FCC 47 CFR PART 15 SUBPART C

TEST REPORT

For

Portable Navigation Device

Model: RN5 (NS-4102), RN5 (NS-4102F), RN5 (NS-4102B)

Trade Name: RoyalTek

Issued to

RoyalTek Company Ltd.
4F, No.188 Wen Hwa 2nd Rd., Kuei Shan,
Tao Yuan 33383, Taiwan, R.O.C.

Issued by

Compliance Certification Services Inc.
No. 11, Wu-Gong 6th Rd., Wugu Industrial Park,
Taipei Hsien 248, Taiwan (R.O.C.)
http://www.ccsemc.com.tw
service@tw.ccsemc.com

Testing Laboratory
1309

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1. TEST RESULT CERTIFICATION

Applicant: RoyalTek Company Ltd.
4F, No.188 Wen Hwa 2nd Rd., Kuei Shan,
Tao Yuan 33383, Taiwan, R.O.C.

Equipment Under Test: Portable Navigation Device

Trade Name: RoyalTek

Model: RN5 (NS-4102), RN5 (NS-4102F), RN5 (NS-4102B)

Date of Test: November 27, 2008 ~ January 7, 2009

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: 2003** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

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

Approved by:

Rex Lai
Section Manager
Compliance Certification Services Inc.

Reviewed by:

Amanda Wu
Section Manager
Compliance Certification Services Inc.

2. EUT DESCRIPTION

<table>
<tr><td>Product</td><td>Portable Navigation Device</td></tr>
<tr><td>Trade Name</td><td>RoyalTek</td></tr>
<tr><td>Model Number</td><td>RN5 (NS-4102), RN5 (NS-4102F), RN5 (NS-4102B)</td></tr>
<tr><td>Model Discrepancy</td><td>All the specification and layout are identical except they come with different model numbers for marketing purposes.</td></tr>
<tr><td>Power Supply</td><td>
<table>
<tr><th></th><th>Trade Name</th><th>Model</th><th>I/P</th><th>O/P</th></tr>
<tr><td>Power Adapter</td><td>PHIHONG</td><td>PSAA05A-050</td><td>100-240V, 200mA, 50-60Hz, 13-20VA</td><td>5V, 1A LPS</td></tr>
<tr><td>Car Charge</td><td>L&K</td><td>G12PCL-549-0041</td><td>DC 10.8-30V</td><td>DC 5V, 1.0A</td></tr>
<tr><td>Car Charge</td><td>NASA</td><td>GER-2MK-D</td><td>DC 10.8-30V</td><td>DC 5V, 1.0A</td></tr>
</table>
</td></tr>
<tr><td>Accessory Type</td><td>Cradle x 1
USB Cable Type:
Unshielded, 1.8m (Detachable) x 1
Unshielded, 1.1m (Detachable) x 1 (RTA-3000)
Earphone Cable Type:
Unshielded, 1.8m (Detachable) x 1
IR Cable Type:
Unshielded, 1.5m (Detachable) x 1</td></tr>
<tr><td>Frequency Range</td><td>2402 ~ 2480 MHz</td></tr>
<tr><td>Transmit Power</td><td>-3.49 dBm</td></tr>
<tr><td>Modulation Technique</td><td>FHSS (GFSK)</td></tr>
<tr><td>Transmit Data Rate</td><td>1Mbps</td></tr>
<tr><td>Number of Channels</td><td>79 Channels</td></tr>
<tr><td>Antenna Specification</td><td>Gain: 0 dBi</td></tr>
<tr><td>Antenna Designation</td><td>PCB antenna</td></tr>
</table>

Remark:

1. *The sample selected for test was production product and was provided by manufacturer.*
2. *This submittal(s) (test report) is intended for FCC ID: **RCCNS-4102** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.*

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4: 2003 and FCC CFR 47 Part 15.207, 15.209 and 15.247.

3.1EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2EUT EXERCISE

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

3.3GENERAL TEST PROCEDURES

Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4: 2003 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-peak and average detector modes.

Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4: 2003.

3.4FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS

(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		

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

3.5DESCRIPTION OF TEST MODES

The EUT (model: RN5 (NS-4102)) had been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting mode was programmed.

Software used to control the EUT for staying in continuous transmitting mode was programmed.

After verification, all tests were carried out with the worst case test modes as shown below except radiated spurious emission below 1GHz and power line conducted emissions below 30MHz, which worst case was in normal link mode only.

Channel Low (2402MHz), Mid (2441MHz) and High (2480MHz) with 1Mbps data rate was chosen for full testing.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

4. INSTRUMENT CALIBRATION

4.1MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

4.2MEASUREMENT EQUIPMENT USED

Equipment Used for Emissions Measurement

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

Conducted Emissions Test Site				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	MY43360131	02/24/2009
Power Meter	Agilent	E4416A	GB41291611	04/06/2009
Power Sensor	Agilent	E9327A	US40441097	06/19/2009

3M Semi Anechoic Chamber				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
Spectrum Analyzer	Agilent	E4446A	US42510252	09/10/2009
Test Receiver	Rohde&Schwarz	ESCI	100064	11/29/2009
Switch Controller	TRC	Switch Controller	SC94050010	05/03/2009
4 Port Switch	TRC	4 Port Switch	SC94050020	05/03/2009
Horn-Antenna	TRC	HA-0502	06	06/04/2009
Horn-Antenna	TRC	HA-0801	04	06/19/2009
Horn-Antenna	TRC	HA-1201A	01	08/11/2009
Horn-Antenna	TRC	HA-1301A	01	08/11/2009
Bilog- Antenna	Sunol Sciences	JB3	A030205	03/28/2009
Loop Antenna	EMCO	6502	8905/2356	05/29/2009
Turn Table	Max-Full	MFT-120S	T120S940302	N.C.R.
Antenna Tower	Max-Full	MFA-430	A440940302	N.C.R.
Controller	Max-Full	MF-CM886	CC-C-1F-13	N.C.R.
Site NSA	CCS	N/A	FCC MRA: TW1039 IC: 2324G-1 / -2	10/17/2009 11/04/2010
Test S/W	LABVIEW (V 6.1)			

Powerline Conducted Emission Room #3				
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Due**
EMI Test Receiver	R&S	ESCS30	845552/030	04/08/2009
LISN	R&S	ENV216	100074	12/03/2009
LISN	FCC	FCC-LISN-50/ 250-16-2-07	06013	10/12/2009
Test S/W	LabVIEW 6.1 (CCS Conduction Test SW Version_01)			

4.3 MEASUREMENT UNCERTAINTY

PARAMETER	UNCERTAINTY
Powerline Conducted Emission Room #3	+/- 1.7806
3M Semi Anechoic Chamber / 30MHz ~ 1GHz	+/-3.7046
3M Semi Anechoic Chamber / Above 1GHz	+/-3.0958

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

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

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

☐ No.199, Chunghsen Road, Hsintien City, Taipei Hsien, Taiwan, R.O.C.
Tel: 886-2-2217-0894 / Fax: 886-2-2217-1029

☒ No.11, Wugong 6th Rd., Wugu Industrial Park, Taipei Hsien 248, Taiwan
Tel: 886-2-2299-9720 / Fax: 886-2-2298-4045

☒ No.81-1, Lane 210, Bade 2nd Rd., Luchu Hsiang, Taoyuan Hsien 338, Taiwan
Tel: 886-3-324-0332 / Fax: 886-3-324-5235

Remark: *The conducted emissions test items was tested at Compliance Certification Services Inc. (Linkou Lab.) The test equipments were listed in page 8 and the test data, please refer page 45-46.*

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

5.2 EQUIPMENT

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, “Radio Interference Measuring Apparatus and Measurement Methods.”

5.3TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3M Semi Anechoic Chamber (FCC MRA: TW1039) to perform FCC Part 15 measurements	FCC MRA: TW1039
Taiwan	TAF	LP0002, RTTE01, FCC Method-47 CFR Part 15 Subpart C, D, E, RSS-210, RSS-310 IDA TS SRD, AS/NZS 4268, AS/NZS 4771, TS 12.1 & 12,2, ETSI EN 300 440-1, ETSI EN 300 440-2, ETSI EN 300 328, ETSI EN 300 220-1, ETSI EN 300 220-2, ETSI EN 301 893, ETSI EN 301 489-1/3/7/17 FCC OET Bulletin 65 + Supplement C, EN 50360, EN 50361, EN 50371, RSS 102, EN 50383, EN 50385, EN 50392, IEC 62209, CNS 14958-1, CNS 14959 FCC Method –47 CFR Part 15 Subpart B IEC / EN 61000-3-2, IEC / EN 61000-3-3, IEC / EN 61000-4-2/3/4/5/6/8/11	Testing Laboratory 1309
Canada	Industry Canada	3M Semi Anechoic Chamber (IC 2324G-1 / IC 2324G-2) to perform	IC 2324G-1 IC 2324G-2

** No part of this report may be used to claim or imply product endorsement by A2LA or any agency of the US Government.*

6. SETUP OF EQUIPMENT UNDER TEST

6.1SETUP CONFIGURATION OF EUT

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

6.2SUPPORT EQUIPMENT

For Wugu Lab

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	Notebook PC	DELL	PP05L	7T390 A03	E2K5HCKT	RS232 Cable: Unshielded, 1.0m	AC I/P: Unshielded, 1.8m DC O/P: Unshielded, 1.8m with a core
2.	Test Kit	N/A	N/A	N/A	N/A	N/A	N/A

For Luchu Lab

No.	Device Type	Brand	Model	Series No.	FCC ID	Data Cable	Power Cord
1.	PC	HP	DX-6120	SGH53102TR	FCC DoC	N/A	Unshielded, 1.8m
2.	LCD Monitor	DELL	2408WFB	CN-0NN792-74261-849-15ES	FCC DoC	Shielded, 1.8m with two cores	Unshielded, 1.8m
3.	Modem	ACEEX	DM-1414	304012265	IFAXDM1414	Unshielded, 1.8m	Unshielded, 1.8m
4.	Printer	EPSON	STYLUS C60	DR3K043129	FCC DoC	Unshielded, 1.8m	Unshielded, 1.8m
5.	PS/2 Keyboard	Logitech	Y-SJ17	SYU13518342	FCC DoC	Unshielded, 1.8m	N/A
6.	PS/2 Mouse	Logitech	M-SBF69	HCA51603814	FCC DoC	Unshielded, 1.8m	N/A

Remark:

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.*

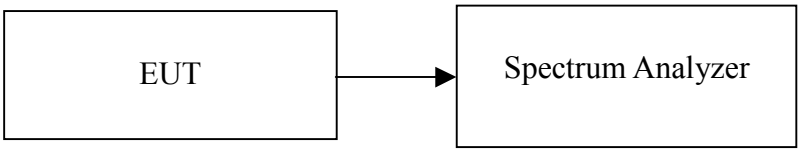
7. FCC PART 15.247 REQUIREMENTS

7.120 DB BANDWIDTH

LIMIT

None; for reporting purposes only.

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 and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=10kHz, VBW = 30kHz, Span = 1.5MHz, Sweep = auto.
4. Mark the peak frequency and 20dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

TEST RESULTS

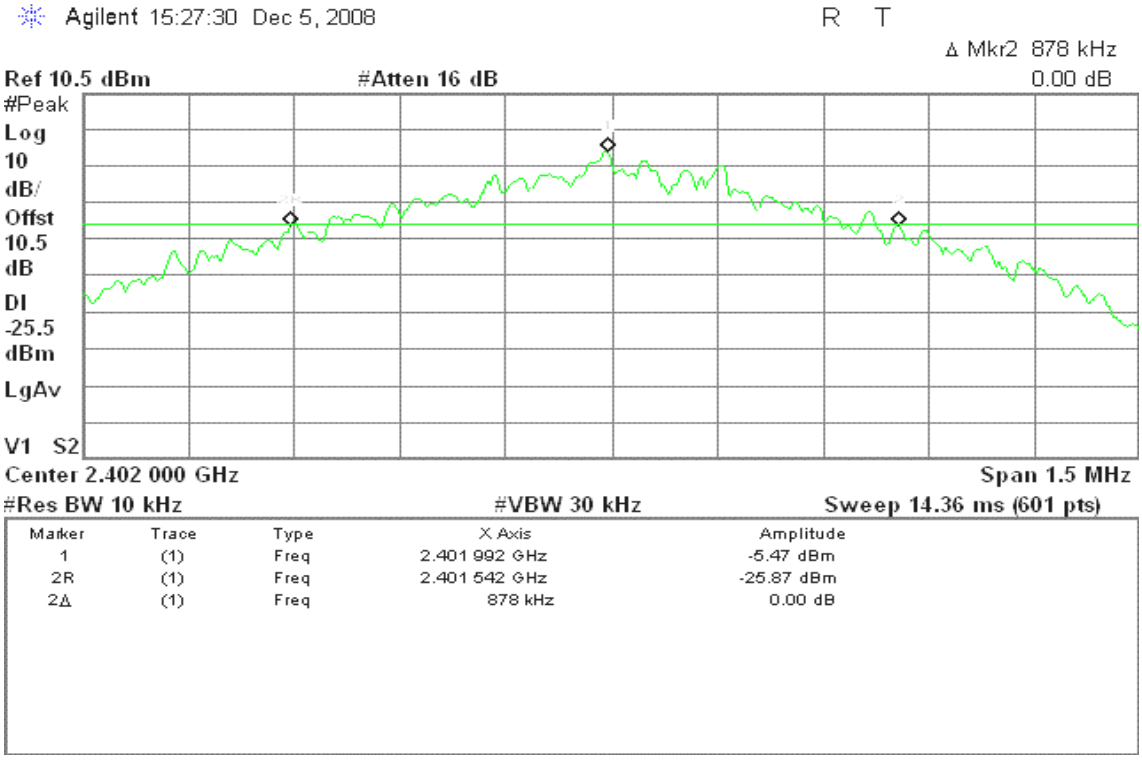
No non-compliance noted.

Test Data

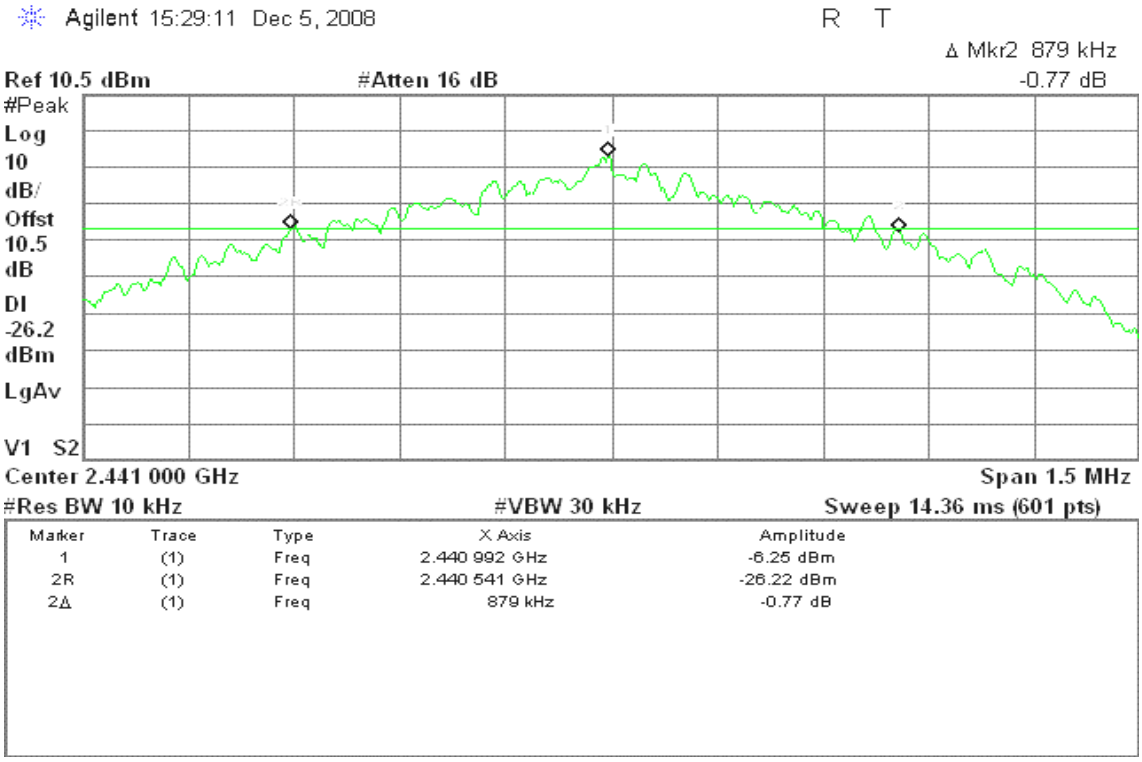
Channel	Frequency (MHz)	20dB Bandwidth (kHz)
Low	2402	878
Mid	2441	879
High	2480	879

Test Plot

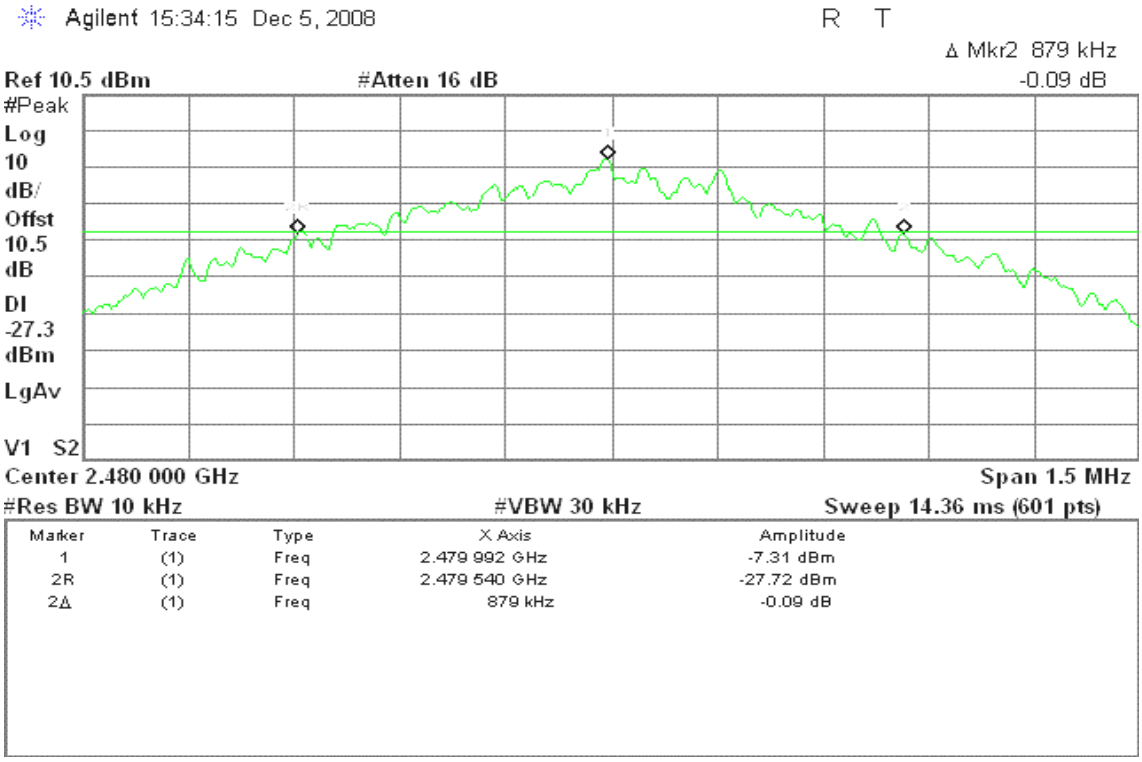
20dB Bandwidth (CH Low)



20dB Bandwidth (CH Mid)



20dB Bandwidth (CH High)



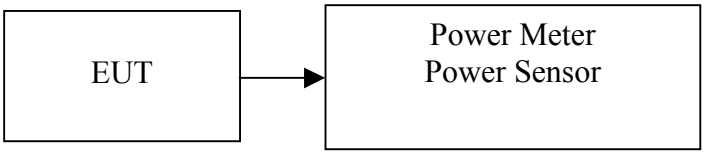
7.2PEAK POWER

LIMIT

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

1. 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.
2. According to §15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 Watt.
3. According to §15.247(b)(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.

Test Configuration



TEST PROCEDURE

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

TEST RESULTS

No non-compliance noted.

Test Data

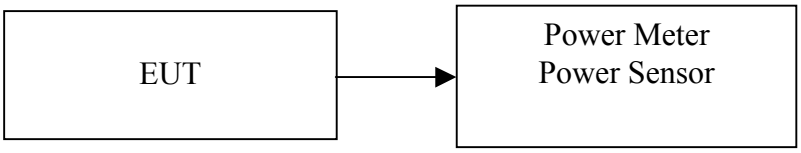
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	-3.49	0.00045	1	PASS
Mid	2441	-4.33	0.00037		PASS
High	2480	-5.47	0.00028		PASS

7.3AVERAGE POWER

LIMIT

None; for reporting purposes only.

Test Configuration



TEST PROCEDURE

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

TEST RESULTS

No non-compliance noted.

Test Data

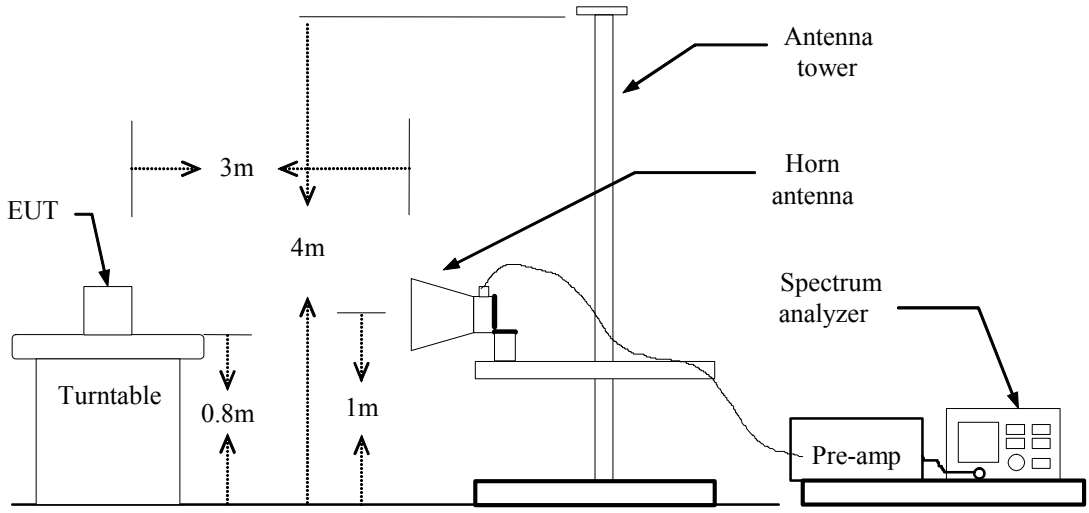
Channel	Frequency (MHz)	Output Power (dBm)	Output Power (W)
Low	2402	-3.97	0.00040
Mid	2441	-4.79	0.00033
High	2480	-5.92	0.00026

7.4BAND EDGES MEASUREMENT

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. 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) (see Section 15.205(c)).

Test Configuration



TEST PROCEDURE

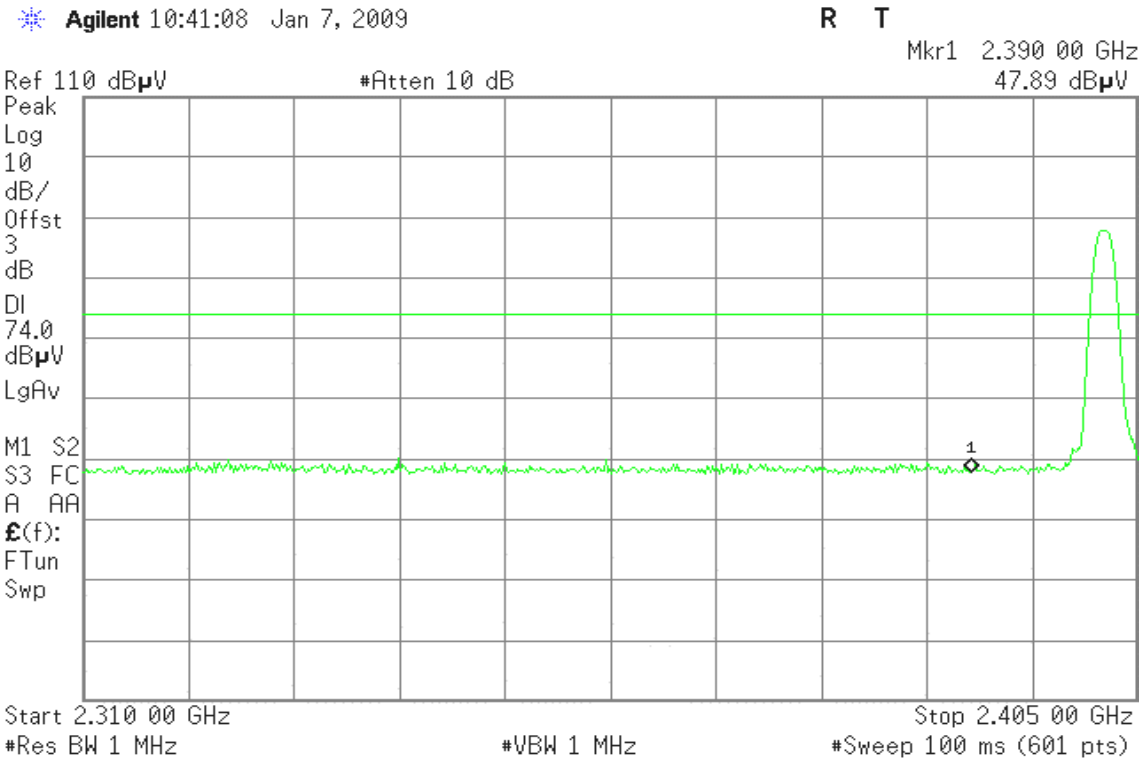
1. The EUT is placed on a turntable, which is 0.8m above the ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.
4. Set the 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

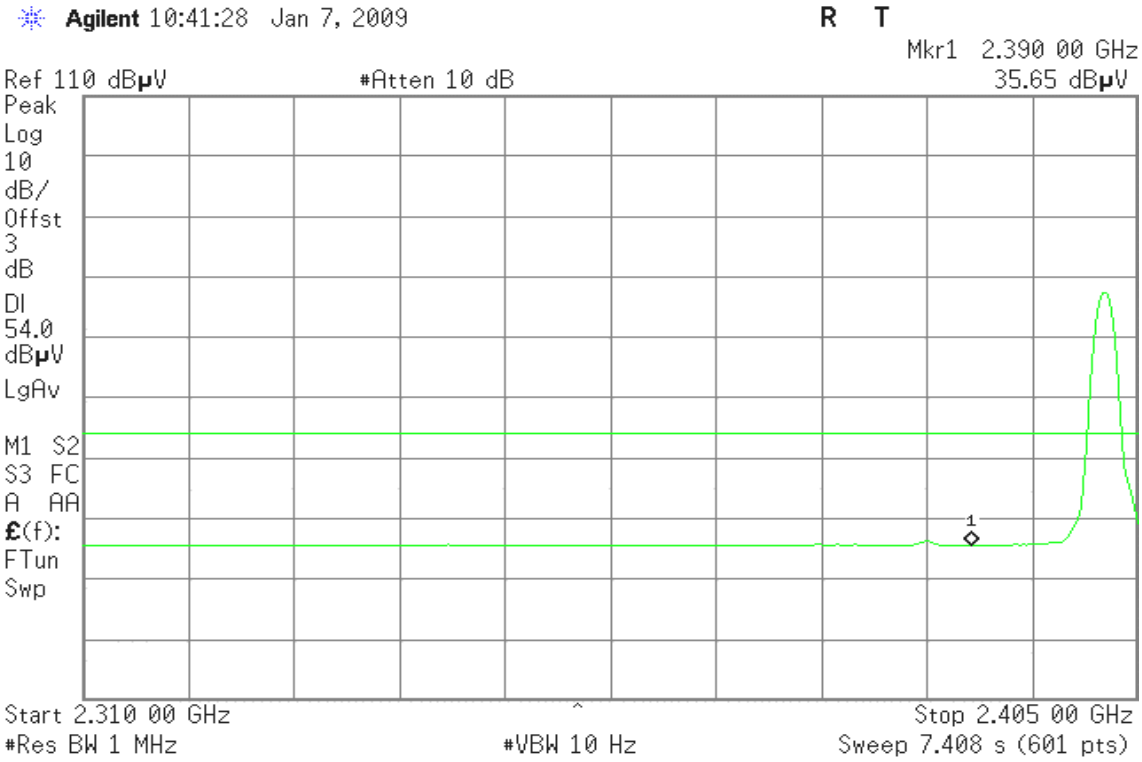
Refer to attach spectrum analyzer data chart.

Band Edges (CH Low)

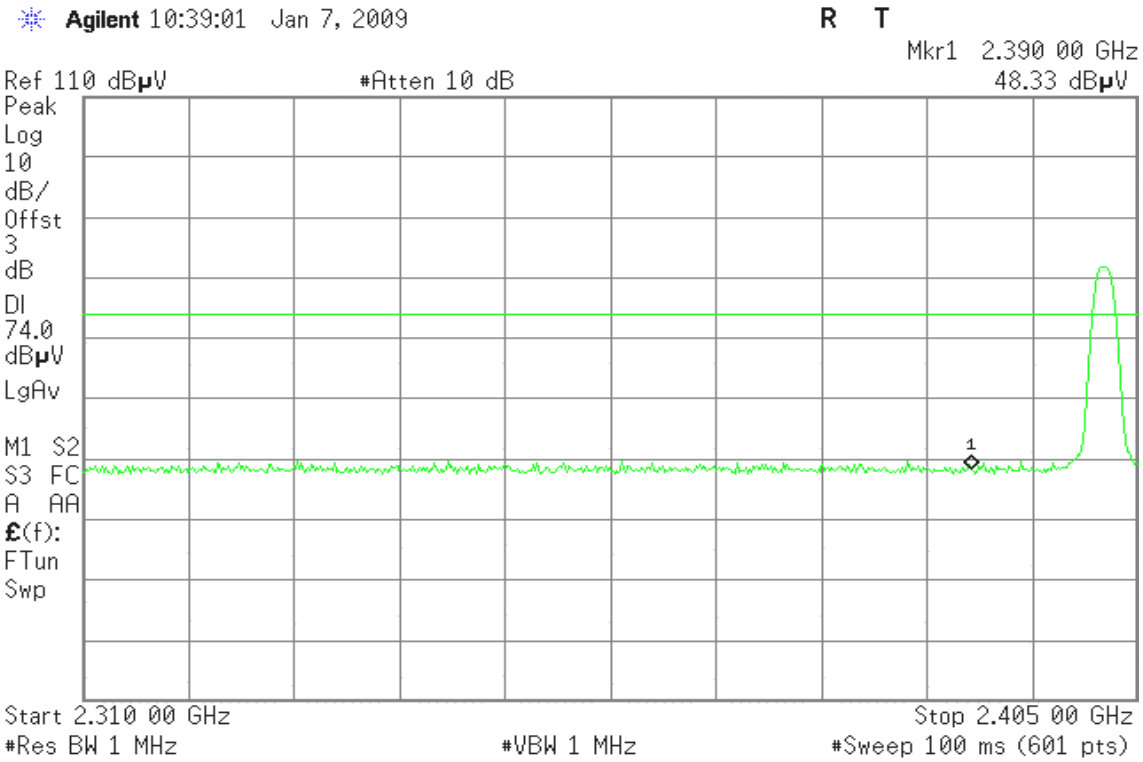
Detector mode: Peak Polarity: Vertical



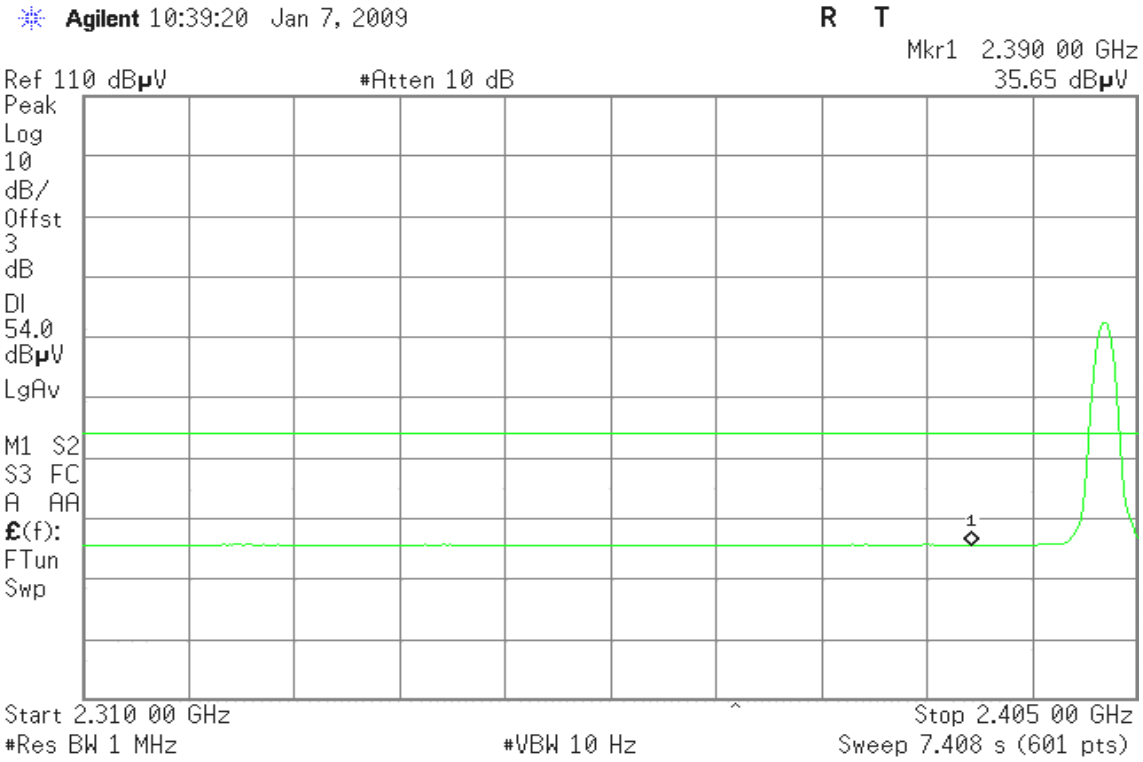
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**

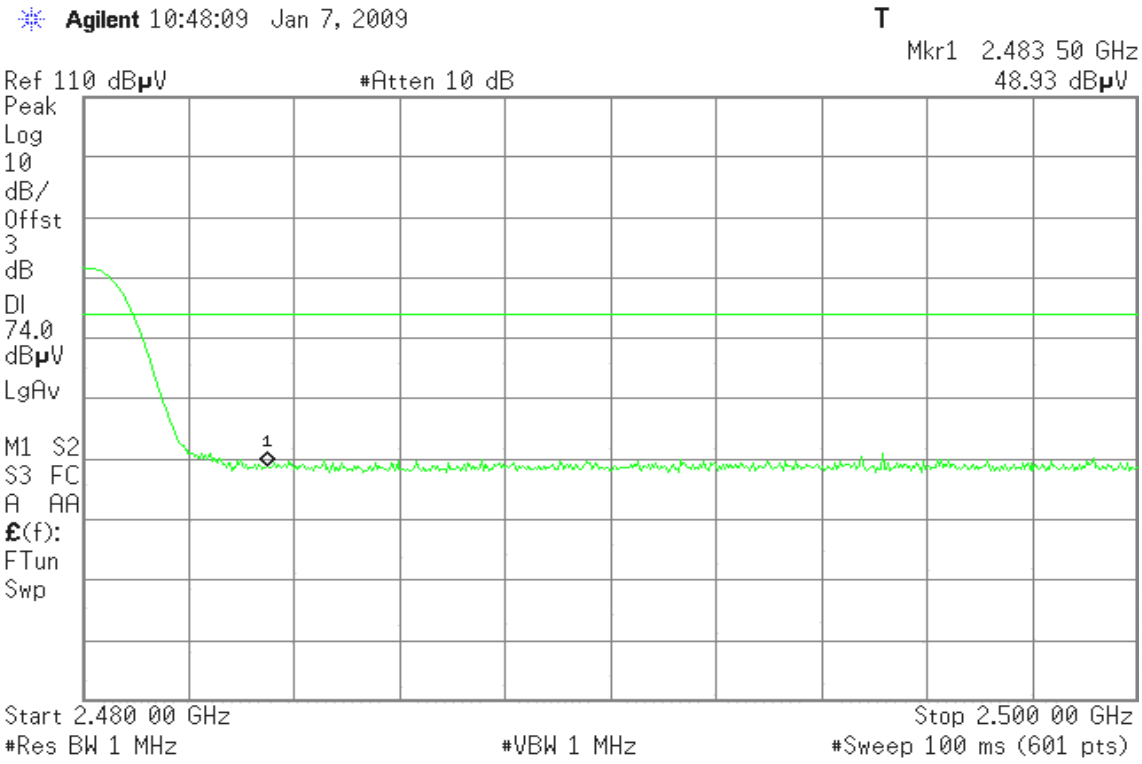


Detector mode: Average **Polarity: Horizontal**

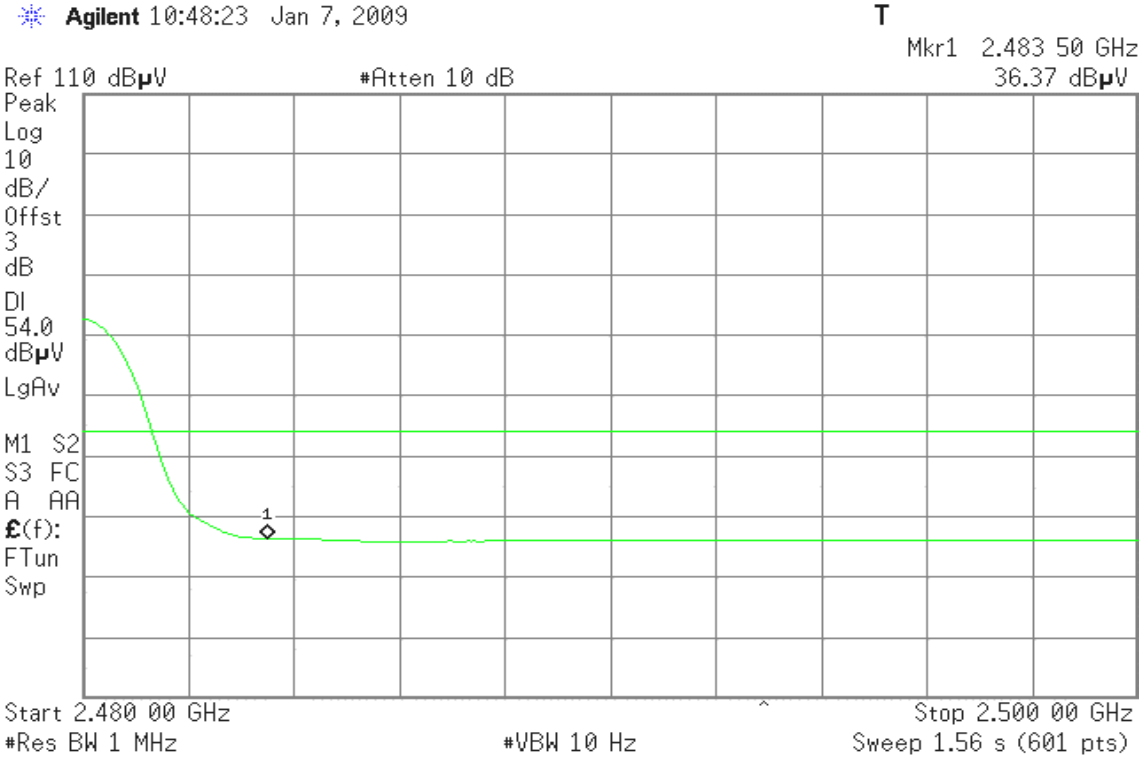


Band Edges (CH High)

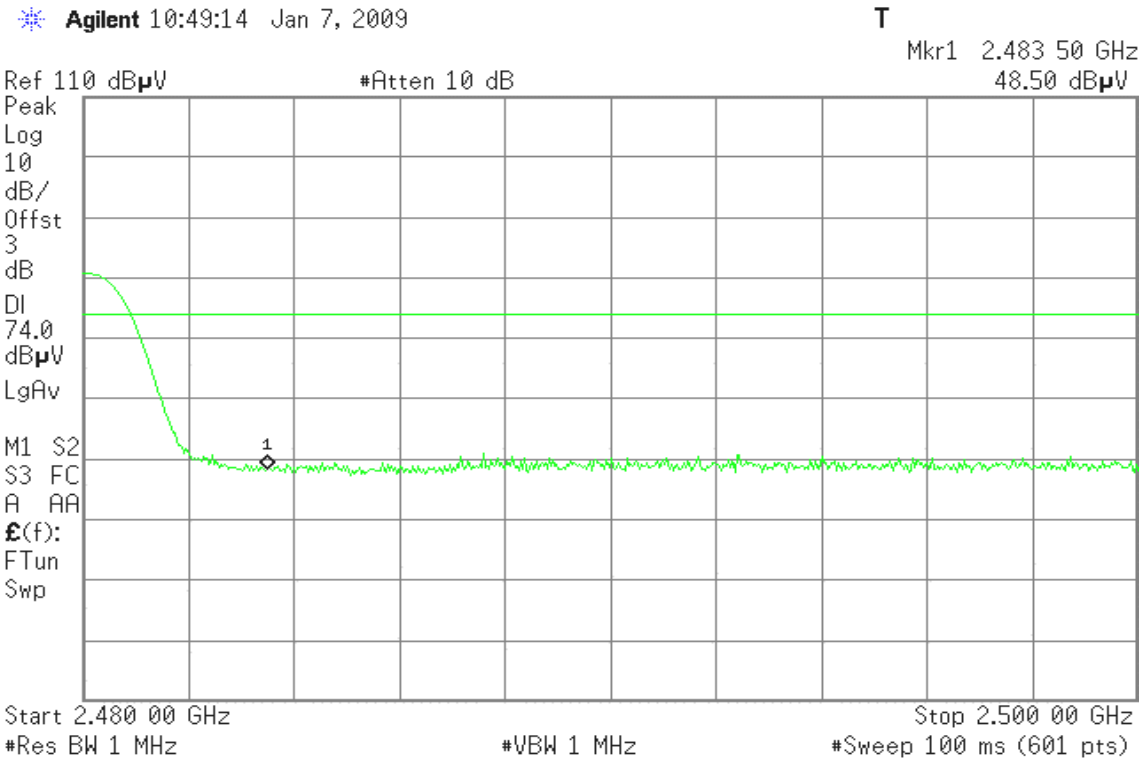
Detector mode: Peak Polarity: Vertical



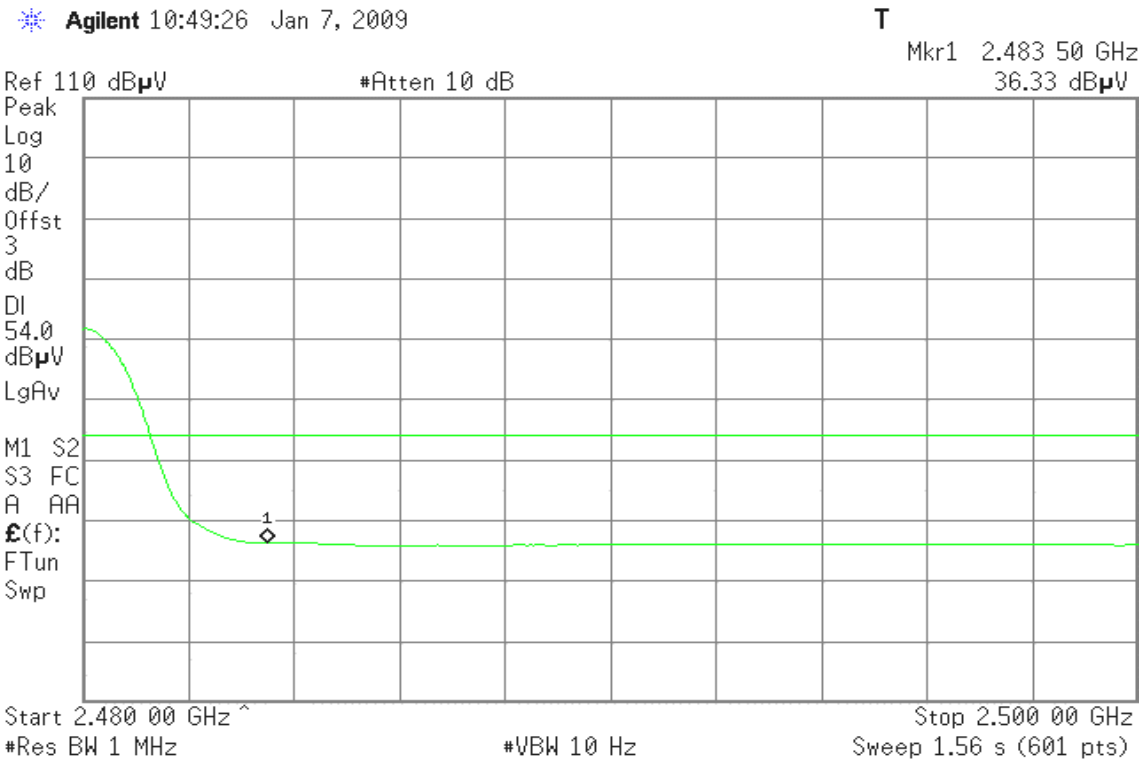
Detector mode: Average Polarity: Vertical



Detector mode: Peak **Polarity: Horizontal**



Detector mode: Average **Polarity: Horizontal**

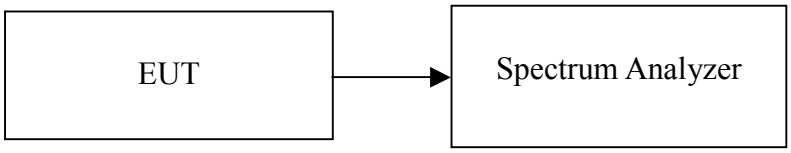


7.5FREQUENCY SEPARATION

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.

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 = 100kHz, Span = 3MHz, Sweep = auto.
5. Max hold, mark 3 peaks of hopping channel and record the 3 peaks frequency.

TEST RESULTS

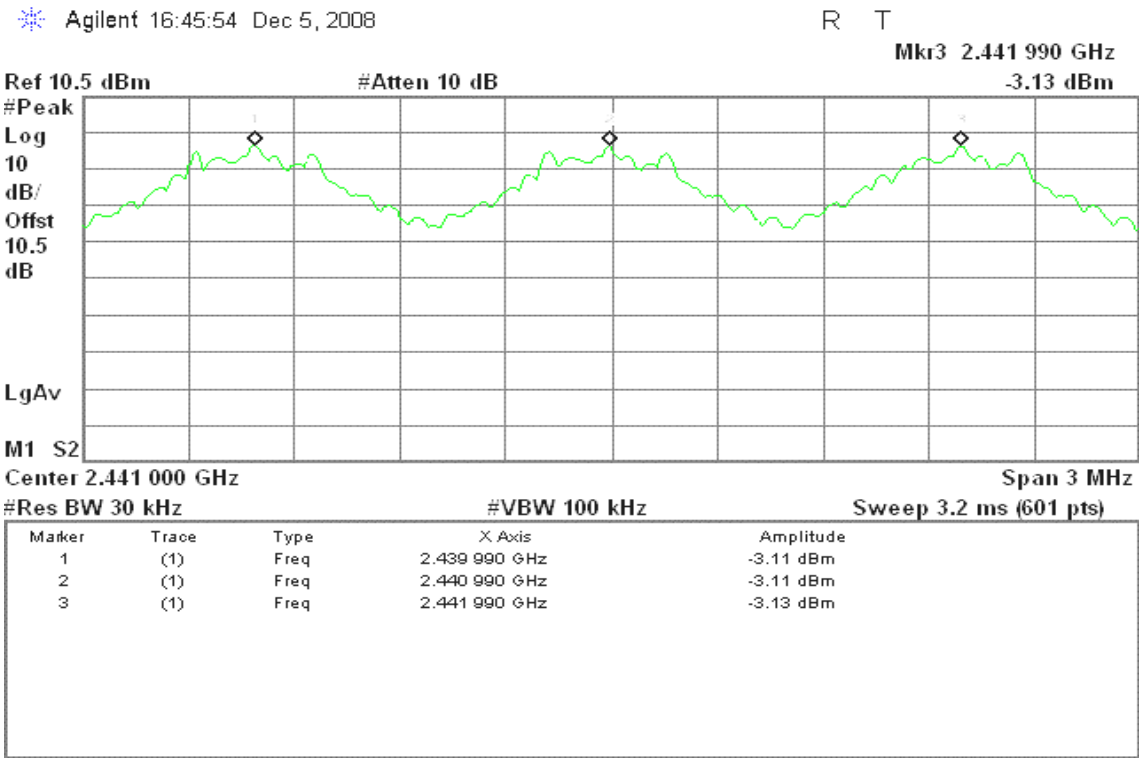
No non-compliance noted

Test Data

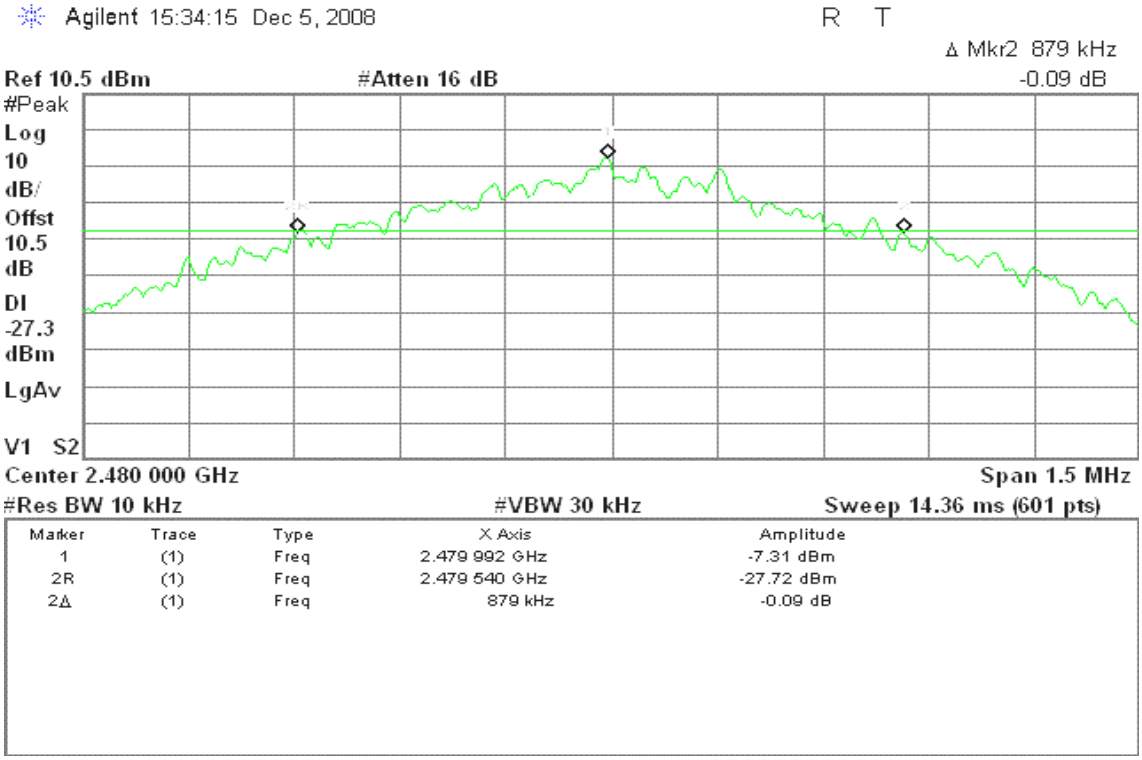
Channel Separation (MHz)	20dB Bandwidth (kHz)	Channel Separation Limit	Result
1.00	879	> 20dB Bandwidth	Pass

Test Plot

Measurement of Channel Separation



Measurement of 20dB Bandwidth

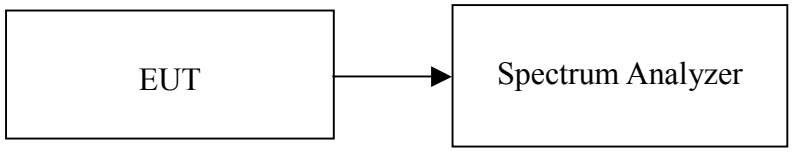


7.6NUMBER OF HOPPING FREQUENCY

LIMIT

According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 75 hopping frequencies.

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 = auto and Start=2441.5MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=510kHz.
5. Max hold, view and count how many channel in the band.

TEST RESULTS

No non-compliance noted

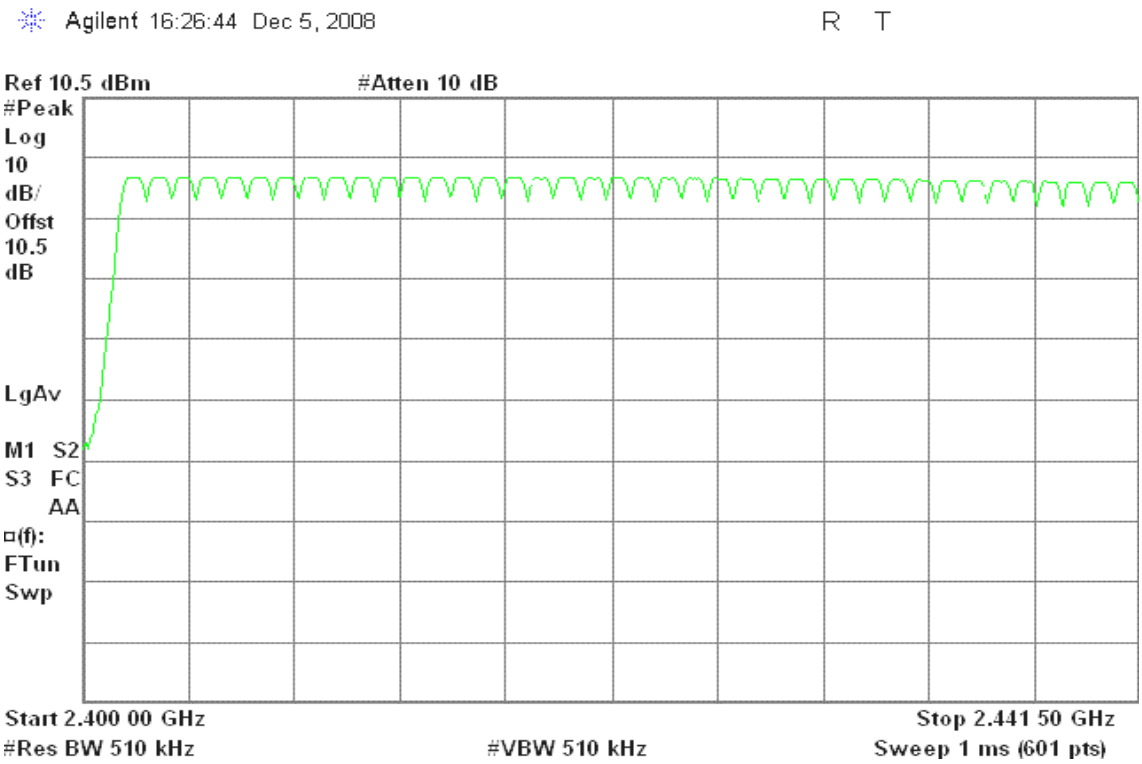
Test Data

Result (No. of CH)	Limit (No. of CH)	Result
79	>75	PASS

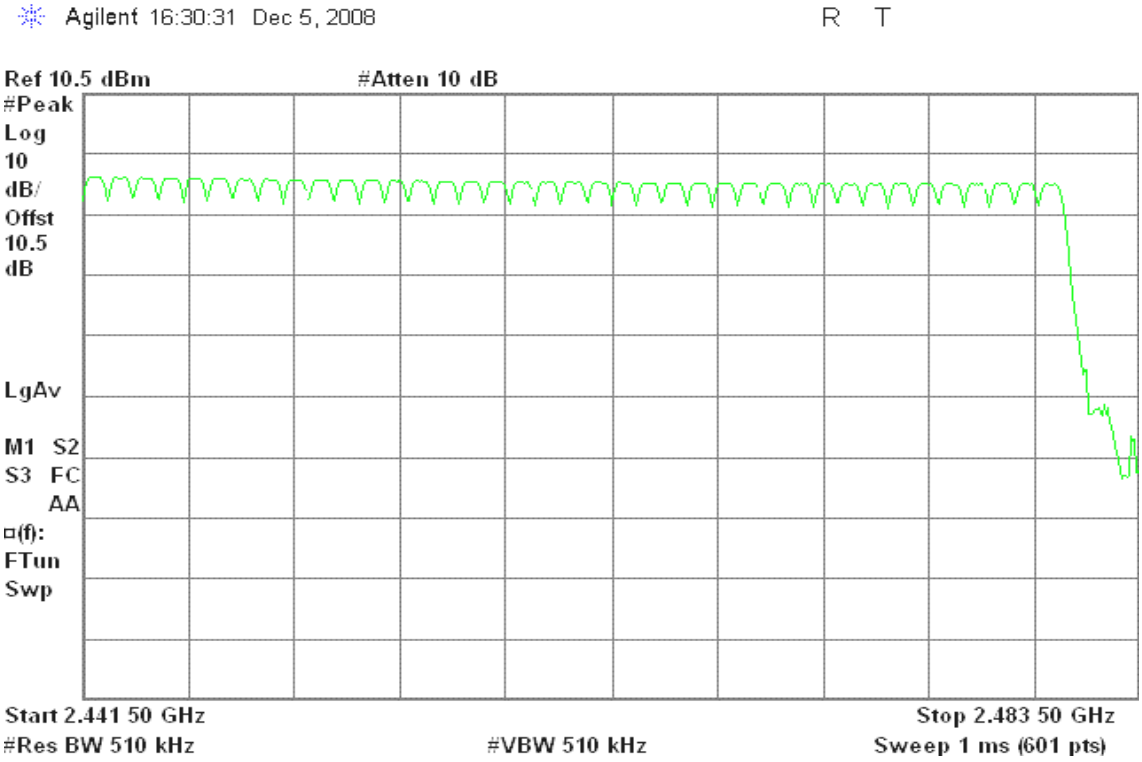
Test Plot

Channel Number

2.4 GHz – 2.4415 GHz



2.4415 GHz – 2.4835 GHz

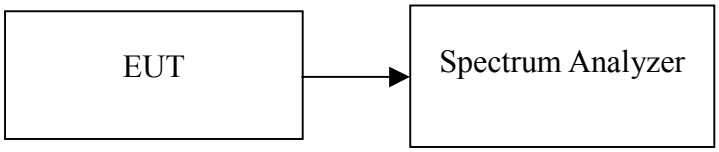


7.7TIME OF OCCUPANCY (DWELL TIME)

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.

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

DH 1

CH Low: 0.566 * (1600/2)/79 * 31.6 = 181.120 (ms)
CH Mid: 0.566 * (1600/2)/79 * 31.6 = 181.120 (ms)
CH High: 0.566 * (1600/2)/79 * 31.6 = 181.120 (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.566	181.120	31.60	400.00	PASS
Mid	0.566	181.120	31.60		PASS
High	0.566	181.120	31.60		PASS

DH 3

CH Low: 1.816 * (1600/4)/79 * 31.6 = 290.560 (ms)
CH Mid: 1.816 * (1600/4)/79 * 31.6 = 290.560 (ms)
CH High: 1.816 * (1600/4)/79 * 31.6 = 290.560 (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.816	290.560	31.60	400.00	PASS
Mid	1.816	290.560	31.60		PASS
High	1.816	290.560	31.60		PASS

DH 5

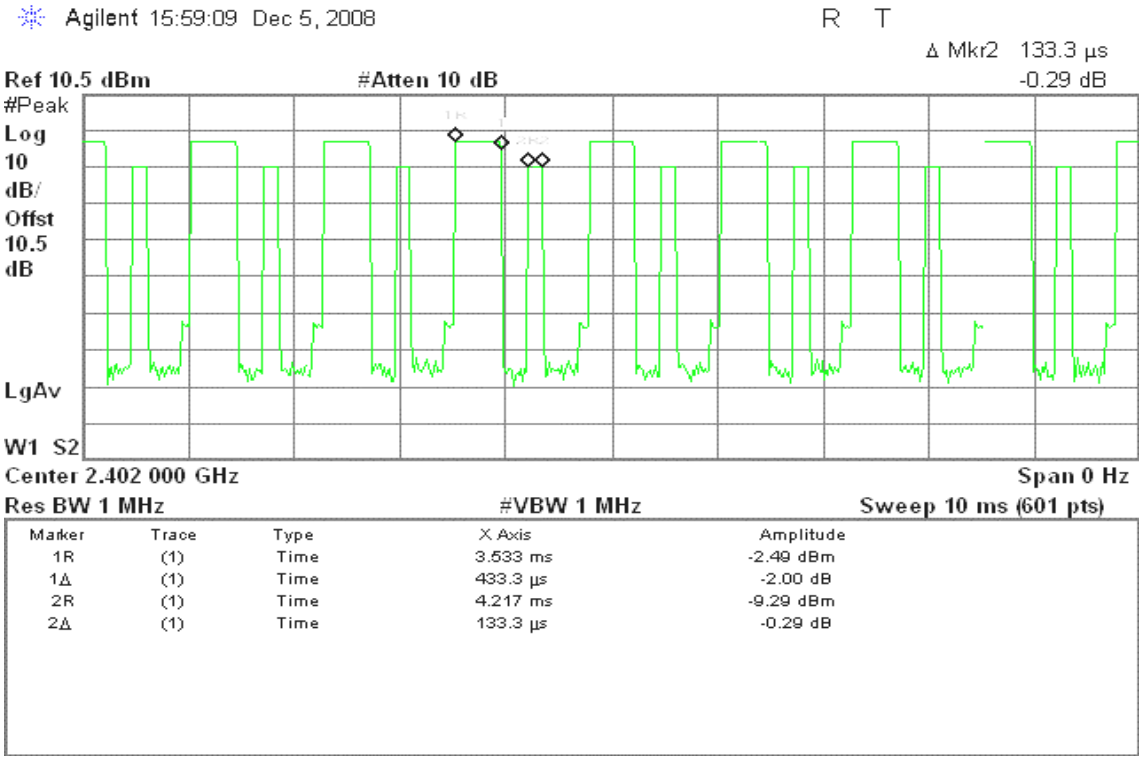
CH Low: 3.050 * (1600/6)/79 * 31.6 = 325.333 (ms)
CH Mid: 3.050 * (1600/6)/79 * 31.6 = 325.333 (ms)
CH High: 3.050 * (1600/6)/79 * 31.6 = 325.333 (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	3.050	325.333	31.60	400.00	PASS
Mid	3.050	325.333	31.60		PASS
High	3.050	325.333	31.60		PASS

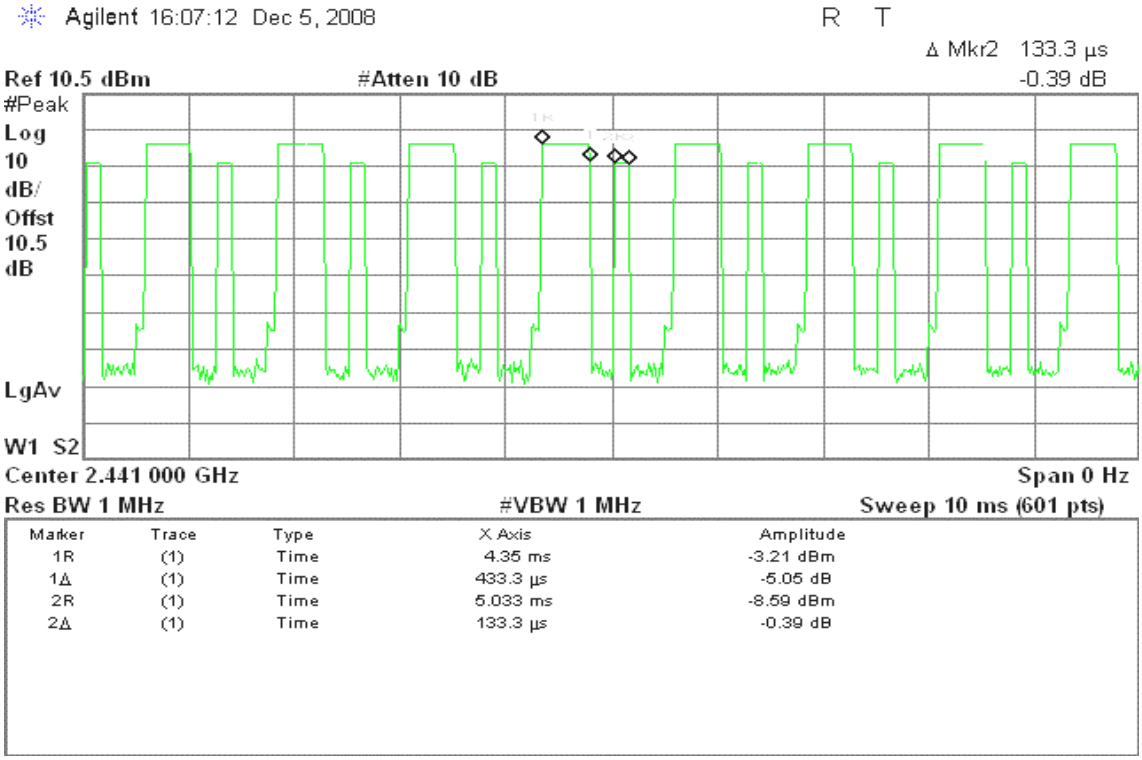
Test Plot

DH 1

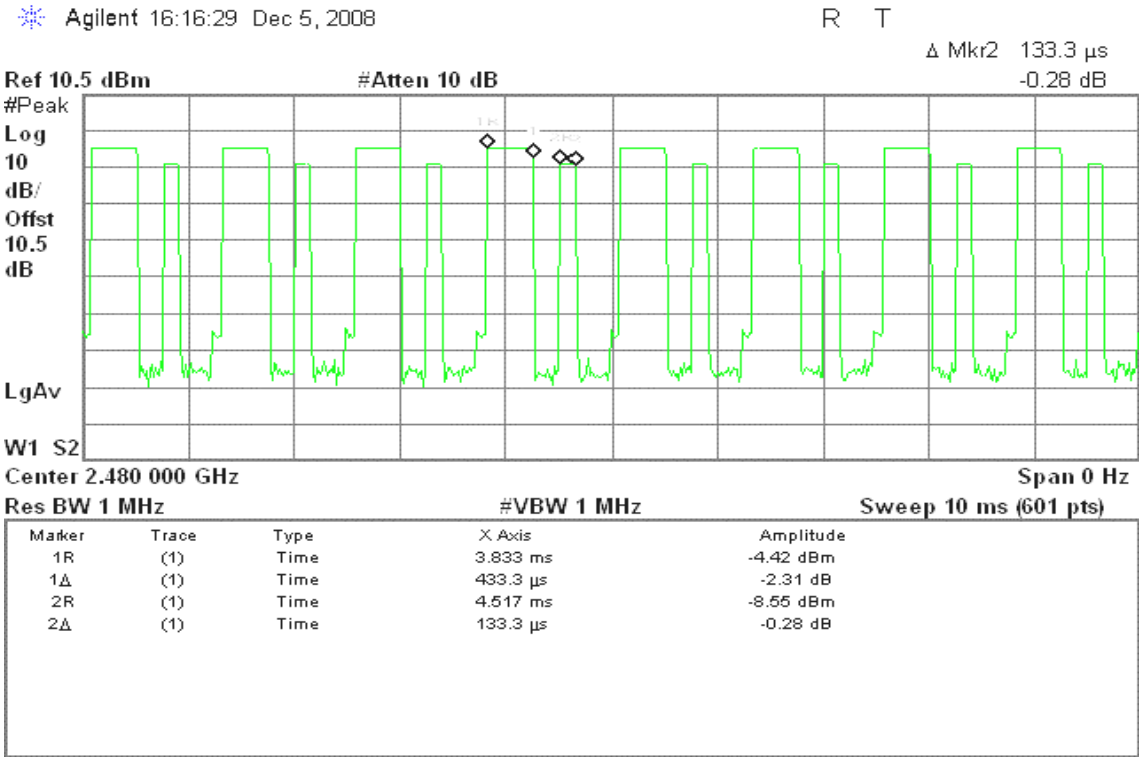
CH Low



CH Mid

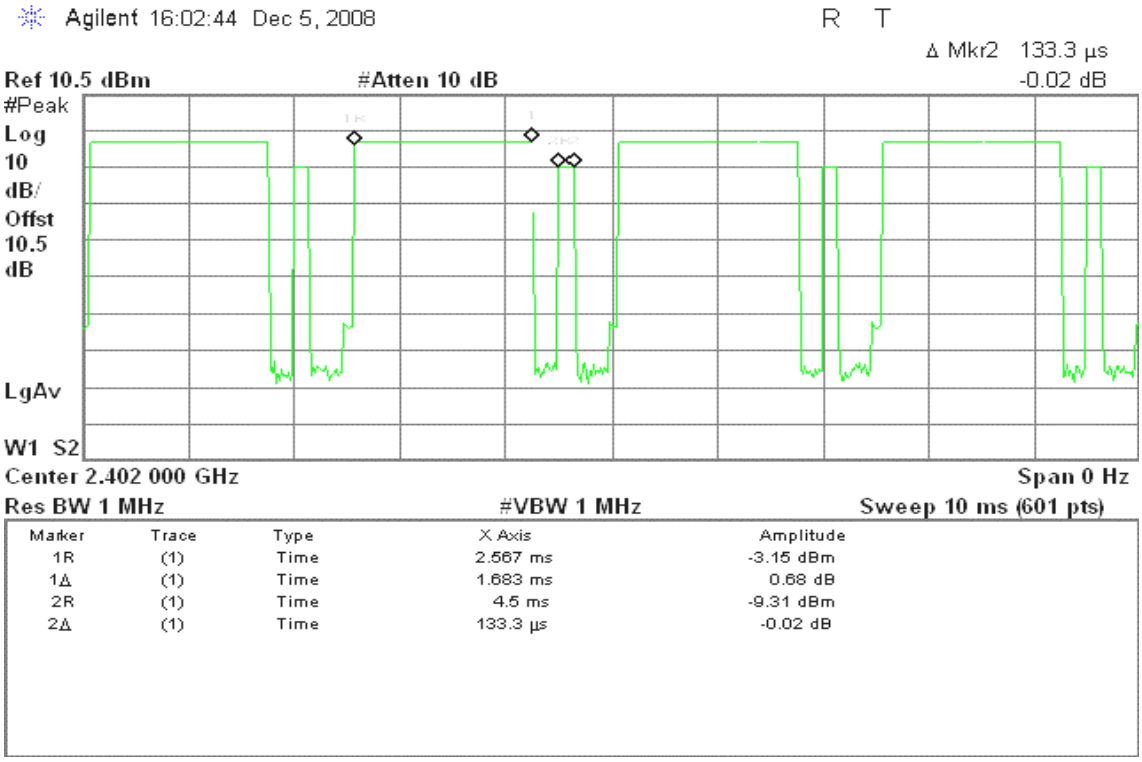


CH High

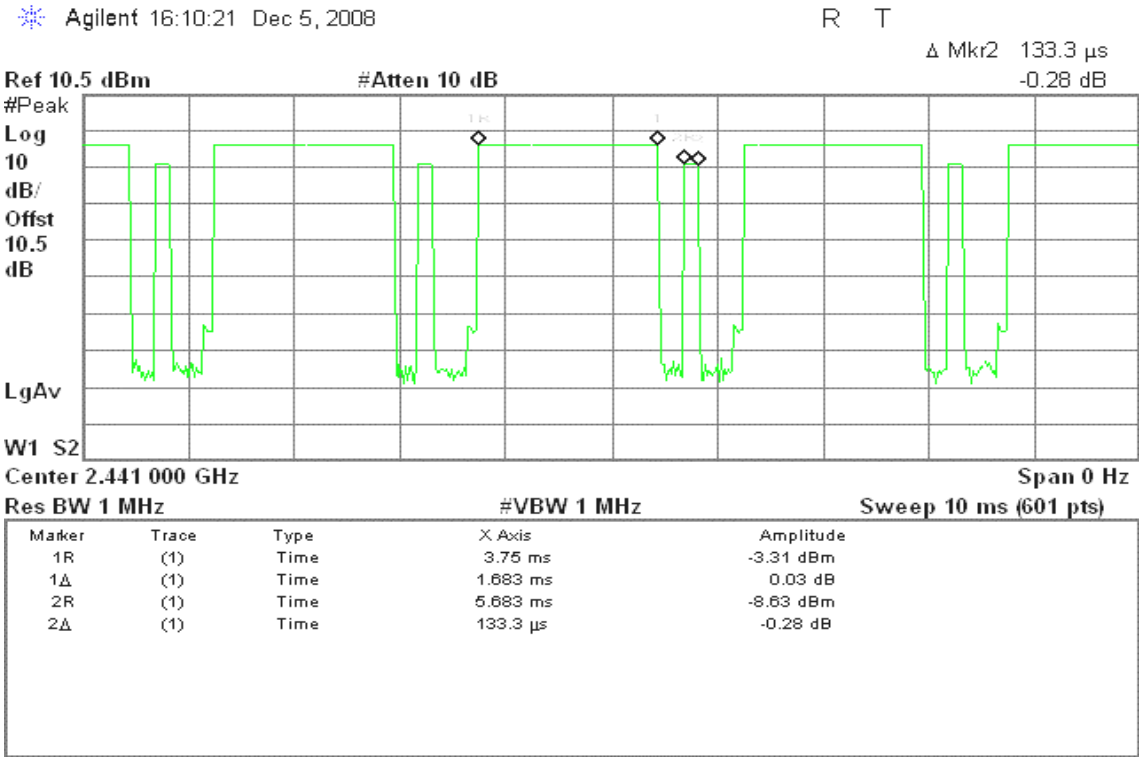


DH 3

CH Low

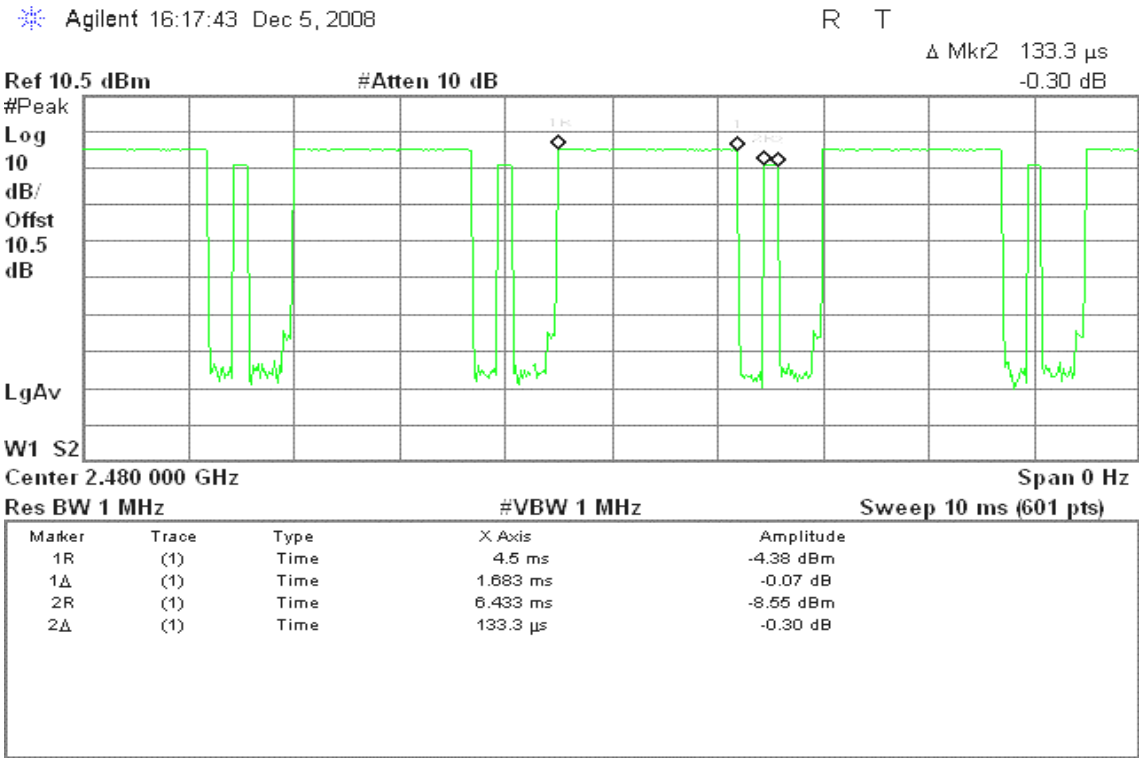


CH Mid



Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	3.75 ms	-3.31 dBm
1Δ	(1)	Time	1.683 ms	0.03 dB
2R	(1)	Time	5.683 ms	-8.63 dBm
2Δ	(1)	Time	133.3 µs	-0.28 dB

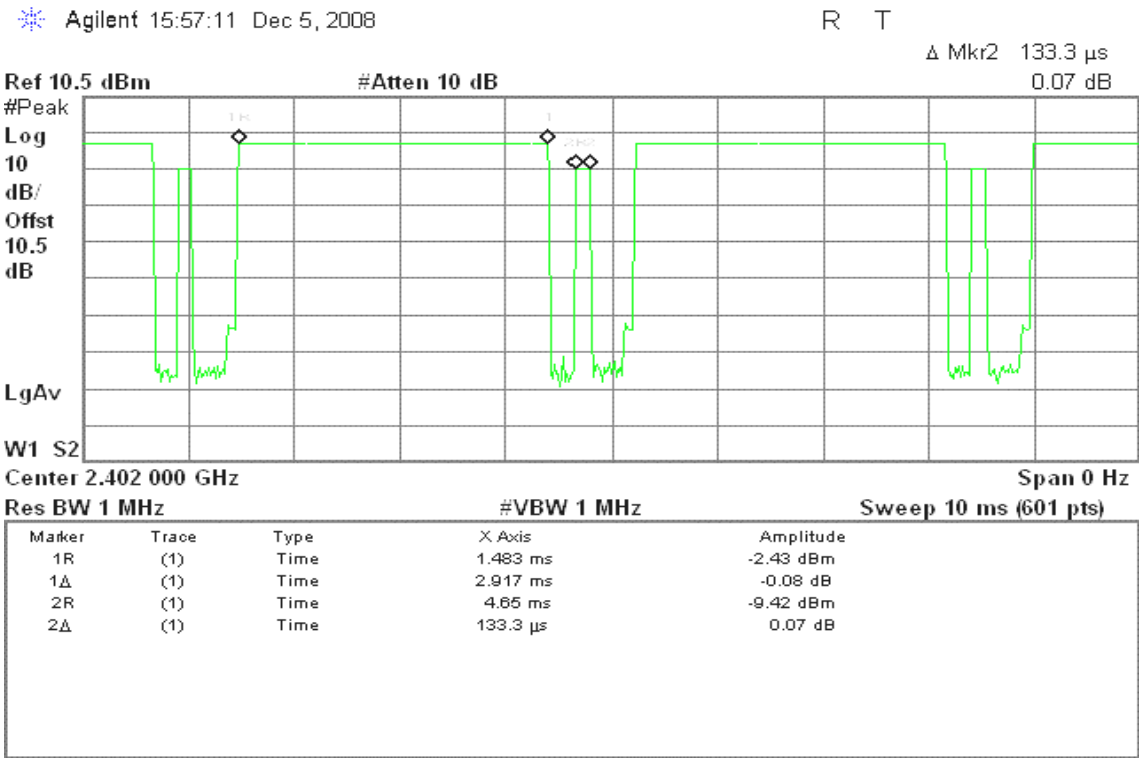
CH High



Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	4.5 ms	-4.38 dBm
1Δ	(1)	Time	1.683 ms	-0.07 dB
2R	(1)	Time	6.433 ms	-8.55 dBm
2Δ	(1)	Time	133.3 µs	-0.30 dB

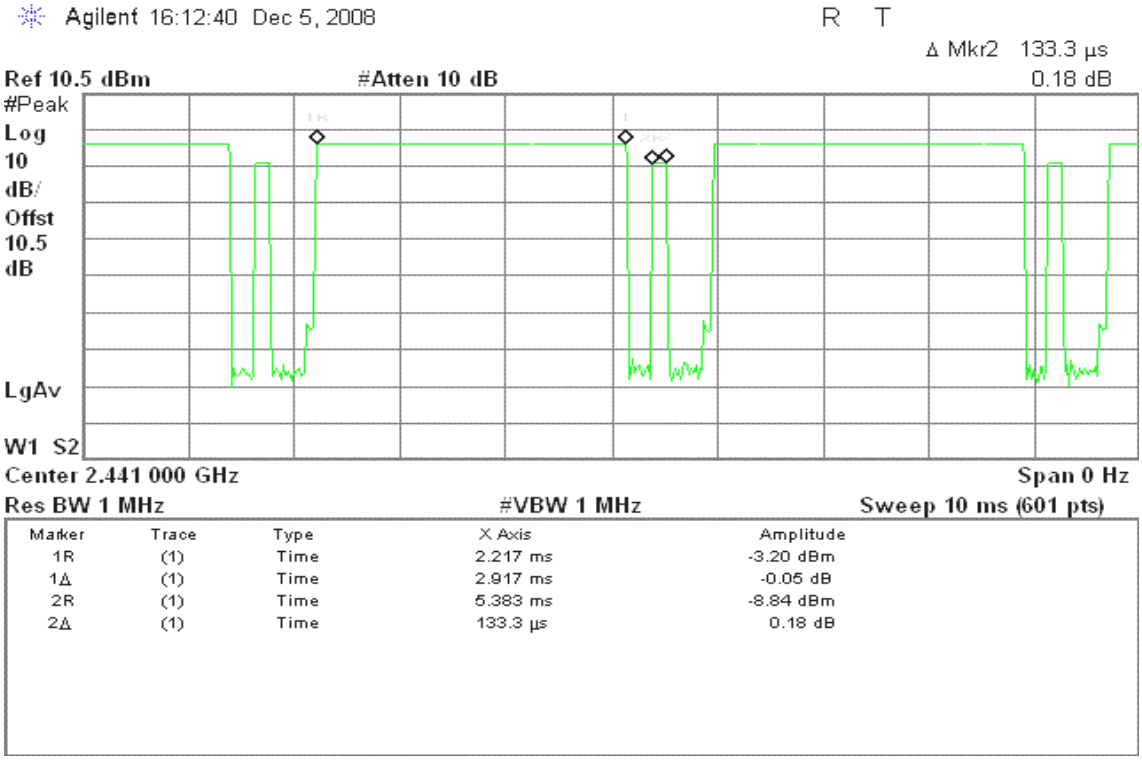
DH 5

CH Low



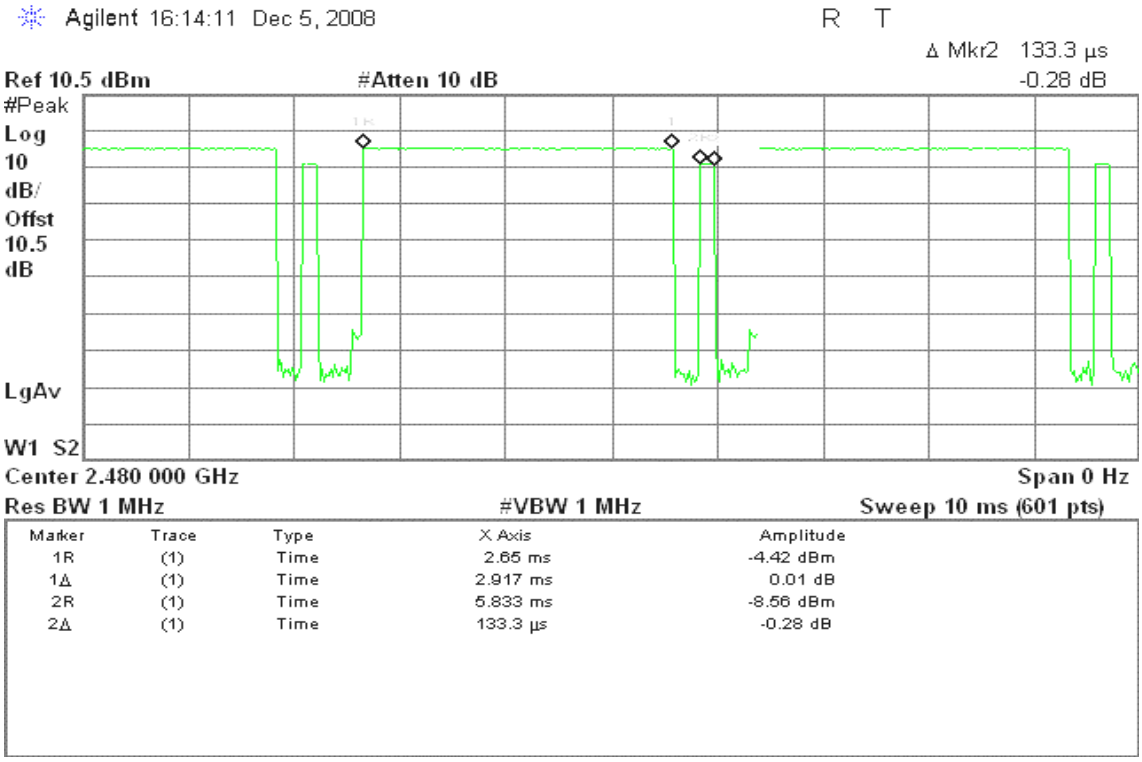
Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	1.483 ms	-2.43 dBm
1Δ	(1)	Time	2.917 ms	-0.08 dB
2R	(1)	Time	4.65 ms	-9.42 dBm
2Δ	(1)	Time	133.3 µs	0.07 dB

CH Mid



Marker	Trace	Type	X Axis	Amplitude
1R	(1)	Time	2.217 ms	-3.20 dBm
1Δ	(1)	Time	2.917 ms	-0.05 dB
2R	(1)	Time	5.383 ms	-8.84 dBm
2Δ	(1)	Time	133.3 µs	0.18 dB

CH High


Agilent 16:14:11 Dec 5, 2008
R T
Δ Mkr2 133.3 µs
-0.28 dB
Ref 10.5 dBm
#Atten 10 dB
#Peak
Log
10
dB/
Offst
10.5
dB
LgAv
W1 S2
Center 2.480 000 GHz
Span 0 Hz
Res BW 1 MHz
#VBW 1 MHz
Sweep 10 ms (601 pts)
Marker Trace Type X Axis Amplitude
1R (1) Time 2.65 ms -4.42 dBm
1Δ (1) Time 2.917 ms 0.01 dB
2R (1) Time 5.833 ms -8.56 dBm
2Δ (1) Time 133.3 µs -0.28 dB

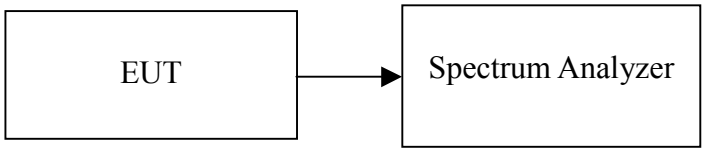
7.8SPURIOUS EMISSIONS

7.8.1 Conducted Measurement

LIMIT

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in 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. 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) (see Section 15.205(c)).

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.

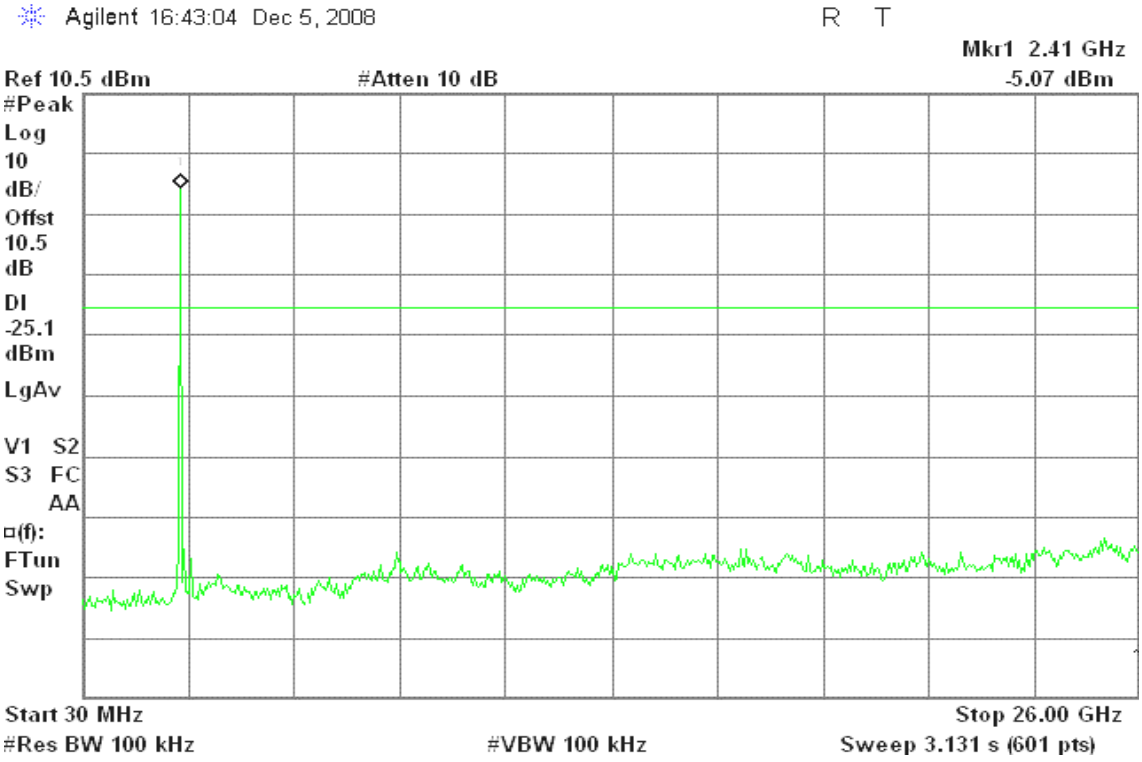
Measurements are made over the 30MHz to 26GHz range with the transmitter set to the lowest, middle, and highest channels.

TEST RESULTS

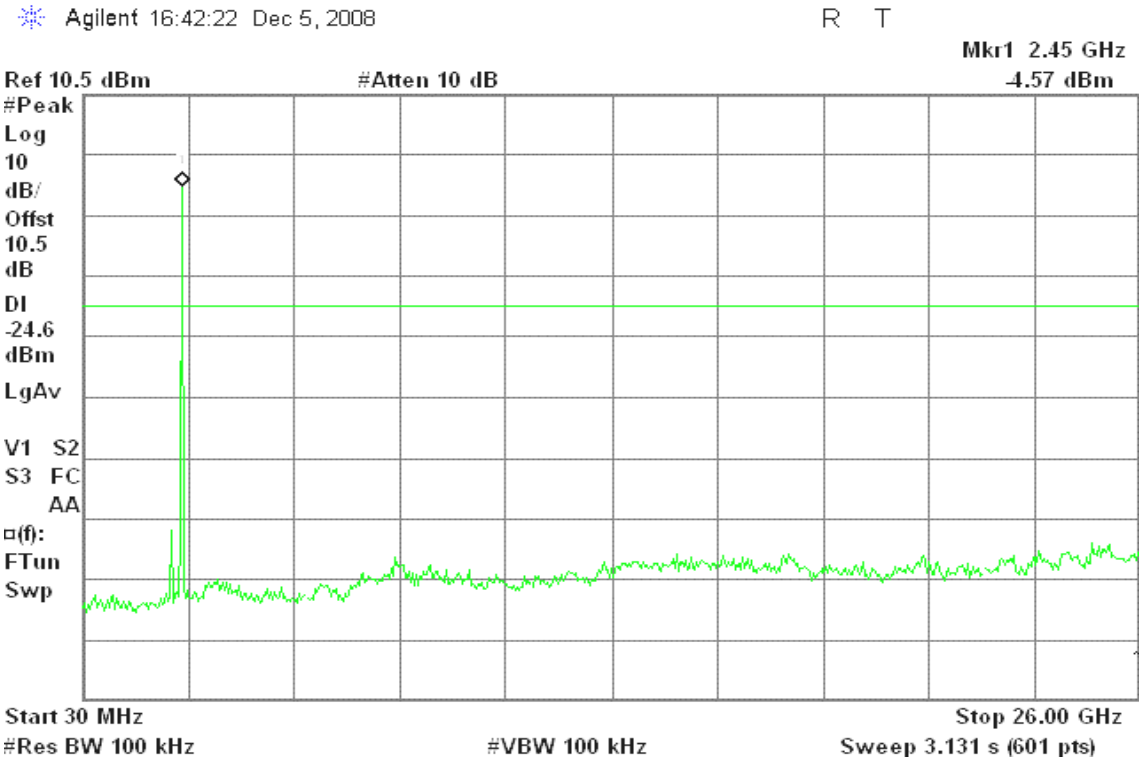
No non-compliance noted

Test Plot

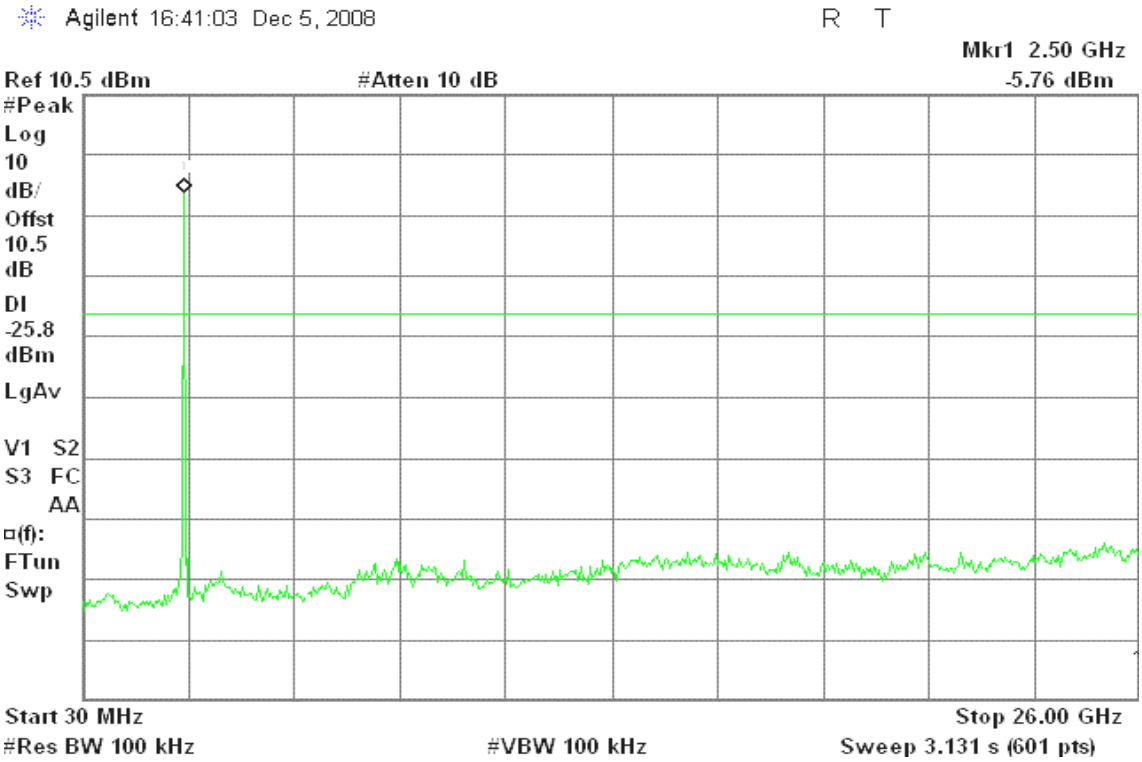
CH Low



CH Mid



CH High


Agilent 16:41:03 Dec 5, 2008
R T
Mkr1 2.50 GHz
Ref 10.5 dBm
#Atten 10 dB
-5.76 dBm
#Peak
Log
10
dB/
Offst
10.5
dB
Dl
-25.8
dBm
LgAv
V1 S2
S3 FC
AA
¤(f):
FTun
Swp
Start 30 MHz
Stop 26.00 GHz
#Res BW 100 kHz
#VBW 100 kHz
Sweep 3.131 s (601 pts)

7.8.2 Radiated Emissions

LIMIT

1. According to §15.209(a), 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 (μV/m)	Measurement Distance (m)
30-88	100*	3
88-216	150*	3
216-960	200*	3
Above 960	500	3

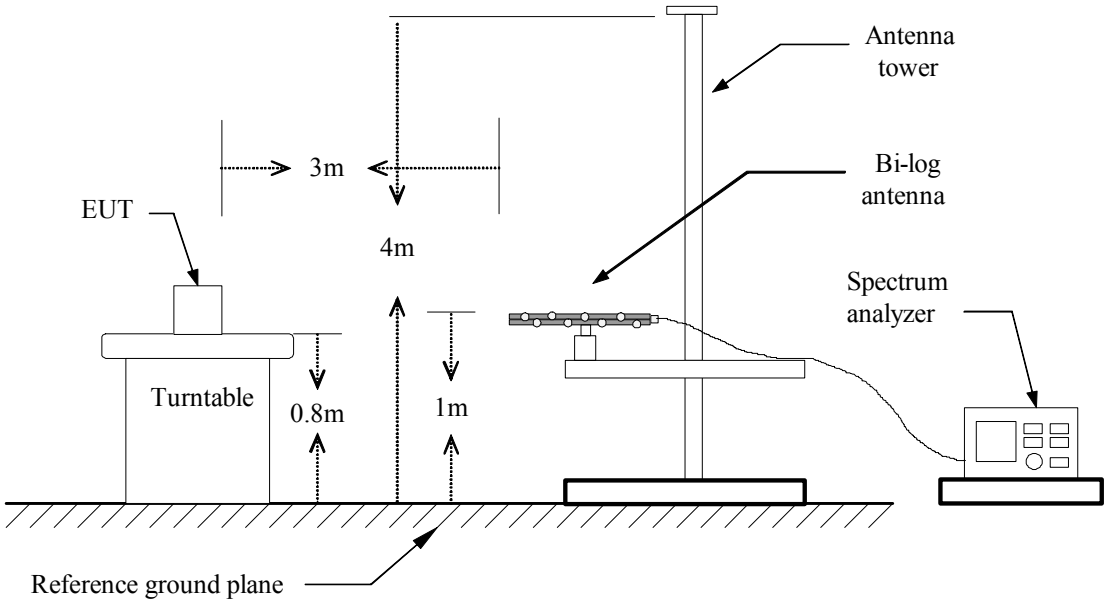
Remark: *Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of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

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

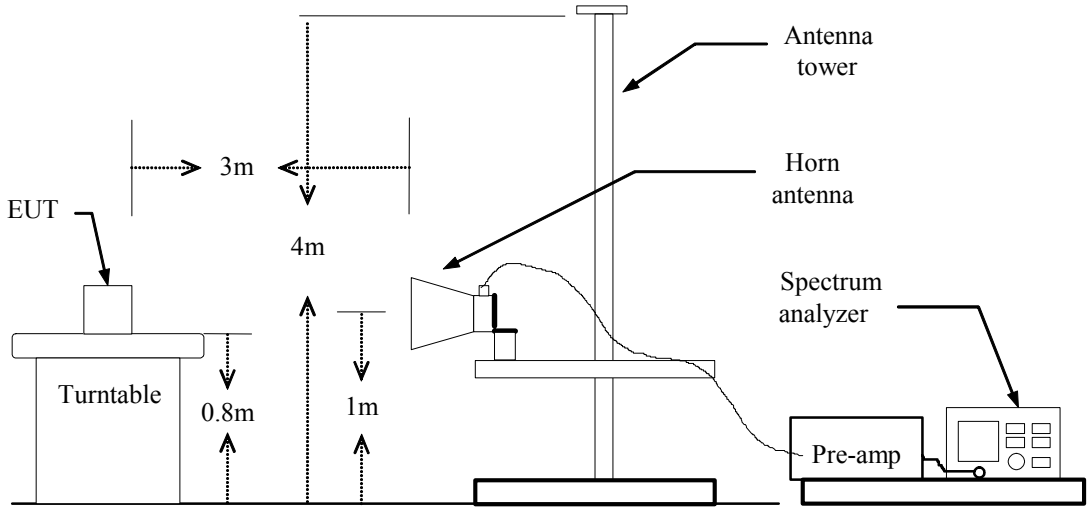
Frequency (MHz)	Field Strength (μV/m at 3-meter)	Field Strength (dBμV/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

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. Set the spectrum analyzer in the following setting as:

   Below 1GHz:

   RBW=100kHz / VBW=300kHz / Sweep=AUTO

   Above 1GHz:

   (a) PEAK: RBW=VBW=1MHz / Sweep=AUTO

   (b) AVERAGE: RBW=1MHz / VBW=10Hz / Sweep=AUTO
7. Repeat above procedures until the measurements for all frequencies are complete.

Below 1 GHz

Operation Mode: Normal Link **Test Date:** January 7, 2009

Temperature: 23°C **Tested by:** Mimic Yang

Humidity: 53 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (dBuV)	Correction Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
52.63	V	46.03	-13.80	32.23	40.00	-7.77	QP
133.47	V	38.28	-8.81	29.47	43.50	-14.03	Peak
266.03	V	42.88	-9.12	33.76	46.00	-12.24	Peak
400.22	V	34.79	-6.05	28.75	46.00	-17.25	Peak
799.53	V	29.98	0.42	30.40	46.00	-15.60	Peak
933.72	V	32.39	1.40	33.79	46.00	-12.21	Peak
107.60	H	37.37	-11.53	25.84	43.50	-17.66	Peak
133.47	H	44.29	-8.81	35.47	43.50	-8.03	Peak
256.33	H	41.37	-9.49	31.88	46.00	-14.12	Peak
266.03	H	44.74	-9.12	35.62	46.00	-10.38	Peak
400.22	H	40.69	-6.05	34.65	46.00	-11.35	Peak
933.72	H	36.19	1.40	37.59	46.00	-8.41	Peak

Remark:

1. *No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).*
2. *Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.*
3. *Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.*
4. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
5. *Margin (dB) = Remark result (dBuV/m) – Quasi-peak limit (dBuV/m).*

Above 1 GHz

Operation Mode: TX / CH Low **Test Date:** January 7, 2009

Temperature: 23°C **Tested by:** Mimic Yang

Humidity: 53 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1020.00	V	60.93	---	-9.49	51.43	---	74.00	54.00	-2.57	Peak
2663.33	V	60.22	39.45	-2.20	58.02	37.25	74.00	54.00	-16.75	AVG
4800.00	V	57.62	49.69	0.40	58.02	50.09	74.00	54.00	-3.91	AVG
N/A										
1026.67	H	60.16	---	-9.48	50.68	---	74.00	54.00	-3.32	Peak
4800.00	H	55.21	45.87	0.40	55.61	46.27	74.00	54.00	-7.73	AVG
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / CH Mid **Test Date:** January 7, 2009

Temperature: 23°C **Tested by:** Mimic Yang

Humidity: 53 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1016.67	V	61.01	---	-9.50	51.51	---	74.00	54.00	-2.49	Peak
2660.00	V	59.11	39.43	-2.21	56.90	37.22	74.00	54.00	-16.78	AVG
4883.33	V	51.33	---	0.22	51.55	---	74.00	54.00	-2.45	Peak
N/A										
1330.00	H	54.85	---	-8.76	46.09	---	74.00	54.00	-7.91	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

Operation Mode: TX / CH High **Test Date:** January 7, 2009

Temperature: 23°C **Tested by:** Mimic Yang

Humidity: 53 % RH **Polarity:** Ver. / Hor.

Frequency (MHz)	Ant.Pol. (H/V)	Reading (Peak) (dBuV)	Reading (Average) (dBuV)	Correction Factor (dB/m)	Result (Peak) (dBuV/m)	Result (Average) (dBuV/m)	Limit (Peak) (dBuV/m)	Limit (Average) (dBuV/m)	Margin (dB)	Remark
1023.33	V	60.02	---	-9.49	50.54	---	74.00	54.00	-3.46	Peak
1043.33	V	59.82	---	-9.44	50.38	---	74.00	54.00	-3.62	Peak
2656.67	V	59.63	39.30	-2.22	57.41	37.08	74.00	54.00	-16.92	AVG
N/A										
1040.00	H	58.79	---	-9.45	49.34	---	74.00	54.00	-4.66	Peak
N/A										

Remark:

1. *Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.*
2. *Radiated emissions measured in frequency above 1000MHz were made with an instrument using peak/average detector mode.*
3. *Average test would be performed if the peak result were greater than the average limit or as required by the applicant.*
4. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*
5. *Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A " remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable limit) and considered that's already beyond the background noise floor.*
6. *Margin (dB) = Remark result (dBuV/m) – Average limit (dBuV/m).*

7.9POWERLINE CONDUCTED EMISSIONS

LIMIT

According to §15.207(a), except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that 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 the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits (dBμV)	
	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

***** *Decreases with the logarithm of the frequency.*

Test Configuration

See test photographs attached in Appendix II 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

Operation Mode: Normal Link **Test Date:** November 27, 2008

Temperature: 20°C **Tested by:** Tony Tsai

Humidity: 57% RH

Freq. (MHz)	QP Reading (dBuV)	AV Reading (dBuV)	Corr. factor (dB)	QP Result (dBuV)	AV Result (dBuV)	QP Limit (dBuV)	AV Limit (dBuV)	QP Margin (dB)	AV Margin (dB)	Note
0.3258	27.89	20.69	9.71	37.60	30.40	59.56	49.56	-21.96	-19.16	L1
0.3688	33.69	26.49	9.71	43.40	36.20	58.53	48.53	-15.13	-12.33	L1
0.4078	37.40	29.70	9.70	47.10	39.40	57.69	47.69	-10.59	-8.29	L1
0.8688	26.49	18.39	9.61	36.10	28.00	56.00	46.00	-19.90	-18.00	L1
2.1344	27.98	20.08	9.72	37.70	29.80	56.00	46.00	-18.30	-16.20	L1
2.8844	23.97	15.57	9.73	33.70	25.30	56.00	46.00	-22.30	-20.70	L1
0.3727	31.89	22.59	9.61	41.50	32.20	58.44	48.44	-16.94	-16.24	L2
0.4039	35.41	25.31	9.69	45.10	35.00	57.77	47.77	-12.67	-12.77	L2
1.6852	24.32	14.22	9.68	34.00	23.90	56.00	46.00	-22.00	-22.10	L2
1.8727	24.70	15.20	9.70	34.40	24.90	56.00	46.00	-21.60	-21.10	L2
2.0914	23.69	15.69	9.71	33.40	25.40	56.00	46.00	-22.60	-20.60	L2
4.5758	22.70	14.00	9.80	32.50	23.80	56.00	46.00	-23.50	-22.20	L2

Remark:

1. *Measuring frequencies from 0.15 MHz to 30MHz.*
2. *The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Quasi-peak detector and average detector.*
3. *The IF bandwidth of SPA between 0.15MHz and 30MHz was 10kHz; the IF bandwidth of Test Receiver between 0.15MHz and 30MHz was 9kHz;*
4. *L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)*
5. *"-" means Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.*

Test Plots

Conducted emissions (Line 1)

Conducted emissions (Line 2)