

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name: Cardio Care

Brand Name: N/A

Model No.: ECG-102, ECG-111

Model Difference: Different internal components: ECG-111 has a headphone jack.
Different appearance: ECG-111 has a headphone jack outside its shell.
Different function: ECG-111 can be measured by an external connection with Pad.

FCC ID: X58-ECG10X

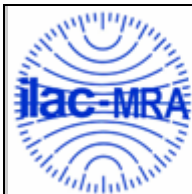
Report No.: ER/2012/C0012

Issue Date: Aug. 05, 2013

FCC Rule Part: §15.247, Cat: DSS

Prepared for: digiO2 International Co., Ltd.
4F-13, No. 79, Sec. 1, Hsin Tai Wu Rd., Hsi Chih Dist., New Taipei City 22101, Taiwan
SGS Taiwan Ltd.

Prepared by: Electronics & Communication Laboratory
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VERIFICATION OF COMPLIANCE

Applicant: digiO2 International Co., Ltd.
4F-13, No. 79, Sec. 1, Hsin Tai Wu Rd., Hsi Chih Dist., New Taipei City
22101, Taiwan

Product Name: Cardio Care

Brand Name: N/A

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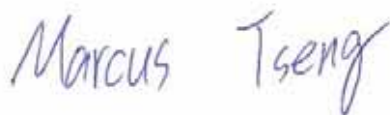
Date of Test: Dec. 19, 2012~ Aug. 01, 2013

Date of EUT Received: Dec. 19, 2012

We hereby certify that:

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

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

Test By:**Date:**

Aug. 05, 2013

*Marcus Tseng / Engineer***Prepared By:****Date:**

Aug. 05, 2013

*Violetta Tang / Clerk***Approved By:****Date:**

Aug. 05, 2013

Jim Chang / Supervisor

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Version

Version No.	Date	Description
00	Aug. 05, 2013	Initial creation of document

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1. GENERAL INFORMATION

General:

Product Name:	Cardio Care	
Brand Name:	N/A	
Model No.:	ECG-102, ECG-111	
Model difference:	Different internal components: ECG-111 has a headphone jack. Different appearance: ECG-111 has a headphone jack outside its shell. Different function: ECG-111 can be measured by an external connection with Pad.	
Hardware Version:	N/A	
Software Version:	N/A	
Power Supply	1.5V AAA Battery *2	
	Battery:	Model No.: LR03, Supplier: D2 TECH

Bluetooth:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V2.0 + EDR (GFSK + $\pi/4$ DQPSK + 8DPSK)
Channel number:	79 channels
Modulation type:	Frequency Hopping Spread Spectrum
Transmit Power:	2.54dBm (Peak)
Dwell Time:	$\leq 0.4s$
Antenna Designation:	Chip Dielectric Antenna / Antenna gain: 2.03dBi

This test report applies for Bluetooth function.

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1.1. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: X58-ECG10X** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with Subpart B is authorized under a Doc procedure.

1.2. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4: 2009. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with FCC Public Notice DA 00-705

1.3. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009. FCC Registration Number is: 990257, Canada Registration Number: 4620A-4

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 & 10 meters) and FCC Registration Number: 94644.

1.4. Special Accessories

Not available for this EUT intended for grant.

1.5. Equipment Modifications

Not available for this EUT intended for grant.

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2. SYSTEM TEST CONFIGURATION

2.1. EUT Configuration

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

2.2. EUT Exercise

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

2.3. Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 7 and 13 of ANSI C63.4: 2009, conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. The turn table 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 and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna. According to the requirements in Section 8 and 13 and Sub-clause 8.3.1.2 of ANSI C63.4: 2009 and DA 00-705.

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2.4. Configuration of Tested System

Fig. 2-1 Configuration of Tested System

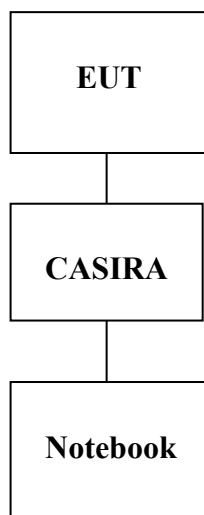


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	CASIRA	CSR	BCES301199/1	7383070403	N/A	N/A
2.	Notebook	DELL	D505	34056609472	N/A	N/A
3.	Test Software	N/A	N/A	N/A	N/A	N/A

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	Conducted Emission	N/A
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)	20dB Bandwidth	Compliant
§15.247I	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.209(a) (f)	Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii)	Time of Occupancy	Compliant
§15.203, §15.247(b)(4)(i)	Antenna Requirement	Compliant

4. 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 (2402MHz), mid (2441MHz) and high (2480MHz) with worst case BR mode is chosen for full testing.

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5. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 1.55 dB
20dB Bandwidth & 99% Power Bandwidth	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 dB
Frequency Separation	+/- 123.36 Hz
Number of hopping frequency	+/- 123.36 Hz
Time of Occupancy	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : Horizontal)	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

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

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6. CONDUCTED EMISSION TEST

6.1. Standard Applicable

According to §15.207 frequency within 150KHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Note		
1.The lower limit shall apply at the transition frequencies		
2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

6.2. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4: 2009.
2. The EUT was plug-in the AC/DC Power adapter. The host system was placed on the center of the back edge on the test table. The peripherals were placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The spacing between the peripherals was 10 centimeters.
4. External I/O cables were draped along the edge of the test table and bundle when necessary.
5. The host system was connected with 120Vac/60Hz power source.

6.3. Measurement 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.

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6.4. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100759	05/20/2011	05/19/2013
EMI Receiver	R&S	ESCS 30	828985/004	09/23/2012	09/22/2013
LISN	Rolf-Heine	NNB-2/16Z	99012	03/23/2012	03/22/2013
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/23/2012	03/22/2013
Coaxial Cables	N/A	WK CE Cable	N/A	01/05/2012	01/04/2013

6.5. Measurement Result

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 Result:

N/A, The device is powered by batteries.

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7. PEAK OUTPUT POWER MEASUREMENT

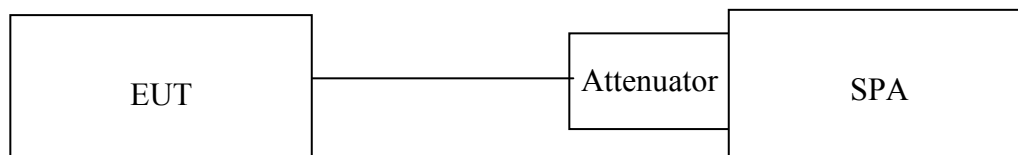
7.1. Standard Applicable

For frequency hopping systems operating in the 2400-2483.5MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125Watts.

7.2. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Sensor	Anritsu	ML2495A	1005007	02/08/2012	02/07/2014
Power Meter	Anritsu	MA2411B	917032	02/08/2012	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/17/2012	03/16/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2012	02/27/2013
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2012	01/04/2013
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2012	02/27/2013
Splitter	Agilent	11636B	N/A	02/28/2012	02/27/2013

7.3. Test Set-up:



7.4. Measurement 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 power meter or spectrum. (Max peak function, >20dB bandwidth, >=RBW)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

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7.5. Measurement Result

BR mode (GFSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	0.57	0.57	0.00114	1
2441.00	1.73	1.73	0.00149	1
2480.00	2.54	2.54	0.00179	1

EDR mode ($\pi/4$ DQPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	-1.17	-1.17	0.00076	0.125
2441.00	-0.28	-0.28	0.00094	0.125
2480.00	0.15	0.15	0.00104	0.125

EDR mode (8DPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	-0.89	-0.89	0.00081	0.125
2441.00	0.02	0.02	0.00100	0.125
2480.00	0.49	0.49	0.00112	0.125

* offset 0.5dB

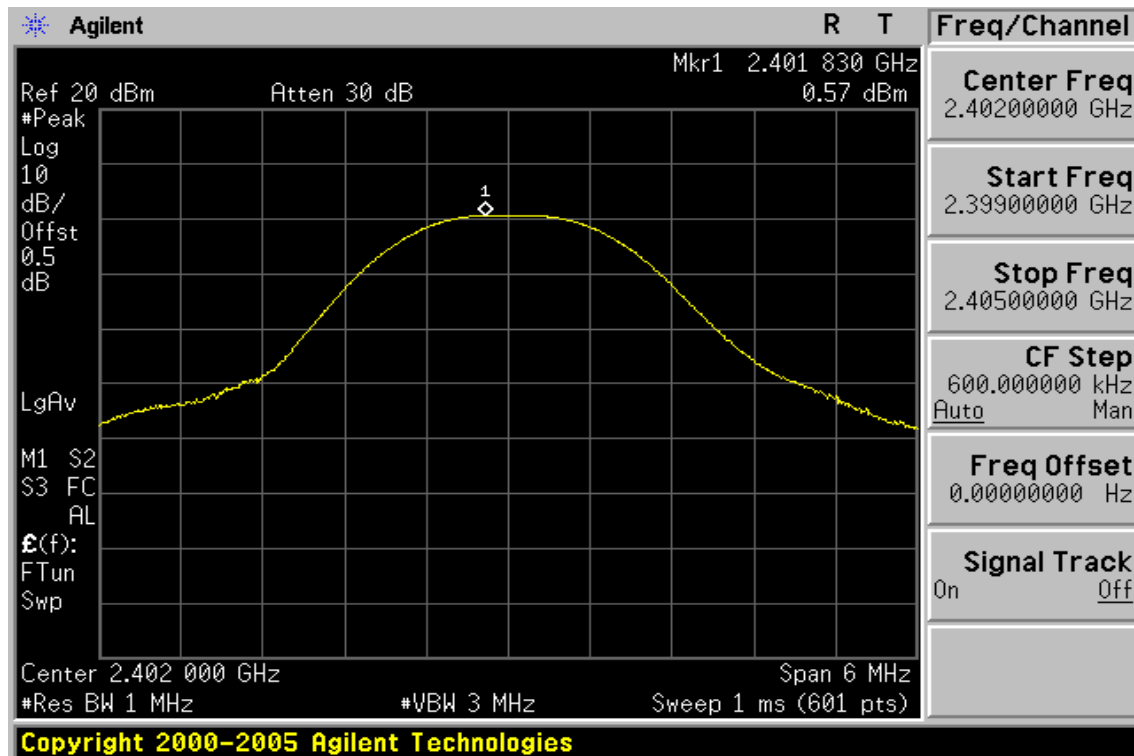
Note: Refer to next page for plots.

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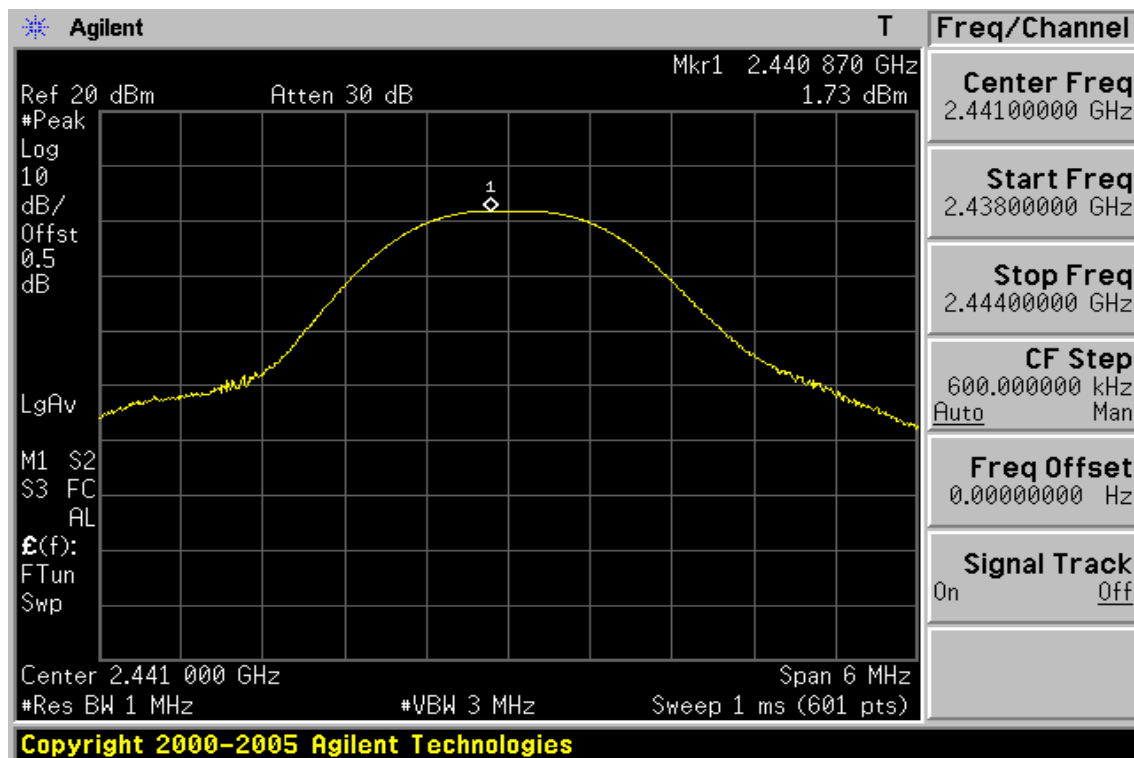
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Peak Power Output Data Plot (CH Low) (BR mode GFSK)



Peak Power Output Data Plot (CH Mid) (BR mode GFSK)

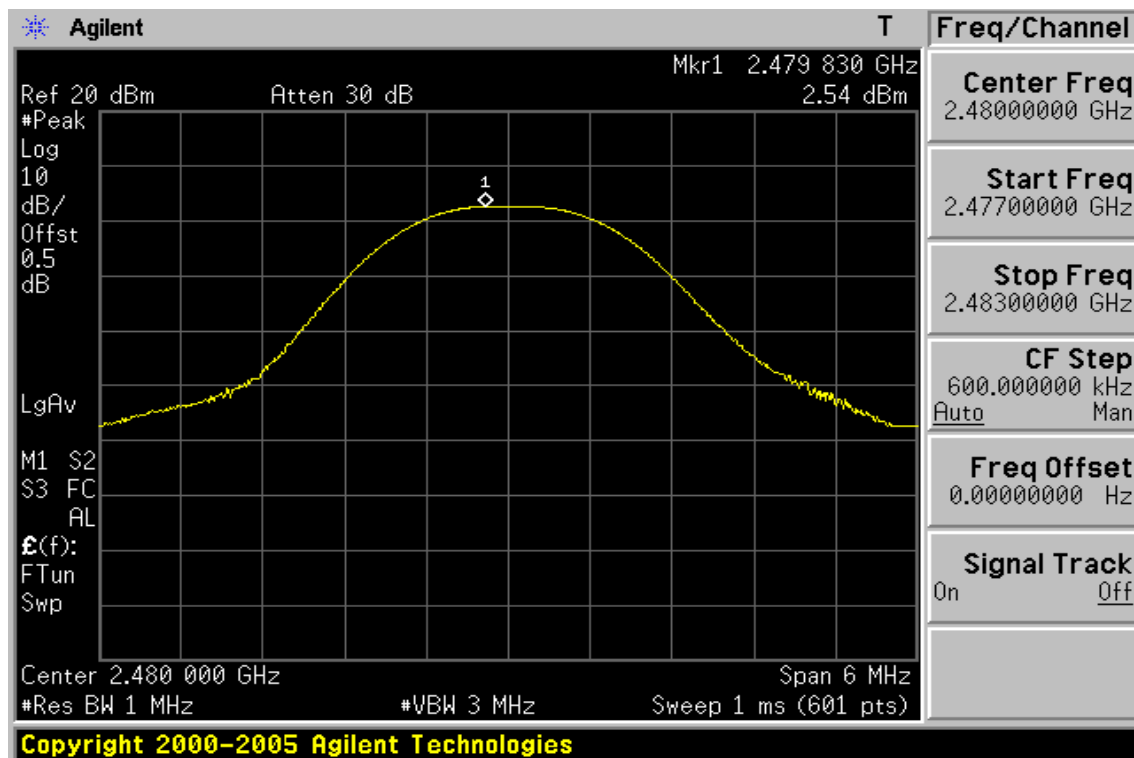
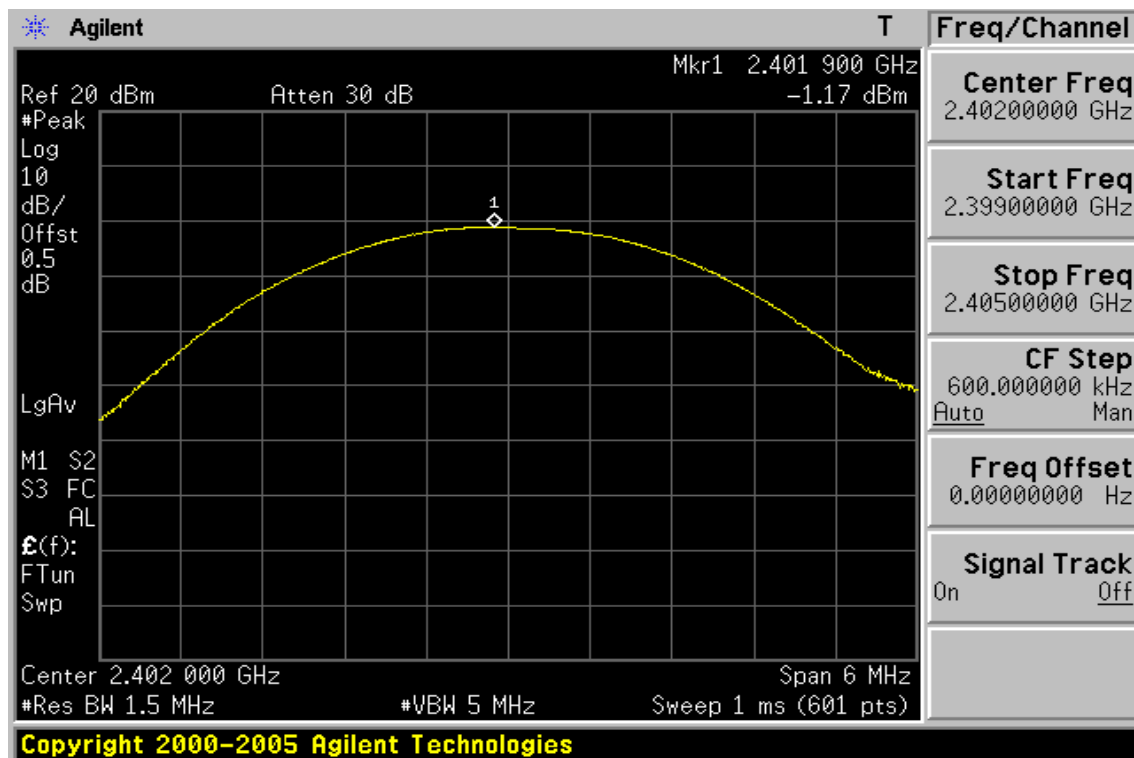


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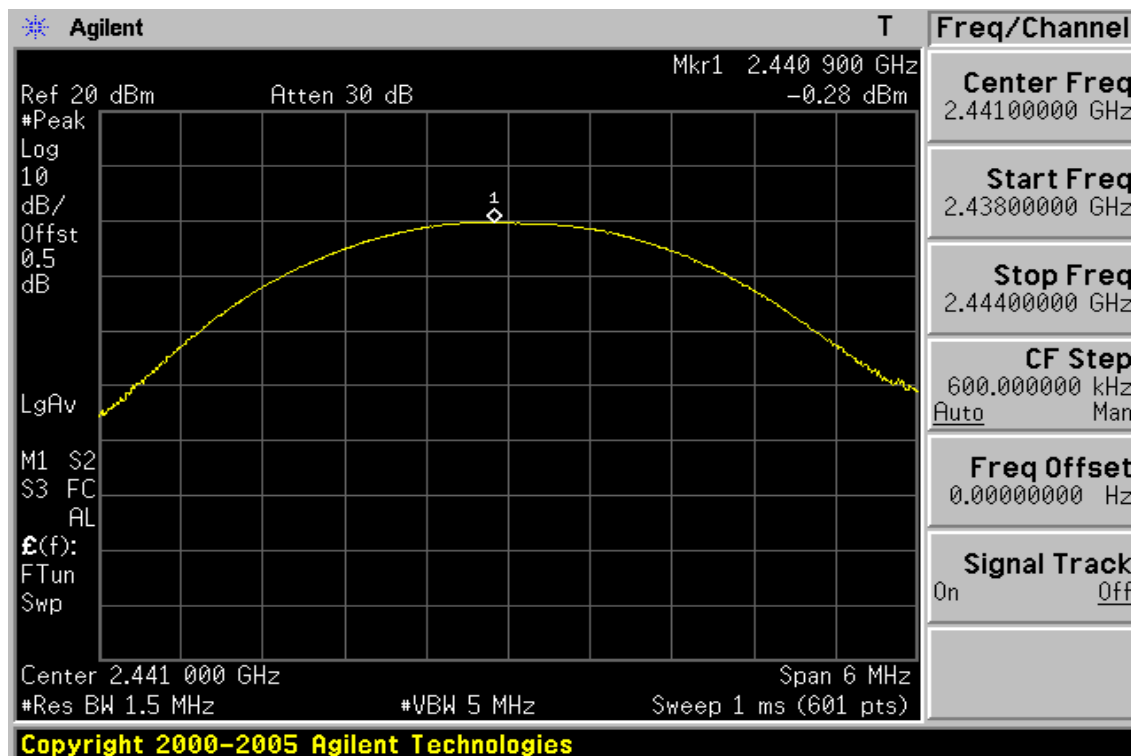
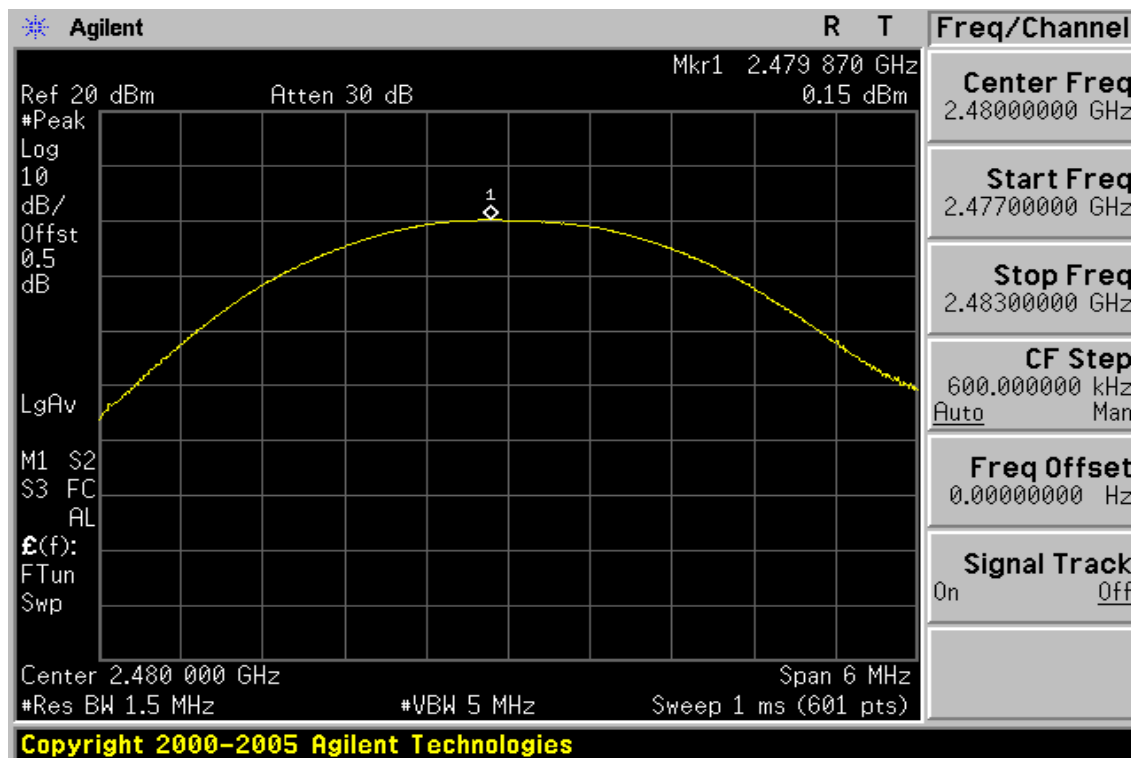
Peak Power Output Data Plot (CH High) (BR mode GFSK)

Peak Power Output Data Plot (CH Low) (EDR mode $\pi/4$ DQPSK)

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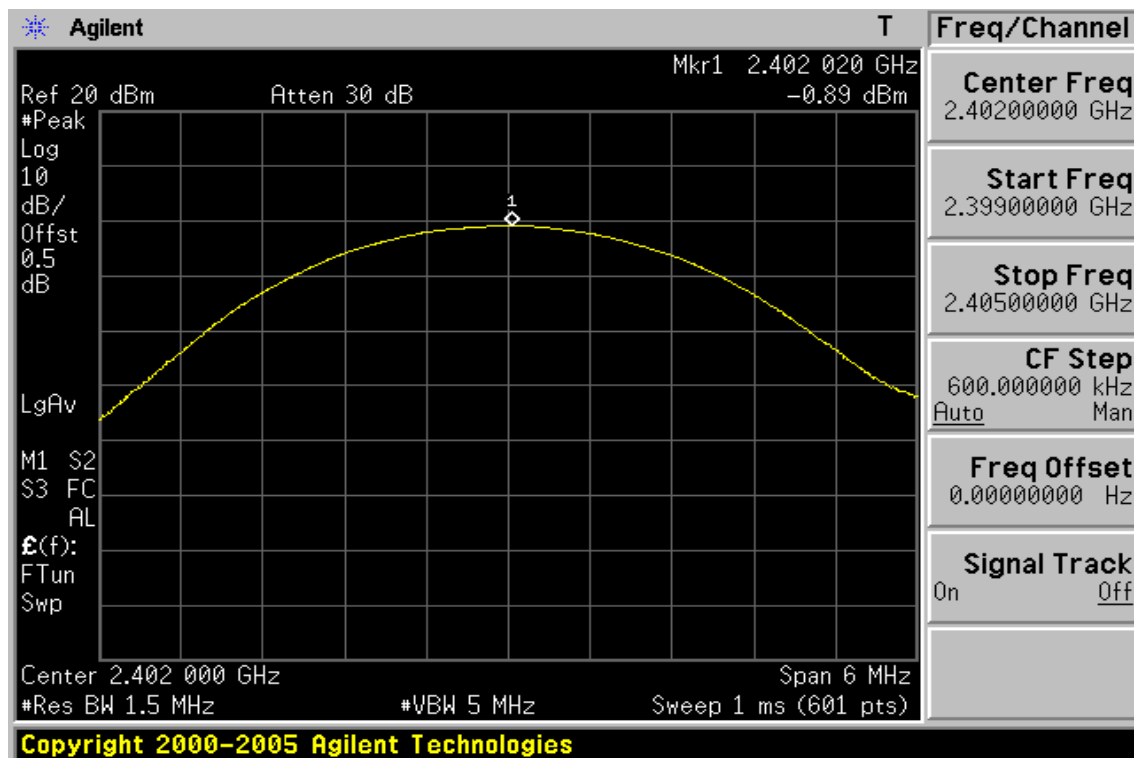
Peak Power Output Data Plot (CH Mid) (EDR mode $\pi/4$ DQPSK)Peak Power Output Data Plot (CH High) (EDR mode $\pi/4$ DQPSK)

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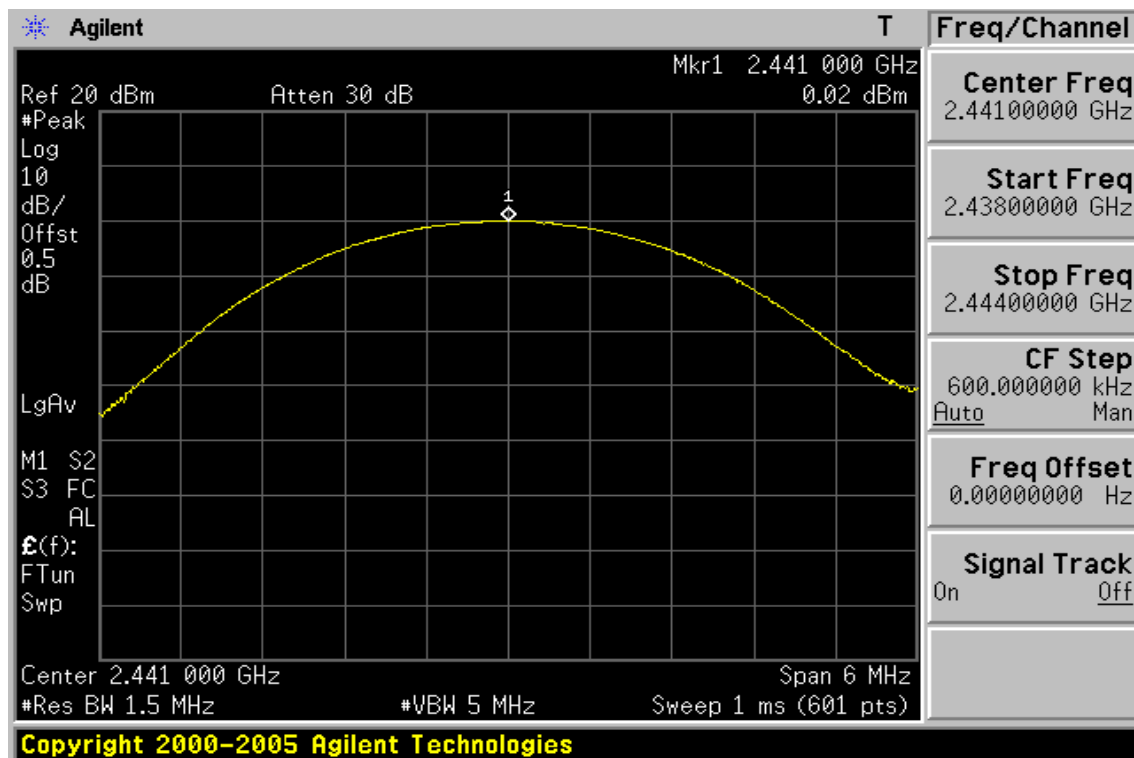
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Peak Power Output Data Plot (CH Low) (EDR mode 8DPSK)



Peak Power Output Data Plot (CH Mid) (EDR mode 8DPSK)

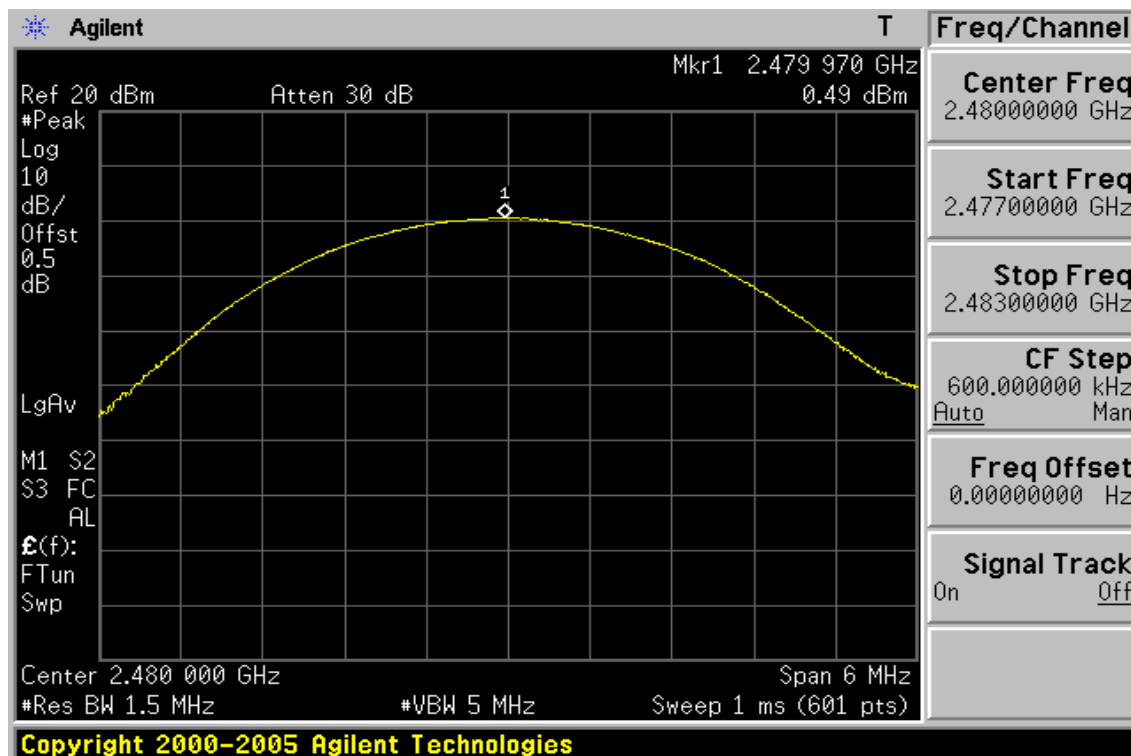


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Peak Power Output Data Plot (CH High) (EDR mode 8DPSK)



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8. 20dB BAND WIDTH

8.1. Standard Applicable

For frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

8.2. Measurement Equipment Used

Refer to section 7.2 for details.

8.3. Test Set-up

Refer to section 7.3 for details.

8.4. Measurement 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=10KHz (1 % of Bandwidth.), Span= 3MHz, Sweep= auto
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

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8.5. Measurement Result:

BR mode (GFSK):

CH	Bandwidth (kHz)
Lower	932.058
Mid	932.468
Higher	934.258

EDR mode ($\pi/4$ DQPSK):

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.320	0.880
Mid	1.320	0.880
Higher	1.317	0.878

EDR mode (8DPSK):

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.300	0.867
Mid	1.295	0.863
Higher	1.294	0.863

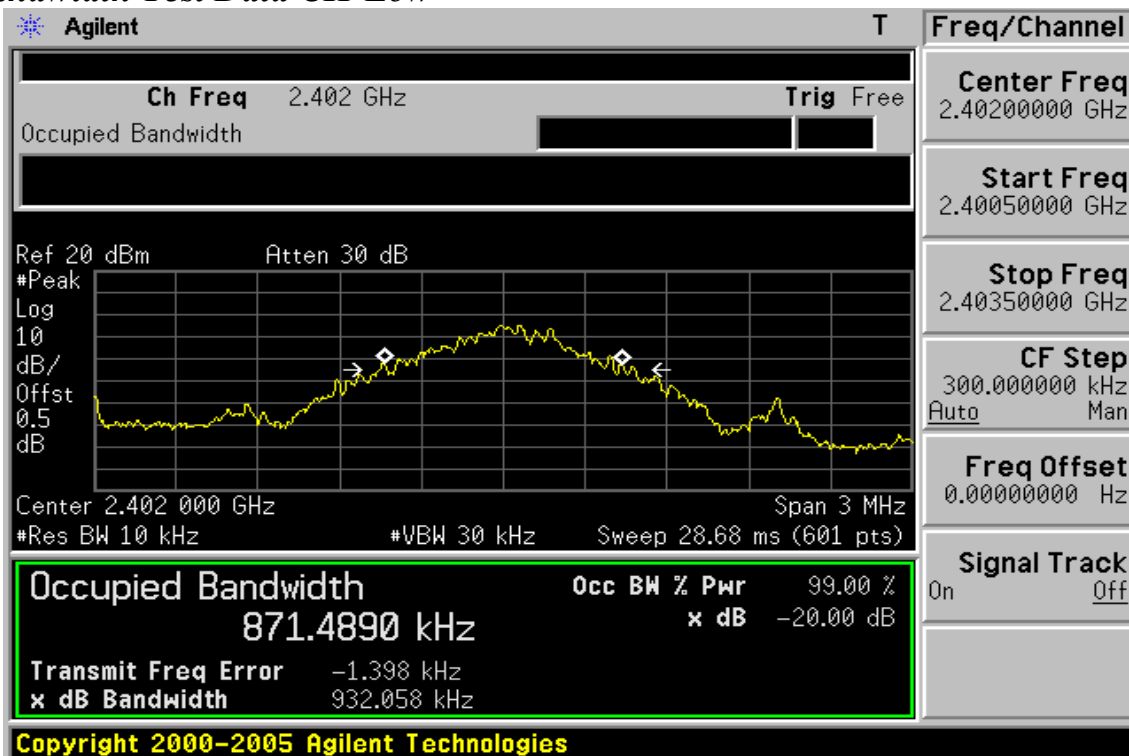
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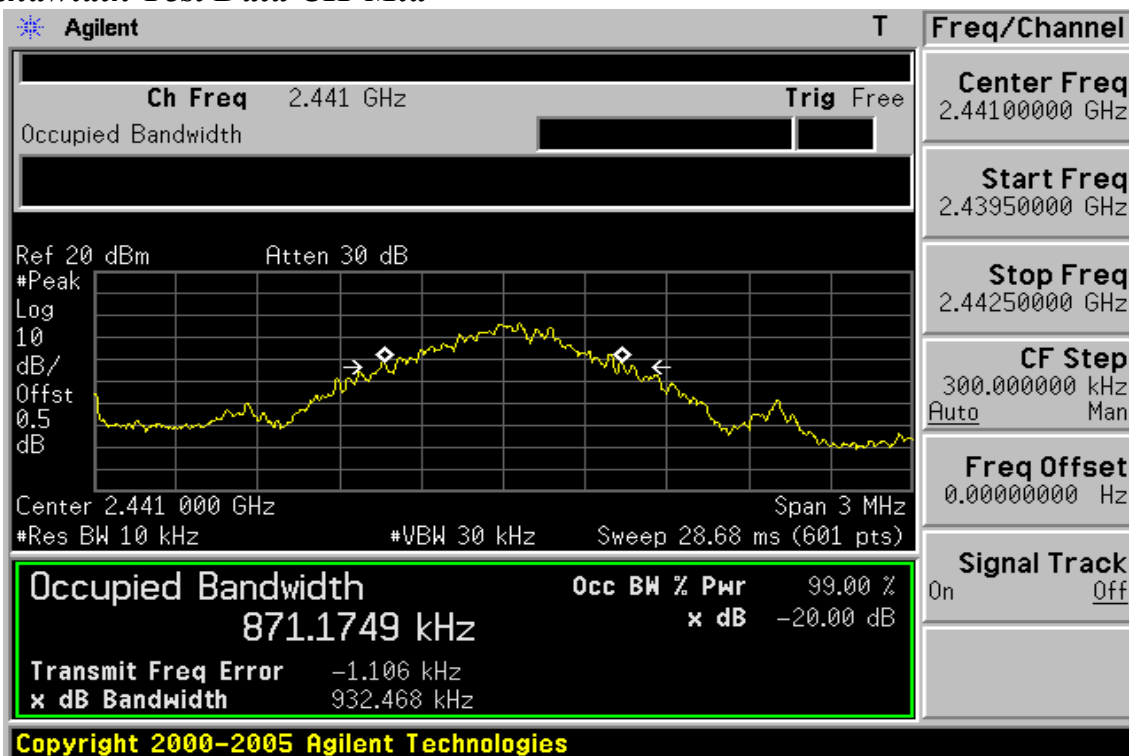
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BR Mode (GFSK)

20dB Bandwidth Test Data CH-Low



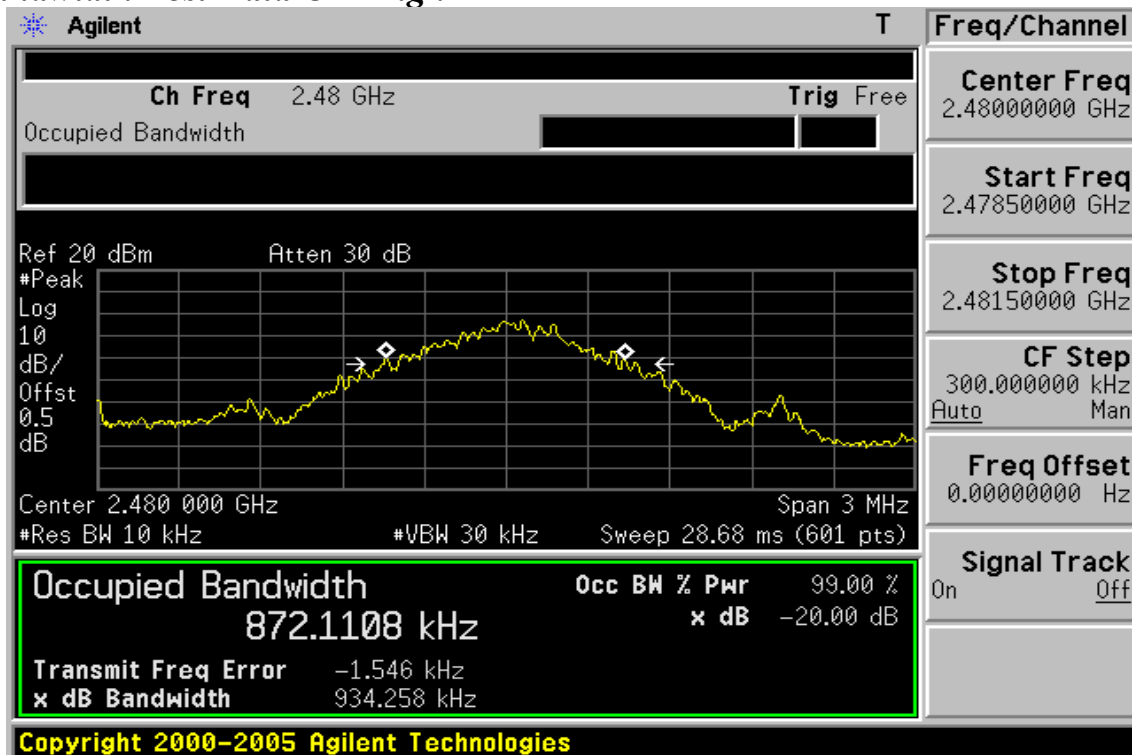
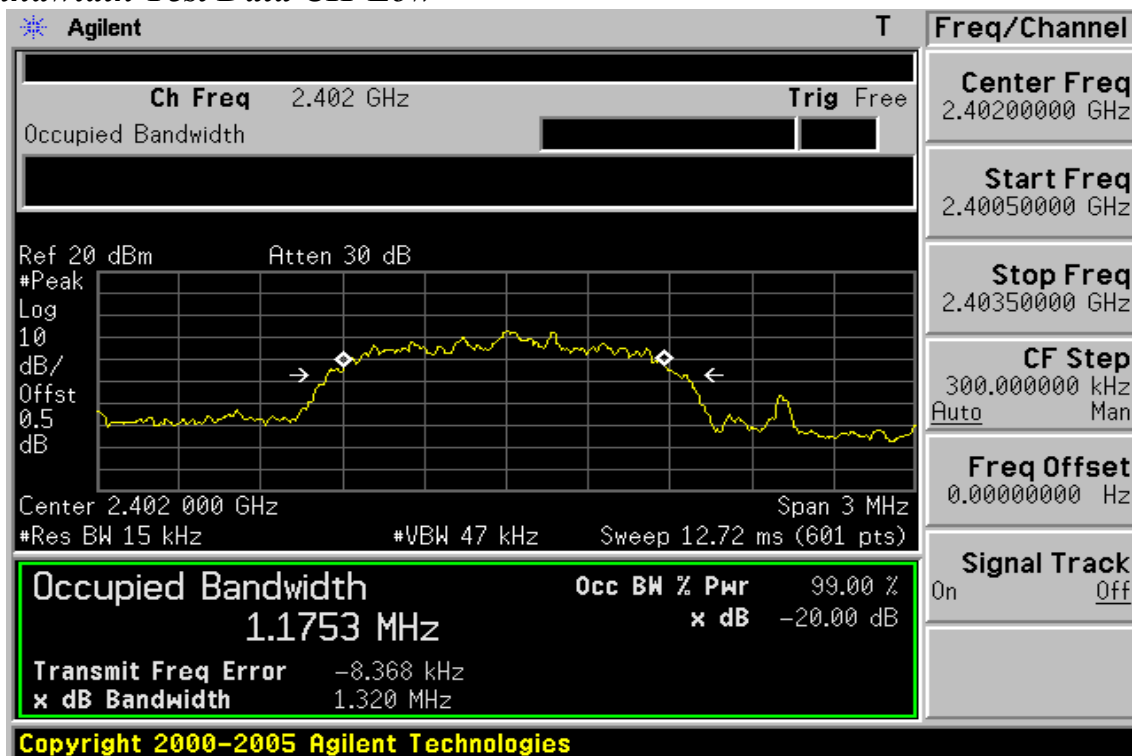
20dB Bandwidth Test Data CH-Mid



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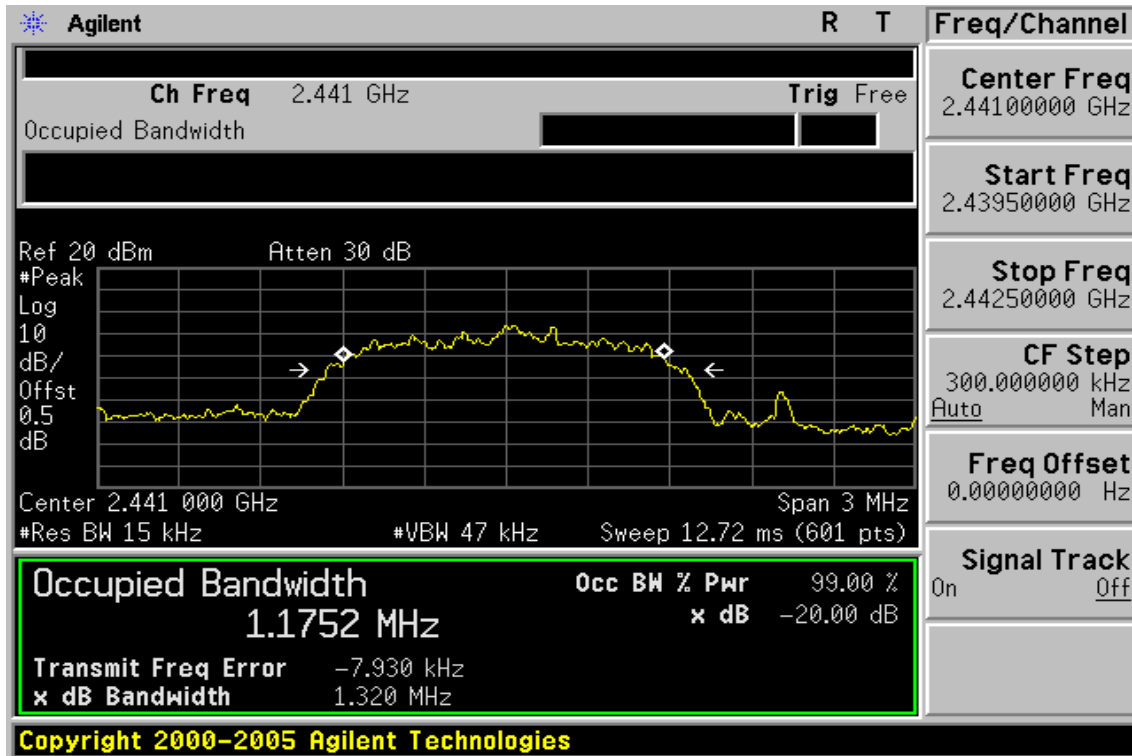
20dB Bandwidth Test Data CH-High**EDR Mode ($\pi/4$ DQPSK)****20dB Bandwidth Test Data CH-Low**

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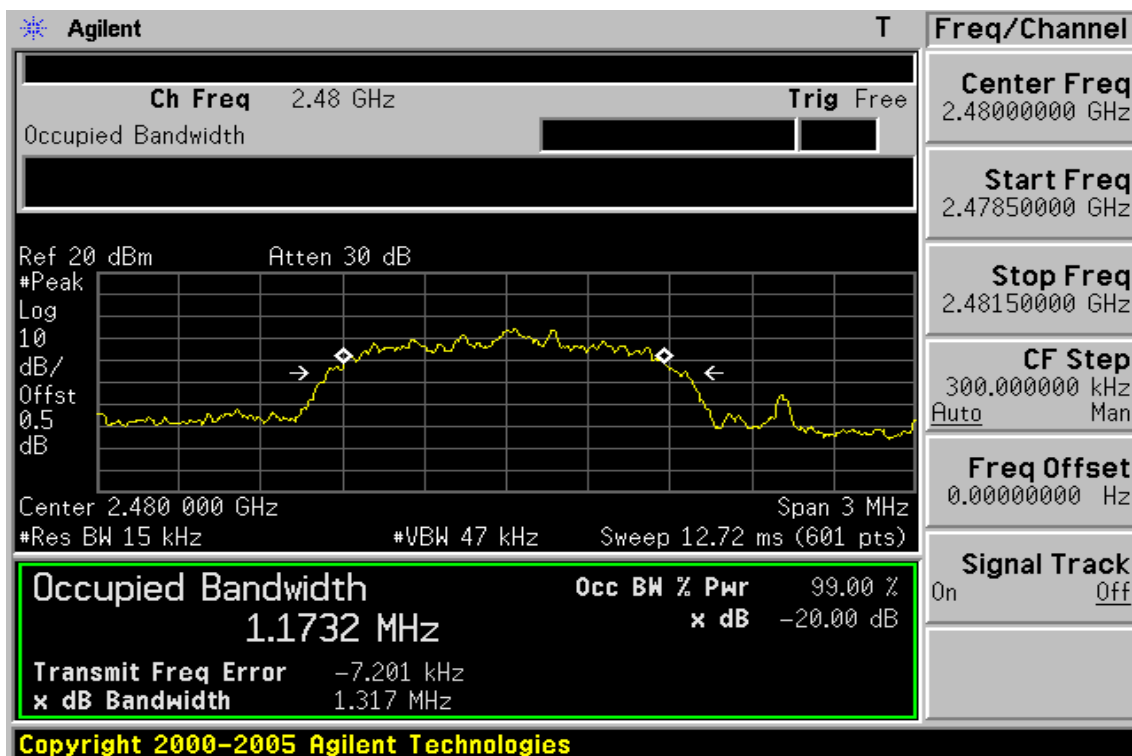
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20dB Bandwidth Test Data CH-Mid



20dB Bandwidth Test Data CH-High

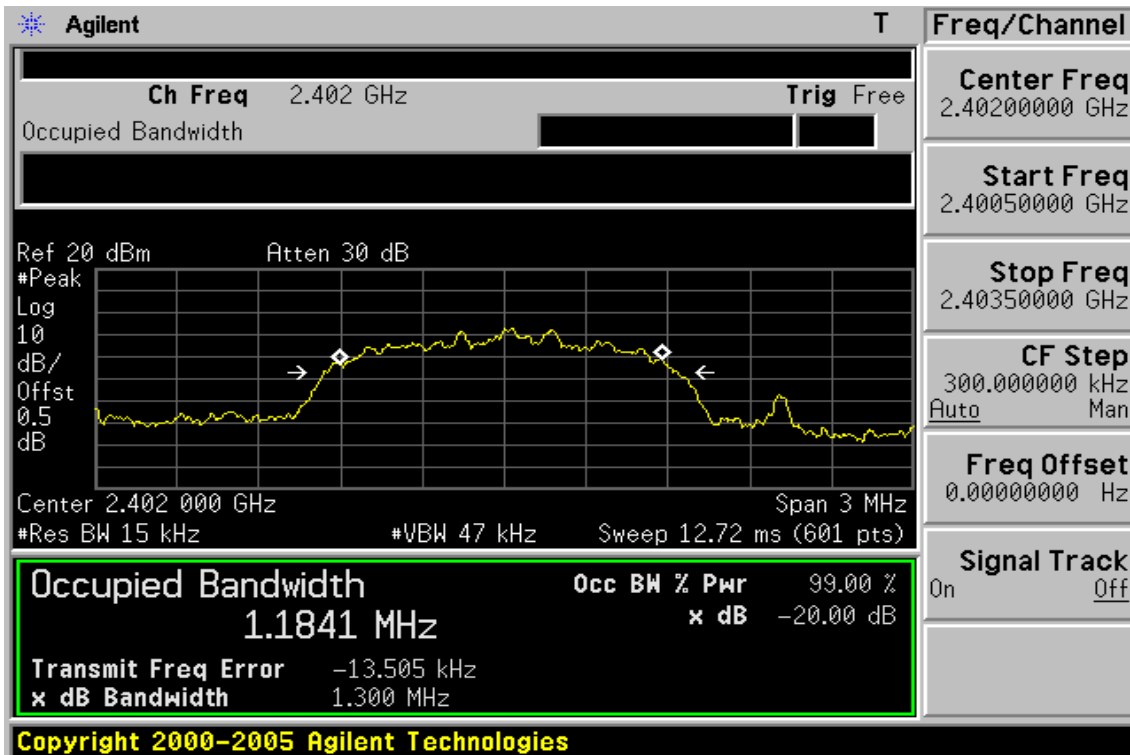


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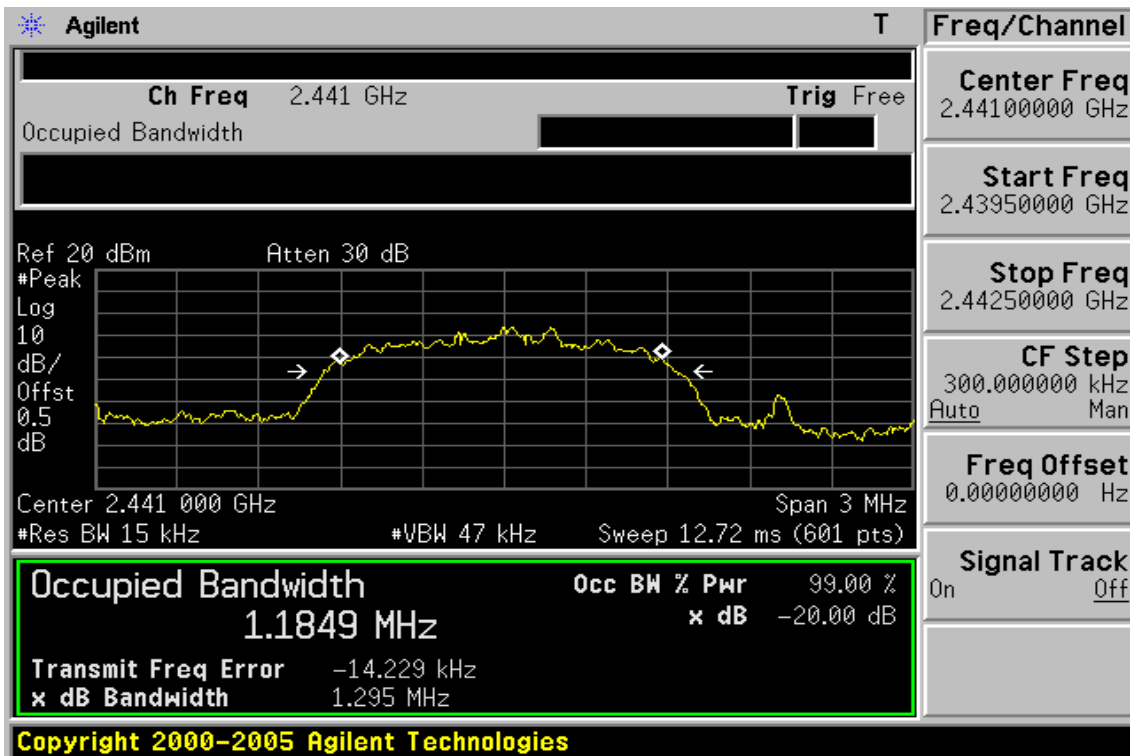
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EDR Mode (8DPSK)

20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid

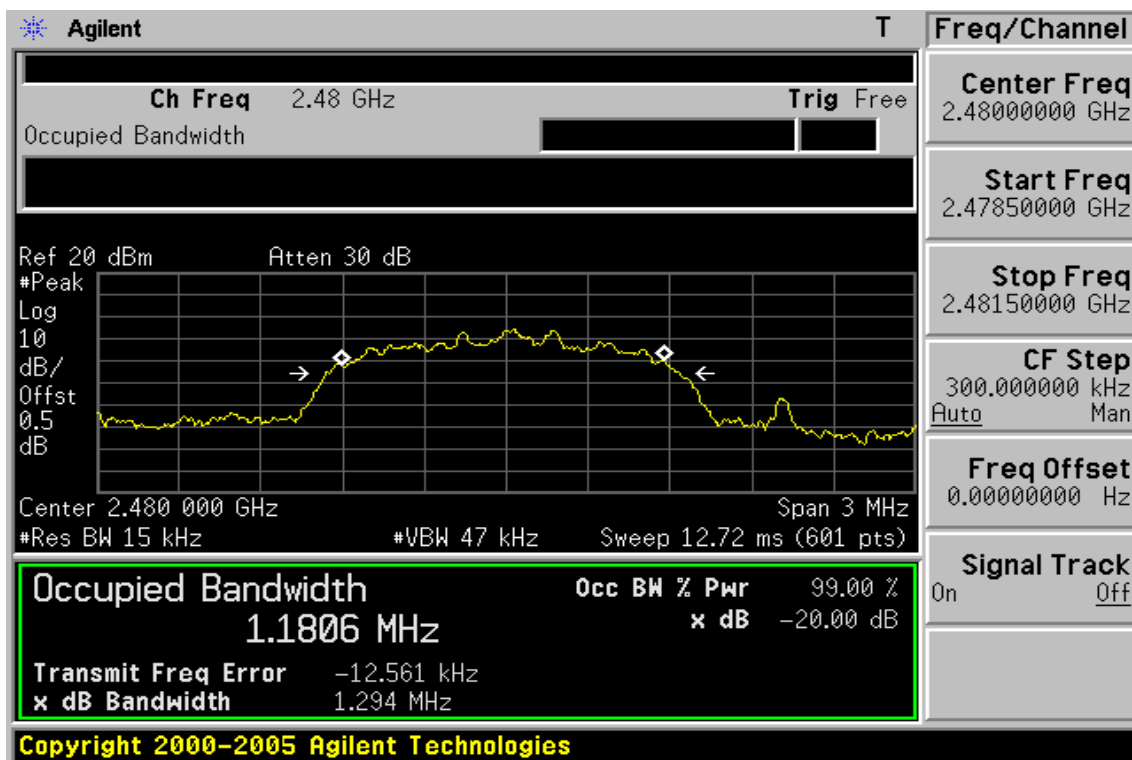


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20dB Bandwidth Test Data CH-High



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9. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

9.1. Standard Applicable

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).

9.2. Measurement Equipment Used

9.2.1. Conducted Emission at antenna port:

Refer to section 7.2 for details.

9.2.2. Radiated emission:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESC17	100759	05/20/2011	05/19/2013
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	02/15/2011	02/14/2013
Spectrum Analyzer	R&S	FSV-30	101398	10/18/2011	10/17/2013
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/10/2012	01/09/2014
Horn antenna	ETS.LINDGREN	3117	123995	05/19/2011	05/18/2013
Horn Antenna	Schwarzbeck	BBHA9170	185	07/11/2011	07/10/2013
Pre-Amplifier	Agilent	8447D	2944A07676	01/04/2012	01/03/2013
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/04/2012	01/03/2013
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	02/28/2012	02/28/2013
Attenuator	Mini-Circuit	BW-S10W2+	004	02/28/2012	02/27/2013
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R
Controller	HD	HD100	N/A	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_Rx	9	01/04/2012	01/03/2013
3m Site NSA	SGS	966 chamber	N/A	07/15/2012	07/14/2013

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966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100759	02/08/2013	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	02/06/2013	02/07/2014
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/10/2012	01/09/2014
Horn antenna	ETS.LINDGREN	3117	123995	05/31/2013	05/30/2014
Horn Antenna	Schwarzbeck	BBHA9170	184	01/17/2012	01/16/2014
Pre-Amplifier	Agilent	8447D	2944A07676	01/04/2013	01/03/2014
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/04/2013	01/03/2014
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	02/28/2013	02/28/2014
Attenuator	Mini-Circuit	BW-S10W2+	004	02/28/2013	02/27/2014
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R
Controller	HD	HD100	N/A	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_Rx	9	01/04/2013	01/03/2014
3m Site NSA	SGS	966 chamber	N/A	07/15/2013	07/14/2014

Note: The measurement was taken place with the long duration of the time, and additional equipment list as shown above indicate those equipment of which has been subject to undertake the calibration in intermediate period of time of the measurement.

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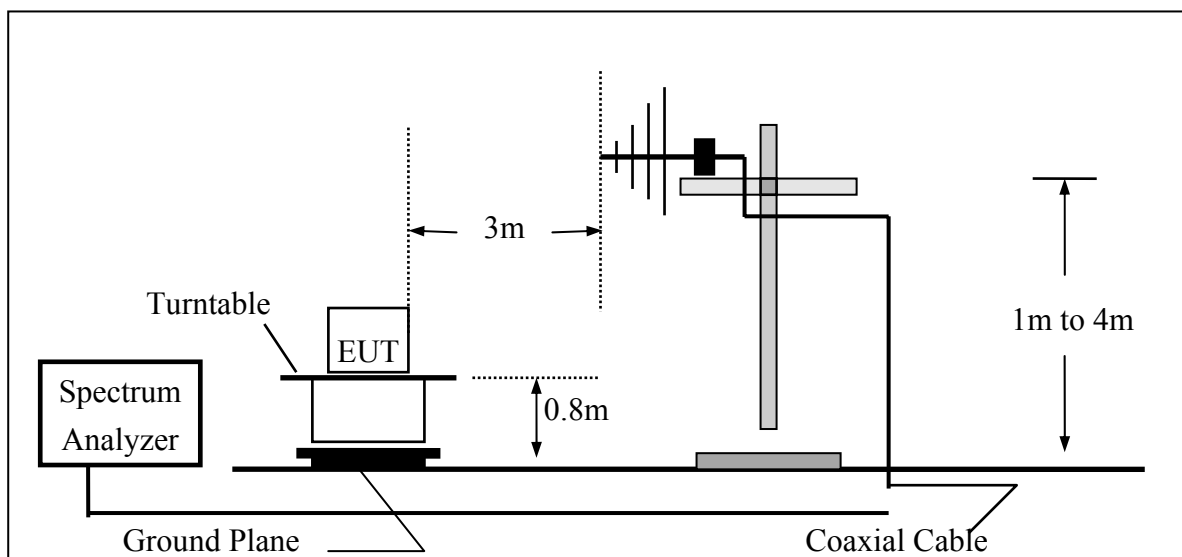
9.3. Test SET-UP:

9.3.1. Conducted Emission at antenna port:

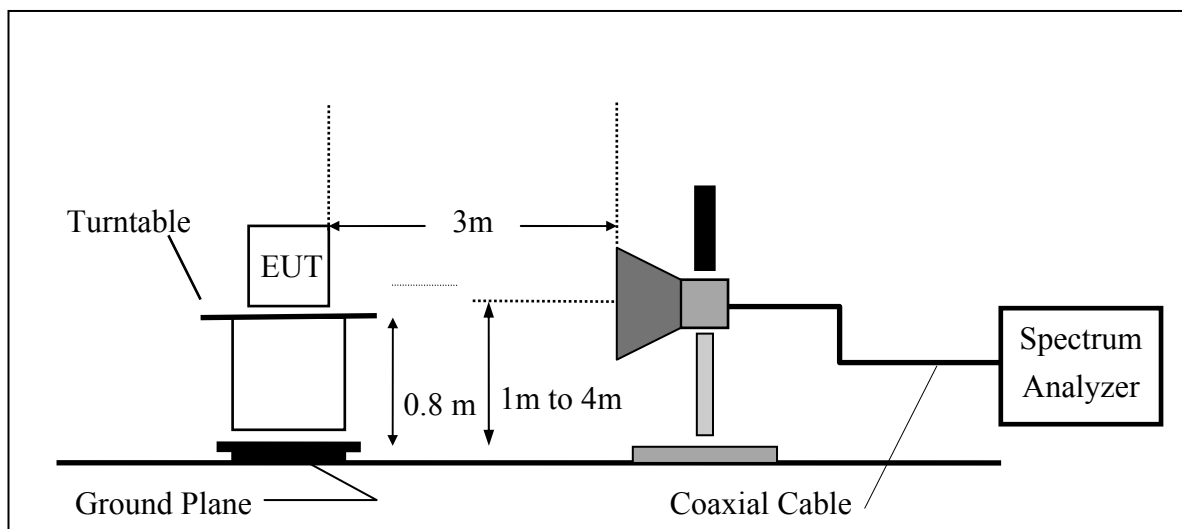
Refer to section 7.3 for details.

9.3.2. Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



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9.4. Measurement 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=100KHz, Span=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.
7. Radiated Emission refer to section 9.

9.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

9.6. Measurement Result

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

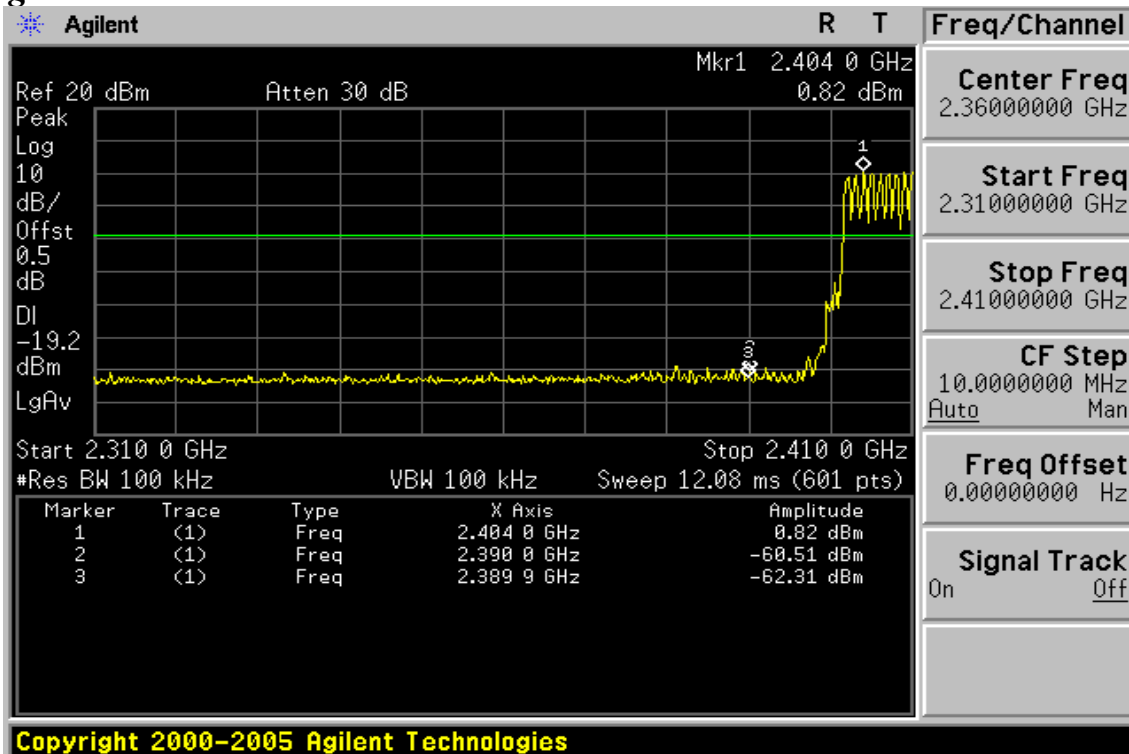
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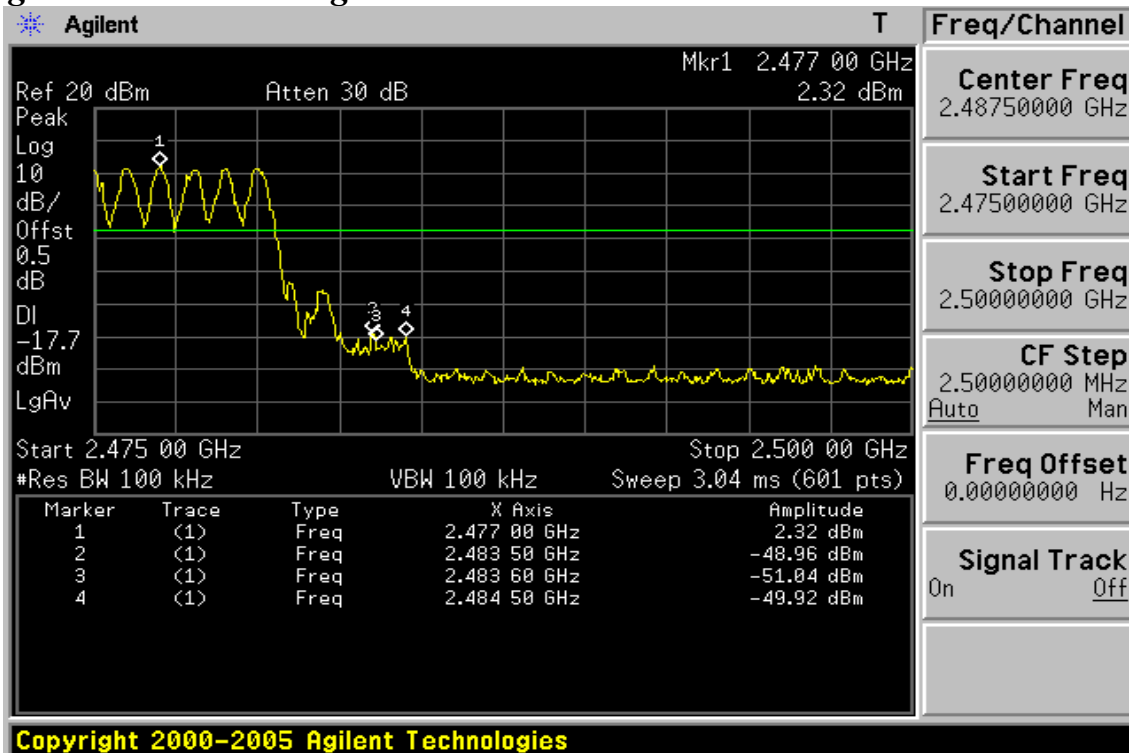
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BR Mode

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Radiated Emission: (BR mode)

Operation Band	:BR	Test Date	:2013-07-30
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	30.26	2.12	32.38	54.00	-21.62
2390.00	E	Peak	44.40	2.12	46.52	74.00	-27.48

Operation Band	:BR	Test Date	:2013-07-30
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	30.18	2.74	32.92	54.00	-21.08
2390.00	E	Peak	43.28	2.74	46.02	74.00	-27.98

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE (radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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Operation Band	:BR	Test Date	:2013-07-30
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Bandedge HIGH	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	30.22	2.53	32.75	54.00	-21.25
2483.50	E	Peak	49.87	2.53	52.40	74.00	-21.60

Operation Band	:BR	Test Date	:2013-07-30
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Bandedge HIGH	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	30.12	3.56	33.68	54.00	-20.32
2483.50	E	Peak	48.22	3.56	51.78	74.00	-22.22

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE (radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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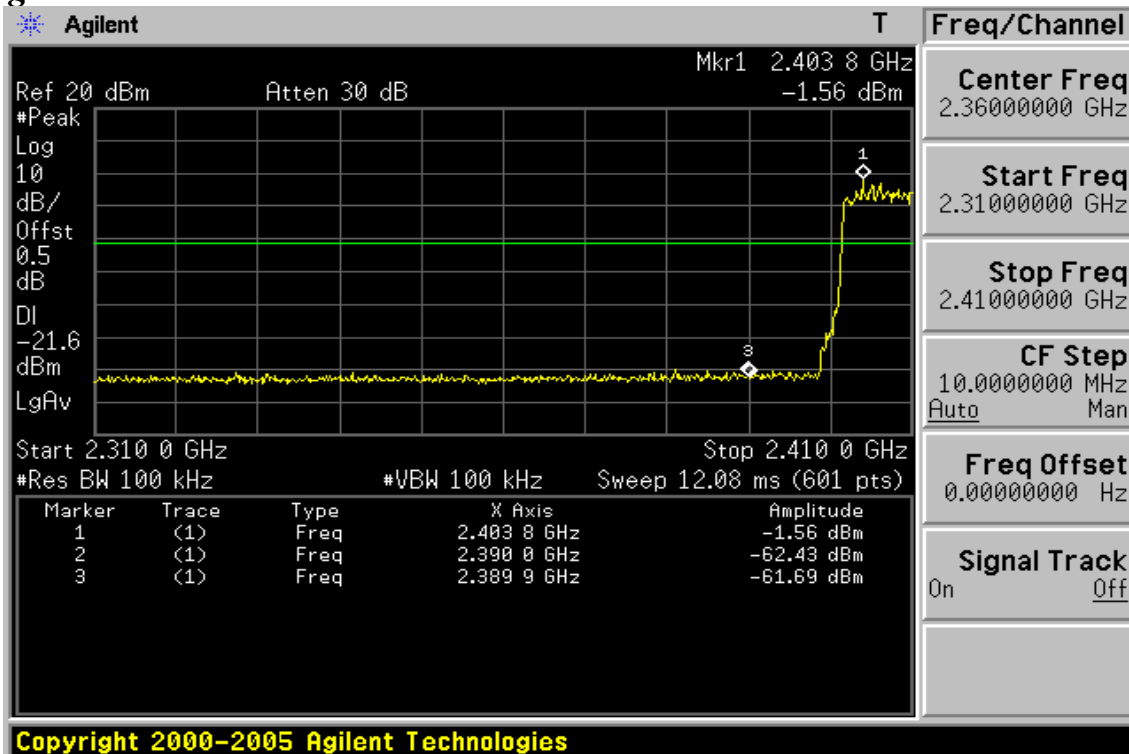
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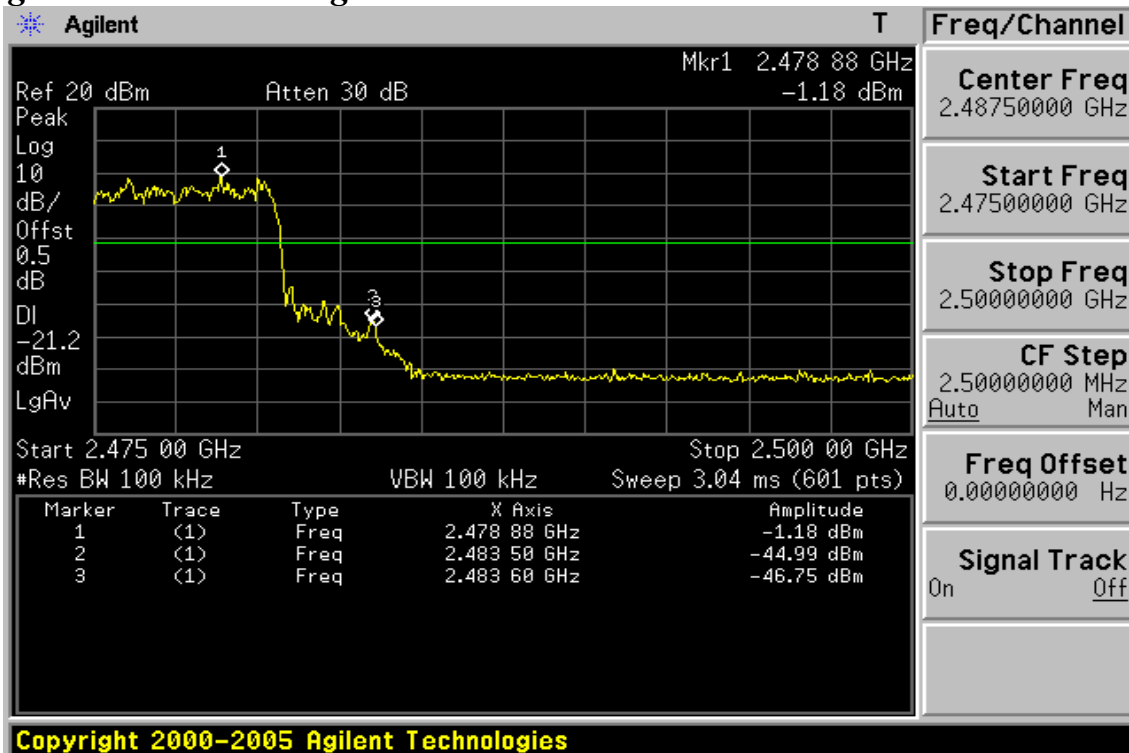
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EDR Mode

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Radiated Emission: (EDR mode)

Operation Band	:EDR	Test Date	:2013-07-30
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	30.56	2.12	32.68	54.00	-21.32
2390.00	E	Peak	43.23	2.12	45.35	74.00	-28.65

Operation Band	:EDR	Test Date	:2013-07-30
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	30.52	2.74	33.26	54.00	-20.74
2390.00	E	Peak	43.33	2.74	46.07	74.00	-27.93

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE (radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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Operation Band	:EDR	Test Date	:2013-07-30
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Bandedge HIGH	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	32.07	2.53	34.60	54.00	-19.40
2483.50	E	Peak	51.45	2.53	53.98	74.00	-20.02

Operation Band	:EDR	Test Date	:2013-07-30
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:Bandedge HIGH	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	31.82	3.56	35.38	54.00	-18.62
2483.50	E	Peak	51.80	3.56	55.36	74.00	-18.64

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

The trace on RE (radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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10. SPURIOUS RADIATED EMISSION TEST

10.1. Standard Applicable

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

10.2. Measurement Equipment Used:

10.2.1. Conducted Emission at antenna port:

Refer to section 7.2 for details.

10.2.2. Radiated emission:

Refer to section 9.2.2 for details.

10.3. Test SET-UP:

10.3.1. Conducted Emission at antenna port:

Refer to section 7.3 for details.

10.3.2. Radiated emission:

Refer to section 9.3.3 for details.

10.4. Measurement Procedure:

Radiated Emission:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency measured were complete.

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Conducted Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 100K & VBW = 300K on Spectrum.
3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30 to 3G, 3G to 8G, 8G to 13G, 13G to 18G and 18G to 26.5GHz.
4. Via Software, combine 5 spans of frequency range into one plot.

10.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

10.6. Measurement Result:

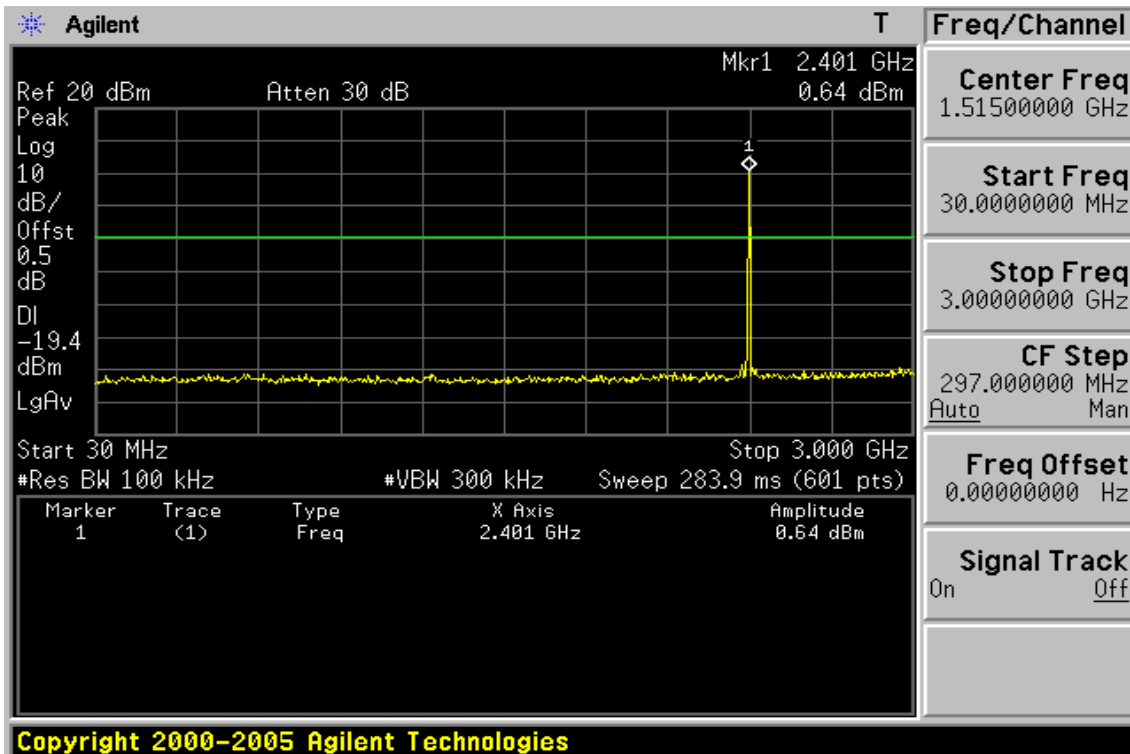
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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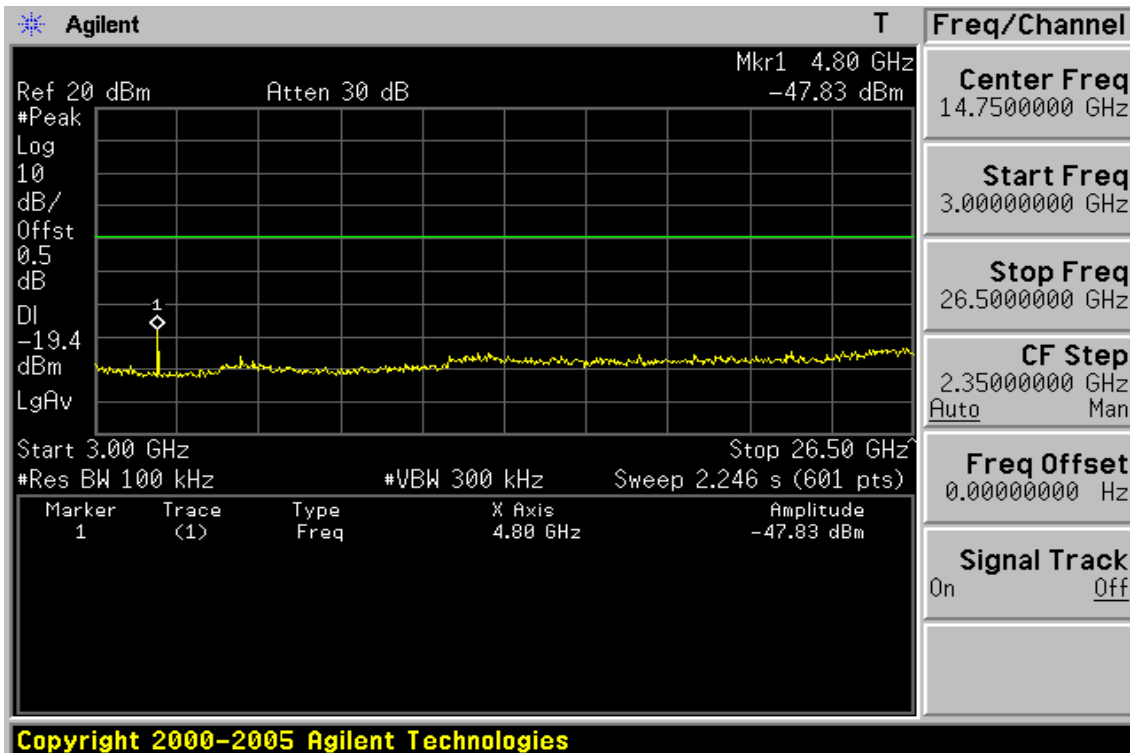
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BR Mode Conducted Spurious Emission Measurement Result Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz

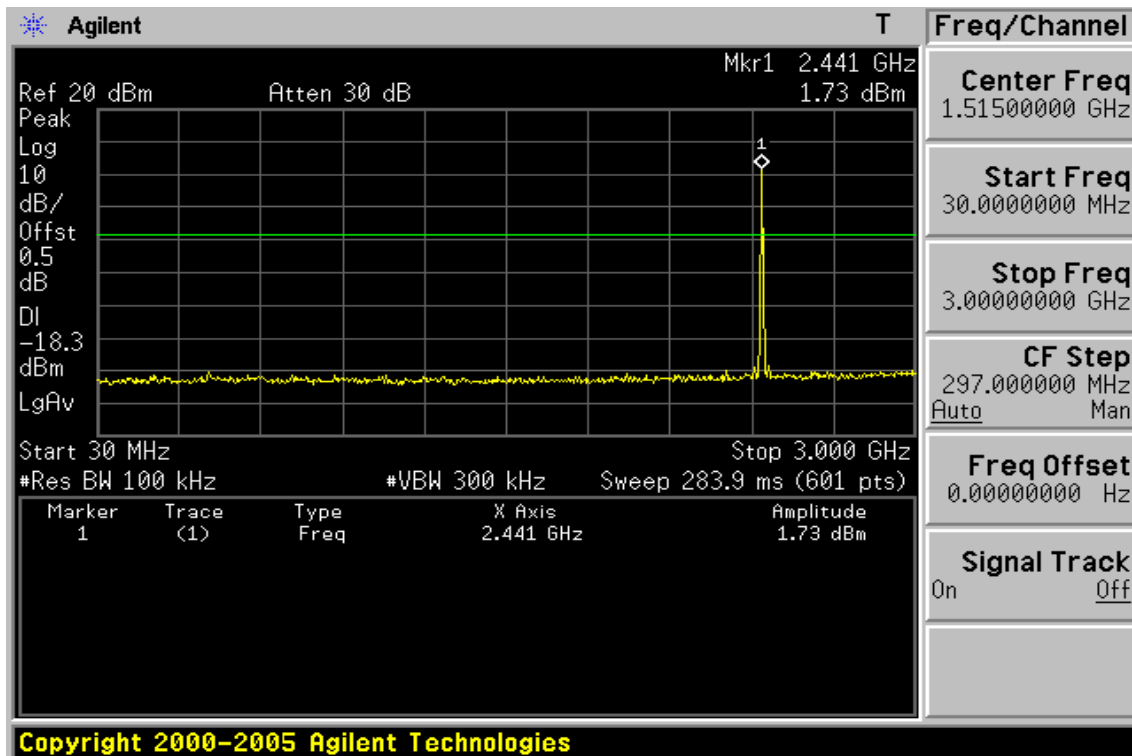


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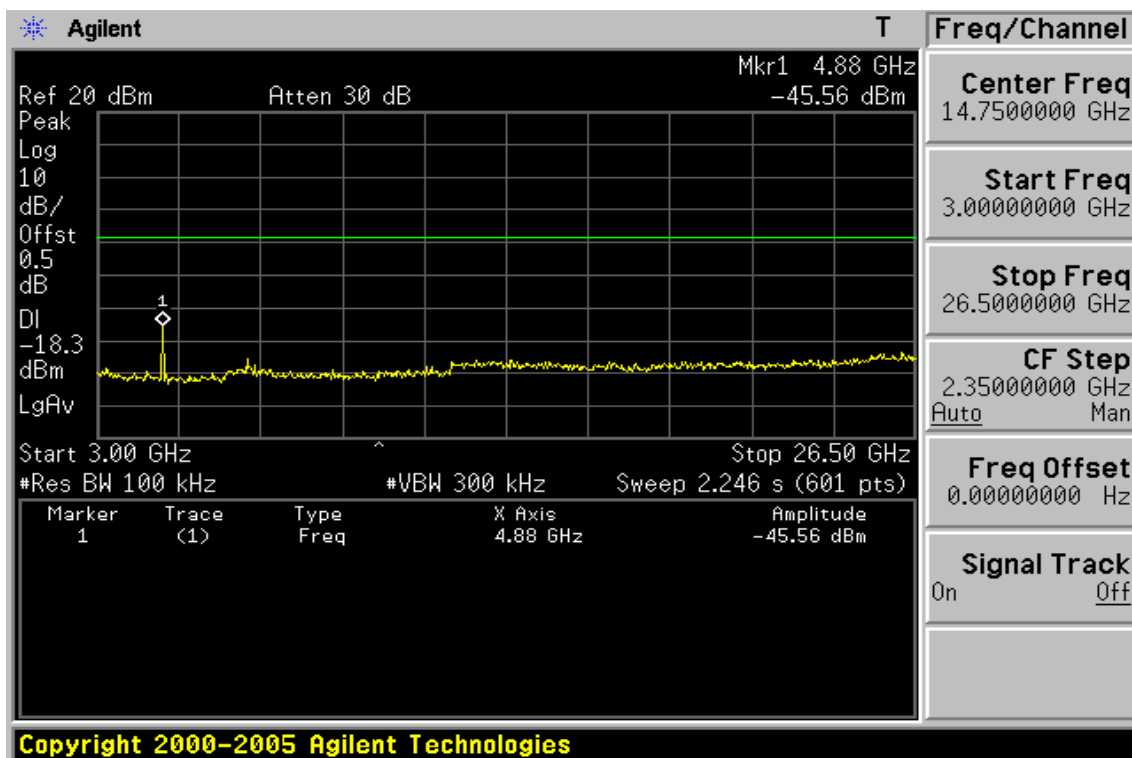
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Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz

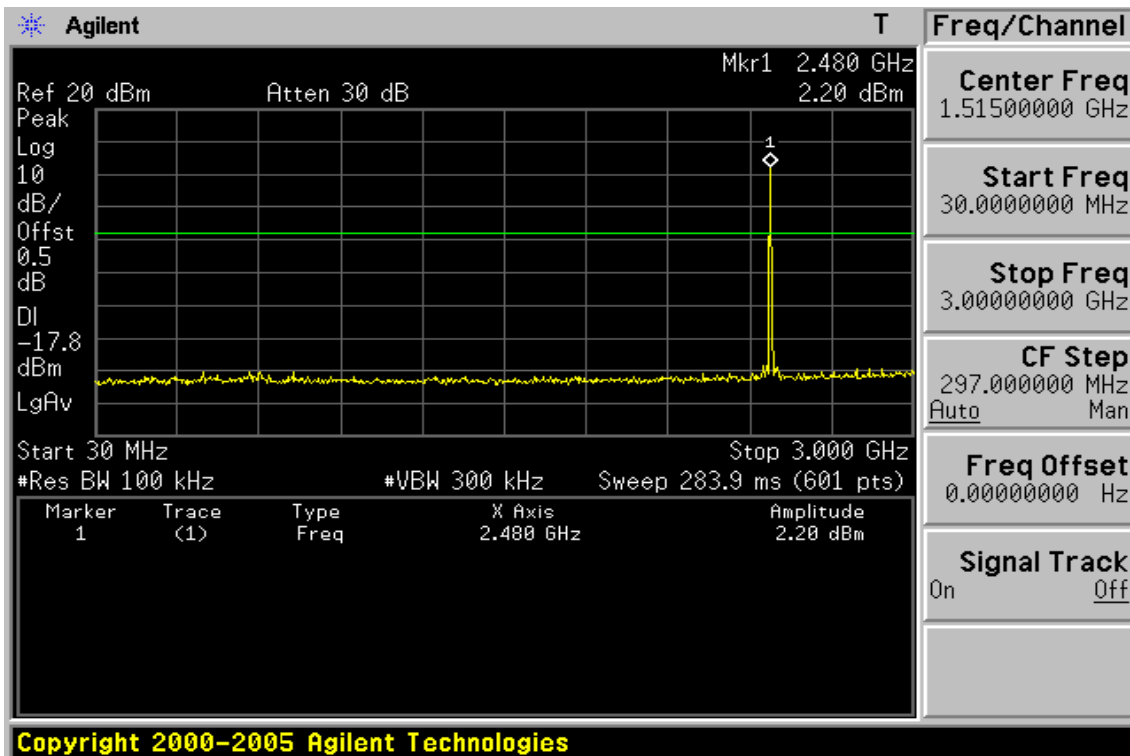


Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

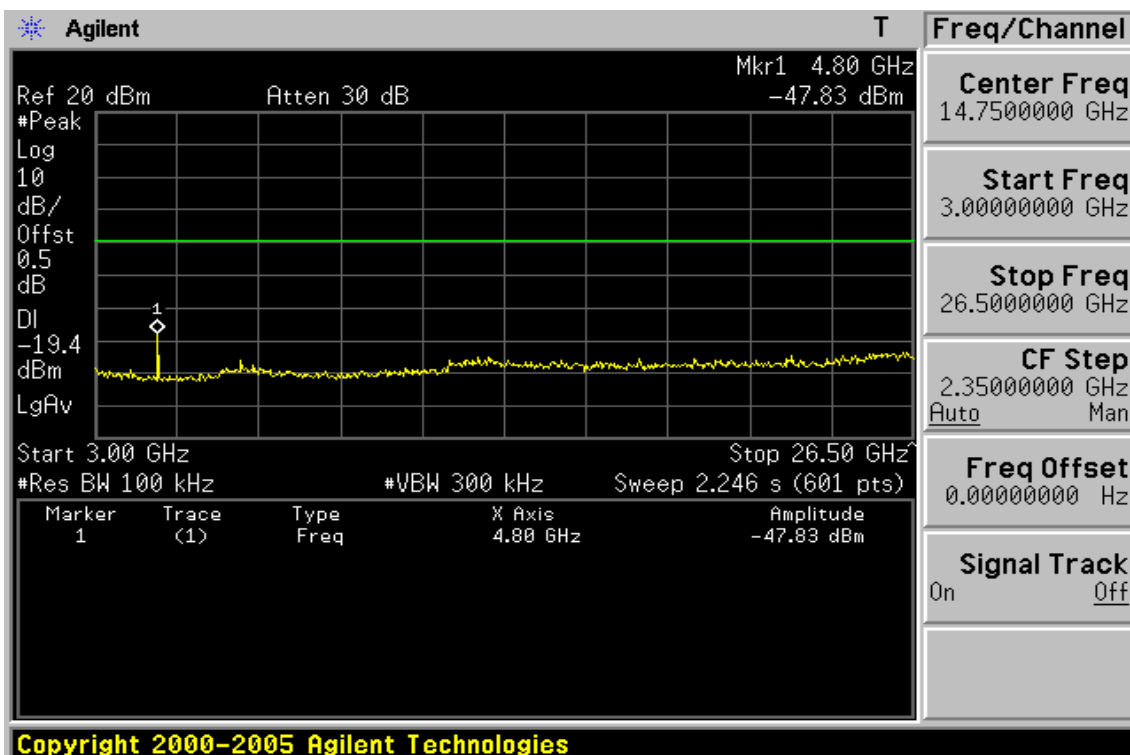
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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Radiated Spurious Emission Measurement Result (The Worst case BR mode)

Operation Band	:BR	Test Date	:2013-08-01
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
44.55	S	Peak	43.92	-13.63	30.29	40.00	-9.71
166.77	S	Peak	41.34	-12.55	28.79	43.50	-14.71
285.11	S	Peak	38.89	-12.68	26.21	46.00	-19.79
499.48	S	Peak	37.25	-8.99	28.26	46.00	-17.74
735.19	S	Peak	34.32	-4.37	29.95	46.00	-16.05
911.73	S	Peak	27.79	-2.27	25.52	46.00	-20.48
4804.00	H	Average	32.25	6.99	39.24	54.00	-14.76
4804.00	H	Peak	41.49	6.99	48.48	74.00	-25.52
7206.00	H	---					
9608.00	H	---					
12010.00	H	---					
14412.00	H	---					
16814.00	H	---					
19216.00	H	---					
21618.00	H	---					
24020.00	H	---					

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Operation Band	:BR	Test Date	:2013-08-01
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
59.10	S	Peak	34.35	-14.28	20.07	40.00	-19.93
166.77	S	Peak	40.95	-12.55	28.40	43.50	-15.10
310.33	S	Peak	47.19	-12.05	35.14	46.00	-10.86
498.51	S	Peak	39.62	-9.00	30.62	46.00	-15.38
782.72	S	Peak	30.96	-3.87	27.09	46.00	-18.91
938.89	S	Peak	27.13	-1.88	25.25	46.00	-20.75
4804.00	H	Average	33.01	7.03	40.04	54.00	-13.96
4804.00	H	Peak	38.16	7.03	45.19	74.00	-28.81
7206.00	H	---					
9608.00	H	---					
12010.00	H	---					
14412.00	H	---					
16814.00	H	---					
19216.00	H	---					
21618.00	H	---					
24020.00	H	---					

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Operation Band	:BR	Test Date	:2013-08-01
Fundamental Frequency	:2441 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
43.58	S	Peak	42.55	-13.59	28.96	40.00	-11.04
133.79	S	Peak	47.65	-13.27	34.38	43.50	-9.12
285.11	S	Peak	37.18	-12.68	24.50	46.00	-21.50
500.45	S	Peak	37.97	-8.97	29.00	46.00	-17.00
768.17	S	Peak	33.18	-3.98	29.20	46.00	-16.80
944.71	S	Peak	28.03	-1.82	26.21	46.00	-19.79
1630.00	S	Average	42.98	-1.42	41.56	54.00	-12.44
1630.00	S	Peak	44.77	-1.42	43.35	74.00	-30.65
4882.00	H	Average	44.88	7.50	52.38	54.00	-1.62
4882.00	H	Peak	50.40	7.50	57.90	74.00	-16.10
7323.00	H	---					
9764.00	H	---					
12205.00	H	---					
14646.00	H	---					
17087.00	H	---					
19528.00	H	---					
21969.00	H	---					
24410.00	H	---					

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Operation Band	:BR	Test Date	:2013-08-01
Fundamental Frequency	:2441 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
58.13	S	Peak	32.93	-14.21	18.72	40.00	-21.28
165.80	S	Peak	40.08	-12.45	27.63	43.50	-15.87
333.61	S	Peak	41.41	-11.65	29.76	46.00	-16.24
498.51	S	Peak	39.69	-9.00	30.69	46.00	-15.31
768.17	S	Peak	30.98	-3.98	27.00	46.00	-19.00
932.10	S	Peak	27.30	-1.96	25.34	46.00	-20.66
1630.00	S	Average	52.44	-0.76	51.68	54.00	-2.32
1630.00	S	Peak	53.19	-0.76	52.43	74.00	-21.57
4882.00	H	Average	42.56	7.44	50.00	54.00	-4.00
4882.00	H	Peak	47.50	7.44	54.94	74.00	-19.06
7323.00	H	---					
9764.00	H	---					
12205.00	H	---					
14646.00	H	---					
17087.00	H	---					
19528.00	H	---					
21969.00	H	---					
24410.00	H	---					

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Operation Band	:BR	Test Date	:2013-08-01
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
43.58	S	Peak	42.51	-13.59	28.92	40.00	-11.08
149.31	S	Peak	44.83	-12.06	32.77	43.50	-10.73
332.64	S	Peak	36.20	-11.66	24.54	46.00	-21.46
500.45	S	Peak	37.31	-8.97	28.34	46.00	-17.66
768.17	S	Peak	33.39	-3.98	29.41	46.00	-16.59
918.52	S	Peak	28.35	-2.15	26.20	46.00	-19.80
1651.00	S	Average	47.40	-1.14	46.26	54.00	-7.74
1651.00	S	Peak	50.76	-1.14	49.62	74.00	-24.38
4960.00	H	Average	44.64	7.64	52.28	54.00	-1.72
4960.00	H	Peak	51.94	7.64	59.58	74.00	-14.42
7440.00	H	---					
9920.00	H	---					
12400.00	H	---					
14880.00	H	---					
17360.00	H	---					
19840.00	H	---					
22320.00	H	---					
24800.00	H	---					

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Operation Band	:BR	Test Date	:2013-08-01
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26 deg_C / 60 RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
		Mode	Reading Level		FS	@3m	
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
58.13	S	Peak	32.30	-14.21	18.09	40.00	-21.91
166.77	S	Peak	41.34	-12.55	28.79	43.50	-14.71
276.38	S	Peak	42.04	-12.94	29.10	46.00	-16.90
534.40	S	Peak	43.42	-8.20	35.22	46.00	-10.78
734.22	S	Peak	30.01	-4.38	25.63	46.00	-20.37
935.98	S	Peak	27.49	-1.91	25.58	46.00	-20.42
1651.00	S	Average	51.25	-0.42	50.83	54.00	-3.17
1651.00	S	Peak	58.05	-0.42	57.63	74.00	-16.37
4960.00	H	Average	42.19	7.49	49.68	54.00	-4.32
4960.00	H	Peak	49.92	7.49	57.41	74.00	-16.59
7440.00	H	---					
9920.00	H	---					
12400.00	H	---					
14880.00	H	---					
17360.00	H	---					
19840.00	H	---					
22320.00	H	---					
24800.00	H	---					

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11. FREQUENCY SEPARATION

11.1. Standard Applicable

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the $2/3 \times 20\text{dB}$ bandwidth of the hopping channel, whichever is greater.

11.2. Measurement Equipment Used:

Refer to section 7.2 for details.

11.3. Test Set-up:

Refer to section 7.3 for details.

11.4. Measurement 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=100KHz, Adjust Span to 5MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

11.5. Measurement Result:

Channel separation (MHz)	Limit	Result
1	$\geq 25\text{KHz}$ or $2/3$ times 20dB bandwidth	PASS

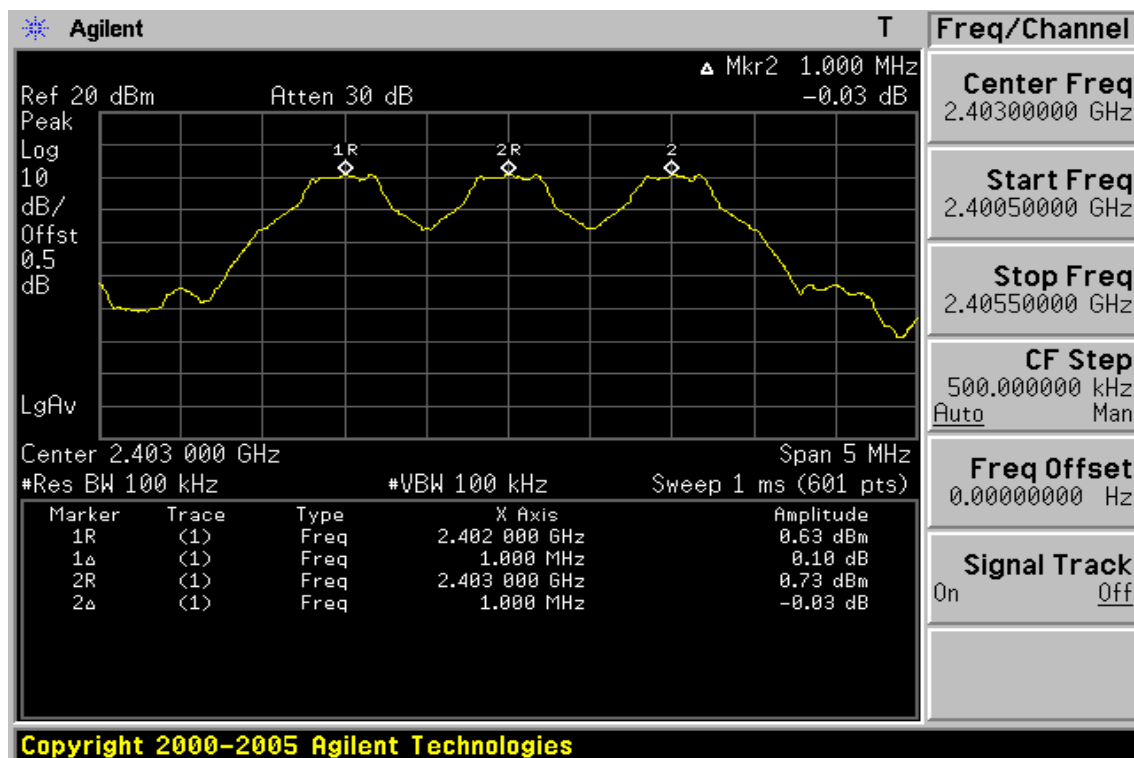
Note: Refer to next page for plots.

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Frequency Separation Test Data



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12. NUMBER OF HOPPING FREQUENCY

12.1. Standard Applicable

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

12.2. Measurement Equipment Used:

Refer to section 7.2 for details.

12.3. Test Set-up:

Refer to section 7.3 for details.

12.4. Measurement 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 = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW=430KHz, VBW=1.5MHz.
5. Max hold, view and count how many channel in the band.

12.5. Measurement Result:

Note: Refer to next page for plots.

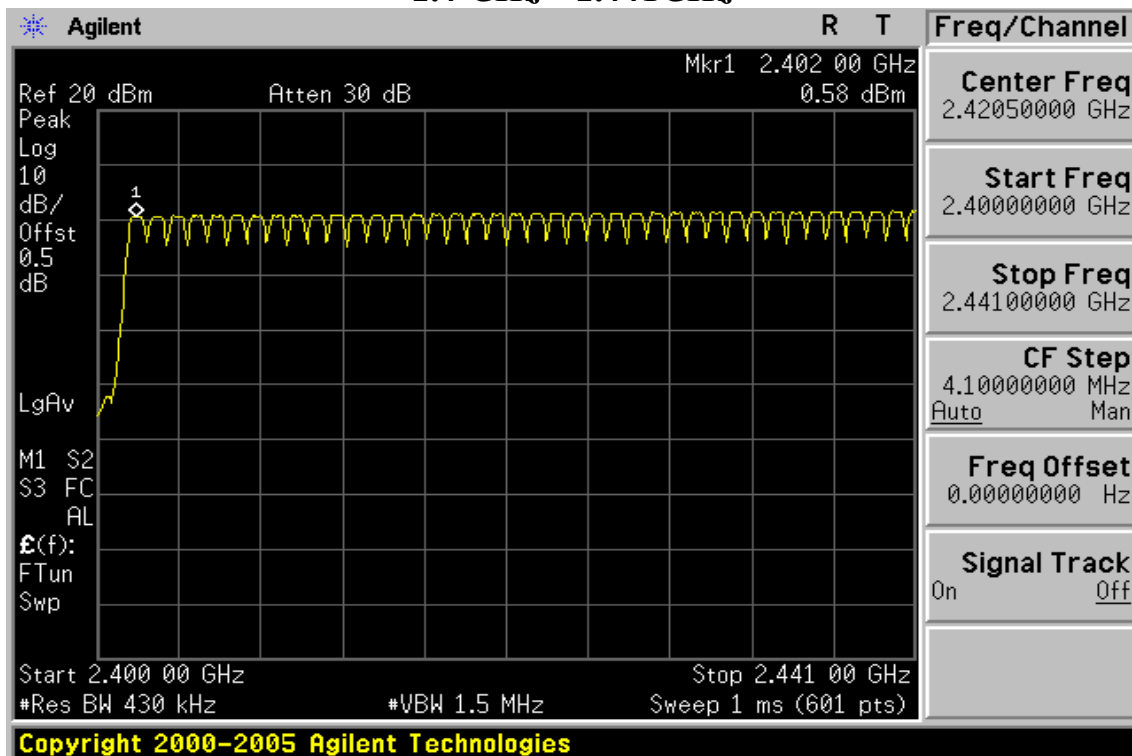
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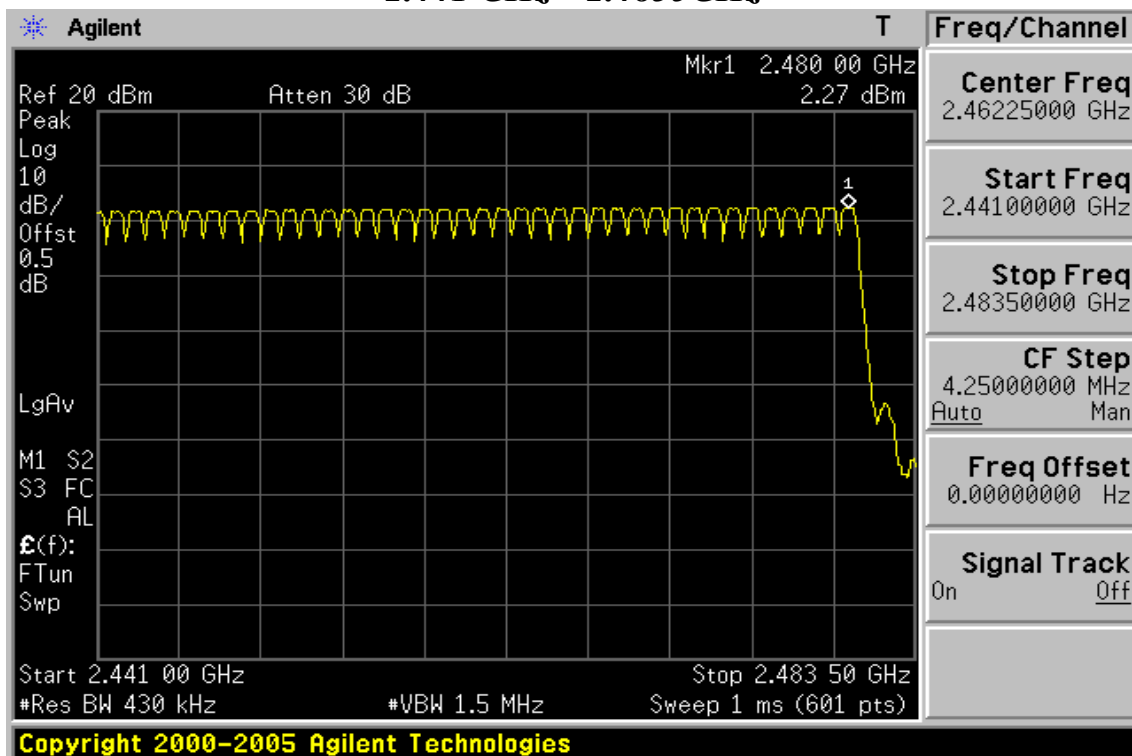
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Channel Number

2.4 GHz – 2.441GHz



2.441 GHz – 2.4835GHz



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13. TIME OF OCCUPANCY (DWELL TIME)

13.1. Standard Applicable

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

13.2. Measurement Equipment Used:

Refer to section 7.2 for details.

13.3. Test Set-up:

Refer to section 7.3 for details.

13.4. Measurement 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=1MHz, VBW=3MHz, Span = 0Hz, Adjust Sweep = 2~7ms.
5. Repeat above procedures until all frequency measured were complete.

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13.5. Measurement Result

A period time = 0.4 (sec) * 79 = 31.6 (s)

CH Low: DH1 time slot = 0.393 (ms) * (1600/(2*79)) * 31.6 = 125.76(ms)

DH3 time slot = 1.650 (ms) * (1600/(4*79)) * 31.6 = 264.00(ms)

DH5 time slot = 2.895 (ms) * (1600/(6*79)) * 31.6 = 308.80(ms)

CH Mid: DH1 time slot = 0.393 (ms) * (1600/(2*79)) * 31.6 = 125.76(ms)

DH3 time slot = 1.650 (ms) * (1600/(4*79)) * 31.6 = 264.00(ms)

DH5 time slot = 2.895 (ms) * (1600/(6*79)) * 31.6 = 308.80(ms)

CH High: DH1 time slot = 0.393 (ms) * (1600/(2*79)) * 31.6 = 125.76(ms)

DH3 time slot = 1.650 (ms) * (1600/(4*79)) * 31.6 = 264.00(ms)

DH5 time slot = 2.895 (ms) * (1600/(6*79)) * 31.6 = 308.80(ms)

Note: Refer to next page for plots.

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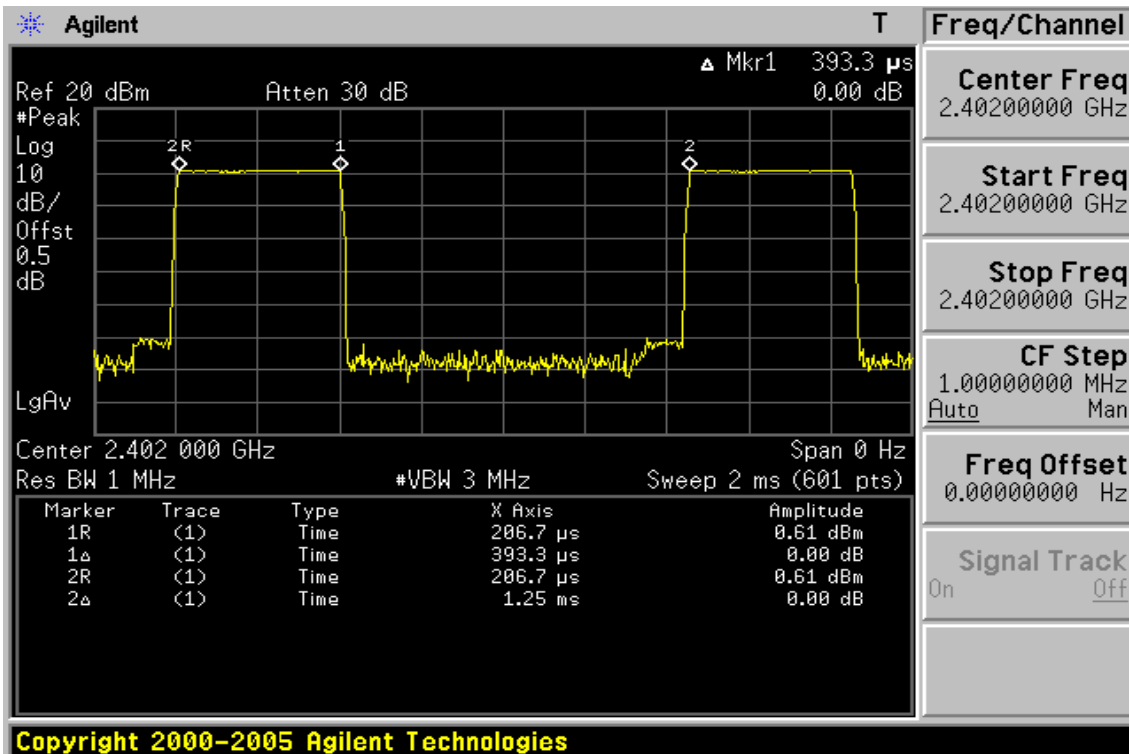
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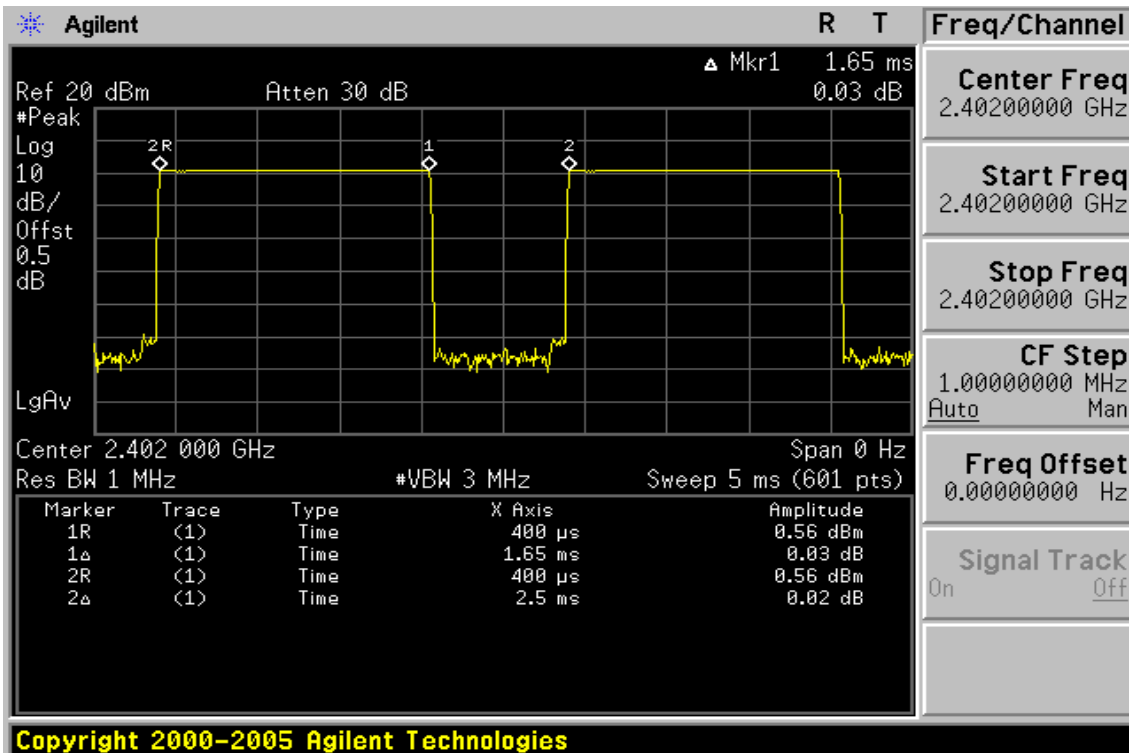
Member of SGS Group

CH-Low

DH1



DH3

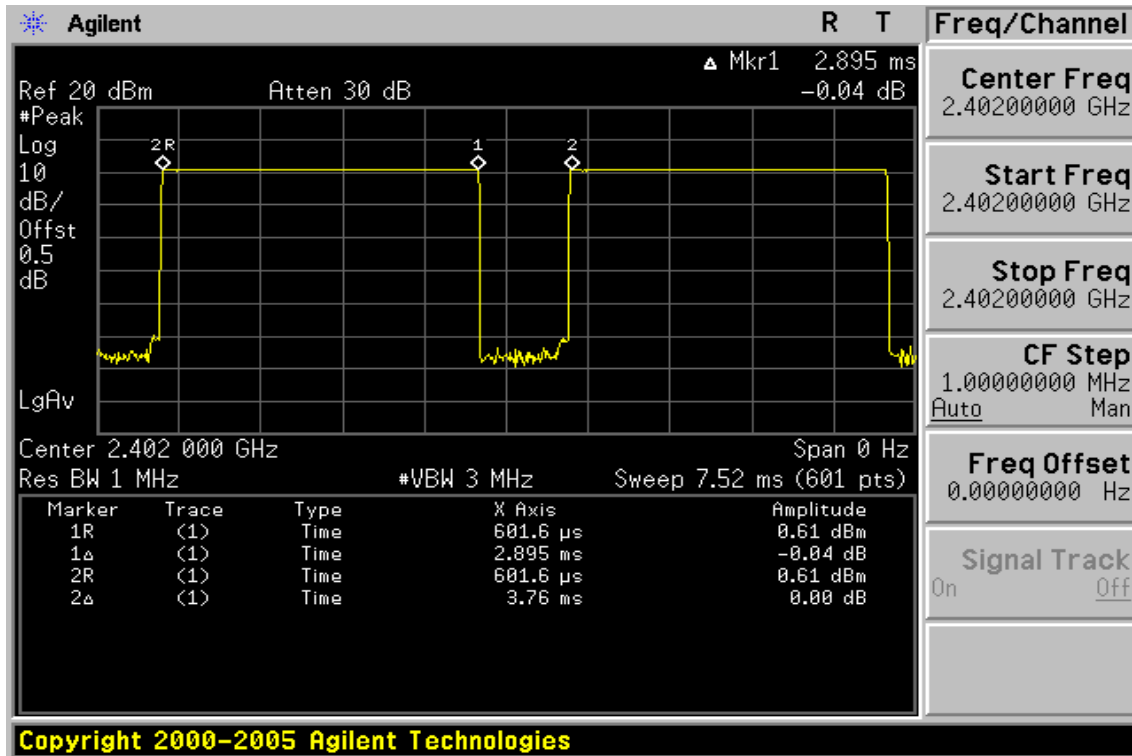


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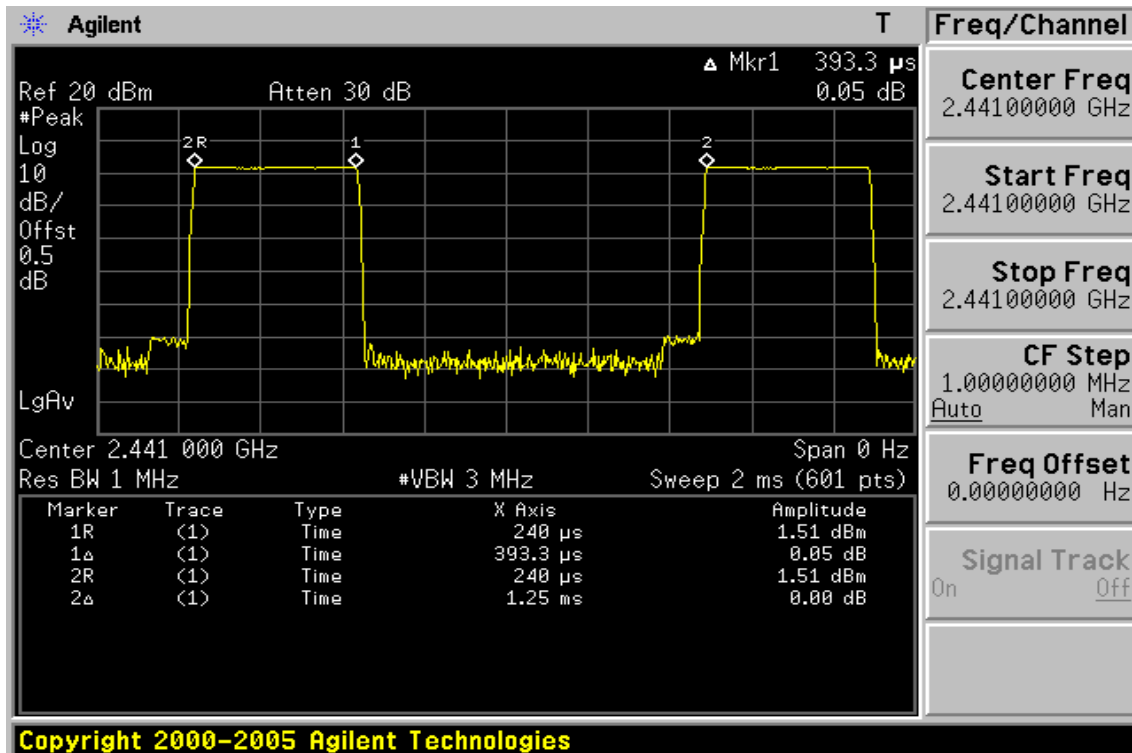
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DH5



CH-Mid

DH1

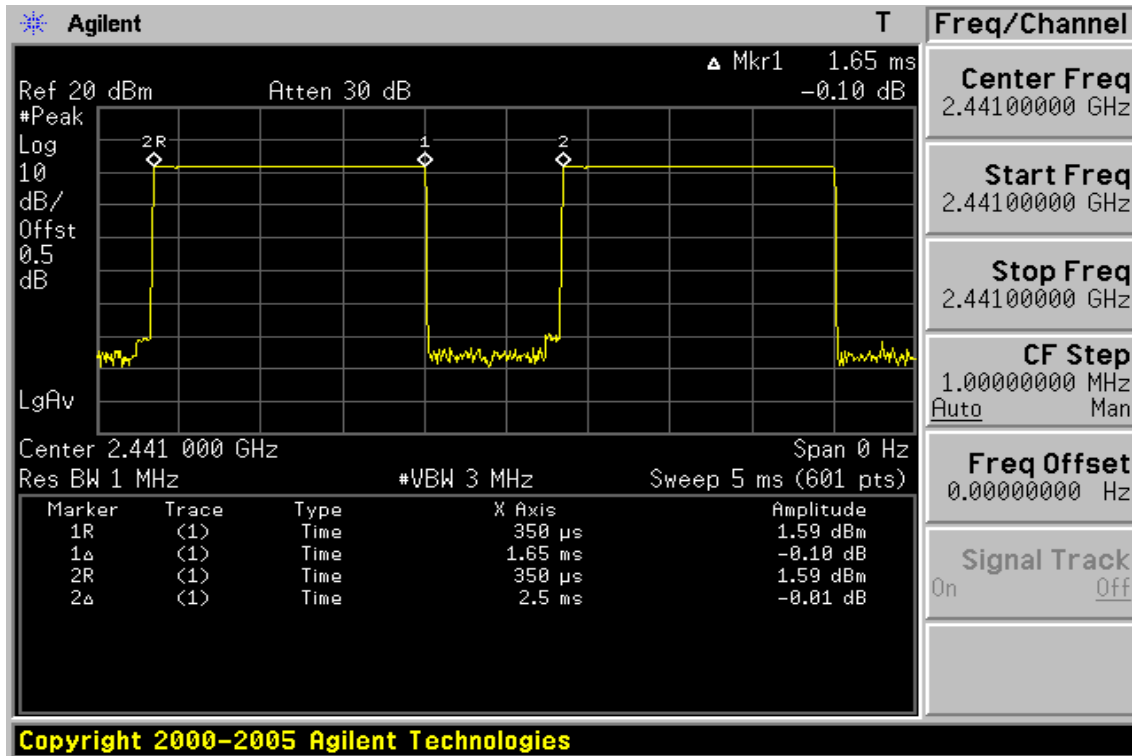


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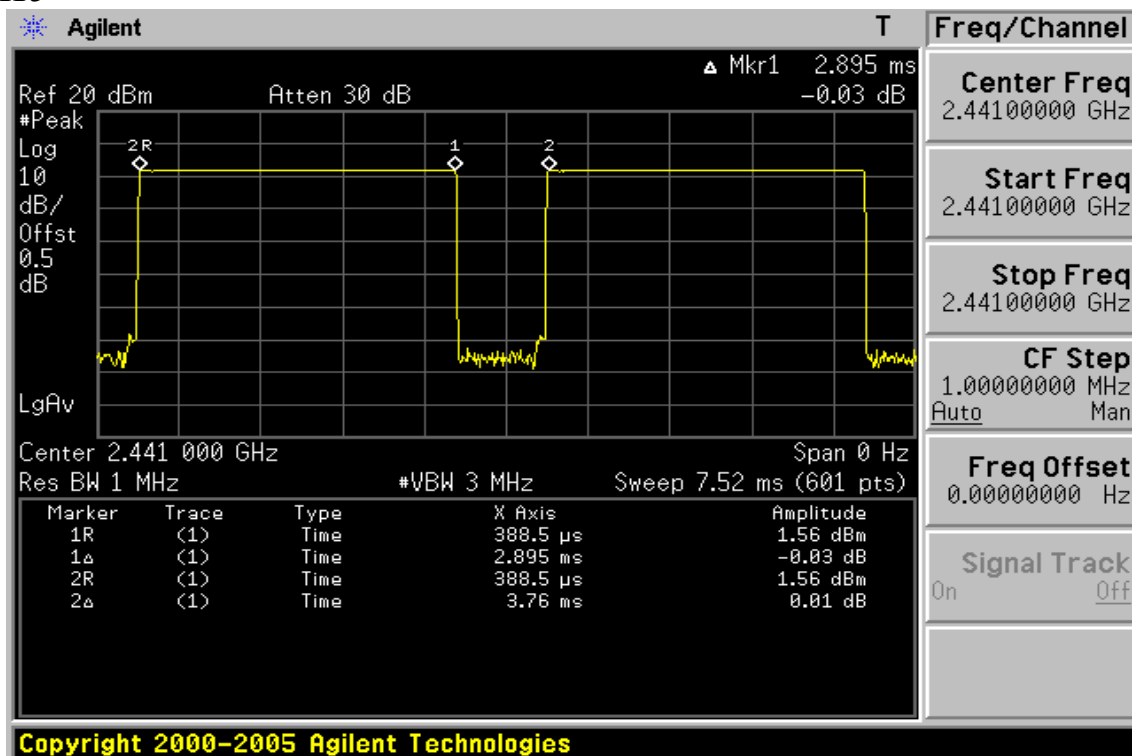
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DH3



DH5

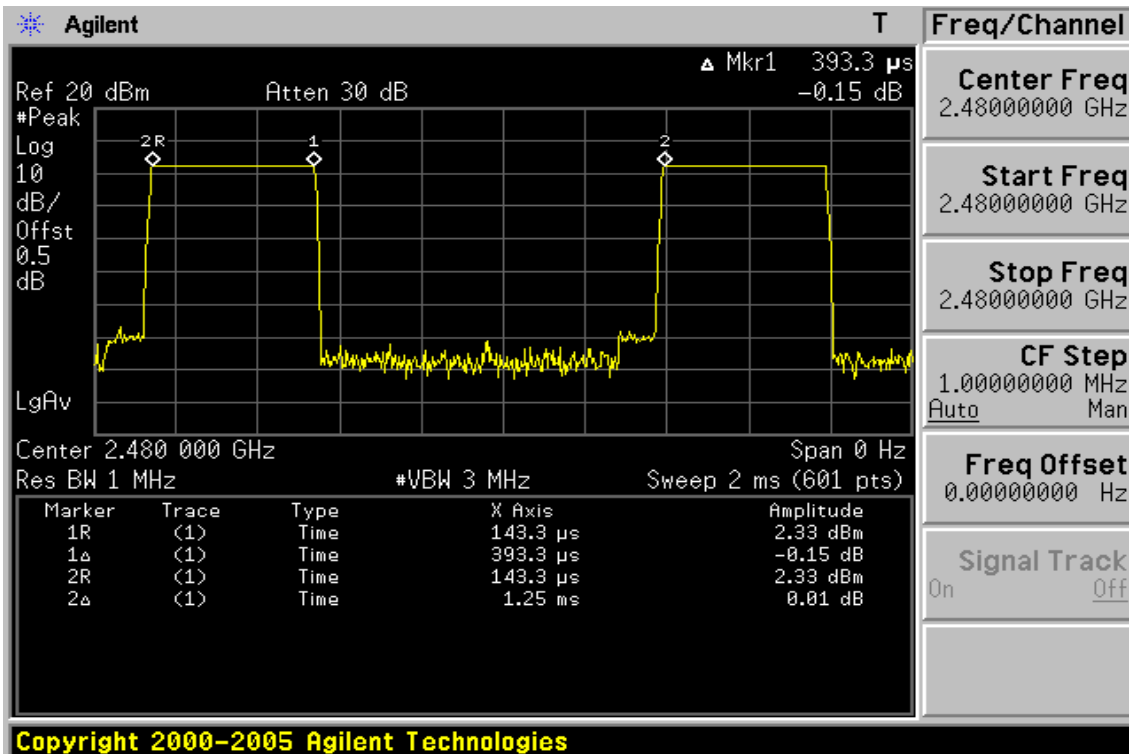


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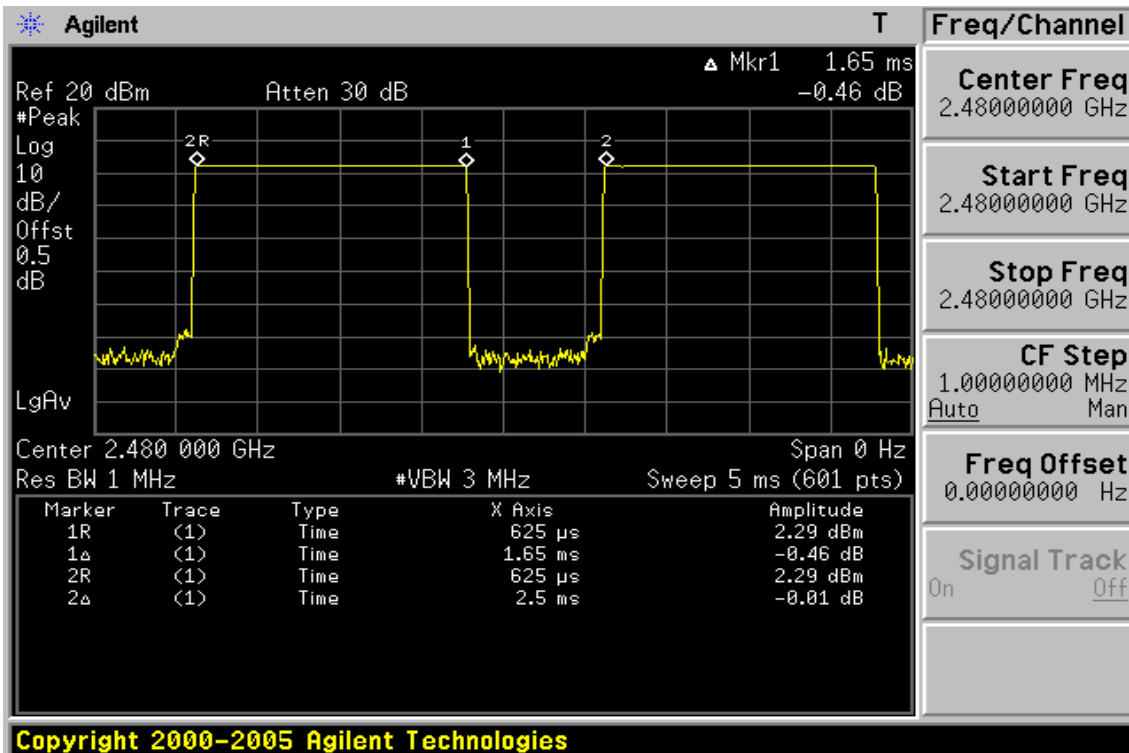
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CH-High DH1



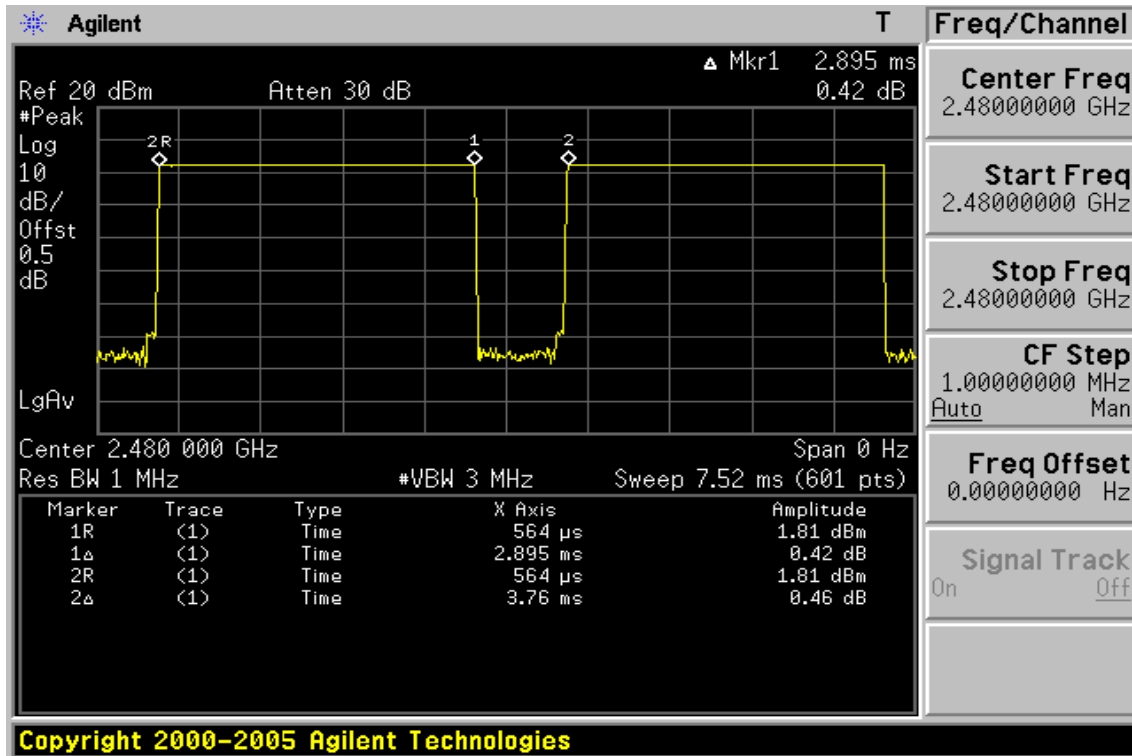
DH3



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DH5



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14. ANTENNA REQUIREMENT

14.1. Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

14.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 2.03dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

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15. RF EXPOSURE

15.1. Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Portable device with its physical nature to be used nearby, the distance between radiating structure and human is less than 20cm.

As per KDB 447498 D01 §4.3.1, The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR, where}$$

f (GHz) is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

15.2. Measurement Result:

Step 1: (<50mW)

This is a portable device and the Max peak output power is (2.38mW) lower than the threshold given and derived as formula given above, where

$$= 1.79 \text{ (mW)} / 5 \text{ (mm)} \cdot \sqrt{2480 \text{ (GHz)}} = 0.565 < 3.0$$

Frequency	Power (avg in dBm)	Power (avg mw)	Distance (mm)	Threshold (<50mm)
2480	2.54	1.794733627	5	0.565269868

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2480	2.54	0.00179	1 Watt = 30 dBm

As the result of calculation result indicates, the RF exposure generating from given transmitter (transmitter employed digital modulation) can be excluded from SAR measurement, and is deemed compliant with RF exposure as per FCC.

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The table of quick reference in terms of power threshold**SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and ≤ 50 mm**

Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table.

MHz	5	10	15	20	25	mm
150	39	77	116	155	194	SAR Test Exclusion Threshold (mW)
300	27	55	82	110	137	
450	22	45	67	89	112	
835	16	33	49	66	82	
900	16	32	47	63	79	
1500	12	24	37	49	61	
1900	11	22	33	44	54	
2450	10	19	29	38	48	
3600	8	16	24	32	40	
5200	7	13	20	26	33	
5400	6	13	19	26	32	
5800	6	12	19	25	31	

Note that the table present above is the table of quick reference, indexing the level of power threshold with respect to the corresponding frequency. The value of the index may be deviated, and therefore, the derivation of exemption based on KDB447498 D01 is used in this test report, relevantly.

~ End of Report ~

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