

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT**INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C REQUIREMENT
AND INDUSTRY CANADA RSS-210**

OF

Product Name: Smart Display

Brand Name: ViewSonic

Model No.: VS15197

Model Difference: N/A

FCC ID: GSS-VS15197

IC: 4280A-VS15197

Report No.: EF/2013/40033

Issue Date: May 28, 2013

FCC Rule Part: §15.247, Cat: DSS

IC Rule Part: RSS-210 issue 8:2010, Annex 8

Prepared for: ViewSonic Corporation
381 Brea Canyon Road, Walnut, CA 91789, USA

Prepared by: SGS Taiwan Ltd.
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CERTIFICATION OF COMPLIANCE

Applicant: ViewSonic Corporation
381 Brea Canyon Road., Walnut, CA 91789, USA
Product Name: Smart Display
Brand Name: ViewSonic
Model No.: VS15197
Model Difference: N/A
FCC ID: GSS-VS15197
IC: 4280A-VS15197
File Number: EF/2013/40033
Date of test: Apr. 23, 2013 ~ May 27, 2013
Date of EUT Received: Apr. 23, 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 RSS-Gen. issue 3:2010, 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 and IC RSS-210 issue 8: 2010 Annex 8.

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

Test By:	<u>Nick Lin</u>	Date:	<u>May 28, 2013</u>
	<i>Nick Lin / Engineer</i>		
Prepared By:	<u>Judy Hsu</u>	Date:	<u>May 28, 2013</u>
	<i>Judy Hsu / Clerk</i>		
Approved By:	<u>Jim Chang</u>	Date:	<u>May 28, 2013</u>
	<i>Jim Chang / Supervisor</i>		

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Version

Version No.	Date	Description
00	May 28, 2013	Initial creation of document

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1. GENERAL INFORMATION

1.1. Product Description

General:

Product Name:	Smart Display	
Brand Name:	ViewSonic	
Model No.:	VS15197	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Power Supply:	100-240V by AC/DC power adapter	
	Adapter:	1. Model: ADP-65VH D, Supplier: Delta 2. Model: DA-65C19, Supplier: Asian Power Devices Inc.

Bluetooth:

Bluetooth Version:	V2.1 + EDR (GFSK + π /4DQPSK + 8DPSK)
Channel number:	79 channels
Modulation type:	GFSK+ π /4DQPSK+8DPSK
Transmit Power:	2.76dBm (Peak)
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	$\leq 0.4s$
Antenna Designation	PIFA Antenna, Gain: -1.37 dBi
Type of Emission:	1M21G7D

The EUT is compliance with Bluetooth 2.1 Standard.

This report applies for Bluetooth.

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

This submittal(s) (test report) is intended for **FCC ID: GSS-VS15197** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules and **IC: 4280A-VS15197** filing to comply with Industry Canada RSS-210 issue 8: 2010 Annex 8. The composite system (digital device) is compliance with FCC part 15; Subpart B is authorized under the certification procedure.

1.3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4:2009 and RSS-Gen: 2010. Radiated testing was performed at an antenna to EUT distance 3 meters. Tested in accordance with FCC Public Notice DA 00-705 – Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

1.4. 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. 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 and 236194, Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. 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.

1.5. Special Accessories

Not available for this EUT intended for grant.

1.6. 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

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

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 7.3.1 of ANSI C63.4:2009 and RSS-Gen Issue3: 2010. 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 of ANSI C63.4:2009 and DA 00-705.

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2.4. Configuration of Tested System

Fig. 2-1 Radiated Emission Configuration

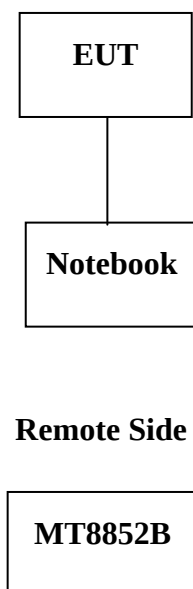


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth test set	Anritsu	MT8852B	6K00006107	Shielded	Un-shielded
2.	Notebook	Lenovo	L412	LR-957X7	Shielded	Un-shielded

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3. SUMMARY OF TEST RESULTS

FCC/IC Rules	Description Of Test	Result
§15.207(a) RSS-Gen §7.2.4	AC Power Line Conducted Emission	Compliant
§15.247(b)(1) RSS-210 issue 8,§A8.4(2)	Peak Output Power	Compliant
§15.247(a)(1) RSS210 issue ,§A8.1(b) RSS-Gen §4.6.3 RSS-Gen §4.6.1	20dB Bandwidth & 99% Power Bandwidth	Compliant
§15.247(d) RSS-210 issue 8,§A8.5	100 kHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(d) §15.209(a) (f) RSS-Gen §7.2.5 RSS-210 issue 8,§A8.5	Spurious Emission	Compliant
§15.247(a)(1) RSS-210 issue 8,§A8.1(b)	Frequency Separation	Compliant
§15.247(a)(1)(iii) RSS-210 issue 8,§A8.1(d)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii) RSS-210 issue 8,§A8.1(d)	Time of Occupancy	Compliant
§15.203, RSS- Gen issue §7.1.2	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 DH5 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 E2 position was reported.

In comparison with BR and EDR mode, emission carried out by EDR is chosen as the most representative measurement to perform measurement of every test item pursuant to Part 15 C and RSS-210.

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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 and RSS-Gen §7.2.4, frequency range within 150 KHz 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. 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	02/08/2013	02/07/2014
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

6.3. 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 AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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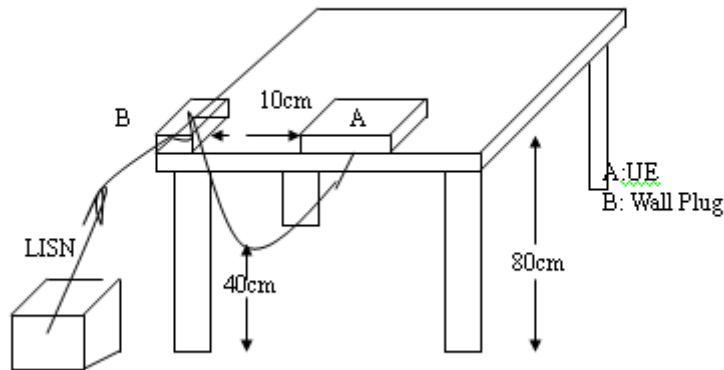
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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 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.

6.6 Measurement Result:

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

Note2: The * reveals the worst-case results that closet to the limit

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation Mode			Test Date:	May 21, 2013
Temperature:	26 °C	Humidity:	60 %	Test By:	Nick

Site ConductionRoom

Limit: FCC Class B Conduction(QP)

EUT: SmartDisplay

M/N: VS15197

Note: ADAPTERAdp_65VHD

Phase: L1

Power: AC 120V/60Hz

Distance:

Mode: OperationMode

Temperature: 26 °C

Humidity: 60%

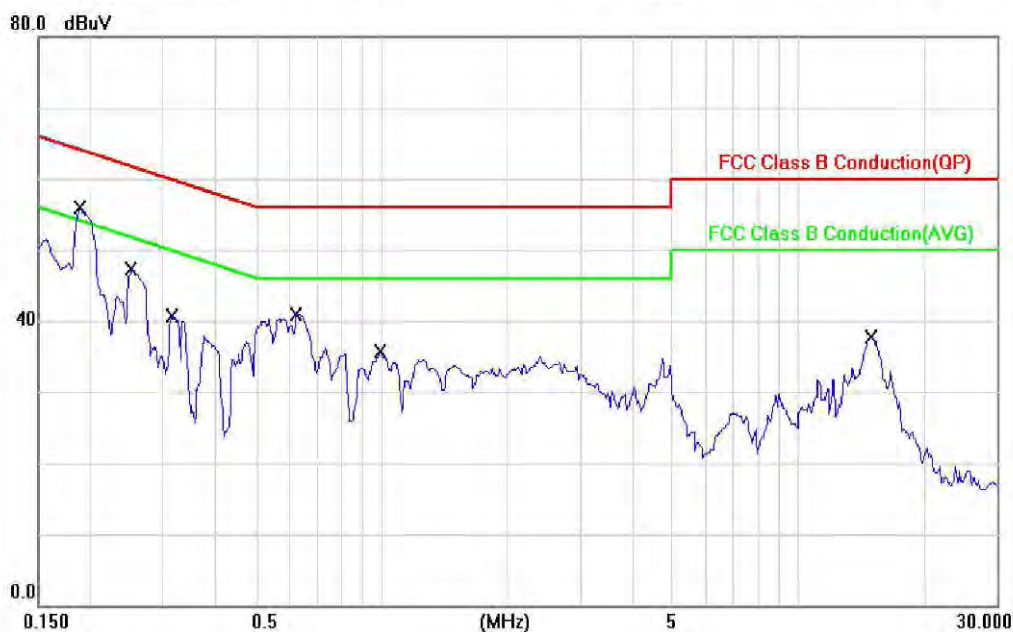
ConductedEmission

File :EF-2013-40032(UI1A)

Data :#1

Date: 2013/5/21

Time: 下午 05:36:16



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1891	42.77	0.08	42.85	64.08	-21.23	QP	
2		0.1891	24.95	0.08	25.03	54.08	-29.05	AVG	
3	*	0.2516	47.23	0.09	47.32	61.70	-14.38	QP	
4		0.3141	40.53	0.08	40.61	59.86	-19.25	QP	
5		0.6250	40.91	0.08	40.99	56.00	-15.01	QP	
6		0.9922	35.55	0.08	35.63	56.00	-20.37	QP	
7		14.9336	37.58	0.19	37.77	60.00	-22.23	QP	

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Site: ConductionRoom
Limit: FCC Class B Conduction(QP)
EUT: SmartDisplay
MN: VS15197
Note: ADAPTER Adp_65VHD

Phase: N
Power: AC 120V/60Hz
Distance:
Mode: OperationMode

Temperature: 26 °C
Humidity: 60%

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1970	51.14	0.14	51.28	63.74	-12.46	QP	
2		0.1970	33.58	0.14	33.72	53.74	-20.02	AVG	
3		0.2633	38.46	0.14	38.60	61.33	-22.73	QP	
4		0.2633	33.20	0.14	33.34	51.33	-17.99	AVG	
5		0.3375	42.22	0.14	42.36	59.26	-16.90	QP	
6		0.5352	39.46	0.12	39.58	56.00	-16.42	QP	
7		0.5352	32.58	0.12	32.70	46.00	-13.30	AVG	
8		1.8594	41.49	0.17	41.66	56.00	-14.34	QP	
9		1.8594	30.67	0.17	30.84	46.00	-15.16	AVG	
10		14.7383	37.72	0.25	37.97	60.00	-22.03	QP	

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Bluetooth Mode			Test Date:	May 21, 2013
Temperature:	26 °C	Humidity:	60 %	Test By:	Nick

Site	ConductionRoom	Phase:	L1	Temperature:	26 °C
Limit:	FCC Class B Conduction(QP)	Power:	AC 120V/60Hz	Humidity:	60%
EUT:	SmartDisplay	Distance:			
M/N:	VS15197	Mode:	OperationMode		
Note:	ADAPTER DA-65C19				

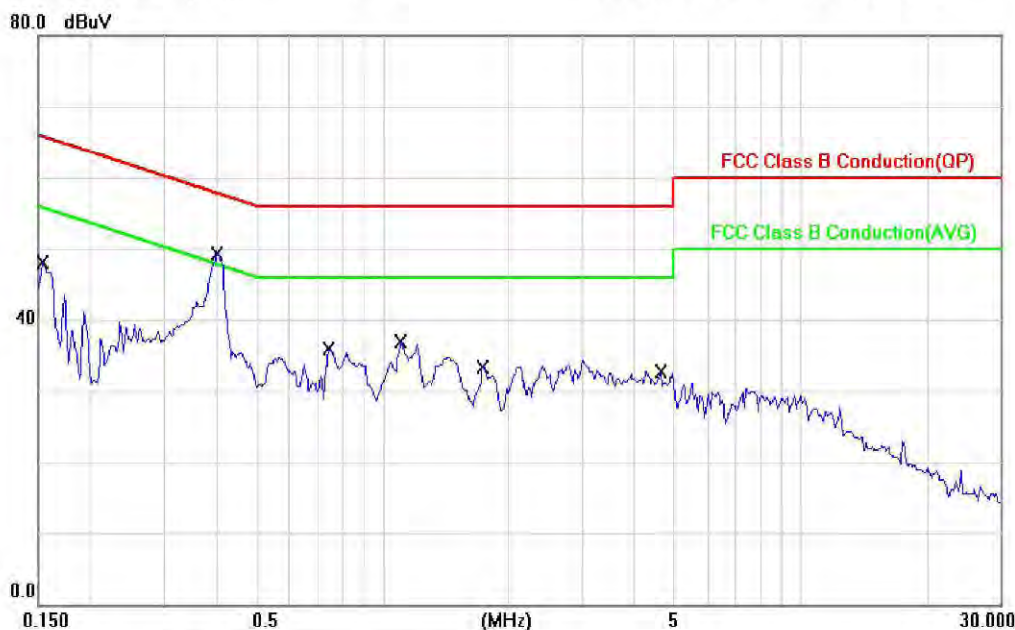
Conducted Emission

File :EF-2013-40032(UI1A)

Data :#5

Date: 2013/5/21

Time : 下午 05:01:20



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1540	48.02	0.09	48.11	65.78	-17.67	QP	
2	*	0.4040	44.23	0.08	44.31	57.77	-13.46	QP	
3		0.4040	25.51	0.08	25.59	47.77	-22.18	AVG	
4		0.7461	35.74	0.07	35.81	56.00	-20.19	QP	
5		1.1094	36.84	0.08	36.92	56.00	-19.08	QP	
6		1.7344	33.25	0.10	33.35	56.00	-22.65	QP	
7		4.6288	32.53	0.13	32.66	56.00	-23.34	QP	

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Site: ConductionRoom
Limit: FCC Class B Conduction(QP)
EUT: SmartDisplay
M/N: VS15197
Note: ADAPTER DA-65C19

Phase: N
Power: AC 120V/60Hz
Distance:
Mode: OperationMode

Temperature: 26 °C
Humidity: 60%

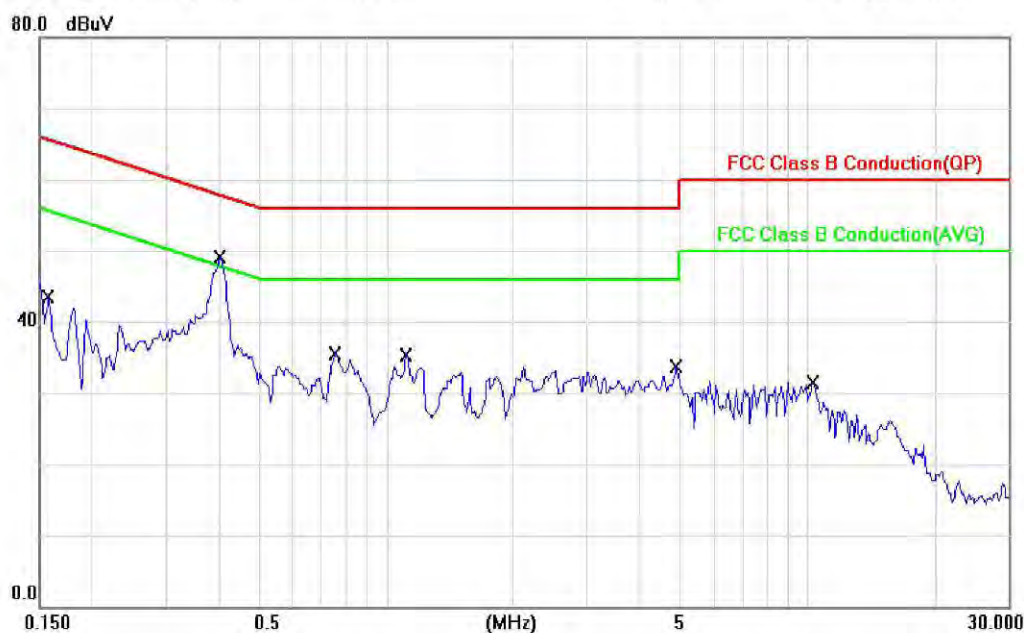
ConductedEmission

File :EF-2013-40032(UI1A)

Data #4

Date: 2013/5/21

Time: 下午 05:55:48



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1578	43.29	0.15	43.44	65.58	-22.14	QP	
2	*	0.4040	44.07	0.13	44.20	57.77	-13.57	QP	
3		0.4040	25.65	0.13	25.78	47.77	-21.99	AVG	
4		0.7578	35.38	0.14	35.52	56.00	-20.48	QP	
5		1.1133	35.23	0.16	35.39	56.00	-20.61	QP	
6		4.8906	33.48	0.20	33.68	56.00	-22.32	QP	
7		10.3086	31.26	0.23	31.49	60.00	-28.51	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.

According to RSS-210 issue 8,§A8.4(2), For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

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

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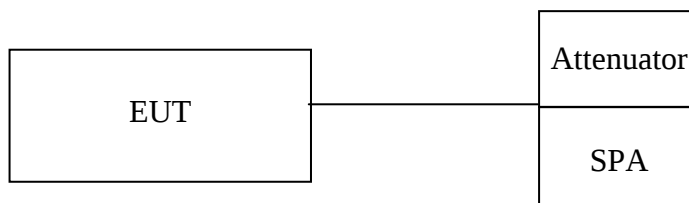
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7.3. Test Set-up:



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	0.97	0.97	0.00125	1
2441.00	2.03	2.03	0.00160	1
2480.00	2.38	2.38	0.00173	1

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

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	0.87	0.87	0.00122	0.125
2441.00	1.94	1.94	0.00156	0.125
2480.00	2.18	2.18	0.00165	0.125

EDR mode (8DPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	1.33	1.33	0.00136	0.125
2441.00	2.49	2.49	0.00177	0.125
2480.00	2.76	2.76	0.00189	0.125

*Note: offset 5.11dB

Note: Refer to next page for plots.

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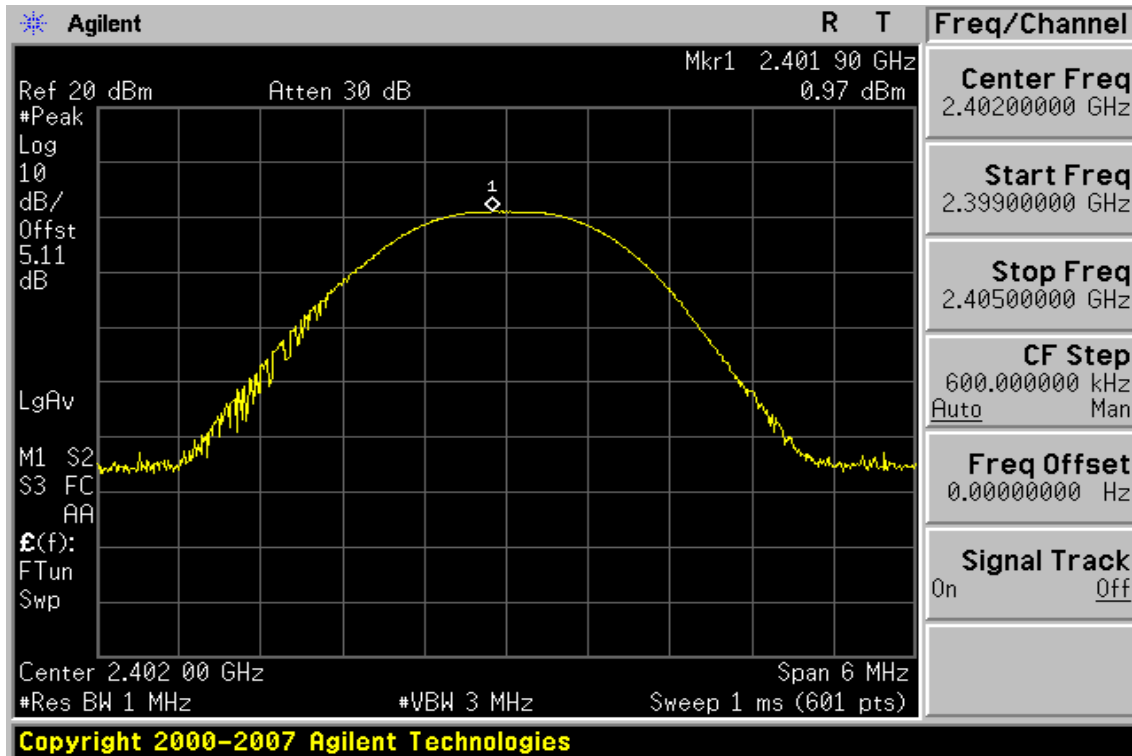
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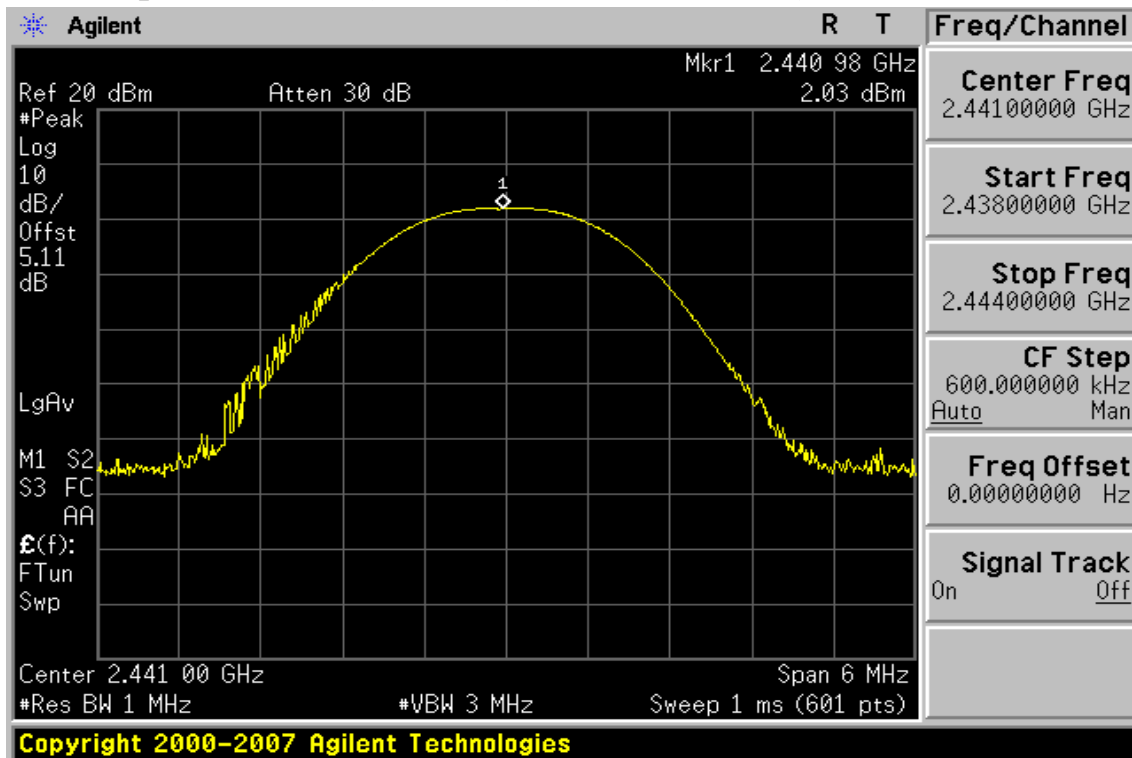
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Peak Power Output Data Plot (CH Low) (BR mode GFSK)



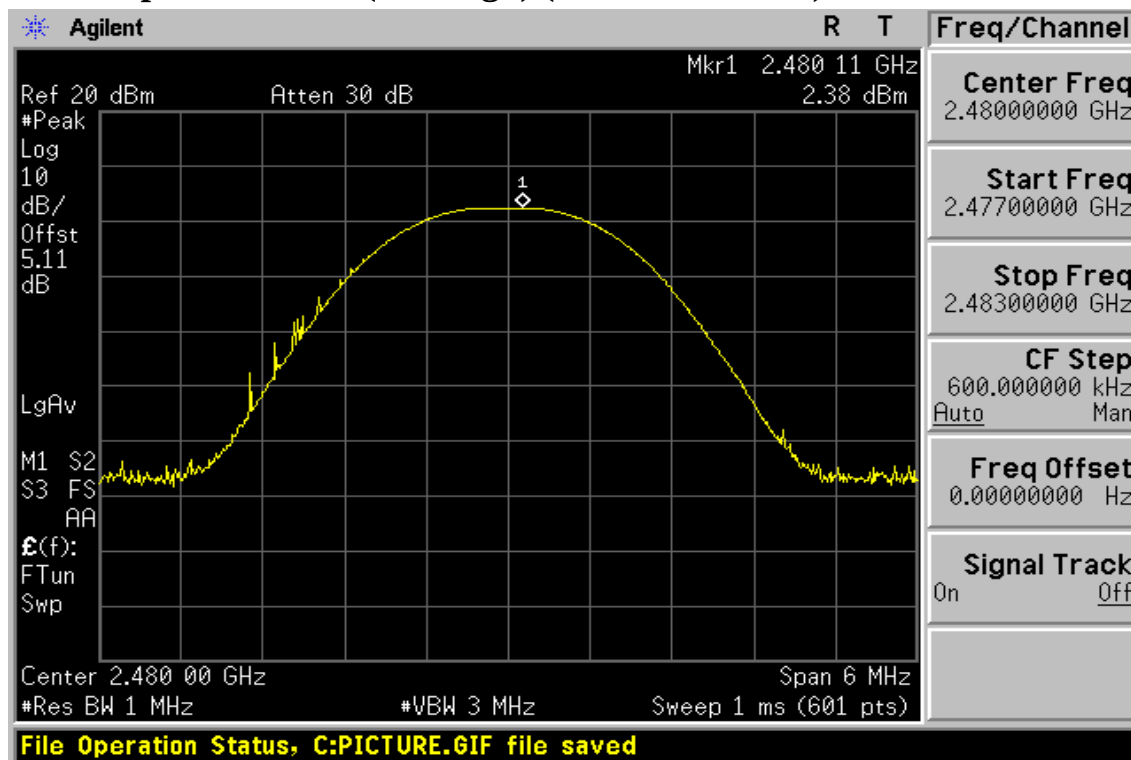
Peak Power Output Data Plot (CH Mid) (BR mode GFSK)



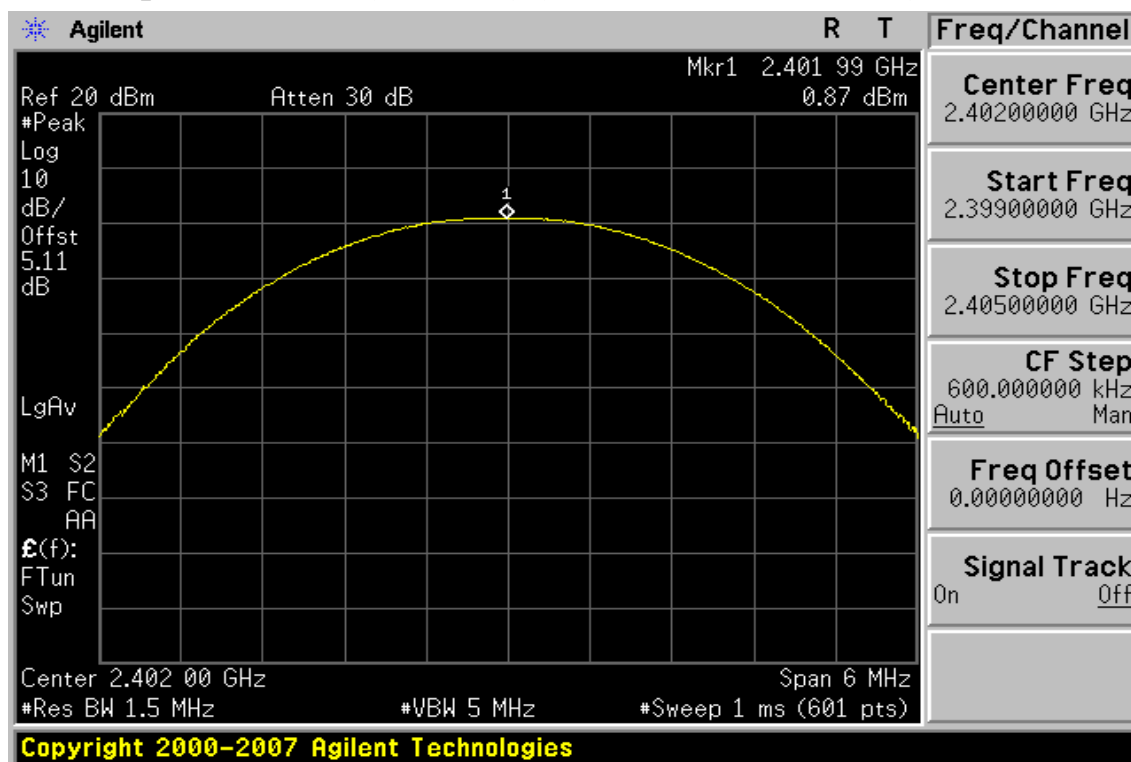
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Peak Power Output Data Plot (CH High) (BR mode GFSK)



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



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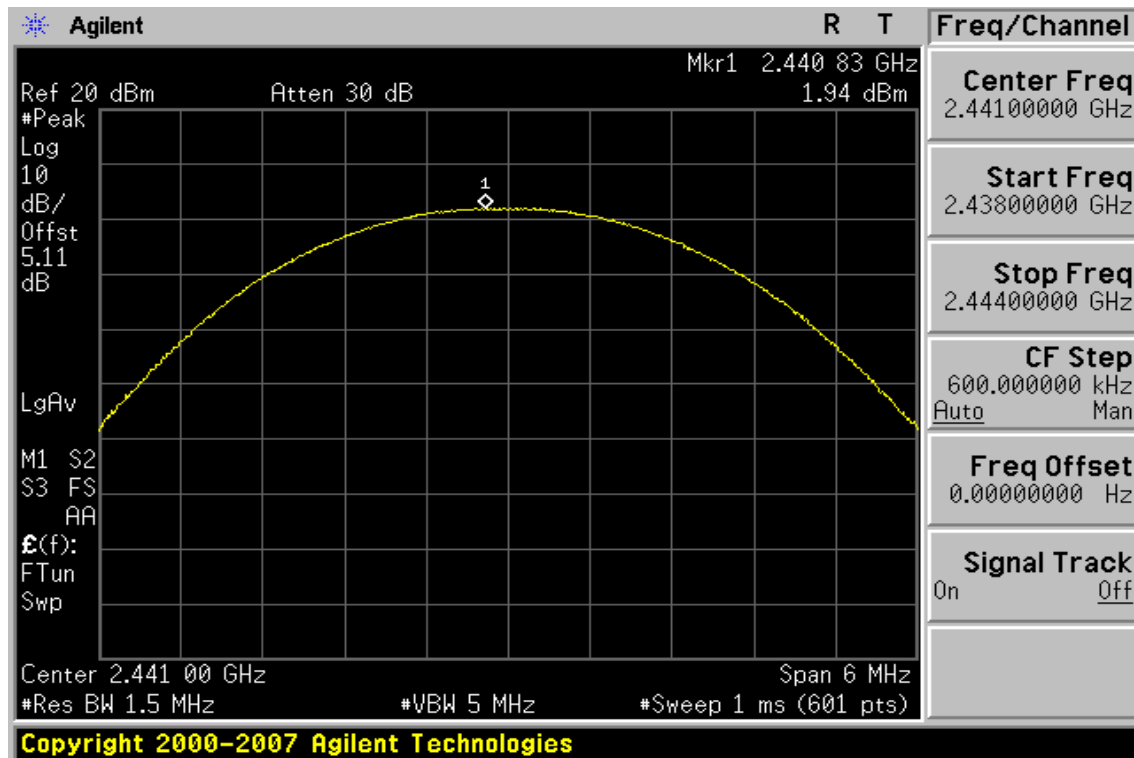
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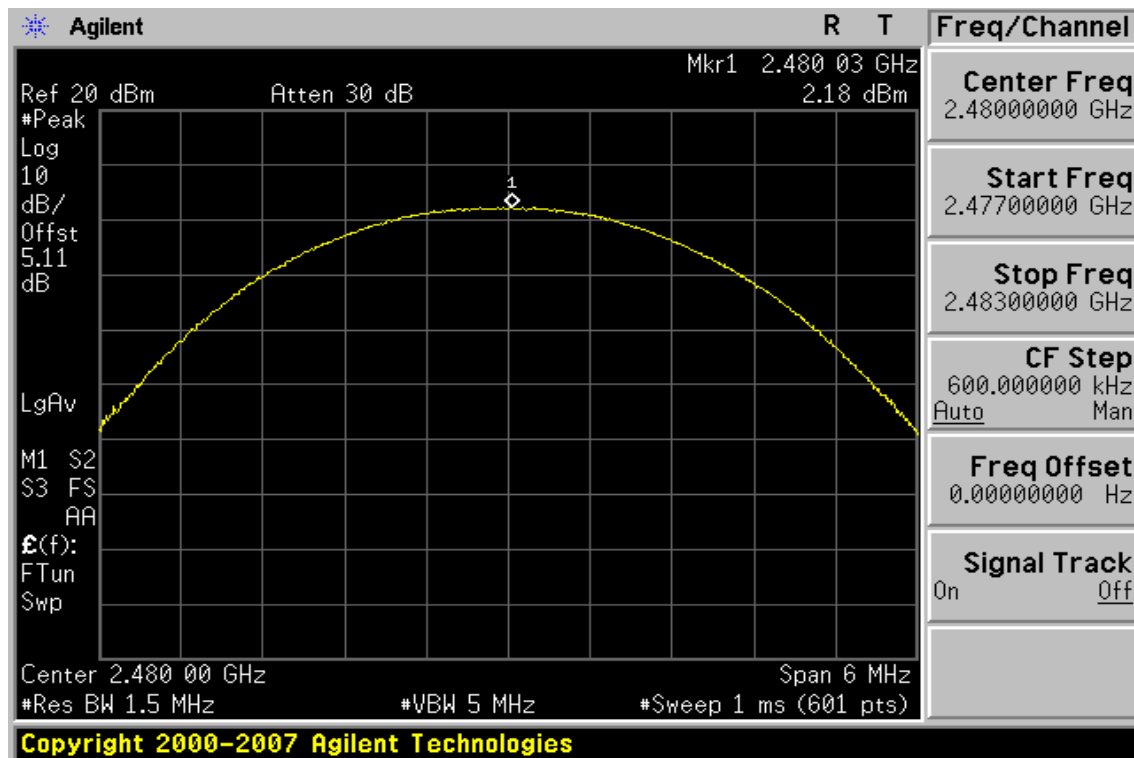
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Peak Power Output Data Plot (CH Mid) (EDR mode $\pi/4$ DQPSK)



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

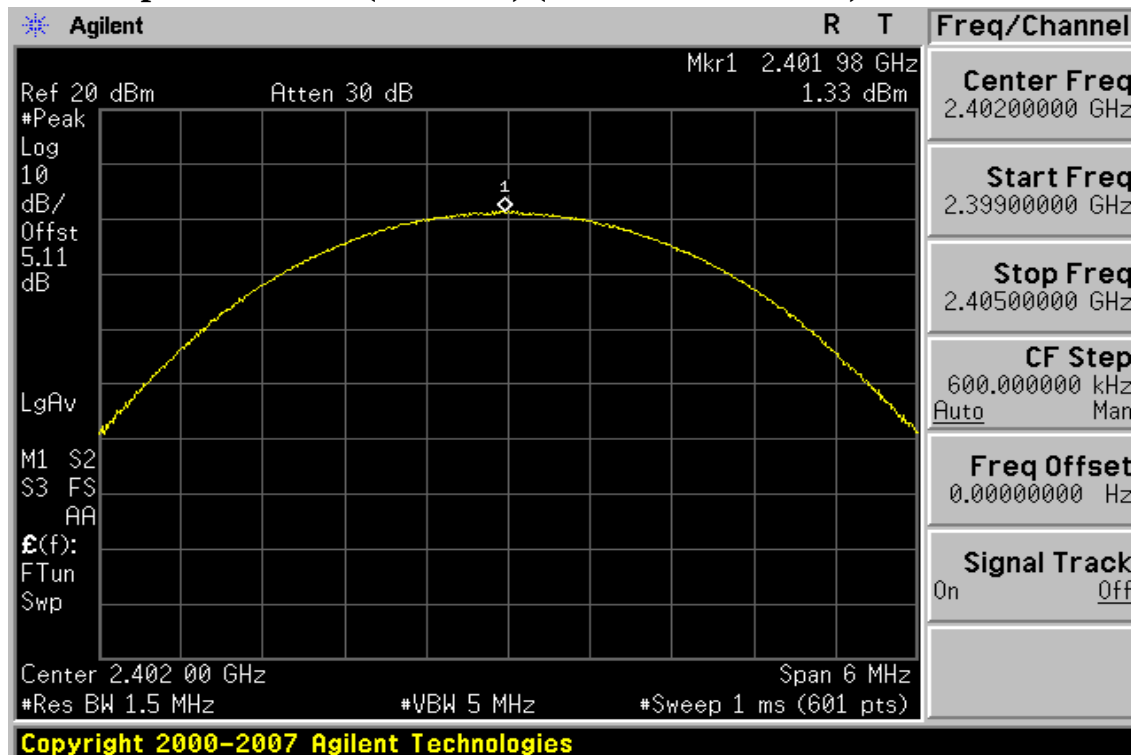


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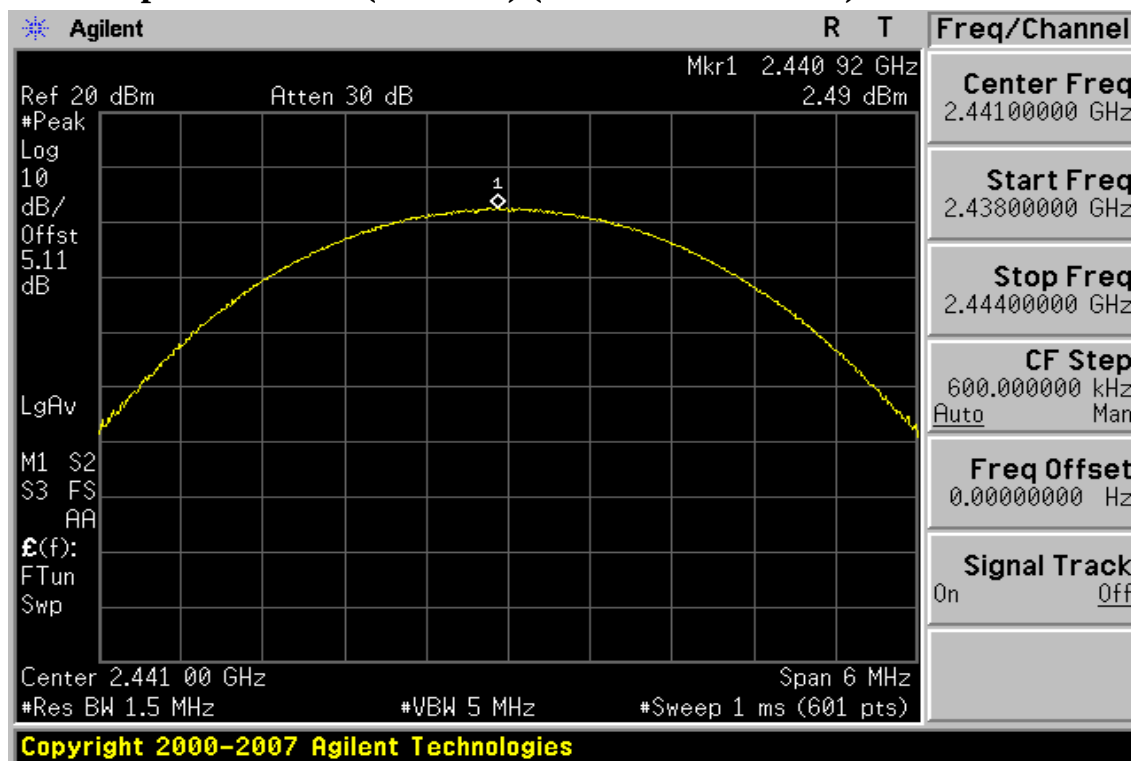
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Peak Power Output Data Plot (CH Low) (EDR mode 8DPSK)



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



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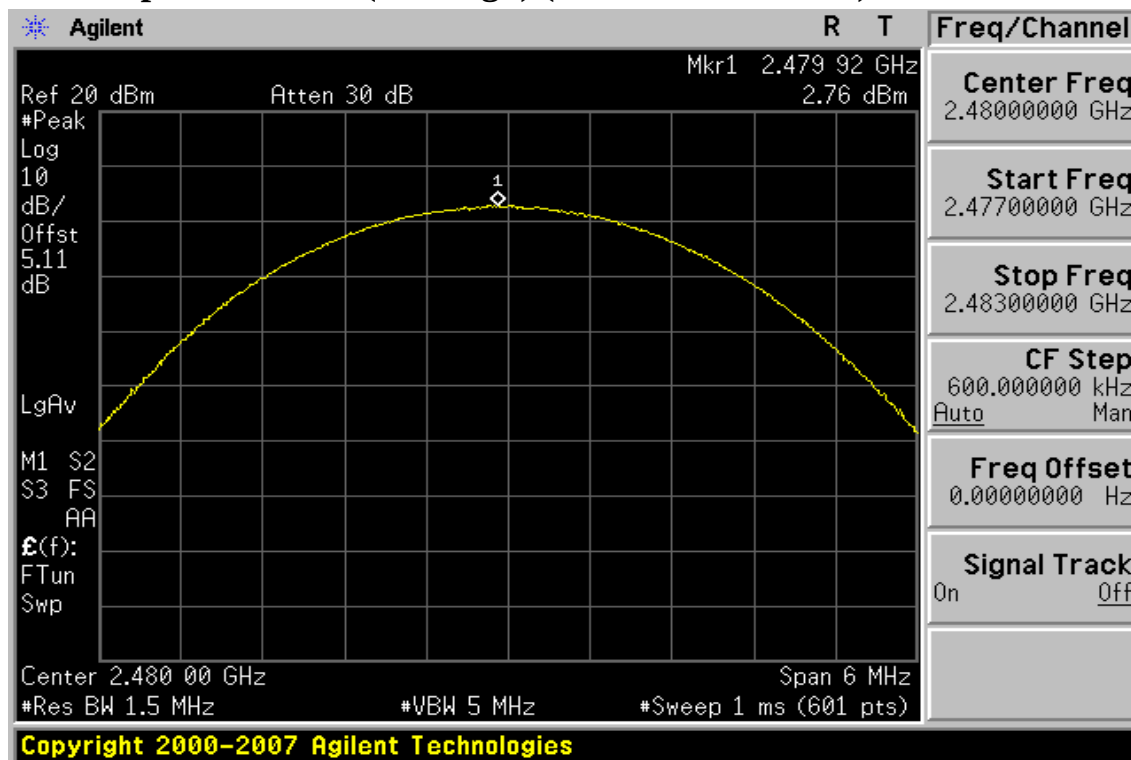
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8. 100 KHz BANDWIDTH OF BAND EDGES MEASUREMENT

8.1 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).

According to RSS-Gen §7.2.5 and RSS-210 issue 8, §A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 5 and 6 is not required. In addition, radiated emissions which fall in the restricted bands of Table 3 must also comply with the radiated emission limits specified in Tables 5 and 6.

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8.2. Measurement Equipment Used:

8.2.1. Conducted Emission at antenna port:

Refer to section 7.2 for details.

8.2.2. Radiated emission:

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	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	05/19/2013	05/18/2014
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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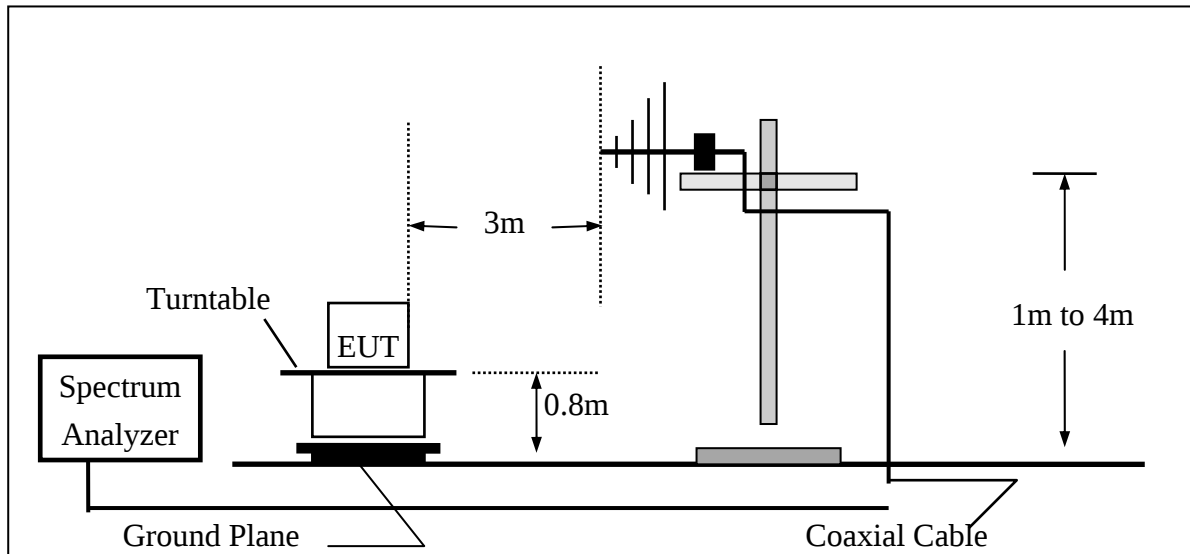
8.3. Test SET-UP:

8.3.1. Conducted Emission at antenna port:

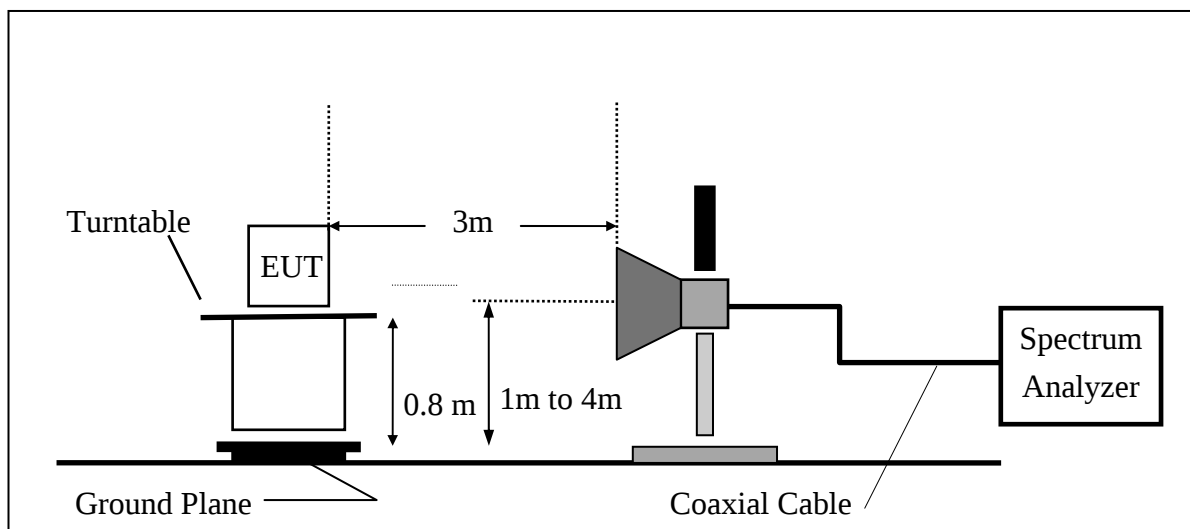
Refer to section 7.3 for details.

8.3.2. 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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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 center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=300 kHz, 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.

8.5. 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	

8.6. Measurement Result:

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

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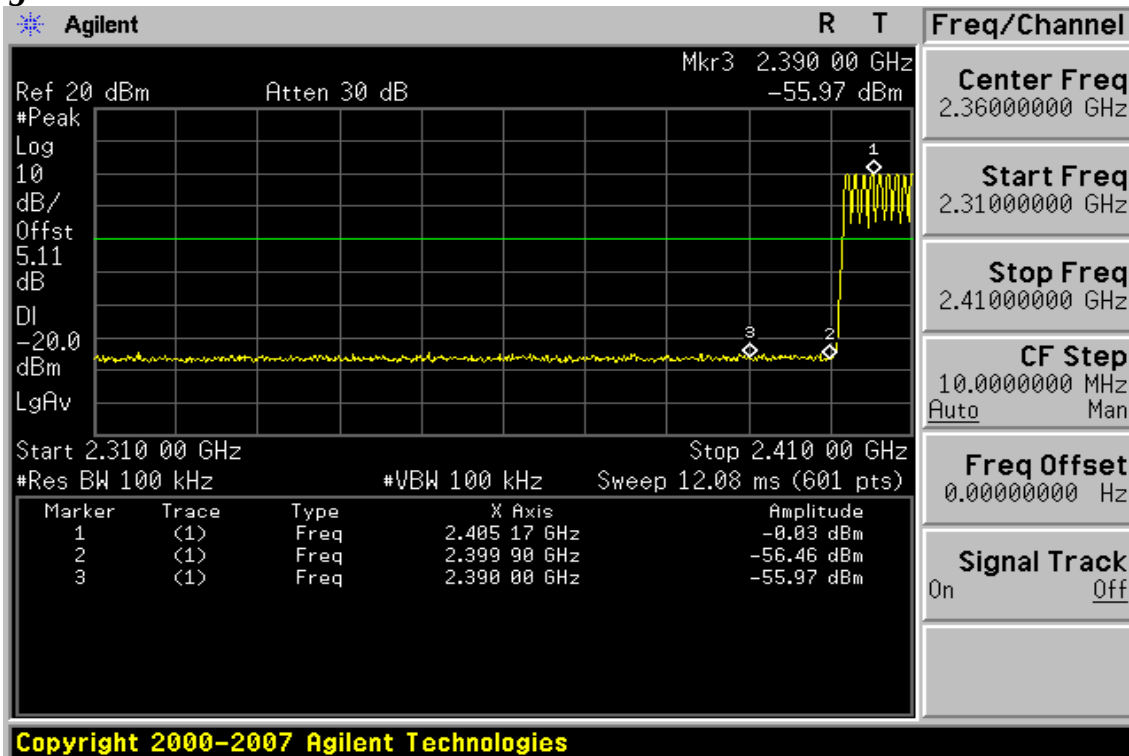
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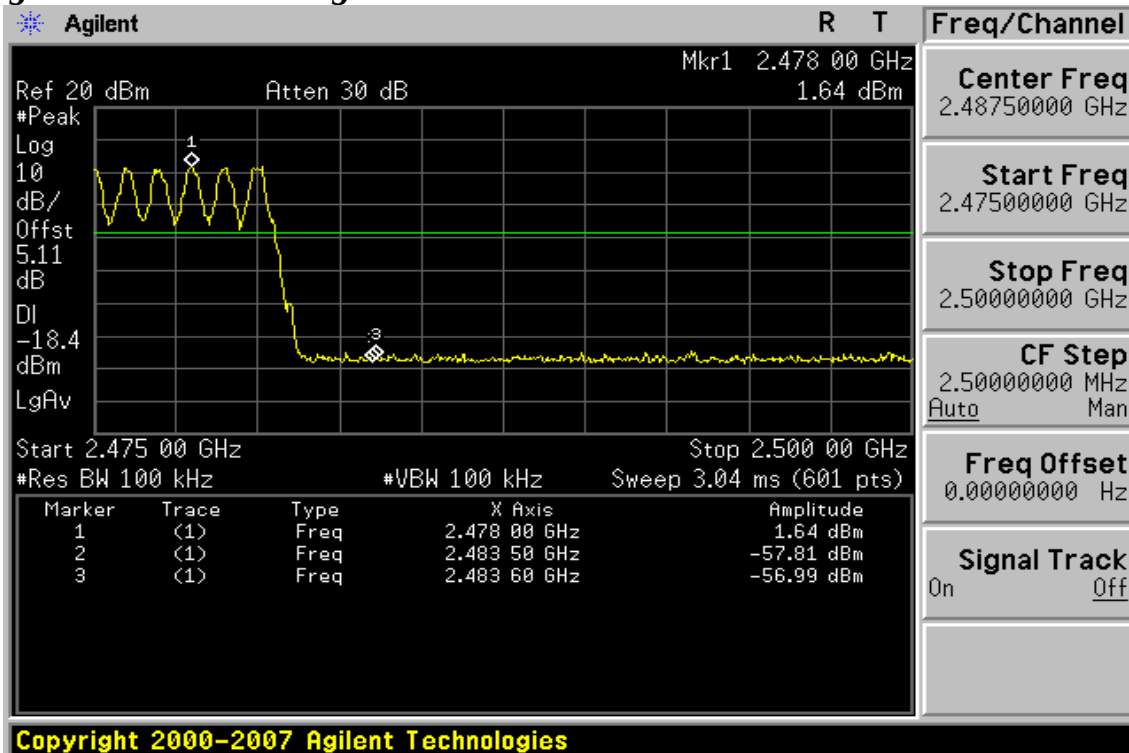
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BR Mode

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	:2013-05-17
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26.1deg_C /67 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	dB μ V	dB	dB μ V/m	dB μ V/m	dB
2390.00	E	Average	30.46	2.12	32.58	54.00	-21.42
2390.00	E	Peak	43.44	2.12	45.56	74.00	-28.44

Operation Band	:BR	Test Date	:2013-05-17
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26.1deg_C /67 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	dB μ V	dB	dB μ V/m	dB μ V/m	dB
2390.00	E	Average	30.53	2.74	33.27	54.00	-20.73
2390.00	E	Peak	43.49	2.74	46.23	74.00	-27.77

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.

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	:2013-05-17
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26.1deg_C /67 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	31.23	2.53	33.76	54.00	-20.24
2483.50	E	Peak	44.61	2.53	47.14	74.00	-26.86

Operation Band	:BR	Test Date	:2013-05-17
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26.1deg_C /67 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	30.63	3.56	34.19	54.00	-19.81
2483.50	E	Peak	42.81	3.56	46.37	74.00	-27.63

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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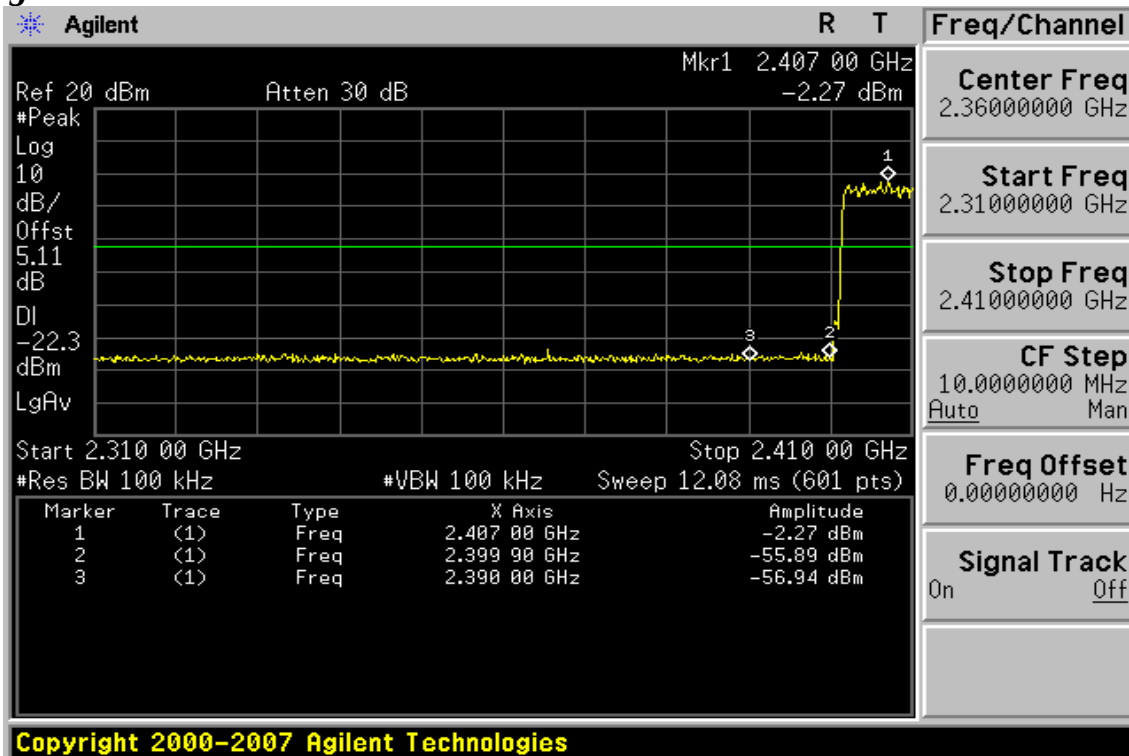
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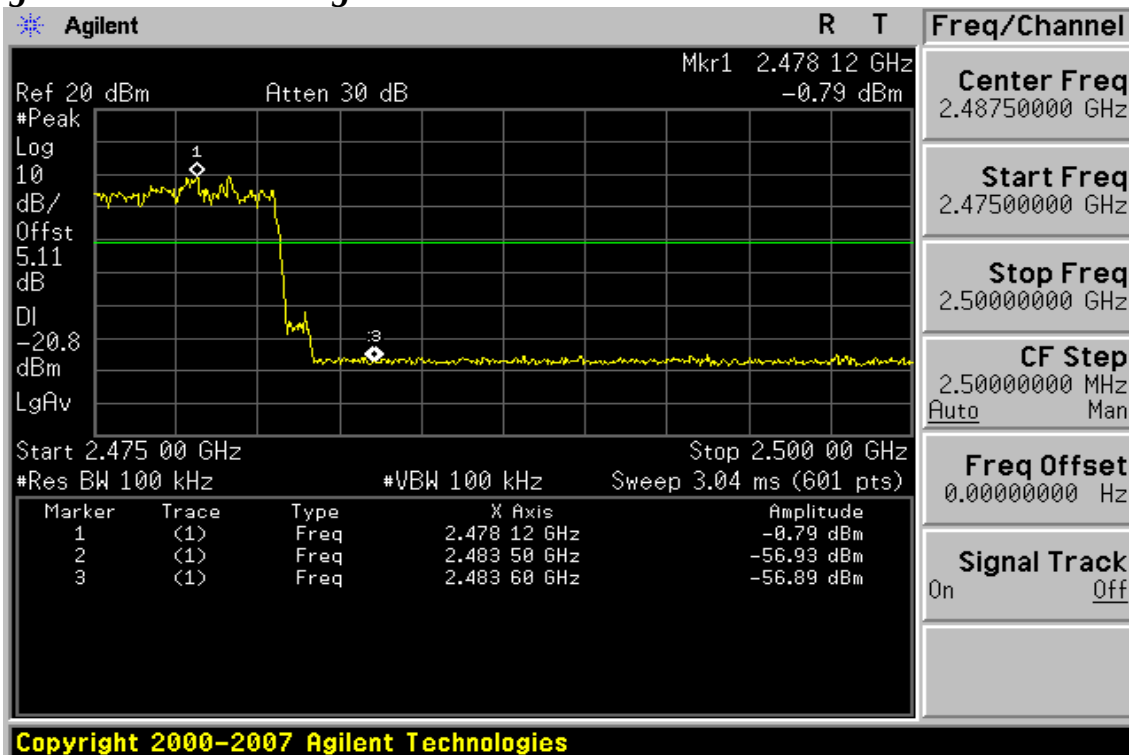
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EDR Mode Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Radiated Emission: (EDR mode)

Operation Band	:EDR	Test Date	:2013-05-17
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26.1deg_C /67 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	dB μ V	dB	dB μ V/m	dB μ V/m	dB
2390.00	E	Average	30.49	2.12	32.61	54.00	-21.39
2390.00	E	Peak	43.40	2.12	45.52	74.00	-28.48

Operation Band	:EDR	Test Date	:2013-05-17
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26.1deg_C /67 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	dB μ V	dB	dB μ V/m	dB μ V/m	dB
2390.00	E	Average	30.52	2.74	33.26	54.00	-20.74
2390.00	E	Peak	43.19	2.74	45.93	74.00	-28.07

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.

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	:2013-05-17
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26.1deg_C /67 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	31.20	2.53	33.73	54.00	-20.27
2483.50	E	Peak	43.84	2.53	46.37	74.00	-27.63

Operation Band	:EDR	Test Date	:2013-05-17
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26.1deg_C /67 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	30.65	3.56	34.21	54.00	-19.79
2483.50	E	Peak	43.21	3.56	46.77	74.00	-27.23

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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9. SPURIOUS EMISSION TEST

9.1. 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.

According to RSS-Gen §7.2.5 and RSS-210 issue 8, §A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced 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 section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 5 and 6 is not required. In addition, radiated emissions which fall in the restricted bands of Table 3 must also comply with the radiated emission limits specified in Tables 5 and 6 of RSS-GEN.

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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:

Refer to section 8.2.2 for details.

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:

Refer to section 8.3.2 for details.

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9.4. 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

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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 two plots containing the range of 30MHz to 3GHz, and 3GHz to 26.5GHz.

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	

Remark:

1. The limit of the emission level is expressed in dBuV/m, which converts $20 \cdot \log(\mu V/m)$
2. $\text{Factor(dB)} = \text{Antenna Factor(dB}\mu V/m) + \text{Cable Loss(dB)} - \text{Pre_Amplifier Gain(dB)}$

9.6. Measurement Result:

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

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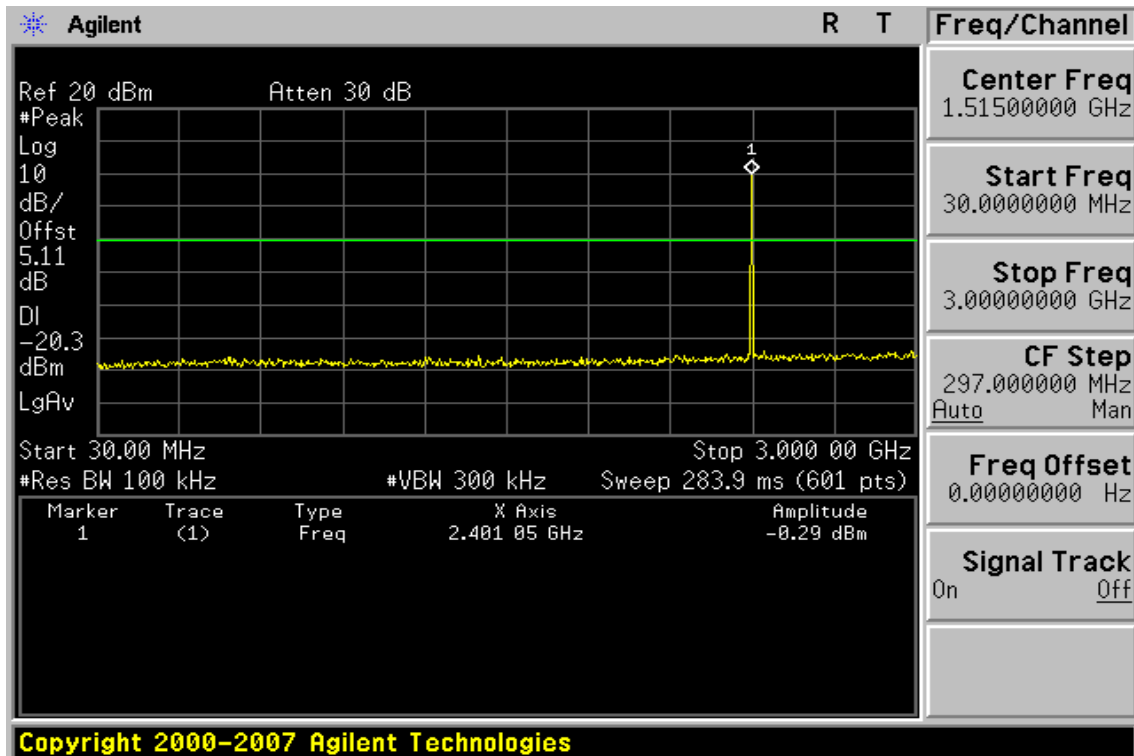
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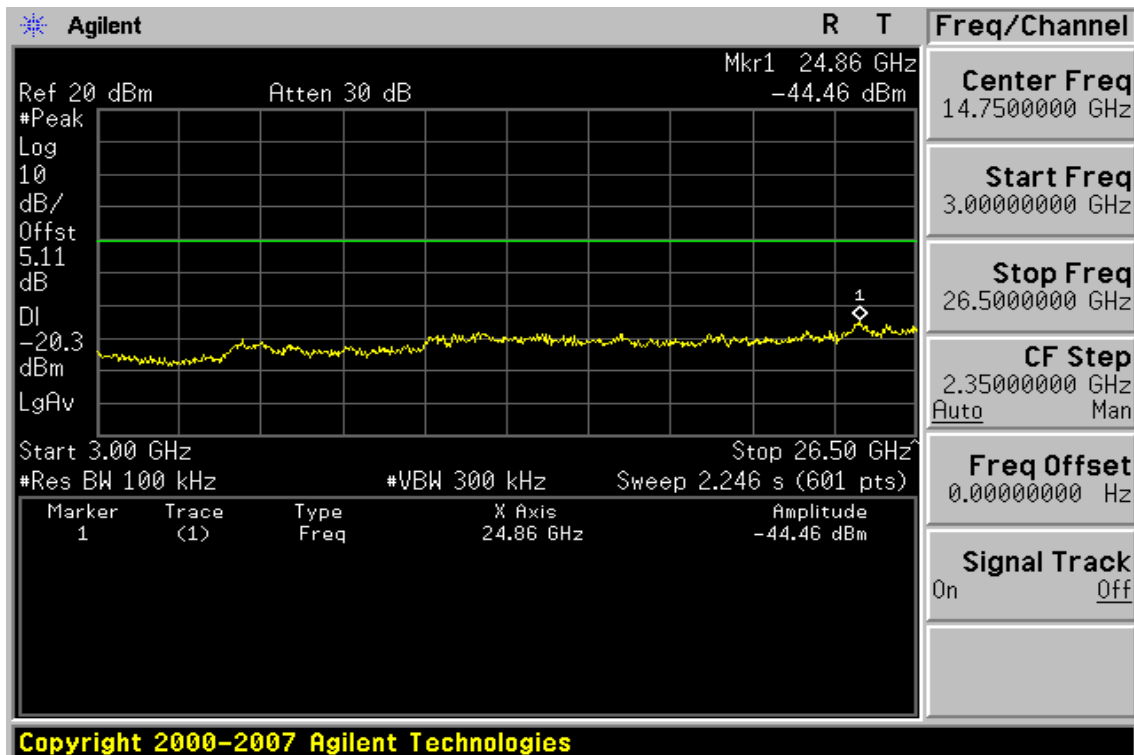
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Conducted Spurious Emission Measurement Result (BR Mode) Ch Low 30MHz – 3GHz



Ch Low 3GHz –26.5GHz

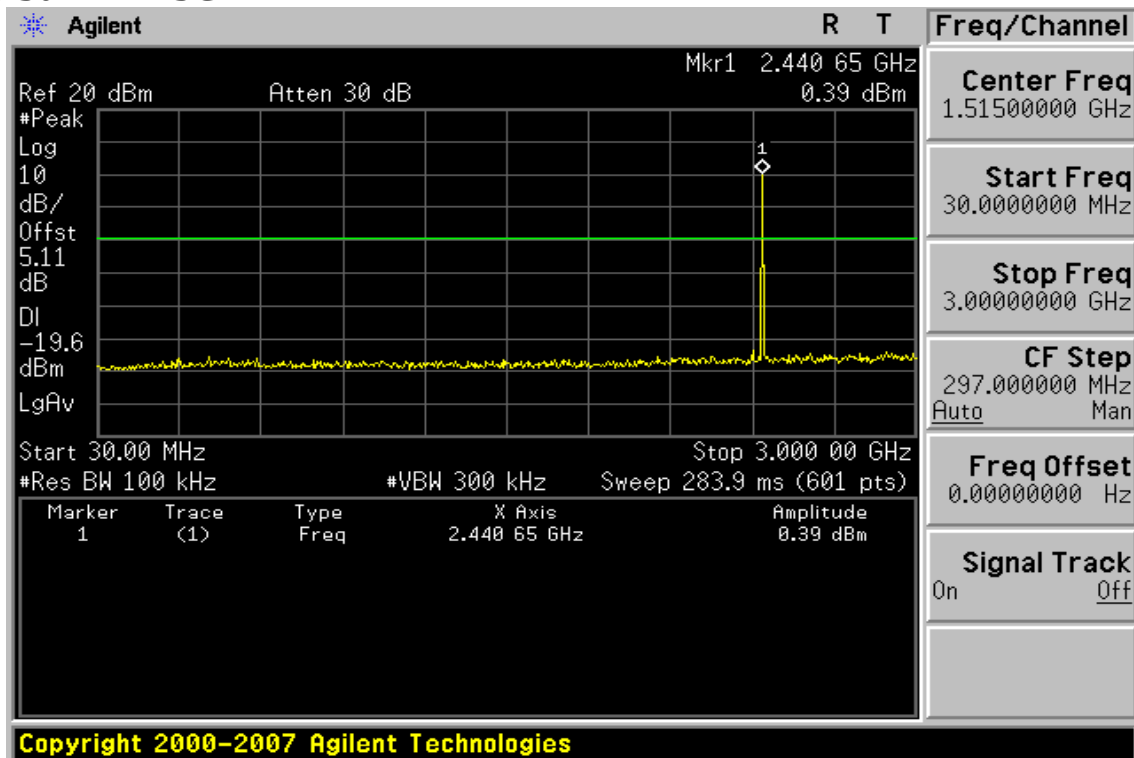


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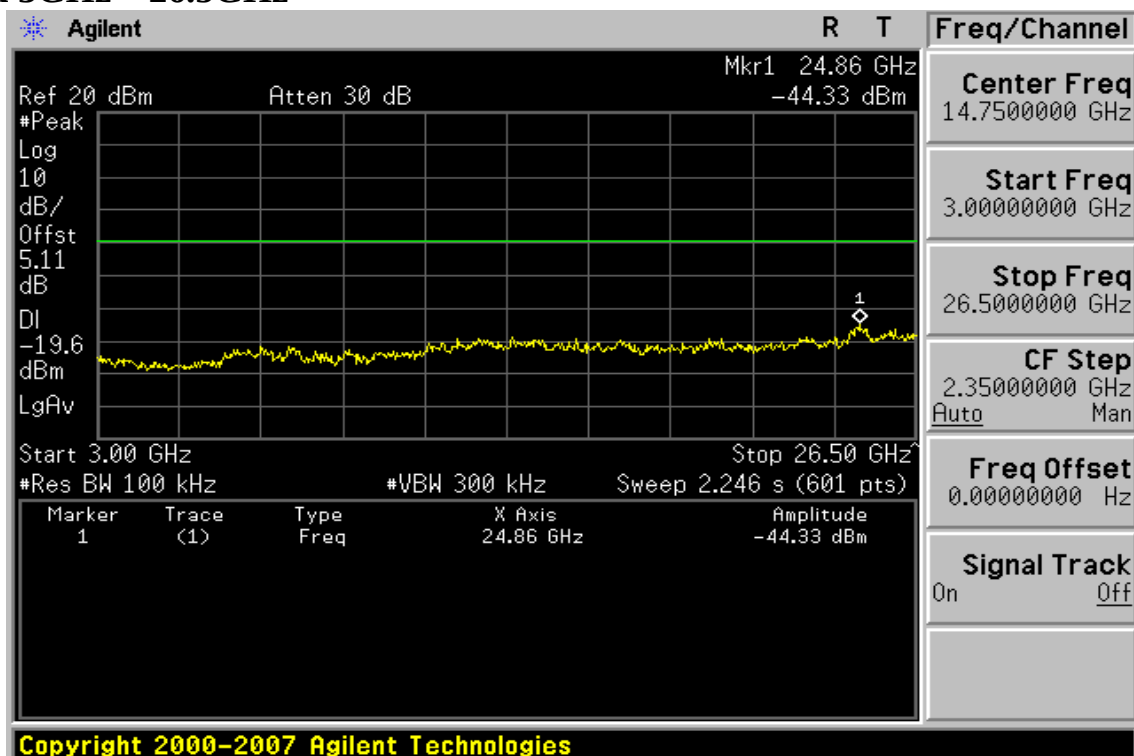
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Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz

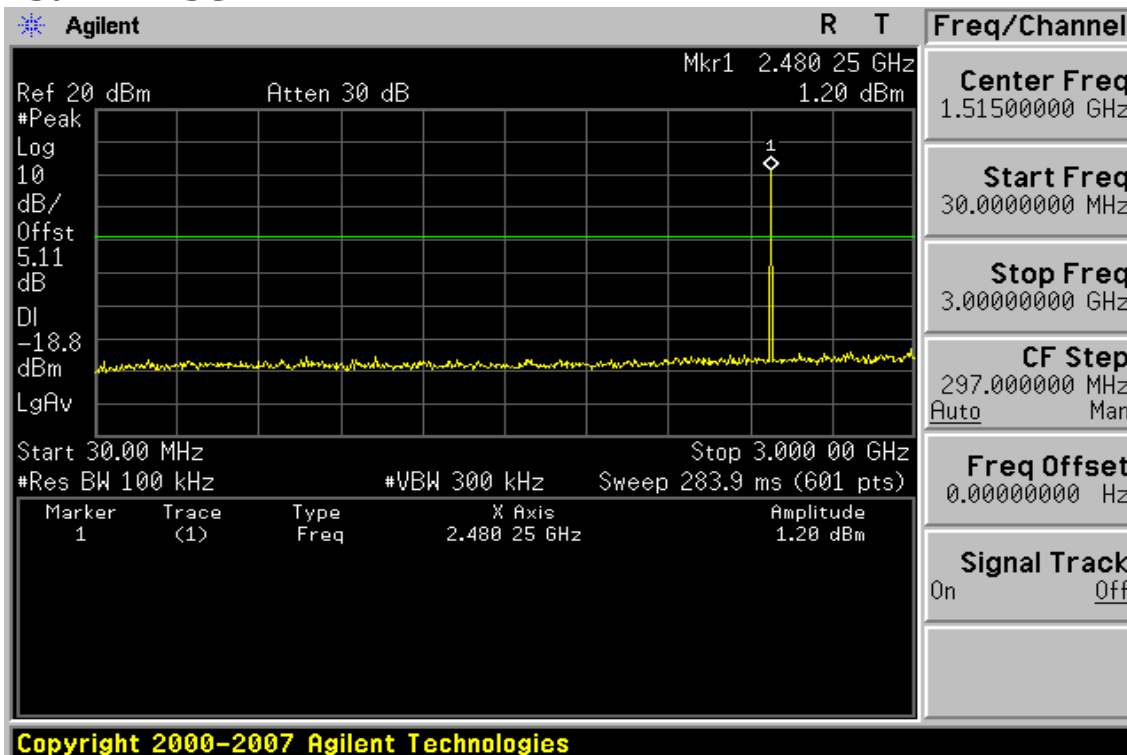


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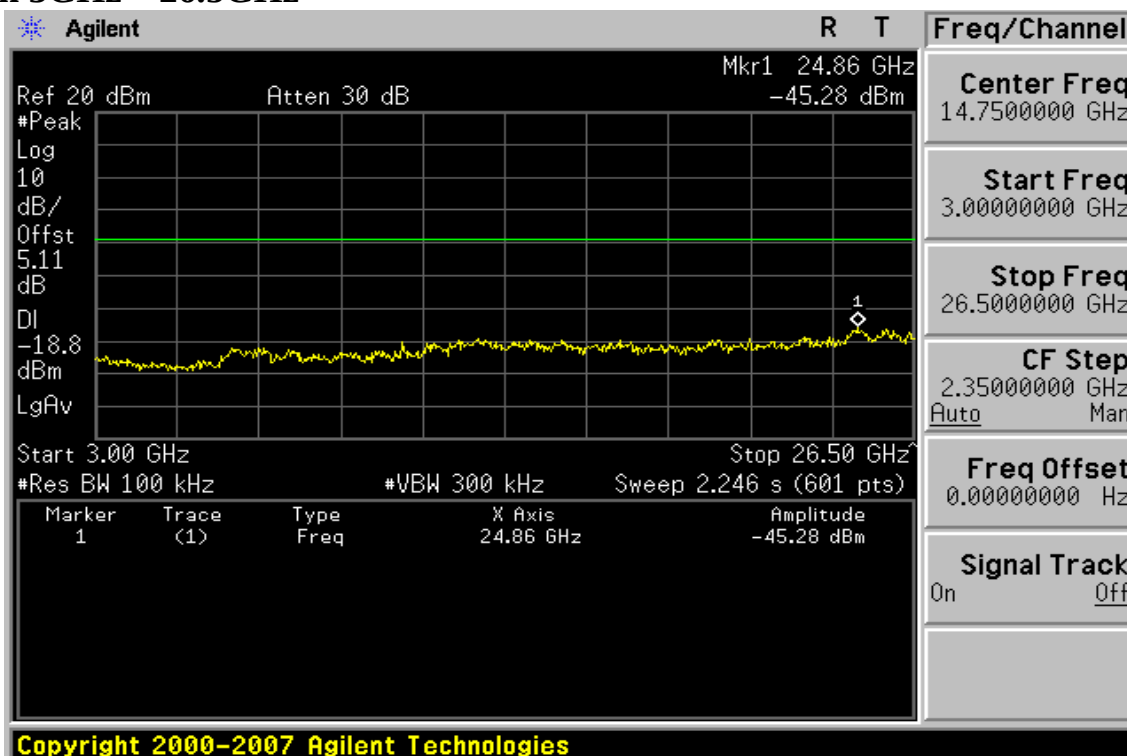
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz

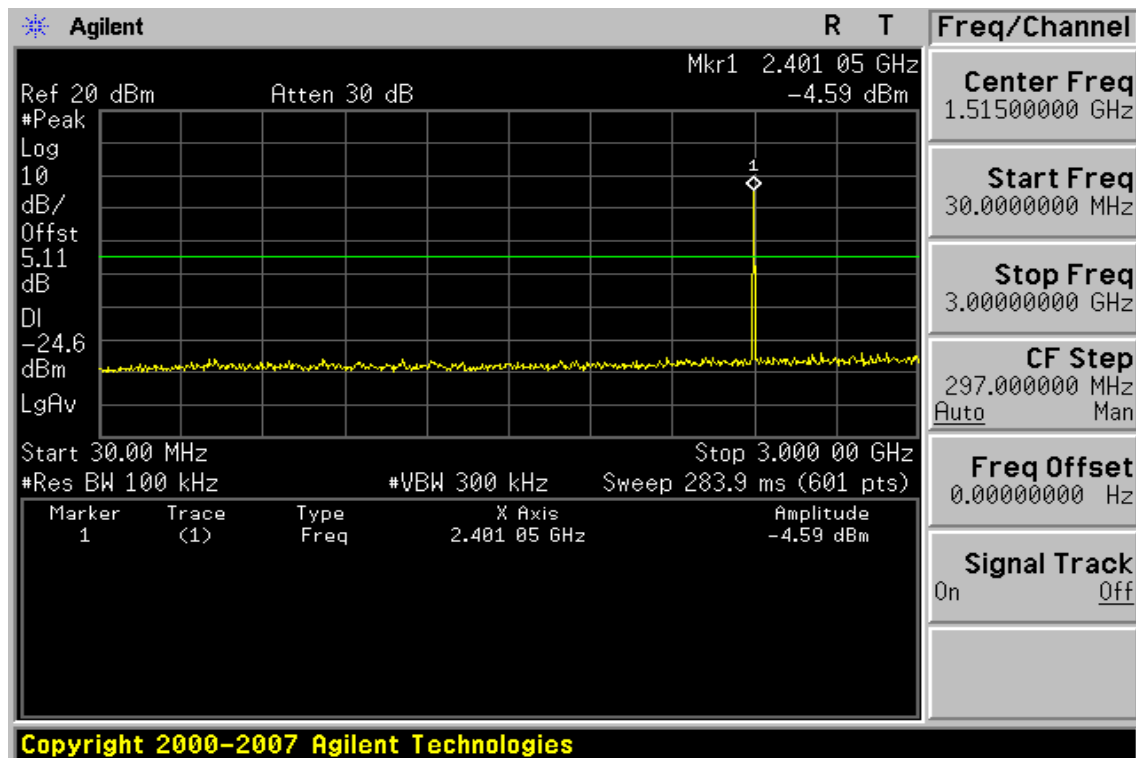


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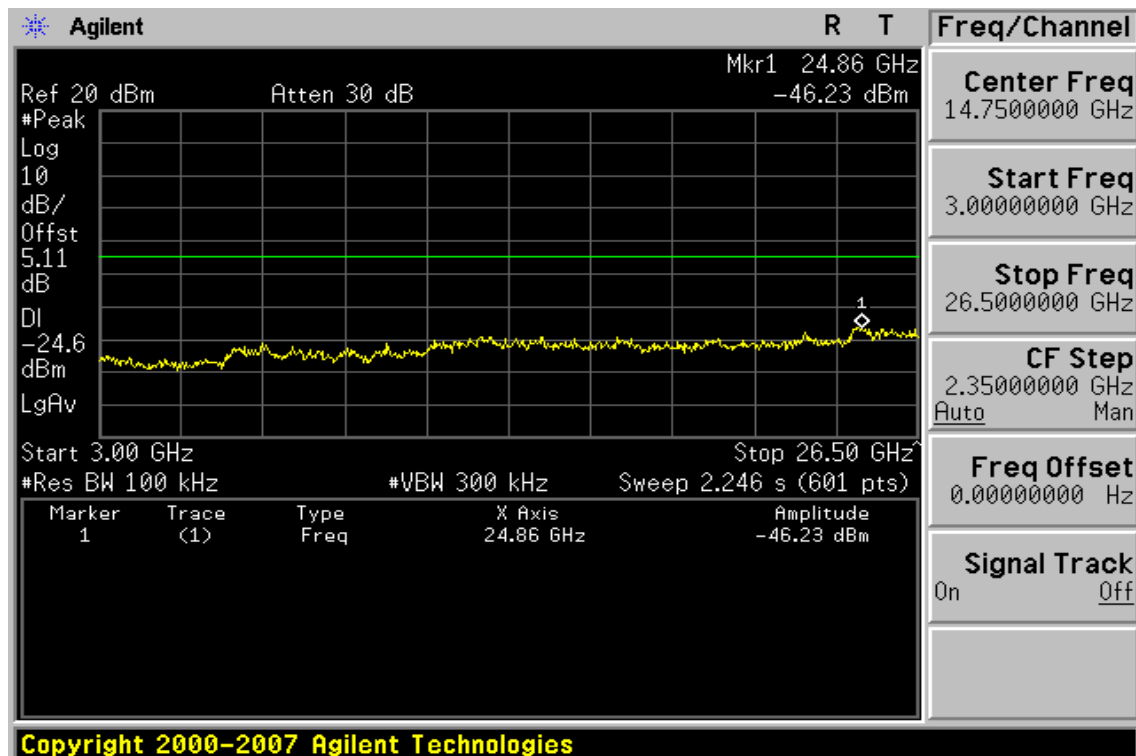
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Conducted Spurious Emission Measurement Result (EDR mode-Worst) Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz

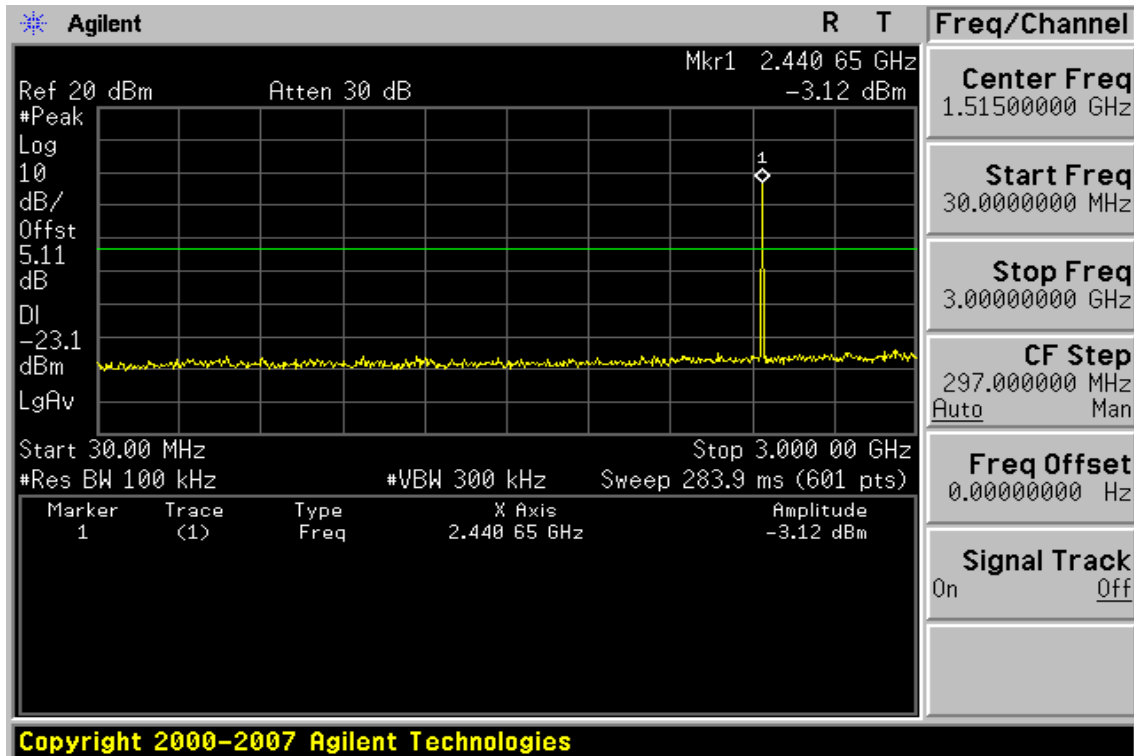


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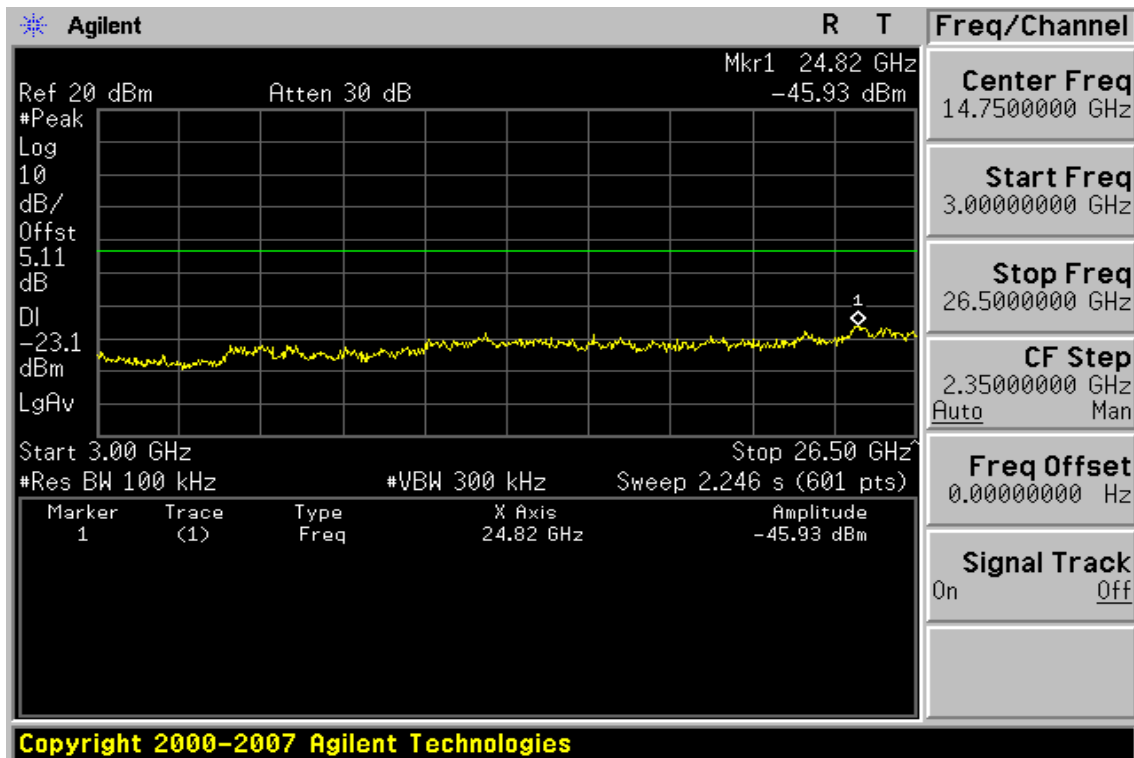
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Ch Mid 30MHz – 3GHz



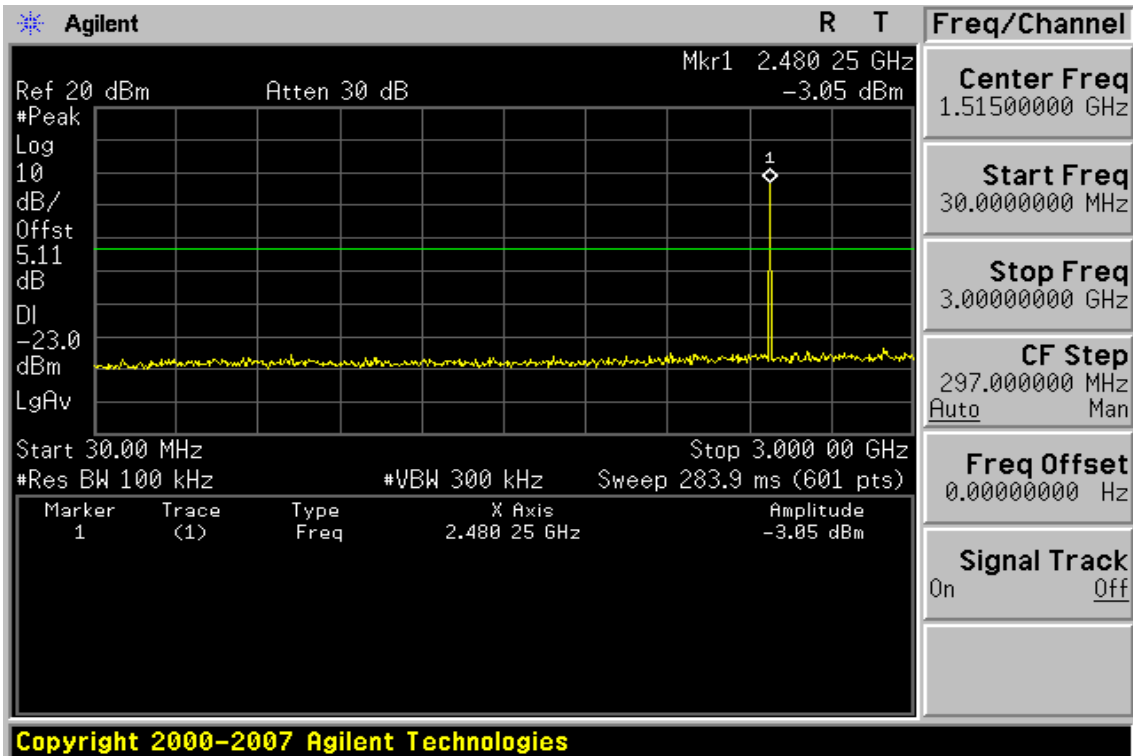
Ch Mid 3GHz – 26.5GHz



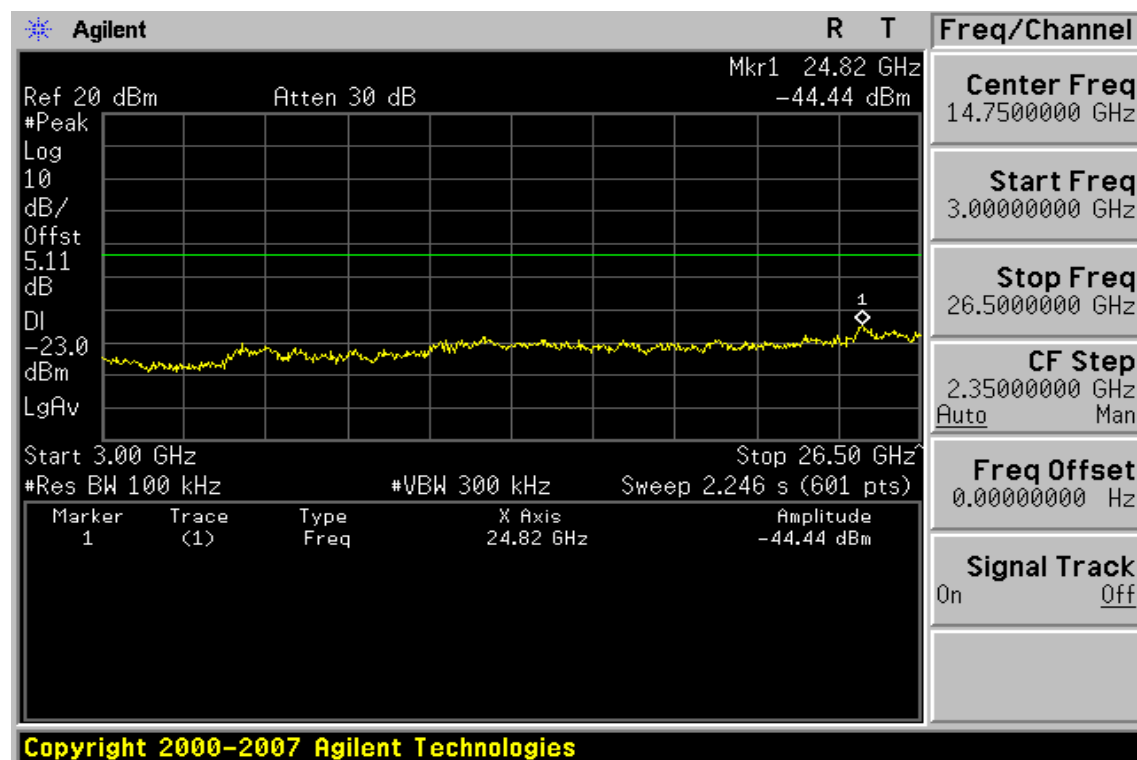
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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Radiated Spurious Emission Measurement Result (Worst EDR mode)

Operation Band	:EDR	Test Date	:2013-05-17
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26.1deg_C /67 RH
Operation Mode	:TX LOW	Engineer	:Allen
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
38.73	S	Peak	41.37	-13.59	27.78	40.00	-12.22
88.20	S	Peak	42.60	-17.68	24.92	43.50	-18.58
113.42	S	Peak	40.52	-15.34	25.18	43.50	-18.32
152.22	S	Peak	39.66	-12.32	27.34	43.50	-16.16
302.57	S	Peak	38.95	-12.51	26.44	46.00	-19.56
943.74	S	Peak	27.23	-2.15	25.08	46.00	-20.92
4804.00	H	Average	27.46	6.99	34.45	54.00	-19.55
4804.00	H	Peak	37.42	6.99	44.41	74.00	-29.59
4990.00	H	Average	25.68	7.12	32.80	54.00	-21.20
4990.00	H	Peak	46.99	7.12	54.11	74.00	-19.89
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	:2013-05-17
Fundamental Frequency	:2402 MHz	Temp./Humi.	:26.1deg_C /67 RH
Operation Mode	:TX LOW	Engineer	:Allen
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
158.04	S	Peak	34.32	-12.30	22.02	43.50	-21.48
193.93	S	Peak	39.96	-15.83	24.13	43.50	-19.37
289.96	S	Peak	37.09	-12.80	24.29	46.00	-21.71
358.83	S	Peak	33.00	-11.56	21.44	46.00	-24.56
421.88	S	Peak	32.98	-10.61	22.37	46.00	-23.63
958.29	S	Peak	27.70	-2.07	25.63	46.00	-20.37
4804.00	H	Average	29.35	7.03	36.38	54.00	-17.62
4804.00	H	Peak	38.15	7.03	45.18	74.00	-28.82
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	:2013-05-17
Fundamental Frequency	:2441 MHz	Temp./Humi.	:26.1deg_C /67 RH
Operation Mode	:TX MID	Engineer	:Allen
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
38.73	S	Peak	41.35	-13.59	27.76	40.00	-12.24
88.20	S	Peak	42.84	-17.68	25.16	43.50	-18.34
112.45	S	Peak	40.36	-15.45	24.91	43.50	-18.59
158.04	S	Peak	41.49	-12.30	29.19	43.50	-14.31
308.39	S	Peak	37.84	-12.37	25.47	46.00	-20.53
920.46	S	Peak	27.42	-2.42	25.00	46.00	-21.00
4882.00	H	Average	25.32	7.16	32.48	54.00	-21.52
4882.00	H	Peak	37.03	7.16	44.19	74.00	-29.81
4976.00	H	Average	25.57	7.14	32.71	54.00	-21.29
4976.00	H	Peak	45.51	7.14	52.65	74.00	-21.35
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	:2013-05-17
Fundamental Frequency	:2441 MHz	Temp./Humi.	:26.1deg_C /67 RH
Operation Mode	:TX MID	Engineer	:Allen
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
159.98	S	Peak	34.95	-12.26	22.69	43.50	-20.81
193.93	S	Peak	39.86	-15.83	24.03	43.50	-19.47
300.63	S	Peak	36.71	-12.55	24.16	46.00	-21.84
336.52	S	Peak	35.55	-11.83	23.72	46.00	-22.28
410.24	S	Peak	32.46	-10.84	21.62	46.00	-24.38
947.62	S	Peak	27.14	-2.12	25.02	46.00	-20.98
4882.00	H	Average	25.82	7.10	32.92	54.00	-21.08
4882.00	H	Peak	38.08	7.10	45.18	74.00	-28.82
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	:2013-05-17
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26.1deg_C /67 RH
Operation Mode	:TX HIGH	Engineer	:Allen
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
38.73	S	Peak	41.28	-13.59	27.69	40.00	-12.31
88.20	S	Peak	43.06	-17.68	25.38	43.50	-18.12
113.42	S	Peak	40.71	-15.34	25.37	43.50	-18.13
152.22	S	Peak	38.42	-12.32	26.10	43.50	-17.40
309.36	S	Peak	39.07	-12.35	26.72	46.00	-19.28
938.89	S	Peak	27.39	-2.20	25.19	46.00	-20.81
4960.00	H	Average	24.92	7.17	32.09	54.00	-21.91
4960.00	H	Peak	36.69	7.17	43.86	74.00	-30.14
4997.00	H	Average	23.91	7.12	31.03	54.00	-22.97
4997.00	H	Peak	44.94	7.12	52.06	74.00	-21.94
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	:2013-05-17
Fundamental Frequency	:2480 MHz	Temp./Humi.	:26.1deg_C /67 RH
Operation Mode	:TX HIGH	Engineer	:Allen
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
159.98	S	Peak	34.20	-12.26	21.94	43.50	-21.56
193.93	S	Peak	39.89	-15.83	24.06	43.50	-19.44
297.72	S	Peak	37.17	-12.62	24.55	46.00	-21.45
332.64	S	Peak	33.29	-11.89	21.40	46.00	-24.60
418.97	S	Peak	32.29	-10.66	21.63	46.00	-24.37
946.65	S	Peak	28.62	-2.12	26.50	46.00	-19.50
4960.00	H	Average	24.85	7.02	31.87	54.00	-22.13
4960.00	H	Peak	36.16	7.02	43.18	74.00	-30.82
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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10. FREQUENCY SEPARATION

10.1. Standard Applicable:

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

According to RSS 210 issue 8, A8.1 (b), frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

10.2. Measurement Equipment Used:

Refer to section 7.2 for details.

10.3. Test Set-up:

Refer to section 7.3 for details.

10.4. 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.

10.5. 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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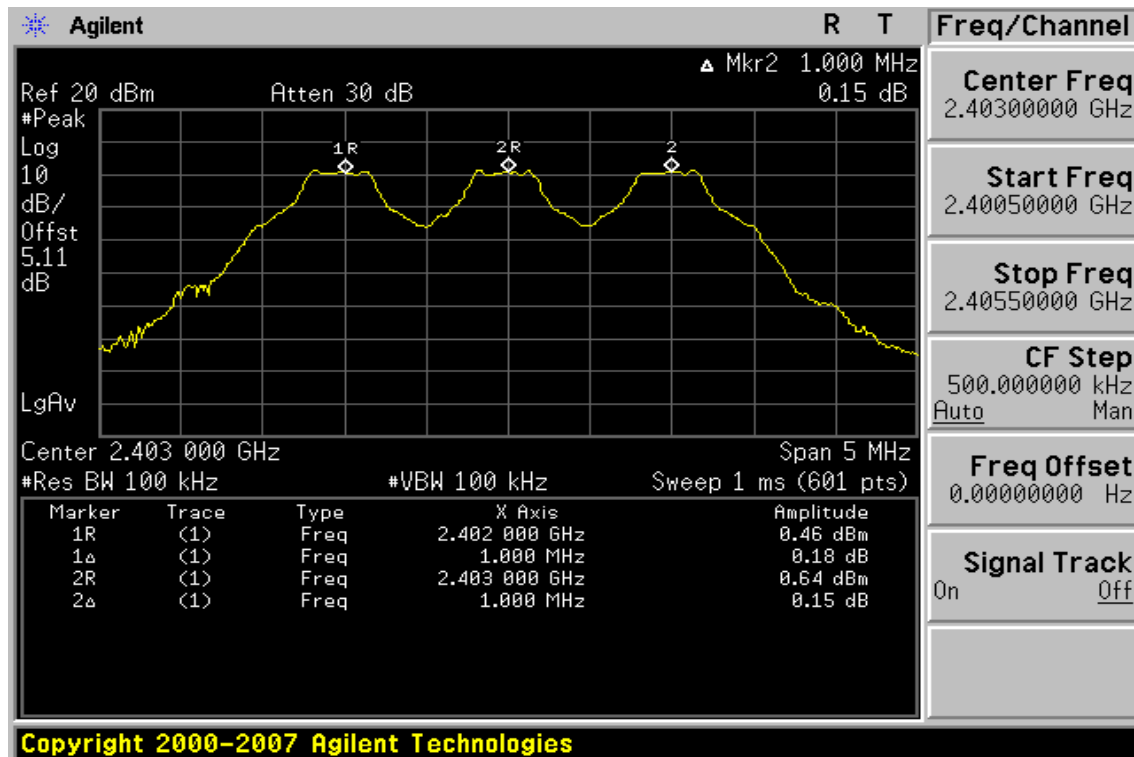
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Frequency Separation Test Data



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11. NUMBER OF HOPPING FREQUENCY

11.1. 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.

According to RSS-210 issue 8, §A8.1(d), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, the maximum conducted output power shall not exceed 1 W. For all other frequency hopping systems, the maximum peak conducted output power shall not exceed 0.125 W.

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 spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW=430KHz, VBW=1.5MHz, , Detector = Peak
5. Max hold, view and count how many channel in the band.

11.5. Measurement Result:

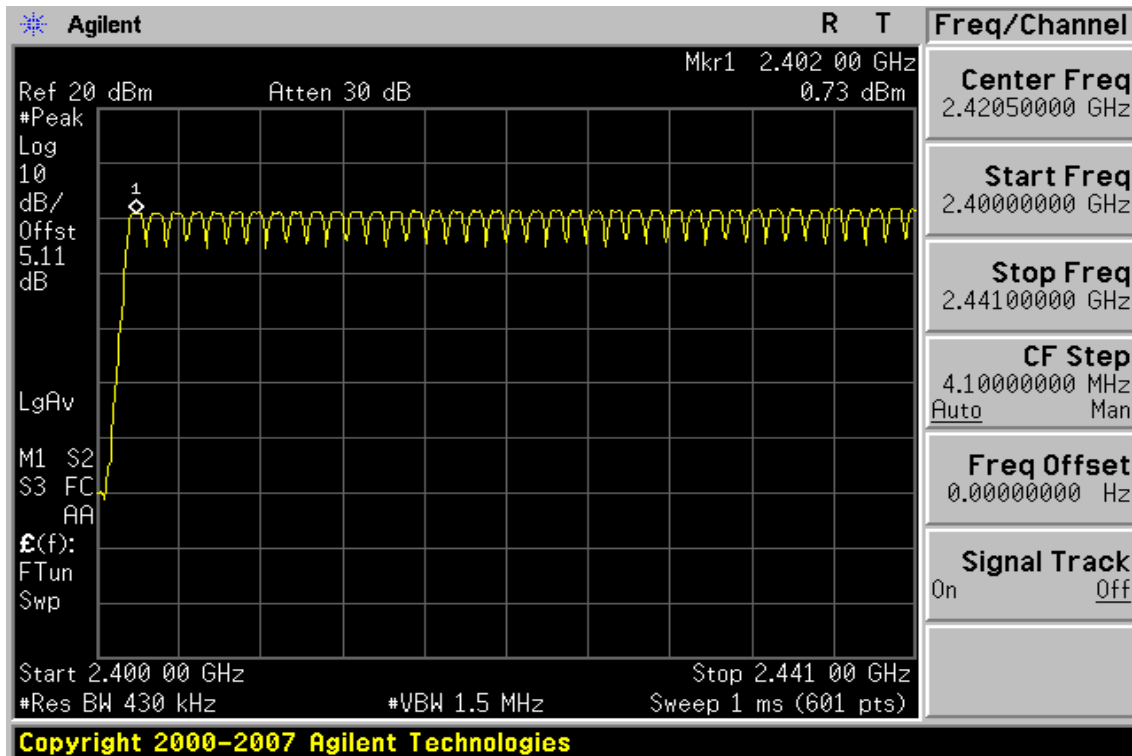
Note: Refer to next page for plots.

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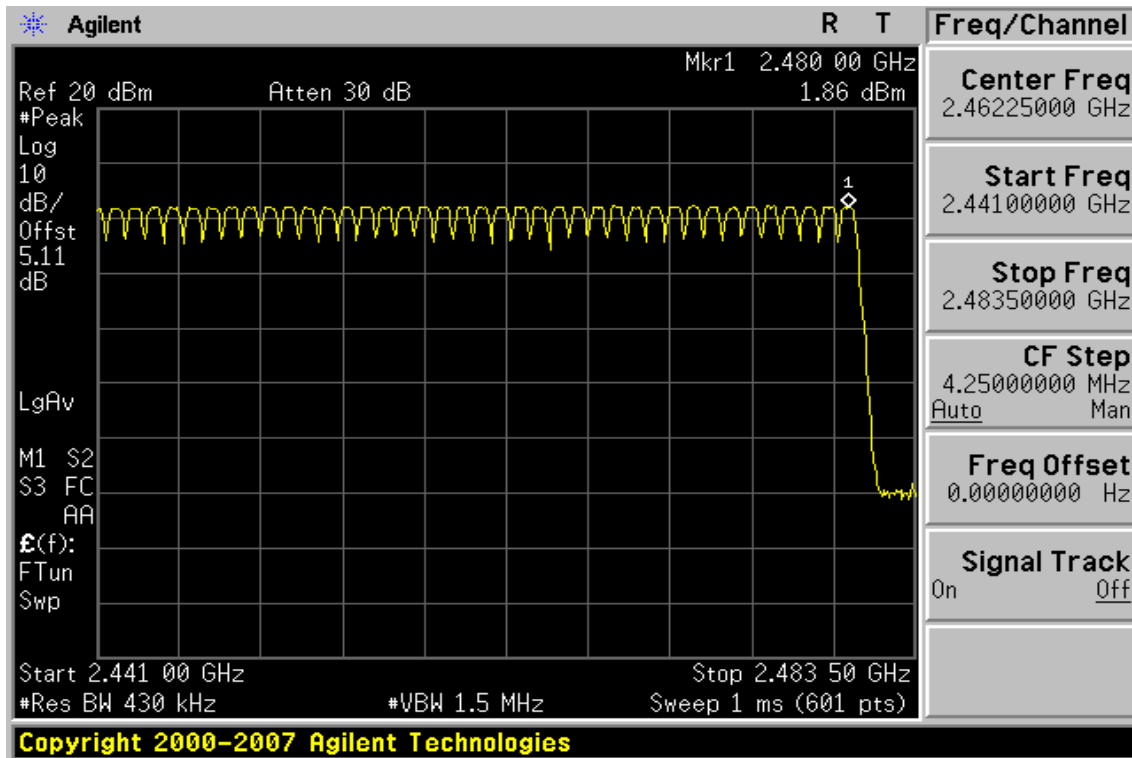
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Channel Number

2.4 GHz – 2.441GHz



2.441 GHz – 2.4835GHz



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12. TIME OF OCCUPANCY (DWELL TIME)

12.1. 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.

According to RSS-210 issue 8, §A8.1(d), Frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

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 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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12.5. Measurement Result:

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

CH Low:	DH1 time slot = 0.383 (ms) * (1600/(2*79)) * 31.6 = 122.56 (ms)
	DH3 time slot = 1.633 (ms) * (1600/(4*79)) * 31.6 = 261.28 (ms)
	DH5 time slot = 2.883 (ms) * (1600/(6*79)) * 31.6 = 307.52 (ms)
CH Mid:	DH1 time slot = 0.380 (ms) * (1600/(2*79)) * 31.6 = 121.60 (ms)
	DH3 time slot = 1.633 (ms) * (1600/(4*79)) * 31.6 = 261.28 (ms)
	DH5 time slot = 2.883 (ms) * (1600/(6*79)) * 31.6 = 307.52 (ms)
CH High:	DH1 time slot = 0.380 (ms) * (1600/(2*79)) * 31.6 = 121.60 (ms)
	DH3 time slot = 1.633 (ms) * (1600/(4*79)) * 31.6 = 261.28 (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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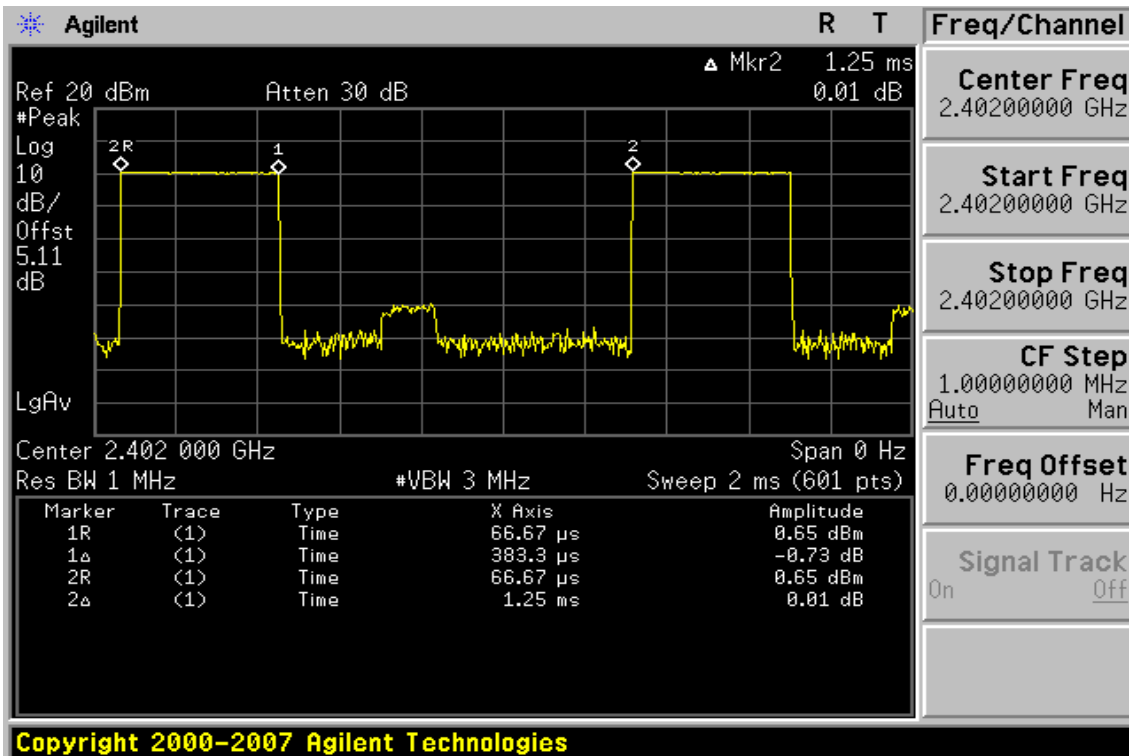
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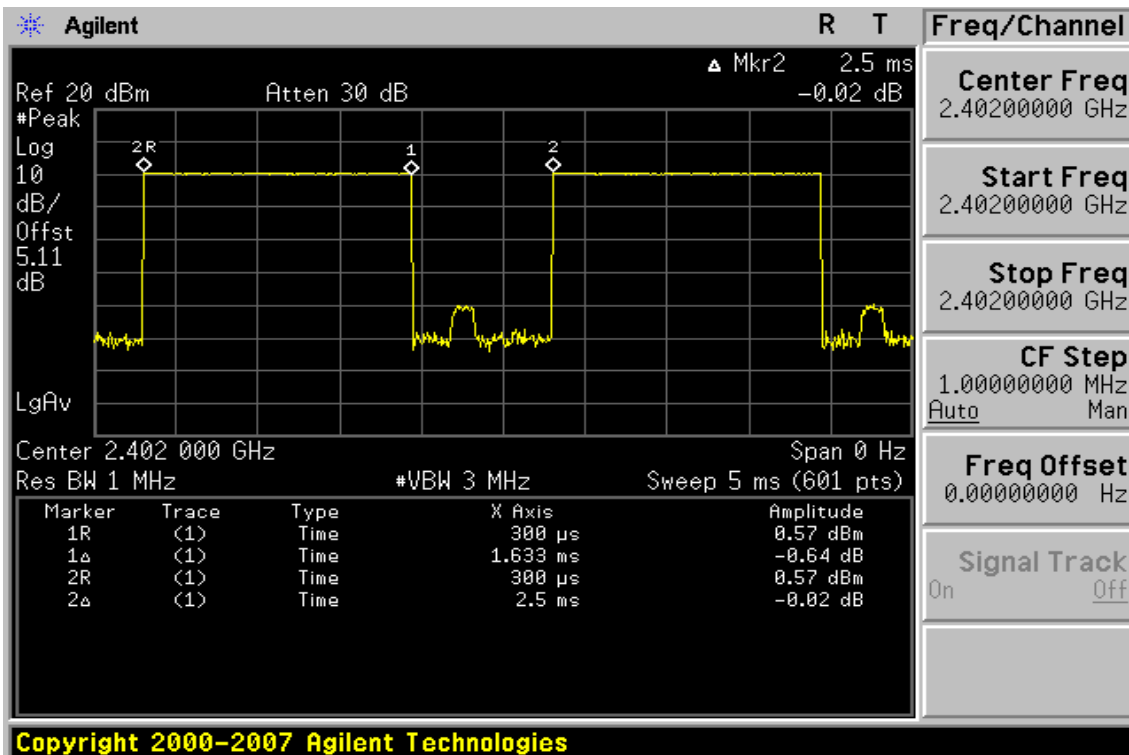
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CH-Low DH1



DH3



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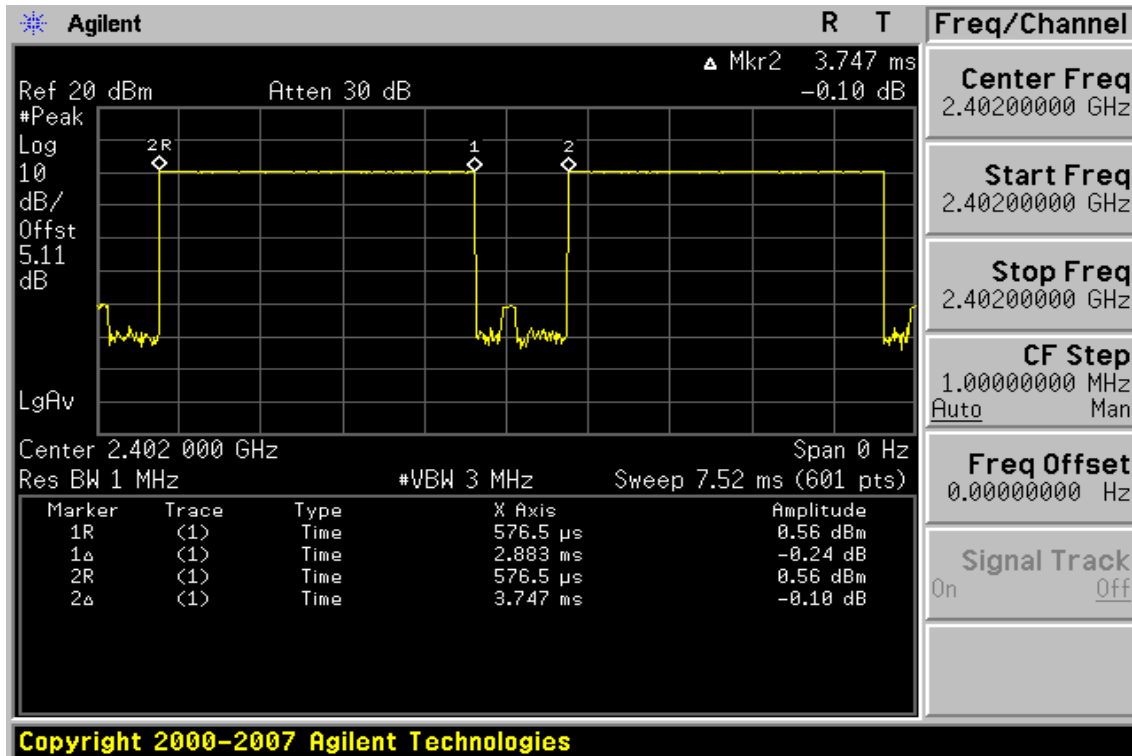
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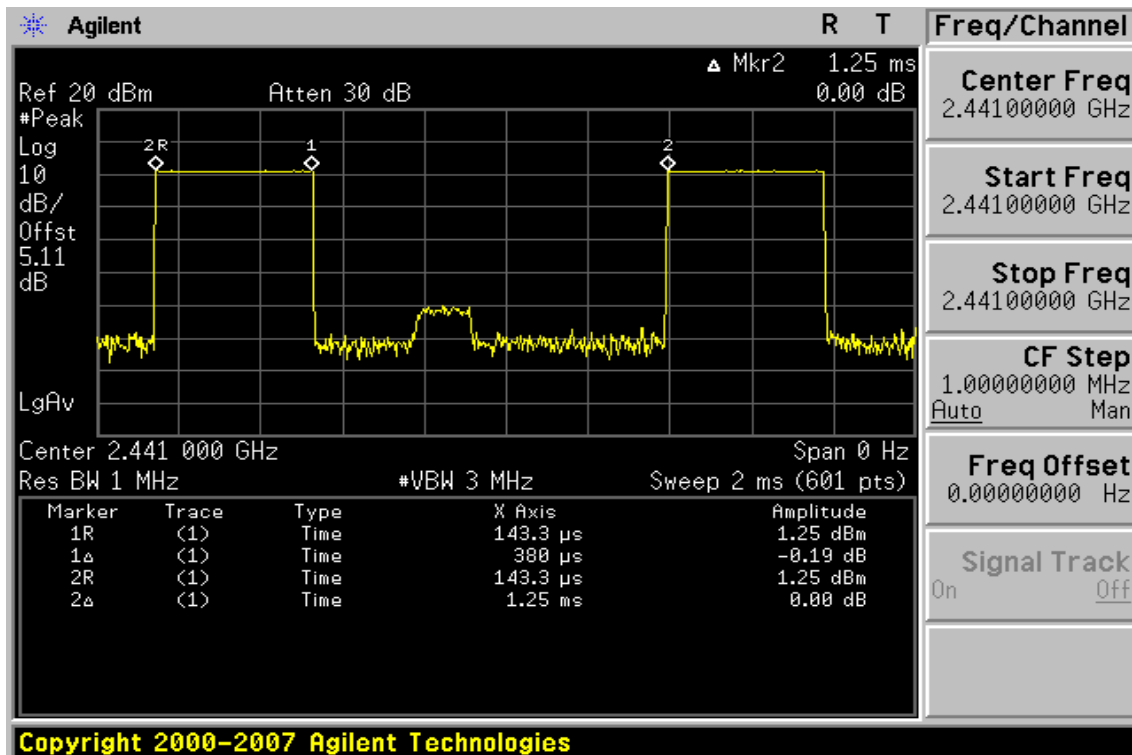
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DH5



CH-Mid

DH1



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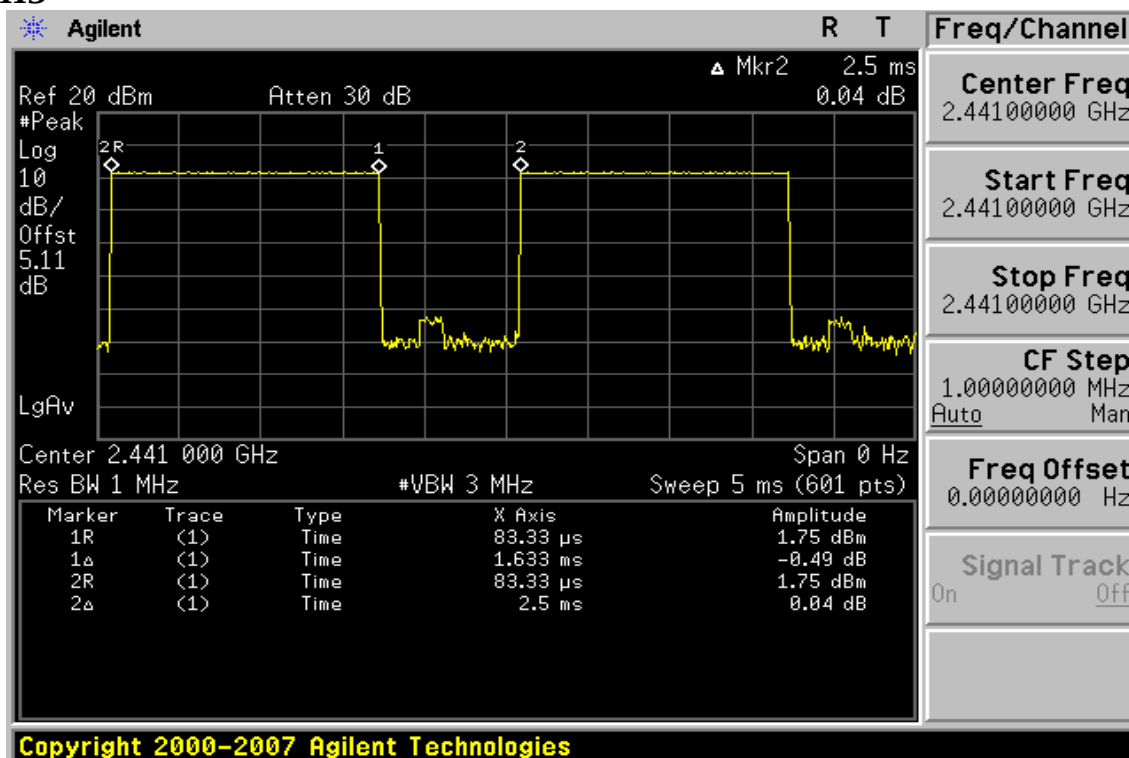
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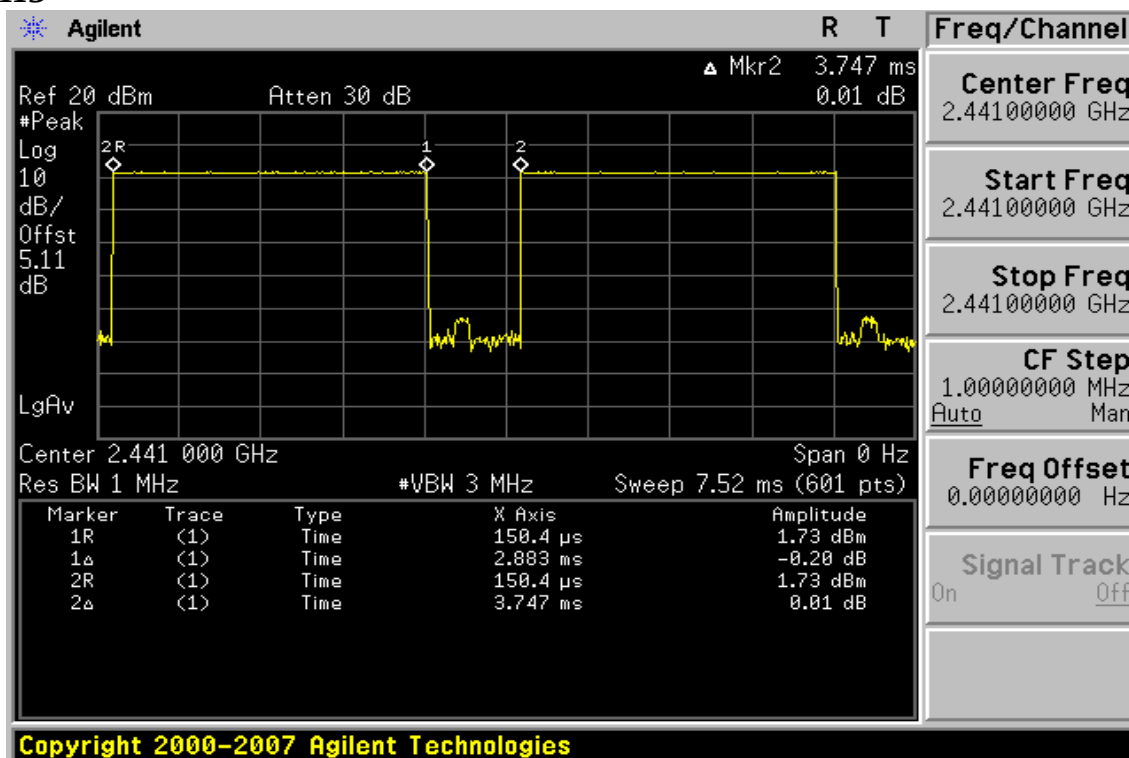
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DH3



DH5



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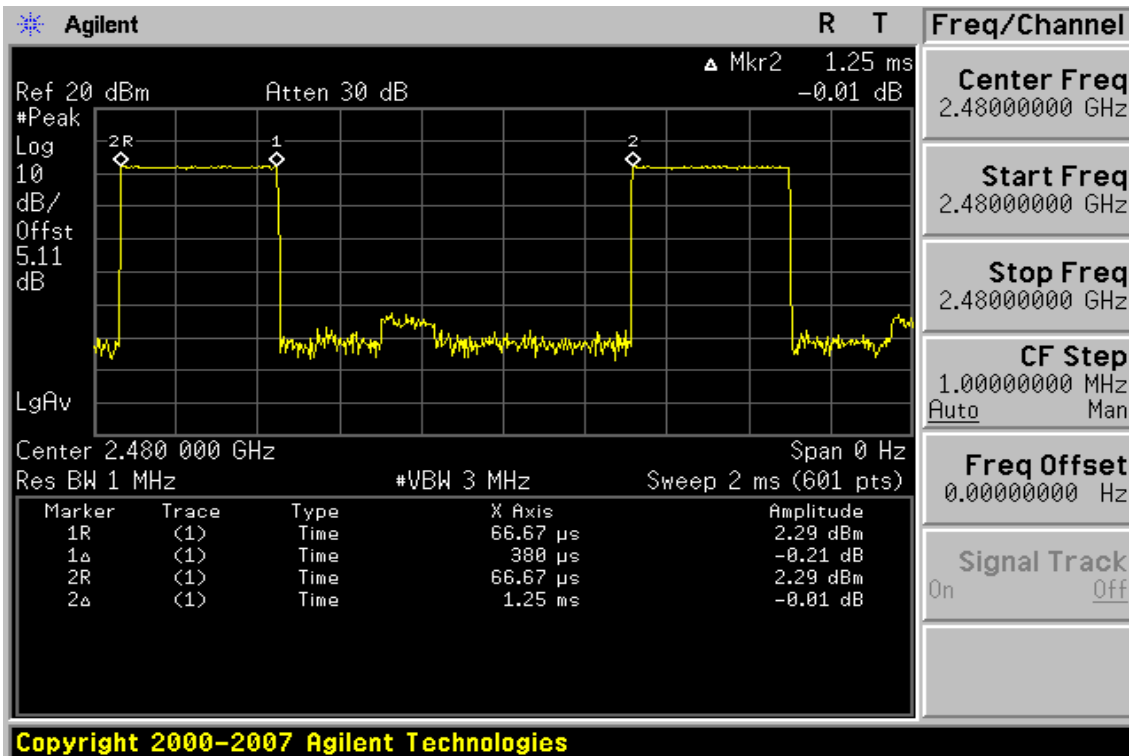
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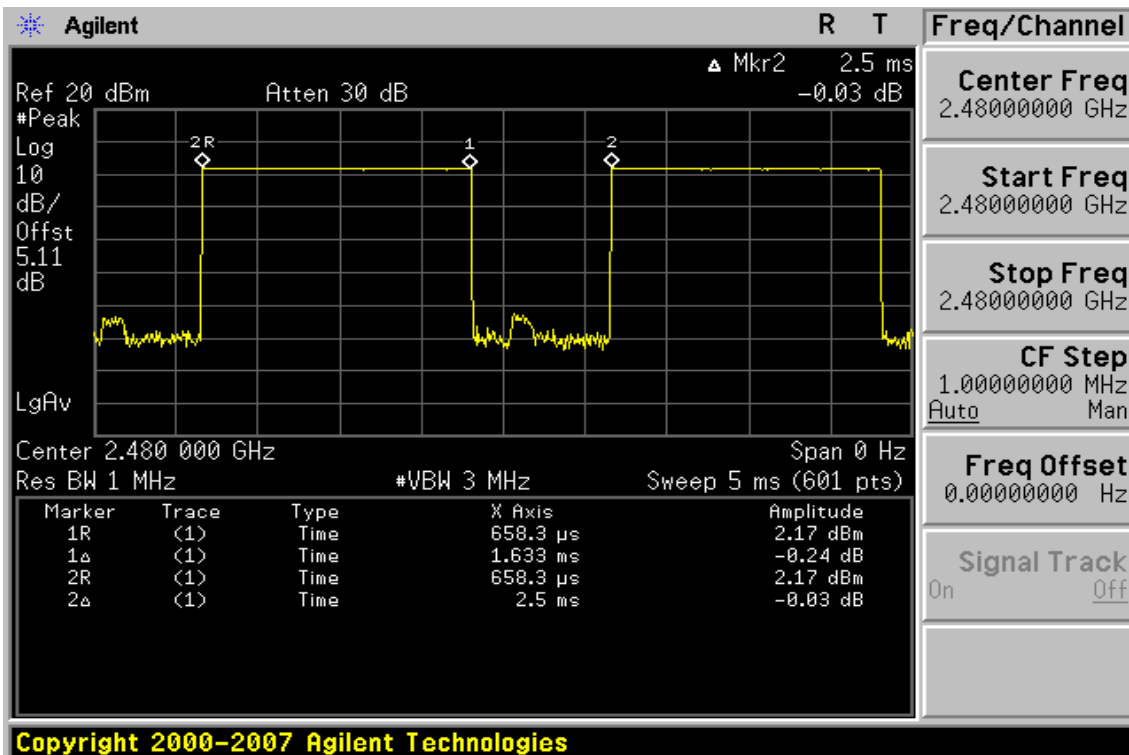
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CH-High DH1



DH3



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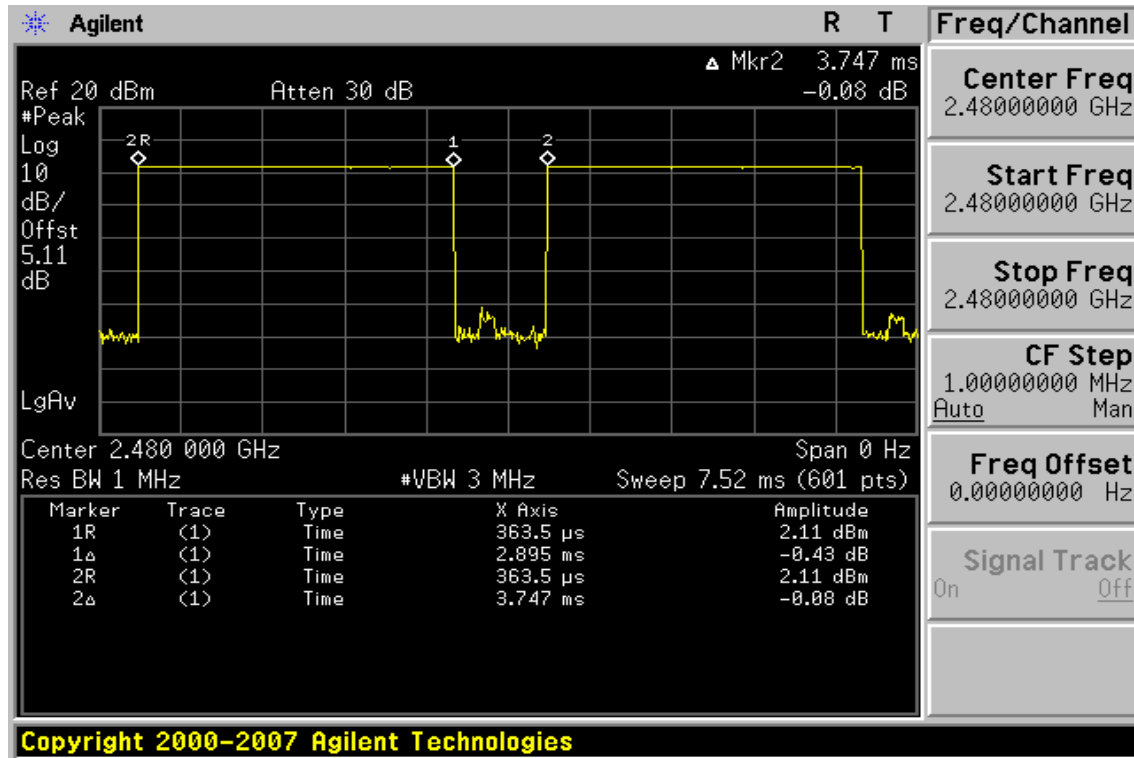
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DH5



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13. 20dB Bandwidth & 99% Bandwidth

13.1. Standard Applicable:

For 20 dB Bandwidth

According to §15.247 (a)(1) and RSS210 A8.1(b), for frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

For 99% Bandwidth

RSS-Gen §4.6.1, the transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

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 the spectrum analyzer as RBW=10KHz (1 % of Bandwidth.), Span= 3MHz, Sweep=auto for 20dB Bandwidth test.
4. Mark the peak frequency and -20dB (upper and lower) frequency and Turn on the 99% bandwidth function, max reading..
5. Repeat above procedure for 99% Bandwidth, but set RBW to 1% of the span, and detector = peak.
6. Repeat above procedures until all frequency measured were complete.

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13.5. Measurement Result:**20dB Bandwidth:****BR mode (GFSK):**

CH	Bandwidth (kHz)
Lower	922.179
Mid	922.570
Higher	922.201

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

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.289	0.859
Mid	1.287	0.858
Higher	1.280	0.853

EDR mode (8DPSK):

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.283	0.855
Mid	1.287	0.858
Higher	1.284	0.856

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**99% Bandwidth:
BR mode (GFSK):**

CH	99% Bandwidth (KHz)
Lower	878.1223
Mid	881.2689
Higher	876.0927

EDR mode (π /4DQPSK):

CH	99% Bandwidth (MHz)
Lower	1.2023
Mid	1.2026
Higher	1.1969

EDR mode (8DPSK):

CH	99% Bandwidth (MHz)
Lower	1.2058
Mid	1.2090
Higher	1.2058

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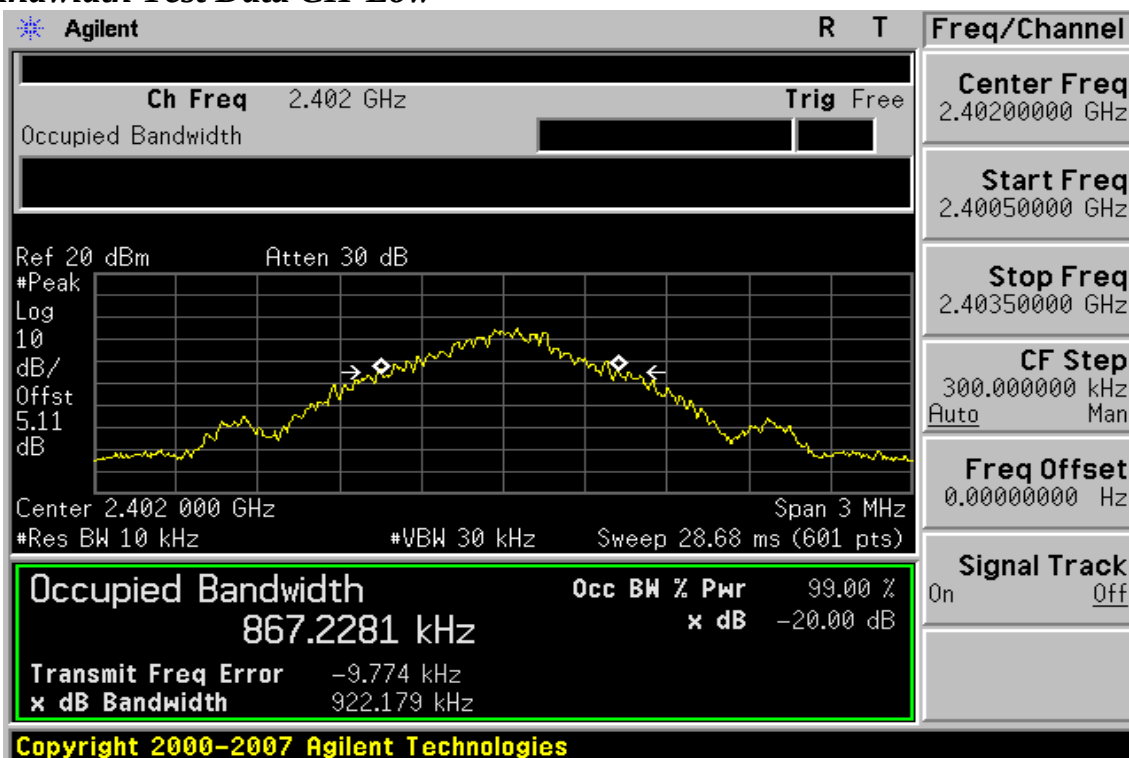
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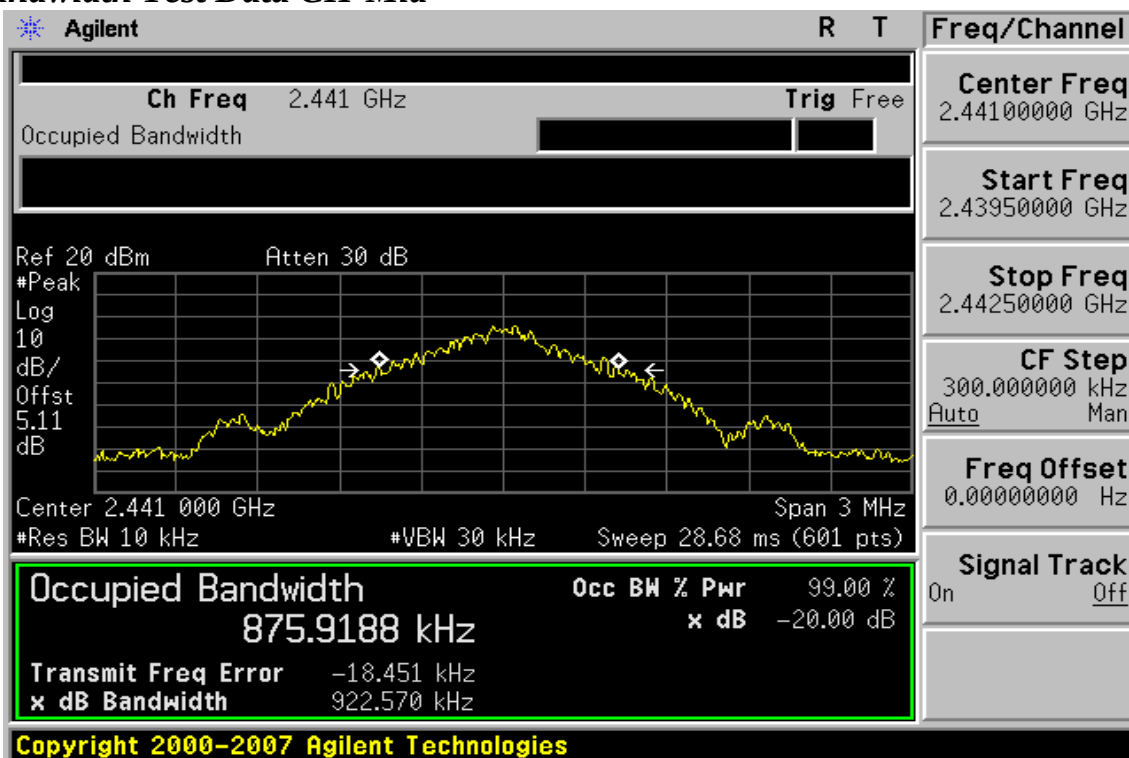
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BR Mode (GFSK) 20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid



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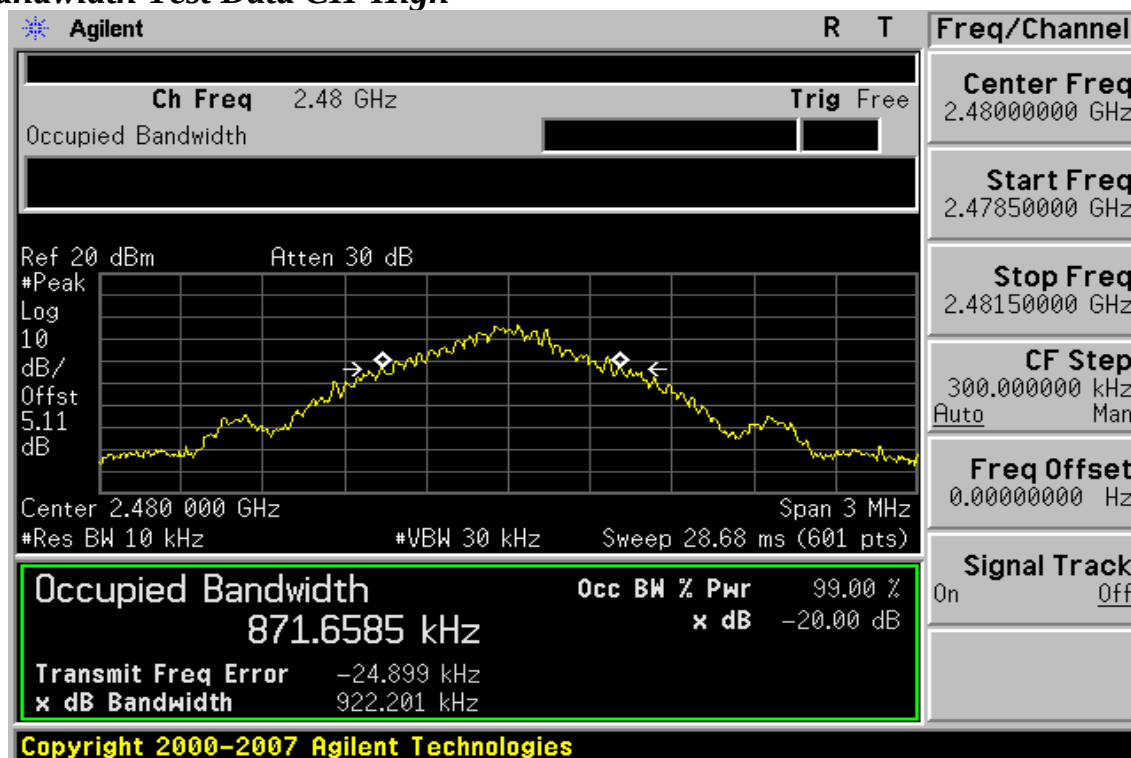
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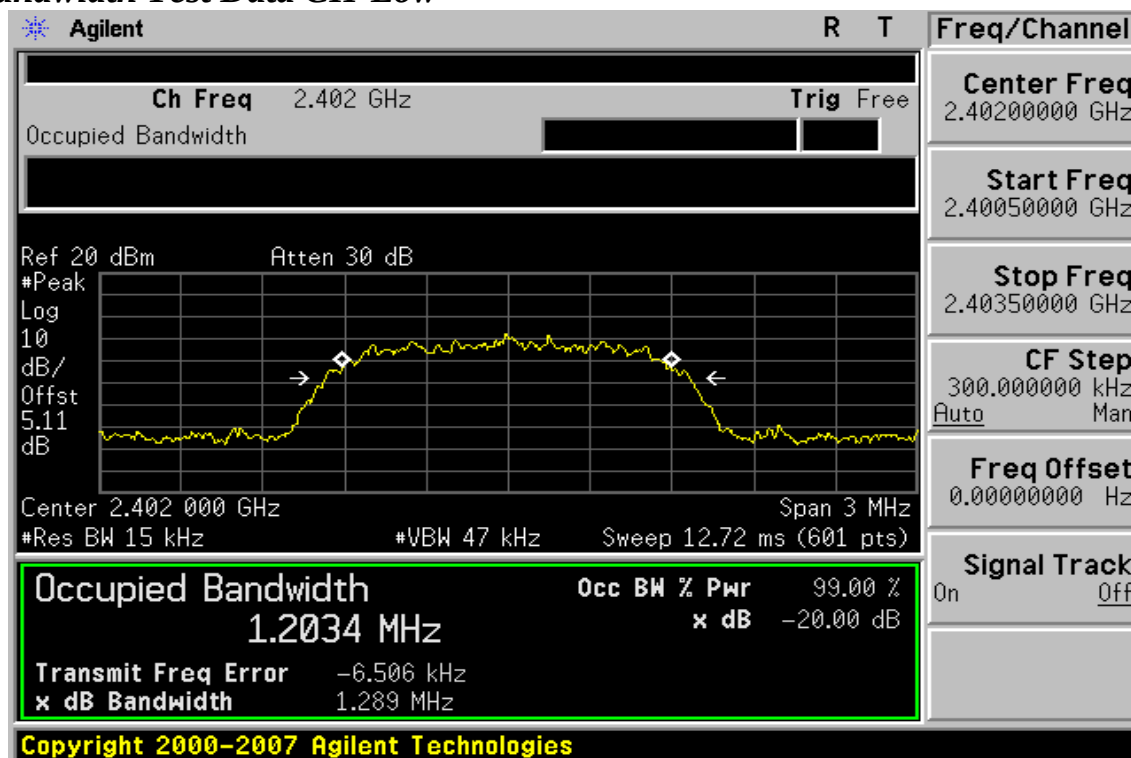
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20dB Bandwidth Test Data CH-High



EDR Mode ($\pi/4$ DQPSK)

20dB Bandwidth Test Data CH-Low



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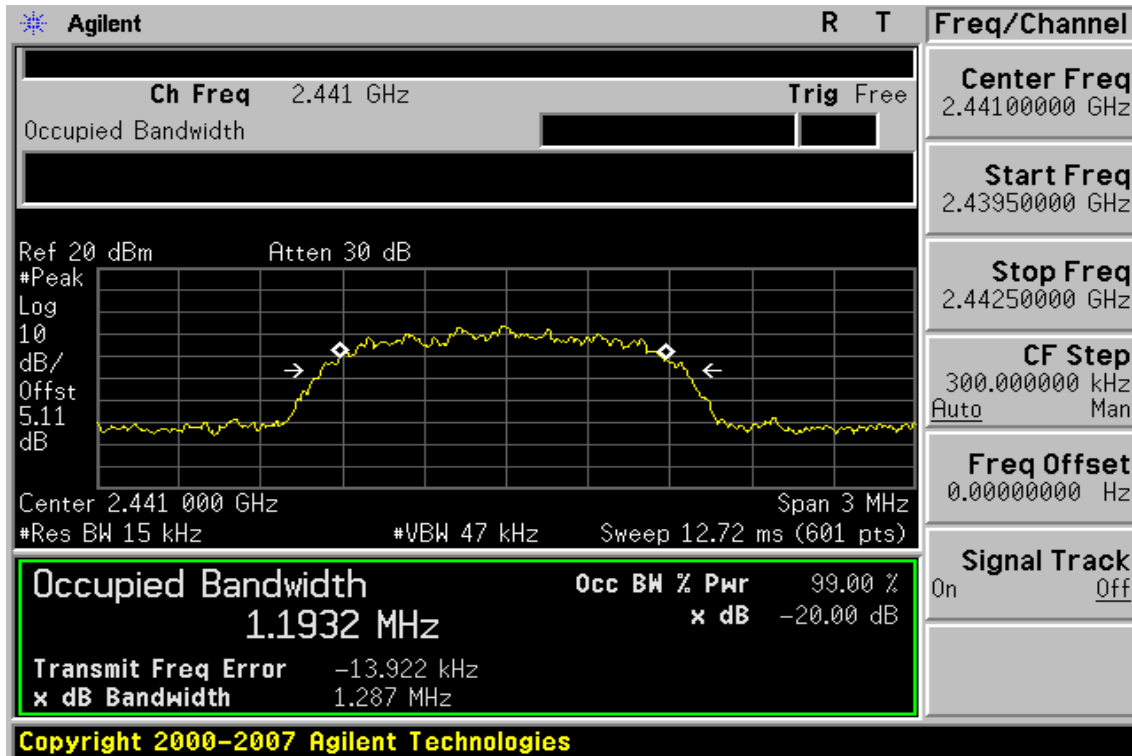
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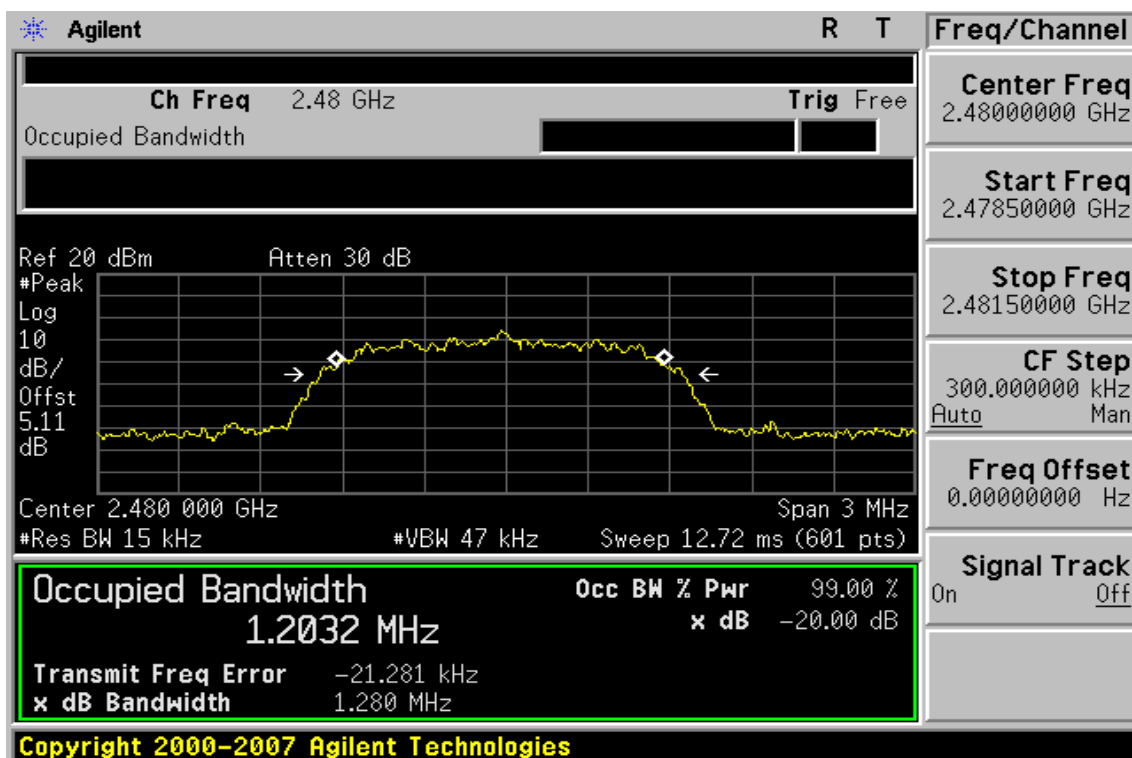
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20dB Bandwidth Test Data CH-Mid



20dB Bandwidth Test Data CH-High



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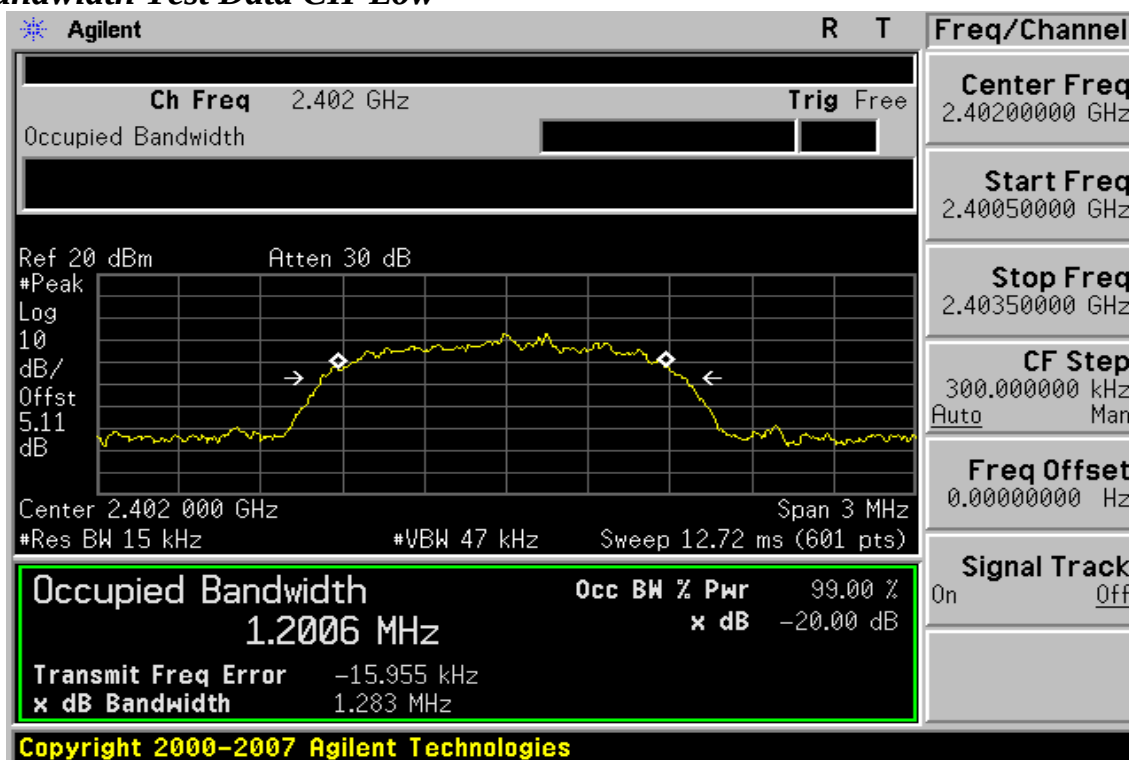
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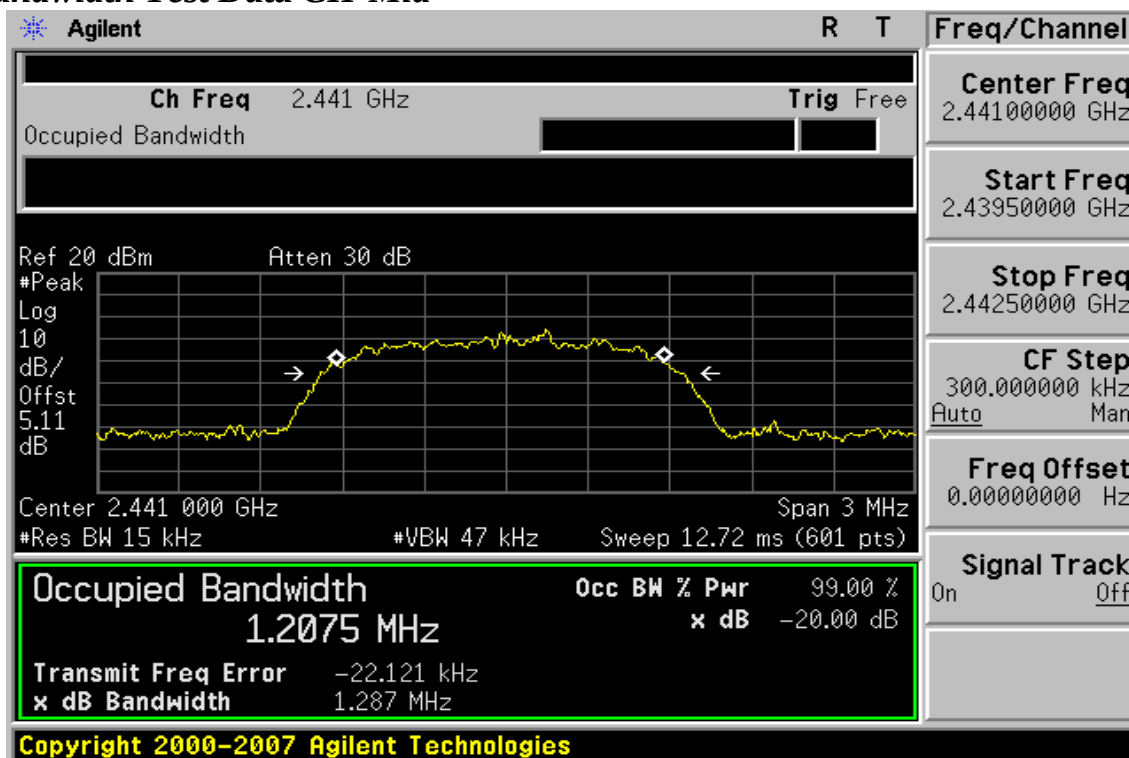
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EDR Mode (8DPSK)

20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid



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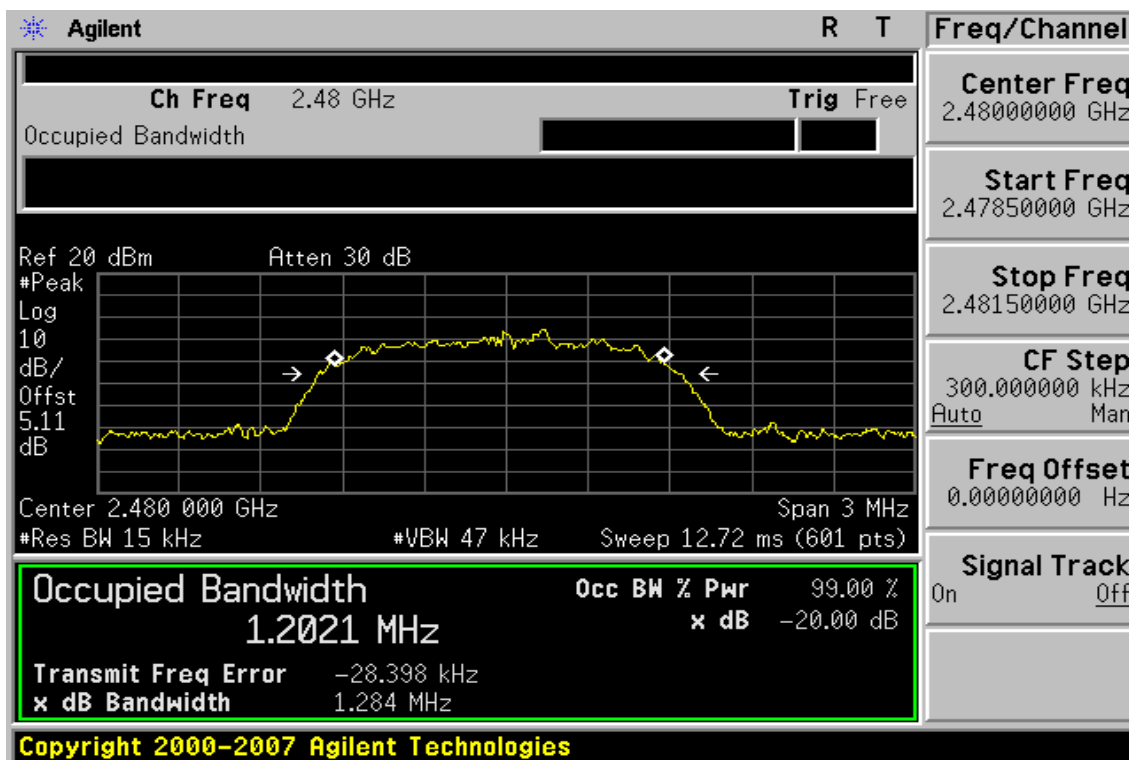
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20dB Bandwidth Test Data CH-High



BR Mode (GFSK)

99% Band Width Test Data CH-Low



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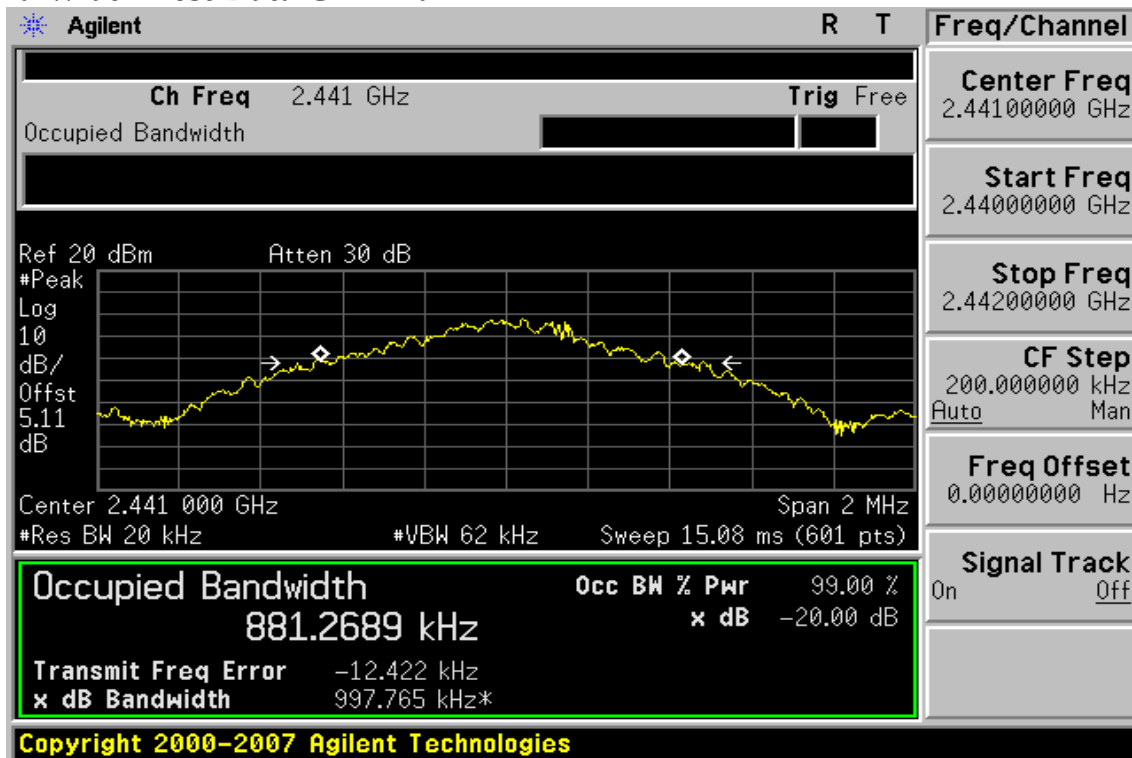
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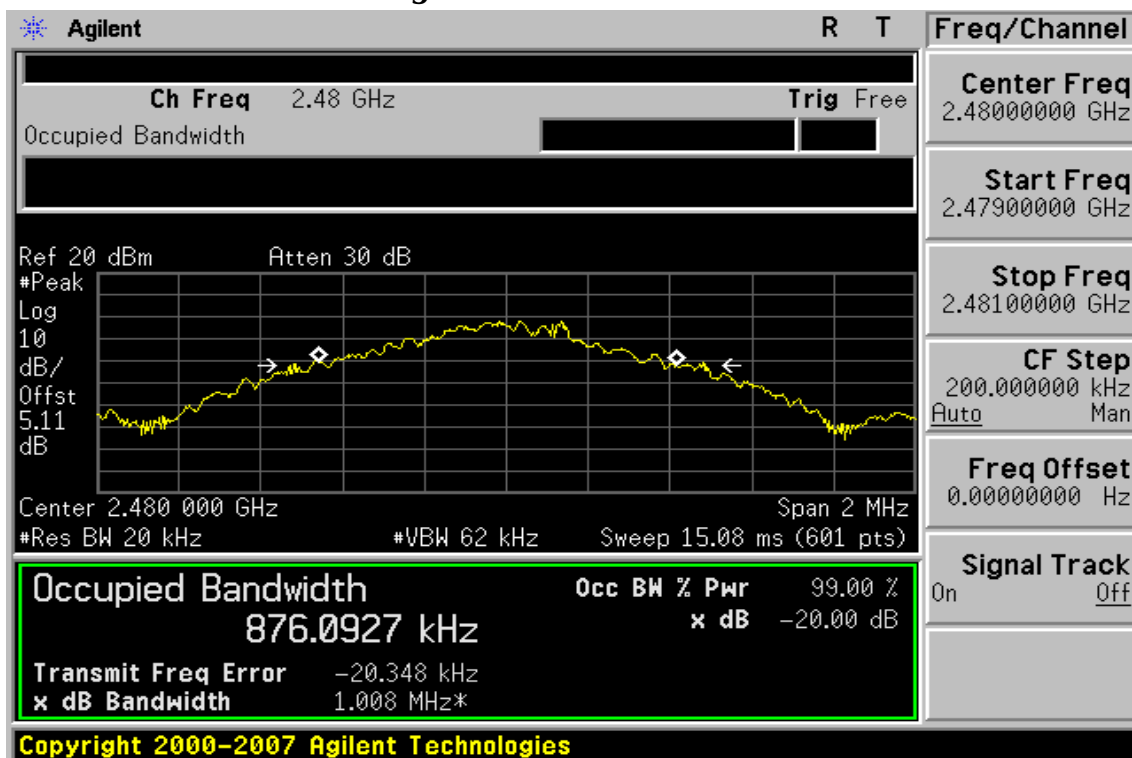
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99% Band Width Test Data CH-Mid



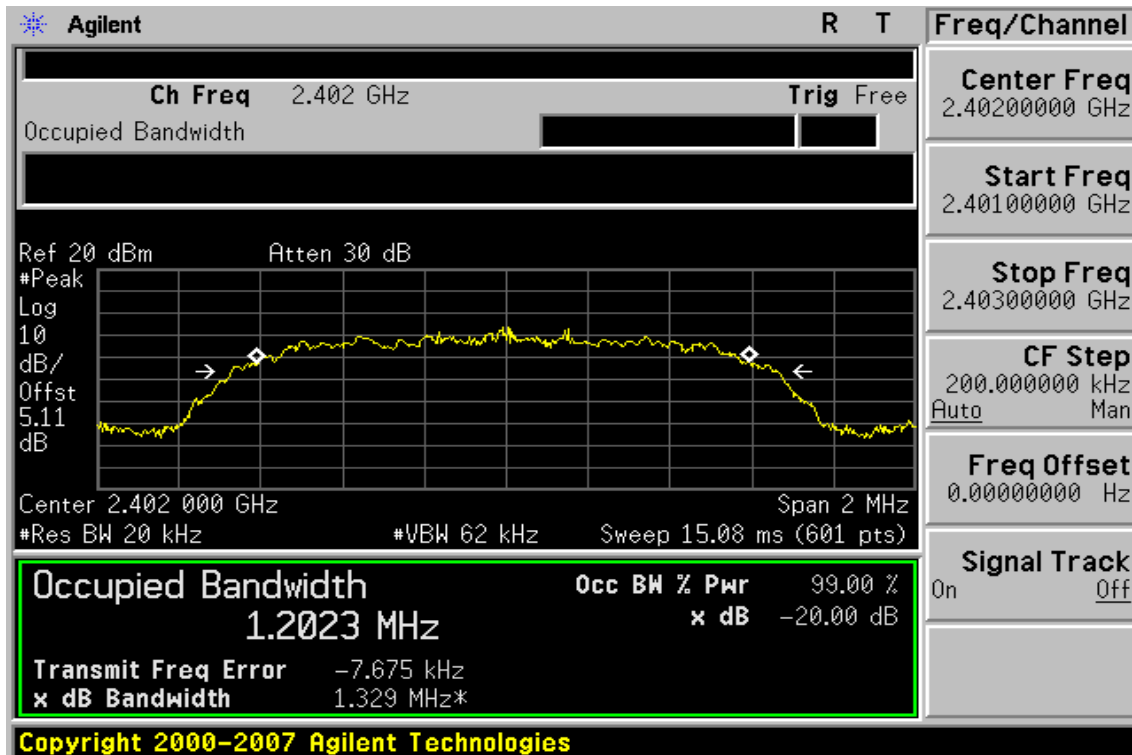
99% Band Width Test Data CH-High



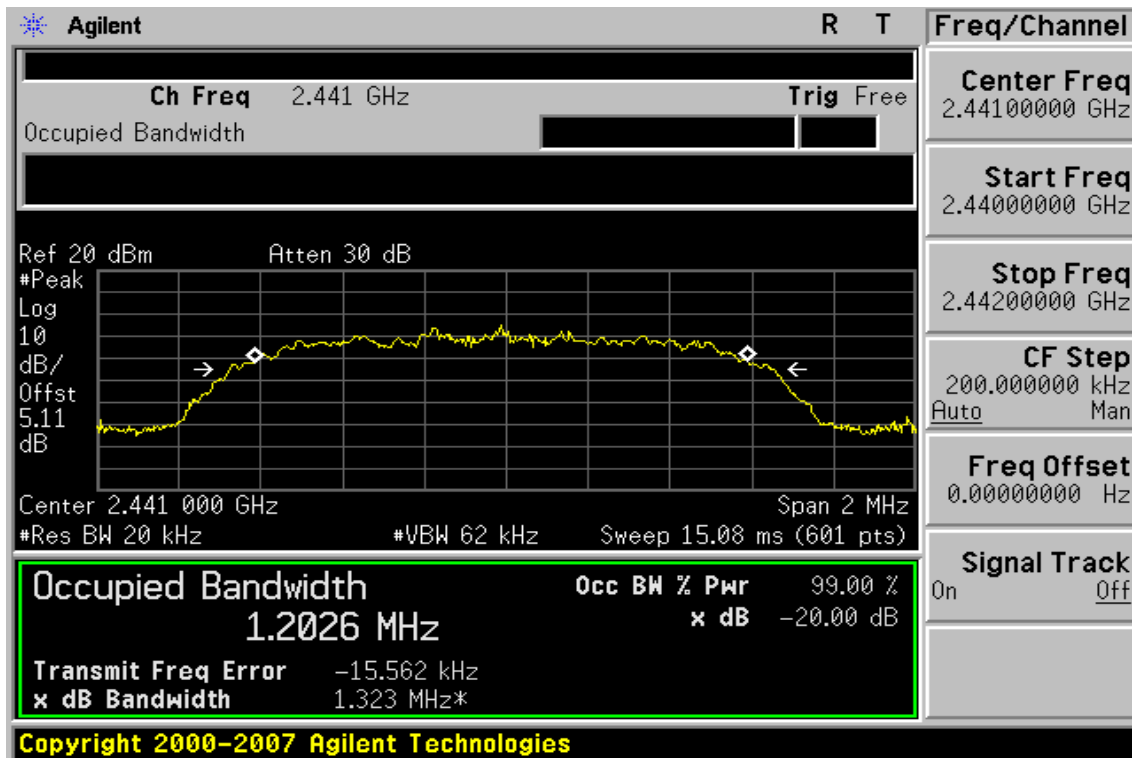
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EDR Mode ($\pi/4$ DQPSK)
99% Band Width Test Data CH-Low



99% Band Width Test Data CH-Mid



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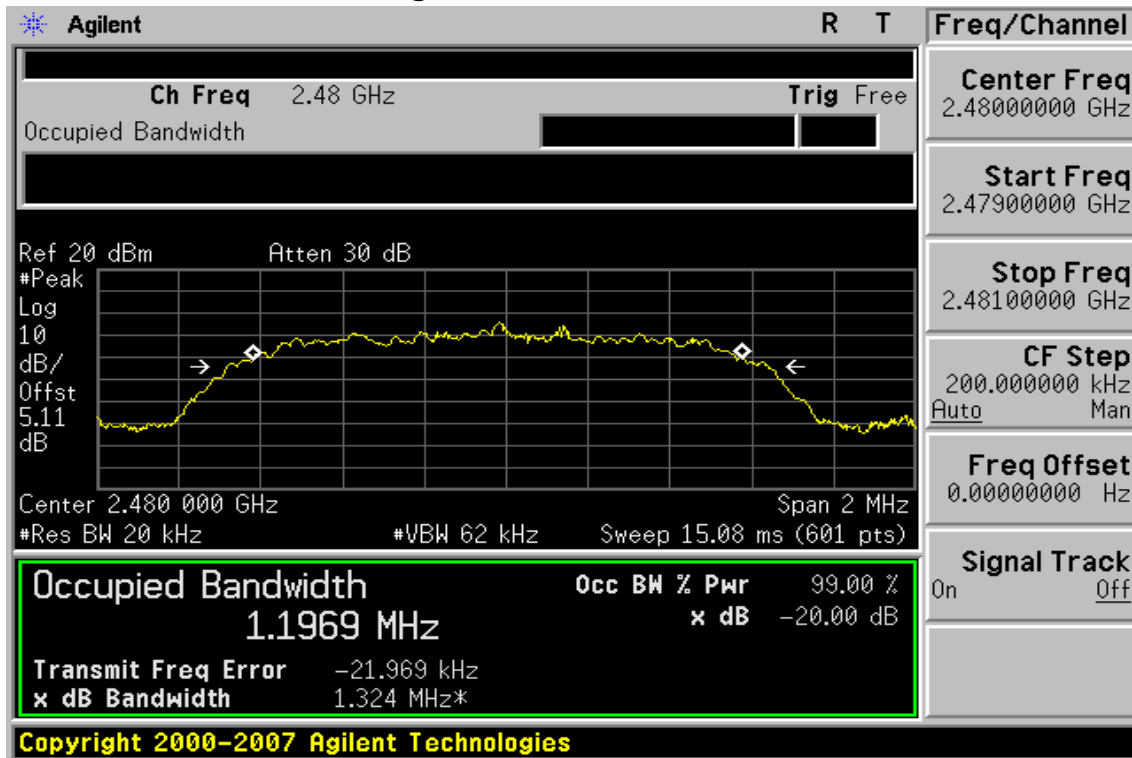
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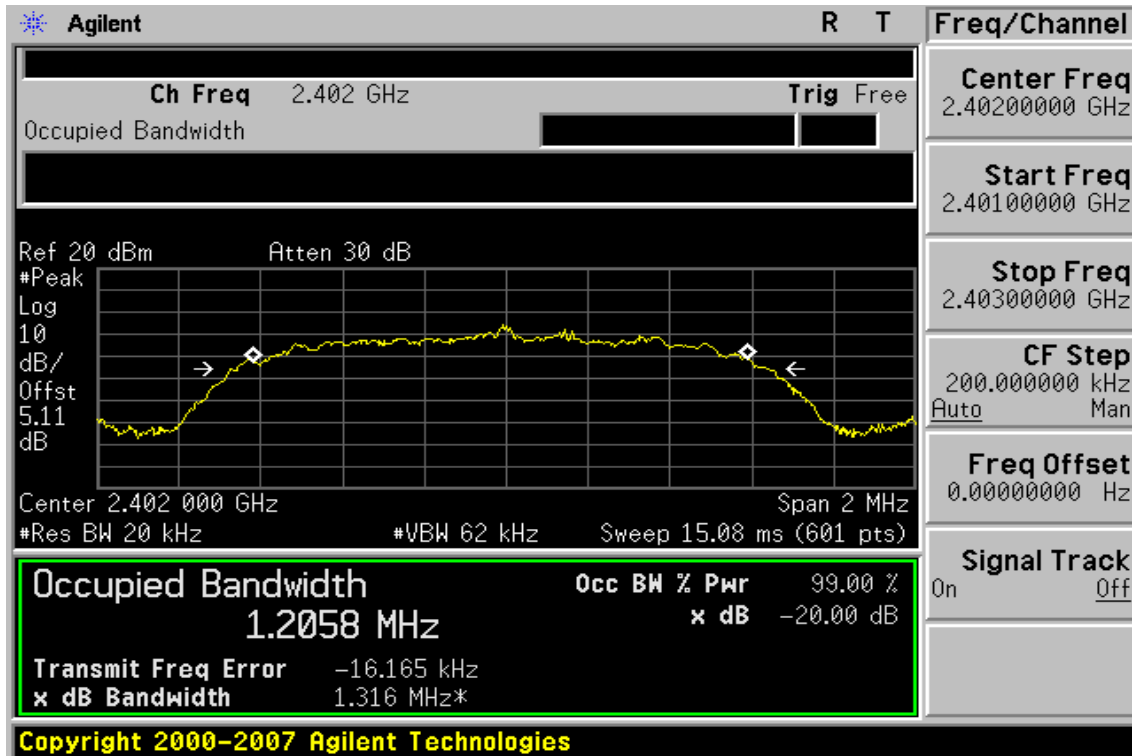
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99% Band Width Test Data CH-High



EDR Mode (8DPSK)

99% Band Width Test Data CH-Low



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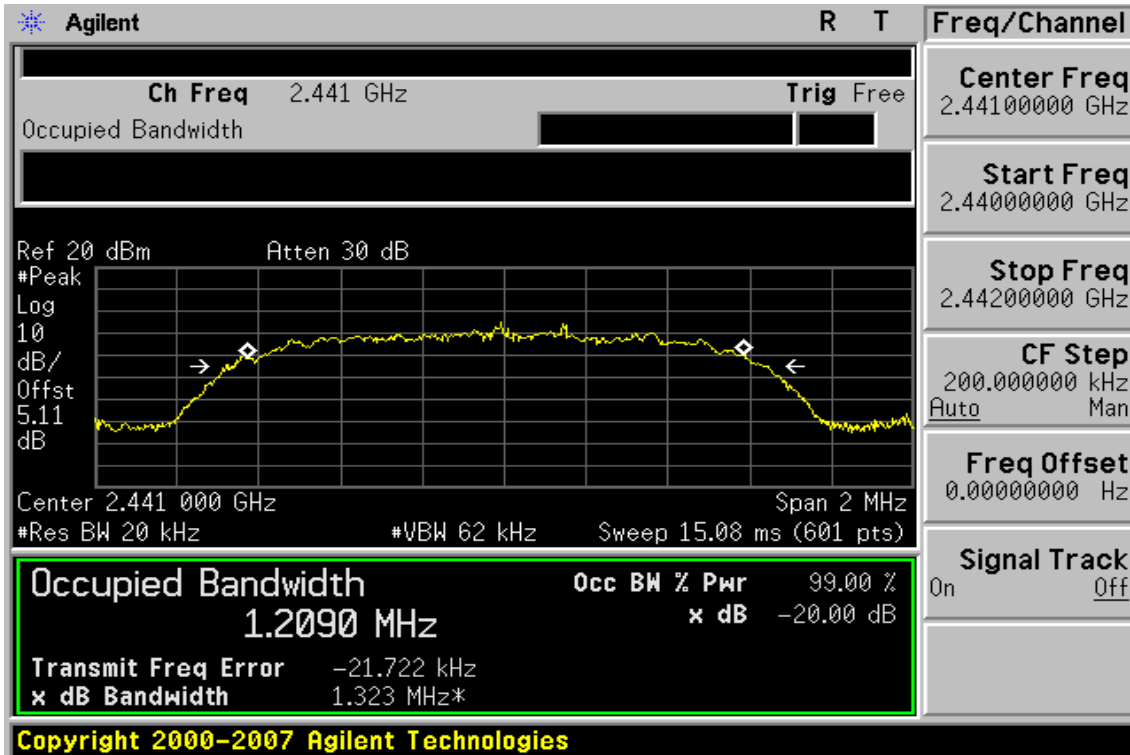
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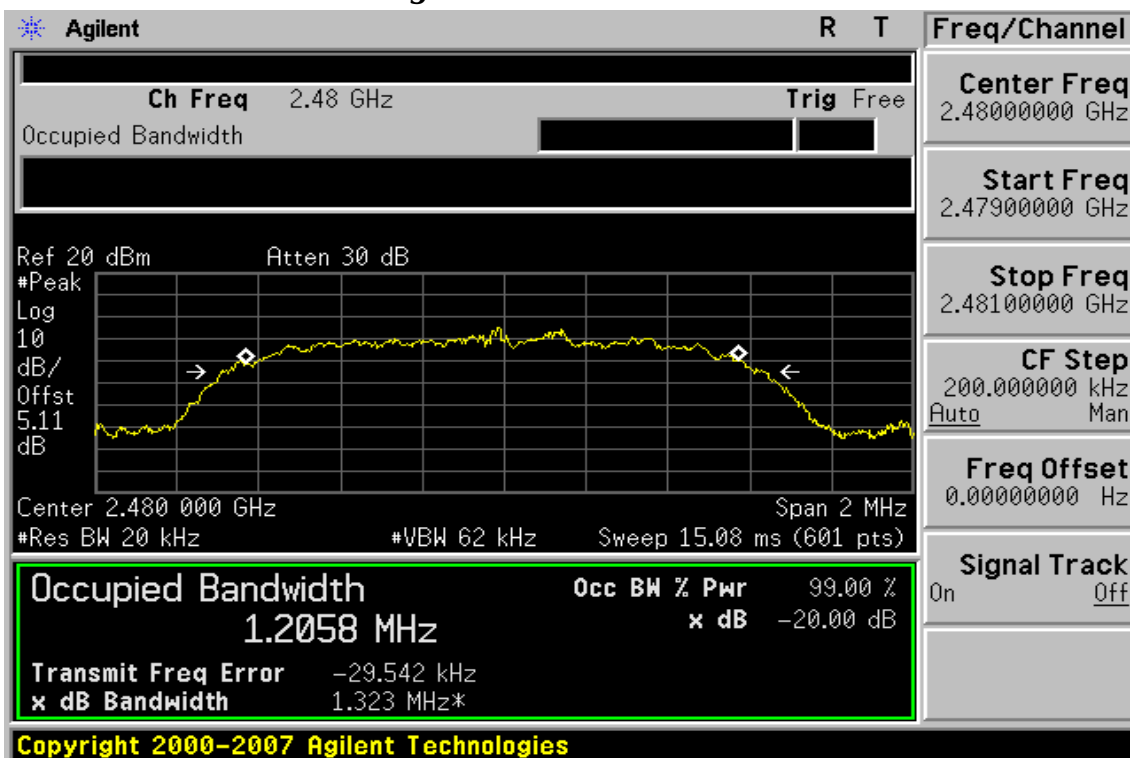
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99% Band Width Test Data CH-Mid



99% Band Width Test Data CH-High



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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.

According to RSS-GEN 7.1.2, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

14.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is -1.37 dBi, and the antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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