SGS-CSTC Standards Technical Services Ltd.

198 Kezhu Road, Scientech Park, Guangzhou Economic & Technological Development District, Guangzhou, China 510663
Telephone: +86 (0) 20 82155555
Fax: +86 (0) 20 82075059
Email: sgs_internet_operations@sgs.com

TEST REPORT

Application No.:	GLEMO1004001150RF
Applicant:	Oticon A/S
Equipment Under Test (EUT):	
EUT Name:	TV adapter
Item No.:	TV75-02
Trade Marks:	Oticon, Bernafon & PhonicEar
IC:	1350B-TVBOX02
♣	Please refer to section 3 of this report which indicates which item was actually tested and which were **electrically** identical.
Radio Function:	Bluetooth
Standards:	RSS-210 Issue 7: June 2007 RSS-Gen Issue 2: June 2007
Date of Receipt:	2010-04-30
Date of Test:	2010-05-05 to 2010-05-10
Date of Issue:	2010-05-10
Test Result :	**Pass***

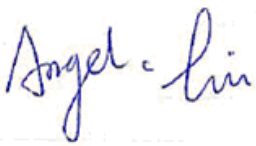
* In the configuration tested, the EUT detailed in this report complied with the standards specified above. Please refer to section 3 of this report for further detail.

Authorized Signature:

Stephen Guo
Manager

2 Version

Revision Record				
Version	**Chapter**	**Date**	**Modifier**	**Remark**
00		2010-05-10		Original

Authorized for issue by:				
Tested By		 **(David Liu) /Signature**		2010-05-05 to 2010-05-10 **Date**
Prepared By		 **(Angel Liu) /Signature**		2010-05-10 **Date**
Checked By		 **(Jeffrey Chen) /Signature**		2010-05-10 **Date**

3 Test Summary

TEST	TEST REQUIREMENT	STANDARD PARAGRAPH	RESULT
Antenna requirement	RSS-Gen	7.1.4	PASS
Occupied Bandwidth	RSS-210	A8.1(b)	PASS
Carrier Frequencies Separated	RSS-210	A8.1(b)	PASS
Hopping Channel Number	RSS-210	A8.1(d)	PASS
Dwell Time	RSS-210	A8.1(d)	PASS
Maximum Peak Output Power	RSS-210	A8.4(2)	PASS
Conducted Emission	RSS-Gen	7.2.2	PASS
Conducted Spurious Emission (30MHz to 25GHz)	RSS-210	A8.5	PASS
Exposure of Humans to RF Fields	RSS-Gen	5.5	PASS
Radiated Spurious Emission (30MHz to 25GHz)	RSS-210 RSS-Gen	A8.5 7.2.3	PASS
Band Edges Measurement	RSS-210	A8	PASS

4 Contents

5 General Information

5.1 Client Information

Applicant:	Oticon A/S
Address of Applicant:	Kongebakken 9 DK-2765 Sm ϕ rum Denmark

5.2 General Description of E.U.T.

Product Name:	TV adapter
Model:	TV75-02
Trade Mark:	Oticon, Bernafon & PhonicEar
Number of Channels	79 Channels
Channel Separation	1 MHz
Type of Modulation	GFSK, (π/4)QPSK, 8DPSK
Dwell time	Per channel is less than 0.4s.
Antenna Type	Integral
Antenna gain:	1.9dBi
Specialty:	Bluetooth V2.1+EDR
Power Supply:	DC 5.0V 200mA
Power Supply information supplied:	Model: UE050217HKKK1-R1 Input: 100-240V~ 50/60Hz 150mA Output: DC 5.0V 200mA

5.3 Description of Support Units

The EUT has been tested with CBT for fixed frequency by testing lab.

5.4 Standards Applicable for Testing

The customer requested RSS tests for the EUT.

The standard used was RSS-210 Issue 7: June 2007; RSS-Gen Issue 2: June 2007.

5.5 Test Facility

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

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

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

Date of Registration: Sep. 08, 2008. Valid until Sep 08, 2010.

5.6 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou 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.

5.7 Deviation from Standards

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

5.8 Abnormalities from Standard Conditions

None.

5.9 Monitoring of EUT for All Immunity Test

None.

6 Equipment Used during Test

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	N/A	N/A
EMC0522	EMI Test Receiver	Rohde & Schwarz	ESIB26	100283	2010-01-25	2011-01-25
EMC0056	EMI Test Receiver	Rohde & Schwarz	ESCI	10036	2009-07-18	2010-07-18
N/A	EMI Test Software	Audix	E3	N/A	N/A	N/A
EMC0514	Coaxial cable	SGS	N/A	N/A	2009-12-09	2010-12-09
EMC0524	Bi-log Type Antenna	Schaffner -Chase	CBL6112B	2966	2009-12-20	2010-12-20
EMC0519	Bilog Type Antenna	Schaffner -Chase	CBL6143	5070	2009-12-20	2010-12-20
EMC0517	Horn Antenna	Rohde & Schwarz	HF906	100095	2009-09-15	2010-09-15
EMC0040	Spectrum Analyzer	Rohde & Schwarz	FSP30	100324	2009-12-05	2010-12-05
EMC0521	1-26.5 GHz Pre-Amplifier	Agilent	8449B	3008A01649	2010-01-25	2011-01-25
EMC0049	Amplifier	Agilent	8447D	2944A10862	2010-02-23	2011-02-23
EMC0075	310N Amplifier	Sonama	310N	272683	2009-10-26	2010-10-26
EMC0523	Active Loop Antenna	EMCO	6502	42963	2009-11-17	2010-11-17
EMC0530	10m Semi- Anechoic Chamber	ETS	N/A	N/A	2009-06-02	2010-06-02

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	2009-12-16	2010-12-16
EMC0007	DMM	Fluke	73	70671122	2009-12-16	2010-12-16

	Reference Equipment				
No:	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date
No. 1	CBT Bluetooth Tester	Rohde & Schwarz	N/A	N/A	2009.12.23
No. 2	Power Splitter	Agilent	N/A	N/A	N/A

7 Test Results

7.1 E.U.T. test conditions

Power supply: AC 120V 60Hz

Type of antenna: Integral

Operating Environment:

Temperature: 20.0 -25.0 °C

Humidity: 38-50 % RH

Atmospheric Pressure: 1000 -1010 mbar

EUT channels and frequencies list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	14	2416	28	2430
1	2403	15	2417	29	2431
2	2404	16	2418	30	2432
3	2405	17	2419	31	2433
4	2406	18	2420	32	2434
5	2407	19	2421	33	2435
6	2408	20	2422	34	2436
7	2409	21	2423	35	2437
8	2410	22	2424	36	2438
9	2411	23	2425	37	2439
10	2412	24	2426	38	2440
11	2413	25	2427	39	2441
12	2414	26	2428	40	2442
13	2415	27	2429	41	2443

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
42	2444	55	2457	68	2470
43	2445	56	2458	69	2471
44	2446	57	2459	70	2472
45	2447	58	2460	71	2473
46	2448	59	2461	72	2474
47	2449	60	2462	73	2475
48	2450	61	2463	74	2476
49	2451	62	2464	75	2477
50	2452	63	2465	76	2478
51	2453	64	2466	77	2479
52	2454	65	2467	78	2480
53	2455	66	2468		
54	2456	67	2469		

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

7.2 Antenna Requirement

7.2.1 Standard requirement

RSS GEN section 7.1.4

A transmitter can only be sold or operated with antennas with which it was certified.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 or RSS-210 Annex 9, the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

7.2.2 EUT Antenna

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 1.9dBi.

Test result: The unit does meet the RSS requirements.

7.3 Occupied Bandwidth

Test Requirement: RSS-210

Test Method: Based on RSS Gen & RSS 210:

Test Status: Test in continuous transmitting mode at lowest, middle and highest channel.

Pre-test the EUT in transmitting mode in different modulation types with different data packages reported the worst case.

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 3 times the 20dB bandwidth, centered on a hopping channel;
3. Set the spectrum analyzer: RBW >= 1% of the 20dB bandwidth (set 100kHz). VBW >= RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and -20dB points or 99% bandwidth.

Test result:

Normal mode:

Test Channel	99% bandwidth(MHz)
Lowest	0.992
Middle	0.992
Highest	0.982

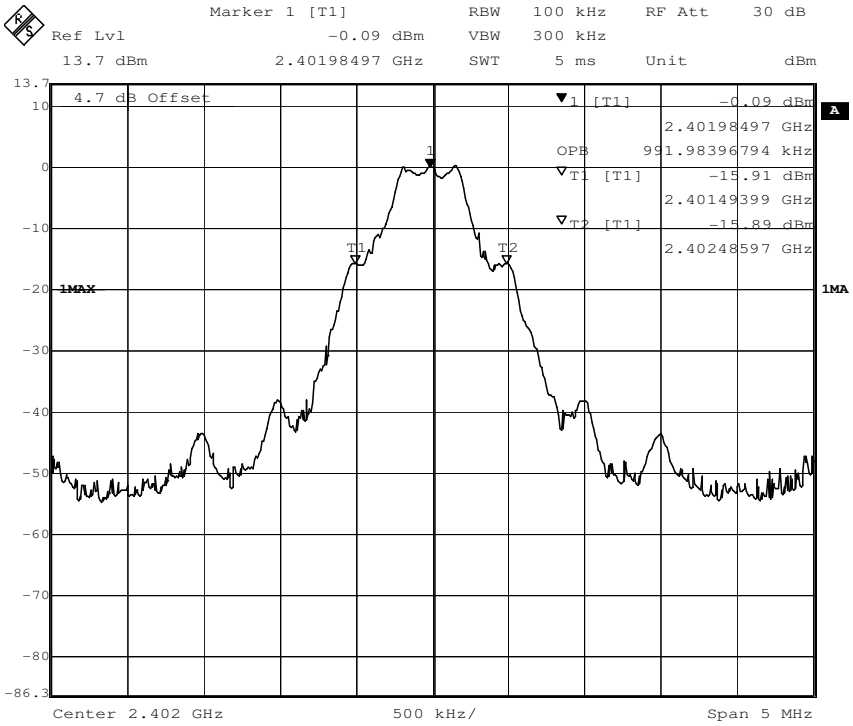
EDR mode:

Test Channel	bandwidth(MHz)
Lowest	1.222
Middle	1.222
Highest	1.222

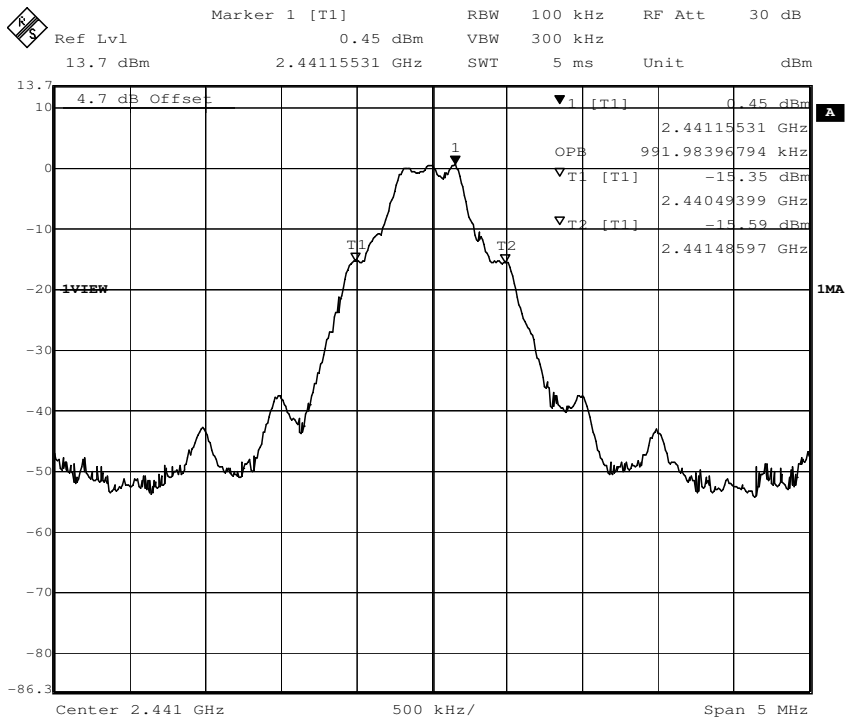
Result plot as follows:

DH5:

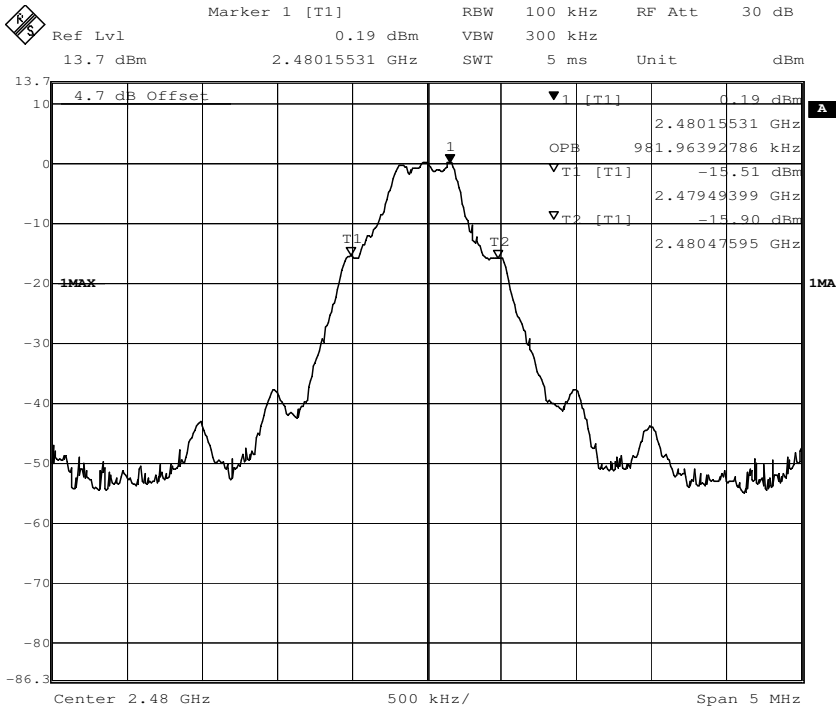
Lowest Channel:



Middle Channel:

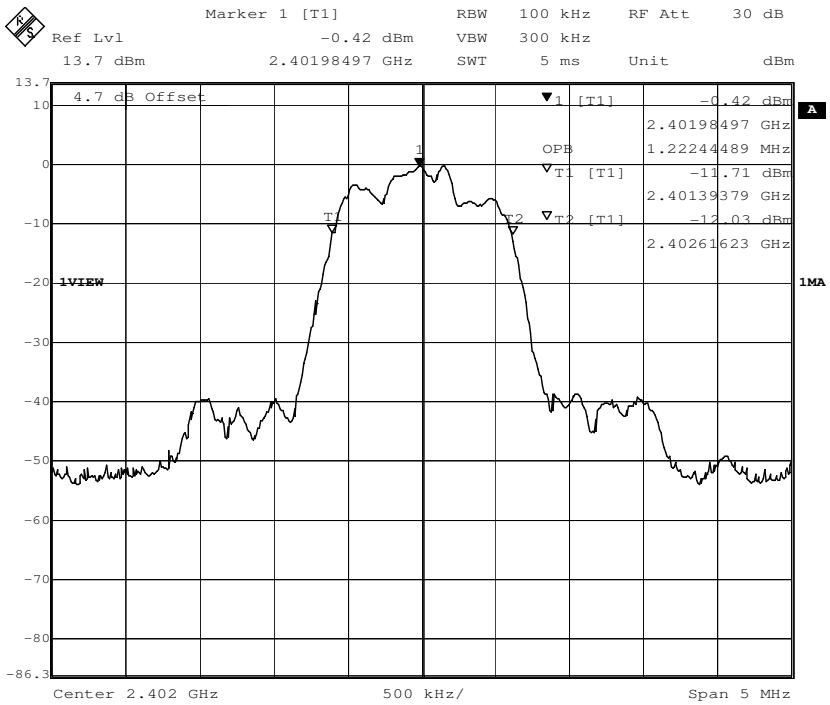


Highest Channel:

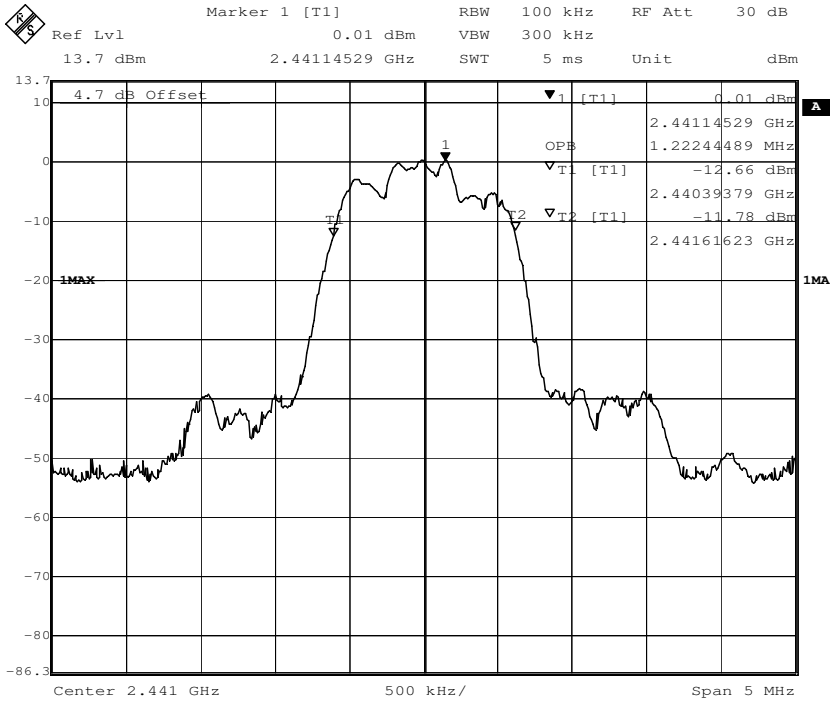


3DH5:

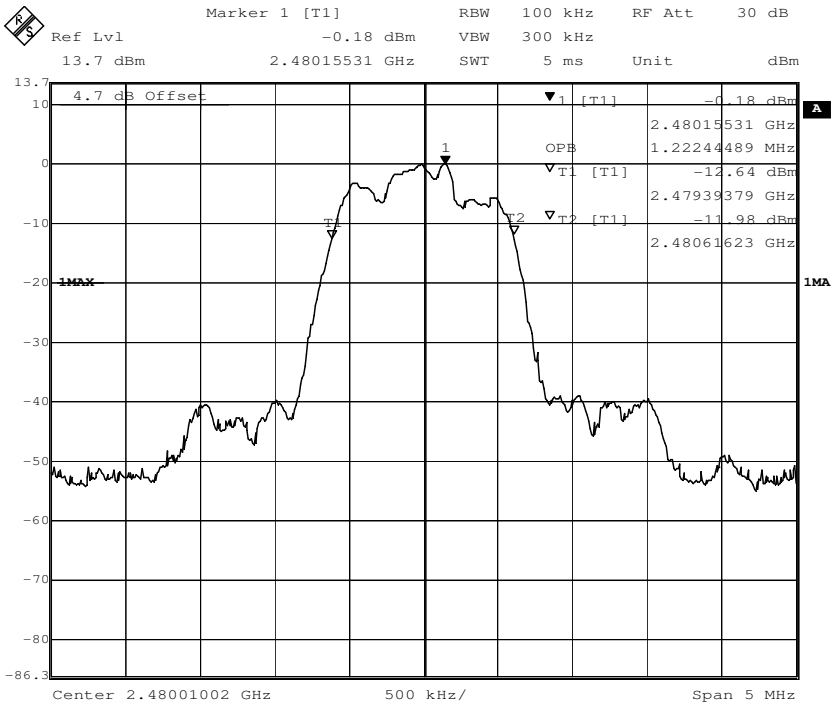
Lowest channel:



Middle channel:



Highest channel:



7.4 Carrier Frequencies Separated

Test Requirement: RSS 210 A8.1(2)

Test Method: Base on RSS 210 A8.1

Test requirements: 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 0.125 W.

Test Status: Test in hopping transmitting operating mode.

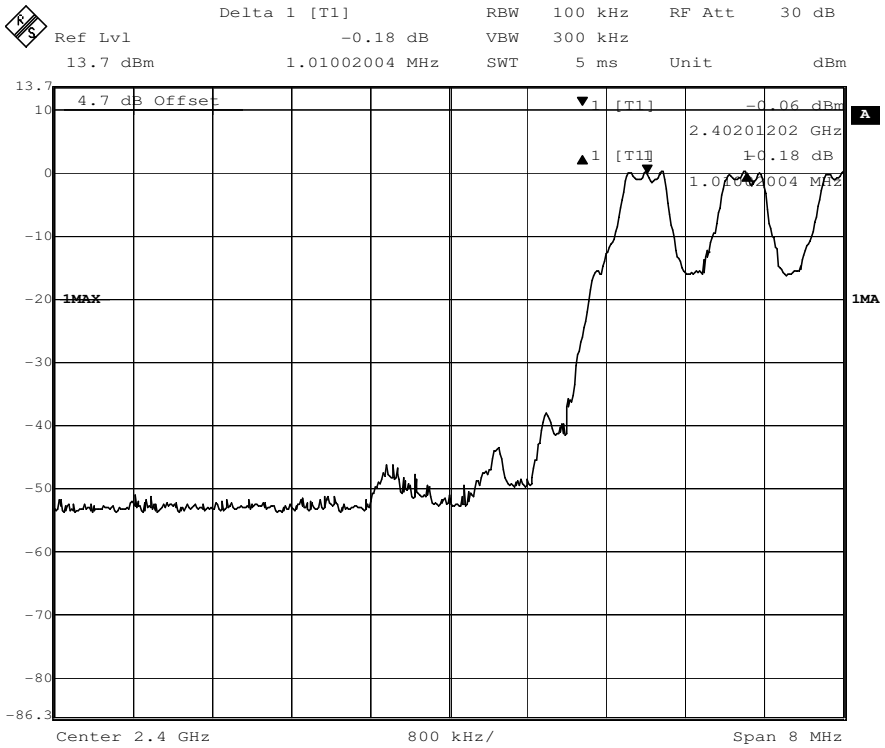
Test Procedure:

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.

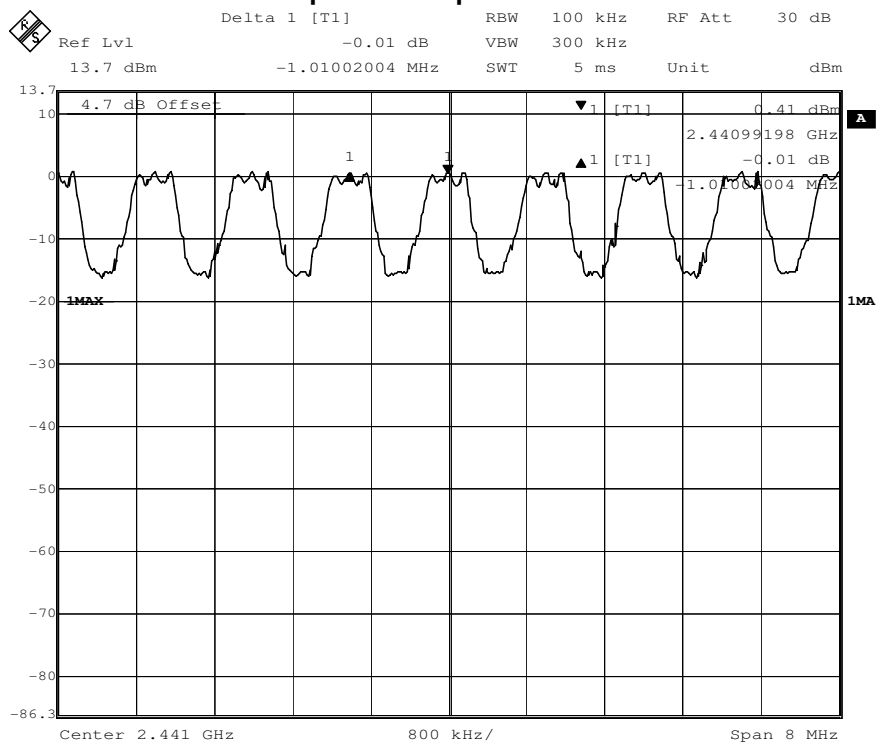
Test result:

Test Channel	Carrier Frequencies Separated	PASS/FAIL
Lower Channels (channel 0 and channel 1)	1.010 MHz	Pass
Middle Channels (channel 39 and channel 40)	1.010 MHz	Pass
Upper Channels (channel 77 and channel 78)	1.010 MHz	Pass

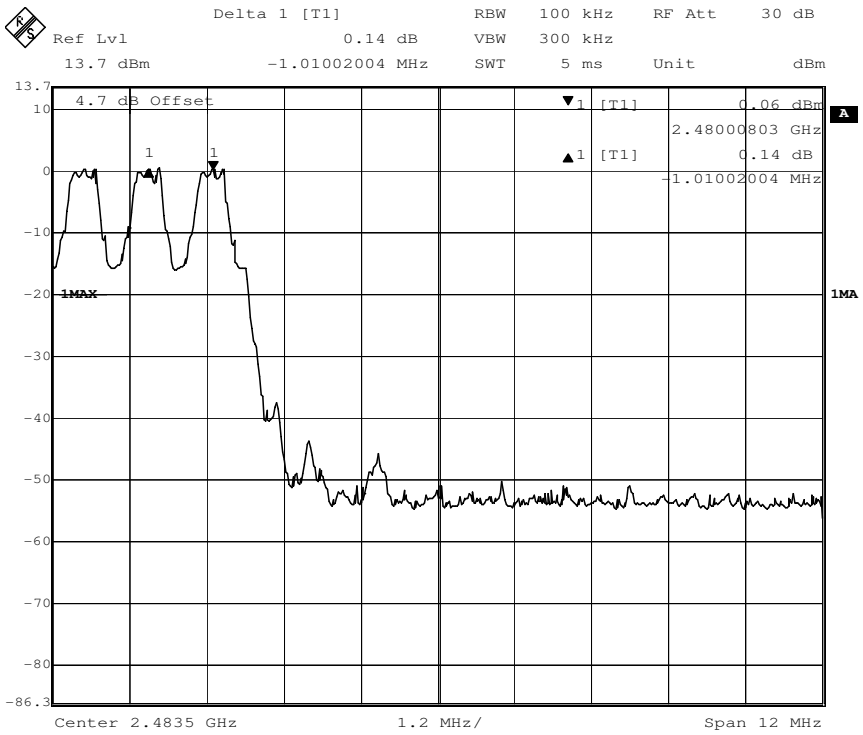
1. Lowest Channels: **Carrier Frequencies Separated**



2. Middle Channels: **Carrier Frequencies Separated**



3. Highest Channels: **Carrier Frequencies Separated**



Test result: The unit does meet the FCC requirements.

7.5 Hopping Channel Number

Test Requirement: RSS 210 8.1(4)

Test Method: Based on RSS 210 8.1

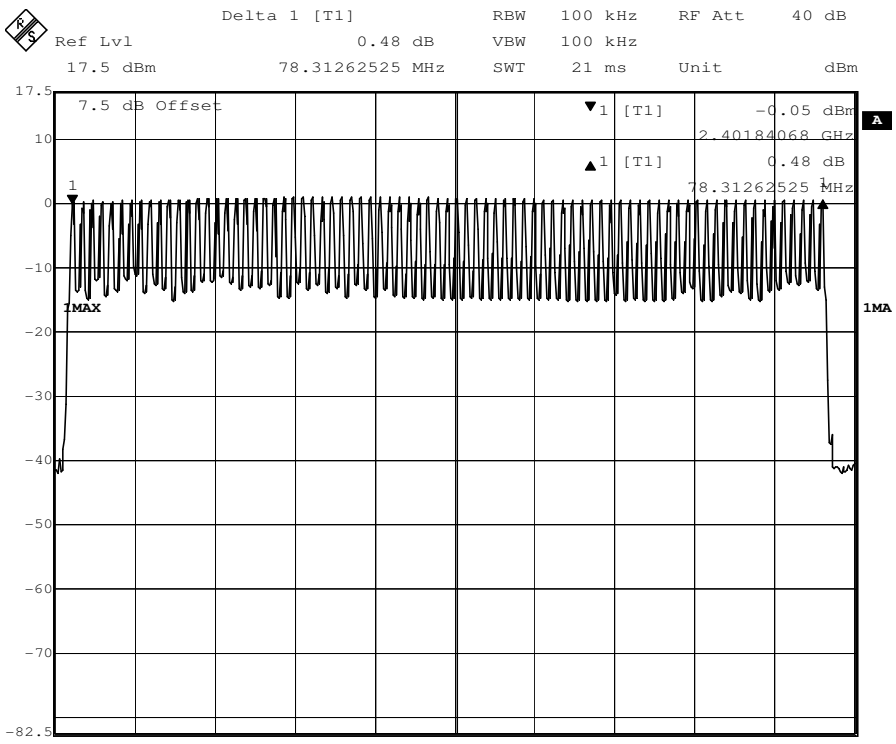
Requirements: Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 hopping channels.

Test Status: Test the EUT in hopping on mode.

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 = 2400MHz. stop frequency = 2483.5MHz. Submit the test result graph.

Test result: Total channels are 79 channels.



Test result: The unit does meet the RSS requirements.

7.6 Dwell Time

Test Requirement: RSS 210 A8.1(4)

Test Method: Based on RSS 210 A8.1

Test requirements: Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 hopping 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Test Status: Test the EUT in continuous transmitting mode at the lowest (2402MHz), middle (2441MHz) and highest (2480MHz) channel with different packages, find the worst case is 8DPSK mode.

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 = 1MHz and VBW = 1MHz.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 = (0.413+0.142) (ms) * (1600/(2*79)) * 31.6 = 177.600ms

3DH3 time slot = (1.665+0.142) (ms) * (1600/(4*79)) * 31.6 = 289.120ms

3DH5 time slot = (2.916+0.120) (ms) * (1600/(6*79)) * 31.6 = 323.840ms

2. **Channel 39:** 2.441GHz

3DH1 time slot = (0.413+0.142) (ms) * (1600/(2*79)) * 31.6 = 177.600ms

3DH3 time slot = (1.665+0.162) (ms) * (1600/(4*79)) * 31.6 = 292.320ms

3DH5 time slot = (2.916+0.120) (ms) * (1600/(6*79)) * 31.6 = 323.840ms

3. **Channel 78:** 2.480GHz

3DH1 time slot = (0.413+0.142) (ms) * (1600/(2*79)) * 31.6 = 177.600ms

3DH3 time slot = (1.665 +0.142)(ms) * (1600/(4*79)) * 31.6 = 289.120ms

3DH5 time slot = (2.916+0.120) (ms) * (1600/(6*79)) * 31.6 = 323.840ms

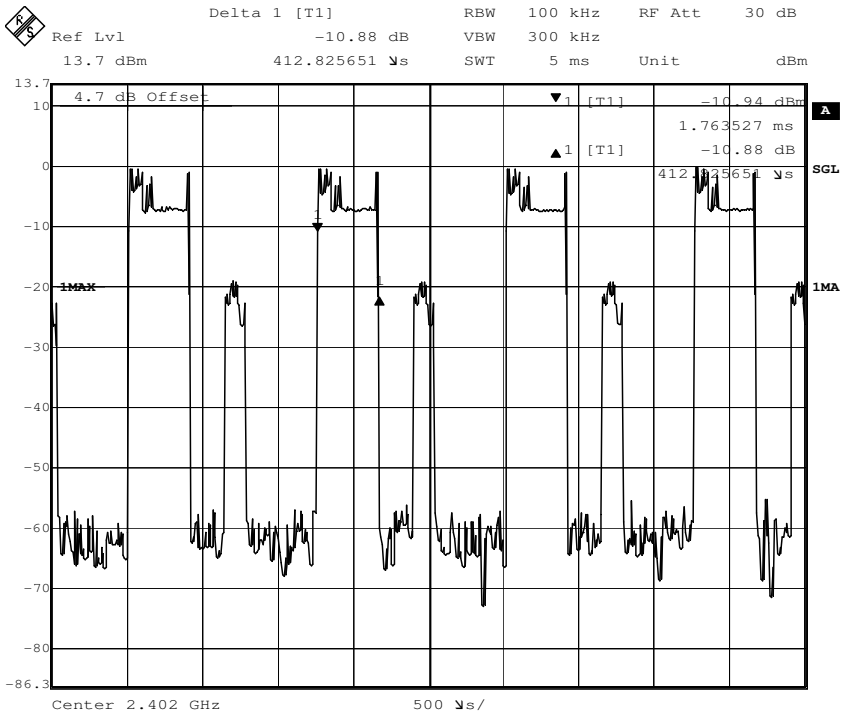
The results are not greater than 0.4 seconds.

The unit does meet the RSS requirements.

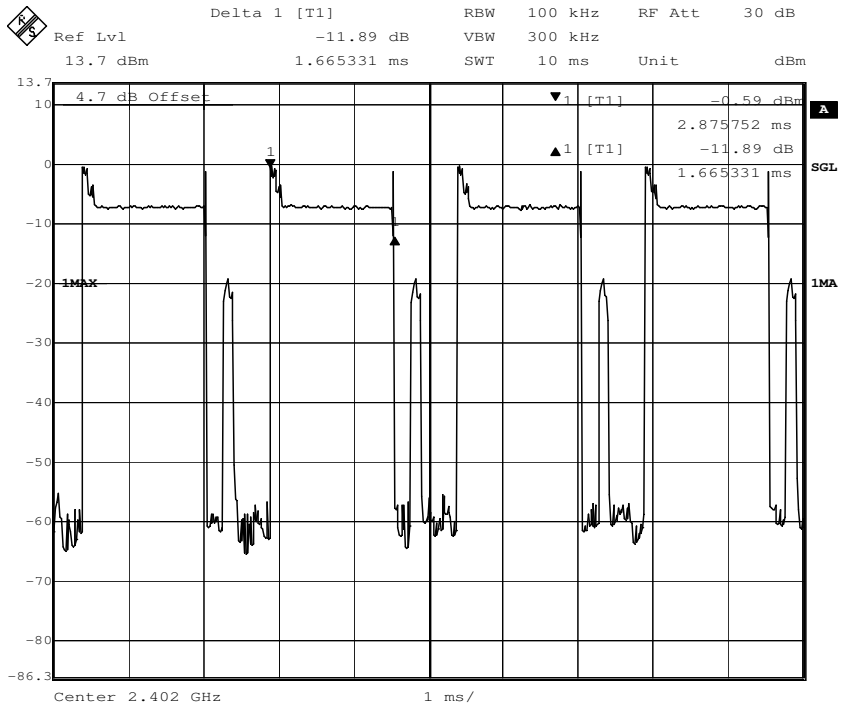
Please refer the graph as below:

1. Lowest channel (2.402 GHz):

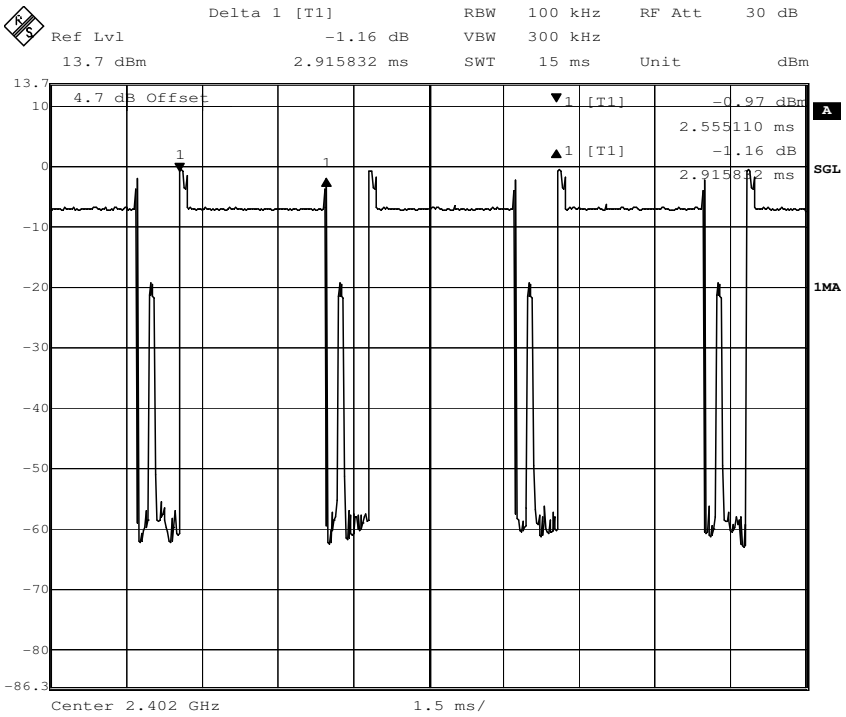
(1). 3DH1



(2) 3DH3

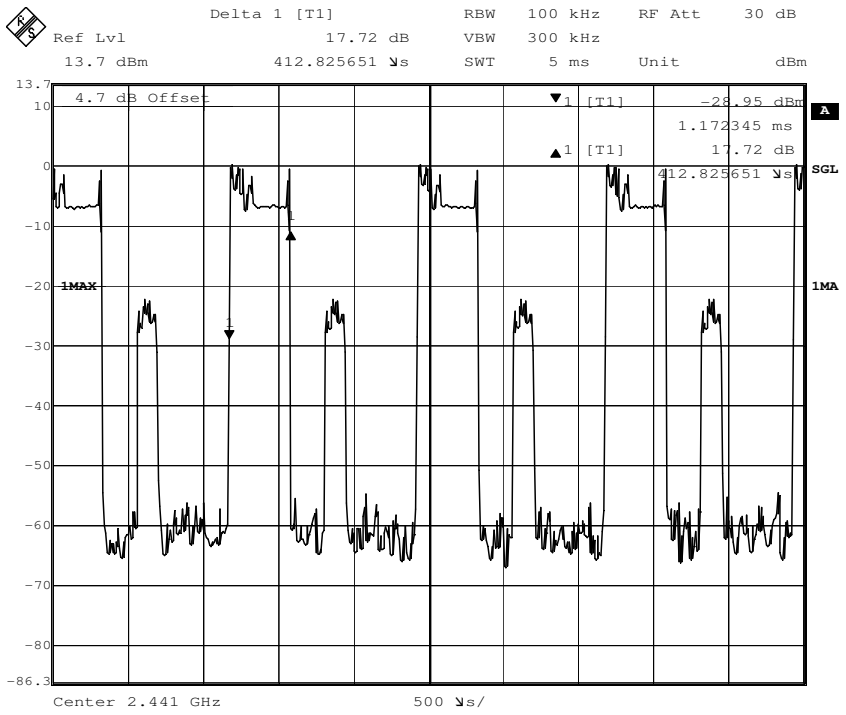


(3) 3DH5

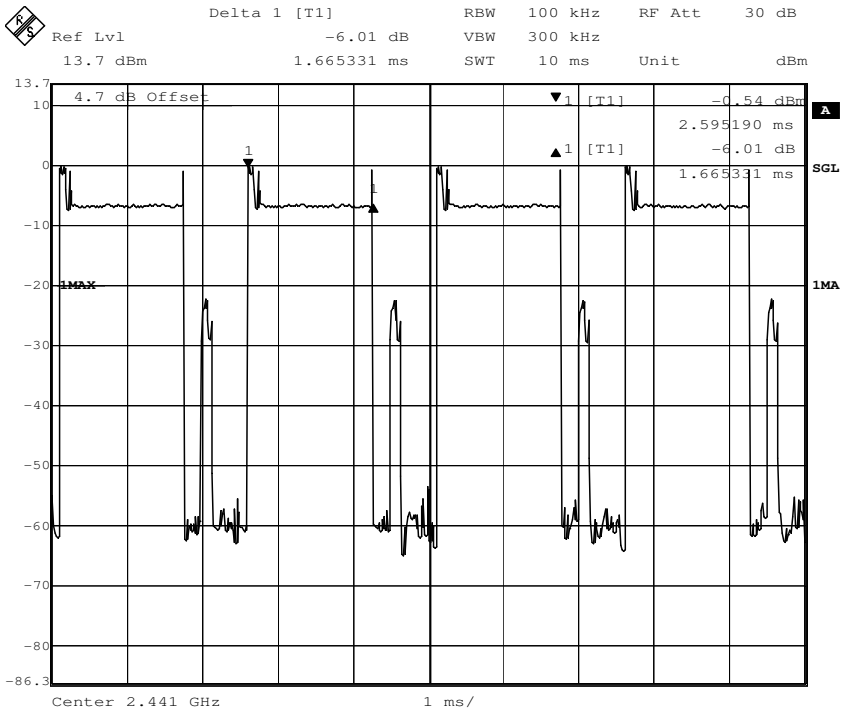


2. Middle Channel (2.441GHz)

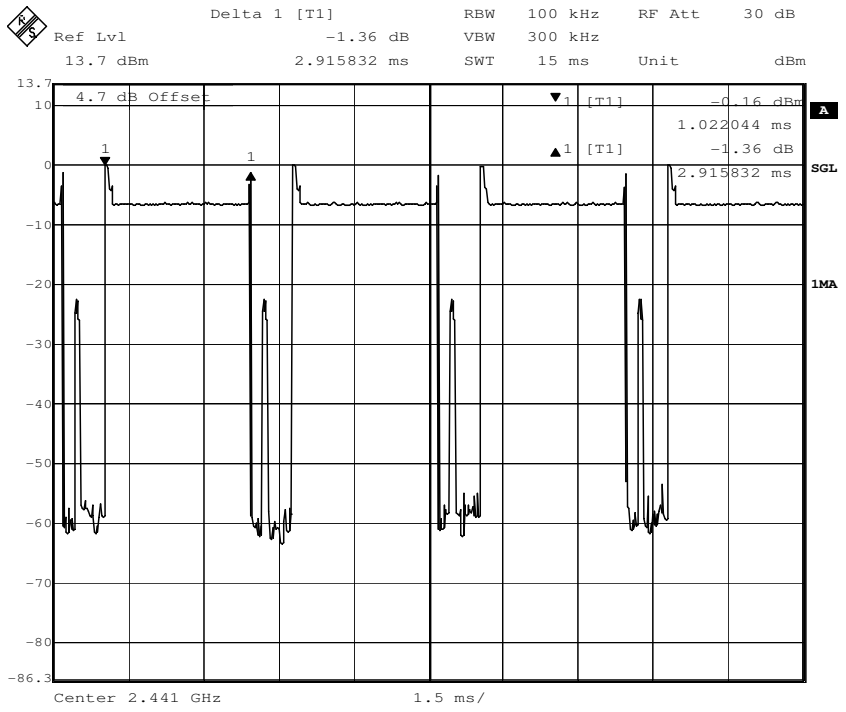
(1). 3DH1



(2) 3DH3

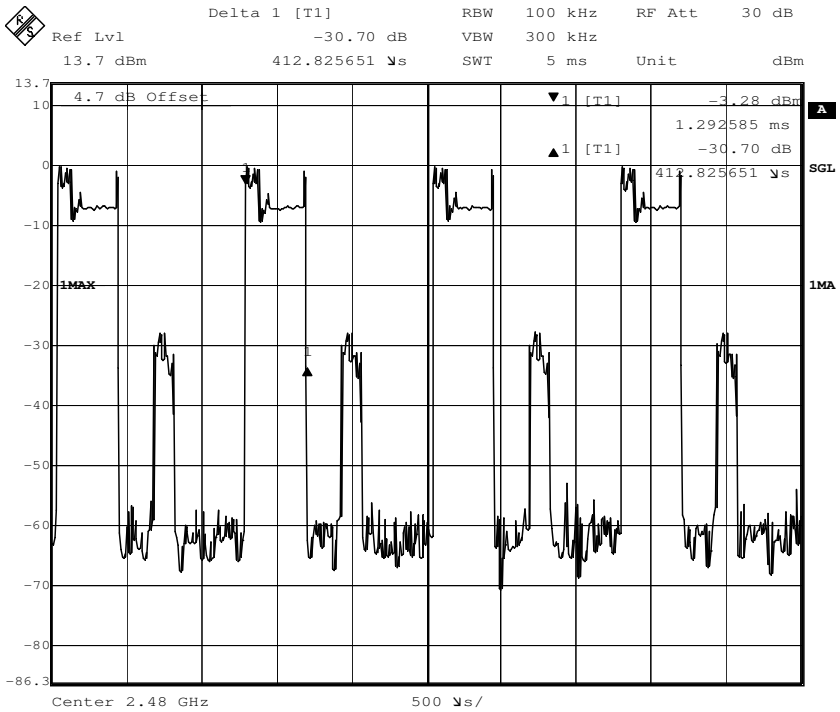


(3) 3DH5

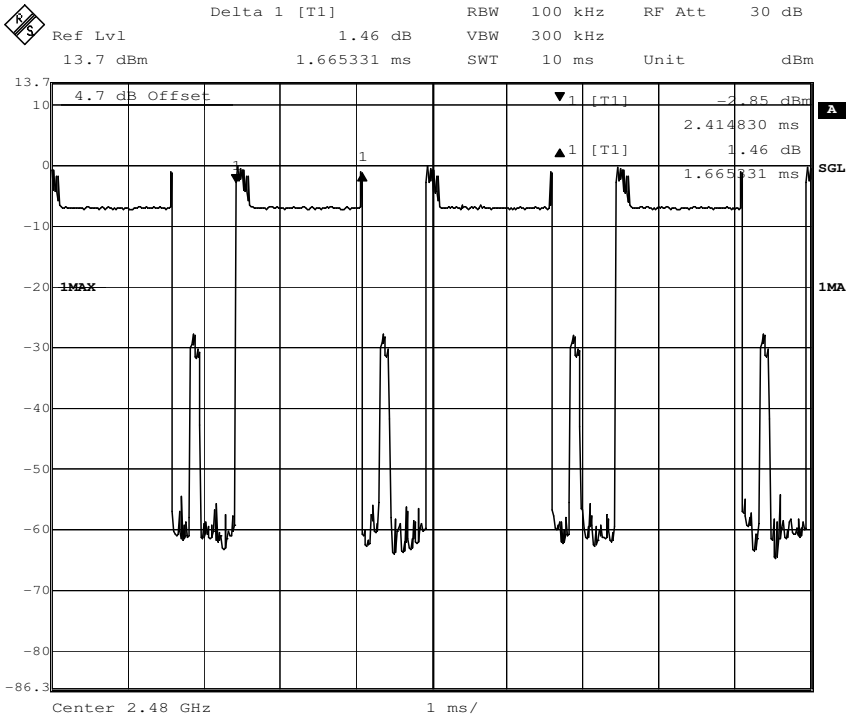


3. Highest Channel (2.480GHz)

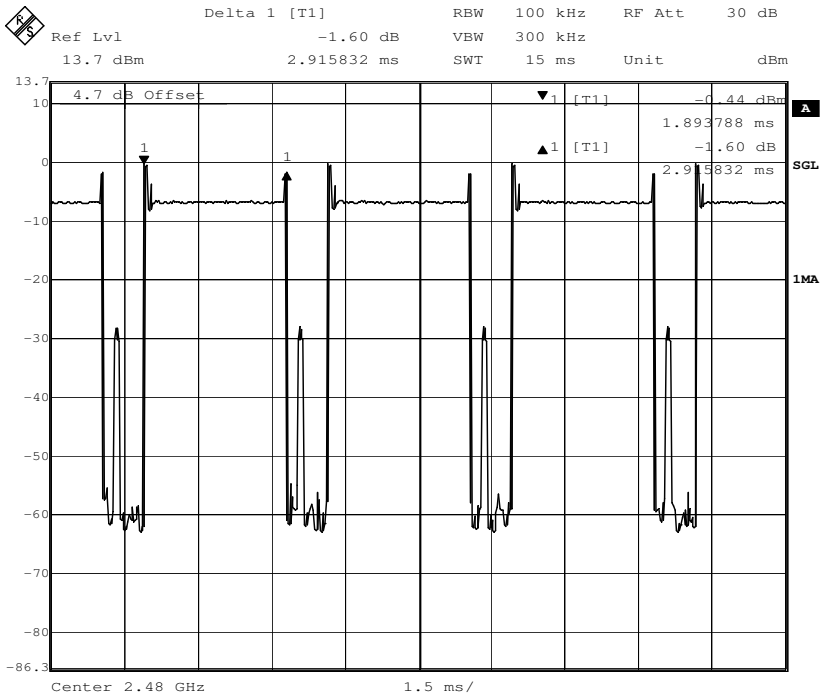
(1). 3DH1



(2) 3DH3



(3) 3DH5



Remark:

In communication data link mode (expect inquiry or page mode) the hopping rate is 1600 per second, the 79 channels will be randomly selected for RF channel, and each channel have equal probability to be selected. The hop selection scheme is defined in Clause 2.6 of Part B of Volume 2 of core specification of Bluetooth.

The Dwell time must be calculated via following formula:

Dwell time = Pulse wide x (Hopping rate / Number of channels) x Period

Period = 0.4 (seconds/ channel) x 79 (channel) = 31.6 seconds

So

Dwell time DH1= slot time * (1600/2/79) * 31.6

Dwell time DH3= slot time * (1600/4/79) * 31.6

Dwell time DH5= slot time * (1600/6/79) * 31.6

The RF channel will remain fixed for duration of a packet, that means for DH3 packet the RF frequency will remain unchanged during 3 slots (1slot=1/1600=625us), and for DH5 packet the RF frequency will remain unchanged during 5 slots, illustrated the principle as below:

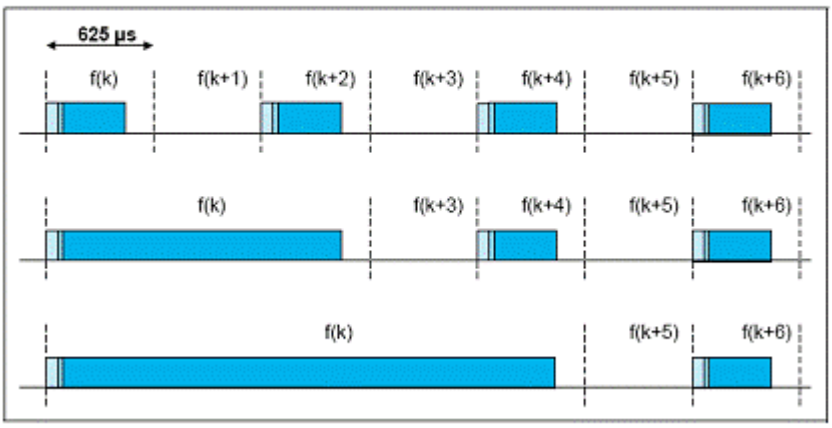


Figure 2.14: Single- and multi-slot packets.

Therefore, in a certain period for different packet types, the quantities of hops (not hopping rate 1600) are different, accurately, the quantity of hops for DH1 is double of DH3's and triple of DH5's.

"for DH1 packet, 1 hop in 1 slot; for DH3 packet, ½ hop in 1 slot; for DH5 packet, 1/3 hop in 1 slot.", explained as below:

From the illustrated hopping scheme:

For DH1, in two slots, there are two hops, i.e. f(k) in Slot(k), f(k+1) in Slot(k+1), means DH1 1 hop in 1 slot;

For DH3, in four slots, there are two hops, i.e. f(k) in Slot(k) & Slot(k+1) & Slot(k+2), f(k+3) in Slot(k+3), means DH3 2 hops in four slots -> ½ hop in 1 slot;

For DH5, in six slots, there are two hops, i.e. f(k) in Slot(k) & Slot(k+1) & Slot(k+2) & Slot(k+3) & Slot(k+4), f(k+5) in Slot(k+5), means DH3 2 hops in six slots -> 1/3 hop in 1 slot.

The Hopping rate in the formula should not be fixed value, for DH1, it is 1600/2; for DH3, it is 1600/4; for DH5, it is 1600/6.

To calculate Dwell time of data transmission of Bluetooth system, the worst case is for Bluetooth PICONET that contains two devices only (although Bluetooth PICONET can support up to eight devices), and for Bluetooth data transmission, after device A sending a packet to device B, device A must get response packet from device B to continue data transmission;

For DH1 packet: assume device A is EUT, the worst case is after device A sending a DH1 packet to device B, device A gets a DH1 response packet from device B, that means device A needs 1 time slot for transmitting and 1 time slot for receiving, therefore, the actual hopping rate of device A is half of 1600, i.e. 800 hops per second for EUT;

For DH3 packet: assume device A is EUT, the worst case is after device A sending a DH3 packet to device B, device A gets a DH1 response packet from device B, that means device A needs 3 time slots for transmitting and 1 time slot for receiving, therefore, the actual hopping rate of device A is quarter of 1600, i.e. 400 hops per second for EUT;

For DH5 packet: assume device A is EUT, the worst case is after device A sending a DH5 packet to device B, device A gets a DH1 response packet from device B, that means device A needs 5 time slots for transmitting and 1 time slot for receiving, therefore, the actual hopping rate of device A is sixth of 1600, i.e. 1600/6=266.7 hops per second for EUT;

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.

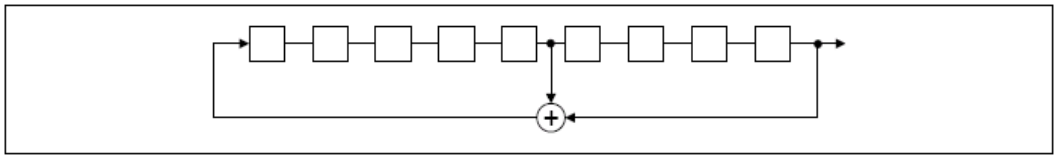
7.7.2 EUT Pseudorandom Frequency Hopping Sequence

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

• Number of shift register stages: 9

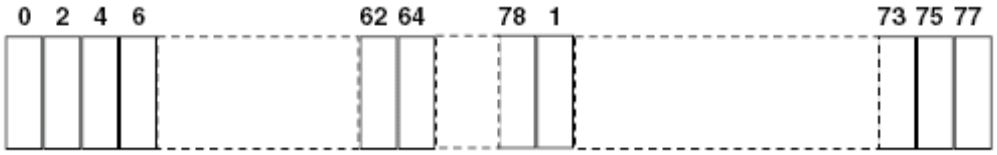
• Length of pseudo-random sequence: 29 -1 = 511 bits

• Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

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

7.8 Maximum Peak Output Power

Test Requirement: RSS 210 A8.4(2)

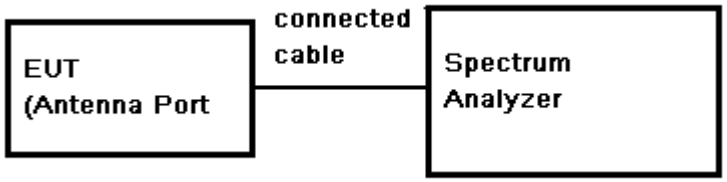
Test Method: Base on RSS Gen & ANSI 63.4.

Test Limit: Regulation A8.4(2) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum conducted output power shall not exceed 1 W. For all other frequency hopping systems, the maximum peak conducted output power shall not exceed 0.125 W.

The non-overlapping hopping channels of EUT over 75, the result refer to the result “Hopping channel number” of this document. So 1 watt limit applies.

Test mode: Pre-test the EUT in transmitting mode in different modulation types with different data packages reported the worst 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 = 2 MHz. VBW = 2 MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

Test Result:

Normal mode:

Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2.402	-0.02	30.0	Pass
Middle	2.441	0.46	30.0	Pass
Highest	2.480	0.22	30.0	Pass

EDR mode:

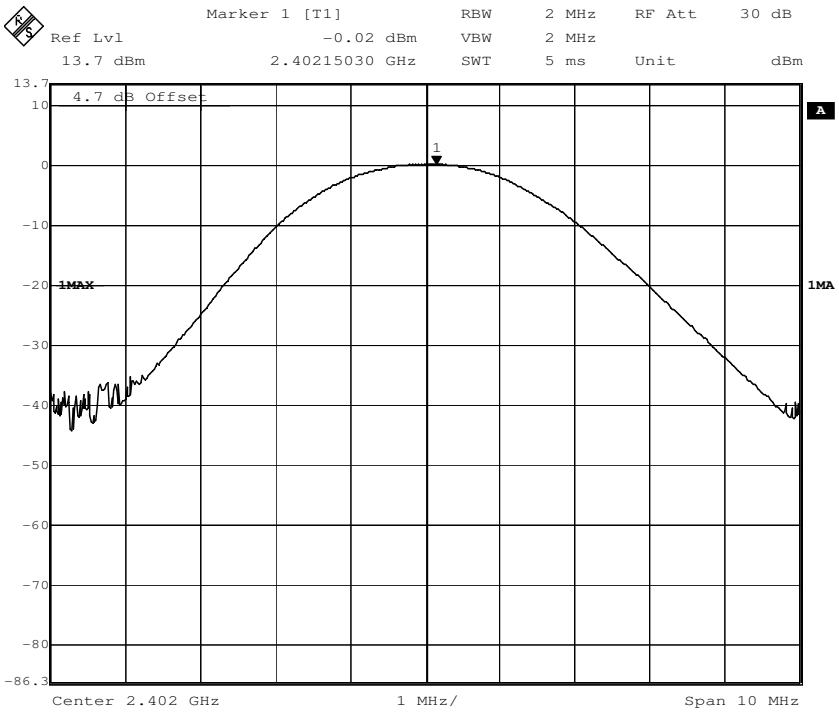
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2.402	1.07	30.0	Pass
Middle	2.441	1.51	30.0	Pass
Highest	2.480	1.22	30.0	Pass

Test result: The unit does meet the FCC requirements.

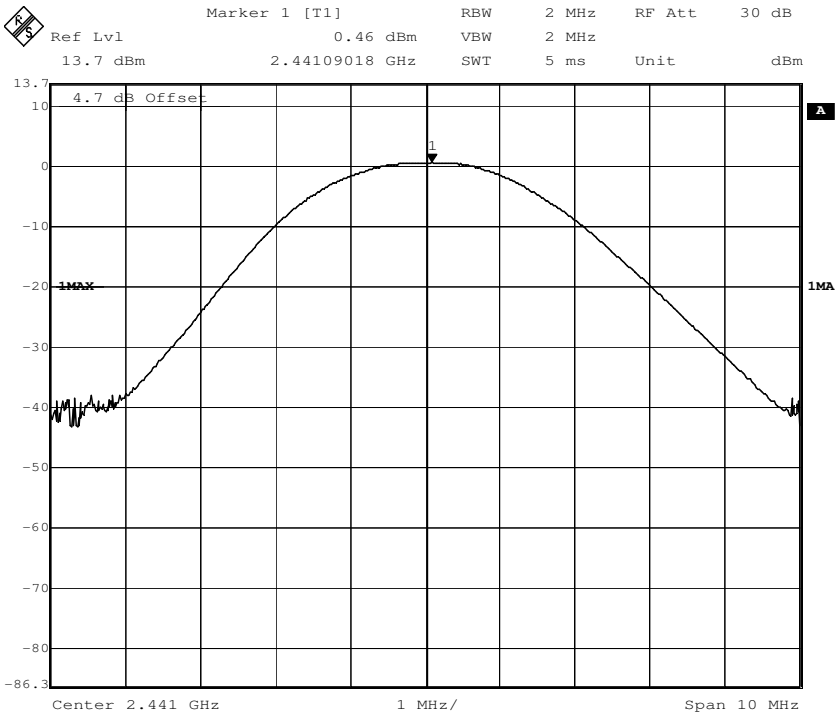
Test result plot as follows:

DH5:

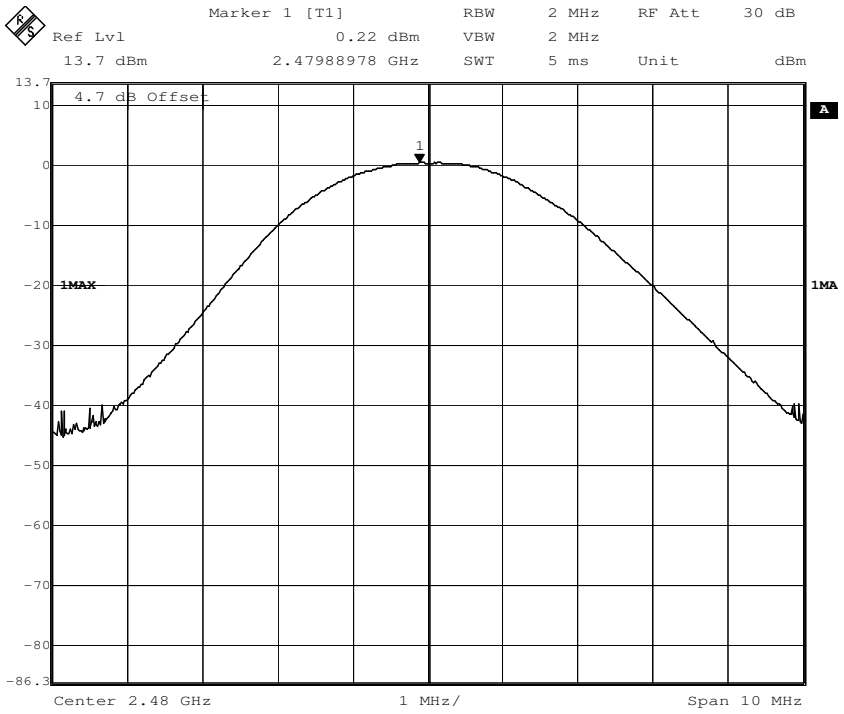
Lowest Channel:



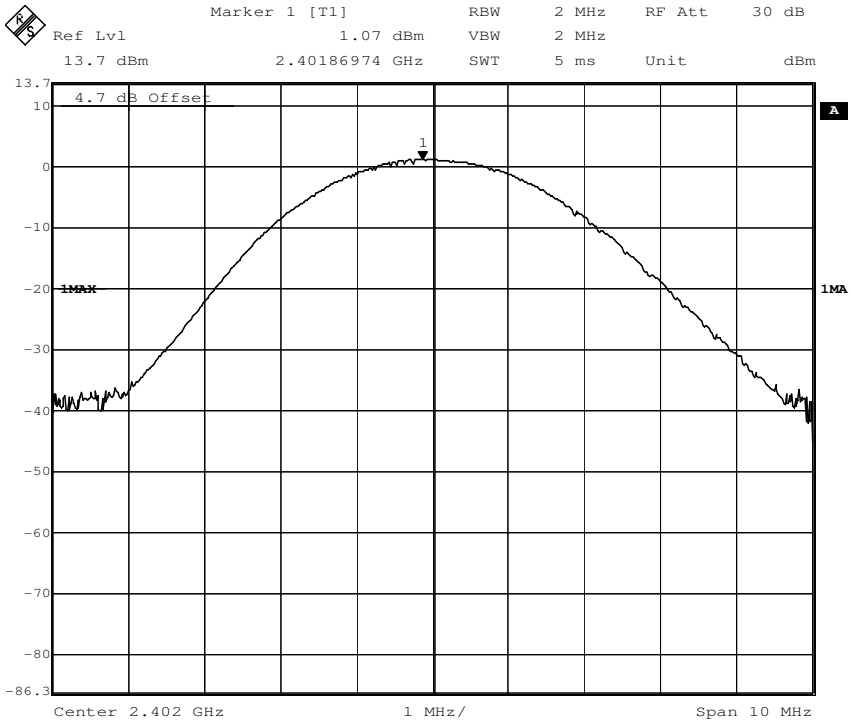
Middle Channel:



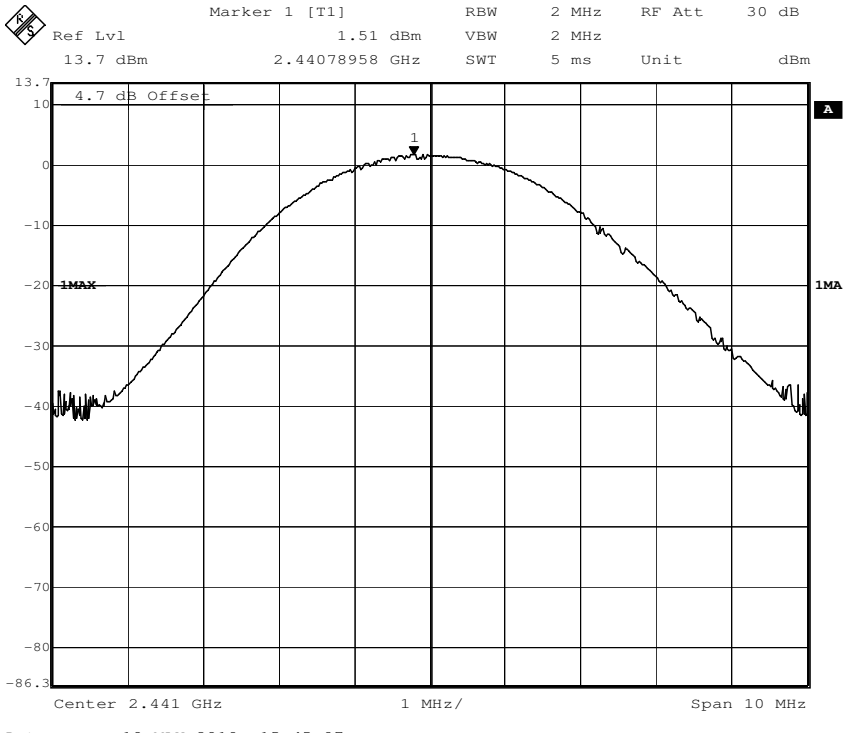
Highest Channel:



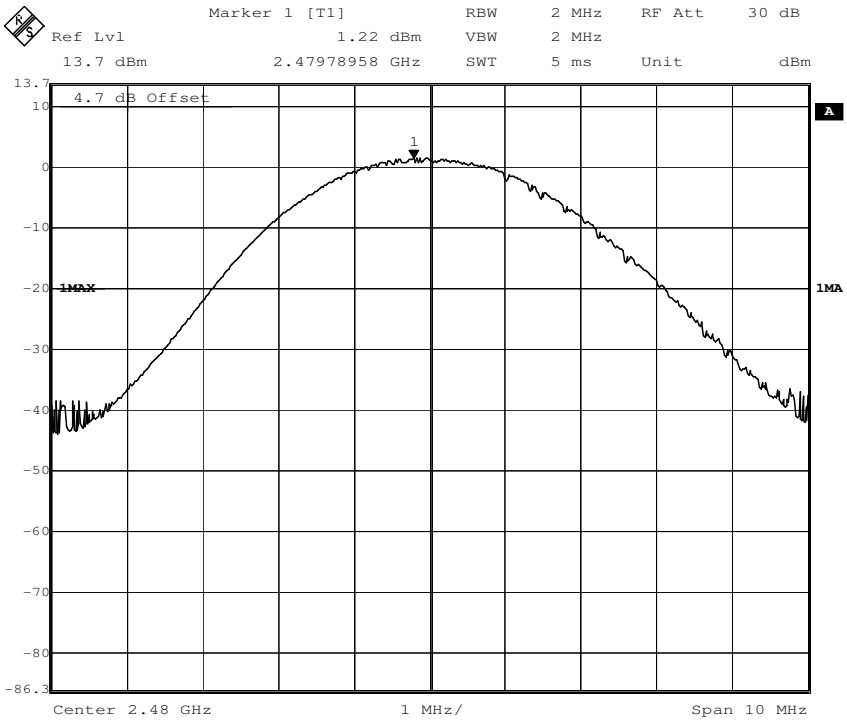
3DH5:
Lowest Channel:



Middle channel:



Highest channel:



7.9 Conducted Spurious Emissions

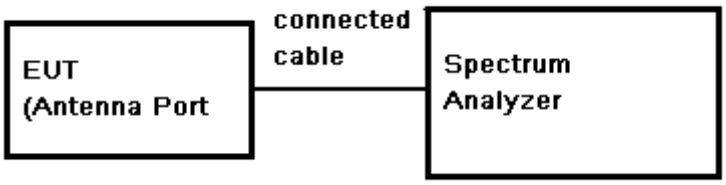
Test Requirement: RSS 210 A8

Test Method: Base on RSS Gen & ANSI 63.4.

Test requirements: (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 Status: Test the EUT in continuous transmitting mode at lowest. Middle, highest channel.
Pre-test the EUT in transmitting mode in different modulation types with different data packages reported the worst case.

Test Configuration:



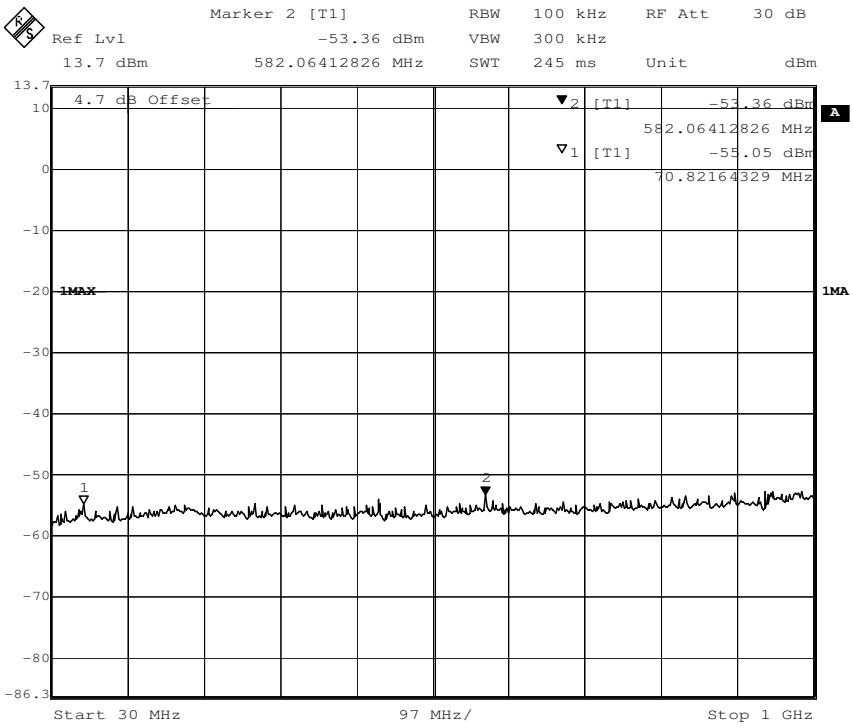
Test Procedure:

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

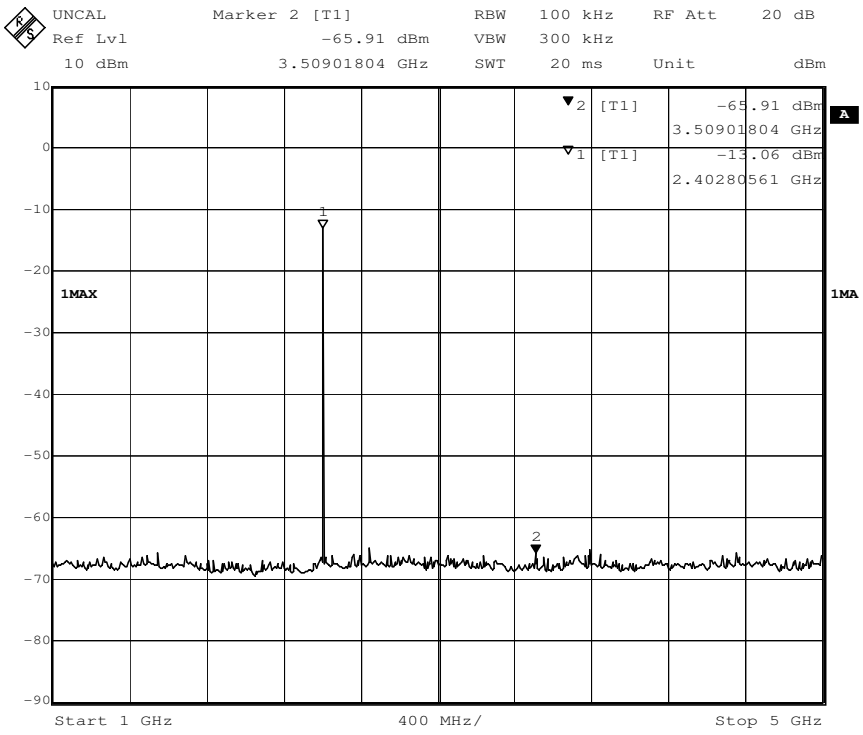
2. Set the spectrum analyzer: RBW = 100KHz. VBW >= RBW. Sweep = auto; Detector Function = Peak (Max. hold).

Test result plot as follows:

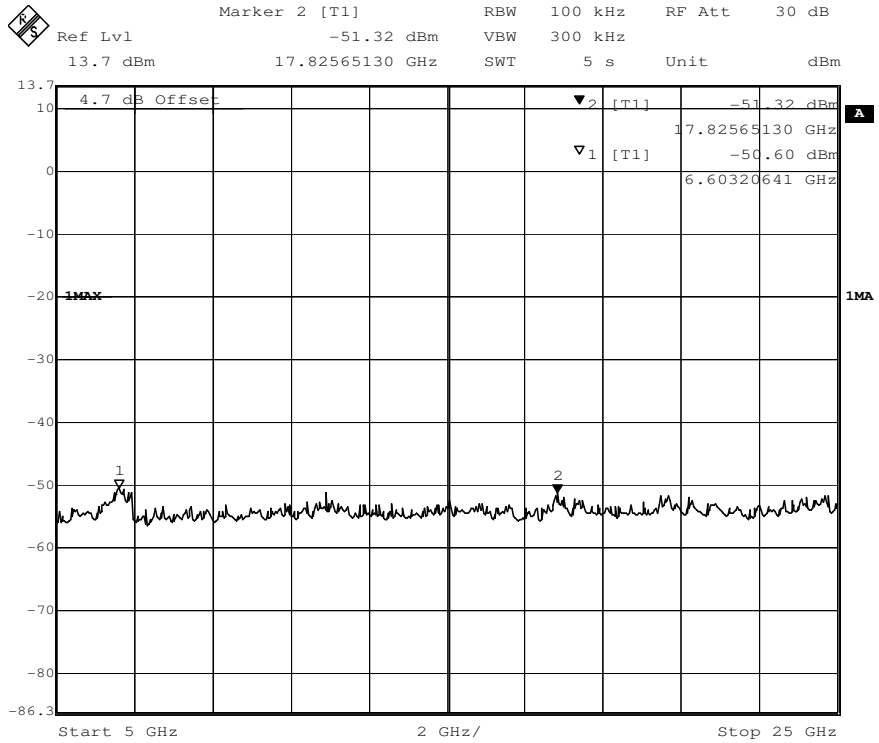
Lowest Channel: 30M to 1GHz



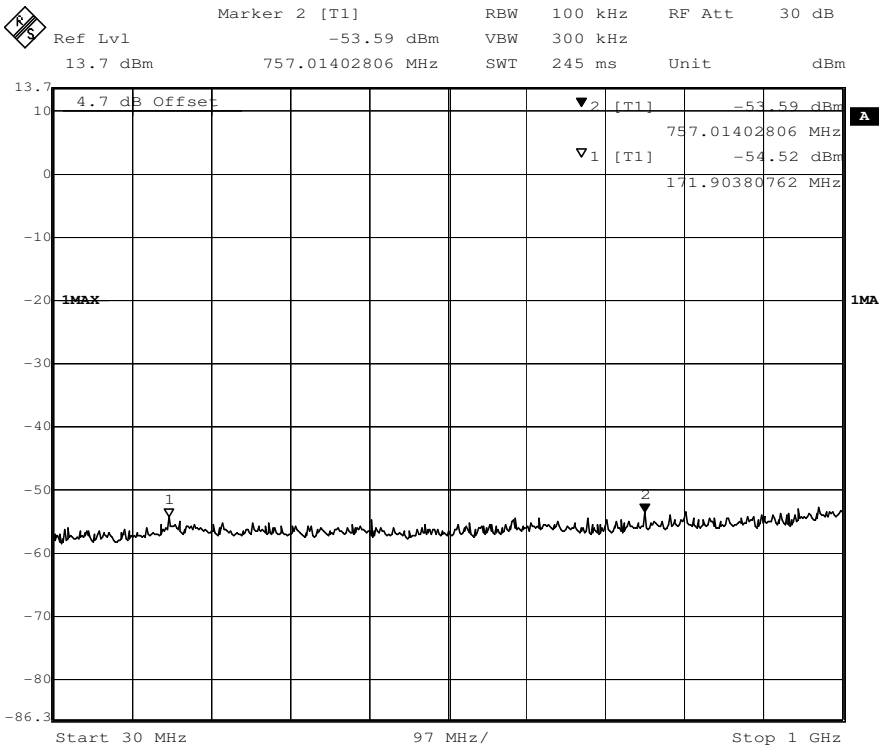
1G to 5GHz



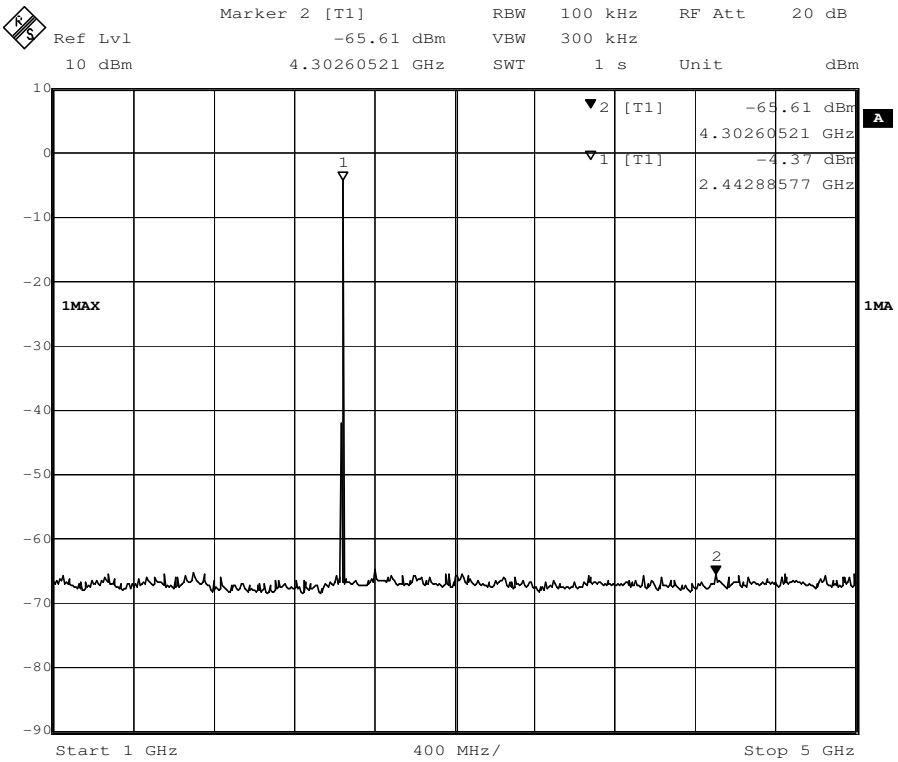
5G to 25GHz



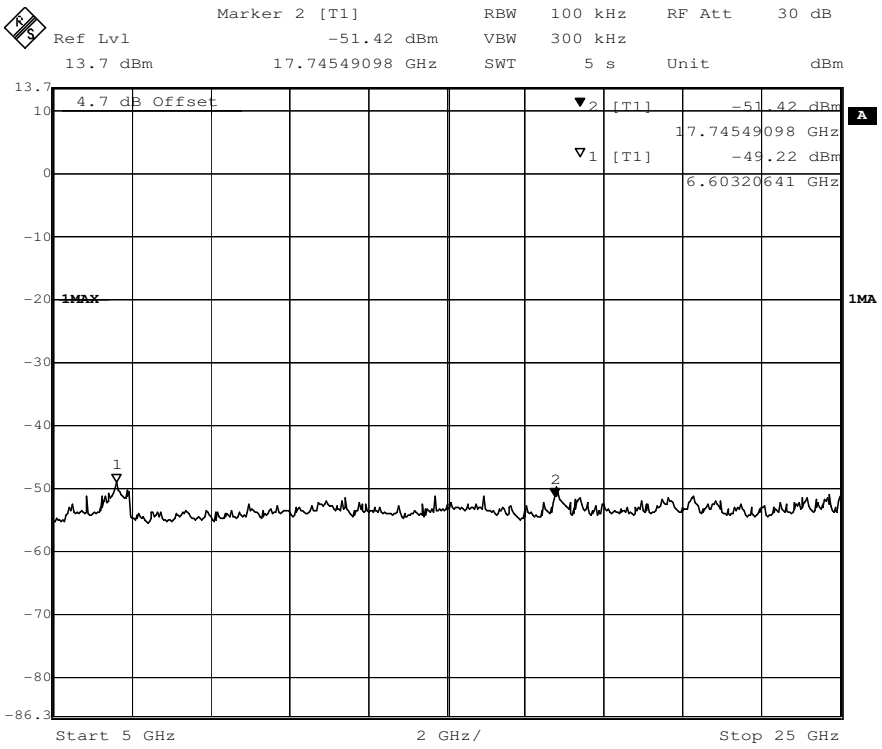
Middle Channel: 30M to 1GHz



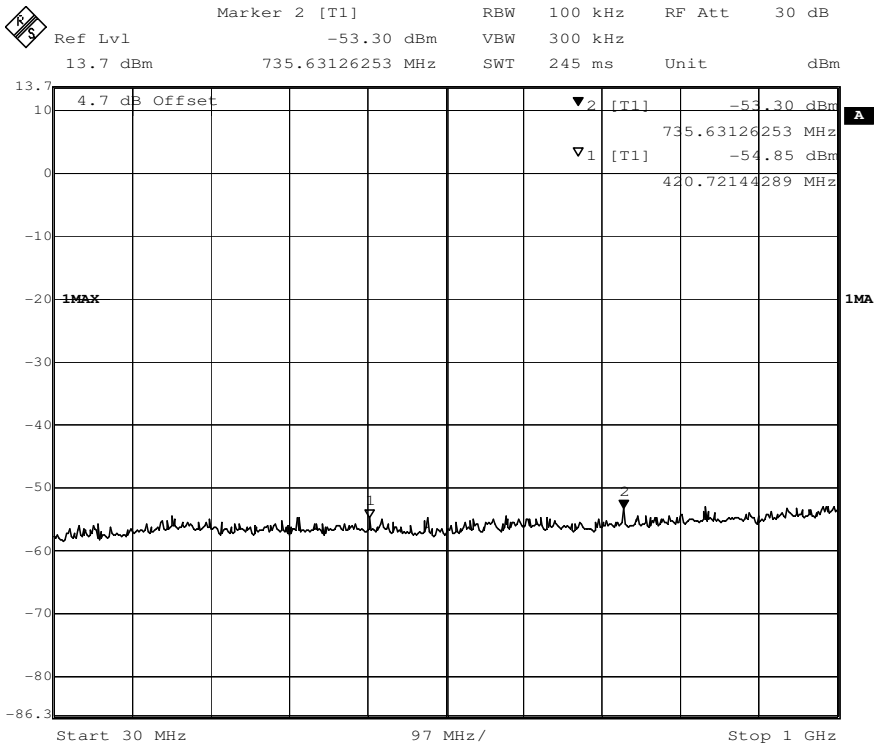
1G to 5GHz



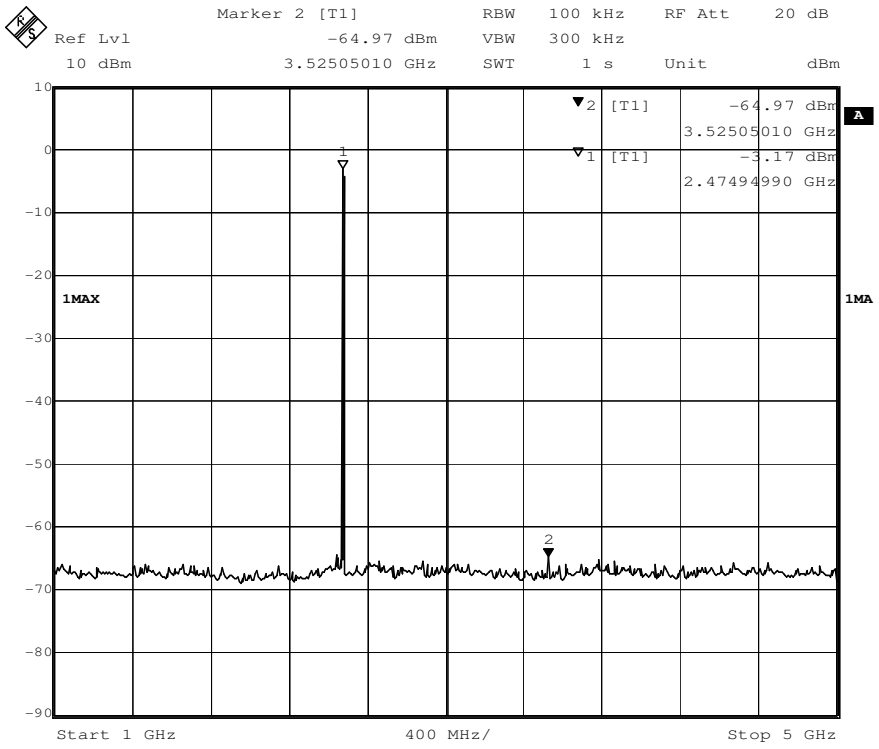
5G to 25GHz



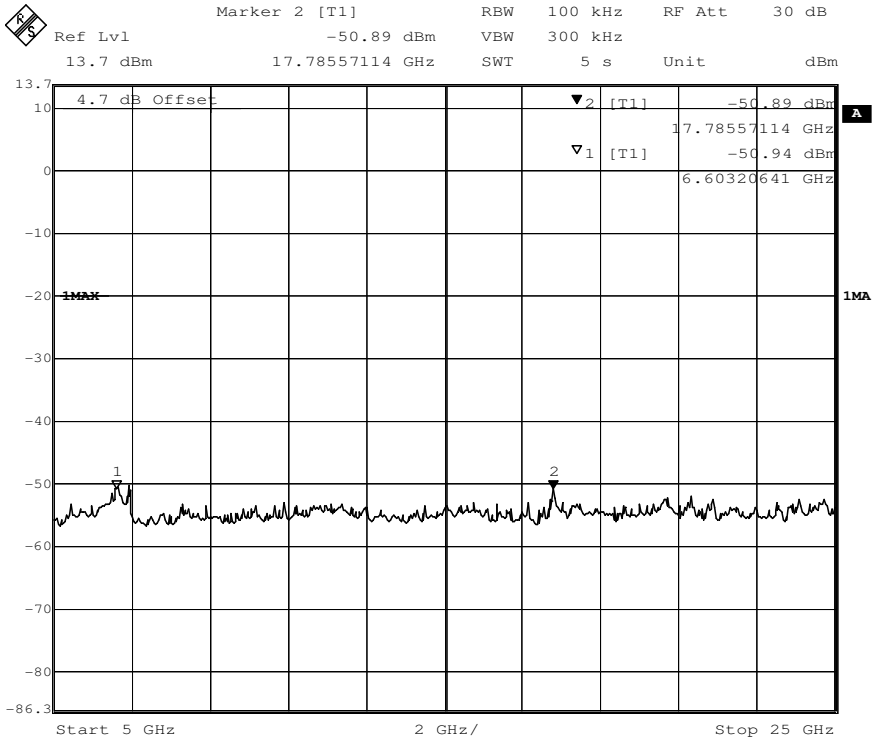
Highest Channel: 30M to 1GHz



1G to 5GHz



5G to 25GHz



7.10 Exposure of Humans to RF Fields

Test Requirement: RSS Gen section 5.5

Test Method: RSS RSS-102

Test Status: Test lowest channel, Middle, highest channel.

Requirements:

The EUT shall comply with the requirement of RSS-102 section 2.5.1:

Exemption from Routine Evaluation Limits – SAR Evaluation:

SAR evaluation is required if the separation distance between the user and the device is less than or equal to 20 cm, except when the device operates:

• from 3 kHz up to 1 GHz inclusively and its output power (i.e. the higher of the conducted or effective isotropic radiated power (e.i.r.p.) source-based time-averaged output power) is less than, or equal to 200 mW for General Public Use and 1000 mW for Controlled Use;

• above 1 GHz up to 2.2 GHz inclusively and its output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based time-averaged output power) is less than, or equal to 100 mW for General Public Use and 500 mW for Controlled Use;

• above 2.2 GHz up to 3 GHz inclusively and its output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based time-averaged output power) is less than, or equal to 20 mW for General Public Use and 100 mW for Controlled Use;

• above 3 GHz up to 6 GHz inclusively and its output power (i.e. the higher of the conducted or radiated (e.i.r.p.) source-based time-averaged output power) is less than, or equal to 10 mW for General Public Use and 50 mW for Controlled Use.

In these cases, the information contained in the RF exposure technical brief may be limited to information which demonstrates how the output power of the device was derived.

7.10.1 Transmitter EIRP

Test Frequency(MHz)	2402	2441	2480
DH5 Measured Level (dBm)	-0.02	0.46	0.22
3DH5 Measured Level (dBm)	1.07	1.51	1.22
Limits	(20mW or 13dBm)		

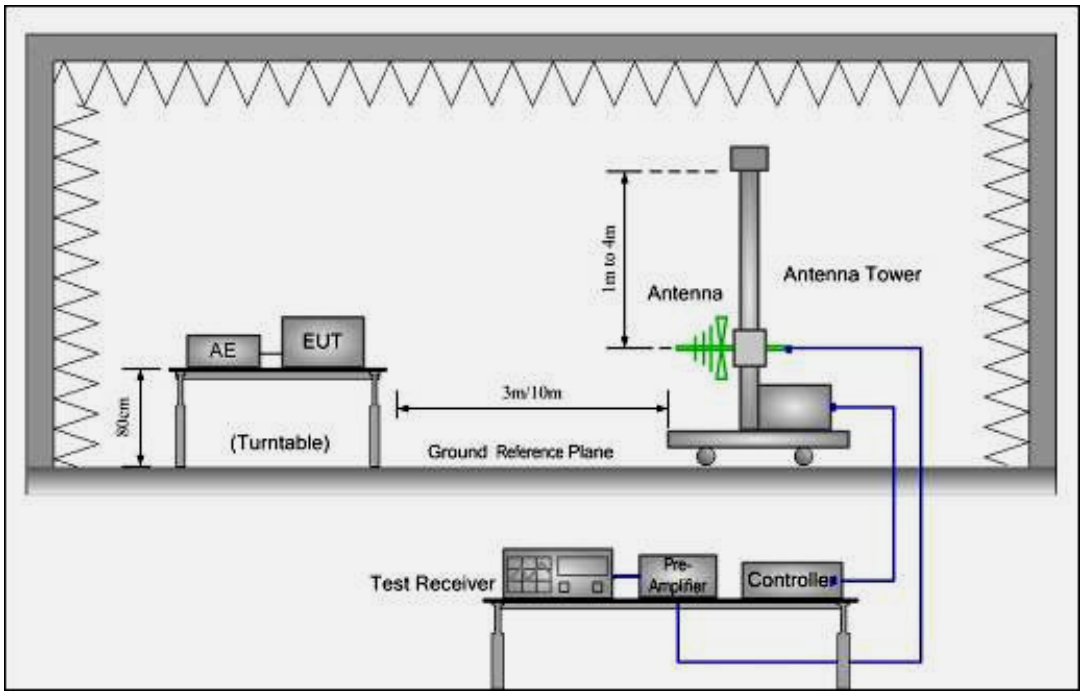
The EUT meet the **Exemption from Routine Evaluation Limits – SAR Evaluation,** so no SAR report is required for the EUT.

7.11 Radiated Spurious Emissions

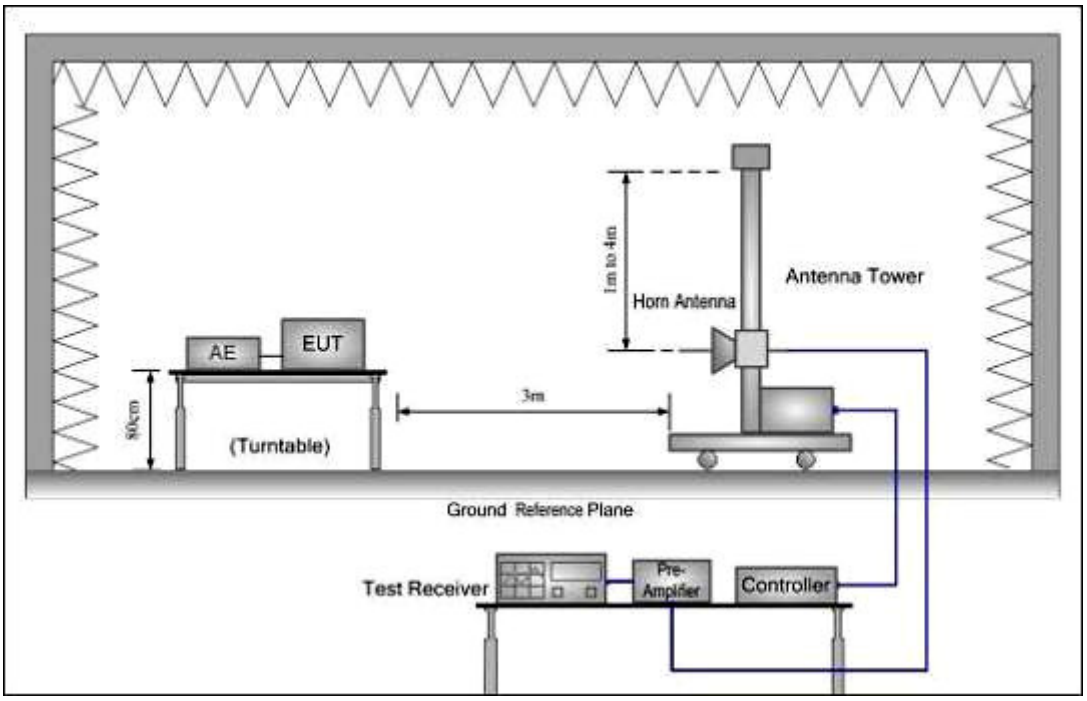
Test Requirement:	RSS 210 A8.4(2)&8.5
Test Method:	RSS Gen & ANSI C63.4
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber and OATS) Test instrumentation resolution bandwidth 120 kHz and Quasi-Peak detector applies (30 MHz - 1000 MHz),1 MHz resolution bandwidth and Peak and Average-Peak detector apply(1000 MHz – 25GHz). Receive antenna scan height 1 m - 4 m, polarization Vertical / Horizontal
Test Status:	Pre-test the EUT in transmitting mode in different modulation types with different data packages reported the worst case.
Table 2 Limit:	40.0 dBμV/m between 30MHz & 88MHz 43.5 dBμV/m between 88MHz & 216MHz 46.0 dBμV/m between 216MHz & 960MHz 54.0 dBμV/m above 960MHz
Requirements:	A8.4(2): For frequency hopping systems operating in the band 2400-2483.5 MHz employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W. Except as provided in Section A8.4(5), the e.i.r.p. shall not exceed 4W. A8.5: In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 2 and 3 is not required. In addition, radiated emissions which fall in the restricted bands of Table 1 must also comply with the radiated emission limits specified in Tables 2 and 3.

Test Configuration:

1) 30MHz to 1GHz emissions:



2) 1GHz to 40GHz emissions:



Test Procedure: The procedure used was ANSI Standard C63.4-2009. The receiver was scanned from 30MHz 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.

Now set the VBW to 10 Hz, 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 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.

Submit this data.

7.11.1 Harmonic and other spurious emissions

7.11.1.1 Test at low Channel in transmitting status

30MHz~1GHz Spurious Emissions .Quasi-Peak Measurement

Frequency (MHz)	Reading Level (dBμV)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
37.760	29.91	19.00	0.50	24.50	24.91	40.00	Vertical
201.690	34.09	10.64	1.30	24.16	21.87	43.50	V
309.360	30.30	13.96	1.60	24.19	21.68	46.00	V
41.640	31.04	16.50	0.60	24.50	23.64	40.00	Horizontal
106.630	32.49	11.62	0.90	24.50	20.51	43.50	H
192.960	34.81	10.30	1.20	24.30	22.01	43.50	H

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4804.000	33.19	6.20	36.30	42.52	45.62	74.00	V
7206.000	36.00	8.36	32.20	40.01	48.92	74.00	V
9608.000	36.42	8.80	32.50	40.53	52.72	74.00	V
4804.000	33.19	6.90	33.01	43.51	50.59	74.00	H
7206.000	36.08	8.36	32.20	40.24	48.70	74.00	H
9608.000	36.40	8.80	32.50	35.27	48.00	74.00	H

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4804.000	33.19	6.20	36.30	38.56	41.66	54.00	V
7206.000	36.05	8.36	32.20	23.23	35.44	54.00	V
9608.000	36.40	8.80	32.50	21.47	34.17	54.00	V
4804.000	33.19	6.90	33.01	36.58	43.66	54.00	H
7206.000	36.11	8.36	32.20	22.77	35.04	54.00	H
9608.000	36.42	8.80	32.50	22.81	35.53	54.00	H

7.11.1.2 Test at middle Channel in transmitting status

30MHz~1GHz Spurious Emissions .Quasi-Peak Measurement

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
95.960	9.24	0.90	24.50	41.55	27.19	43.50	Vertical
128.940	12.26	1.00	24.40	38.81	27.67	43.50	V
198.780	10.58	1.20	24.22	43.33	30.89	43.50	V
94.990	9.00	0.90	24.50	38.36	23.76	43.50	Horizontal
167.740	10.00	1.20	24.34	43.41	30.27	43.50	H
198.780	10.58	1.20	24.22	45.68	33.24	43.50	H

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4882.000	33.27	7.20	32.97	50.55	58.04	74.00	V
7323.000	36.16	6.95	32.29	36.68	47.50	74.00	V
9764.000	36.40	7.20	32.44	38.44	49.60	74.00	V
4882.000	33.27	7.20	32.97	50.31	57.81	74.00	H
7323.000	36.16	6.95	32.29	36.95	47.77	74.00	H
9764.000	36.40	7.20	32.44	38.19	49.35	74.00	H

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4882.000	33.27	7.20	32.97	42.65	50.14	54.00	V
7323.000	36.16	6.95	32.29	21.99	32.81	54.00	V
9764.000	36.40	7.20	32.44	23.46	34.62	54.00	V
4882.000	33.27	7.20	32.97	45.28	52.78	54.00	H
7323.000	36.16	6.95	32.29	22.45	33.27	54.00	H
9764.000	36.40	7.20	32.44	21.82	32.98	54.00	H

7.11.1.3 Test at high Channel in transmitting status

30MHz~1GHz Spurious Emissions .Quasi-Peak Measurement

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
137.670	11.74	1.00	24.40	40.19	28.53	43.50	Vertical
490.750	16.99	2.00	25.40	36.65	30.24	46.00	V
718.700	19.28	2.40	25.399	35.48	31.77	46.00	V
95.925	9.24	0.90	24.50	40.93	26.57	43.50	Horizontal
549.920	18.30	2.10	25.40	33.27	28.27	46.00	H
934.040	20.60	2.70	24.86	35.98	24.42	46.00	H

1~25 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4960.000	33.36	7.33	32.92	50.12	57.90	74.00	V
7440.000	36.23	6.05	32.37	39.49	49.40	74.00	V
9920.000	36.50	7.04	32.50	40.16	51.20	74.00	V
4960.000	33.36	7.33	32.92	50.43	58.20	74.00	H
7440.000	36.23	6.05	32.37	39.82	49.73	74.00	H
9920.000	36.50	7.04	32.50	41.53	52.57	74.00	H

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4960.000	33.36	7.33	32.92	42.56	50.34	54.00	V
7440.000	36.23	6.05	32.37	24.19	34.10	54.00	V
9920.000	36.50	7.04	32.50	23.52	34.56	54.00	V
4960.000	33.36	7.33	32.92	42.57	50.34	54.00	H
7440.000	36.23	6.05	32.37	34.35	44.26	54.00	H
9920.000	36.50	7.04	32.50	31.84	42.88	54.00	H

Remark:

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

Final Test Level =Receiver Reading + Antenna Factor + Cable Factor –Preamplifier Factor.

2). As shown in Section, for frequencies above 1000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

3). The test only perform the EUT in transmitting status since the test frequencies were over 1GHz only required transmitting status.

Test result: The unit does meet the RSS requirements.

7.11.1.4 Test in receiving status

Noise floor emission can be found,

20.0dBuV/m Quasi-peak value from 30MHz to 1GHz,

40.0dBuV/m Peak value above 1GHz,

28.0dBuV/m Average value above 1GHz.

No any emission can be found or be detected in the receiving mode.

7.11.2 Radiated Emissions which fall in the restricted bands

Test Requirement:	RSS-210 clause 2.6
Test Method:	Base on ANSI 63.4
Test Status:	Test the EUT in continuous transmitting mode at lowest channel, Middle, highest channel.
Measurement Distance:	3m (Semi-Anechoic Chamber)
Limit:	40.0 dBμV/m between 30MHz & 88MHz; 43.5 dBμV/m between 88MHz & 216MHz; 46.0 dBμV/m between 216MHz & 960MHz; 54.0 dBμV/m above 960MHz.
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, 100 kHz for f < 1 GHz VBW =10Hz Sweep = auto Detector function = peak Trace = max hold

Test Result:

1. Low Channel

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBμV)	Average Reading Level (dBμV)	Peak Emission Level (dBμV/m)	Average Emission Level (dBμV/m)
2310.000	28.32	4.23	37.03	51.00	32.45	46.52	27.97
2350.000	28.42	4.30	37.10	50.40	31.50	46.02	27.12
2390.000	27.88	4.65	34.30	50.50	31.20	48.73	29.43
2490.000	28.83	4.40	37.00	50.90	32.10	47.13	28.33
2500.000	28.83	4.40	37.00	51.77	32.25	48.00	28.48
2483.500	28.74	4.80	34.73	52.40	34.00	51.21	32.81

2. Middle Channel

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBμV)	Average Reading Level (dBμV)	Peak Emission Level (dBμV/m)	Average Emission Level (dBμV/m)
2310.000	28.32	4.23	37.03	52.10	33.13	47.62	28.6
2350.000	28.42	4.30	37.10	52.39	33.84	48.01	29.46
2390.000	27.88	4.65	34.30	51.81	32.63	50.04	30.86
2490.000	28.83	4.40	37.00	52.53	33.90	48.76	30.13
2500.000	28.83	4.40	37.00	53.09	34.84	49.32	31.07
2483.500	28.74	4.80	34.73	53.20	34.64	52.01	33.45

3. High Channel

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dBμV)	Average Reading Level (dBμV)	Peak Emission Level (dBμV/m)	Average Emission Level (dBμV/m)
2310.000	28.32	4.23	37.03	52.24	33.34	47.76	28.86
2350.000	28.42	4.30	37.10	53.06	33.59	48.68	29.21
2390.000	27.88	4.65	34.30	51.98	32.84	50.21	31.07
2490.000	28.83	4.40	37.00	53.98	34.51	50.21	30.74
2500.000	28.83	4.40	37.00	54.69	35.30	50.92	31.53
2483.500	28.74	4.80	34.73	53.29	35.33	52.10	34.14

Remark: No any other emission which falls in restricted bands can be detected and be reported.

Test result: The unit does meet the RSS requirements.

Restricted Frequency Bands

MHz
0.090-0.110
2.1735-2.1905
3.020-3.026
4.125-4.128
4.17725-4.17775
4.20725-4.20775
5.677-5.683
6.215-6.218
6.26775-6.26825
6.31175-6.31225
8.291-8.294
8.362-8.366
8.37625-8.38675
8.41425-8.41475
12.29-12.293
12.51975-12.52025
12.57675-12.57725
13.36-13.41
16.42-16.423
16.69475-16.69525
16.80425-16.80475
25.5-25.67
37.5-38.25

MHz
73-74.6
74.8-75.2
108-138
156.52475-156.52525
156.7-156.9
240-285
322-335.4
399.9-410
608-614
960-1427
1435-1626.5
1645.5-1646.5
1660-1710
1718.8-1722.2
2200-2300
2310-2390
2655-2900
3260-3267
3332-3339
3345.8-3358
3500-4400
4500-5150
5350-5460

MHz
7250-7750
8025-8500

GHz
9.0-9.2
9.3-9.5
10.6-12.7
13.25-13.4
14.47-14.5
15.35-16.2
17.7-21.4
22.01-23.12
23.6-24.0
31.2-31.8
36.43-36.5
Above 38.6

Note: Certain frequency bands listed in Table 1 and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard as well as in RSS-310.

7.12 Band Edges Requirement

Test Requirement:	RSS-210
Test Method:	Based on ANSI 63.4 & DA 00-705
Test Status:	Operation within the band 2400 – 2483.5 MHz Test the EUT in normal mode and EDR mode, found the worst case is in normal mode and report it.
Requirements:	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)).
Method of Measurement:	Set RBW of spectrum analyzer to 100 kHz and VBW of spectrum analyzer to 100 kHz with suitable frequency span including 100 kHz bandwidth from band edge. Pretest the EUT in hopping on and hopping off, found the worse case was the hoping off. The band edge was measured and recorded the worse case.

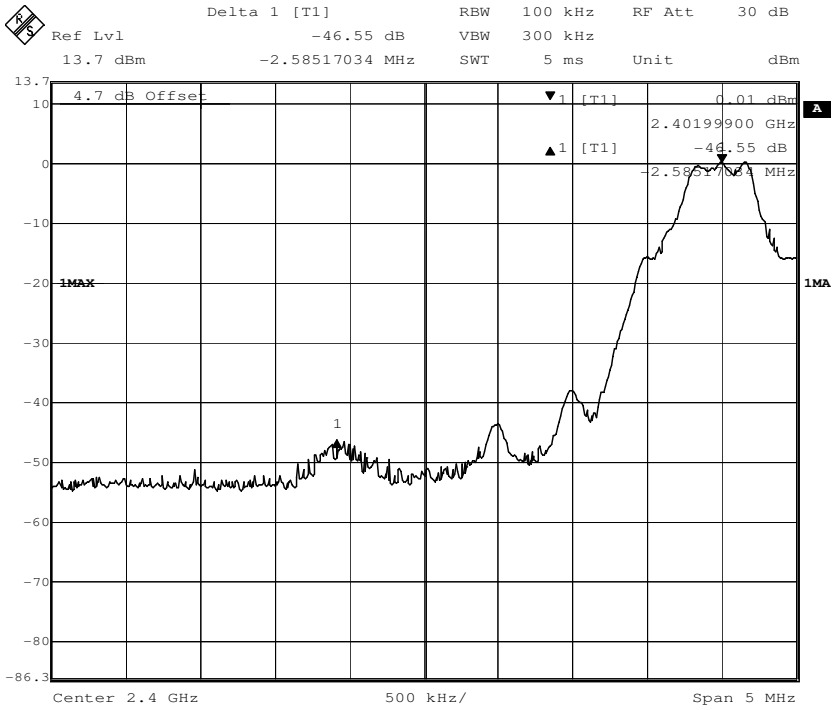
The band edges was measured and recorded Result:

The Lower Edges attenuated more than 20dB.

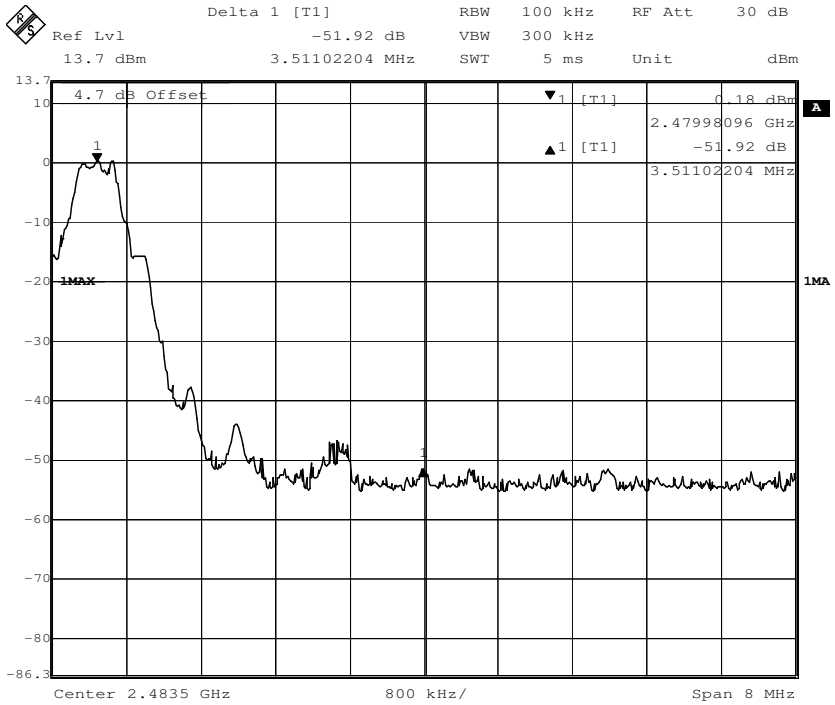
The Upper Edges attenuated more than 20dB.

The graph as below. Represents the emissions take for this device.

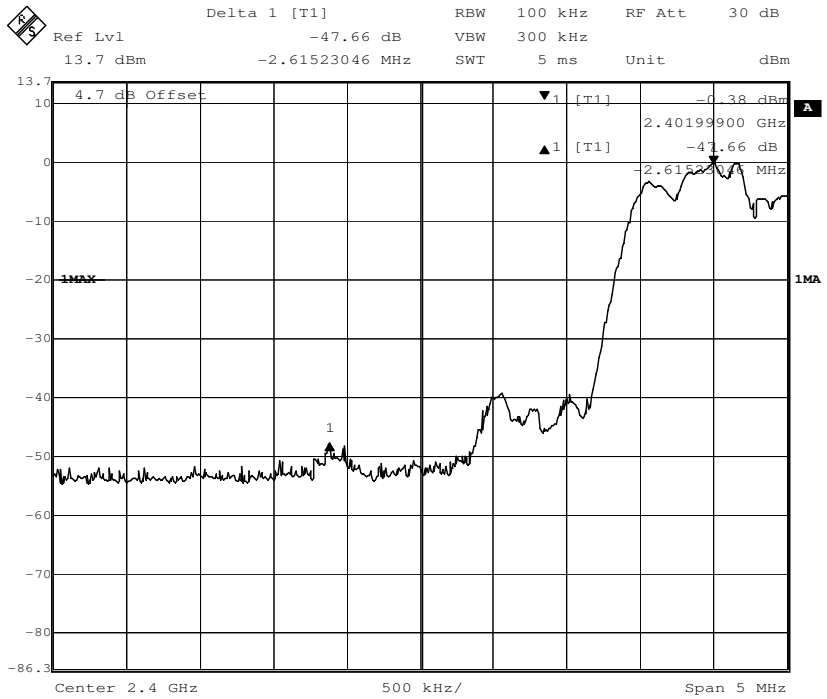
DH5:
Low channel:



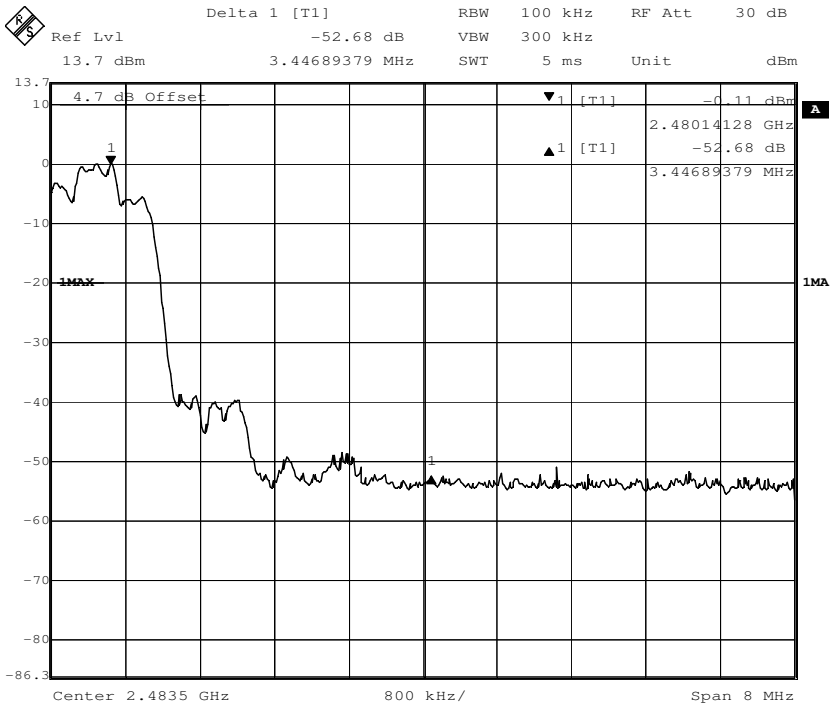
Highest Channel:



3DH5:
Low channel:



Highest Channel:



Test result: The unit does meet the RSS requirements.