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FEDERAL COMMUNICATIONS COMMISSION
Registration number: 282399

Report No.: GLEMR071103574RFT
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FCC ID: UZ5-BHM2100001

TEST REPORT

Application No. : GLEMR071103574RF
Applicant: Phoenix International Co., Ltd
FCC ID: UZ5-BHM2100001
Fundamental Carrier Frequency : 2.402GHz to 2.480GHz
Equipment Under Test (EUT):
Name: Bluetooth Mono Headset
Model: BHM-110, BHM-121, BHM-123, BHM-125, MiniStar II, 87552♣
♣ Please refer to section 2 of this report which indicates which item was actually tested and which were electrically identical.
Serial No.: Not supplied by client
Standards: FCC PART 15, SUBPART C: 2007 (Section 15.247)
Date of Receipt: Nov 26, 2007
Date of Test: Nov 29, 2007 – Dec 07, 2007
Date of Issue: Dec 10, 2007

Test Result :	PASS *
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* In the configuration tested, the EUT detailed in this report complied with the standards specified above. Please refer to section 2 of this report for further detail.

Authorized Signature:

Stephen Guo
Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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2 Test Summary

Test	Test Requirement	Standard Paragraph	Result
Antenna Requirement	FCC PART 15 :2007	Section 15.247 (c)	PASS
Occupied Bandwidth	FCC PART 15 :2007	Section 15.247 (a1)	PASS
Carrier Frequencies Separated	FCC PART 15 :2007	Section 15.247(a)(1)	PASS
Hopping Channel Number	FCC PART 15 :2007	Section 15.247(a)(1)(iii)	PASS
Dwell Time	FCC PART 15 :2007	Section 15.247(a)(1)(iii)	PASS
Pseudorandom Frequency Hopping Sequence	FCC PART 15 :2007	Section 15.247(a)(1)	PASS
Maximum Peak Output Power	FCC PART 15 :2007	Section 15.247(b)(1)	PASS
RF Exposure Compliance Requirement	FCC PART 15 :2007	15.247(b)(4)& TCB Exclusion List (7 July 2002)	PASS
Conducted Emission	FCC PART 15 :2007	Section 15.207	PASS
Conducted Spurious Emission (30MHz to 25GHz)	FCC PART 15 :2007	Section 15.209 &15.247(d)	PASS
Radiated Spurious Emission (30MHz to 25GHz)	FCC PART 15 :2007	Section 15.209 &15.247(d)	PASS
Radiated Emission	FCC PART 15 :200	Section 15.209	PASS
Band Edges Measurement	FCC PART 15 :2007	Section 15.247 (d) &15.205	PASS

Remark: ♣

Model: BHM-110, BHM-121, BHM-123, BHM-125, MiniStar II, 87552

For only one model was tested, according to the confirmation from the applicant.

Since the applicant declared electrical circuit design, layout, components used and internal wiring were identical for the above items, with only difference being the model no.



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4 General Information

4.1 Client Information

Applicant: Phoenix International Co., Ltd
Address of Applicant: 11F, No.42-1, Sec.1, Zhong-Yang N. Rd. Peitou, Taipei 112, Taiwan, R.O.C.

4.2 General Description of E.U.T.

Product Name: Bluetooth Mono Headset
Model: BHM-110, BHM-121, BHM-123, BHM-125, MiniStar II, 87552
Number of Channels: 79 Channels
Channel Separation: 1 MHz
Type of Modulation: FHSS (Frequency Hopping Spread Spectrum);
Adaptive Frequency Hopping (AFH) is used.
Dwell time: Per channel is less than 0.4s.
Antenna Type: Integral
Power supply: Inside Rechargeable Batteries supplied: Battery or AC/DC Adapter supplied.

4.3 Description of Support Units

The EUT has been tested with AC/DC adapter for charging supplied by testing lab.

4.4 Standards Applicable for Testing

The customer requested FCC tests for the EUT.

The standard used was FCC PART 15, SUBPART C: 2007 (Section 15.247), ANSI C63.4:2003, DA 00-705.

4.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory, No.198 Kezhu Road, Science Town Economic& Technology Development District Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.

4.6 Other Information Requested by the Customer

None.



4.7 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. With the above and NVLAP's accreditation, SGS-CSTC is an authorized test laboratory for the DoC process.



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5 Equipments Used during Test

RE in Chamber/OATS						
No:	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (dd-mm-yy)	Cal.Due date (dd-mm-yy)
EMC0525	Compact Semi-Anechoic Chamber	ChangZhou ZhongYu	N/A	N/A	06-03-2007	06-03-2008
EMC0522	EMI Test Receiver	Rohde & Schwarz	ESIB26	100249	05-12-2007	05-12-2008
N/A	EMI Test Software	Audix	E3	N/A	N/A	N/A
EMC0514	Coaxial cable	SGS	N/A	N/A	04-12-2007	04-12-2008
EMC0524	Bi-log Type Antenna	Schaffner -Chase	CBL6112B	2966	12-08-2007	12-08-2008
EMC0519	Bilog Type Antenna	Schaffner -Chase	CBL6143	5070	12-08-2007	12-08-2008
EMC0517	Horn Antenna	Rohde & Schwarz	HF906	100095	12-08-2007	12-08-2008
EMC0040	Spectrum Analyzer	Rohde & Schwarz	FSP30	100324	05-12-2007	05-12-2008
EMC0520	0.1-1300 MHz Pre-Amplifier	HP	8447D OPT 010	2944A06252	28-03-2007	28-03-2008
EMC0521	1-26.5 GHz Pre-Amplifier	Agilent	8449B	3008A01649	28-03-2007	28-03-2008
EMC0523	Active Loop Antenna	EMCO	6502	00042963	09-08-2006	09-08-2008
EMC0530	10m Semi- Anechoic Chamber	ETS	N/A	N/A	10-08-2007	10-08-2008

Conducted Emission						
No:	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Date (dd-mm-yy)	Cal.Due date (dd-mm-yy)
EMC0306	Shielding Room	Zhong Yu	8 x 3 x 3.8 m ³	N/A	N/A	N/A
EMC0102	LISN	Schaffner Chase	MNZ050D/1	1421	05-12-2007	05-12-2008
EMC0506	EMI Test Receiver	Rohde & Schwarz	ESCS30	100085	05-12-2007	05-12-2008
EMC0107	Coaxial Cable	SGS	2m	N/A	24-11-2007	26-11-2008
EMC0106	Voltage Probe	SGS	N/A	N/A	N/A	N/A

6 Test Results		
6.1 E.U.T. test conditions		
Power supply:	AC adapter or Battery inside.	
Type of antenna:	Integral	
Operating Environment:		
Temperature:	20.0 -25.0 °C	
Humidity:	38-52 % RH	
Atmospheric Pressure:	992 -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
	1 MHz or less	1
	1 to 10 MHz	2
	More than 10 MHz	3
		Location in the range of operation
		Middle
		1 near top and 1 near bottom
		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	14	2416	28	2430
1	2403	15	2417	29	2431
2	2404	16	2418	30	2432
3	2405	17	2419	31	2433
4	2406	18	2420	32	2434
5	2407	19	2421	33	2435
6	2408	20	2422	34	2436
7	2409	21	2423	35	2437
8	2410	22	2424	36	2438
9	2411	23	2425	37	2439
10	2412	24	2426	38	2440
11	2413	25	2427	39	2441
12	2414	26	2428	40	2442
13	2415	27	2429	41	2443



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

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

6.2 Antenna Requirement

6.2.1 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 band 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.

6.2.2 EUT Antenna

The antenna is integrated on the main PCB and no consideration of replacement. The gain of the antenna is less than 0 dBi.



Test result: The unit does meet the FCC requirements.

6.3 Occupied Bandwidth

Test Requirement: FCC Part 15 C
Test Method: Based on FCC Part15 C Section 15.247 & DA 00-705
Test Date: Dec 06, 2007
Test Status: Test in fixing operating frequency at lowest, middle, highest channel.

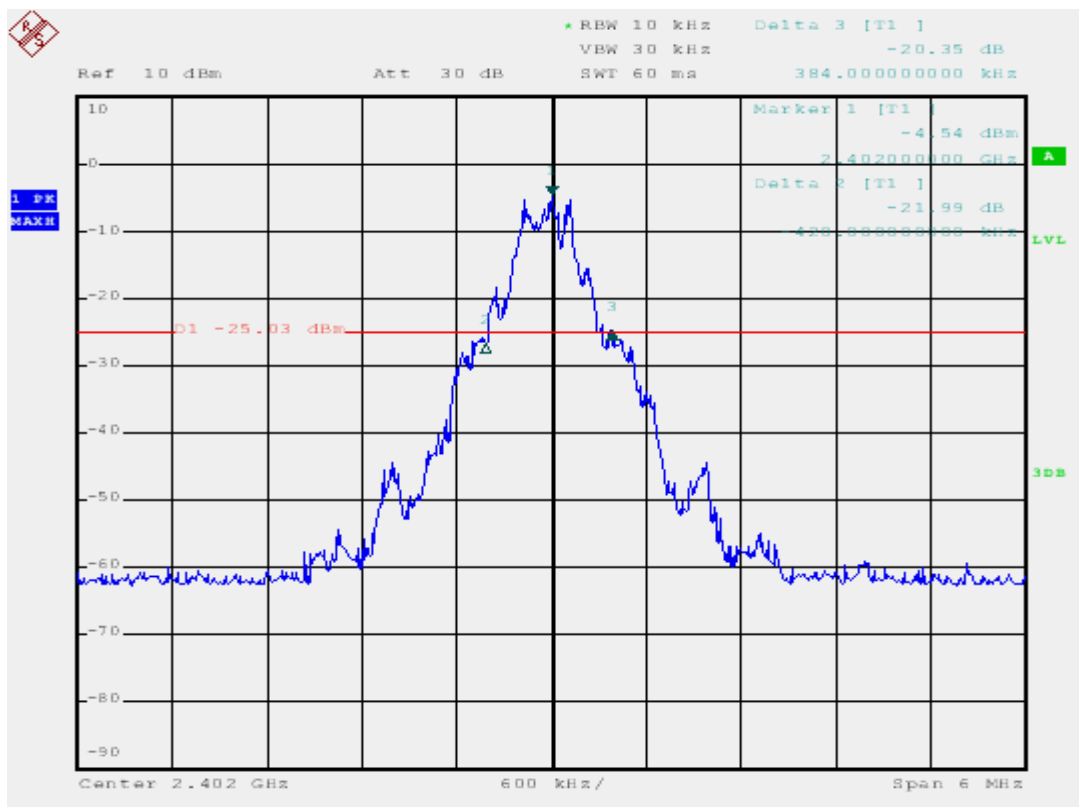
Test Procedure:

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, centered on a hopping channel;
3. Set the spectrum analyzer: RBW \geq 1% of the 20dB bandwidth (set 10kHz), VBW \geq RBW, Sweep = auto; Detector Function = Peak, Trace = Max Hold.
4. Mark the peak frequency and -20dB points.

Test result:

Test Channel	20 dB bandwidth
Low	804kHz
Middle	844kHz
High	790kHz

Lowest Channel:



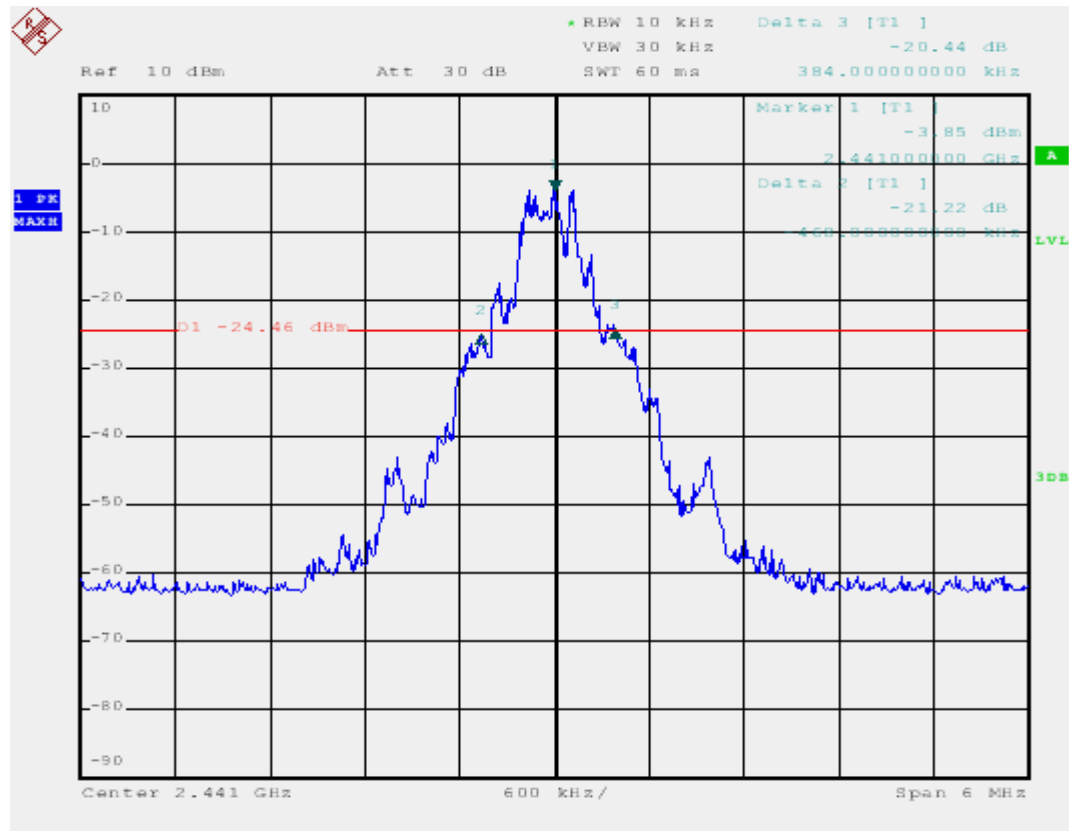


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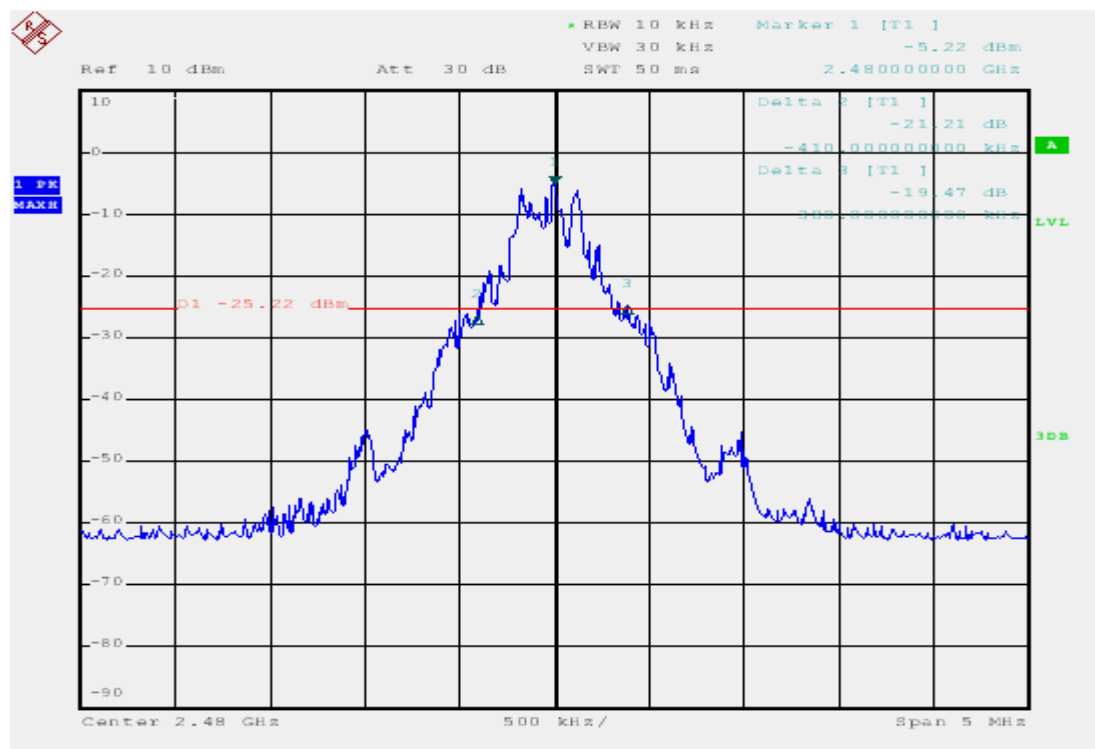
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Middle Channel:



Highest Channel:





6.4 Carrier Frequencies Separated

Test Requirement: FCC Part 15 C

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

Test Date: Dec 07, 2007

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 operating mode.

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: RBW \geq 1% of the span (set 100 kHz), VBW \geq RBW , Span = 10MHz, 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)	0,988MHz	Pass
Middle Channels (channel 39 and channel 40)	1,024MHz	Pass
Upper Channels (channel 77 and channel 78)	1.088MHz	Pass

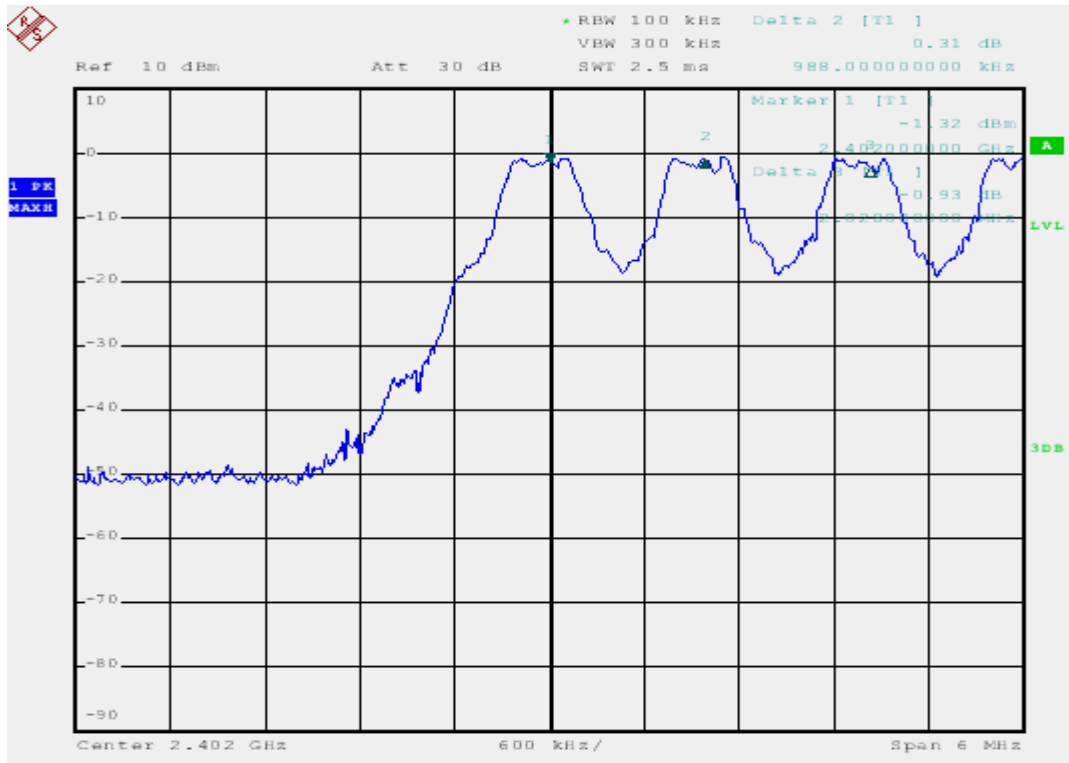


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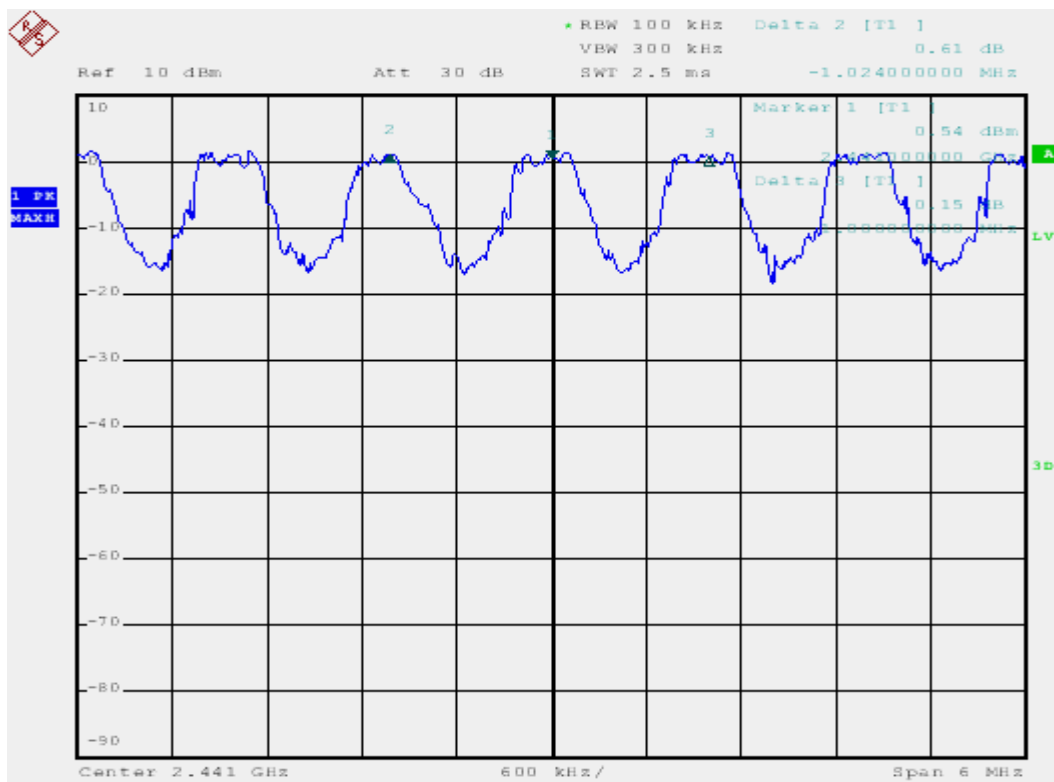
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1. Lowest Channels: Carrier Frequencies Separated

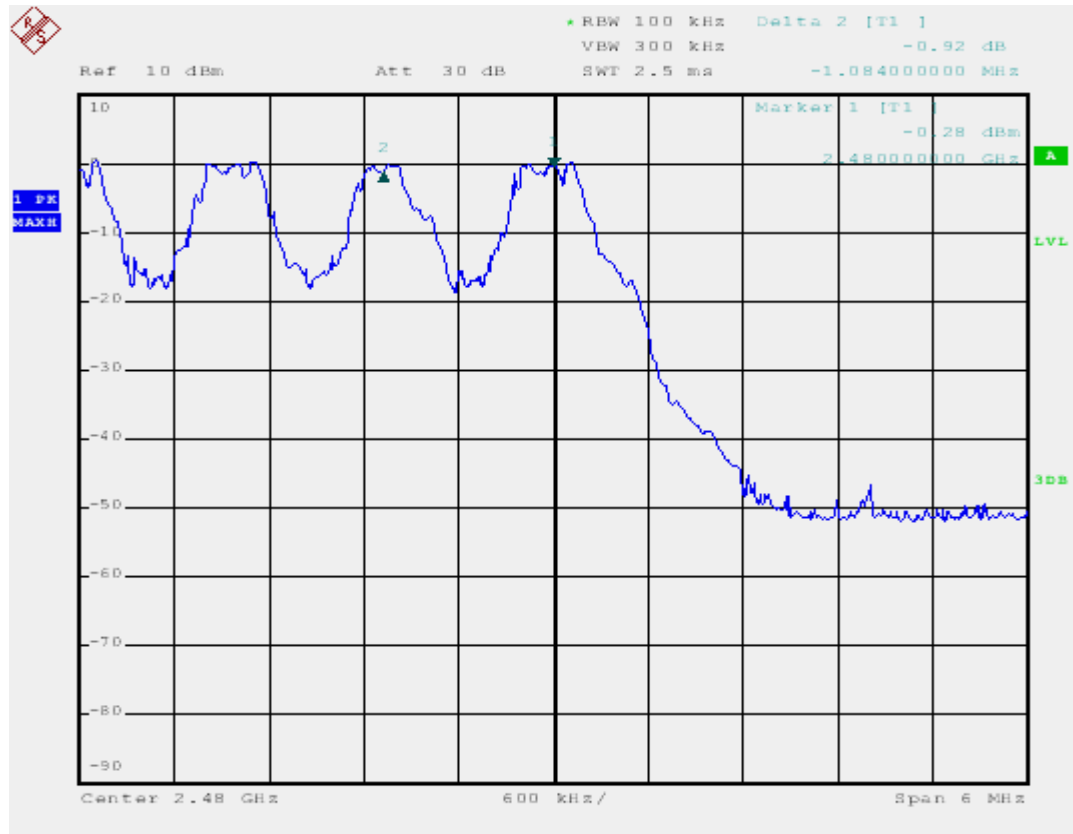


2. Middle Channels: Carrier Frequencies Separated





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



Test result: The unit does meet the FCC requirements.



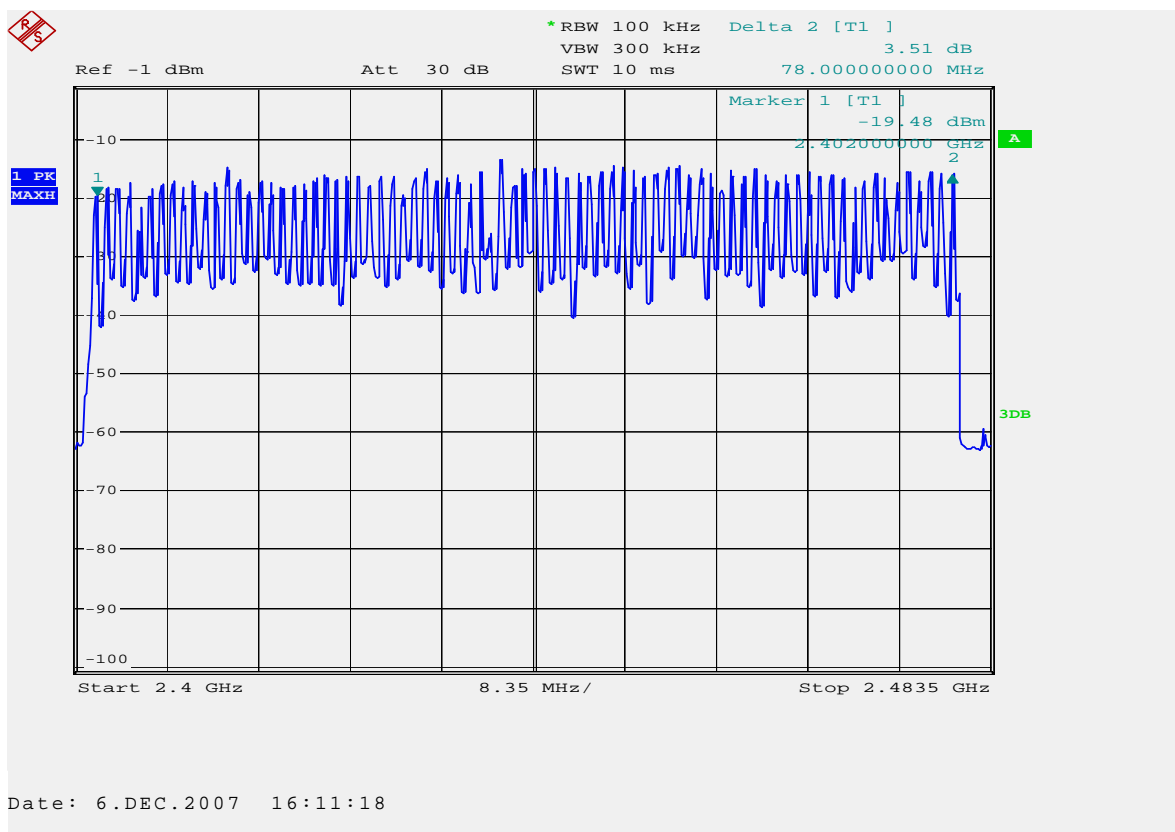
6.5 Hopping Channel Number

Test Requirement: FCC Part15 C
Test Method: Based on FCC Part15 C Section 15.247 & DA 00-705
Test Date: October 11, 2007
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 in hopping transmitting operating mode.

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: 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 = 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.



6.6 Dwell Time

Test Requirement:	FCC Part 15 C
Test Method:	Based on FCC Part15 C Section 15.247 & DA 00-705
Test Date:	Dec 06, 2007
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 in hopping transmitting operating mode.

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 spectrum analyzer span = 0, centered on a hopping channel;
- 3.Set RBW = 1MHz and VBW = 3MHz, 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: $T = 0,4 \text{ Second/Channel} \times 79 \text{ Channel} = 31,6 \text{ s}$

1. Channel 0: 2.402GHz

DH1 time slot = $0,166 \text{ (ms)} \times (1600/(2 \times 79)) \times 31,6 = 53,120 \text{ ms}$

DH3 time slot = $0,144 \text{ (ms)} \times (1600/(4 \times 79)) \times 31,6 = 23,040 \text{ ms}$

DH5 time slot = $0,180 \text{ (ms)} \times (1600/(6 \times 79)) \times 31,6 = 19,200 \text{ ms}$

2. Channel 39: 2.441GHz

DH1 time slot = $0,168 \text{ (ms)} \times (1600/(2 \times 79)) \times 31,6 = 53,760 \text{ ms}$

DH3 time slot = $0,180 \text{ (ms)} \times (1600/(4 \times 79)) \times 31,6 = 19,200 \text{ ms}$

DH5 time slot = $0,170 \text{ (ms)} \times (1600/(6 \times 79)) \times 31,6 = 18,133 \text{ ms}$

3. Channel 78: 2.480GHz

DH1 time slot = $0,144 \text{ (ms)} \times (1600/(2 \times 79)) \times 31,6 = 46,080 \text{ ms}$

DH3 time slot = $0,176 \text{ (ms)} \times (1600/(4 \times 79)) \times 31,6 = 28,160 \text{ ms}$

DH5 time slot = $0,180 \text{ (ms)} \times (1600/(6 \times 79)) \times 31,6 = 19,200 \text{ ms}$

The results are not greater than 0.4 seconds.

The unit does meet the FCC requirements.



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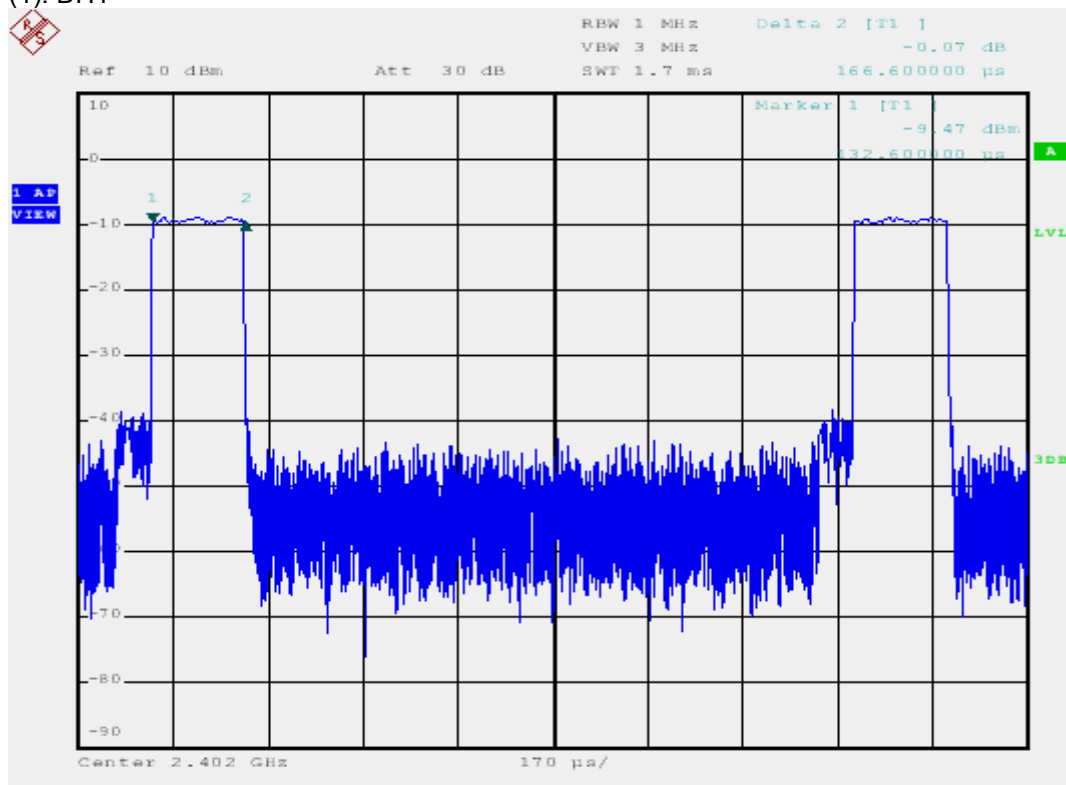
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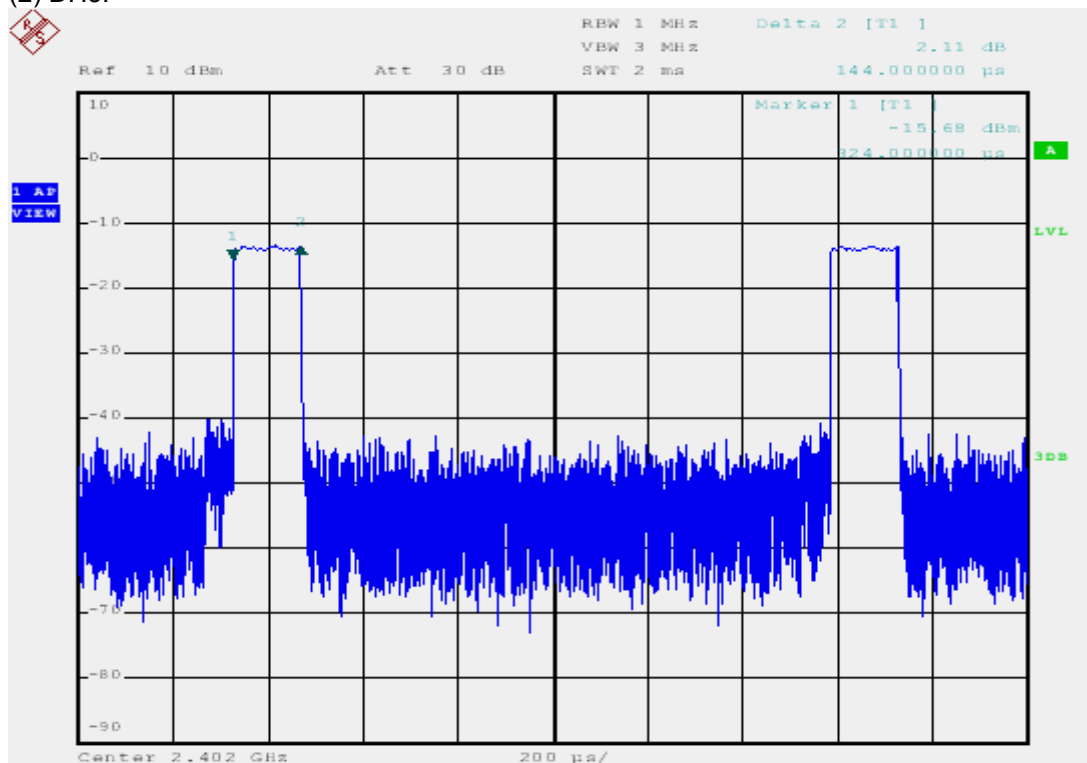
Please refer the graph as below:

1. Lowest channel (2.402 GHz):

(1). DH1



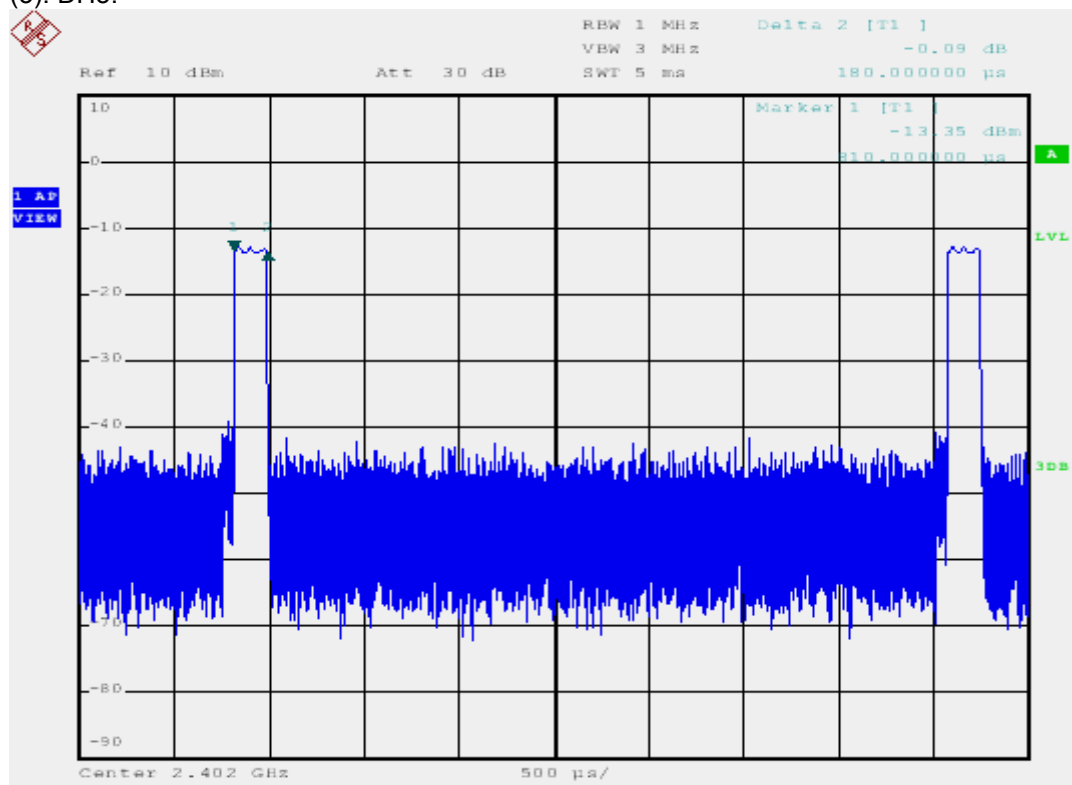
(2) DH3:





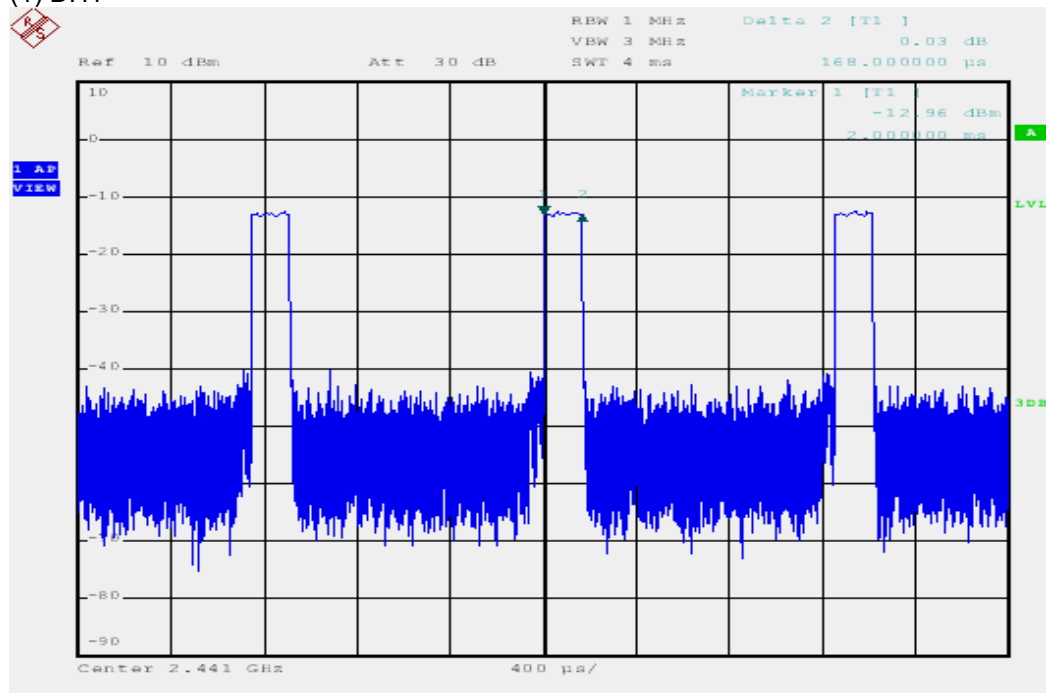
1. Lowest channel (2.402 GHz):

(3). DH5:



2. Middle Channel (2.441GHz)

(1) DH1





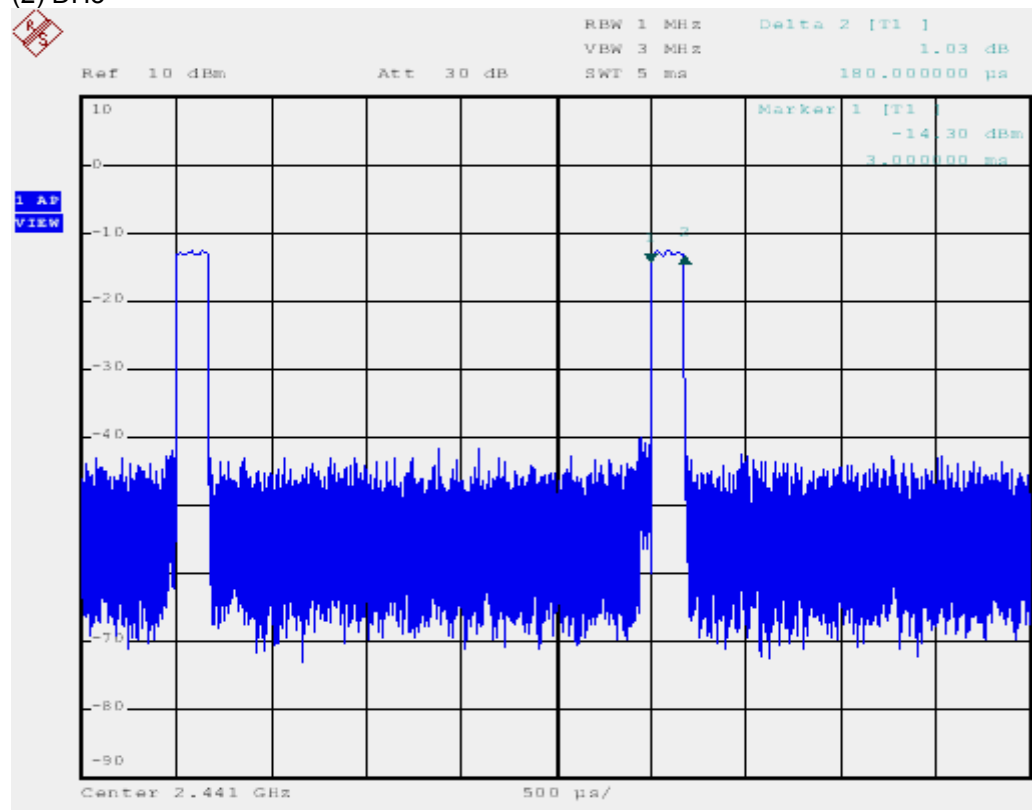
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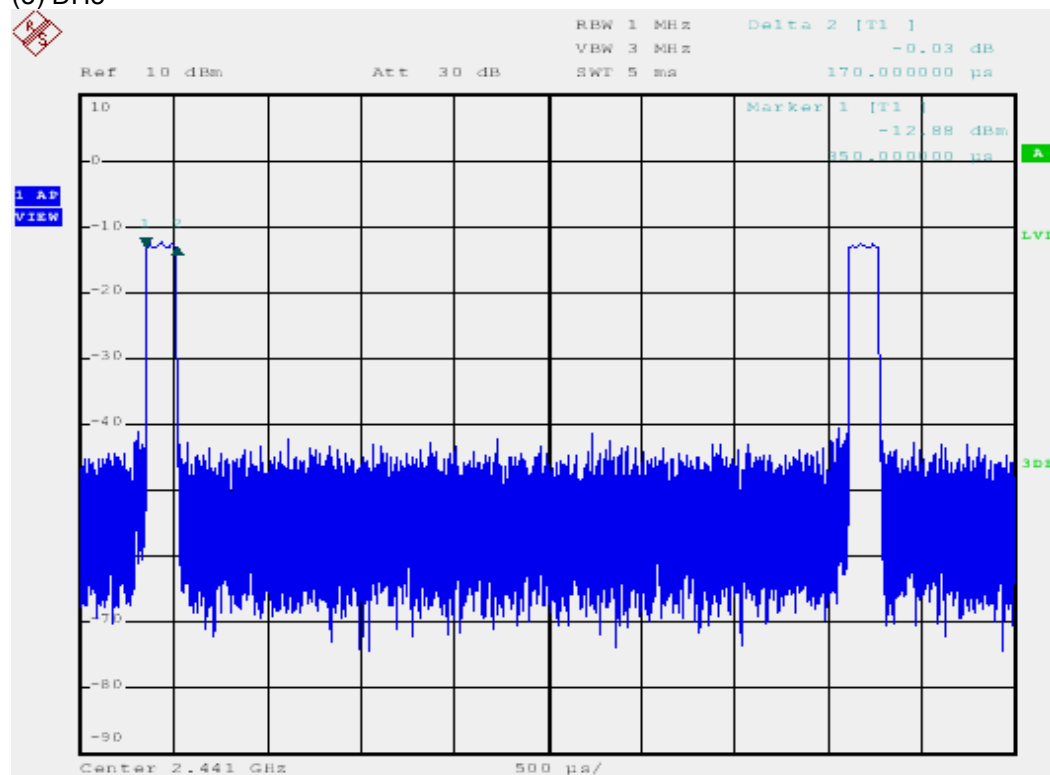
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2. Middle Channel (2.441GHz)

(2) DH3



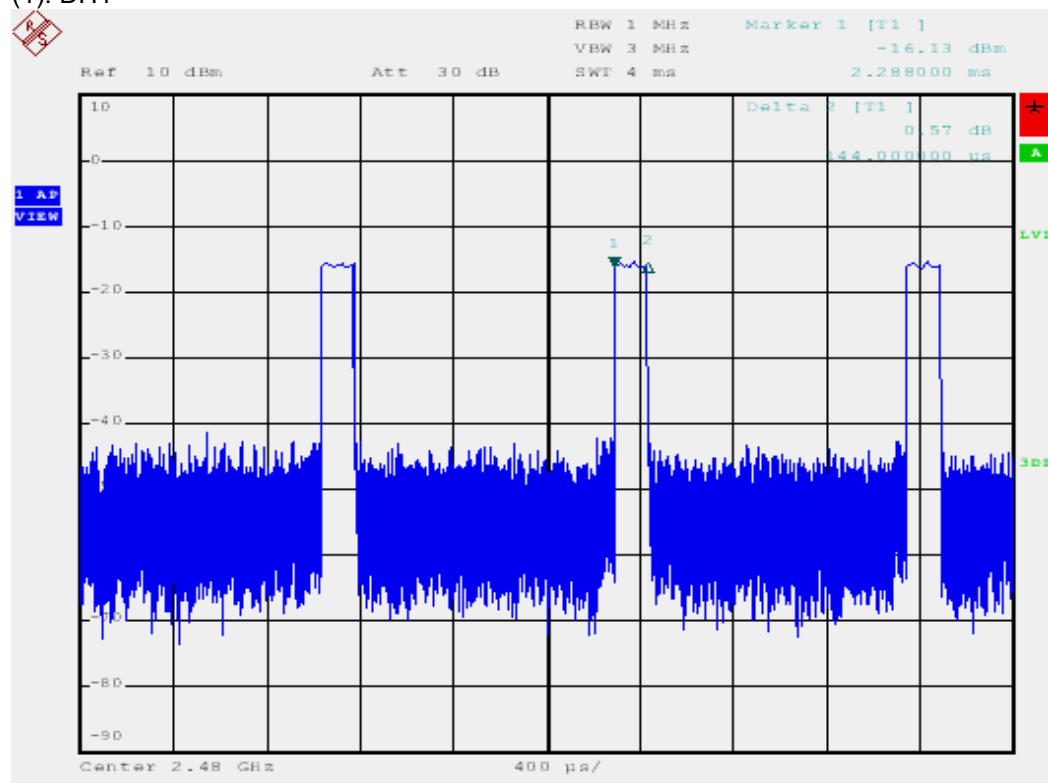
(3) DH5



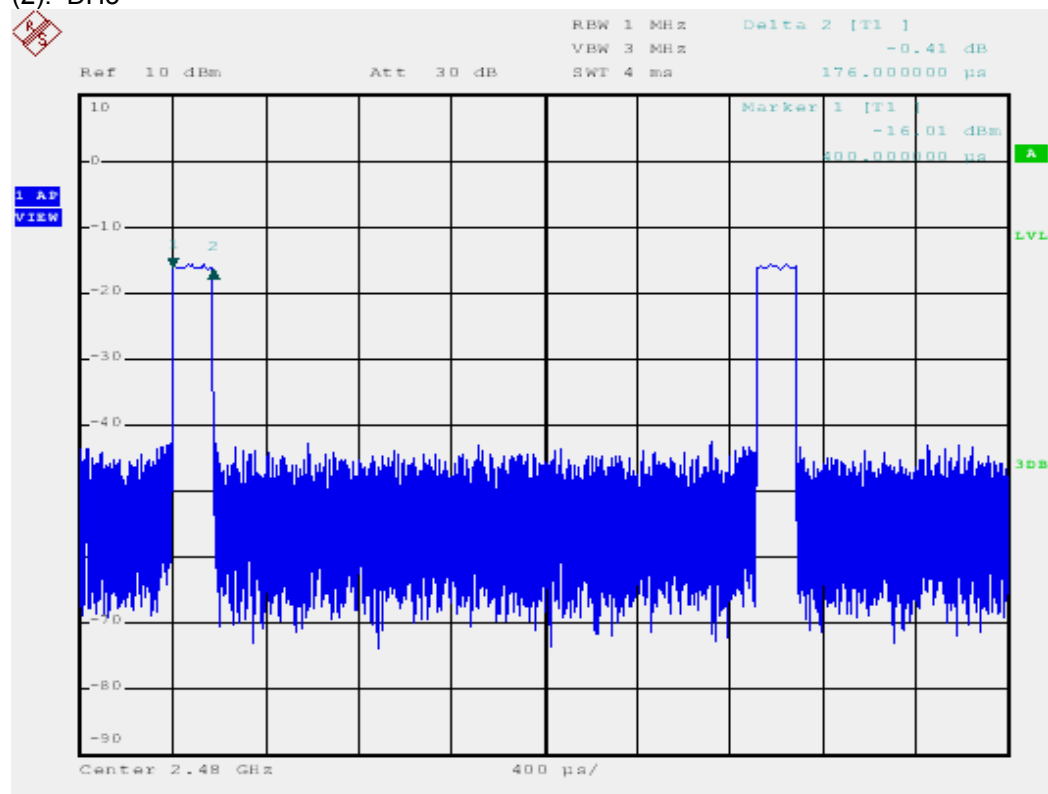


3. Highest channel (2.480GHz)

(1). DH1



(2). DH3





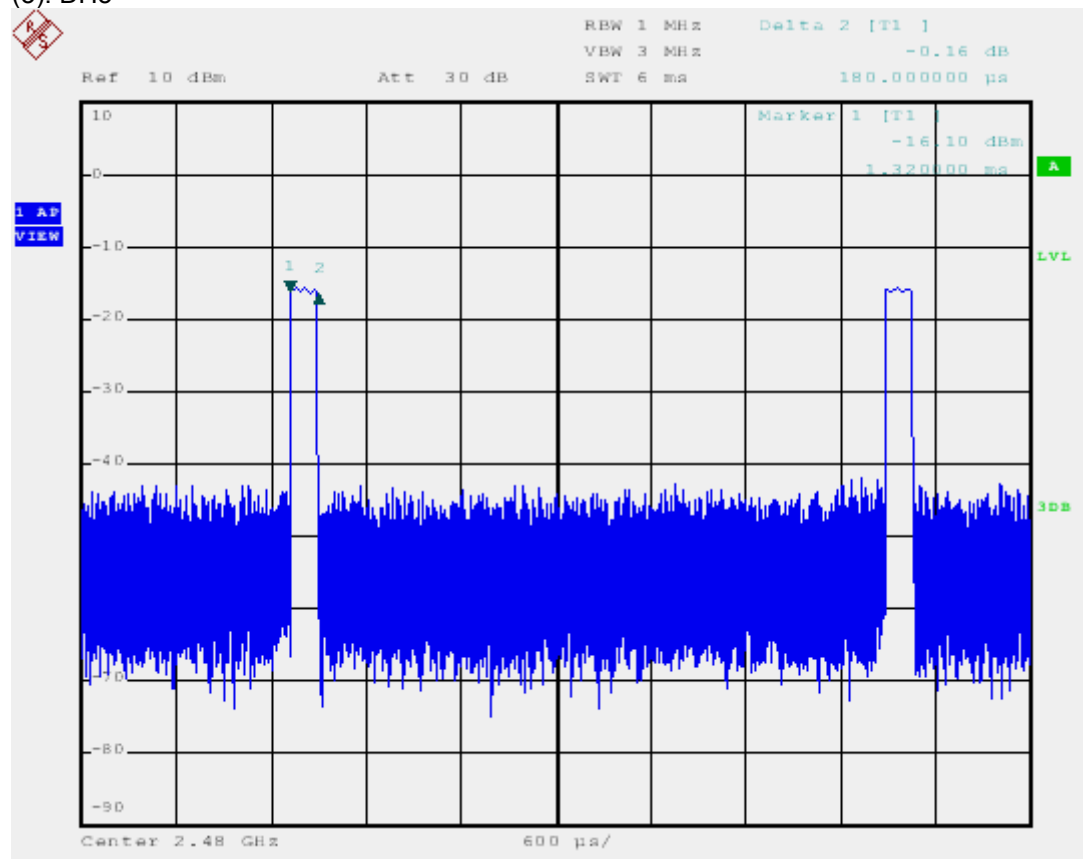
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3. Highest channel (2.480GHz)

(3). DH5



6.7 Pseudorandom Frequency Hopping Sequence

6.7.1 Standard requirement

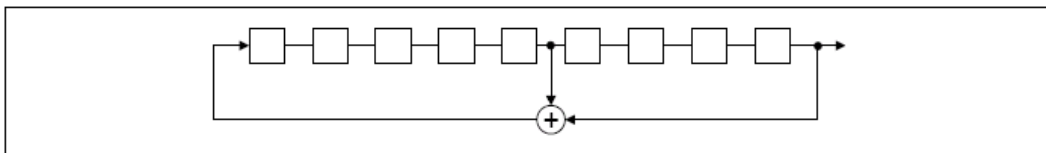
15.247(a)(1) requirement:

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.

6.7.2 EUT Pseudorandom Frequency Hopping Sequence

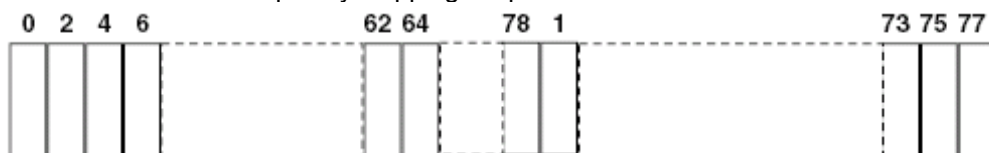
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage, and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONES; i.e. the shift register is initialized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

6.8 Maximum Peak Output Power

Test Requirement: FCC Part 15.247 & DA 00-705

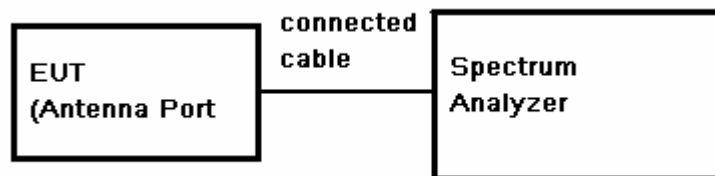
Test Method: Base on ANSI 63.4.

Test Date: Dec 06, 2007

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: Test in fixing frequency transmitting mode.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1 MHz, VBW = 3 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:

Test Channel	Fundamental Frequency (MHz)	Reading Power (dBm)	Cable Loss (dB)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Lowest	2.402	1,56	0.20	1,76	30.0	28,24
Middle	2.441	-0,83	0.20	-0,63	30.0	30,63
Highest	2.480	-1,74	0.20	-1,54	30.0	31,54

Test result: The unit does meet the FCC requirements.

Test result plot as follows:

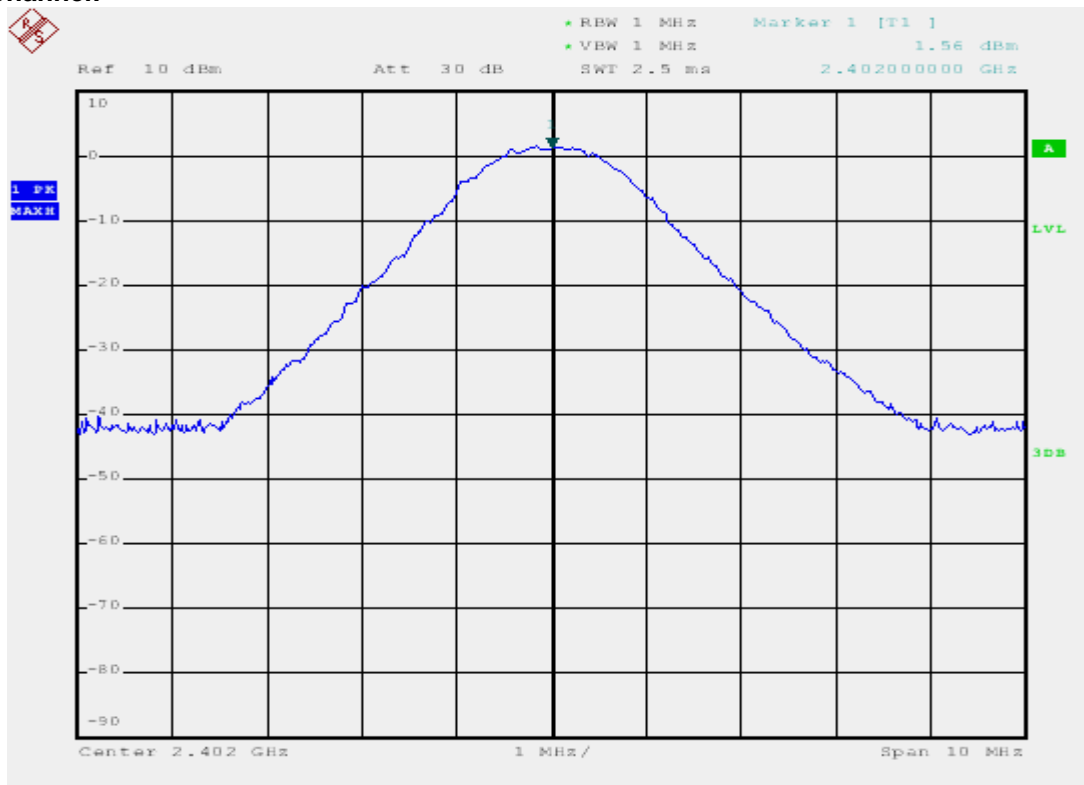


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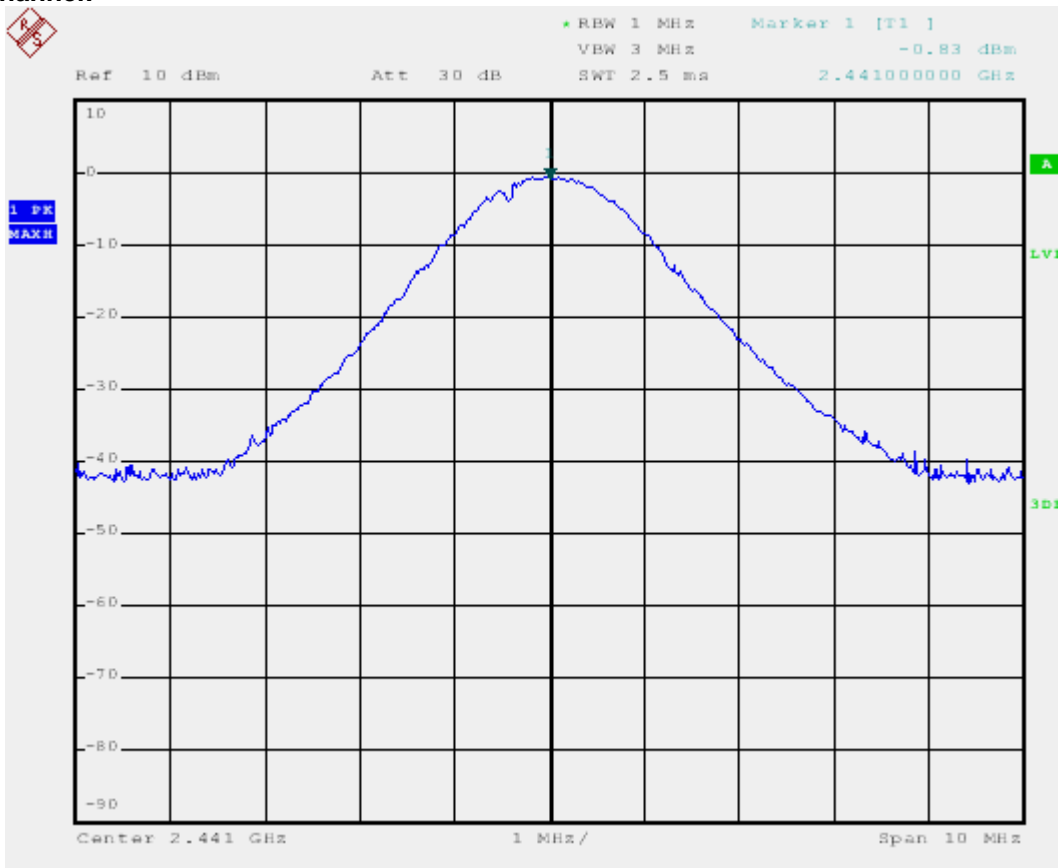
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Lowest Channel:



Middle Channel:



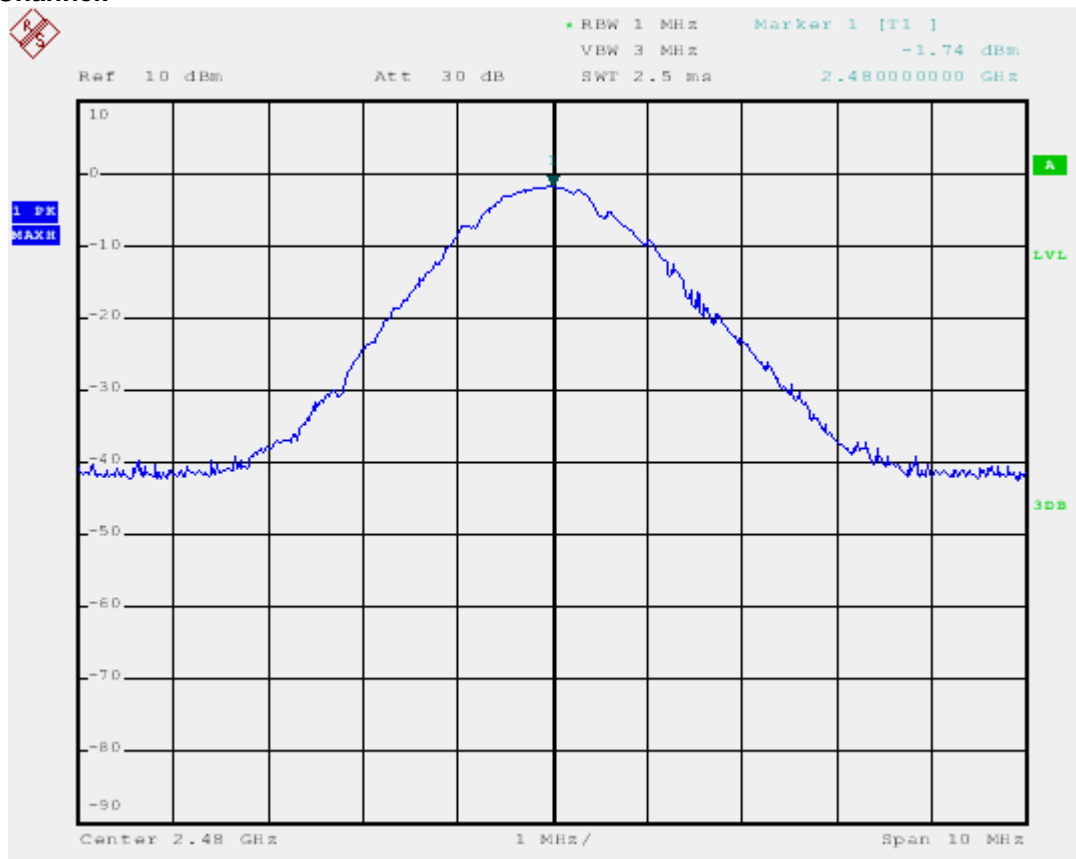


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Highest Channel:



6.9 RF Exposure Compliance Requirement

6.9.1 Standard requirement

15.247(b)(4) requirement:

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

TCB Exclusion List (7 July 2002)

Exposure category	low threshold	high threshold
general population	(60/fGHz) mW, $d < 2.5$ cm (120/fGHz) mW, $d \geq 2.5$ cm	(900/fGHz) mW, $d < 20$ cm
occupational	(375/fGHz) mW, $d < 2.5$ cm (900/fGHz) mW, $d \geq 2.5$ cm	(2250/fGHz) mW, $d < 20$ cm

6.9.2 EUT RF Exposure

The Max Conducted Peak Output Power is **1,76dBm(1,50mW)** in channel 0;

The antenna is generally less than **0dBi** PCB integrated in the actual use. 0dB logarithmic terms convert to numeric result is nearly **10**;

According to the formula, calculate the EIRP test result:

$$\text{EIRP} = P \times G = 1,50 \text{ mW} \times 1,0 = 1,50 \text{ mW} \text{ ①}$$

SAR requirement:

$$S = 120 / f(\text{GHz}) = 120 / 2.441 = 49,16 \text{ mW} \text{ ② ;}$$

$$\text{①} < \text{②},$$

So the SAR report is not required.



6.10 Conducted Spurious Emissions

Test Requirement: FCC Part 15.247 & DA 00-705

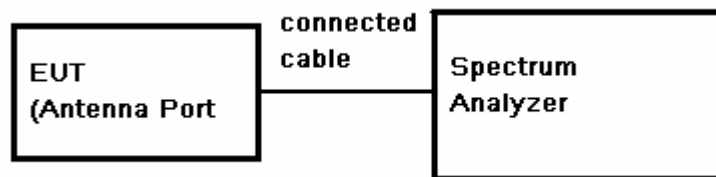
Test Method: Based on FCC Part15 C Section 15.247:

Test Date: Dec 06, 2007

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 lowest, middle, highest channel.

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: RBW = 100KHz, VBW \geq RBW, Sweep = auto; Detector Function = Peak (Max. hold).

Test result plot as follows:



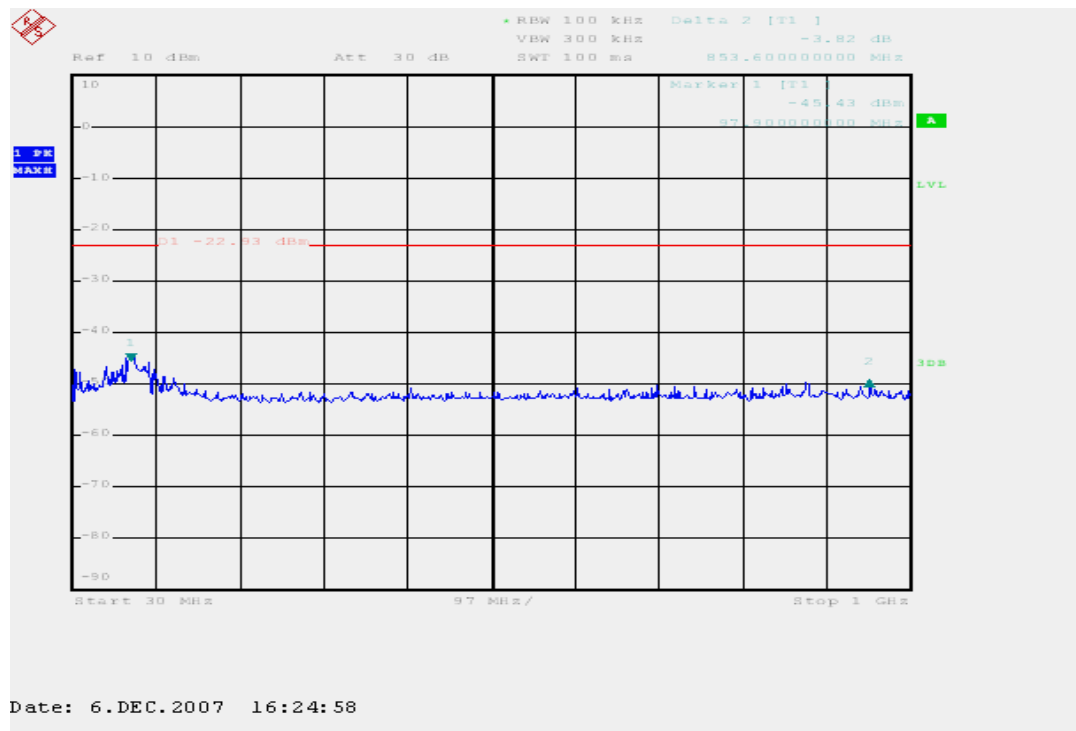
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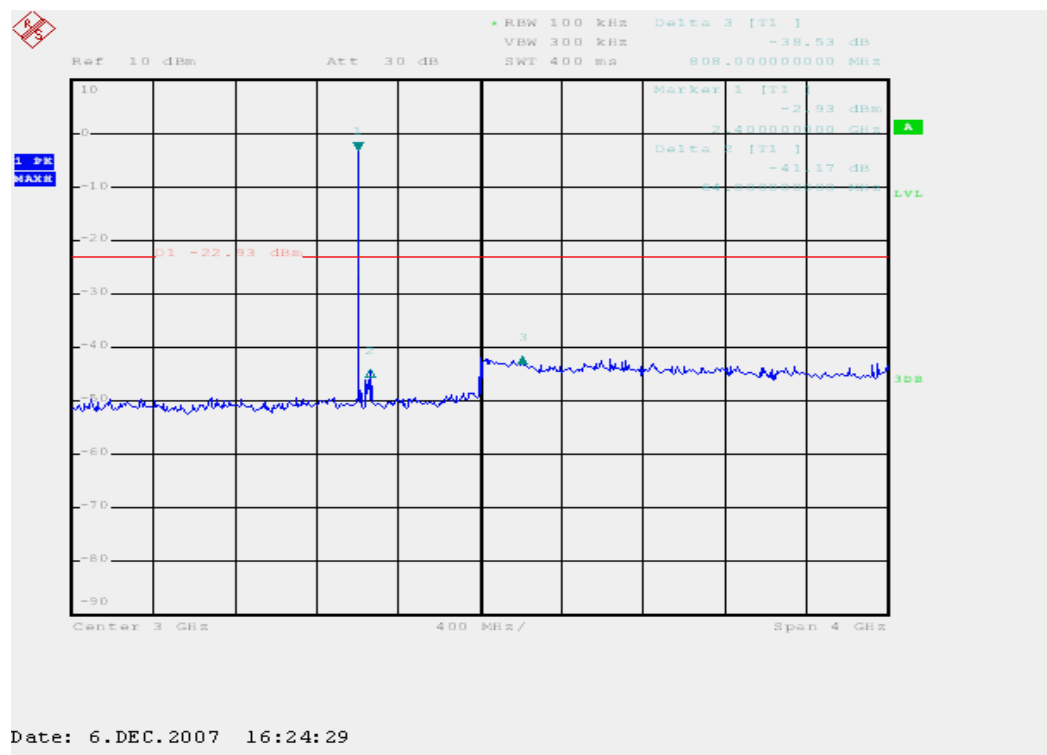
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Lowest Channel:

30M to 1GHz



1G to 5GHz



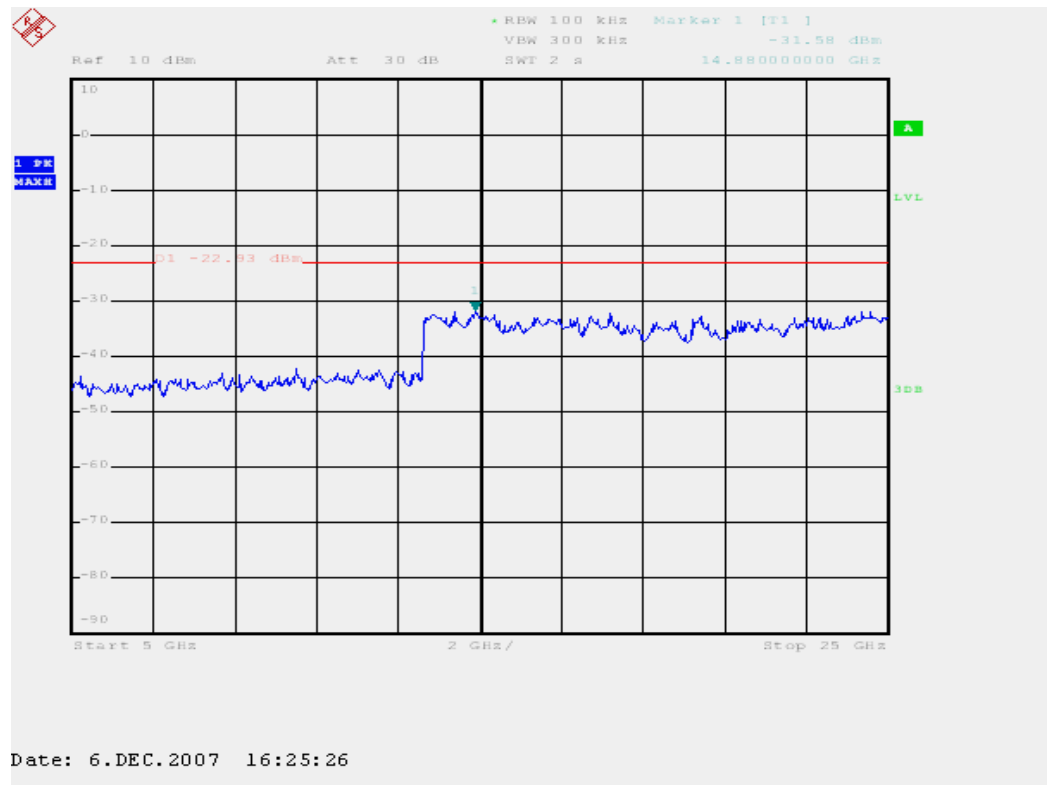


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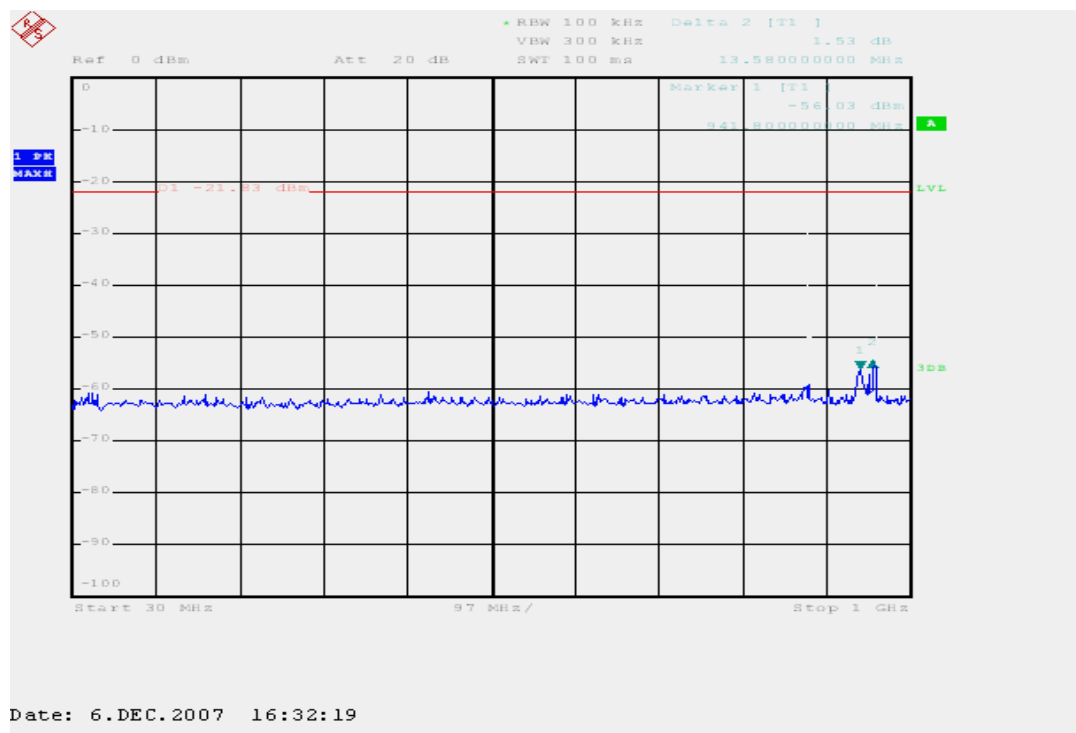
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5G to 25GHz



Middle Channel: 30M to 1GHz



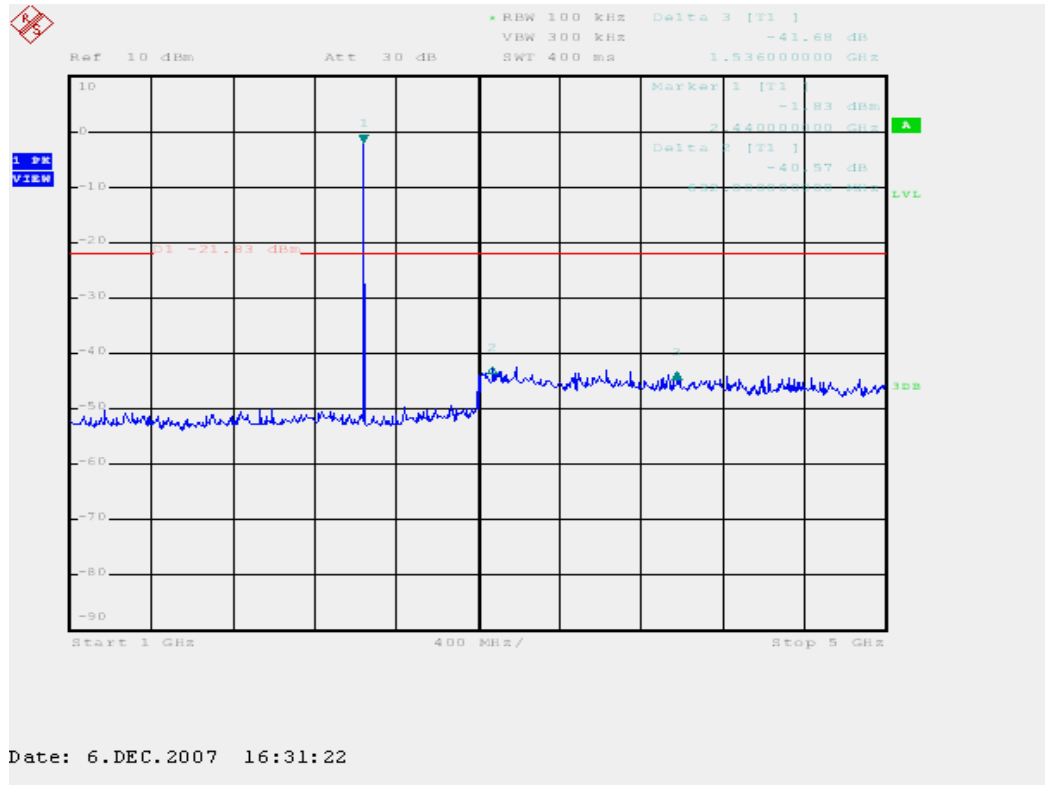


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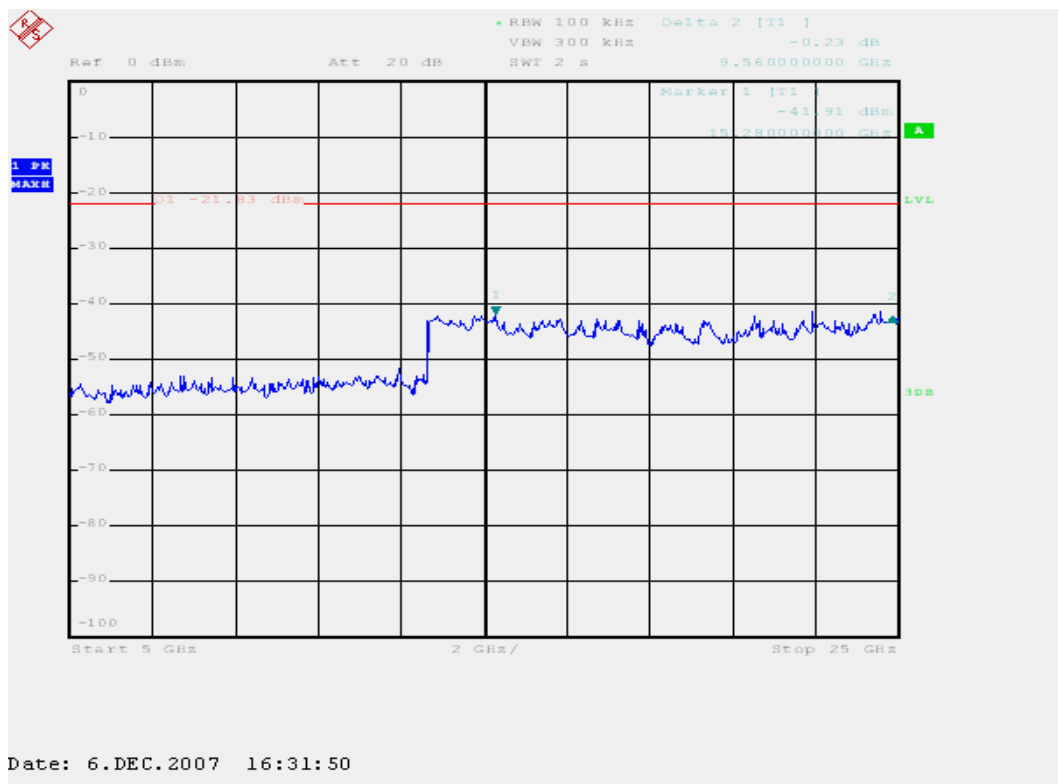
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1G to 5GHz



5G to 25GHz



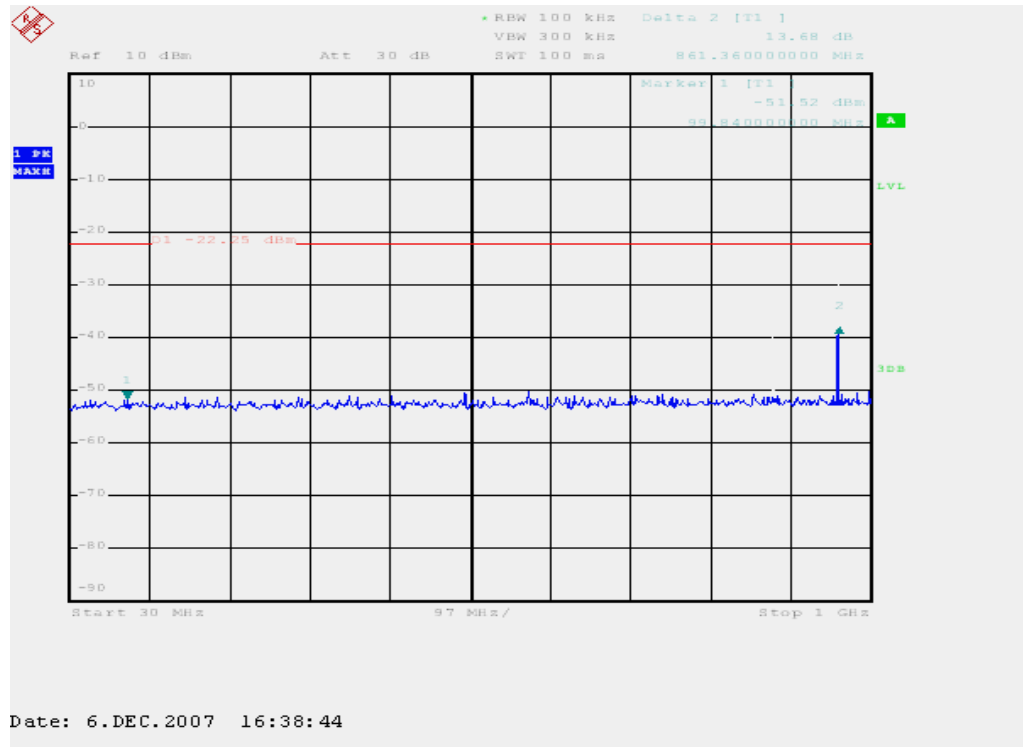


SGS-CSTC Standards Technical Services Ltd.

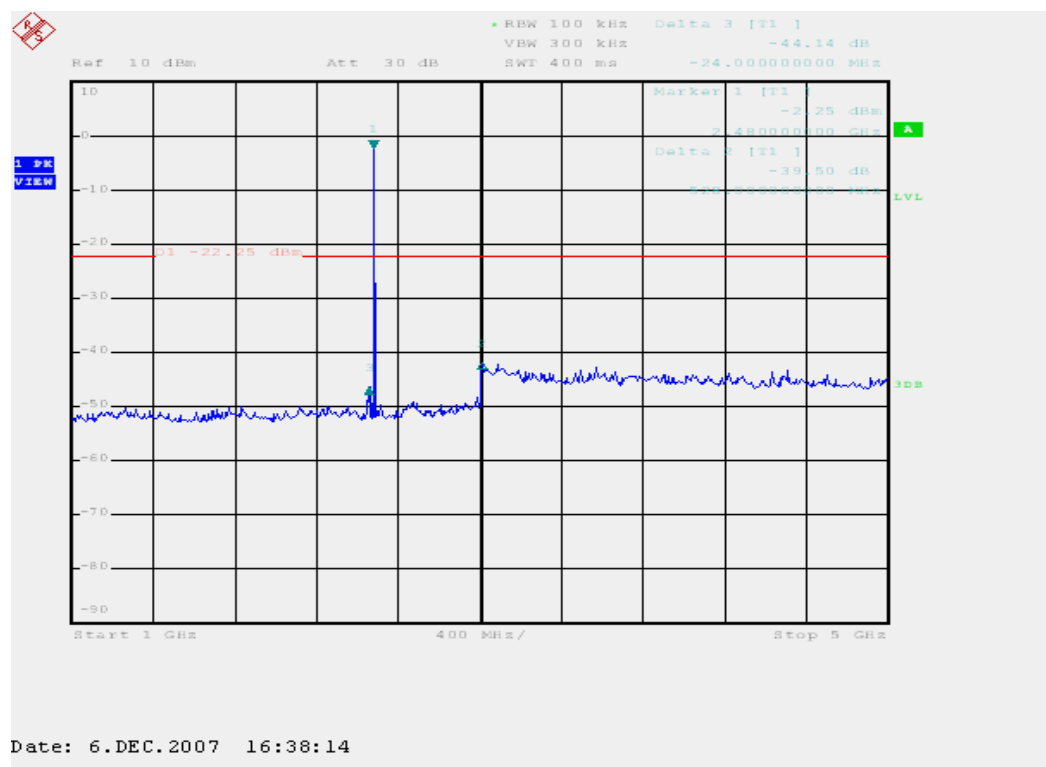
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Highest Channel: 30M to 1GHz



1G to 5GHz

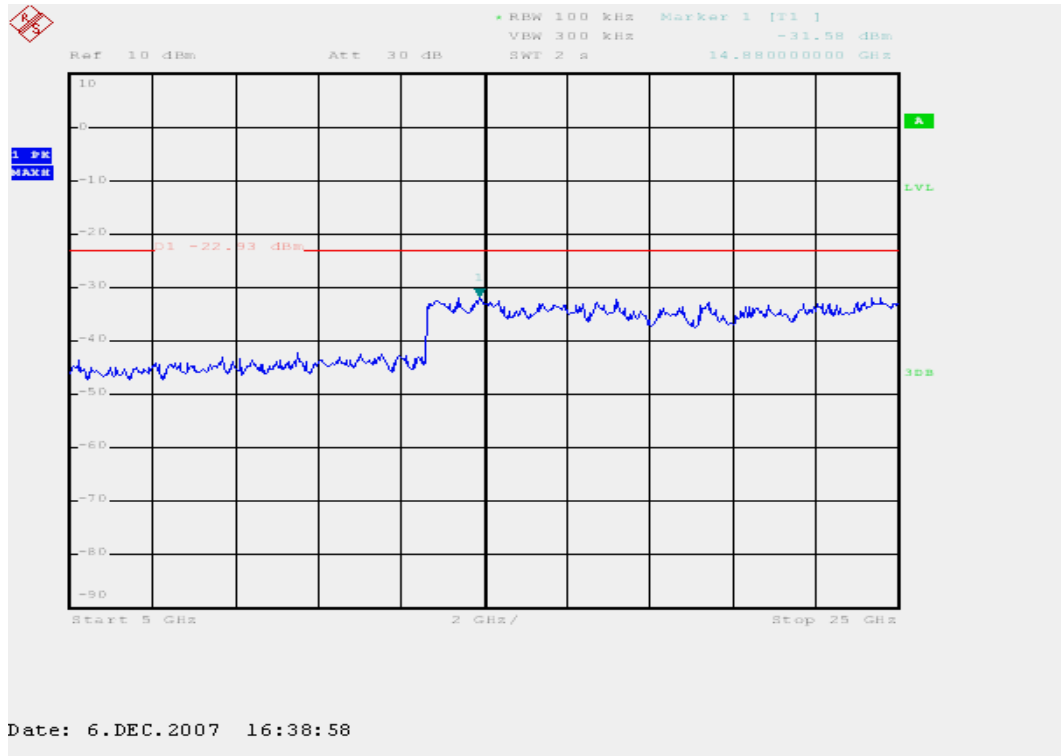




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5G to 25GHz

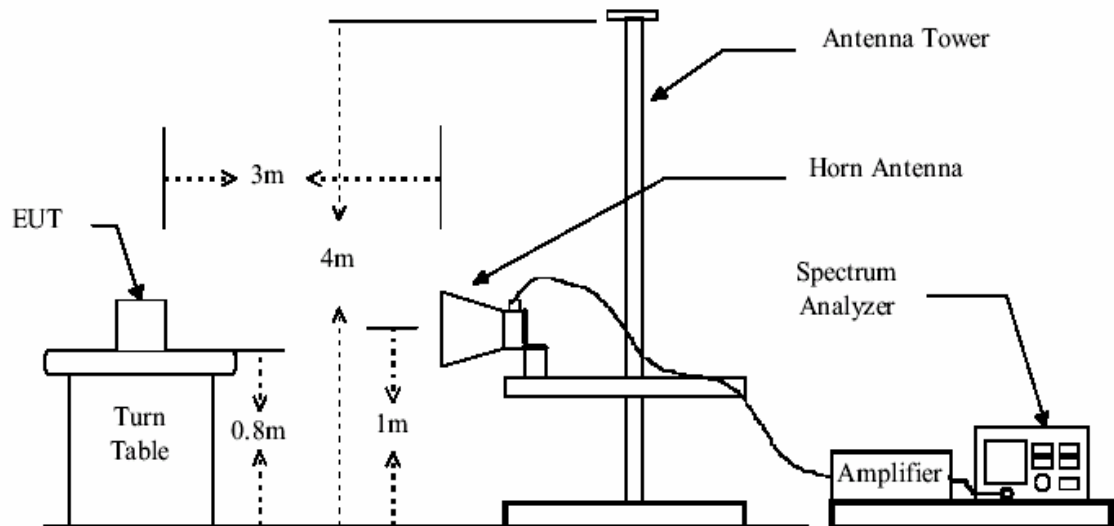
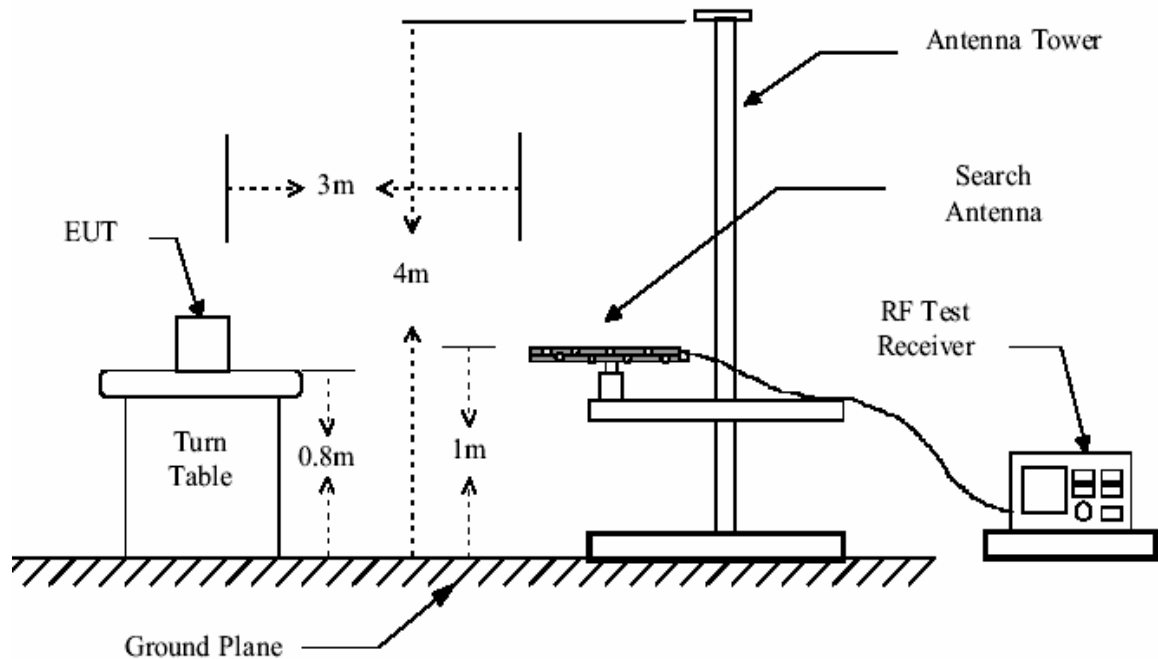




6.11 Radiated Spurious Emissions

Test Requirement:	FCC 15.247(d) & 15.209
Test Method:	ANSI C63.4 section 8 & 13
Test Date:	Dec 07, 2007
Test Status:	Test lowest channel, middle, highest channel.
Test site:	Measurement Distance: 3m (Semi-Anechoic Chamber) Test instrumentation resolution bandwidth 120 kHz and Quasi-Peak detector applies (30 MHz - 1000 MHz), 1MHz resolution bandwidth and Peak and Average-Peak detector apply (1000 MHz – 25GHz). Receive antenna scan height 1 m - 4 m, polarization Vertical / Horizontal
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
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, provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Configuration:



Test Procedure: The procedure used was ANSI Standard C63.4-2001. 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.

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.

The following test results were performed on the EUT.

6.11.1 Harmonics Emissions & Other Spurious Emissions

Test in low Channel in transmitting status- Vertical polarization

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)
129,910	13,49	1,30	25,10	30,83	20,52	43,50

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)
4804,000	33,20	6,60	33,00	41,0	48,2	74,0
7206,000	36,08	8,36	32,20	40,8	49,0	74,0
9608,000	36,40	8,80	32,50	40,0	52,7	74,0

Average Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Reading Level (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)
4804,000	33,20	6,60	33,00	28,2	35,0	54,0
7206,000	36,08	8,36	32,20	23,0	35,2	54,0
9608,000	36,40	8,80	32,50	21,3	34,0	54,0

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)
2402,000	28,60	4,60	34,76	90,79	56,0	89,24	54,4



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Test in low Channel in transmitting status- Horizontal polarization

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

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
448.070	16.40	1.58	25.46	45.3	37.8	46.0

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

Peak Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4804,000	33,20	6,60	33,00	41,5	48,7	74,0
7206,000	36,08	8,36	32,20	40,5	48,7	74,0
9608,000	36,40	8,80	32,50	40,3	53,0	74,0

Average Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4804,000	33,20	6,60	33,00	28,5	35,3	54,0
7206,000	36,08	8,36	32,20	22,0	34,2	54,0
9608,000	36,40	8,80	32,50	22,3	35,0	54,0

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
2402,000	28,60	4,60	34,76	88,80	85,5	87,24	83,9

Test in middle Channel in transmitting status- Vertical polarization

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

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
135,730	13,1	0,85	24,40	32,1	21,7	43,5



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

Peak Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4882,000	33,30	6,70	32,95	40,9	48,0	74,0
7323,000	36,16	6,95	32,29	37,7	48,5	74,0
9764,000	36,40	7,20	32,44	38,8	50,0	74,0

Average Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4882,000	33,30	6,70	32,95	20,9	28,0	54,0
7323,000	36,16	6,95	32,29	21,7	32,5	54,0
9764,000	36,40	7,20	32,44	22,8	34,0	54,0

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
2441,000	28,69	4,80	34,74	87,6	85,0	86,2	83,6

Test in middle Channel in transmitting status- Horizontal polarization

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

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
135,730	13,1	0,85	24,40	31,8	21,4	43,5

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

Peak Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4882,000	33,30	6,70	32,95	41,0	48,1	74,0
7323,000	36,16	6,95	32,29	38,0	48,8	74,0
9764,000	36,40	7,20	32,44	38,9	50,0	74,0



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Average Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading Level (dB μ V/m)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4882,000	33,30	6,70	32,95	26,0	33,1	54,0
7323,000	36,16	6,95	32,29	22,0	32,8	54,0
9764,000	36,40	7,20	32,44	21,9	33,0	54,0

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
2441,000	28,69	4,80	34,74	86,9	84,1	85,6	81,8

Test in high Channel in transmitting status- Vertical polarization

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

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
249,200	15,25	1,19	24,40	32,9	25,0	46,0

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

Peak Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4960,000	33,34	6,75	32,93	41,3	48,5	74,0
7440,000	36,23	6,05	32,37	40,0	49,9	74,0
9920,000	36,50	7,04	32,50	40,4	51,4	74,0

Average Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4960,000	33,34	6,75	32,93	21,3	28,5	54,0
7440,000	36,23	6,05	32,37	23,9	33,8	54,0
9920,000	36,50	7,04	32,50	22,4	33,4	54,0



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Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
2480,000	28,74	4,80	34,73	84,6	82,7	83,2	81,3

Test in high Channel in transmitting status- Horizontal polarization

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

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
249,190	15,25	1,19	24,40	38,5	30,5	46,0

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

Peak Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4960,000	33,34	6,75	32,93	40,8	48,0	74,0
7440,000	36,23	6,05	32,37	40,5	50,4	74,0
9920,000	36,50	7,04	32,50	41,0	51,0	74,0

Average Measurement

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Emission Reading (dB μ V)	Emission Level (dB μ V/m)	Limit (dB μ V/m)
4960,000	33,34	6,75	32,93	30,8	38,0	54,0
7440,000	36,23	6,05	32,37	30,5	30,4	54,0
9920,000	36,50	7,04	32,50	31,0	31,0	54,0

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
2480,000	28,74	4,80	34,73	85,0	84,3	83,8	83,1

Remark: No other radiation has been found.



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Receiver: 30MHz~25 GHz Harmonics & Spurious Emissions

Vertical polarization:

Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
1611,000	25,91	3,30	35,33	52,0	39,0	45,9	31,0
4915,000	33,31	6,71	32,95	41,0	30,9	48,1	32,0

Horizontal polarization:

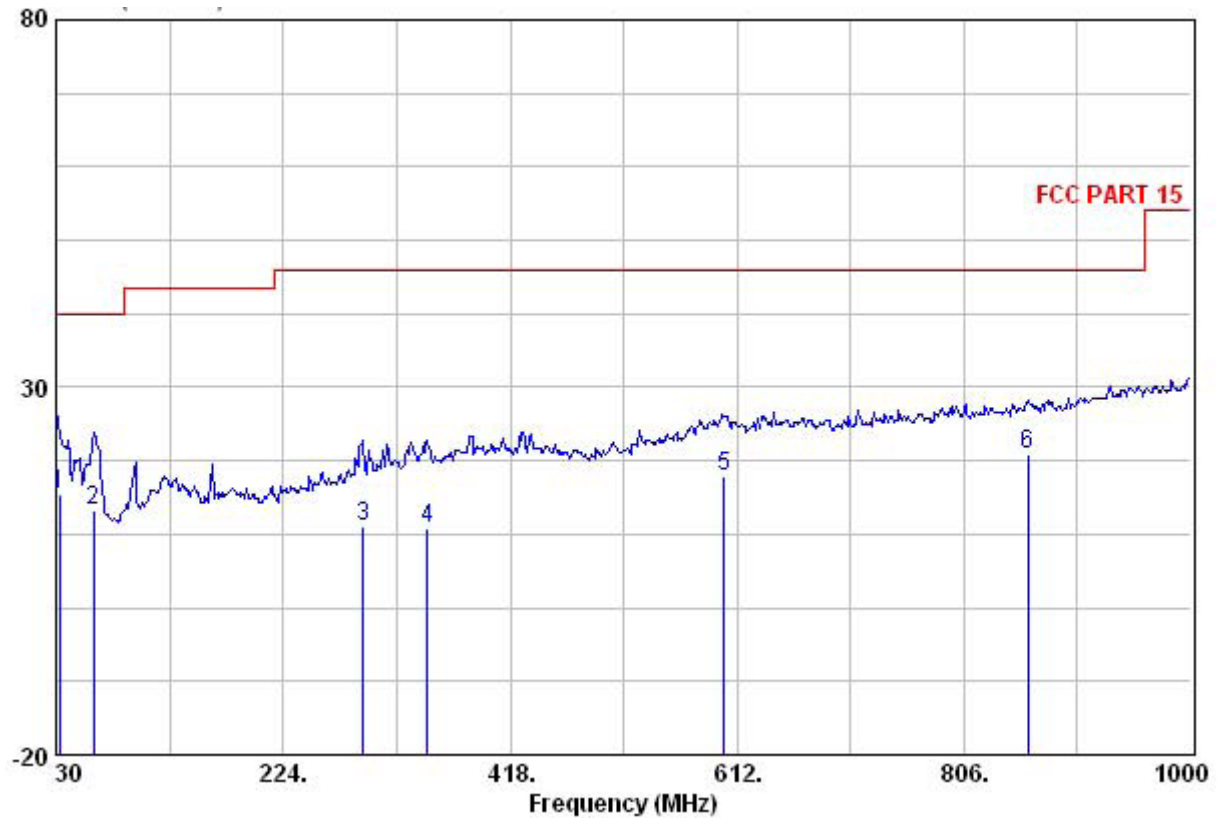
Frequency (MHz)	Antenna factors(dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
1611,000	25,91	3,30	35,33	52,6	38,1	46,5	32,0
4915,000	33,31	6,71	32,95	41,9	26,0	49,0	33,1

None of radiation has been found in receiving mode.

Test result: The unit does meet the FCC requirements.

Other Spurious Emission below 1GHz:

Antenna Polarization: Vertical:



Freq	ReadAntenna	Cable	Preamp	Limit	Over			
Level	Factor	Loss	Factor	Line	Limit	Remark		
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
32.910	18.88	21.24	0.66	25.38	15.40	40.00	-24.60	QP
62.010	26.08	11.23	0.94	25.10	13.15	40.00	-26.85	QP
291.900	19.10	14.18	2.10	24.40	10.98	46.00	-35.02	QP
347.190	17.50	15.70	2.30	24.70	10.80	46.00	-35.20	QP
600.360	20.85	19.80	3.10	25.80	17.95	46.00	-28.05	QP
861.290	21.46	20.92	3.80	25.23	20.95	46.00	-25.05	QP

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Remark:

- 1). N/A: For this intentional radiator operates below 25 GHz, the spectrum shall be investigated to the tenth harmonic of the highest fundamental frequency. And above the third harmonic of this intentional radiator, the disturbance is very low. So the test result only displays to 3rd harmonic.
- 2). As shown in Section 15.35(b), 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.

6.11.2 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 Date:	Dec 07, 2007
Measurement Distance:	3m (Semi-Anechoic Chamber)
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
Detector:	Peak for pre-scan: 100kHz resolution bandwidth and 100kHz video bandwidth within 1GHz, 1MHz resolution bandwidth and 1MHz video bandwidth above 1GHz

Test Result:

1. Low Channel

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
2390,000	27,88	4,65	34,30	50,8	32,0	49,0	30,3
2483,500	28,74	4,80	34,73	54,6	32,7	52,8	30,9

2. Middle Channel

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
2390,000	27,88	4,65	34,30	51,0	33,0	49,2	31,3
2483,500	28,74	4,80	34,73	54,0	32,7	52,2	30,9

3. High Channel

Frequency (MHz)	Antenna factors (dB/m)	Cable loss(dB)	Preamp factor(dB)	Peak Reading Level (dB μ V)	Average Reading Level (dB μ V)	Peak Emission Level (dB μ V/m)	Average Emission Level (dB μ V/m)
2390,000	27,88	4,65	34,30	51,8	32,5	50,0	30,8
2483,500	28,74	4,80	34,73	54,0	32,3	52,2	30,5

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

The unit does meet the FCC requirements.



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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	(²)
13.36 - 13.41	322 - 335.4		



6.12 Band Edges Requirement

Test Requirement: FCC Part 15 C

Test Method: Based on ANSI 63.4 & DA 00-705

Operation within the band 2400 – 2483,5 MHz

Test Date: October 11, 2007

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 300 kHz with suitable frequency span including 100 kHz bandwidth from band edge.

The band edges was measured and recorded.

The band edges was measured and recorded Result:

The Lower Edges: the value is -49,44dB that is attenuated more than 20dB.

The Upper Edges: the value is -51,02dB that is attenuated more than 20dB.

The graph as below, represents the emissions take for this device.

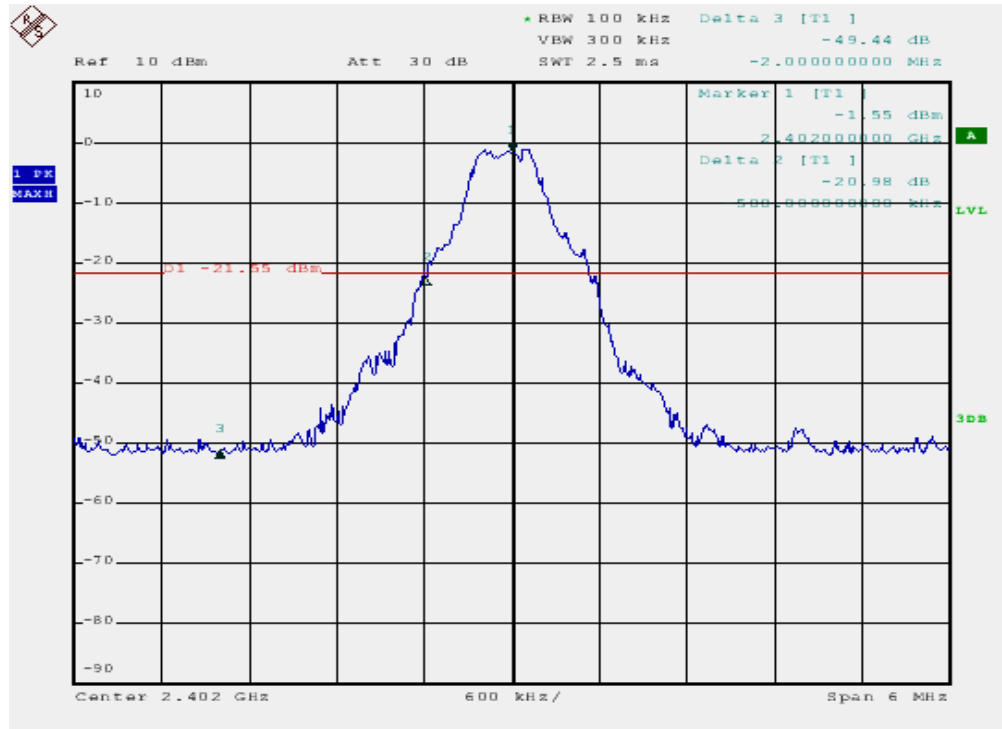


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Lowest Channel:



Highest Channel:

