

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name: Bluetooth Remote Handset

Brand Name: HTC

Model No.: BL R120

Model Difference: N/A

FCC ID: NM8BLR120

Report No.: EF/2013/40011

Issue Date: May. 09, 2013

FCC Rule Part: §15.247, Cat: DSS

Prepared for: HTC Corporation.
23 Xinghua Road, Taoyuan City, Taoyuan
County 330, Taiwan
SGS Taiwan Ltd.
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VERIFICATION OF COMPLIANCE

Applicant: HTC Corporation.
23 Xinghua Road, Taoyuan City, Taoyuan County 330, Taiwan

Product Name: Bluetooth Remote Handset

Brand Name: HTC

Model No.: BL R120

FCC ID: NM8BLR120

Model Difference: N/A

File Number: EF/2013/40011

Date of Test: Apr. 12, 2013~ May. 07, 2013

Date of EUT Received: Apr. 12, 2013

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: Nick Lin **Date:** May. 09, 2013

Nick Lin / Engineer

Prepared By: Tiffany Kao **Date:** May. 09, 2013

Tiffany Kao / Clerk

Approved By: Jim Chang **Date:** May. 09, 2013

Jim Chang / Supervisor

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Version

Version No.	Date	Description
00	May. 09, 2013	Initial creation of document

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1. GENERAL INFORMATION

General:

Product Name	Bluetooth Remote Handset	
Brand Name	HTC	
Model No.	BL R120	
Model Difference	N/A	
Hardware Version	N/A	
Software Version	N/A	
2 nd Source Vendor	1. XTAL 2. Microphone 3. Speaker	
Power Supply	3.7V Li-ion Polymer Battery or 5Vdc from adapter	
	Battery:	Model No.: BN02100, Supplier: ATL
	Adapter:	1. Model No.: TC U250, Supplier: Delta 2. Model No.: TC U250, Supplier: Pihong

Bluetooth:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V2.1 + EDR (GFSK + /4DQPSK + 8DPSK)
Channel number:	79 channels
Modulation type:	Frequency Hopping Spread Spectrum
Transmit Power:	6.25dBm (Peak)
Dwell Time:	<= 0.4s
Operating Mode:	Point-to-Point
Antenna Designation:	Monopole Antenna / Antenna gain: 0.9dBi

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: NM8BLR120** 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 are: 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 a placed on as 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 30MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as 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

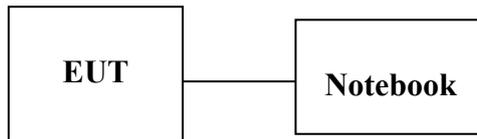


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Software	BlueSuite	CSR	Version1.22	N/A	N/A
2.	Notebook	IBM	T60	L3DK794	Shielded	Un-shielded

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power Line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)(1)	20dB Bandwidth	Compliant
§15.247(d)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(d) §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, Mid and High with highest rated data rate were chosen as worst case for full testing.

The field strength of spurious radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth Transmitter for channel Low, Mid and High the worst case H position was reported.

In comparison with BDR and EDR mode, emission carried out by EDR (8DPSK modulation) is chosen as the most representative measurement to perform measurement of every test item pursuant to Part 15C.

The Additional measurement data of Peak Output Power and 100 KHz Bandwidth Of Frequency Band Edges will be presented for 2nd Source vendor.

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5. MEASUREMENT UNCERTAINTY FOR FIELD STRENGTH OF SPURIOUS RADIATION

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

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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	03/23/2013	03/22/2014
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/23/2013	03/22/2014
Coaxial Cables	N/A	WK CE Cable	N/A	01/05/2013	01/04/2014

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.

Note: Refer to next page for measurement data and plots.

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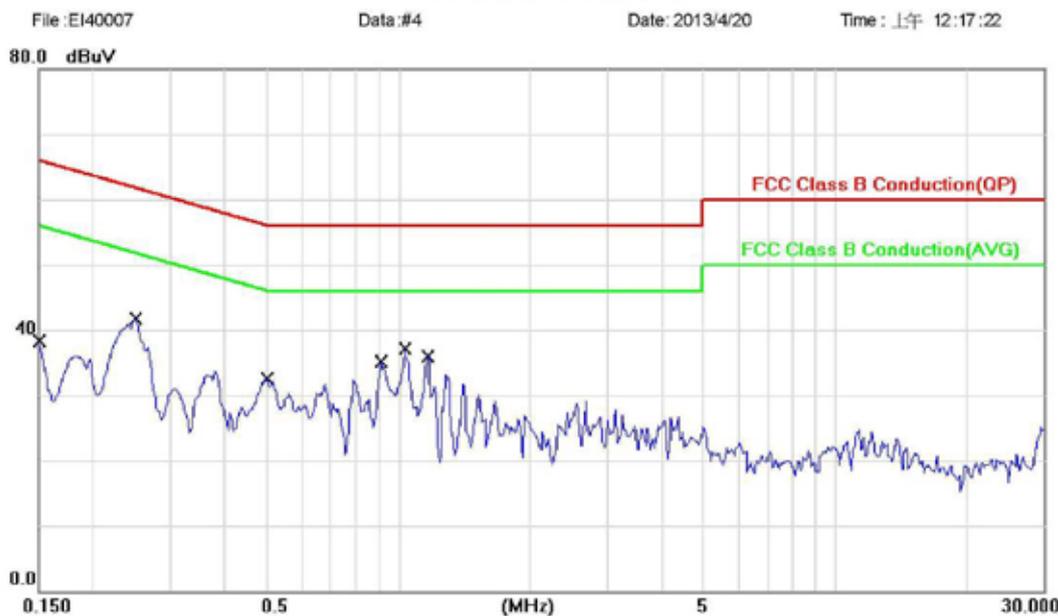
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Bluetooth Mode			Test Date:	Apr. 22, 2013
Temperature:	23	Humidity:	57 %	Test By:	Nick

Site	ConductionRoom	Phase:	L1	Temperature:	28 °C
Limit:	FCC Class B Conduction(QP)	Power:	AC 120V/60Hz	Humidity:	60%
EUT:	Bluetooth Remote Handset	Distance:			
M/N:	BLR120	Mode:	Operation mode		
Note:	DELTA				

ConductedEmission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1500	38.28	0.09	38.37	66.00	-27.63	QP	
2		0.2516	41.69	0.09	41.78	61.70	-19.92	QP	
3		0.5000	32.35	0.07	32.42	56.00	-23.58	QP	
4		0.9180	35.07	0.08	35.15	56.00	-20.85	QP	
5	*	1.0351	37.04	0.08	37.12	56.00	-18.88	QP	
6		1.1720	35.76	0.08	35.84	56.00	-20.16	QP	

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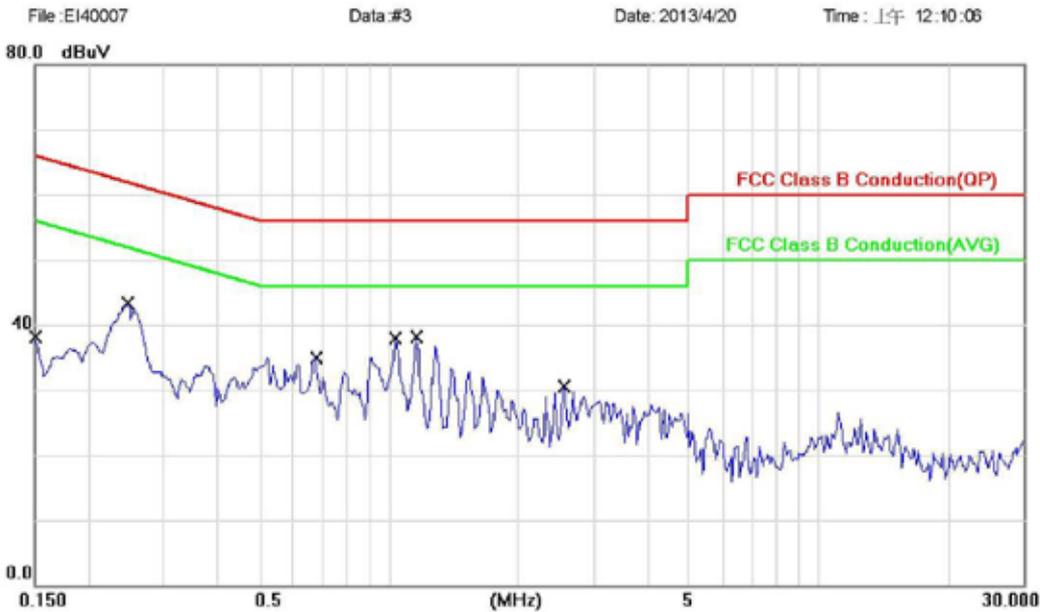
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Site: ConductionRoom	Phase: N	Temperature: 26 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 60%
EUT: Bluetooth Remote Handset	Distance:	
MN: BLR120	Mode: Operation mode	
Note: DELTA		

Conducted Emission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1500	38.04	0.15	38.19	66.00	-27.81	QP	
2		0.2477	43.15	0.14	43.29	61.83	-18.54	QP	
3		0.6758	34.68	0.14	34.82	56.00	-21.18	QP	
4		1.0391	37.72	0.16	37.88	56.00	-18.12	QP	
5	*	1.1601	38.01	0.16	38.17	56.00	-17.83	QP	
6		2.5625	30.24	0.17	30.41	56.00	-25.59	QP	

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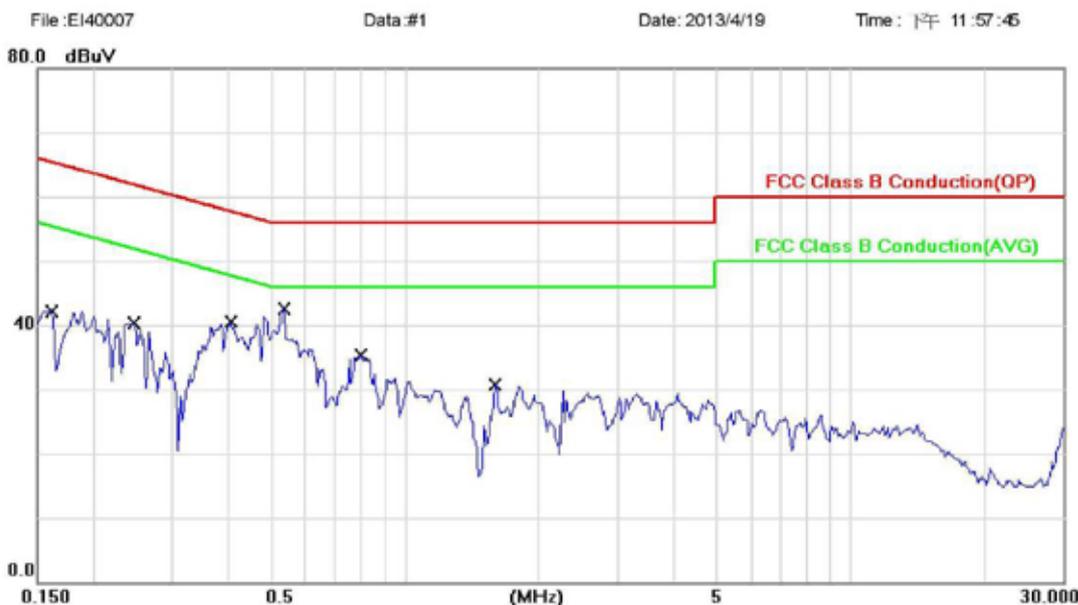
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Bluetooth Mode			Test Date:	Apr. 22, 2013
Temperature:	23	Humidity:	57 %	Test By:	Nick

Site	ConductionRoom	Phase:	L1	Temperature:	26 °C
Limit:	FCC Class B Conduction(QP)	Power:	AC 120V/60Hz	Humidity:	60%
EUT:	Bluetooth Remote Handset	Distance:			
M/N:	BLR120	Mode:	Operation mode		
Note:	PHIHONG				

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measurement dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1617	42.11	0.09	42.20	65.38	-23.18	QP	
2		0.2477	40.23	0.08	40.31	61.83	-21.52	QP	
3		0.4078	40.40	0.08	40.48	57.69	-17.21	QP	
4	*	0.5391	42.51	0.07	42.58	56.00	-13.42	QP	
5		0.7970	35.19	0.07	35.26	56.00	-20.74	QP	
6		1.6016	30.61	0.10	30.71	56.00	-25.29	QP	

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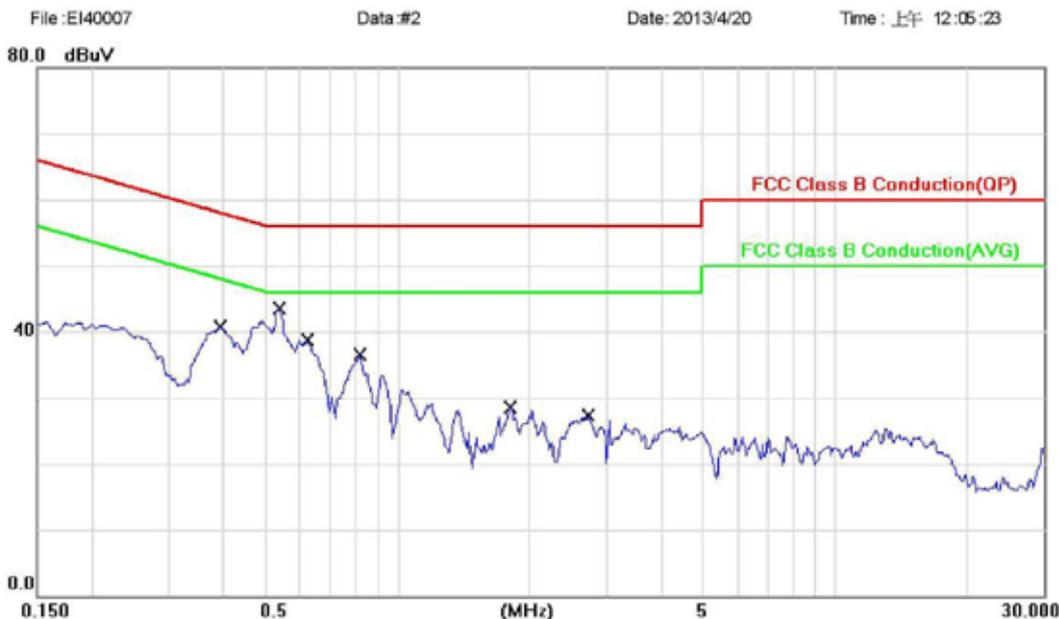
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Site: ConductionRoom	Phase: N	Temperature: 26 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 60%
EUT: Bluetooth Remote Handset	Distance:	
M/N: BLR120	Mode: Operation mode	
Note: PHIHONG		

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.3922	40.55	0.13	40.68	58.02	-17.34	QP	
2	*	0.5391	43.37	0.12	43.49	56.00	-12.51	QP	
3		0.6250	38.51	0.14	38.65	56.00	-17.35	QP	
4		0.8242	36.37	0.14	36.51	56.00	-19.49	QP	
5		1.8164	28.42	0.17	28.59	56.00	-27.41	QP	
6		2.7305	27.10	0.17	27.27	56.00	-28.73	QP	

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7. PEAK OUTPUT POWER MEASUREMENT

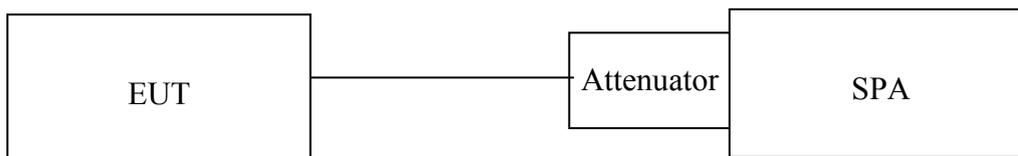
7.1. Standard Applicable

According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz 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: 0.125 Watts.

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	04/15/2013	04/14/2014
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/15/2013	03/14/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2013	01/04/2014
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014
Splitter	Agilent	11636B	N/A	02/28/2013	02/27/2014

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

Main Source

BDR mode (GFSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	5.97	5.97	0.00395	1
2441.00	5.59	5.59	0.00362	1
2480.00	6.06	6.06	0.00404	1

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

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	5.98	5.98	0.00396	0.125
2441.00	5.67	5.67	0.00369	0.125
2480.00	5.84	5.84	0.00384	0.125

EDR mode (8DPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	6.25	6.25	0.00422	0.125
2441.00	5.93	5.93	0.00392	0.125
2480.00	6.17	6.17	0.00414	0.125

** offset 1dB*

Note: Refer to next page for plots.

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Second Source

BDR mode (GFSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	6.07	6.07	0.00405	1
2441.00	5.63	5.63	0.00366	1
2480.00	5.94	5.94	0.00393	1

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

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	5.88	5.88	0.00387	0.125
2441.00	5.50	5.50	0.00355	0.125
2480.00	5.53	5.53	0.00357	0.125

EDR mode (8DPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	6.18	6.18	0.00415	0.125
2441.00	5.77	5.77	0.00378	0.125
2480.00	5.80	5.80	0.00380	0.125

** offset 1dB*

Note: Refer to next page for plots.

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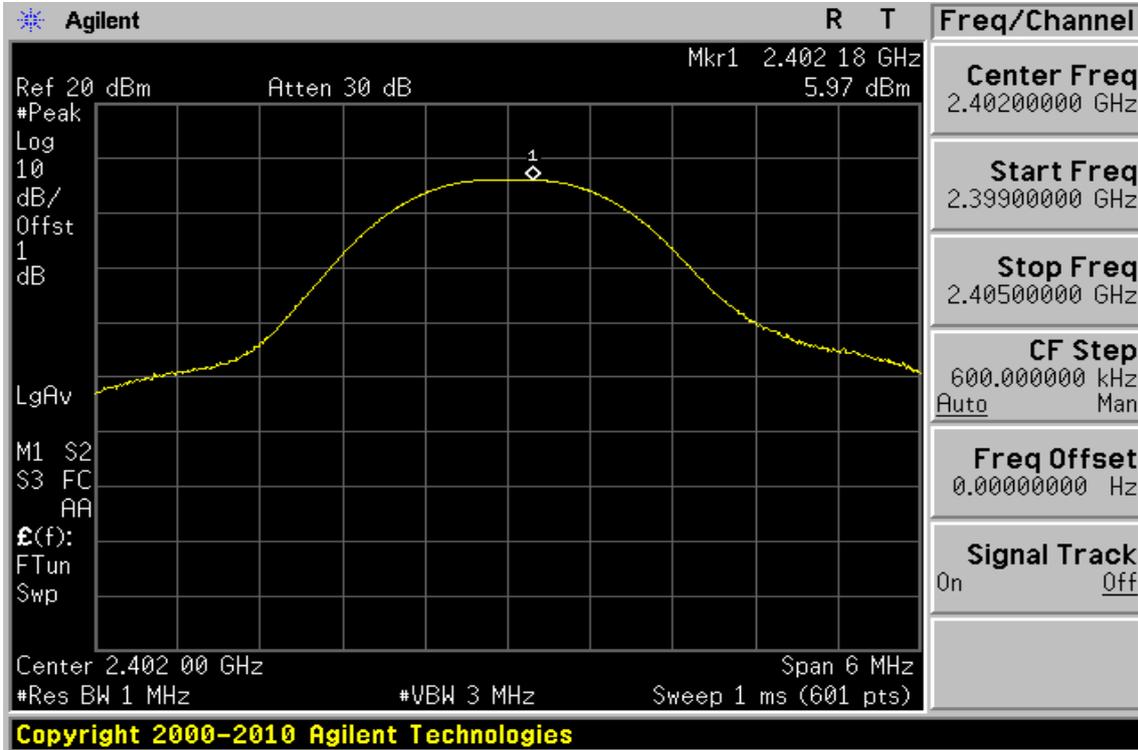
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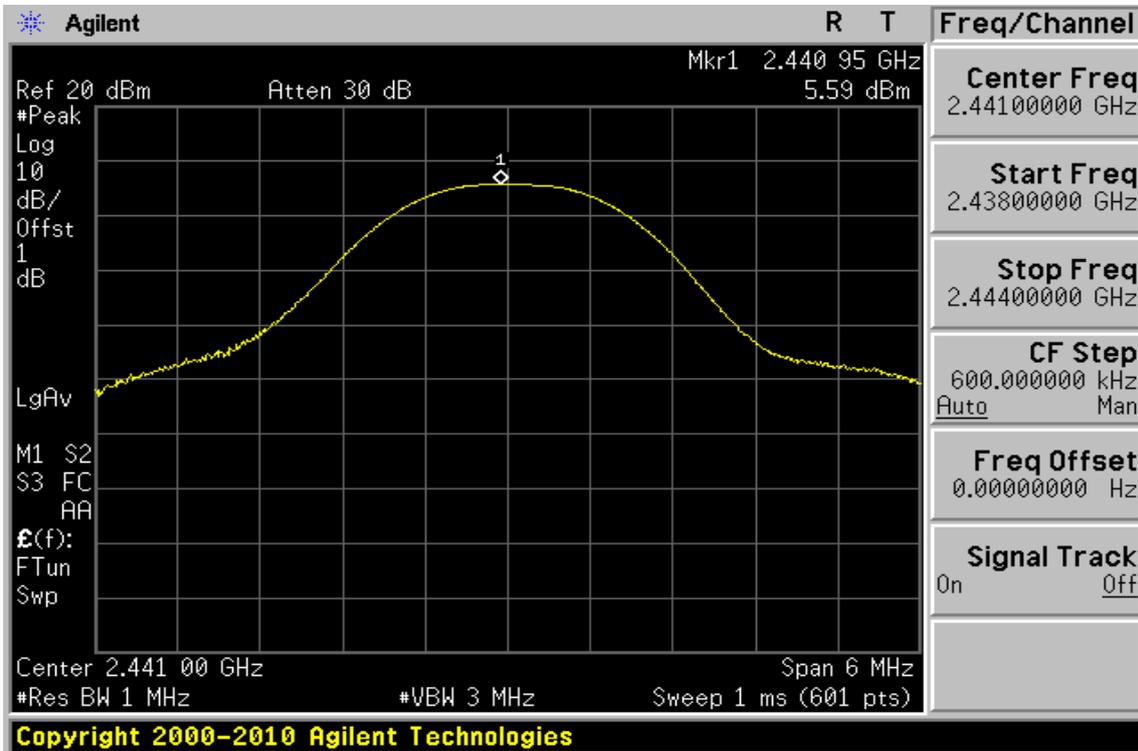
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Main Source

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



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



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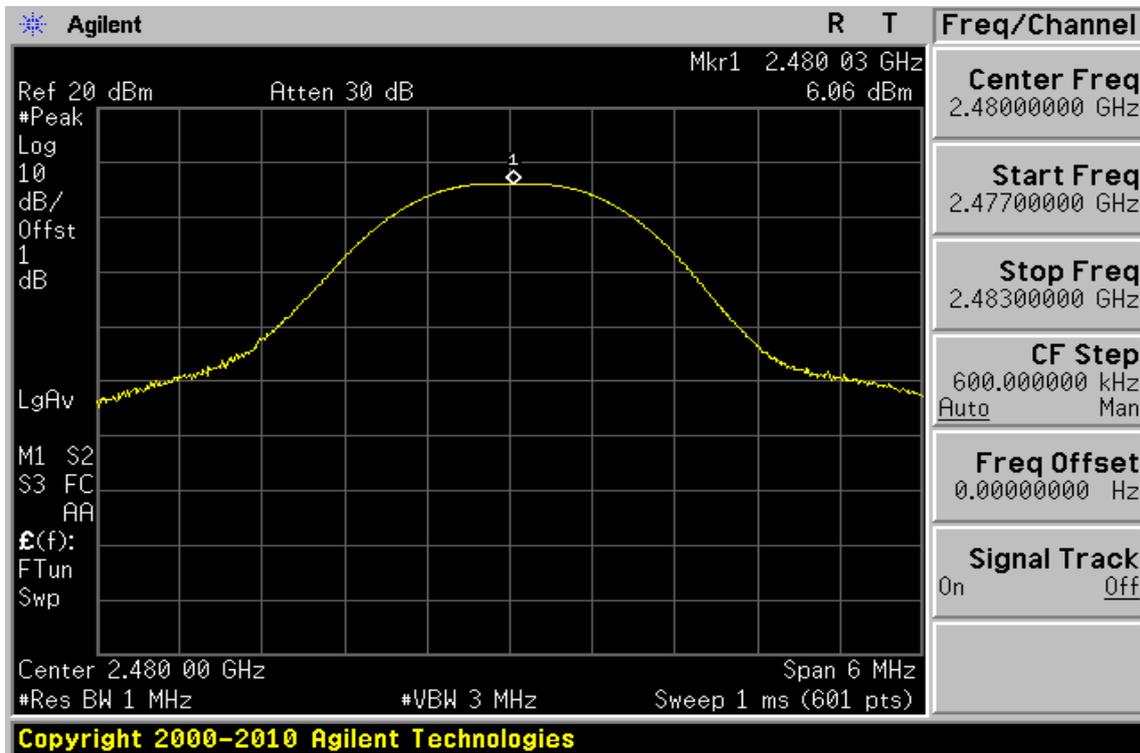
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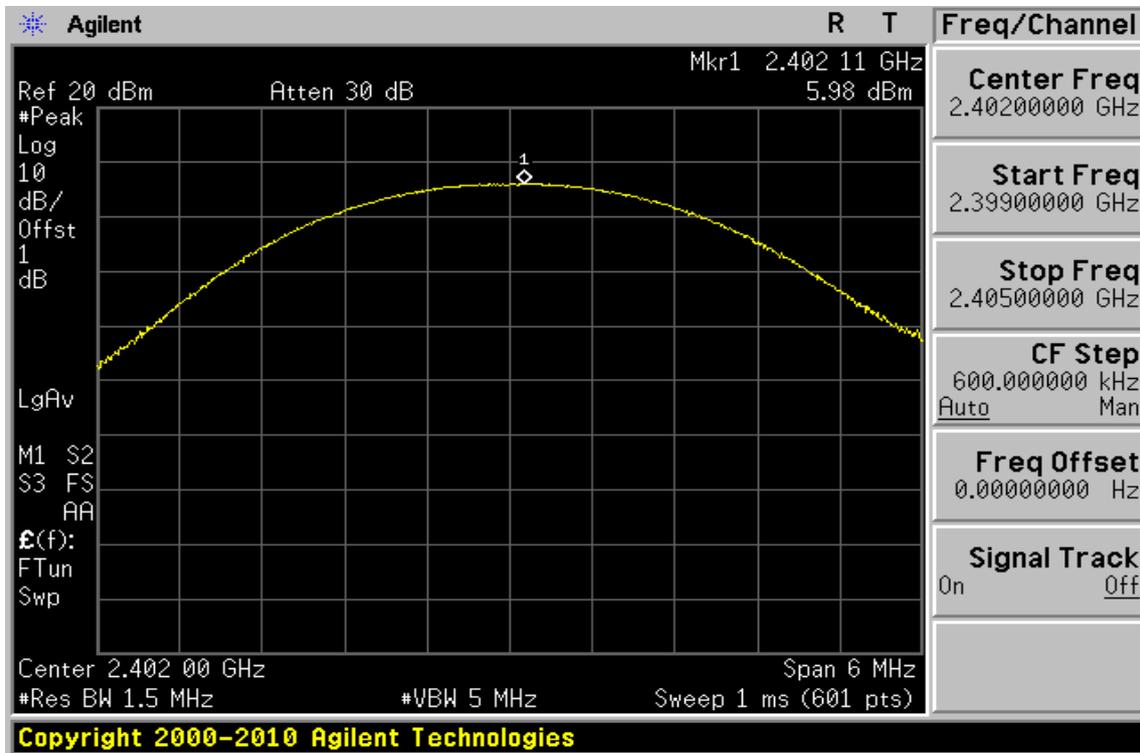
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Peak Power Output Data Plot (CH High) (BDR mode GFSK)



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



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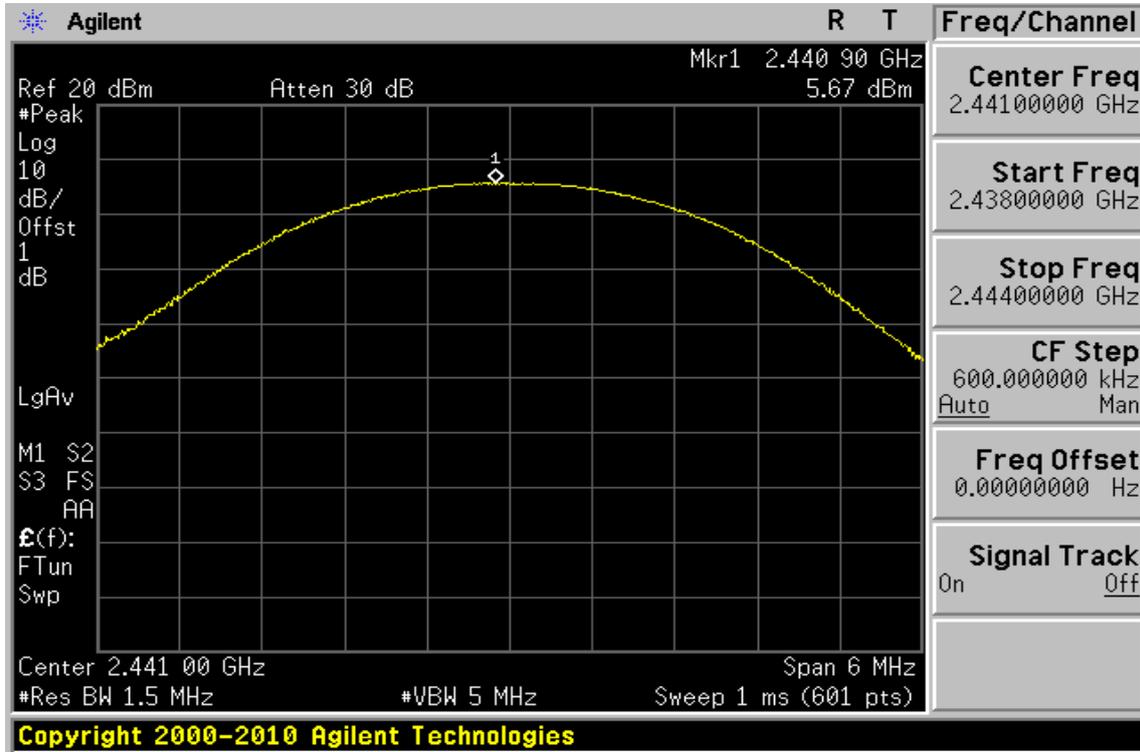
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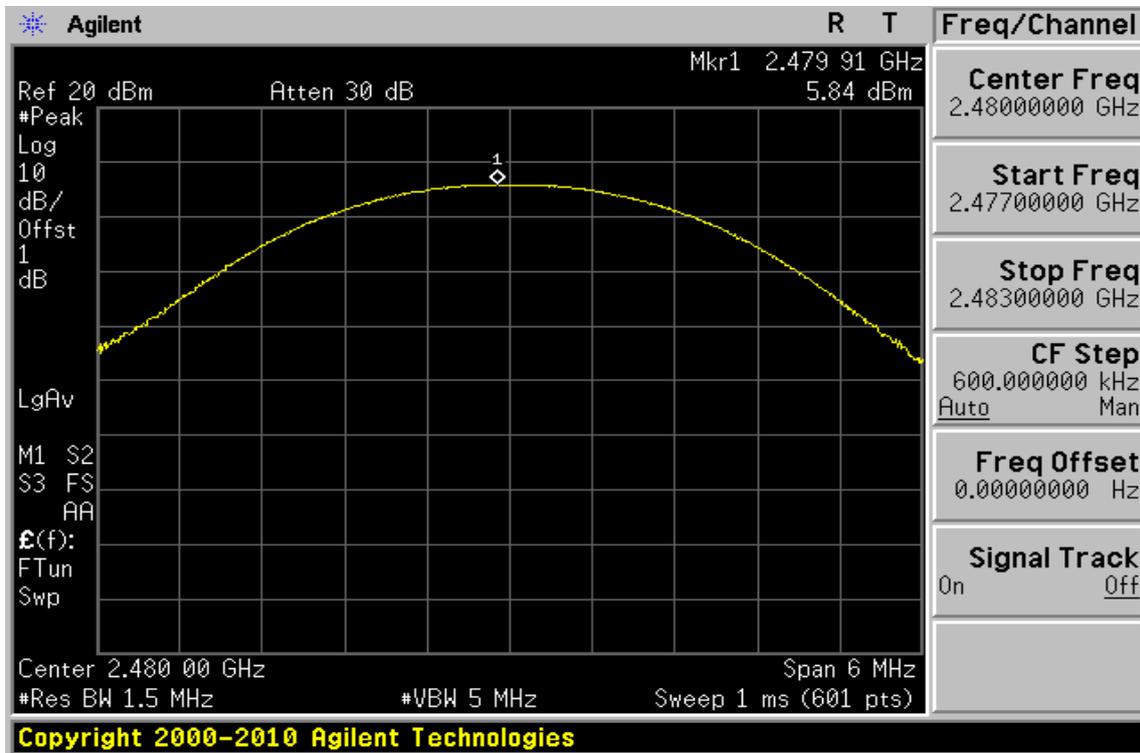
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Peak Power Output Data Plot (CH Mid) (EDR mode $\pi/4$ DQPSK)



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



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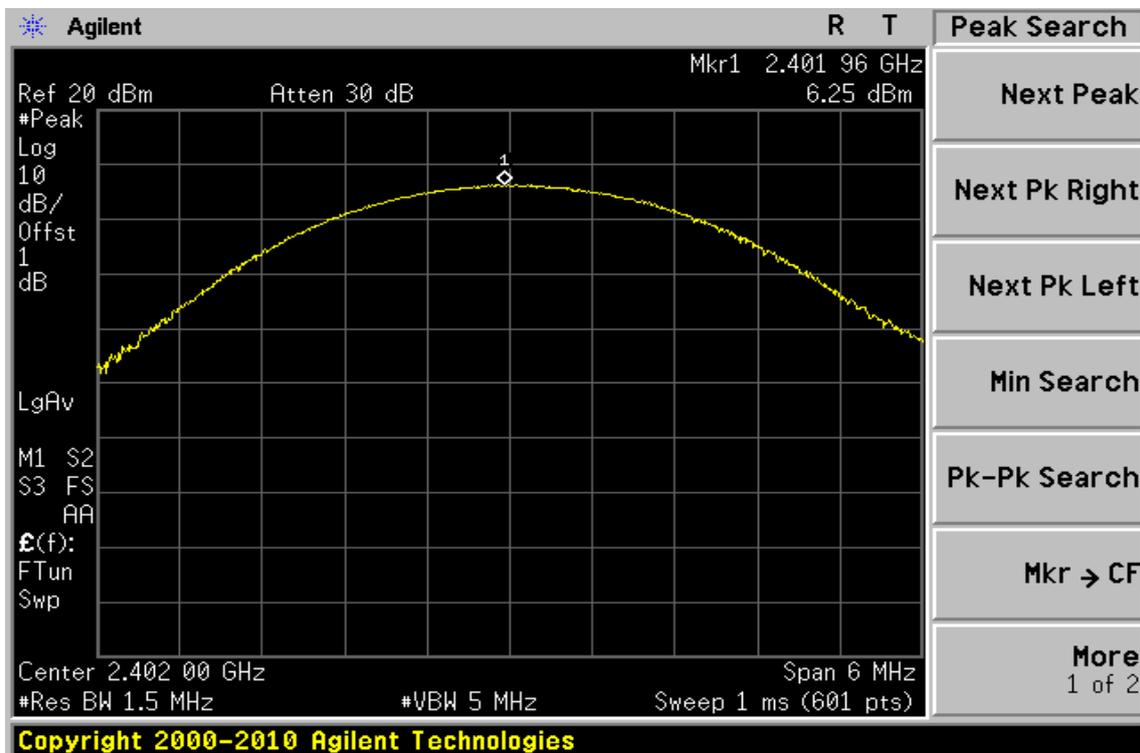
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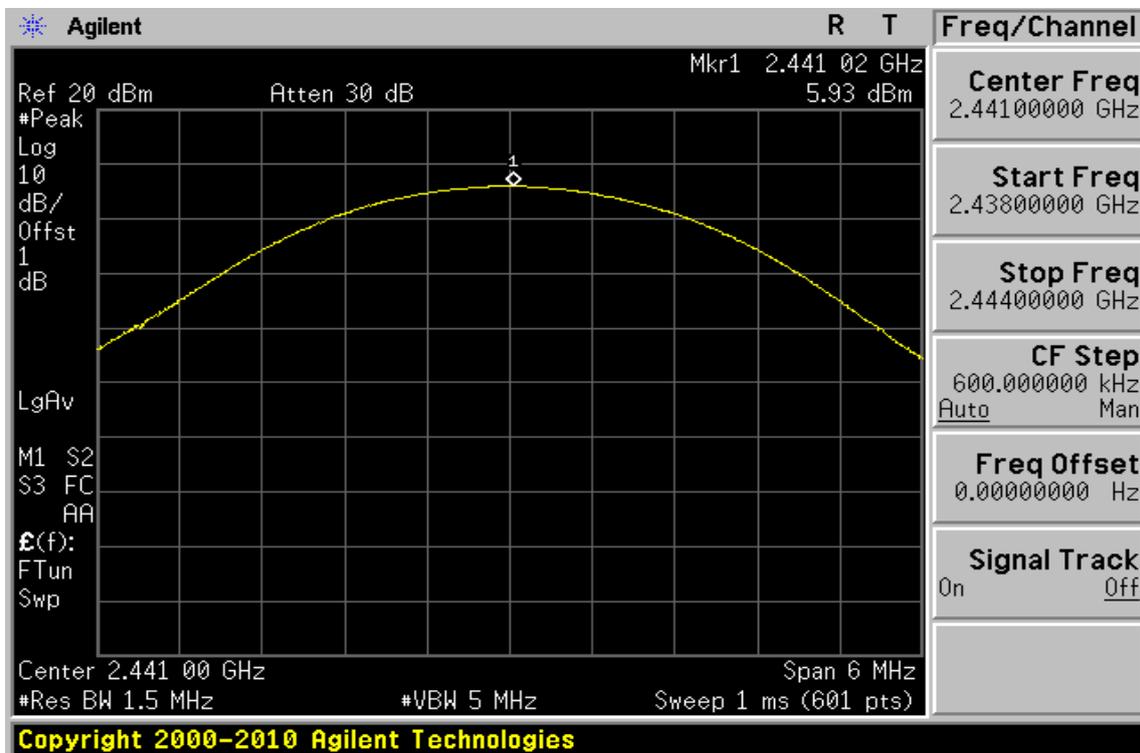
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Peak Power Output Data Plot (CH Low) (EDR mode 8DPSK)



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



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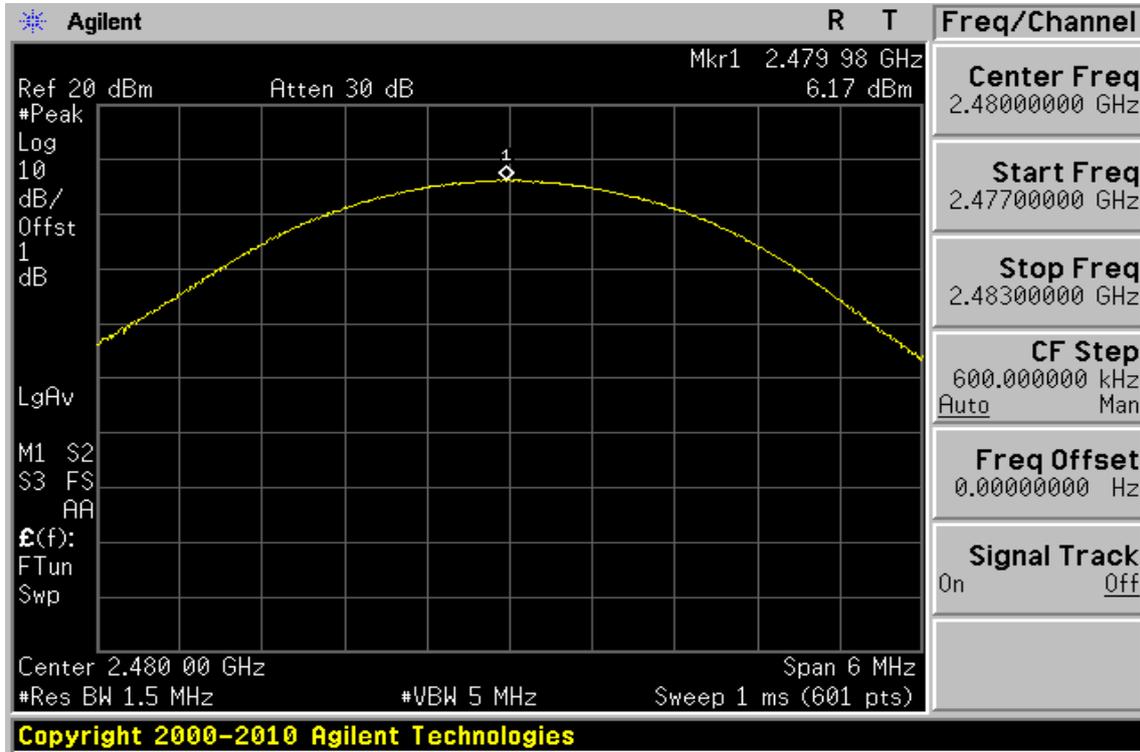
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Peak Power Output Data Plot (CH High) (EDR mode 8DPSK)



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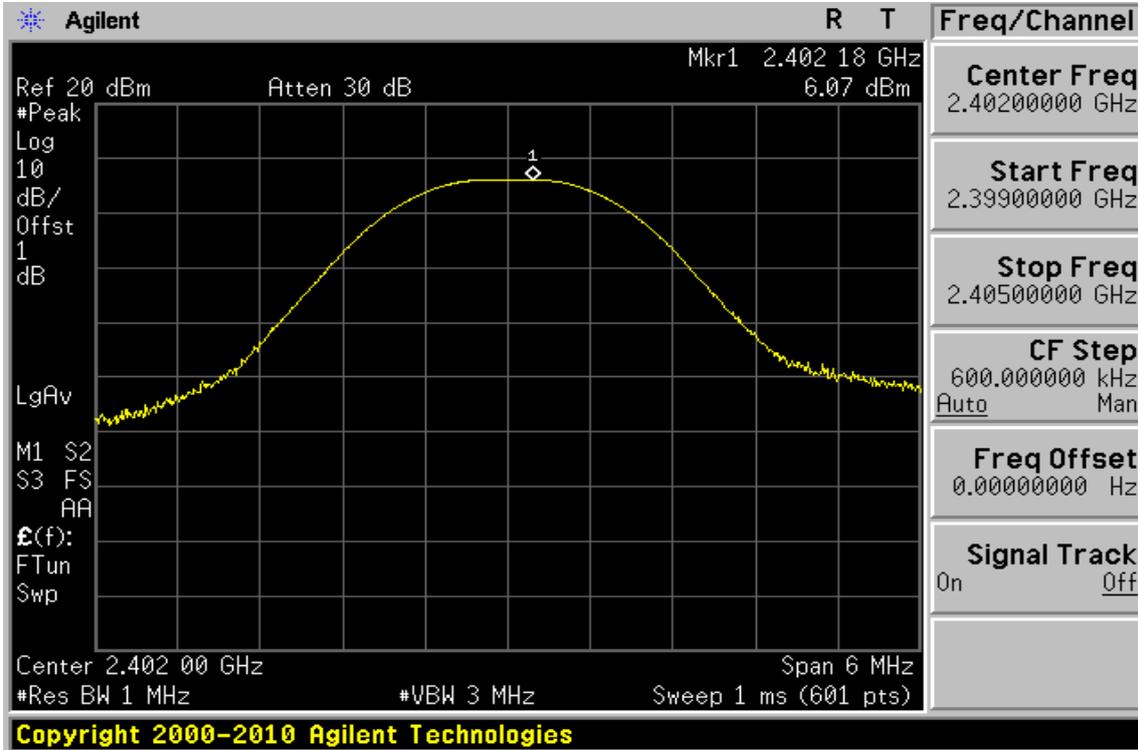
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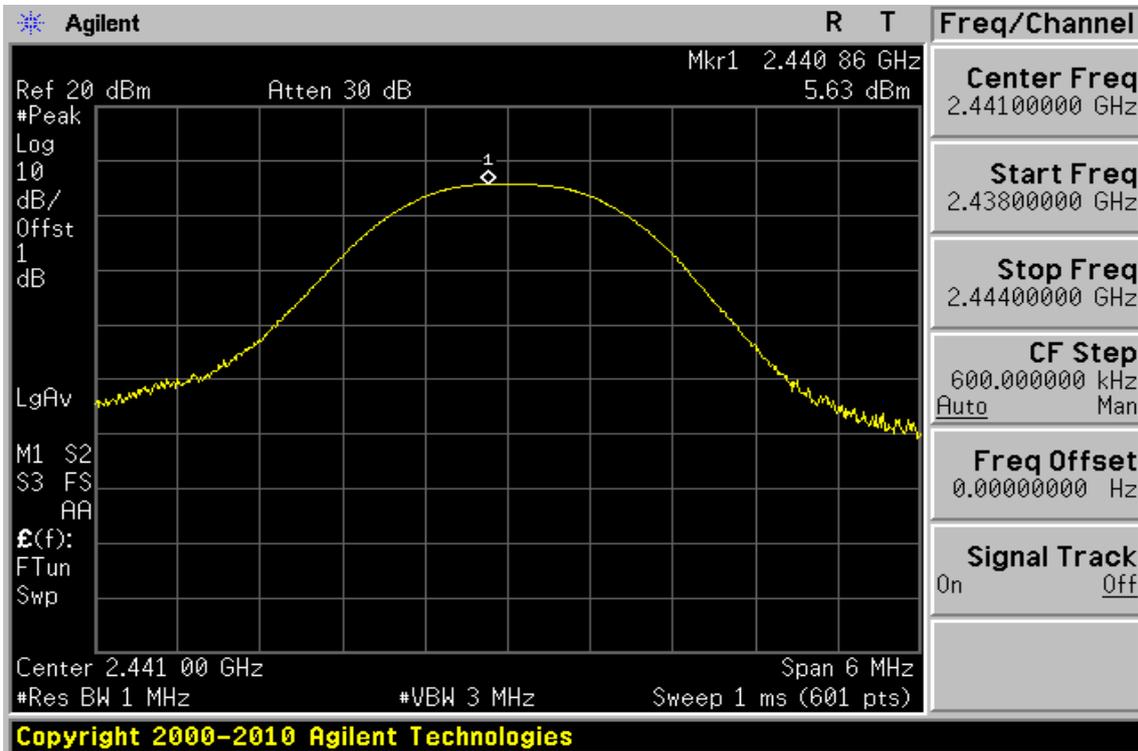
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Peak Power Output Data Plot (CH Low) (BDR mode GFSK)



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



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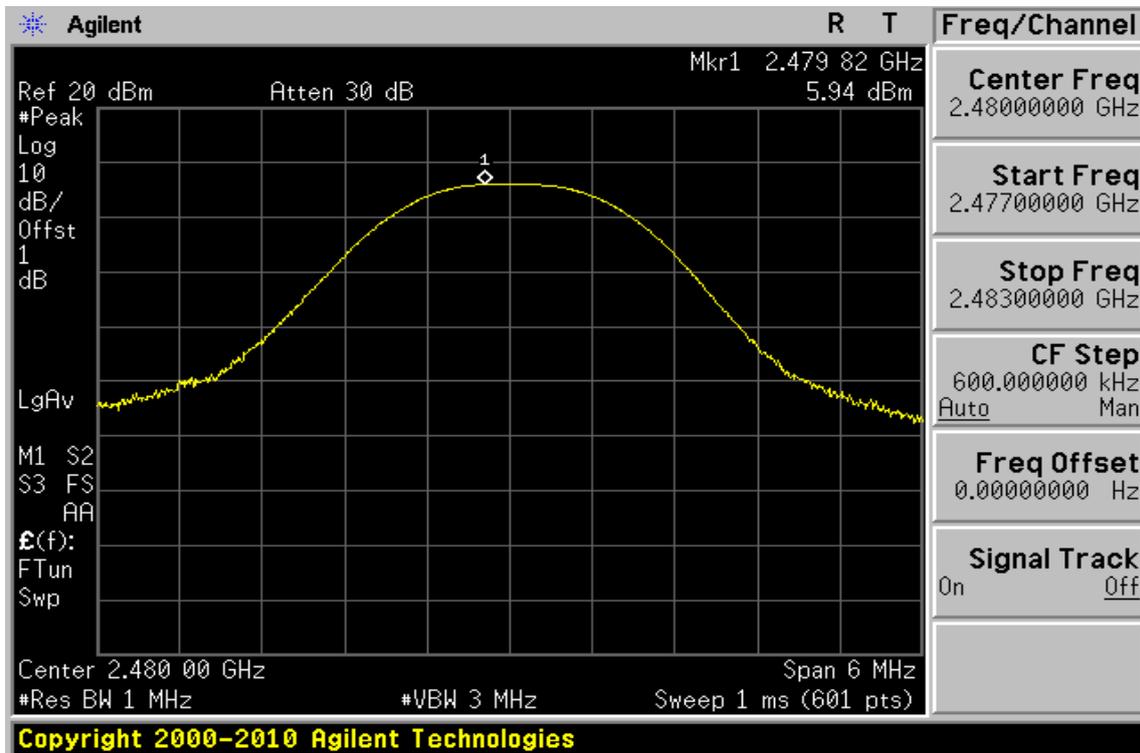
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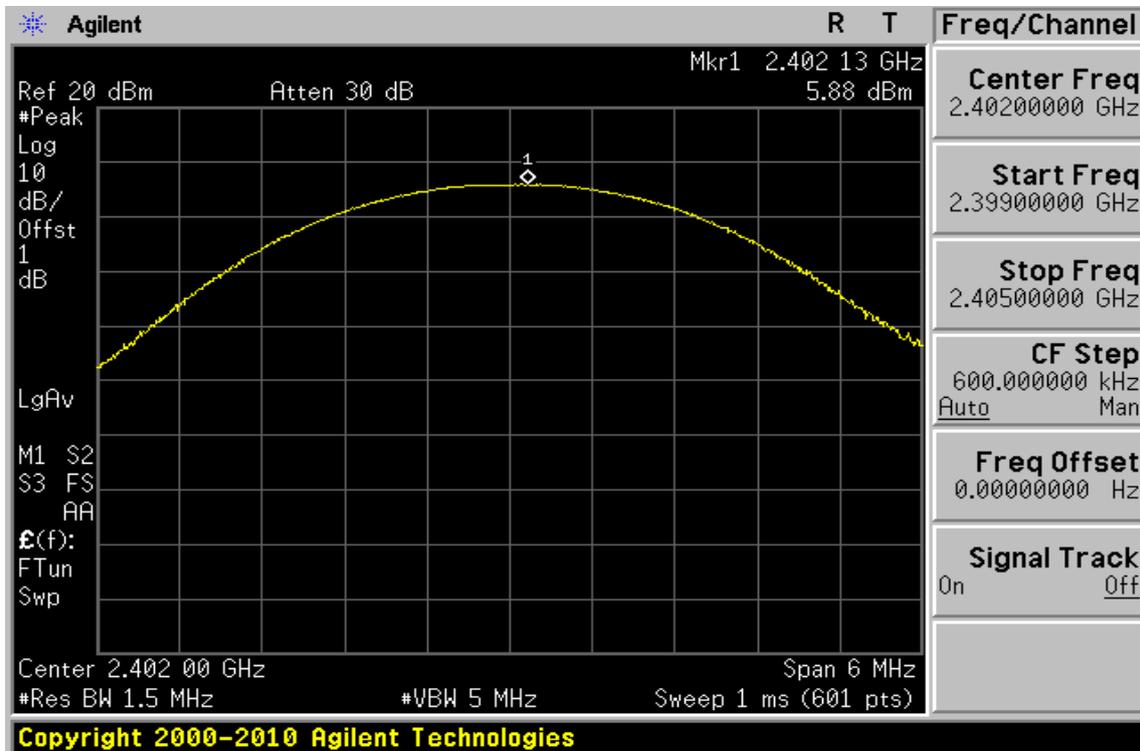
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Peak Power Output Data Plot (CH High) (BDR mode GFSK)



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



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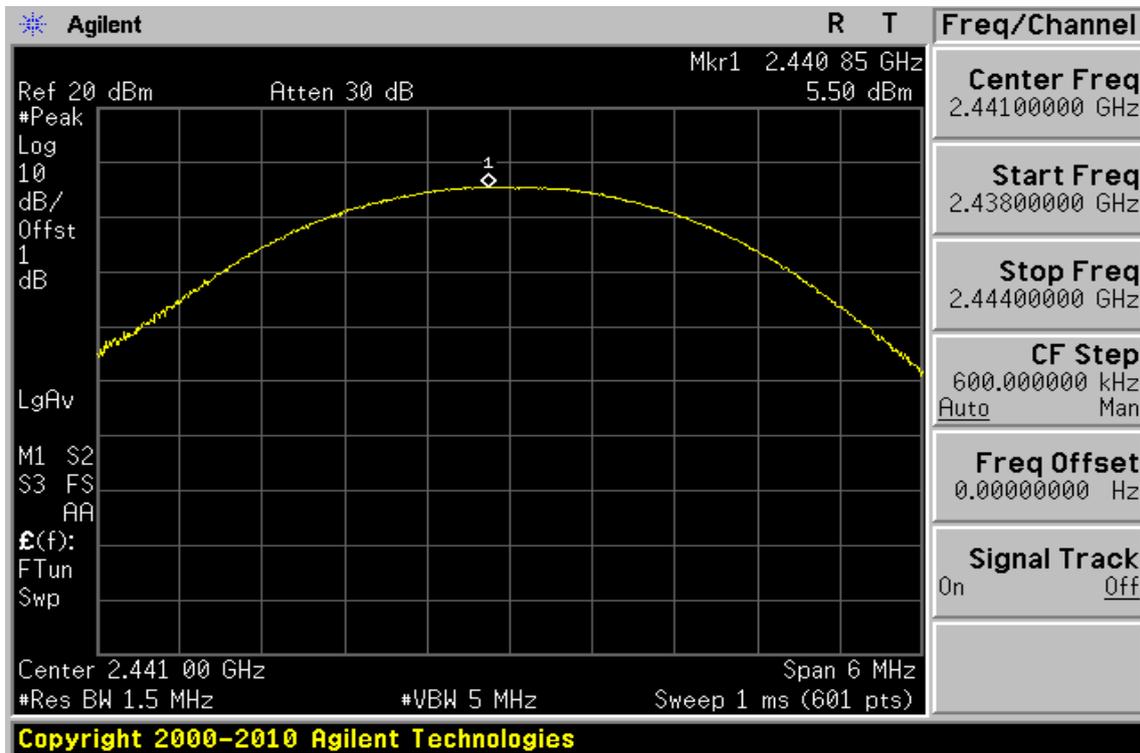
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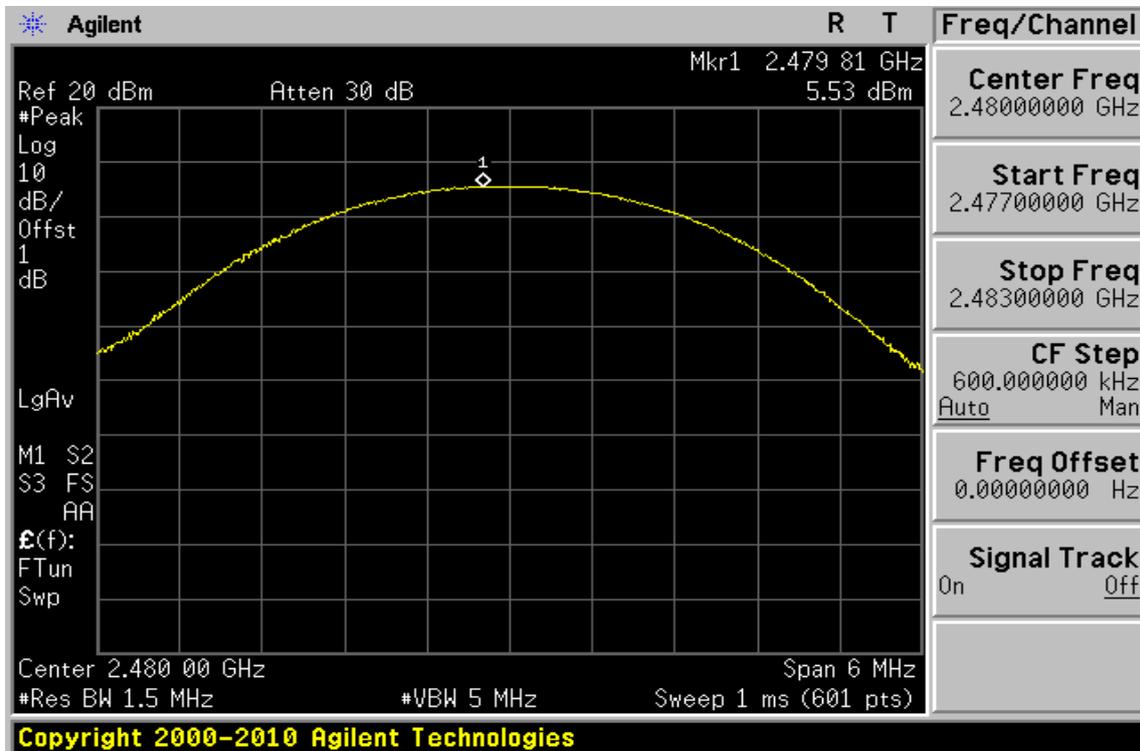
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Peak Power Output Data Plot (CH Mid) (EDR mode $\pi/4$ DQPSK)



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



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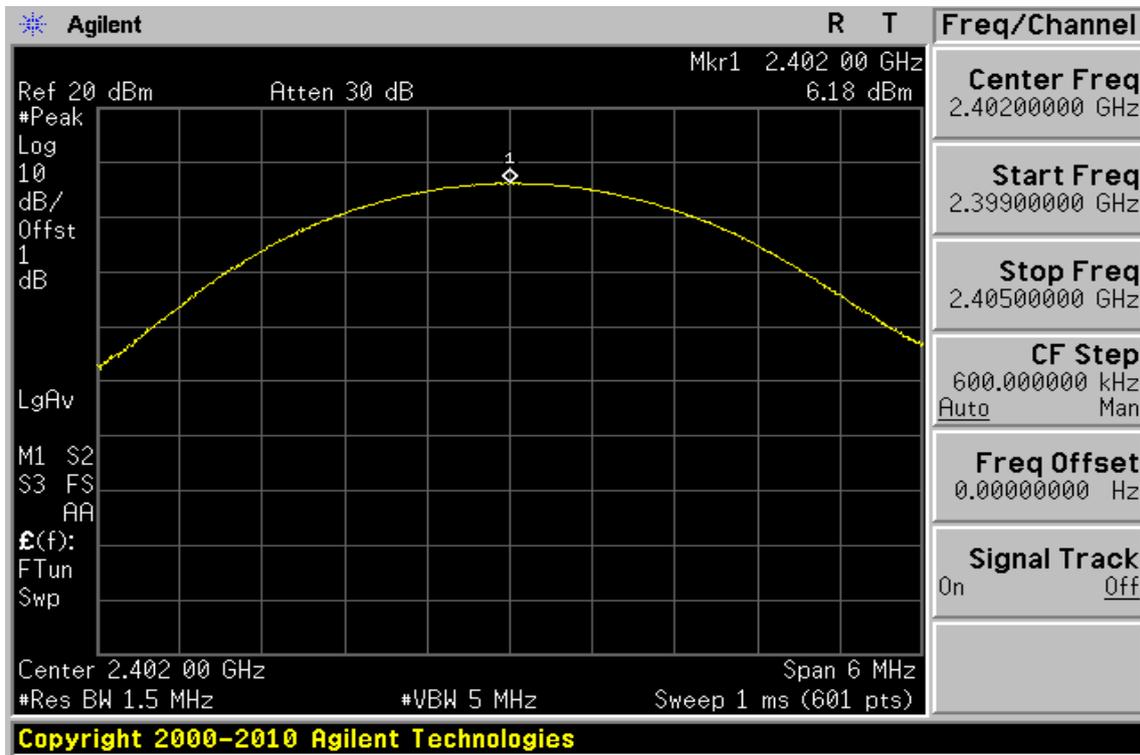
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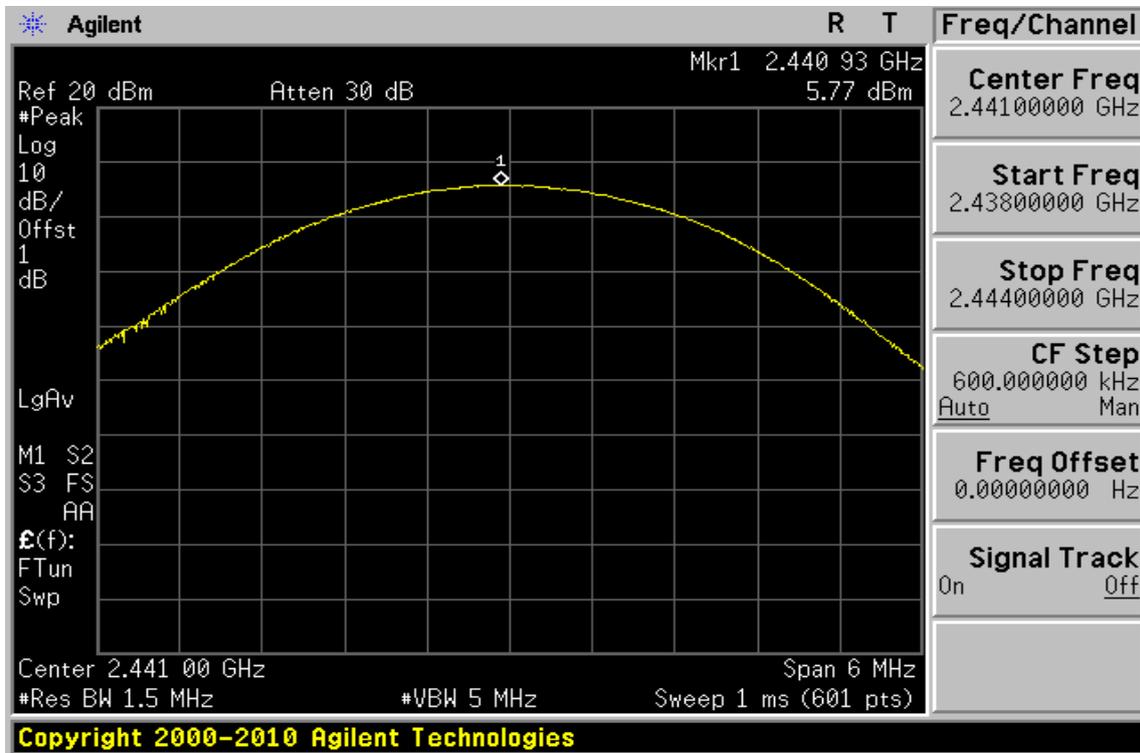
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Peak Power Output Data Plot (CH Low) (EDR mode 8DPSK)



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



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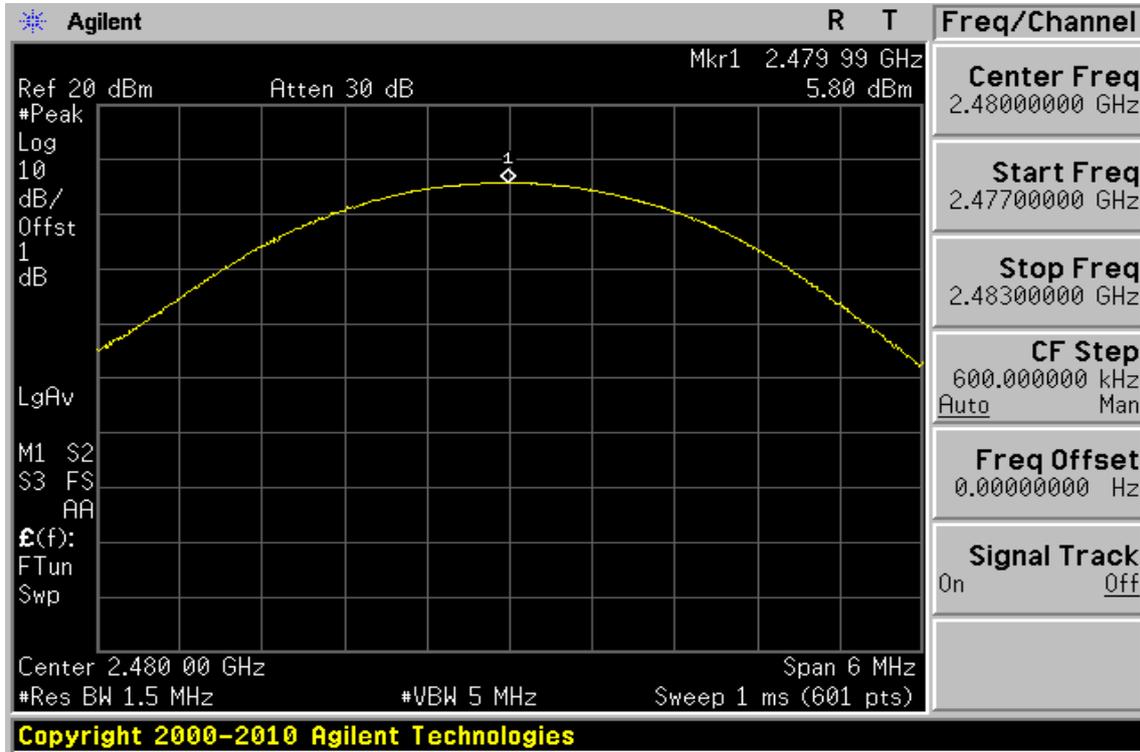
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Peak Power Output Data Plot (CH High) (EDR mode 8DPSK)



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8. 20dB BAND WIDTH

8.1. Standard Applicable

According to §15.247(a)(1) 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:

BDR mode (GFSK):

CH	Bandwidth (kHz)
Lower	928.409
Mid	927.601
Higher	928.361

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

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.256	0.837
Mid	1.278	0.852
Higher	1.262	0.841

EDR mode (8DPSK):

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.266	0.844
Mid	1.261	0.841
Higher	1.251	0.834

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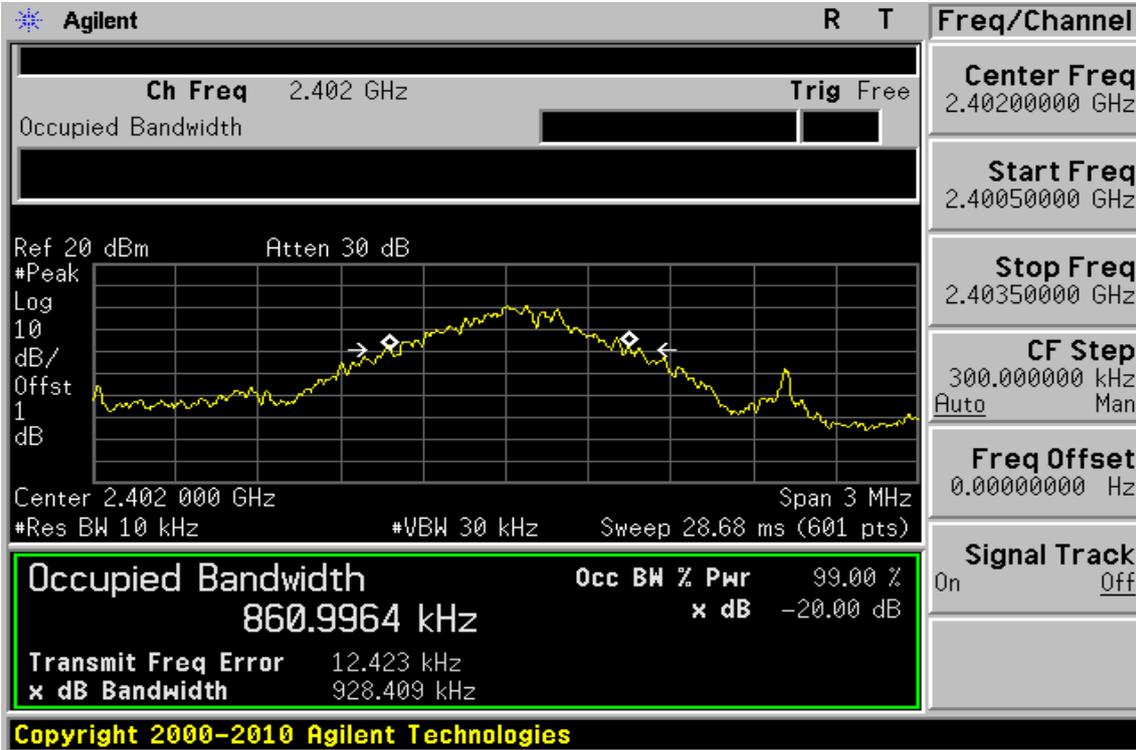
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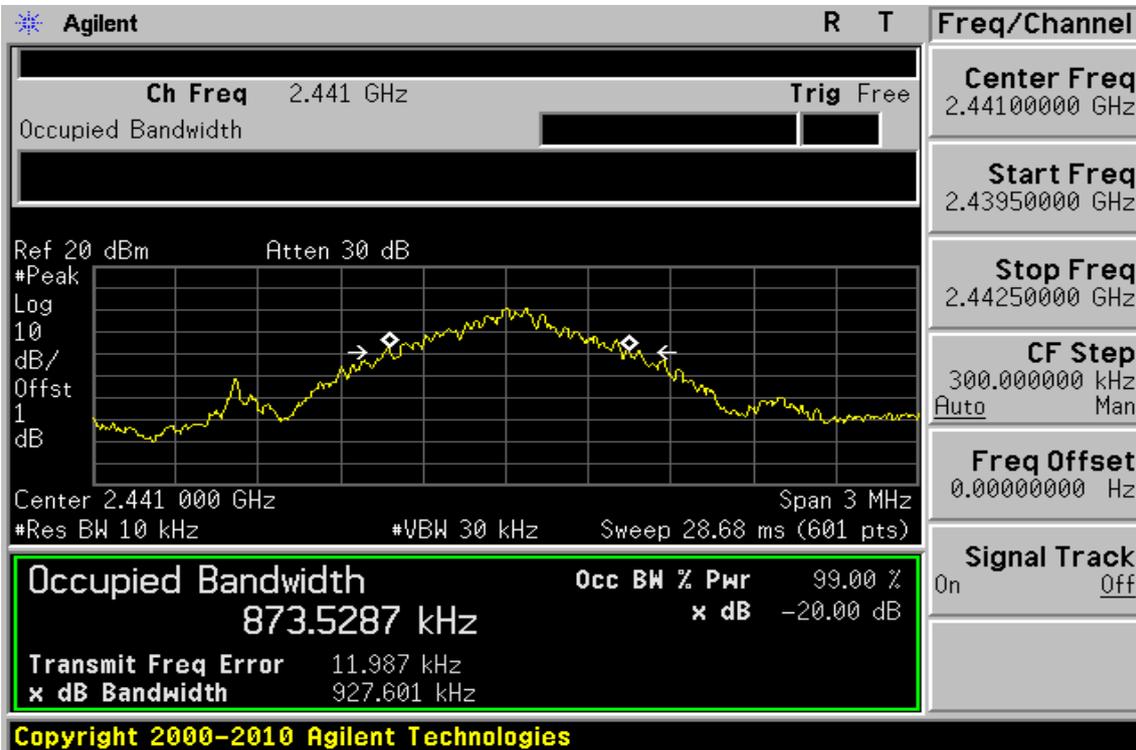
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BDR Mode (GFSK)

20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid



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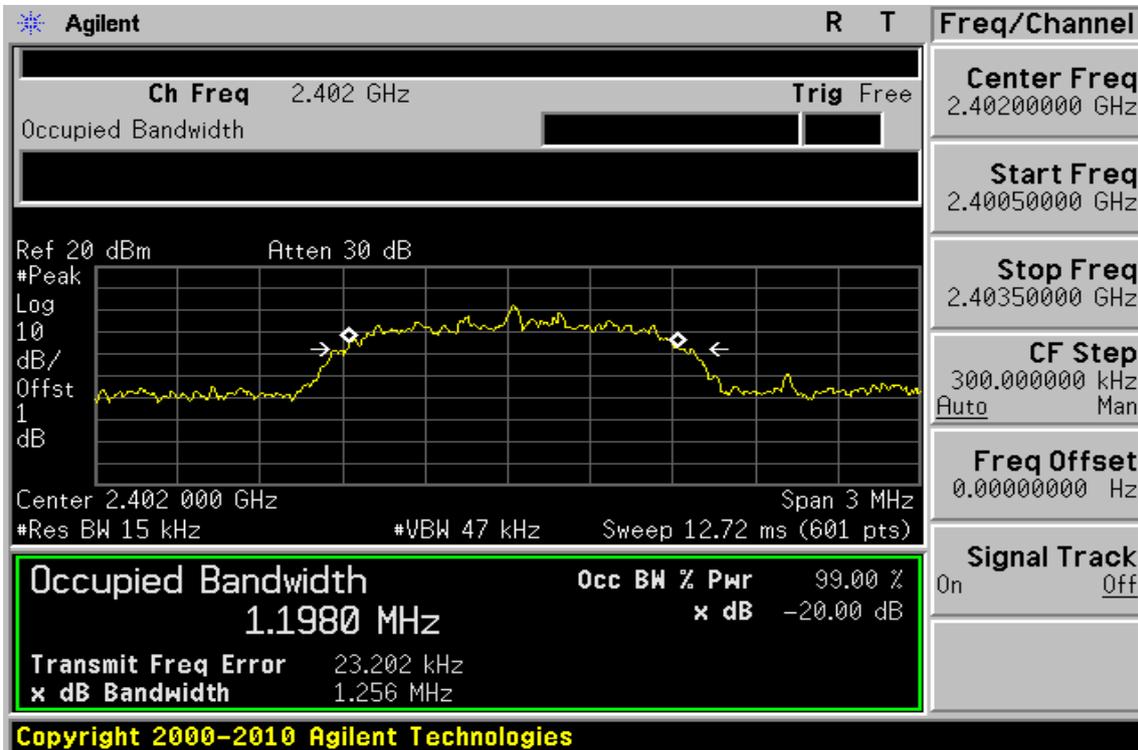
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20dB Bandwidth Test Data CH-High



EDR Mode ($\pi/4$ DQPSK)

20dB Bandwidth Test Data CH-Low



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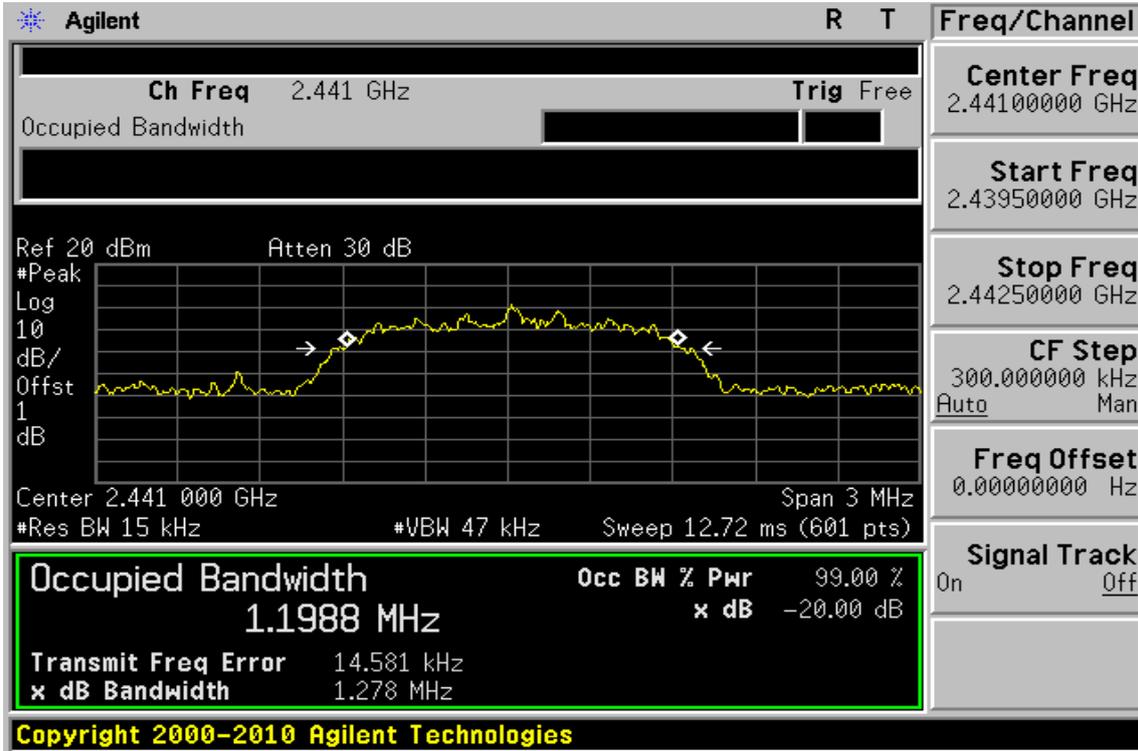
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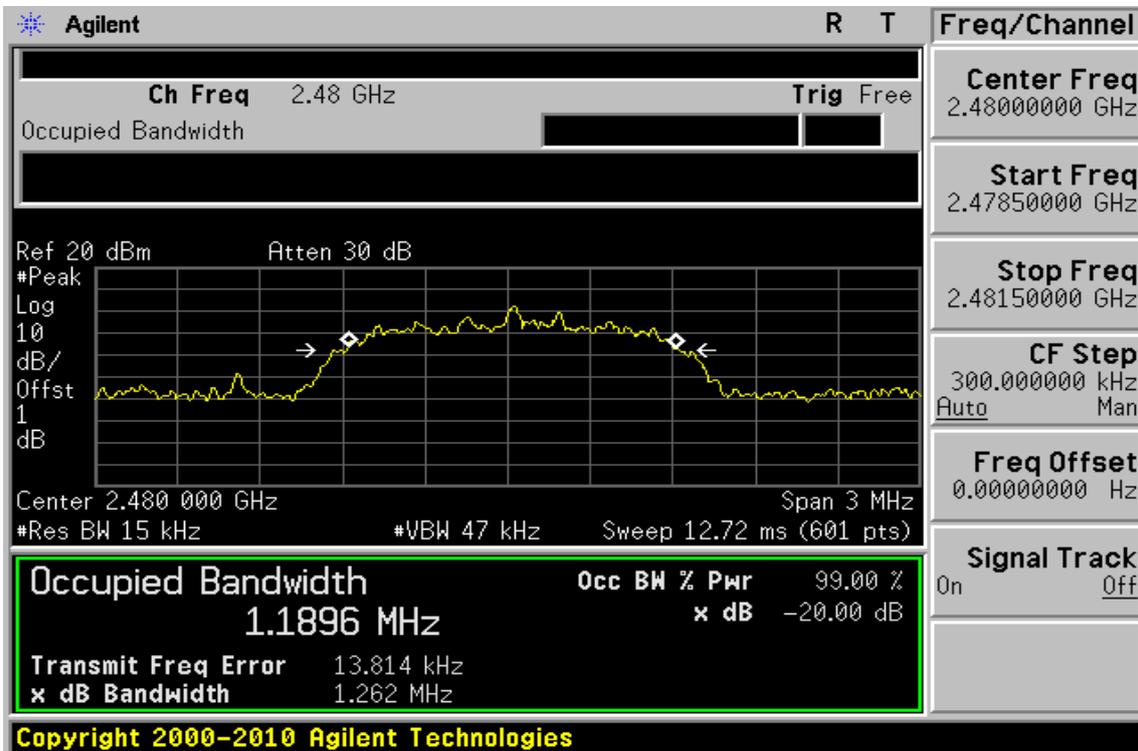
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20dB Bandwidth Test Data CH-Mid



20dB Bandwidth Test Data CH-High



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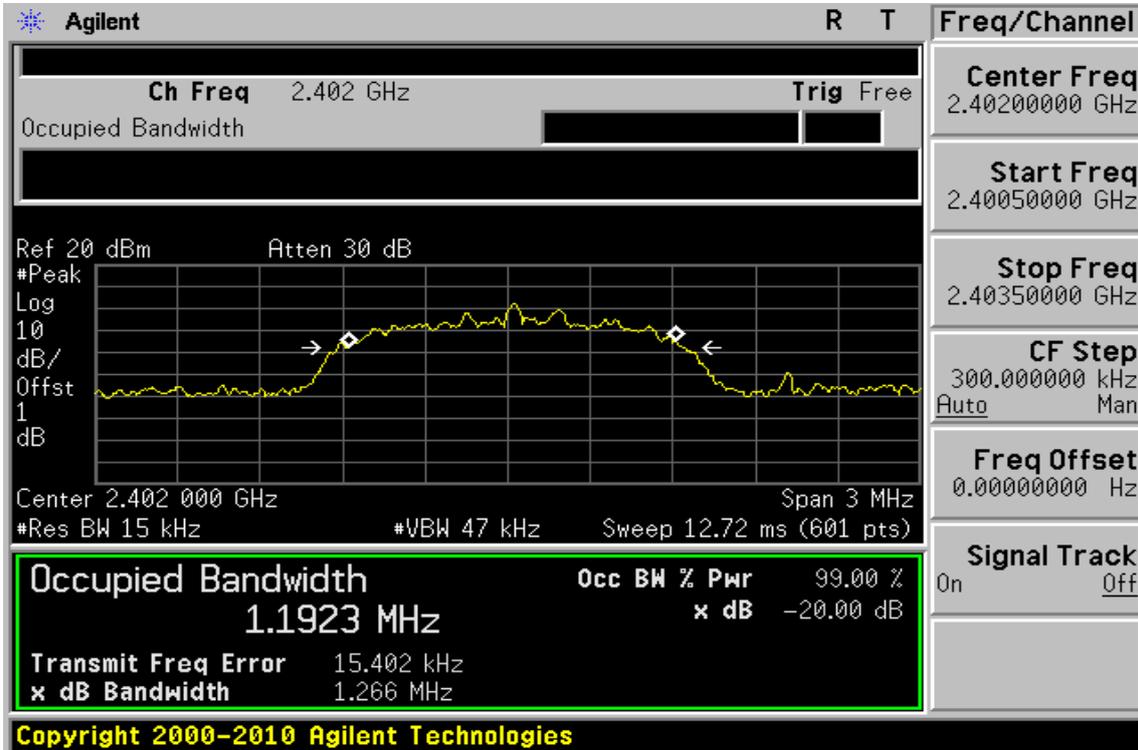
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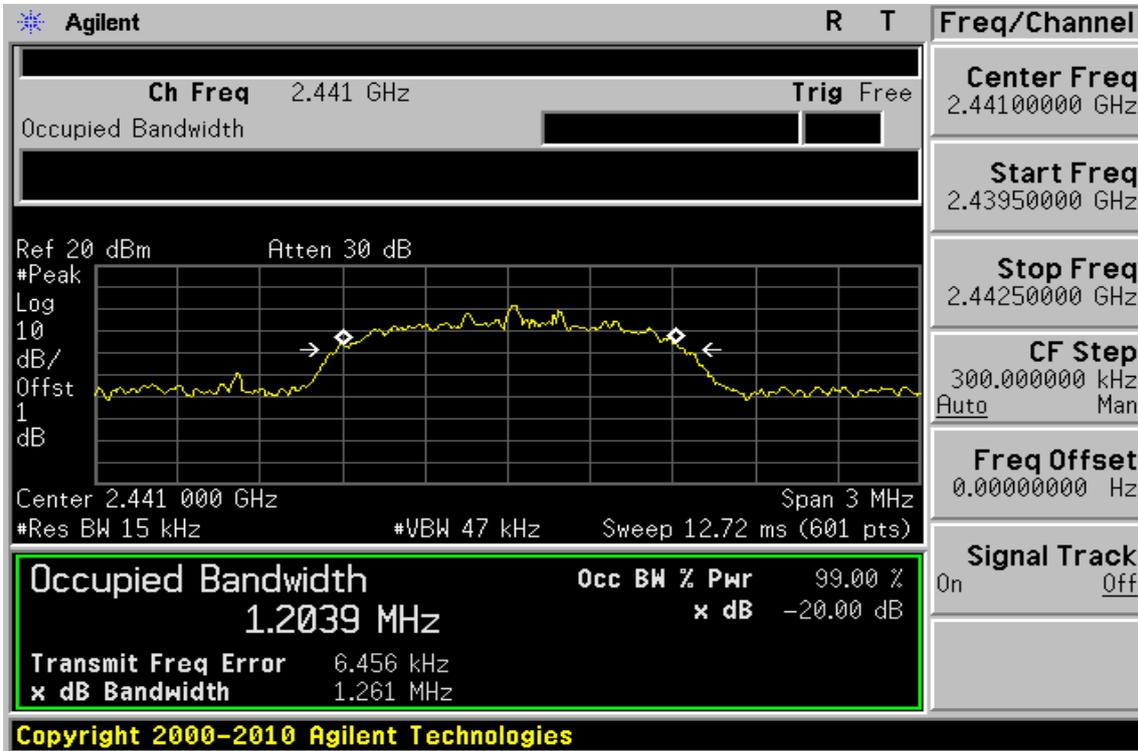
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EDR Mode (8DPSK)

20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid



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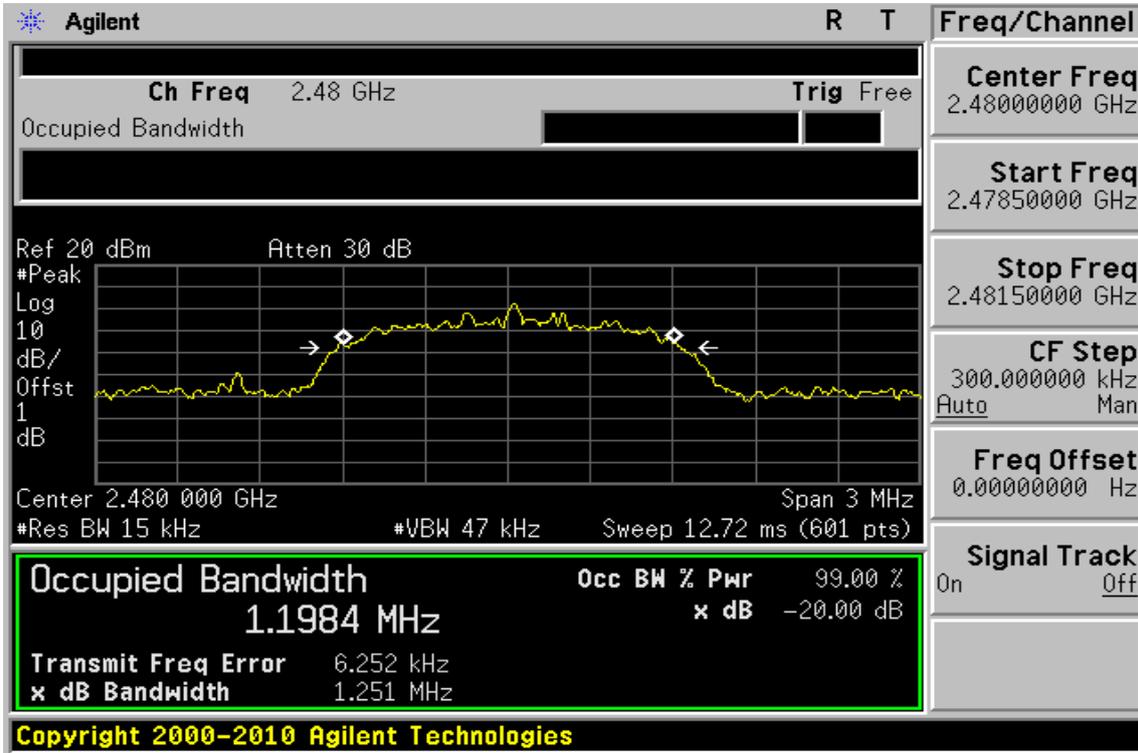
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20dB Bandwidth Test Data CH-High



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9. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

9.1. Standard Applicable

According to §15.247(d), 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 100 kHz 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	04/15/2013	04/14/2014
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	02/06/2013	02/07/2014
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	01/04/2013	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	07/15/2012	07/14/2013

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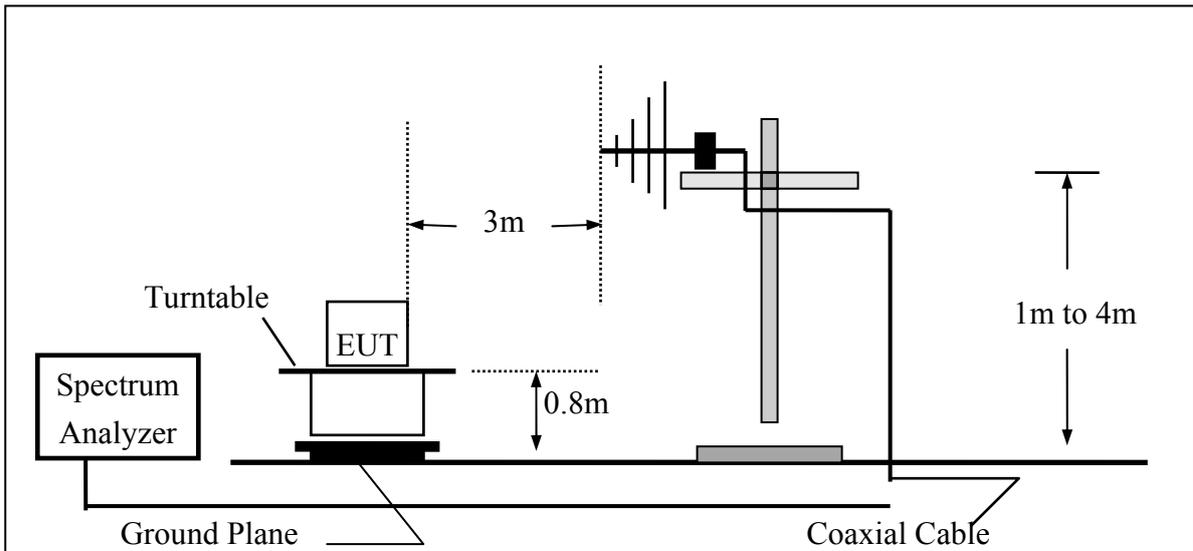
9.3. Test SET-UP:

9.3.1. Conducted Emission at antenna port:

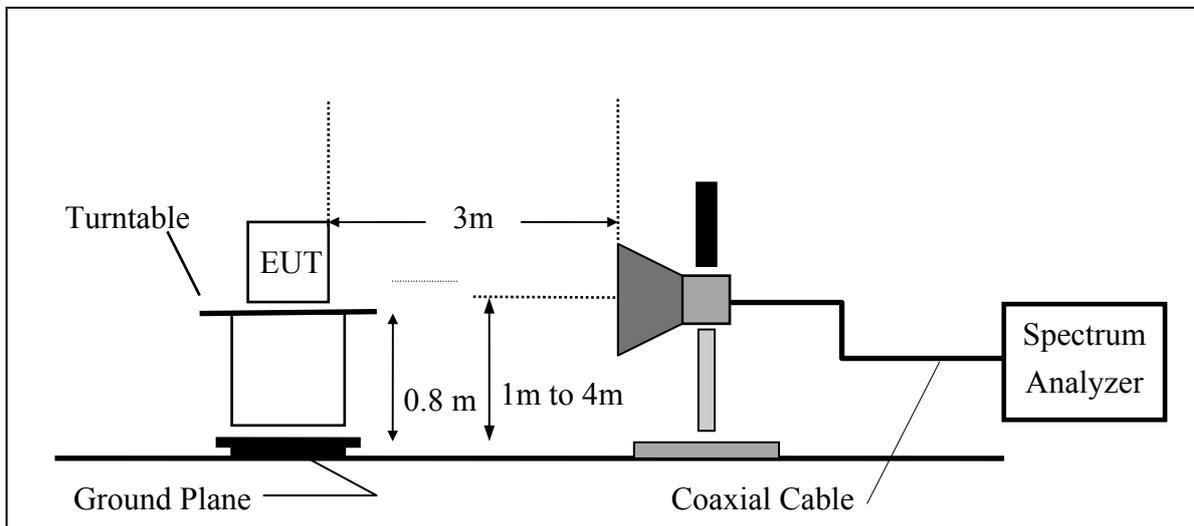
Refer to section 7.3 for details.

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.

Auxiliary Procedure (Setting on Spectrum to capture the reading of emission level):

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

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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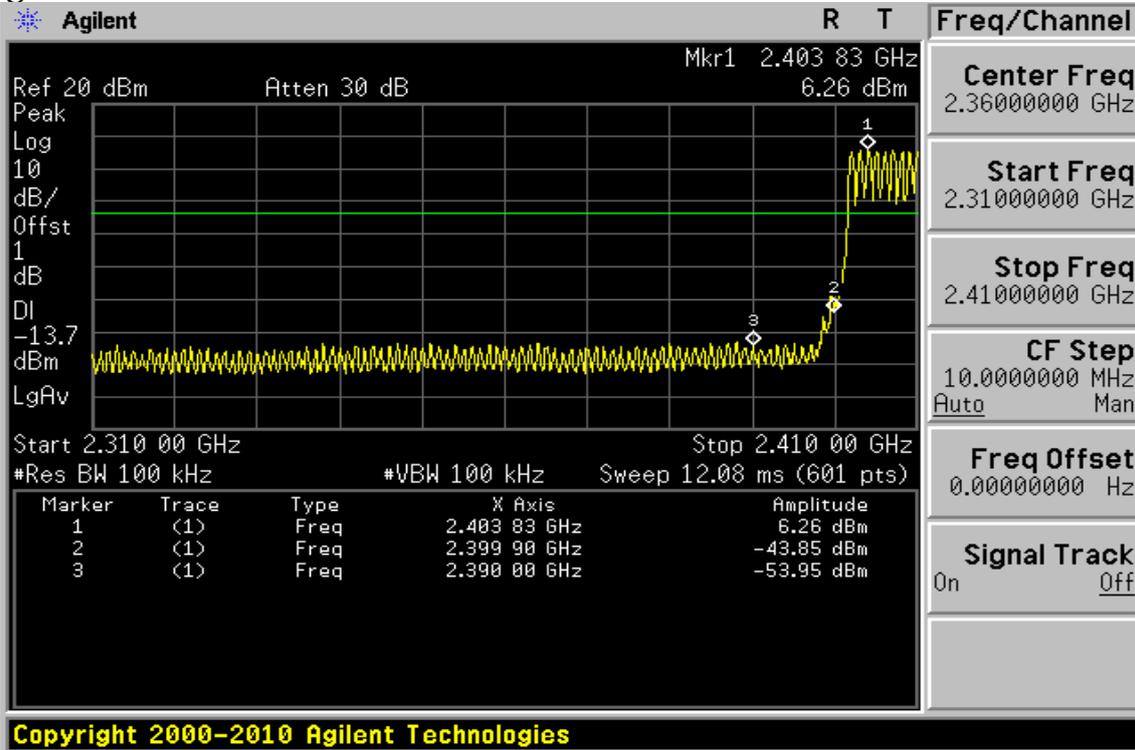
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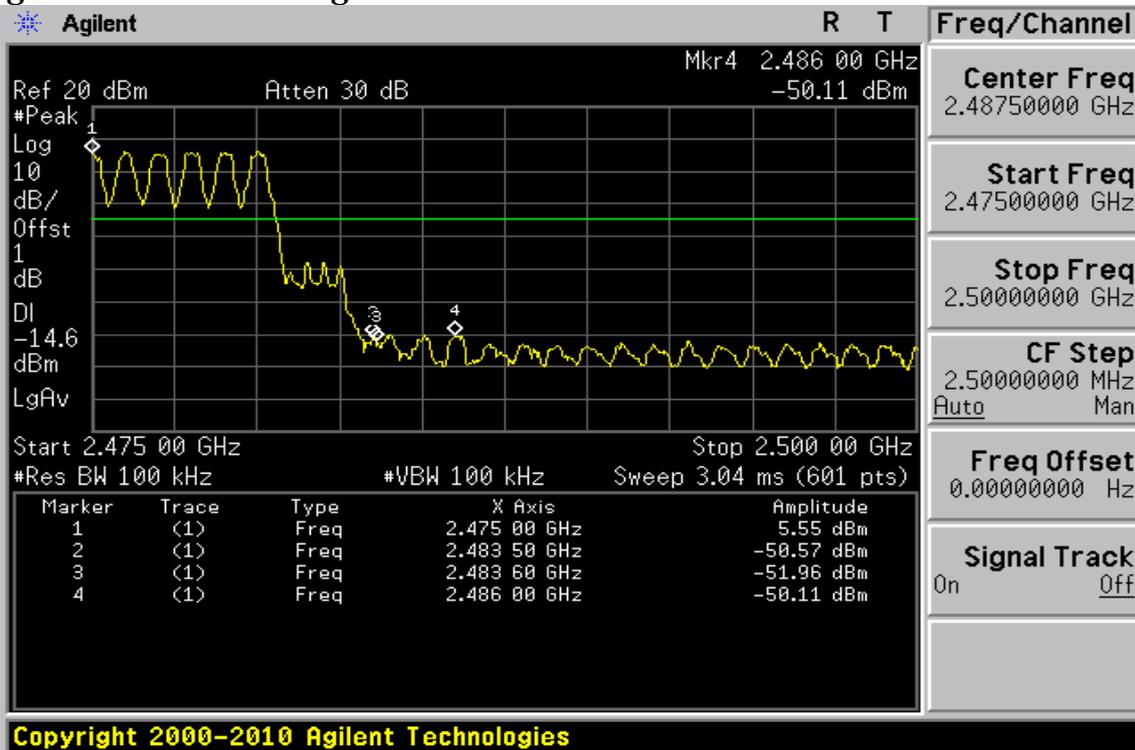
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BDR Mode

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Radiated Emission: (BDR mode) – Main Source

Operation Band	:BR	Test Date	:2013-04-22
Fundamental Frequency	:2402MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:H 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	32.10	2.12	34.22	54.00	-19.78
2390.00	E	Peak	45.11	2.12	47.23	74.00	-26.77

Operation Band	:BR	Test Date	:2013-04-22
Fundamental Frequency	:2402MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:H 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	31.35	2.74	34.09	54.00	-19.91
2390.00	E	Peak	44.14	2.74	46.88	74.00	-27.12

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	:2013-04-22
Fundamental Frequency	:2480MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:H 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	37.11	2.53	39.64	54.00	-14.36
2483.50	E	Peak	49.46	2.53	51.99	74.00	-22.01

Operation Band	:BR	Test Date	:2013-04-22
Fundamental Frequency	:2480MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:H 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	42.39	3.56	45.95	54.00	-8.05
2483.50	E	Peak	52.73	3.56	56.29	74.00	-17.71

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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Radiated Emission: (BDR mode) – Second Source

Operation Band	:BR	Test Date	:2013-05-03
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:H 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	31.63	2.12	33.75	54.00	-20.25
2390.00	E	Peak	44.11	2.12	46.23	74.00	-27.77

Operation Band	:BR	Test Date	:2013-05-03
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:H 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	33.06	2.74	35.80	54.00	-18.20
2390.00	E	Peak	46.27	2.74	49.01	74.00	-24.99

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.

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Operation Band	:BR	Test Date	:2013-05-03
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:H 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	31.60	2.53	34.13	54.00	-19.87
2483.50	E	Peak	45.92	2.53	48.45	74.00	-25.55

Operation Band	:BR	Test Date	:2013-05-03
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:H 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	31.40	3.56	34.96	54.00	-19.04
2483.50	E	Peak	45.69	3.56	49.25	74.00	-24.75

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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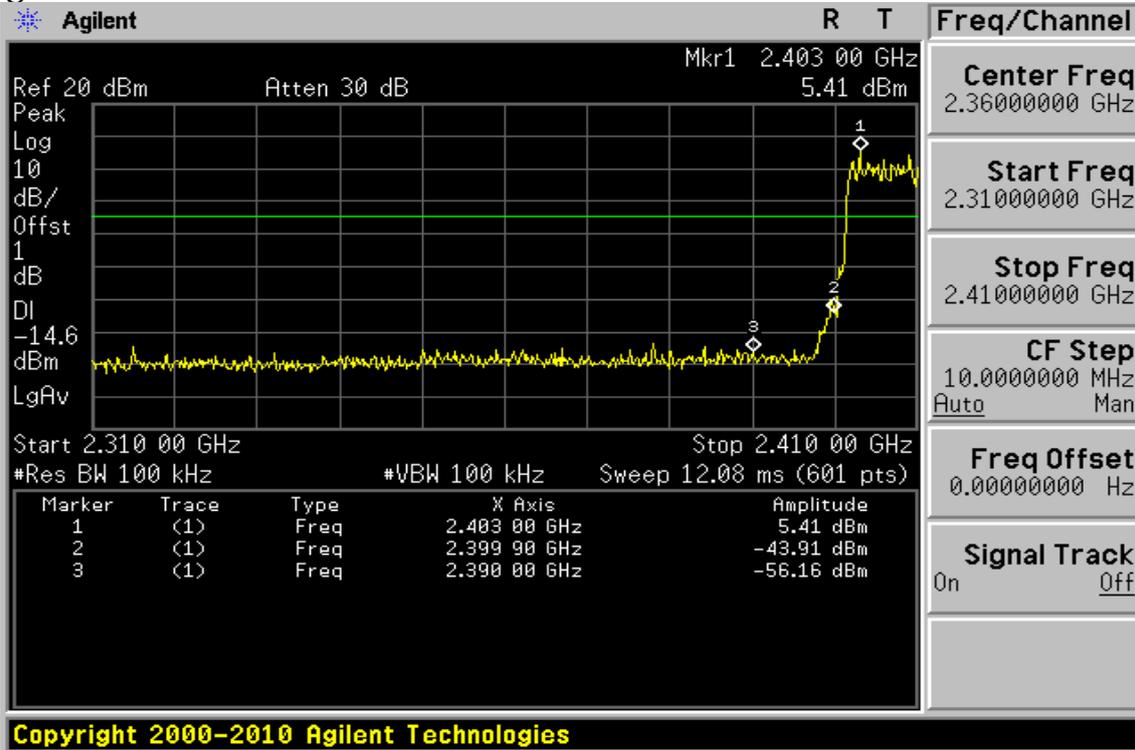
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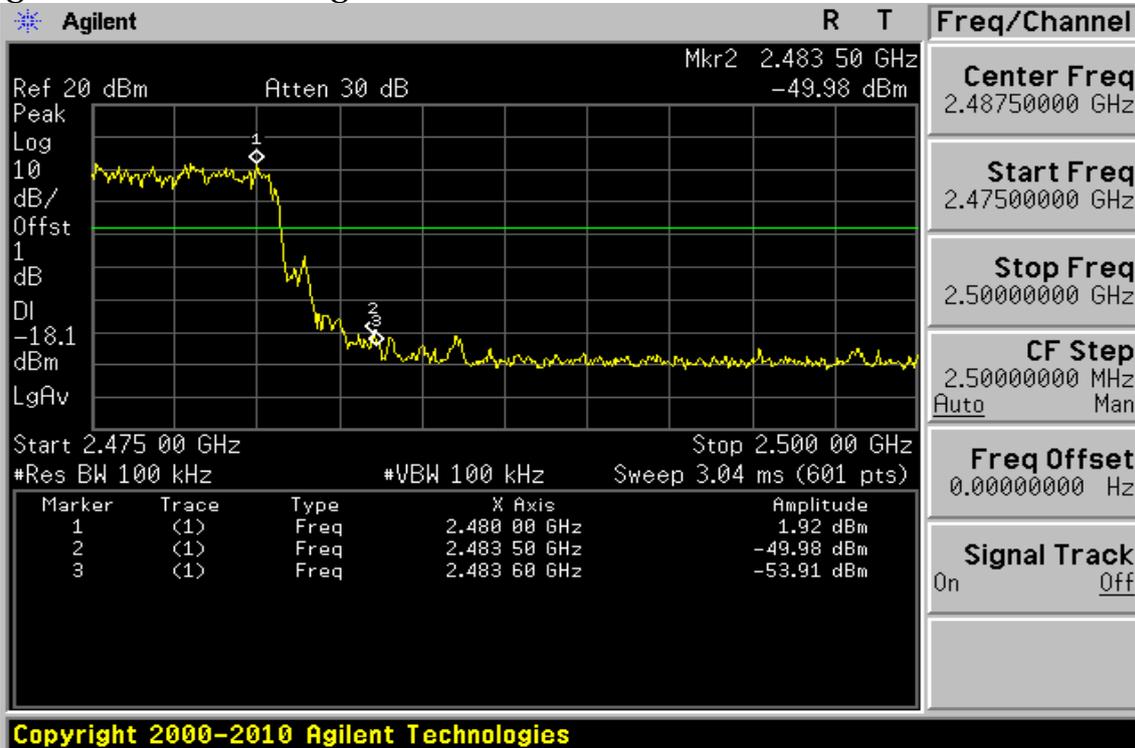
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EDR Mode

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Radiated Emission: (EDR mode)-Main Source

Operation Band	:EDR	Test Date	:2013-04-22
Fundamental Frequency	:2402MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:H 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	32.58	2.12	34.70	54.00	-19.30
2390.00	E	Peak	45.34	2.12	47.46	74.00	-26.54

Operation Band	:EDR	Test Date	:2013-04-22
Fundamental Frequency	:2402MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:H 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	31.66	2.74	34.40	54.00	-19.60
2390.00	E	Peak	44.66	2.74	47.40	74.00	-26.60

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	:2013-04-22
Fundamental Frequency	:2480MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:H 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	37.02	2.53	39.55	54.00	-14.45
2483.50	E	Peak	54.89	2.53	57.42	74.00	-16.58

Operation Band	:EDR	Test Date	:2013-04-22
Fundamental Frequency	:2480MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:H 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	42.13	3.56	45.69	54.00	-8.31
2483.50	E	Peak	57.89	3.56	61.45	74.00	-12.55

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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Radiated Emission: (EDR mode)-Second Source

Operation Band	:ER	Test Date	:2013-05-03
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:H 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	31.35	2.12	33.47	54.00	-20.53
2390.00	E	Peak	44.48	2.12	46.60	74.00	-27.40

Operation Band	:ER	Test Date	:2013-05-03
Fundamental Frequency	:2402 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:H 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	32.64	2.74	35.38	54.00	-18.62
2390.00	E	Peak	45.15	2.74	47.89	74.00	-26.11

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	:ER	Test Date	:2013-05-03
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:H 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	31.22	2.53	33.75	54.00	-20.25
2483.50	E	Peak	46.61	2.53	49.14	74.00	-24.86

Operation Band	:ER	Test Date	:2013-05-03
Fundamental Frequency	:2480 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:H 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	31.19	3.56	34.75	54.00	-19.25
2483.50	E	Peak	45.09	3.56	48.65	74.00	-25.35

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(d),

Emission at antenna port:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Radiated Spurious Emission

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

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.

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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.

Auxiliary Procedure (Setting on Spectrum to capture the reading of emission level):

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz

VBW \geq RBW

Sweep = auto

Detector function = peak

Trace = max hold

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.

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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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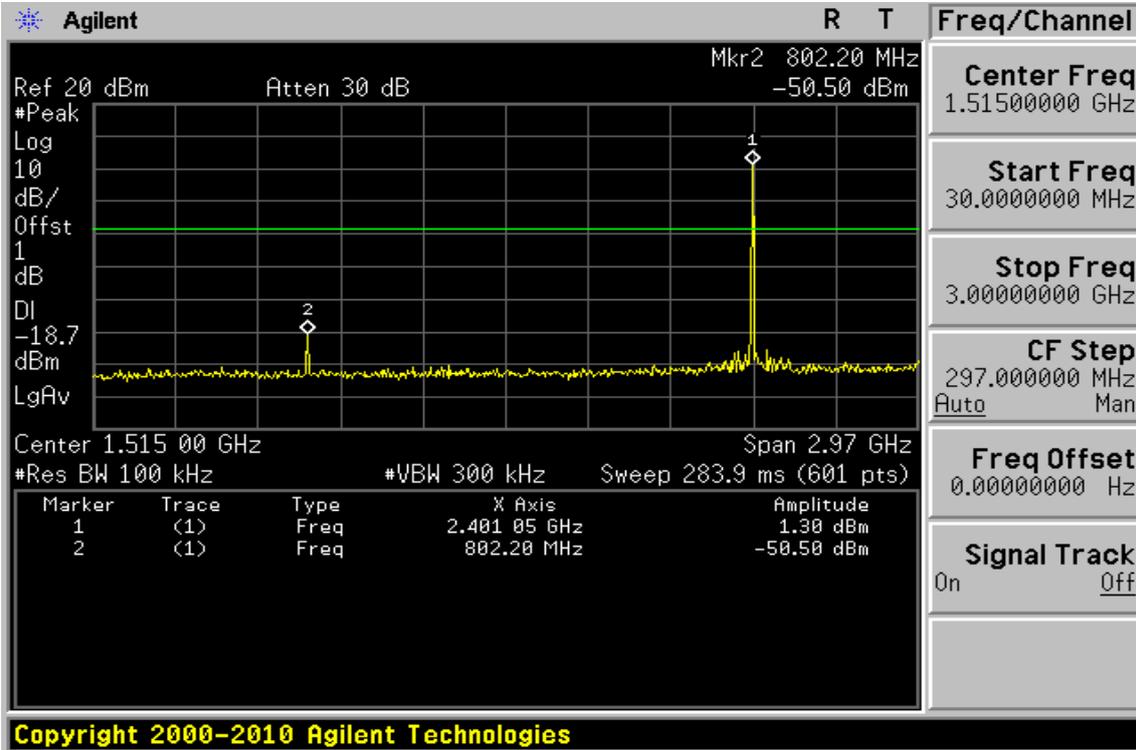
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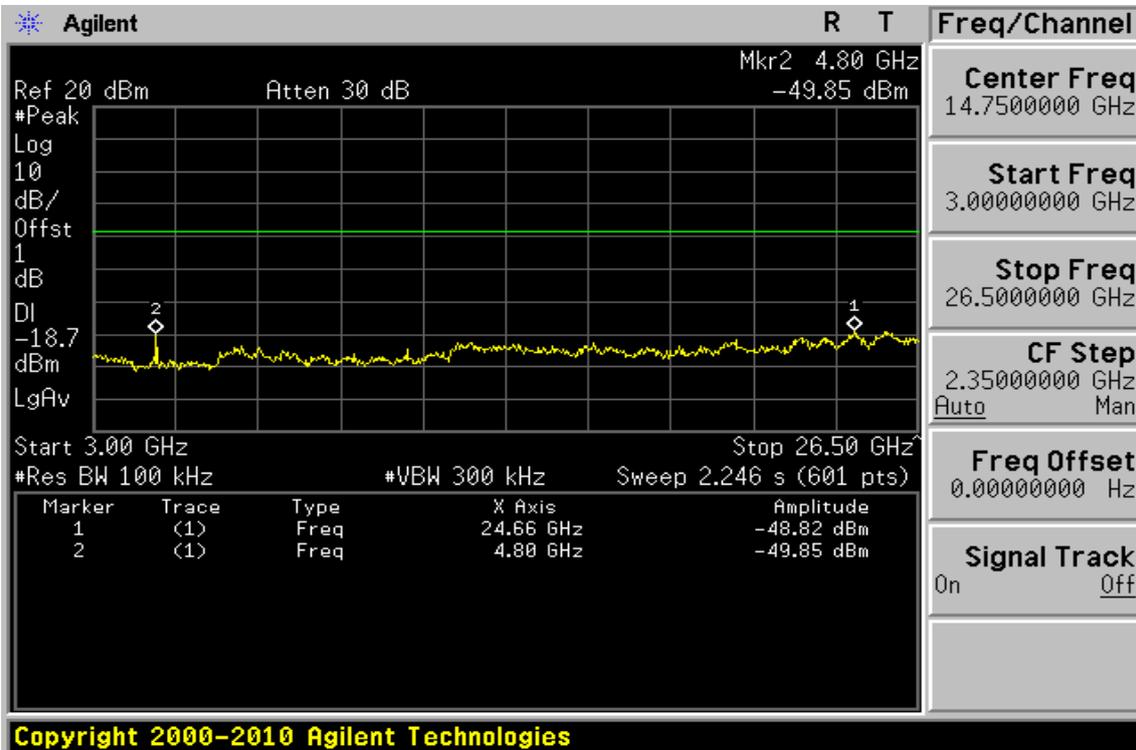
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EDR Mode Conducted Spurious Emission Measurement Result (Worst Case) Ch Low 30MHz – 3GHz



Ch Low 3GHz –26.5GHz



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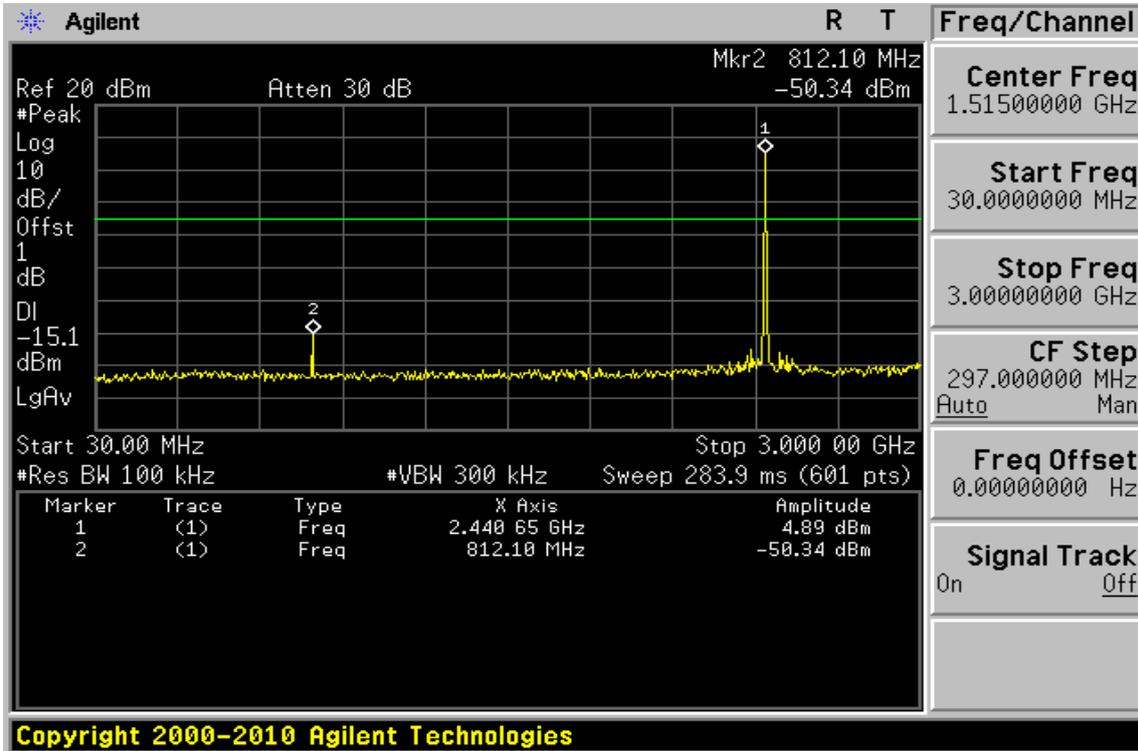
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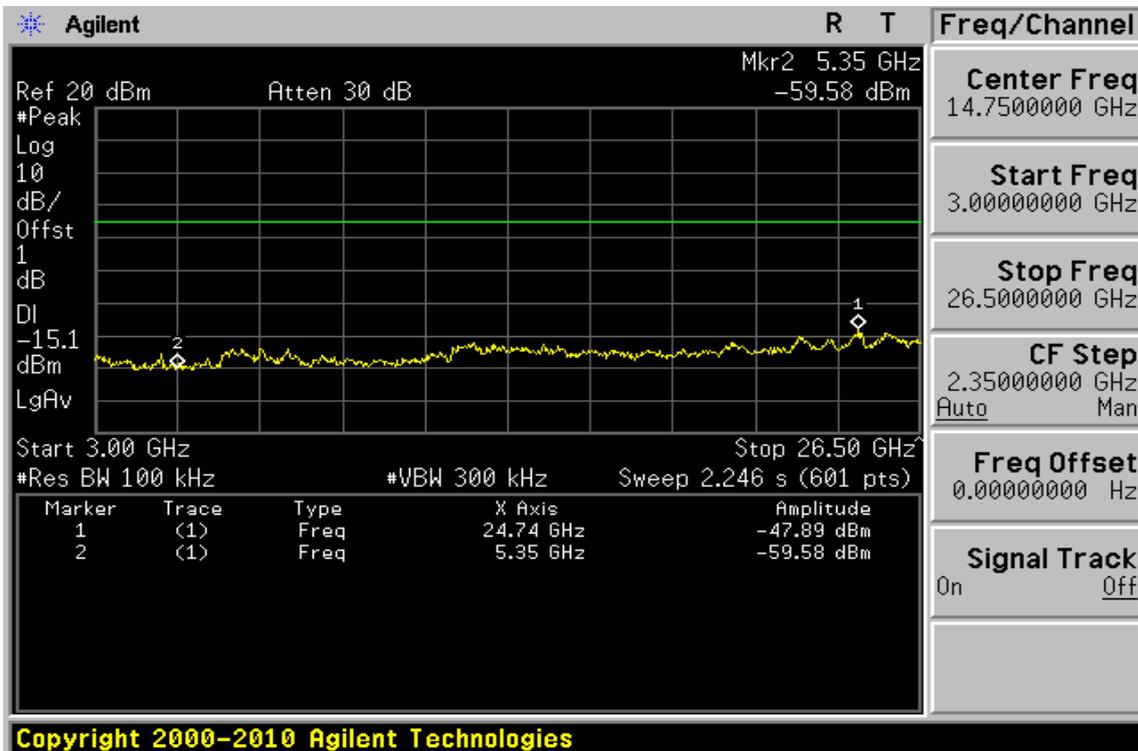
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Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz



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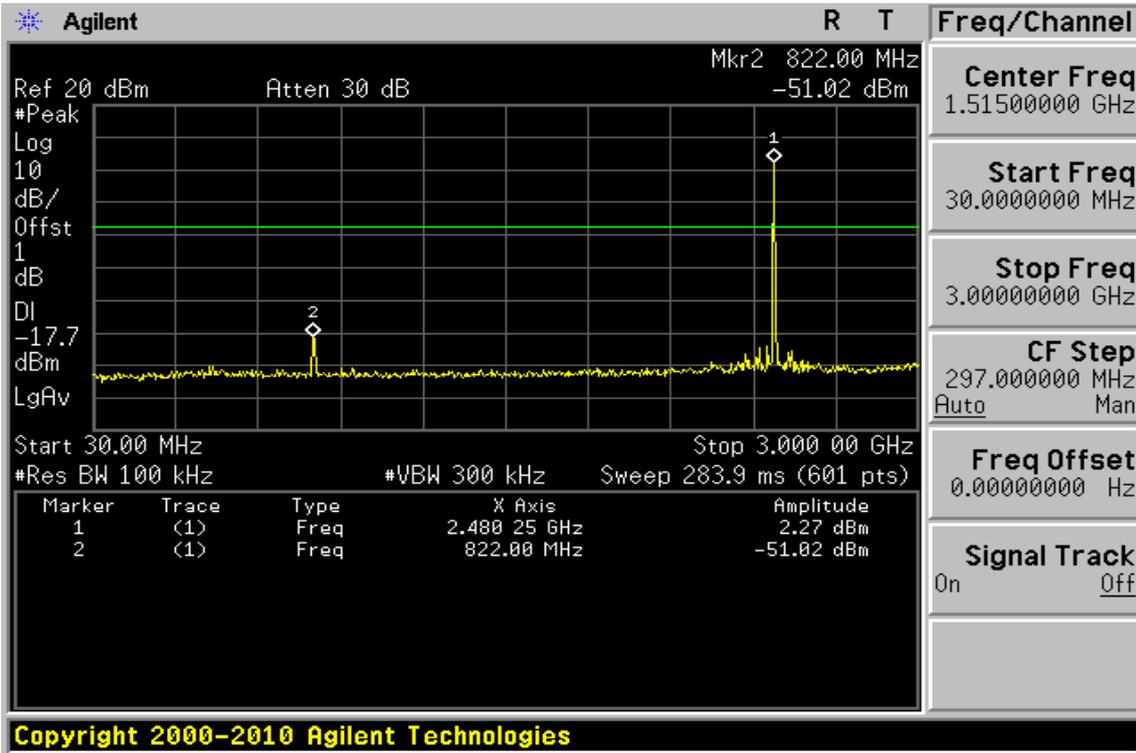
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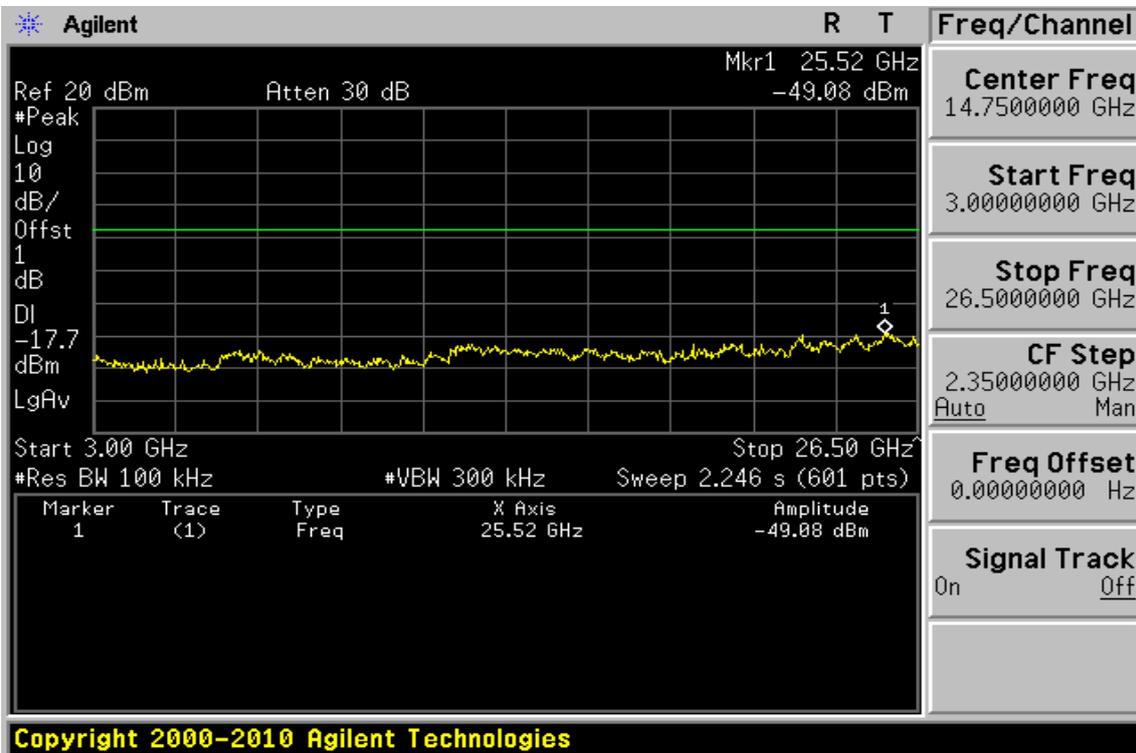
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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

Operation Band	:EDR	Test Date	:2013-04-22
Fundamental Frequency	:2402 MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:H 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. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
114.39	S	Peak	33.68	-15.22	18.46	43.50	-25.04
332.64	S	Peak	26.43	-11.89	14.54	46.00	-31.46
479.11	S	Peak	28.13	-9.82	18.31	46.00	-27.69
577.08	S	Peak	28.33	-8.05	20.28	46.00	-25.72
727.43	S	Peak	27.44	-5.32	22.12	46.00	-23.88
897.18	S	Peak	27.57	-2.87	24.70	46.00	-21.30
4804.00	H	Average	28.80	6.99	35.79	54.00	-18.21
4804.00	H	Peak	38.97	6.99	45.96	74.00	-28.04
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	:EDR	Test Date	:2013-04-22
Fundamental Frequency	:2402 MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:H 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. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
155.13	S	Peak	27.21	-12.30	14.91	43.50	-28.59
291.90	S	Peak	27.74	-12.76	14.98	46.00	-31.02
382.11	S	Peak	28.74	-11.26	17.48	46.00	-28.52
552.83	S	Peak	28.10	-8.53	19.57	46.00	-26.43
685.72	S	Peak	27.58	-5.95	21.63	46.00	-24.37
903.97	S	Peak	27.02	-2.73	24.29	46.00	-21.71
4804.00	H	Average	31.04	7.03	38.07	54.00	-15.93
4804.00	H	Peak	38.93	7.03	45.96	74.00	-28.04
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	:EDR	Test Date	:2013-04-22
Fundamental Frequency	:2441 MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:H 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. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
114.39	S	Peak	34.06	-15.22	18.84	43.50	-24.66
283.17	S	Peak	26.67	-12.97	13.70	46.00	-32.30
384.05	S	Peak	28.11	-11.23	16.88	46.00	-29.12
559.62	S	Peak	27.94	-8.39	19.55	46.00	-26.45
731.31	S	Peak	28.11	-5.27	22.84	46.00	-23.16
921.43	S	Peak	27.10	-2.39	24.71	46.00	-21.29
4882.00	H	Average	33.77	7.16	40.93	54.00	-13.07
4882.00	H	Peak	42.55	7.16	49.71	74.00	-24.29
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	:EDR	Test Date	:2013-04-22
Fundamental Frequency	:2441 MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:H 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. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
161.92	S	Peak	27.39	-12.43	14.96	43.50	-28.54
283.17	S	Peak	33.33	-12.97	20.36	46.00	-25.64
468.44	S	Peak	28.04	-9.90	18.14	46.00	-27.86
606.18	S	Peak	27.95	-7.42	20.53	46.00	-25.47
762.35	S	Peak	27.88	-4.77	23.11	46.00	-22.89
935.98	S	Peak	27.86	-2.23	25.63	46.00	-20.37
4882.00	H	Average	30.41	7.10	37.51	54.00	-16.49
4882.00	H	Peak	39.25	7.10	46.35	74.00	-27.65
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	:EDR	Test Date	:2013-04-22
Fundamental Frequency	:2480 MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:H 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. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
114.39	S	Peak	34.72	-15.22	19.50	43.50	-24.00
277.35	S	Peak	26.93	-13.13	13.80	46.00	-32.20
451.95	S	Peak	27.61	-10.01	17.60	46.00	-28.40
592.60	S	Peak	27.89	-7.72	20.17	46.00	-25.83
728.40	S	Peak	27.81	-5.31	22.50	46.00	-23.50
943.74	S	Peak	27.20	-2.15	25.05	46.00	-20.95
4960.00	H	Average	35.19	7.17	42.36	54.00	-11.64
4960.00	H	Peak	43.60	7.17	50.77	74.00	-23.23
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	:EDR	Test Date	:2013-04-22
Fundamental Frequency	:2480 MHz	Temp./Humi.	:24.3deg_C/57RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:H 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. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
147.37	S	Peak	27.29	-12.53	14.76	43.50	-28.74
286.08	S	Peak	28.02	-12.89	15.13	46.00	-30.87
373.38	S	Peak	29.54	-11.37	18.17	46.00	-27.83
580.96	S	Peak	27.36	-7.96	19.40	46.00	-26.60
691.54	S	Peak	28.39	-5.86	22.53	46.00	-23.47
859.35	S	Peak	27.26	-3.54	23.72	46.00	-22.28
4960.00	H	Average	29.23	7.02	36.25	54.00	-17.75
4960.00	H	Peak	39.11	7.02	46.13	74.00	-27.87
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 $\frac{2}{3} * 20\text{dB}$ 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 $\frac{2}{3}$ times 20dB bandwidth	PASS

Note: Refer to next page for plots.

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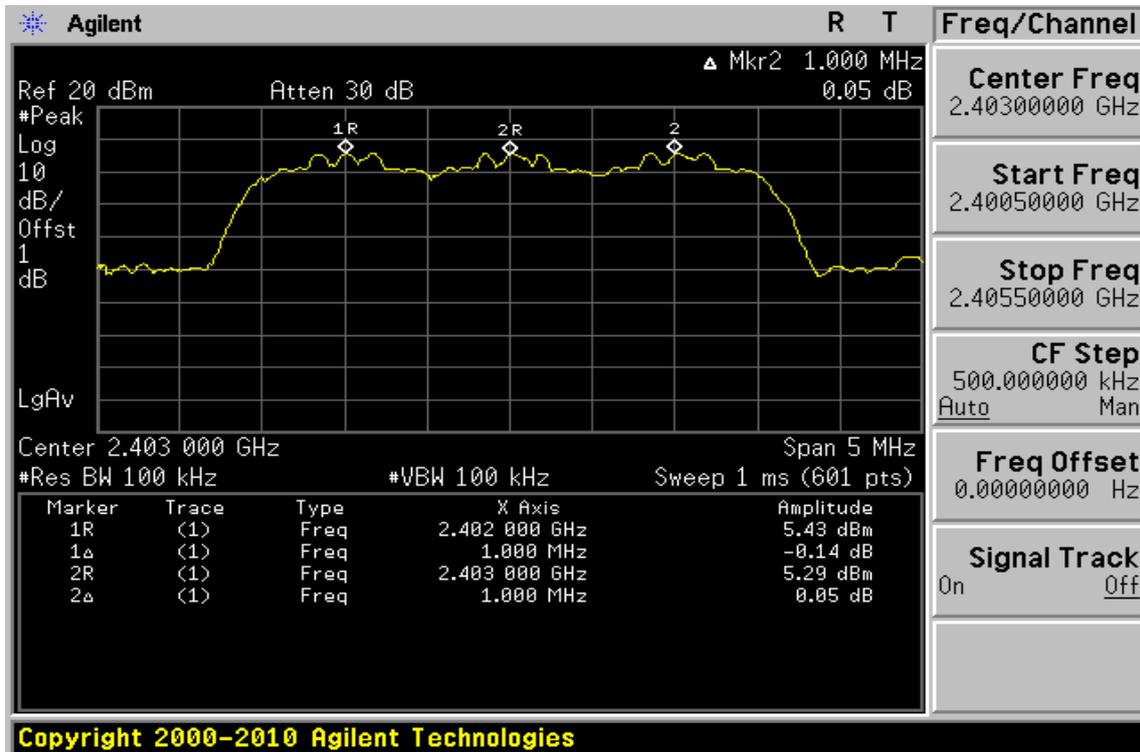
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Frequency Separation Test Data



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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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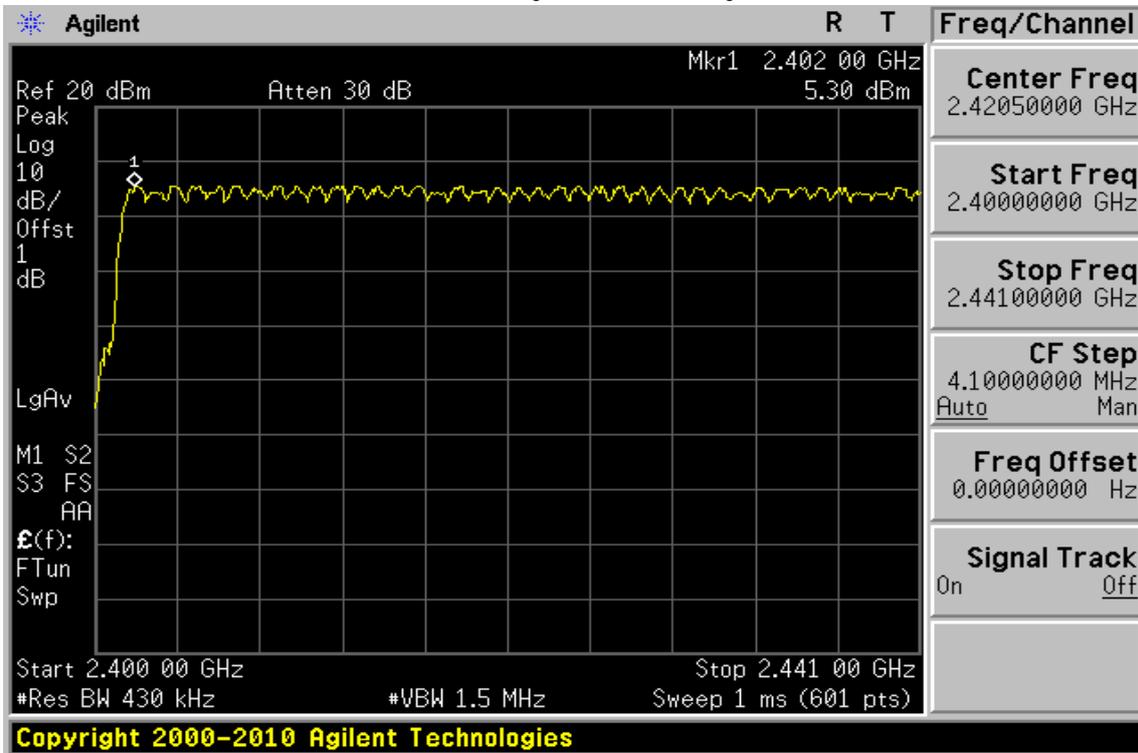
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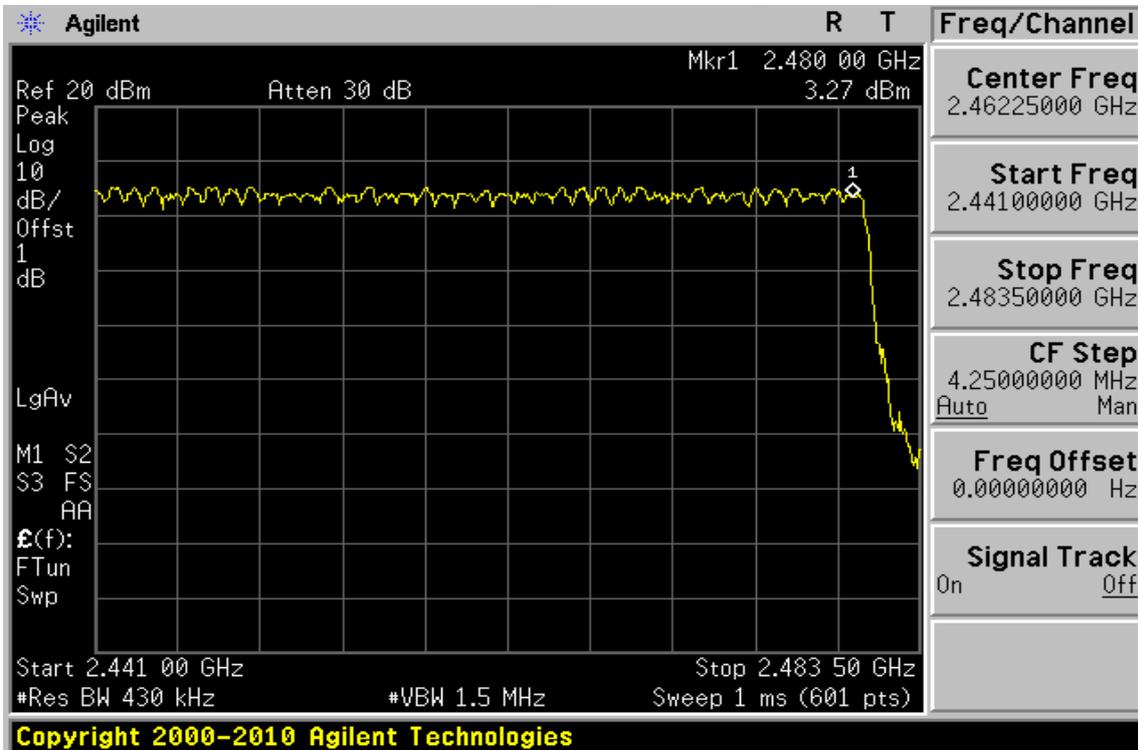
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Channel Number

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 = 2~7.52ms.
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 = 0.410 (ms) * (1600/(2*79)) * 31.6 = 131.20(ms)

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

DH5 time slot = 2.908 (ms) * (1600/(6*79)) * 31.6 = 310.19(ms)

CH Mid: DH1 time slot = 0.407 (ms) * (1600/(2*79)) * 31.6 = 130.24(ms)

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

DH5 time slot = 2.908 (ms) * (1600/(6*79)) * 31.6 = 310.19(ms)

CH High: DH1 time slot = 0.407 (ms) * (1600/(2*79)) * 31.6 = 130.24(ms)

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

DH5 time slot = 2.908 (ms) * (1600/(6*79)) * 31.6 = 310.19(ms)

Note: Refer to next page for plots.

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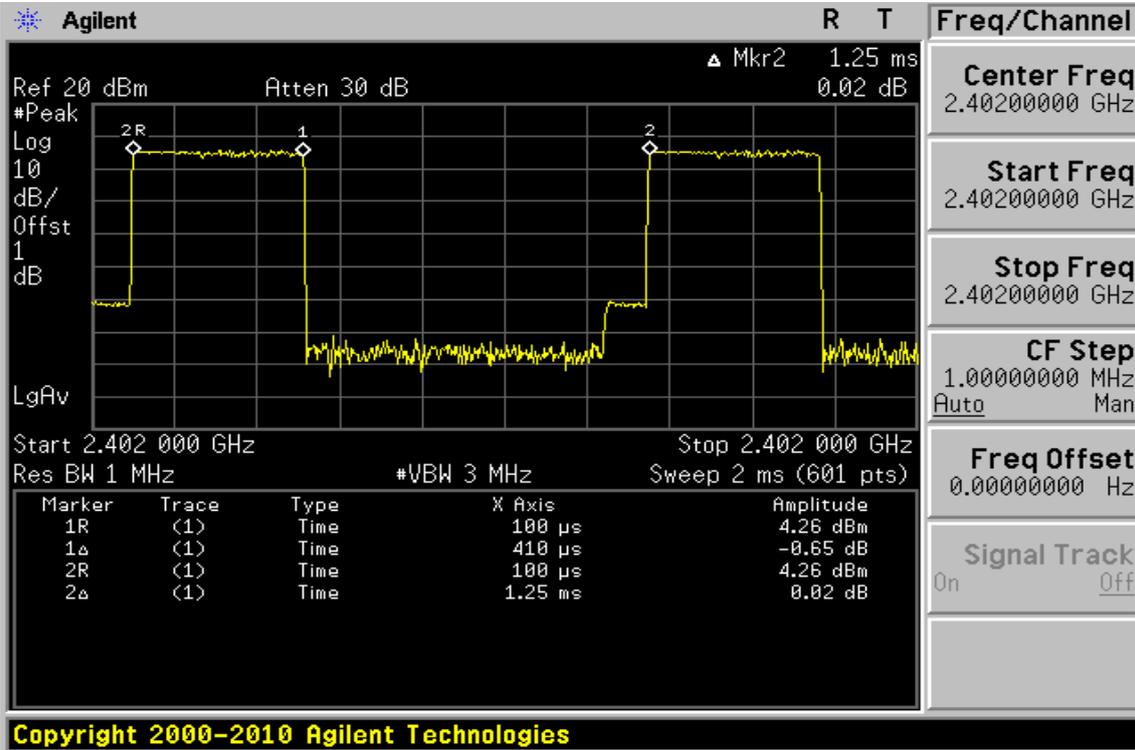
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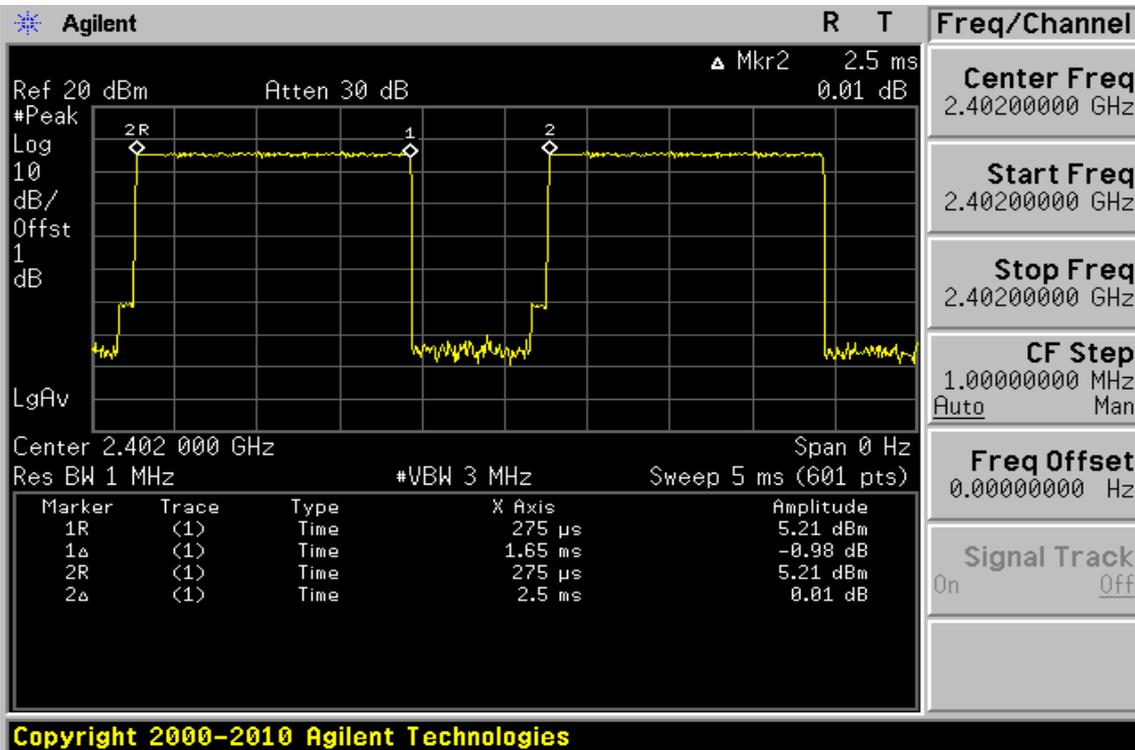
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CH-Low

DH1



DH3



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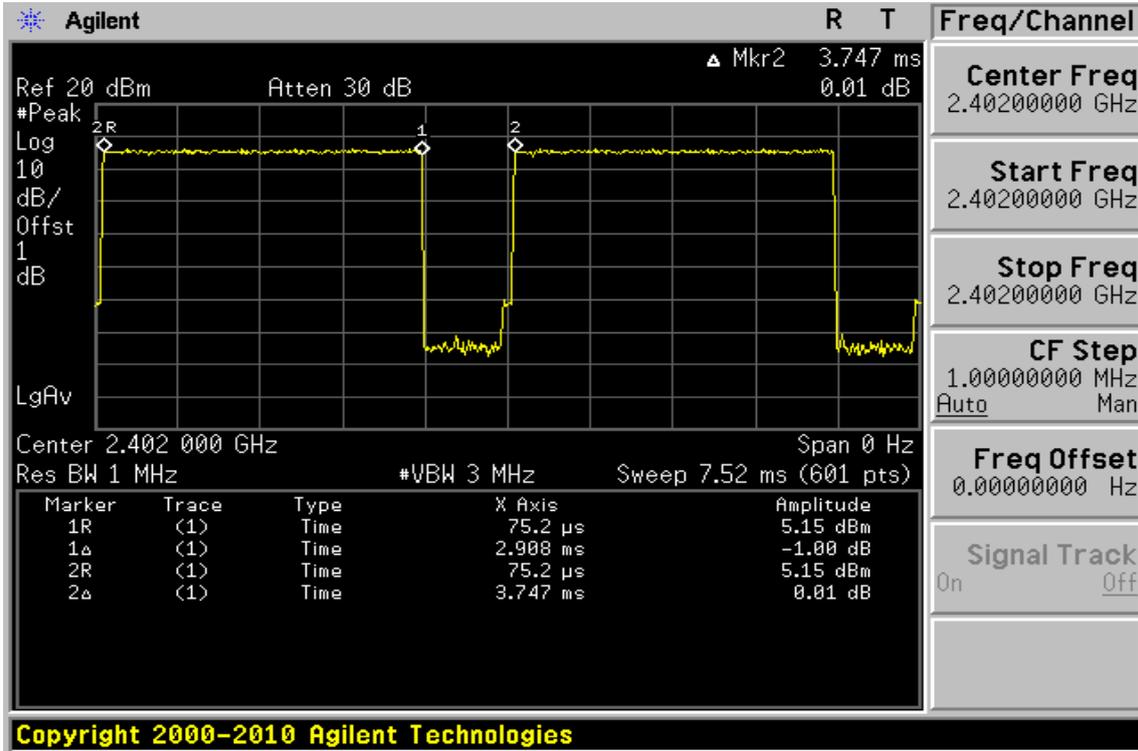
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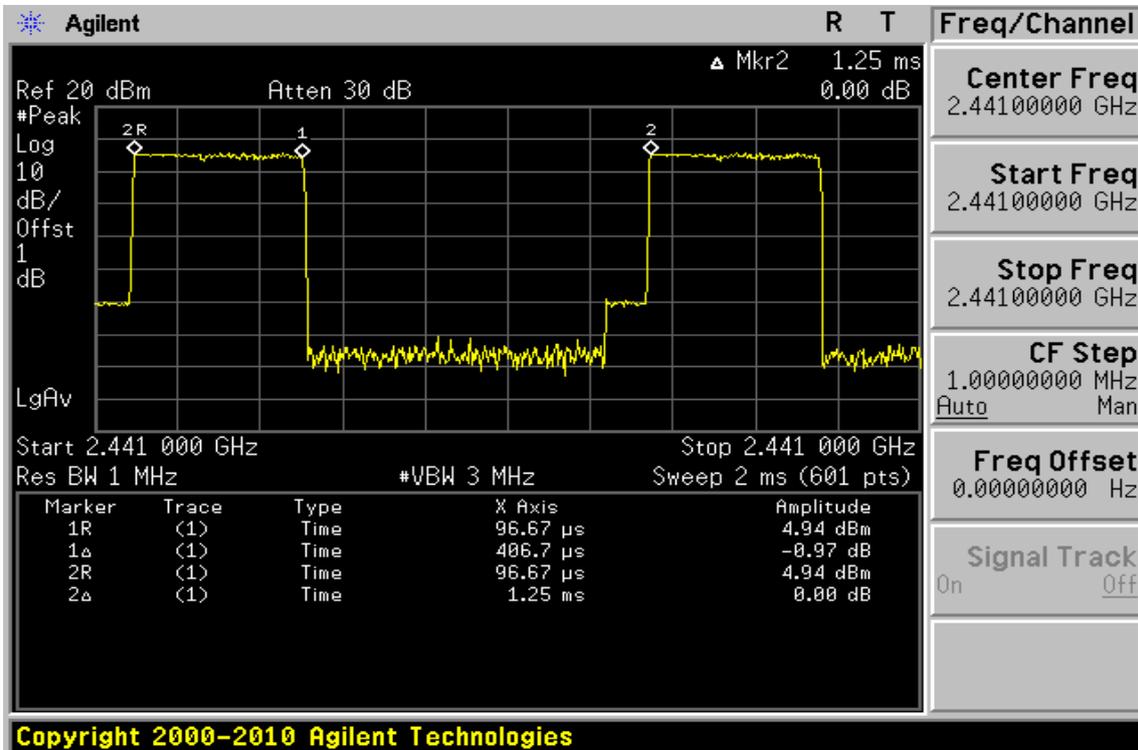
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DH5



CH-Mid

DH1



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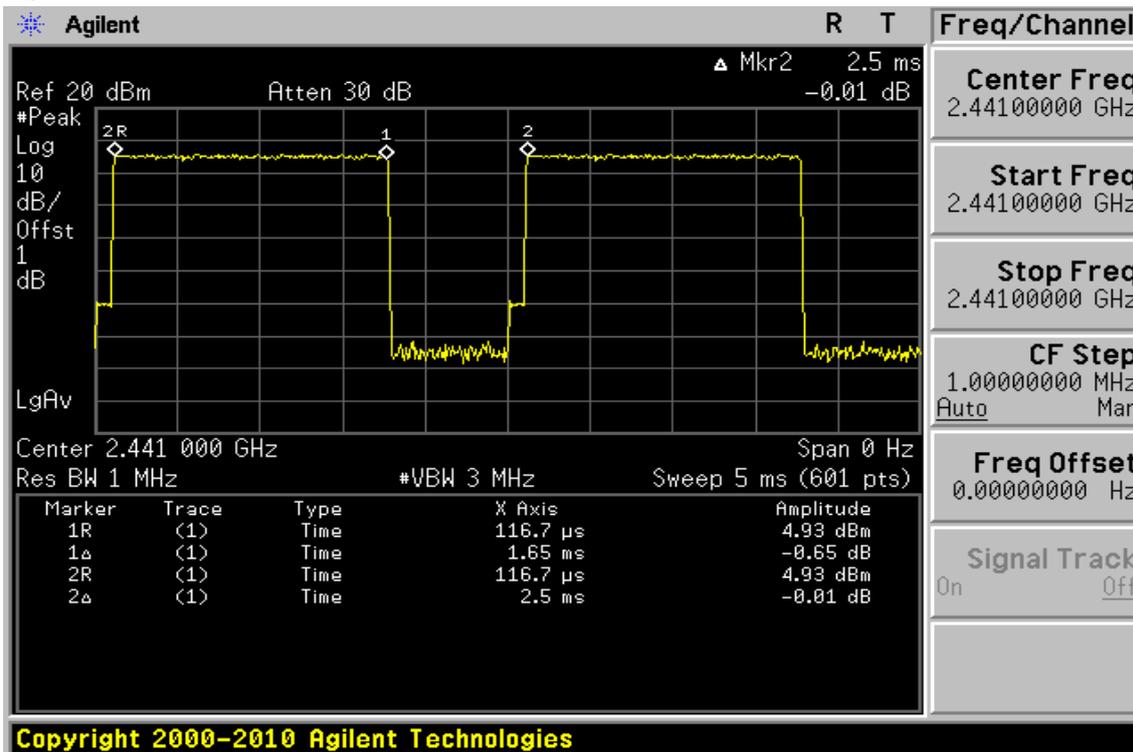
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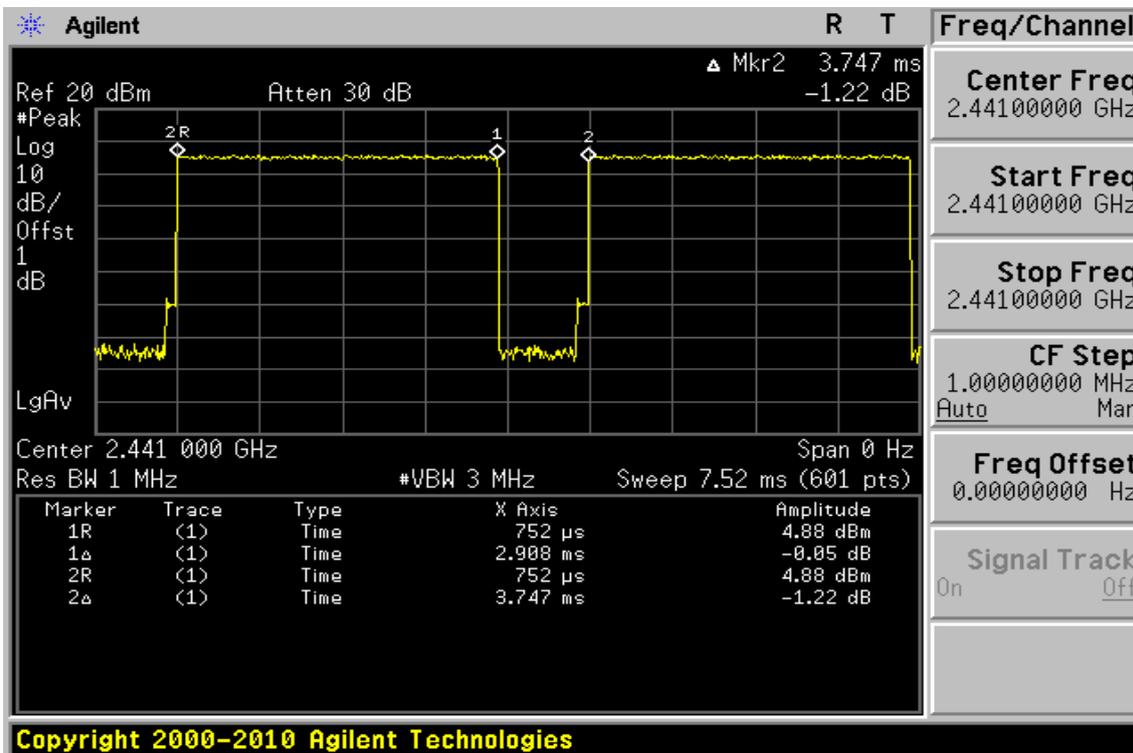
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DH3



DH5



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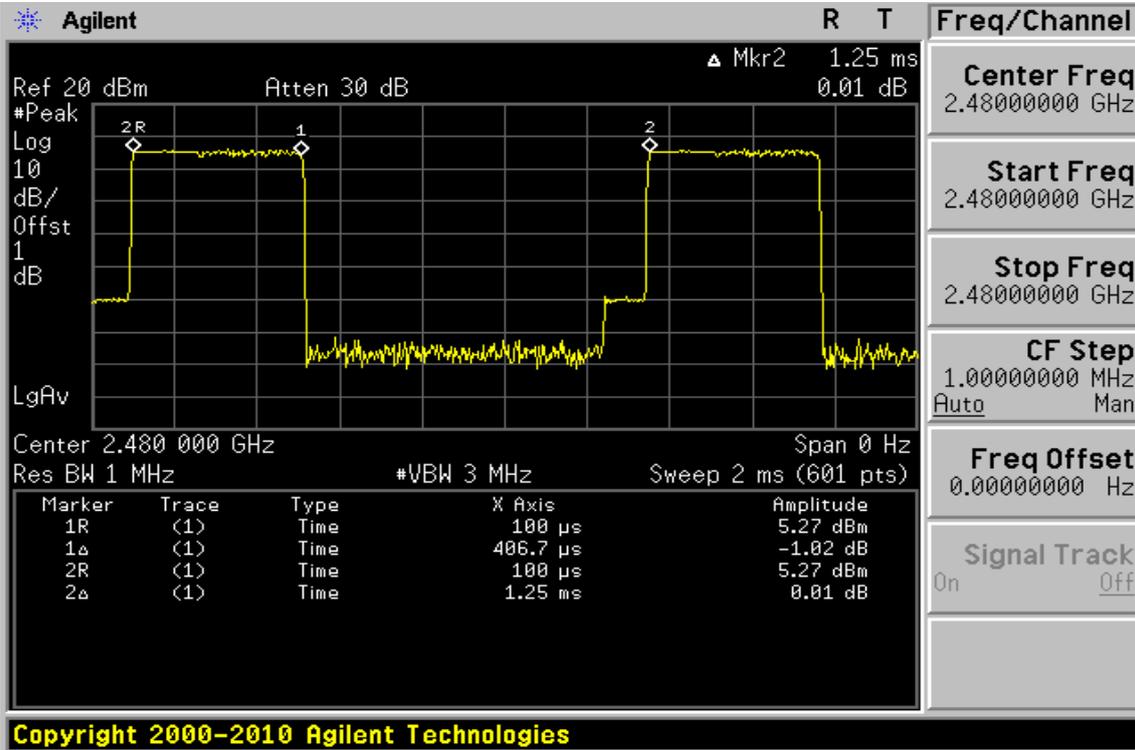
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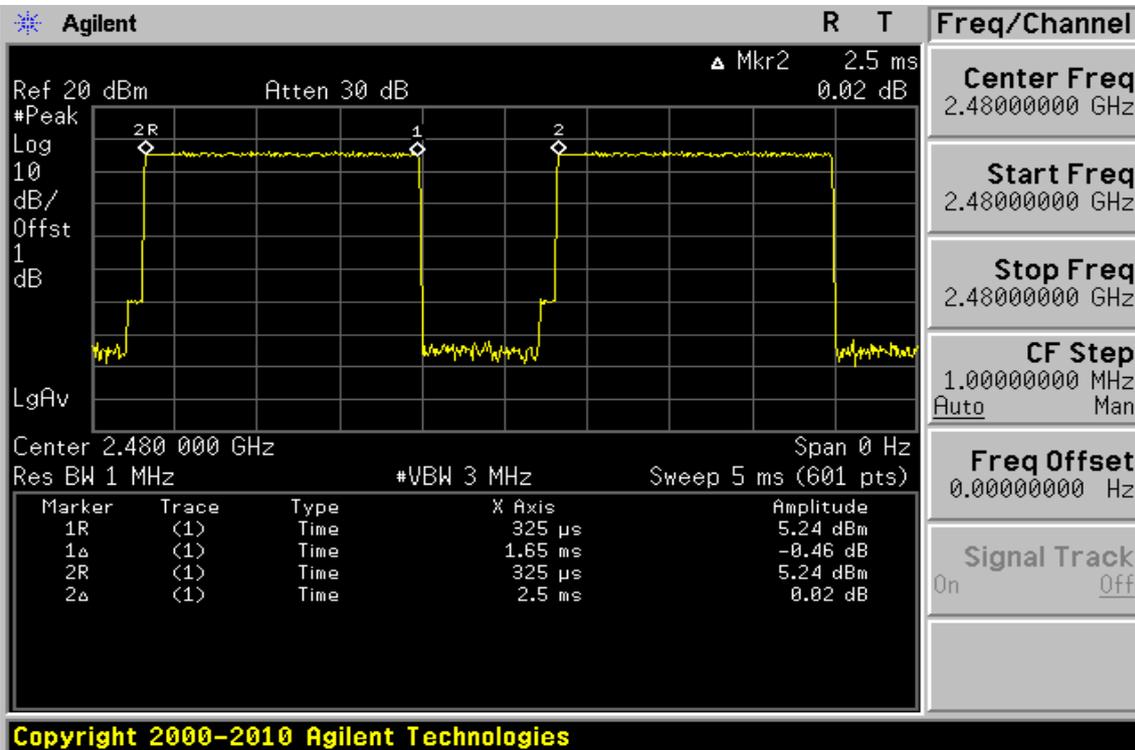
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CH-High DH1



DH3



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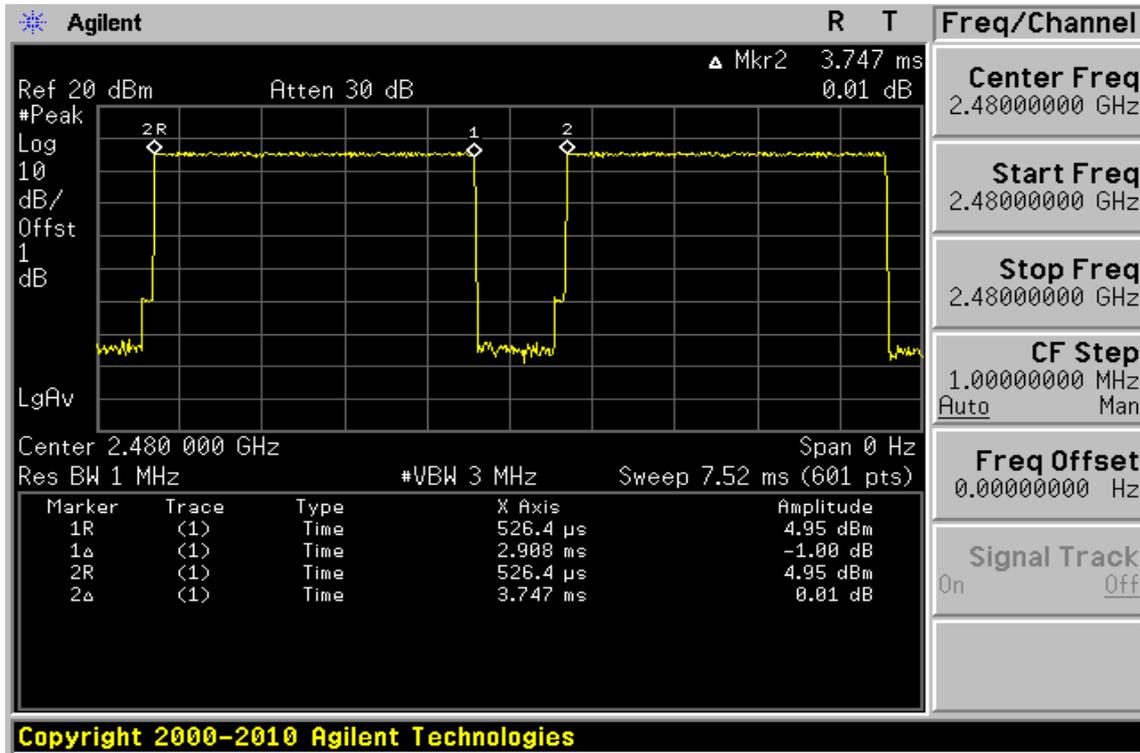
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14. ANTENNA REQUIREMENT

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.

14.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is 0.9dBi, 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 (4.22mW) lower than the threshold given and derived as formula given above, where

$$=4.22 \text{ (mW)}/5 \text{ (mm)} \cdot \sqrt{2.402 \text{ (GHz)}} = 1.31 < 3.0$$

Frequency	Power (avg in dBm)	Power (avg mw)	Distance (mm)	Threshold (<50mm)
2402	6.25	4.216965034	5	1.307123122

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402	6.25	0.00422	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.

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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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.

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