ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name:	**Smart Phone**
Brand Name:	**SHARP**
Model No.:	**HR00204**
Model Difference:	**N/A**
FCC ID:	**APYHRO00204**
Report No.:	**ER/2014/50114**
Issue Date:	**Jun. 27, 2014**
FCC Rule Part:	**§15.247, Cat: DSS**
Prepared for:	**SHARP CORPORATION** **22-22, Nagaike-cho, Abeno-ku, CS & Env. Promotion Div. Quality Compliance Dept. Osaka 545-8522, Japan**
Prepared by:	**SGS Taiwan Ltd.** **Electronics & Communication Laboratory** **No.134, Wu Kung Road, New Taipei Industrial Park, Wuku District, New Taipei City, Taiwan 24803**

Testing Laboratory
0513

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VERIFICATION OF COMPLIANCE

Applicant:	SHARP CORPORATION 22-22, Nagaike-cho, Abeno-ku, CS & Env. Promotion Div. Quality Compliance Dept. Osaka 545-8522, Japan
Product Name:	Smart Phone
Brand Name:	SHARP
Model No.:	HR00204
Model Difference:	N/A
File Number:	ER/2014/50114
FCC ID:	APYHRO00204
Date of test:	Jun. 05, 2014 ~ Jun. 25, 2014
Date of EUT Received:	Jun. 05, 2014

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory 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 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:	Marcus Tseng	***Date:***	Jun. 27, 2014
	Marcus Tseng / Engineer		
Prepared By:	Tiffany Kao	***Date:***	Jun. 27, 2014
	Tiffany Kao / Clerk		
Approved By:	Jim Chang	***Date:***	Jun. 27, 2014
	Jim Chang / Supervisor		

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Version

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1. GENERAL INFORMATION

1.1. Product description

General:

Product Name:	Smart Phone	
Brand Name:	SHARP	
Model No.:	HR00204	
Model difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Data Cable (USB):	Model: QCNWGA044AFZZ, Supplier: LUXSAHRE	
Power Supply:	3.8Vdc Rechargeable Li-ion Battery or 5Vdc from AC/DC Adapter	
	Battery:	Model: UBATIA246AFN1, Supplier: SONY
	Adapter:	Model No.: XN-2QC25, Supplier: Salom

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Bluetooth:

Bluetooth Version:	☒ V4.0 (dual mode)
Frequency Range:	2402 – 2480MHz
Channel number:	79 channels max.
Rated Power:	6.29 dBm (Peak)
Modulation type:	GFSK + π/4DQPSK + 8DPSK
Dwell Time:	<=0.4s
Antenna Designation:	Integrated Antenna, -2.5dBi

The EUT is compliance with Bluetooth V4.0 (dual mode) standard.

This test 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: APYHRO00204** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (digital device) is compliance with FCC part 15; Subpart B is authorized under the DoC procedure.

1.3. Test Methodology

Both conducted and radiated testing was 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 – 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. Electronics & Communication Laboratory No.134, Wu Kung Road, Wuku Industrial Zone, Taipei County, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2009. FCC Registration Number is: 990257. Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No.2, Keji 1st Rd., Guishan Township, Taoyuan County, Taiwan, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 455997.

1.5. Special Accessories

There is no special accessory used while test was conducted.

1.6. Equipment Modifications

There was no modification incorporated into the EUT.

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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 general criterion in Section 7.1 of ANSI C63.4:2009.Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz, and the measurement procedure 7.3 in ANSI 63.4:2009 is followed to carry out the test. The CISPR Quasi-Peak and Average detector mode is employed according to §15.107

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 of ANSI C63.4:2009 and DA 00-705.

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2.4. Configuration of Tested System

Fig. 2-1 Conducted (Antenna Port) Configuration

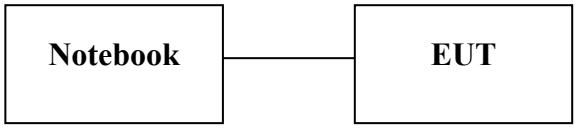

Fig. 2-2 Radiated Emission (Antenna Port) Configuration

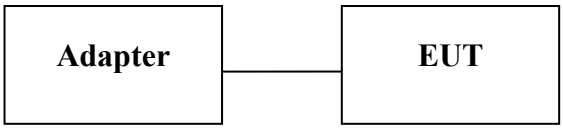

Fig. 2-2 AC Power Line Conducted Emission

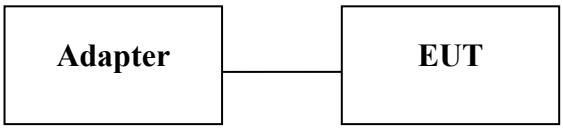

Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	Notebook	Lenovo	L420	LR-7HXZA	shielded	unshielded
2.	Bluetooth Test Set	N/A	N/A	N/A	N/A	N/A

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	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,	Antenna Requirement	Compliant

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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.

Channel Low: channel 1 at 2402MHz
Channel Mid: channel 39 at 2441MHz
Channel High: channel 78 at 2480MHz

In comparison with BR and EDR mode, emission carried out by EDR is chosen as the most representative measurement to perform measurement of radiated spurious emission pursuant to Part 15C.Modulation, EDR, is selected to be performed for 100 kHz Bandwidth Band Edge, Conducted Spurious Emission, Frequency Separation, Number of hopping frequency due to its characteristics of wider bandwidth.

Data type being used to conduct the measurement:
DH1/DH3/DH5 (GFSK) with 1Mbps
2DH1/2DH3/2DH5 (Π/4 DQPSK) with 2Mbps
3DH1/3DH3/3DH5 (8DPSK) with 3Mbps

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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	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 dB
Frequency Separation	+/- 123.36 Hz
Number of hopping frequency	+/- 123.36 Hz
Time of Occupancy	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC= +/- 0.2%

Radiated Spurious Emission:

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

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

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

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6. CONDUCTED EMISSION TEST

6.1. Standard Applicable

According to §15.207, frequency within 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	100760	05/26/2014	05/25/2015
LISN	Rolf-Heine	NNB-2/16Z	99012	03/26/2014	03/25/2015
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/19/2014	03/18/2015
Coaxial Cables	N/A	WK CE Cable	N/A	11/26/2013	11/25/2014

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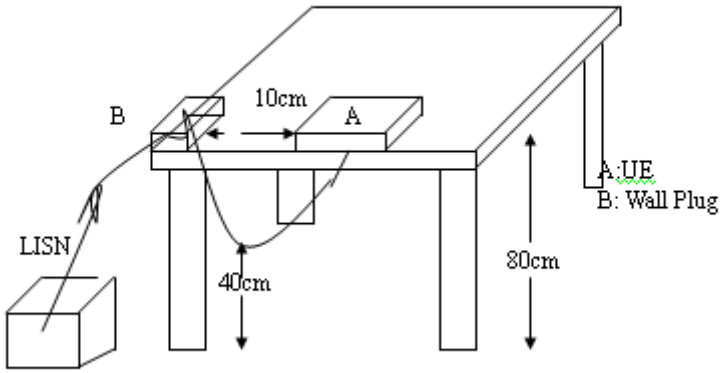
6.3. EUT Setup

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.

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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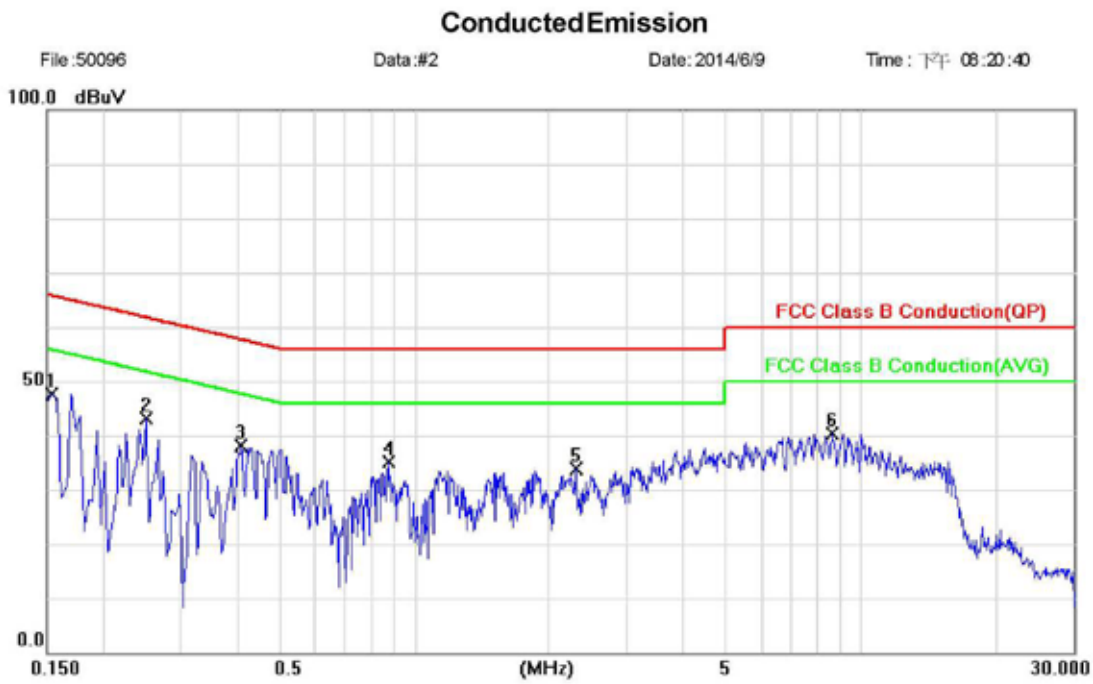
AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Bluetooth Mode			Test Date:	Jun. 09, 2014
Temperature:	26 ℃	Humidity:	60 %	Test By:	Nick

Site ConductionRoom
Limit: FCC Class B Conduction(QP)
Mode: Operation
Note: Adapter:XN2QC25

Phase: L1
Power: AC 120V/60Hz

Temperature: 26 ℃
Humidity: 60%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1540	47.63	0.05	47.68	65.78	-18.10	peak	
2		0.2500	43.02	0.06	43.08	61.76	-18.68	peak	
3		0.4100	38.10	0.07	38.17	57.65	-19.48	peak	
4		0.8740	34.94	0.09	35.03	56.00	-20.97	peak	
5		2.2980	33.63	0.13	33.76	56.00	-22.24	peak	
6		8.6220	39.99	0.29	40.28	60.00	-19.72	peak	

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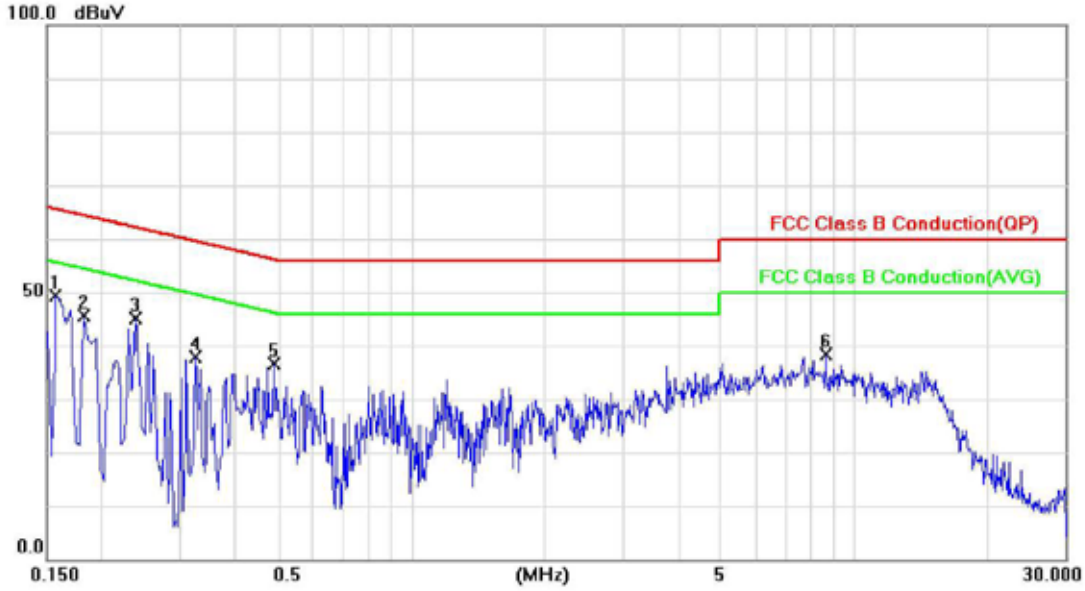
Site	ConductionRoom	Phase:	N	Temperature:	26 ℃
Limit:	FCC Class B Conduction(QP)	Power:	AC 120V/60Hz	Humidity:	60%
Mode:	Operation				
Note:	Adapter:XN2QC25				

Conducted Emission

File :50096 Data :#1 Date: 2014/6/9 Time : 下午 08:19:25



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector	Comment
1	*	0.1580	49.39	0.05	49.44	65.57	-16.13	peak	
2		0.1820	45.59	0.06	45.65	64.39	-18.74	peak	
3		0.2380	45.15	0.06	45.21	62.17	-16.96	peak	
4		0.3260	37.72	0.07	37.79	59.55	-21.76	peak	
5		0.4900	36.46	0.07	36.53	56.17	-19.64	peak	
6		8.6180	38.00	0.29	38.29	60.00	-21.71	peak	

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7. PEAK OUTPUT POWER MEASUREMENT

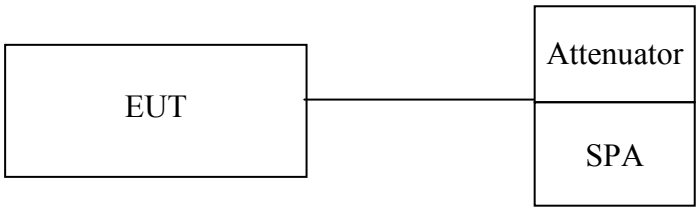
7.1. Standard Applicable

According to §15.247(b)(1), for frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, The Limit: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: The Limit: 0.125 Watts.

7.2. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/19/2014	05/18/2015
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015

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 Hold, Detector = Peak, RBW >=20dB bandwidth)
3. Record the max. reading.
4. Repeat above procedures until all default test channel is completed.

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7.5. Measurement Result

BR mode (GFSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	4.27	0.00267	1
2441.00	6.05	0.00403	1
2480.00	4.70	0.00295	1

EDR mode (π/4DQPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	4.20	0.00263	0.125
2441.00	6.03	0.00401	0.125
2480.00	4.74	0.00298	0.125

EDR mode (8DPSK):

Frequency (MHz)	Reading Power (dBm)	Output Power (W)	Limit (W)
2402.00	4.46	0.00279	0.125
2441.00	**6.29**	0.00426	0.125
2480.00	5.05	0.00320	0.125

**Note: offset 0.5dB*

Note: Refer to next page for plots.

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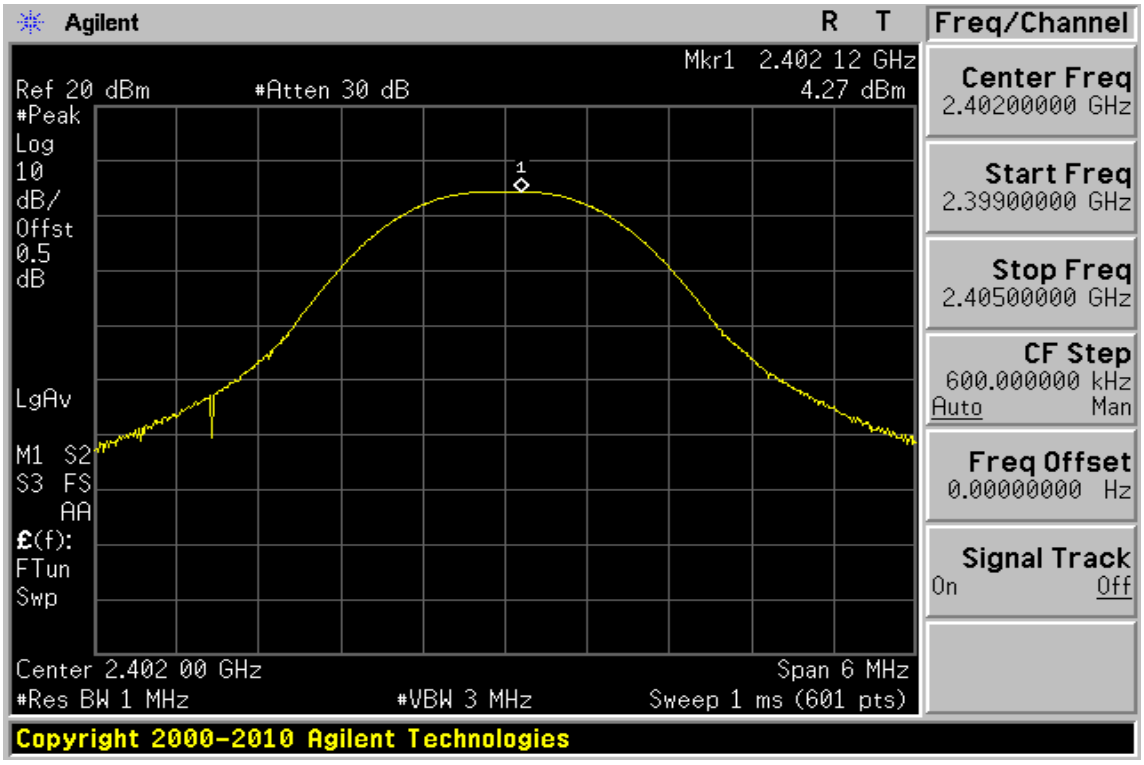
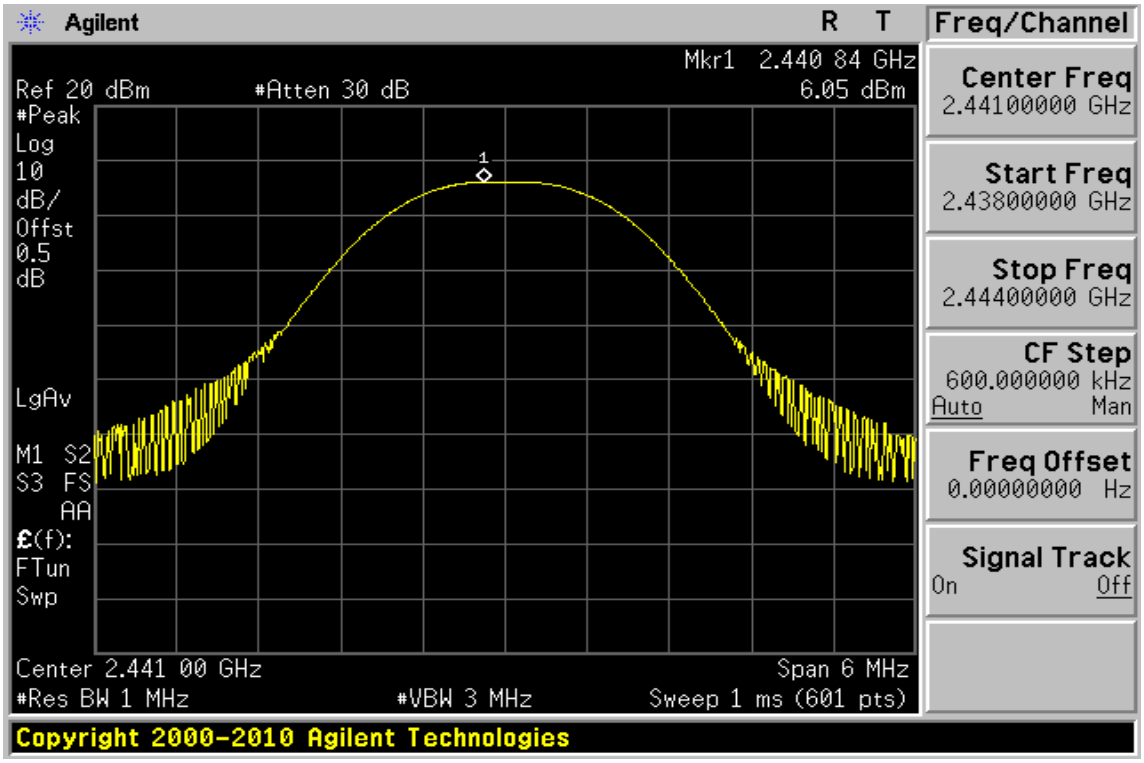
Peak Power Output Data Plot (CH Low) (BR mode GFSK)



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



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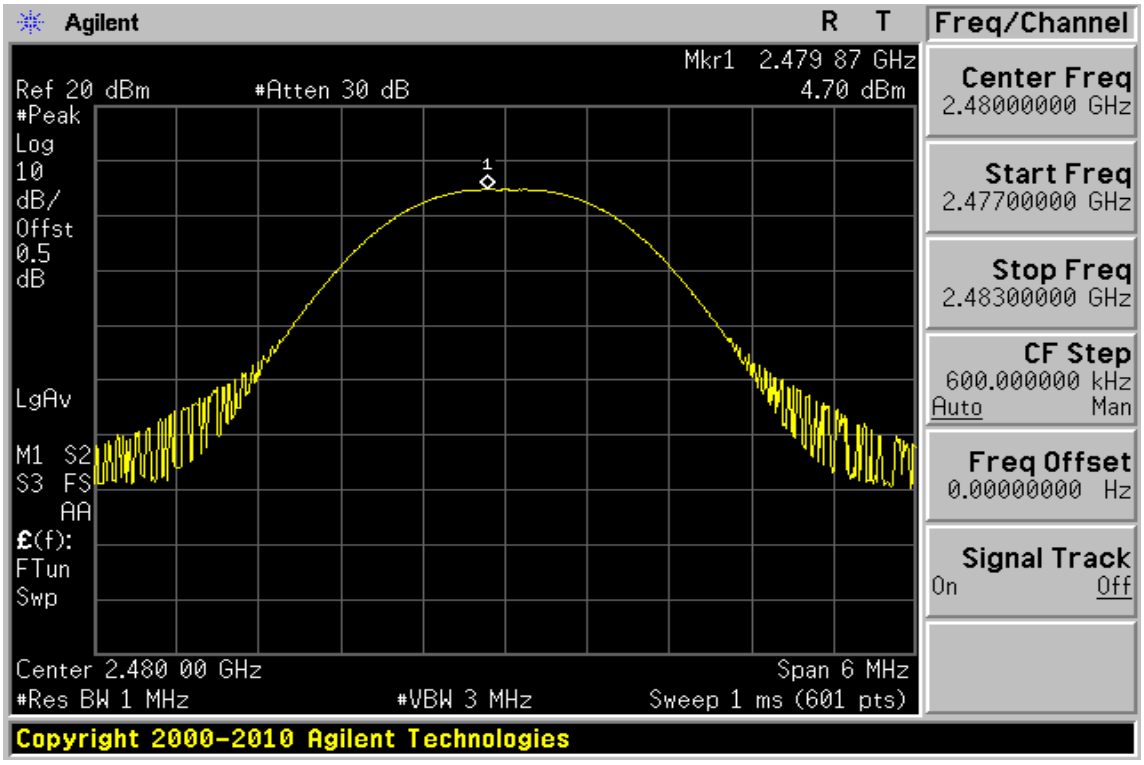
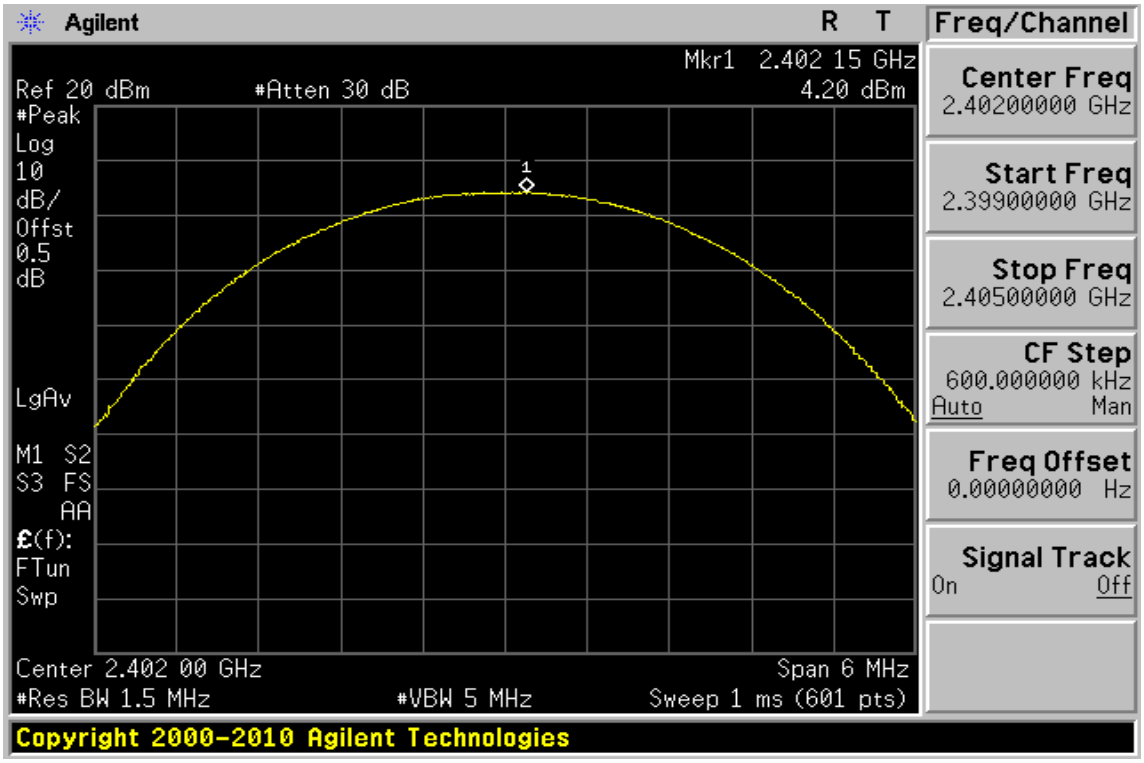
Peak Power Output Data Plot (CH High) (BR mode GFSK)



Peak Power Output Data Plot (CH Low) (EDR mode π/4DQPSK)



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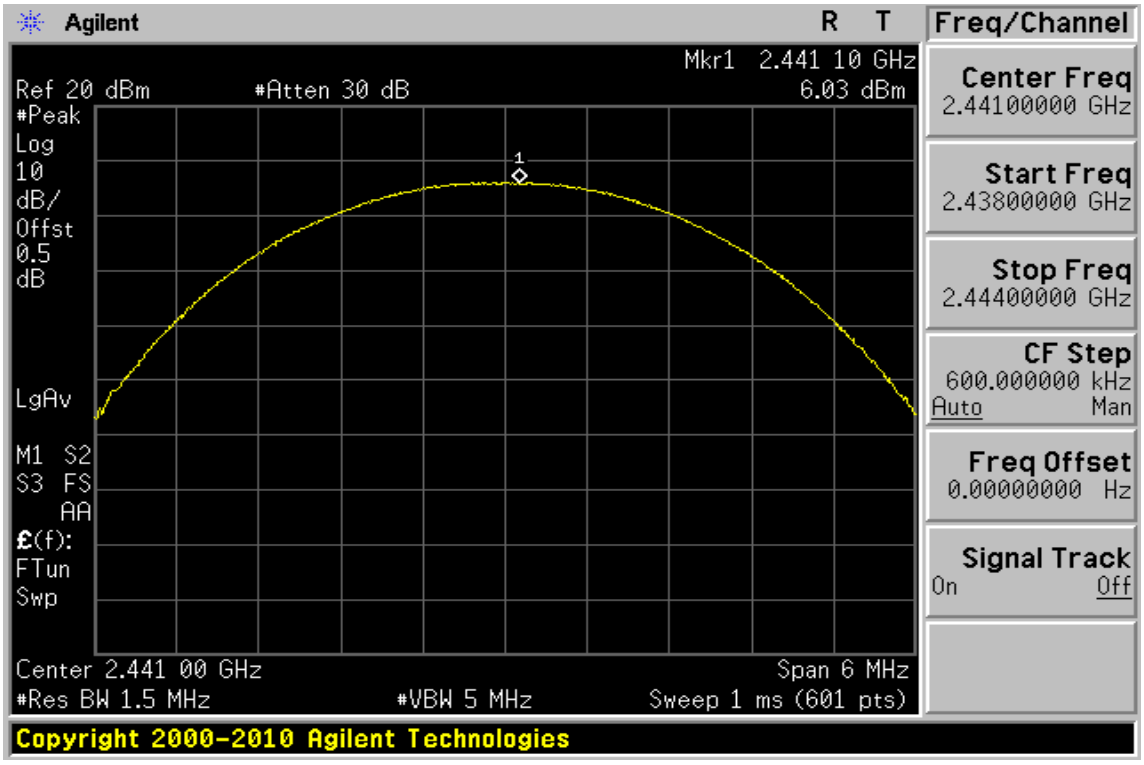
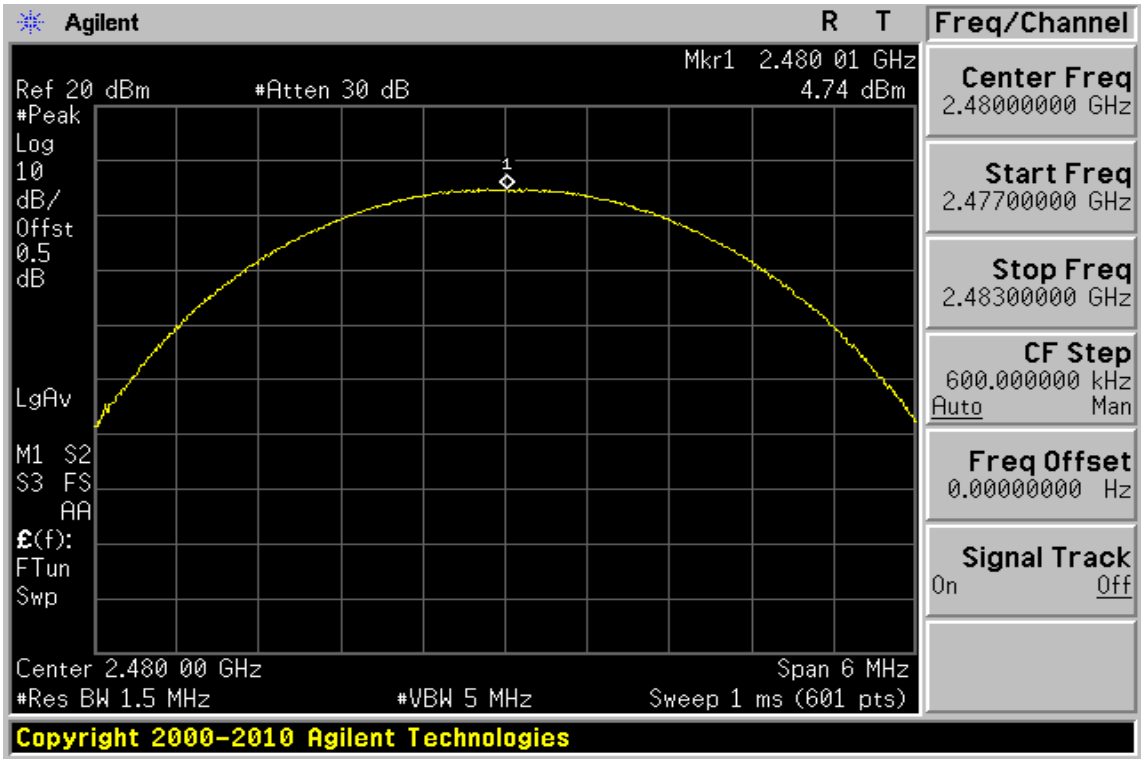
Peak Power Output Data Plot (CH Mid) (EDR mode π/4DQPSK)



Peak Power Output Data Plot (CH High) (EDR mode π/4DQPSK)



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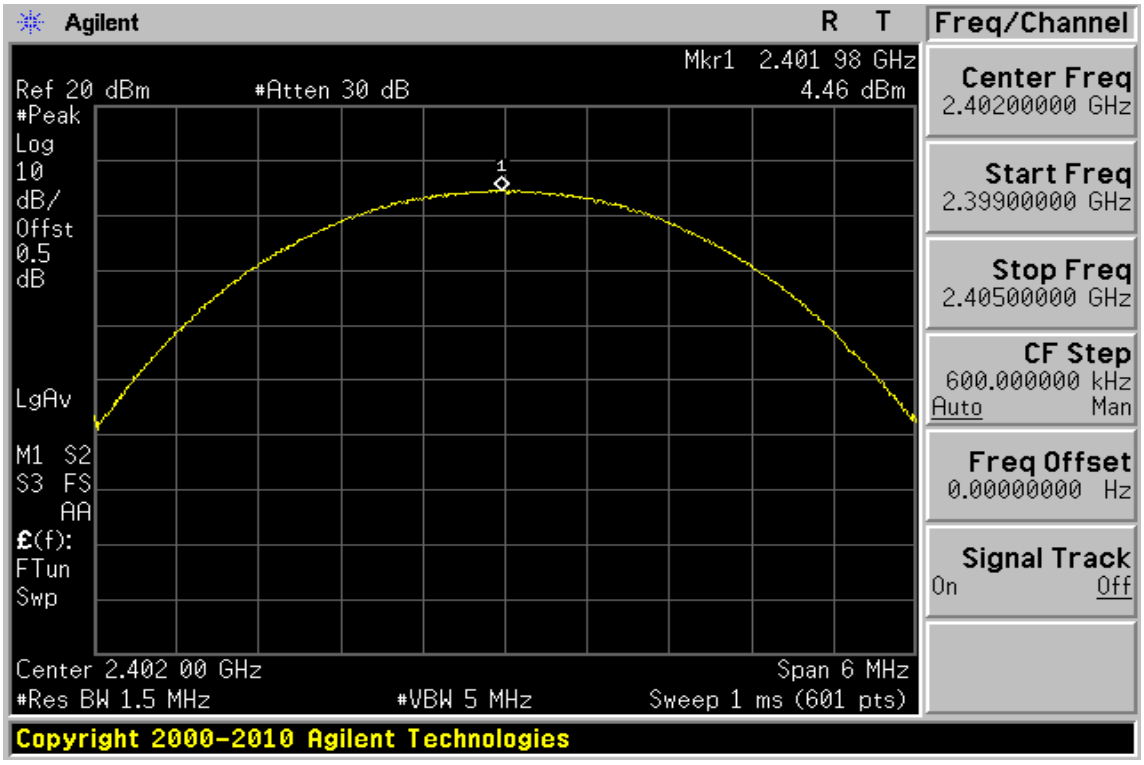
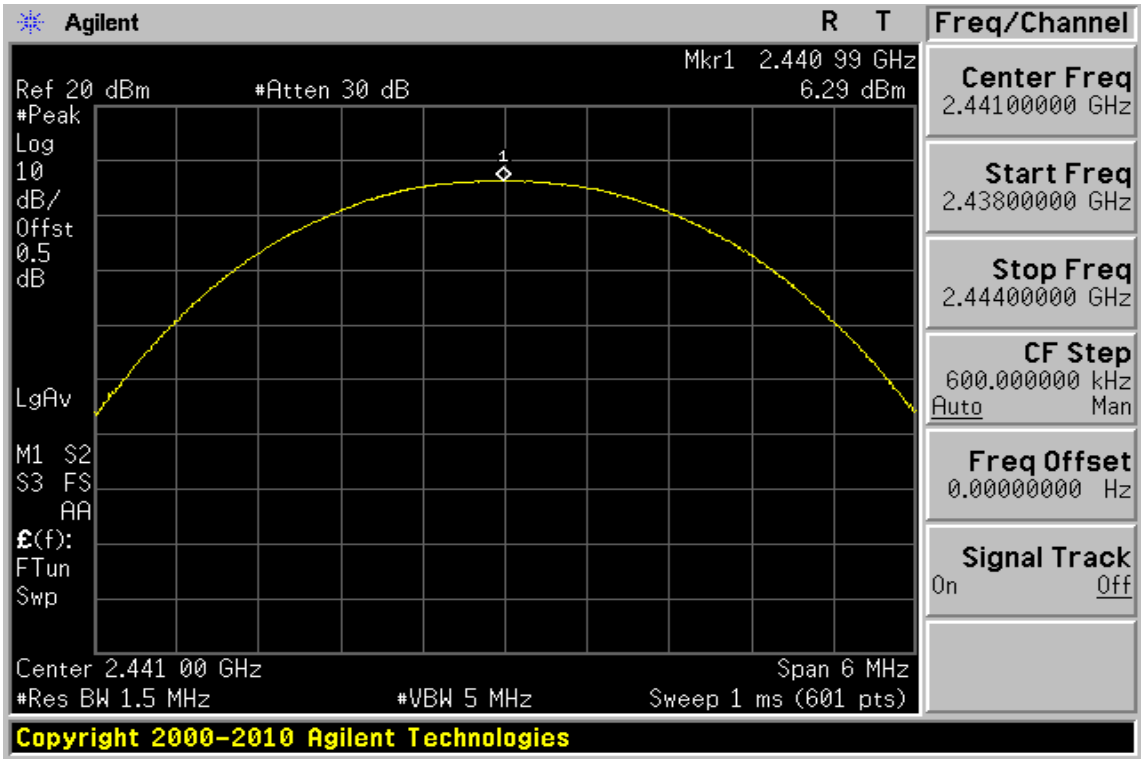
Peak Power Output Data Plot (CH Low) (EDR mode 8DPSK)



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



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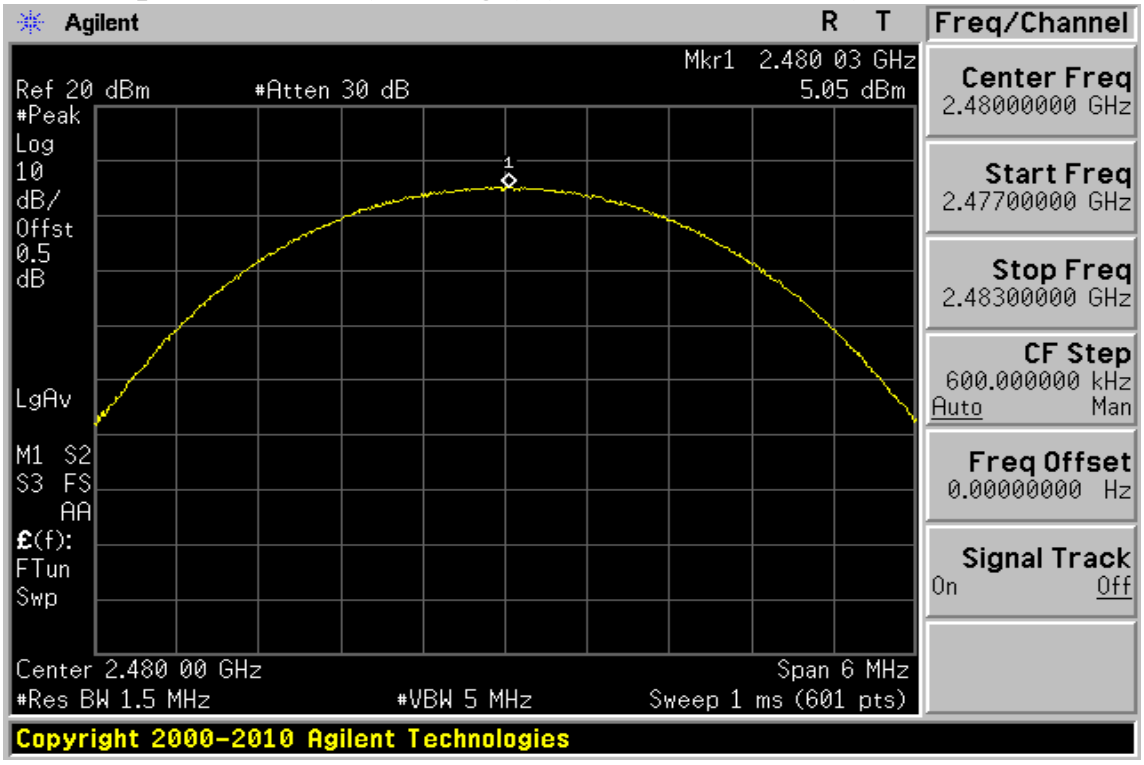
Peak Power Output Data Plot (CH High) (EDR mode 8DPSK)



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8. 20dB BANDWIDTH

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

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/19/2014	05/18/2015
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015

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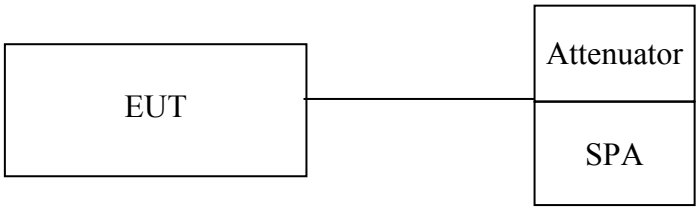
8.3. Test Set-up



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=10 kHz (1 % of 20 dB Bandwidth.), VBW = 30 kHz, Span= 3MHz, Sweep=auto, Detector = Peak, and Max hold 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 test default channel is completed

NOTE: cable loss as 4.2dB that offsets in the spectrum

NOTE2: For the plot of bandwidth measurement, the marker of the 99% bandwidth is diamond-shape while the marker of the 20dB BW is arrow-mark

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8.5. Measurement Result:

20dB Bandwidth : BR mode (GFSK)

CH	Bandwidth (kHz)
Lower	884.182
Mid	883.887
Higher	884.689

20dB Bandwidth : EDR mode (π/4DQPSK)

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.326	0.884
Mid	1.255	0.837
Higher	1.230	0.820

20dB Bandwidth : EDR mode (8DPSK)

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.243	0.829
Mid	1.242	0.828
Higher	1.265	0.843

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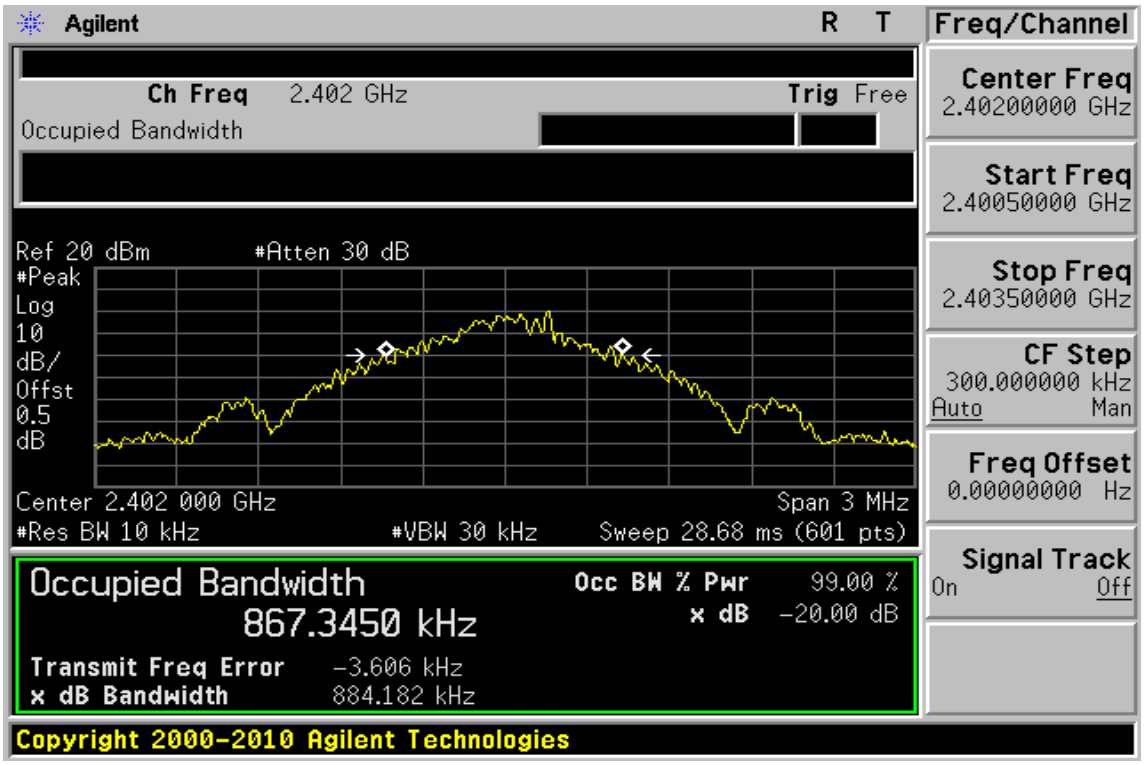
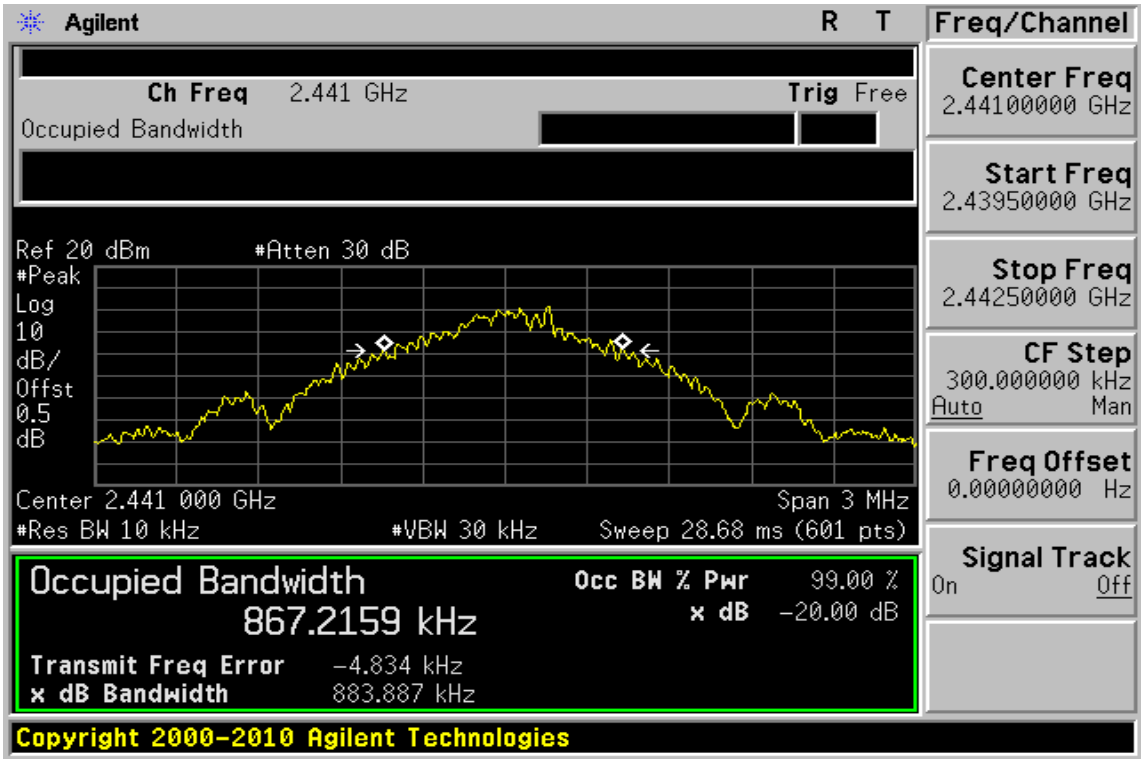
BR Mode (GFSK)

20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid



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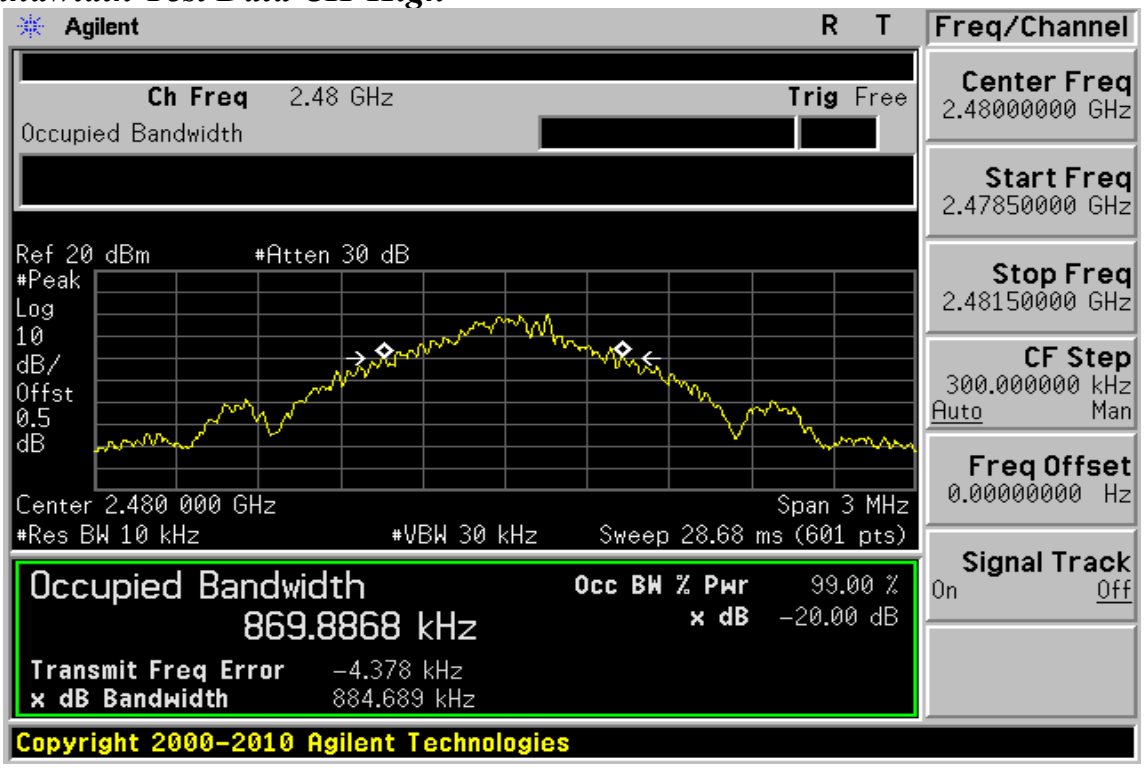
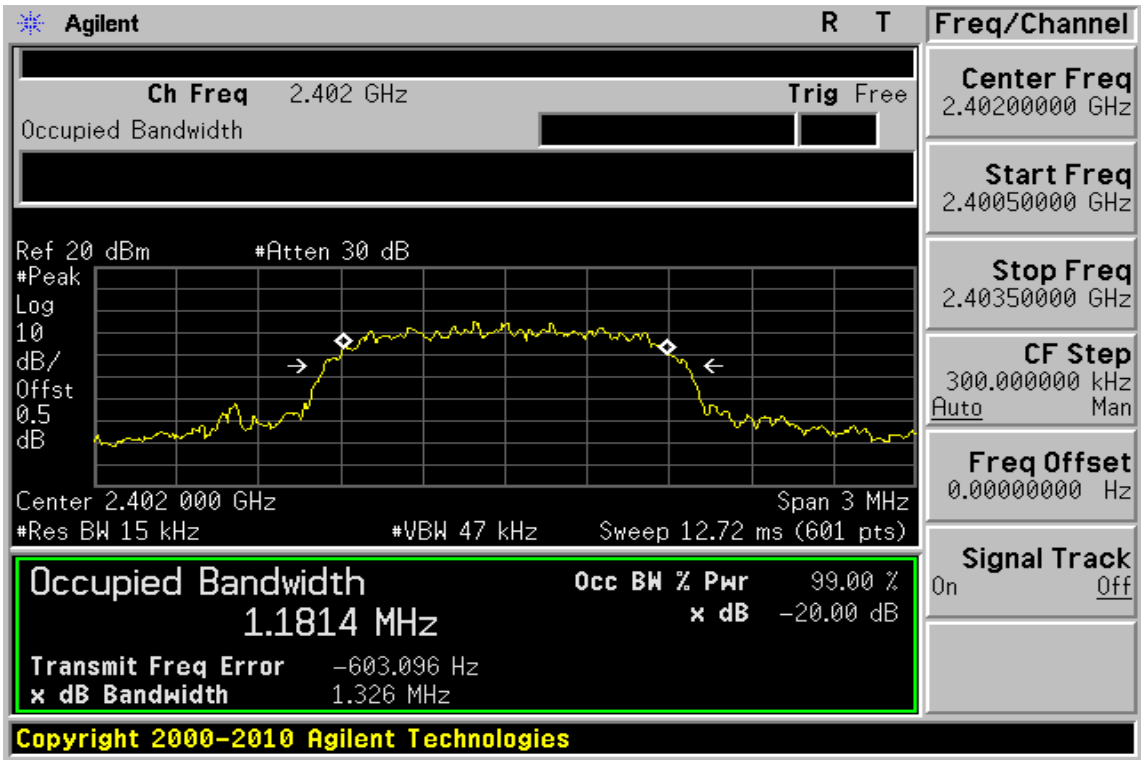
20dB Bandwidth Test Data CH-High



EDR Mode (π/4DQPSK)

20dB Bandwidth Test Data CH-Low



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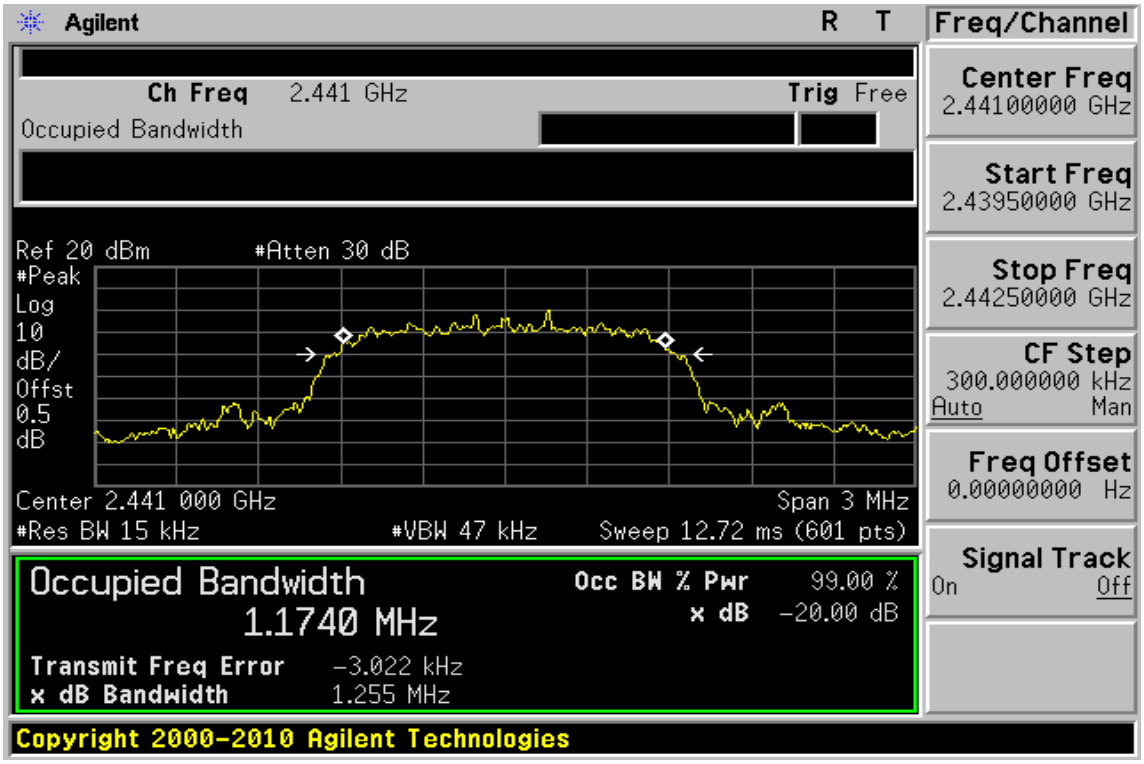
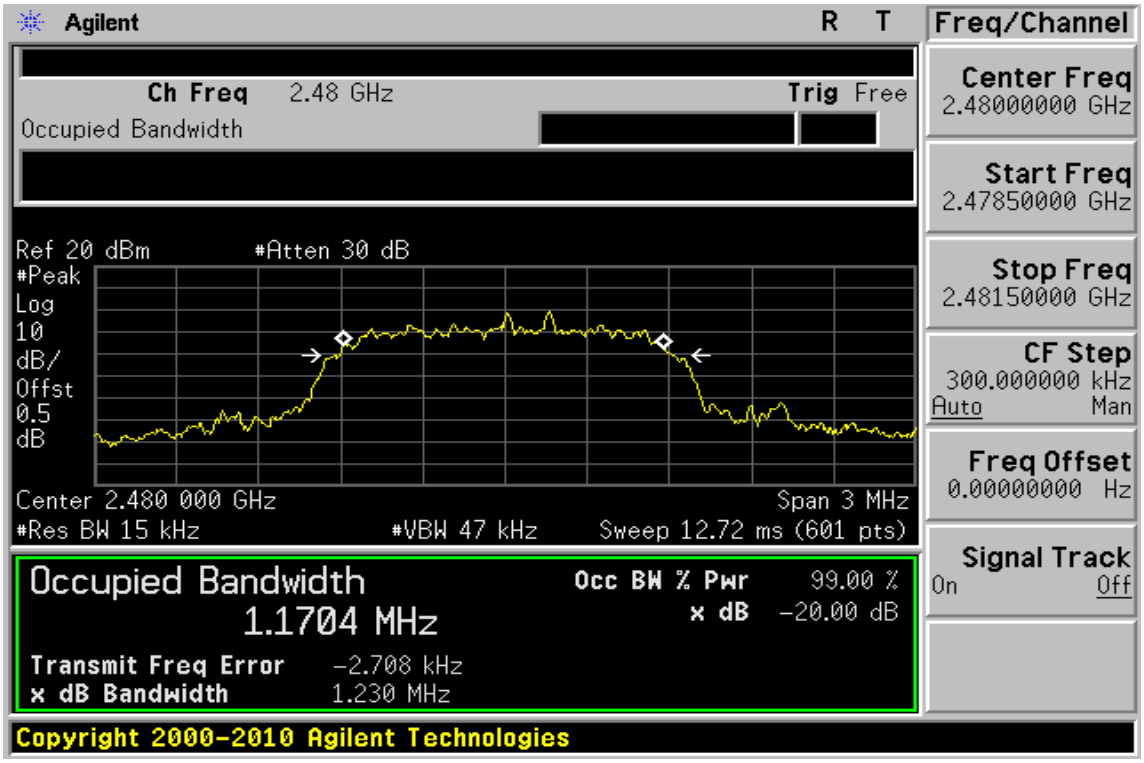
20dB Bandwidth Test Data CH-Mid



20dB Bandwidth Test Data CH-High



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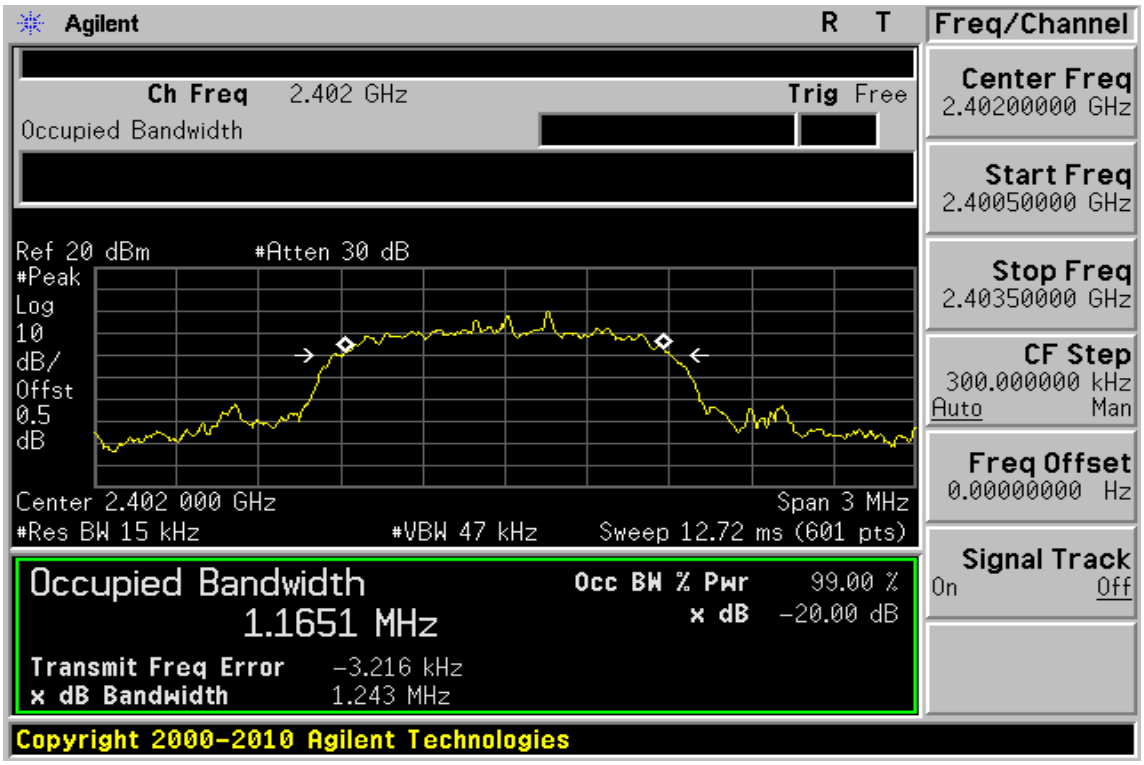
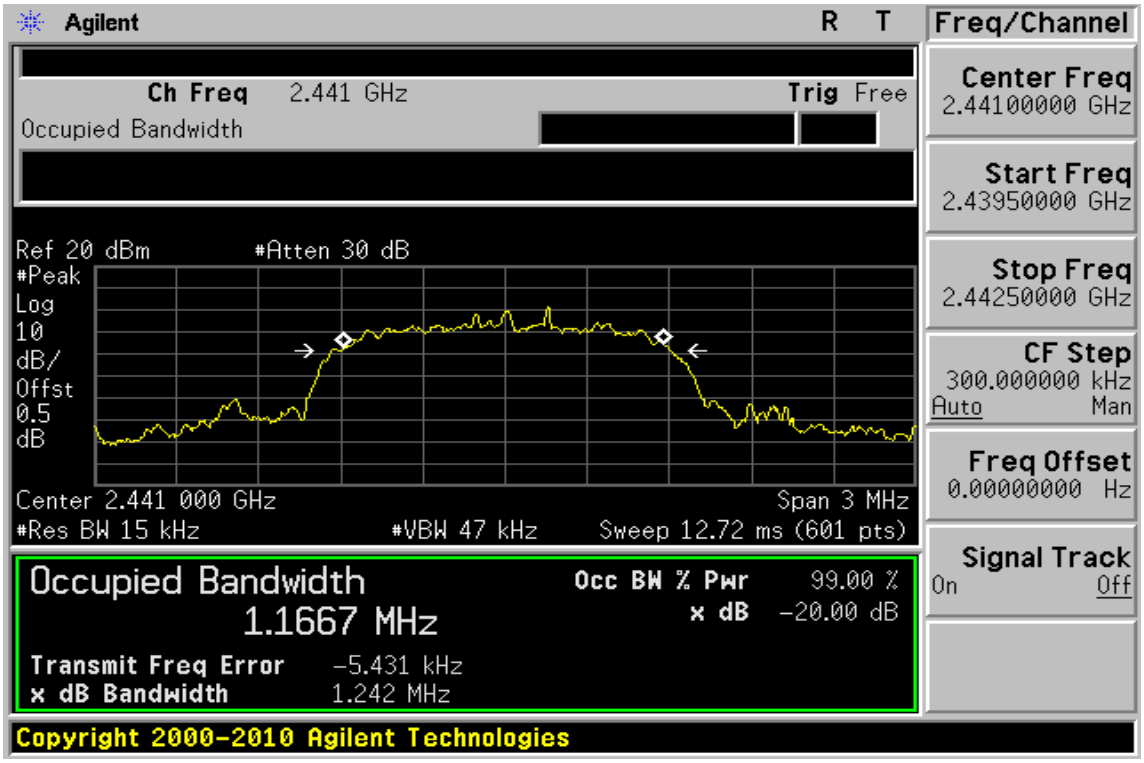
EDR Mode (8DPSK)

20dB Bandwidth Test Data CH-Low



20dB Bandwidth Test Data CH-Mid



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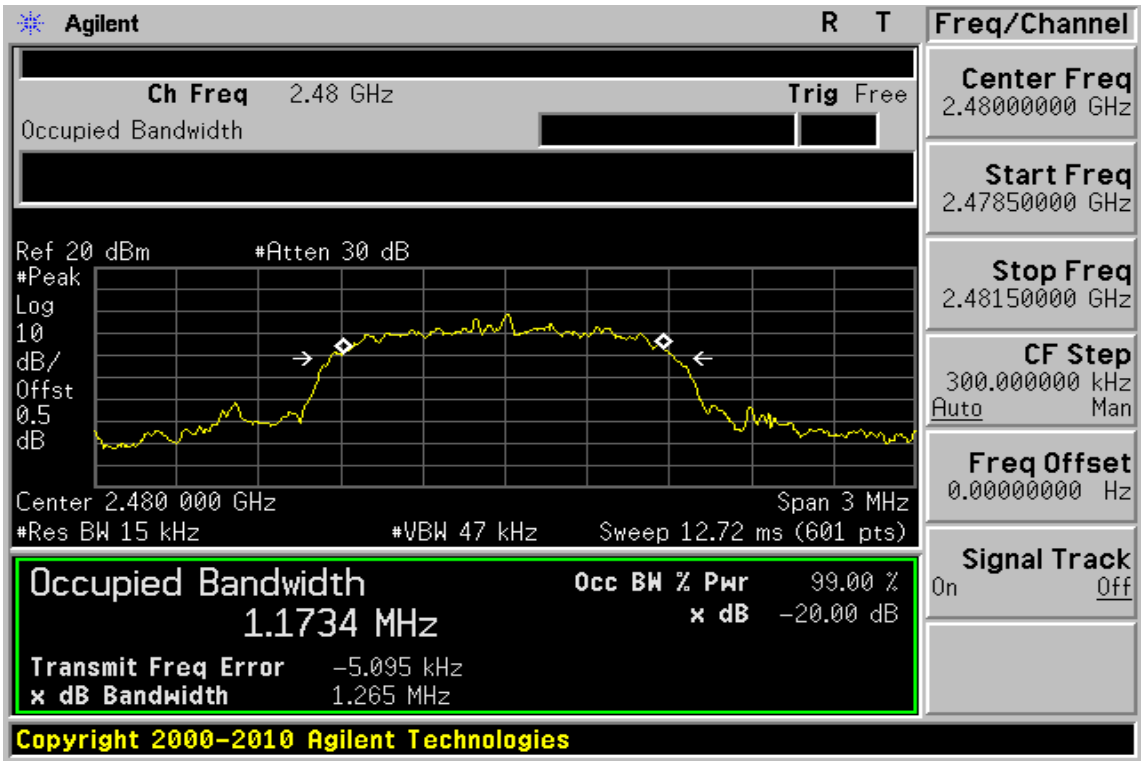
20dB Bandwidth Test Data CH-High



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9. BAND EDGES EMISSION 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 in 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 in15.209(a).

9.2. Measurement Equipment Used

9.2.1. Conducted Emission at antenna port:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/19/2014	05/18/2015
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015

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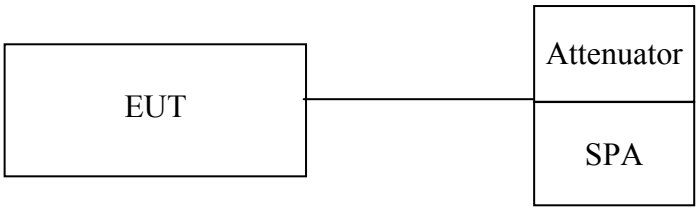
9.3. Test SET-UP:

9.3.1. Conducted Emission at antenna port:



9.4. Measurement Procedure

100 kHz BANDWIDTH OF BAND EDGES:

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.

Out-Of-Band 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 30MHz 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.

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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 -1 Out-Of-Band EMISSION:

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

NOTE: cable loss as 0.5dB that offsets in the spectrum

NOTE: the occurrence of the spike on the conducted emission is the signal of the fundamental emission.

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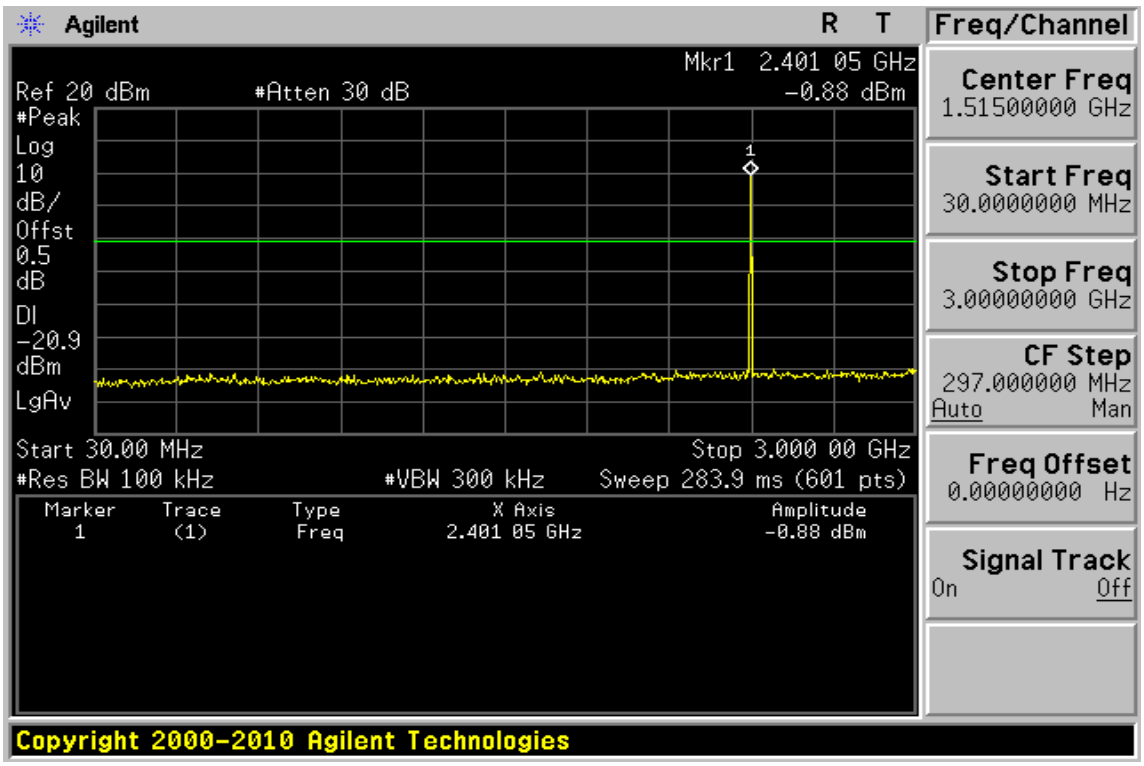
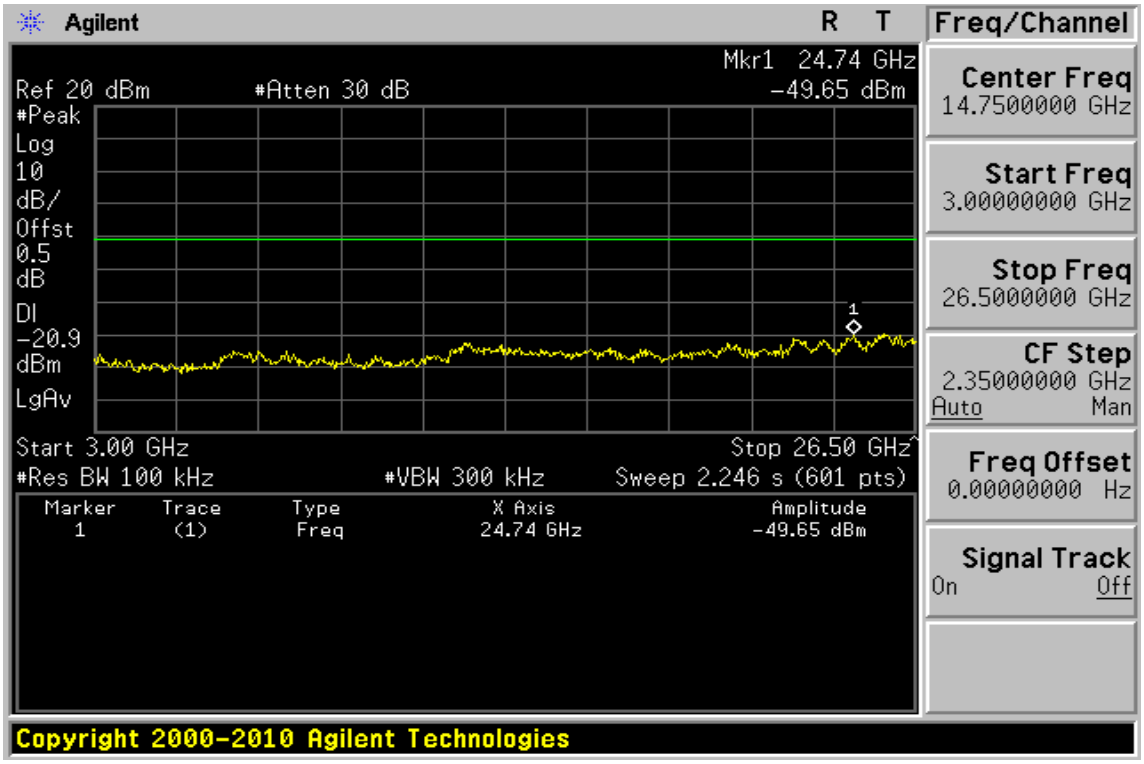
9.7 Measurement Result -1 Conducted Spurious Emission Measurement Result

Ch Low 30MHz – 3GHz (Worst: EDR mode)



Ch Low 3GHz – 26.5GHz



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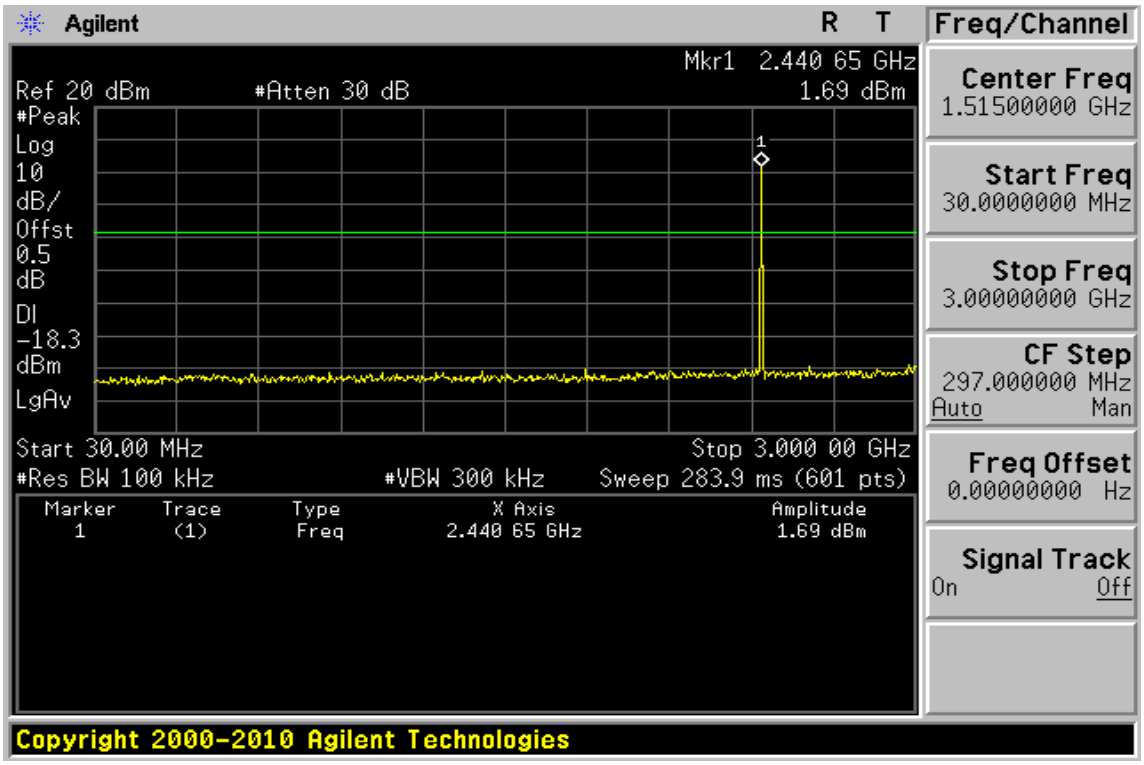
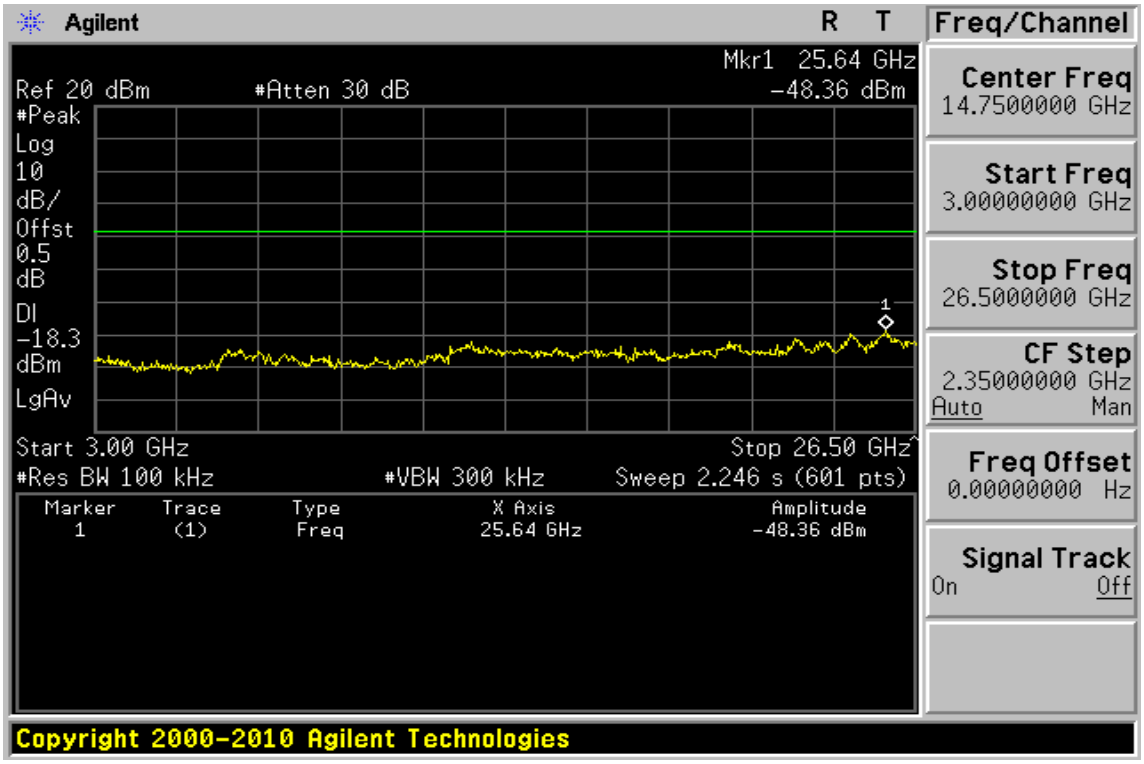
Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz



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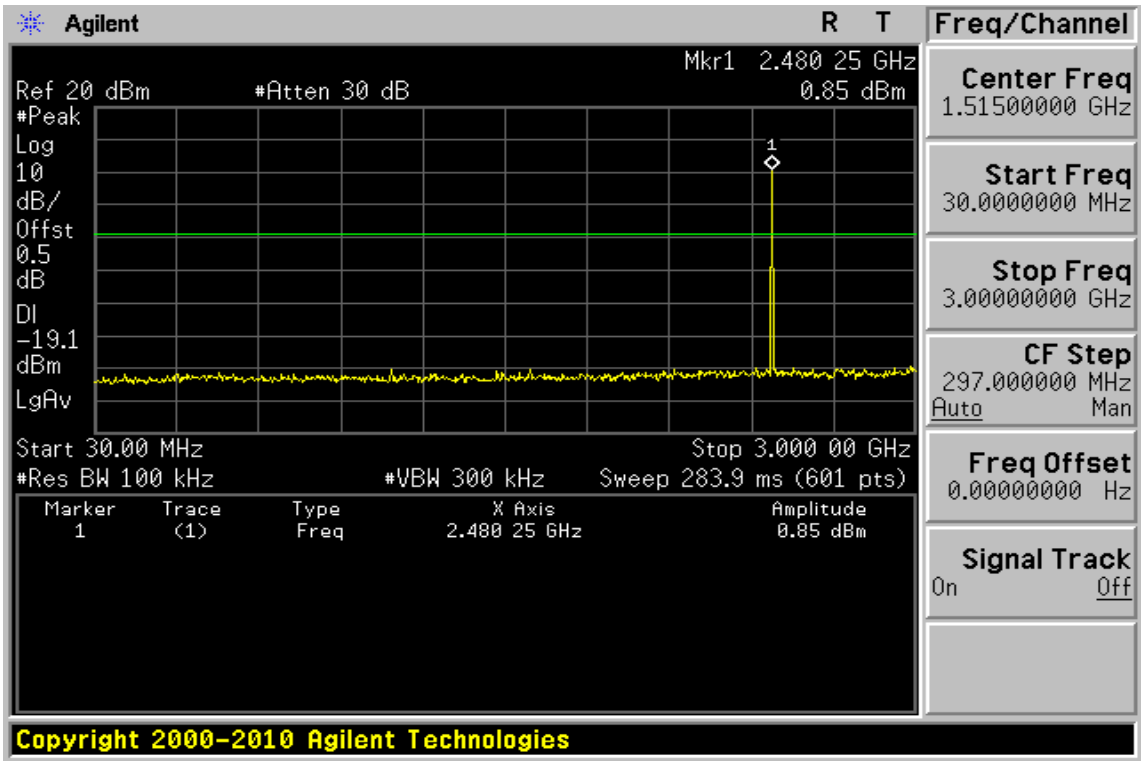
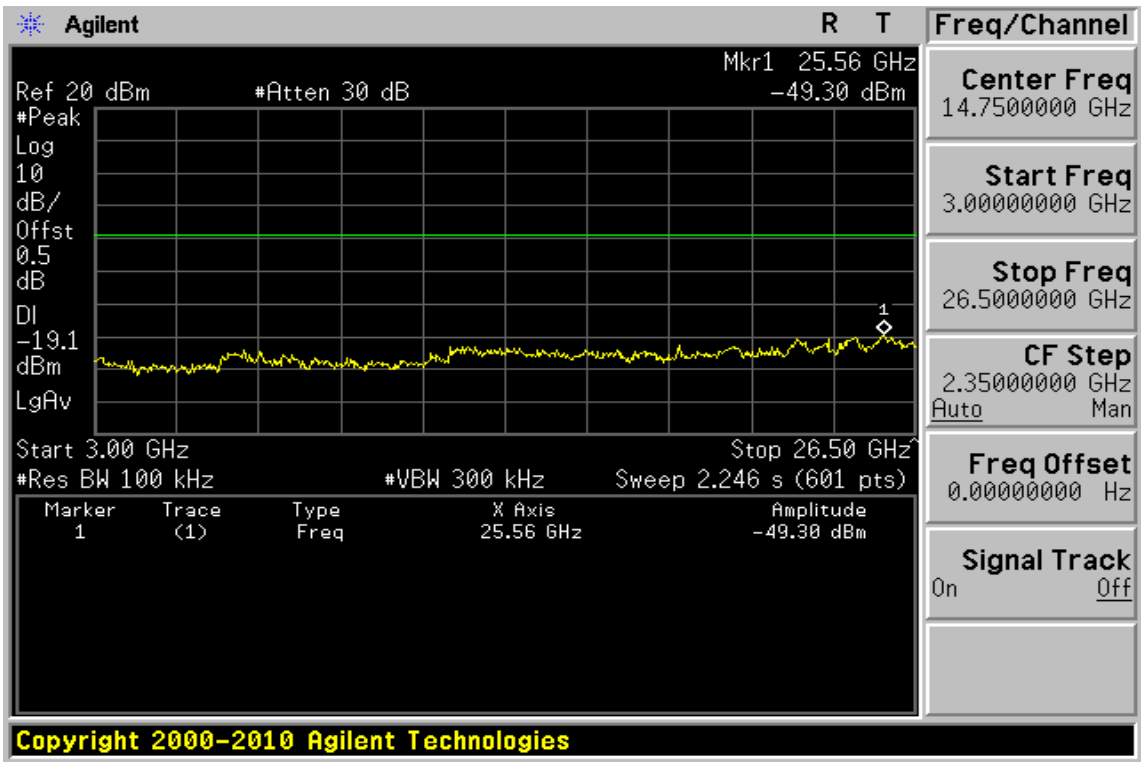
Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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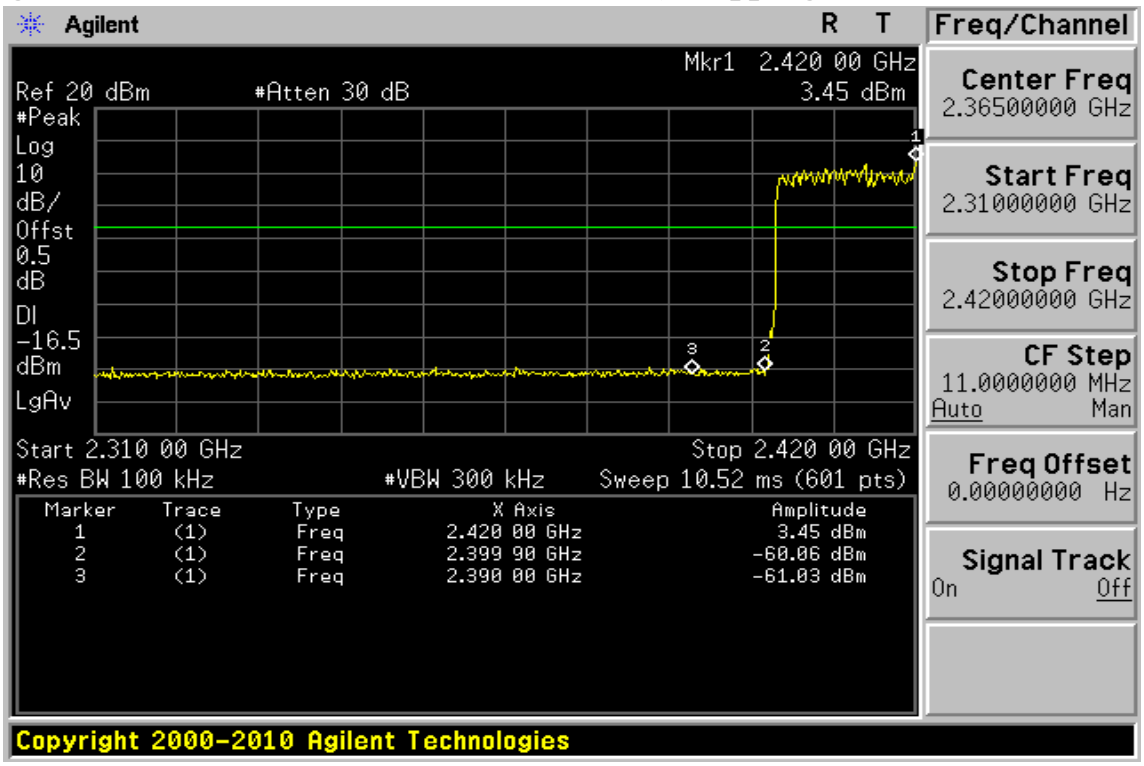
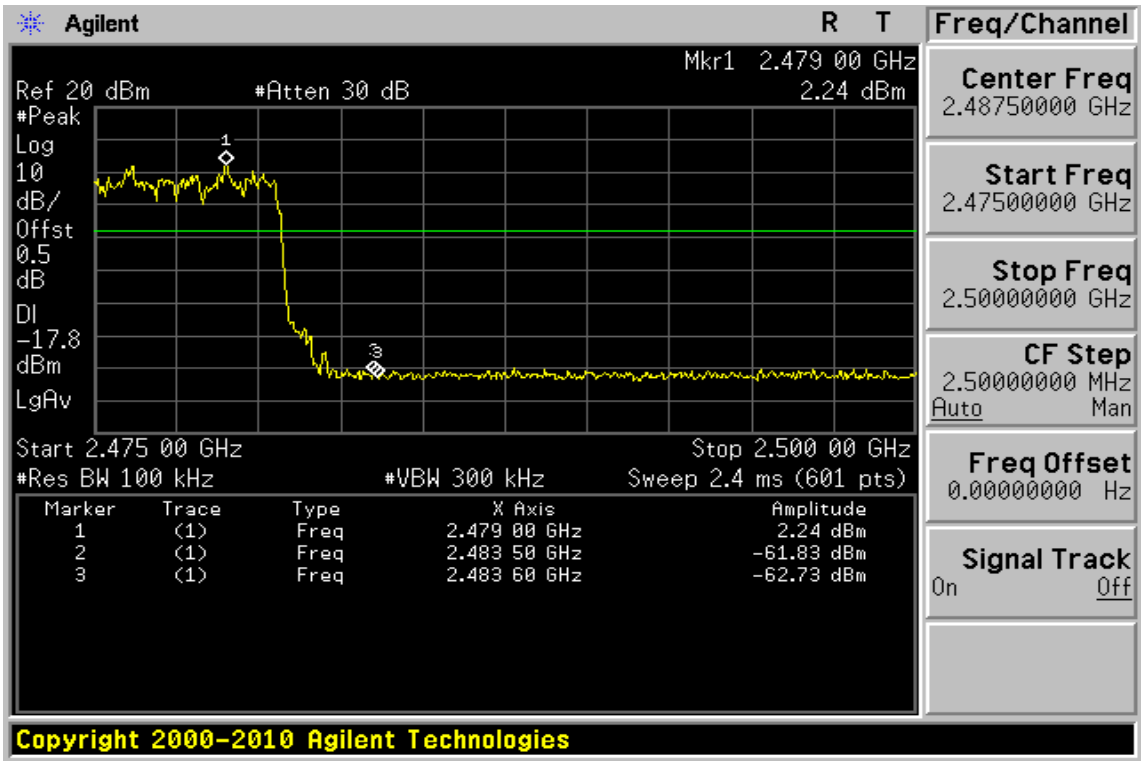
9.8 Measurement Result -2 100 kHz BANDWIDTH OF BAND EDGE:

Band Edges Test Data CH-Low (Worst: EDR mode) Hopping mode



Band Edges Test Data CH-High



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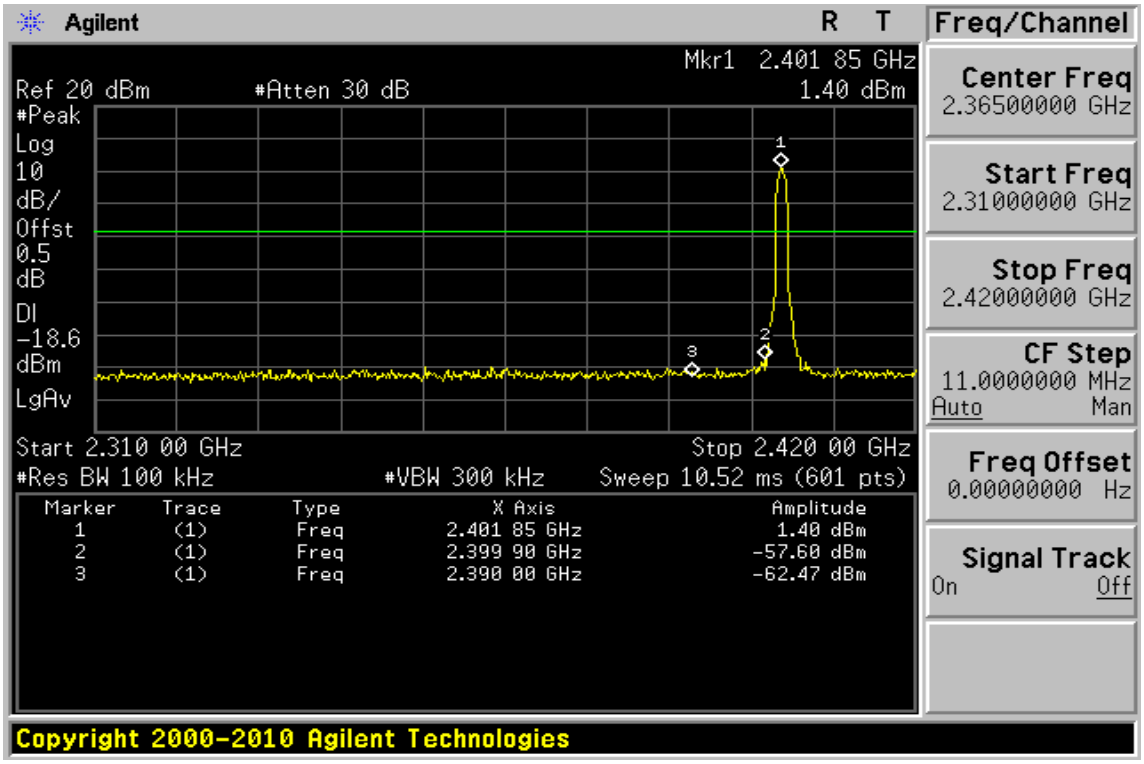
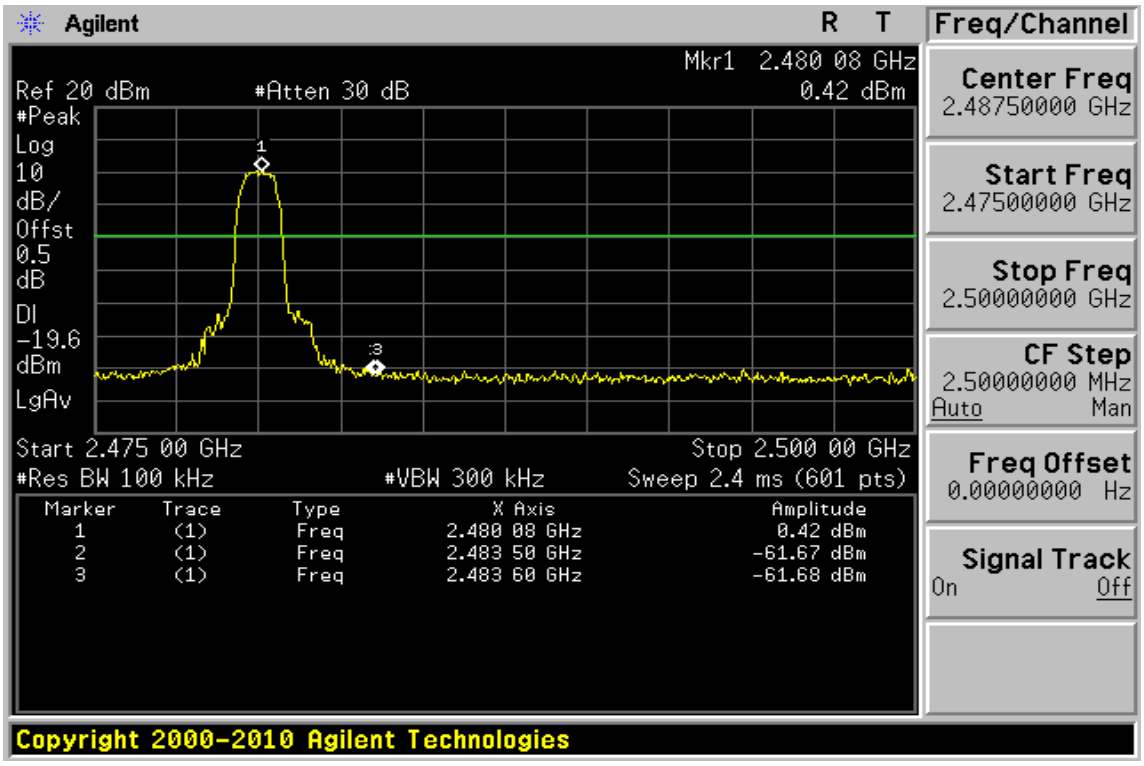
Band Edges Test Data CH-Low (Worst: EDR mode) Non-Hopping mode



Band Edges Test Data CH-High



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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.

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10.2. Measurement Equipment Used:

10.2.1. Radiated emission:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100760	05/26/2014	05/25/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/19/2014	05/18/2015
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	01/20/2014	01/19/2015
Spectrum Analyzer	R&S	FSV-30	101398	10/22/2013	10/21/2014
Loop Antenna	ETS.LINDGREN	6502	00148045	07/05/2013	07/04/2014
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/02/2014	01/01/2015
Horn antenna	ETS.LINDGREN	3117	123995	05/19/2014	05/18/2015
Horn Antenna	Schwarzbeck	BBHA9170	184	01/23/2014	01/22/2015
Pre-Amplifier	Agilent	8447D	2944A07676	01/03/2014	01/02/2015
Pre-Amplifier	Agilent	8449B	3008A00578	01/03/2014	01/02/2015
Pre-Amplifier	EMC Instruments Corp.	EMC184045	980135	01/24/2014	01/23/2015
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	02/27/2014	02/26/2015
Attenuator	Mini-Circuit	BW-S10W2+	004	02/27/2014	02/26/2015
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	01/03/2014	01/02/2015
3m Site NSA	SGS	966 chamber	N/A	07/15/2013	07/14/2014

NOTE: N.C.R refers to Not Calibrated Required.

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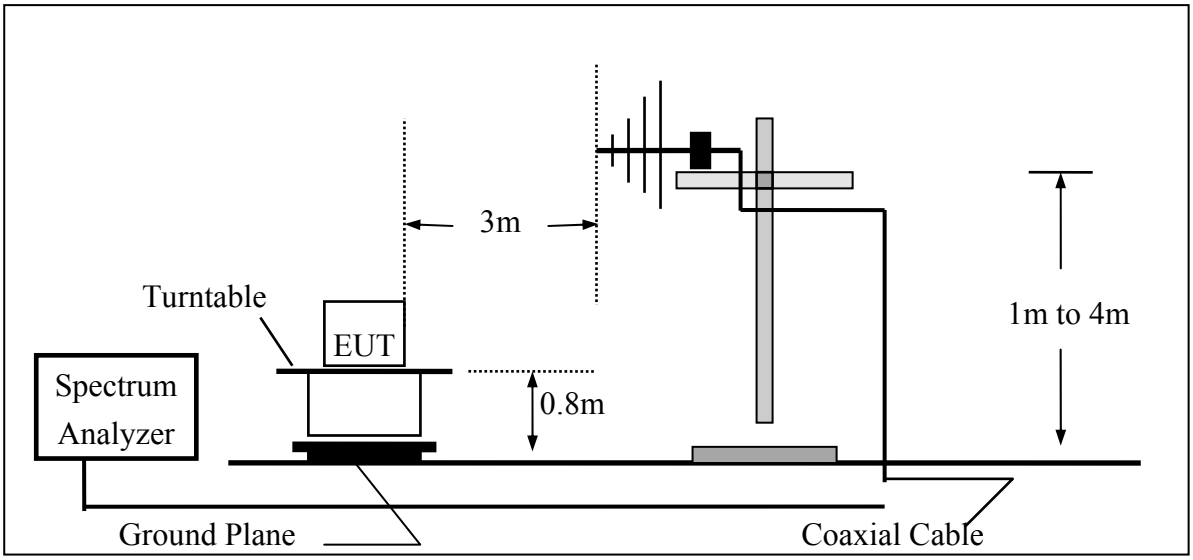
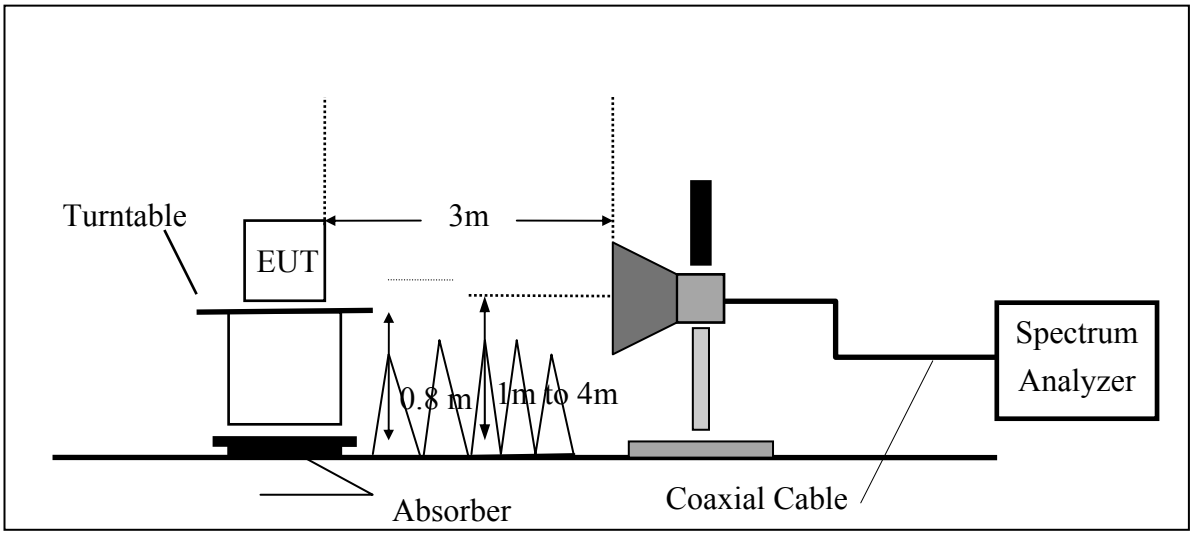
10.3. Test SET-UP:

10.3.1. 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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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 of the interest 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 ≥ 1 GHz, 100 kHz for f < 1 GHz

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

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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	

Remark:

1. The limit of the emission level is expressed in dBuV/m, which converts 20*log(uV/m)
2. Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

10.6. Measurement Result:

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

Note: For the tabular table as presents below, “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency. “E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor

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10.6.1 Radiated Emission – Band Edge: (Worst: EDR mode) Hopping mode

Operation Band	:EDR+Hopping	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:H Plane	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	dBuV/m	dB	dBuV/m	dBuV/m	dB
2390.00	E	Average	30.16	2.48	32.64	54.00	-21.36
2390.00	E	Peak	41.40	2.48	43.88	74.00	-30.12

Operation Band	:EDR+Hopping	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:H Plane	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	dBuV/m	dB	dBuV/m	dBuV/m	dB
2390.00	E	Average	30.18	2.48	32.66	54.00	-21.34
2390.00	E	Peak	42.81	2.48	45.29	74.00	-28.71

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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Operation Band	:EDR+Hopping	Test Date	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:H Plane	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	dBuV/m	dB	dBuV/m	dBuV/m	dB
2483.50	E	Average	30.02	2.84	32.86	54.00	-21.14
2483.50	E	Peak	41.64	2.84	44.48	74.00	-29.52

Operation Band	:EDR+Hopping	Test Date	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:H Plane	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	dBuV/m	dB	dBuV/m	dBuV/m	dB
2483.50	E	Average	30.06	2.84	32.90	54.00	-21.10
2483.50	E	Peak	41.89	2.84	44.73	74.00	-29.27

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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Band Edge: (Worst: EDR mode) Non-Hopping mode

Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:H Plane	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	dBuV/m	dB	dBuV/m	dBuV/m	dB
2390.00	E	Average	30.18	2.48	32.66	54.00	-21.34
2390.00	E	Peak	42.11	2.48	44.59	74.00	-29.41

Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:H Plane	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	dBuV/m	dB	dBuV/m	dBuV/m	dB
2390.00	E	Average	30.16	2.48	32.64	54.00	-21.36
2390.00	E	Peak	41.76	2.48	44.24	74.00	-29.76

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	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:H Plane	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	dBuV/m	dB	dBuV/m	dBuV/m	dB
2483.50	E	Average	30.39	2.84	33.23	54.00	-20.77
2483.50	E	Peak	43.31	2.84	46.15	74.00	-27.85

Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:H Plane	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	dBuV/m	dB	dBuV/m	dBuV/m	dB
2483.50	E	Average	31.13	2.84	33.97	54.00	-20.03
2483.50	E	Peak	43.95	2.84	46.79	74.00	-27.21

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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10.6.2 Radiated Spurious Emission Measurement Result (worst case EDR mode)

Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:H Plane	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 dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
72.68	S	Peak	50.79	-15.74	35.05	40.00	-4.95
260.86	S	Peak	42.51	-12.61	29.90	46.00	-16.10
292.87	S	Peak	47.14	-11.35	35.79	46.00	-10.21
461.65	S	Peak	36.26	-7.89	28.37	46.00	-17.63
666.32	S	Peak	31.12	-4.18	26.94	46.00	-19.06
914.64	S	Peak	28.60	-0.37	28.23	46.00	-17.77
4804.00	H	Average	24.92	6.75	31.67	54.00	-22.33
4804.00	H	Peak	37.56	6.75	44.31	74.00	-29.69
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	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:H Plane	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 dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
71.71	S	Peak	51.07	-15.54	35.53	40.00	-4.47
194.90	S	Peak	50.87	-15.02	35.85	43.50	-7.65
331.67	S	Peak	42.69	-10.71	31.98	46.00	-14.02
461.65	S	Peak	37.24	-7.89	29.35	46.00	-16.65
665.35	S	Peak	31.77	-4.20	27.57	46.00	-18.43
988.36	S	Peak	28.13	0.32	28.45	54.00	-25.55
4804.00	H	Average	25.06	6.75	31.81	54.00	-22.19
4804.00	H	Peak	39.31	6.75	46.06	74.00	-27.94
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	:2014-06-11
Fundamental Frequency	:2441 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:H Plane	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 dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
71.71	S	Peak	50.53	-15.54	34.99	40.00	-5.01
259.89	S	Peak	42.95	-12.66	30.29	46.00	-15.71
292.87	S	Peak	46.65	-11.35	35.30	46.00	-10.70
461.65	S	Peak	37.22	-7.89	29.33	46.00	-16.67
665.35	S	Peak	30.50	-4.20	26.30	46.00	-19.70
947.62	S	Peak	28.28	0.25	28.53	46.00	-17.47
4882.00	H	Average	25.03	6.93	31.96	54.00	-22.04
4882.00	H	Peak	37.53	6.93	44.46	74.00	-29.54
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	:2014-06-11
Fundamental Frequency	:2441 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:H Plane	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 dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
120.21	S	Peak	49.73	-14.99	34.74	43.50	-8.76
194.90	S	Peak	51.24	-15.02	36.22	43.50	-7.28
331.67	S	Peak	42.66	-10.71	31.95	46.00	-14.05
462.62	S	Peak	37.44	-7.86	29.58	46.00	-16.42
666.32	S	Peak	32.33	-4.18	28.15	46.00	-17.85
954.41	S	Peak	27.71	0.31	28.02	46.00	-17.98
4882.00	H	Average	25.15	6.93	32.08	54.00	-21.92
4882.00	H	Peak	37.92	6.93	44.85	74.00	-29.15
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	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:H Plane	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 dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
71.71	S	Peak	50.31	-15.54	34.77	40.00	-5.23
260.86	S	Peak	42.92	-12.61	30.31	46.00	-15.69
292.87	S	Peak	46.93	-11.35	35.58	46.00	-10.42
461.65	S	Peak	38.33	-7.89	30.44	46.00	-15.56
666.32	S	Peak	37.54	-4.18	33.36	46.00	-12.64
947.62	S	Peak	27.94	0.25	28.19	46.00	-17.81
4960.00	H	Average	24.23	7.08	31.31	54.00	-22.69
4960.00	H	Peak	37.13	7.08	44.21	74.00	-29.79
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	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:H Plane	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 dBuV/m	Factor dB	Actual FS dBuV/m	Limit @3m dBuV/m	Margin dB
121.18	S	Peak	51.05	-14.90	36.15	43.50	-7.35
194.90	S	Peak	51.14	-15.02	36.12	43.50	-7.38
331.67	S	Peak	42.09	-10.71	31.38	46.00	-14.62
479.11	S	Peak	38.28	-7.62	30.66	46.00	-15.34
666.32	S	Peak	37.62	-4.18	33.44	46.00	-12.56
937.92	S	Peak	28.18	0.09	28.27	46.00	-17.73
4960.00	H	Average	24.30	7.08	31.38	54.00	-22.62
4960.00	H	Peak	37.03	7.08	44.11	74.00	-29.89
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

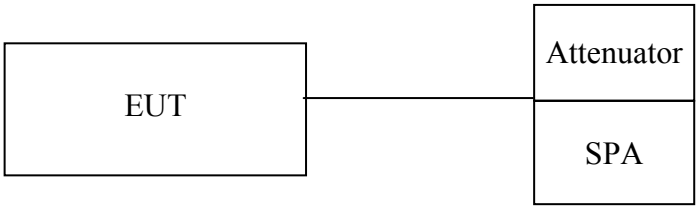
11.1. Standard Applicable

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25 kHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

11.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/19/2014	05/18/2015
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015

11.3. Test Set-up:



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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=100 kHz, 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	>=25 kHz or 2/3 times 20dB bandwidth	PASS

Note: Refer to next page for plots.

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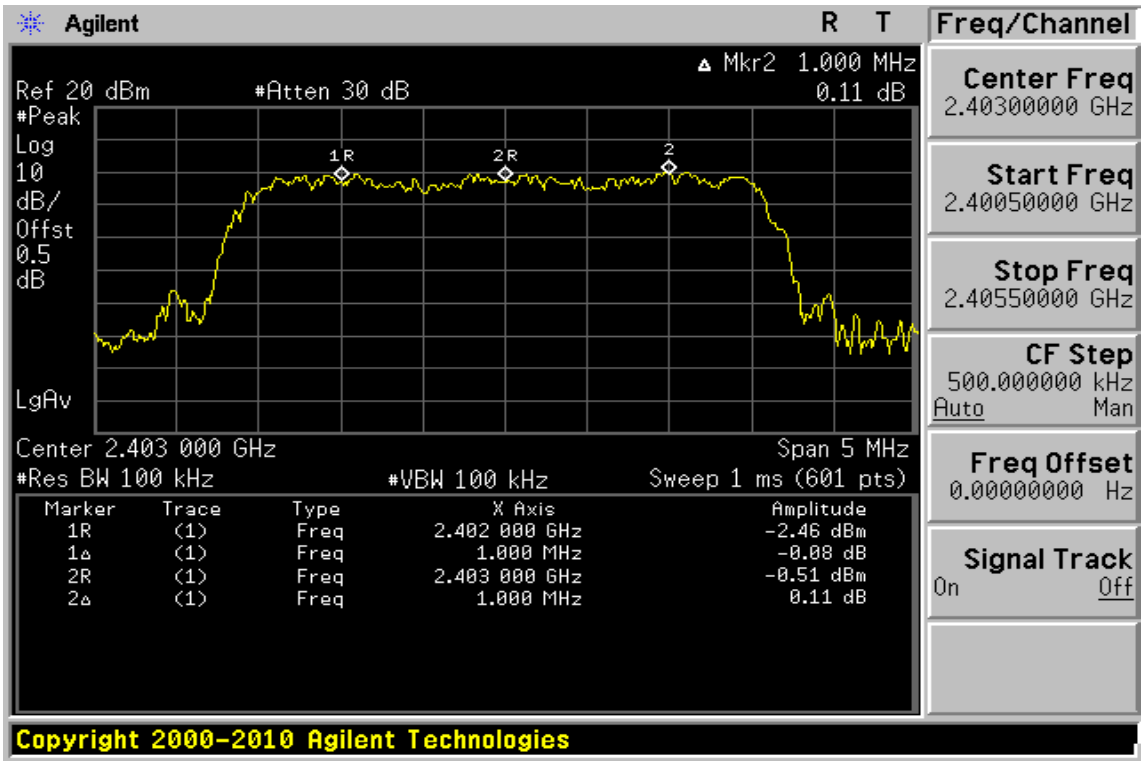
Frequency Separation Test Data



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No.134,WuKungRoad,NewTaipeiIndustrialPark,WukuDistrict,NewTaipeiCity,Taiwan24803/新北市五股區新北產業園區五工路 134 號
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Member of SGS Group

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:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/30/2013	05/29/2014
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015

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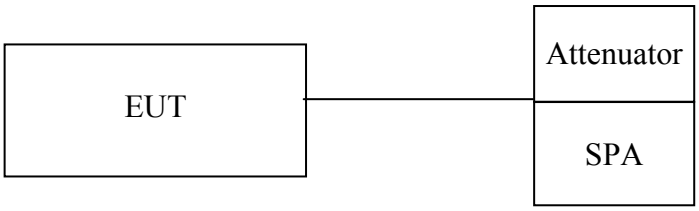
12.3. Test Set-up:



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=430 kHz, VBW=1.5MHz., Detector = Peak
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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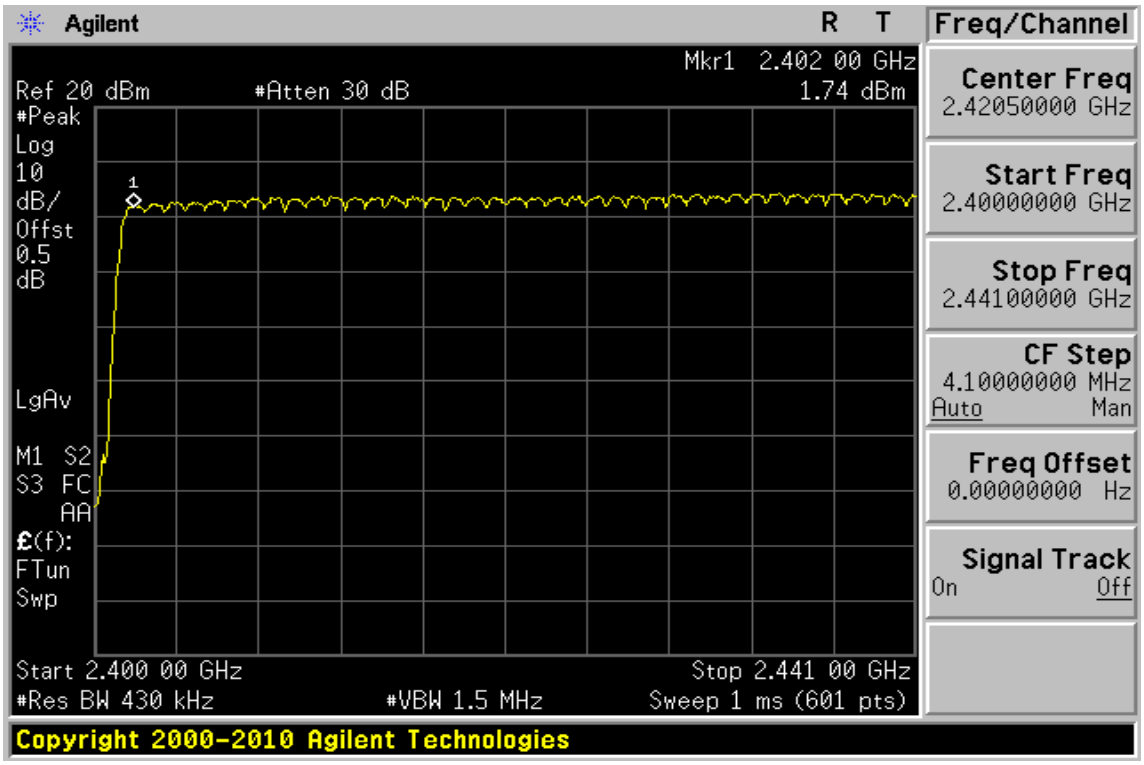
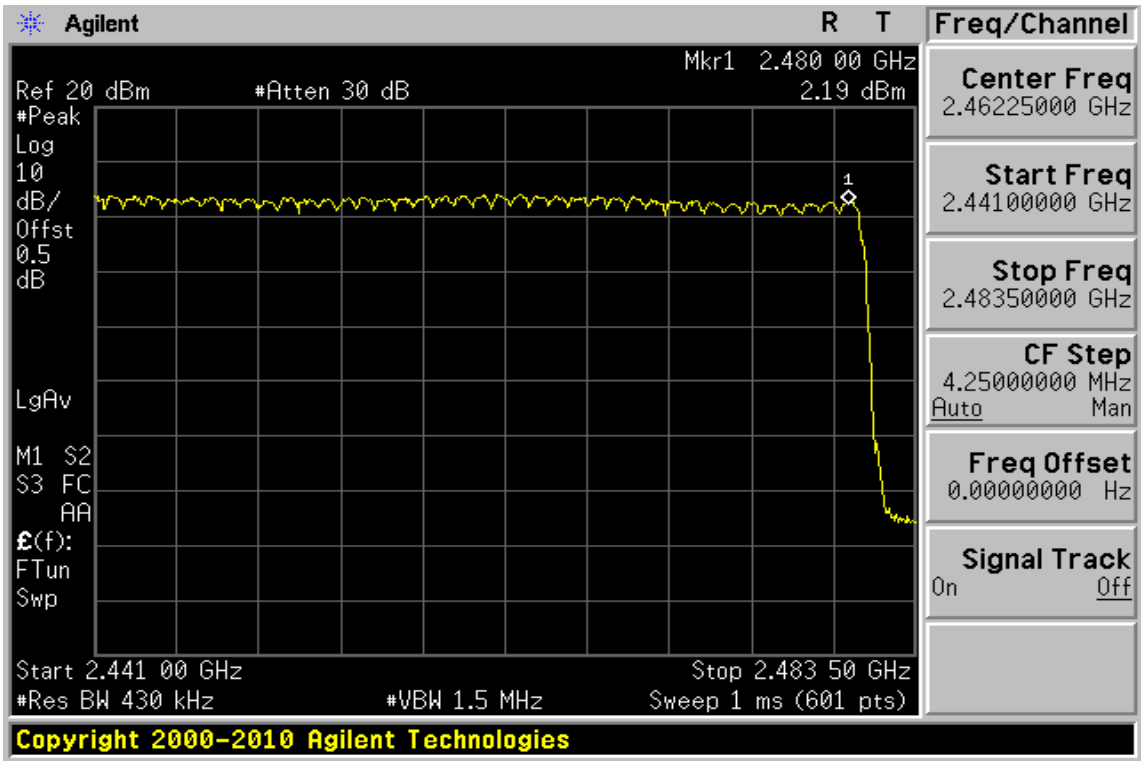
Channel Number

2.4 GHz – 2.441GHz



2.441 GHz – 2.4835GHz



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13. TIME OF OCCUPANCY (DWELL TIME)

13.1. Standard Applicable

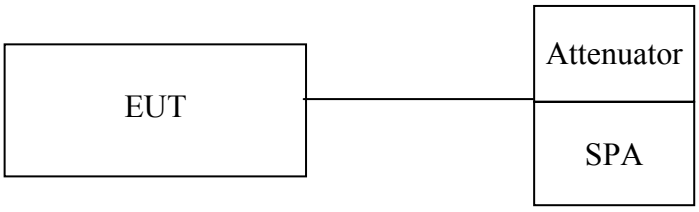
According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

Limit: 0.4s = 400ms

13.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Meter	Anritsu	ML2495A	1005007	01/13/2014	01/12/2015
Power Sensor	Anritsu	MA2411B	917032	01/13/2014	01/12/2015
Spectrum Analyzer	Agilent	E4446A	MY51100003	05/19/2014	05/18/2015
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/08/2014	03/07/2015
DC Block	Mini-Circuits	BLK-18-S+	1	02/27/2014	02/26/2015
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/03/2014	01/02/2015
Attenuator	Mini-Circuit	BW-S10W2+	002	02/27/2014	02/26/2015
Splitter	Agilent	11636B	N/A	02/27/2014	02/26/2015

13.3. Test Set-up:



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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, VBW=1MHz, 3MHz, Span = 0Hz , Detector = Peak, Adjust Sweep = 2~7ms.
5. Repeat above procedures until all frequency of the interest measured were complete.

Formula Deduced: time occupancy of one time slot X Hopping rate / total slot in one channel / total channel that hops X period of working channels.

Where, standard hopping rate is 1600 hops/s, slot in one channel for DH1, DH3, and DH5 is 2, 4, and 6, respectively.

DH1 consists of single time slot of the uplink, and one slot of the downlink Total Slot: 2

DH3 consists of three time slot of the uplink, and one slot of the downlink. Total Slot: 4

DH5 consists of five time slot of the uplink, and one slot of the downlink. Total Slot: 6

Note: the result of the complete test default channel at 1Mbps is recorded on the test report, 2Mbps, and 3Mbps only records the measurement result at middle channel that reveals no much deviation.

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13.5. Tabular Result of the Measurement:

1Mbps (GFSK):

Test Channel:	Mode:	Measurement Result (ms):	Limit (ms):
Low:	DH1	121.60	400ms
	DH3	261.28	400ms
	DH5	307.52	400ms
Middle:	DH1	121.60	400ms
	DH3	261.28	400ms
	DH5	307.52	400ms
High:	DH1	119.36	400ms
	DH3	261.28	400ms
	DH5	258.72	400ms

2 Mbps (Π/4 DQPSK):

Test Channel:	Mode:	Measurement Result (ms):	Limit (ms):
Middle:	2DH1	121.60	400ms
	2DH3	261.28	400ms
	2DH5	307.52	400ms

3 Mbps (8DPSK):

Test Channel:	Mode:	Measurement Result (ms):	Limit (ms):
Middle:	3DH1	121.60	400
	3DH3	261.28	400
	3DH5	307.52	400

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

1Mbps:

CH Low	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 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 =	119.36	(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 =	258.72	(ms)

2Mbps:

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

3Mbps:

CH Mid	3DH1 time slot	=	0.380 (ms) * (1600/2/79)	* 31.6 =	121.60	(ms)
	3DH3 time slot	=	1.633 (ms) * (1600/4/79)	* 31.6 =	261.28	(ms)
	3DH5 time slot	=	2.883 (ms) * (1600/6/79)	* 31.6 =	307.52	(ms)

13.6. Measurement Result:

Note: Refer to next page for plots.

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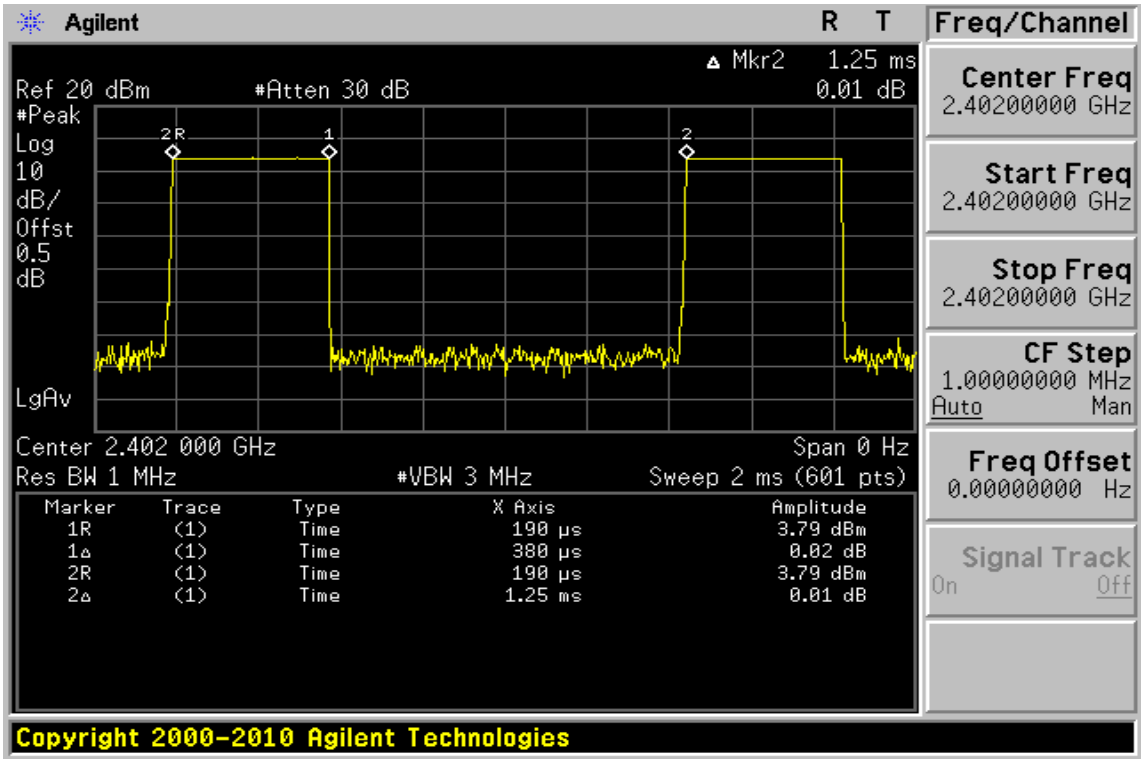
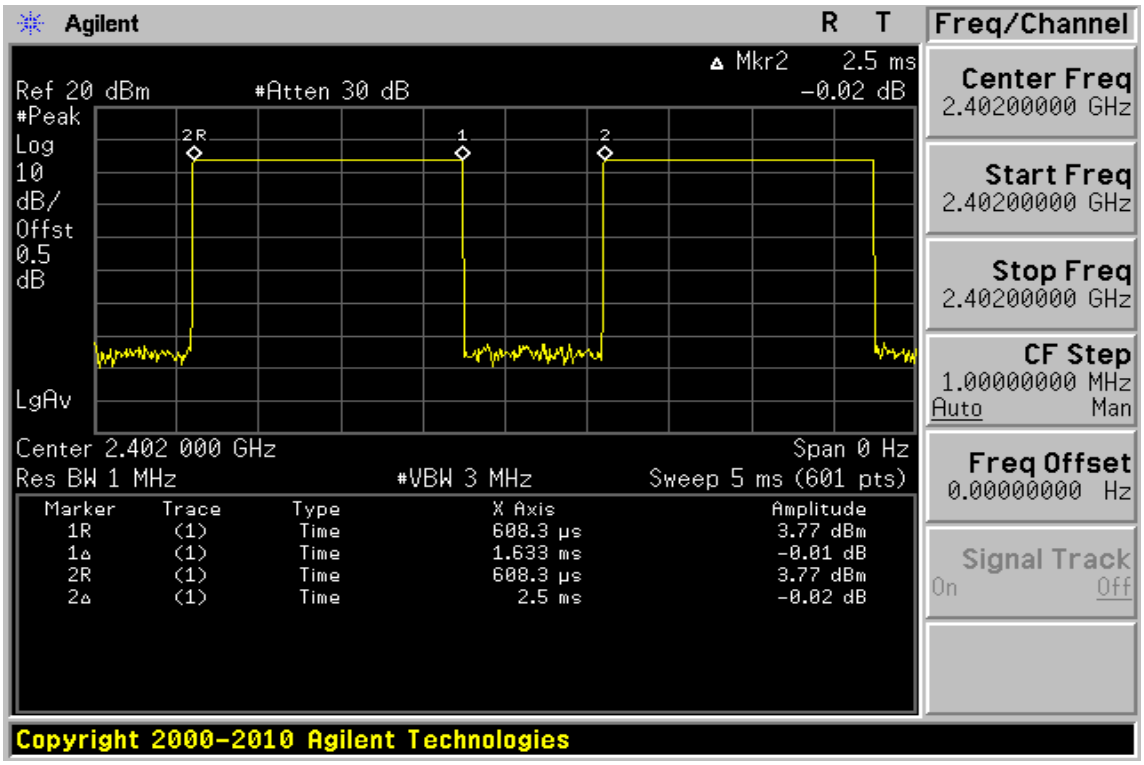
CH-Low

DH1



DH3



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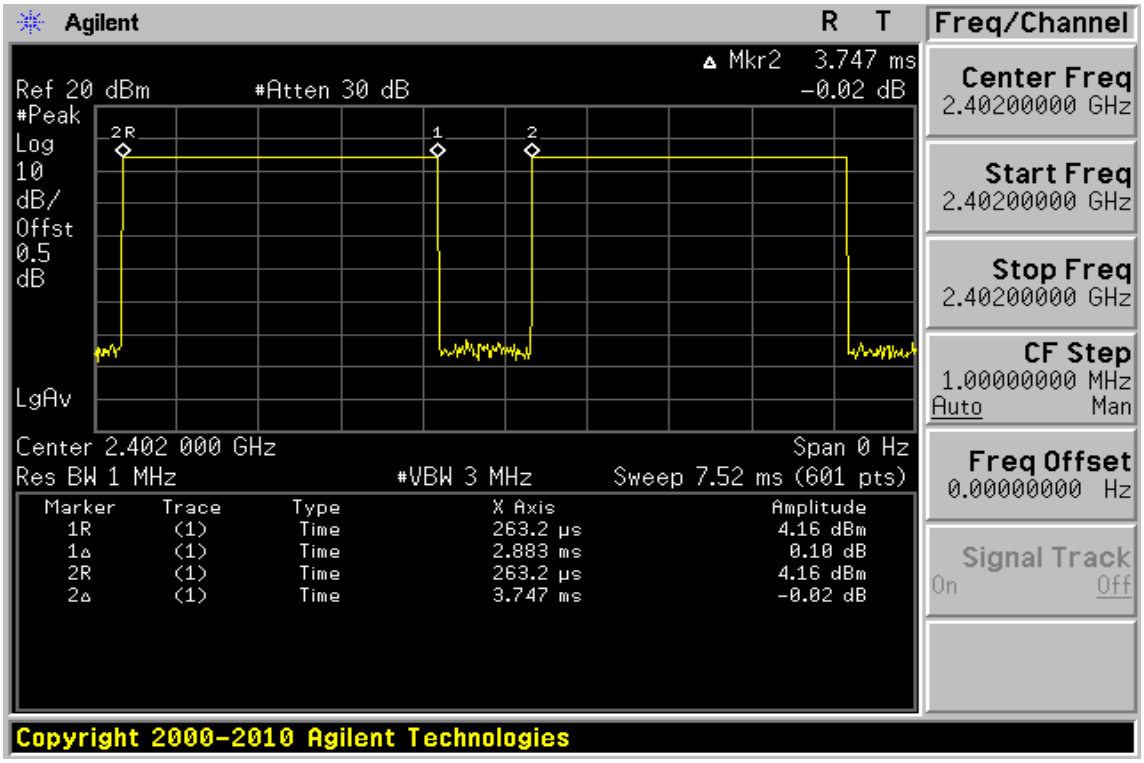
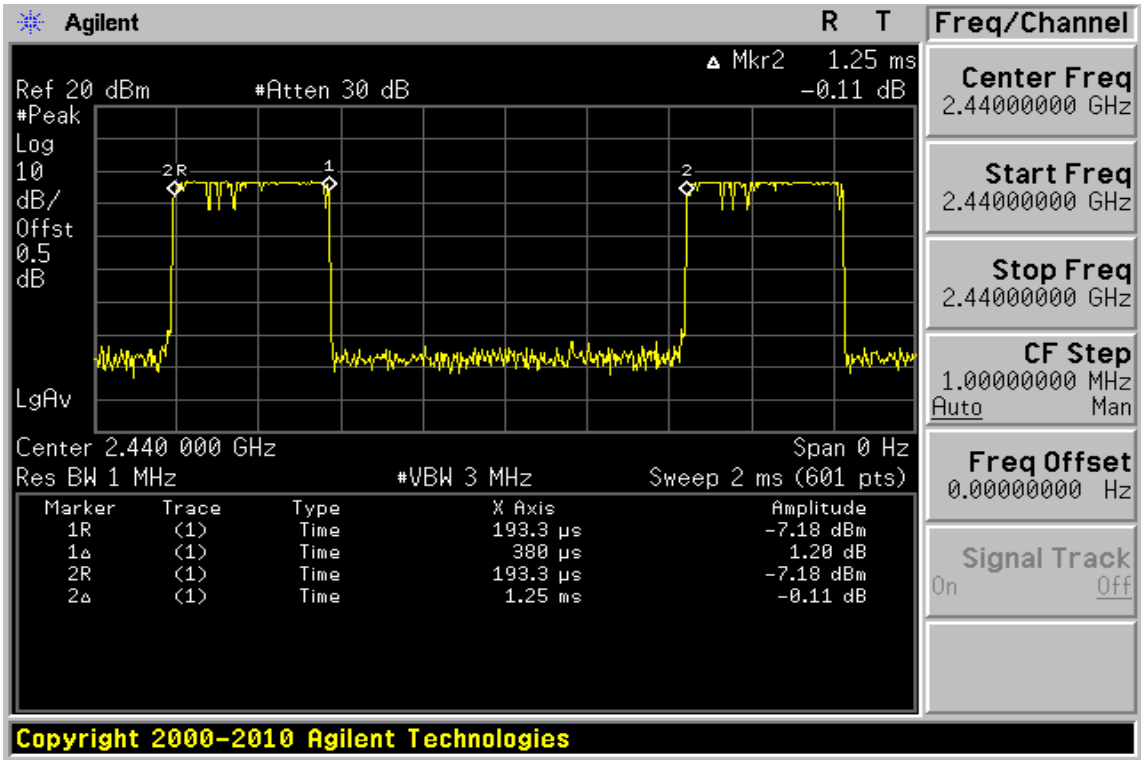
DH5



CH-Mid

DH1



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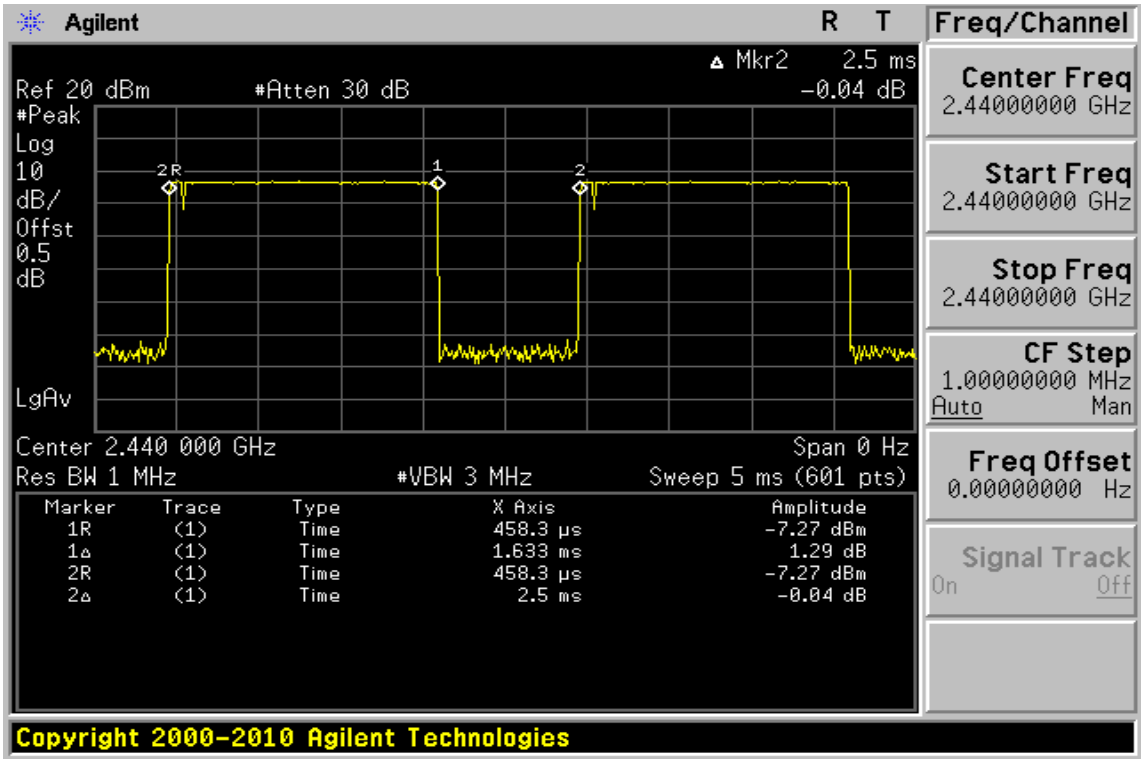
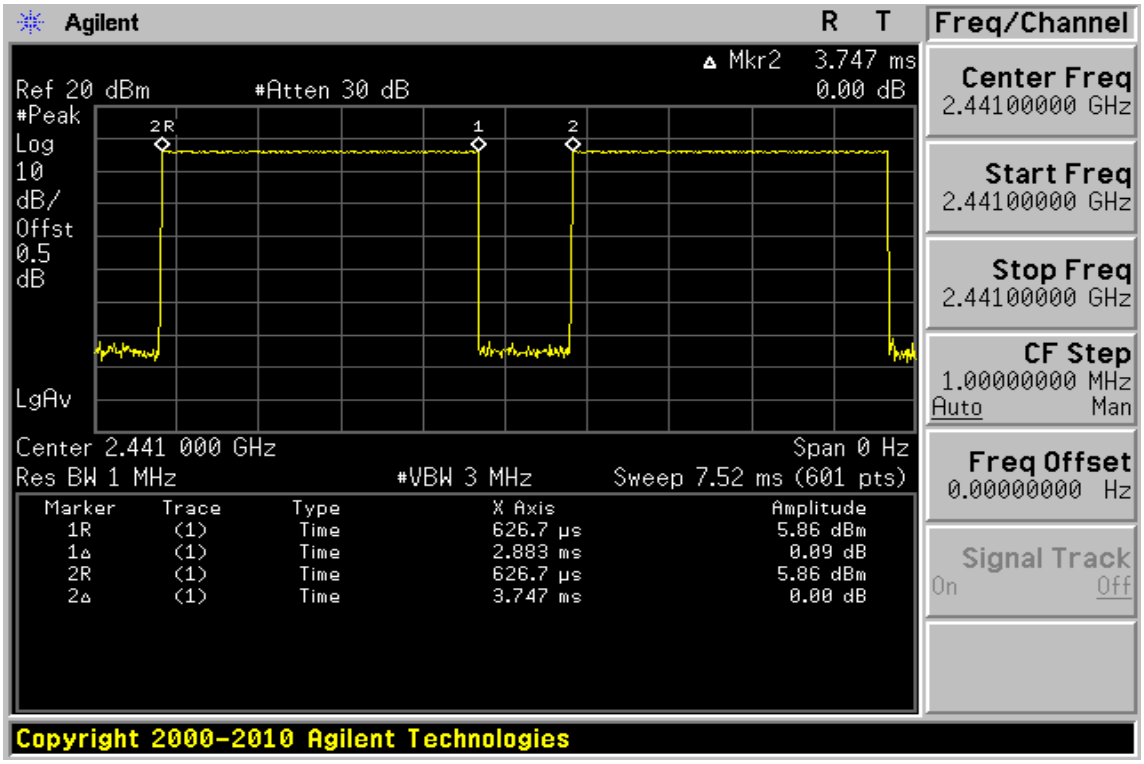
DH3



DH5



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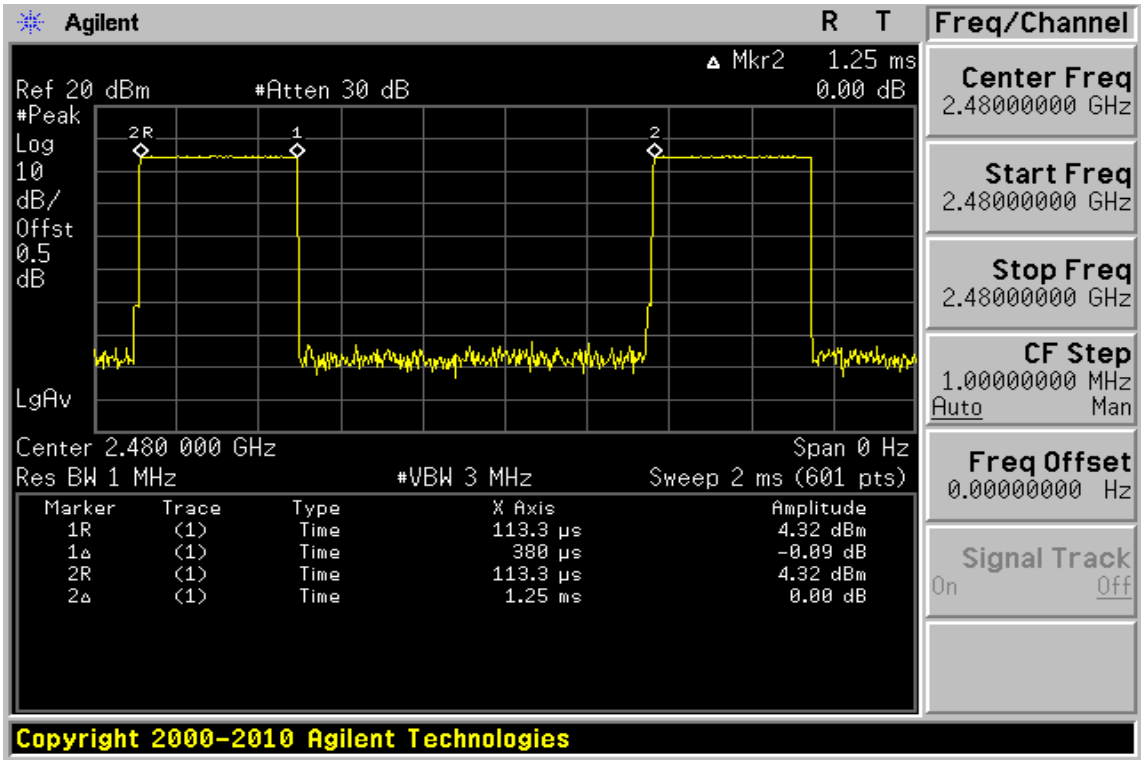
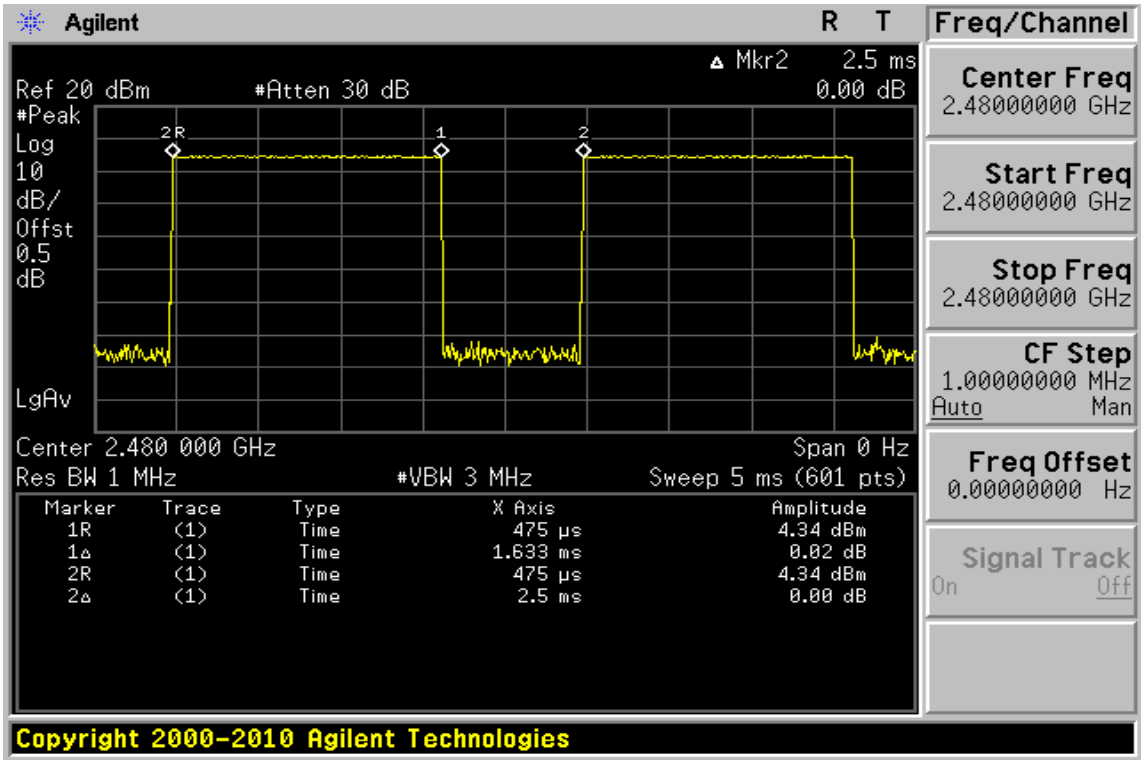
CH-High

DH1



DH3



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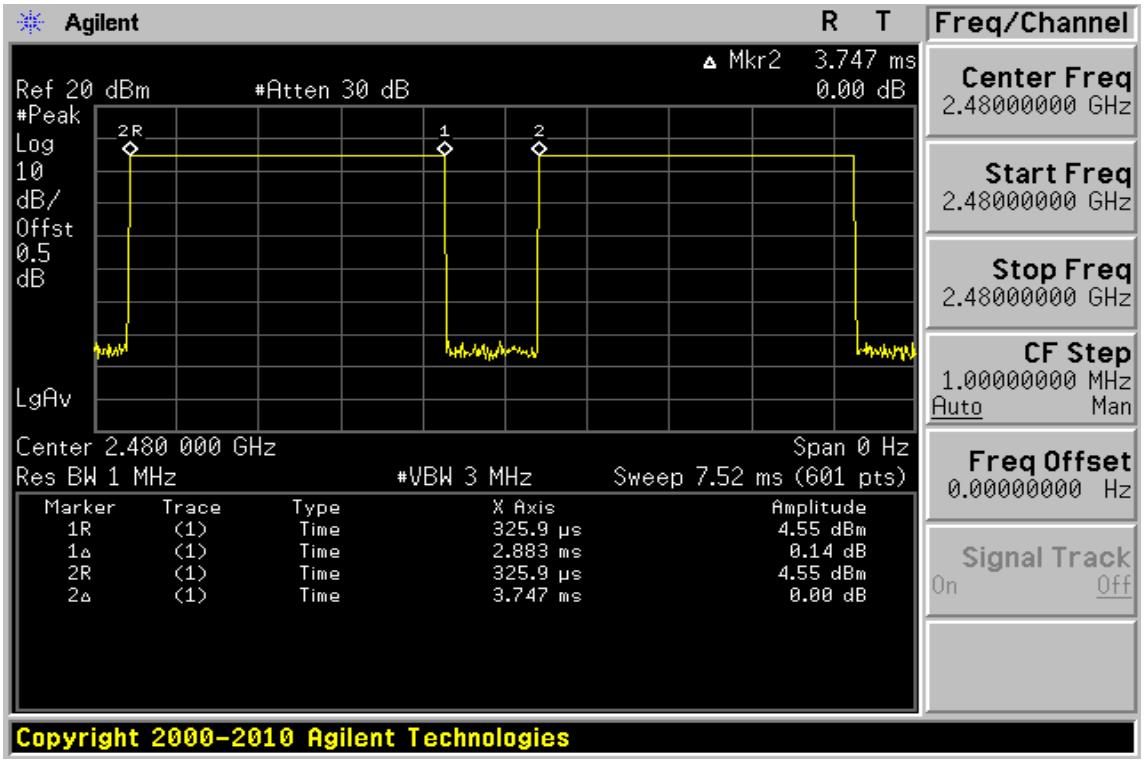
DH5



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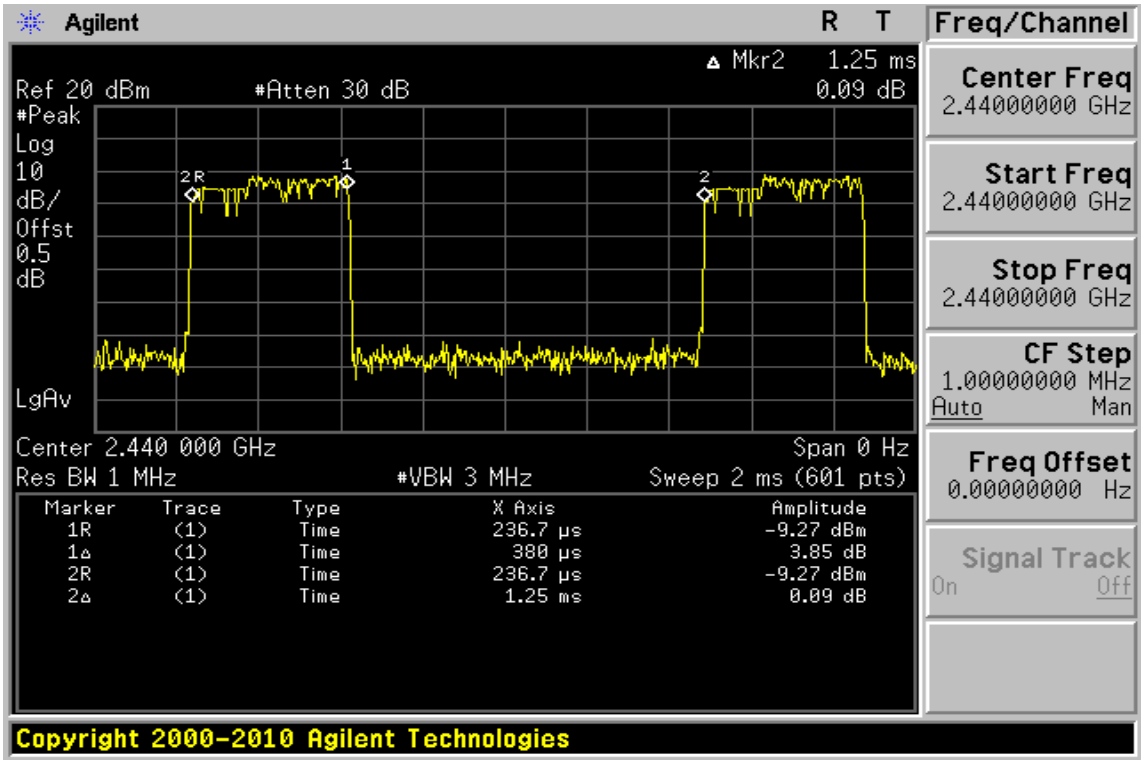
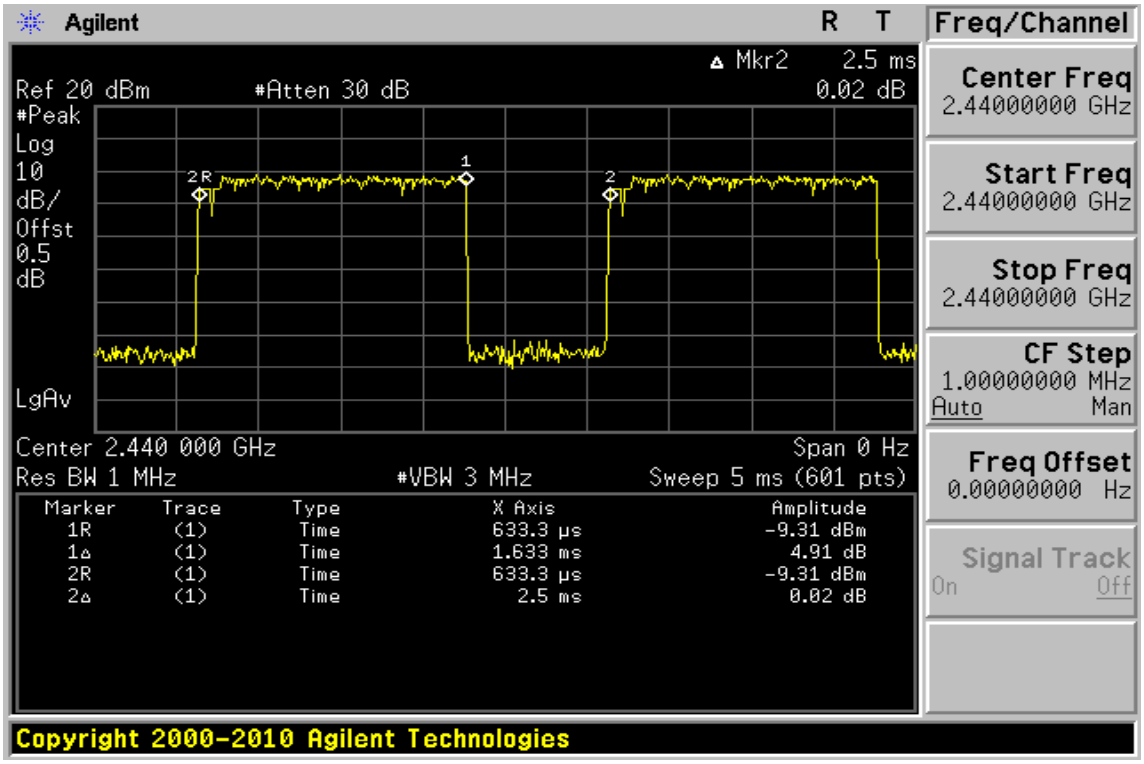
CH-Mid

2DH1



2DH3



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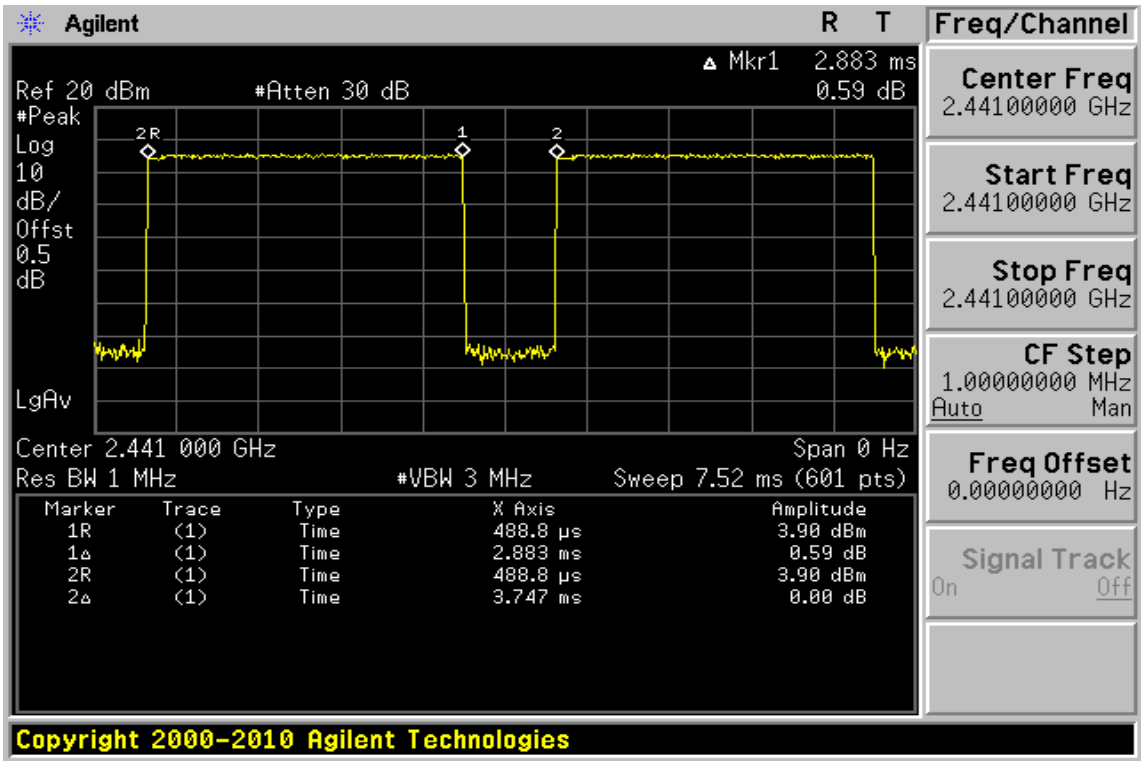
2DH5



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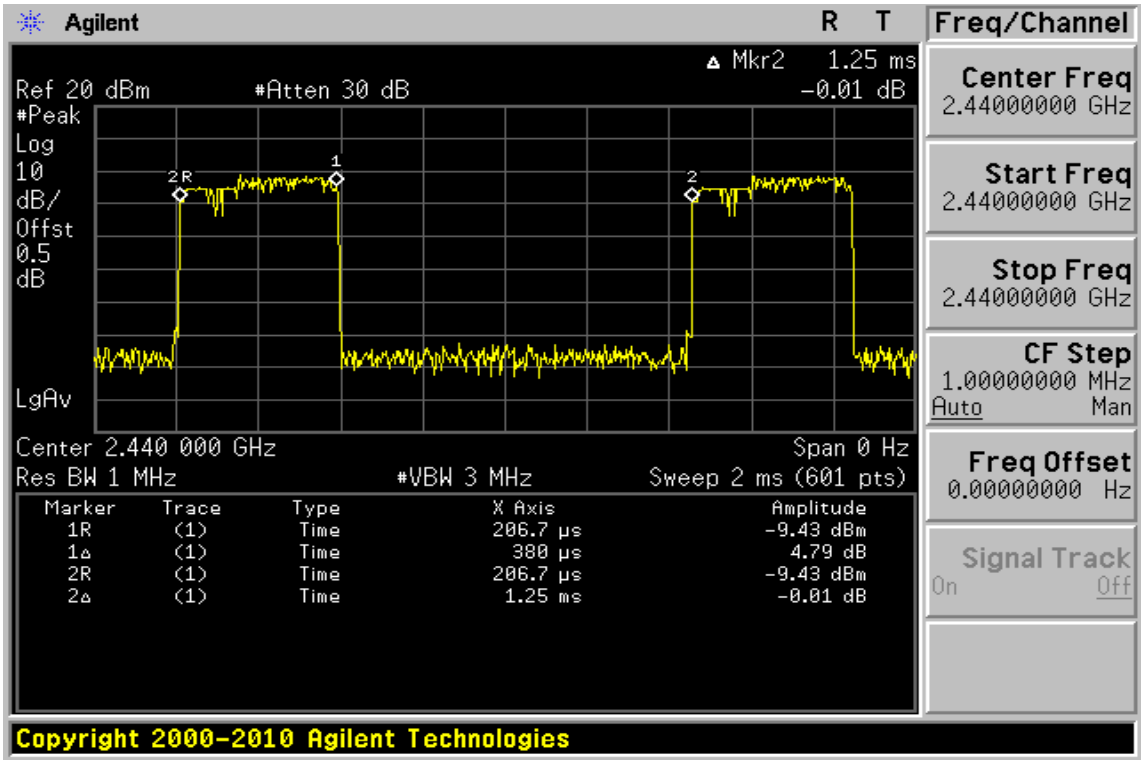
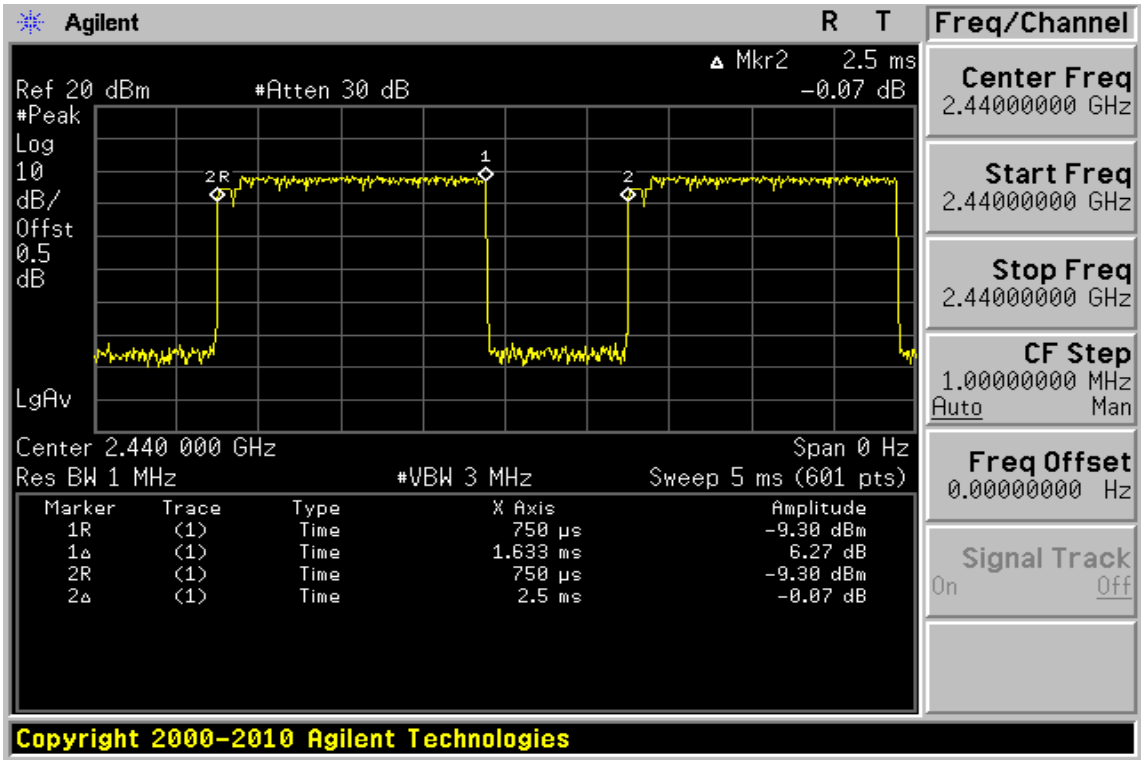
CH-Mid

3DH1



3DH3



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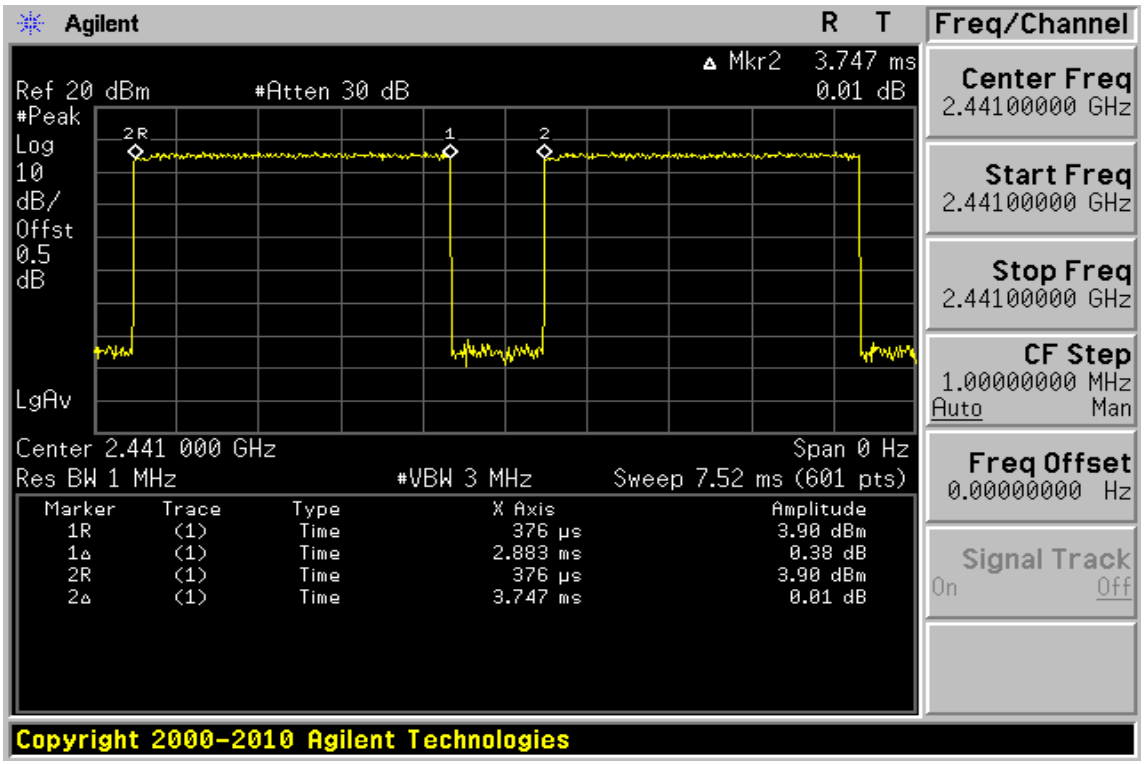
3DH5



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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 -2.5dBi, 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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APPENDIX 1

MEASUREMENT PLOT OF RADIATED SPURIOUS EMISSION

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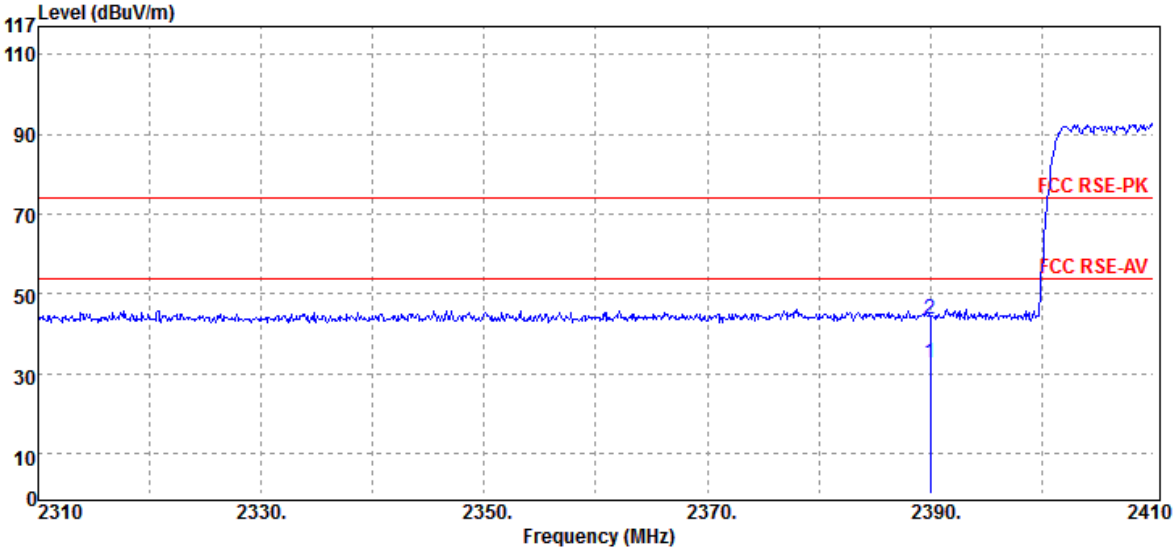
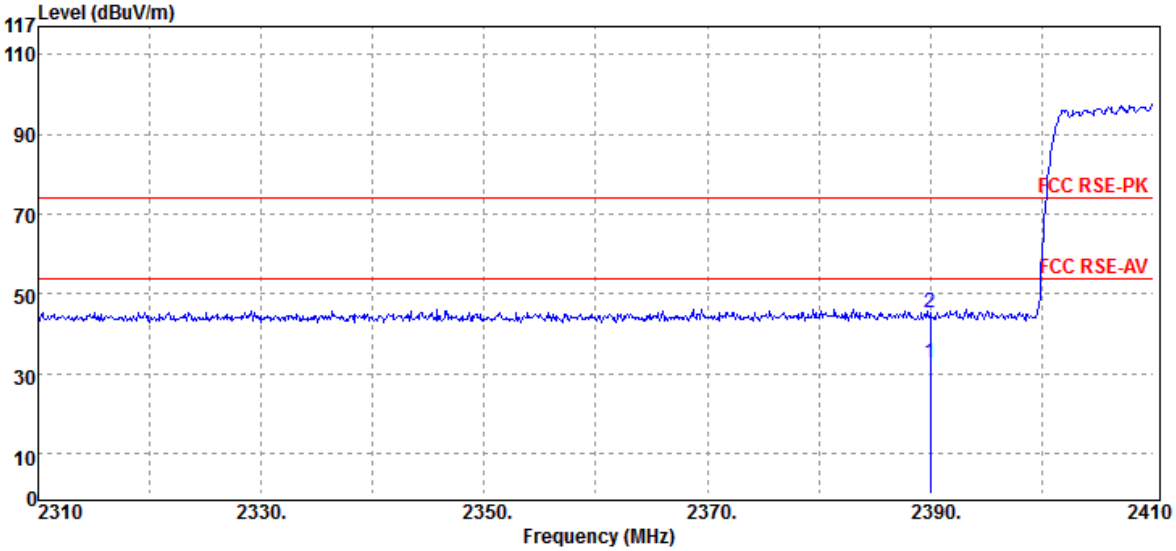
Band Edges Radiated Emission: (Hopping Mode)

Note: The emission that surpasses the limit of peak represents the fundamental emission of the operation that does not account to be conformed to the limit of the interest.

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

Operation Band	:EDR+Hopping	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:H Plan	Measurement Antenna Pol.	:Ver. / Hor.





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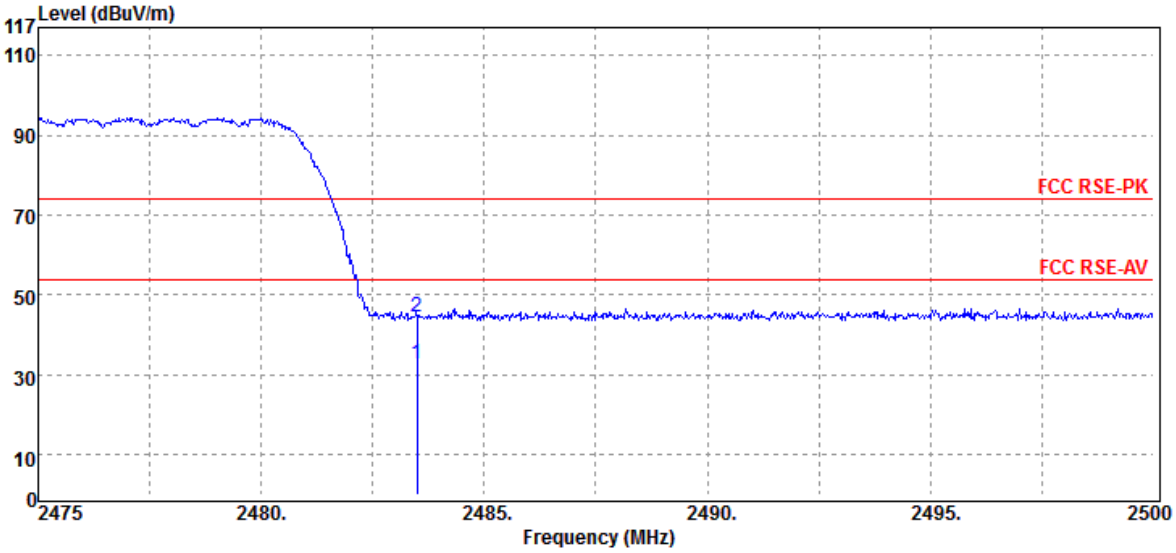
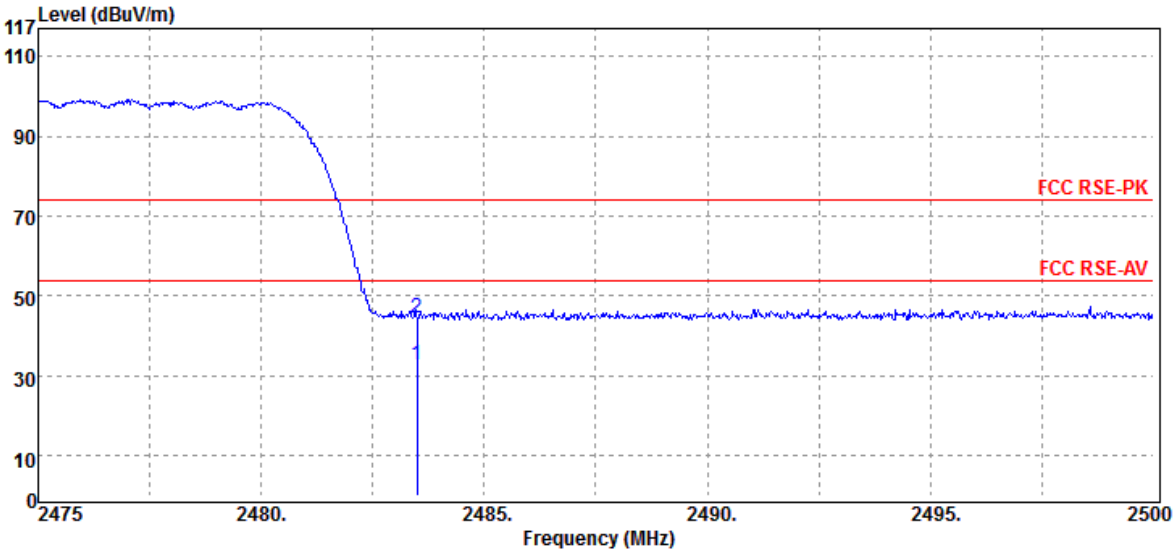
Operation Band	:EDR+Hopping	Test Date	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:Ver. / Hor.





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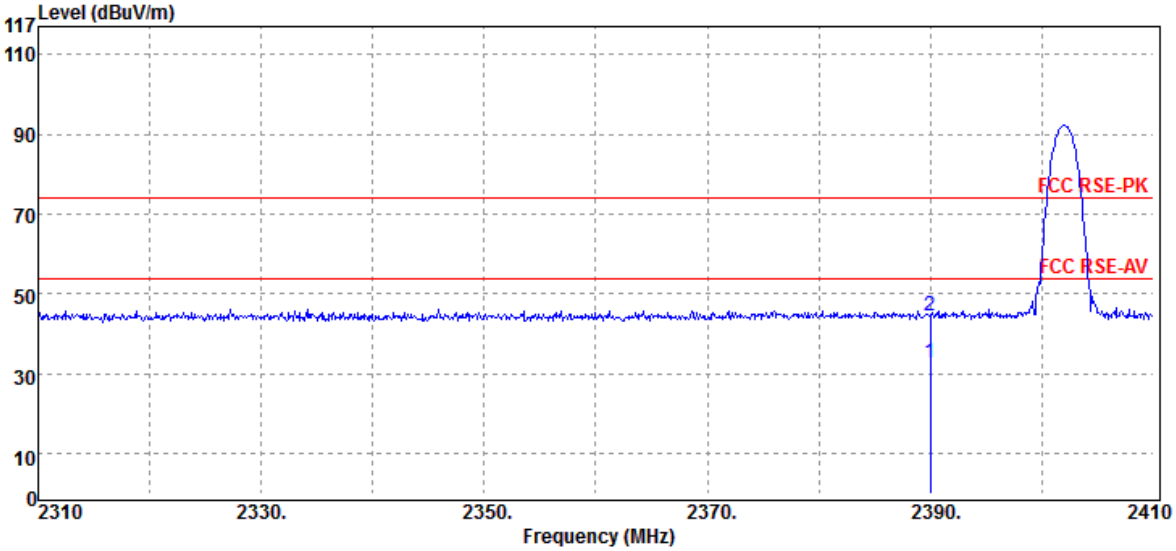
t (886-2) 2299-3279 f (886-2) 2298-0488 www.tw.sgs.com
Member of SGS Group

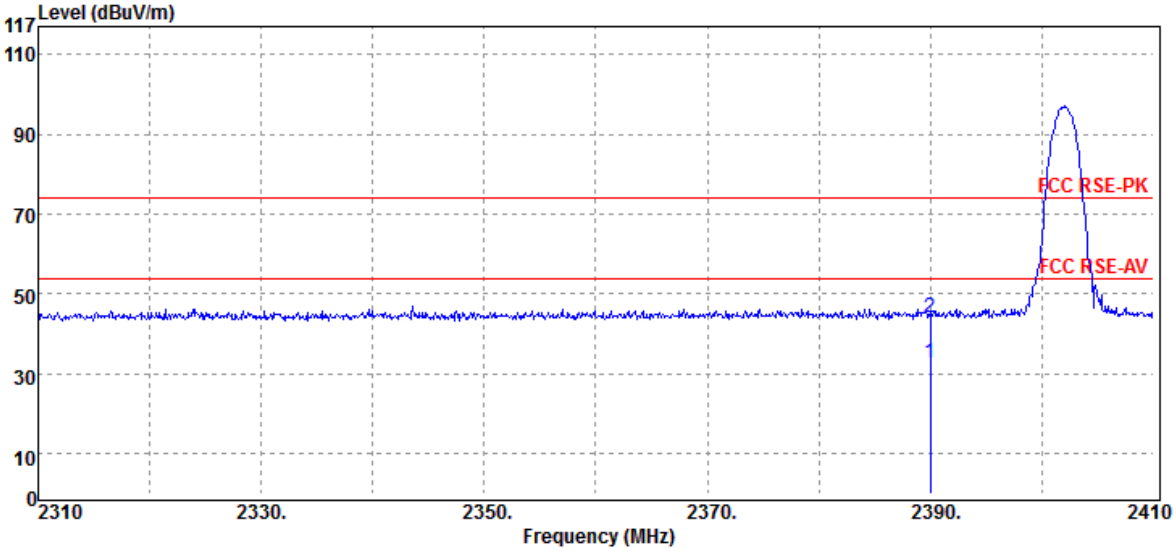
Band Edges Radiated Emission: (Non-Hopping Mode)

Note: The emission that surpasses the limit of peak represents the fundamental emission of the operation that does not account to be conformed to the limit of the interest.

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

Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:Ver. / Hor.





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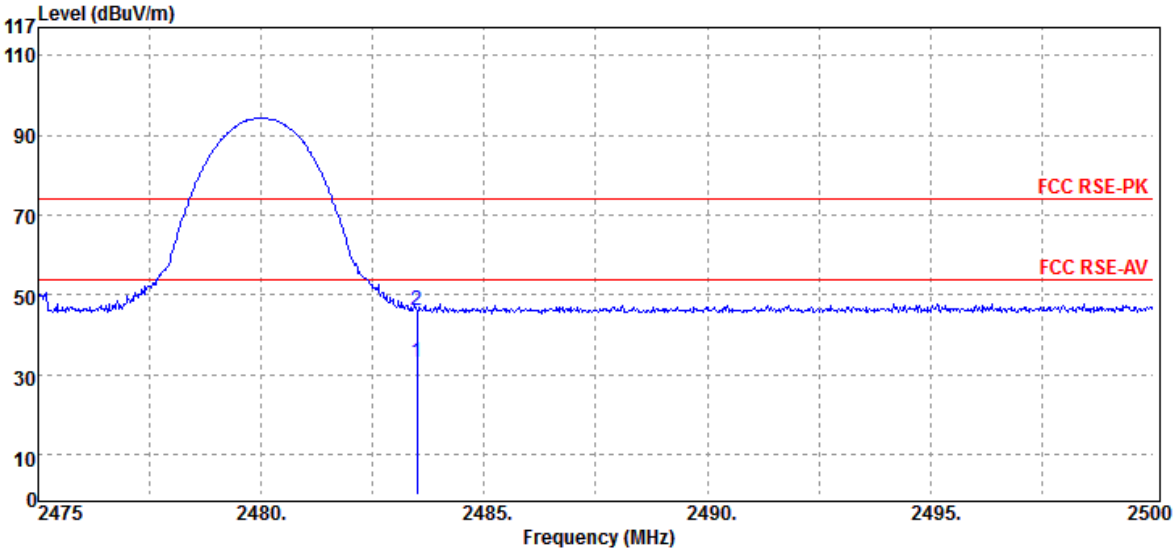
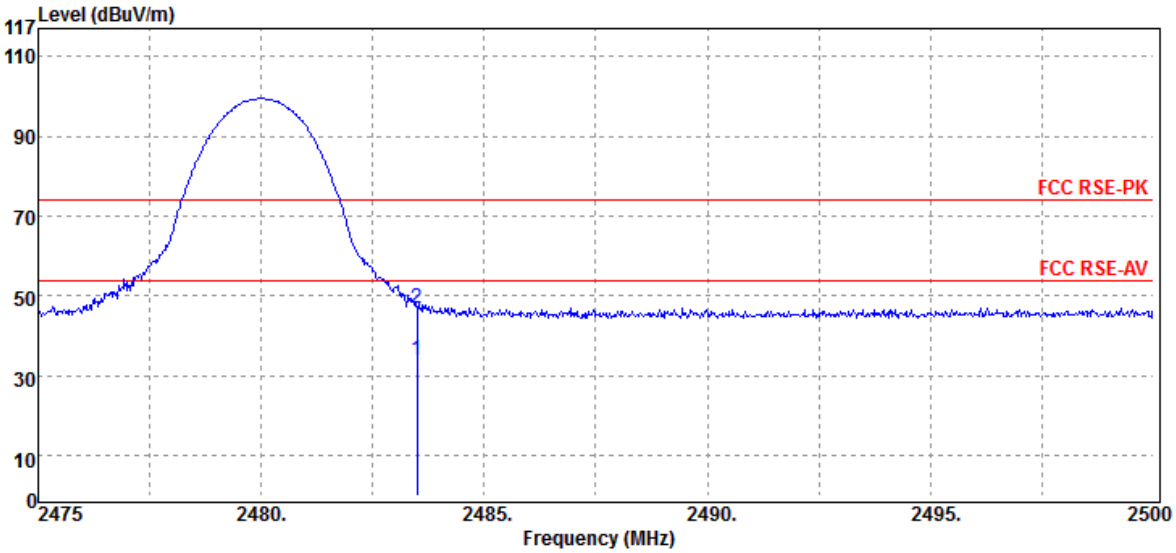
Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:Band Edge HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:Ver. / Hor.





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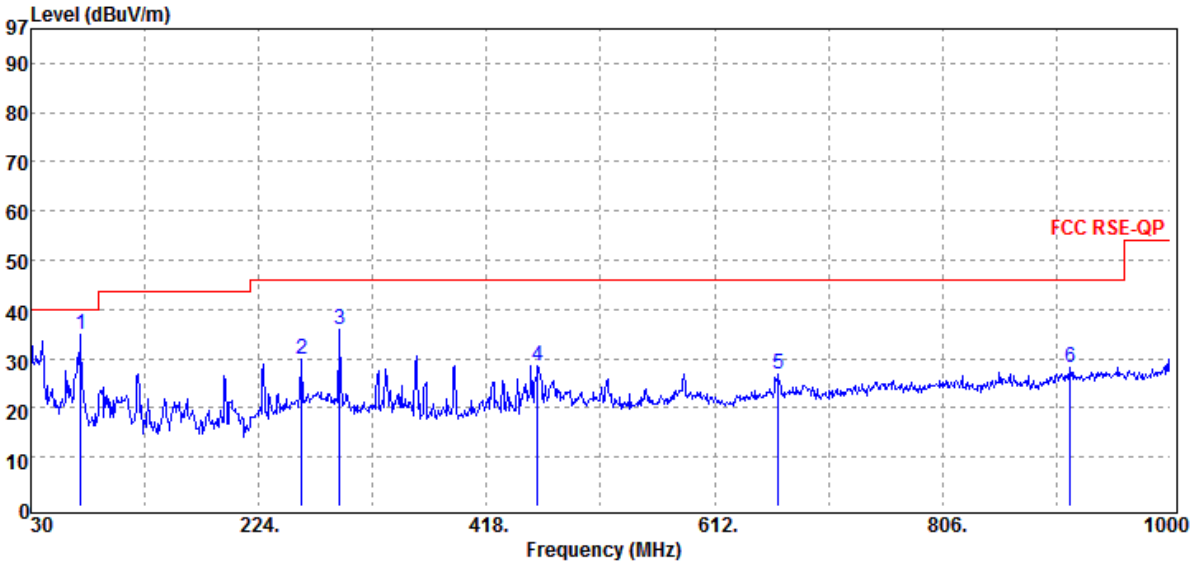
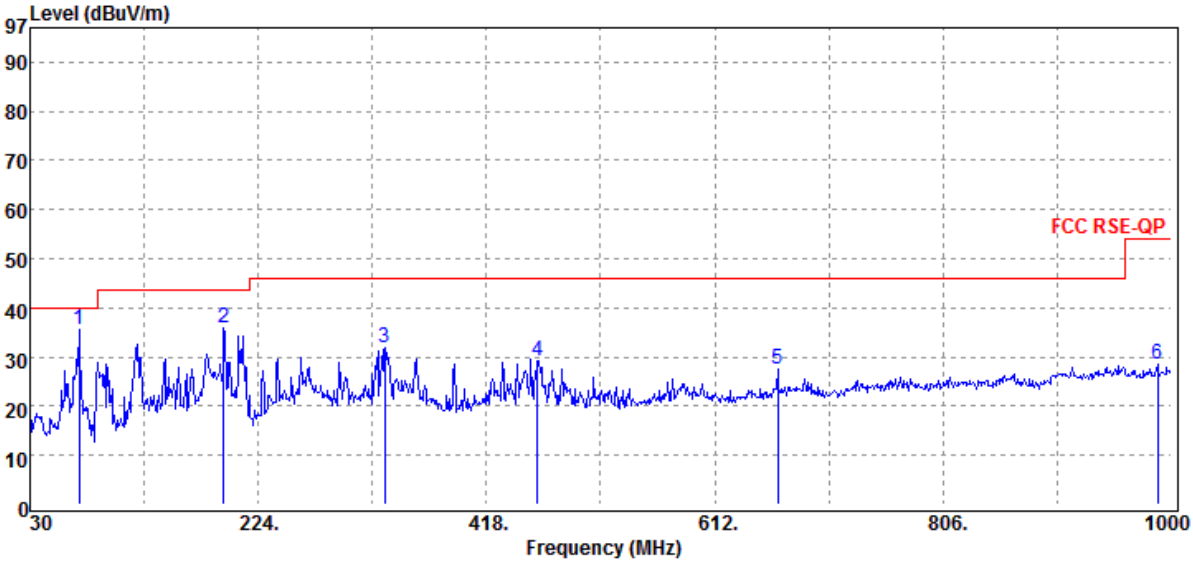
Radiated Spurious Emission Measurement photos Result (below 1GHz)

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

Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:Ver. / Hor.





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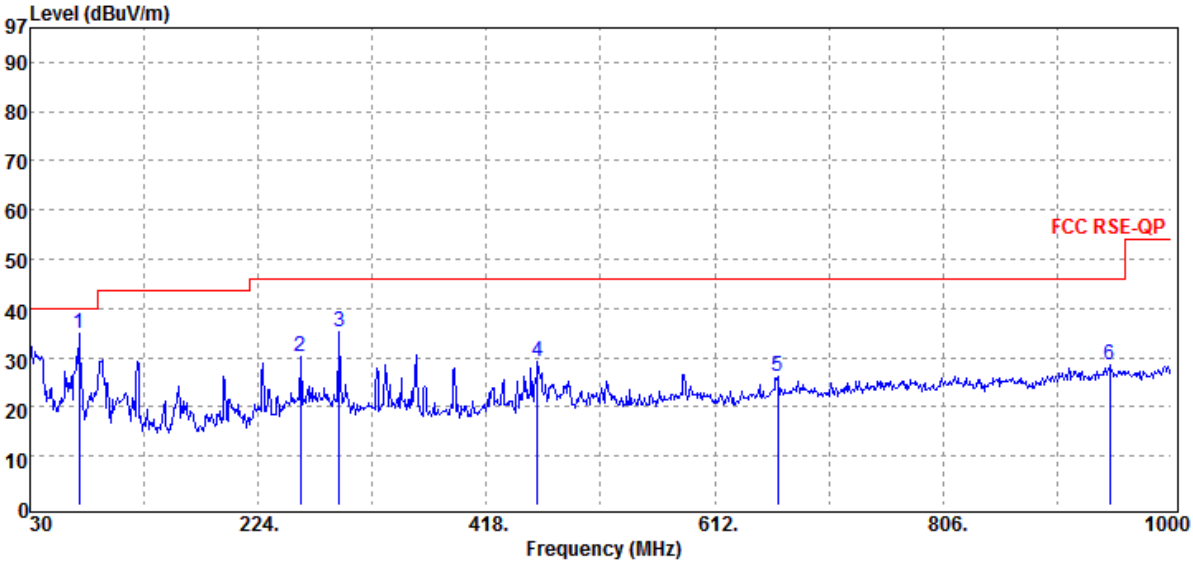
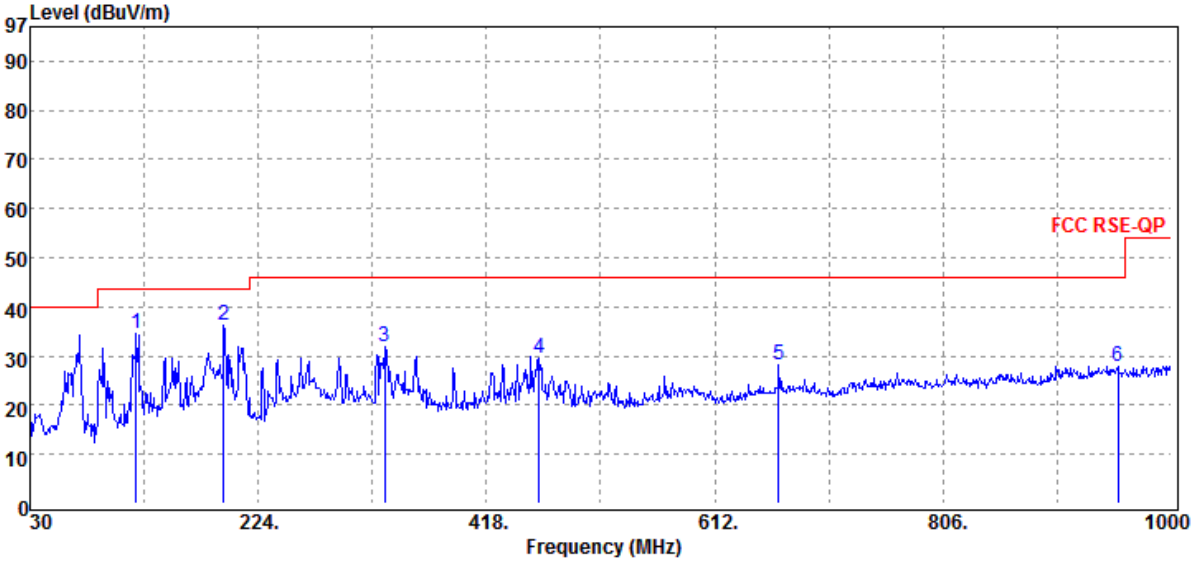
Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2441 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:Ver. / Hor.





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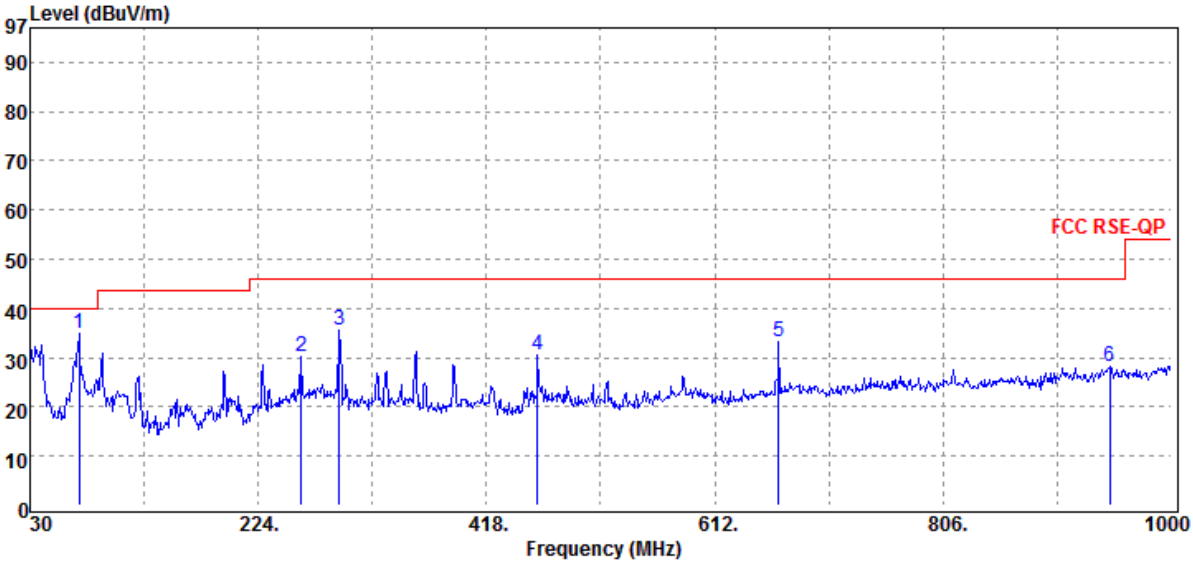
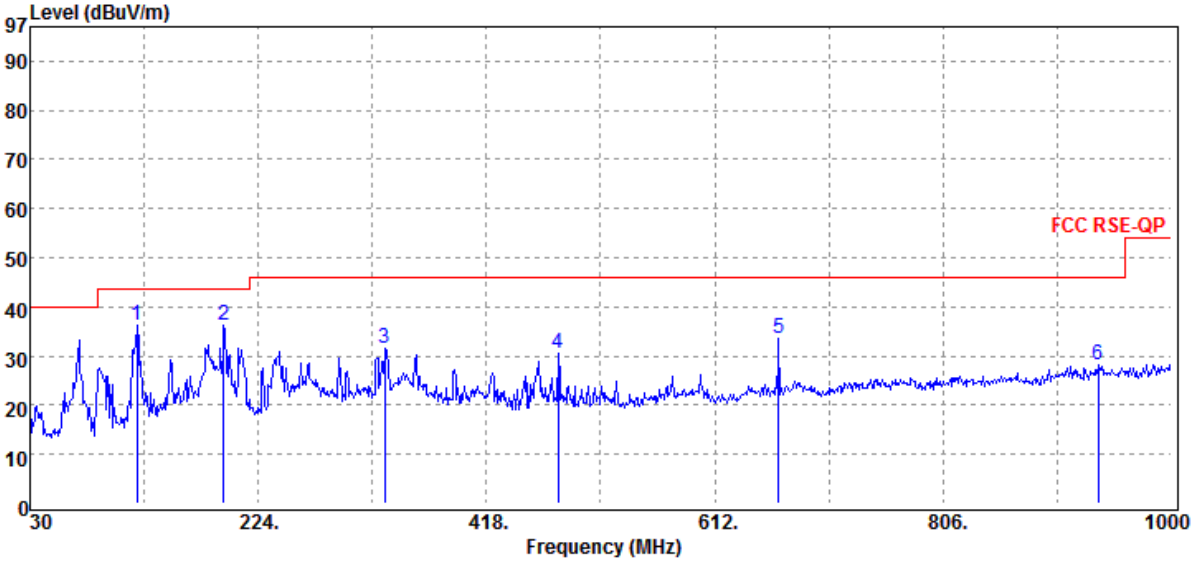
Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:Ver. / Hor.





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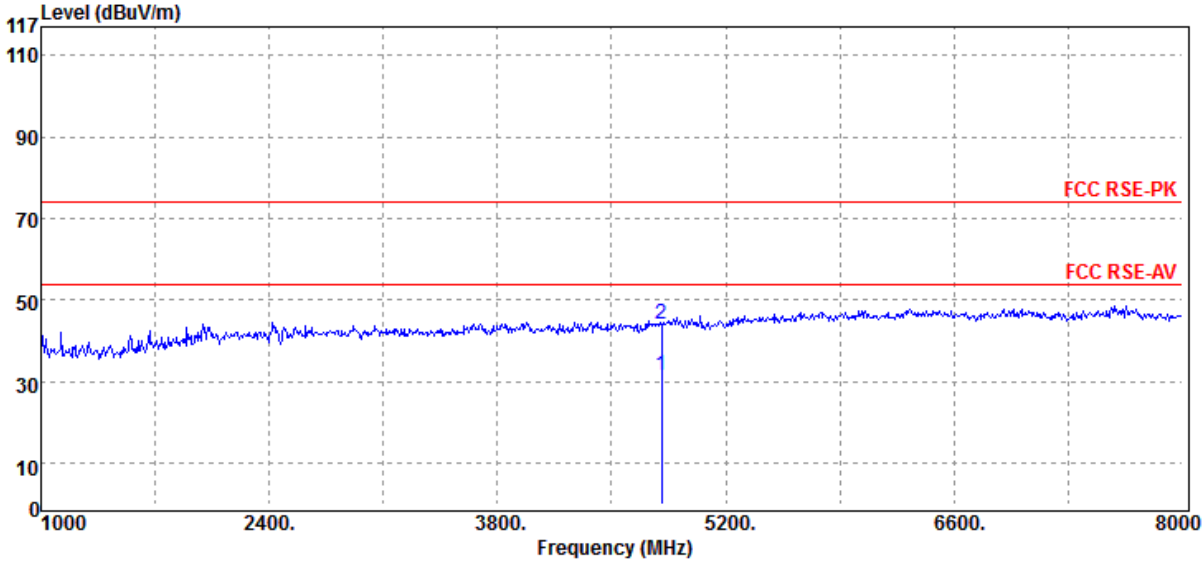
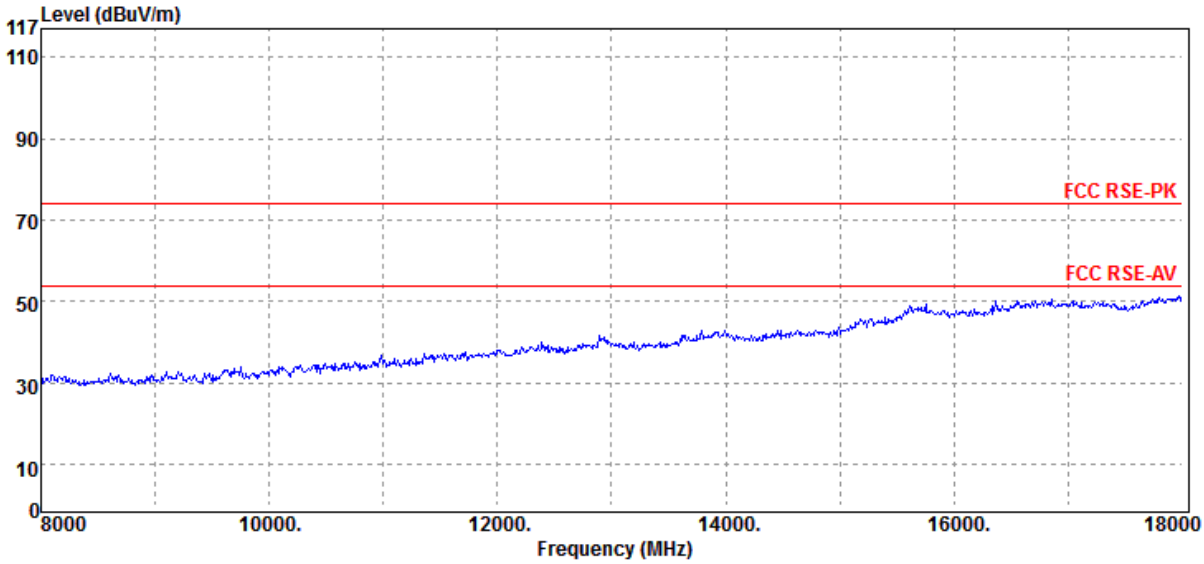
Radiated Spurious Emission Measurement photos Result (above 1GHz)

Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL





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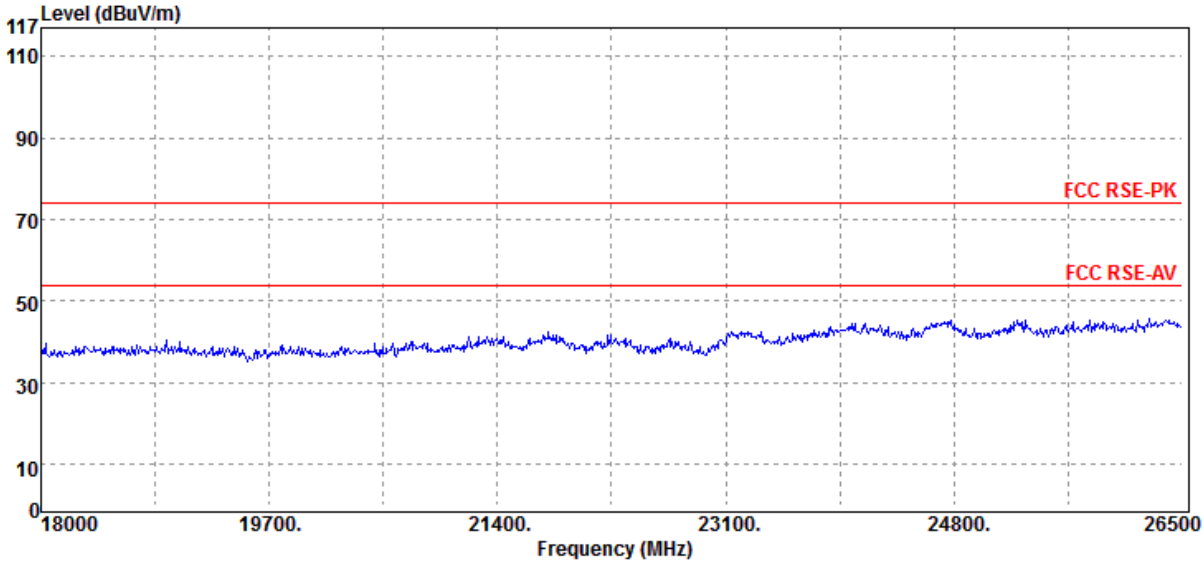

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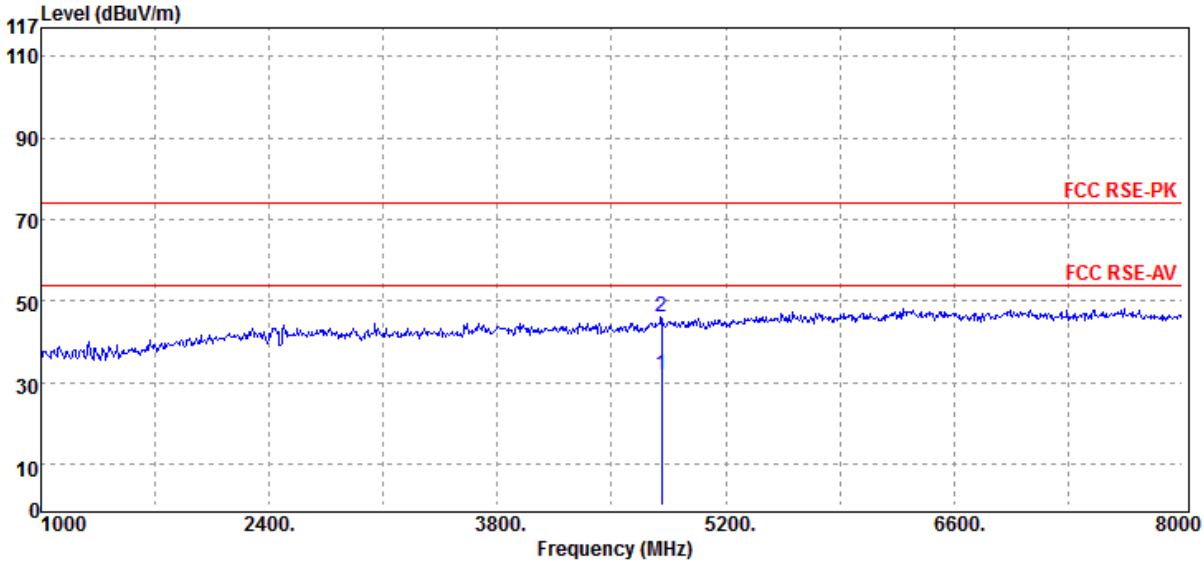
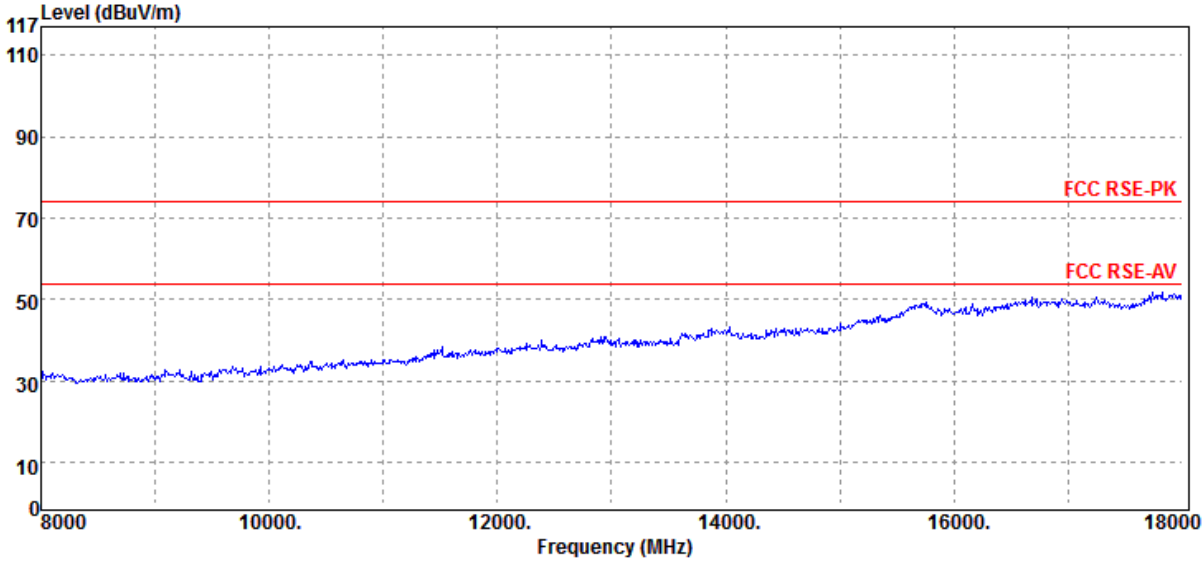
Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2402 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX LOW	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL





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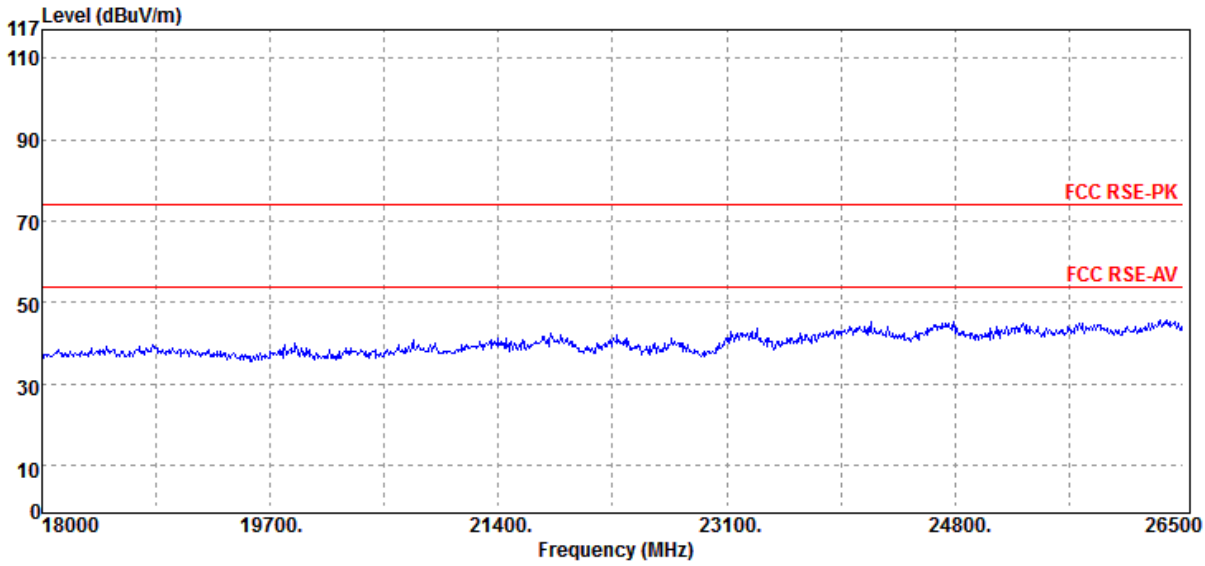

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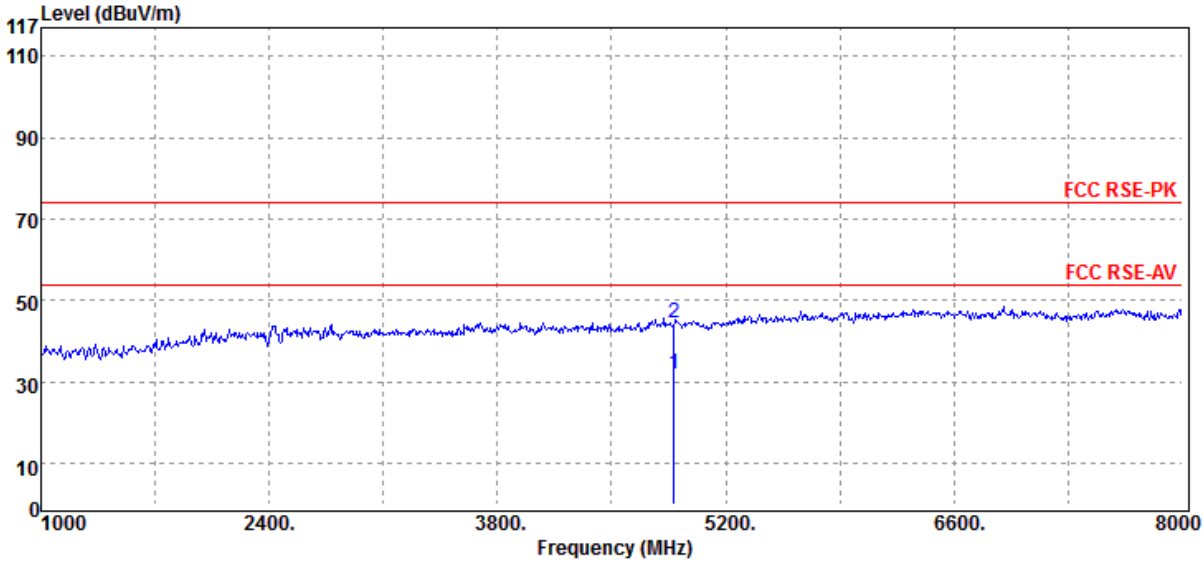
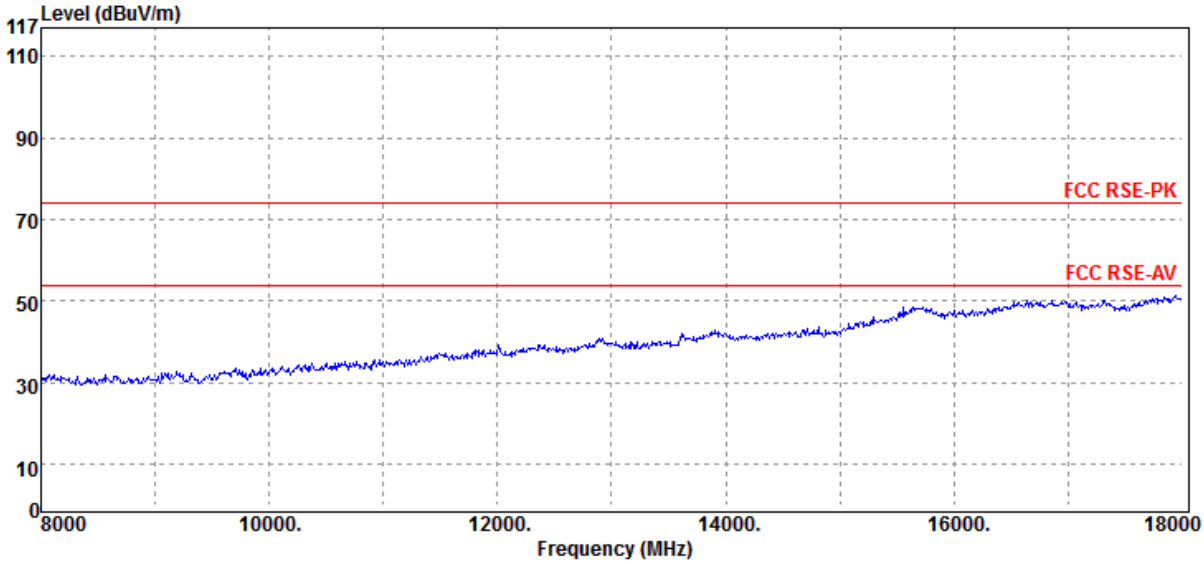
Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2441 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL





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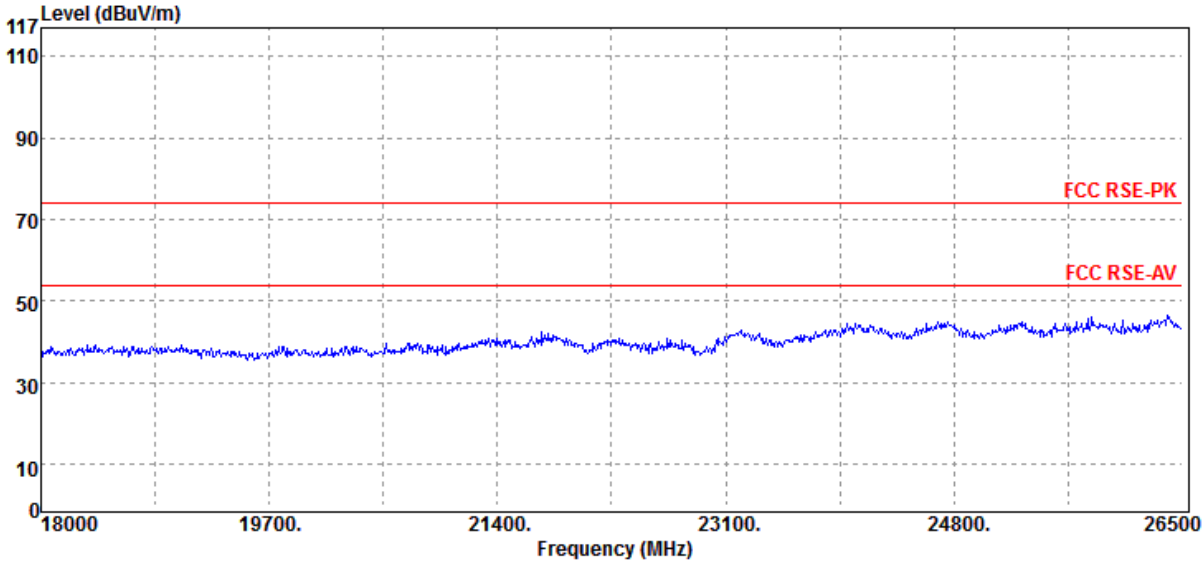

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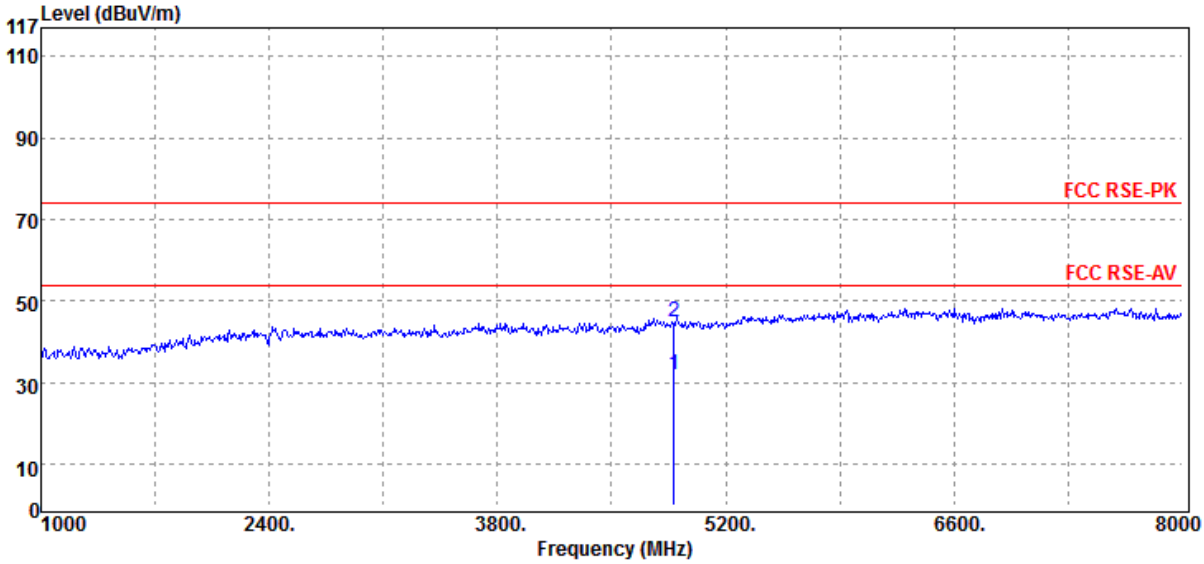
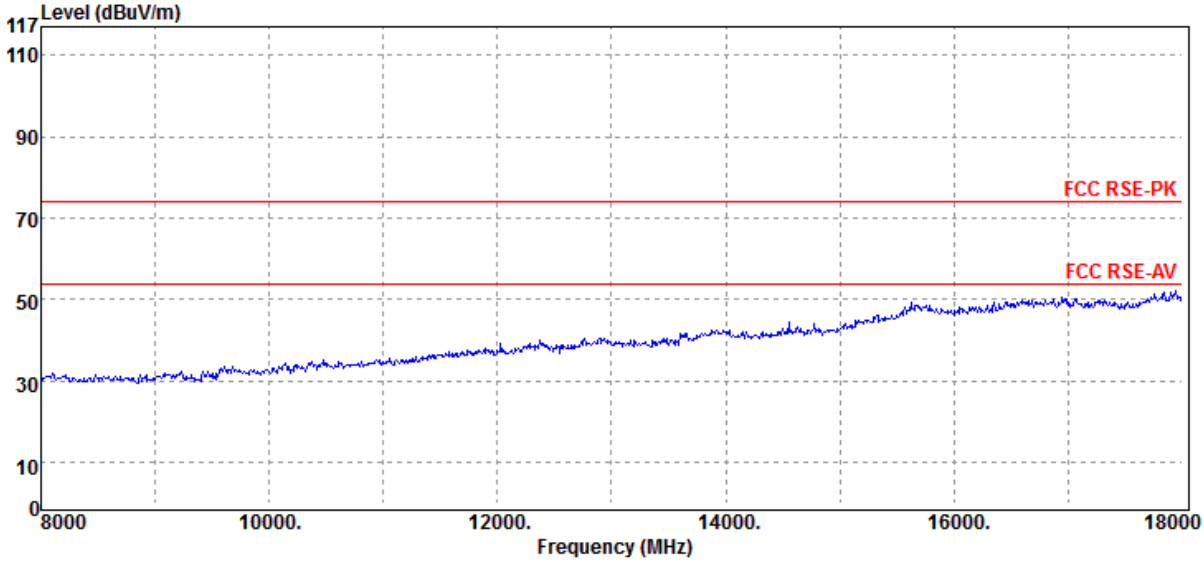
Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2441 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX MID	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL





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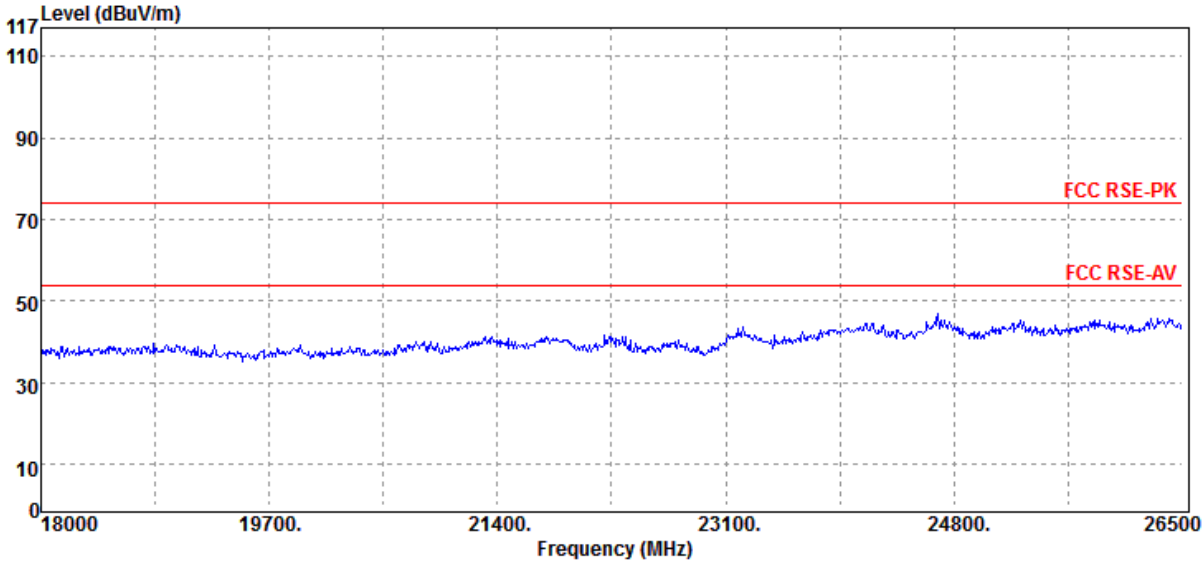

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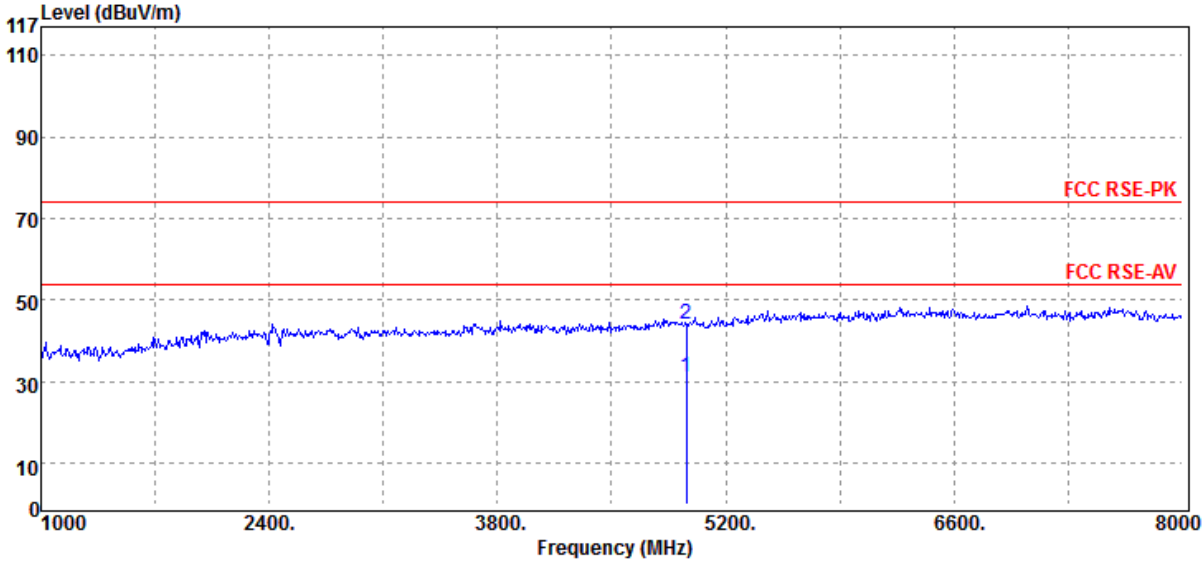
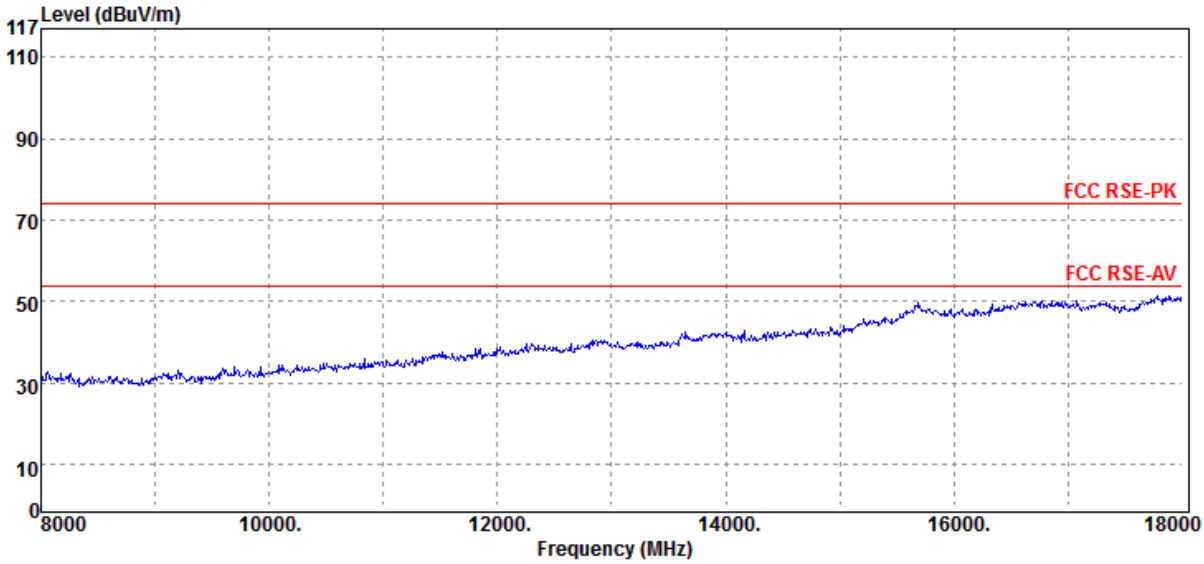
Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:VERTICAL





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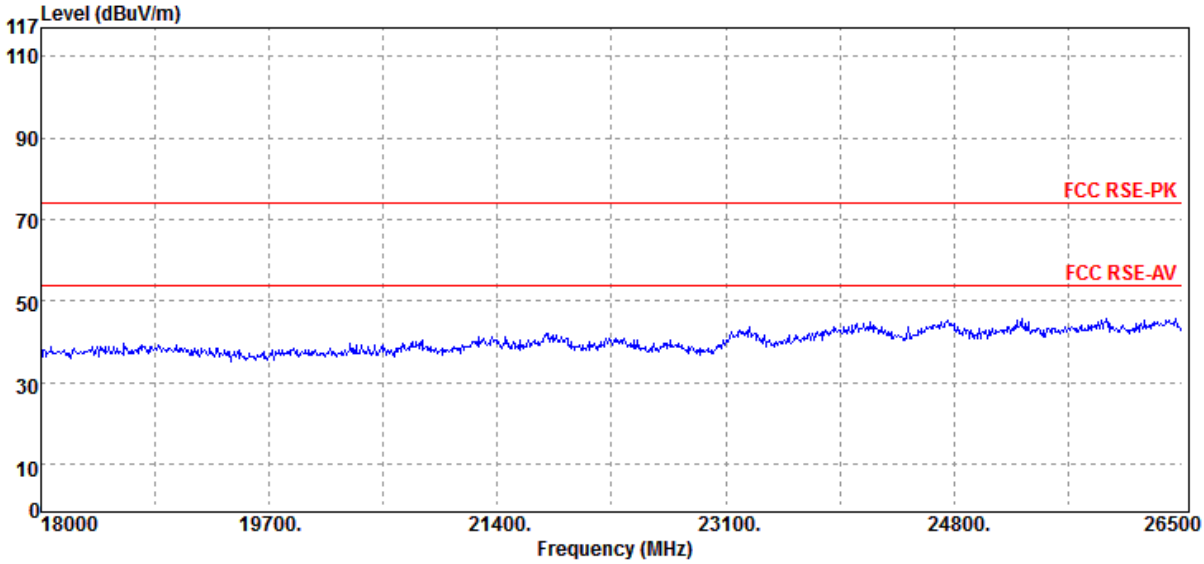

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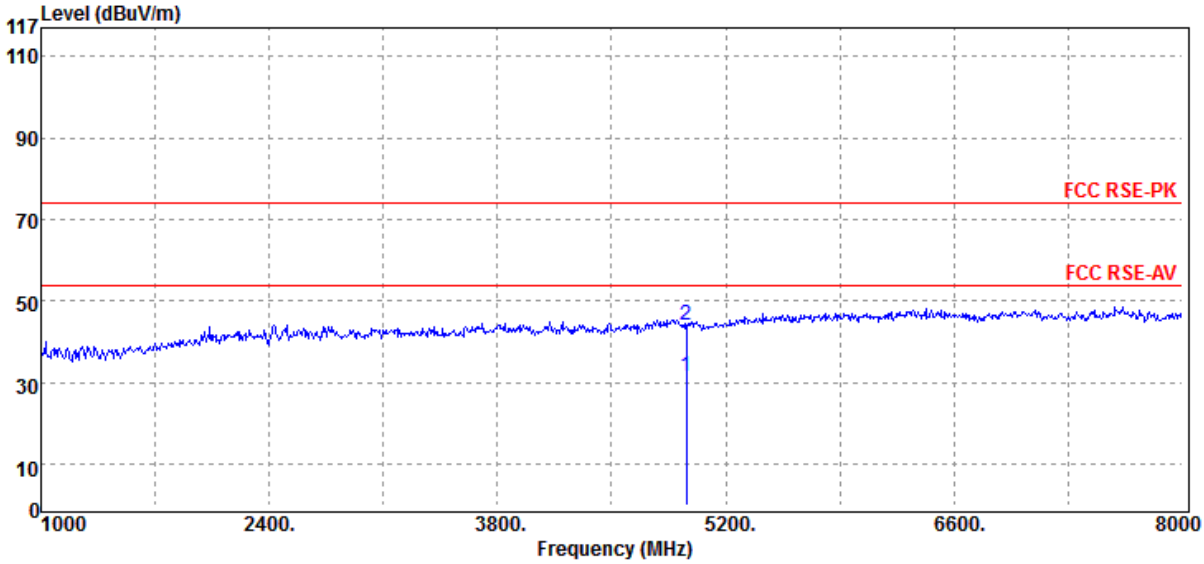
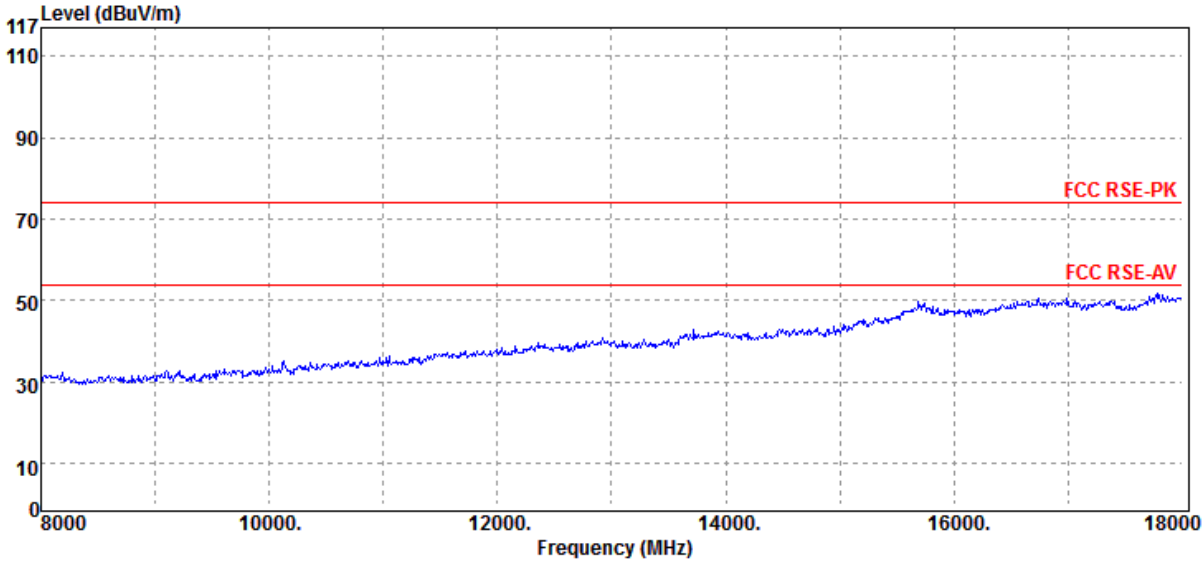
Operation Band	:EDR	Test Date	:2014-06-11
Fundamental Frequency	:2480 MHz	Temp./Humi.	:21 deg_C / 61 RH
Operation Mode	:TX HIGH	Engineer	:Tin
EUT Pol.	:H Plane	Measurement Antenna Pol.	:HORIZONTAL





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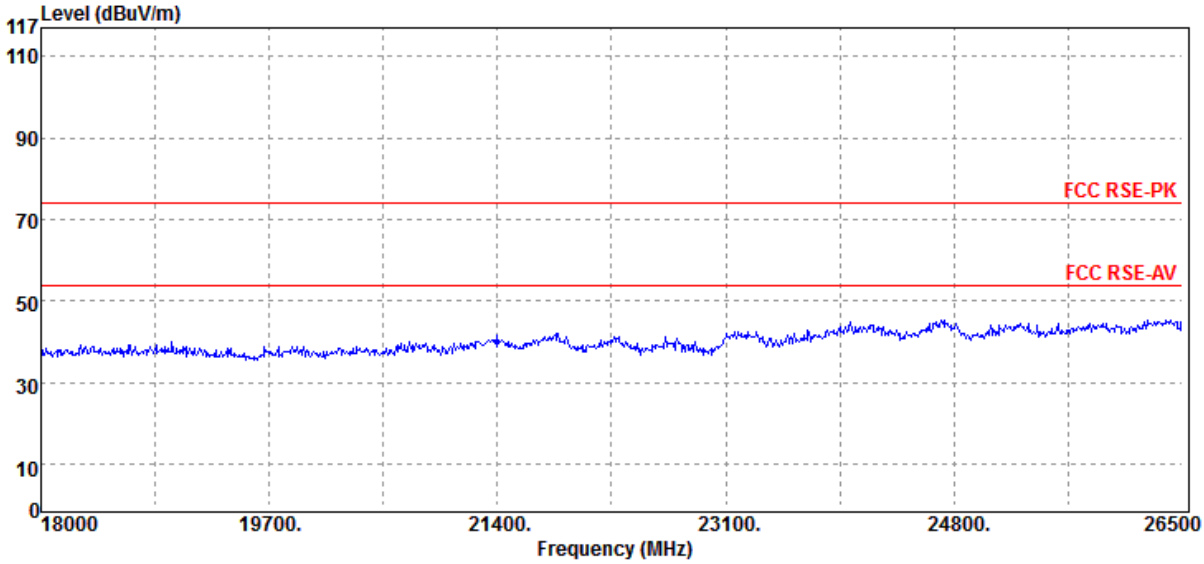

~ End of Report ~

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