms
3DH5 time slot	=	2.945	(ms)	*	11	*	(31.6/3.16)	=	323.950	ms

The average time of occupancy in the specified 31.6 second period is equal to pulse width*(# of pulse in observation period)*(test period / observation period)

The results are not greater than 0.4 seconds.

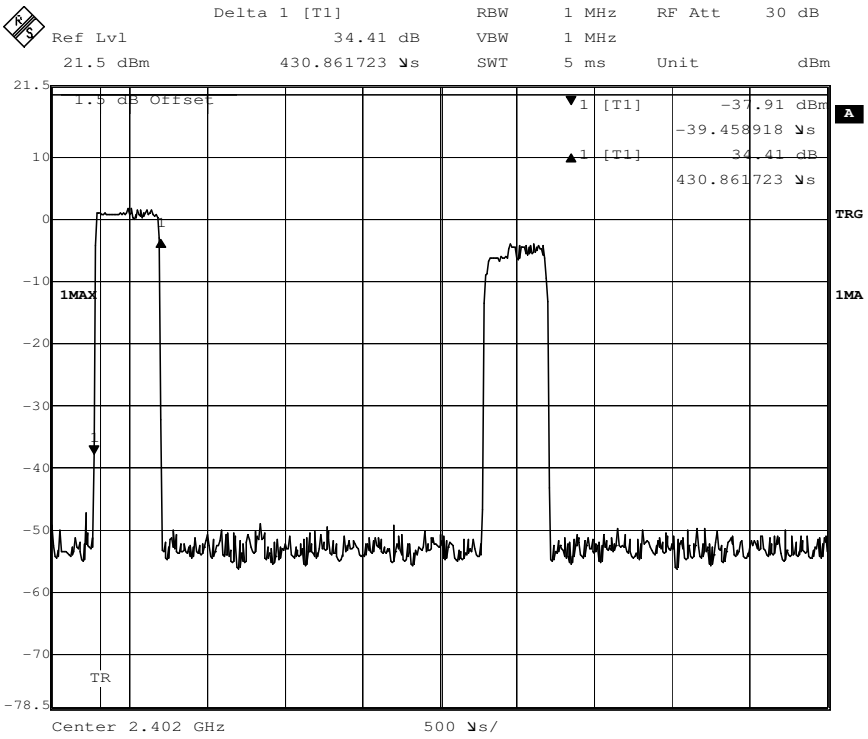
The unit does meet the FCC requirements.

Result plot as follows:

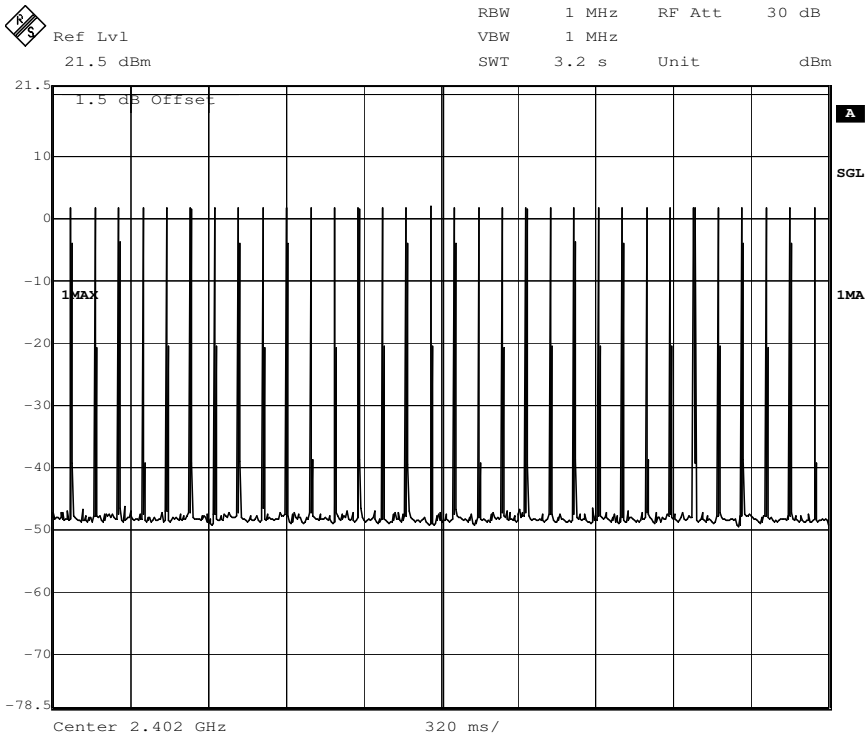
1. Lowest channel (2.402 GHz):

(1). 3DH1

Pulse Width:

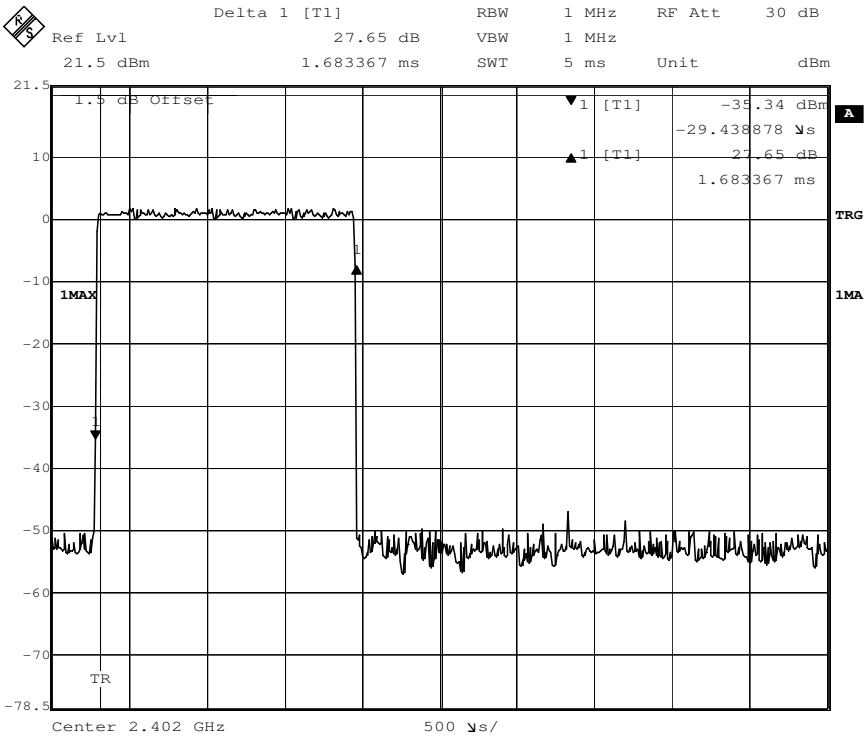


Number of Pulses in 3.16 S observation period:

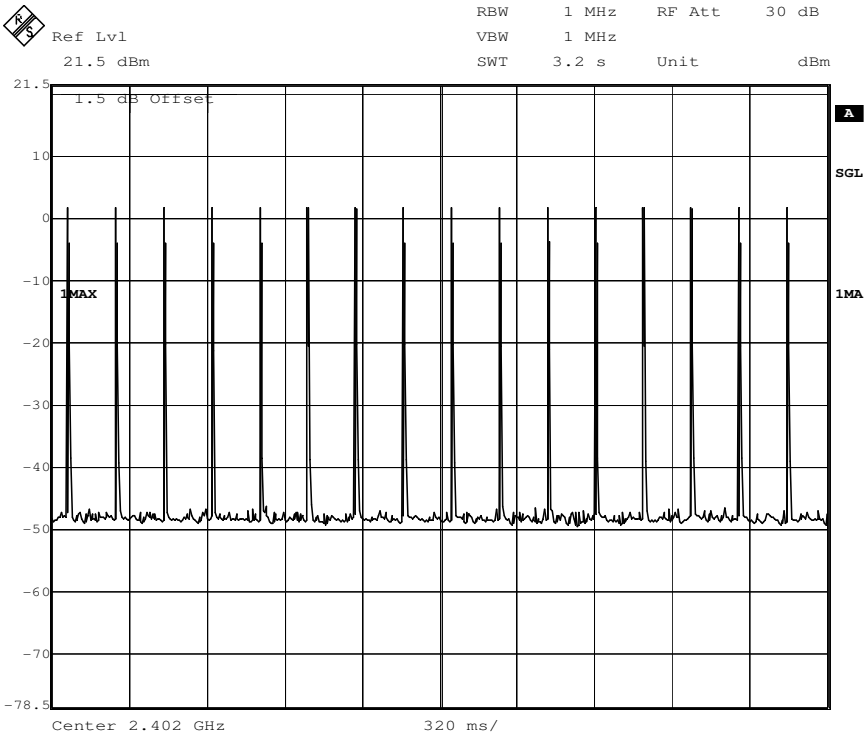


(2) 3DH3

Pulse Width:

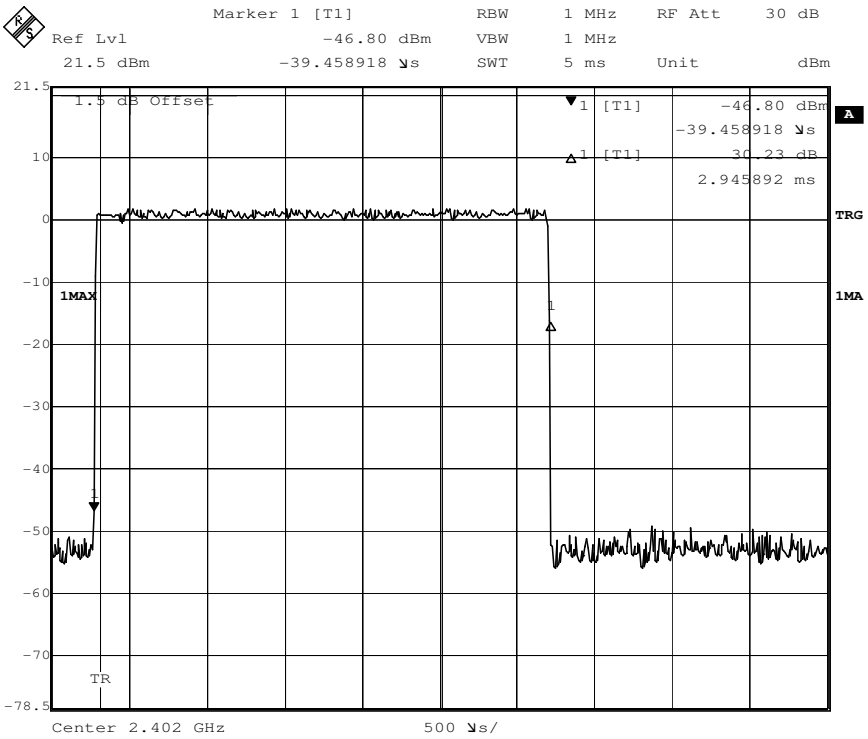


Number of Pulses in 3.16 S observation period:

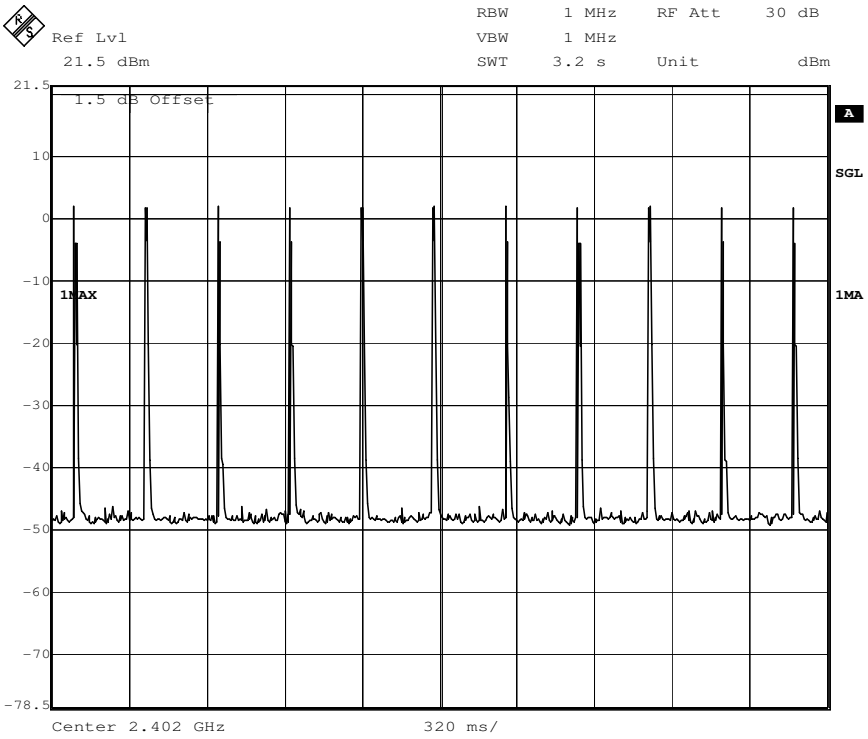


(3) 3DH5

Pulse Width:



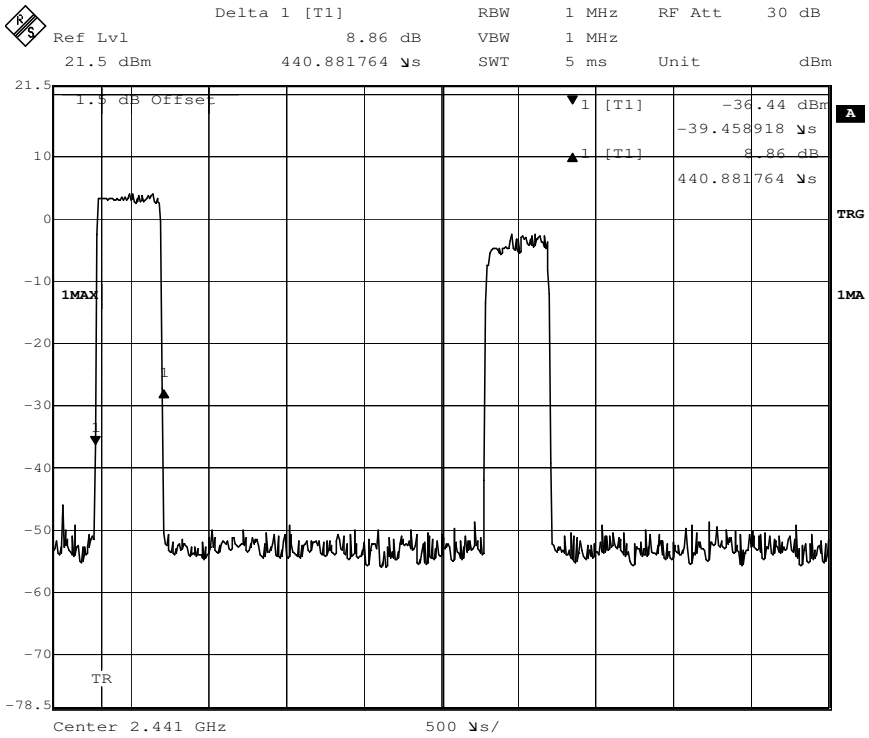
Number of Pulses in 3.16 S observation period:



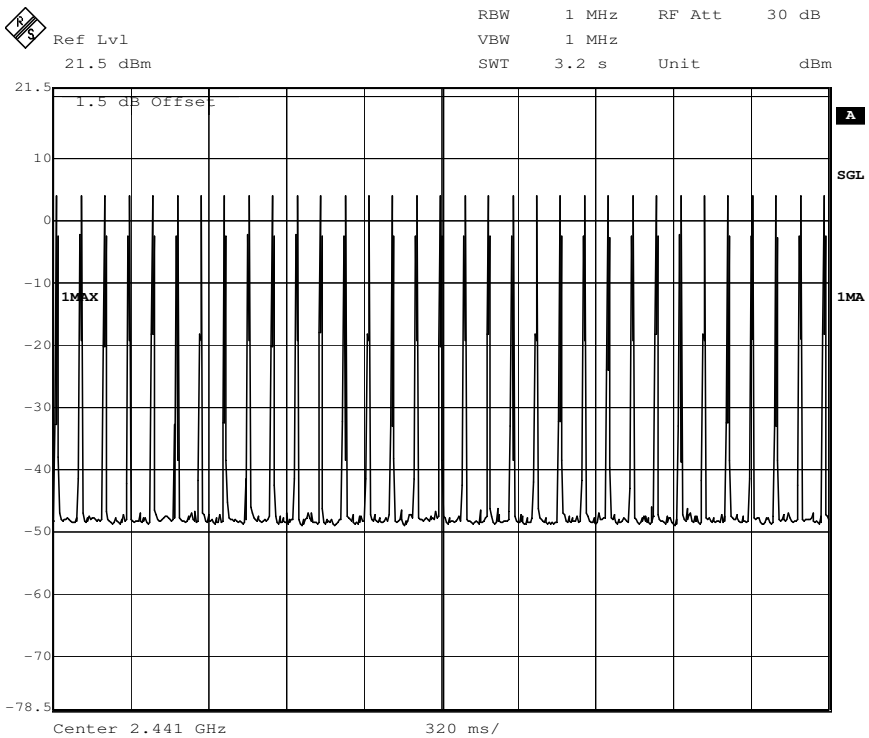
2. Middle Channel (2.441 GHz):

(1). 3DH1

Pulse Width:

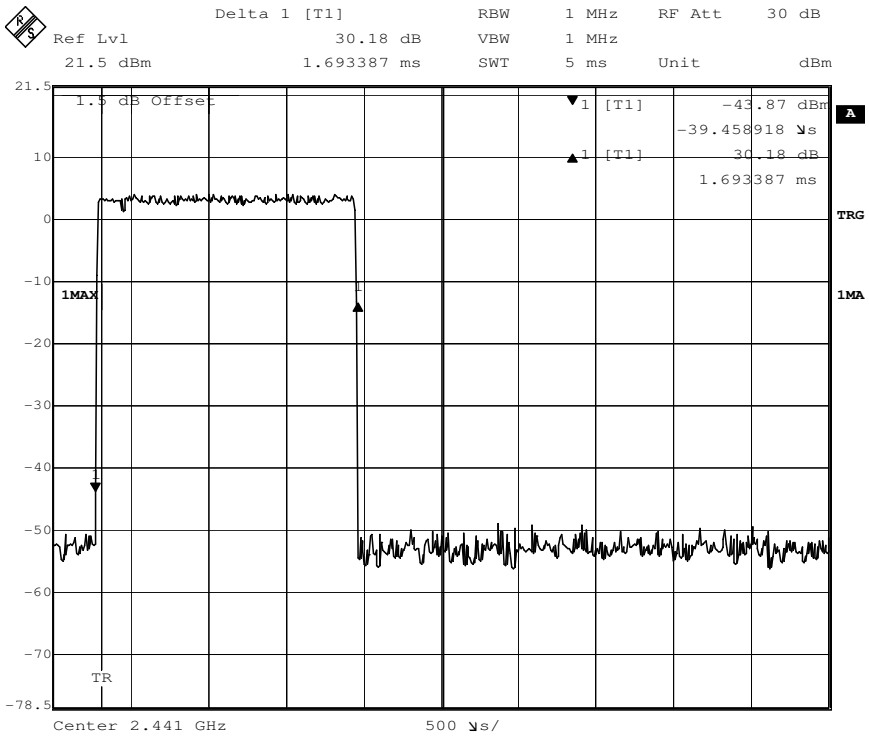


Number of Pulses in 3.16 S observation period:

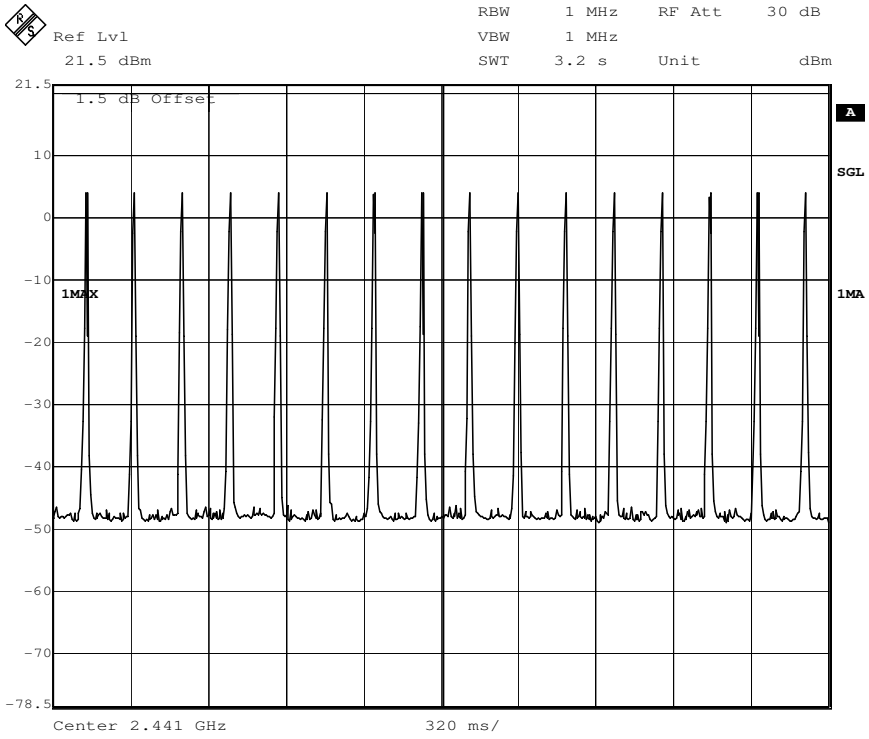


(2) 3DH3

Pulse Width:

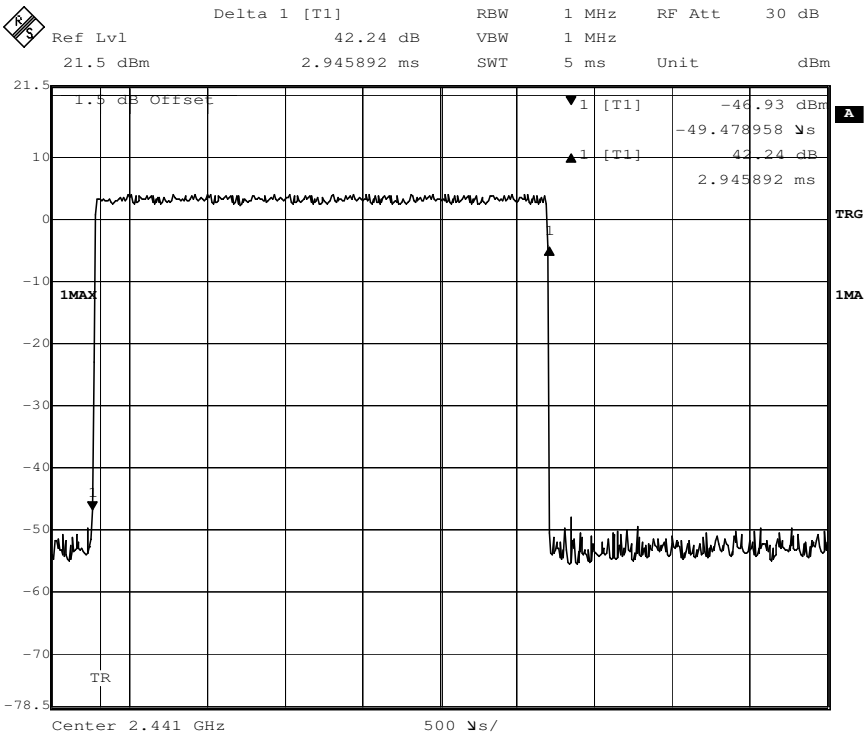


Number of Pulses in 3.16 S observation period:

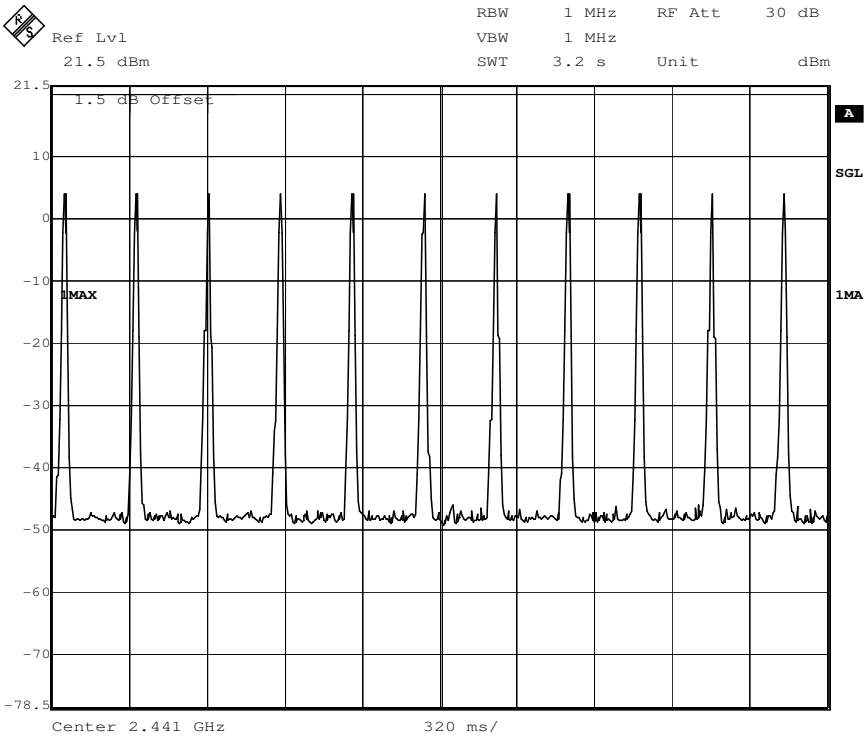


(3) 3DH5

Pulse Width:



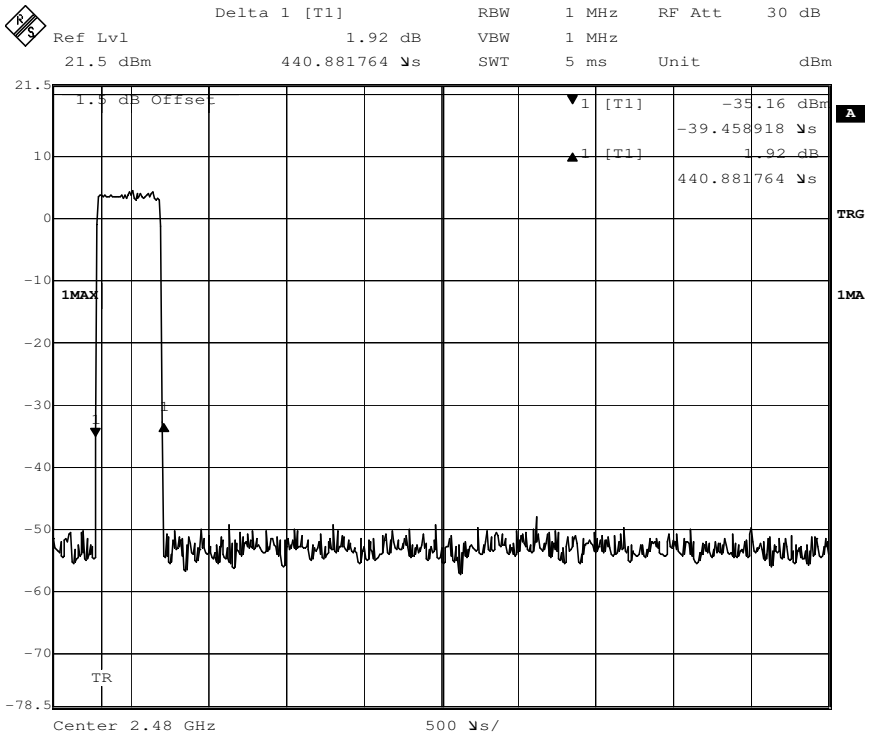
Number of Pulses in 3.16 S observation period:



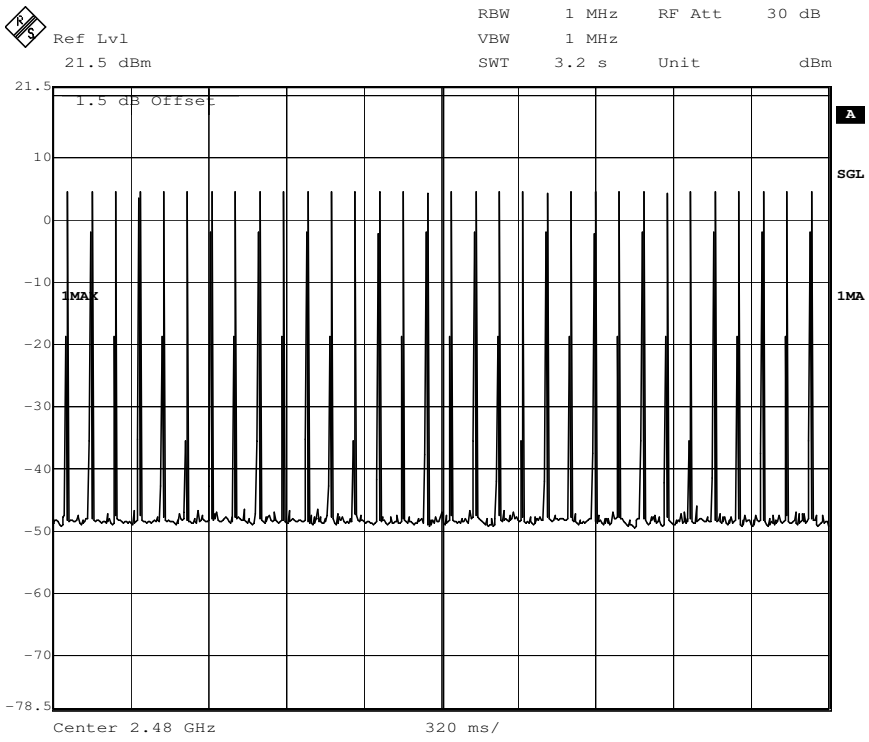
3. Highest Channel (2.480 GHz):

(1). 3DH1

Pulse Width:

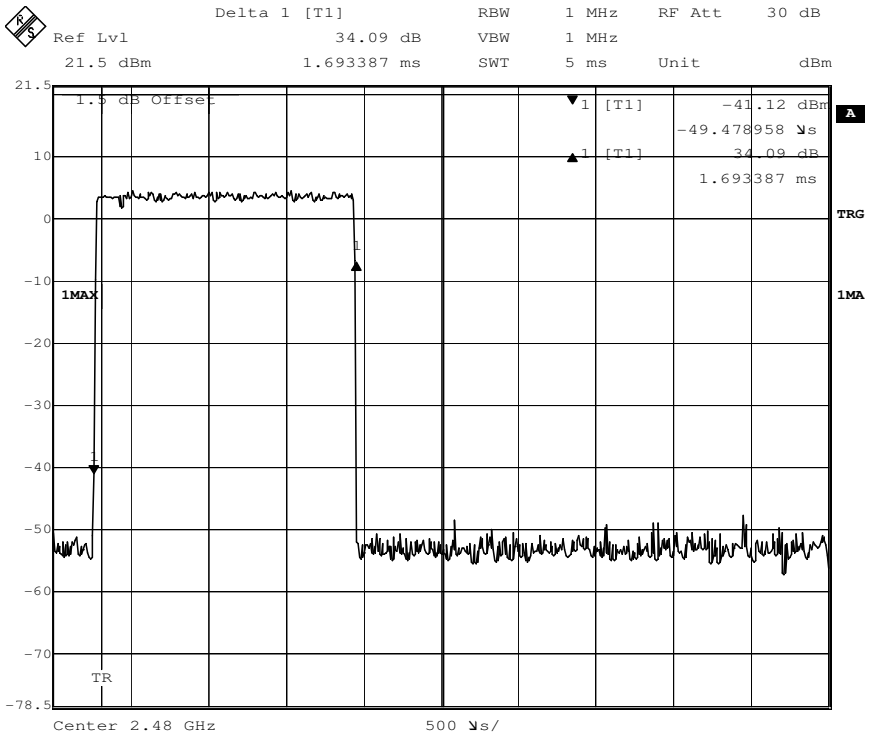


Number of Pulses in 3.16 S observation period:

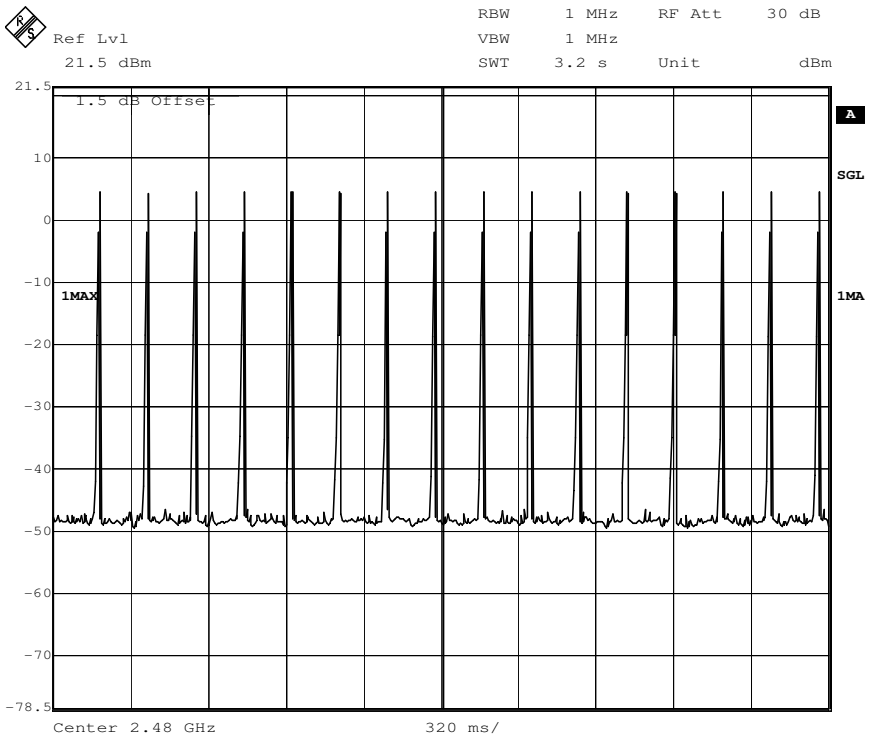


(2) 3DH3

Pulse Width:

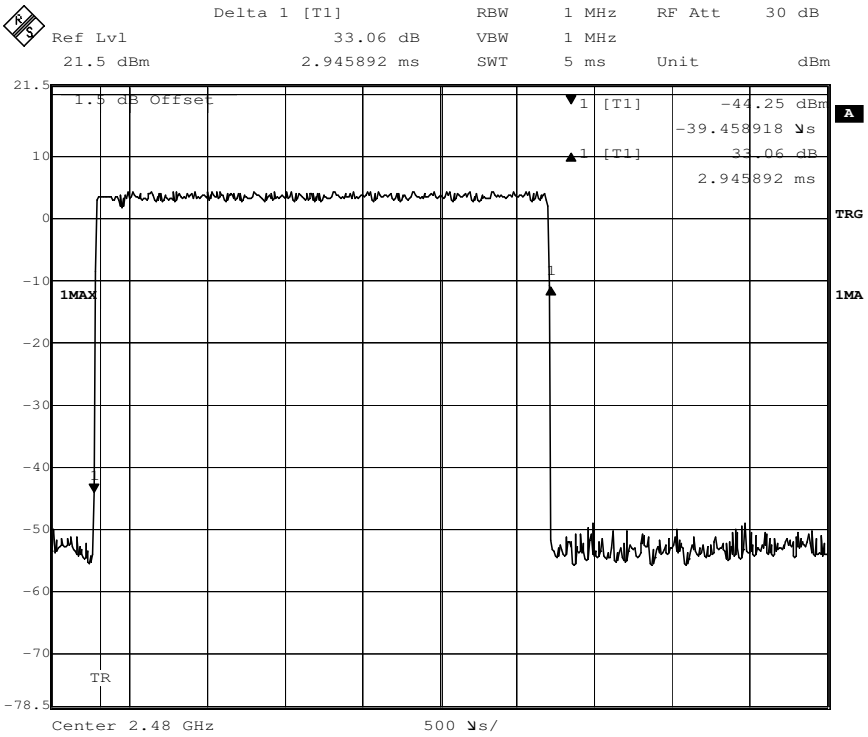


Number of Pulses in 3.16 S observation period:

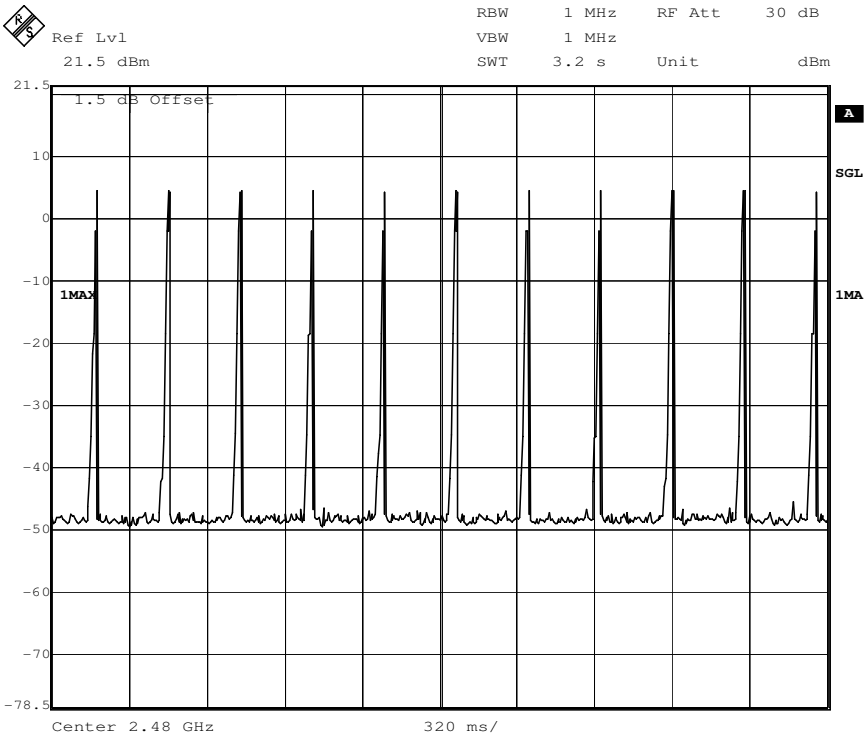


(3) 3DH5

Pulse Width:



Number of Pulses in 3.16 S observation period:



7.7 Pseudorandom Frequency Hopping Sequence

7.7.1 Standard requirement

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.

7.7.2 Other requirements Frequency Hopping Spread Spectrum System

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

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.

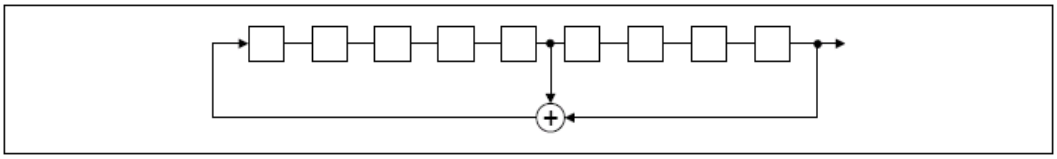
Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hopsets to avoid hopping on occupied channels is permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

Compliance for section 15.247(a)(1)

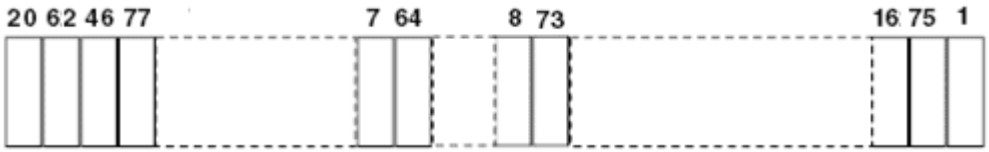
According to Bluetooth Core Specification, the pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage
outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive 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.

According to Bluetooth Core Specification, Bluetooth receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any Bluetooth transmitters and shift frequencies in synchronization with the transmitted signals.

Compliance for section 15.247(g)

According to Bluetooth Core Specification, the Bluetooth system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

Compliance for section 15.247(h)

According to Bluetooth Core specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

According to the Bluetooth Core specification, the Bluetooth system is designed not have the ability to coordinated with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

7.8 Maximum Peak Output Power

Test Requirement: FCC Part 15 C section 15.247

(b)(1)For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

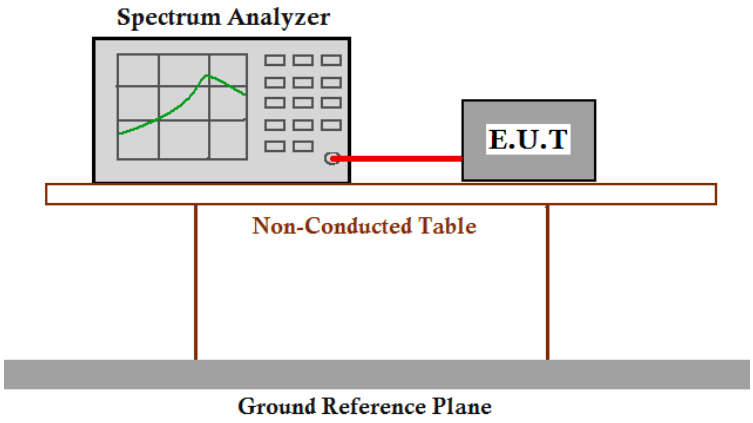
Refer to the result "Hopping channel number" of this document. The 1 watt (30.0 dBm) limit applies.

Test Method: ANSI C63.10: Clause 7.8.5

Test mode: Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet and modulation type. Compliance test in continuous transmitting mode with normal mode and GFSK modulation type (DH5) and EDR mode with 8DPSK modulation type (3DH5) as the worst case was found.

Test the EUT B/O mode.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW > 20 dB bandwidth of the emission being measured, VBW>= RBW. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

Test Result:

GFSK modulation type DH5 mode:

Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	4.36	30.0	Pass
Middle	2441	5.98	30.0	Pass
Highest	2480	6.10	30.0	Pass

8DPSK modulation type 3DH5 mode:

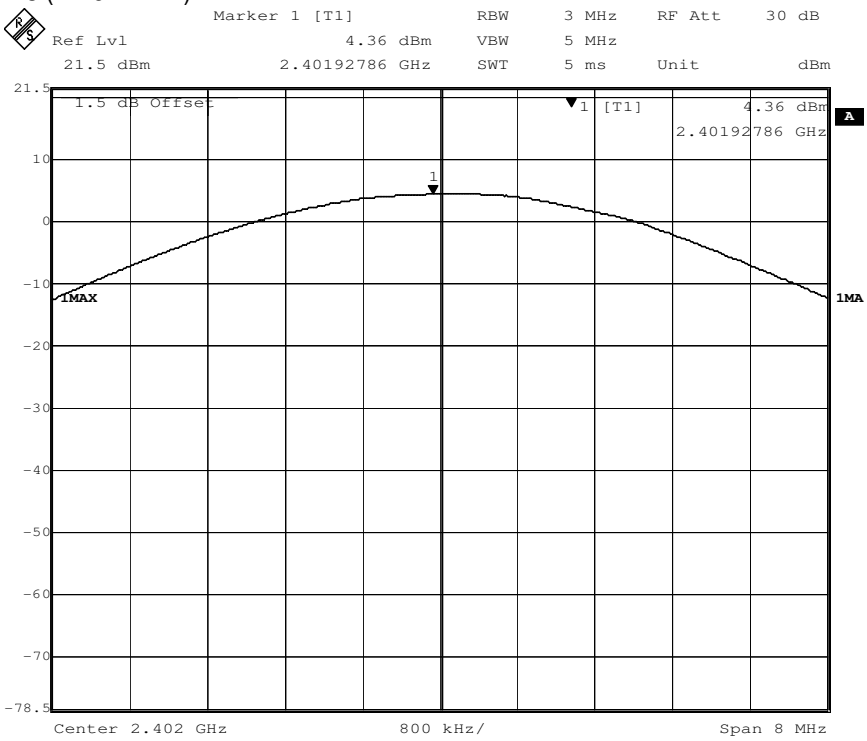
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	2.49	30.0	Pass
Middle	2441	4.67	30.0	Pass
Highest	2480	4.98	30.0	Pass

Test result: The unit does meet the FCC requirements.

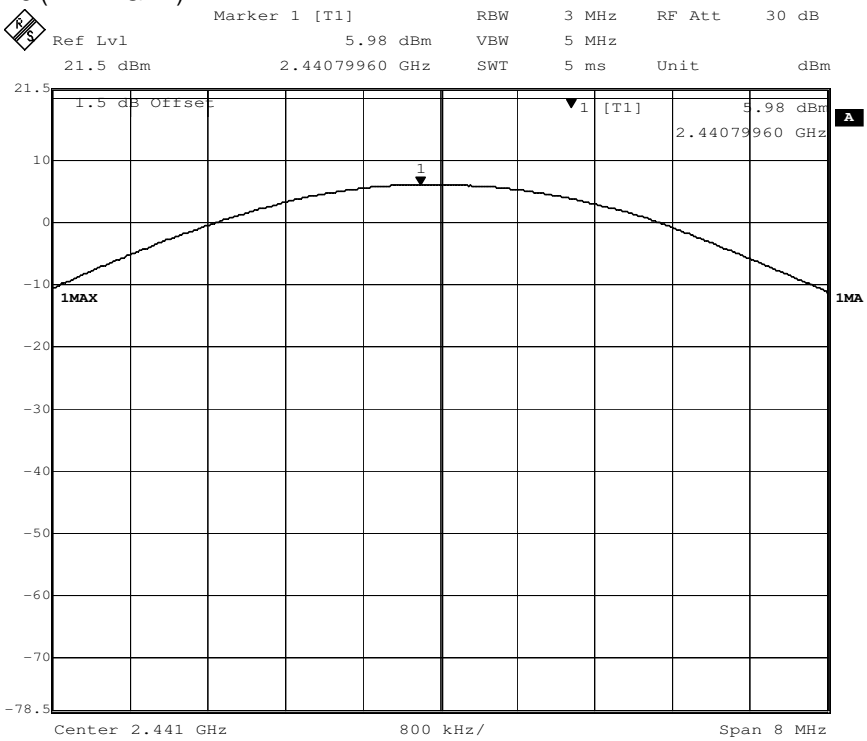
Result plot as follows:

GFSK modulation type DH5 mode:

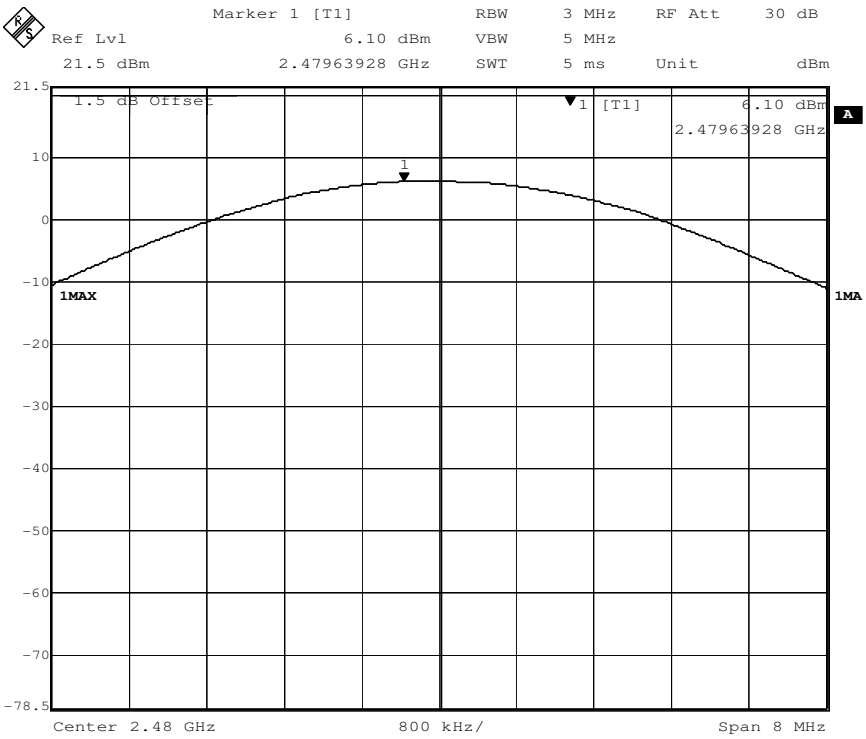
Lowest Channel(2.402 MHz):



Middle Channel(2.441 GHz):

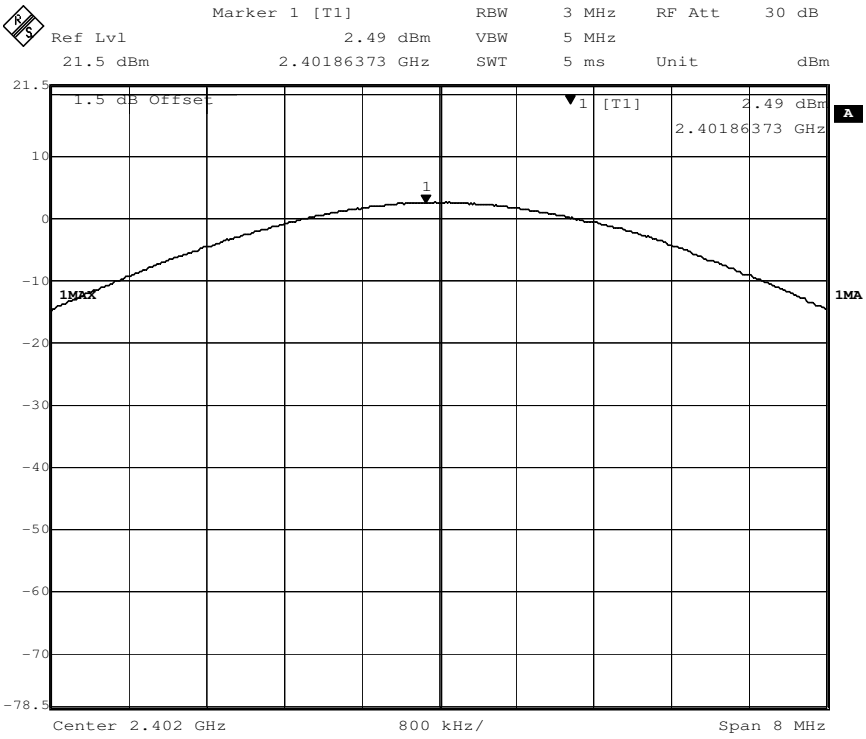


Highest Channel(2.480 GHz):

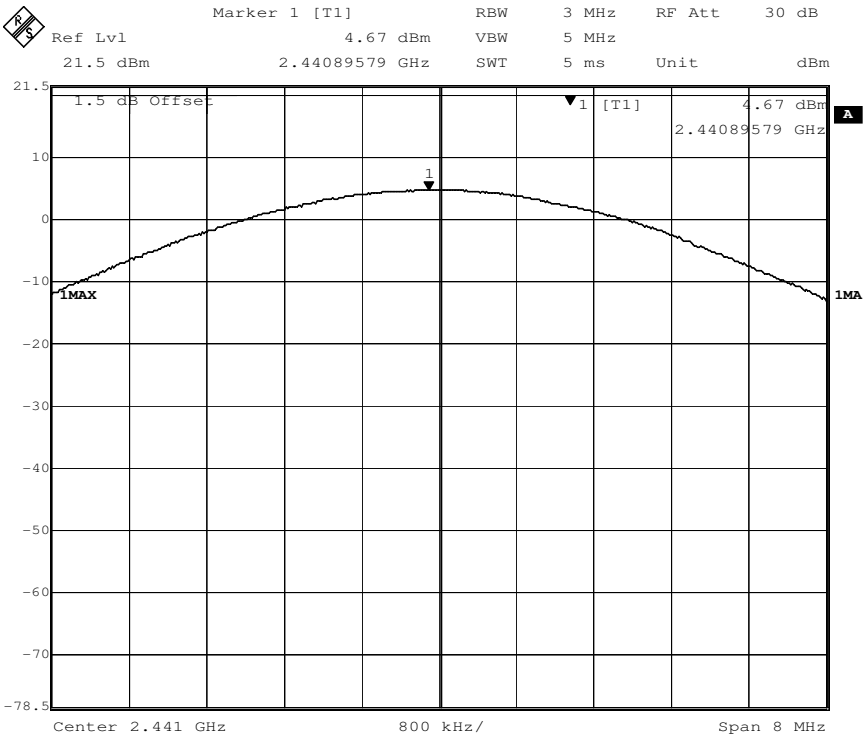


8DPSK modulation type 3DH5 mode:

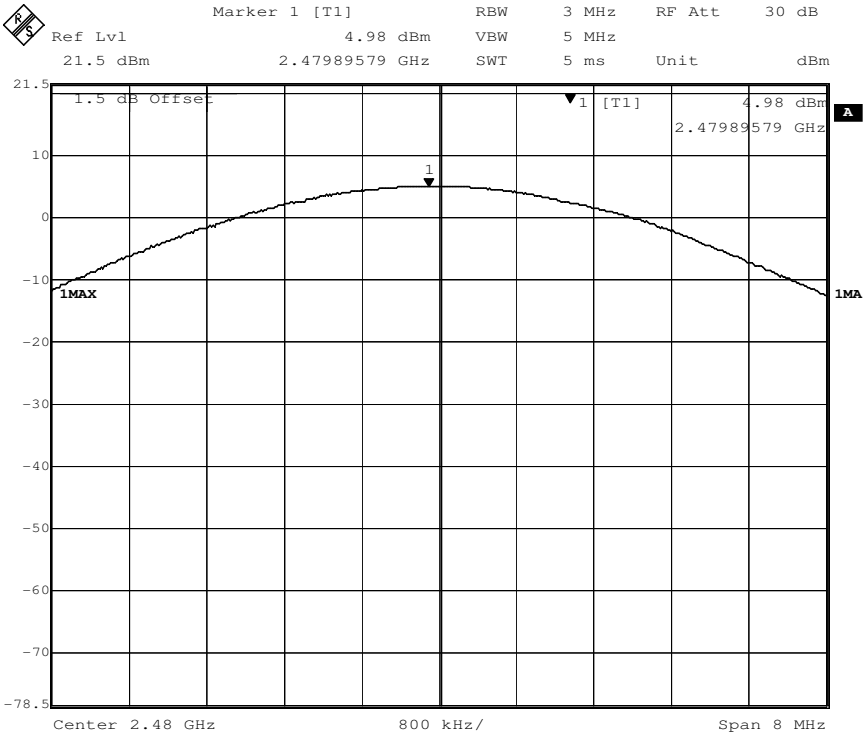
Lowest channel(2.402 GHz):



Middle channel(2.441 GHz):



Highest channel(2.480 GHz):



7.9 Conducted Spurious Emissions

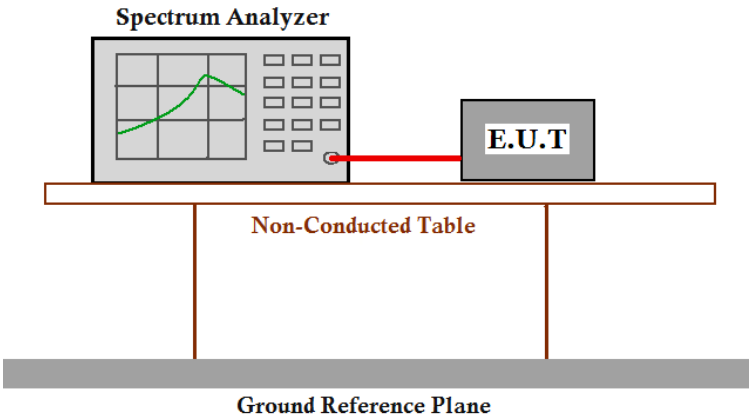
Test Requirement: FCC Part15 C section 15.247

(d) 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.

Test Method: ANSI C63.10: Clause 7.8.8

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet and modulation type. Compliance test in continuous transmitting mode with normal mode and GFSK modulation type (DH5) as the worst case was found.
Pretest the EUT at Transmitting mode and Charge + Transmitting mode, found the Charge + Transmitting mode was worse case

Test Configuration:



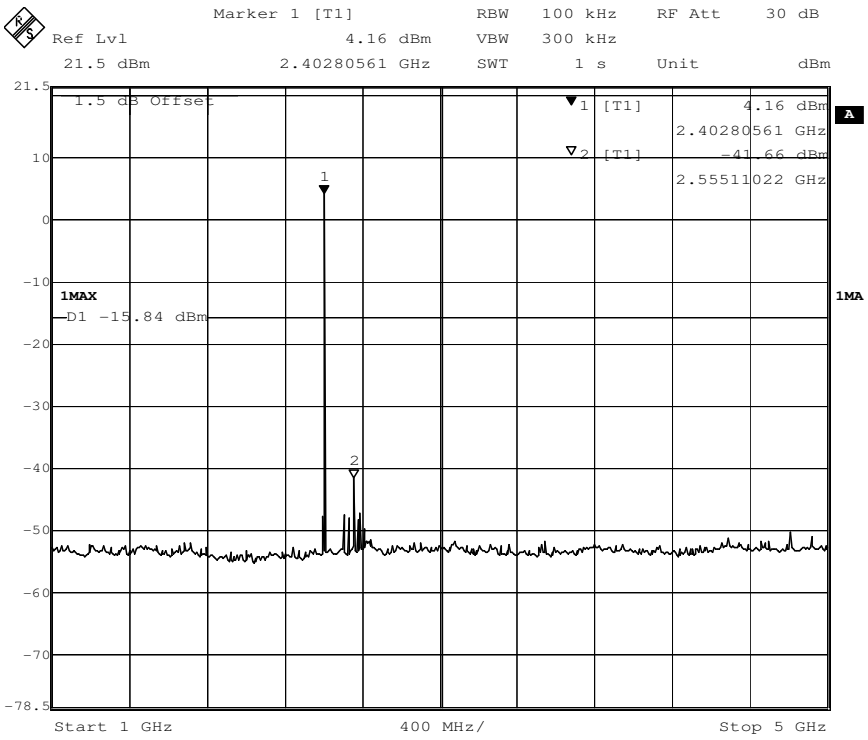
Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.

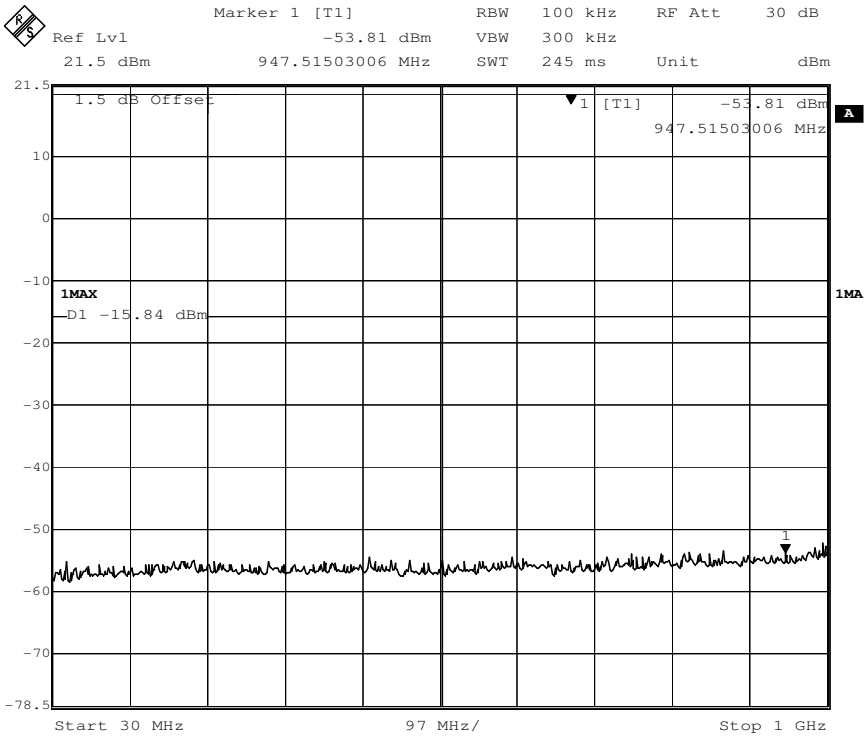
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 300KHz. Sweep = auto; Detector Function = Peak (Max. hold).

Result plot as follows:

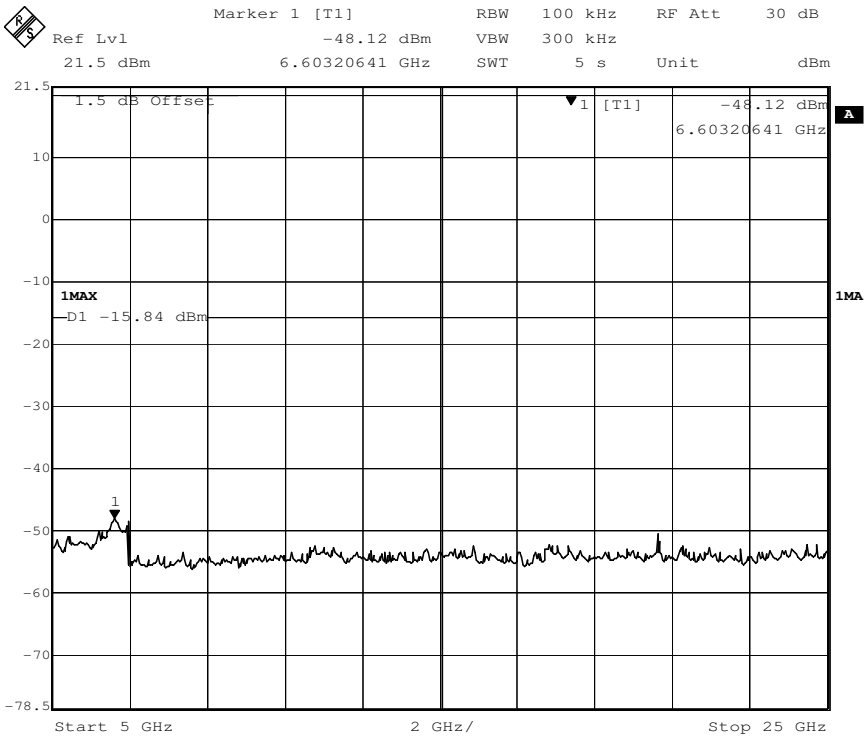
Lowest Channel: 1GHz to 5GHz



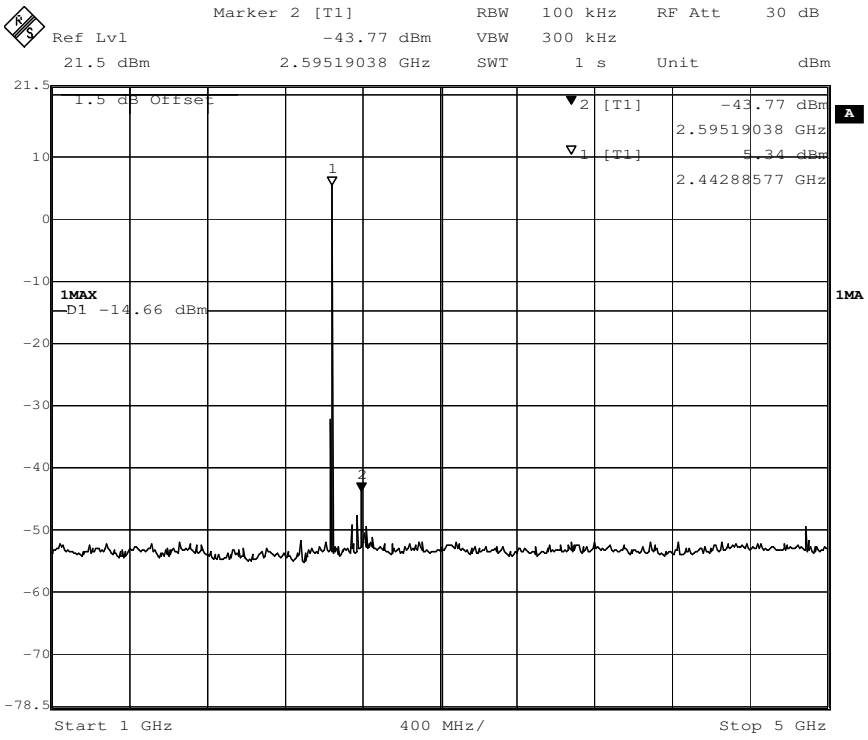
Lowest Channel: 30MHz to 1GHz



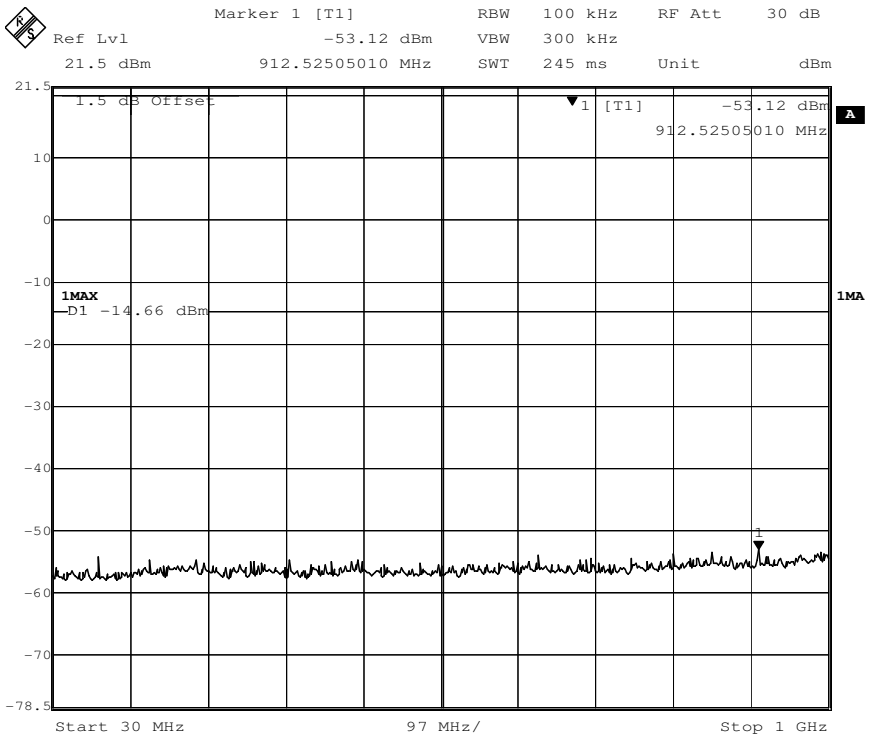
Lowest Channel: 5GHz to 25GHz



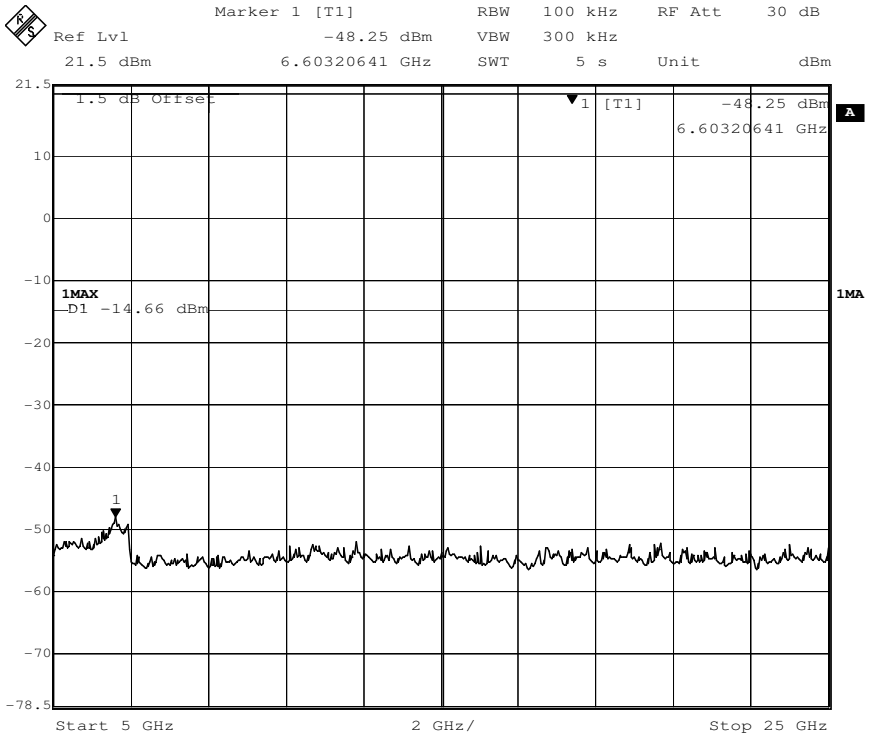
Middle Channel: 1GHz to 5GHz



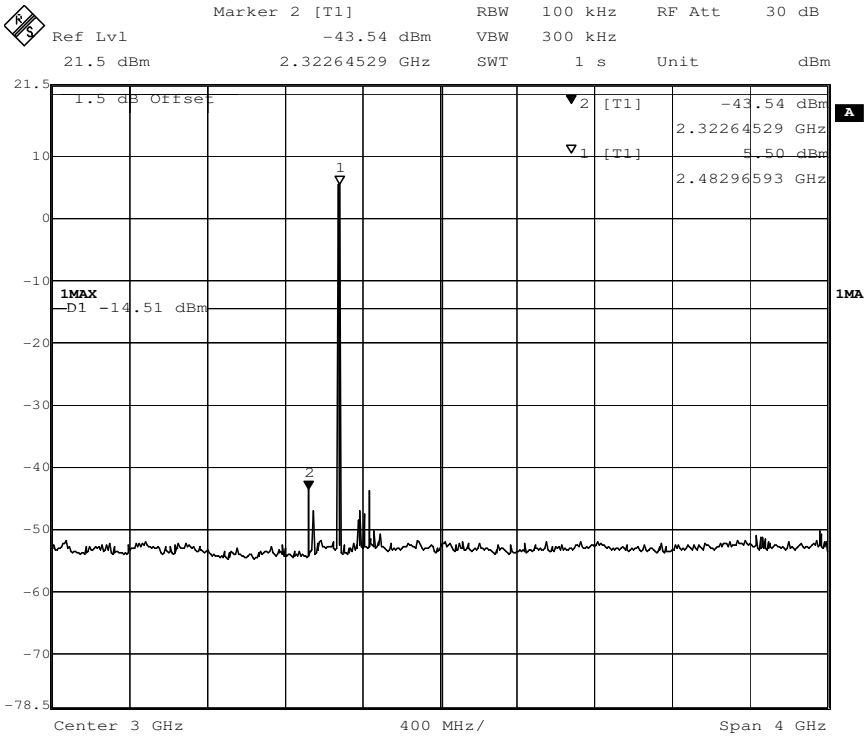
Middle Channel: 30MHz to 1GHz



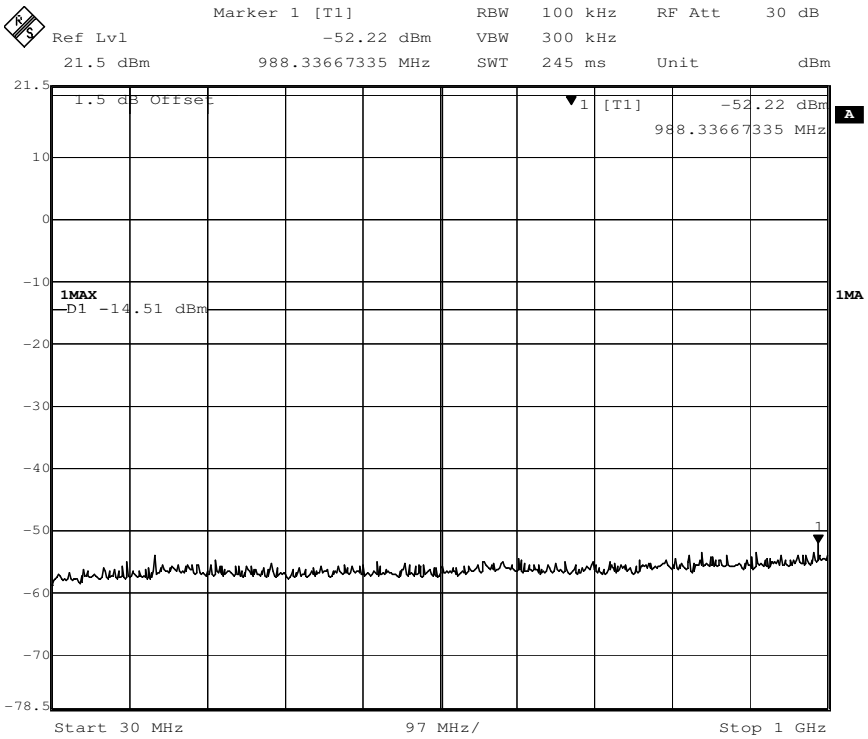
Middle Channel: 5GHz to 25GHz



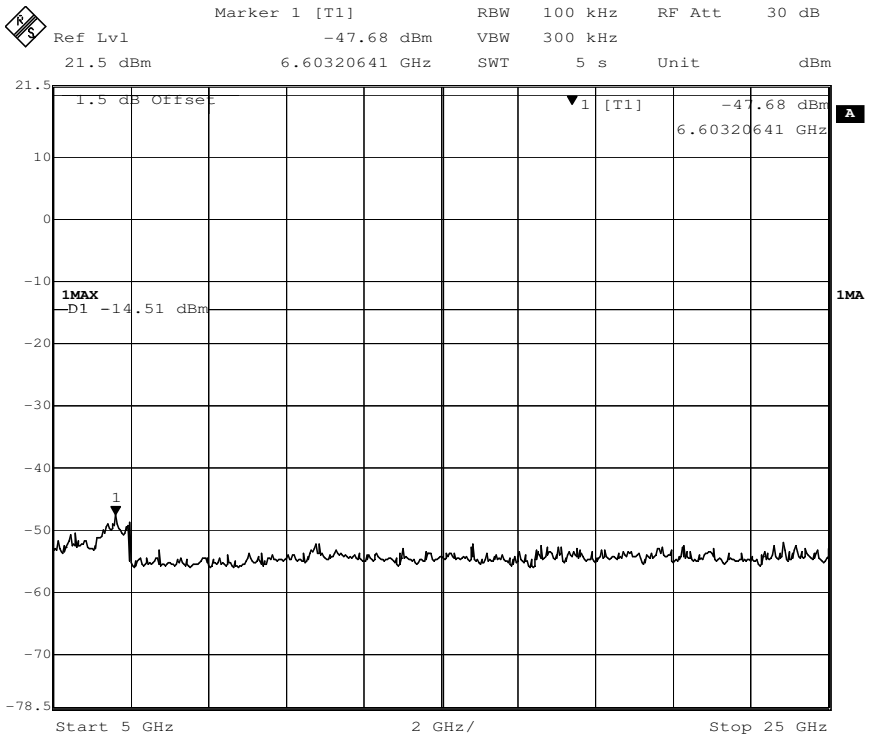
Highest Channel: 1GHz to 5GHz



Highest Channel: 30MHz to 1GHz



Highest Channel: 5GHz to 25GHz



7.10 Radiated Spurious Emissions

Test Requirement: 47 CFR Part 15C Section 15.209 and 15.205

Test Method: ANSI C63.10: 2013

Test Site: Measurement Distance:3m (Semi-Anechoic Chamber below 1GHz, Full Anechoic Chamber above 1GHz)

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	100 kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

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.

Test Setup:

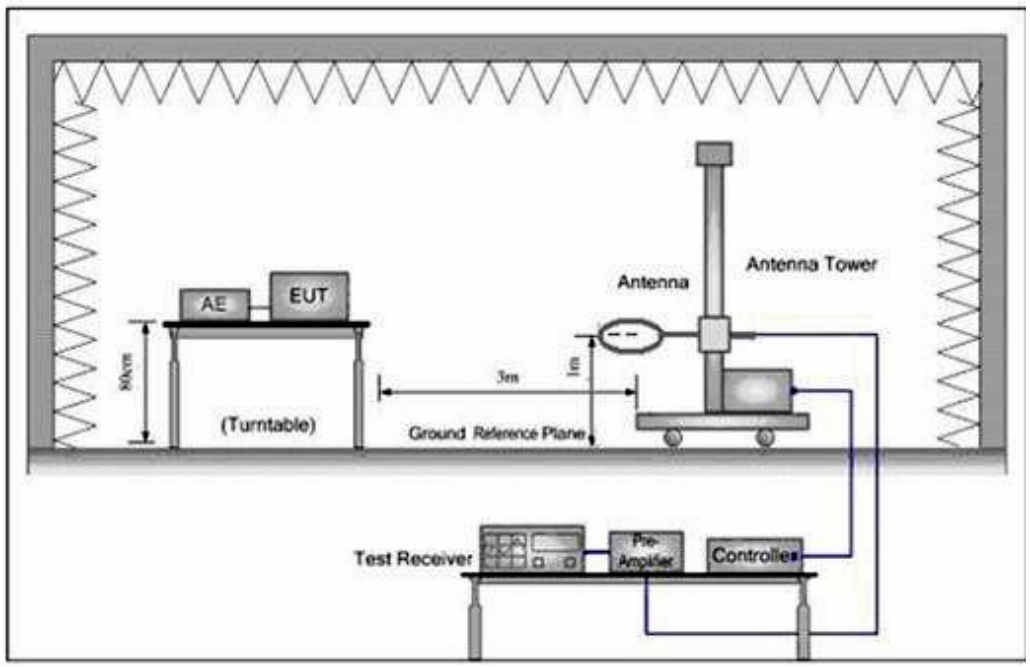


Figure 1. Below 30MHz

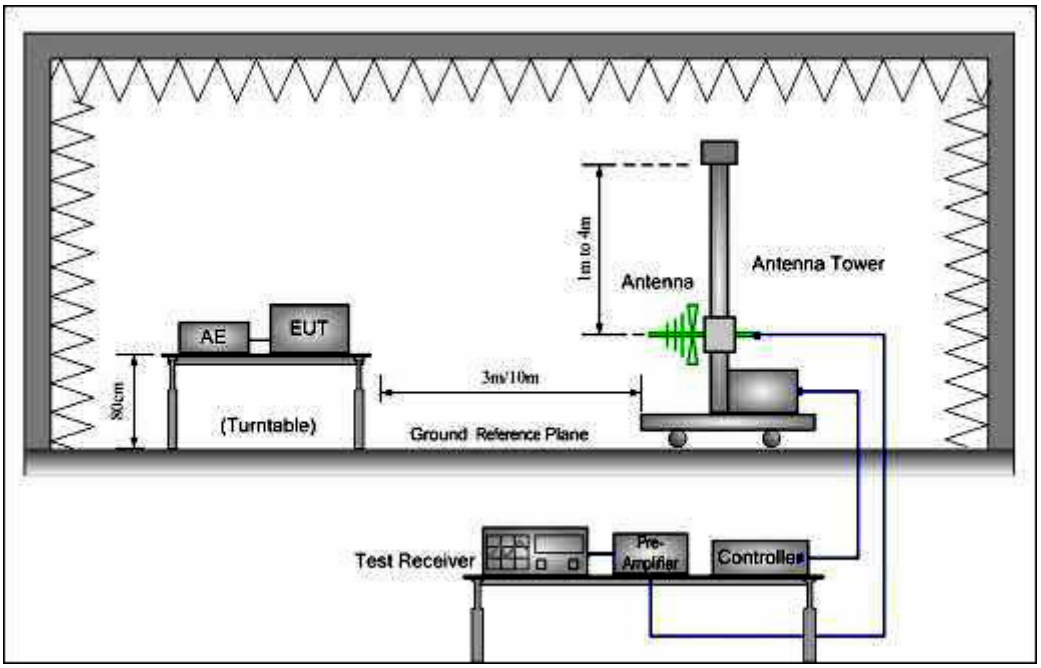


Figure 2. 30MHz to 1GHz

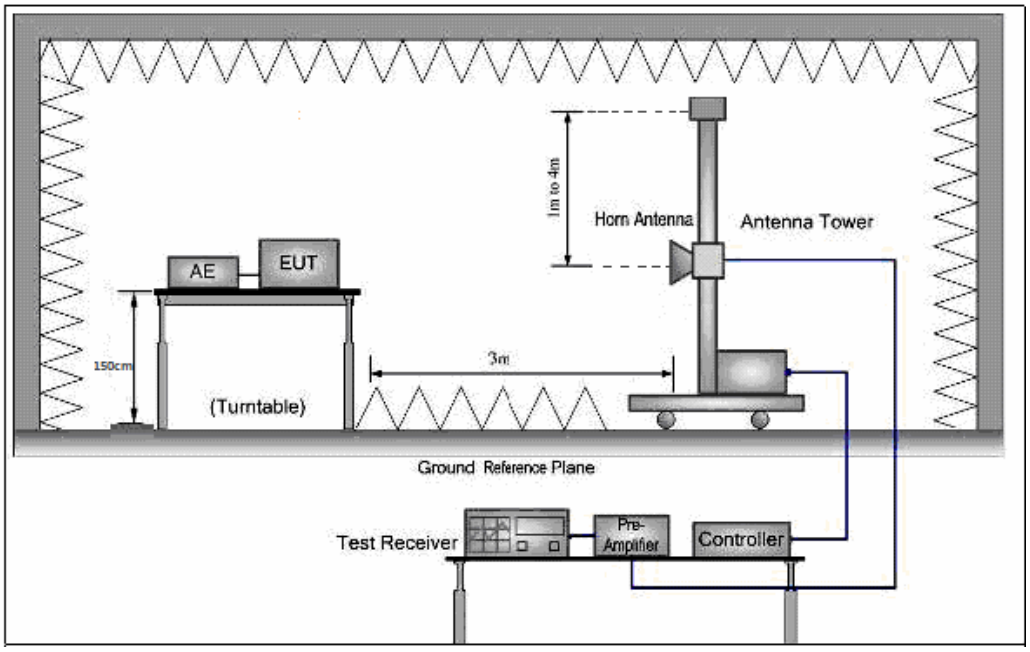


Figure 3. Above 1 GHz

Test Procedure:

a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 and 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter full-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

d. 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.

e. 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 degree to 360 degrees to find the maximum reading.

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

g. 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.

h. Test the EUT in the lowest channel (2402MHz),the middle channel (2441MHz),the Highest channel (2480MHz)

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

Exploratory Test Mode:	Non-hopping transmitting mode with all kind of modulation and all kind of data type Transmitting mode, Charge + Transmitting mode.
Final Test Mode:	Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet and modulation type. Compliance test in continuous transmitting mode with normal mode and GFSK modulation type (DH5) as the worst case was found. Pretest the EUT at Transmitting mode and Charge + Transmitting mode, found the Charge + Transmitting mode which it is worse case For below 1GHz part, through pre-scan, the worst case is the lowest channel. Only the worst case is recorded in the report.
Instruments Used:	Refer to section 6 for details
Test Results:	Pass

Test Result:

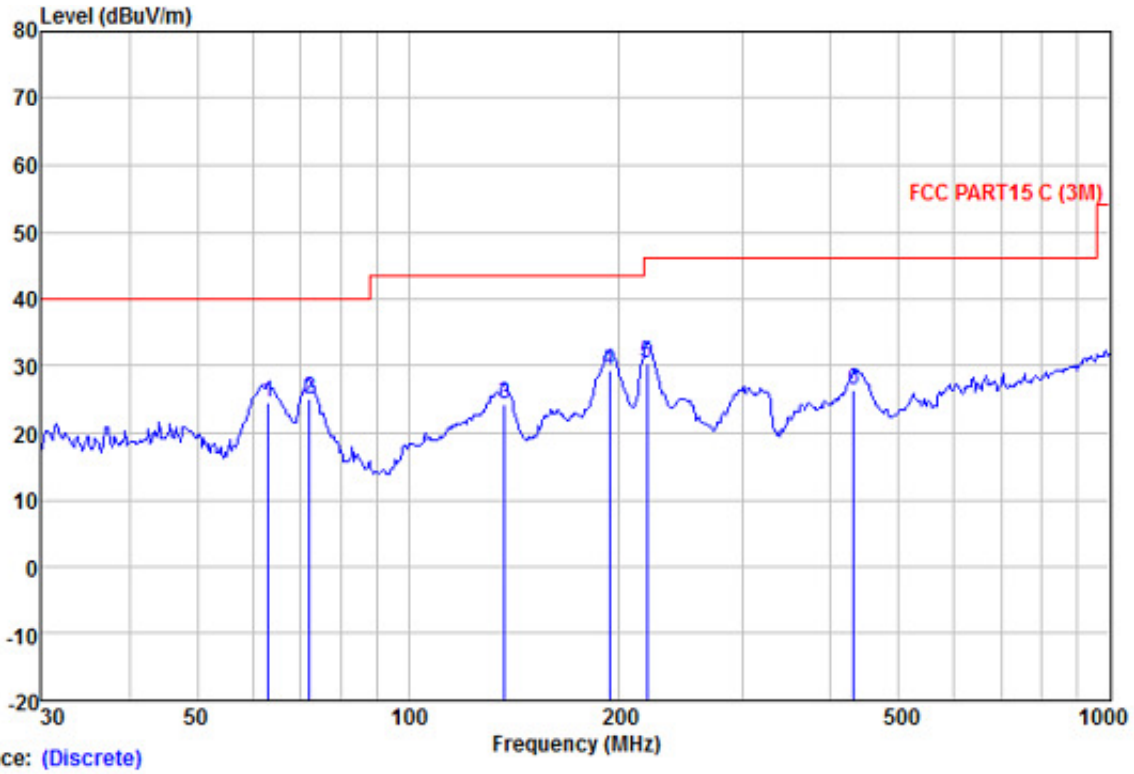
9KHz~30 MHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with Loop antenna and the amplitude of spurious emissions from the radiator are attenuated more than 20dB below the limit, so the test data were not recorded in the test report.

30MHz~1GHz Field Strength of Unwanted Emissions. Quasi-Peak Measurement

The measurements with Log antenna.

Lowest channel/ Vertical:

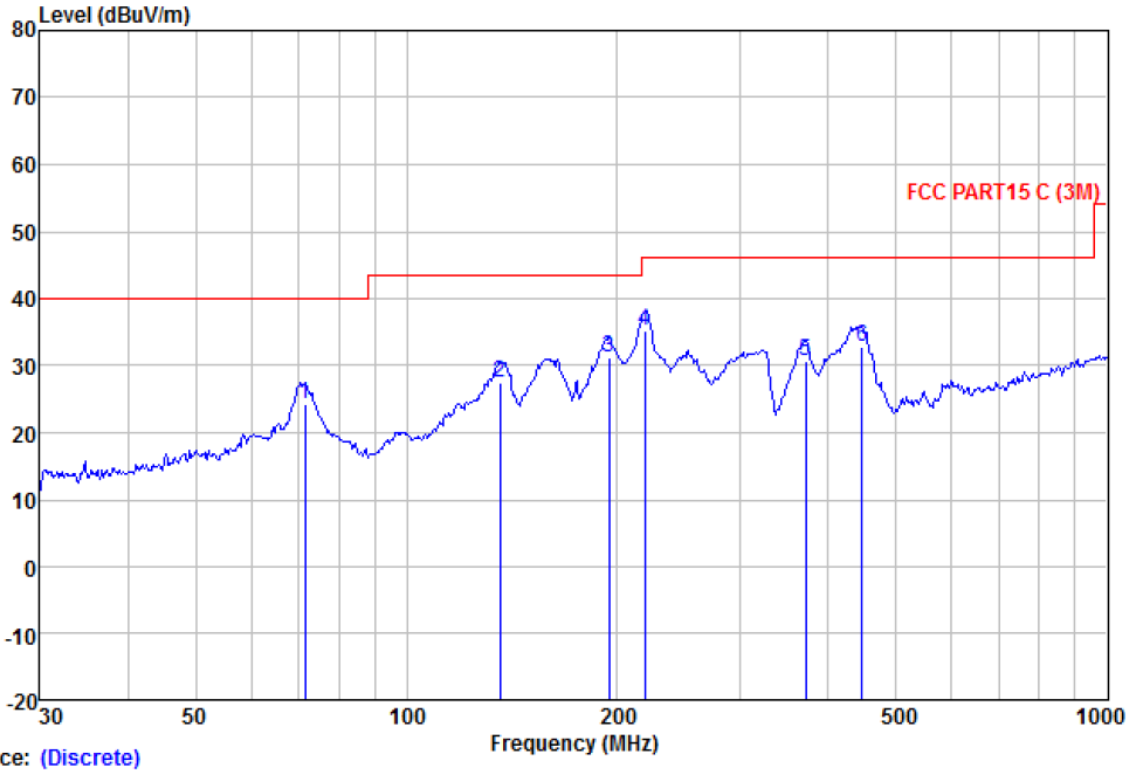


Trace: (Discrete)

```
Site        : SGS
Condition   : FCC PART15 C (3M) 3m VUBL9168(3M) VERTICAL
Job         :
Application:
Test Mode   : FHSS 2402
Product     :
Model       :
Engineer    :
Remark      : Level=Read Level + Cable loss
            : + Antenna Factor - Preamp factor
```

	Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	63.092	36.31	13.75	1.45	27.00	24.51	40.00	-15.49	QP
2	72.338	38.49	12.16	1.55	27.00	25.20	40.00	-14.80	QP
3	136.939	36.03	12.82	2.21	26.83	24.23	43.50	-19.27	QP
4	193.095	41.71	11.62	2.66	26.61	29.38	43.50	-14.12	QP
5	219.075	42.87	11.20	2.82	26.53	30.36	46.00	-15.64	QP
6	431.032	33.06	16.76	4.07	27.37	26.52	46.00	-19.48	QP

Lowest channel /Horizontal:



Trace: (Discrete)

```
Site       : SGS
Condition  : FCC PART15 C (3M)  HORIZONTAL
Job        :
Application:
Test Mode  : FHSS 2402
Product    :
Model      :
Engineer   :
Remark     : Level=Read Level + Cable loss
           : + Antenna Factor - Preamp factor
```

	Freq	ReadLevel	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1	71.581	37.48	12.36	1.53	27.00	24.37	40.00	-15.63	QP
2	135.982	39.46	12.75	2.20	26.84	27.57	43.50	-15.93	QP
3	194.453	43.74	11.52	2.68	26.61	31.33	43.50	-12.17	QP
4	219.075	47.69	11.20	2.82	26.53	35.18	46.00	-10.82	QP
5	370.702	38.10	15.88	3.77	26.95	30.80	46.00	-15.20	QP
6	446.414	38.93	17.20	4.15	27.51	32.77	46.00	-13.23	QP

Above 1GHz Field Strength of Unwanted Emissions. Peak & Average Measurement

Lowest channel: Peak Measurement:								
Frequency (MHz)	Reading Level (dBμV)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over limit	Antenna polarization
4804.000	51.24	30.79	9.95	40.21	51.77	74.00	-22.23	V
7206.000	39.10	35.45	12.73	39.25	48.03	74.00	-25.97	V
9608.000	33.87	37.51	14.48	37.97	47.89	74.00	-26.11	V
12010.000	32.49	39.50	15.80	38.08	49.71	74.00	-24.29	V
4804.000	49.13	30.79	9.95	40.21	49.66	74.00	-24.34	H
7206.000	37.39	35.45	12.73	39.25	46.32	74.00	-27.68	H
9608.000	34.38	37.51	14.48	37.97	48.40	74.00	-25.60	H
12010.000	32.99	39.50	15.80	38.08	50.21	74.00	-23.79	H

Lowest channel: Average Measurement:								
Frequency (MHz)	Reading Level (dBμV)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over limit	Antenna polarization
4804.000	43.60	30.79	9.95	40.21	44.13	54.00	-9.87	V
7206.000	32.08	35.45	12.73	39.25	41.01	54.00	-12.99	V
9608.000	25.64	37.51	14.48	37.97	39.66	54.00	-14.34	V
12010.000	24.36	39.50	15.80	38.08	41.58	54.00	-12.42	V
4804.000	38.92	30.79	9.95	40.21	39.45	54.00	-14.55	H
7206.000	29.41	35.45	12.73	39.25	38.34	54.00	-15.66	H
9608.000	22.40	37.51	14.48	37.97	36.42	54.00	-17.58	H
12010.000	20.59	39.50	15.80	38.08	37.81	54.00	-16.19	H

Above 1GHz Field Strength of Unwanted Emissions. Peak & Average Measurement

Middle channel: Peak Measurement:								
Frequency (MHz)	Reading Level (dBμV)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over limit	Antenna polarization
4882.000	49.85	30.95	10.02	40.22	50.60	74.00	-23.40	V
7323.000	38.16	35.74	12.93	39.22	47.61	74.00	-26.39	V
9764.000	33.74	37.70	14.45	37.90	47.99	74.00	-26.01	V
12205.000	33.84	39.21	16.05	38.10	51.00	74.00	-23.00	V
4882.000	52.00	30.95	10.02	40.22	52.75	74.00	-21.25	H
7323.000	39.08	35.74	12.93	39.22	48.53	74.00	-25.47	H
9764.000	33.77	37.70	14.45	37.90	48.02	74.00	-25.98	H
12205.000	34.53	39.21	16.05	38.10	51.69	74.00	-22.31	H
Middle channel: Average Measurement:								
Frequency (MHz)	Reading Level (dBμV)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over limit	Antenna polarization
4882.000	41.18	30.95	10.02	40.22	41.93	54.00	-12.07	V
7323.000	29.13	35.74	12.93	39.22	38.58	54.00	-15.42	V
9764.000	25.11	37.70	14.45	37.90	39.36	54.00	-14.64	V
12205.000	20.34	39.21	16.05	38.10	37.50	54.00	-16.50	V
4882.000	40.73	30.95	10.02	40.22	41.48	54.00	-12.52	H
7323.000	30.04	35.74	12.93	39.22	39.49	54.00	-14.51	H
9764.000	25.60	37.70	14.45	37.90	39.85	54.00	-14.15	H
12205.000	22.89	39.21	16.05	38.10	40.05	54.00	-13.95	H

Above 1GHz Field Strength of Unwanted Emissions. Peak & Average Measurement

Highest channel: Peak Measurement:								
Frequency (MHz)	**Reading Level (dBμV)**	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Over limit**	**Antenna polarization**
4960.000	46.32	31.05	10.07	40.23	47.21	74.00	-26.79	V
7440.000	37.23	35.92	13.04	39.20	46.99	74.00	-27.01	V
9920.000	34.86	37.92	14.41	37.84	49.35	74.00	-24.65	V
12400.000	33.66	38.93	16.29	38.12	50.76	74.00	-23.24	V
4960.000	49.72	31.05	10.07	40.23	50.61	74.00	-23.39	H
7440.000	37.35	35.92	13.04	39.20	47.11	74.00	-26.89	H
9920.000	33.32	37.92	14.41	37.84	47.81	74.00	-26.19	H
12400.000	32.92	38.93	16.29	38.12	50.02	74.00	-23.98	H
Highest channel: Average Measurement:								
Frequency (MHz)	**Reading Level (dBμV)**	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Over limit**	**Antenna polarization**
4960.000	37.29	31.05	10.07	40.23	38.18	54.00	-15.82	V
7440.000	29.03	35.92	13.04	39.20	38.79	54.00	-15.21	V
9920.000	23.56	37.92	14.41	37.84	38.05	54.00	-15.95	V
12400.000	21.65	38.93	16.29	38.12	38.75	54.00	-15.25	V
4960.000	41.64	31.05	10.07	40.23	42.53	54.00	-11.47	H
7440.000	29.36	35.92	13.04	39.20	39.12	54.00	-14.88	H
9920.000	21.83	37.92	14.41	37.84	36.32	54.00	-17.68	H
12400.000	22.58	38.93	16.29	38.12	39.68	54.00	-14.32	H

7.11 Radiated Emissions which fall in the restricted bands

Test Requirement: FCC Part15 C Section 15.247

(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Test Method: ANSI C63.10: Clause 6.3, 6.5 and 6.6

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), middle (2441 MHz) and highest (2480 MHz) channel with different data packet and modulation type. Compliance test in continuous transmitting mode with normal mode and GFSK modulation type (DH5) as the worst case was found.

Pretest the EUT at Transmitting mode and Charge + Transmitting mode, found the Charge + Transmitting mode was worse case.

Measurement Distance: 3m (Semi-Anechoic Chamber below 1GHz, Full Anechoic Chamber above 1GHz)

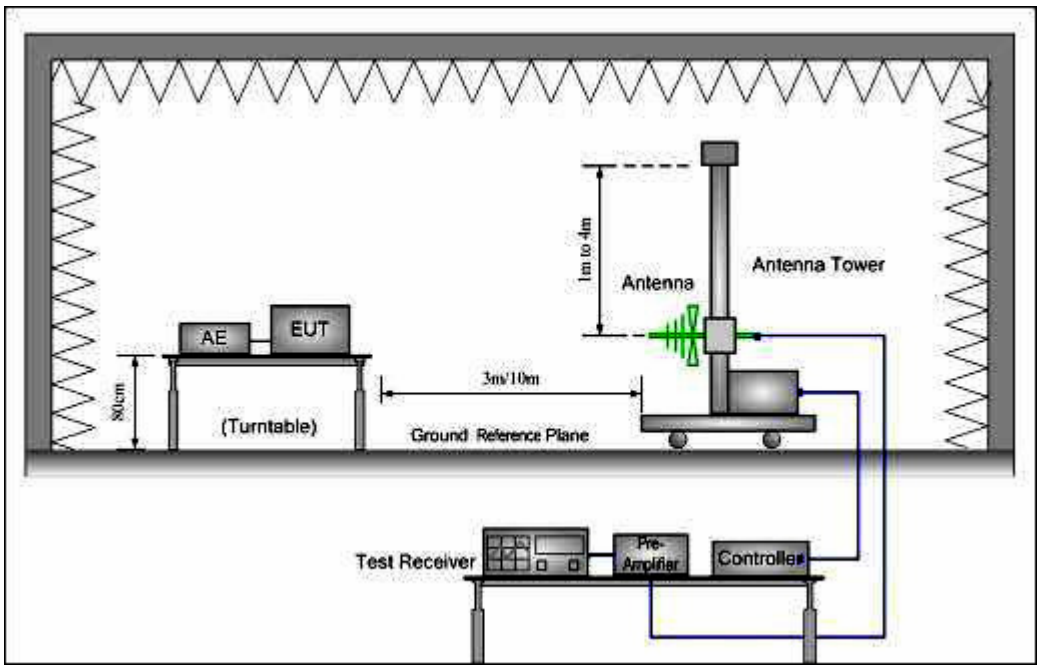
Limit: Section 15.209(a)

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

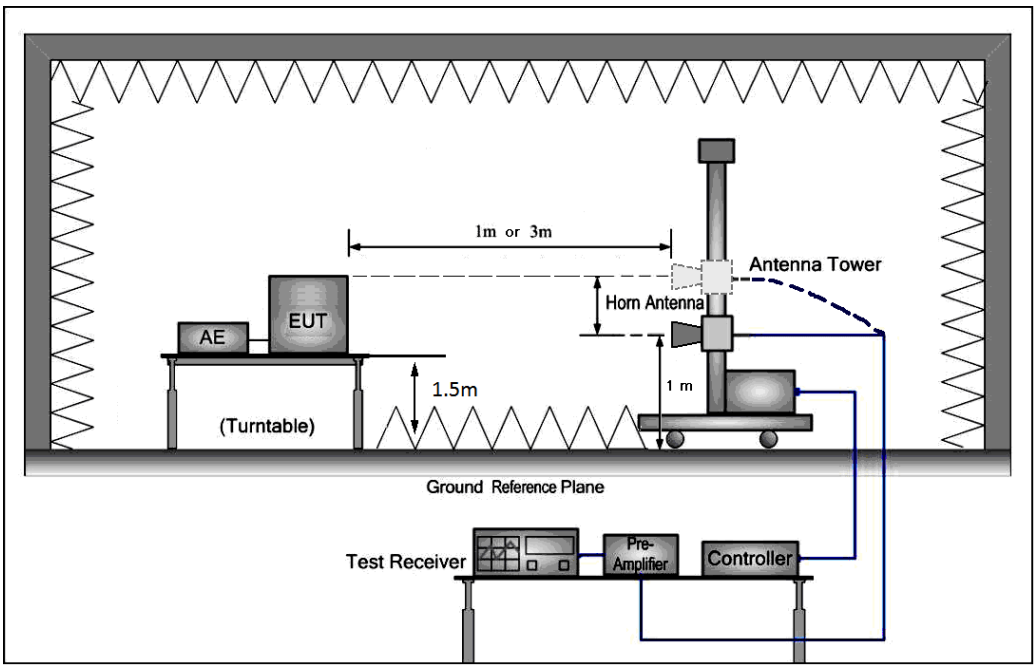
Detector: For PK value:
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
For AV value:
RBW = 1 MHz for f ≥ 1 GHz,
VBW =10 Hz
Sweep = auto
Detector function = peak
Trace = max hold

Test Configuration:

1) 30 MHz to 1 GHz emissions:



2) Above 1 GHz emissions:



Test Procedure:

Test site with RF absorbing material covering the ground plane that met the site validation criterion called out in CISPR 16-1-4:2010 was used to perform radiated emission test above 1 GHz.

The receiver scanned from the lowest frequency generated within the EUT to 25GHz.When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The worst case emissions were reported.

From 30MHz to 1GHz, read the Quasi-Peak field strength of the emissions with receiver QP detector RBW=120KHz.

Above 1GHz, read the Peak field strength and Average field strength.

Read the Peak field strength through RBW=1MHz,VBW=3MHz in spectrum analyzer setting;

Read the Average field strength through RBW=1MHz,VBW=10Hz in spectrum analyzer setting;

While maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the average field strength reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit.

Section 15.205 Restricted bands of operation.

(a) Except as shown in paragraph (d) of this section. only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	
13.36 - 13.41	322 - 335.4		

Test Result:

Above 1GHz Radiated Emissions. Peak & Average Measurement

Lowest channel: Peak Measurement:								
Frequency (MHz)	**Reading Level (dBμV)**	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Over limit**	**Antenna polarization**
2310.000	42.13	26.25	6.80	39.07	36.11	74.00	-37.89	V
2390.000	43.17	26.43	6.87	39.10	37.37	74.00	-36.63	V
2483.500	42.22	26.58	7.07	39.14	36.73	74.00	-37.27	V
2500.000	41.93	26.60	7.10	39.14	36.49	74.00	-37.51	V
2310.000	42.48	26.25	6.80	39.07	36.46	74.00	-37.54	H
2390.000	43.56	26.43	6.87	39.10	37.76	74.00	-36.24	H
2483.500	42.42	26.58	7.07	39.14	36.93	74.00	-37.07	H
2500.000	41.81	26.60	7.10	39.14	36.37	74.00	-37.63	H
Lowest channel: Average Measurement:								
Frequency (MHz)	**Reading Level (dBμV)**	**Antenna factors (dB/m)**	**Cable loss (dB)**	**Preamp factor (dB)**	**Emission Level (dBμV/m)**	**Limit (dBμV/m)**	**Over limit**	**Antenna polarization**
2310.000	34.09	26.25	6.80	39.07	28.07	54.00	-25.93	V
2390.000	32.11	26.43	6.87	39.10	26.31	54.00	-27.69	V
2483.500	33.46	26.58	7.07	39.14	27.97	54.00	-26.03	V
2500.000	32.76	26.60	7.10	39.14	27.32	54.00	-26.68	V
2310.000	31.46	26.25	6.80	39.07	25.44	54.00	-28.56	H
2390.000	31.30	26.43	6.87	39.10	25.50	54.00	-28.50	H
2483.500	34.15	26.58	7.07	39.14	28.66	54.00	-25.34	H
2500.000	33.88	26.60	7.10	39.14	28.44	54.00	-25.56	H

Above 1GHz Radiated Emissions. Peak & Average Measurement

Middle channel: Peak Measurement:								
Frequency (MHz)	Reading Level (dBμV)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over limit	Antenna polarization
2310.000	40.31	26.25	6.80	39.07	34.29	74.00	-39.71	V
2390.000	40.79	26.43	6.87	39.10	34.99	74.00	-39.01	V
2483.500	40.47	26.58	7.07	39.14	34.98	74.00	-39.02	V
2500.000	41.32	26.60	7.10	39.14	35.88	74.00	-38.12	V
2310.000	41.35	26.25	6.80	39.07	35.33	74.00	-38.67	H
2390.000	41.47	26.43	6.87	39.10	35.67	74.00	-38.33	H
2483.500	40.44	26.58	7.07	39.14	34.95	74.00	-39.05	H
2500.000	42.02	26.60	7.10	39.14	36.58	74.00	-37.42	H
Middle channel: Average Measurement:								
Frequency (MHz)	Reading Level (dBμV)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over limit	Antenna polarization
2310.000	29.86	26.25	6.80	39.07	23.84	54.00	-30.16	V
2390.000	32.26	26.43	6.87	39.10	26.46	54.00	-27.54	V
2483.500	31.81	26.58	7.07	39.14	26.32	54.00	-27.68	V
2500.000	32.57	26.60	7.10	39.14	27.13	54.00	-26.87	V
2310.000	31.42	26.25	6.80	39.07	25.40	54.00	-28.60	H
2390.000	30.11	26.43	6.87	39.10	24.31	54.00	-29.69	H
2483.500	29.81	26.58	7.07	39.14	24.32	54.00	-29.68	H
2500.000	34.57	26.60	7.10	39.14	29.13	54.00	-24.87	H

Above 1GHz Radiated Emissions. Peak & Average Measurement

Highest channel: Peak Measurement:								
Frequency (MHz)	Reading Level (dBμV)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over limit	Antenna polarization
2310.000	41.38	26.25	6.80	39.07	35.36	74.00	-38.64	V
2390.000	42.49	26.43	6.87	39.10	36.69	74.00	-37.31	V
2483.500	75.25	26.58	7.07	39.14	69.76	74.00	-4.24	V
2500.000	43.00	26.60	7.10	39.14	37.56	74.00	-36.44	V
2310.000	42.48	26.25	6.80	39.07	36.46	74.00	-37.54	H
2390.000	41.92	26.43	6.87	39.10	36.12	74.00	-37.88	H
2483.500	74.36	26.58	7.07	39.14	68.87	74.00	-5.13	H
2500.000	42.01	26.60	7.10	39.14	36.57	74.00	-37.43	H
Highest channel: Average Measurement:								
Frequency (MHz)	Reading Level (dBμV)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over limit	Antenna polarization
2310.000	33.88	26.25	6.80	39.07	27.86	54.00	-26.14	V
2390.000	35.11	26.43	6.87	39.10	29.31	54.00	-24.69	V
2483.500	45.60	26.58	7.07	39.14	40.11	54.00	-13.89	V
2500.000	34.81	26.60	7.10	39.14	29.37	54.00	-24.63	V
2310.000	33.19	26.25	6.80	39.07	27.17	54.00	-26.83	H
2390.000	33.43	26.43	6.87	39.10	27.63	54.00	-26.37	H
2483.500	44.48	26.58	7.07	39.14	38.99	54.00	-15.01	H
2500.000	34.08	26.60	7.10	39.14	28.64	54.00	-25.36	H

Test result: The unit does meet the FCC requirements.

7.12 Band Edges Requirement

Test Requirement: FCC Part15 C section 15.247

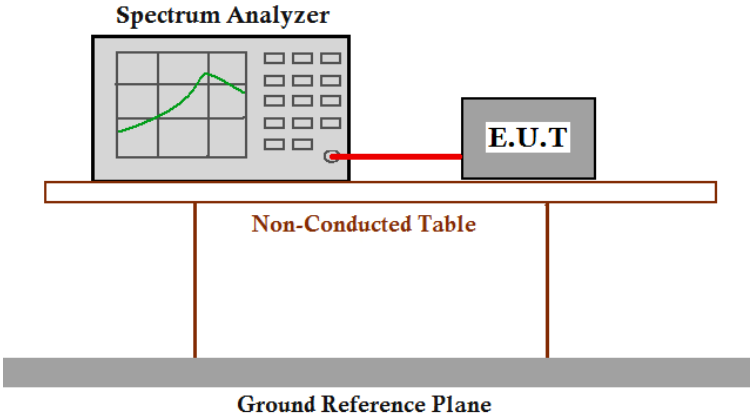
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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 Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Frequency Band: 2400 MHz to 2483.5 MHz

Test Method: ANSI C63.10: Clause 6.10

Test Status: Pre-test the EUT in continuous transmitting mode at the lowest (2402 MHz), and highest (2480 MHz) channel and hopping mode with different data packet and modulation type. Through Pre-scan, find the normal mode with GFSK modulation type DH5 of data type is the worst case Pre-test the EUT in B/O mode and charging mode find the worst case is B/O Mode.

Test Configuration:



Test Procedure: Use the following spectrum analyzer settings:

Span = 10MHz (wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products which fall outside of the authorized band of operation.)

RBW = 100 kHz and VBW = 300 kHz

Sweep = auto

Detector function = peak

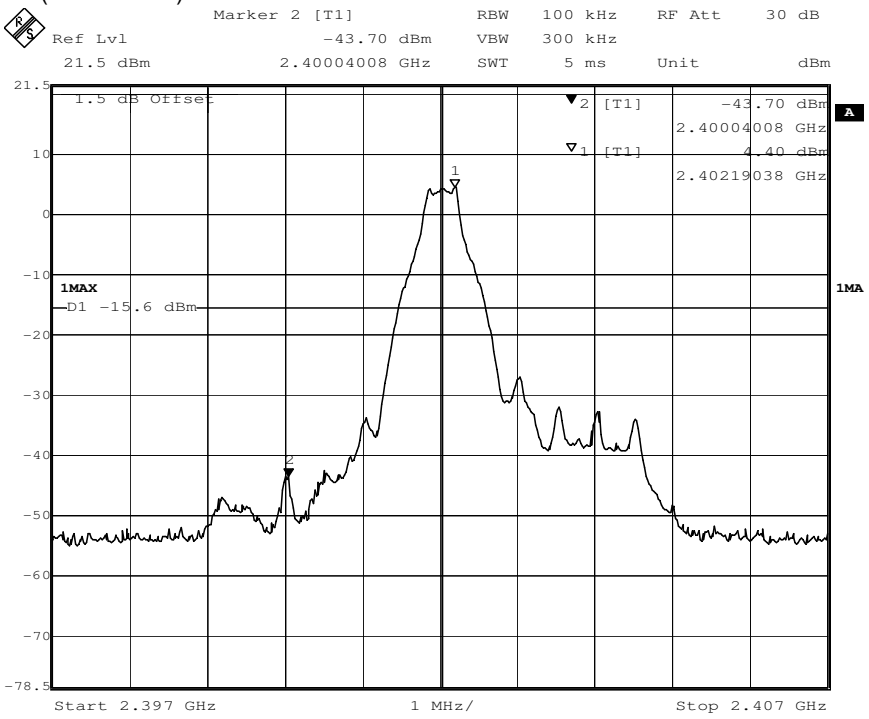
Trace = max hold

Test Result:

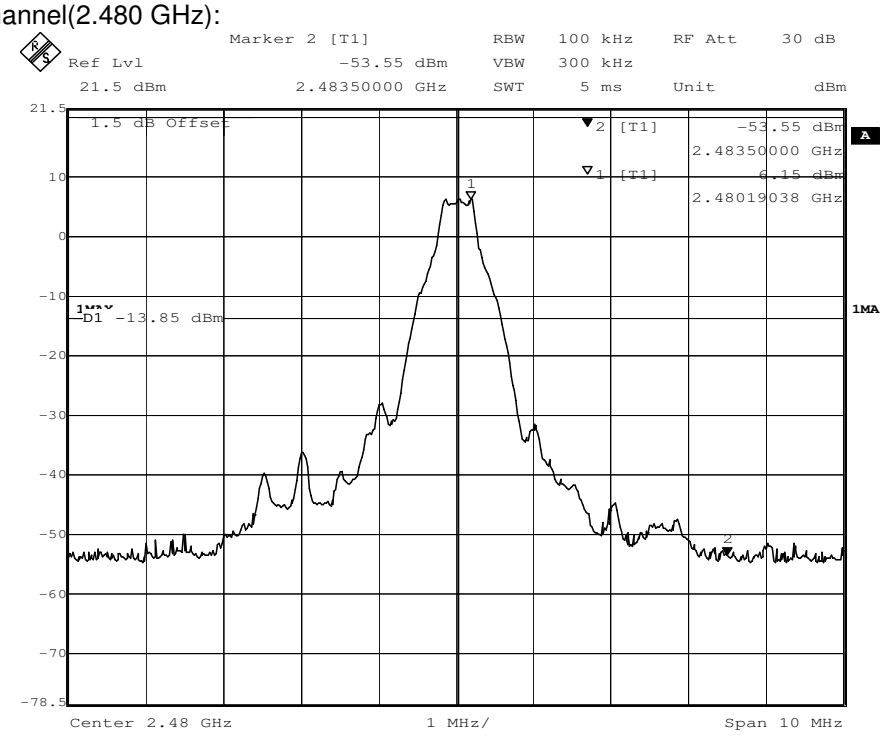
Compare with the output power of the lowest frequency, the Lower Edges attenuated more than 20dB
Compare with the output power of the highest frequency, the Upper Edges attenuated more than 20dB.

Non-hopping mode:

Lowest channel(2.402 GHz):

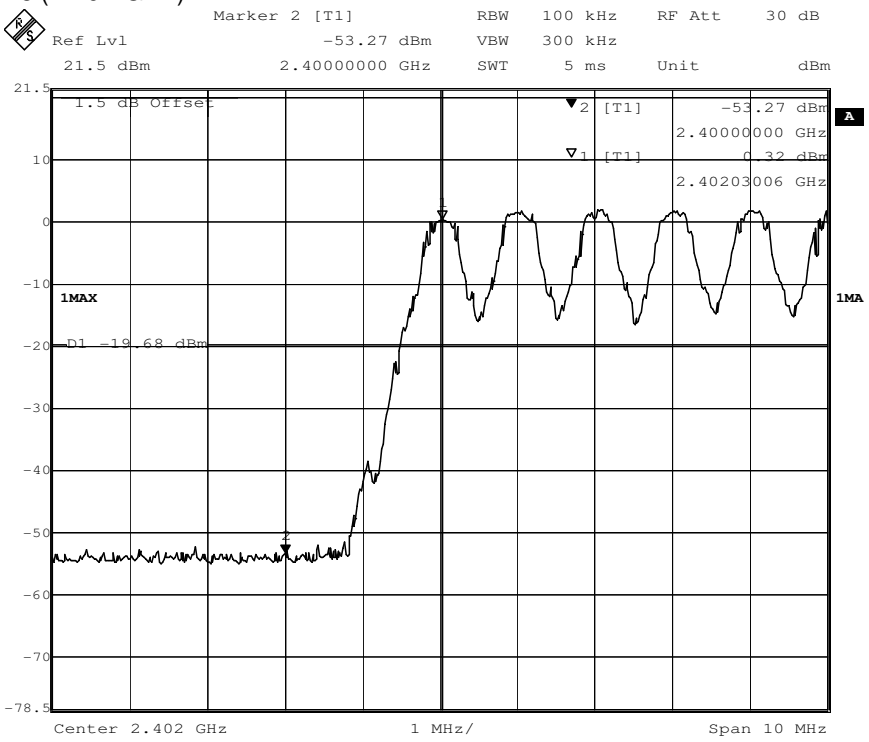


Highest Channel(2.480 GHz):

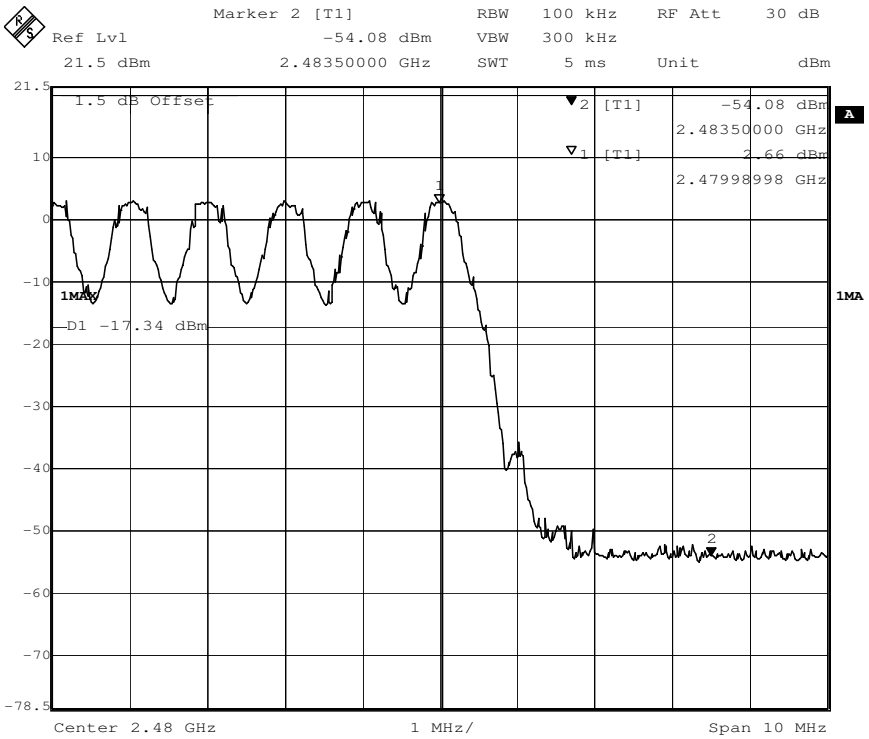


Hopping mode:

Lowest channel(2.402 GHz):



Highest Channel(2.480 GHz):



Test result: The unit does meet the FCC requirements.

7.13 Conducted Emissions at Mains Terminals 150 kHz to 30 MHz

Test Requirement: FCC Part 15 C section 15.207

Test Method: ANSI C63.10: Clause 6.2

Frequency Range: 150 kHz to 30 MHz

Detector: Peak for pre-scan (9 kHz Resolution Bandwidth)

Test Limit

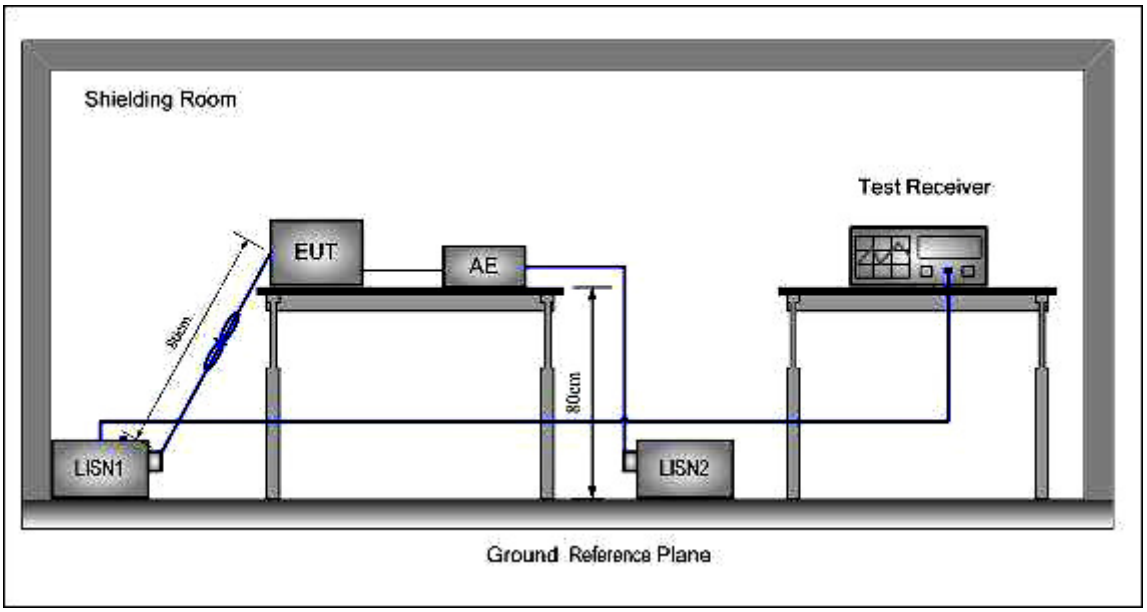
Limits for conducted disturbance at the mains ports of class B

Frequency Range (MHz)	Class B Limit dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
NOTE 1 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

EUT Operation: Test in normal operating mode. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

Test Configuration:



Test procedure:

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

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

3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

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.

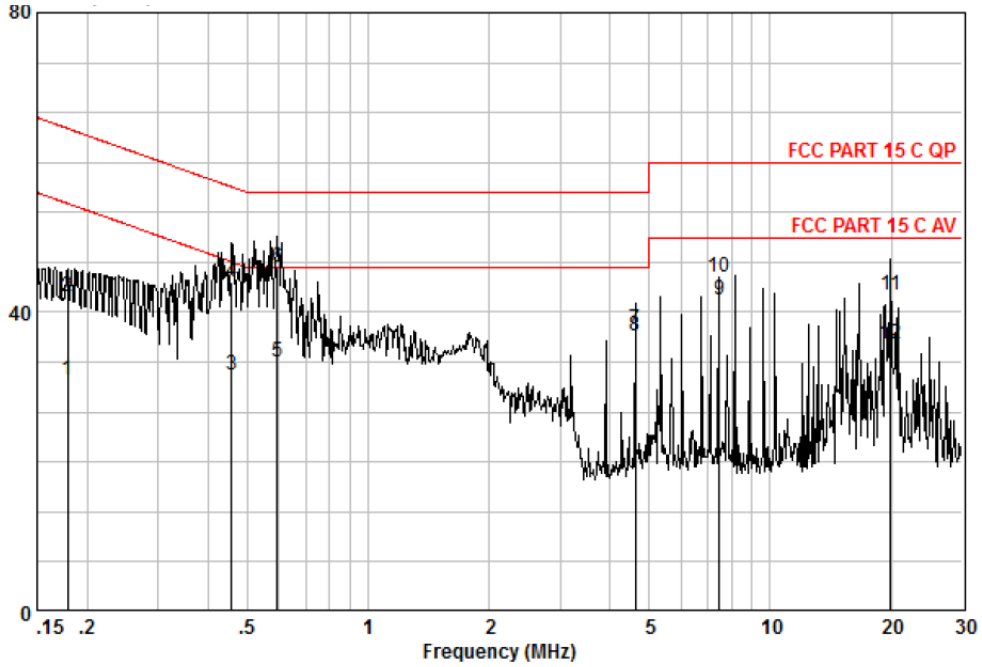
7.13.1 Measurement Data

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. For EUT the communicating was worst case mode.

The following Quasi-Peak and Average measurements were performed on the EUT:

Neutral Line

Level(dBμV)

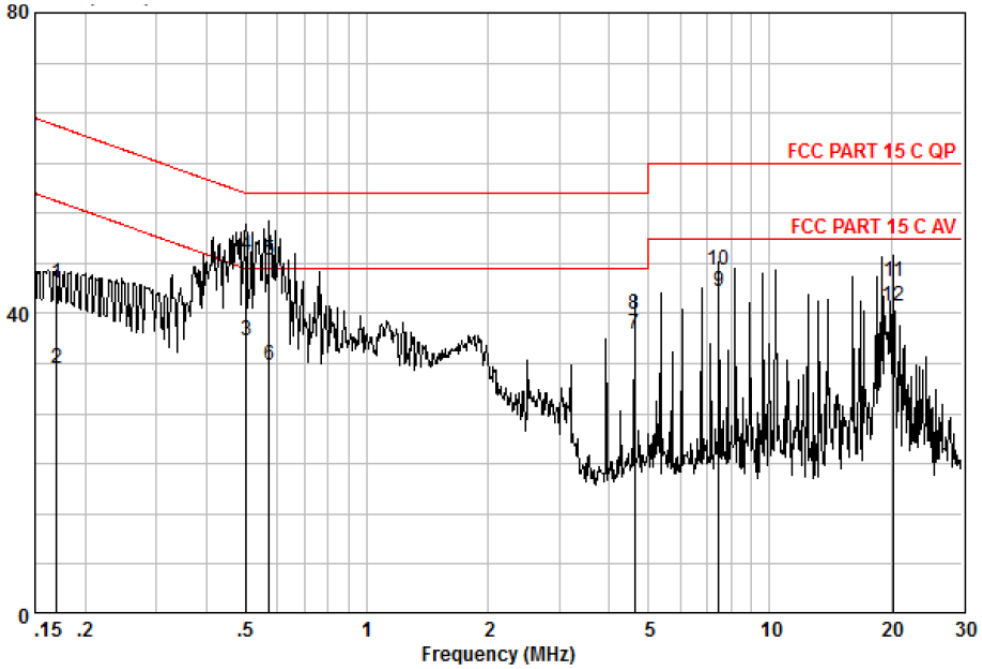


Measure data:

Frequency MHz	read level dBuV	Cable Loss dB	LISN Factor dB	Measured level dBuV	Limit Line dBuV	Over limit dB	Remark
0.179	21.21	0.10	9.56	30.87	54.55	-23.68	AVERAGE
0.179	32.41	0.10	9.56	42.07	64.55	-22.48	QP
0.456	21.94	0.19	9.55	31.68	46.76	-15.08	AVERAGE
0.456	34.28	0.19	9.55	44.02	56.76	-12.74	QP
0.595	23.68	0.23	9.54	33.45	46.00	-12.55	AVERAGE
0.595	36.26	0.23	9.54	46.03	56.00	-9.97	QP
4.622	27.49	0.67	9.61	37.77	56.00	-18.23	QP
4.622	26.54	0.67	9.61	36.82	46.00	-9.18	AVERAGE
7.466	31.34	0.64	9.67	41.65	50.00	-8.35	AVERAGE
7.466	34.44	0.64	9.67	44.75	60.00	-15.25	QP
19.895	31.55	0.70	10.01	42.26	60.00	-17.74	QP
19.895	25.14	0.70	10.01	35.85	50.00	-14.15	AVERAGE

Live Line

Level(dBμV)



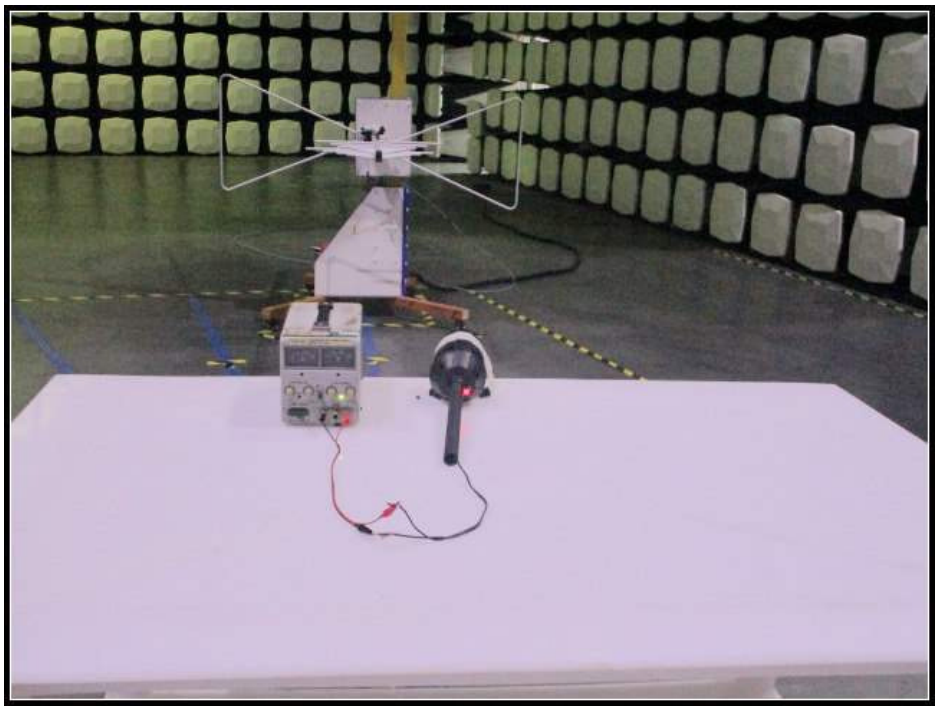
Measure data:

Frequency MHz	read level dBuV	Cable Loss dB	LISN Factor dB	Measured level dBuV	Limit Line dBuV	Over limit dB	Remark
0,169	34,23	0,10	9,69	44,02	64,99	-20,97	QP
0,169	22,80	0,10	9,69	32,59	54,99	-22,40	AVERAGE
0,502	26,59	0,20	9,71	36,50	46,00	-9,50	AVERAGE
0,502	37,93	0,20	9,71	47,84	56,00	-8,16	QP
0,573	37,27	0,22	9,70	47,19	56,00	-8,81	QP
0,573	23,32	0,22	9,70	33,24	46,00	-12,76	AVERAGE
4,622	26,87	0,67	9,74	37,28	46,00	-8,72	AVERAGE
4,622	29,46	0,67	9,74	39,87	56,00	-16,13	QP
7,479	32,45	0,64	9,79	42,88	50,00	-7,12	AVERAGE
7,479	35,25	0,64	9,79	45,68	60,00	-14,32	QP
20,295	33,42	0,70	10,04	44,16	60,00	-15,84	QP
20,295	30,18	0,70	10,04	40,92	50,00	-9,08	AVERAGE

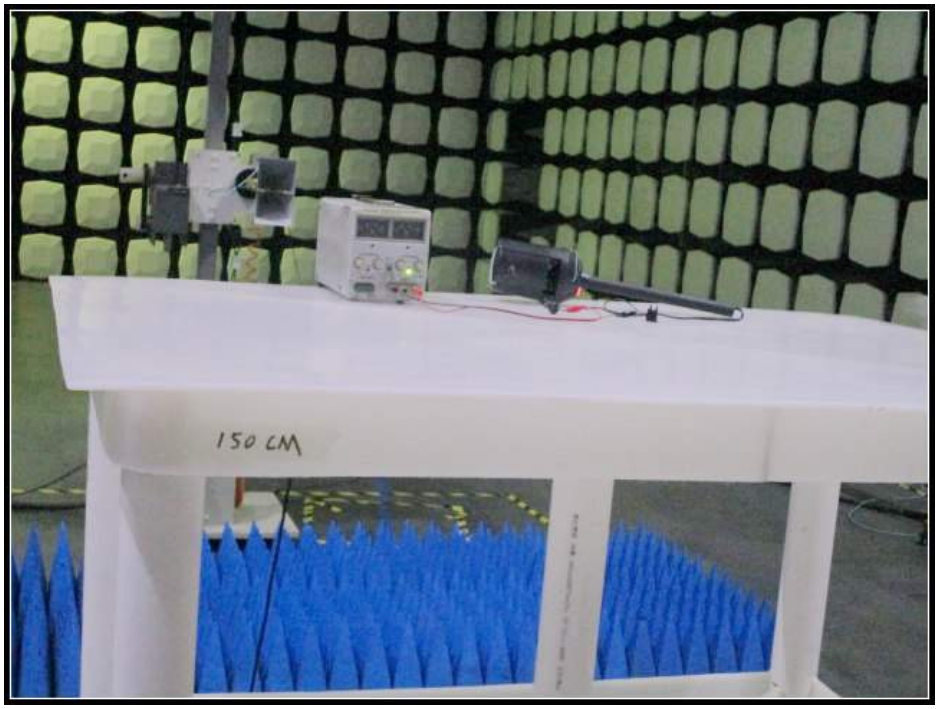
8 Photographs

8.1 Radiated Emissions

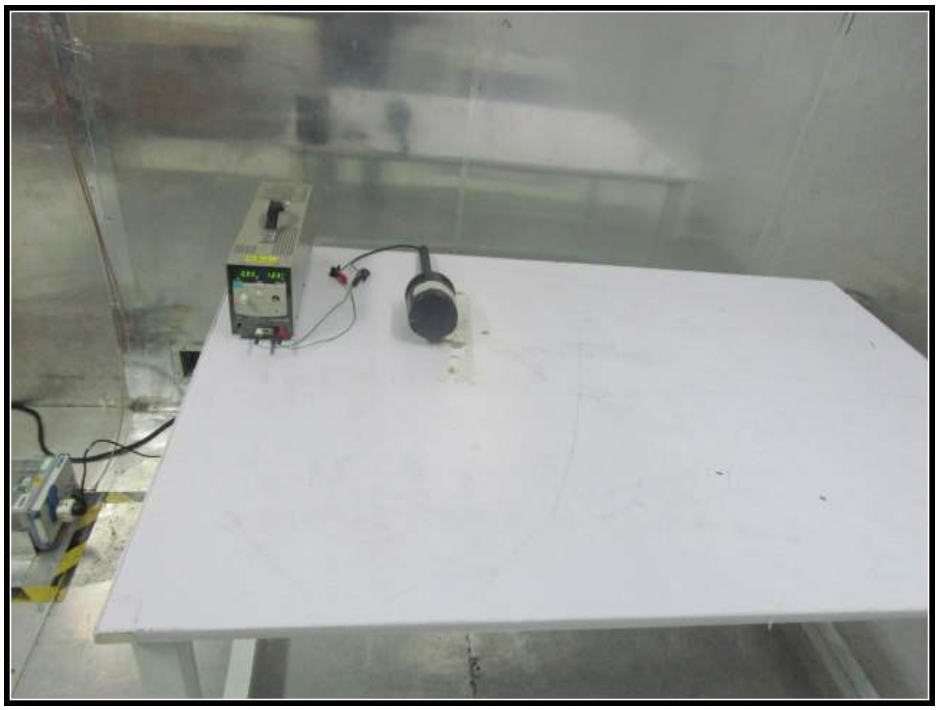
30MHz to 1GHz



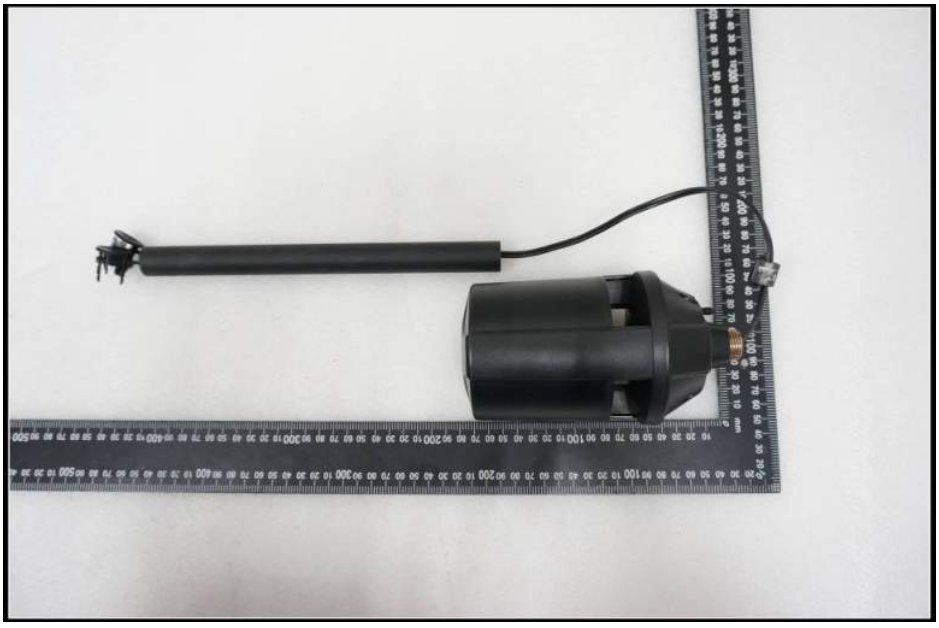
Above 1 GHz:

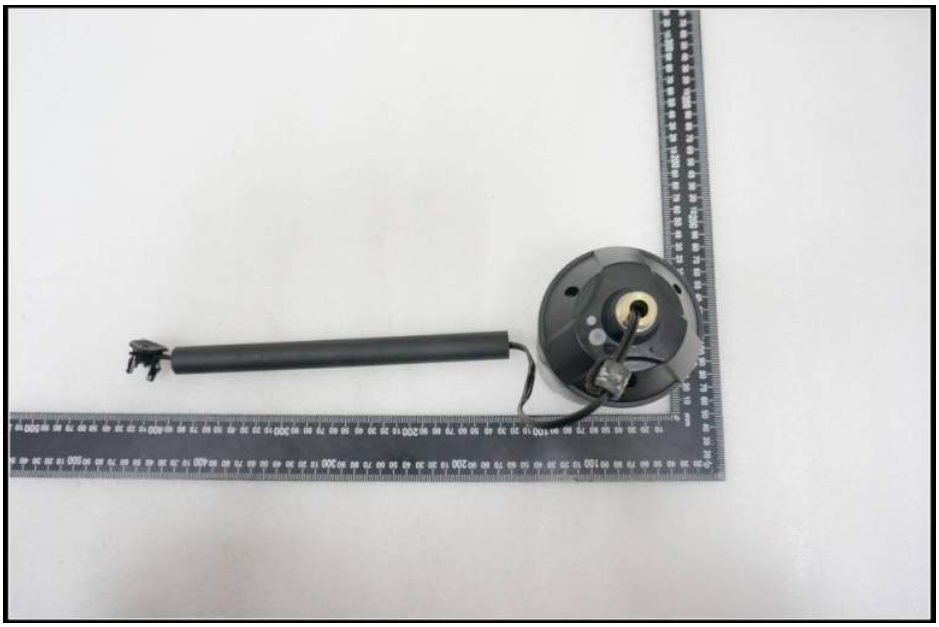


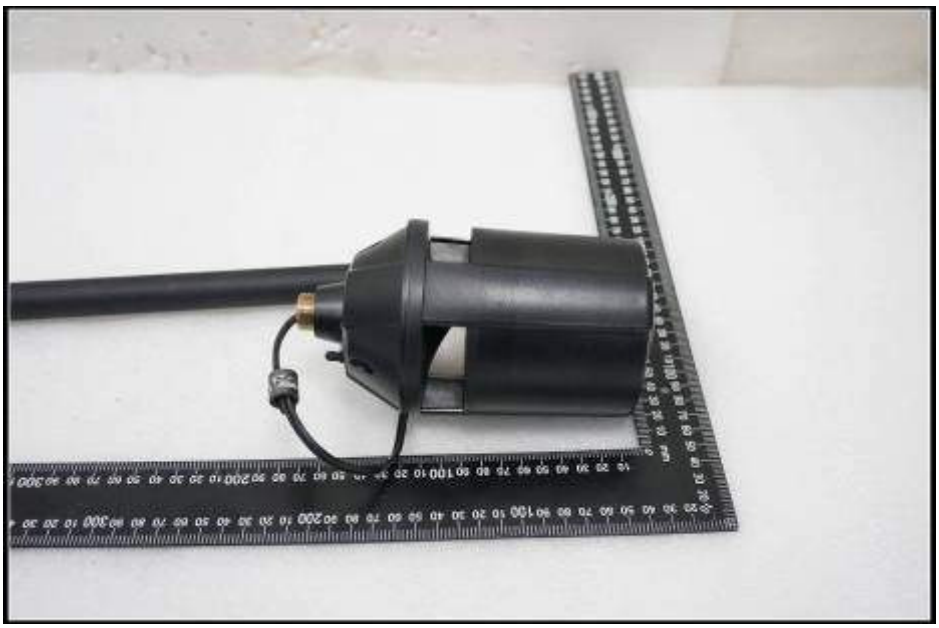
8.2 Conducted Emissions at Mains Terminals 150 kHz to 30 MHz

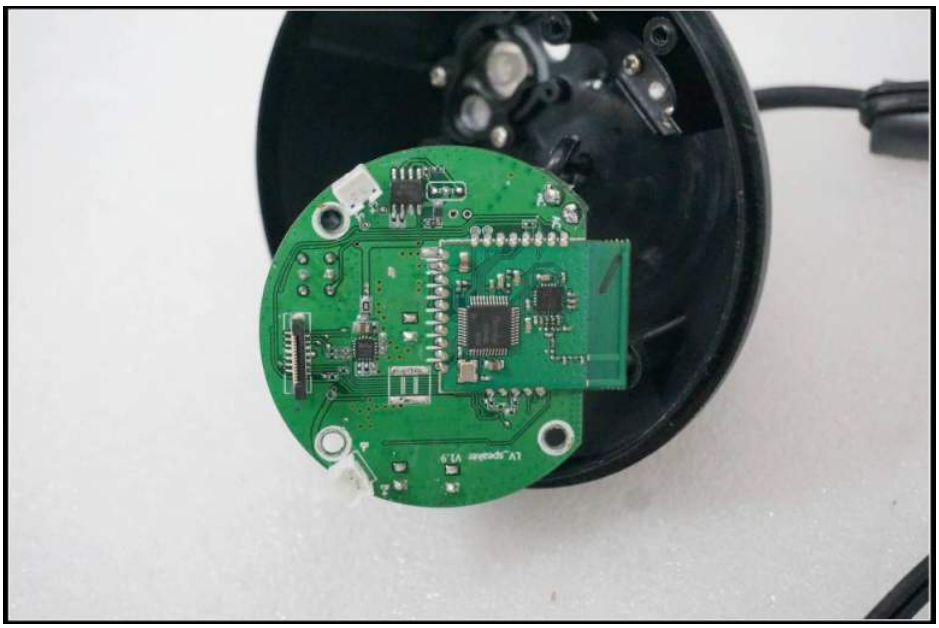


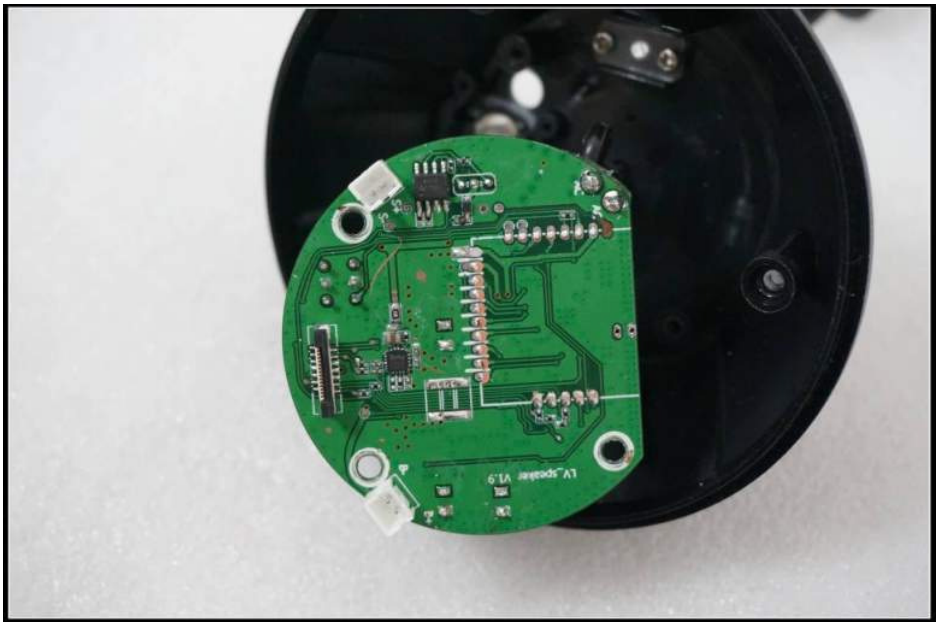
8.3 EUT Constructional Details

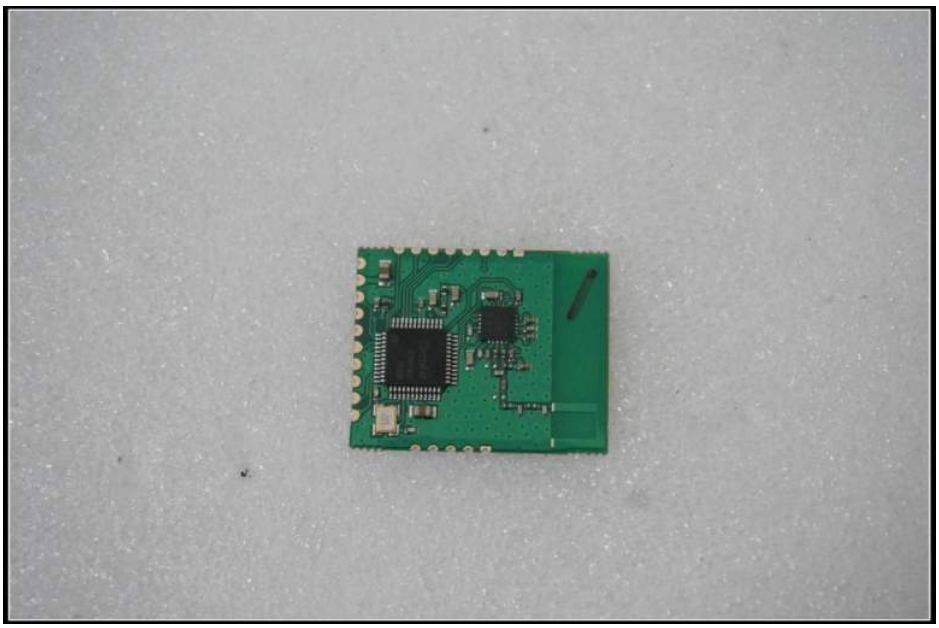


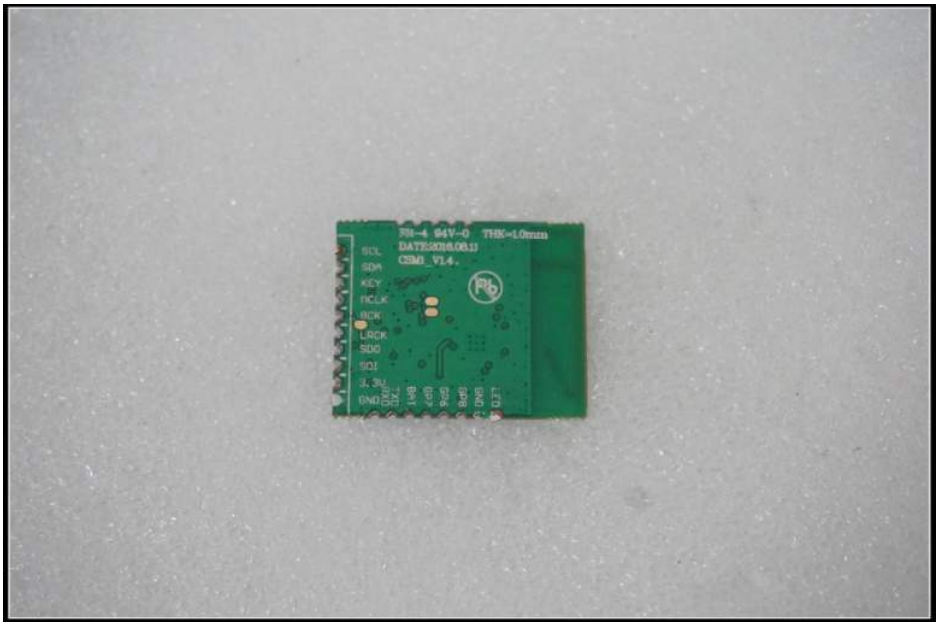


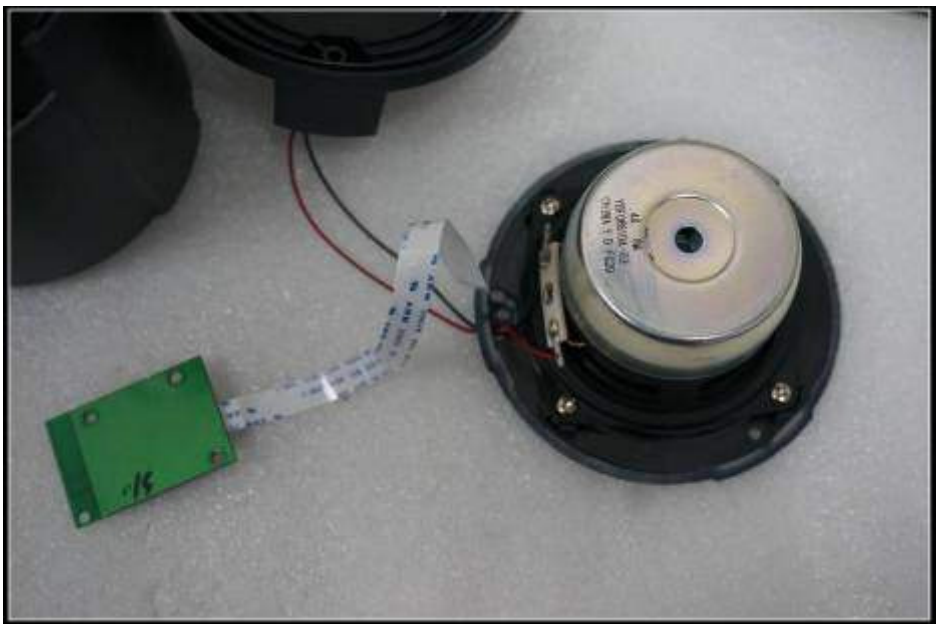


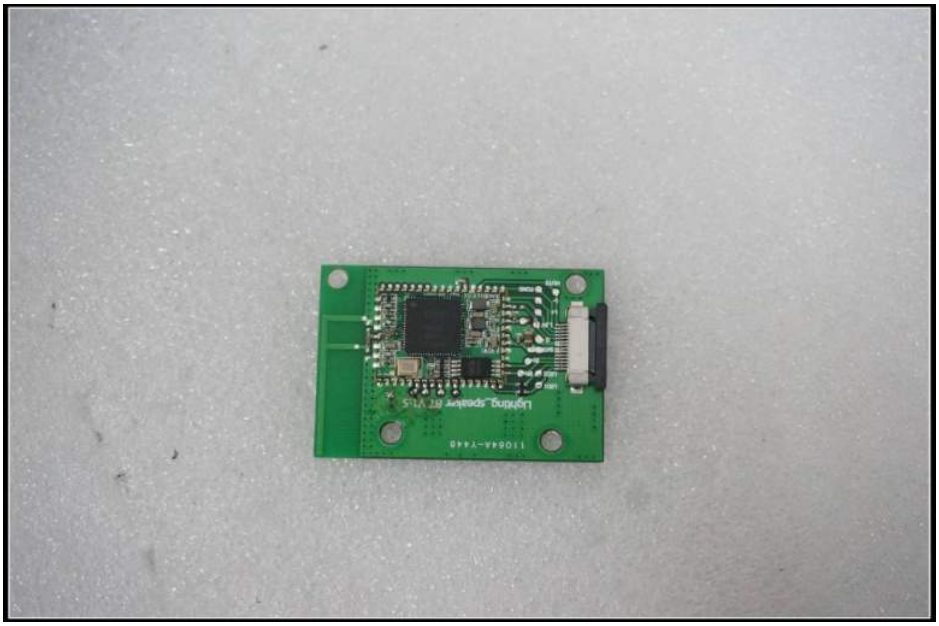


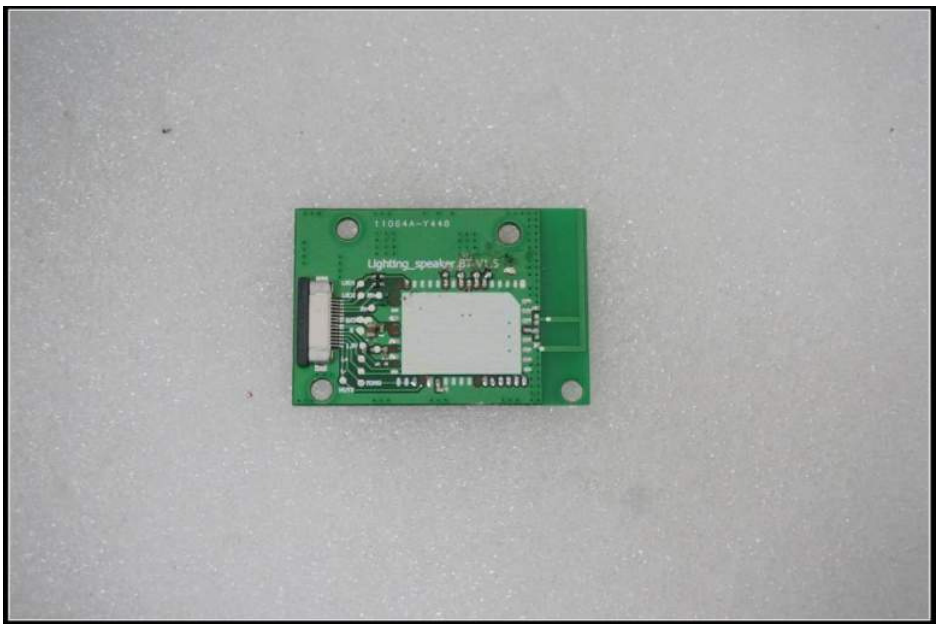


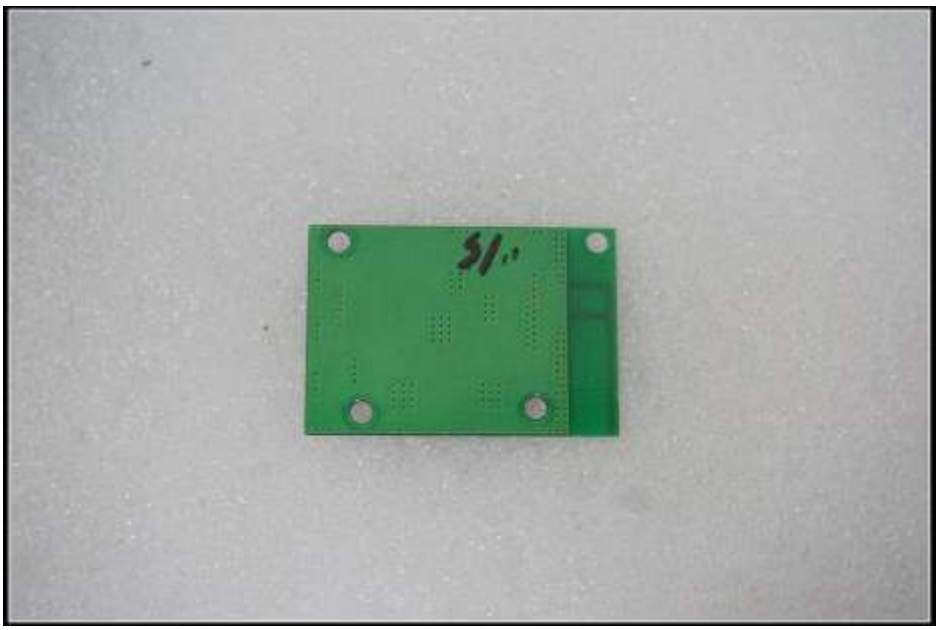


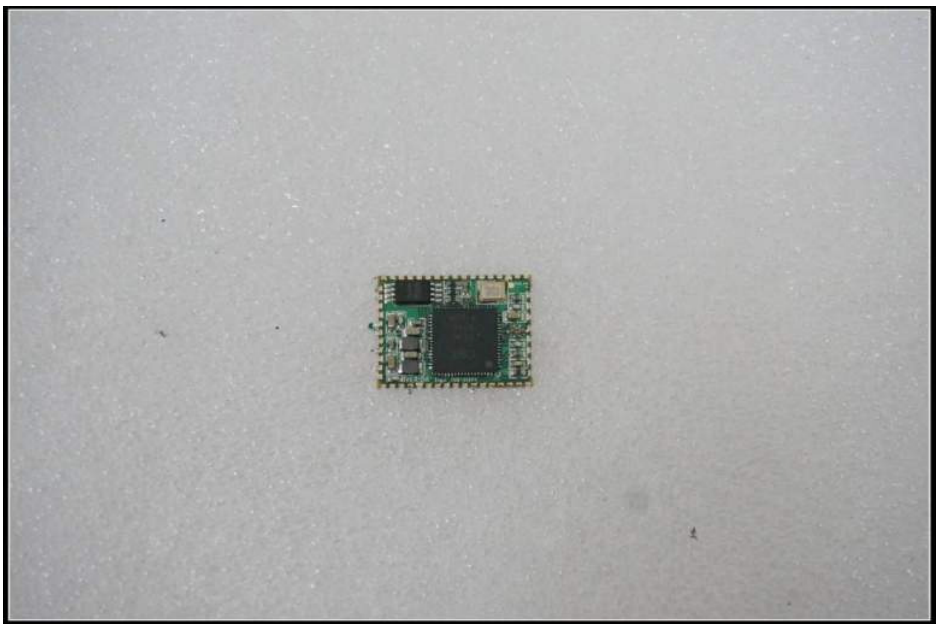


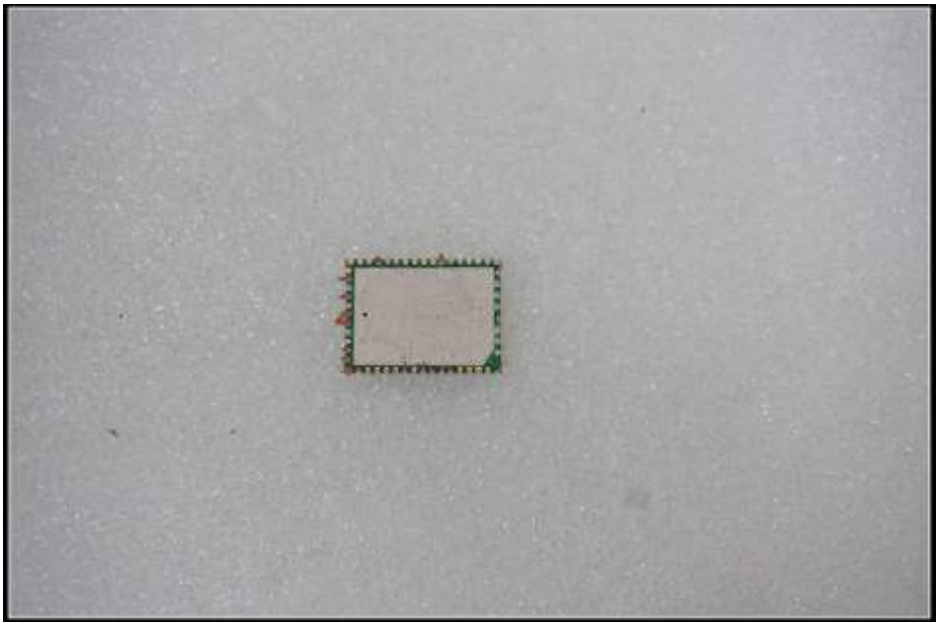












--End of Report--