



FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Wireless Helmet Communicator
Model: RAPTOR-i, RAPTOR-w

Brand: VERTIX

Test Report Number:

SZ110817B04-RP

Prepared for

XTREME DSP GLOBAL PTE LTD
21 BUKIT BATOK CRESCENT #05-84, WCEGA TOWER, SINGAPORE
658065

Prepared by

Compliance Certification Services (Shenzhen) Inc.
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Issued Date: February 24, 2012



TESTING CERT #2861.01

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Revision History

Rev.	Issue No.	Revisions	Effect Page	Revised By
00	SZ110817B04-RP	Initial Issue	ALL	Amay Tang



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1. TEST RESULT CERTIFICATION

Product:	Wireless Helmet Communicator
Model:	RAPTOR-i, RAPTOR-w
Brand:	VERTIX
Tested:	August 17 ~ February 23, 2012
Applicant:	XTREME DSP GLOBAL PTE LTD 21 BUKIT BATOK CRESCENT #05-84, WCEGA TOWER, SINGAPORE 658065
Manufacturer:	DELLKING INDUSTRIAL CO., LTD 904, Deqingchuang Building, Bulong Road, Buji Town, Longgang District, Shenzhen, China

APPLICABLE STANDARDS	
STANDARD	TEST RESULT
FCC 47 CFR Part 15 Subpart C	No non-compliance noted

We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4: 2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.207, 15.209 and 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Tom Gan
Supervisor of EMC Dept.
Compliance Certification Service Inc.

Reviewed by:

Aven Zhou
Supervisor of Report Dept.
Compliance Certification Service Inc.



2. EUT DESCRIPTION

Product	Wireless Helmet Communicator
Model Number	RAPTOR-i, RAPTOR-w
Trade Name	VERTIX
Model Discrepancy	Software upgrade to enable walkie connectivity with No additional components.
Identify Number	SZ110817B04-RP
Power Supply	DC5V supplied by PC or DC3.7V supplied by the lithium-ion battery
Received Date	August 17, 2011
Frequency Range	2402 ~ 2480 MHz
Transmit Power	GFSK :10.33dBm 8DPSK :11.73dBm
Modulation Technique	FHSS (GFSK for 1Mbps, $\pi/4$ -DQPSK for 2Mbps, 8DPSK for 3Mbps)
Number of Channels	79 Channels
Antenna Specification	Antenna with 2.0dBi gain (Max)
Temperature Range	0°C ~ +40°C

Note: This submittal(s) (test report) is intended for FCC ID: XUR-VTX-RTR-IW filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.



3. TEST METHODOLOGY

3.1 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

The following test mode(s) were scanned during the preliminary test below 1G:

Test Item	Test mode	Worse mode
Conducted Emission	Mode 1: Normal Link	<input checked="" type="checkbox"/>
Radiated Emission	Mode 1: Normal Link	<input checked="" type="checkbox"/>

Above 1G, Channel Low (2402MHz) 、 Mid (2441MHz) and High (2480MHz) were chosen for full testing for GFSK.



4. FACILITIES AND ACCREDITATIONS

4.1 FACILITIES

All measurement facilities used to collect the measurement data are located at

No10-1, Mingkeda Logistics Park, No.18 Huanguan South RD. Guan Lan Town, Baoan District, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.4:2003, ANSI C63.7 and CISPR Publication 22. All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

4.2 ACCREDITATIONS

Our laboratories are accredited and approved by the following accreditation body according to ISO/IEC 17025.

USA	A2LA
Taiwan	TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

USA	FCC
Japan	VCCI
Canada	INDUSTRY CANADA
Taiwan	BSMI
Norway	Nemko

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.ccsrf.com>

4.3 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Uncertainty
Conducted emissions	9kHz~30MHz	+/- 3.18dB
Radiated emissions	30MHz ~ 200MHz	+/- 3.79dB
	200MHz ~1000MHz	+/- 3.62dB
	Above 1000MHz	+/- 5.04dB
	Band Edges	+/-0.182 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

The measured result is above (below) the specification limit by a margin less than the measurement uncertainty; it is therefore not possible to state compliance based on the 95% level of confidence. However, the result indicates that compliance (non-compliance) is more probable than non-compliance) with the specification limit.



5. SETUP OF EQUIPMENT UNDER TEST

5.1 SETUP CONFIGURATION OF EUT

See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

5.2 SUPPORT EQUIPMENT

No.	Equipment	Model No.	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
1	Notebook	Studio 1435	5315448686549	N/A	DELL	N/A	Unshielded 1.80

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.



6. FCC PART 15.247 REQUIREMENTS

6.1 20DB BANDWIDTH

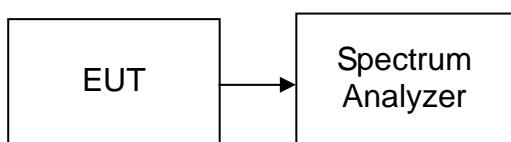
None; for reporting purpose only.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/19/2011	03/19/2012

Remark: Each piece of equipment is scheduled for calibration once a year.

TEST CONFIGURATION



TEST PROCEDURE

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT, then connect a low loss RF cable from antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=30kHz, VBW=30kHz, Span=3MHz, Sweep = auto.
4. Mark the peak frequency and 20dB (upper and lower) frequency.
5. Repeat until all the test channels are investigated.

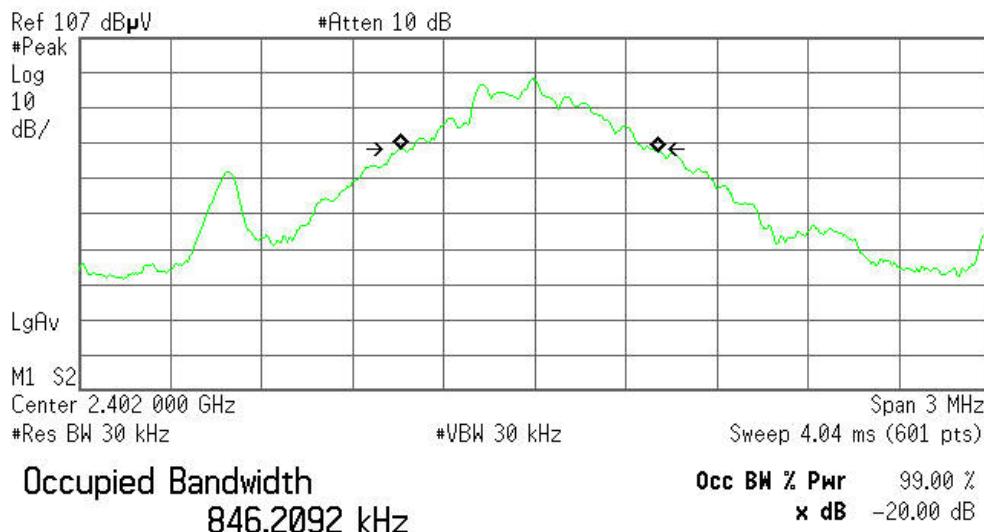
TEST RESULTS

No non-compliance noted

**Test plot (GFSK)****20dB Bandwidth (CH Low)**

Agilent 00:26:12 Aug 21, 2011

R T

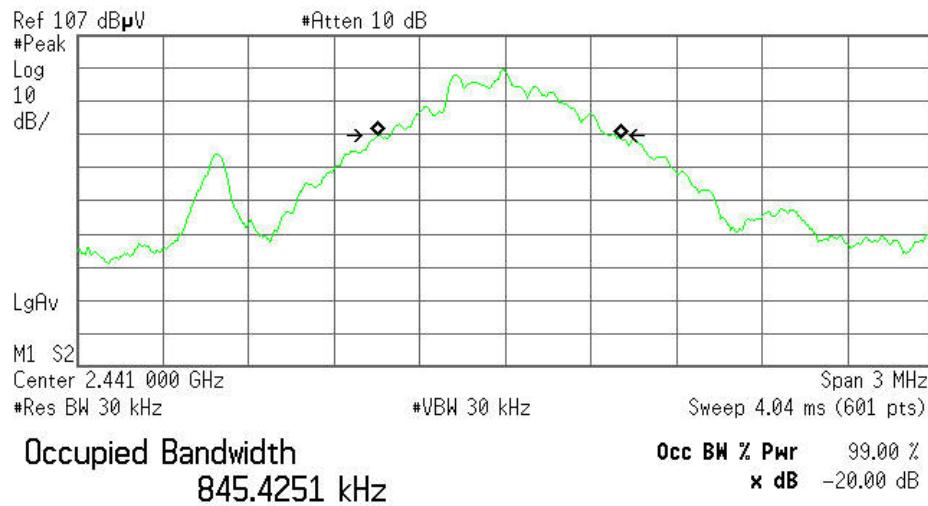


Transmit Freq Error -17.093 kHz
x dB Bandwidth 841.773 kHz

20dB Bandwidth (CH Mid)

Agilent 00:27:22 Aug 21, 2011

R T

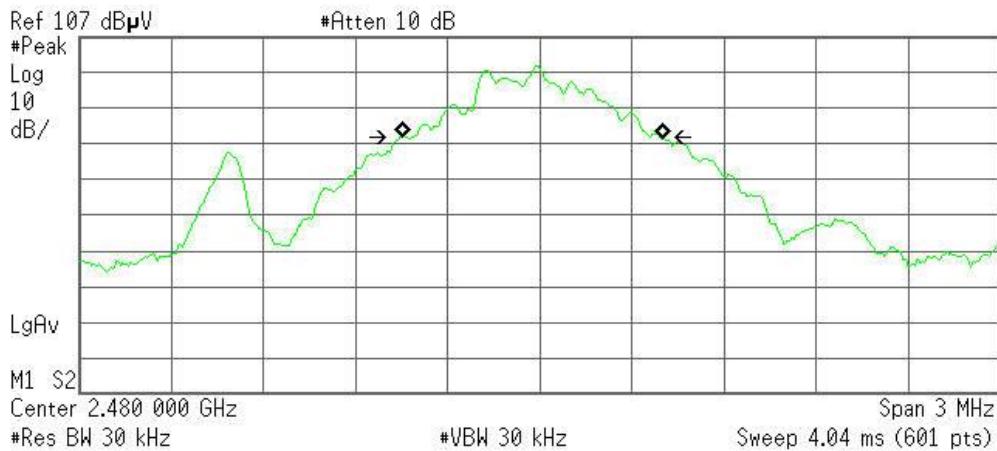


Transmit Freq Error -19.965 kHz
x dB Bandwidth 834.799 kHz

**20dB Bandwidth (CH High)**

Agilent 00:28:31 Aug 21, 2011

R T

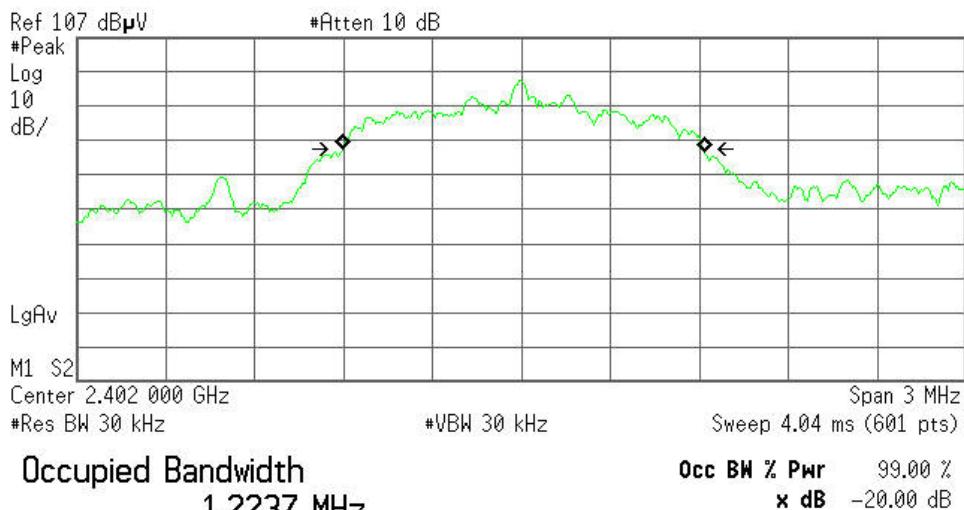


Transmit Freq Error -22.629 kHz
x dB Bandwidth 841.063 kHz

Test plot (8DPSK)**20dB Bandwidth (CH Low)**

Agilent 00:31:45 Aug 21, 2011

R T

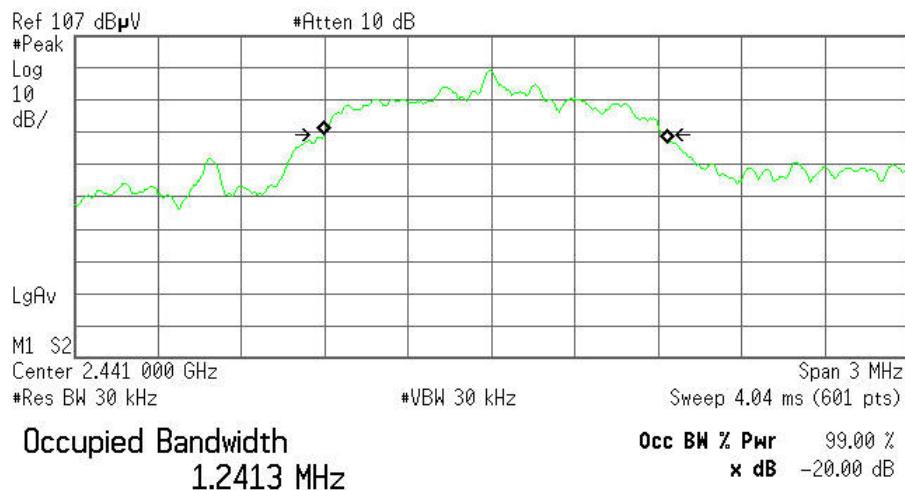


Transmit Freq Error 7.788 kHz
x dB Bandwidth 1.220 MHz

**20dB Bandwidth (CH Mid)**

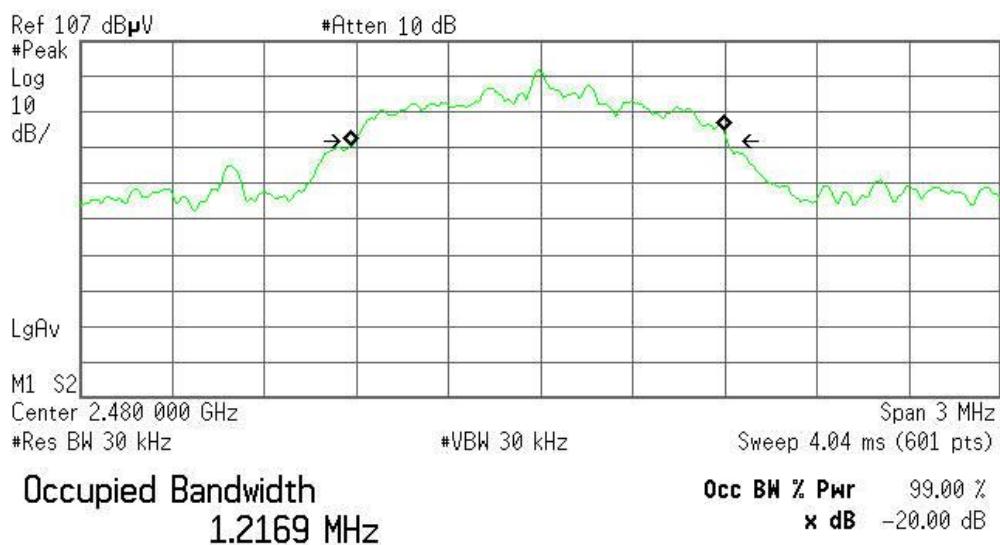
Agilent 00:31:05 Aug 21, 2011

R T

**20dB Bandwidth (CH High)**

Agilent 00:30:01 Aug 21, 2011

R T





6.2 PEAK POWER

LIMIT

The maximum peak output power of the intentional radiator shall not exceed the following:

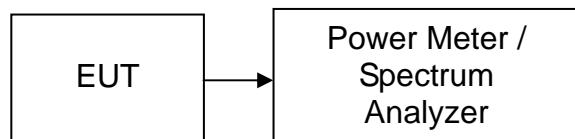
1. For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6dBi.
3. 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.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Power Meter	Anritsu	ML2487A	6K00001491	03/19/2011	03/19/2012
Spectrum Analyzer	Agilent	E4446A	US44300399	03/19/2011	03/19/2012

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

The transmitter output is connected to the RF Power Meter. The RF Power Meter is set to the peak power detection.



TEST RESULTS

No non-compliance noted

Test Datac

GFSK

Channel	Frequency (MHz)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (mW)	Result
Low	2402	6.83000	3.50	10.33	0.01079	125	Pass
Mid	2441	8.38000	3.50	11.88	0.01542		Pass
High	2480	6.99000	3.50	10.49	0.01119		Pass

8DPSK

Channel	Frequency (MHz)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (mW)	Result
Low	2402	7.69000	3.50	11.19	0.01315	125	Pass
Mid	2441	8.23000	3.50	11.73	0.01489		Pass
High	2480	6.42000	3.50	9.92	0.00982		Pass



6.3 PEAK POWER SPECTRAL DENSITY

LIMIT

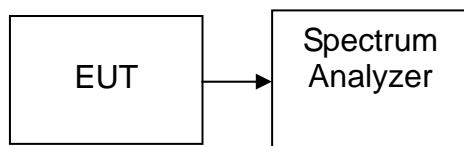
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping operation turned off, shall comply with the power density requirements of paragraph (d) of this section.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/19/2011	03/19/2012

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3kHz, VBW = 10kHz, Span = 300kHz, Sweep=100s
4. Record the max. reading.
5. Repeat the above procedure until the measurements for all frequencies are completed.

TEST RESULTS

Not applicable. Since EUT is the Bluetooth device.

6.4 BAND EDGES MEASUREMENT

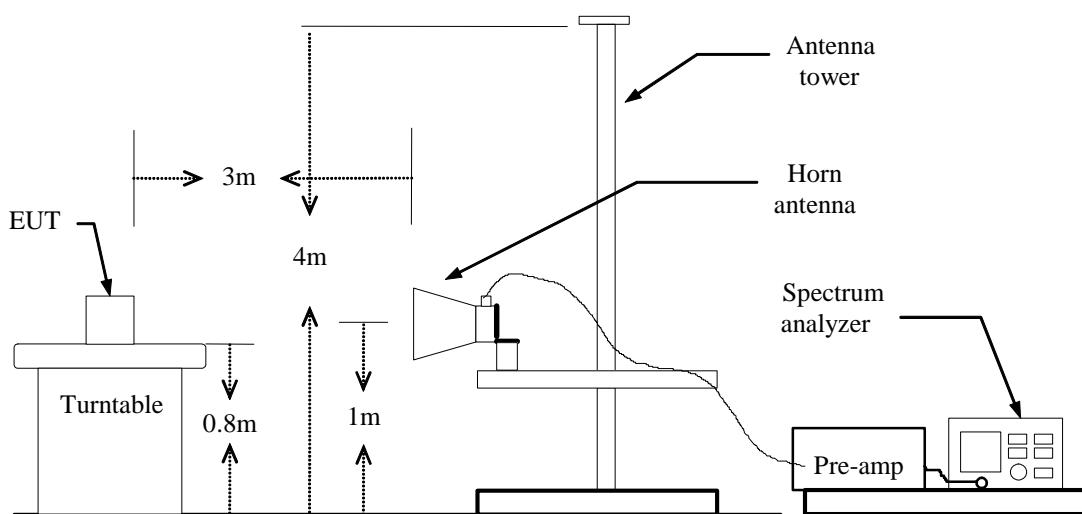
LIMIT

According to §15.247(c), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

MEASUREMENT EQUIPMENT USED

Radiated Emission Test Site 966 (2)					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	03/19/2011	03/19/2012
Amplifier	MITEQ	AM-1604-3000	1411843	03/18/2011	03/18/2012
Turn Table	EMCO	2081-1.21	N/A	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
High Noise Amplifier	Agilent	8449B	3008A01838	03/18/2011	03/18/2012
Bilog Antenna	SCHAFFNER	CBL6143	5082	06/03/2011	06/03/2012
Horn Antenna	SCHWARZBECK	BBHA9120D	D286	03/19/2011	03/19/2012
Loop Antenna	A. R. A	PLA-1030/B	1029	03/19/2011	03/19/2012
Temp. / Humidity Meter	VICTOR	VC230	N/A	03/31/2011	03/31/2012
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

Test Configuration





TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:
 - (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO
 - (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
5. Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

TEST RESULTS

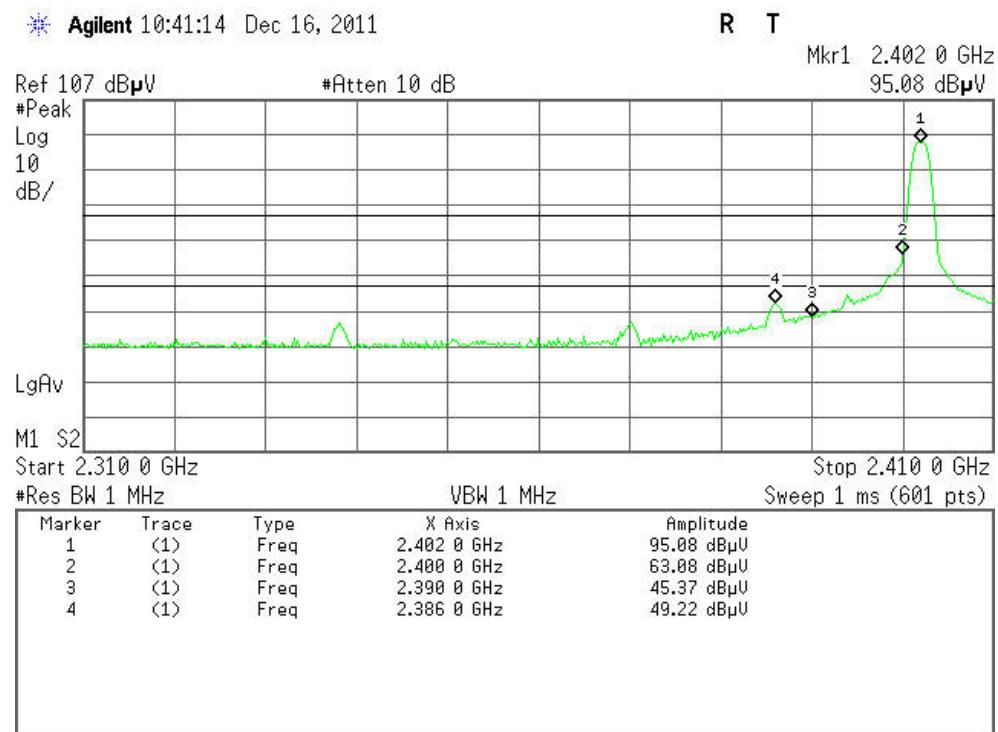
Refer to attach spectrum analyzer data chart.

Test Data (GFSK)

Band Edges (CH-Low)

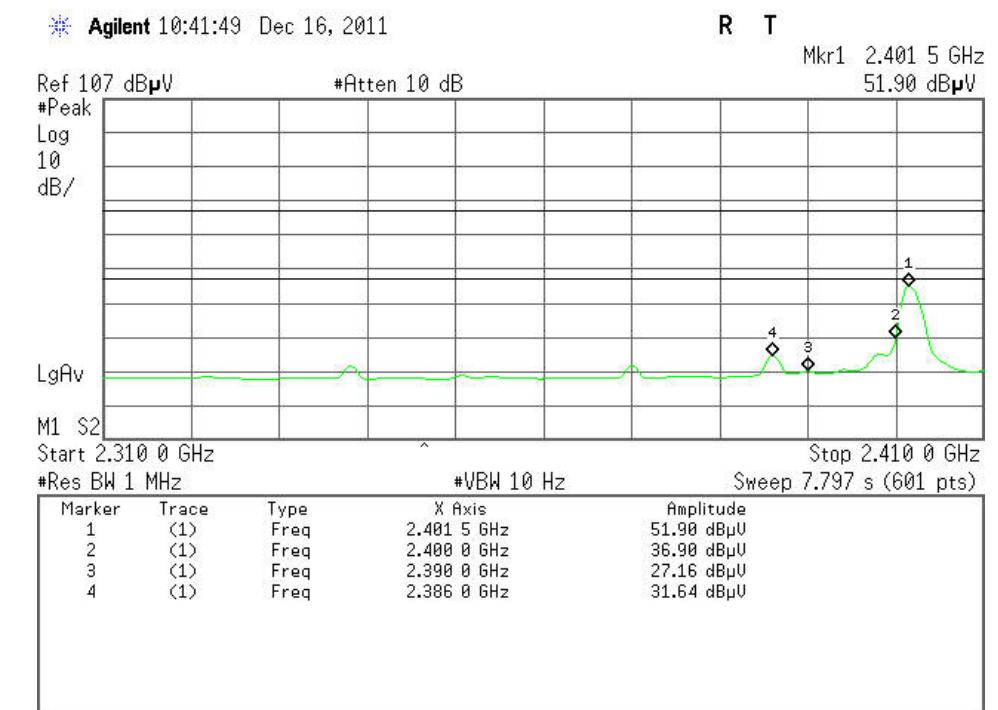
Detector mode: Peak

Polarity: Vertical



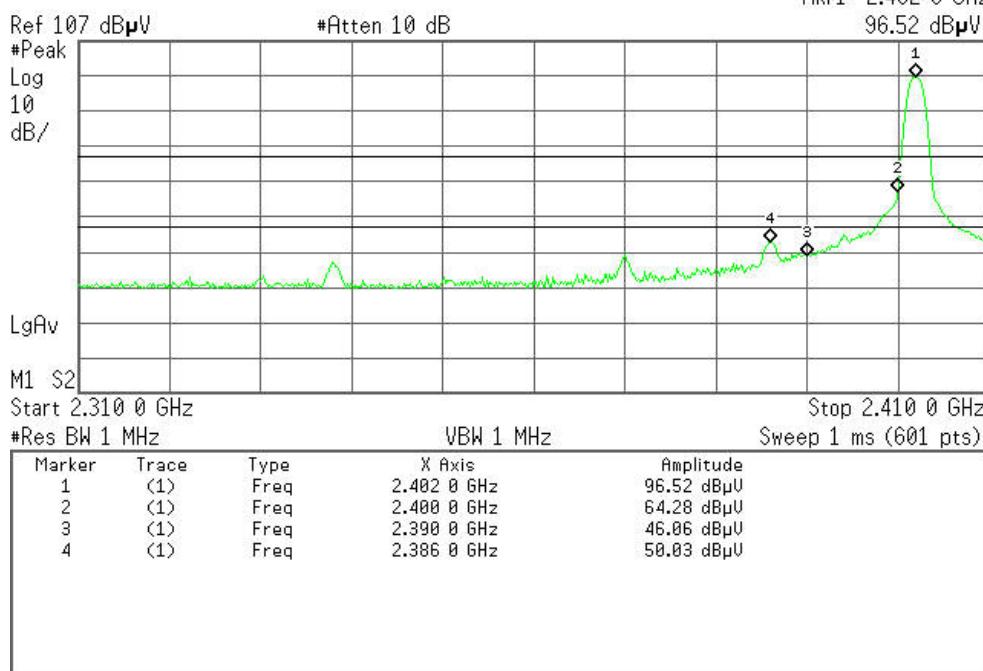
Detector mode: Average

Polarity: Vertical

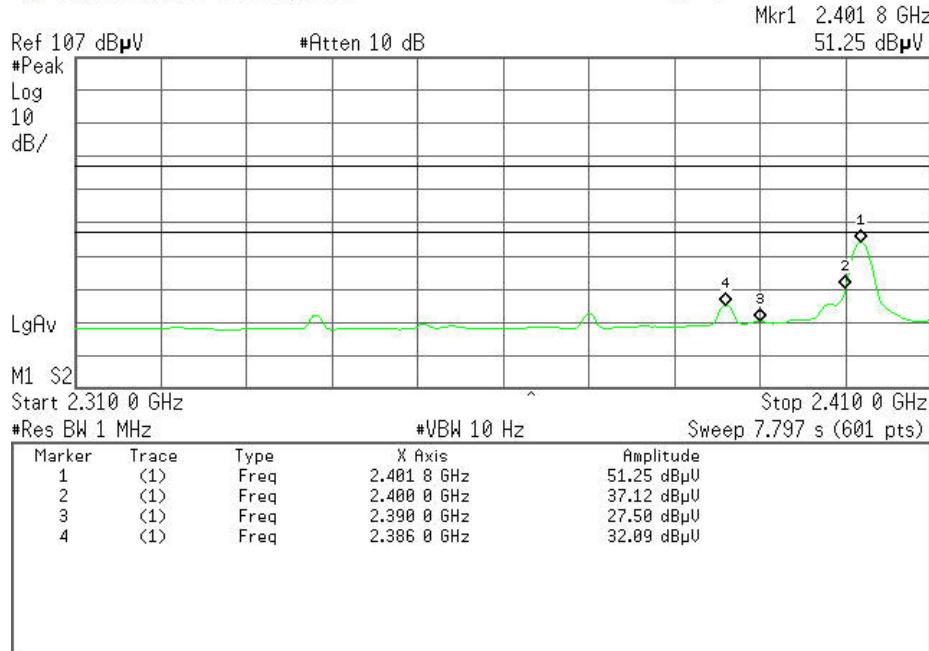


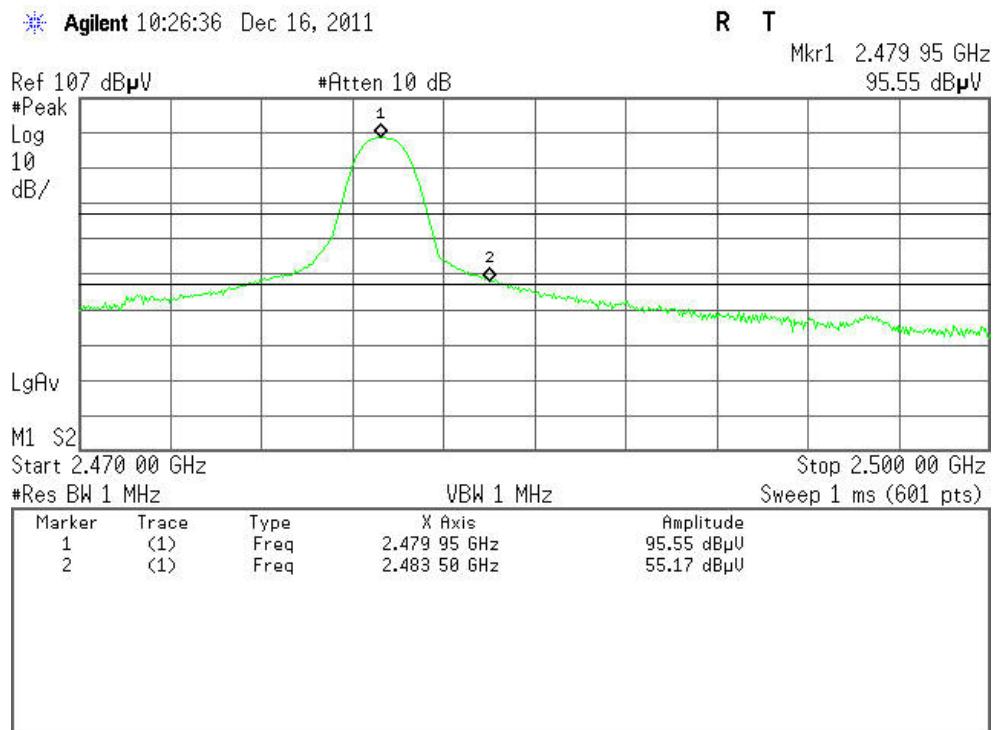
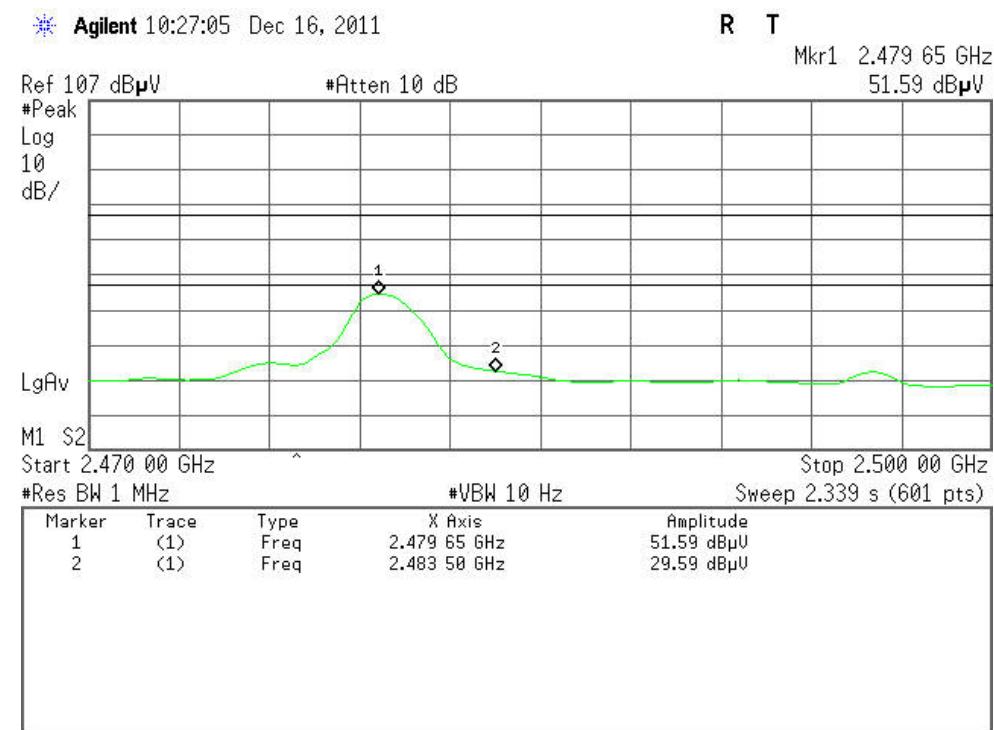
**Detector mode: Peak****Polarity: Horizontal**

* Agilent 10:43:22 Dec 16, 2011

**Detector mode: Average****Polarity: Horizontal**

* Agilent 10:43:51 Dec 16, 2011



**Band Edges (CH-High)****Detector mode: Peak****Polarity: Vertical****Detector mode: Average****Polarity: Vertical**

**Detector mode: Peak****Polarity: Horizontal**

Agilent 10:23:03 Dec 16, 2011

R T

Mkr1 2.480 05 GHz
96.25 dB μ VRef 107 dB μ V

#Atten 10 dB

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.470 00 GHz

VBW 1 MHz

Stop 2.500 00 GHz

#Res BW 1 MHz

Sweep 1 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.480 05 GHz	96.25 dB μ V
2	(1)	Freq	2.483 50 GHz	56.49 dB μ V

Detector mode: Average**Polarity: Horizontal**

Agilent 10:23:30 Dec 16, 2011

R T

Mkr1 2.479 60 GHz
52.25 dB μ VRef 107 dB μ V

#Atten 10 dB

#Peak

Log

10

dB/

LgAv

M1 S2

Start 2.470 00 GHz

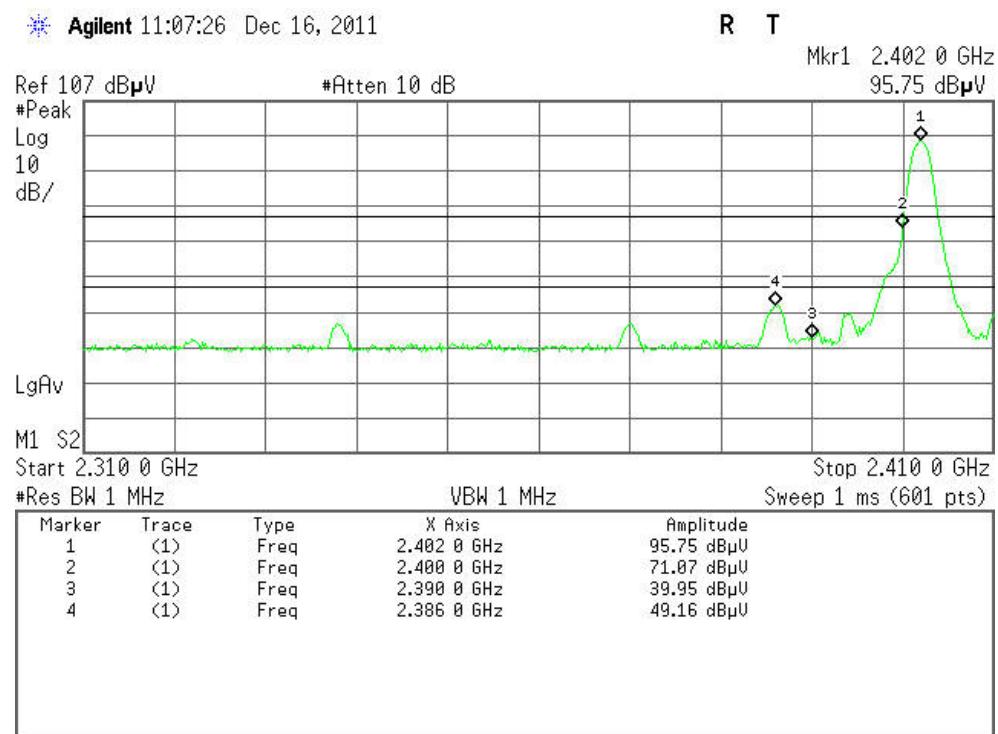
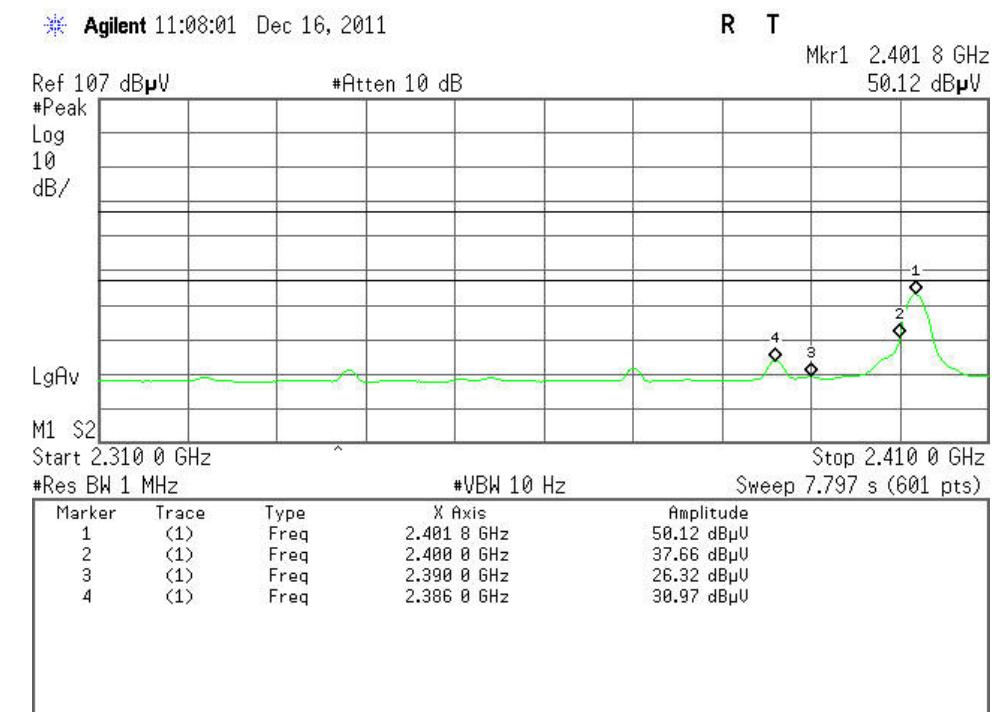
Stop 2.500 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

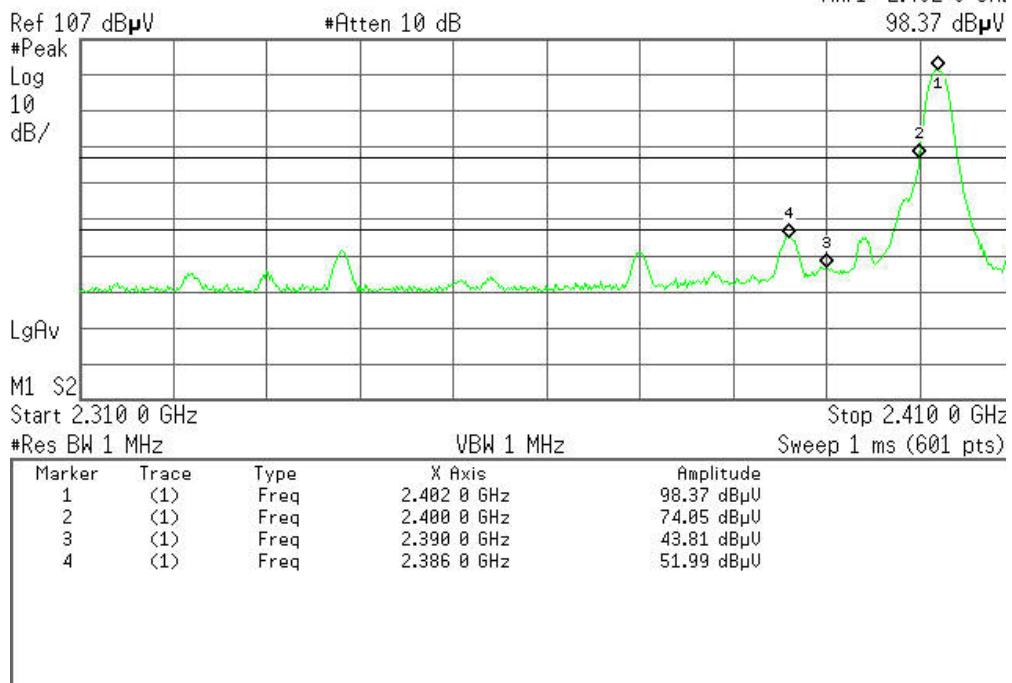
Sweep 2.339 s (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 60 GHz	52.25 dB μ V
2	(1)	Freq	2.483 50 GHz	29.87 dB μ V

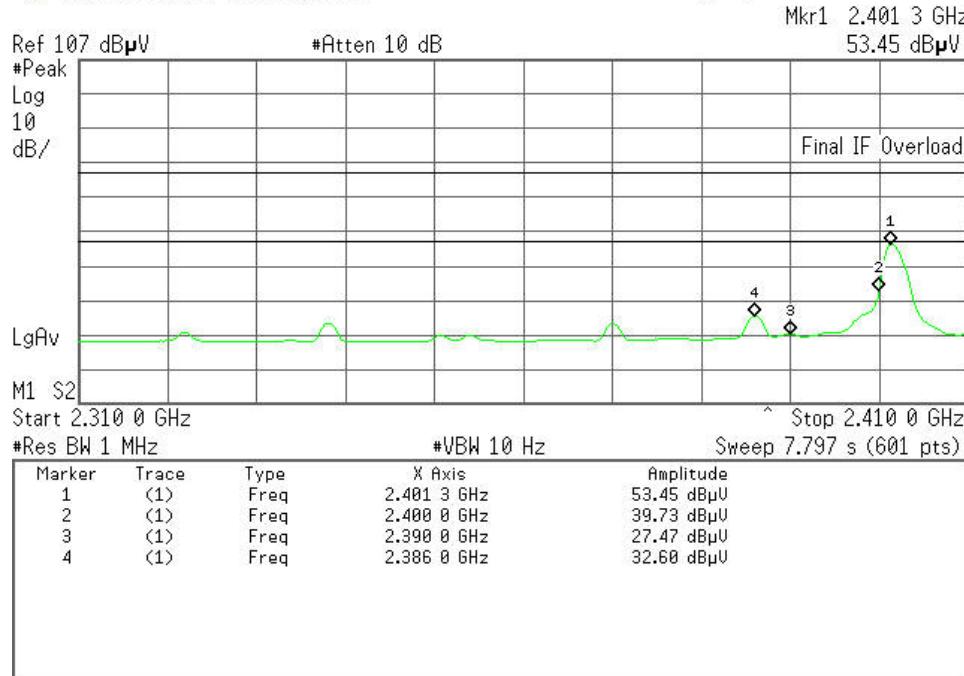
**Test Data (8DPSK)****Band Edges (CH-Low)****Detector mode: Peak****Polarity: Vertical****Detector mode: Average****Polarity: Vertical**

**Detector mode: Peak****Polarity: Horizontal**

* Agilent 11:03:00 Dec 16, 2011

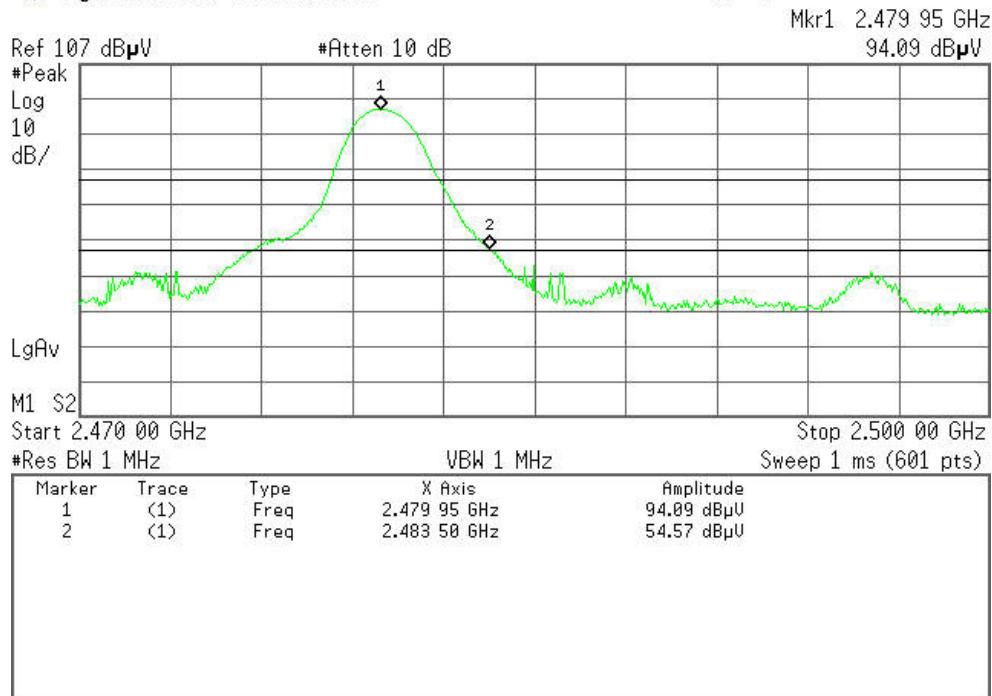
**Detector mode: Average****Polarity: Horizontal**

* Agilent 11:03:58 Dec 16, 2011

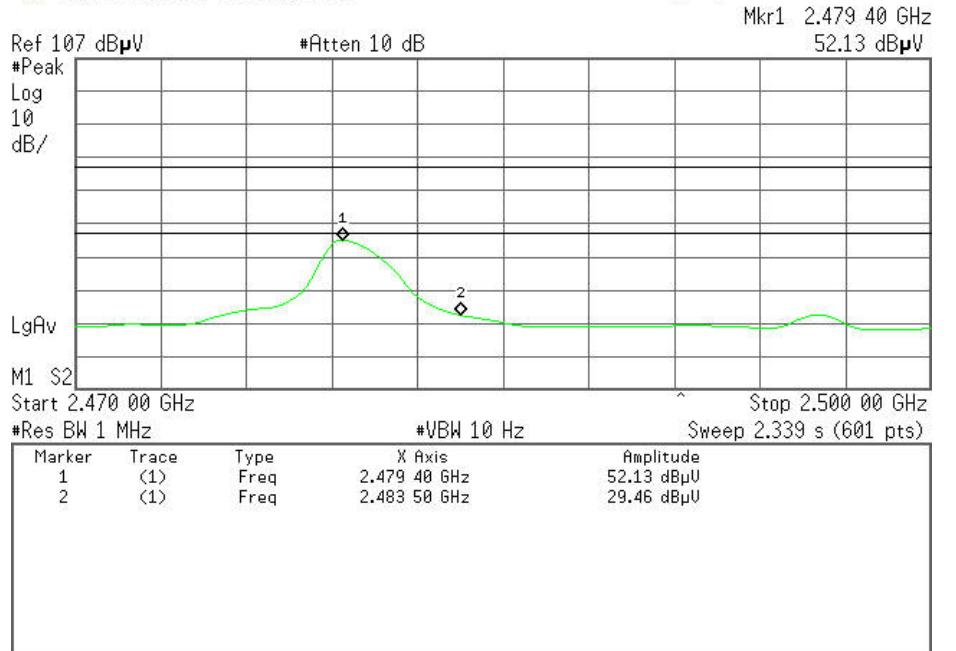


**Band Edges (CH-High)****Detector mode: Peak****Polarity: Vertical**

* Agilent 10:15:17 Dec 16, 2011

**Detector mode: Average****Polarity: Vertical**

* Agilent 10:15:55 Dec 16, 2011



**Detector mode: Peak****Polarity: Horizontal**

Agilent 10:18:57 Dec 16, 2011

R T

Mkr1 2.479 90 GHz
97.02 dB μ VRef 107 dB μ V

#Atten 10 dB

#Peak
Log
10
dB/

LgAv

M1 S2

Start 2.470 00 GHz

VBW 1 MHz

Stop 2.500 00 GHz

#Res BW 1 MHz

Sweep 1 ms (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 90 GHz	97.02 dB μ V
2	(1)	Freq	2.483 50 GHz	57.39 dB μ V

Detector mode: Average**Polarity: Horizontal**

Agilent 10:19:39 Dec 16, 2011

R T

Mkr1 2.479 75 GHz
51.64 dB μ VRef 107 dB μ V

#Atten 10 dB

#Peak
Log
10
dB/

LgAv

M1 S2

Start 2.470 00 GHz

#VBW 10 Hz

Stop 2.500 00 GHz

#Res BW 1 MHz

Sweep 2.339 s (601 pts)

Marker	Trace	Type	X Axis	Amplitude
1	(1)	Freq	2.479 75 GHz	51.64 dB μ V
2	(1)	Freq	2.483 50 GHz	30.40 dB μ V



6.5 FREQUENCY SEPARATION

LIMIT

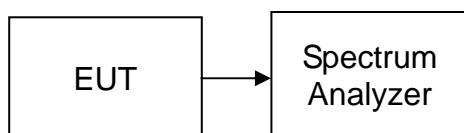
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel 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.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/19/2011	03/19/2012
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/22/2011	07/22/2012

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel.
4. Set the spectrum analyzer as RBW=30kHz, VBW=30kHz, Adjust Span to 4 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

TEST RESULTS

No non-compliance noted

Test Data

GFSK

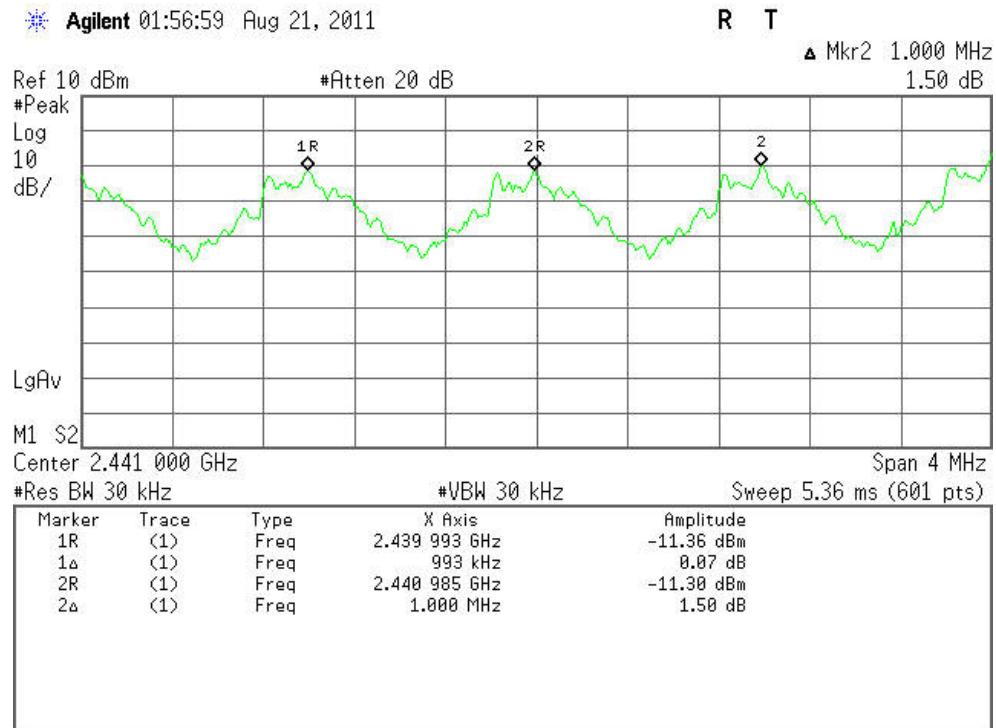
Channel Separation (MHz)	Two-thirds of the 20 dB Bandwidth (kHz)	Channel Separation Limit	Result
1.000	561.182	> Two-thirds of the 20 dB Bandwidth	Pass

8DPSK

Channel Separation (MHz)	Two-thirds of the 20 dB Bandwidth (kHz)	Channel Separation Limit	Result
1.000	811.333	> Two-thirds of the 20 dB Bandwidth	Pass

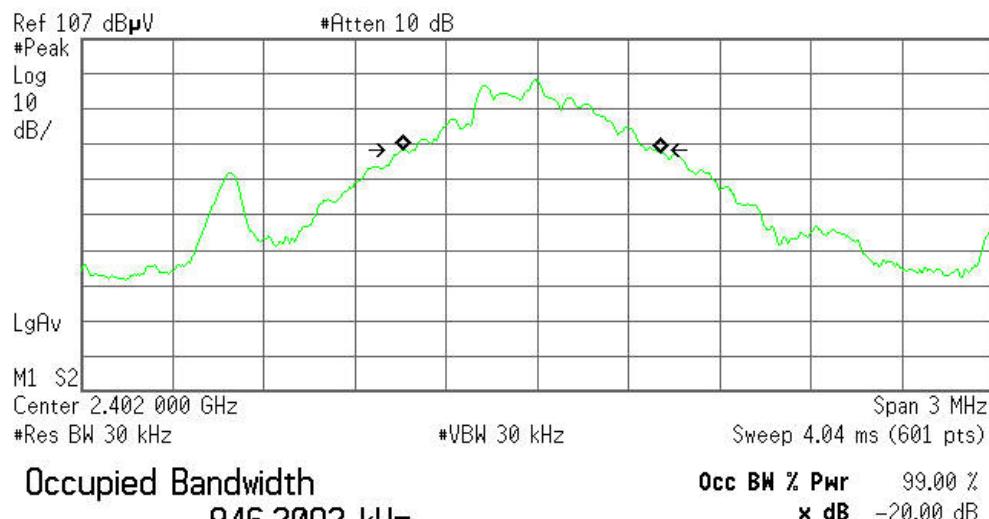
GFSKTest PlotMeasurement of Channel Separation

Agilent 01:56:59 Aug 21, 2011

20 dB bandwidth(CH Low)

Agilent 00:26:12 Aug 21, 2011

R T



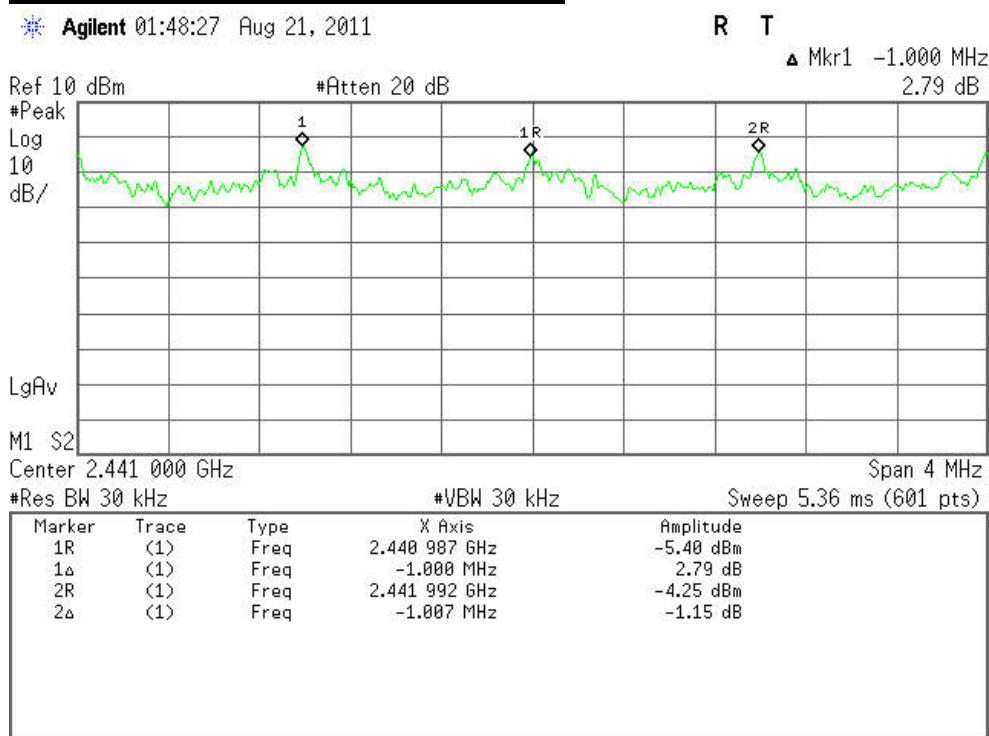
Transmit Freq Error -17.093 kHz
x dB Bandwidth 841.773 kHz



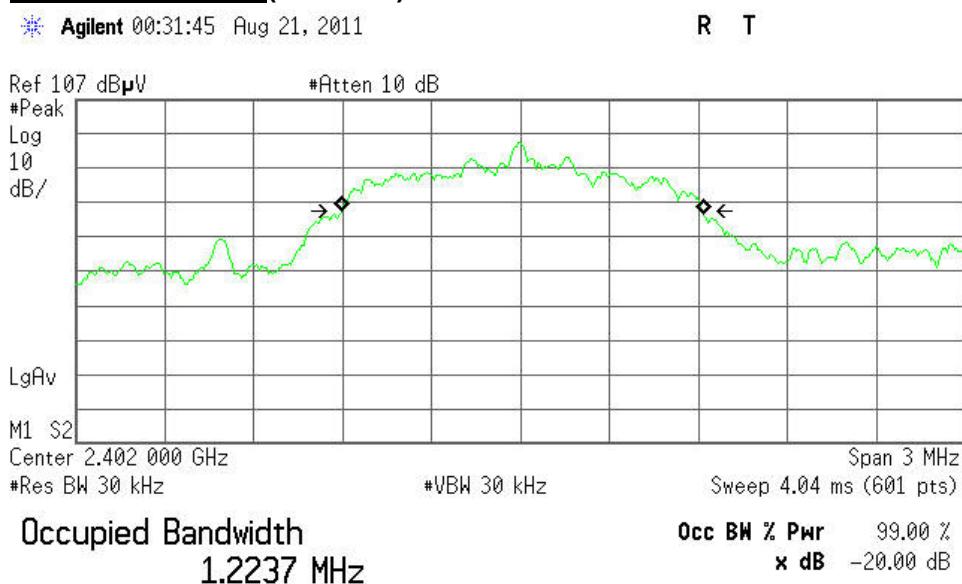
8DPSK

Test Plot

Measurement of Channel Separation



20 dB bandwidth(CH Low)



Transmit Freq Error 7.788 kHz
x dB Bandwidth 1.220 MHz



6.6 NUMBER OF HOPPING FREQUENCY

LIMIT

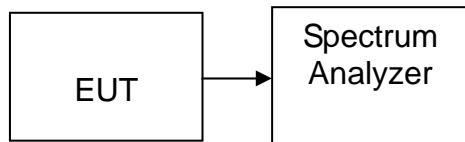
According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/19/2011	03/19/2012

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2441.5MHz, Sweep = 1ms and Start=2441.5MHz, Stop = 2483.5MHz, Sweep = 1ms.
4. Set the spectrum analyzer as RBW, VBW=300kHz,
5. Max hold, view and count how many channel in the band.

TEST RESULTS

No non-compliance noted

Test Data

GFSK

Result (No. of CH)	Limit (No. of CH)	Result
79	>15	PASS

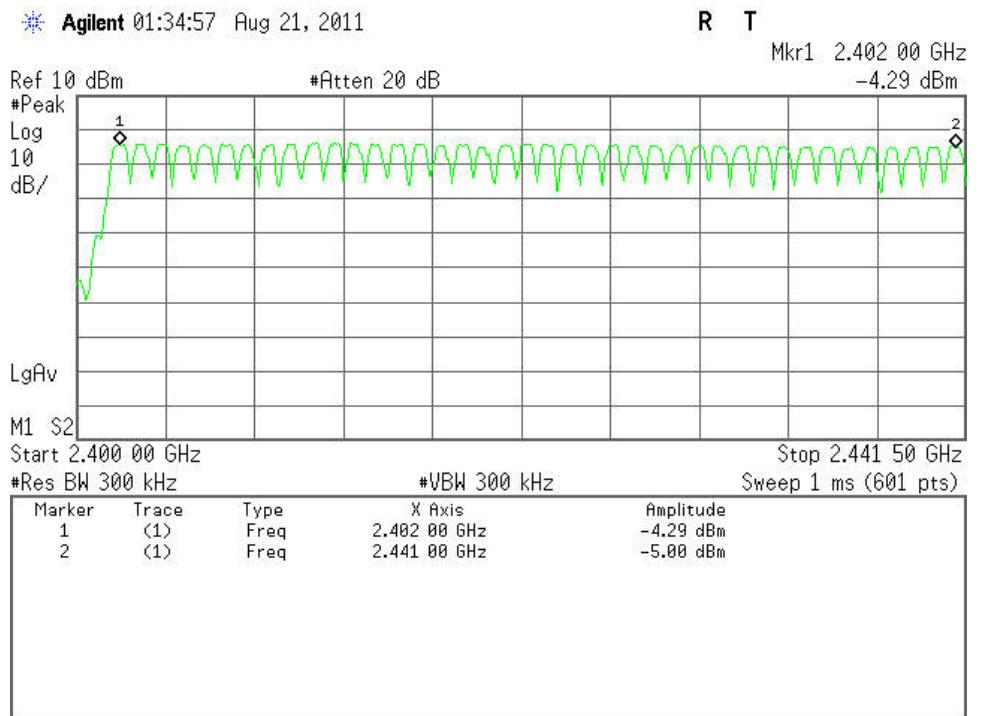


Test Plot (GFSK)

Channel Number

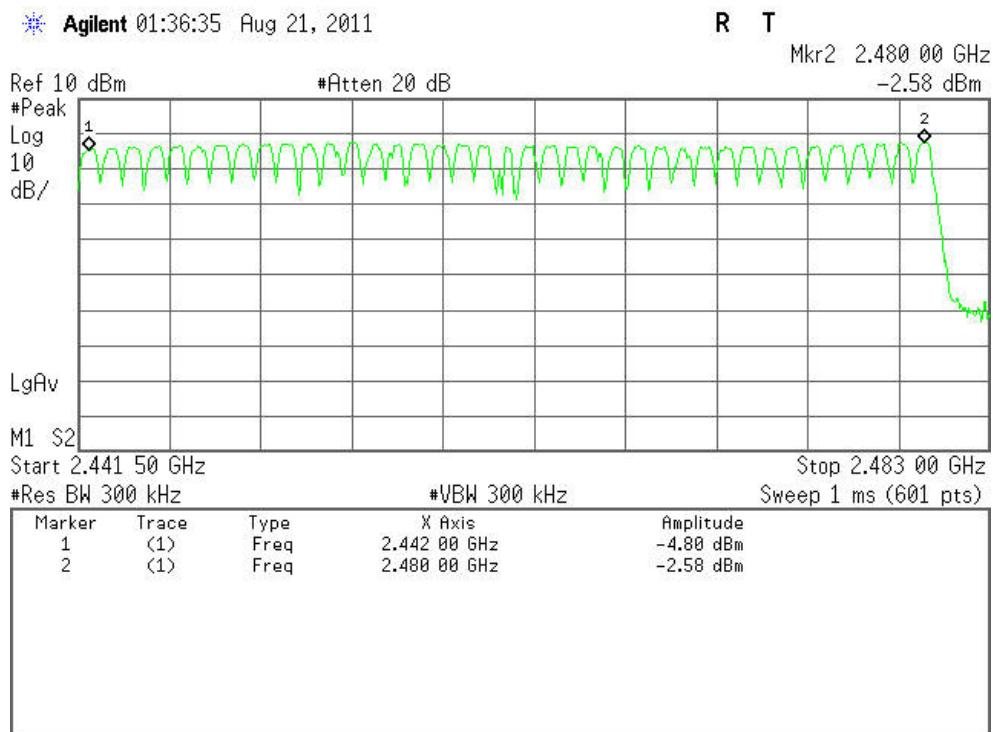
2.400 GHz – 2.441 GHz

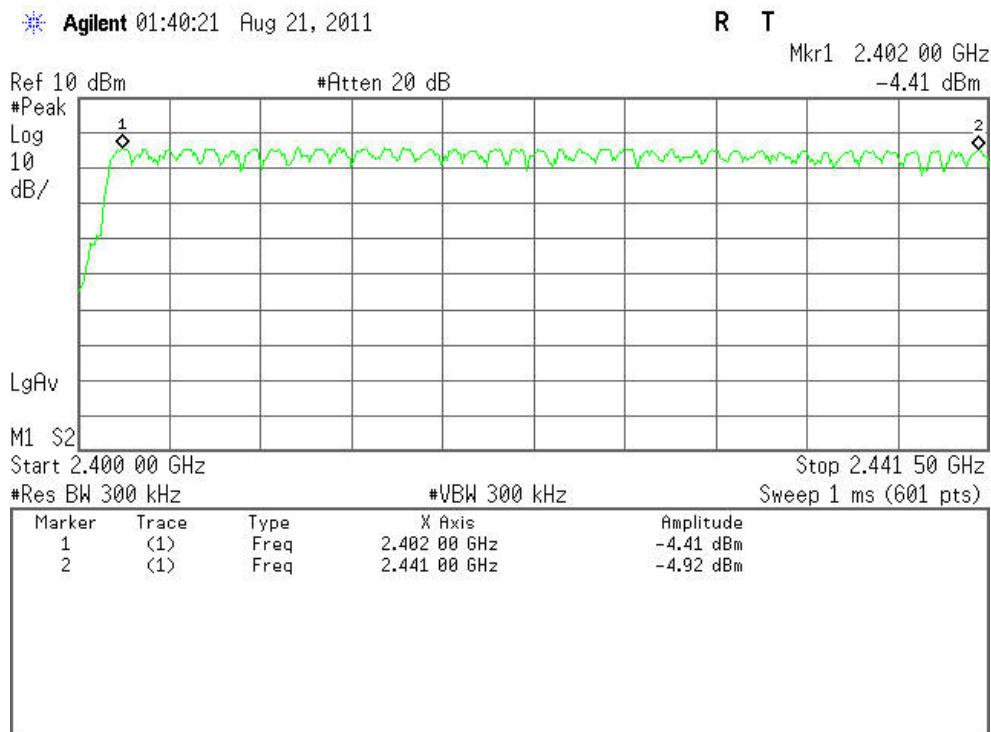
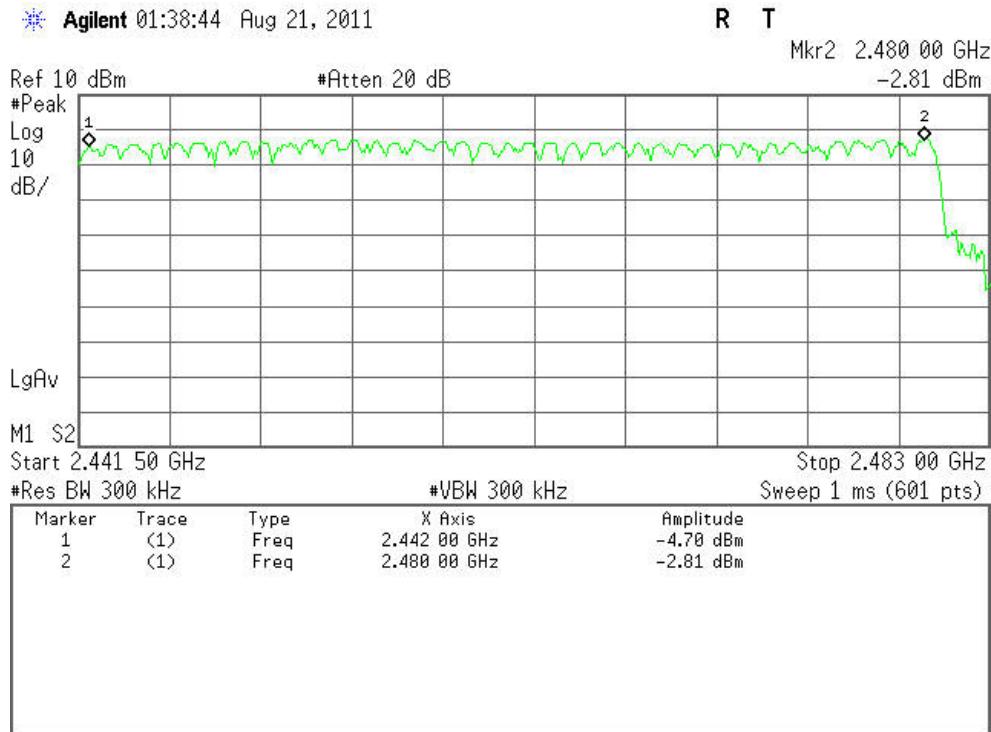
Agilent 01:34:57 Aug 21, 2011



2.441 GHz – 2.483 GHz

Agilent 01:36:35 Aug 21, 2011



Test Plot (8DPSK)Channel Number**2.400 GHz – 2.441 GHz****2.441 GHz –2.483 GHz**



6.7 TIME OF OCCUPANCY (DWELL TIME)

LIMIT

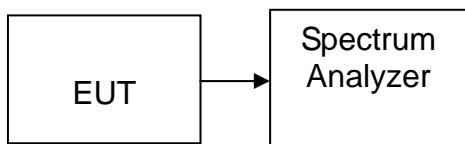
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/19/2011	03/19/2012

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=1MHz, Span = 0Hz, Sweep = auto.
5. Repeat above procedures until all frequency measured were complete.



TEST RESULTS

No non-compliance noted

Test Data

GFSK

DH 1

CH Mid: $0.495 * (1600/2)/79 * 31.6 = 158.400$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	0.495	158.400	31.60	400.00	PASS

DH 3

CH Mid: $1.755 * (1600/4)/79 * 31.6 = 280.800$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	1.755	280.800	31.60	400.00	PASS

DH 5

CH Mid: $3.000 * (1600/6)/79 * 31.6 = 320.000$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	3.000	320.000	31.60	400.00	PASS

**Test Data****8DPSK****DH 1**CH Mid: $0.511 * (1600/2)/79 * 31.6 = 163.520$ (ms)

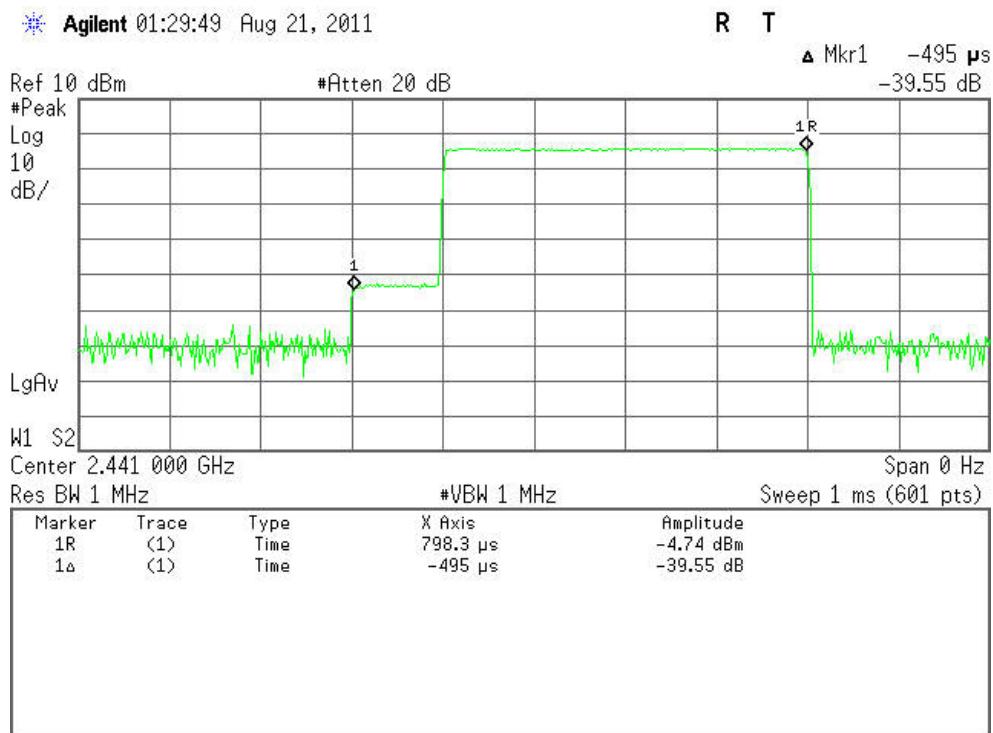
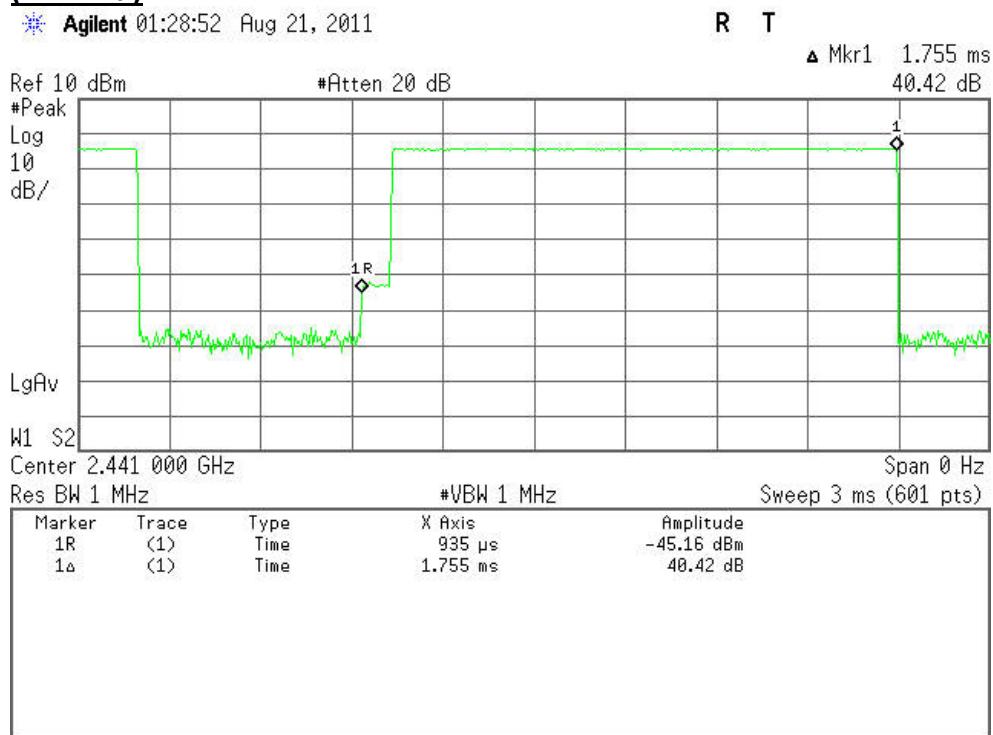
CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	0.511	163.520	31.60	400.00	PASS

DH 3CH Mid: $1.755 * (1600/4)/79 * 31.6 = 280.800$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	1.755	280.800	31.60	400.00	PASS

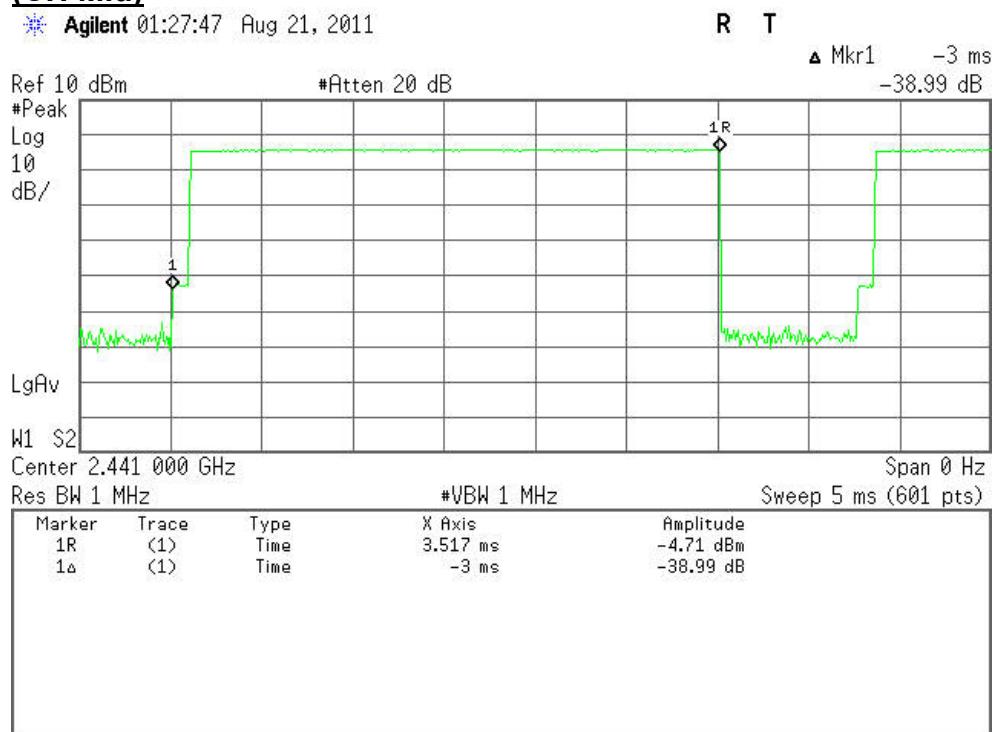
DH 5CH Mid: $3.008 * (1600/6)/79 * 31.6 = 320.853$ (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Mid	3.008	320.853	31.60	400.00	PASS

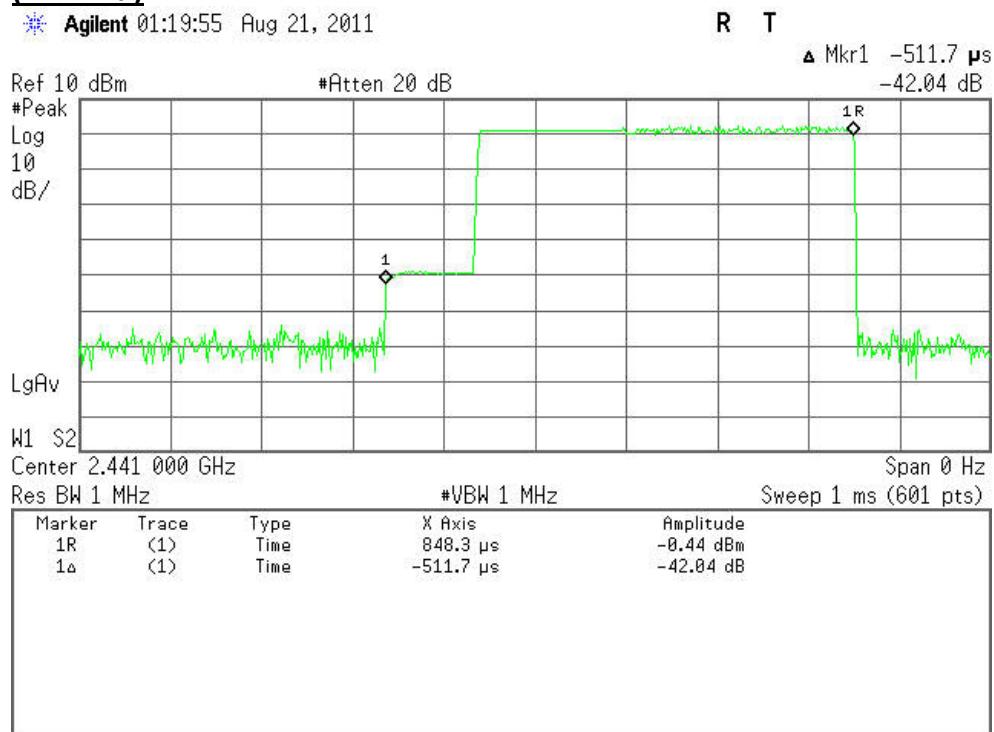
**Test Plot****GFSK****DH 1****(CH Mid)****DH 3****(CH Mid)**

**DH 5****(CH Mid)**

Agilent 01:27:47 Aug 21, 2011

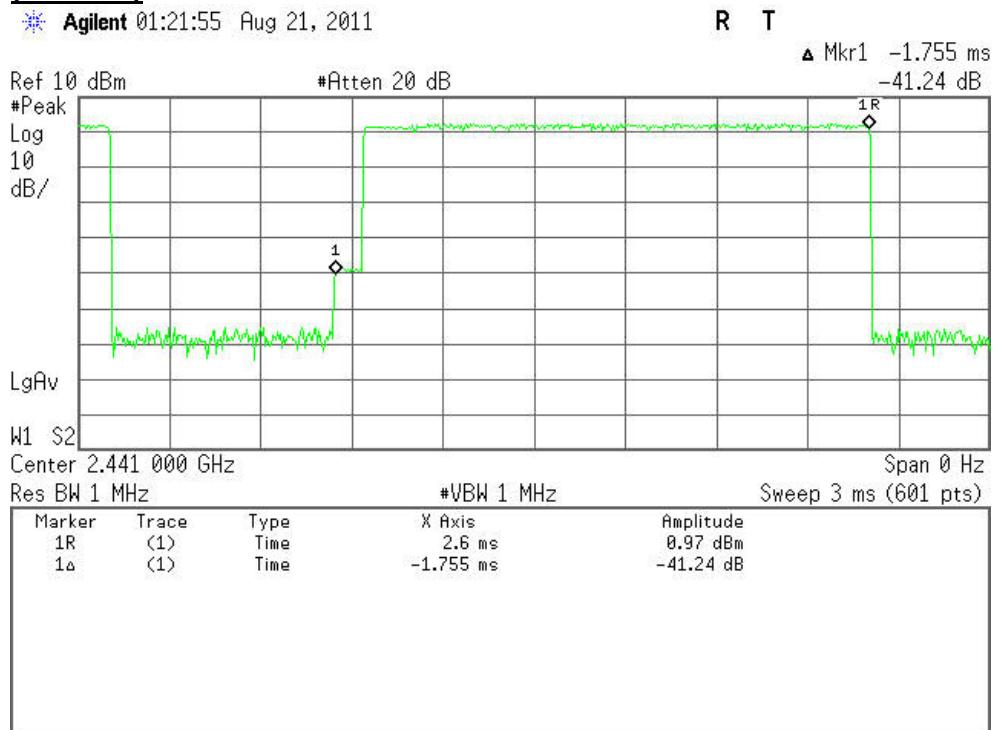
**Test Plot****8DPSK****DH 1****(CH Mid)**

Agilent 01:19:55 Aug 21, 2011

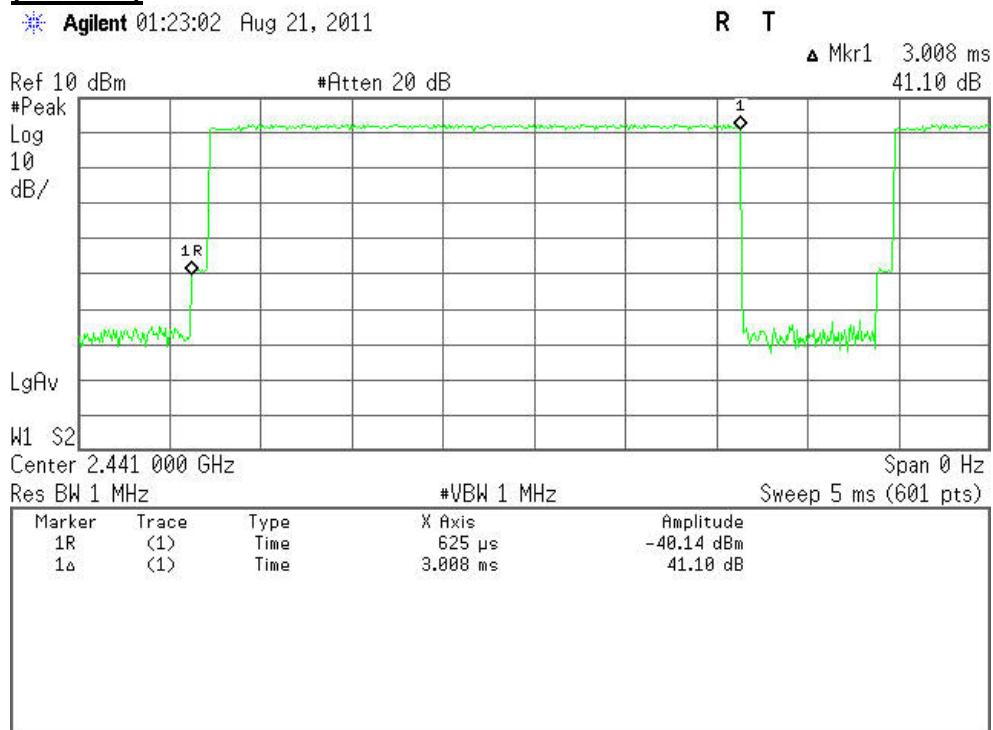


**DH 3****(CH Mid)**

Agilent 01:21:55 Aug 21, 2011

**DH 5****(CH Mid)**

Agilent 01:23:02 Aug 21, 2011





6.8 SPURIOUS EMISSIONS

6.8.1. Conducted Measurement

LIMIT

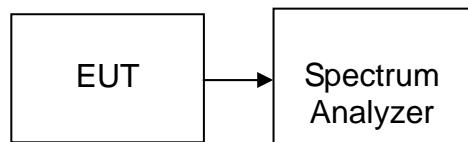
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. 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)).

MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Last Calibration	Due Calibration
Spectrum Analyzer	Agilent	E4446A	US44300399	03/19/2011	03/19/2012

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



TEST PROCEDURE

Conducted RF measurements of the transmitter output were made to confirm that the EUT antenna port conducted emissions meet the specified limit and to identify any spurious signals that require further investigation or measurements on the radiated emissions site.

The transmitter output is connected to the spectrum analyzer. The resolution bandwidth is set to 100 KHz. The video bandwidth is set to 100 KHz.

Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

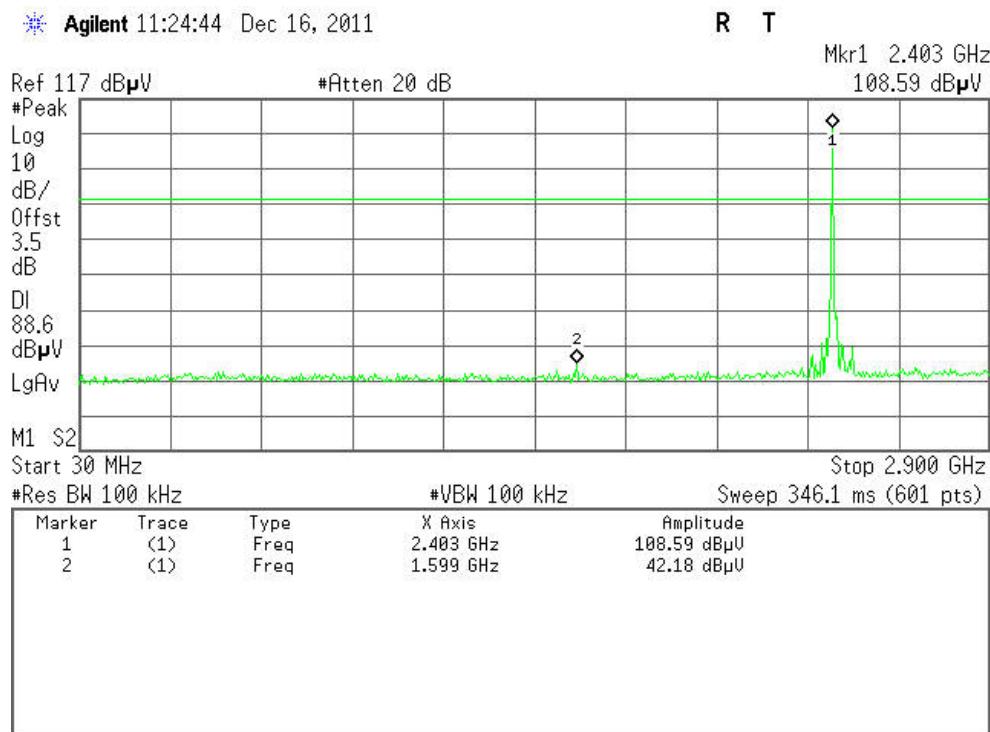
No non-compliance noted



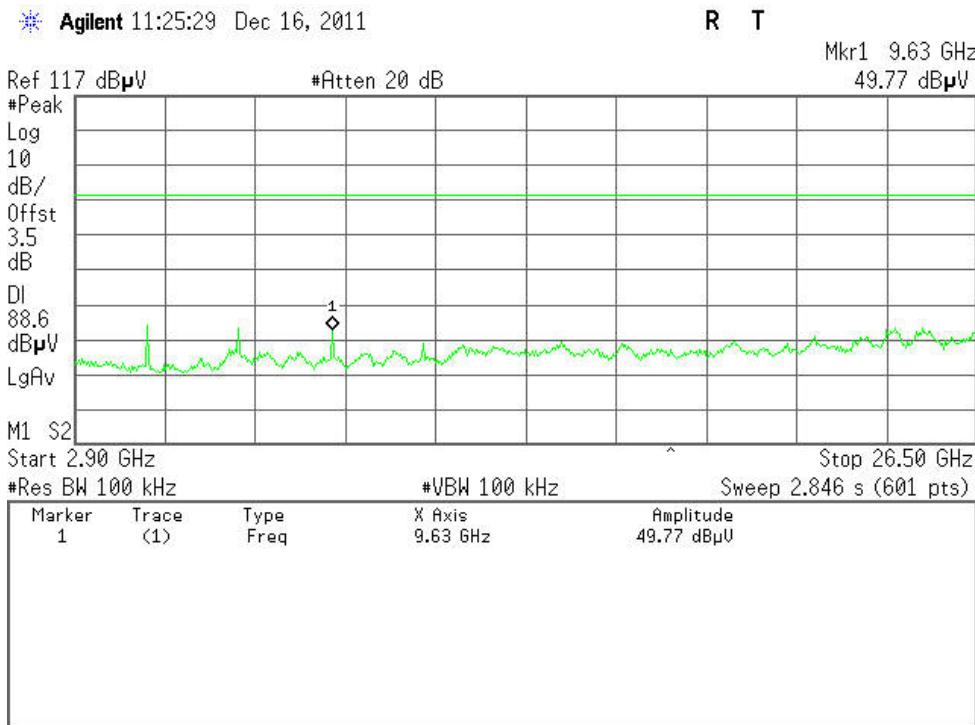
Test Plot (GFSK)

CH Low

30MHz ~2.9GHz



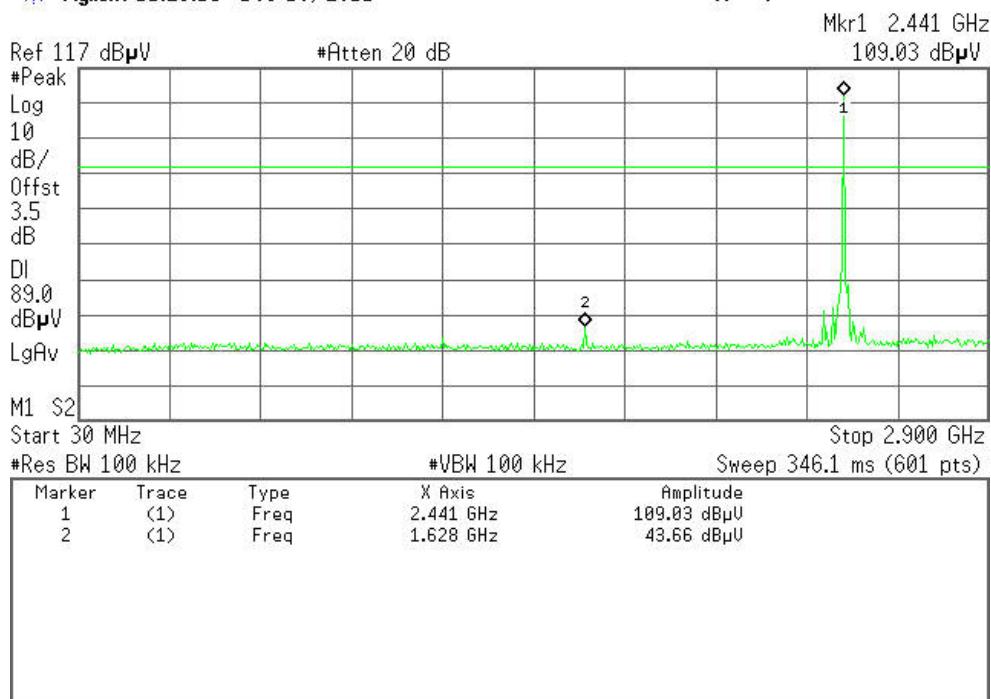
2.9MHz ~26.5GHz



**CH Mid****30MHz ~ 2.9GHz**

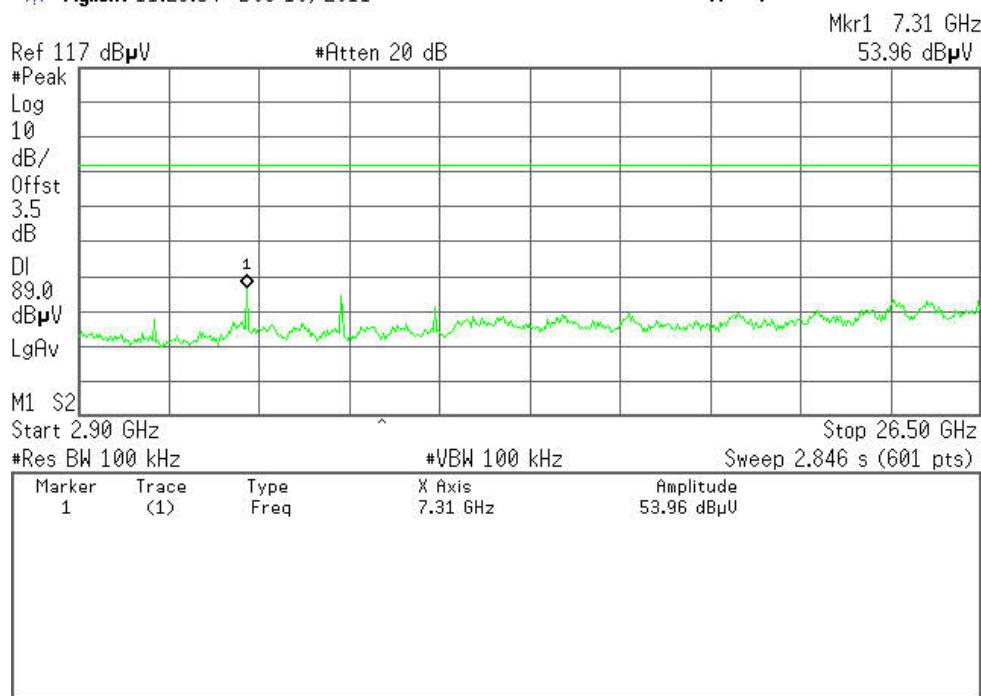
Agilent 11:23:15 Dec 16, 2011

R T

**2.9GHz ~ 26.5GHz**

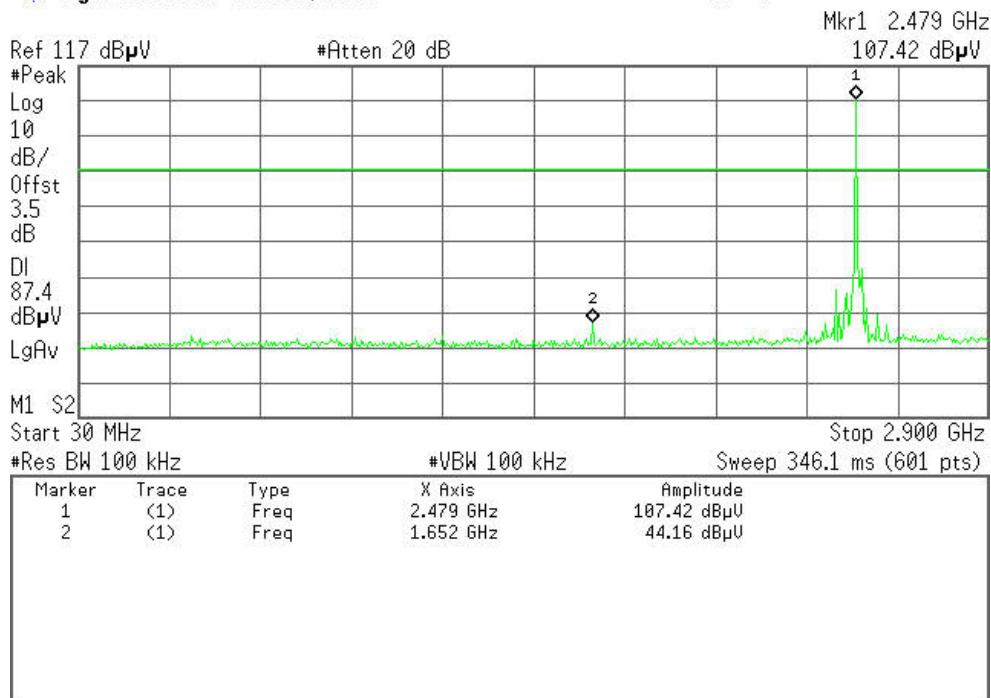
Agilent 11:23:54 Dec 16, 2011

R T

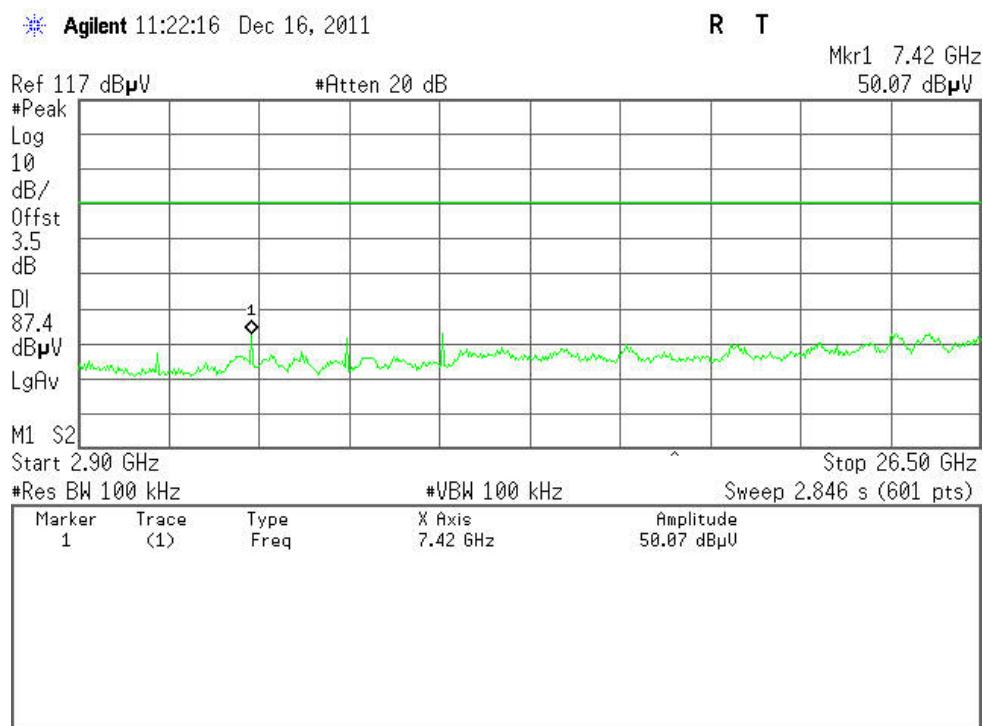


**CH High****30MHz ~ 2.9GHz**

Agilent 11:20:57 Dec 16, 2011

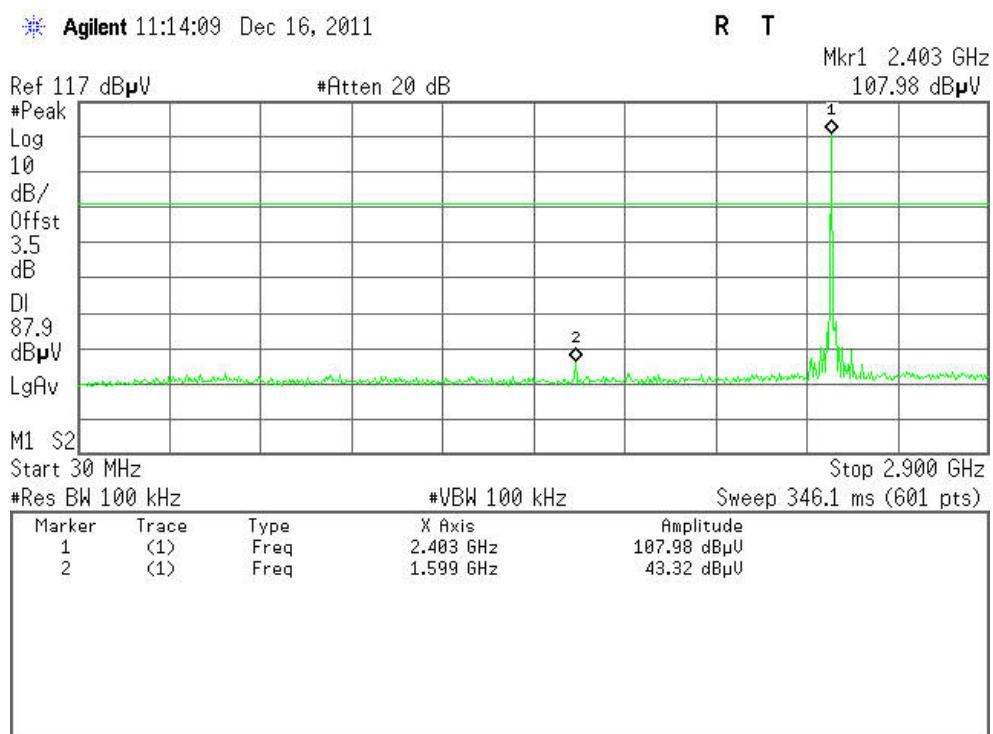
**2.9GHz ~ 26.5GHz**

Agilent 11:22:16 Dec 16, 2011

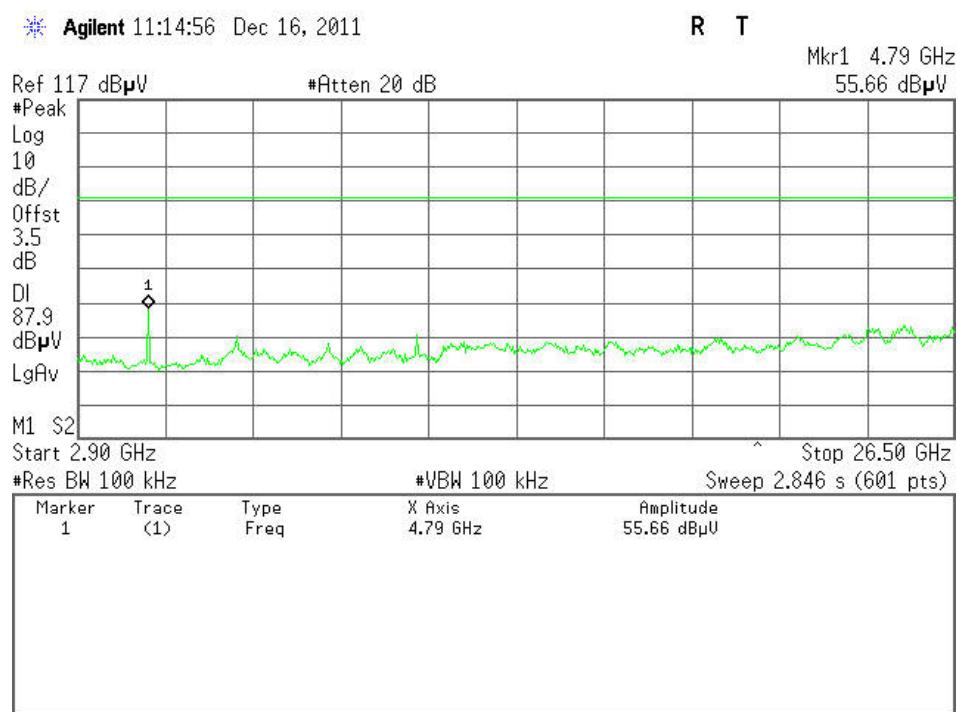


Test Plot (8DPSK)CH Low**30MHz ~2.9GHz**

Agilent 11:14:09 Dec 16, 2011

**2.9MHz ~26.5GHz**

Agilent 11:14:56 Dec 16, 2011



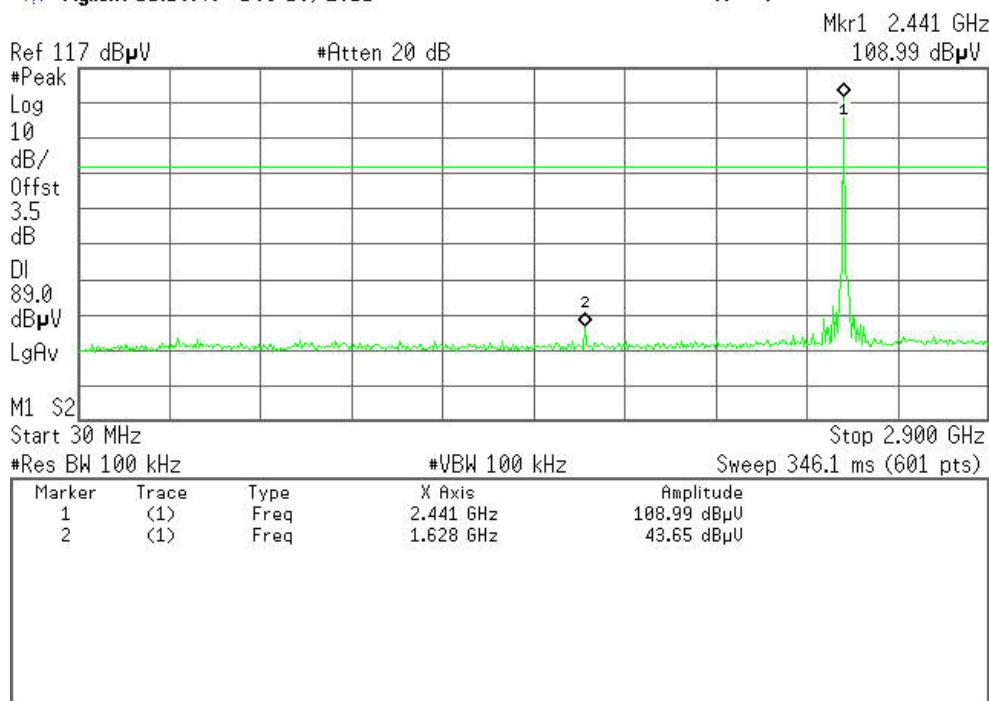


CH Mid

30MHz ~ 2.9GHz

Agilent 11:16:40 Dec 16, 2011

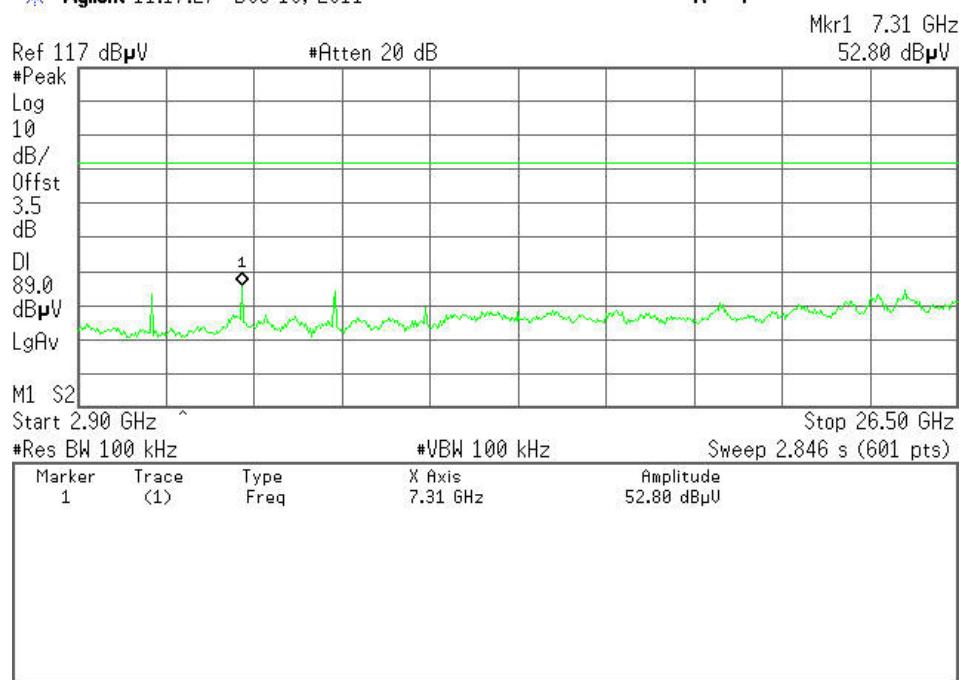
R T



2.9GHz ~ 26.5GHz

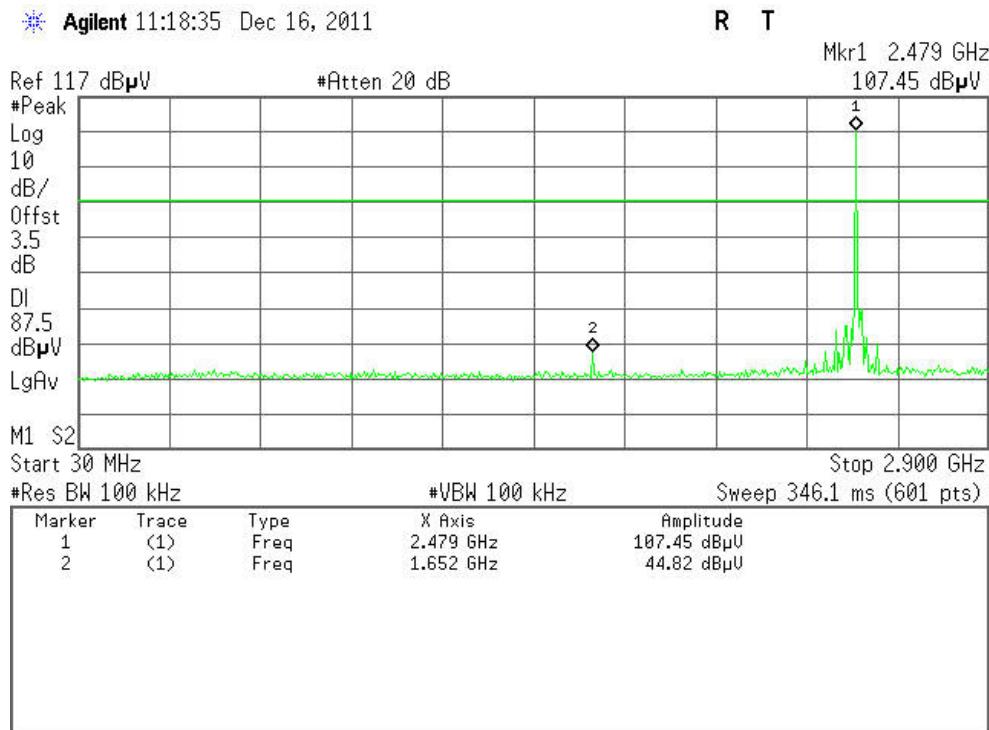
Agilent 11:17:27 Dec 16, 2011

R T

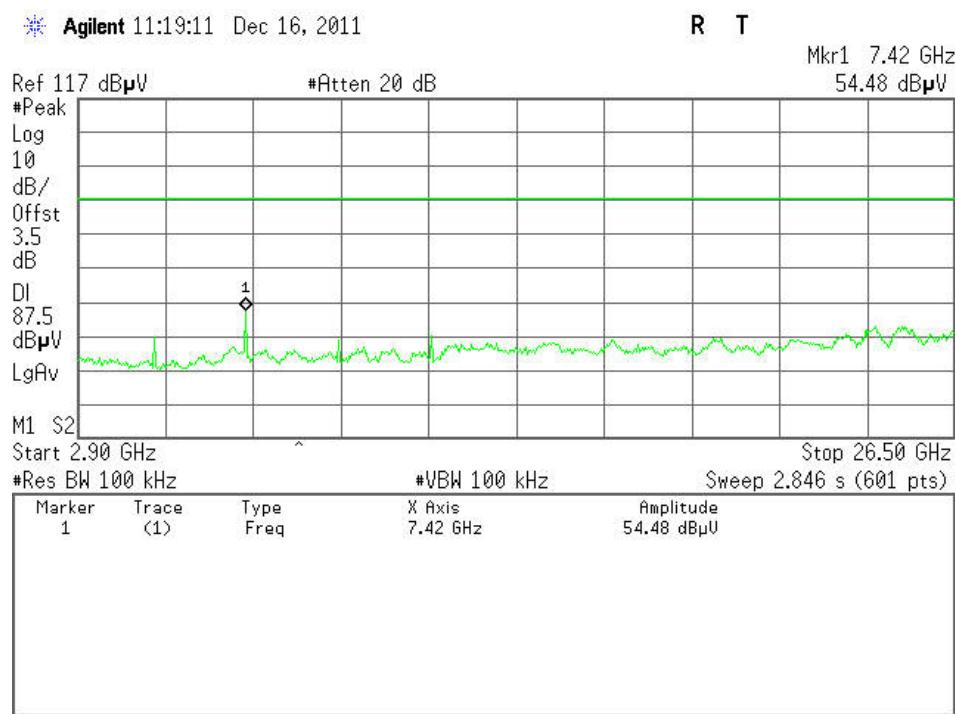


**CH High****30MHz ~ 2.9GHz**

* Agilent 11:18:35 Dec 16, 2011

**2.9GHz ~ 26.5GHz**

* Agilent 11:19:11 Dec 16, 2011





6.8.2. Radiated Emissions

LIMIT

1. Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (mV/m)	Measurement Distance (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

Note: Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

2. In the above emission table, the tighter limit applies at the band edges.

Frequency (Hz)	Field Strength (μ V/m at 3-meter)	Field Strength (dB μ V/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

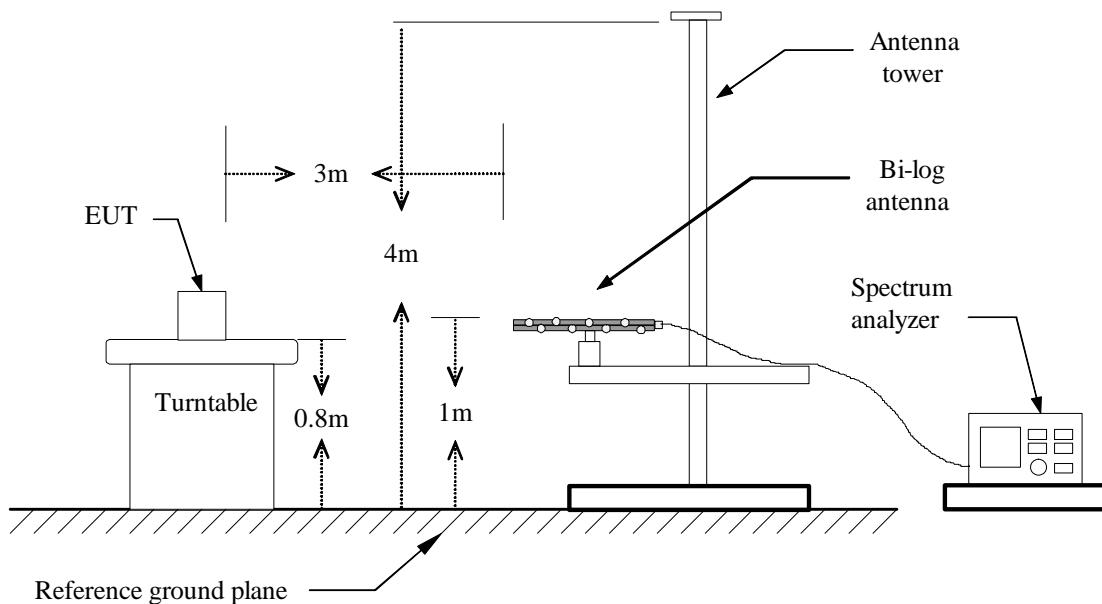
**MEASUREMENT EQUIPMENT USED**

Radiated Emission Test Site 966 (2)					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
PSA Series Spectrum Analyzer	Agilent	E4446A	US44300399	03/19/2011	03/19/2012
Amplifier	MITEQ	AM-1604-3000	1411843	03/18/2011	03/18/2012
Turn Table	EMCO	2081-1.21	N/A	N.C.R	N.C.R
Controller	CT	N/A	N/A	N.C.R	N.C.R
High Noise Amplifier	Agilent	8449B	3008A01838	03/18/2011	03/18/2012
Bilog Antenna	SCHAFFNER	CBL6143	5082	06/03/2011	06/03/2012
Horn Antenna	SCHWARZBEC K	BBHA9120D	D286	03/19/2011	03/19/2012
Loop Antenna	A, R, A	PLA-1030/B	1029	03/19/2011	03/19/2012
Temp. / Humidity Meter	VICTOR	VC230	N/A	03/31/2011	03/31/2012
Antenna Tower	SUNOL	TLT2	N/A	N.C.R	N.C.R
Test S/W	FARAD	LZ-RF / CCS-SZ-3A2			

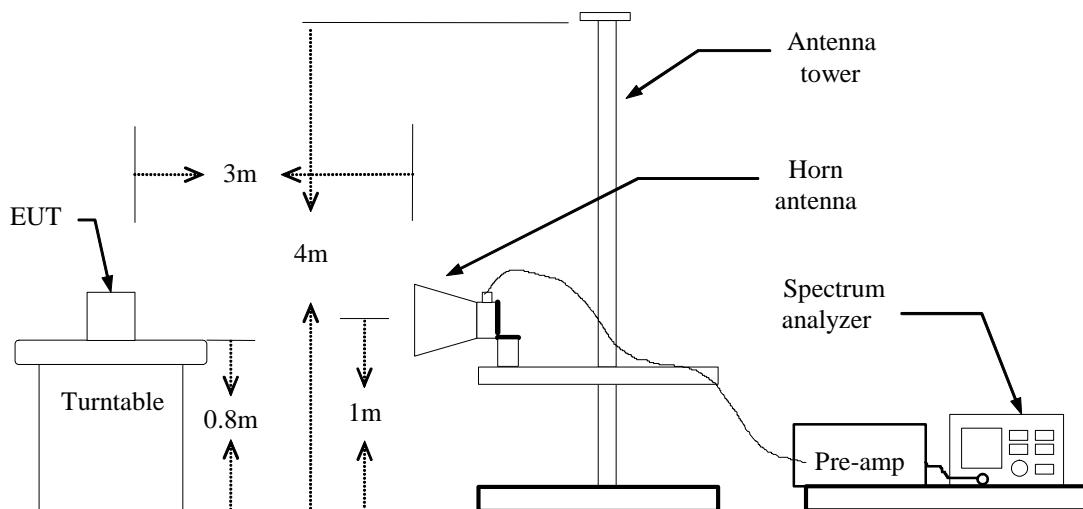
Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration

Below 1 GHz



Above 1 GHz





TEST PROCEDURE

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.



TEST RESULTS

Below 1 GHz

Operation Mode: Normal Link

Test Date: August 24, 2011

Temperature: 26°C

Tested by: Sunday Hu

Humidity: 60% RH

Polarity: Ver. / Hor.

(The chart below shows the highest readings taken from the final data.)

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
112.4500	43.75	-20.83	22.92	43.50	-20.58	V	peak
288.6666	50.75	-19.45	31.30	46.00	-14.70	V	peak
319.3833	47.75	-17.93	29.82	46.00	-16.18	V	peak
384.0500	46.29	-16.13	30.16	46.00	-15.84	V	peak
416.3833	41.98	-15.36	26.62	46.00	-19.38	V	peak
511.7667	38.81	-13.47	25.34	46.00	-20.66	V	peak
<hr/>							
309.6833	60.22	-18.43	41.79	46.00	-4.21	H	peak
335.5500	59.11	-17.64	41.47	46.00	-4.53	H	peak
384.0500	53.75	-16.13	37.62	46.00	-8.38	H	peak
416.3833	54.10	-15.36	38.74	46.00	-7.26	H	peak
448.7167	49.50	-14.85	34.65	46.00	-11.35	H	peak
511.7667	47.80	-13.47	34.33	46.00	-11.67	H	peak

****Remark:** No emission found between lowest internal used/generated frequency to 30MHz.

Notes:

1. Measuring frequencies from 9kHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30MHz to 1GHz were made with an instrument using Quasi-peak detector mode.
3. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.

**Above 1 GHz****GFSK****Operation Mode:** TX(CH Low)**Test Date:** August 24, 2011**Temperature:** 24°C**Tested by:** Sunday Hu**Humidity:** 52% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1490.0000	48.80	-10.30	38.50	74.00	-35.50	V	peak
2050.0000	48.48	-9.26	39.22	74.00	-34.78	V	peak
2773.3333	48.75	-7.49	41.26	74.00	-32.74	V	peak
4418.3333	46.79	-2.21	44.58	74.00	-29.42	V	peak
4803.3333	52.02	-0.64	51.38	74.00	-22.62	V	peak
4920.0000	46.73	-0.27	46.46	74.00	-27.54	V	peak
<hr/>							
1186.6667	49.47	-11.46	38.01	74.00	-35.99	H	peak
3380.0000	46.56	-5.11	41.45	74.00	-32.55	H	peak
3590.0000	46.27	-3.86	42.41	74.00	-31.59	H	peak
4803.3333	48.04	-0.64	47.40	74.00	-26.60	H	peak
5538.3333	46.31	1.35	47.66	74.00	-26.34	H	peak
5748.3333	46.38	2.31	48.69	74.00	-25.31	H	peak

**Operation Mode:** TX(CH Mid)**Test Date:** August 24, 2011**Temperature:** 24°C**Tested by:** Sunday Hu**Humidity:** 52% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1093.3333	49.25	-11.71	37.54	74.00	-36.46	V	peak
1443.3333	48.79	-10.28	38.51	74.00	-35.49	V	peak
2400.0000	49.20	-9.71	39.49	74.00	-34.51	V	peak
2960.0000	47.45	-6.23	41.22	74.00	-32.78	V	peak
4885.0000	51.96	-0.38	51.58	74.00	-22.42	V	peak
7323.3333	46.19	5.28	51.47	74.00	-22.53	V	peak
<hr/>							
2948.3333	47.87	-6.31	41.56	74.00	-32.44	H	Peak
3415.0000	46.34	-4.97	41.37	74.00	-32.63	H	Peak
3730.0000	47.05	-3.85	43.20	74.00	-30.80	H	Peak
4885.0000	47.89	-0.38	47.51	74.00	-26.49	H	Peak
6273.3333	45.28	3.77	49.05	74.00	-24.95	H	Peak
6728.3333	44.98	4.26	49.24	74.00	-24.76	H	Peak



Operation Mode: TX(CH High)

Test Date: August 24, 2011

Temperature: 24 °C

Tested by: Sunday Hu

Humidity: 52% RH

Polarity: Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1058.3333	49.93	-11.79	38.14	74.00	-35.86	V	peak
1606.6667	48.09	-10.30	37.79	74.00	-36.21	V	peak
2061.6667	47.98	-9.26	38.72	74.00	-35.28	V	peak
2738.3333	48.93	-7.72	41.21	74.00	-32.79	V	peak
4955.0000	53.10	-0.15	52.95	74.00	-21.05	V	peak
7440.0000	50.93	5.54	56.47	74.00	-17.53	V	peak
7440.0000	39.05	5.54	44.59	54.00	-9.41	V	AVG
<hr/>							
1420.0000	47.91	-10.26	37.65	74.00	-36.35	H	peak
1991.6667	48.44	-9.31	39.13	74.00	-34.87	H	peak
2971.6667	47.78	-6.15	41.63	74.00	-32.37	H	peak
3578.3333	46.71	-3.94	42.77	74.00	-31.23	H	peak
4091.6667	46.20	-3.28	42.92	74.00	-31.08	H	peak
4955.0000	46.90	-0.15	46.75	74.00	-27.25	H	peak

**8DPSK****Operation Mode:** TX(CH Low)**Test Date:** August 24, 2011**Temperature:** 24°C**Tested by:** Sunday Hu**Humidity:** 52% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
2925.0000	47.52	-6.47	41.05	74.00	-32.95	V	Peak
3695.0000	46.03	-3.84	42.19	74.00	-31.81	V	Peak
4126.6667	45.95	-3.16	42.79	74.00	-31.21	V	Peak
4803.3333	48.44	-0.64	47.80	74.00	-26.20	V	Peak
5760.0000	45.36	2.37	47.73	74.00	-26.27	V	Peak
6215.0000	45.90	3.81	49.71	74.00	-24.29	V	Peak
1455.0000	48.11	-10.28	37.83	74.00	-36.17	H	Peak
2691.6667	48.04	-8.02	40.02	74.00	-33.98	H	Peak
3345.0000	46.31	-5.19	41.12	74.00	-32.88	H	Peak
3881.6667	45.38	-3.75	41.63	74.00	-32.37	H	Peak
4791.6667	45.04	-0.70	44.34	74.00	-29.66	H	Peak
5235.0000	44.97	0.66	45.63	74.00	-28.37	H	Peak

**Operation Mode:** TX(CH Mid)**Test Date:** August 24, 2011**Temperature:** 24°C**Tested by:** Sunday Hu**Humidity:** 52% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
4150.0000	46.14	-3.09	43.05	74.00	-30.95	V	Peak
4488.3333	45.41	-2.04	43.37	74.00	-30.63	V	Peak
4885.0000	49.89	-0.38	49.51	74.00	-24.49	V	Peak
5655.0000	44.96	1.80	46.76	74.00	-27.24	V	Peak
6331.6667	45.43	3.73	49.16	74.00	-24.84	V	Peak
7323.3333	46.49	5.28	51.77	74.00	-22.23	V	Peak
4885.0000	49.02	-0.38	48.64	74.00	-25.36	H	Peak
5270.0000	45.69	0.74	46.43	74.00	-27.57	H	Peak
5690.0000	44.98	1.99	46.97	74.00	-27.03	H	Peak
6250.0000	44.96	3.79	48.75	74.00	-25.25	H	Peak
6658.3333	44.31	4.22	48.53	74.00	-25.47	H	Peak
7323.3333	47.21	5.28	52.49	74.00	-21.51	H	Peak

**Operation Mode:** TX(CH High)**Test Date:** August 24, 2011**Temperature:** 24 °C**Tested by:** Sunday Hu**Humidity:** 52% RH**Polarity:** Ver. / Hor.

Frequency (MHz)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Pole (V/H)	Remark
1711.6667	53.82	-10.21	43.61	74.00	-30.39	V	Peak
3380.0000	47.27	-5.11	42.16	74.00	-31.84	V	Peak
4955.0000	50.22	-0.15	50.07	74.00	-23.93	V	Peak
6331.6667	45.95	3.73	49.68	74.00	-24.32	V	Peak
7241.6667	44.55	5.07	49.62	74.00	-24.38	V	Peak
7440.0000	52.43	5.54	57.97	74.00	-16.03	V	Peak
7440.0000	36.31	5.54	41.85	54.00	-12.15	V	AVG
<hr/>							
3613.3333	45.54	-3.81	41.73	74.00	-32.27	H	Peak
4080.0000	45.24	-3.31	41.93	74.00	-32.07	H	Peak
4371.6667	45.40	-2.35	43.05	74.00	-30.95	H	Peak
4955.0000	46.31	-0.15	46.16	74.00	-27.84	H	Peak
5795.0000	45.19	2.56	47.75	74.00	-26.25	H	Peak
7603.3333	45.34	5.80	51.14	74.00	-22.86	H	Peak



6.9 POWERLINE CONDUCTED EMISSIONS

LIMIT

For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range is listed as follows:

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

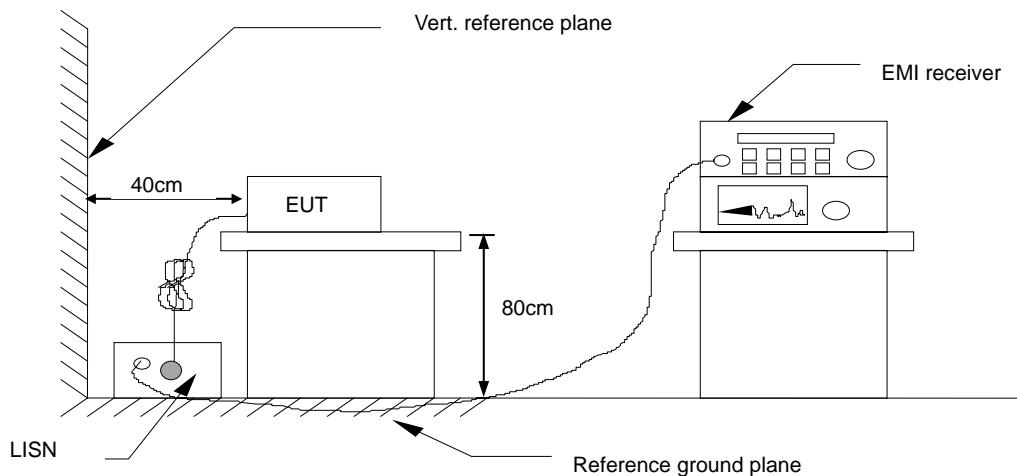
Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

MEASUREMENT EQUIPMENT USED

Conducted Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
ESCI EMI TEST RECEIVE.ESCI	ROHDE&SCHWARZ	ESCI	100783	03/19/2011	03/19/2012
LISN	SCHAFFNER	NNB42	2001/001	05/26/2011	05/26/2012
LISN	EMCO	3825/2	8901-1459	03/19/2011	03/19/2012
Temp. / Humidity Meter	VICTOR	VC230	N/A	03/31/2011	03/31/2012
Test S/W	FARAD	EZ-EMC/ CCS-3A1-CE			

Remark: Each piece of equipment is scheduled for calibration once a year.

Test Configuration



See test photographs attached in Appendix 1 for the actual connections between EUT and support equipment.

TEST PROCEDURE

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

TEST RESULTS

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

**Test Data**

Model No.	RAPTOR-i	RBW,VBW	9 kHz
Environmental Conditions	26°C, 60% RH	Test Mode	Mode 1
Tested by	Sunday Hu	Line	L1

(The chart below shows the highest readings taken from the final data.)

Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
0.1900	38.02	31.25	11.52	49.54	42.77	64.03	54.04	-14.49	-11.27	Pass
0.2500	30.56	24.34	11.52	42.08	35.86	61.75	51.76	-19.67	-15.90	Pass
1.1860	19.65	16.10	11.53	31.18	27.63	56.00	46.00	-24.82	-18.37	Pass
3.5380	26.35	21.40	11.62	37.97	33.02	56.00	46.00	-18.03	-12.98	Pass
10.7900	27.62	15.91	12.04	39.66	27.95	60.00	50.00	-20.34	-22.05	Pass
23.6340	28.59	17.34	12.70	41.29	30.04	60.00	50.00	-18.71	-19.96	Pass

NOTE: L1 = Line One (Live Line)

Model No.	RAPTOR-i	RBW,VBW	9 kHz
Environmental Conditions	26deg°C, 60% RH	Test Mode	Normal Link
Tested by	Sunday	Line	L2

(The chart below shows the highest readings taken from the final data.)

Frequency (MHz)	QuasiPeak Reading (dBuV)	Average Reading (dBuV)	Correction Factor (dB)	QuasiPeak Result (dBuV)	Average Result (dBuV)	QuasiPeak Limit (dBuV)	Average Limit (dBuV)	QuasiPeak Margin (dB)	Average Margin (dB)	Remark (Pass/Fail)
0.1900	38.90	32.06	11.52	50.42	43.58	64.04	54.04	-13.62	-10.46	Pass
0.2500	29.44	23.30	11.53	40.97	34.83	61.76	51.76	-20.79	-16.93	Pass
4.1540	30.13	24.78	11.64	41.77	36.42	56.00	46.00	-14.23	-9.58	Pass
10.7900	27.57	15.41	12.03	39.60	27.44	60.00	50.00	-20.40	-22.56	Pass
18.2580	27.63	24.14	12.32	39.95	36.46	60.00	50.00	-20.05	-13.54	Pass
23.4460	30.92	19.69	12.67	43.59	32.36	60.00	50.00	-16.41	-17.64	Pass

NOTE: L2 = Line Two (Neutral Line).