SGS-CSTC Standards Technical Services Co., 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
FEDERAL COMMUNICATIONS COMMISSION
Registration number: 282399

TEST REPORT

Application No.:	GZEM1011002573RF
Applicant:	Accessory Workshop LLC
FCC ID:	YX7-TY-101
Equipment Under Test (EUT):	
EUT Name:	Bluetooth keyboard
Item No.:	TY-101
Radio Function:	Bluetooth
Standards:	FCC PART 15 Subpart C:2009
Date of Test:	2010-11-20 to 2010-11-29
Date of Issue:	2010-11-30
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		2010-11-30		Original

Authorized for issue by:				
Tested By		Daniel He **(Daniel He) /Project Engineer**		2010-11-16 to 2010-11-25 **Date**
Prepared By		Daniel He **(Daniel He) /Clerk**		2010-11-26 **Date**
Checked By		Strong Yao **(Strong Yao)/Reviewer**		2010-11-30 **Date**

3 Test Summary

Test	Test Requirement	Standard Paragraph	Result
Antenna Requirement	FCC PART 15 :2009	Section 15.247 (c)	PASS
Occupied Bandwidth	FCC PART 15 :2009	Section 15.247 (a1)	PASS
Carrier Frequencies Separated	FCC PART 15 :2009	Section 15.247(a)(1)	PASS
Hopping Channel Number	FCC PART 15 :2009	Section 15.247(a)(1)(iii)	PASS
Dwell Time	FCC PART 15 :2009	Section 15.247(a)(1)(iii)	PASS
Pseudorandom Frequency Hopping Sequence	FCC PART 15 :2009	Section 15.247(a)(1)	PASS
Maximum Peak Output Power	FCC PART 15 :2009	Section 15.247(b)(1)	PASS
Conducted Spurious Emission (30MHz to 25GHz)	FCC PART 15 :2009	Section 15.209 &15.247(d)	PASS
Radiated Spurious Emission (30MHz to 25GHz)	FCC PART 15 :2009	Section 15.209 &15.247(d)	PASS
Band Edges Measurement	FCC PART 15 :2009	Section 15.247 (d) &15.205	PASS

4 Contents

5 General Information

5.1 Client Information

Applicant:	Accessory Workshop LLC
Address of Applicant:	16 Arcadian Ave Suite C7 Paramus NJ 070652

5.2 General Description of E.U.T.

Product Name:	Bluetooth keyboard
Model:	TY-101
Number of Channels	79 Channels
Channel Separation	1 MHz
Type of Modulation	GFSK
Dwell time	Per channel is less than 0.4s.
Antenna Type	Integral
Antenna gain:	0dBi
Power Supply:	3.7V DC (lithium battery)

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 FCC tests for the EUT.

The standard used was FCC PART 15 Subpart C: 2009. ANSI C63.4:2003. DA 00-705.

5.5 Test Facility

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

- **NVLAP – Lab Code: 200611-0**

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

- **FCC – Registration No.: 282399**

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

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	2010-09-06	2011-09-06
EMC0522	EMI Test Receiver	Rohde & Schwarz	ESIB26	100283	2010-01-25	2011-01-25
EMC0056	EMI Test Receiver	Rohde & Schwarz	ESCI	10036	2010-06-02	2011-06-02
N/A	EMI Test Software	Audix	E3	N/A	N/A	N/A
EMC0514	Coaxial cable	SGS	N/A	N/A	2009-12-09	2011-12-09
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
EMC0518	Horn Antenna	Rohde & Schwarz	HF906	100096	2010-09-11	2011-09-11
EMC0521	1-26.5 GHz Pre-Amplifier	Agilent	8449B	3008A01649	2010-01-25	2011-01-25
EMC0049	Amplifier	Agilent	8447D	2944A10862	2010-04-21	2011-04-21
EMC0075	310N Amplifier	Sonama	310N	272683	2010-10-25	2011-10-25
EMC0523	Active Loop Antenna	EMCO	6502	42963	2010-11-17	2011-11-17
EMC0530	10m Semi-Anechoic Chamber	ETS	N/A	N/A	2010-05-17	2011-05-17

Reference Equipment						
No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (YYYY-MM-DD)	Cal.Due date (YYYY-MM-DD)
No. 1	CBT Bluetooth Tester	Rohde & Schwarz	N/A	N/A	2009-12-23	2010-12-23
No. 2	Power Splitter	Agilent	N/A	N/A	N/A	N/A

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

7 Test Results

7.1 E.U.T. test conditions

Type of antenna: Integral

Operating Environment:

Temperature: 20.0 -25.0 °C

Humidity: 38-50 % RH

Atmospheric Pressure: 1000 -1010 mbar

Test frequencies: 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:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz or less	1	Middle
1 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

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(2402MHz), middle channel: 39 channel(2441MHz) and the highest channel: 78 channel(2480MHz)

7.2 Antenna Requirement

7.2.1 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.

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 0 dBi.

Test result: The unit does meet the FCC requirements.

7.3 Occupied Bandwidth

Test Requirement: FCC Part 15 C

Test Method: Based on FCC Part15 C Section 15.247 & DA 00-705

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

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 >= 1% of the 20dB bandwidth VBW >= RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and -20dB points bandwidth.

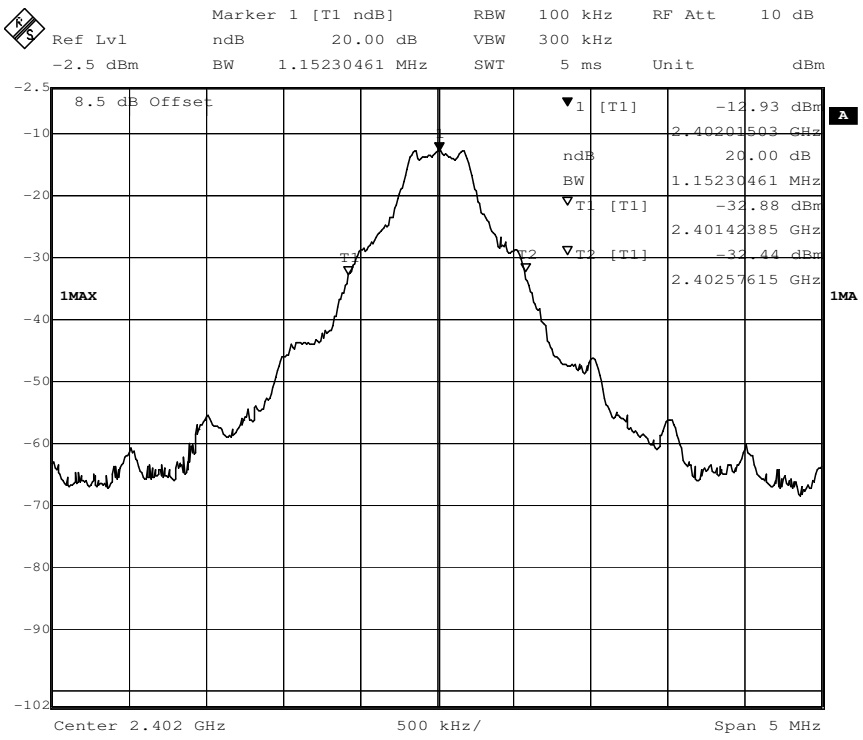
Test result:

Normal mode:

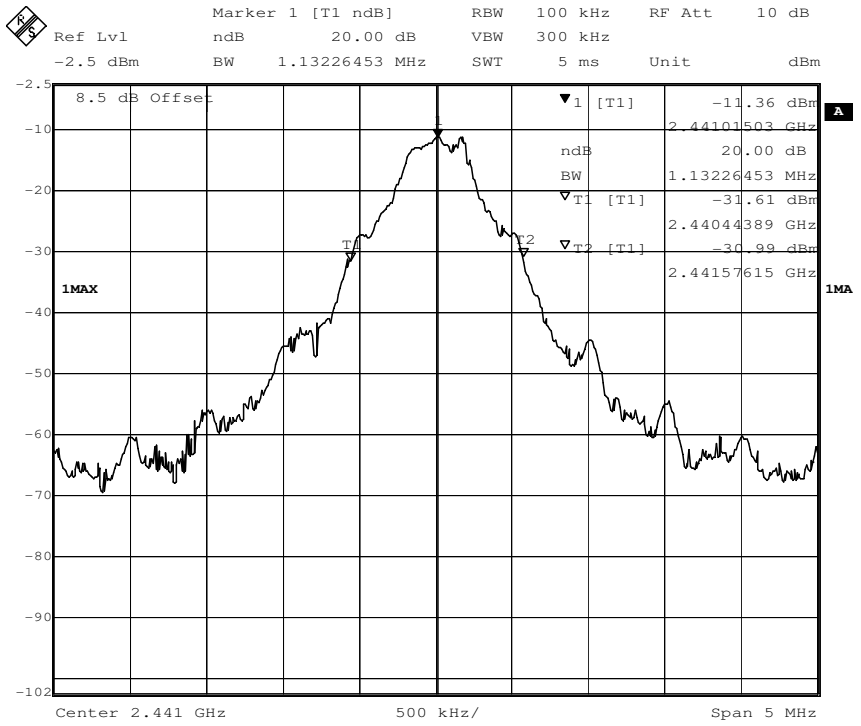
Test Channel	Bandwidth(MHz)	2/3 bandwidth(MHz)
Lowest	1.152	0.768
Middle	1.132	0.754
Highest	1.132	0.754

Result plot as follows:

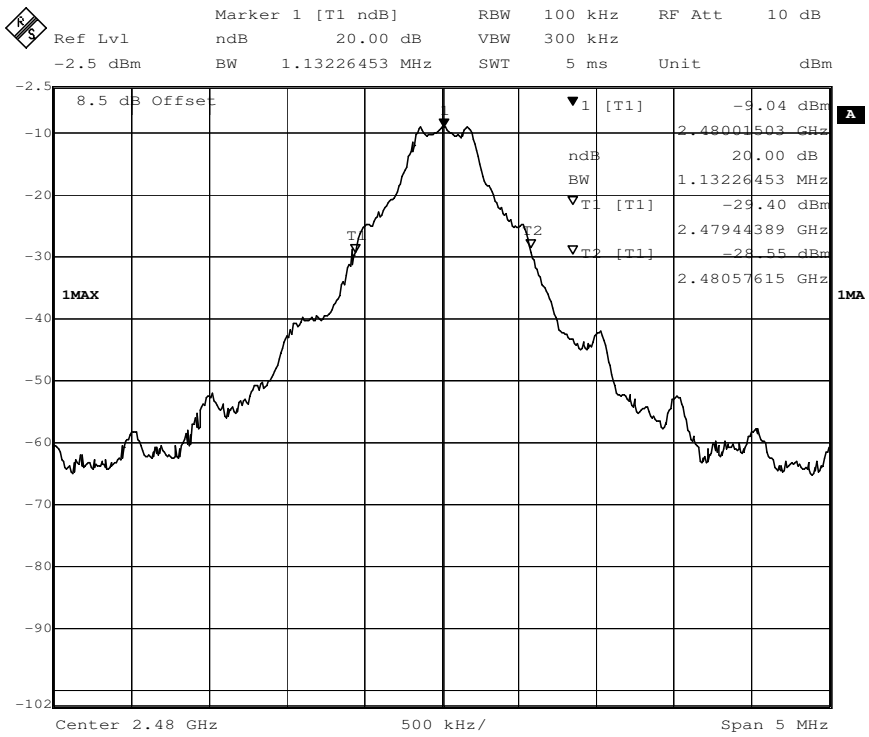
DH5:
Lowest Channel:



Middle Channel:



Highest Channel:



7.4 Carrier Frequencies Separated

Test Requirement: FCC Part 15 C

Test Method: Based on FCC Part15 C Section 15.247 & DA 00-705

Test requirements: Regulation 15.247(a),(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

Test Status: Test in hopping transmitting 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.

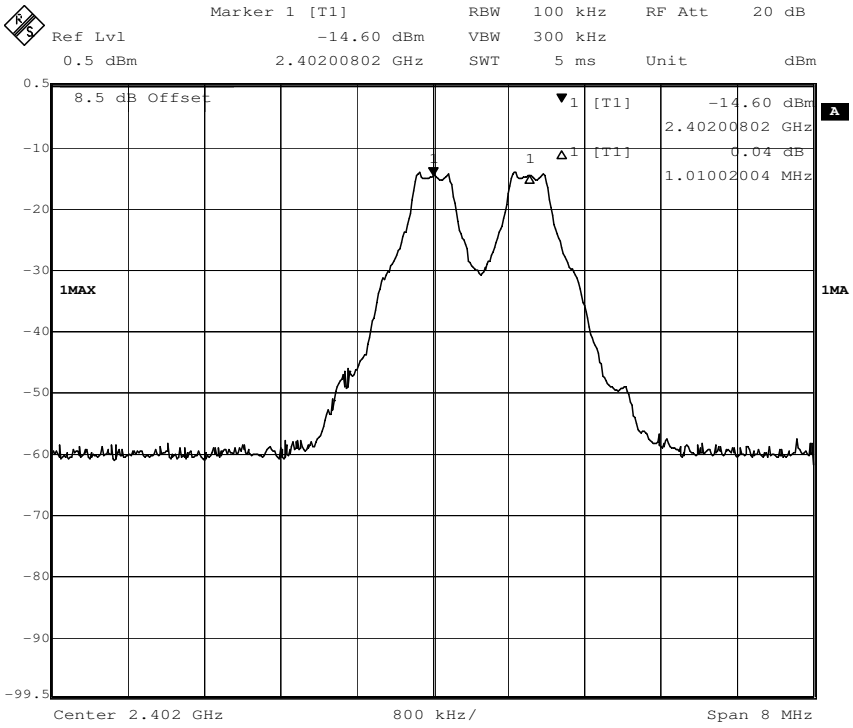
Test result:

Test Channel	Carrier Frequencies Separated	PASS/FAIL
Lower Channels (channel 0 and channel 1)	1.010MHz	Pass
Middle Channels (channel 39 and channel 40)	1.026MHz	Pass
Upper Channels (channel 77 and channel 78)	1.012MHz	Pass

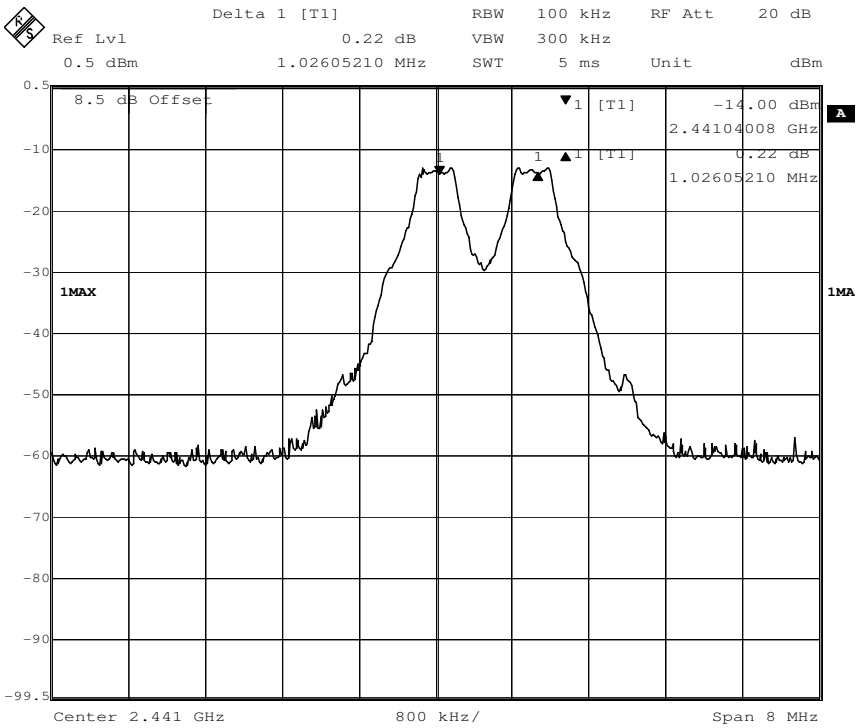
Remark:

The limit is maximum two-thirds of the 20 dB bandwidth: 768 kHz.

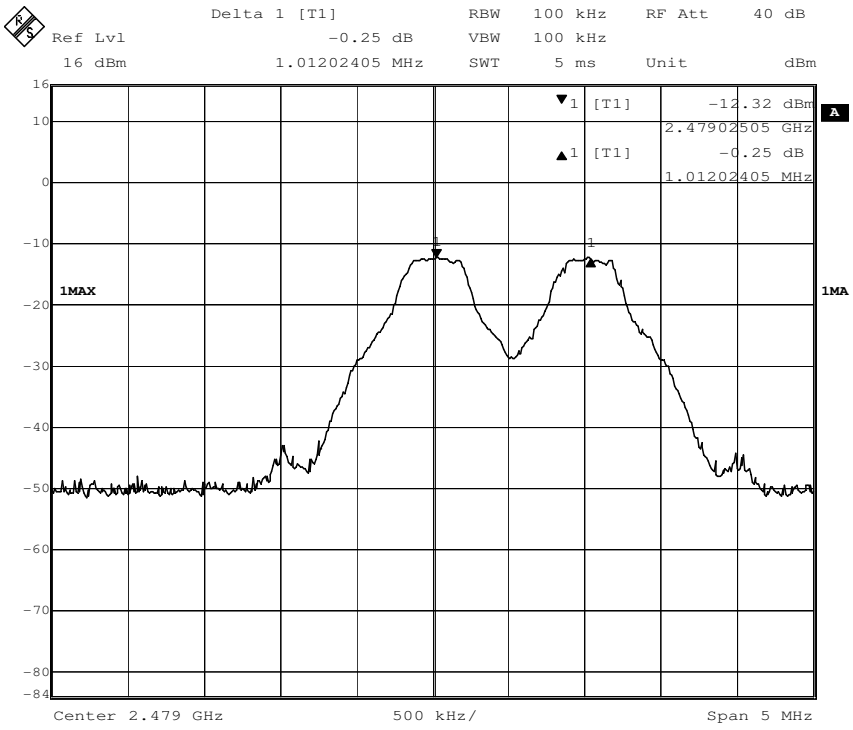
1. Lowest Channels: **Carrier Frequencies Separated**



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



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



Test result: The unit does meet the FCC requirements.

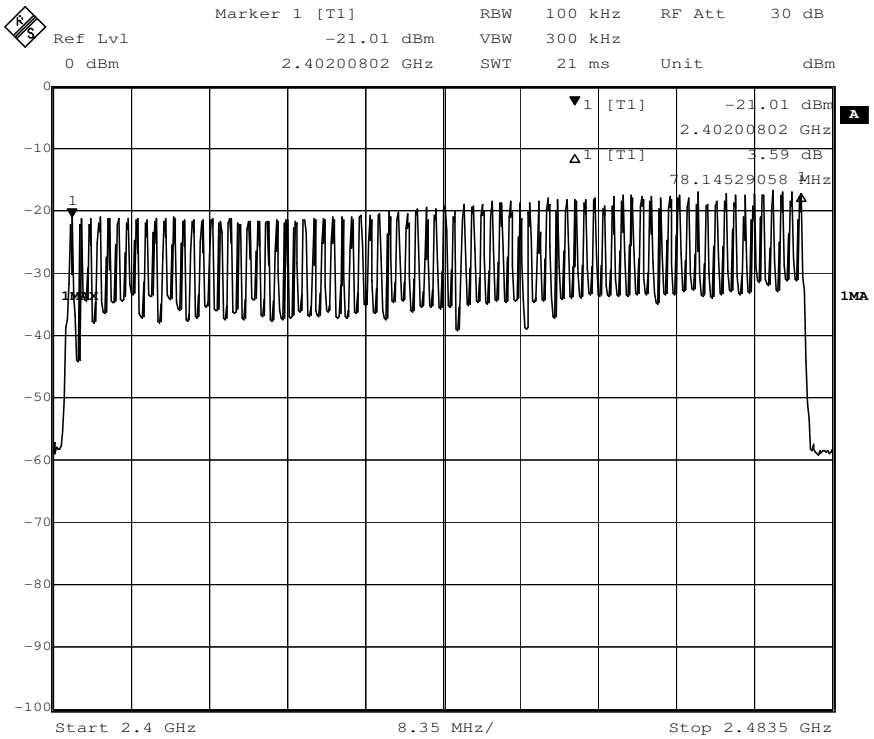
7.5 Hopping Channel Number

Test Requirement:	FCC Part15 C
Test Method:	Based on FCC Part15 C Section 15.247 & DA 00-705
Requirements:	Regulation 15.247 (a) (1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Status:	Test the EUT in hopping 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 FCC requirements.

7.6 Dwell Time

Test Requirement:	FCC Part 15 C
Test Method:	Based on FCC Part15 C Section 15.247 & DA 00-705
Test requirements:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Status:	Test the EUT in continuous transmitting mode at the lowest (2402MHz), middle (2441MHz) and highest (2480MHz) channel with different packages.

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

Channel 39: 2.441GHz

DH1 time slot=0.435(ms)*(1600/ (2*79))*31.6=139 ms

DH3 time slot=1.72(ms)*(1600/ (4*79))*31.6=275ms

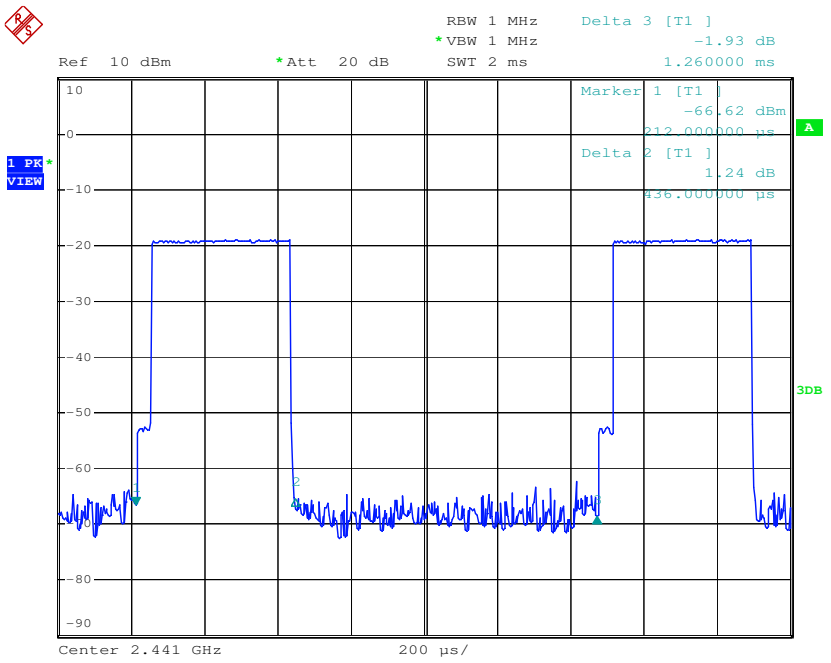
DH5 time slot=3.00(ms)*(1600/ (6*79))*31.6=319ms

Remark: record the worst case in the report.

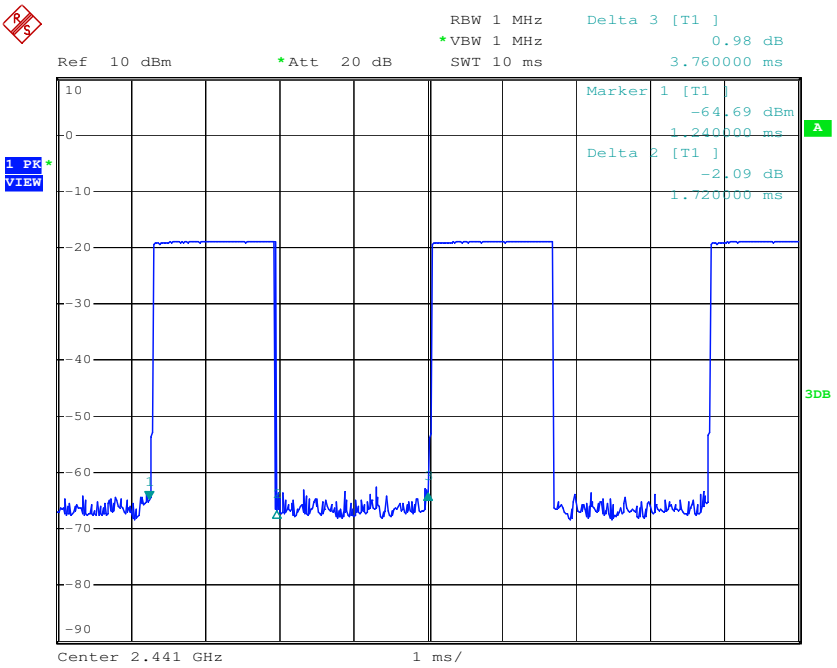
The unit does meet the FCC requirements.

2. Middle Channel (2.441GHz)

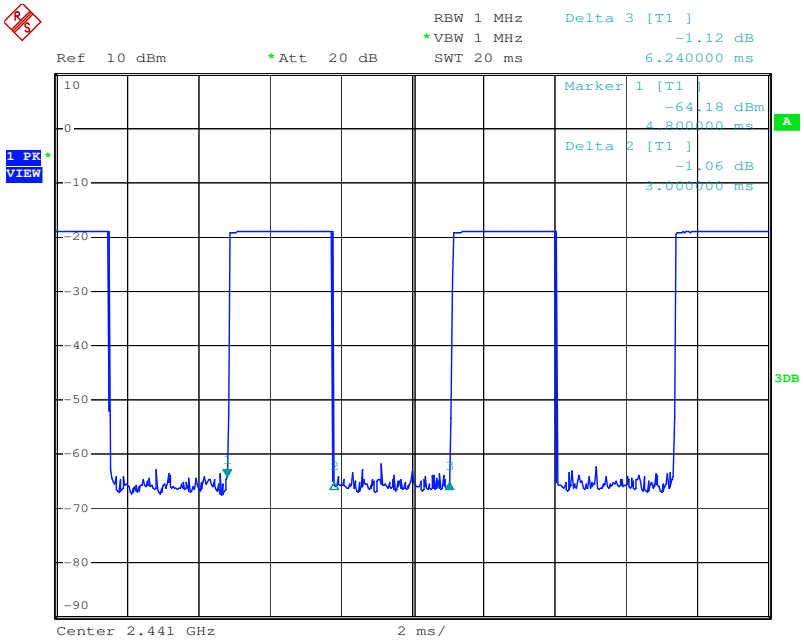
(1). DH1



(2) DH3



(3) DH5



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:

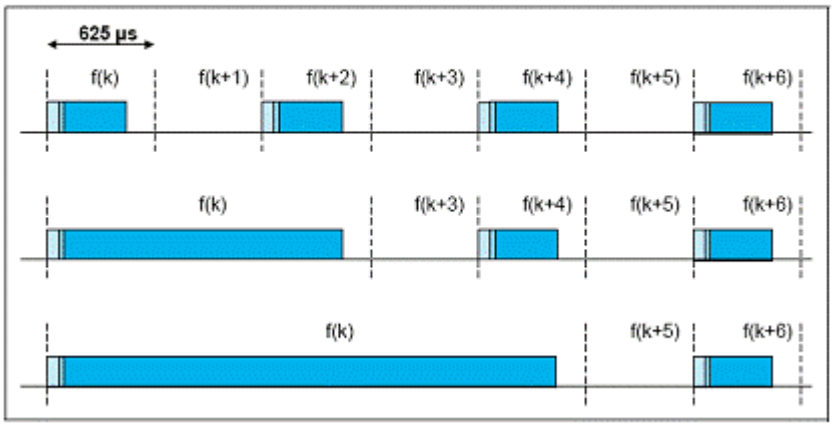


Figure 2.14: Single- and multi-slot packets.

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.

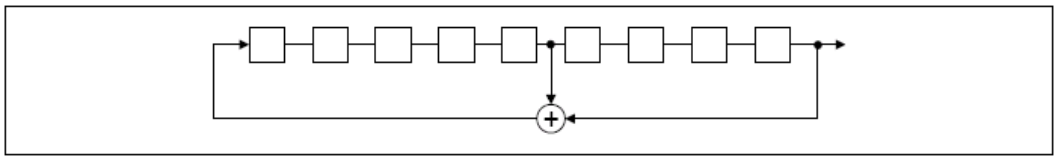
7.7.2 EUT Pseudorandom Frequency Hopping Sequence

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

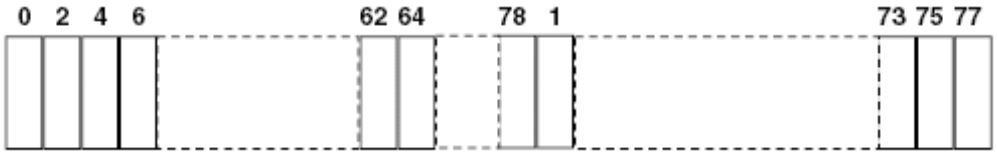
• Length of pseudo-random sequence: 29 -1 = 511 bits

• 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: FCC Part 15.247 & DA 00-705

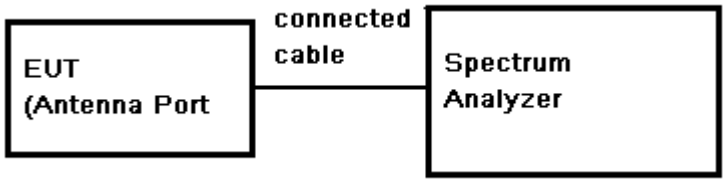
Test Method: Base on ANSI 63.4.

Test Limit: Regulation 15.247 (b)(1)For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Refer to the result “Hopping channel number” of this document. The 1 watt (30.0dBm) 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:

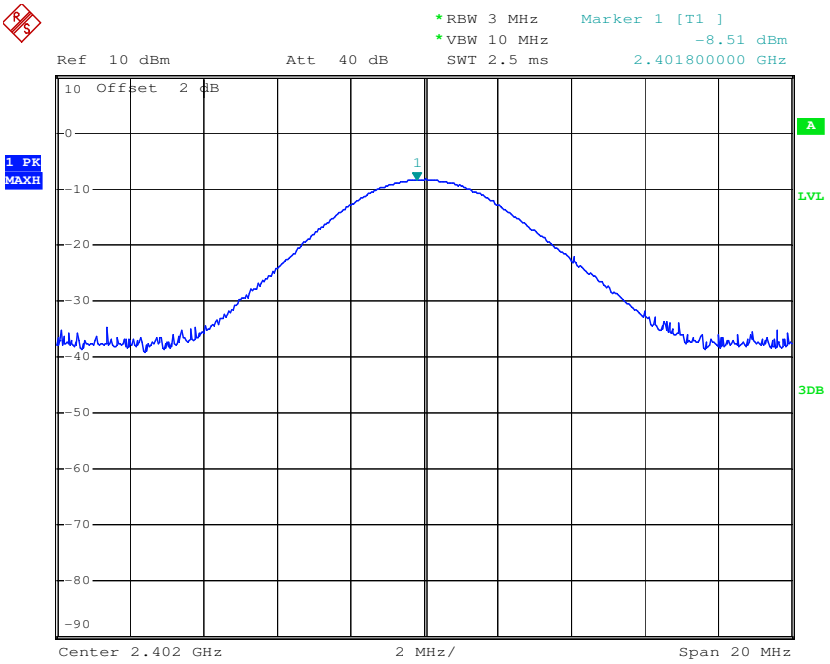
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	2.402	-8.51	30	Pass
Middle	2.441	-8.25	30	Pass
Highest	2.480	-8.01	30	Pass

Test result: The unit does meet the FCC requirements.

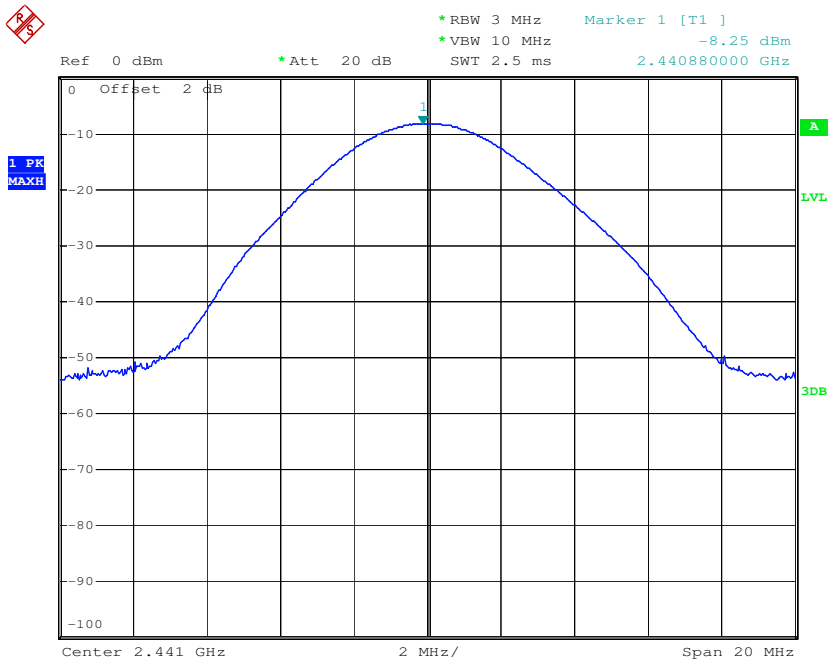
Test result plot as follows:

Normal mode:

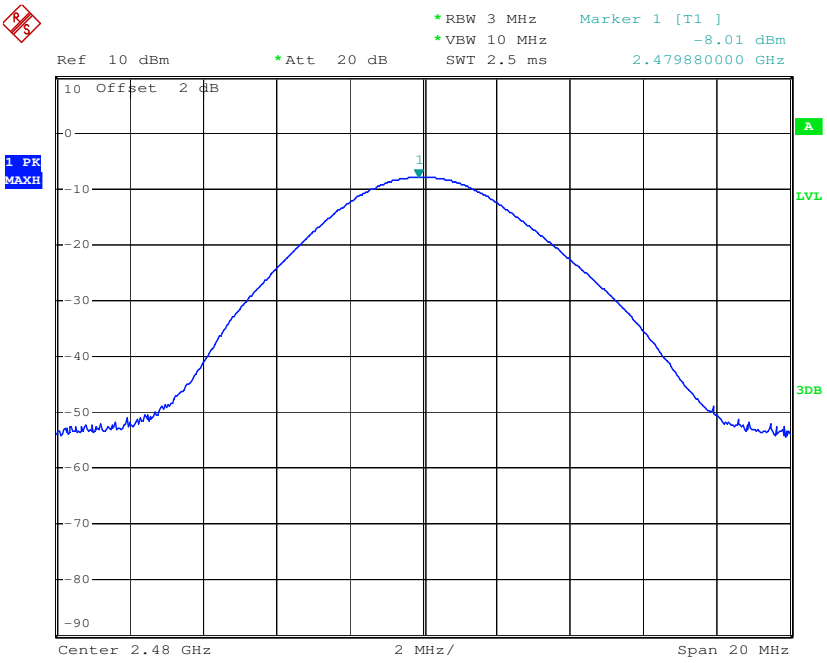
Lowest Channel:



Middle Channel:



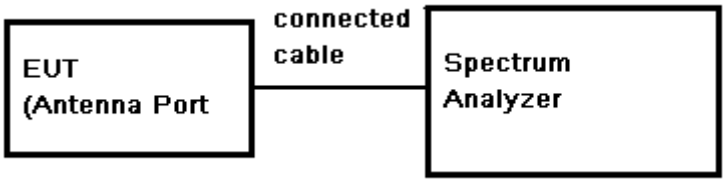
Highest Channel:



7.9 Conducted Spurious Emissions

Test Requirement:	FCC Part 15.247 & DA 00-705
Test Method:	Based on FCC Part15 C Section 15.247&15.209:
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. Pretest the EUT in hopping on and hopping off, found the worse case was the hoping off, and measured and recorded the worse case.

Test Configuration:



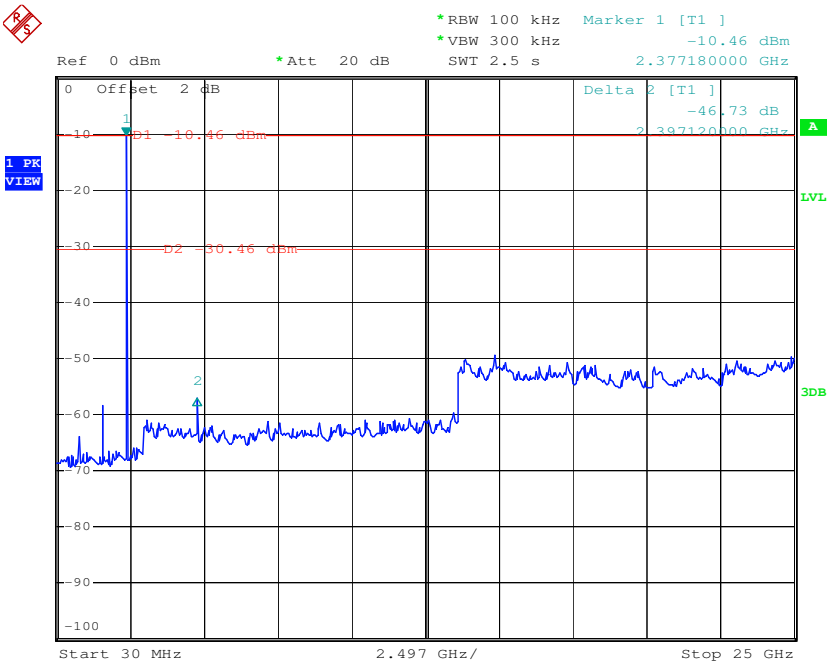
Test Procedure:

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

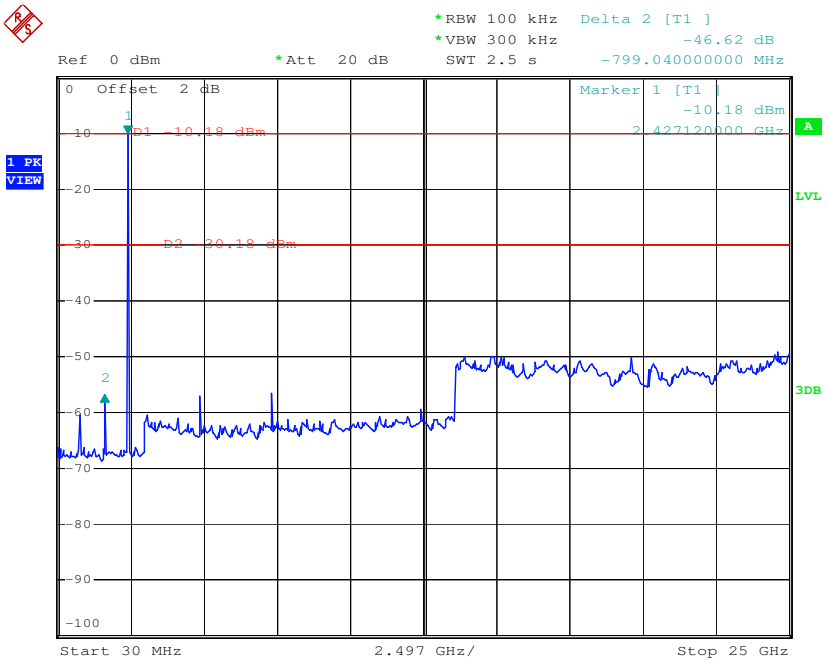
2. Set the spectrum analyzer: RBW = 100KHz. VBW >= RBW. Sweep = auto; Detector Function = Peak (Max. hold).

Test result plot as follows:

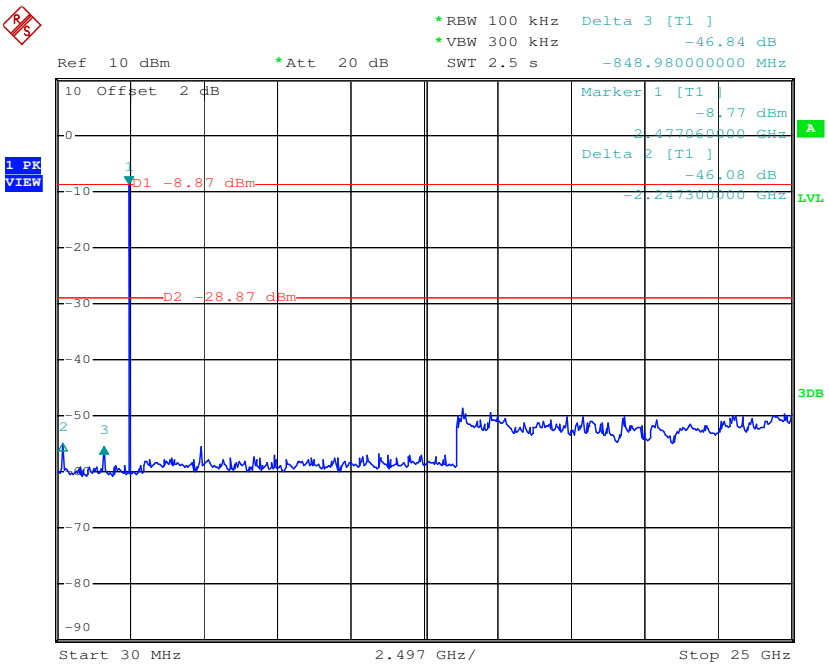
Lowest Channel



Middle Channel



Highest Channel

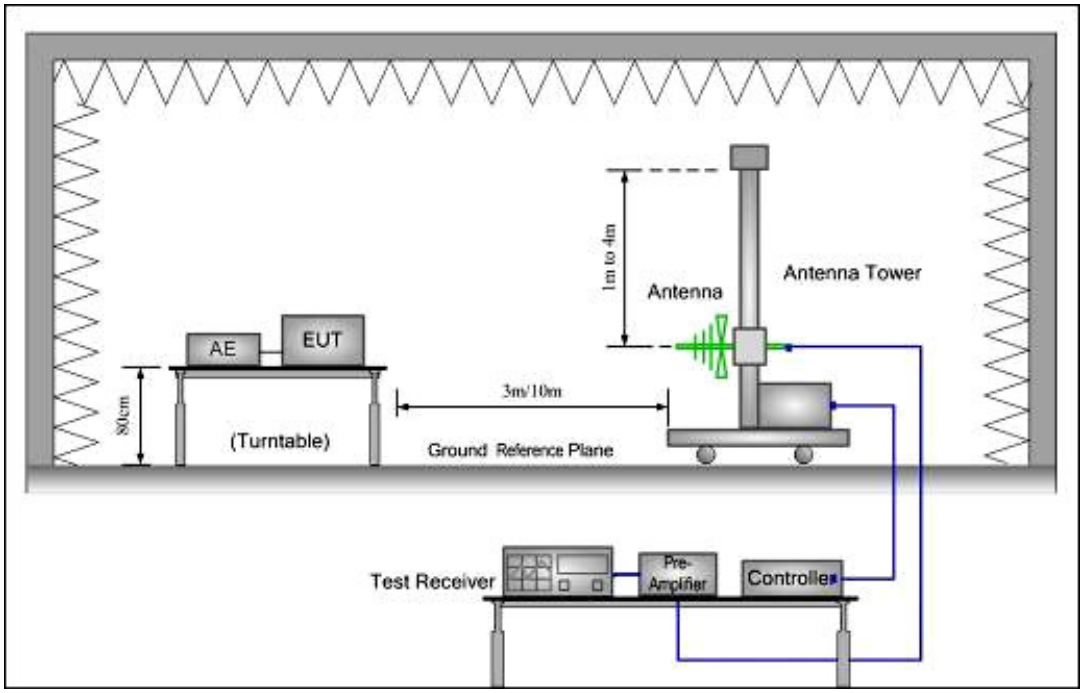


7.10 Radiated Spurious Emissions

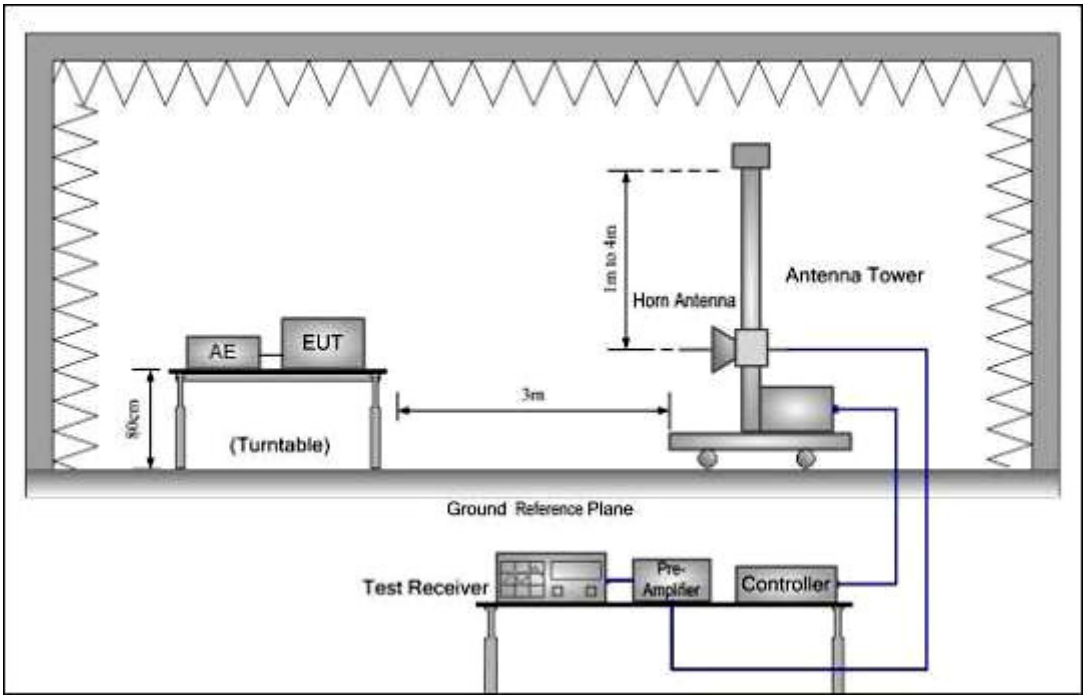
Test Requirement:	FCC 15.247(d) & 15.209
Test Method:	ANSI C63.4 section 8 & 13
Test Status:	Test the EUT in continuous transmitting mode at lowest channel, Middle, highest channel on the charging and battery modes, found the worse case was on the charging mode, and recorded the worse case.
Detector:	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
15.209 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
15.247(d) limit:	(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 Configuration:

1) 30MHz to 1GHz emissions:



2) 1GHz to 40GHz 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 20log(dwell time/100 ms), in an effort to demonstrate compliance with the 15.209 limit. Submit this data.

7.10.1 Harmonic and other spurious emissions

7.10.1.1 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

7.10.1.2 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

7.10.1.3 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 FCC requirements.

7.10.2 Radiated Emissions which fall in the restricted bands

Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands. as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	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 FCC 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 -	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.52525	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	156.7 - 156.9	3260 - 3267	23.6 - 24.0
12.29 - 12.293	162.0125 - 167.17	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	167.72 - 173.2	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	240 - 285	3600 - 4400	
13.36 - 13.41	322 - 335.4		

7.11 Band Edges Requirement

Test Requirement:	FCC Part 15 C
Test Method:	Based on ANSI 63.4
	Operation within the band 2400 – 2483.5 MHz
Test Status:	Test the EUT in continuous transmitting mode at lowest channel and highest channel.
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.

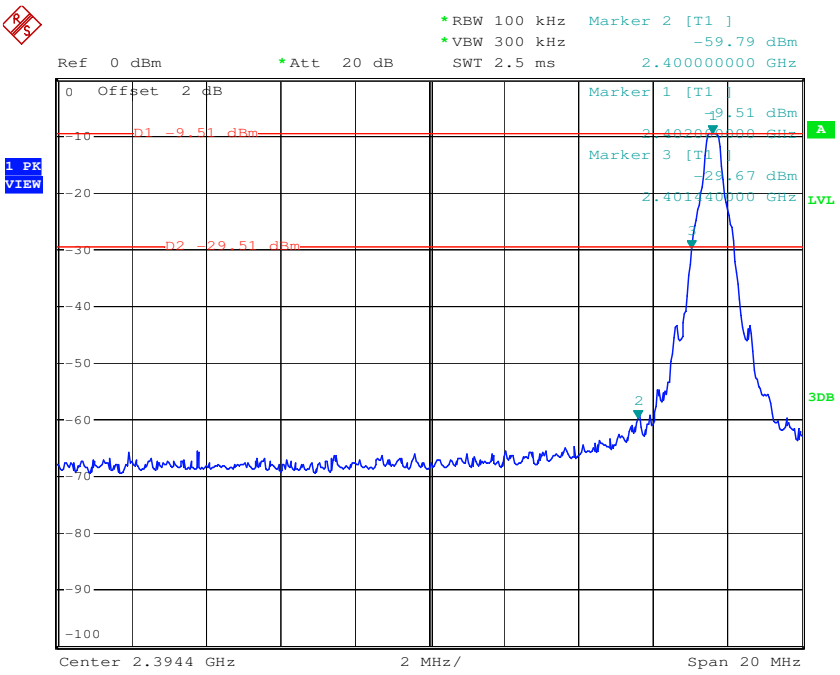
The band edges was measured and recorded Result:

The Lower Edges attenuated more than 20dB.

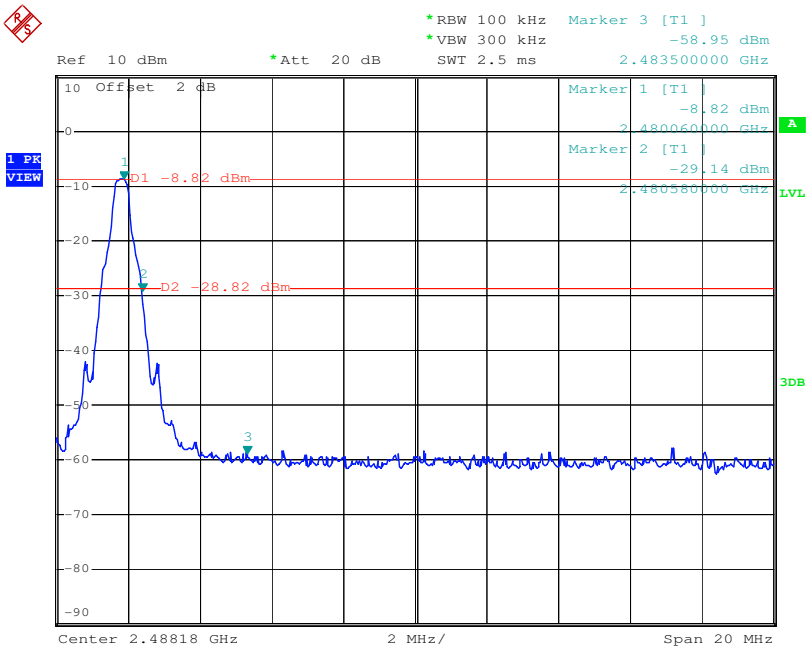
The Upper Edges attenuated more than 20dB.

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

DH5:
Low channel:



Highest Channel:



Test result: The unit does meet the FCC requirements.

7.12 Conducted Emissions at Mains Terminals 150 kHz to 30MHz

Test Requirement: FCC Part 15.207

Test Method: ANSI C63.4

Frequency Range: 150KHz to 30MHz

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

Test Limit

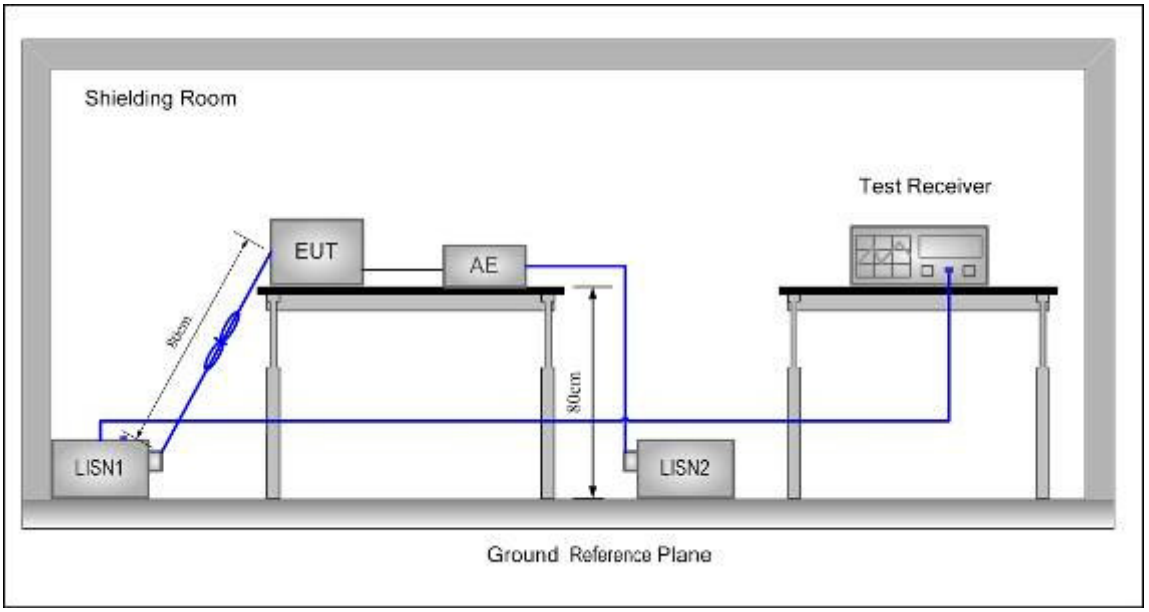
Limits for conducted disturbance at the mains ports of class B

Frequency Range (MHz)	Class B Limit (dBuV)	
	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 mode. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

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

Test Configuration:



Test procedure:

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

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

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

4. The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

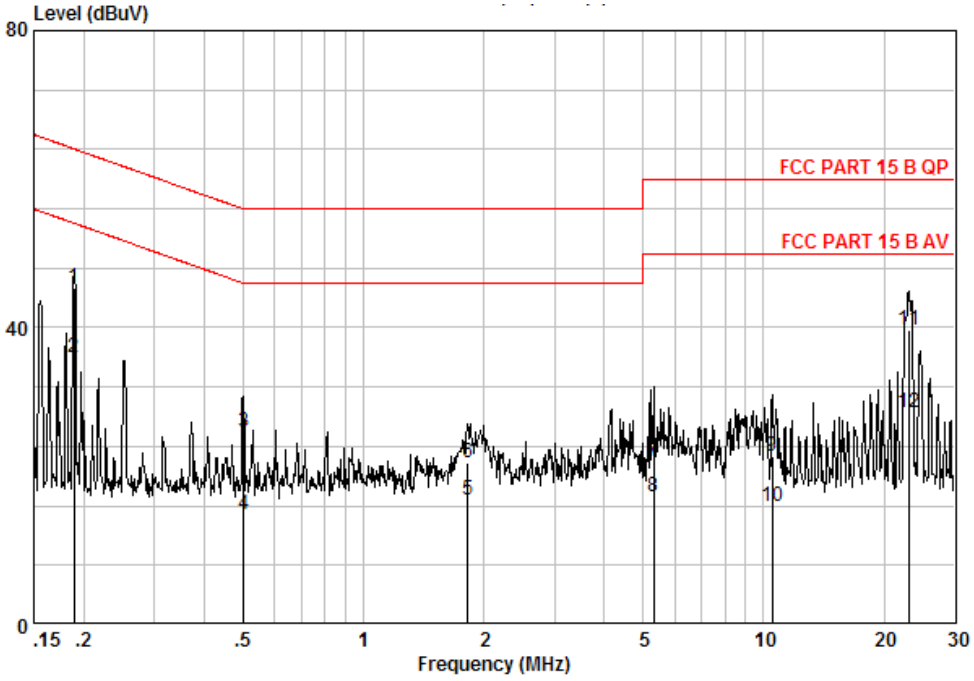
7.12.1 Measurement Data

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

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected. For EUT the communicating was worst case mode.

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

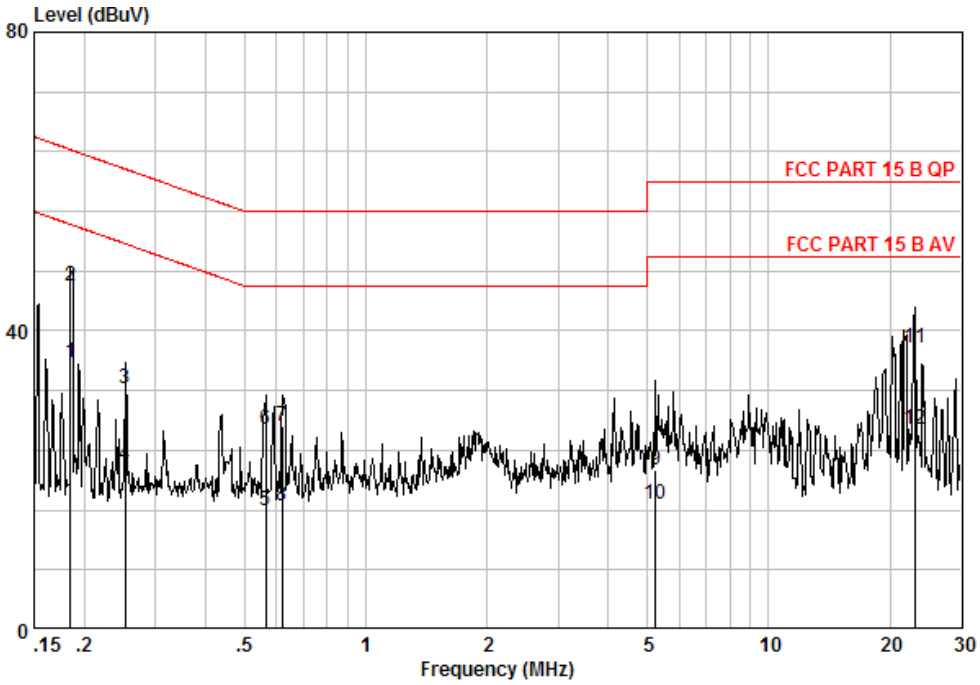
Neutral Line



Measure data:

Freq	Read Level	Cable Loss	LISN Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB	dB	dBuV	dBuV	dB	
0.189	35.66	0.12	9.62	45.40	64.06	-18.66	QP
0.189	26.16	0.12	9.62	35.90	54.06	-18.16	AVERAGE
0.502	16.28	0.05	9.63	25.96	56.00	-30.04	QP
0.502	5.16	0.05	9.63	14.84	46.00	-31.16	AVERAGE
1.819	7.04	0.02	9.66	16.72	46.00	-29.28	AVERAGE
1.819	12.08	0.02	9.66	21.76	56.00	-34.24	QP
5.305	12.14	0.17	9.70	22.01	60.00	-37.99	QP
5.305	7.35	0.17	9.70	17.22	50.00	-32.78	AVERAGE
10.508	12.74	0.17	9.78	22.69	60.00	-37.31	QP
10.508	5.98	0.17	9.78	15.93	50.00	-34.07	AVERAGE
23.140	29.28	0.27	10.17	39.72	60.00	-20.28	QP
23.140	18.09	0.27	10.17	28.53	50.00	-21.47	AVERAGE

Live Line



Measure result:

Freq	Read Level	Cable Loss	LISN Factor	Level	Limit Line	Over Limit	Remark
MHz	dBuV	dB	dB	dBuV	dBuV	dB	
0.184	26.10	0.11	9.62	35.83	54.28	-18.45	AVERAGE
0.184	36.26	0.11	9.62	45.99	64.28	-18.29	QP
0.252	22.52	0.10	9.62	32.24	61.69	-29.45	QP
0.252	12.21	0.10	9.62	21.93	51.69	-29.76	AVERAGE
0.564	6.32	0.05	9.61	15.98	46.00	-30.02	AVERAGE
0.564	17.24	0.05	9.61	26.90	56.00	-29.10	QP
0.621	17.52	0.05	9.62	27.18	56.00	-28.82	QP
0.621	6.85	0.05	9.62	16.51	46.00	-29.49	AVERAGE
5.249	11.46	0.17	9.65	21.28	60.00	-38.72	QP
5.249	6.98	0.17	9.65	16.80	50.00	-33.20	AVERAGE
23.018	27.42	0.27	10.08	37.77	60.00	-22.23	QP
23.018	16.56	0.27	10.08	26.91	50.00	-23.09	AVERAGE

Remark: Level = Real Level + Cable loss + LISN factor

Test Results: The unit does meet the FCC requirements.

--End of Report--