

TEST REPORT

Applicant:	Kanto Distribution Inc.
Address of Applicant:	150-4320 Viking Way, Richmond, BC Canada
Manufacturer:	Sonicstar (Guangzhou) Electronics Co., Ltd
Address of Manufacturer:	No.13 Taoyuan West Street, Shima, Junhe, Baiyun District, Guangzhou, 510440, China
Product name:	Powered Speaker system
Model:	YUMI
Rating(s):	110-120V~ 60Hz 120W 230-240V~ 50Hz 120W
Trademark:	kanto
Standards:	FCC Part 15.247 :2010 RSS-210 issue 8
FCC ID:	QHK-2YEKN001
IC ID:	10678A-2YEKN001
Data of Receipt:	2012-10-10
Date of Test:	2012-10-11~2012-10-26
Date of Issue:	2012-10-29
Test Result	Pass*

* In the configuration tested, the test item complied with the standards specified above.

Authorized for issue by:

Test by:

Jumy qiu

Oct.29.2012 Jumy Qiu

Project Engineer

Reviewed by:

Pauler Li

Oct.29.2012

Pauler Li

Project Engineer

Date

Name/Position

Signature

Date

Name/Position

Signature

Possible test case verdicts:

test case does not apply to the test object ...: N/A

test object does meet the requirement: P (Pass)

test object does not meet the requirement ...: F (Fail)

Testing Laboratory information:

Testing Laboratory Name: I-Test Laboratory

Address.....: 1-2 floor, South Block, Building A2 , No 3 Keyan Lu,
Science City, Guangzhou, Guangdong Province, P.R. China

Testing location : Same as above

Tel : 0086-20-32209330

Fax : 0086-20-62824387

E-mail : itl@i-testlab.com

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

This report would be invalid test report without all the signatures of testing technician and approver.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

General product information:

/

1 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 (99% and -20dB)	FCC PART 15 C section 15.247 (a)(1); RSS 210 A8.1 (1)	ANSI C63.10: Clause 6.9 & DA 00-705	PASS
Carrier Frequencies Separated	FCC PART 15 C section 15.247(a)(1); RSS 210 A8.1 (1)	DA 00-705	PASS
Hopping Channel Number	FCC PART 15 C section 15.247(a)(1)(iii) RSS 210 A8.1 (4)	DA 00-705	PASS
Dwell Time	FCC PART 15 C section 15.247(a)(1)(iii); RSS 210 A8.1 (4)	DA 00-705	PASS
Pseudorandom Frequency Hopping Sequence	FCC PART 15 C section 15.247(a)(1); RSS 210 A8.1 (1)	DA 00-705	PASS
Maximum Peak Output Power	FCC PART 15 C section 15.247(b)(1); RSS 210 A8.4 (2)	ANSI C63.10: Clause 6.10 & DA 00-705	PASS
Conducted Spurious Emission (30 MHz to 25 GHz)	FCC PART 15 C section 15.247(d); RSS 210 A8.5	ANSI C63.10: Clause 6.7 & DA 00-705	PASS
Radiated Spurious Emission (9 kHz to 25 GHz)	FCC PART 15 C section 15.247(d); RSS 210 A8.5	ANSI C63.10: Clause 6.4, 6.5 and 6.6 & DA 00-705	PASS
Band Edges Measurement	FCC PART 15 C section 15.247 (d) & 15.205	ANSI C63.10: Clause 6.9 & DA 00-705	PASS
Conducted Emissions at Mains Terminals	FCC PART 15 C section 15.207; RSS GEN Table 2	ANSI C63.10: Clause 6.2 & DA 00-705	PASS
Remark:			
N/A: not applicable. Refer to the relative section for the details. 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 C63.10:2009 in the whole report. DA 00-705: "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"			

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3 General Information

3.1 Client Information

Applicant: Kanto Distribution Inc.
Address of Applicant: 150-4320 Viking Way, Richmond, BC Canada

3.2 General Description of E.U.T.

Name: Powered Speaker system
Model No.: YUMI
Trade Mark: kanto
Operating Frequency: 2402 MHz to 2480 MHz
Channels: 79 channels with 1MHz step
Type of Modulation: GFSK, ($\pi/4$) DQPSK, 8DPSK
Dwell time: Per channel is less than 0.4s.
Antenna Type: PCB Layout
Antenna gain: 0dBi
Speciality: Bluetooth 2.1 with EDR
Function: BT function to receive audio signal.

3.3 Details of E.U.T.

EUT Power Supply: AC Power, Class II
Rated power: 110-120V~ 60Hz 120W
230-240V~ 50Hz 120W
Test mode: The program used to control the EUT for staying in continuous receiving mode is programmed.
Channel lowest (2402MHz), middle (2441MHz) and highest (2480MHz) are chosen for full testing.
Normal mode: the Bluetooth has been tested on the Modulation of GFSK;
EDR mode: the Bluetooth has been tested on the Modulation of ($\pi/4$)DQPSK and 8DPSK, compliance test and record the worst case on 8DPSK.
Power cord: 1.5M*3pins

3.4 Description of Support Units

The EUT has been tested as an independent unit for fixed frequency by testing lab.

3.5 Test Location

All tests were performed at:

Guangzhou ITL Co., Ltd.

1-2 floor, South Block, Building A2 , No 3 Keyan Lu, Science City, Guangzhou, Guangdong Province, P.R. China

0086-20-32209330

itl@i-testlab.com

No tests were sub-contracted.

3.6 Deviation from Standards

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

3.7 Abnormalities from Standard Conditions

None.

3.8 Other Information Requested by the Customer

None.

3.9 Test Facility

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

- CNAS(Lab code:L4957)
- FCC (Registration No.:935596)
- IC (Registration NO.:8368A)

3.10 Measurement Uncertainty

Parameter	Uncertainty
Radio frequency	$\pm 1.06 \times 10^{-7}$
total RF power, conducted	1.37 dB
RF power density , conducted	2.89 dB
All emissions, radiated	± 3.35 dB
Temperature	± 0.23 °C
Humidity	± 0.3 %
DC and low frequency voltages	± 0.3 %

4 Instruments Used during Test

No	Test Equipment	Manufacturer	Model No	Serial No	Cal. Due Date
1	Spectrum Analyzer	Agilent	N9010A	MY51250936	2013.02.29
2	Pre Amplifier	HP	8447F	3113A05905	2013.09.06
3	Pre Amplifier	Mini-circuits	MLA-0120-A02-34	2648A04738	2013.06.07
4	Biconilog Antenna	ETS•Lindgren	3142D	00108096	2013.01.28
5	Horn Antenna	A-INFOMW	JXTXLB-10180-N	J2031090612 133	2012.12.17
6	EMI Test Receiver	R&S	ESCI	100124	2013.06.07
7	LISN	R&S	ENV216	100120	2013.06.07
8	50Ω Coaxial Cable	Mini-circuits	CBL	ITL-115	2013.09.06
9	Semi-Anechoic chamber	ETS•Lindgren	FACT3 2.0	ITL-100	2013.04.10
10	Loop Antenna	ZHINAN	ZN30900A	002489	2013.01.22

5 Test Results

5.1 E.U.T. test conditions

Test Voltage: Input: AC 120V, 60 Hz

Temperature: 20.0 -25.0 °C

Humidity: 38-50 % RH

Atmospheric Pressure: 1000 -1010 mbar

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	Number of	Location in frequency range
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	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz,
At or above 10 GHz to below	5th harmonic of highest fundamental frequency or to 100 GHz,
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz,

EUT channels and frequencies list:

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

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

5.2 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 an PCB Layout Bluetooth antenna and no consideration of replacement. The best case gain of the antenna is 0dBi.

Test result: The unit does meet the FCC requirements.

5.3 Occupied Bandwidth

Test Requirement:

FCC Part 15 C section 15.247 and RSS-210

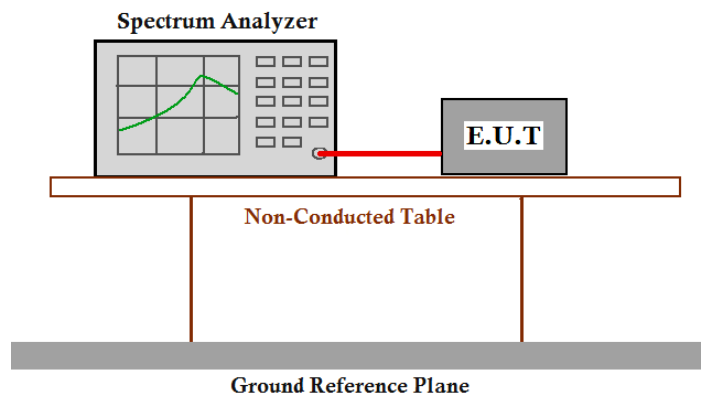
(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies 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 & DA 00-705

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. Compliance test in normal mode (DH5) and EDR mode (3DH5) as the worst case was found.

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

Test result (-20dB bandwidth)**Normal mode:**

Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.14	0.759
Middle	1.14	0.759
Highest	1.13	0.753

EDR mode:

Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.39	0.926
Middle	1.39	0.926
Highest	1.39	0.926

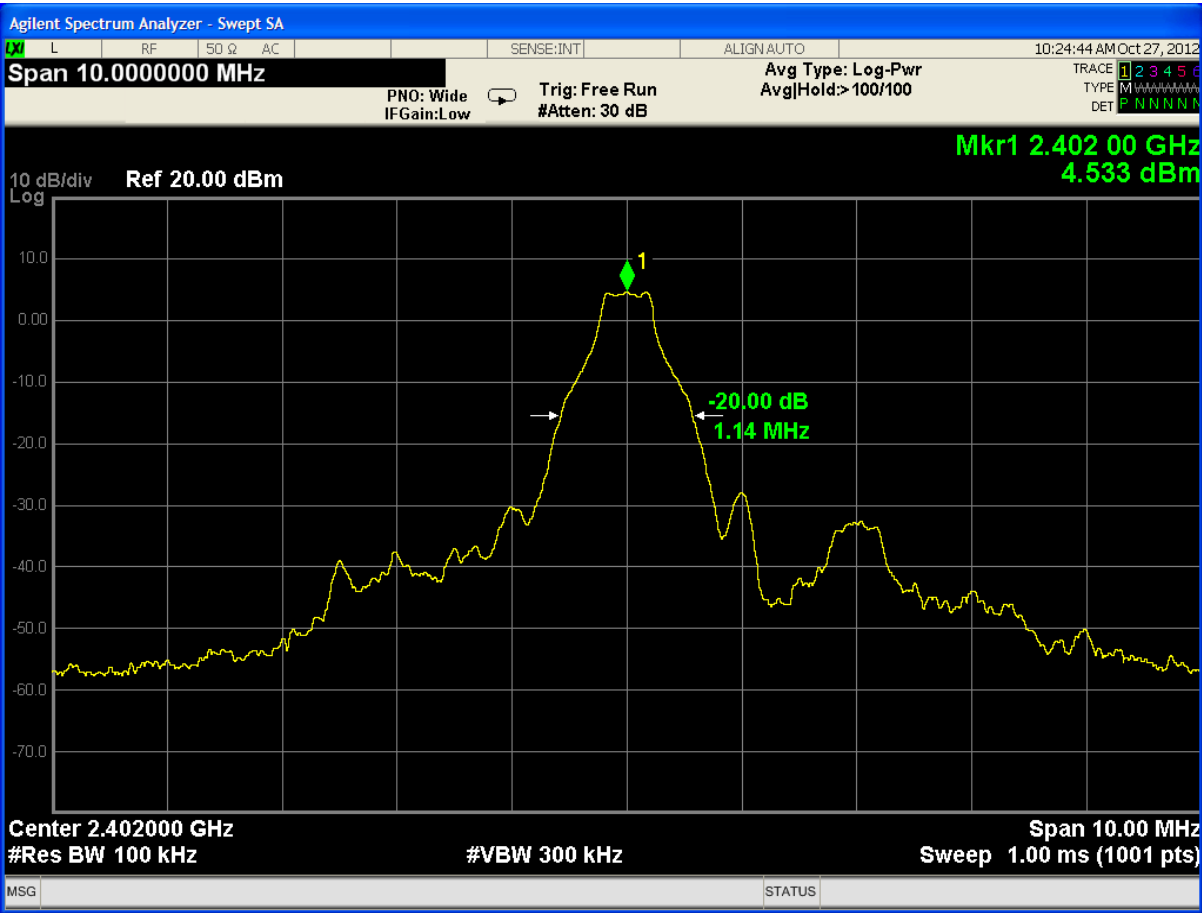
Test result (99% bandwidth)**EDR mode:**

Test Channel	Bandwidth(MHz)
Lowest	1.21
Middle	1.22
Highest	1.22

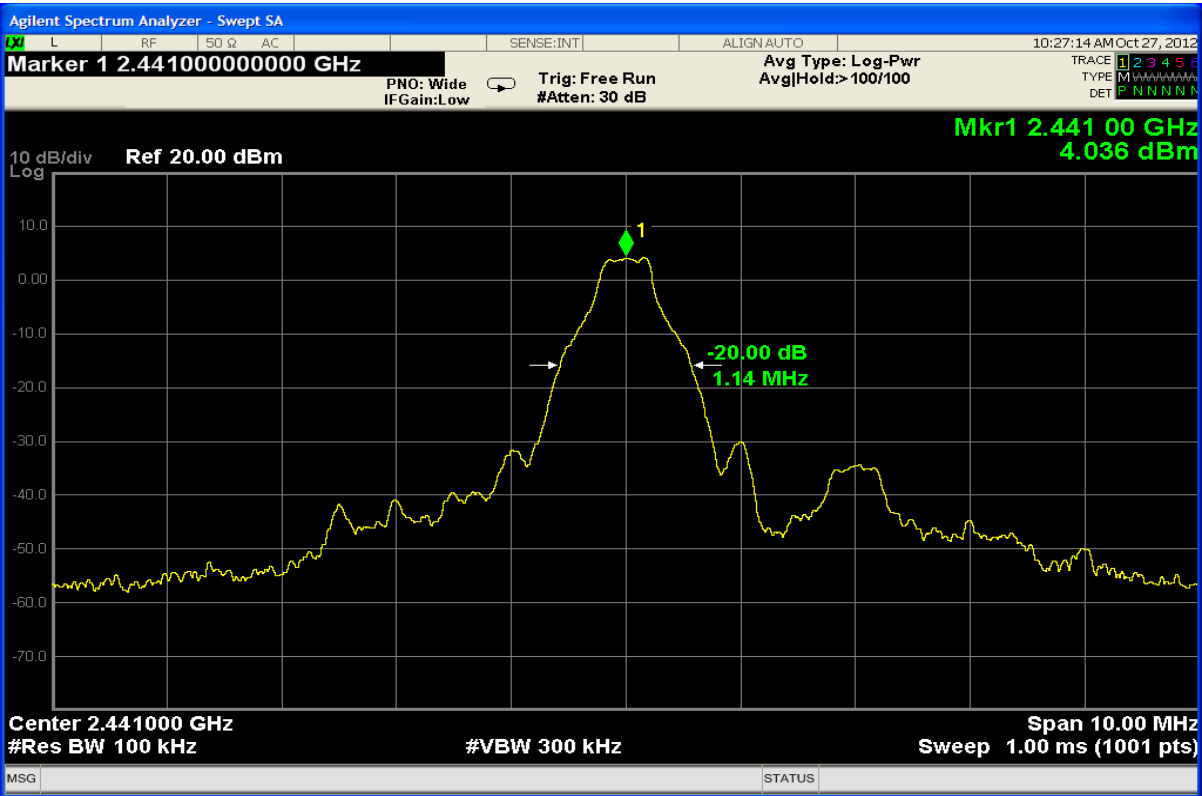
Result plot as follows:

DH5:

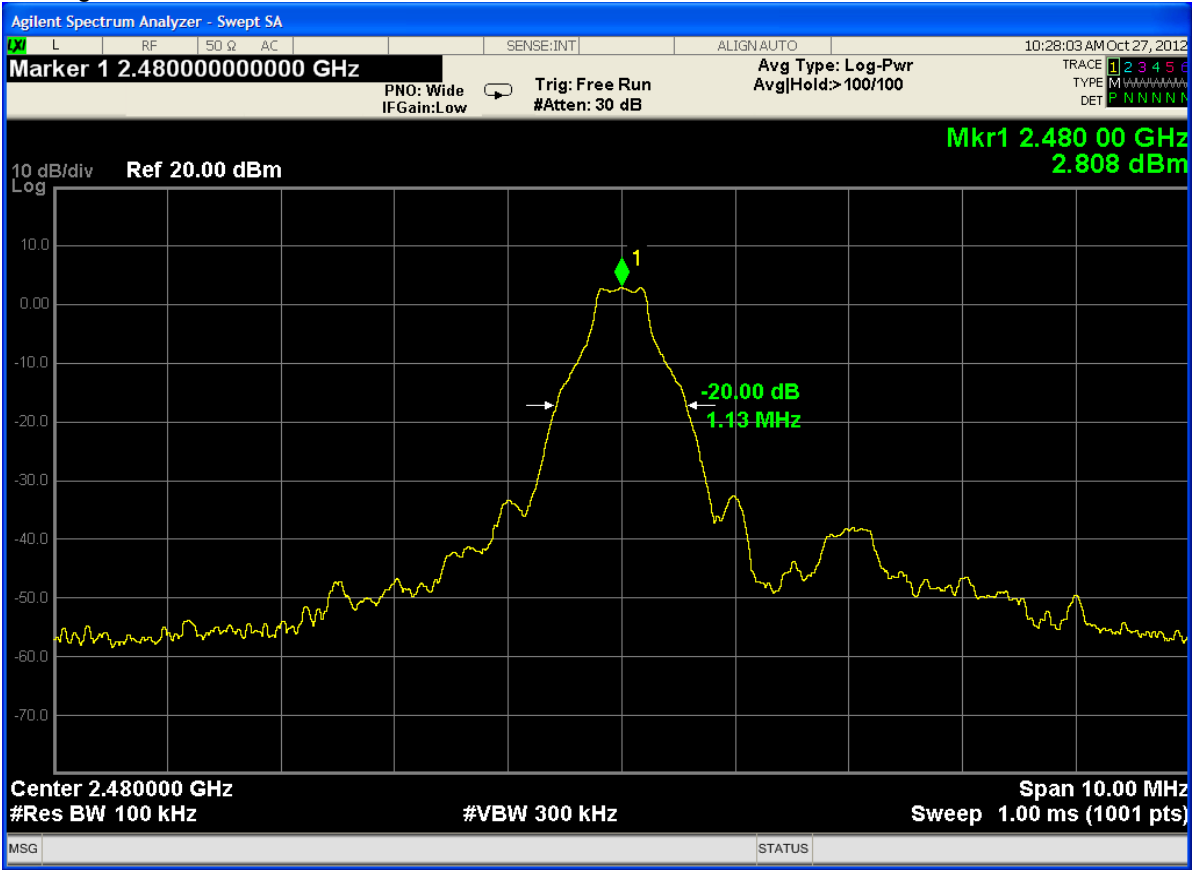
Lowest Channel:



Middle Channel:

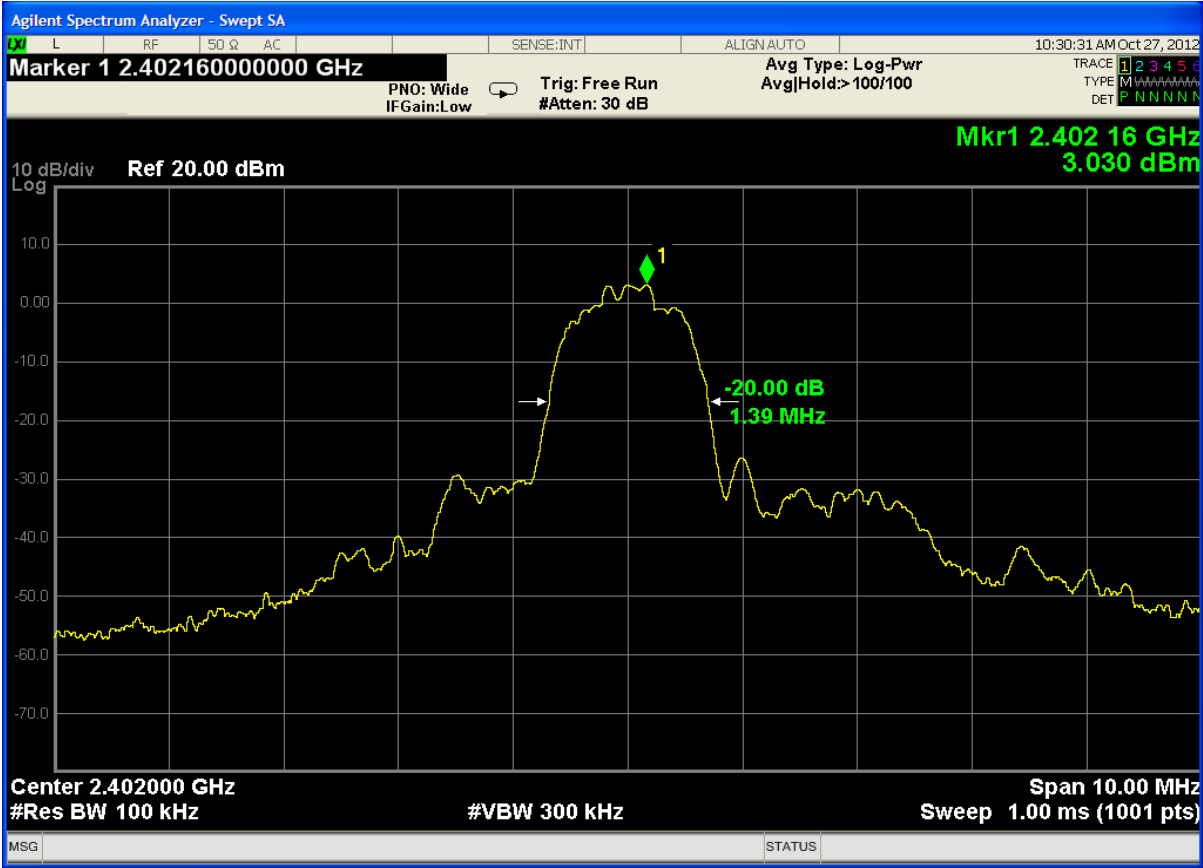


Highest Channel:

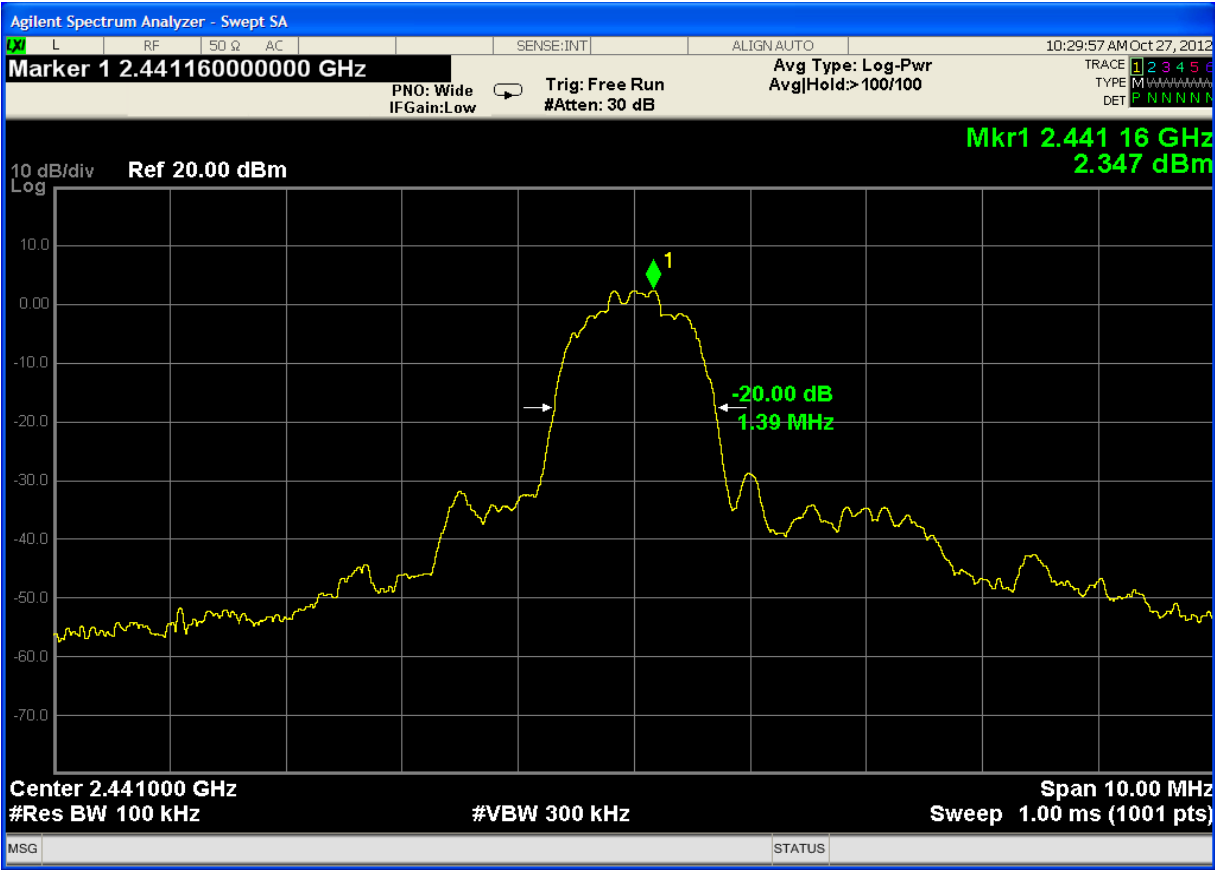


3DH5:

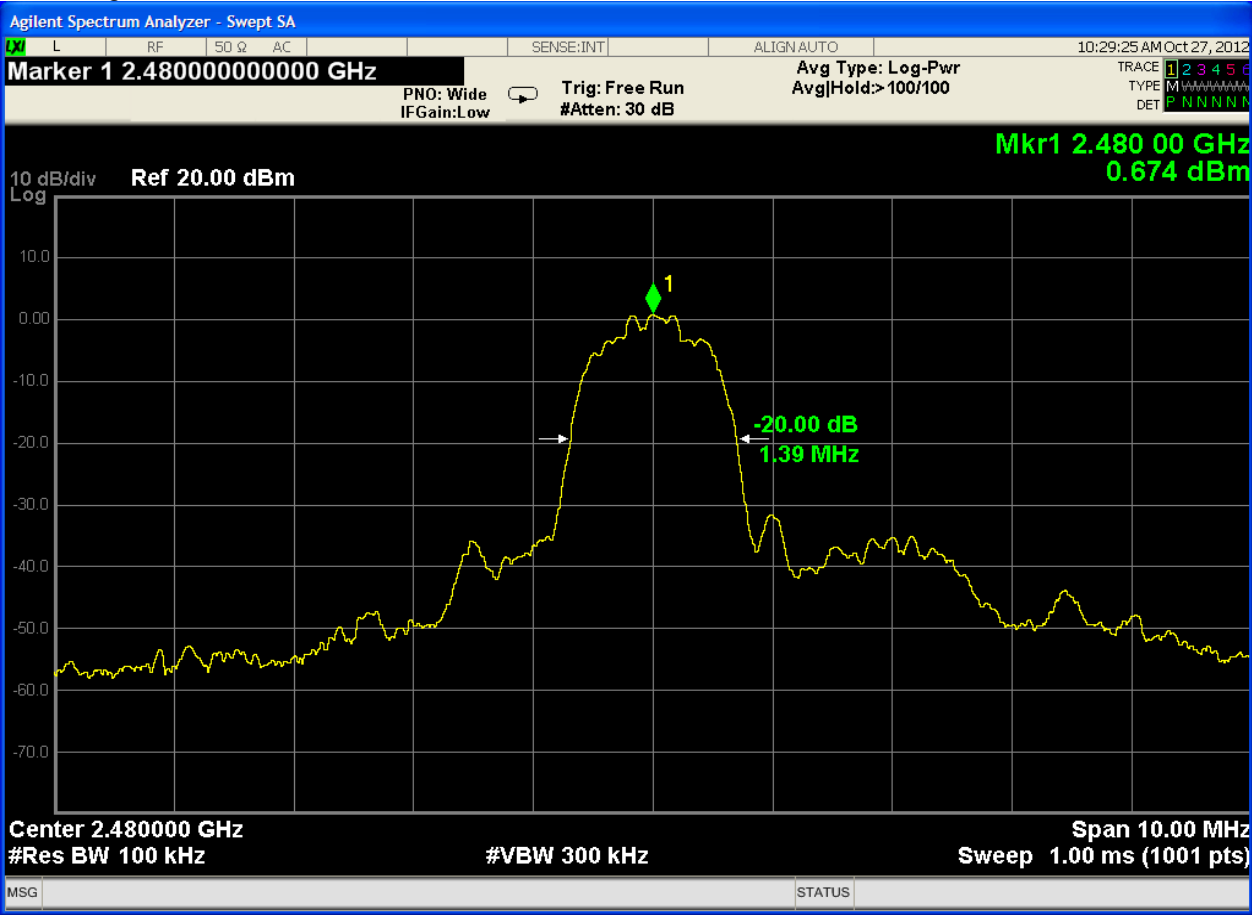
Lowest channel:



Middle channel:

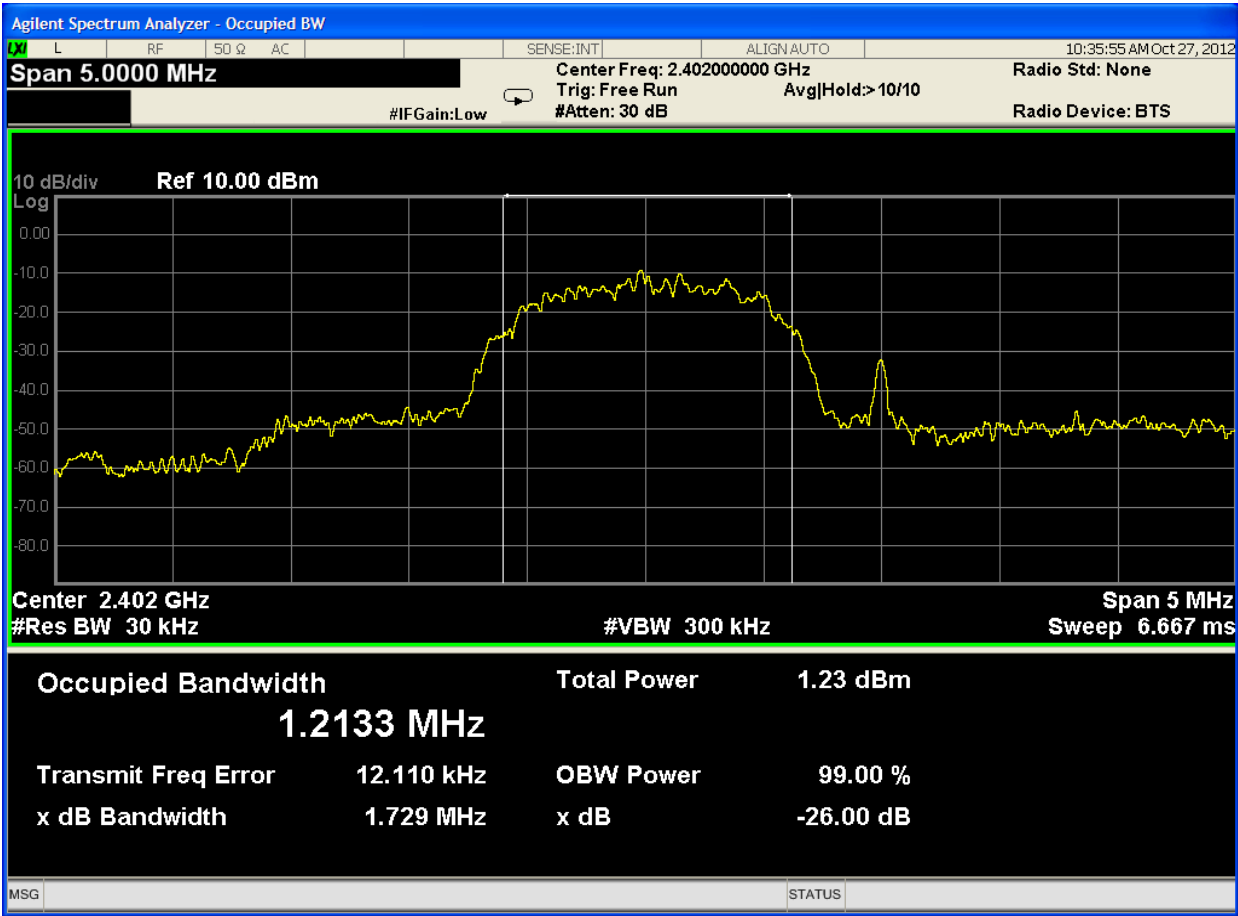


Highest channel:

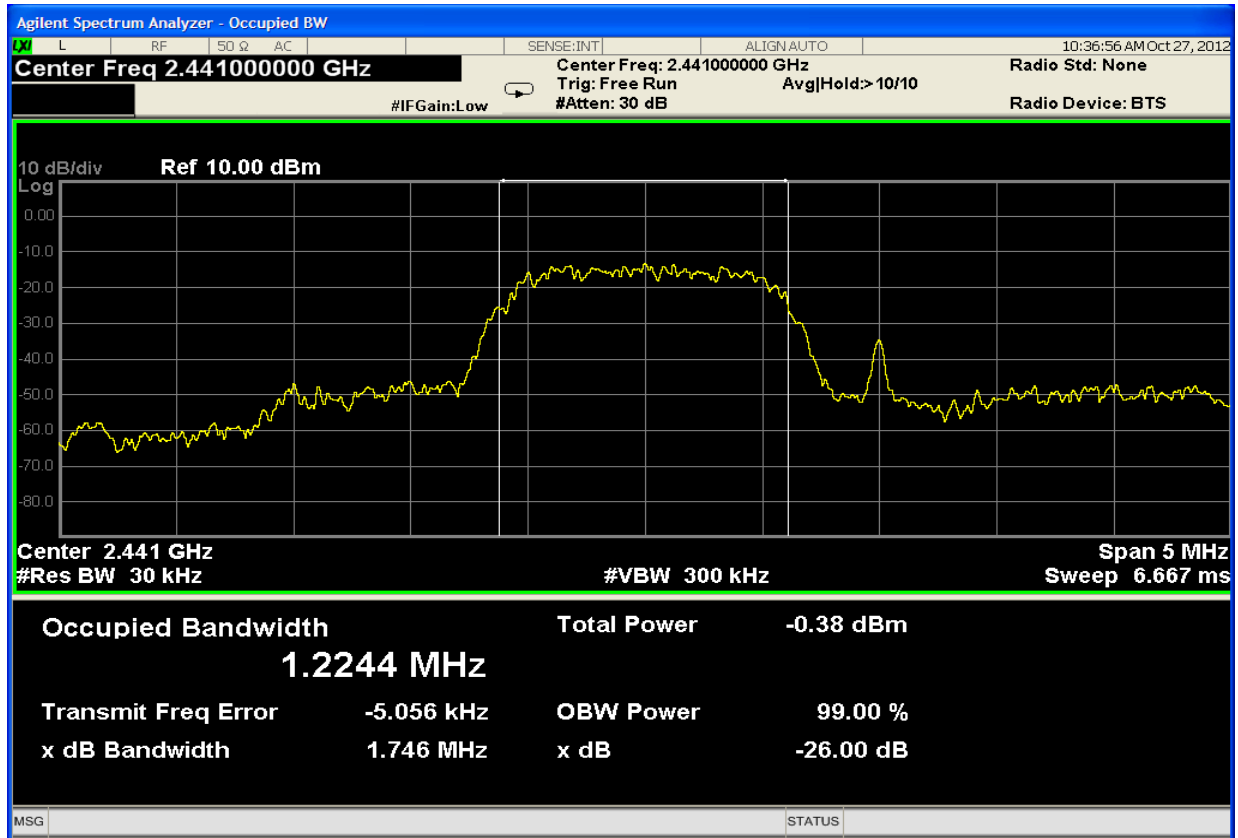


3DH5:(99% bandwidth)

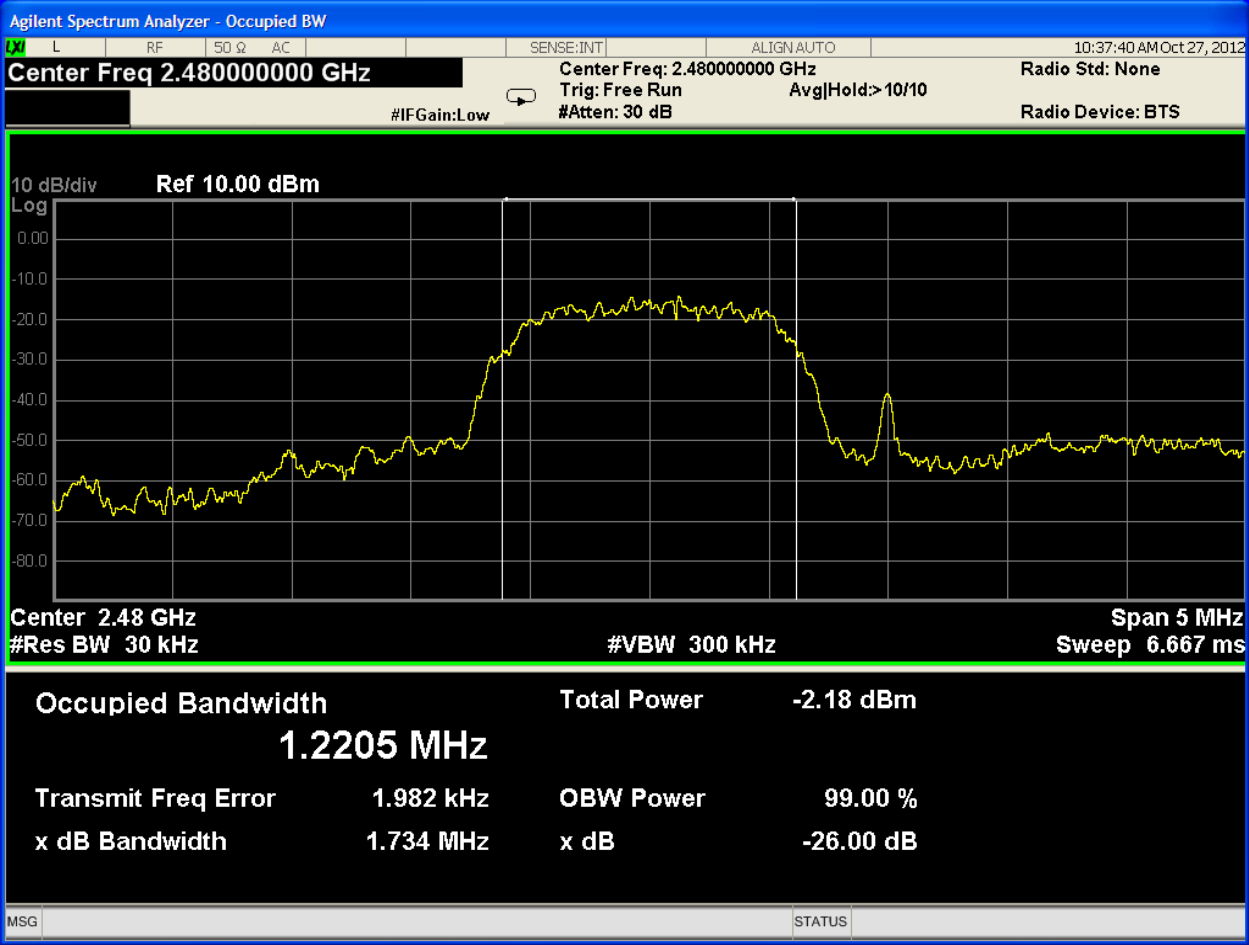
Lowest channel:



Middle channel:



Highest channel:



5.4 Carrier Frequencies Separated

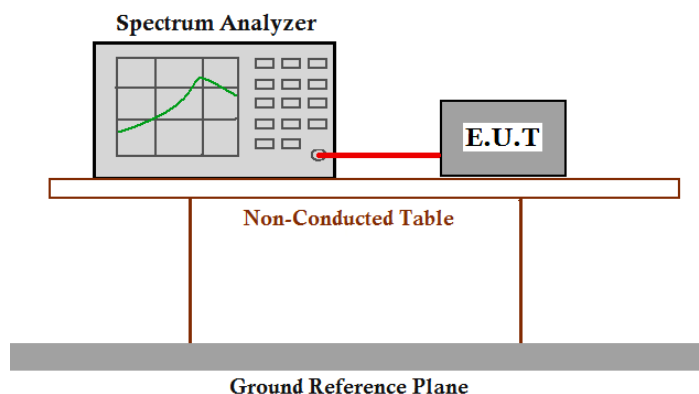
Test Requirement: FCC Part 15 C section 15.247 and RSS-210

(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: DA 00-705

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

Test Configuration:



Test Procedure:

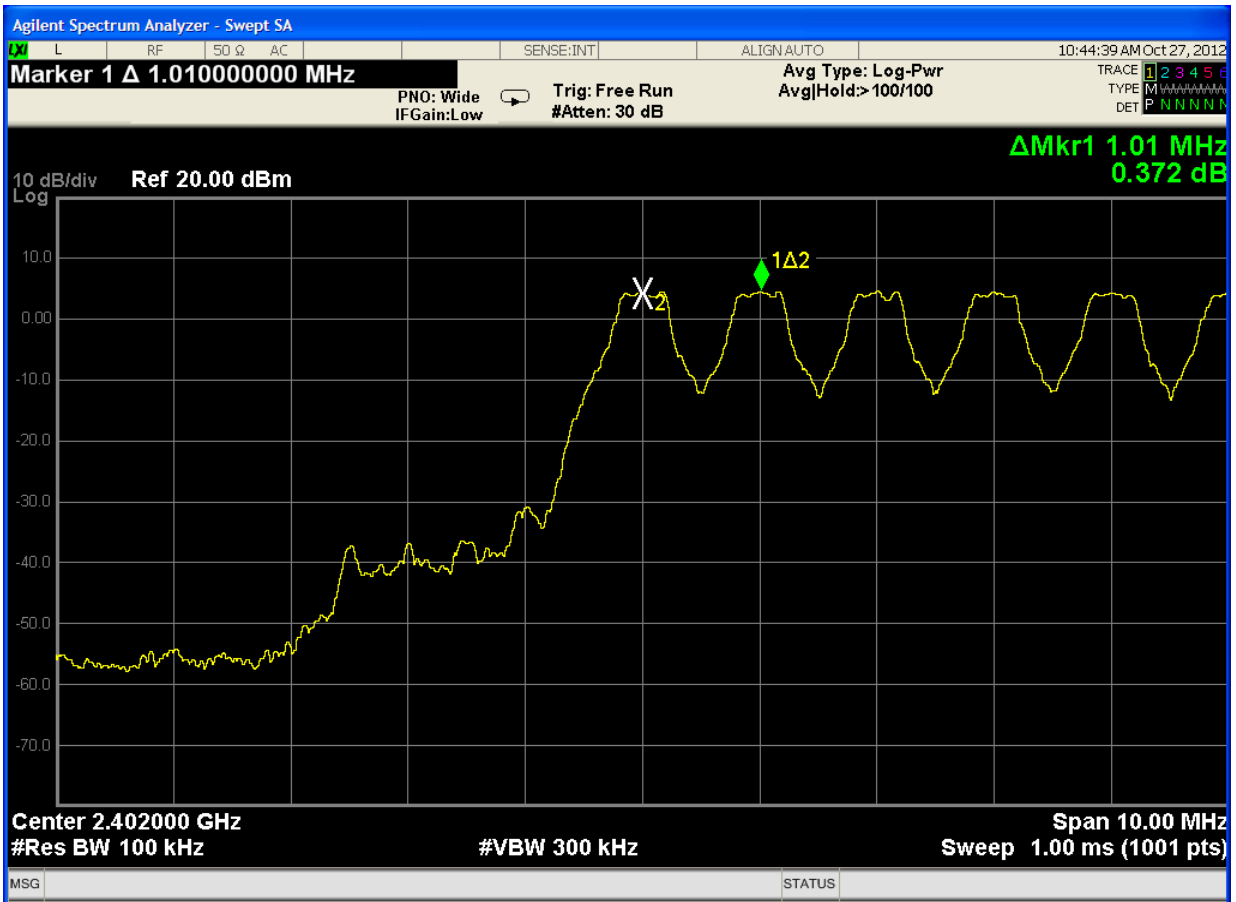
1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW \geq 1% of the span, VBW \geq RBW, Sweep = auto; Detector Function = Peak. Trace = Max, hold.
3. Allow the trace to stabilize. Use the marker-delta function 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:

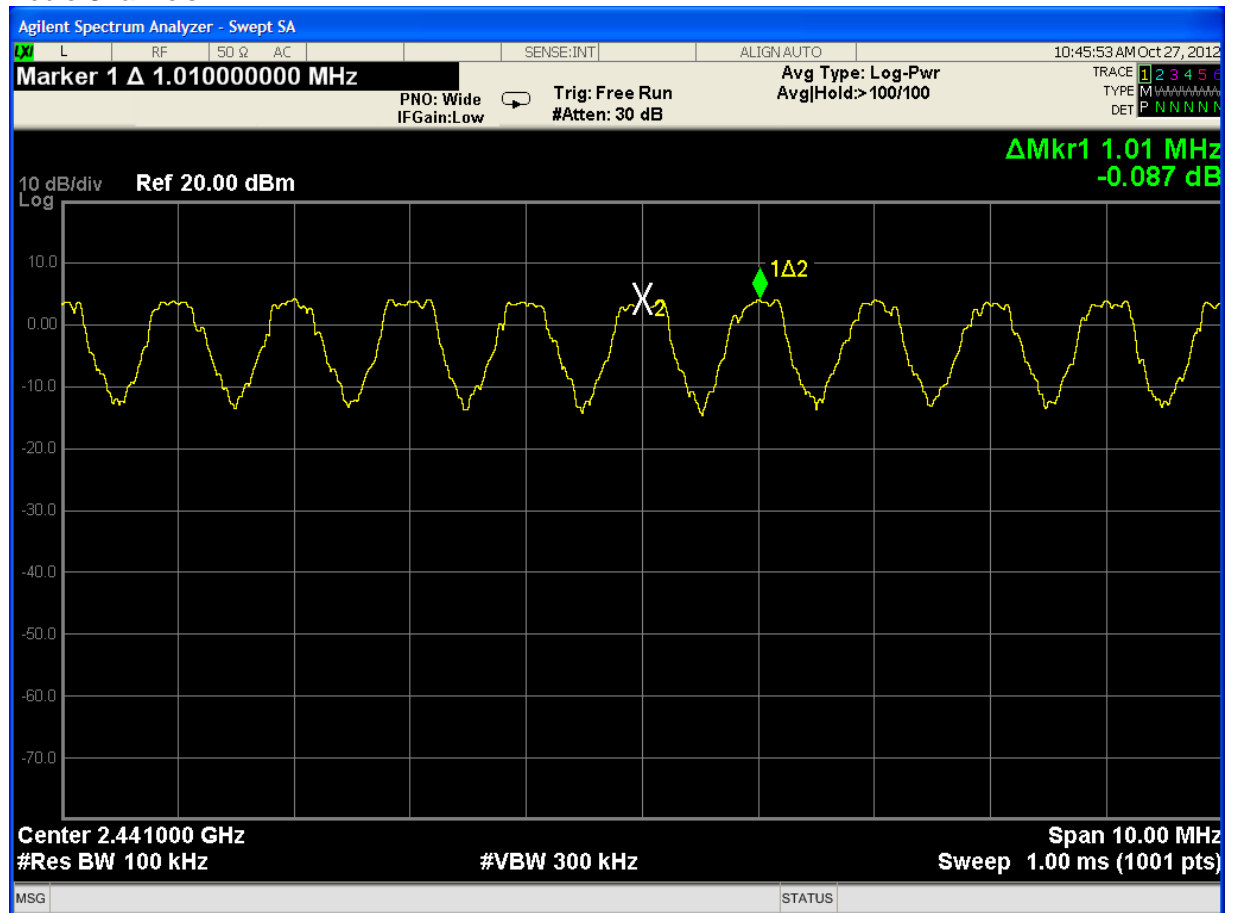
Test Channel	Carrier Frequencies Separated	Pass/Fail
Lower Channels (channel 0 and channel 1)	1.01MHz	Pass
Middle Channels (channel 39 and channel 40)	1.01MHz	Pass
Upper Channels (channel 77 and channel 78)	1.00MHz	Pass
Remark: The limit is maximum two-thirds of the 20 dB bandwidth: 0.921 MHz		

Carrier Frequencies Separated plot:

1. Lowest Channels:



2. Middle Channels:



3. Highest Channels



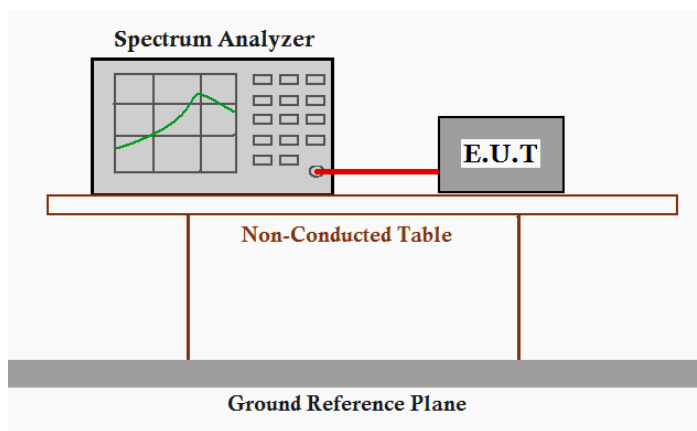
5.5 Hopping Channel Number

Test Requirement: FCC Part15 C section 15.247 and RSS-210
(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

Test Method: DA 00-705

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

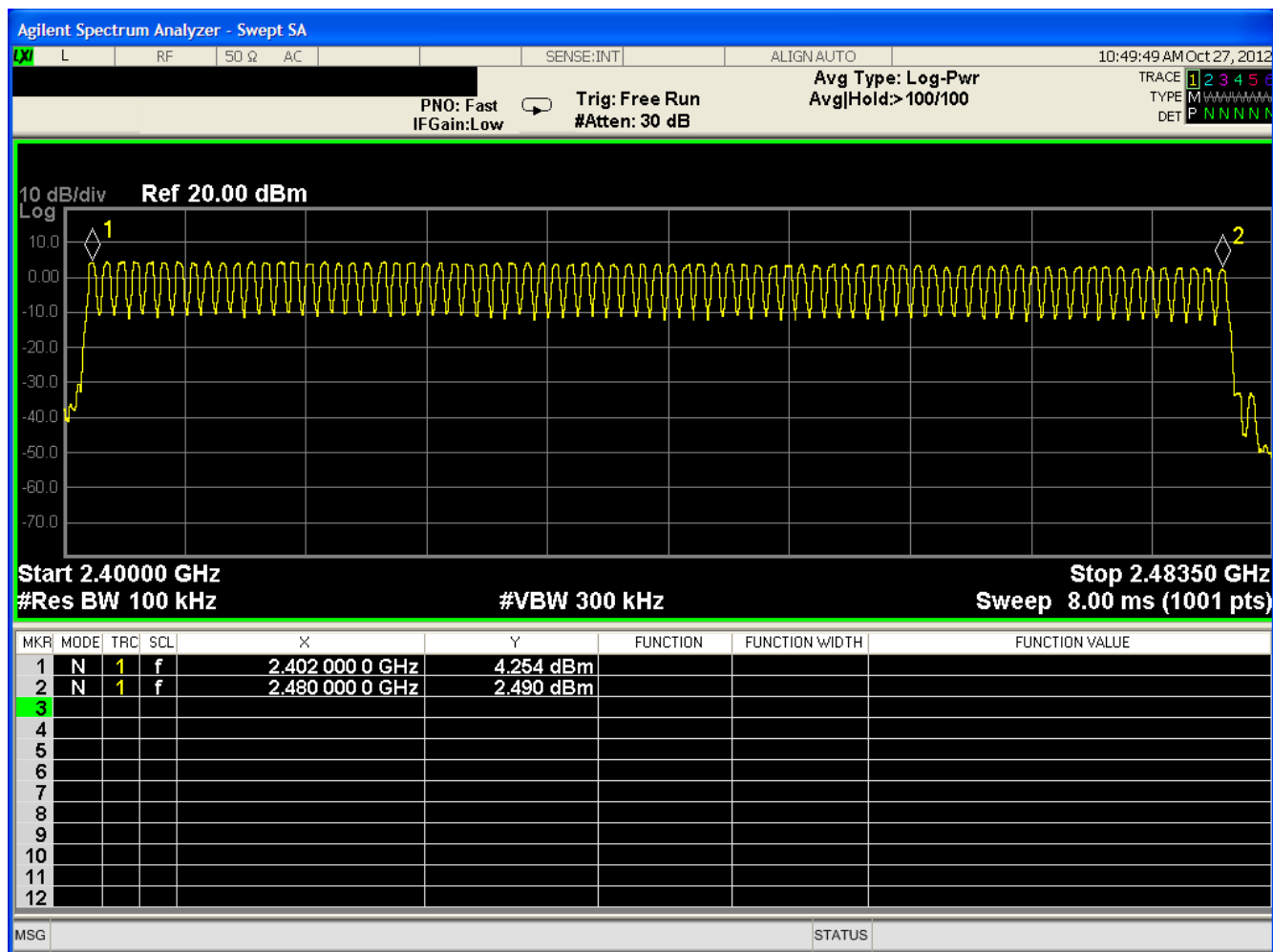
Test Configuration:



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 = 300 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: The unit does meet the FCC and RSS-210 requirements.



Test result: The unit does meet the FCC and RSS-210 requirements.

5.6 Dwell Time

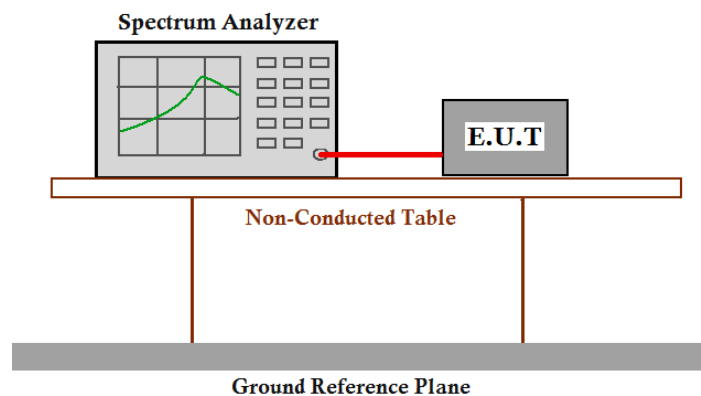
Test Requirement: FCC Part 15 C section 15.247 and RSS-210

(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: DA 00-705

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. Compliance test in hopping with EDR mode (3DH1, 3DH3 and 3DH5) as the worst case was found.

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 = View;
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: $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

1. **Channel 0:** 2.402GHz

3DH1 time slot = $0.41(\text{ms}) * (1600/(2*79)) * 31.6 = 131.2 \text{ ms}$

3DH3 time slot = $1.66 (\text{ms}) * (1600/(4*79)) * 31.6 = 265.6\text{ms}$

3DH5 time slot = $2.90 (\text{ms}) * (1600/(6*79)) * 31.6 = 309.3 \text{ ms}$

2. **Channel 39:** 2.441GHz

3DH1 time slot = $0.41 (\text{ms}) * (1600/(2*79)) * 31.6 = 131.2 \text{ ms}$

3DH3 time slot = $1.66 (\text{ms}) * (1600/(4*79)) * 31.6 = 265.6\text{ms}$

3DH5 time slot = $2.91 (\text{ms}) * (1600/(6*79)) * 31.6 = 309.3\text{ms}$

3. **Channel 78:** 2.480GHz

3DH1 time slot = $0.41 (\text{ms}) * (1600/(2*79)) * 31.6 = 131.2 \text{ ms}$

3DH3 time slot = $1.66 (\text{ms}) * (1600/(4*79)) * 31.6 = 265.6\text{ms}$

3DH5 time slot = $2.90(\text{ms}) * (1600/(6*79)) * 31.6 = 309.3\text{ms}$

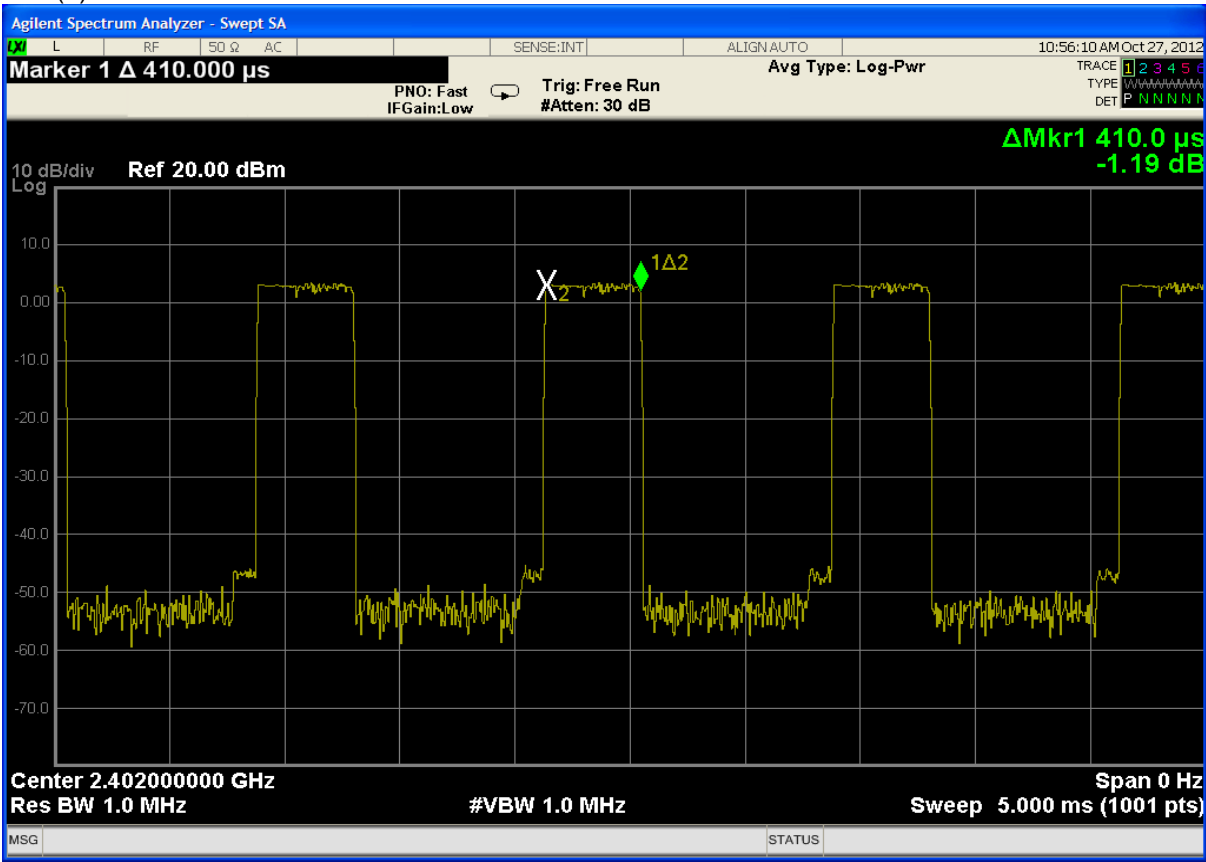
The results are not greater than 0.4 seconds

The unit does meet the FCC and RSS-210 requirements.

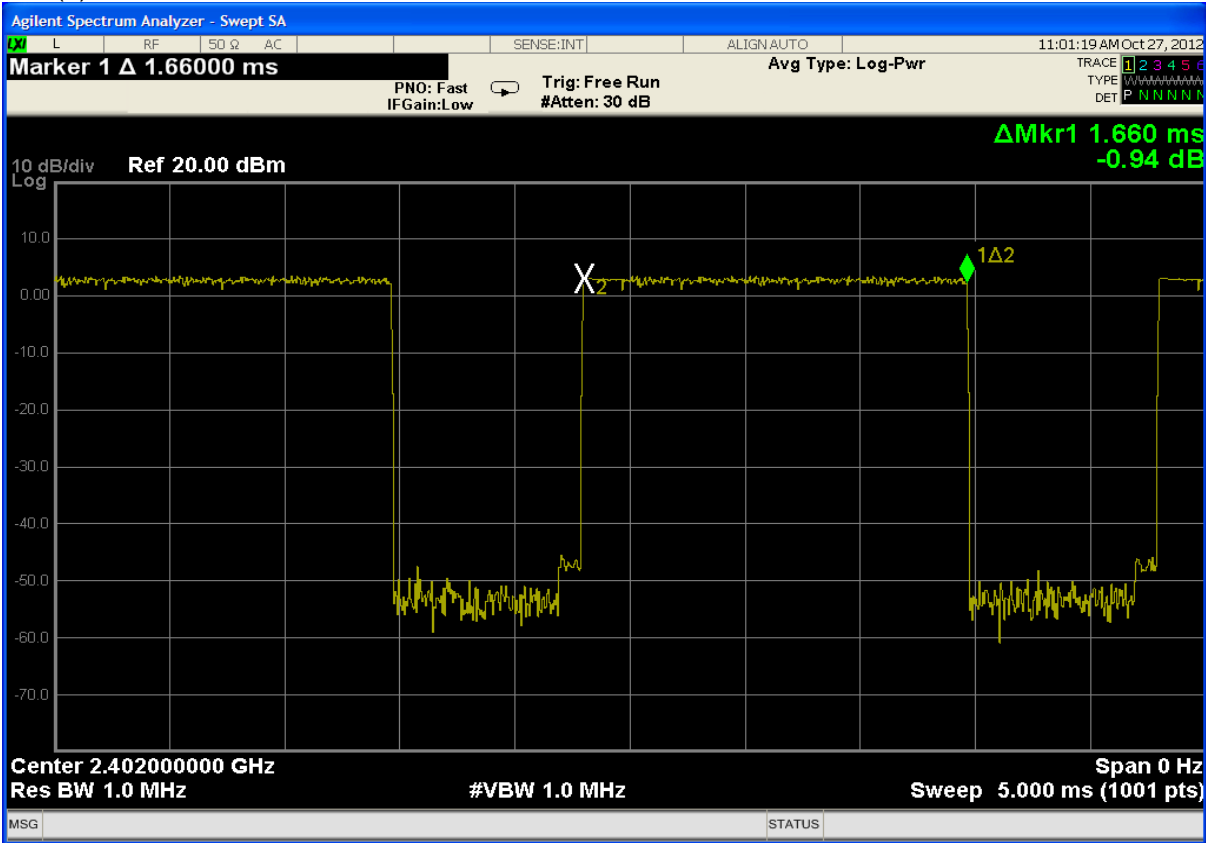
Please refer the graph as below:

1. Lowest channel (2.402 GHz):

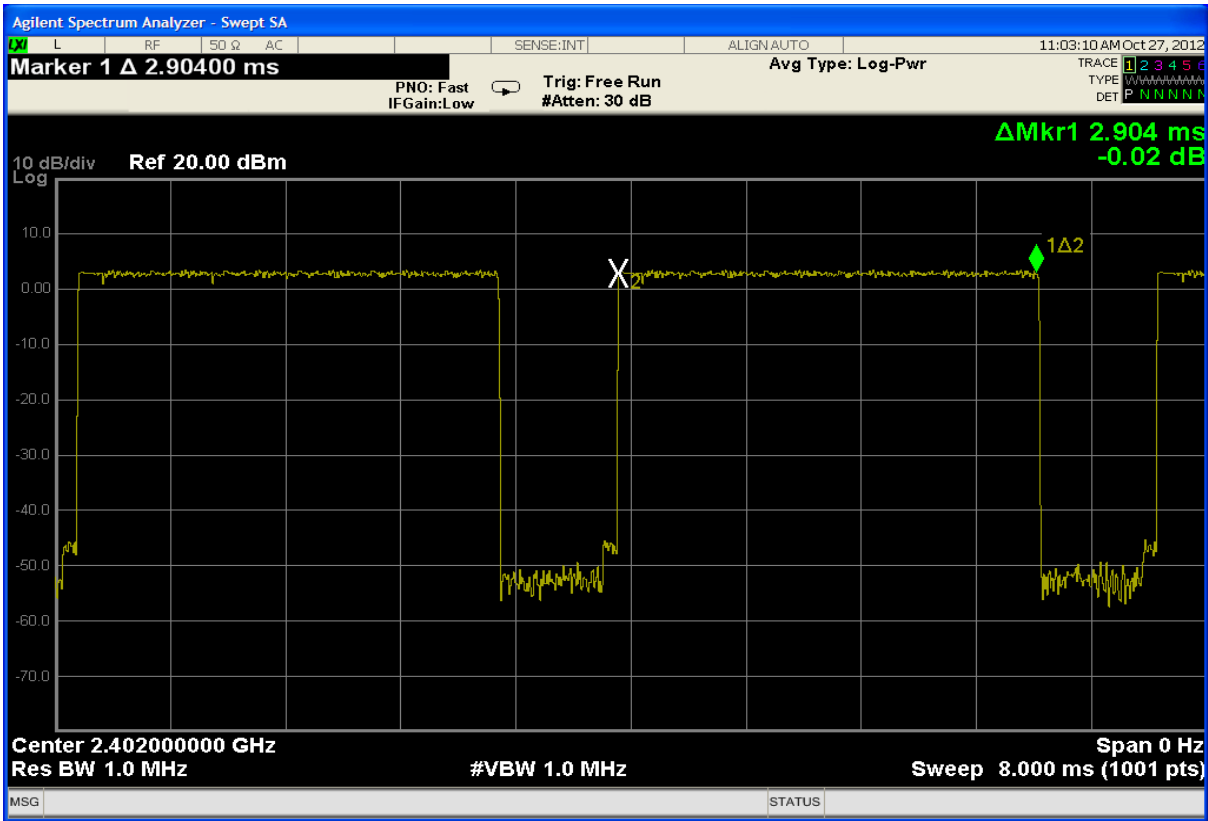
(1). 3DH1



(2) 3DH3

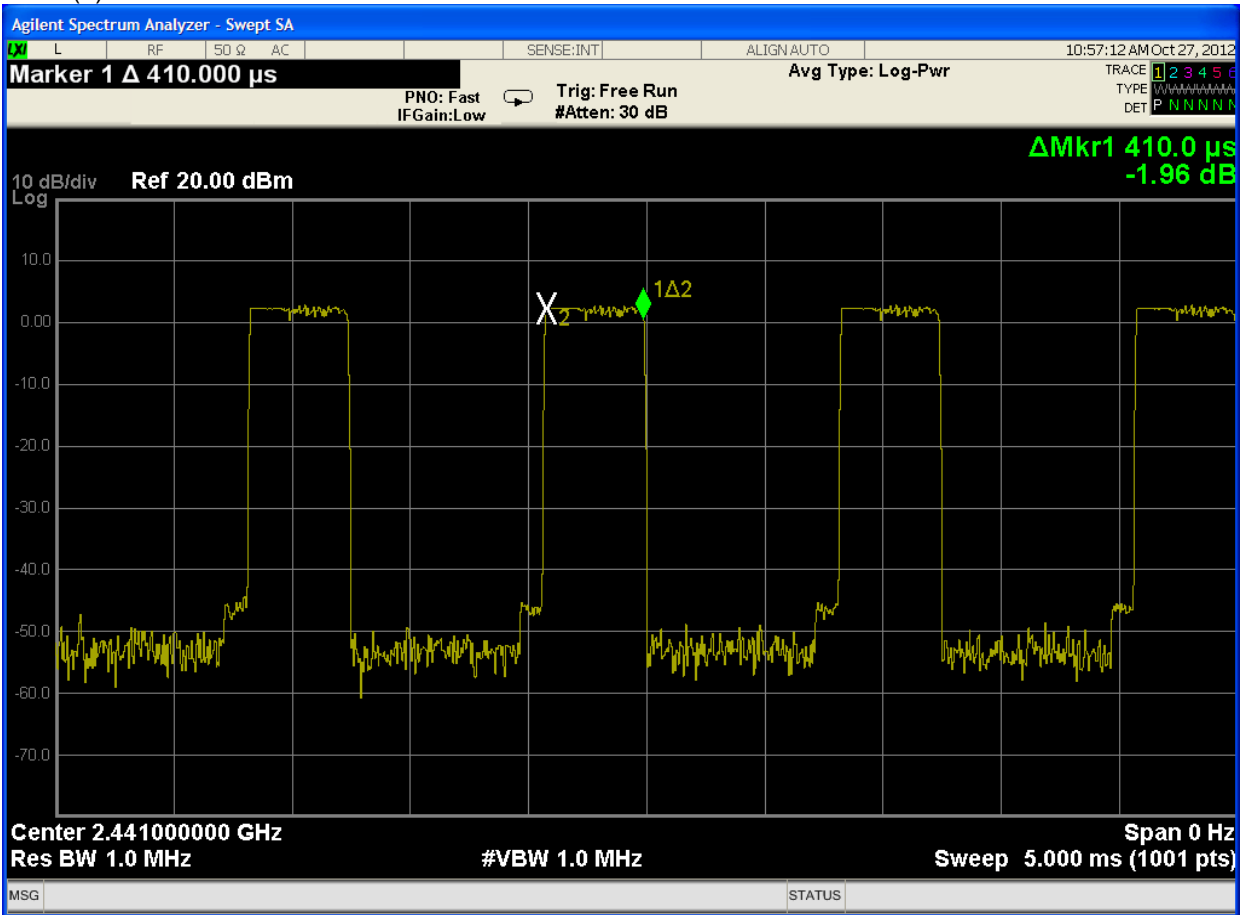


(3) 3DH5

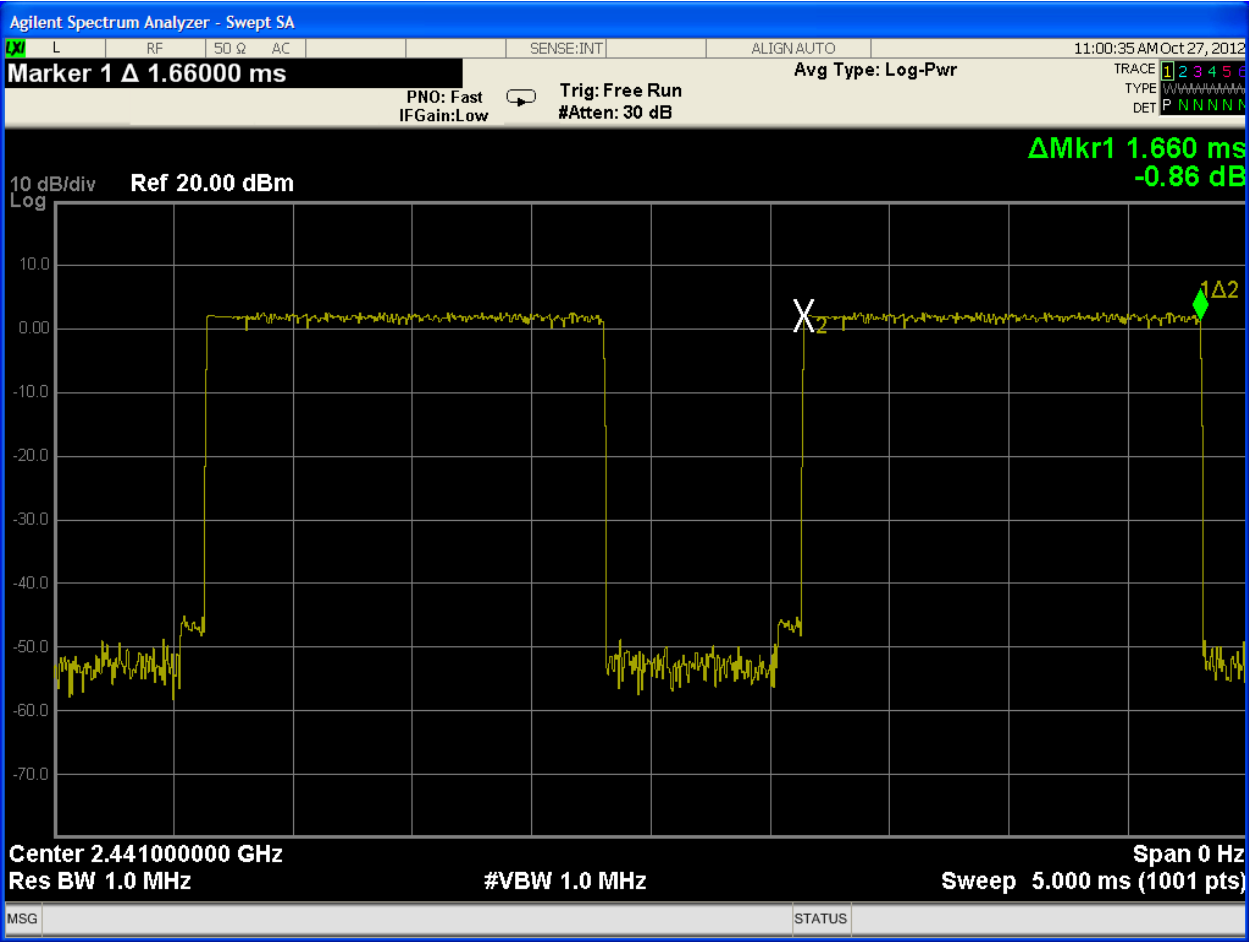


2. Middle channel (2.441 GHz):

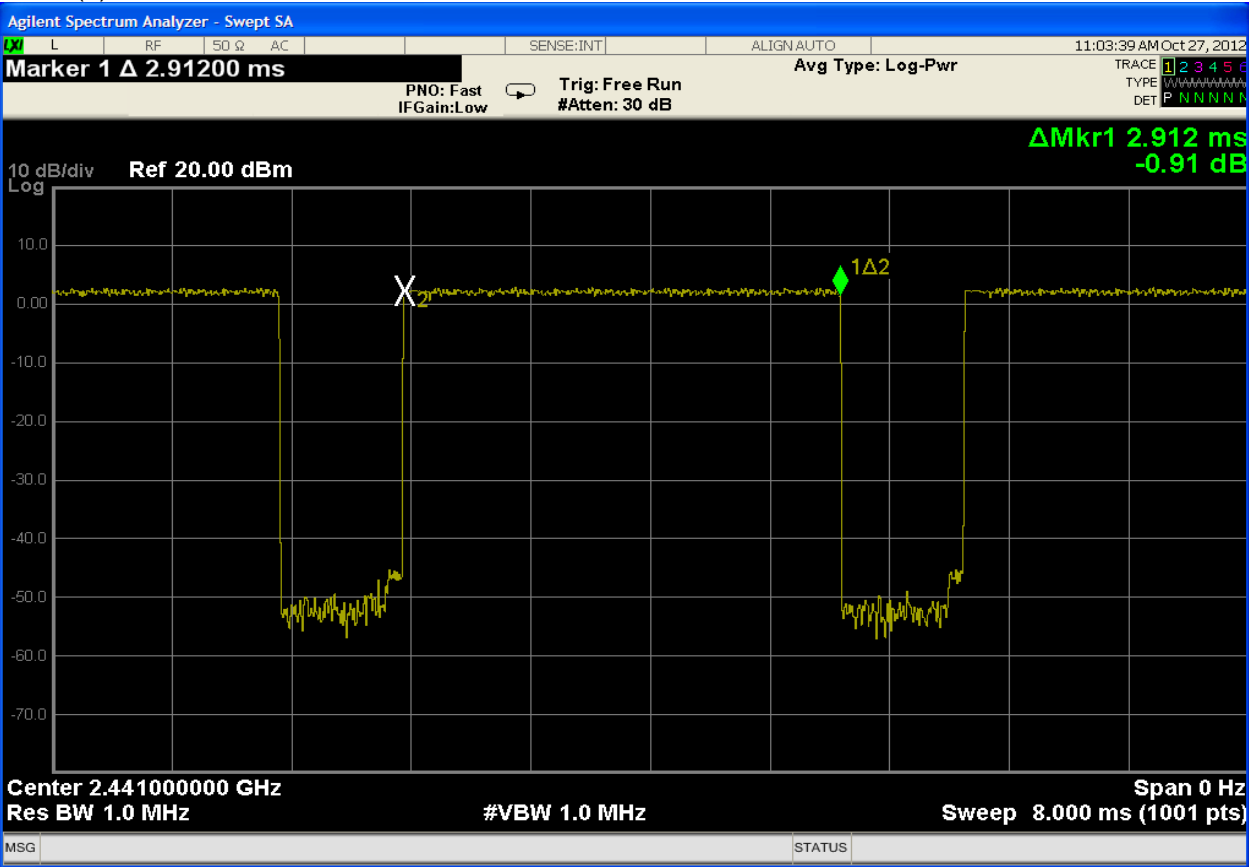
(1). 3DH1



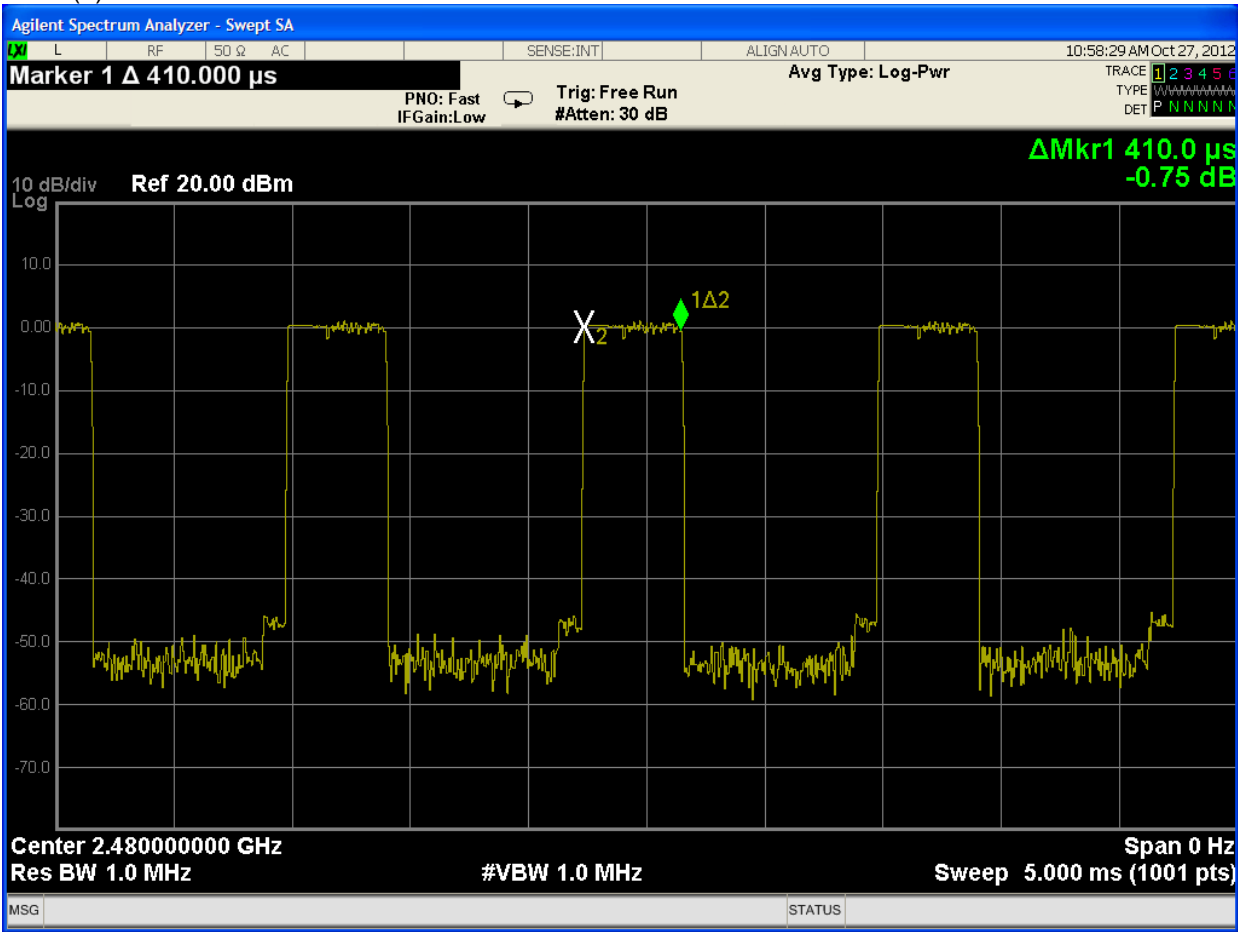
(2) 3DH3



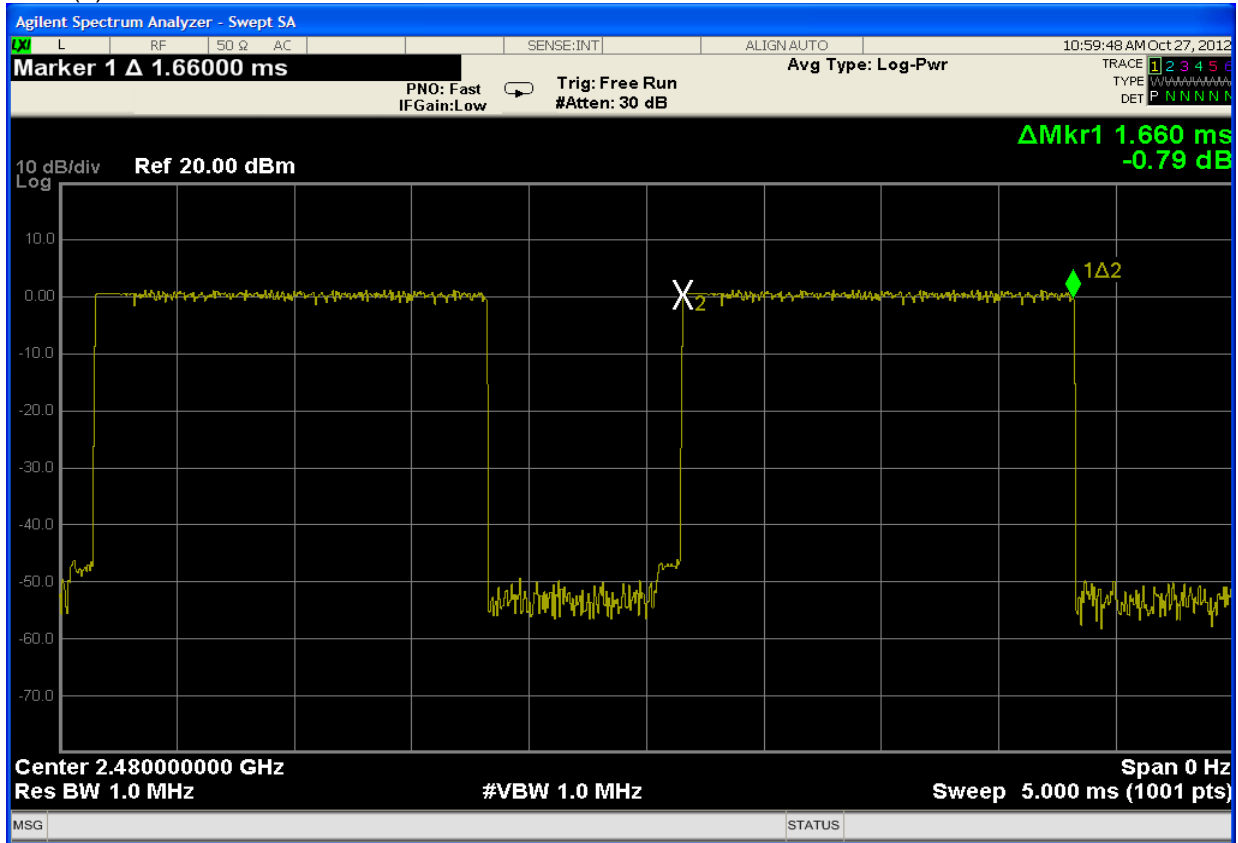
(3) 3DH5



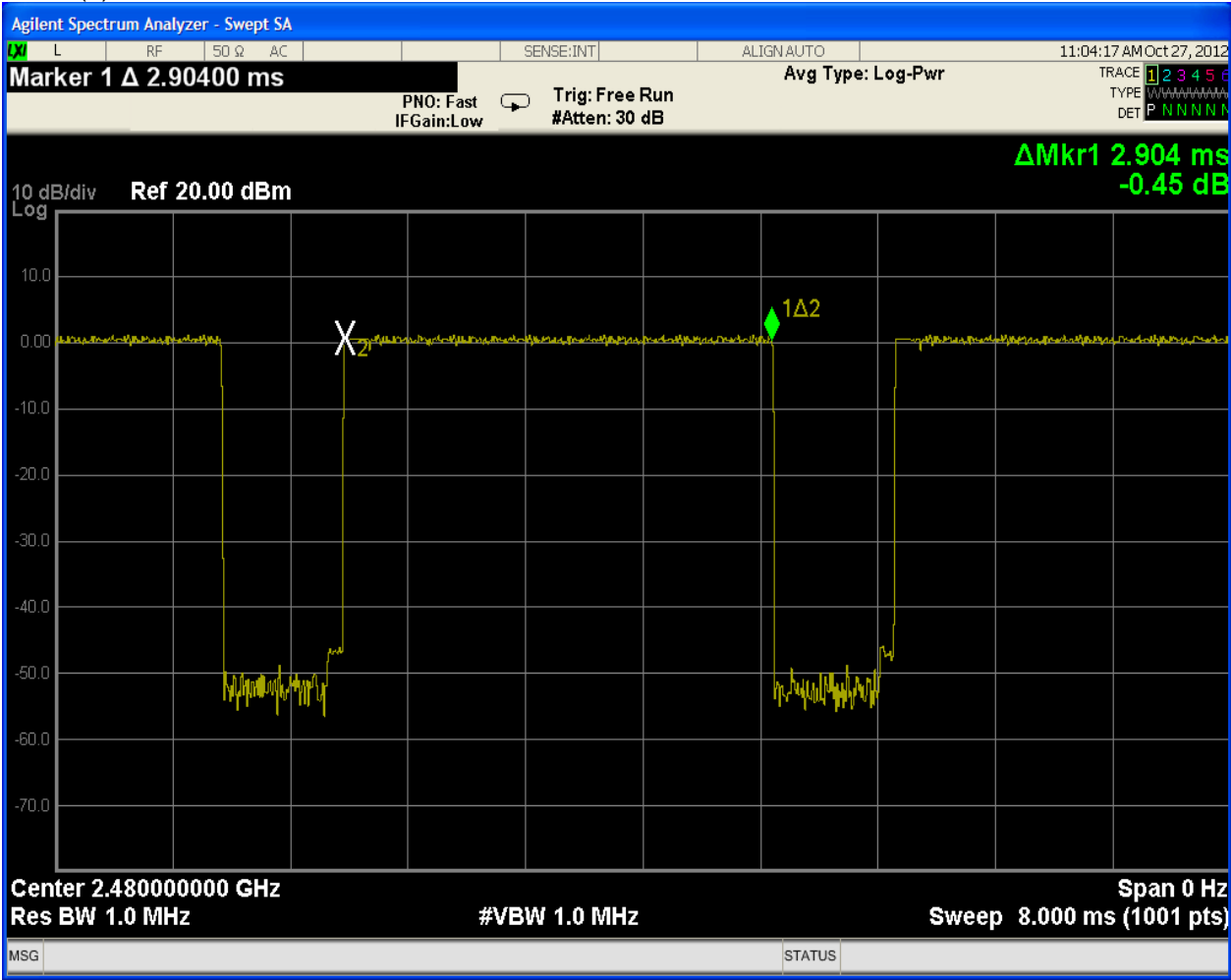
- 3. Highest channel (2.480 GHz):
 - (1). 3DH1



- (2) 3DH3



(3) 3DH5



Remark:

In communication data link mode (except 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 (1 slot=1/1600=625us), and for DH5 packet the RF frequency will remain unchanged during 5 slots, illustrated the principle as below:

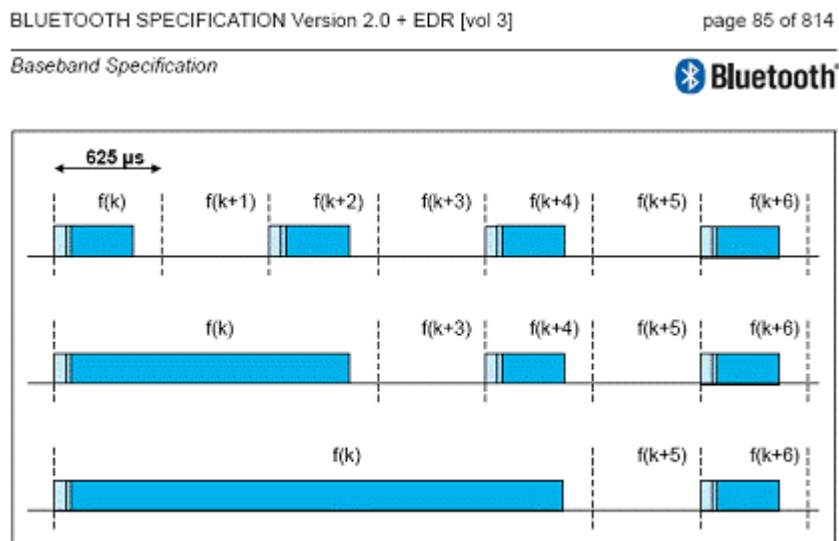


Figure 2.14: Single- and multi-slot packets.

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, 1/2 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 -> $\frac{1}{2}$ 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 -> $\frac{1}{3}$ 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;

5.7 Pseudorandom Frequency Hopping Sequence

5.7.1 Standard requirement

15.247(a)(1) and RSS-210 requirement:

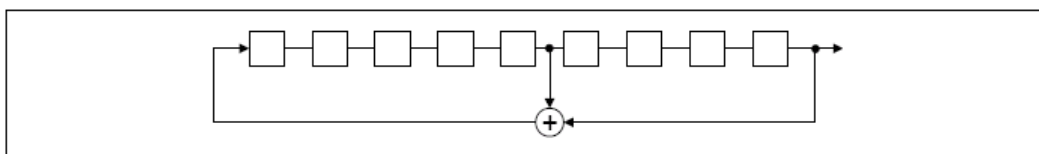
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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.

5.7.2 EUT Pseudorandom Frequency Hopping Sequence

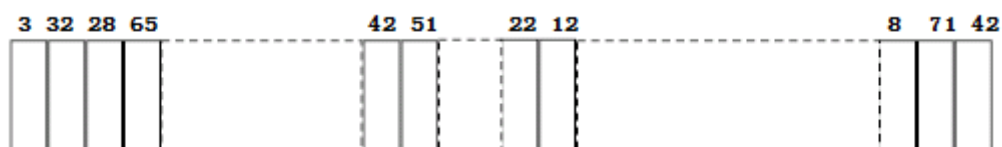
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized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

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



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

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

5.8 Maximum Peak Output Power

Test Requirement: FCC Part 15 C section 15.247 and RSS-210

(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.

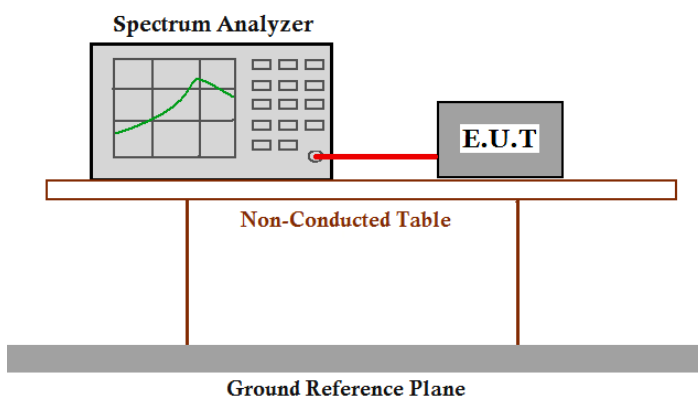
Refer to the result "Hopping channel number" of this document. The 1 watt (30.0 dBm) limit applies.

Test Method: ANSI C63.10: Clause 6.10 & DA 00-705

Test Limit:

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. Compliance test in continuous transmitting mode with normal (DH5) and EDR mode (3DH5) as the worst case was found.

Test Configuration:



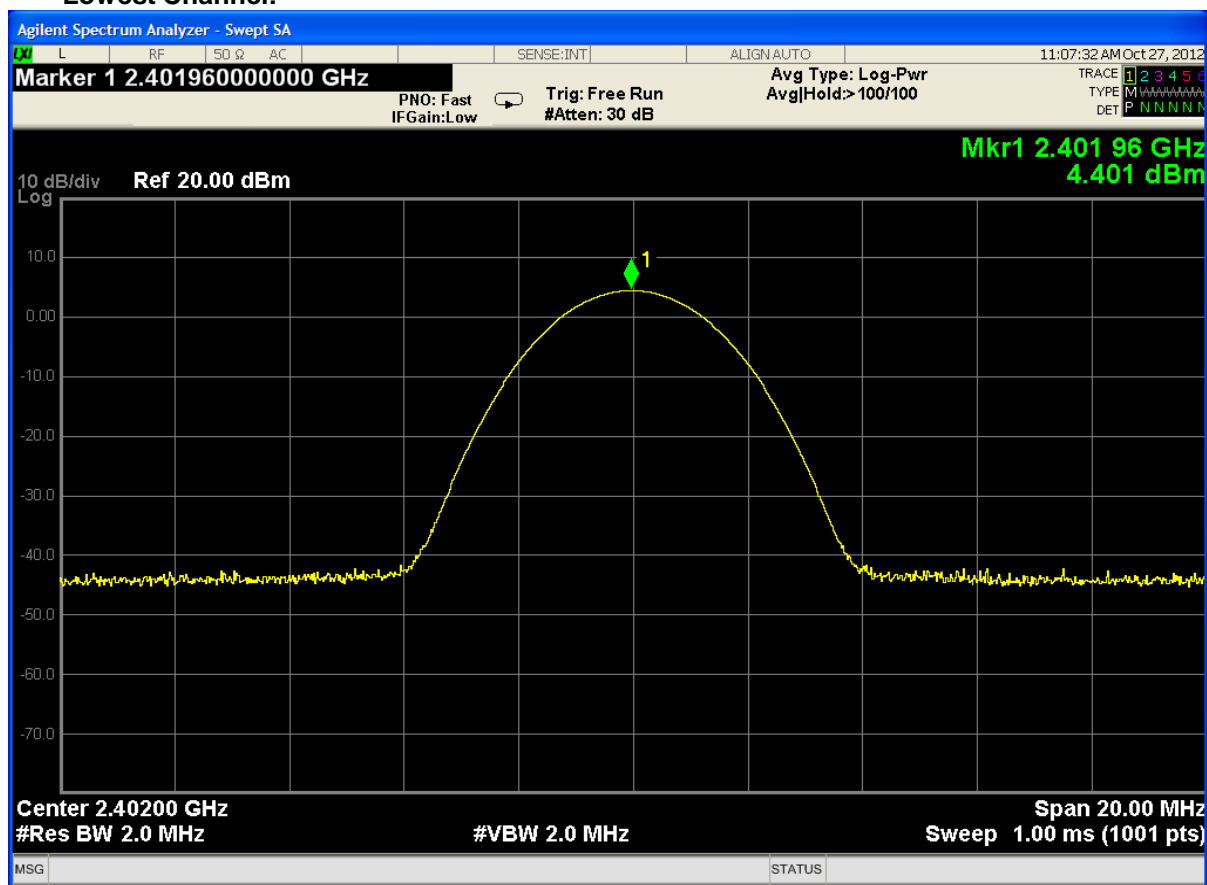
Test Procedure:

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.

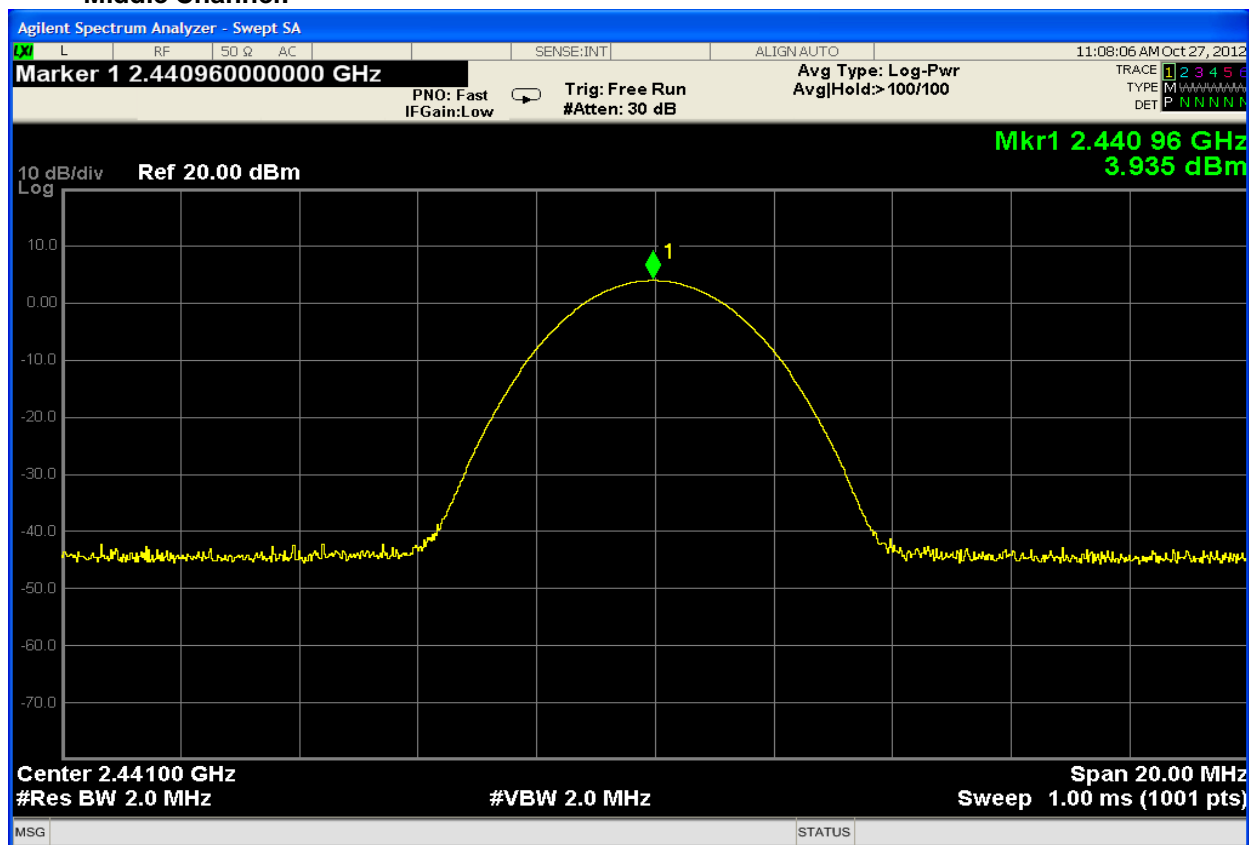
Test Result:				
Normal mode:				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	5.401	30.0	Pass
Middle	2441	4.935	30.0	Pass
Highest	2480	3.638	30.0	Pass
EDR mode:				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2402	5.422	30.0	Pass
Middle	2441	4.968	30.0	Pass
Highest	2480	3.694	30.0	Pass
Remark: cable lose=1.0dB				
Test result: The unit does meet the FCC and RSS-210 requirements.				
Test result plot as follows:				

Normal mode:

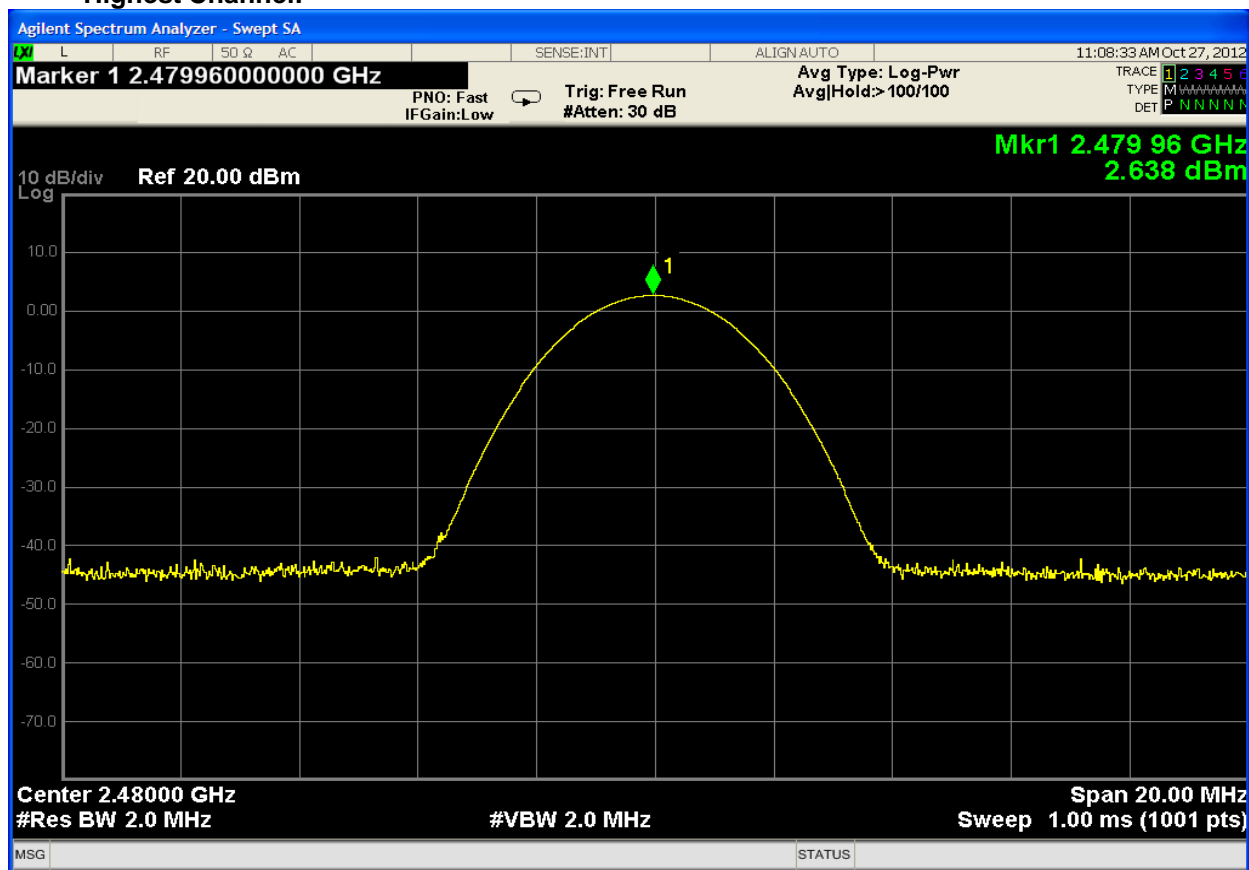
Lowest Channel:



Middle Channel:

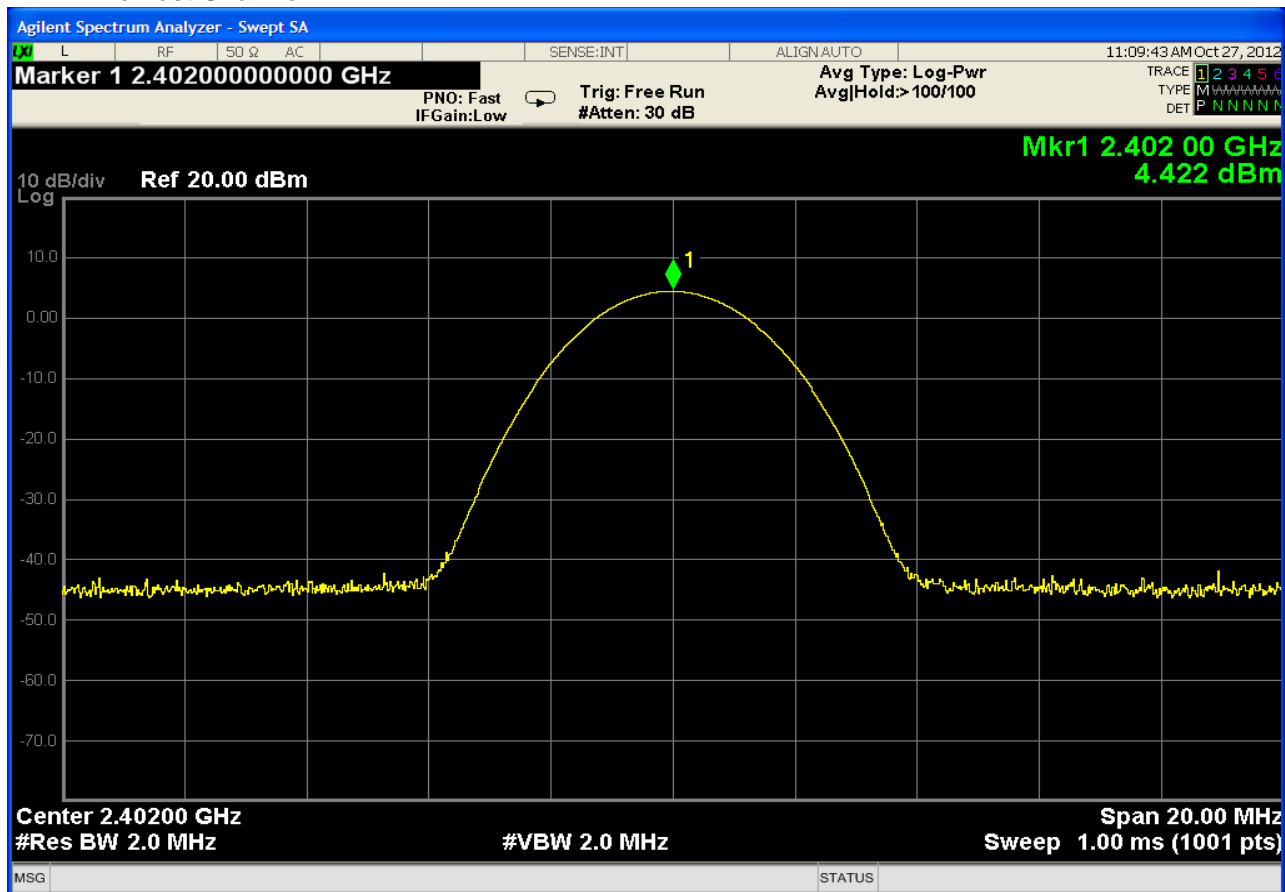


Highest Channel:

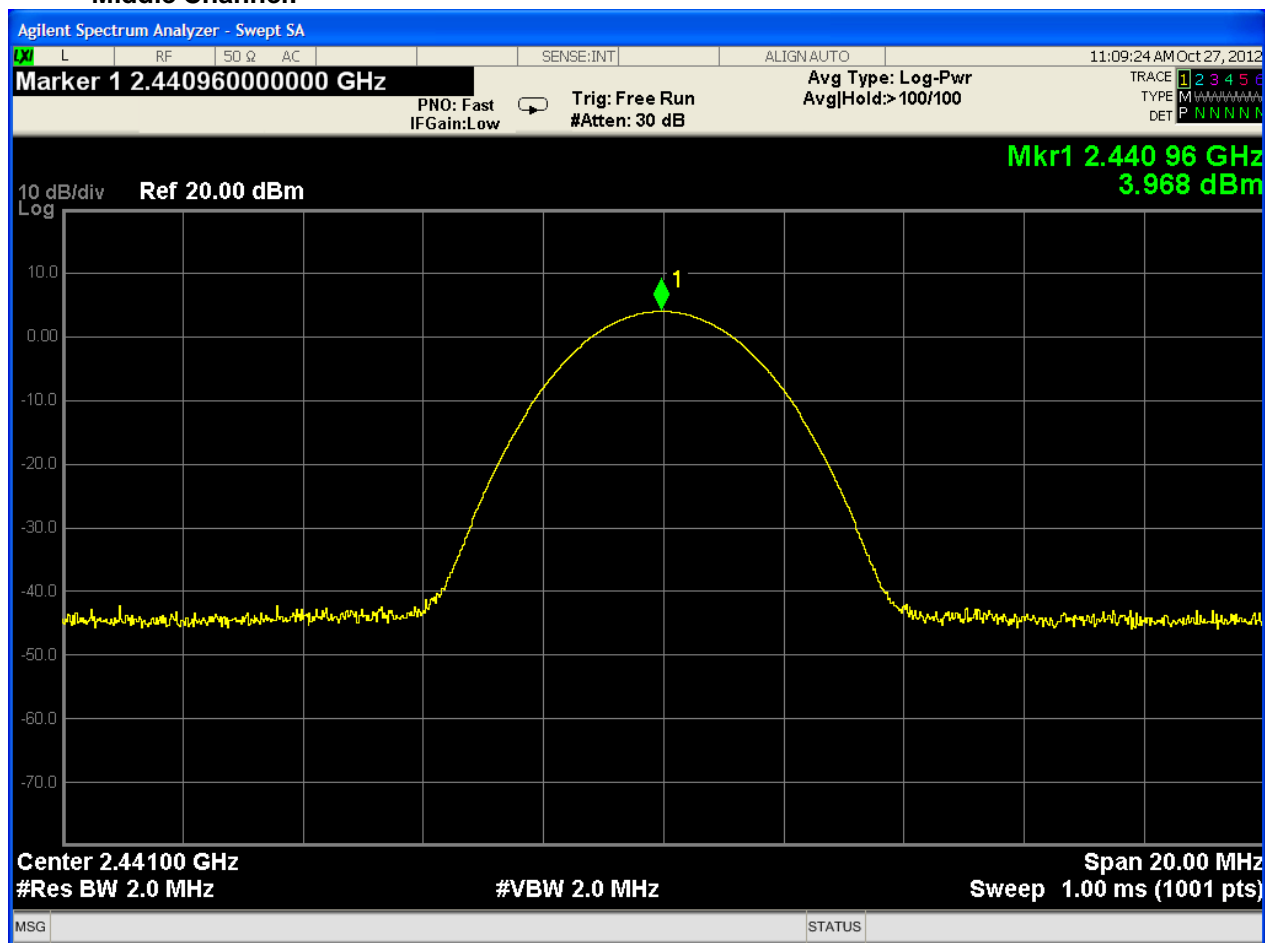


EDR mode:

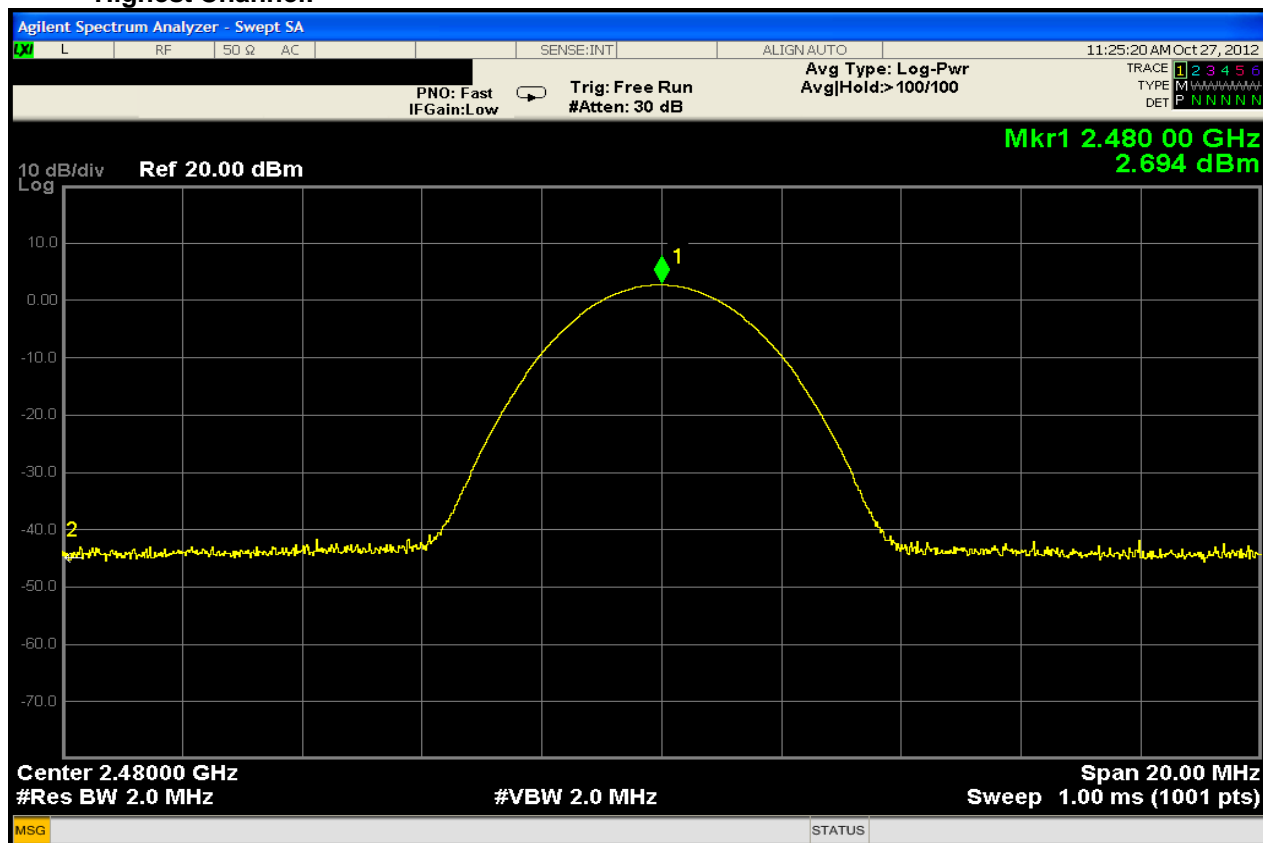
Lowest Channel:



Middle Channel:



Highest Channel:



5.9 Conducted Spurious Emissions

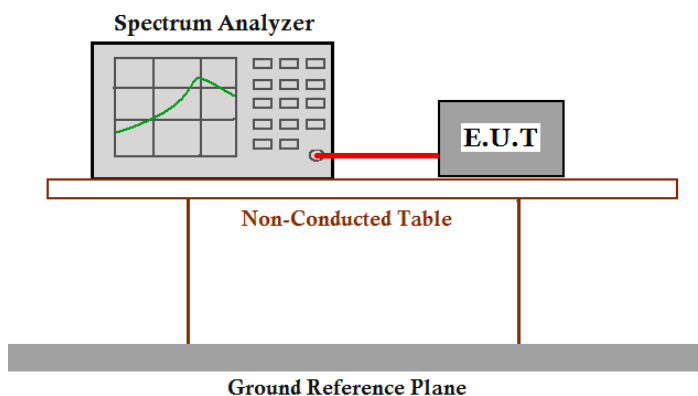
Test Requirement: FCC Part15 C section 15.247 and RSS-210

(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 6.7 & DA 00-705

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. Compliance test in continuous transmitting mode with normal mode (DH5) as the worst case was found.

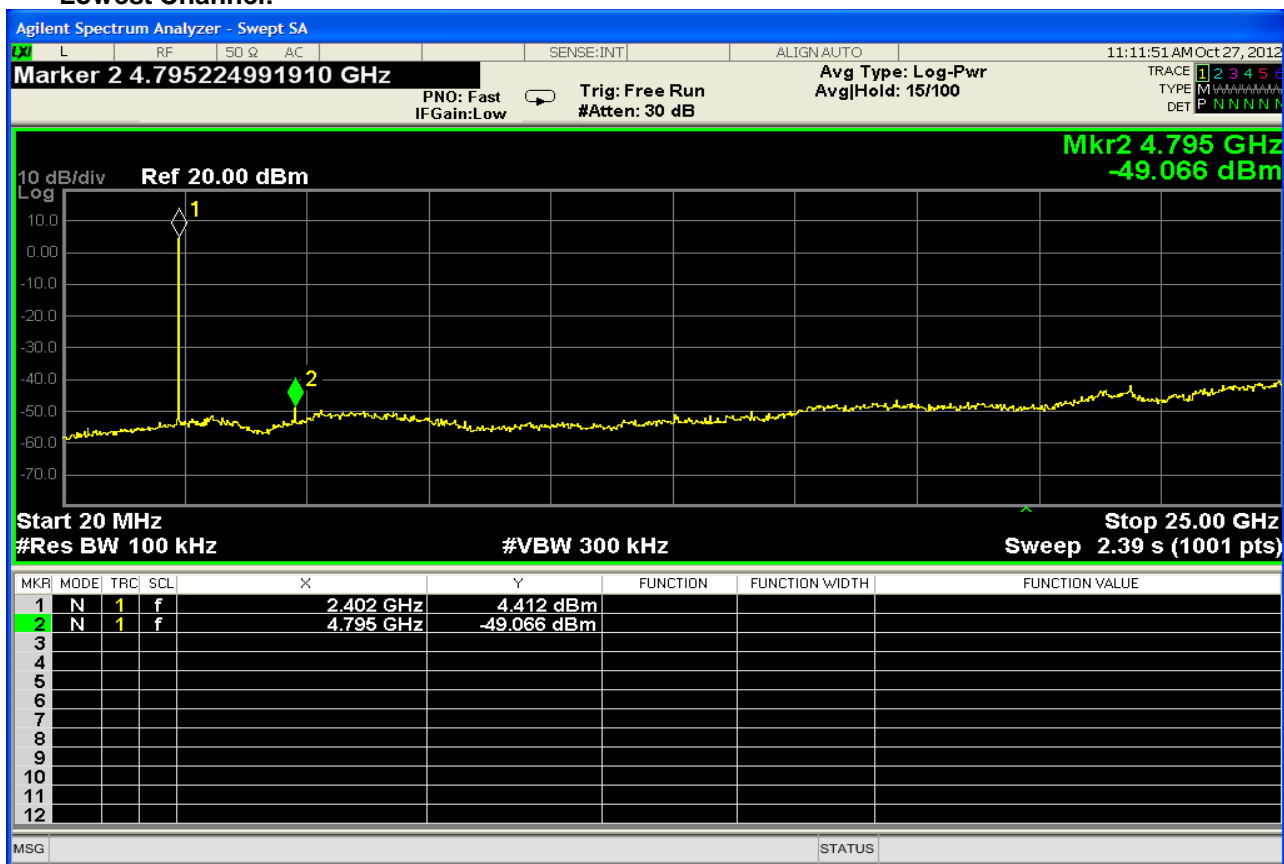
Test Configuration:



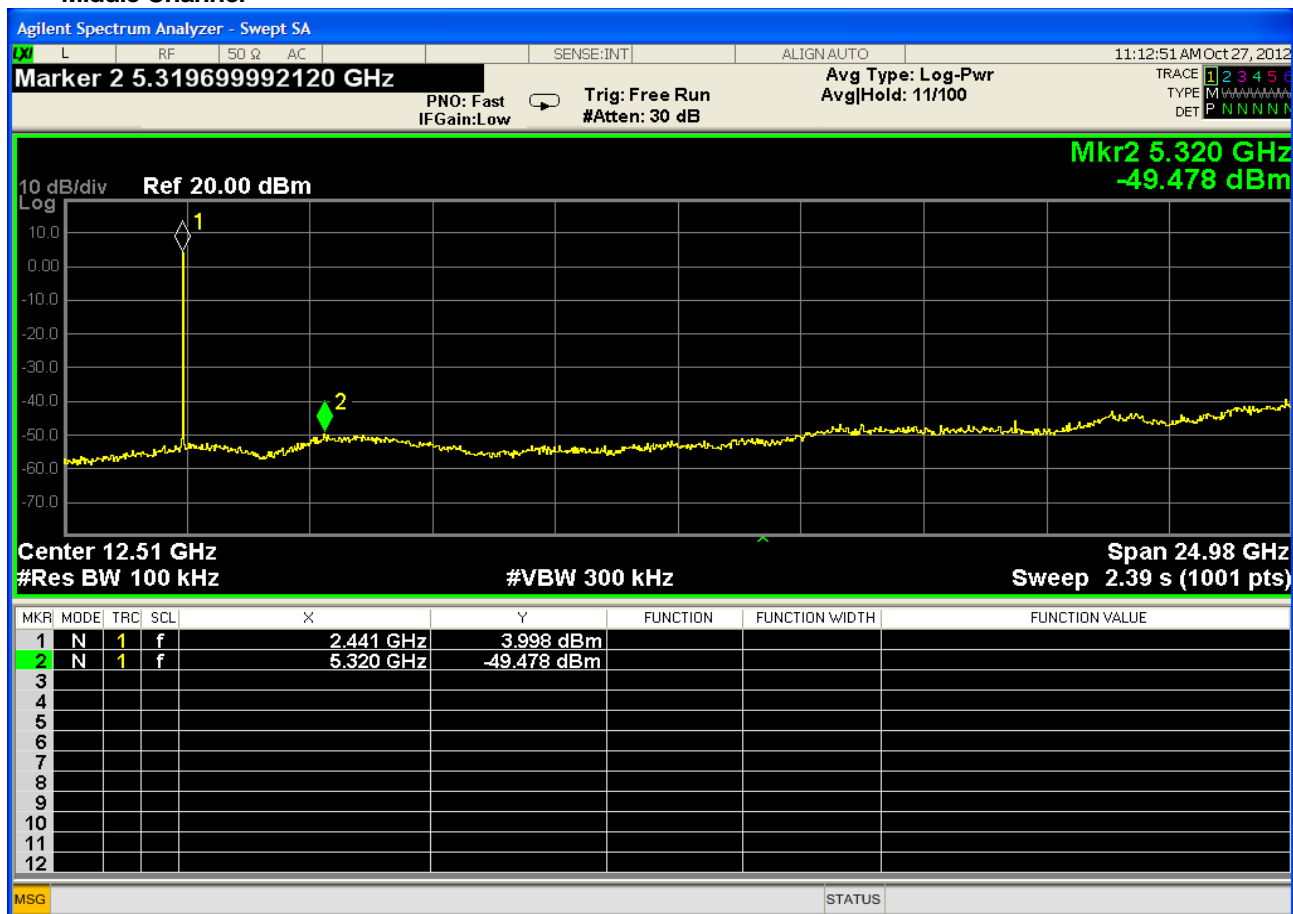
Test Procedure:

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 \geq RBW. Sweep = auto; Detector Function = Peak (Max. hold).

Test result plot as follows:
Lowest Channel:



Middle Channel



Agilent Spectrum Analyzer - Swept SA

Marker 2 4.970049991980 GHz

PNO: Fast IFGain: Low Trig: Free Run #Atten: 30 dB

Avg Type: Log-Pwr Avg|Hold: 7/100

TRACE 1 2 3 4 5 6
TYPE M
DET P NNNNN

11:13:27 AM Oct 27, 2012

10 dB/div Ref 20.00 dBm

Log

Mkr2 4.970 GHz
-46.572 dBm

Center 12.51 GHz
#Res BW 100 kHz

#VBW 300 kHz

Span 24.98 GHz
Sweep 2.39 s (1001 pts)

MKR	MODE	TRC	SCL	X	Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE
1	N	1	f	2.480 GHz	2.636 dBm			
2	N	1	f	4.970 GHz	-46.572 dBm			
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

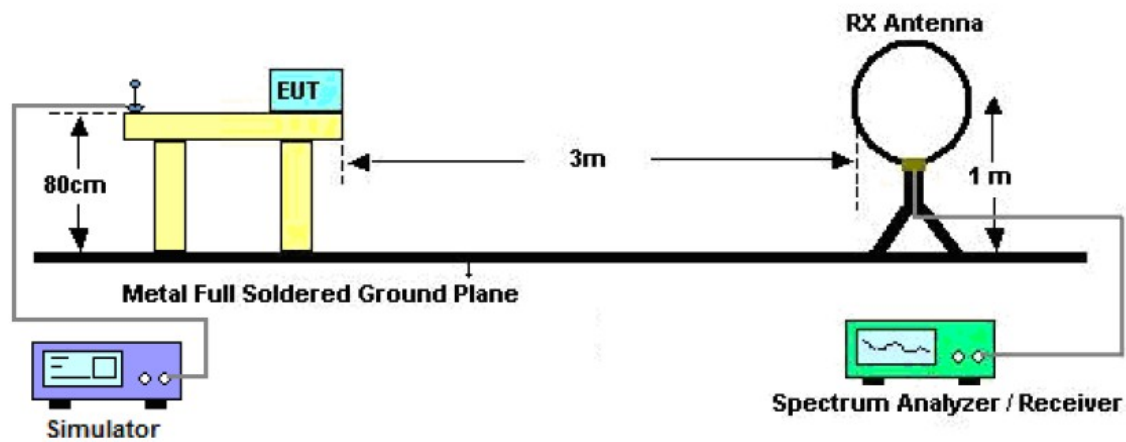
MSG STATUS

5.10 Radiated Spurious Emissions

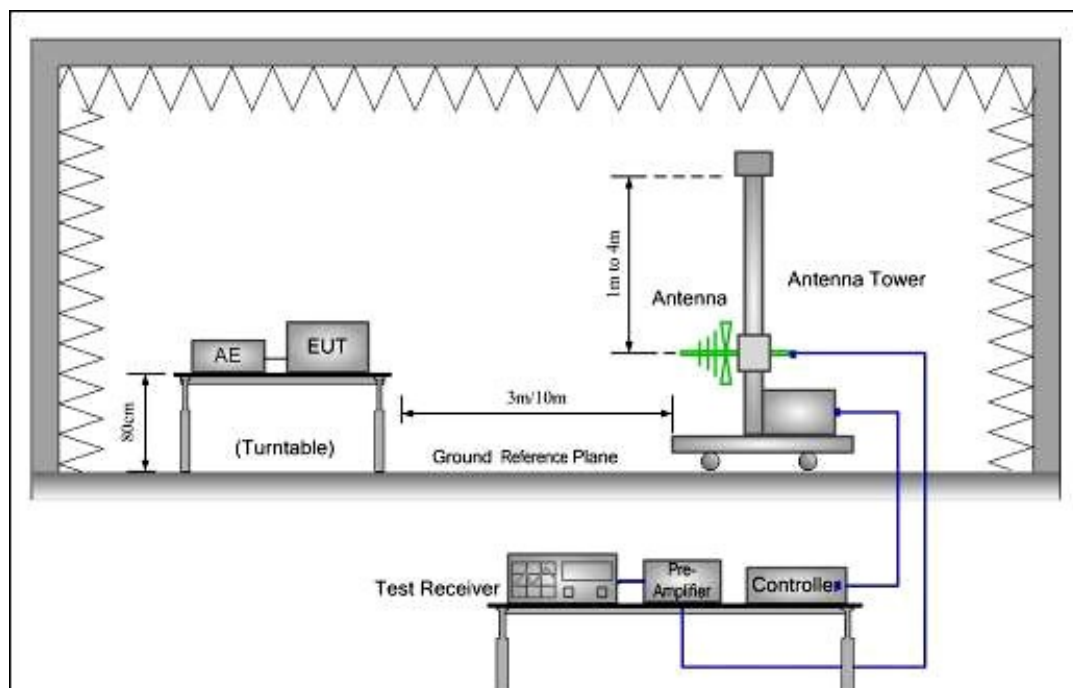
Test Requirement:	FCC Part15 C section 15.247 and RSS-210 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below 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, and provided the transmitter demonstrates compliance with the peak conducted power limits.
Test Method:	ANSI C63.10: Clause 6.4, 6.5 and 6.6 & DA 00-705
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. Compliance test in continuous transmitting mode with normal mode (DH5) as the worst case was found.
Detector:	For PK value: RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, 9kHz for <30 MHz VBW \geq RBW Sweep = auto Detector function = peak Trace = max hold For AV value: RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz, 9kHz for <30 MHz VBW =10 Hz Sweep = auto Detector function = peak Trace = max hold
15.209 Limit:	40.0 dB μ V/m between 30MHz & 88MHz 43.5 dB μ V/m between 88MHz & 216MHz 46.0 dB μ V/m between 216MHz & 960MHz 54.0 dB μ V/m above 960MHz

Test Configuration:

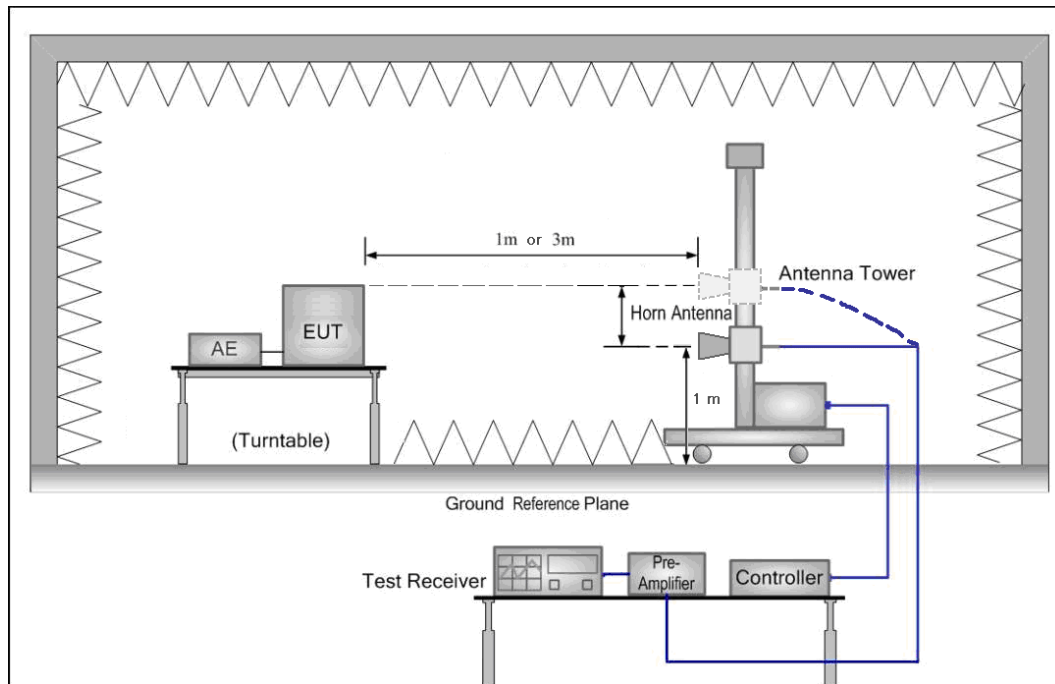
- 1) 9kHz to 30MHz emissions:



- 2) 30 MHz to 1 GHz emissions:



3) 1 GHz to 40 GHz emissions:



Test Procedure: The procedure used was ANSI Standard C63.4:2003. 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 $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit.

Submit this data.

5.10.1 Harmonic and other spurious emissions

Test at low Channel in transmitting status

9kHz~30MHz Test result

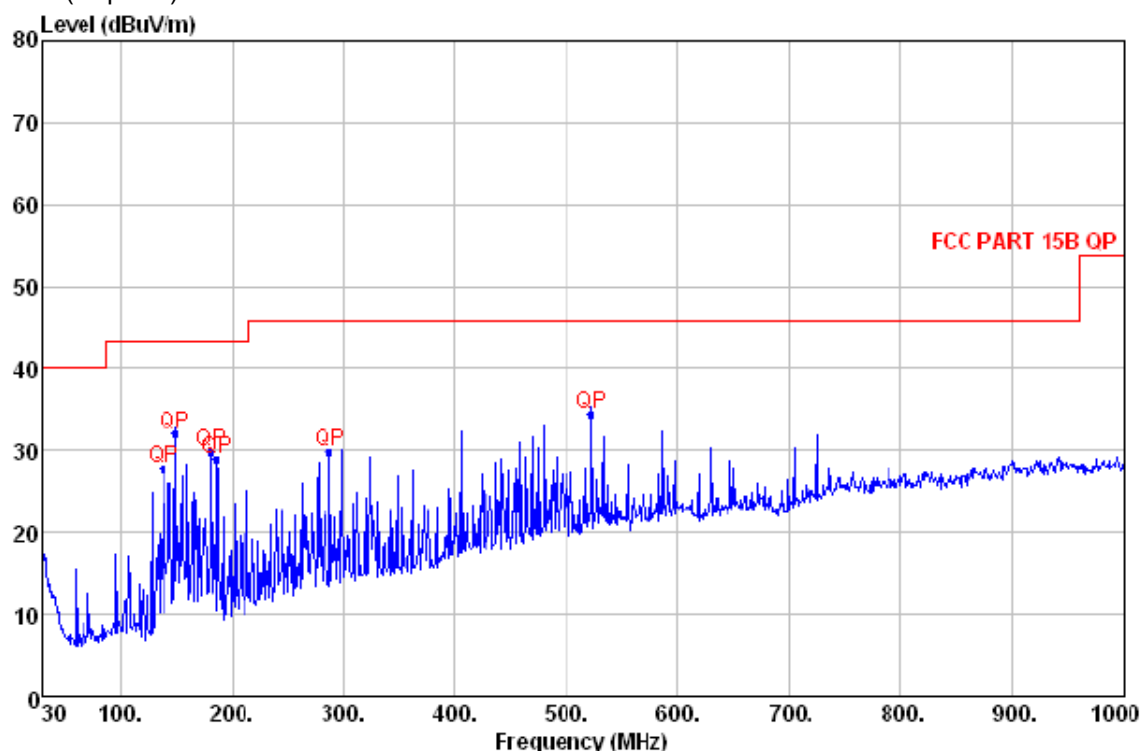
The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

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

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Level dBμV/m	Remark	Antenna Factor dB/m	Cable Loss dB	Limit Line dBμV/m	Margin dB	A/pos cm	T/pos deg
1	138.640	27.77	QP	7.40	1.40	43.50	-15.73	100	128
2	149.310	32.05	QP	7.14	1.46	43.50	-11.45	100	229
3	181.320	29.90	QP	8.30	1.62	43.50	-13.60	100	61
4	186.170	28.86	QP	8.44	1.64	43.50	-14.64	200	161
5	288.020	29.82	QP	13.42	2.08	46.00	-16.18	200	208
6	522.760	34.53	QP	19.02	2.84	46.00	-11.47	200	305

Level=Read Level + Antenna Factor + Cable Loss

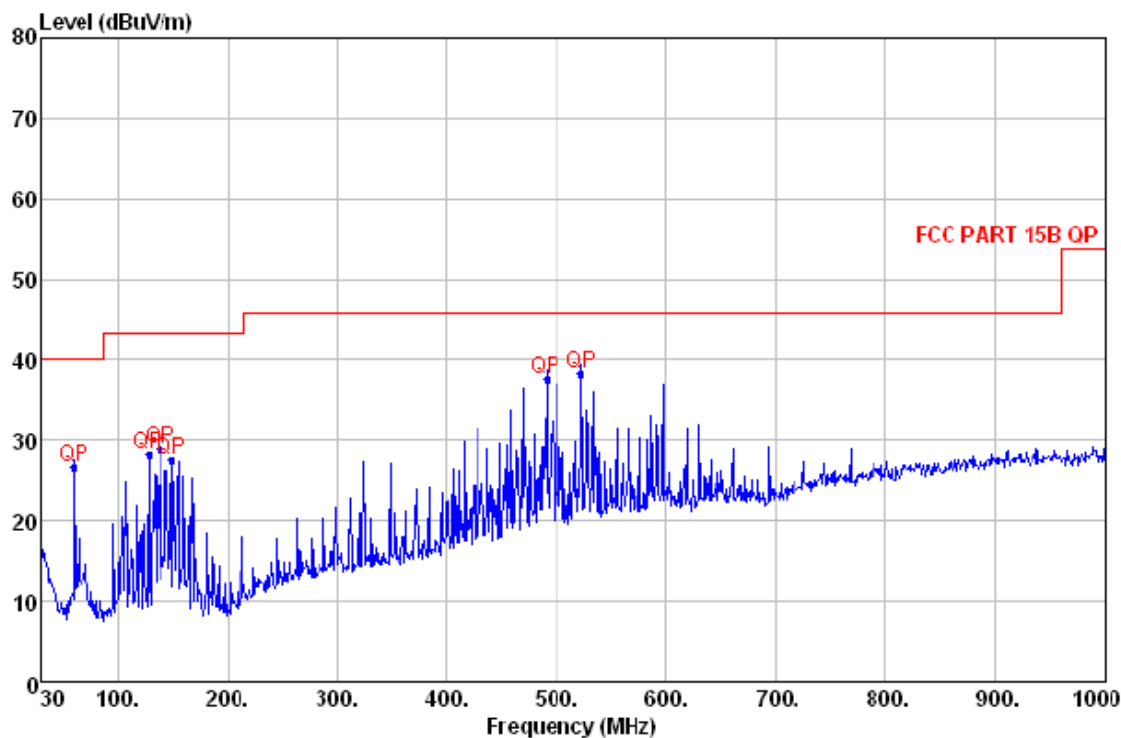
Test at low Channel in transmitting status

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

Vertical:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Level dBμV/m	Remark	Antenna Factor dB/m	Cable Loss dB	Limit Line dBμV/m	Margin dB	A/pos cm	T/pos deg
1	60.070	26.70	QP	6.70	0.89	40.00	-13.30	100	91
2	127.970	28.28	QP	7.52	1.35	43.50	-15.22	100	61
3	138.640	28.91	QP	7.40	1.40	43.50	-14.59	100	234
4	149.310	27.68	QP	7.14	1.46	43.50	-15.82	200	204
5	490.750	37.75	QP	18.30	2.75	46.00	-8.25	200	124
6	522.760	38.39	QP	19.02	2.84	46.00	-7.61	200	191

Level=Read Level + Antenna Factor + Cable Loss

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

Peak Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamplifier factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4804.000	32.53	5.20	33.48	49.61	53.86	74.00	V
7206.000	37.47	7.20	32.76	48.21	60.12	74.00	V
9608.000	38.08	8.36	34.08	48.42	60.78	74.00	V
4804.000	32.53	5.20	33.48	49.45	53.7	74.00	H
7206.000	37.47	7.20	32.76	47.28	59.19	74.00	H
9608.000	38.08	8.36	34.08	48.63	60.99	74.00	H

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamplifier factor (dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
4804.000	32.53	5.20	33.48	44.61	48.86	54.00	V
7206.000	37.47	7.20	32.76	38.18	50.09	54.00	V
9608.000	38.08	8.36	34.08	36.43	48.79	54.00	V
4804.000	32.53	5.20	33.48	43.79	48.04	54.00	H
7206.000	37.47	7.20	32.76	37.75	49.66	54.00	H
9608.000	38.08	8.36	34.08	37.06	49.42	54.00	H

Test at Middle Channel in transmitting status

9kHz~30MHz Test result

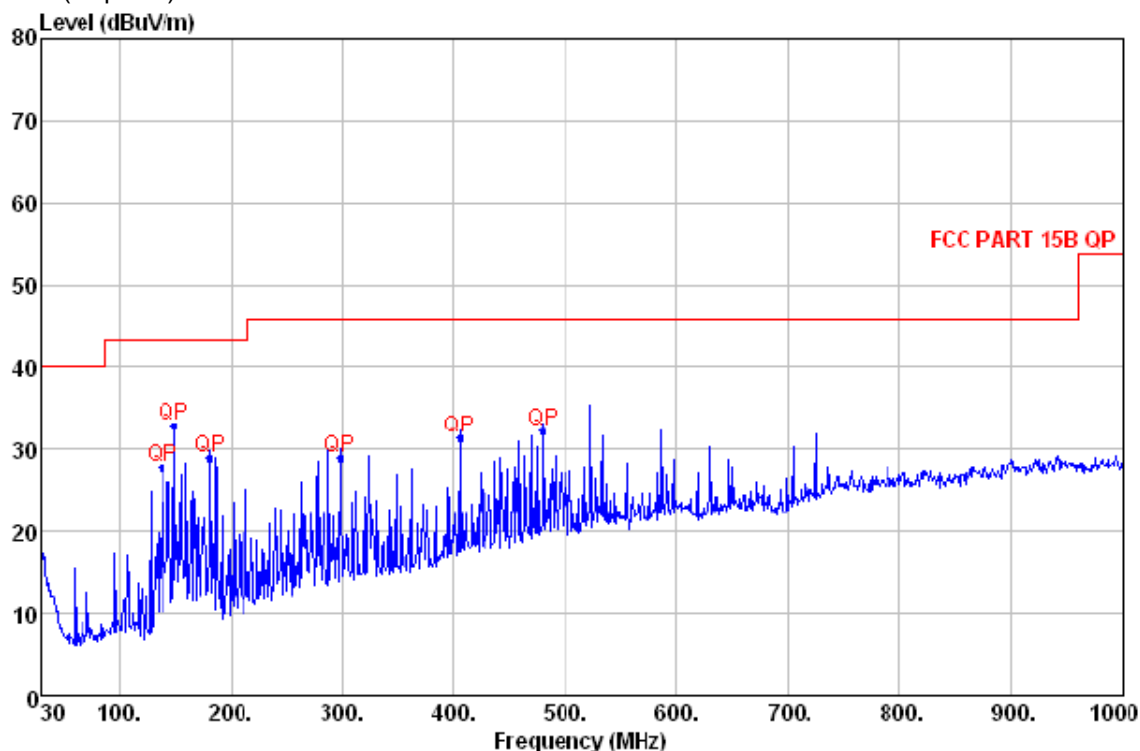
The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

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

Horizontal:

Peak scan

Level (dB μ V/m)



Quasi-peak measurement

No.	Freq MHz	Level dB μ V/m	Remark	Antenna Factor dB/m	Cable Loss dB	Limit Line dB μ V/m	Margin dB	A/pos cm	T/pos deg
1	138.640	27.77	QP	7.40	1.40	43.50	-15.73	100	121
2	149.310	33.05	QP	7.14	1.46	43.50	-10.45	100	210
3	181.320	28.90	QP	8.30	1.62	43.50	-14.60	100	155
4	298.690	29.00	QP	13.77	2.12	46.00	-17.00	200	264
5	405.390	31.41	QP	16.05	2.47	46.00	-14.59	200	288
6	480.080	32.31	QP	18.00	2.72	46.00	-13.69	200	302

Level=Read Level + Antenna Factor + Cable Loss

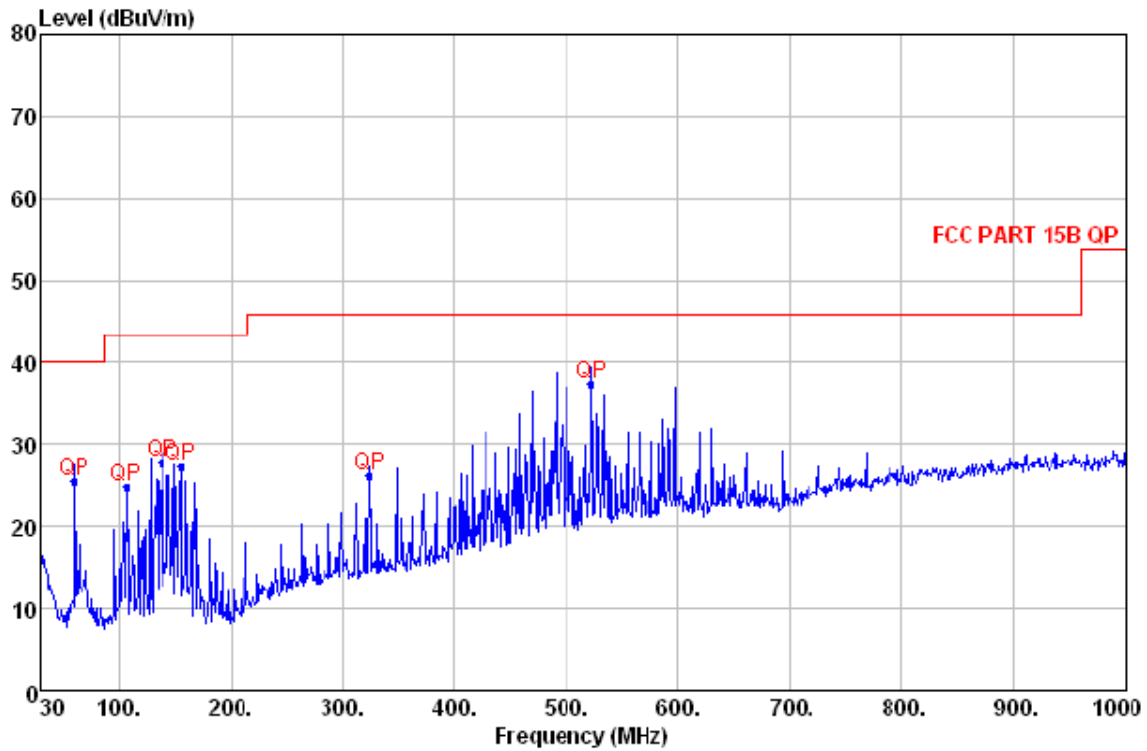
Test at Middle Channel in transmitting status

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

Vertical:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Level dBμV/m	Remark	Antenna Factor dB/m	Cable Loss dB	Limit Line dBμV/m	Margin dB	A/pos cm	T/pos deg
1	60.070	25.70	QP	6.70	0.89	40.00	-14.30	100	84
2	106.630	25.02	QP	8.50	1.21	43.50	-18.48	100	154
3	138.640	27.91	QP	7.40	1.40	43.50	-15.59	100	251
4	156.100	27.38	QP	7.64	1.49	43.50	-16.12	200	198
5	323.910	26.36	QP	14.00	2.20	46.00	-19.64	200	220
6	522.760	37.39	QP	19.02	2.84	46.00	-8.61	200	186

Level=Read Level + Antenna Factor + Cable Loss

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	32.57	5.27	33.15	49.78	54.47	74.00	V
7323.000	35.50	7.68	32.61	50.45	61.02	74.00	V
9764.000	39.51	8.66	34.17	44.32	58.32	74.00	V
4882.000	32.57	5.27	33.15	48.13	52.82	74.00	H
7323.000	35.50	7.68	32.61	48.62	59.19	74.00	H
9764.000	39.51	8.66	34.17	44.39	58.39	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	32.57	5.27	33.15	37.62	42.31	54.00	V
7323.000	35.50	7.68	32.61	39.46	50.03	54.00	V
9764.000	39.51	8.66	34.17	34.69	48.69	54.00	V
4882.000	32.57	5.27	33.15	38.32	43.01	54.00	H
7323.000	35.50	7.68	32.61	39.77	50.34	54.00	H
9764.000	39.51	8.66	34.17	34.31	48.31	54.00	H

Test at high Channel in transmitting status

9kHz~30MHz Test result

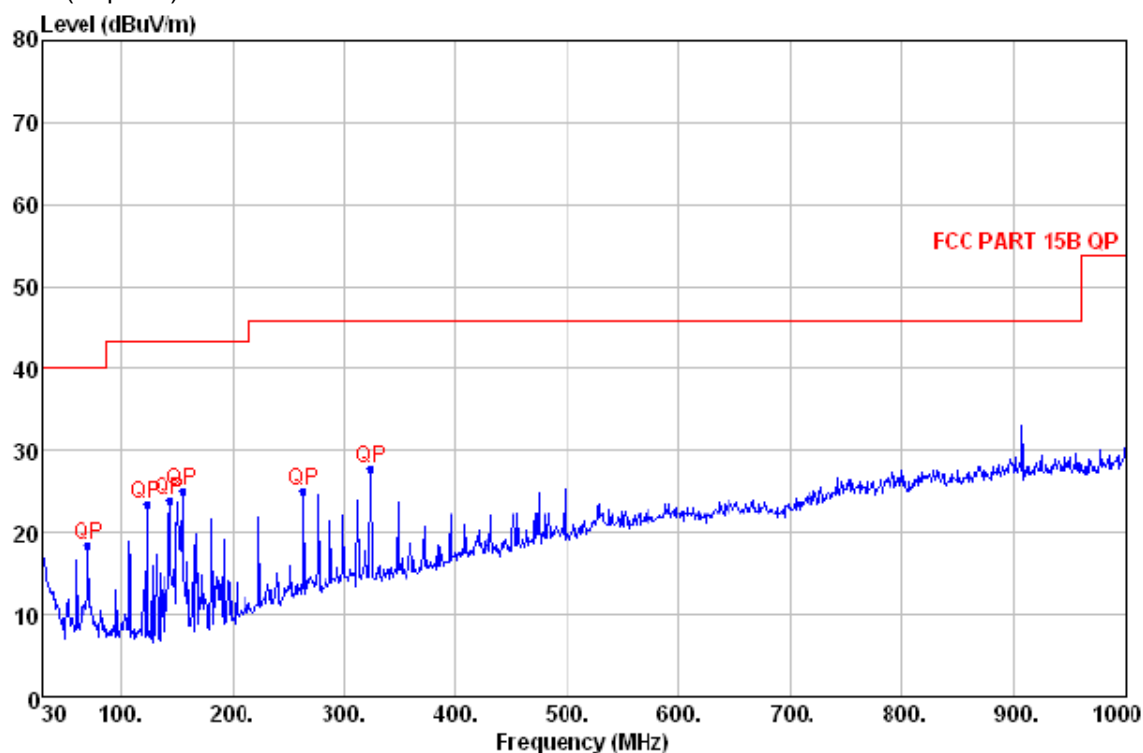
The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

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

Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Level dBμV/m	Remark	Antenna Factor dB/m	Cable Loss dB	Limit Line dBμV/m	Margin dB	A/pos cm	T/pos deg
1	71.710	18.54	QP	7.14	0.99	40.00	-21.46	100	241
2	123.120	23.58	QP	7.70	1.32	43.50	-19.92	100	157
3	144.460	24.15	QP	7.40	1.43	43.50	-19.35	100	107
4	156.100	25.17	QP	7.64	1.49	43.50	-18.33	200	294
5	263.770	25.12	QP	12.42	1.98	46.00	-20.88	200	194
6	323.910	27.94	QP	14.00	2.20	46.00	-18.06	200	148

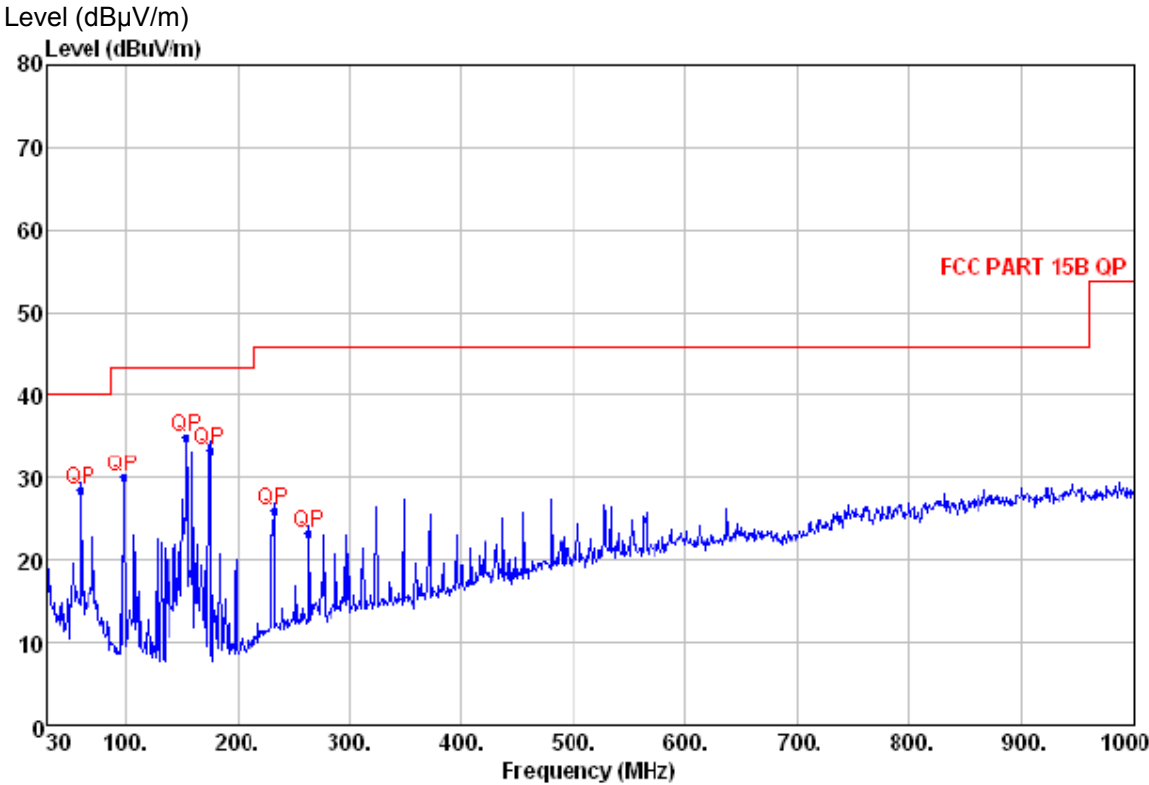
Level=Read Level + Antenna Factor + Cable Loss

Test at High Channel in transmitting status

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

Vertical:

Peak scan



Quasi-peak measurement

No.	Freq	Level	Remark	Antenna	Cable	Limit	Margin	A/pos	T/pos
	MHz	dBμV/m		Factor	Loss	Line	dB	cm	deg
				dB/m	dB	dBμV/m			
1	60.070	28.47	QP	6.70	0.89	40.00	-11.53	100	127
2	98.870	30.09	QP	8.63	1.16	43.50	-13.41	100	167
3	155.130	35.05	QP	7.61	1.49	43.50	-8.45	100	220
4	175.500	33.52	QP	8.21	1.59	43.50	-9.98	200	127
5	232.730	25.98	QP	11.04	1.85	46.00	-20.02	200	82
6	263.770	23.39	QP	12.42	1.98	46.00	-22.61	200	317

Level=Read Level + Antenna Factor + Cable Loss

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 (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)	Antenna polarization
4960.000	32.70	6.20	32.82	50.62	54.70	74.00	V
7440.000	35.60	8.47	32.46	45.05	56.66	74.00	V
9920.000	38.68	8.75	35.26	44.39	58.56	74.00	V
4960.000	32.70	6.20	32.82	49.42	53.50	74.00	H
7440.000	35.60	8.47	32.46	45.88	57.49	74.00	H
9920.000	38.68	8.75	35.26	45.38	59.55	74.00	H

Average Measurement:

Frequency (MHz)	Antenna factors (dB/m)	Cable loss (dB)	Preamp factor (dB)	Reading Level (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)	Antenna polarization
4960.000	32.70	6.20	32.82	37.38	41.46	54.00	V
7440.000	35.60	8.47	32.46	38.03	49.64	54.00	V
9920.000	38.68	8.75	35.26	35.72	49.89	54.00	V
4960.000	32.70	6.20	32.82	39.32	43.40	54.00	H
7440.000	35.60	8.47	32.46	38.67	50.28	54.00	H
9920.000	38.68	8.75	35.26	35.02	49.19	54.00	H

Test at Receiving status

9kHz~30MHz Test result

The Low frequency, which started from 9kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not report

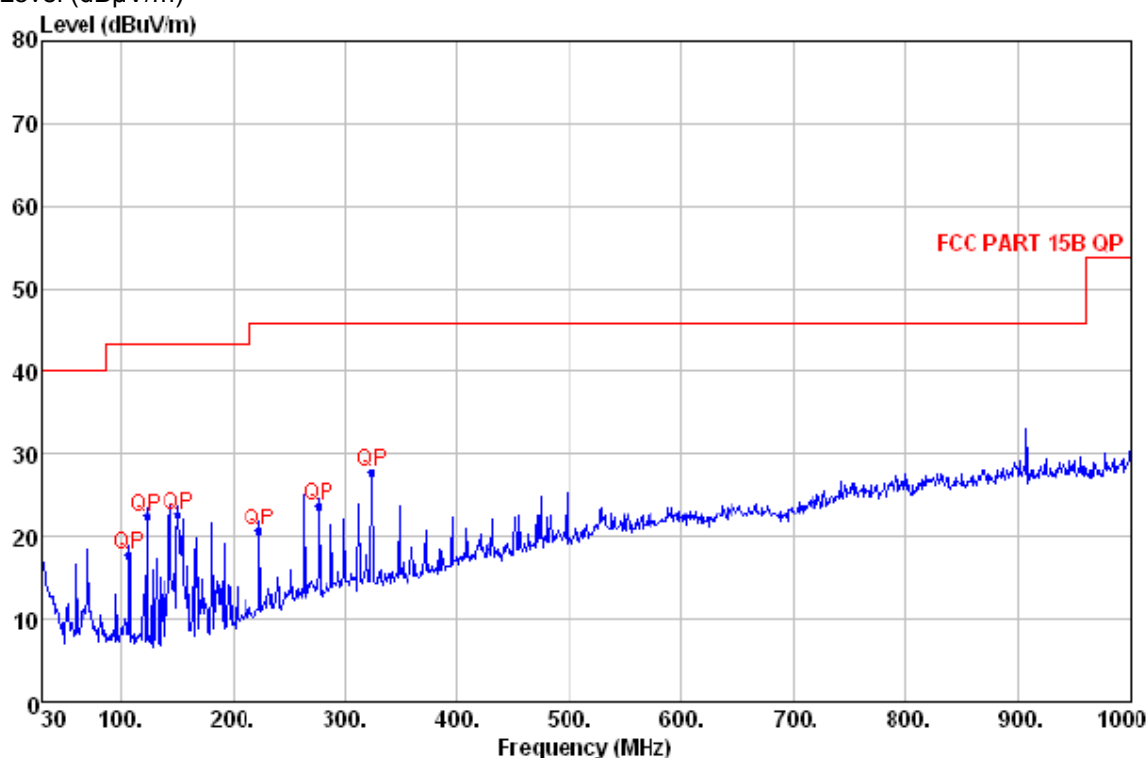
30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Horizontal:

Peak scan

Peak scan

Level (dBμV/m)



Quasi-peak measurement

No.	Freq MHz	Level dBμV/m	Remark	Antenna Factor dB/m	Cable Loss dB	Limit Line dBμV/m	Margin dB	A/pos cm	T/pos deg
1	107.600	17.92	QP	8.50	1.22	43.50	-25.58	100	84
2	123.120	22.58	QP	7.70	1.32	43.50	-20.92	100	168
3	152.220	22.82	QP	7.32	1.47	43.50	-20.68	100	310
4	224.000	20.80	QP	10.58	1.81	46.00	-25.20	200	198
5	276.380	23.84	QP	12.71	2.03	46.00	-22.16	200	124
6	323.910	27.94	QP	14.00	2.20	46.00	-18.06	200	155

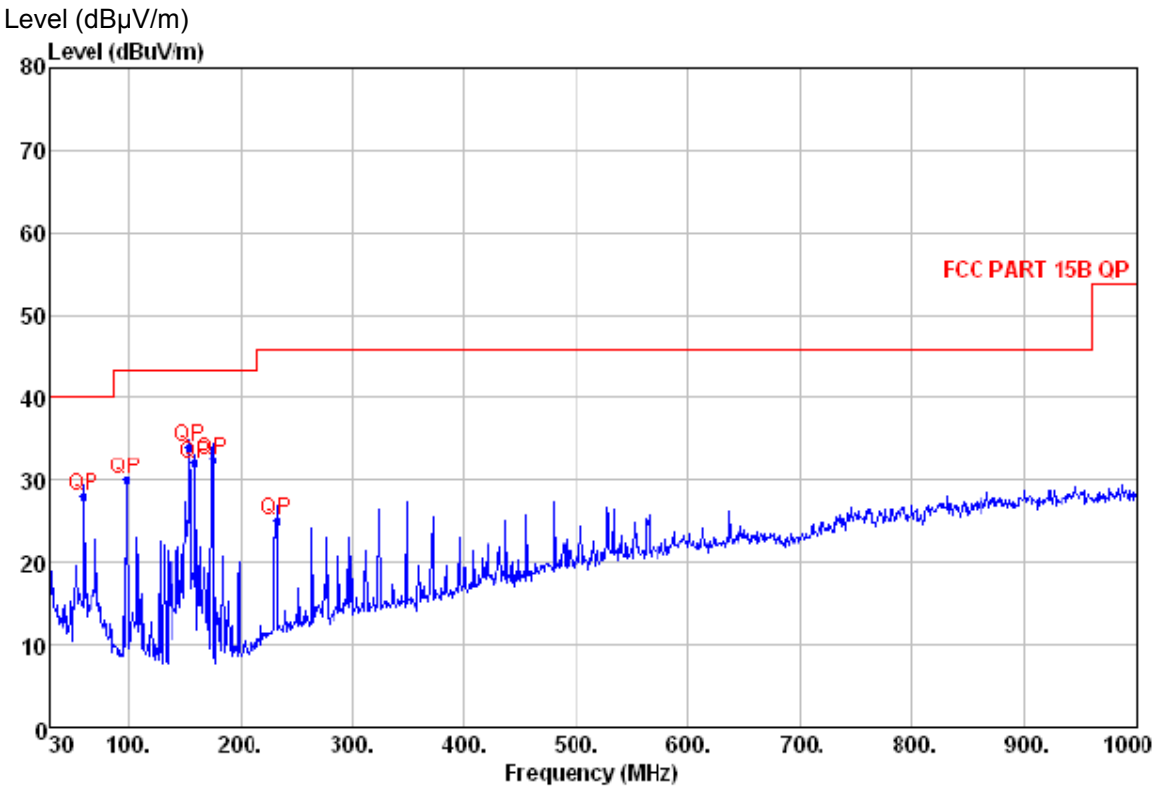
Level=Read Level + Antenna Factor + Cable Loss

Test at Receiving status

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

Vertical:

Peak scan



Quasi-peak measurement

No.	Freq	Level	Remark	Antenna	Cable	Limit	Margin	A/pos	T/pos
	MHz	dBμV/m		Factor	Loss	Line	dB	cm	deg
				dB/m	dB	dBμV/m			
1	60.070	28.17	QP	6.70	0.89	40.00	-11.83	100	135
2	98.870	30.09	QP	8.63	1.16	43.50	-13.41	100	178
3	155.130	34.05	QP	7.61	1.49	43.50	-9.45	100	235
4	159.980	32.19	QP	7.80	1.51	43.50	-11.31	200	64
5	175.500	32.52	QP	8.21	1.59	43.50	-10.98	200	110
6	232.730	25.27	QP	11.04	1.85	46.00	-20.73	200	98

Level=Read Level + Antenna Factor + Cable Loss

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

No emission is found in the 1-25GHz

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 Loss – 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 FCC and RSS-210 requirements.

5.11 Radiated Emissions which fall in the restricted bands

Test Requirement:	FCC Part15 C Section 15.247 and RSS-210 (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 6.4, 6.5 and 6.6 & DA 00-705
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. Compliance test in continuous transmitting mode with normal mode (DH5) as the worst case was found.
Measurement Distance:	3m (Semi-Anechoic Chamber)
Limit:	Section 15.209(a) 40.0 dB μ V/m between 30MHz & 88MHz; 43.5 dB μ V/m between 88MHz & 216MHz; 46.0 dB μ V/m between 216MHz & 960MHz; 54.0 dB μ V/m above 960MHz.
Detector:	For PK value: RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz VBW \geq RBW Sweep = auto Detector function = peak Trace = max hold For AV value: RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz VBW =10 Hz Sweep = auto Detector function = peak Trace = max hold

Test Result:**1. Low Channel**

Antenna polarization: Vertical

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	27.93	4.23	35.60	48.16	37.89	44.72	34.45
2390.000	27.61	4.30	35.60	49.37	38.21	45.68	34.52
2500.000	27.55	4.40	35.60	47.33	37.66	43.68	34.01
2483.500	27.55	4.40	35.60	48.18	37.99	44.53	34.34

Antenna polarization: Horizontal

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	27.93	4.23	35.60	48.52	37.22	45.08	33.78
2390.000	27.61	4.30	35.60	48.63	38.23	44.94	34.54
2500.000	27.55	4.40	35.60	49.55	39.24	45.90	35.59
2483.500	27.55	4.40	35.60	48.30	39.38	44.65	35.73

2. Middle Channel

Antenna polarization: Vertical

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	27.93	4.23	35.60	47.38	38.17	43.94	34.73
2390.000	27.61	4.30	35.60	48.47	38.26	44.78	34.57
2500.000	27.55	4.40	35.60	48.74	39.74	45.09	36.09
2483.500	27.55	4.40	35.60	50.19	38.89	46.54	35.24

Antenna polarization: Horizontal

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	27.93	4.23	35.60	49.61	37.69	46.17	34.25
2390.000	27.61	4.30	35.60	48.65	38.07	44.96	34.38
2500.000	27.55	4.40	35.60	48.15	39.16	44.50	35.51
2483.500	27.55	4.40	35.60	49.39	37.31	45.74	33.66

3. High Channel

Antenna polarization: Vertical

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	27.93	4.23	35.60	49.05	37.28	45.61	33.84
2390.000	27.61	4.30	35.60	49.44	37.18	45.75	33.49
2500.000	27.55	4.40	35.60	50.17	39.27	46.52	35.62
2483.500	27.55	4.40	35.60	50.24	39.34	46.59	35.69

Antenna polarization: Horizontal

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	27.93	4.23	35.60	49.17	39.17	45.73	35.73
2390.000	27.61	4.30	35.60	50.26	38.57	46.57	34.88
2500.000	27.55	4.40	35.60	49.23	37.12	45.58	33.47
2483.500	27.55	4.40	35.60	48.24	37.63	44.59	33.98

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

Test result: The unit does meet the FCC and RSS-210 requirements.

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 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12

5.12 Band Edges Requirement

Test Requirement: FCC Part15 C section 15.247

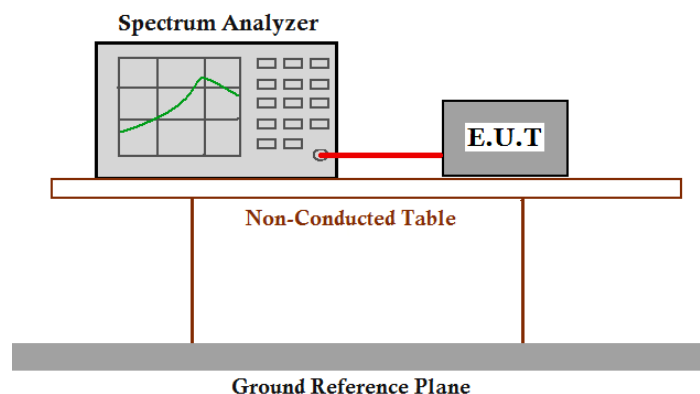
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains 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 6.9 & DA 00-705

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. Compliance test in continuous transmitting mode with normal (DH5) and EDR mode (3DH5) as the worst case was found.

Test Configuration:



Test Procedure: 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.

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.

Low channel:

High channel:



3DH5:
Low channel:



High channel:



Test result: The unit does meet the FCC requirements.

5.13 Conducted Emissions at Mains Terminals 150 kHz to 30 MHz

Test Requirement: FCC Part 15 C section 15.207 and RSS-GEN

Test Method: ANSI C63.10: Clause 6.2 & DA 00-705

Frequency Range: 150 kHz to 30 MHz

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

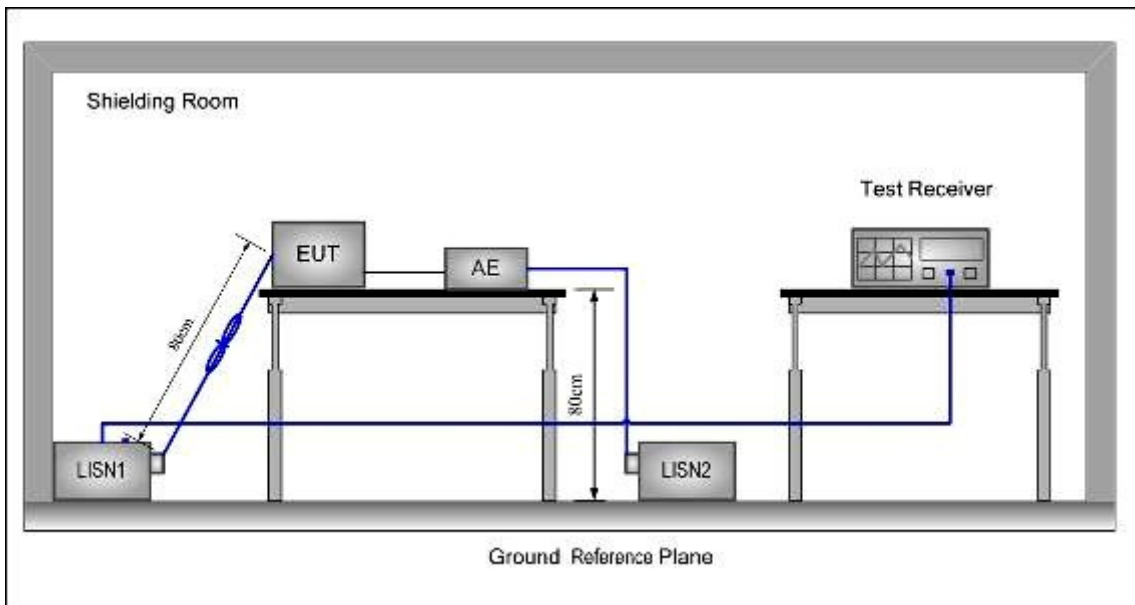
Test Limit

Limits for conducted disturbance at the mains ports of class B

Frequency Range	Class B Limit dB(μ V)	
	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 $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3. The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 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.

5.13.1 Measurement Data

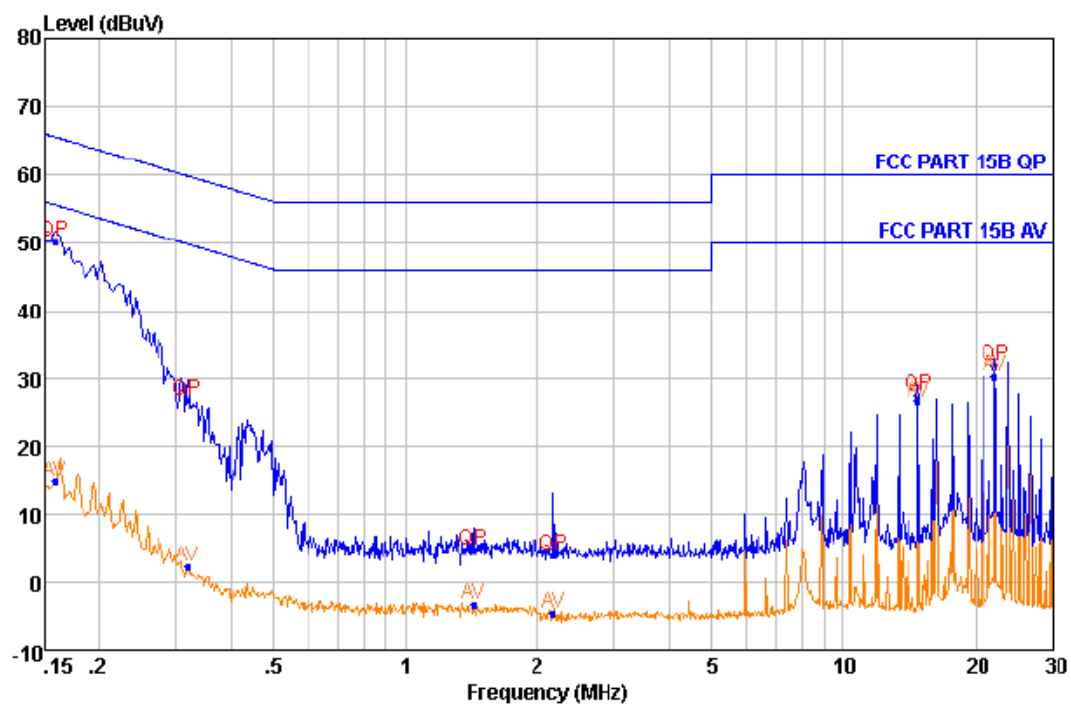
An initial pre-scan was performed on the live and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected. For EUT the communicating was worst case mode.

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

Live line

Peak Scan:

Level (dBμV)



Quasi-peak and Average measurement

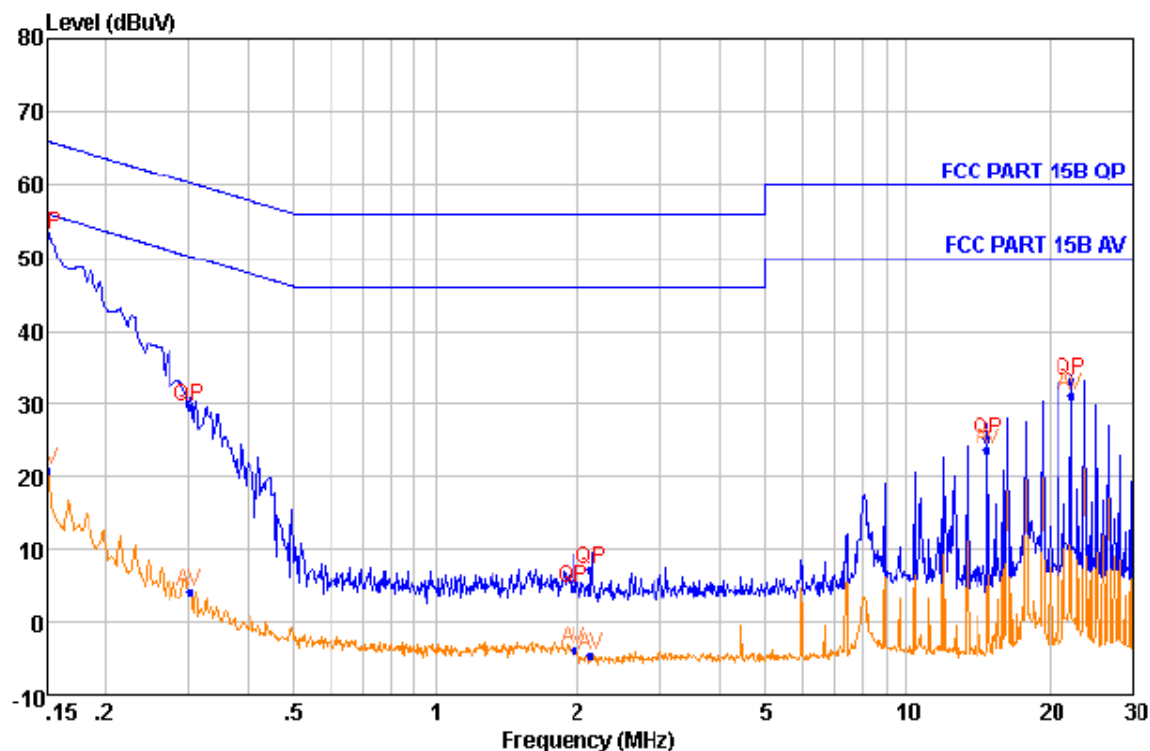
NO.	Freq MHz	Level dBμV	Remark	LISN Factor dB	Cable Loss dB	Limit Line dBμV	Margin dB
1	0.158	50.28	QP	9.70	0.20	65.56	-15.28
2	0.158	14.86	Average	9.70	0.20	55.56	-40.70
3	0.318	26.97	QP	9.66	0.24	59.77	-32.80
4	0.318	2.33	Average	9.66	0.24	49.77	-47.44
5	1.430	4.84	QP	9.66	0.33	56.00	-51.16
6	1.430	-3.26	Average	9.66	0.33	46.00	-49.26
7	2.174	4.11	QP	9.65	0.35	56.00	-51.89
8	2.174	-4.57	Average	9.65	0.35	46.00	-50.57
9	14.804	27.63	QP	9.71	0.46	60.00	-32.37
10	14.804	26.69	Average	9.71	0.46	50.00	-23.31
11	22.129	31.83	QP	9.68	0.48	60.00	-28.17
12	22.129	30.27	Average	9.68	0.48	50.00	-19.73

Level=Read Level + Lisn Factor + Cable Loss

Neutral Line

Peak Scan:

Level (dBμV)



Quasi-peak and Average measurement

NO.	Freq MHz	Level dBμV	Remark	LISN Factor dB	Cable Loss dB	Limit Line dBμV	Margin dB
1	0.150	53.19	QP	9.71	0.20	66.00	-12.81
2	0.150	20.86	Average	9.71	0.20	56.00	-35.14
3	0.301	29.57	QP	9.65	0.24	60.21	-30.64
4	0.301	4.17	Average	9.65	0.24	50.21	-46.04
5	1.965	4.12	QP	9.62	0.35	56.00	-51.28
6	1.965	-3.67	Average	9.62	0.35	46.00	-49.67
7	2.138	7.21	QP	9.62	0.35	56.00	-48.79
8	2.138	-4.48	Average	9.62	0.35	46.00	-50.48
9	14.804	25.16	QP	9.63	0.46	60.00	-34.84
10	14.804	23.69	Average	9.63	0.46	50.00	-26.31
11	22.252	33.20	QP	9.62	0.48	60.00	-26.80
12	22.252	31.12	Average	9.62	0.48	50.00	-18.88

Level=Read Level + Lisn Factor + Cable Loss

--End of Report--