



**FCC 47 CFR PART 15 SUBPART C**

**TEST REPORT**

**For**

**2.1 Portable Stereo Bluetooth Speaker**

**Model: BT-328**

**Trade Name: Artdio , kinyo**

*Prepared for*

**KINYO CO., LTD.**

**NO.476 MING HU ROAD, HSIN CHU CITY, TAIWAN, R.O.C.**

*Prepared by*

**COMPLIANCE CERTIFICATION SERVICES (SHENZHEN) INC.**

**(aka COMPLIANCE ENGINEERING SERVICE (CHINA))**

**NO. 5, JINAO INDUSTRIAL PARK, NO. 35 JUKENG ROAD,**

**DASHUIKENG VILLAGE, GUANLAN TOWN, BAOAN**

**DISTRICT, SHENZHEN, CHINA**

**TEL: 86-755-28055000**

**FAX: 86-755-28055221**



---

***Note:** This report shall not be reproduced except in full, without the written approval of Compliance Certification Services Inc. This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document*



## TABLE OF CONTENTS

<b>1. TEST RESULT CERTIFICATION.....</b>	<b>3</b>
<b>2. EUT DESCRIPTION .....</b>	<b>4</b>
<b>3. TEST METHODOLOGY .....</b>	<b>5</b>
3.1 EUT CONFIGURATION .....	5
3.2 EUT EXERCISE .....	5
3.3 GENERAL TEST PROCEDURES .....	5
3.4 FCC PART 15.205 RESTRICTED BANDS OF OPERATIONS .....	6
3.5 DESCRIPTION OF TEST MODES .....	6
<b>4. INSTRUMENT CALIBRATION.....</b>	<b>7</b>
<b>5. FACILITIES AND ACCREDITATIONS .....</b>	<b>8</b>
5.1 FACILITIES .....	8
5.2 EQUIPMENT .....	8
5.3 LABORATORY ACCREDITATIONS AND LISTING .....	8
<b>6. SETUP OF EQUIPMENT UNDER TEST .....</b>	<b>9</b>
6.1 SETUP CONFIGURATION OF EUT .....	9
6.2 SUPPORT EQUIPMENT .....	9
<b>7. FCC PART 15.247 REQUIREMENTS.....</b>	<b>10</b>
7.1 PEAK POWER .....	10
7.2 PEAK POWER SPECTRAL DENSITY .....	11
7.3 BAND EDGES MEASUREMENT .....	14
7.4 FREQUENCY SEPARATION .....	19
7.5 NUMBER OF HOPPING FREQUENCY.....	22
7.6 SPURIOUS EMISSIONS .....	24
7.7 POWERLINE CONDUCTED EMISSIONS .....	46
<b>APPENDIX 1 PHOTOGRPHS OF TEST SETUP.....</b>	<b>48</b>



## 1. TEST RESULT CERTIFICATION

**Applicant:** KINYO CO.,LTD.  
No 476 Ming Hu Road Hsin Chu City Taiwan,R.O.C.

**Equipment Under Test:** 2.1 Portable Stereo Bluetooth Speaker

**Trade Name:** Artdio , kinyo

**Model:** BT-328

**Date of Test:** December 22,2007-February 22, 2008

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 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:**

---

Clinton Kao  
Manager  
Compliance Certification Service Inc.

**Reviewed by:**

---

Vincent Yao  
Assistant manager  
Compliance Certification Service Inc.



## 2. EUT DESCRIPTION

<b>Product</b>	2.1 Portable Stereo Bluetooth Speaker
<b>Trade Name</b>	Artdio , kinyo
<b>Model Number</b>	BT-328
<b>Model Discrepancy</b>	N/A
<b>Power Supply</b>	AC120V/60Hz AC Input Cable: Un-shielded, 1.60m
<b>Frequency Range</b>	2402 ~ 2480 MHz
<b>Transmit Power</b>	-3.26 dBm
<b>Modulation Technique</b>	FHSS
<b>Number of Channels</b>	79 Channels
<b>Antenna Specification</b>	PCB Antenna Gain: 3 dBi (max)
<b>Temperature Range</b>	0 ~ +55°C

**Note:** This submittal(s) (test report) is intended for FCC ID: VF6ARTDIOBT328 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. Radiated testing was performed at an antenna to EUT distance 3 meters.

#### **3.1 EUT 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.

#### **3.2 EUT 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.

#### **3.3 GENERAL 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 max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4: 2003.

### 3.4 FCC 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
<sup>1</sup> 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	( <sup>2</sup> )
13.36 - 13.41	322 - 335.4		

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> 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.

### 3.5 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.

Channel low, mid and high with highest data rate (worst case) are chosen for full testing.

The field strength of spurious radiation emission was measured in the following position: EUT stand-up position (Y mode) and lie-down position (X, Z mode) The following data show only the worst case setup.

The worst case (X axis) was reported.



## **4. 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.



## **5. FACILITIES AND ACCREDITATIONS**

### **5.1 FACILITIES**

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

No. 5, Jinao industrial park, No.35 Jukeng Road, Dashuikeng Village, Guanlan Town, Baoan District, Shenzhen, China

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4: 2003 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."

### **5.3 LABORATORY ACCREDITATIONS AND LISTING**

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

<b>USA</b>	<b>FCC</b>
<b>Japan</b>	<b>VCCI</b>
<b>Canada</b>	<b>INDUSTRY CANADA,</b>
<b>Taiwan</b>	<b>TAF, BSMI</b>

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





## 6. SETUP OF EQUIPMENT UNDER TEST

### 6.1 SETUP CONFIGURATION OF EUT

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

### 6.2 SUPPORT EQUIPMENT

No.	Equipment	Model No.	Serial No.	FCC ID	Trade Name	Data Cable	Power Cord
1	Mouse	C324	N/A	N/A	LENOVO	Shielded 1.50m	N/A
2	PC	M4600C	NS04619689NS16052619	N/A	LENOVO	Shielded 1.50m	Shielded 1.80m
3	Keyboard	N/A	2D505000B	N/A	DELL	Shielded 1.50m	N/A
4	Printer	P310B	C41344000NK02520275	N/A	EPSON	Shielded 1.50m	Shielded 1.80m
5	Modem	SUPERFAX6.0	9013593	IFXDM1414	ACEEX	Shielded 1.50m	Unshielded 1.80m
6	Monitor	CPD-220	2404330	N/A	SONY	Shielded 1.50m	Shielded 1.80m
7	Saitek i-250	DM08	N/A	QIWDM08	N/A	N/A	N/A

**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.*



## 7. FCC PART 15.247 REQUIREMENTS

### 7.1 PEAK POWER

#### LIMIT

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

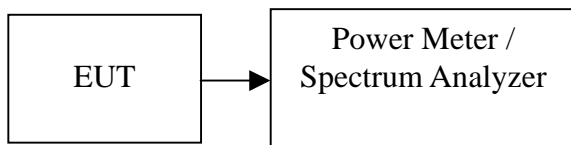
1. For systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz: 1 watt.
2. Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional 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 6 dBi.

#### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
RF Power Meter & Sensor	Anritsu	ML2487A	6K00001491	02/23/2009

**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 Data

Channel	Frequency (MHz)	Reading Power (dBm)	Factor (dB)	Output Power (dBm)	Output Power (W)	Limit (W)	Result
Low	2402	-4.92	1.0	-3.92	0.00041	1	PASS
Md	2441	-4.26	1.0	-3.26	0.00047		PASS
Hgh	2480	-4.36	1.0	-3.36	0.00046		PASS



## 7.2 PEAK POWER SPECTRAL DENSITY

### LIMIT

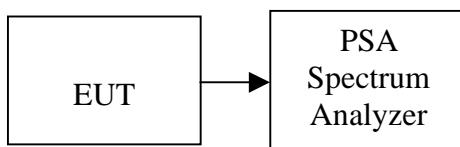
1. For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
2. The direct sequence operating of the hybrid system, with the frequency hopping 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	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300399	02/08/2009

*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

*No non-compliance noted*

#### Test Data

Channel	Frequency	Reading (dBm)	Factor (dB)	PPSD (dBm)	Limit (dBm)	Result
Low	2402	-15.72	2.00	-13.72	8.00	PASS
Mid	2441	-15.69	2.00	-13.69		PASS
High	2480	-16.51	2.00	-14.51		PASS



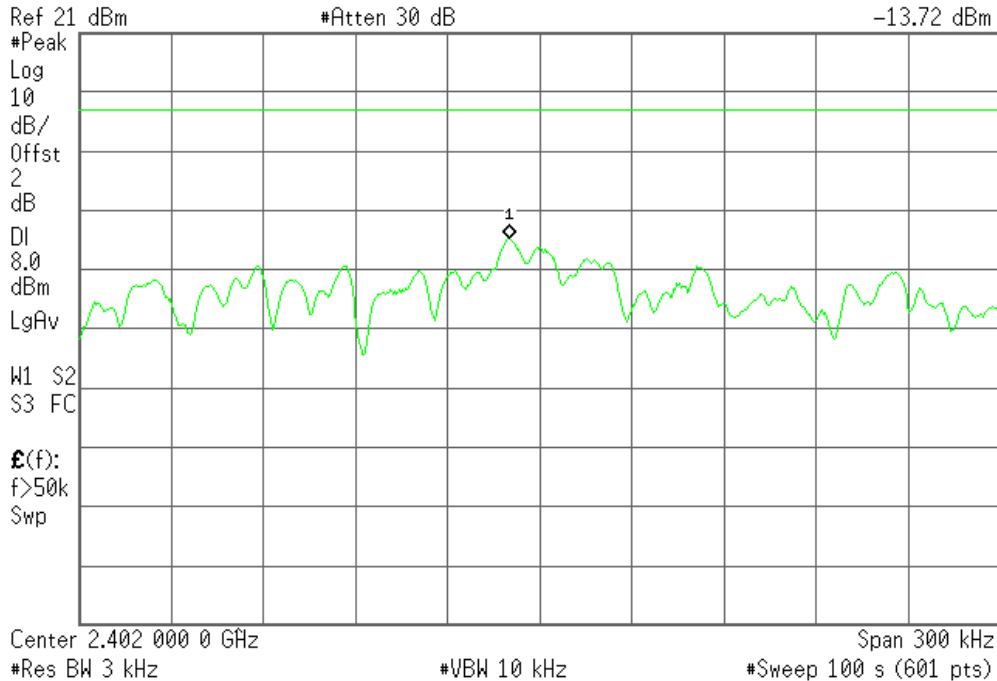
## Test Plot

### PPSD (CH Low)

Agilent 22:02:51 Jan 24, 2008

R T

Mkr1 2.401 990 0 GHz  
-13.72 dBm

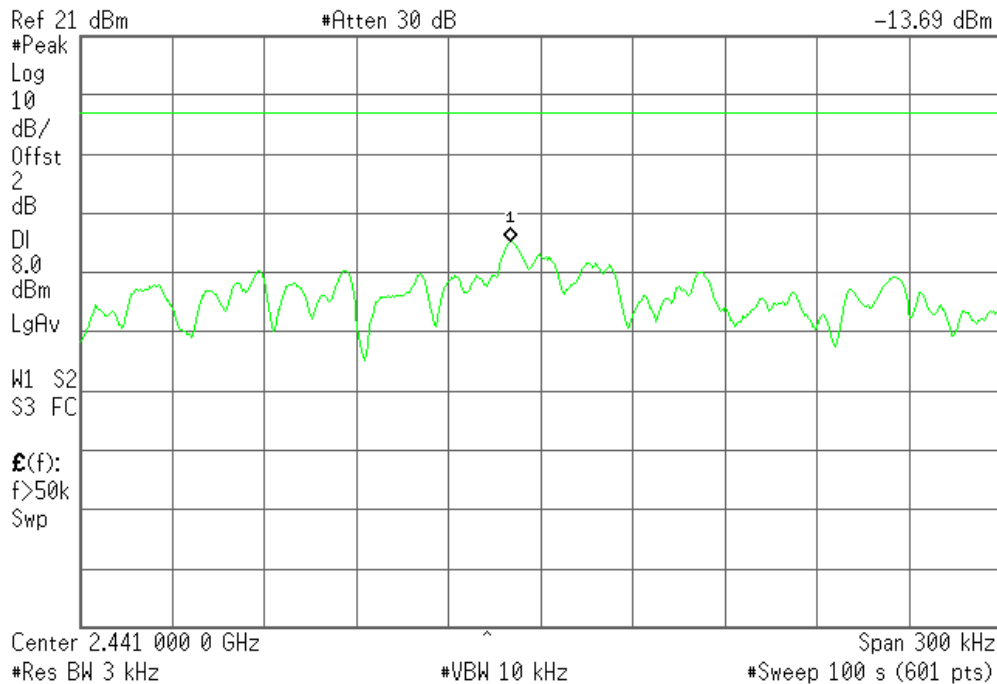


### PPSD (CH Mid)

Agilent 22:00:31 Jan 24, 2008

R T

Mkr1 2.440 990 0 GHz  
-13.69 dBm





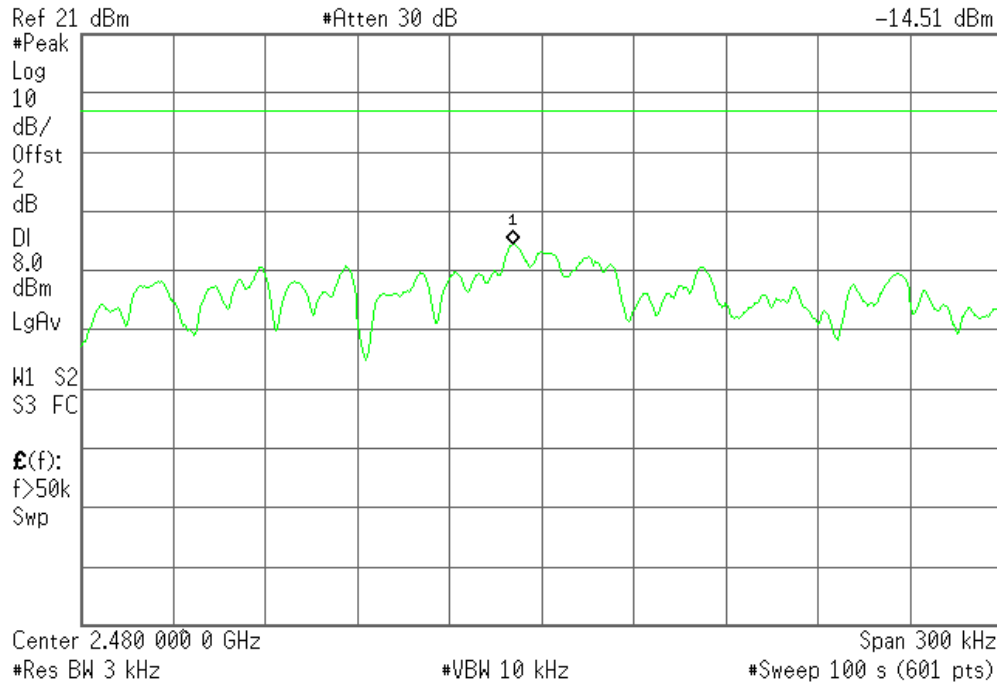
## PPSD (CH High)

Agilent 21:57:43 Jan 24, 2008

R T

Mkr1 2.479 990 5 GHz

-14.51 dBm



## 7.3 BAND EDGES MEASUREMENT

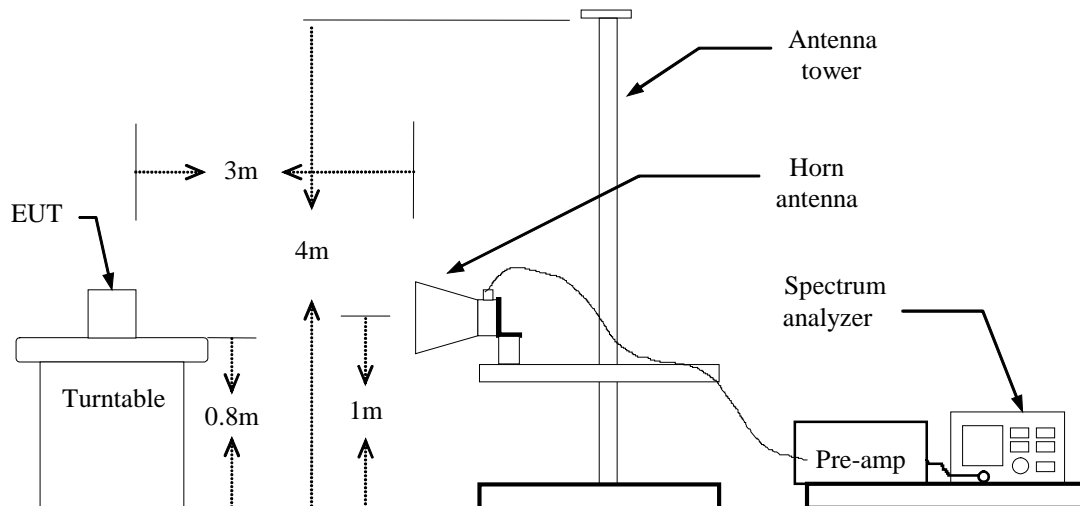
### LIMIT

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

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300399	02/08/2009

### 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

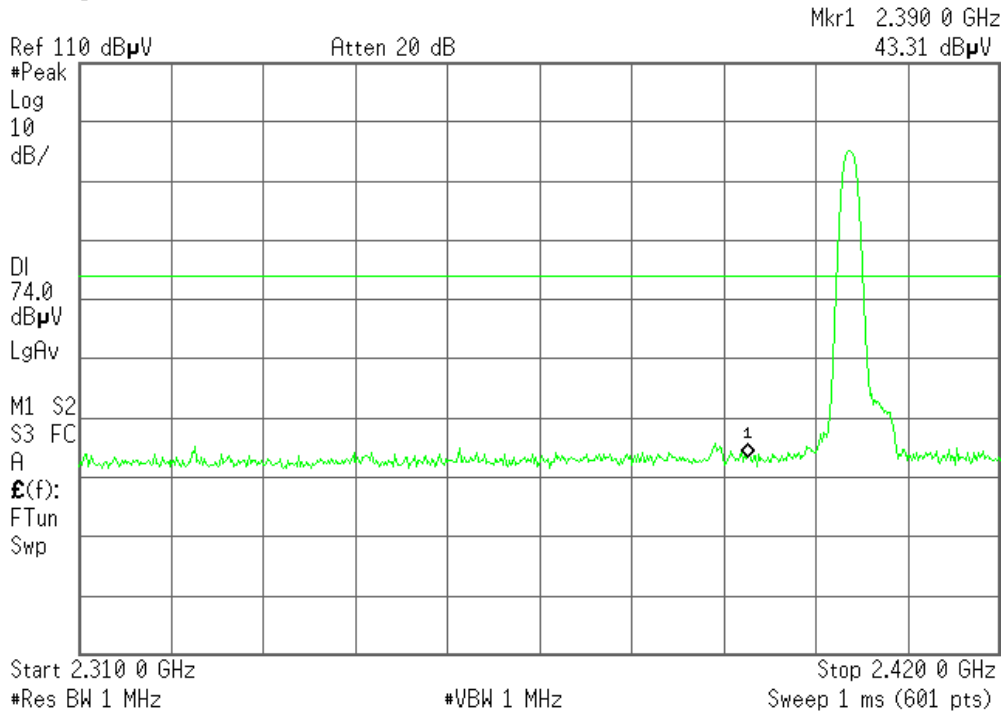
### Band Edges (CH-Low)

Detector mode: Peak

Polarity: Vertical

Agilent 08:29:43 Jan 24, 2008

R T

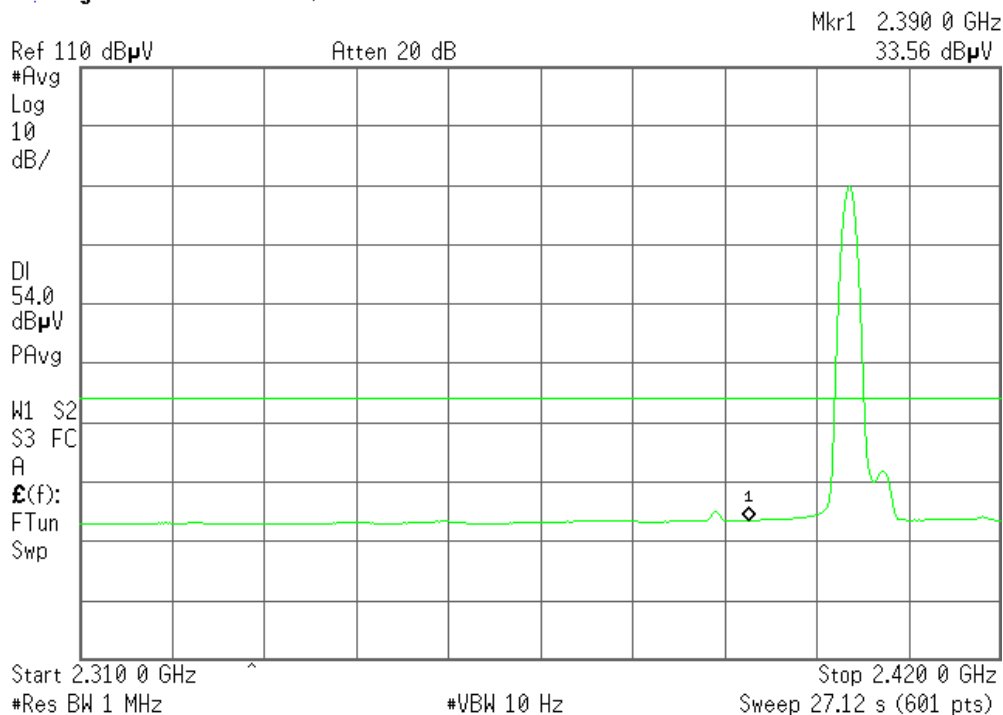


Detector mode: Average

Polarity: Vertical

Agilent 08:30:33 Jan 24, 2008

R T



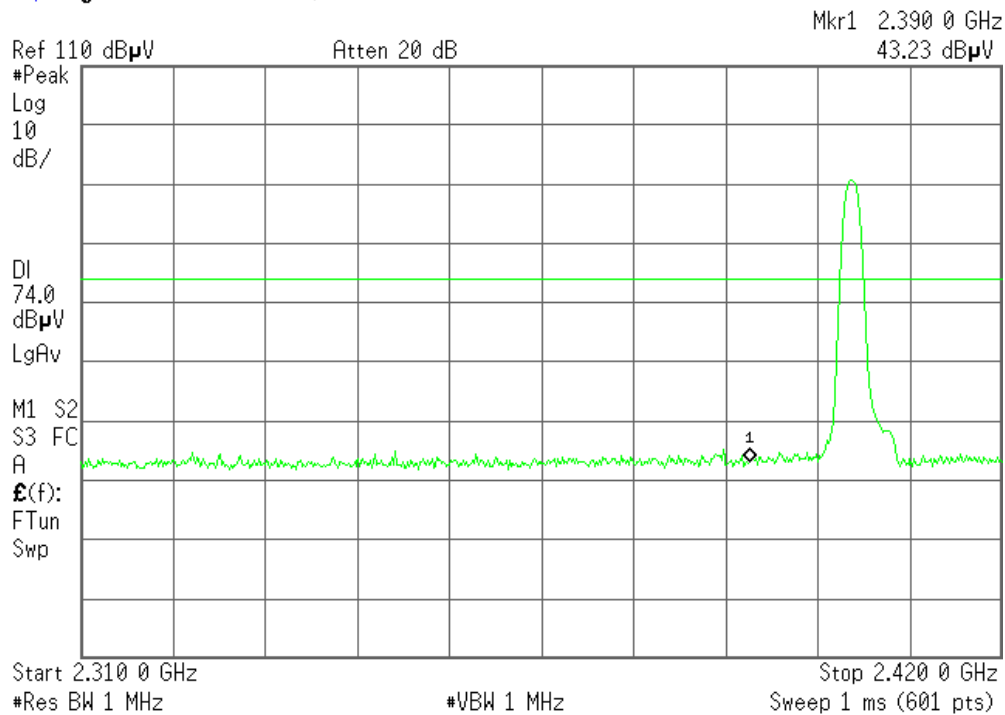


**Detector mode: Peak**

**Polarity: Horizontal**

Agilent 08:14:54 Jan 24, 2008

R T

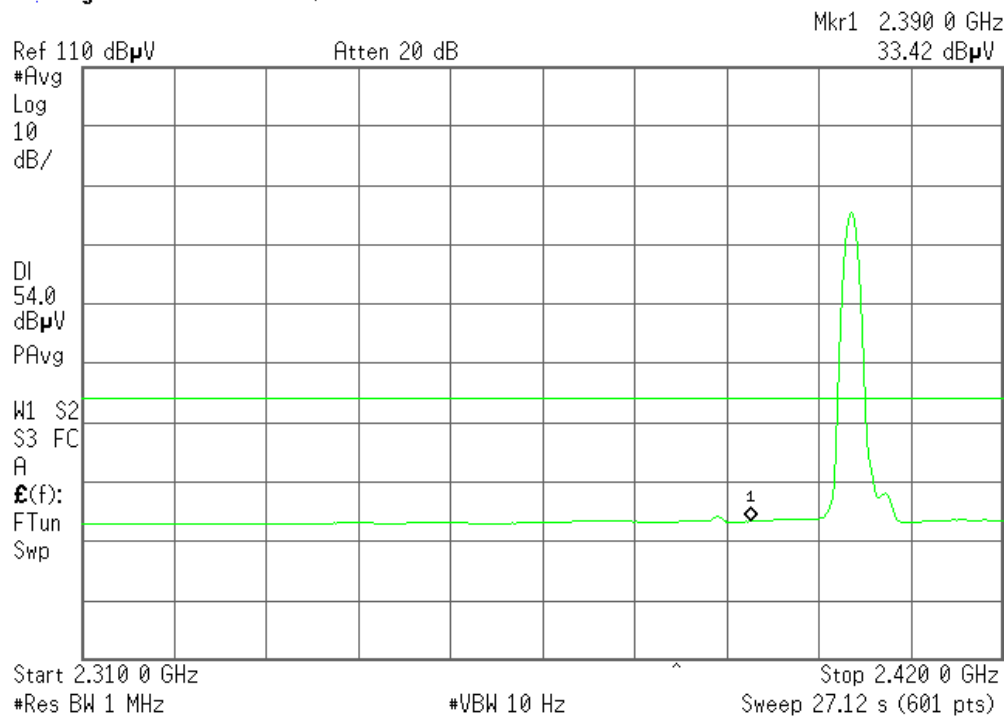


**Detector mode: Average**

**Polarity: Horizontal**

Agilent 08:16:01 Jan 24, 2008

R T







## Band Edges (CH-High)

Detector mode: Peak

Polarity: Vertical

Agilent 08:27:36 Jan 24, 2008

R T

Mkr1 2.483 50 GHz  
52.07 dB $\mu$ V

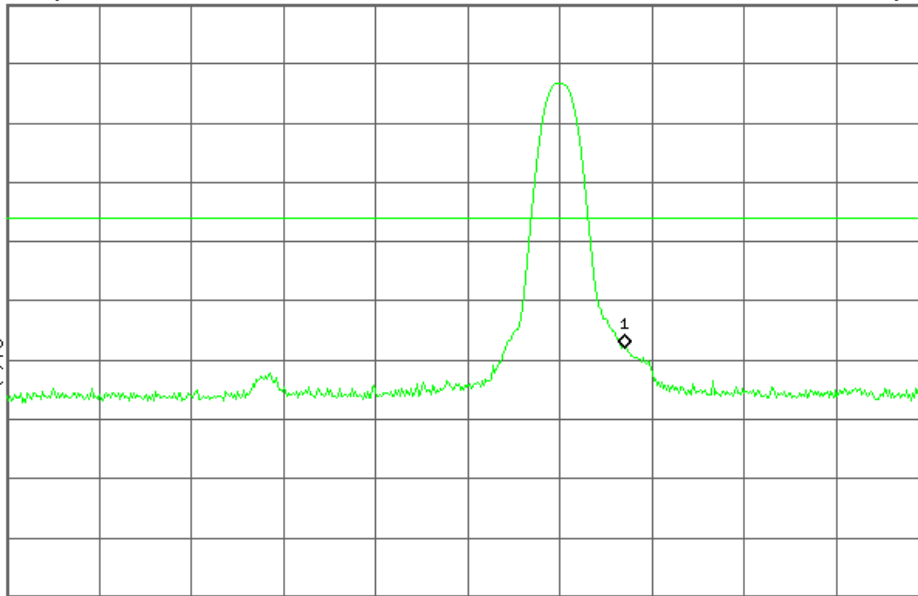
Ref 110 dB $\mu$ V

Atten 20 dB

#Peak  
Log  
10  
dB/

DI  
74.0  
dB $\mu$ V  
LgAv

M1 S2  
S3 FC  
A  
E(f):  
FTun  
Swp



Start 2.450 00 GHz

#Res BW 1 MHz

#VBW 1 MHz

Stop 2.500 00 GHz

#Sweep 100 ms (601 pts)

Detector mode: Average

Polarity: Vertical

Agilent 08:28:13 Jan 24, 2008

R T

Mkr1 2.483 50 GHz  
39.61 dB $\mu$ V

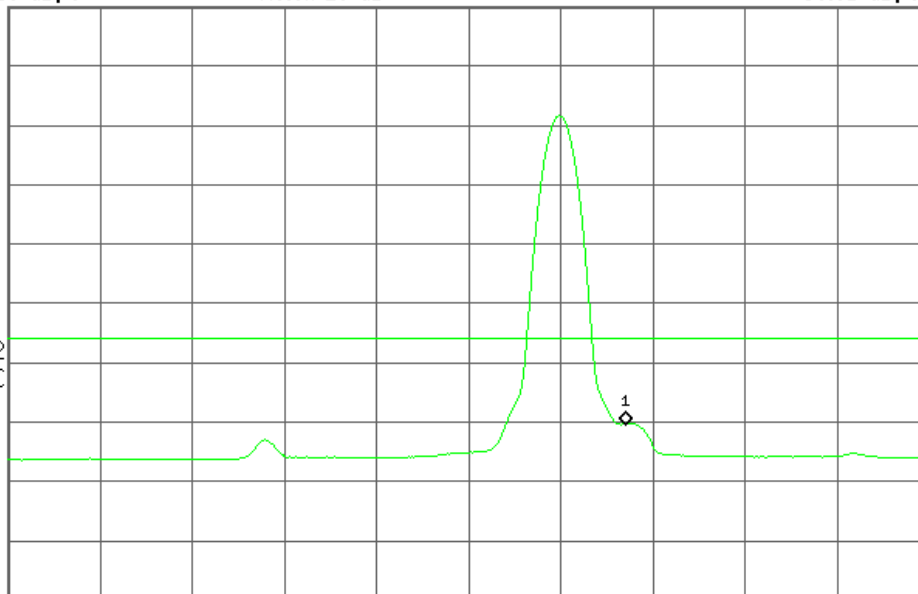
Ref 110 dB $\mu$ V

Atten 20 dB

#Avg  
Log  
10  
dB/

DI  
54.0  
dB $\mu$ V  
PAvg

M1 S2  
S3 FC  
A  
E(f):  
FTun  
Swp



Start 2.450 00 GHz

#Res BW 1 MHz

#VBW 10 Hz

Stop 2.500 00 GHz

Sweep 12.33 s (601 pts)



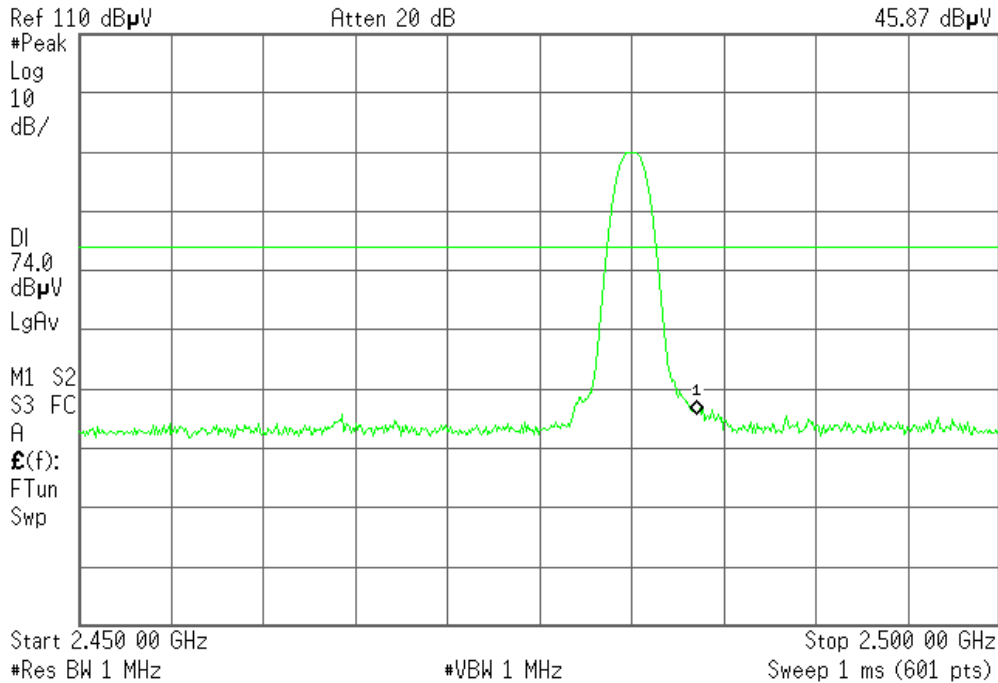
**Detector mode: Peak**

**Polarity: Horizontal**

Agilent 08:18:43 Jan 24, 2008

R T

Mkr1 2.483 50 GHz  
45.87 dB $\mu$ V



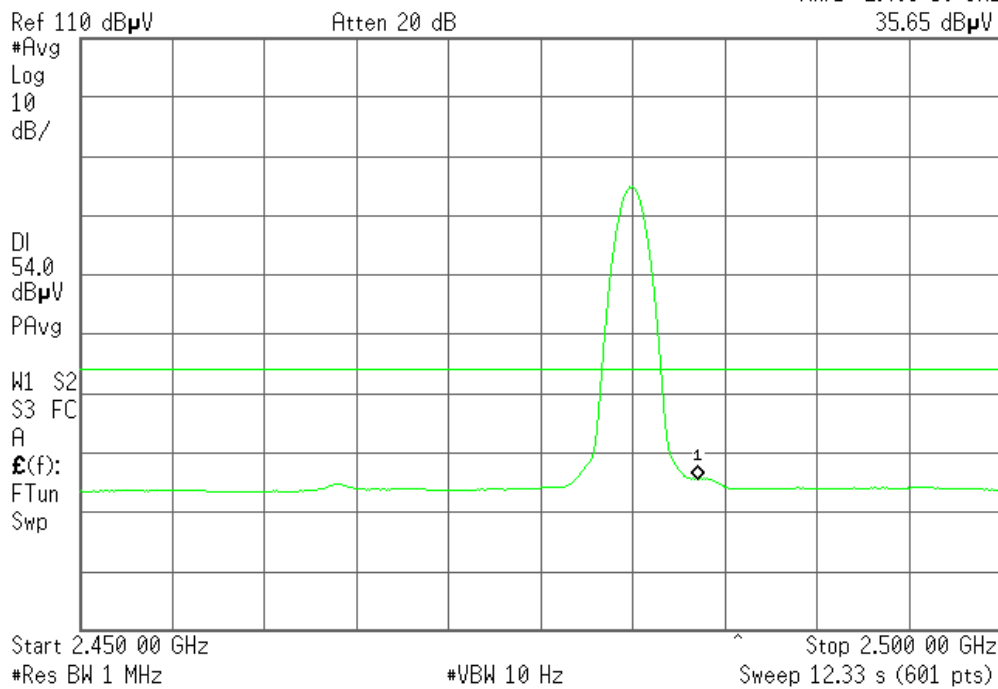
**Detector mode: Average**

**Polarity: Horizontal**

Agilent 08:19:25 Jan 24, 2008

R T

Mkr1 2.483 50 GHz  
35.65 dB $\mu$ V





## 7.4 FREQUENCY SEPARATION

### LIMIT

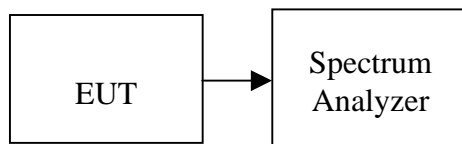
According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300399	02/08/2009
Spectrum Analyzer	R&S	FSP30	1093.4495.30	07/22/2008

**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, VBW=30kHz, Adjust Span to 3 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

Channel Separation (MHz)	Limit (kHz)	Result
1.0	840kHz (20dB BW, Max)	Pass



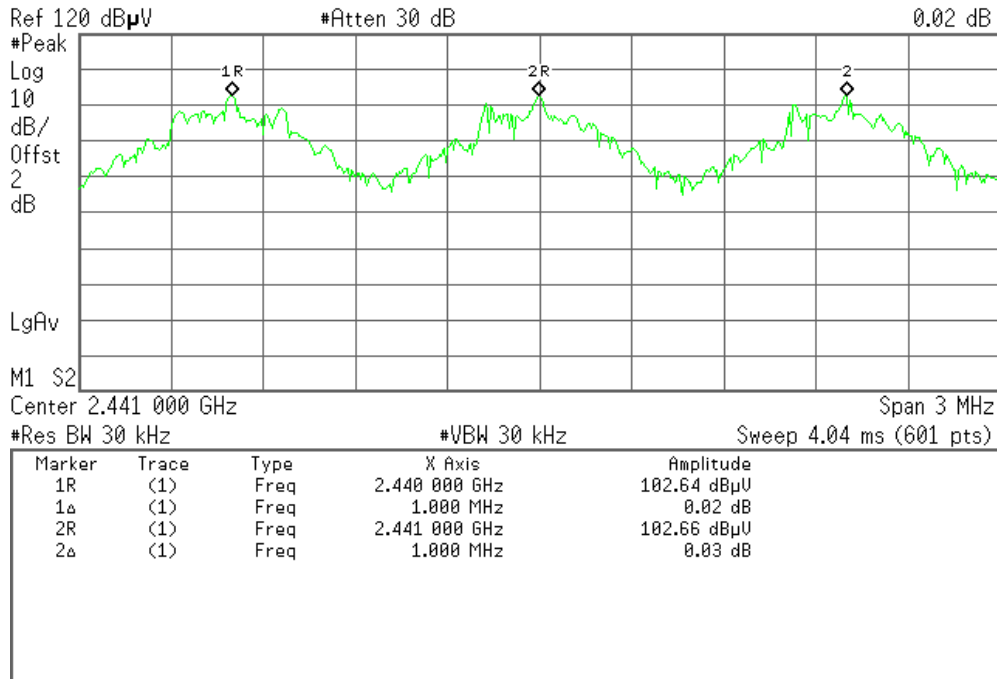
## Test Plot

### Measurement of Channel Separation

Agilent 17:51:10 Jan 24, 2008

R T

▲ Mkr1 1.000 MHz  
0.02 dB



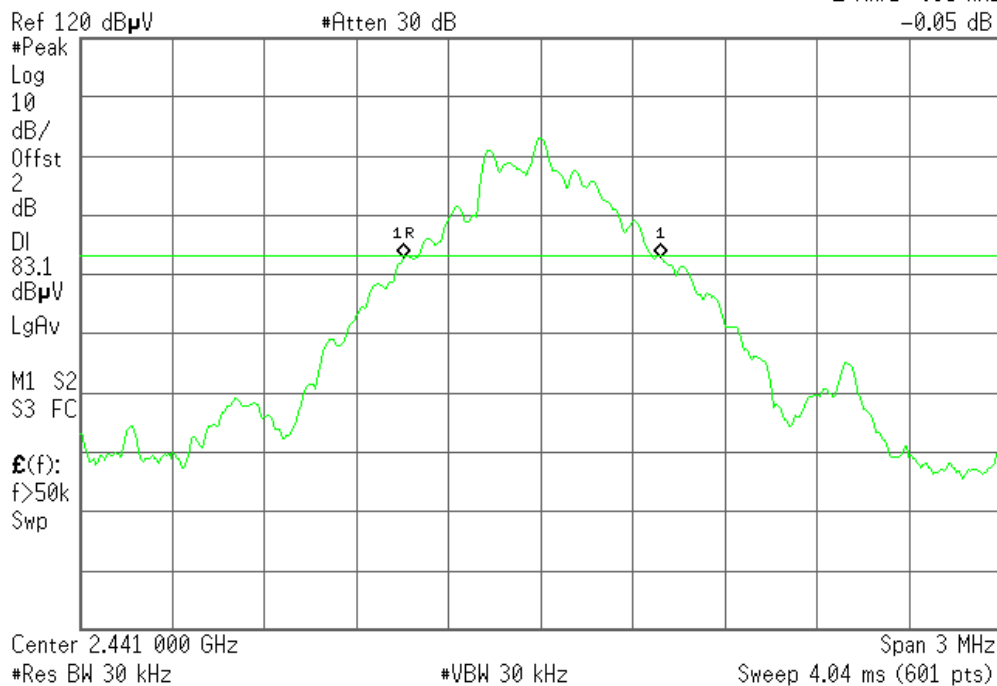
## Test Plot

### 20 dB bandwidth(CH Mid)

Agilent 17:20:19 Jan 24, 2008

R T

▲ Mkr1 835 kHz  
-0.05 dB





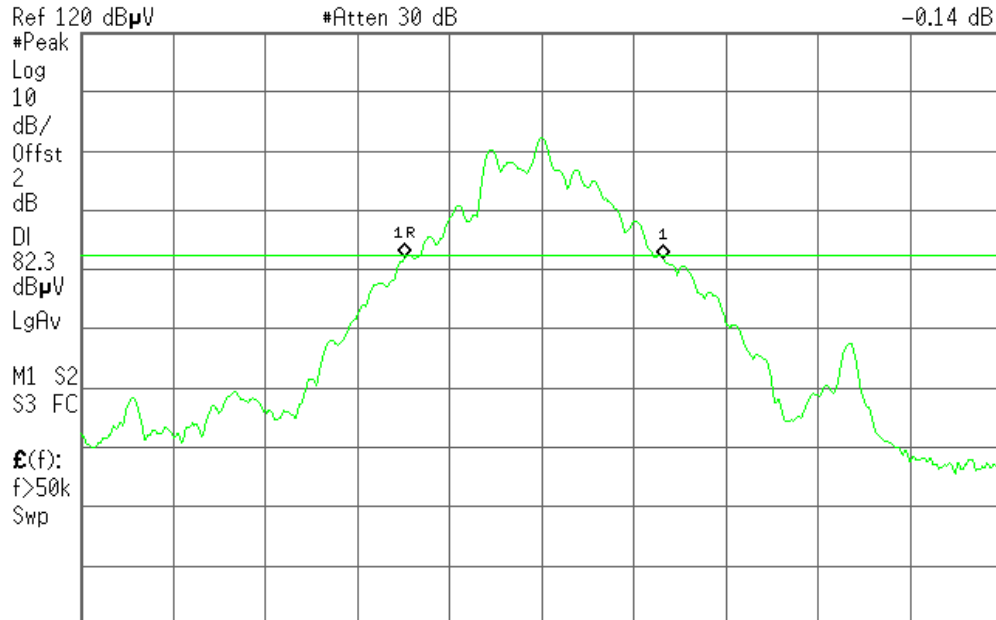
## 20 dB bandwidth(CH Low)

Agilent 17:16:31 Jan 24, 2008

R T

Mkr1 840 kHz

-0.14 dB



Center 2.402 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 30 kHz

Sweep 4.04 ms (601 pts)

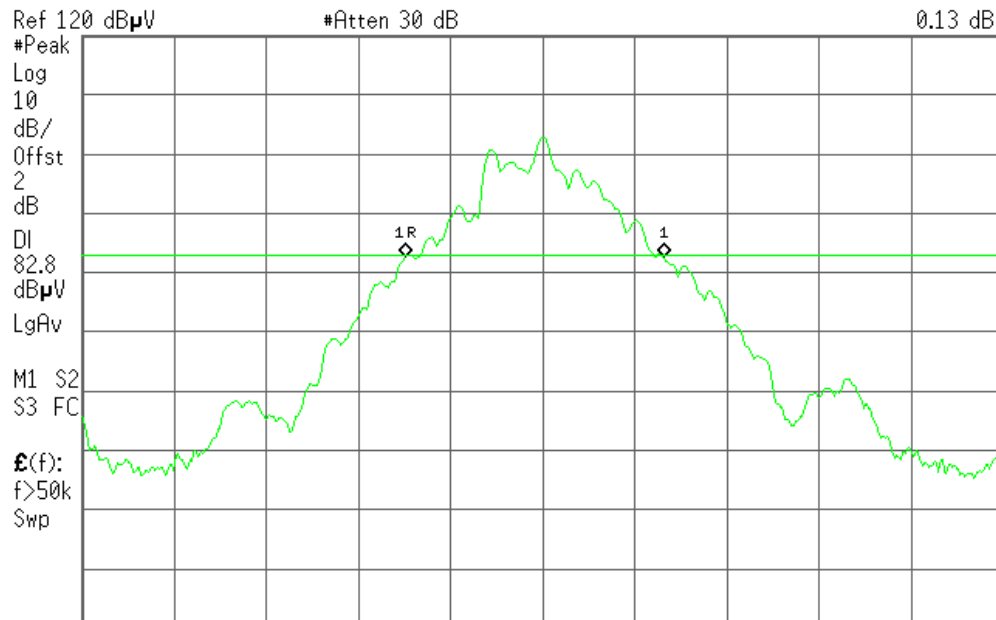
## 20 dB bandwidth (CH High)

Agilent 17:21:44 Jan 24, 2008

R T

Mkr1 840 kHz

0.13 dB



Center 2.480 000 GHz

Span 3 MHz

#Res BW 30 kHz

#VBW 30 kHz

Sweep 4.04 ms (601 pts)



## 7.5 NUMBER OF HOPPING FREQUENCY

### LIMIT

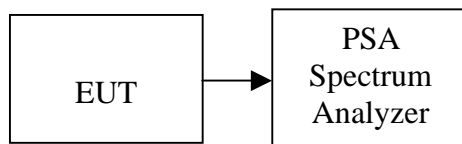
According to §15.247(a)(1)(ii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300399	02/08/2009

*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=100kHz,
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	>15	PASS



## Test Plot

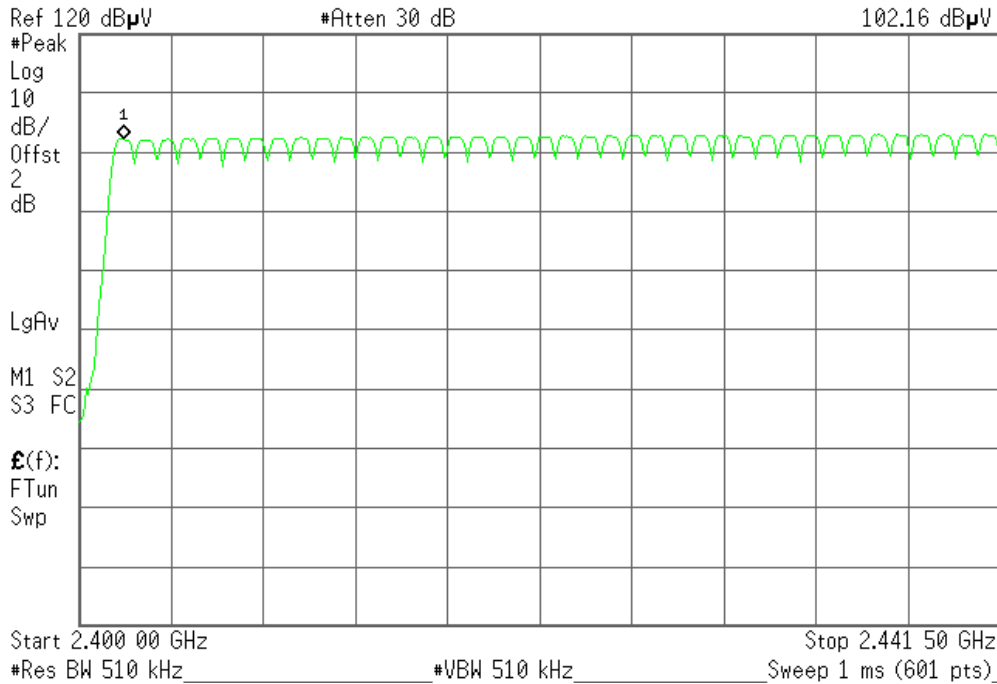
### Channel Number

#### 2.4 GHz – 2.441 GHz

Agilent 17:58:25 Jan 24, 2008

R T

Mkr1 2.402 00 GHz  
102.16 dB $\mu$ V

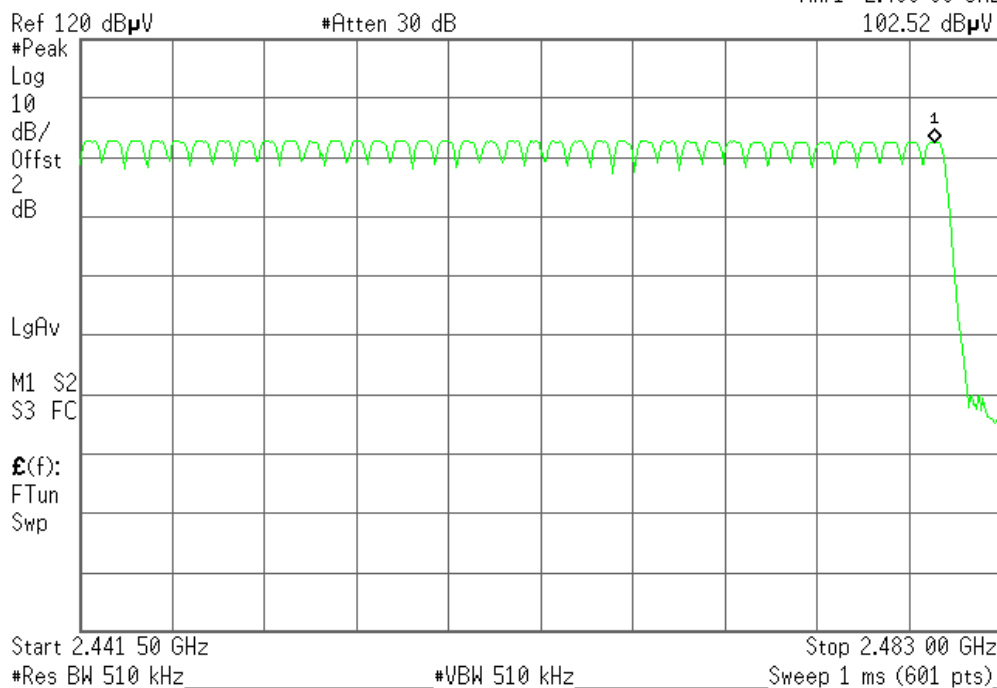


#### 2.441 GHz – 2.4835 GHz

Agilent 17:59:56 Jan 24, 2008

R T

Mkr1 2.480 00 GHz  
102.52 dB $\mu$ V





## 7.6 TIME OF OCCUPANCY (DWELL TIME)

### LIMIT

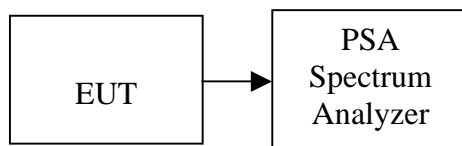
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands. The average time of occupancy on any channels shall not greater than 0.4 s within a period 0.4 s multiplied by the number of hopping channels employed.

### MEASUREMENT EQUIPMENT USED

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300399	02/08/2009

*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**

#### **DH 1**

CH Low:  $0.42 * (1600/2)/79 * 31.6 = 134.4$  (ms)

CH Mid:  $0.42 * (1600/2)/79 * 31.6 = 134.4$  (ms)

CH High:  $0.43 * (1600/2)/79 * 31.6 = 137.6$  (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	0.42	134.4	31.60	400.00	PASS
Mid	0.42	134.4	31.60		PASS
High	0.43	137.6	31.60		PASS

#### **DH 3**

CH Low:  $1.67 * (1600/4)/79 * 31.6 = 267.2$  (ms)

CH Mid:  $1.68 * (1600/4)/79 * 31.6 = 268.8$  (ms)

CH High:  $1.67 * (1600/4)/79 * 31.6 = 267.2$  (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	1.67	267.2	31.60	400.00	PASS
Mid	1.68	268.8	31.60		PASS
High	1.67	267.2	31.60		PASS

#### **DH 5**

CH Low:  $2.93 * (1600/6)/79 * 31.6 = 312.5$  (ms)

CH Mid:  $2.93 * (1600/6)/79 * 31.6 = 312.5$  (ms)

CH High:  $2.92 * (1600/6)/79 * 31.6 = 311.5$  (ms)

CH	Pulse Time (ms)	Total of Dwell (ms)	Period Time (s)	Limit (ms)	Result
Low	2.93	312.5	31.60	400.00	PASS
Mid	2.93	312.5	31.60		PASS
High	2.92	311.5	31.60		PASS



## Test Plot

### DH 1

#### (CH Low)

Agilent 18:15:37 Jan 24, 2008

R T

Δ Mkr1 416.7 μs  
-0.17 dB

Ref 120 dBμV

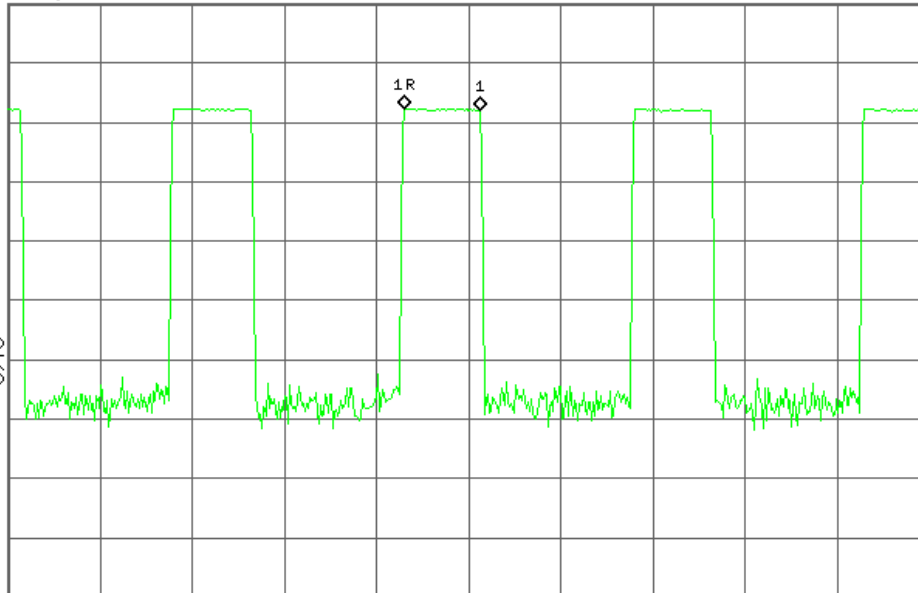
#Atten 30 dB

#Peak  
Log  
10  
dB/  
Offst  
2  
dB

LgAv

W1 S2  
S3 FS

£(f):  
FTun



Center 2.402 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 5 ms (601 pts)

Agilent 18:15:04 Jan 24, 2008

R T

Δ Mkr1 1.25 ms  
-0.03 dB

Ref 120 dBμV

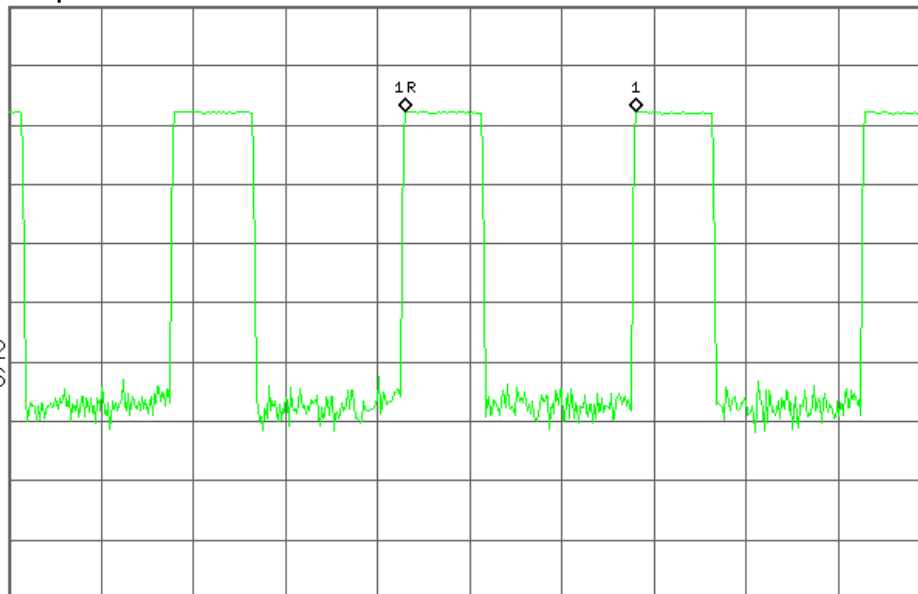
#Atten 30 dB

#Peak  
Log  
10  
dB/  
Offst  
2  
dB

LgAv

W1 S2  
S3 FS

£(f):  
FTun



Center 2.402 000 GHz

Span 0 Hz

Res BW 1 MHz

#VBW 1 MHz

Sweep 5 ms (601 pts)

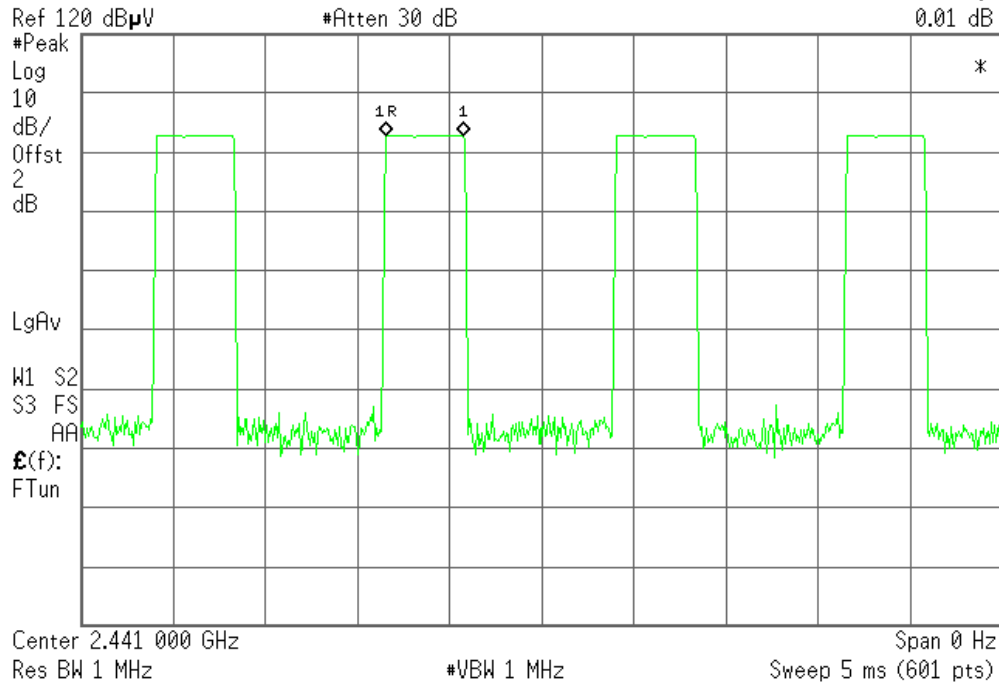


**(CH Mid)**

Agilent 21:46:50 Jan 24, 2008

R T

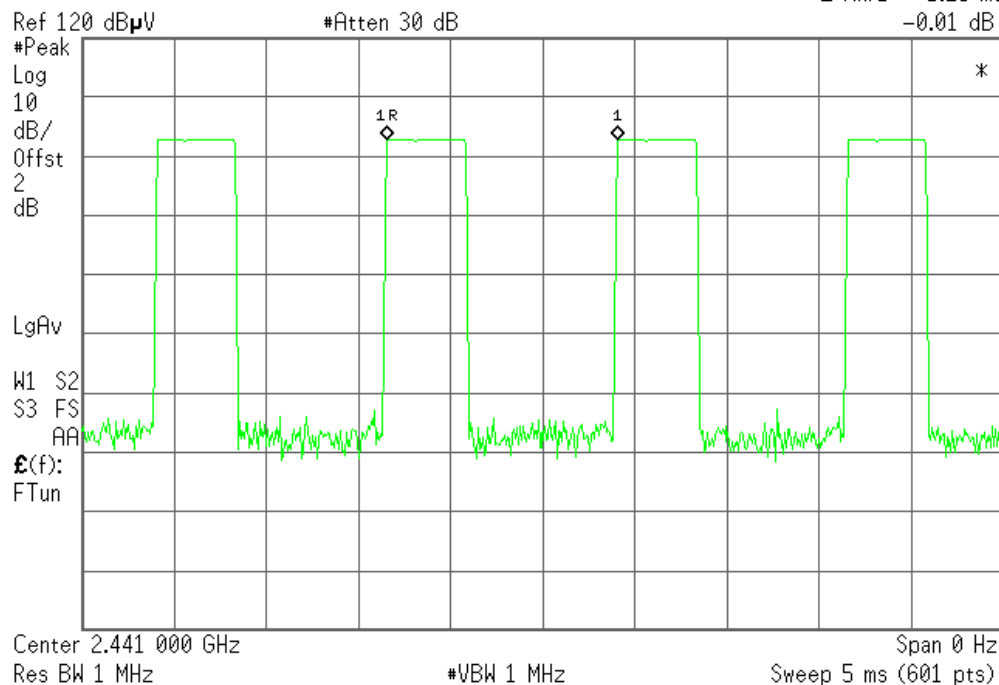
Δ Mkr1 416.7 μs  
0.01 dB



Agilent 21:46:06 Jan 24, 2008

R T

Δ Mkr1 1.25 ms  
-0.01 dB



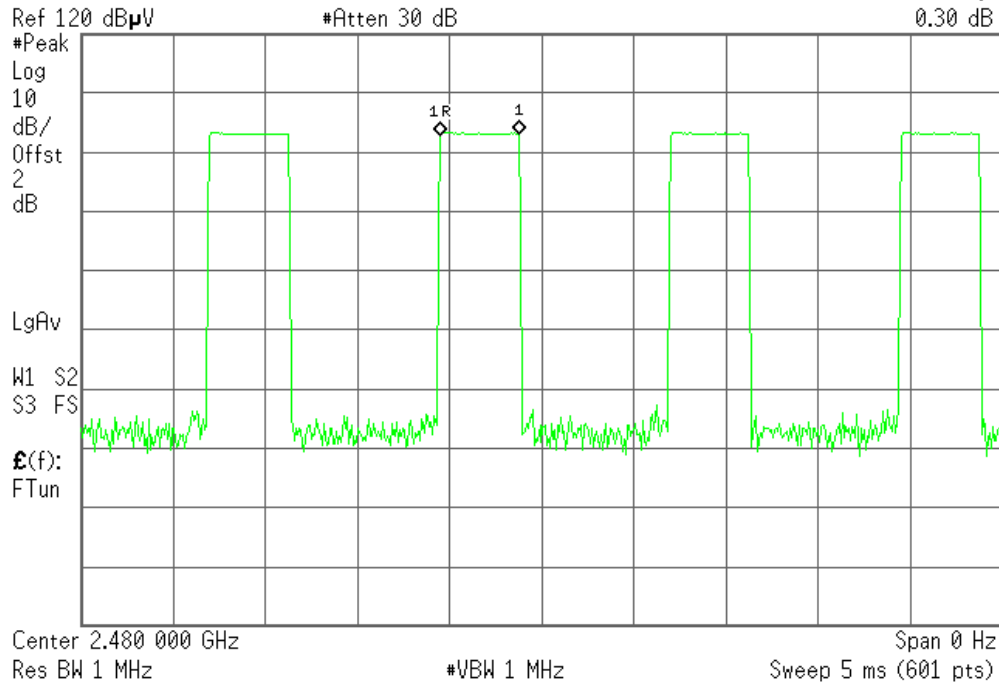


**(CH High)**

Agilent 21:50:19 Jan 24, 2008

R T

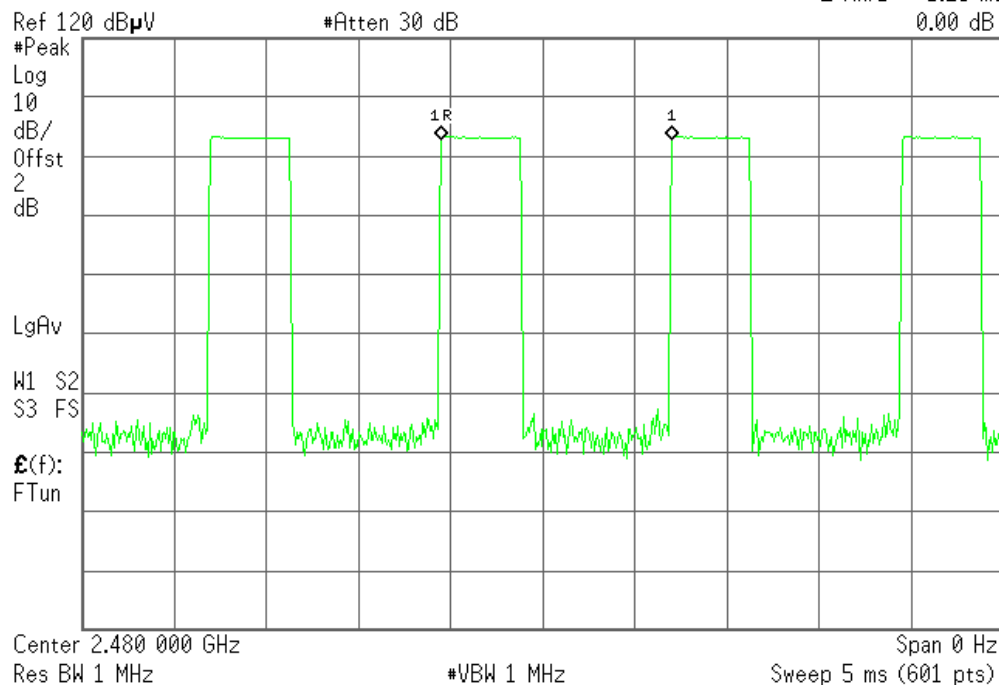
▲ Mkr1 425  $\mu$ s  
0.30 dB



Agilent 21:49:52 Jan 24, 2008

R T

▲ Mkr1 1.25 ms  
0.00 dB





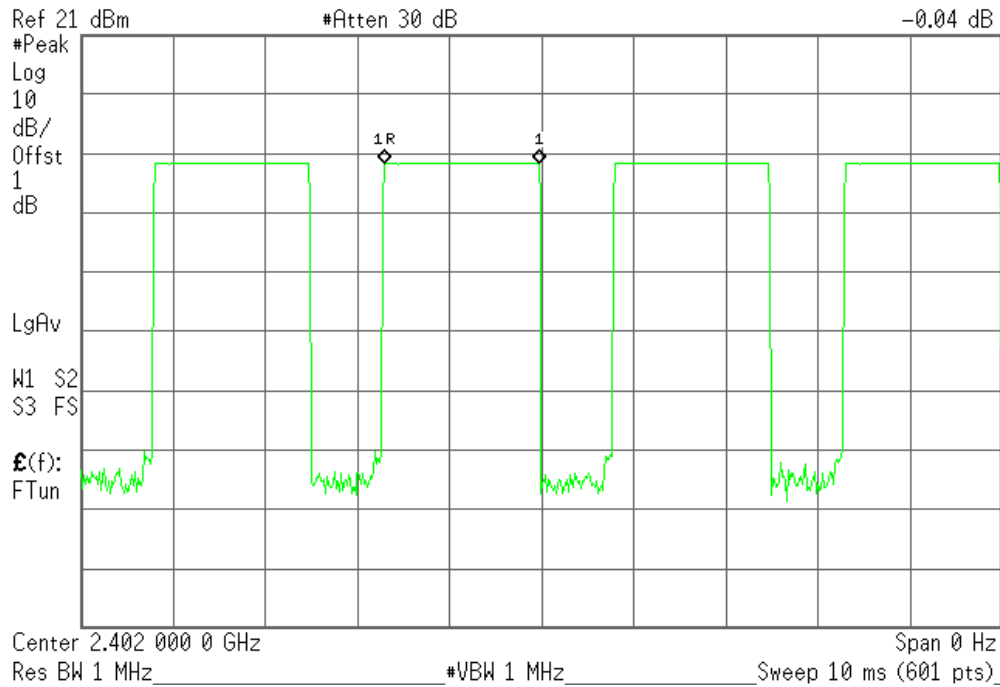
### DH 3

#### (CH Low)

Agilent 16:40:06 Jun 11, 2007

R T

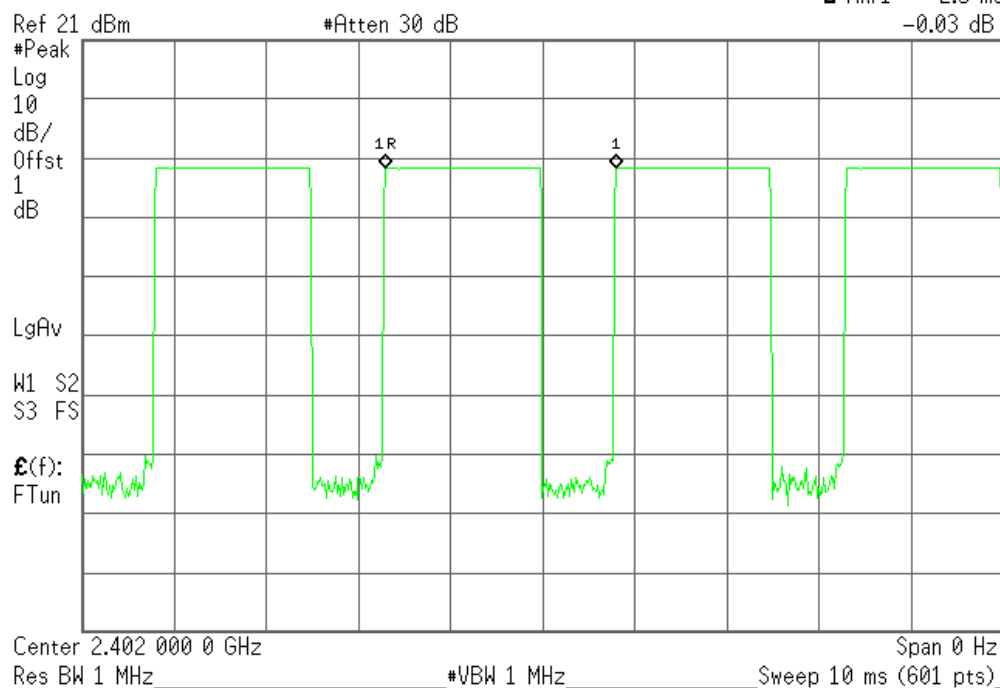
Δ Mkr1 1.667 ms  
-0.04 dB



Agilent 16:40:51 Jun 11, 2007

R

Δ Mkr1 2.5 ms  
-0.03 dB



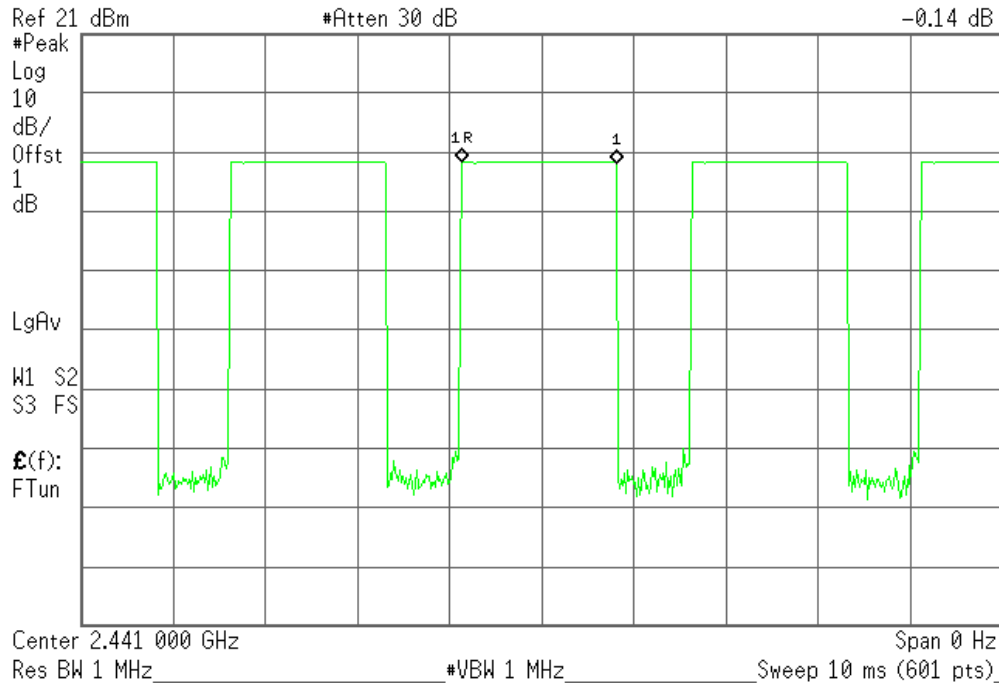


**(CH Mid)**

Agilent 16:45:18 Jun 11, 2007

R T

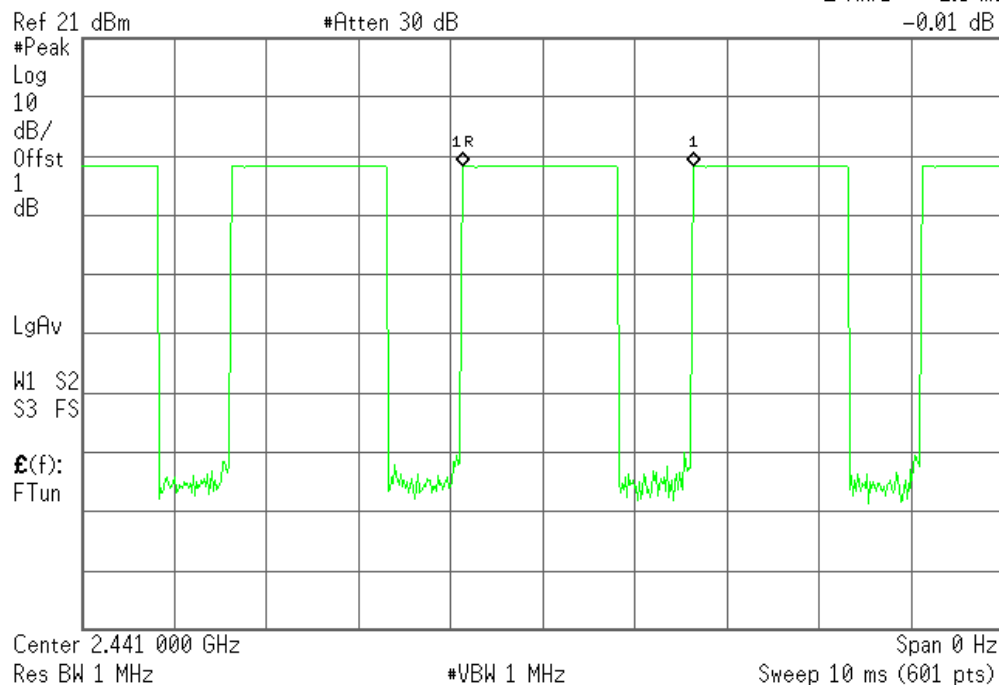
▲ Mkr1 1.683 ms  
-0.14 dB



Agilent 16:46:08 Jun 11, 2007

R

▲ Mkr1 2.5 ms  
-0.01 dB



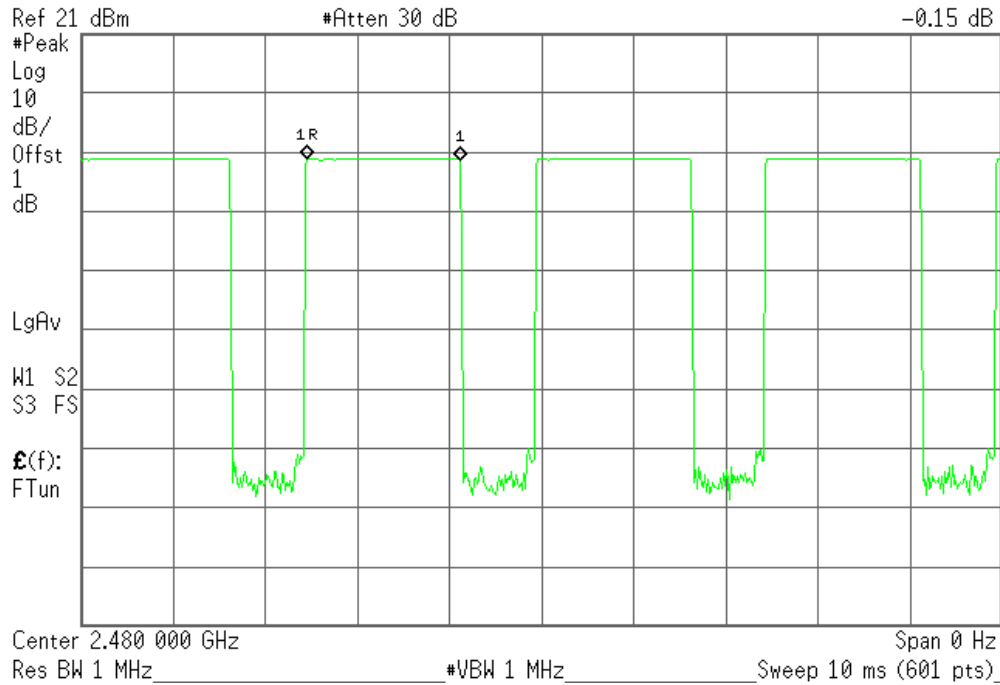


**(CH High)**

Agilent 16:50:26 Jun 11, 2007

R

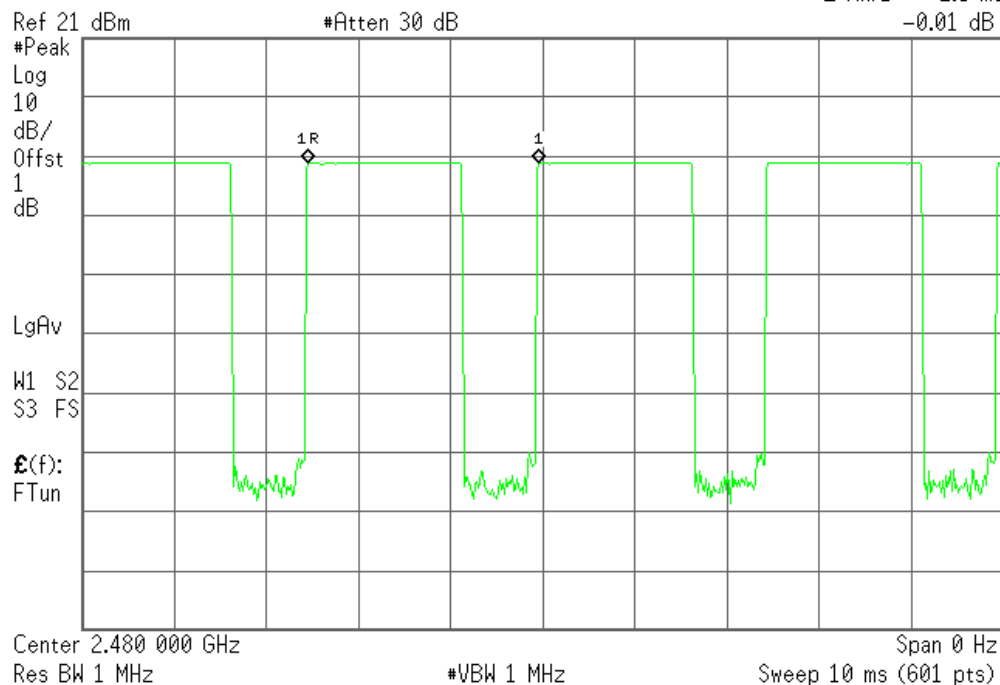
▲ Mkr1 1.667 ms  
-0.15 dB



Agilent 16:51:20 Jun 11, 2007

R

▲ Mkr1 2.5 ms  
-0.01 dB





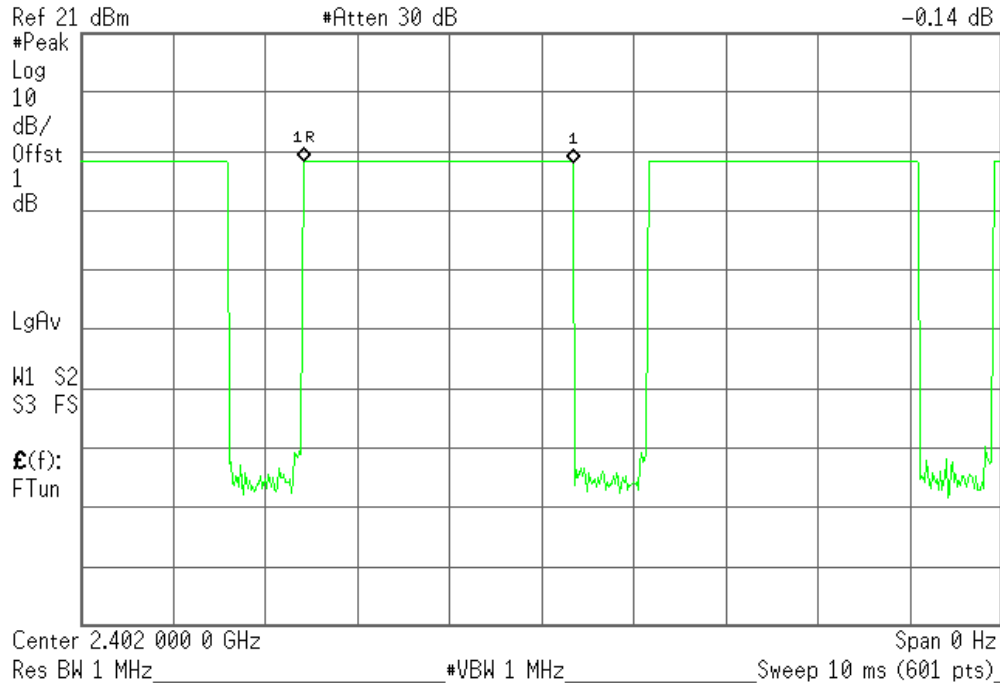
## DH5

### (CH Low)

Agilent 16:41:45 Jun 11, 2007

R T

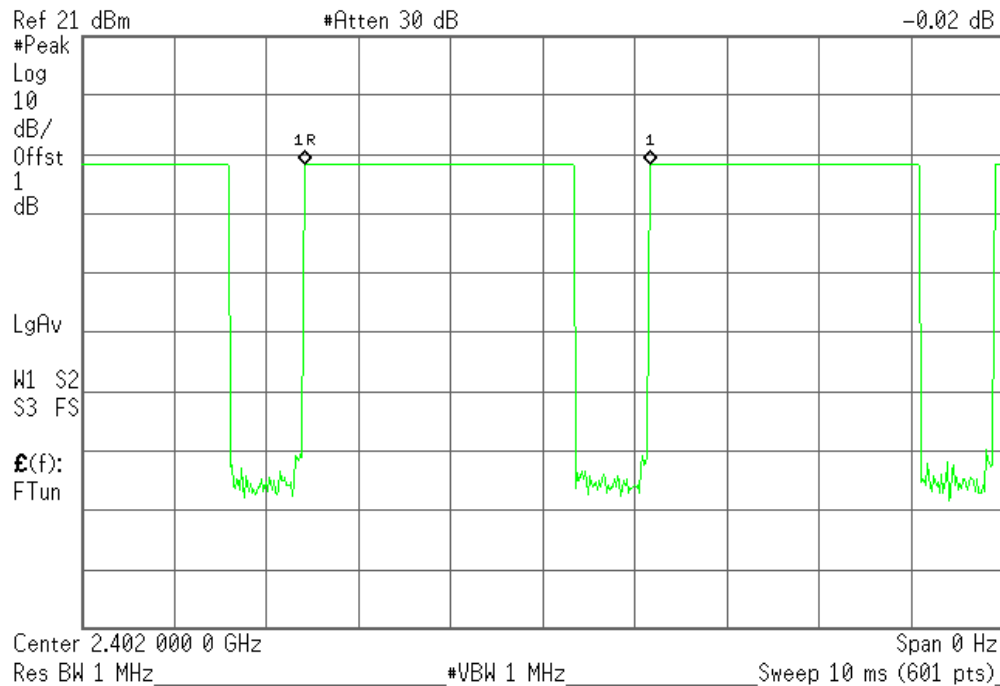
▲ Mkr1 2.933 ms  
-0.14 dB



Agilent 16:42:20 Jun 11, 2007

R T

▲ Mkr1 3.75 ms  
-0.02 dB





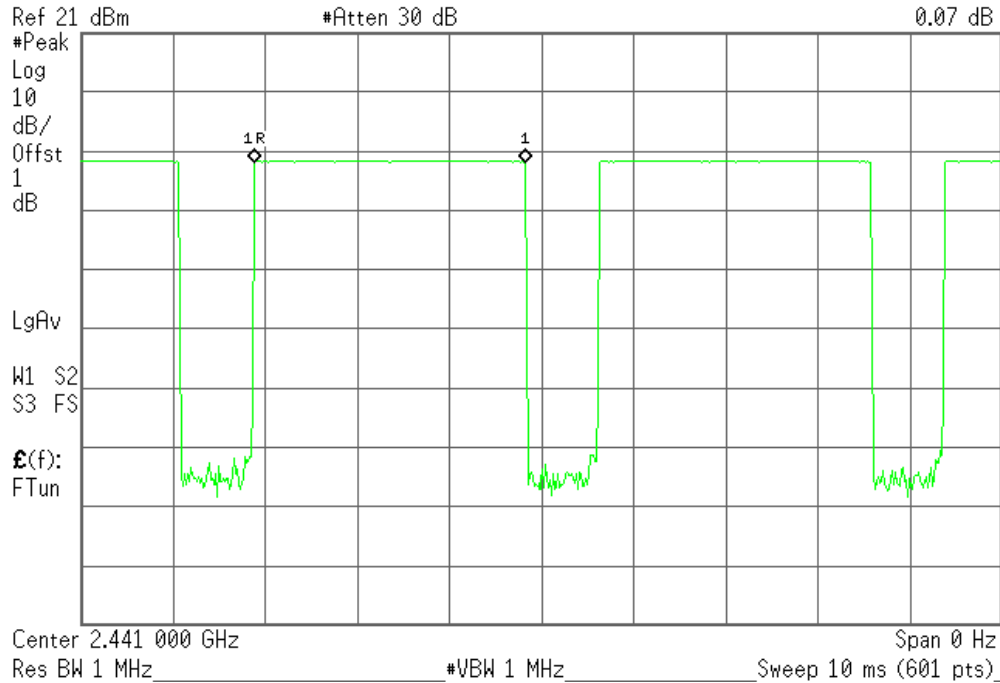


**(CH Mid)**

Agilent 16:47:14 Jun 11, 2007

R T

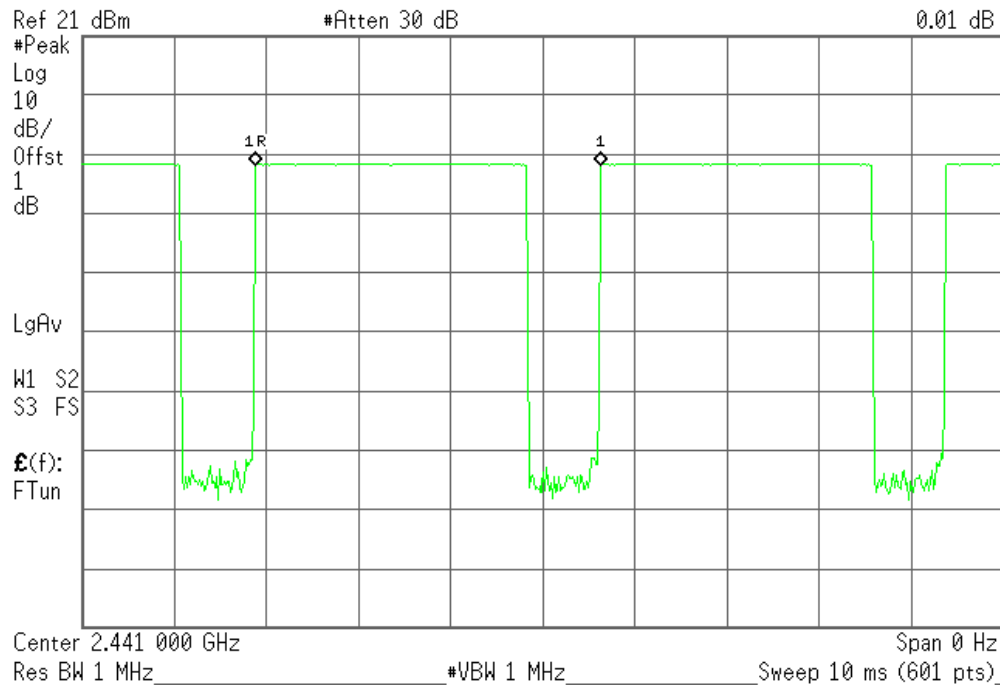
▲ Mkr1 2.933 ms  
0.07 dB



Agilent 16:47:28 Jun 11, 2007

R

▲ Mkr1 3.75 ms  
0.01 dB



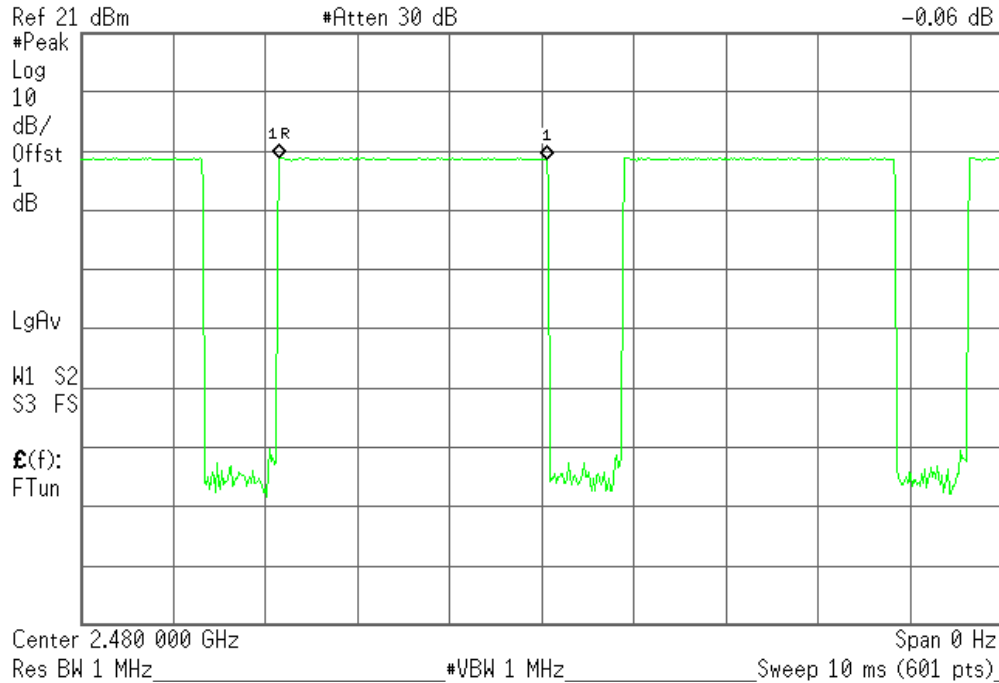


**(CH High)**

Agilent 16:52:28 Jun 11, 2007

R T

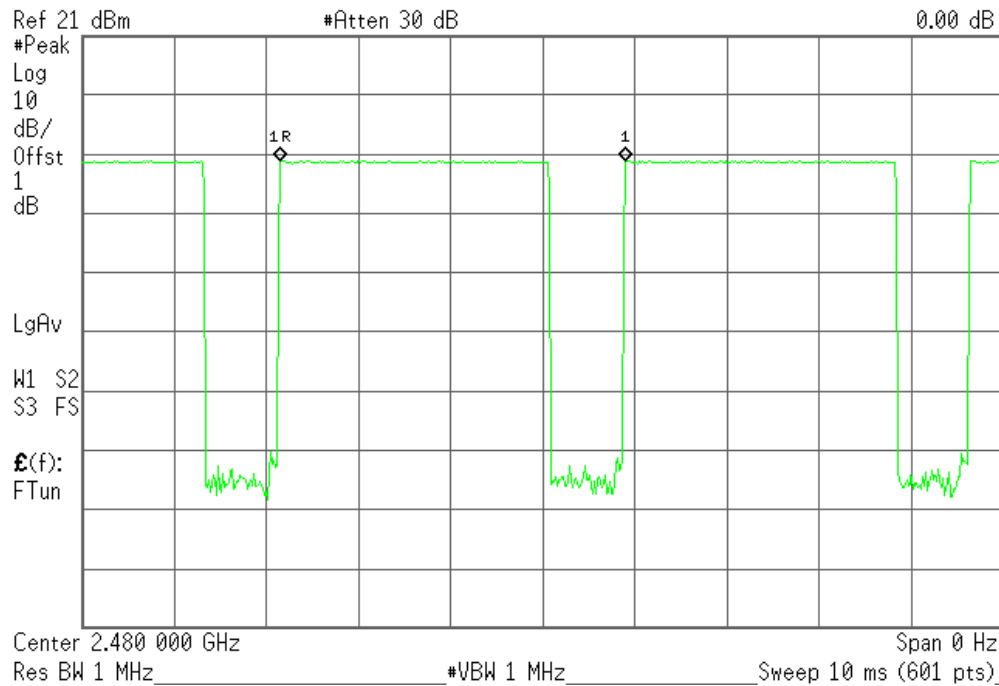
▲ Mkr1 2.917 ms  
-0.06 dB



Agilent 16:52:42 Jun 11, 2007

R

▲ Mkr1 3.75 ms  
0.00 dB





## SPURIOUS EMISSIONS

### 7.7 Conducted Measurement

#### LIMIT

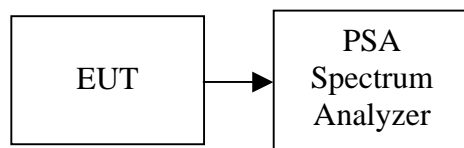
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300399	02/08/2009

*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*



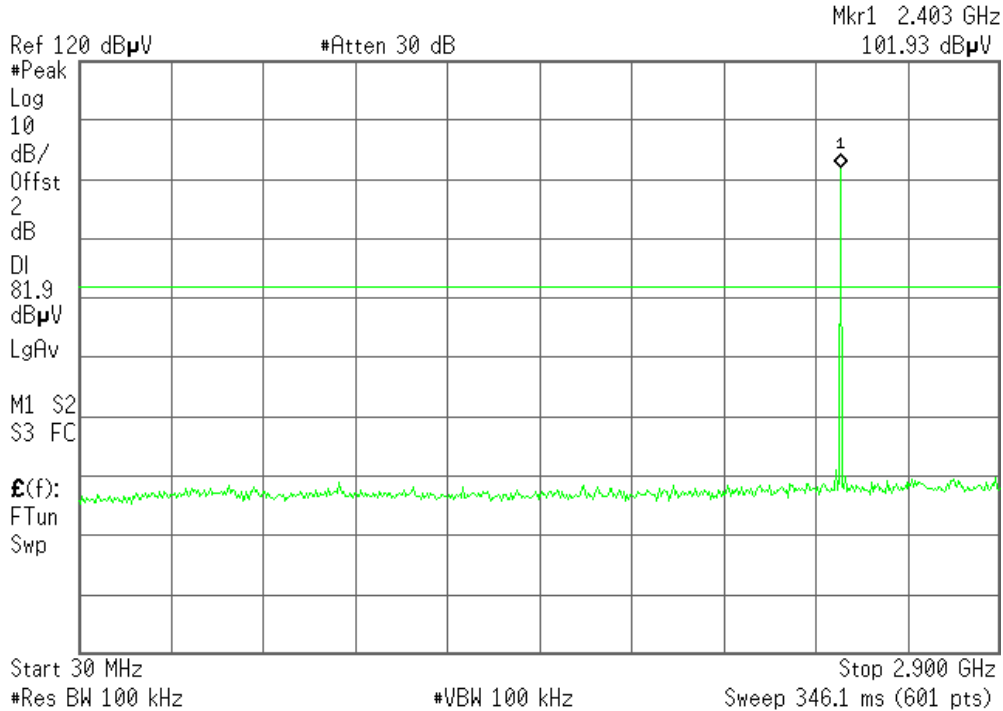
## Test Plot

### CH Low

#### 30MHz – 2.9GHz

Agilent 17:29:29 Jan 24, 2008

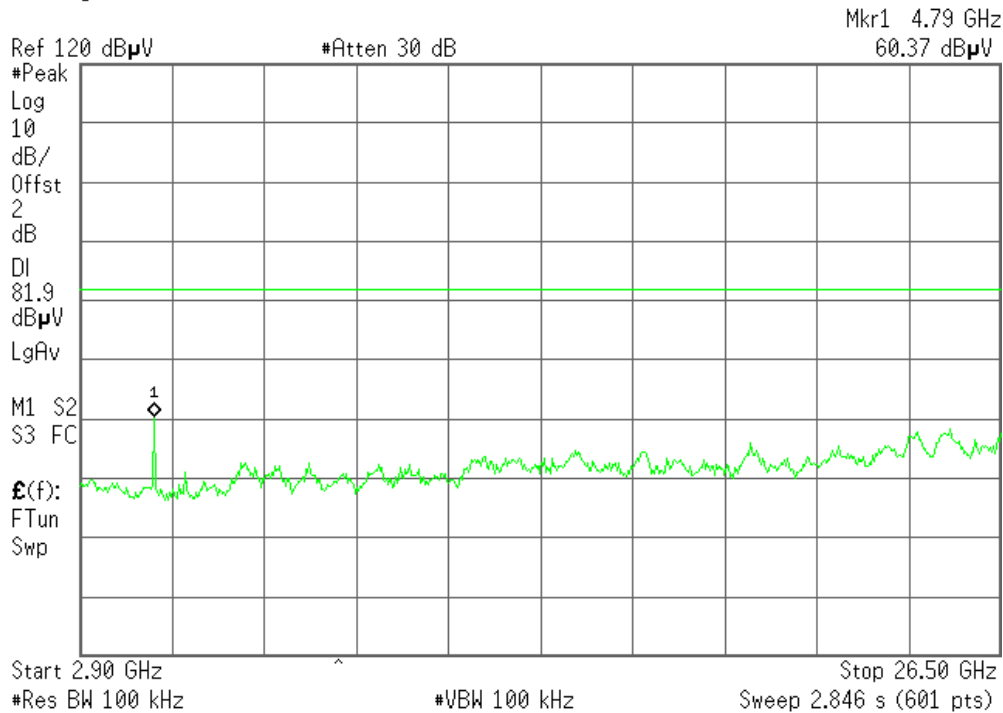
R T



#### 2.9GHz – 26.5GHz

Agilent 17:30:36 Jan 24, 2008

R T



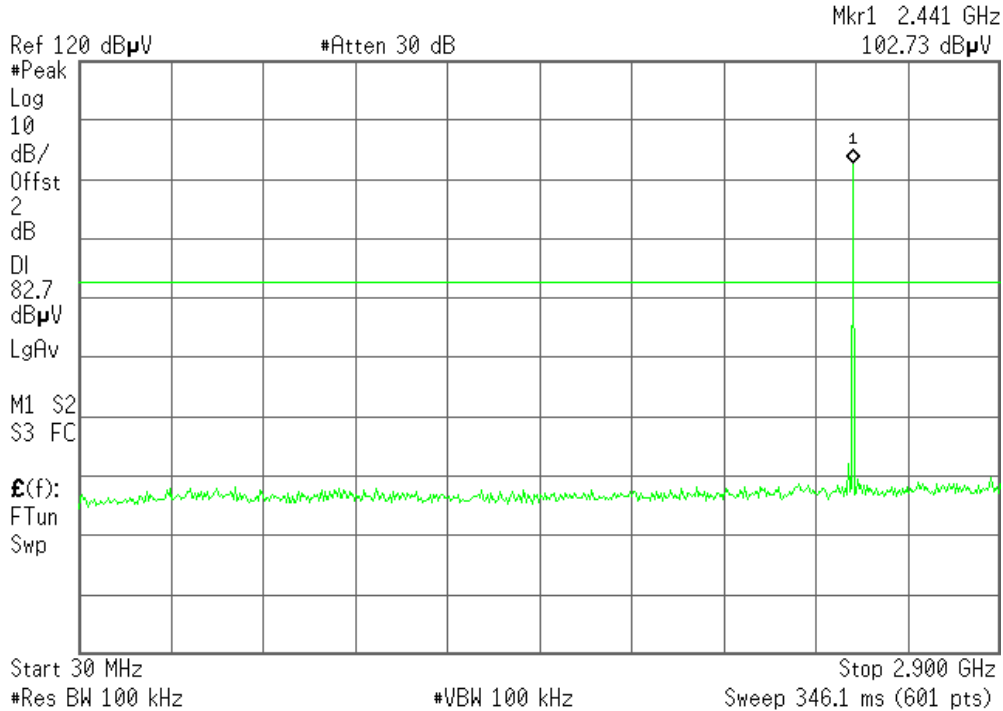


## CH Mid

### 30MHz – 2.9GHz

Agilent 17:31:46 Jan 24, 2008

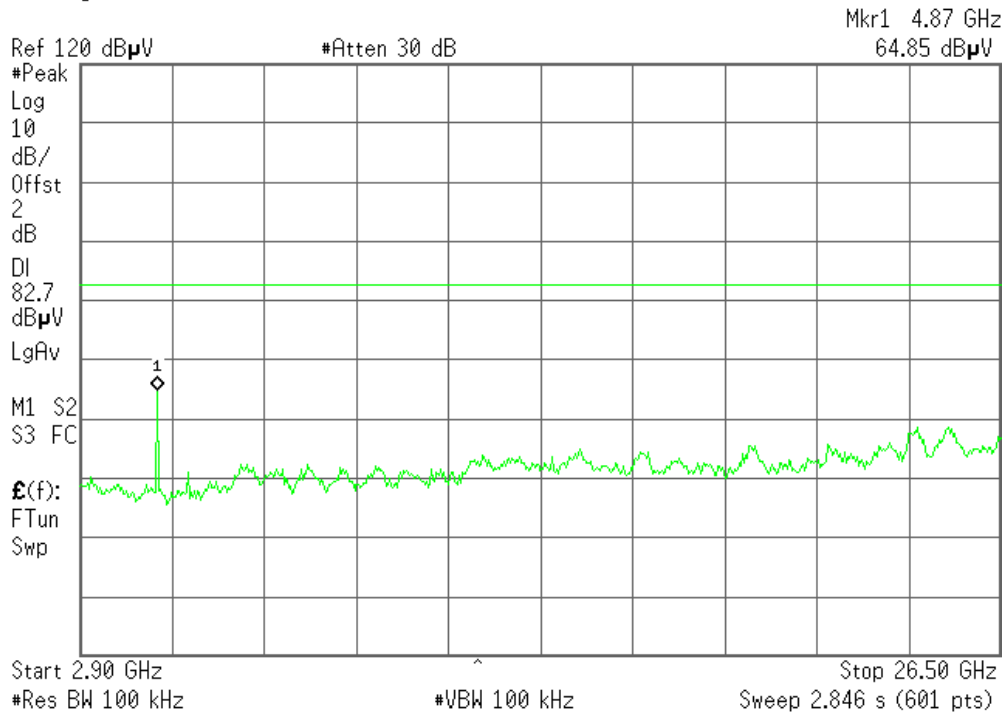
R T



### 2.9GHz – 26.5GHz

Agilent 17:32:27 Jan 24, 2008

R T



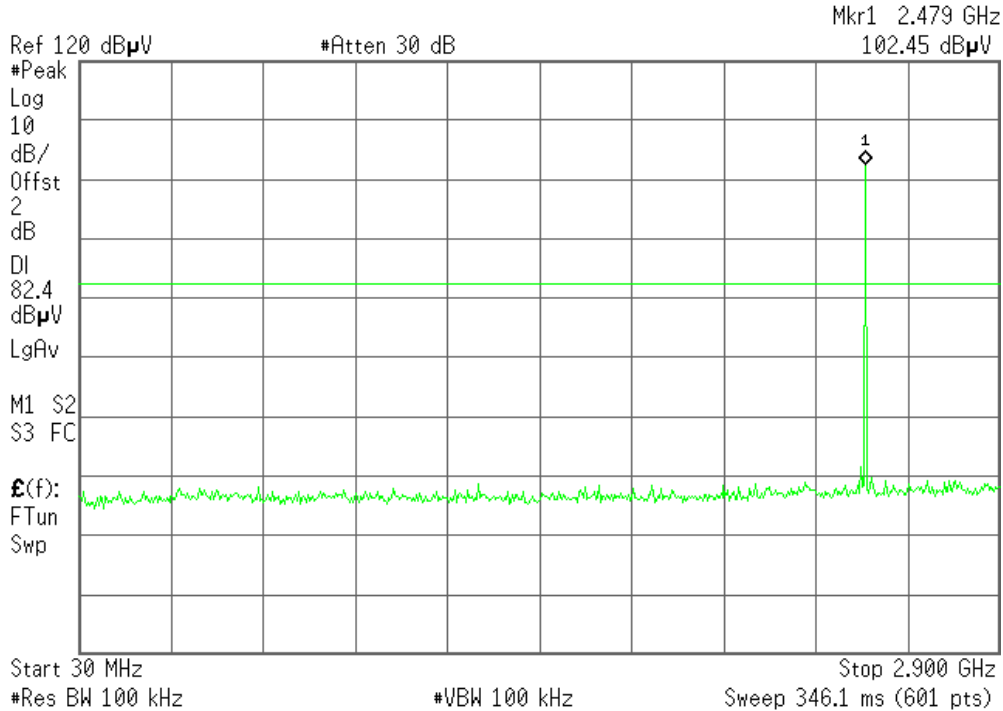


## CH High

### 30MHz – 2.9GHz

Agilent 17:34:35 Jan 24, 2008

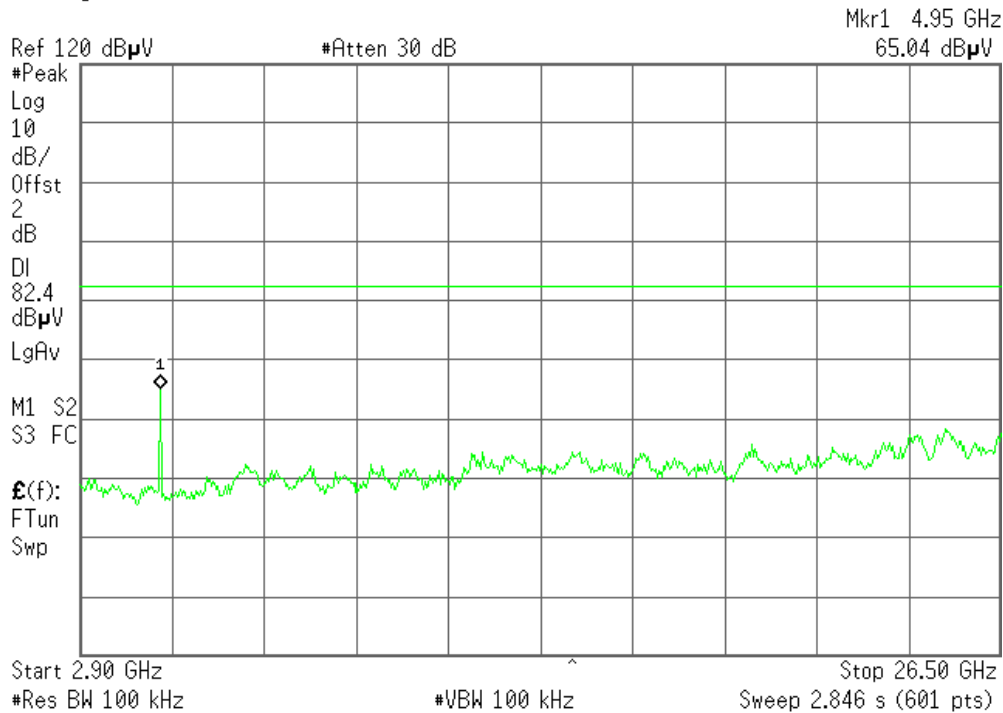
R T



### 2.9GHz – 26.5GHz

Agilent 17:35:15 Jan 24, 2008

R T





## 7.7.2 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)
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 ( $\mu$ V/m at 3-meter)	Field Strength (dB $\mu$ V/m at 3-meter)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

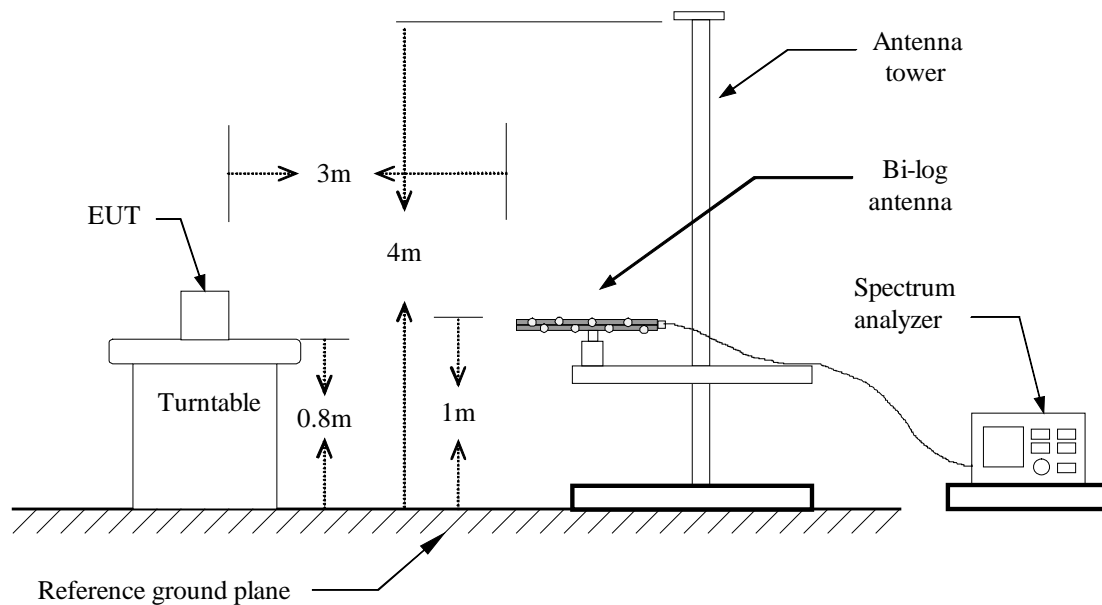
## **MEASUREMENT EQUIPMENT USED**

966 RF CHAMBER 2				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Spectrum Analyzer	Agilent	E4446A	US44300399	02/08/2009
EMI Test Receiver	R&S	ESCI	1166.5950 03	01/13/2009
Pre-Amplifier	MITEQ	N/A	AFS42-00102650-42-10P-42	02/14/2009
Bilog Antenna	SCHWAZBECK	CBL6143	5082	06/09/2008
Turn Table	EMCO	2081-1.21	N/A	N.C.R
Antenna Tower	CT	N/A	N/A	N.C.R
Controller	CT	N/A	N/A	N.C.R
RF Comm. Test set	HP	8920B	US36142090	N.C.R
Site NSA	C&C	N/A	N/A	06/09/2008
Horn Antenna	TRC	N/A	N/A	03/04/2008

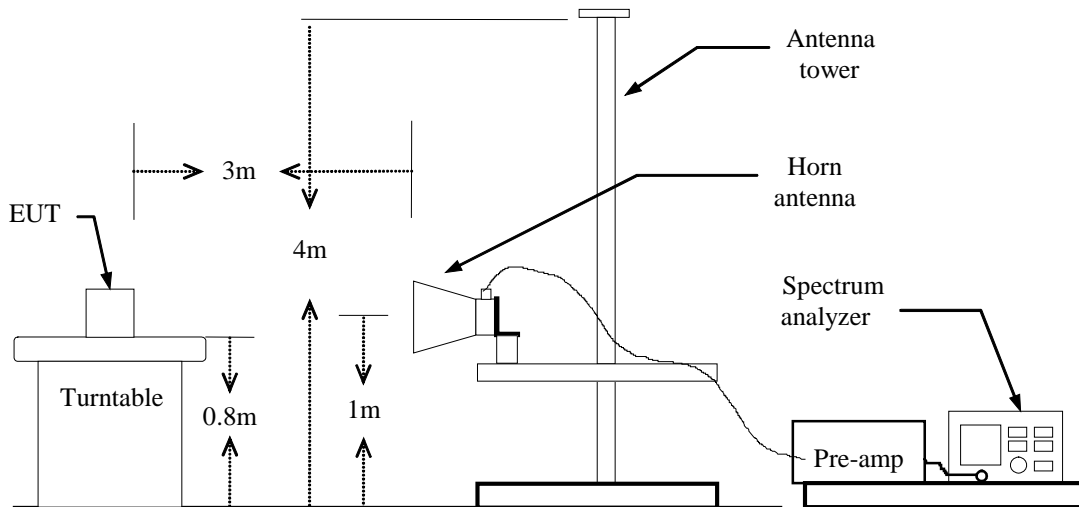
**Remark:** Each piece of equipment is scheduled for calibration once a year.

### **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**Test Date:** February 25,2008**Temperature:** 20°C**Tested by:** Tom**Humidity:** 70 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limits 3m (dBuV/m)	Safe Margin (dBuV/m)
67.350	V	Peak	42.85	-17.54	25.31	40.00	-14.69
96.600	V	Peak	45.87	-15.60	30.27	43.50	-13.23
128.100	V	Peak	45.75	-16.63	29.12	43.50	-14.38
175.800	V	Peak	49.28	-14.82	34.46	43.50	-9.04
223.950	V	Peak	51.60	-13.12	38.48	46.00	-7.52
340.833	V	Peak	42.50	-9.62	32.88	46.00	-13.12
61.500	H	Peak	44.82	-17.40	27.42	40.00	-12.58
87.150	H	Peak	42.92	-16.18	26.74	40.00	-13.26
157.350	H	Peak	49.14	-15.23	33.91	43.50	-9.59
223.950	H	Peak	50.69	-13.12	37.57	46.00	-8.43
337.333	H	Peak	41.08	-9.73	31.35	46.00	-14.65
442.333	H	Peak	36.58	-8.25	28.33	46.00	-17.67

**Notes:**

1. Measuring frequencies from 30 MHz to the 1GHz.
2. Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak detector mode.
3. 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.
4. The IF bandwidth of SPA between 30MHz to 1GHz was 100kHz.

**Above 1 GHz****Operation Mode:** TX(CH Low)**Test Date:** February 25,2008**Temperature:** 20°C**Tested by:** Tom**Humidity:** 70 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1556.66	V	54.46	---	-9.20	45.26	---	74.00	54.00	-8.74	Peak
1770.00	V	55.97	---	-8.36	47.61	---	74.00	54.00	-6.39	Peak
2663.33	V	51.51	---	-5.03	46.48	---	74.00	54.00	-7.52	Peak
4800.00	V	62.26	52.89	0.64	62.90	53.53	74.00	54.00	-0.47	AVG.
N/A										
1603.33	H	56.25	---	-9.01	47.24	---	74.00	54.00	-6.76	Peak
1990.00	H	52.66	---	-7.50	45.16	---	74.00	54.00	-8.84	Peak
2663.33	H	52.23	---	-5.03	47.20	---	74.00	54.00	-6.80	Peak
4808.33	H	56.91	52.91	0.65	57.56	53.56	74.00	54.00	-0.44	AVG.
N/A										

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.



Operation Mode: TX(CH Mid)

Test Date: February 25,2008

Temperature: 20°C

Tested by: Tom

Humidity: 70 % RH

Polarity: Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1076.66	V	59.42	---	-11.75	47.67	---	74.00	54.00	-6.33	Peak
1626.67	V	57.82	---	-8.92	48.90	---	74.00	54.00	-5.10	Peak
1760.00	V	57.84	---	-8.40	49.44	---	74.00	54.00	-4.56	Peak
4883.33	V	59.58	52.09	0.78	60.36	52.87	74.00	54.00	-1.13	AVG.
N/A										
1626.67	H	57.60	---	-8.92	48.68	---	74.00	54.00	-5.32	Peak
1760.00	H	58.52	---	-8.40	50.12	---	74.00	54.00	-3.88	Peak
2210.00	H	55.46	---	-6.63	48.83	---	74.00	54.00	-5.17	Peak
4883.33	H	54.20	49.45	0.78	54.98	50.23	74.00	54.00	-3.77	AVG.
N/A										

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.

**Operation Mode:** TX(CH High)**Test Date:** February 25,2008**Temperature:** 20°C**Tested by:** Tom**Humidity:** 70 % RH**Polarity:** Ver. / Hor.

Freq. (MHz)	Ant. Pol H/V	Peak Reading (dBuV)	AV Reading (dBuV)	Ant. / CL CF (dB)	Actual Fs		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
					Peak (dBuV/m)	AV (dBuV/m)				
1076.66	V	60.34	---	-11.75	48.59	---	74.00	54.00	-5.41	Peak
1493.33	V	56.10	---	-9.46	46.64	---	74.00	54.00	-7.36	Peak
1553.33	V	55.05	---	-9.21	45.84	---	74.00	54.00	-8.16	Peak
4958.33	V	55.32	50.44	0.91	56.23	51.35	74.00	54.00	-2.65	AVG.
N/A										
1493.33	H	58.14	---	-9.46	48.68	---	74.00	54.00	-5.32	Peak
1760.00	H	56.16	---	-8.40	47.76	---	74.00	54.00	-6.24	Peak
2663.33	H	53.39	---	-5.03	48.36	---	74.00	54.00	-5.64	Peak
4958.33	H	58.17	51.23	0.91	59.08	52.14	74.00	54.00	-1.86	AVG.
N/A										

**Notes:**

1. Measuring frequencies from 1 GHz to the 10th harmonic of highest fundamental frequency.
2. Measurements above show only up to 6 maximum emissions noted, or would be lesser 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.
3. Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
4. Spectrum setting:
  - a. Peak Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 1MHz, Sweep time = 200 ms.
  - b. AV Setting 1GHz - 26GHz, RBW = 1MHz, VBW = 10Hz, Sweep time = 200 ms.

## 7.8 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 (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

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 G				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
ESCI EMI TEST RECEIV.ESCI	ROHDE&SCHWARZ	1166.5950 03	100088	02/05/2009
LISN	EMCO	3825/2	1371	02/05/2009
LISN	EMCO	3825/2	8901-1459	02/05/2009

*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.

**Operation Mode:** Normal                      **Test Date:** February 25,2008  
**Temperature:** 22°C                      **Humidity:** 67% RH  
**Tested by:** Tom

FREQ MHz	PEAK RAW dBuV	Q.P. RAW dBuV	AVG RAW dBuV	Q.P. Limit dBuV	AVG Limit dBuV	Q.P. Margin dB	AVG Margin dB	NOTE
0.172	58.98	51.13	31.24	65.36	55.36	-14.23	-24.12	L1
0.209	57.16	48.53	26.69	64.31	54.31	-15.78	-27.62	L1
0.242	55.33	46.82	26.36	63.35	53.35	-16.53	-26.99	L1
0.290	51.45	43.92	23.67	61.97	51.97	-18.05	-28.30	L1
0.368	49.49	40.92	29.06	59.75	49.75	-18.83	-20.69	L1
0.713	47.53	37.95	23.37	56.00	46.00	-18.05	-22.63	L1
0.168	60.72	51.80	41.13	65.47	55.47	-13.67	-14.34	L2
0.201	58.11	48.66	34.99	64.52	54.52	-15.86	-19.53	L2
0.253	53.29	44.72	34.78	63.03	53.03	-18.31	-18.25	L2
0.294	51.45	42.04	30.60	61.87	51.87	-19.83	-21.27	L2
0.368	49.16	41.85	34.78	59.75	49.75	-17.90	-14.97	L2
0.713	45.32	38.26	30.28	56.00	46.00	-17.74	-15.72	L2

**Note:**

1. The measuring frequencies range between 0.15 MHz and 30 MHz.
2. The emissions measured in the frequency range between 0.15 MHz and 30MHz were made with an instrument using Quasi-peak detector and Average detector.
3. "---" denotes the emission level was or more than 2dB below the Average limit, and no re-check was made.
4. 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.
5. L1 = Line One (Live Line) / L2 = Line Two (Neutral Line)

## **APPENDIX 1**

### **PHOTOGRPHS OF TEST SETUP**

#### **Radiated Emission Set up Photos**





## Conducted Emission Set Up Photos

