



Test Report issued under the responsibility of:

ITC ENGINEERING SERVICES, INC.

FCC CFR Title 47 Part 15 Subpart C 15.205, 15.209, 15.247	
Report Reference No. :	20140924-01R1 R-6 Glasses_FCC
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Testing Laboratory..... :	ITC Engineering Services, Inc.
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Test Specification Standard..... :	FCC CFR Title 47 Part 15 Subpart C 15.205, 15.209, 15.247
Test Procedure	ANSI C63.4:2009, ANSI C63.10:2009 (Test Procedures) & Public Notice DA 00-705:2000
Judgment	Complies
Test Item Description..... :	802.11 b/g/n, Bluetooth 2.0 + EDR, GPS/GLONASS enabled Augmentation Eyewear
Manufacturer Logo.....	
Manufacturer	Osterhout Design Group
Model/Type Reference.....	R-6 Glasses
RF Operating Frequency Band.....	2.400 - 2.4835 GHz



TESTING CERT #3382.01

ISO/IEC 17025:2005 Accredited Laboratory

TABLE OF CONTENTS

1	DOCUMENTATION	6
1.1	TESTING LOCATION	6
1.2	REVISION HISTORY	6
1.3	DECLARATION/DISCLAIMER	7
1.4	CONDITION OF EUT	7
1.5	GENERAL DESCRIPTION OF EUT	7
1.6	OPERATIONAL DESCRIPTION OF EUT	7
1.7	LIST OF APPLICANT PERIPHERALS/SUPPORTING EQUIPMENT USED DURING TEST	8
1.8	GENERAL TEST REMARKS	8
1.9	SUMMARY OF TESTS	8
1.10	MEASUREMENT UNCERTAINTY	9
1.11	TEST SET UP PHOTOS	9
2	RADIATED EMISSIONS PER FCC PART 15.209.....	11
2.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	11
2.2	TEST EQUIPMENT.....	11
2.3	TEST SET UP PHOTO(S).....	11
2.4	LIMITS/REQUIREMENTS.....	12
2.5	TEST DESCRIPTION AND PROCEDURE	12
2.6	TEST DATA PLOTS.....	12
3	CONDUCTED POWER LINE EMISSIONS PER FCC PART 15.207	15
3.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	15
3.2	TEST EQUIPMENT.....	15
3.3	TEST SET UP PHOTO(S).....	15
3.4	LIMITS/REQUIREMENTS.....	16
3.5	TEST DESCRIPTION AND PROCEDURE	16
3.6	TEST DATA PLOTS.....	16
4	MINIMUM 6 DB BANDWIDTH PER FCC PART 15.247 (A)(2) – 802.11B/G/N.....	17
4.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	17
4.2	TEST EQUIPMENT.....	17
4.3	TEST SET UP PHOTO(S).....	17
4.4	LIMITS/REQUIREMENTS.....	17
4.5	TEST DESCRIPTION AND PROCEDURE	18
4.6	6DB BANDWIDTH MEASUREMENT TEST DATA.....	18
4.7	6DB BANDWIDTH MEASUREMENT PLOTS	19
4.8	CARRIER FREQUENCY SEPARATION PLOT	20
5	PEAK CONDUCTED OUTPUT POWER PER FCC PART 15.247 (B)(3) – 802.11B/G/N	21
5.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	21
5.2	TEST EQUIPMENT.....	21
5.3	TEST SET UP PHOTO(S).....	21
5.4	LIMITS/REQUIREMENTS.....	21
5.5	TEST DESCRIPTION AND PROCEDURE	21



5.6	TEST DATA TABLES	21
5.7	PEAK POWER PLOTS.....	22
6	POWER SPECTRAL DENSITY PER FCC PART 15.247 (D) – 802.11B/G/N.....	23
6.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	23
6.2	TEST EQUIPMENT.....	23
6.3	TEST SET UP PHOTO(S).....	23
6.4	LIMITS/REQUIREMENTS.....	23
6.5	TEST DESCRIPTION AND PROCEDURE	24
6.6	TEST DATA TABLES	24
6.7	POWER SPECTRAL DENSITY PLOTS.....	24
7	LOWER/UPPER BAND EDGE PER FCC PART 15 SECTION 15.247 (D) – 802.11B/G/N.....	26
7.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	26
7.2	TEST EQUIPMENT.....	26
7.3	TEST SET UP PHOTO(S).....	26
7.4	LIMITS/REQUIREMENTS.....	26
7.5	TEST DESCRIPTION AND PROCEDURE	26
7.6	TEST PLOTS.....	27
8	OCCUPIED BANDWIDTH PER FCC PART 2 SECTION 2.1049 (H) – 802.11B/G/N	30
8.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	30
8.1	TEST EQUIPMENT.....	30
8.1	TEST SET UP PHOTO(S).....	30
8.2	LIMITS/REQUIREMENTS.....	30
8.3	TEST DESCRIPTION AND PROCEDURE	30
8.4	TEST PLOTS.....	31
9	MINIMUM 6 DB BANDWIDTH PER FCC PART 15.247 (A)(2) – BLUETOOTH 2.0 + EDR.....	32
9.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	32
9.2	TEST EQUIPMENT.....	32
9.3	TEST SET UP PHOTO(S).....	32
9.4	LIMITS/REQUIREMENTS.....	32
9.5	TEST DESCRIPTION AND PROCEDURE	33
9.6	6DB BANDWIDTH MEASUREMENT TEST DATA.....	33
9.7	6DB BANDWIDTH MEASUREMENT PLOTS	34
9.1	CARRIER FREQUENCY SEPARATION PLOT	35
10	PEAK CONDUCTED OUTPUT POWER PER FCC PART 15.247 (B)(3) – BLUETOOTH 2.0 + EDR.....	36
10.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	36
10.2	TEST EQUIPMENT.....	36
10.3	TEST SET UP PHOTO(S).....	36
10.4	LIMITS/REQUIREMENTS.....	36
10.5	TEST DESCRIPTION AND PROCEDURE	36
10.6	TEST DATA TABLES	36
10.1	PEAK POWER PLOTS.....	37
11	POWER SPECTRAL DENSITY PER FCC PART 15.247 (D) – BLUETOOTH 2.0 + EDR	38
11.1	ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	38
11.3	TEST EQUIPMENT.....	38
11.6	TEST SET UP PHOTO(S).....	38



11.7 LIMITS/REQUIREMENTS.....	38
11.8 TEST DESCRIPTION AND PROCEDURE	38
11.9 TEST DATA TABLES	38
11.10 POWER SPECTRAL DENSITY PLOTS.....	39
12 LOWER/UPPER BAND EDGE PER FCC PART 15 SECTION 15.247 (D) – BLUETOOTH 2.0 + EDR.....	40
12.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	40
12.2 TEST EQUIPMENT.....	40
12.3 TEST SET UP PHOTO(S).....	40
12.4 LIMITS/REQUIREMENTS.....	40
12.5 TEST DESCRIPTION AND PROCEDURE	40
12.6 TEST PLOTS.....	41
13 OCCUPIED BANDWIDTH PER FCC PART 2 SECTION 2.1049 (H) – BLUETOOTH 2.0 + EDR	43
13.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	43
13.2 TEST EQUIPMENT.....	43
13.3 TEST SET UP PHOTO(S).....	43
13.4 LIMITS/REQUIREMENTS.....	43
13.5 TEST DESCRIPTION AND PROCEDURE	43
13.6 TEST PLOTS.....	44
14 SPURIOUS & RESTRICTED BANDS EMISSIONS PER FCC PART 15 SECTIONS 15.209 & 15.205	45
14.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS	45
14.2 TEST EQUIPMENT.....	45
14.3 TEST SET UP PHOTO(S).....	45
14.4 LIMITS/REQUIREMENTS.....	45
14.5 TEST DESCRIPTION AND PROCEDURE	46
14.6 SPURIOUS EMISSIONS PLOTS.....	47
15 GAIN OF TRANSMISSION ANTENNA PER FCC PART 15.247 (B)(4)	54
15.1 LIMITS/REQUIREMENTS.....	54
16 APPENDIX	55
16.1 EUT TECHNICAL SPECIFICATIONS.....	56
16.2 EUT PHOTOS	56

LIST OF FIGURES

FIGURE 1: CONDUCTED RF TEST SETUP	9
FIGURE 2: RE TEST SETUP - ACTIVE LOOP ANTENNA	10
FIGURE 3: RE TEST SETUP - BICONICAL ANTENNA - LOG PERIODIC ANTENNA	10
FIGURE 4: RE TEST SETUP - HORN ANTENNAS	10
FIGURE 5: CE TEST SETUP - FRONT VIEW - SIDE VIEW	11
FIGURE 6: RADIATED EMISSIONS – ACTIVE LOOP, 9 KHZ – 1.705 MHZ	12
FIGURE 7: RADIATED EMISSIONS – ACTIVE LOOP, 1.705 – 30 MHZ	13
FIGURE 8: RADIATED EMISSIONS – BICONICAL, HORIZONTAL POLARIZATION	13
FIGURE 9: RADIATED EMISSIONS – BICONICAL, VERTICAL POLARIZATION	14
FIGURE 10: RADIATED EMISSIONS – LOG-PERIODIC, HORIZONTAL POLARIZATION	14
FIGURE 11: RADIATED EMISSIONS – LOG-PERIODIC, VERTICAL POLARIZATION	15



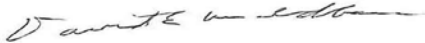
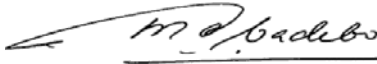
FIGURE 12: CONDUCTED EMISSIONS – HOT AC LINE.....	16
FIGURE 13: CONDUCTED EMISSIONS – NEUTRAL AC LINE	17
FIGURE 14: 802.11 CHANNELS.....	18
FIGURE 15: 802.11B 6DB BANDWIDTH (CH1 SHOWN, CH6 & 11 SIMILAR)	19
FIGURE 16: 802.11G 6DB BANDWIDTH (CH1 SHOWN, CH6 & 11 SIMILAR)	19
FIGURE 17: 802.11N 6DB BANDWIDTH (CH1 SHOWN, CH6 & 11 SIMILAR)	20
FIGURE 18: CARRIER FREQUENCY SEPARATION 25 MHZ (CH1, 6 & 11)	20
FIGURE 19: 802.11B PEAK POWER (CH1 SHOWN, CH6 & 11 SIMILAR)	22
FIGURE 20: 802.11G PEAK POWER (CH1 SHOWN, CH6 & 11 SIMILAR)	22
FIGURE 21: 802.11N PEAK POWER (CH1 SHOWN, CH6 & 11 SIMILAR)	23
FIGURE 22: 802.11B POWER SPECTRAL DENSITY (CH1 SHOWN, CH6 & 11 SIMILAR).....	24
FIGURE 23: 802.11G POWER SPECTRAL DENSITY (CH1 SHOWN, CH6 & 11 SIMILAR)	25
FIGURE 24: 802.11N POWER SPECTRAL DENSITY (CH1 SHOWN, CH6 & 11 SIMILAR)	25
FIGURE 25: 802.11B CH1 LOWER BAND EDGE	27
FIGURE 26: 802.11G CH1 LOWER BAND EDGE.....	27
FIGURE 27: 802.11N CH1 LOWER BAND EDGE.....	28
FIGURE 28: 802.11B CH11 UPPER BAND EDGE	28
FIGURE 29: 802.11G CH11 UPPER BAND EDGE	29
FIGURE 30: 802.11N CH11 UPPER BAND EDGE	29
FIGURE 31: 802.11B OCCUPIED BANDWIDTH (CH1 SHOWN, CH6 & 11 SIMILAR).....	31
FIGURE 32: 802.11G OCCUPIED BANDWIDTH (CH1 SHOWN, CH6 & 11 SIMILAR).....	31
FIGURE 33: 802.11N OCCUPIED BANDWIDTH (CH1 SHOWN, CH6 & 11 SIMILAR)	32
FIGURE 34: BLUETOOTH 2.0 + EDR CHANNELS (79).....	33
FIGURE 35: 6DB GFSK BANDWIDTH (CH0 SHOWN, CH20 & 39 SIMILAR)	34
FIGURE 36: 6DB EDR BANDWIDTH (CH0 SHOWN, CH20 & 39 SIMILAR)	34
FIGURE 37: GFSK CARRIER FREQUENCY SEPARATION 1 MHZ (CH0, 1 & 2).....	35
FIGURE 38: EDR CARRIER FREQUENCY SEPARATION 1 MHZ (CH0 & 2 SHOWN)	35
FIGURE 39: GFSK PEAK POWER (CH0 SHOWN, CH20 & 39 SIMILAR)	37
FIGURE 40: EDR PEAK POWER (CH0 SHOWN, CH20 & 39 SIMILAR)	37
FIGURE 41: GFSK POWER SPECTRAL DENSITY (CH0 SHOWN, CH20 & 39 SIMILAR)	39
FIGURE 42: EDR POWER SPECTRAL DENSITY (CH0 SHOWN, CH20 & 39 SIMILAR)	39
FIGURE 43: GFSK CH0 LOWER BAND EDGE	41
FIGURE 44: EDR CH0 LOWER BAND EDGE.....	41
FIGURE 45: GFSK CH39 UPPER BAND EDGE	42
FIGURE 46: EDR CH39 UPPER BAND EDGE	42
FIGURE 47: GFSK OCCUPIED BANDWIDTH (CH0 SHOWN, CH20 & 39 SIMILAR)	44
FIGURE 48: EDR OCCUPIED BANDWIDTH (CH0 SHOWN, CH20 & 39 SIMILAR).....	44
FIGURE 49: DRG HORN, HORIZONTAL POLARIZATION: 802.11B/G/N (CH1 SHOWN, CH6 & 11 SIMILAR)	47
FIGURE 50: DRG HORN, VERTICAL POLARIZATION: 802.11B/G/N (CH1 SHOWN, CH6 & 11 SIMILAR)	47
FIGURE 51: LOG-PERIODIC, HORIZONTAL POLARIZATION: 802.11 & BT	48
FIGURE 52: LOG-PERIODIC, VERTICAL POLARIZATION: 802.11 & BT	48
FIGURE 53: BICONICAL, HORIZONTAL POLARIZATION: 802.11 & BT	49
FIGURE 54: BICONICAL, VERTICAL POLARIZATION: 802.11 & BT	49
FIGURE 55: ACTIVE LOOP, HORIZONTAL POLARIZATION: 802.11 & BT	50
FIGURE 56: ACTIVE LOOP, VERTICAL POLARIZATION: 802.11 & BT	50
FIGURE 57: DRG HORN, HORIZONTAL POLARIZATION: BT CH0, 20, 39	51
FIGURE 57: DRG HORN, VERTICAL POLARIZATION: BT CH0, 20, 39	51
FIGURE 59: DRG HORN, HORIZONTAL POLARIZATION: 802.11 & BT	52
FIGURE 60: DRG HORN, VERTICAL POLARIZATION: 802.11 & BT	52
FIGURE 61: 15-40GHZ HORN, HORIZONTAL POLARIZATION: 802.11 & BT	53



FIGURE 62: 15-40GHZ HORN, VERTICAL POLARIZATION: 802.11 & BT	53
FIGURE 63: FRONT OBLIQUE VIEW	56
FIGURE 64: REAR OBLIQUE VIEW	57

1 DOCUMENTATION

1.1 TESTING LOCATION

☒ ITC Testing Laboratory:	:	ITC Engineering Services, Inc.	
Testing Location/Address	:	9959 Calaveras Road, PO Box 543, Sunol, CA 94586, USA	
Prepared By (Name + Signature)	:	D.E. Waldbeser	
Tested By (Name + Signature)	:	D.E. Waldbeser	
Approved By (Name + Signature)	:	Michael Gbadebo, PE	
☐ Manufacturer Facility	:		
Testing Location/Address	:		
Tested By (Name + Signature)	:		
Approved By (+ Signature)	:		
☐ 3 rd Party Test Facility	:		
Testing Location/Address	:		
Tested By (Name + Signature)	:		
Approved By (+ Signature)	:		

1.2 REVISION HISTORY

#	Revision Date	Old Report Number	New Report Number	Revision
1	11/10/2014	20140924-01 R-6 Glasses_FCC	20140924-01R1 R-6 Glasses_FCC	FCC ID & antenna type inserted, page 7.; Orthogonal planes clause inserted at section 2.5, page 12.

1.3 DECLARATION/DISCLAIMER

It is the manufacturer's responsibility to assure that additional production units of these models are manufactured with identical electrical and mechanical characteristics. This report is the confidential property of the applicant. As a mutual protection to our applicants, the public, and ourselves, extracts from the test report shall not be reproduced except in full without ITC Engineering Service's written approval. The applicant/manufacturer shall not use this report to claim product endorsement by any US Government agency.

1.4 CONDITION OF EUT

Equipment Under Test (EUT) was tested as it was received. The radiated mode tests utilize the EUT internal antenna. Both the WiFi and the Bluetooth radios use the same antenna. For the conducted mode tests, the internal antenna RF cable connector is disconnected from the PCB and a suitable patch cable to the spectrum analyzer is used. The EUT WiFi and Bluetooth radios are software controllable by means of a laptop and a USB connection.

1.5 GENERAL DESCRIPTION OF EUT

Product	R-6 Glasses
Model No.	N/A
Power Supply	Internal rechargeable Lithium Polymer battery, 1300 mAH (2)
I/O Ports	Custom magnetic USB / charging receptacle
Operating Frequency Range	2.400- 2.4835 GHz
802.11 b/g/n	
FCC ID	2ADCMODGR-6
Modulation Type	CCK, BPSK, QPSK, 16-QAM, 64-QAM
Modulation Technology	b: DSSS; g: DSSS, OFDM; n: OFDM
Transfer Rate	b: 1-11 Mbps, g: 6-54 Mbps, n: 7.2-72.2 Mbps (20 MHz channel)
Number of Channels	11
Maximum Output Power	+13 to +18 dBm typ.
Bluetooth 2.0 + EDR	
FCC ID	2ADCMODGR-6
Modulation Type	GFSK (1 Mbps), EDR: $\pi/4$ -DPSK (2 Mbps), 8DPSK (3 Mbps)
Modulation Technology	FHSS, AFH
Transfer Rate	1 , 2, 3Mbps
Number of Channels	79
Maximum Output Power	+7 to +9 dBm typ.
Antenna	
Antenna Type	
Antenna Gain, Peak	0 dBi
Radiation Pattern	Omni-directional

1.6 OPERATIONAL DESCRIPTION OF EUT

The R-6 Smart Glasses offers immersive 3D HD viewing of stored or streaming video content, with stereo audio, in a static setting, or in a head orientation tracking augmented vision mode.

1.7 LIST OF APPLICANT PERIPHERALS/SUPPORTING EQUIPMENT USED DURING TEST

Description	Manufacturer	Model Name	Serial Number
Laptop	Apple	MacBook Pro	
AC Adapter	Apple		-

1.8 GENERAL TEST REMARKS

The EUT was operated under the following conditions during the testing:

☐	Standby	☐	Test Program (H – Pattern)
☐	Test Program (Color Bar)	☐	Test Program (Applicant Specific)
☐	TV/VCR Signal Input	☐	Signal Generator Input
☐	Continuous Audio Tone (1kHz)	☐	Cycled Audio Tone (1kHz)
☐	Printer/Parallel Function	☐	Modem/Serial Function
☐	Serpentine Program with I/O	☐	Serpentine Program without I/O
☐	Practice Operation	☐	Normal Operating Mode
☐	Essential Operation (Functional Safety)	☐	Continuous Unmonitored Operation
☒	Continuous Monitored Operation	☐	Non-Continuous Operation

The requirements according to the technical regulations are:

☒	Met	☐	Not Met
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The Equipment Under Test does:

☒	Fulfill the general approval requirements	☐	Not fulfill the general approval requirements
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1.9 SUMMARY OF TESTS

ITC Engineering Services, Inc. as an independent testing laboratory, declares that the equipment specified above was tested to the requirements of:

Section of FCC Title 47 CFR	Test Description	Result
15.209	Radiated Emissions, general	Passed
15.207	Conducted Emissions	Passed
15.247 (a)(2)	6 dB Bandwidth	Passed
15.247 (b)(3)	Peak Conducted Output Power	Passed
15.247 (e)	Power Spectral Density	Passed
15.247 (d)	Band-Edge Measurement	Passed
2.1049 (h)	Occupied Bandwidth	Passed
15.209/.205	Spurious & Restricted Band Emissions	Passed
15.247 (b)(4)	Gain of Transmission Antenna	Passed

1.10 MEASUREMENT UNCERTAINTY

The measurement of uncertainty levels were estimated based on calculation in accordance with TR 100-028-1. Using the value $k = 2$ for expanded uncertainty, this provides a 95% level of confidence.

	Measurement Method	Calculated Uncertainty (dB)
1	RF Power, Conducted	± 1.5
2	Radiated emission of transmitter (30MHz - 1 GHz) @ 3m	± 3.2
3	Radiated emission of transmitter (1 GHz - 24 GHz) @ 3m	± 2.5

1.11 TEST SET UP PHOTOS



FIGURE 1: Conducted RF Test Setup

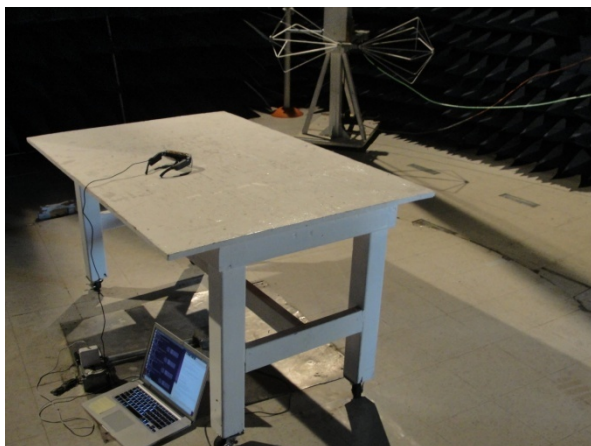
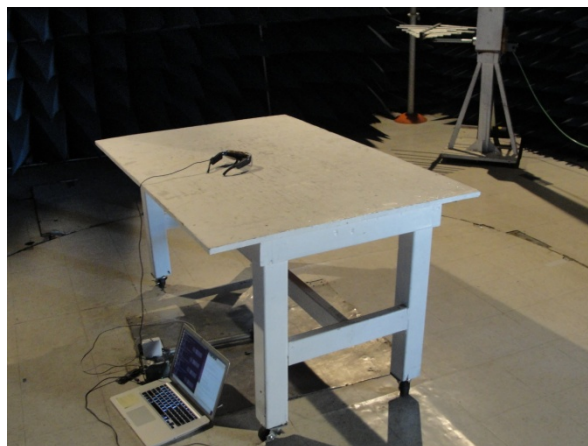
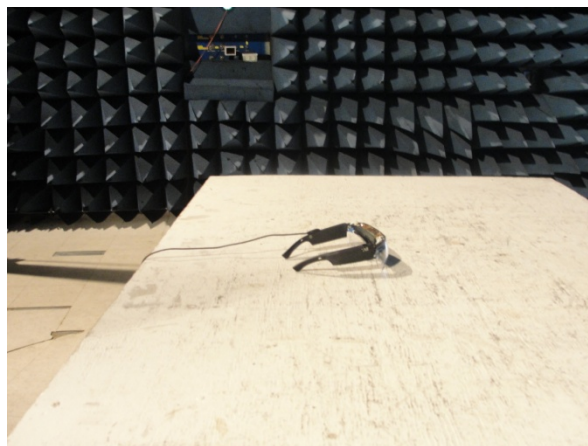
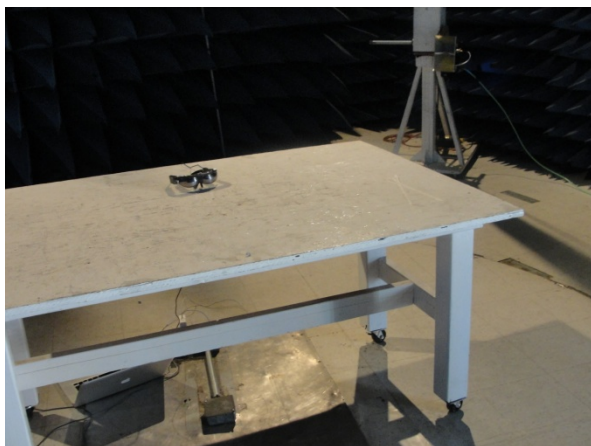
**FIGURE 2: RE Test Setup - Active Loop Antenna****FIGURE 3: RE Test Setup - Biconical Antenna****- Log Periodic Antenna****FIGURE 4: RE Test Setup - Horn Antennas**



FIGURE 5: CE Test Setup - Front View

- Side View

2 RADIATED EMISSIONS PER FCC PART 15.209

2.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/28-29/14
Test Engineer:	D.E. Waldbeser
Temperature	21°C avg.
Humidity:	48% avg.

2.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
EMC Analyzer	Agilent	E7402A	MY45112375	7/31/15	2 yr
Active Loop Antenna	EMCO	6502	1071/1001	10/14/16	2 yr
Bi-Conical Antenna	EMCO	3104	3459	10/14/16	2 yr
Log Periodic Antenna	EMCO	3146	9510-4202	6/16/16	2 yr

2.3 TEST SET UP PHOTO(S)

Refer to Section 1.10 (Figures 2-4).

2.4 LIMITS/REQUIREMENTS

Frequency (MHz)	Field strength Average ($\mu\text{V/m}$)	Field strength Average ($\text{dB}\mu\text{V/m}$)	Field strength Peak ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)	Average Limit @ 3m ($\text{dB}\mu\text{V/m}$)	Peak Limit @ 3m ($\text{dB}\mu\text{V/m}$)
0.009-0.49	267 – 4.9 ⁺	48.5 - 13.8	68.5 – 33.8	300*	88.5 – 53.8	108.5 – 73.8
0.49-1.705	49 – 14.1 [*]	33.8 - 23	53.8 - 43	30*	53.8 - 43	73.8 - 63
1.705-30	30	29.5	49.5	30*	49.5	69.5
30-88	100	40	60	3	-	-
88-216	150	43.5	63.5	3	-	-
216-960	200	46	66	3	-	-
Above 960	500	54	74	3	-	-

⁺ 2400/F(kHz) ^{*} 24000/F(kHz)

*Measurement performed at 3m per 47 CFR 15.31 (f)(2) distance scaling factor.

2.5 TEST DESCRIPTION AND PROCEDURE

The EUT was placed on a non-conducting table whose surface is 80 cm above the ground plane. The table may be rotated in order to maximize the signal received by the measurement system. RF emissions from 9 kHz to 1 GHz are received by a series of antennas. The active loop, biconical, log-periodic and DRG horn are located 3m away from the EUT. The elevation of the antennas above the ground plane is adjusted (1-4 m) for maximum signal, except for the active loop which is fixed at 1m. Both horizontally and vertically polarized signals are detected and recorded. All the radiated emissions tests were performed in three orthogonal planes. Data plots included below are the worst case data.

2.6 TEST DATA PLOTS

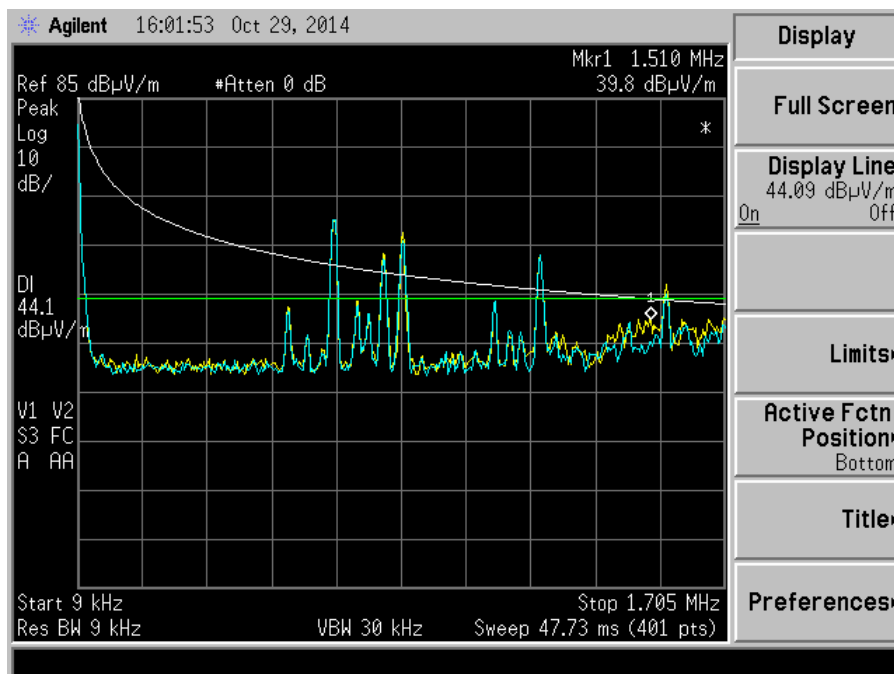


FIGURE 6: Radiated Emissions – Active Loop, 9 kHz – 1.705 MHz
Blue trace = EUT off, Yellow trace = EUT on



FIGURE 7: Radiated Emissions – Active Loop, 1.705 – 30 MHz
 Blue trace = EUT off, Yellow trace = EUT on



FIGURE 8: Radiated Emissions – Biconical, Horizontal Polarization
 Blue trace = EUT off, Yellow trace = EUT on

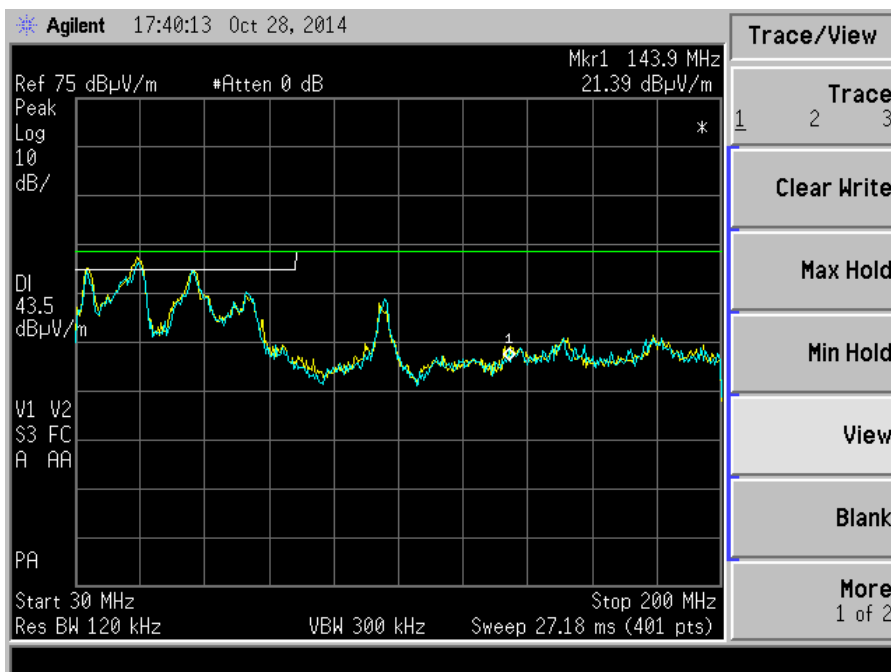


FIGURE 9: Radiated Emissions – Biconical, Vertical Polarization
Blue trace = EUT off, Yellow trace = EUT on



FIGURE 10: Radiated Emissions – Log-periodic, Horizontal Polarization
Blue trace = EUT off, Yellow trace = EUT on, Magenta = chamber background

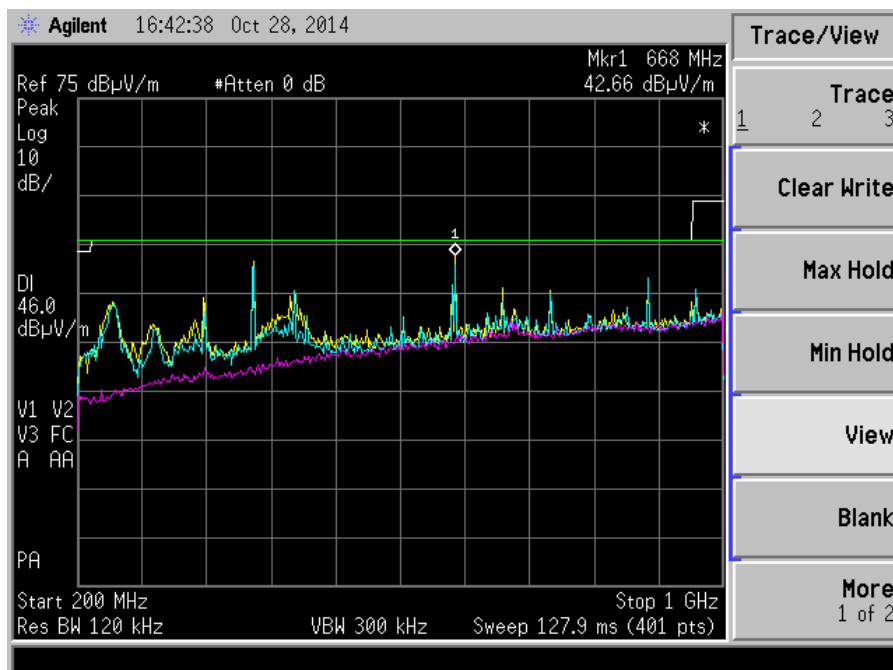


FIGURE 11: Radiated Emissions – Log-periodic, Vertical Polarization
Blue trace = EUT off, Yellow trace = EUT on, Magenta = chamber background

3 CONDUCTED POWER LINE EMISSIONS PER FCC PART 15.207

3.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/2/14
Test Engineer:	D.E. Waldbeser
Temperature	21°C
Humidity:	48%

3.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
EMC Analyzer	Agilent	E7402A	MY45112375	7/31/15	2 yr
LISN	EMCO	3825/2	8901-1229	10/15/16	2 yr

3.3 TEST SET UP PHOTO(S)

Refer to Section 1.10 (Figures 2-3).

3.4 LIMITS/REQUIREMENTS

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

3.5 TEST DESCRIPTION AND PROCEDURE

The EUT was placed in a shielded room 80 cm above the horizontal ground reference plane and 40 cm away from the vertical ground reference plane. AC mains input to the DC charging adapter was supplied through a LISN (Line Impedance Stabilization Network) and the excess power cord was looped into figure "8" above the LISN. The 5Vdc output of the charging adapter was supplied to the EUT. The line conducted tests were performed on the AC mains hot and neutral lines.

3.6 TEST DATA PLOTS

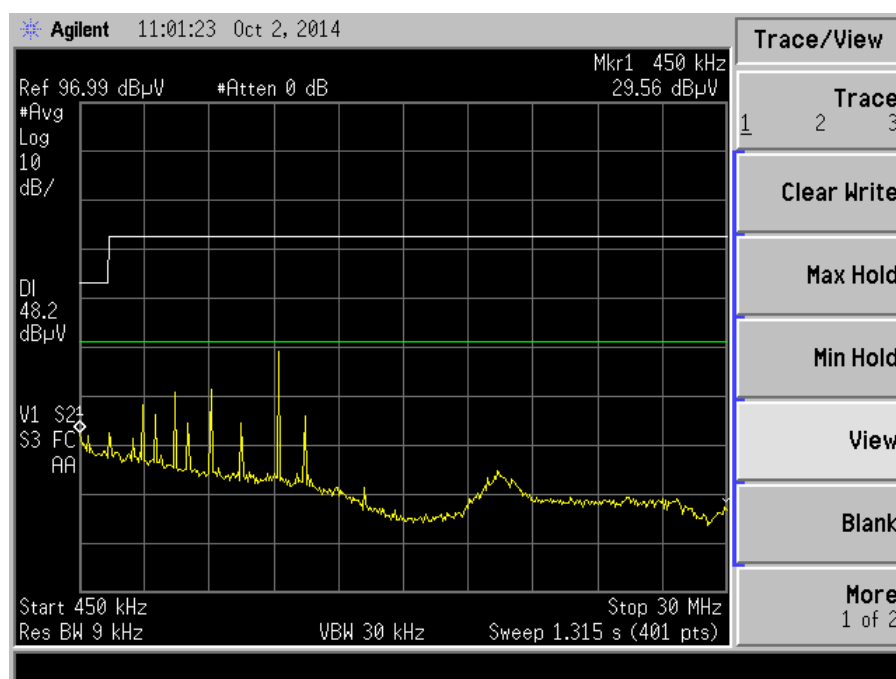


FIGURE 12: Conducted Emissions – Hot AC Line

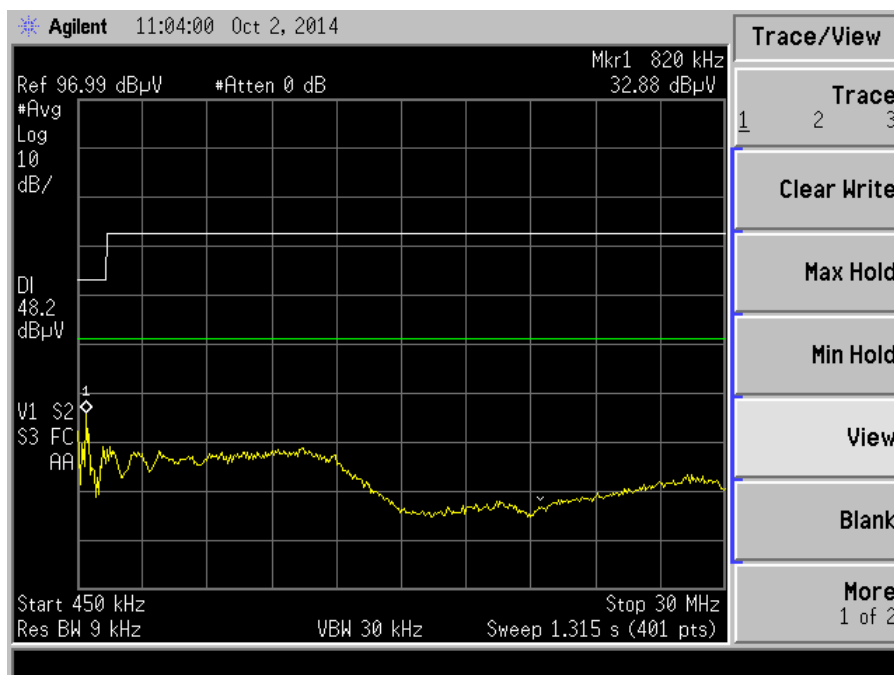


FIGURE 13: Conducted Emissions – Neutral AC Line

4 MINIMUM 6 DB BANDWIDTH PER FCC PART 15.247 (A)(2) – 802.11B/G/N

4.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/9/14, 10/13/14
Test Engineer:	D.E. Waldbeser
Temperature	21°C avg.
Humidity:	48% avg.

4.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

4.3 TEST SET UP PHOTO(S)

Refer to Section 1.10 (Figure1).

4.4 LIMITS/REQUIREMENTS

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

4.5 TEST DESCRIPTION AND PROCEDURE

The EUT is connected to the spectrum analyzer by disconnecting the internal antenna cable from the PCB MHF connector and attaching a suitable patch cable. The minimum 6dB bandwidth is determined by measuring the width of the carrier signal between the lowest frequency and the highest frequency of the carrier signal where the level is 6dB below the maximum signal power. The EUT is set to transmit single channel, modulated and maximum controlled power output. The test is performed at or near the low, mid and high channel of the operating band.

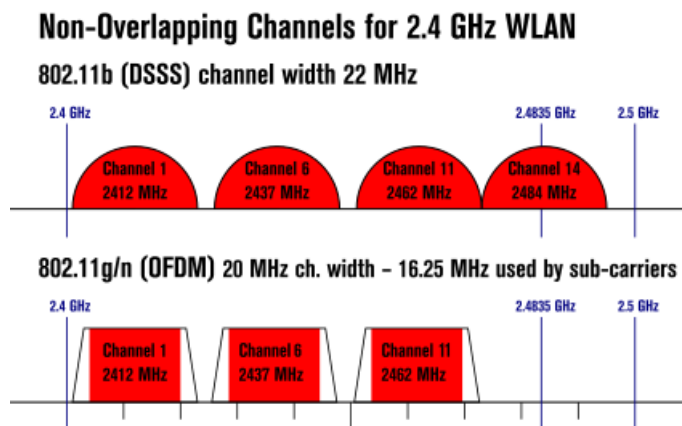


FIGURE 14: 802.11 Channels

4.6 6DB BANDWIDTH MEASUREMENT TEST DATA

Channel	Freq. (MHz)	Measured 6dB BW (MHz)			Result
		b	g	n	
1	2412	10	16.3	17.7	Pass
6	2437	9.5	16.3	17.8	Pass
11	2462	9	16.4	17.8	Pass

4.7 6DB BANDWIDTH MEASUREMENT PLOTS

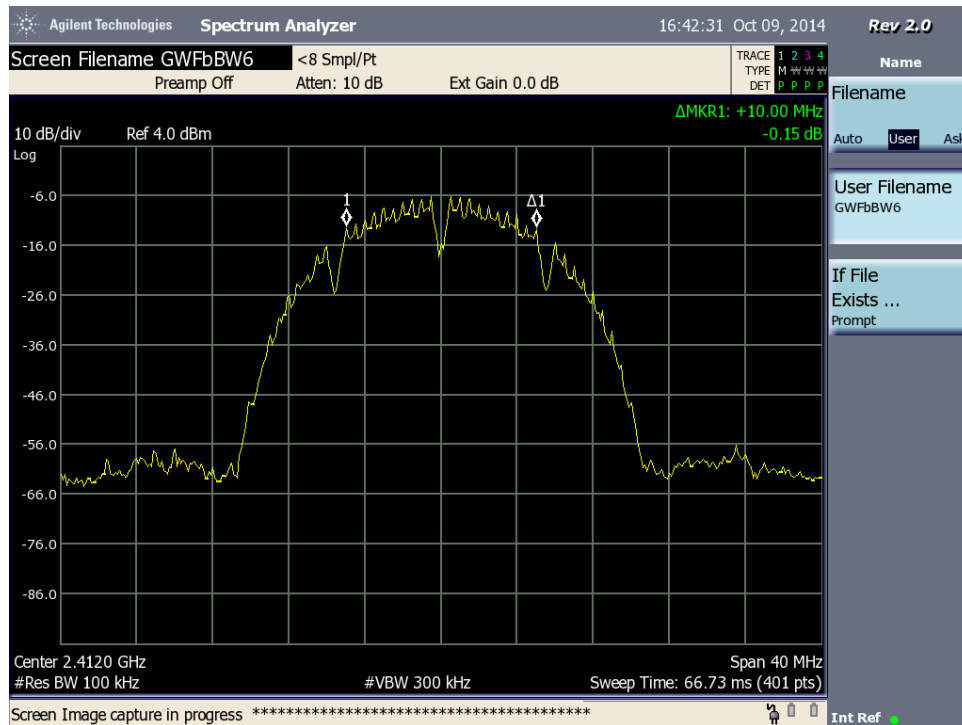


FIGURE 15: 802.11b 6dB Bandwidth (Ch1 shown, Ch6 & 11 similar)

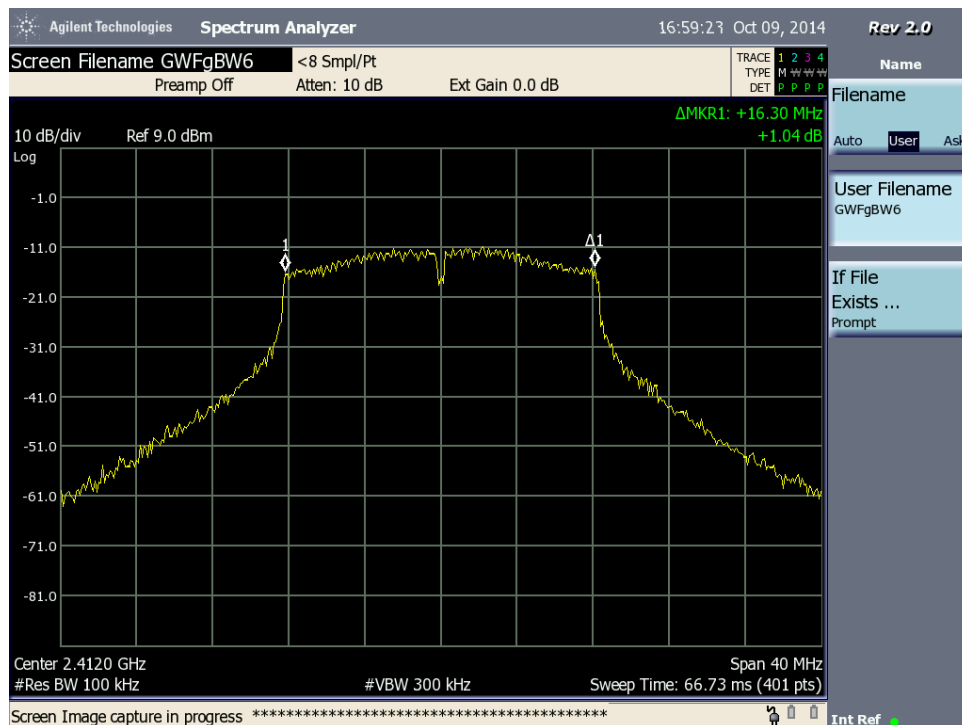


FIGURE 16: 802.11g 6dB Bandwidth (Ch1 shown, Ch6 & 11 similar)

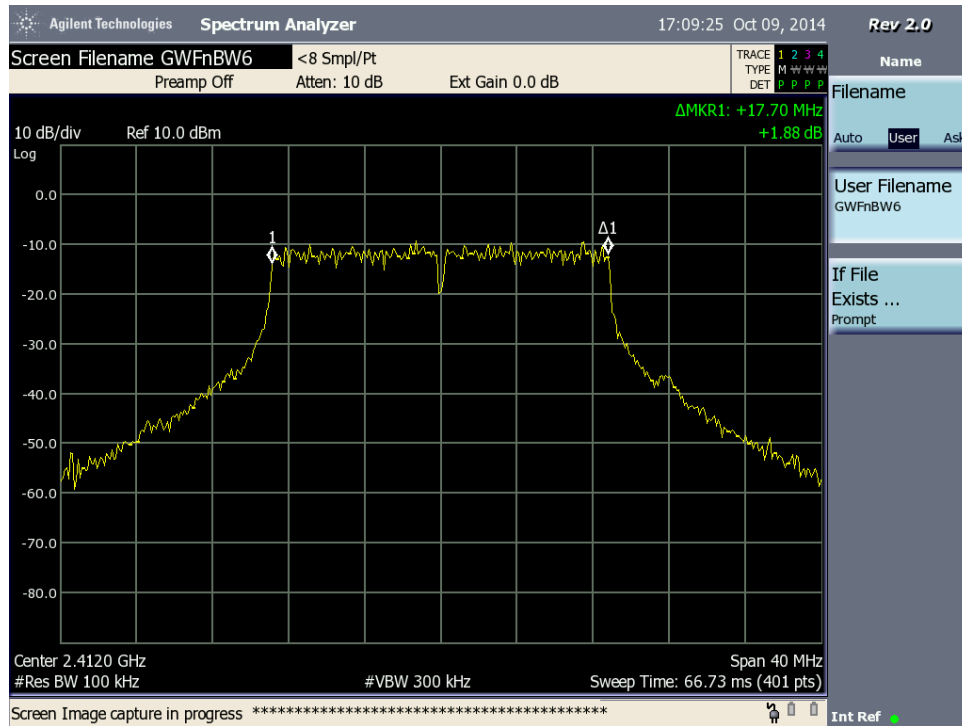


FIGURE 17: 802.11n 6dB Bandwidth (Ch1 shown, Ch6 & 11 similar)

4.8 CARRIER FREQUENCY SEPARATION PLOT

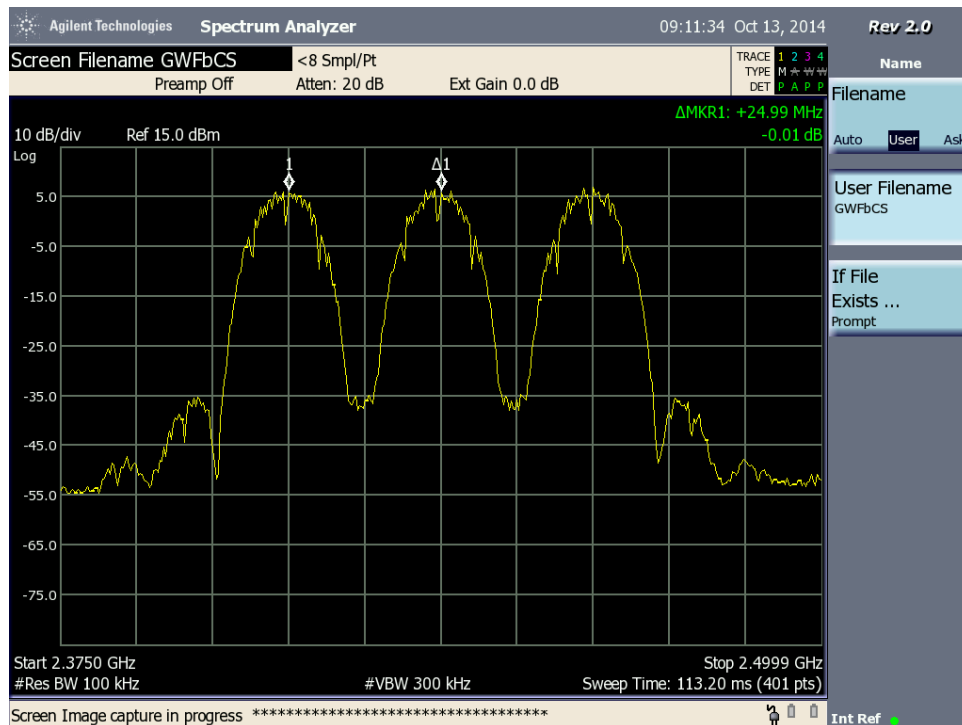


FIGURE 18: Carrier Frequency Separation 25 MHz (Ch1, 6 & 11)

5 PEAK CONDUCTED OUTPUT POWER PER FCC PART 15.247 (B)(3) – 802.11B/G/N

5.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/9-10/14
Test Engineer:	D.E. Waldbeser
Temperature	23°C avg.
Humidity:	41% avg.

5.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

5.3 TEST SET UP PHOTO(S)

Refer to section 1.10 (Figure 1)

5.4 LIMITS/REQUIREMENTS

- (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
 (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

5.5 TEST DESCRIPTION AND PROCEDURE

The EUT antenna port is connected to the spectrum analyzer. The maximum peak conducted output power was measured at the center peak of the selected channel. Measurements are performed at each of the low, mid and high frequencies in the band.

5.6 TEST DATA TABLES

Channel	Freq. (MHz)	MPP (dBm)			CPP (dBm)			Margin = 30 - CPP (dB)			Result
		b	g	n	b	g	n	b	g	n	
1	2402	19.5	22.2	19.1	20.2	22.9	19.8	9.8	7.1	10.2	Passed
6	2437	20.4	21.9	19	21.1	22.6	19.7	8.9	7.4	10.3	Passed
11	2462	20.3	22.6	19.4	21	23.3	20.1	9.7	6.7	9.9	Passed

MPP = Measured Peak Power

CPP = Corrected Peak Power = MPP + Cable Loss (0.7 dB)

5.7 PEAK POWER PLOTS

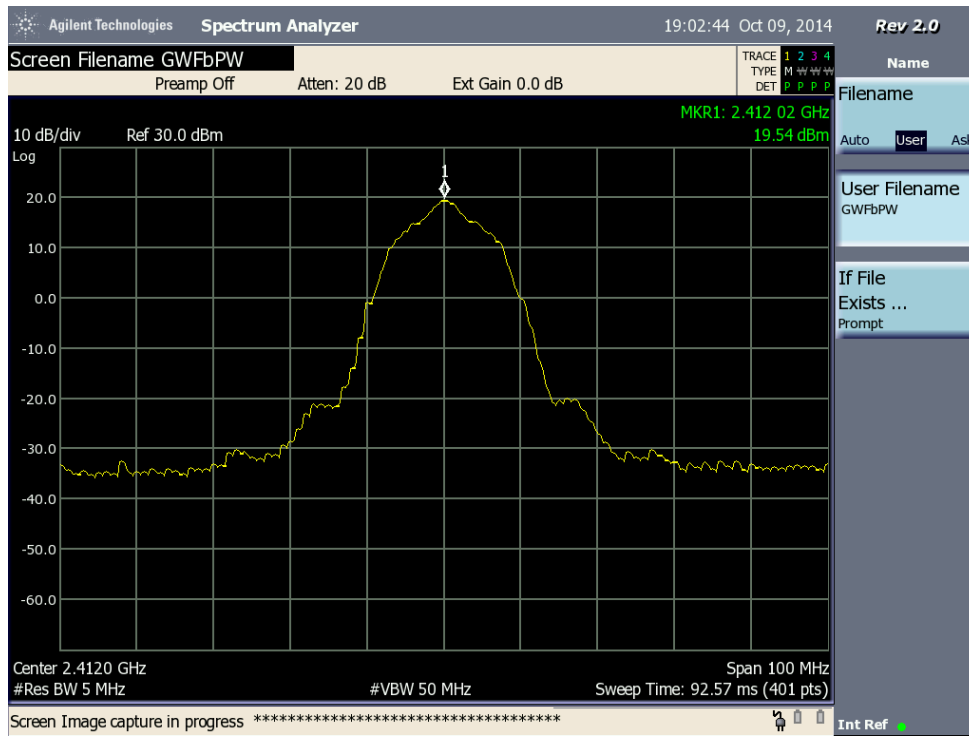


FIGURE 19: 802.11b Peak Power (Ch1 shown, Ch6 & 11 similar)

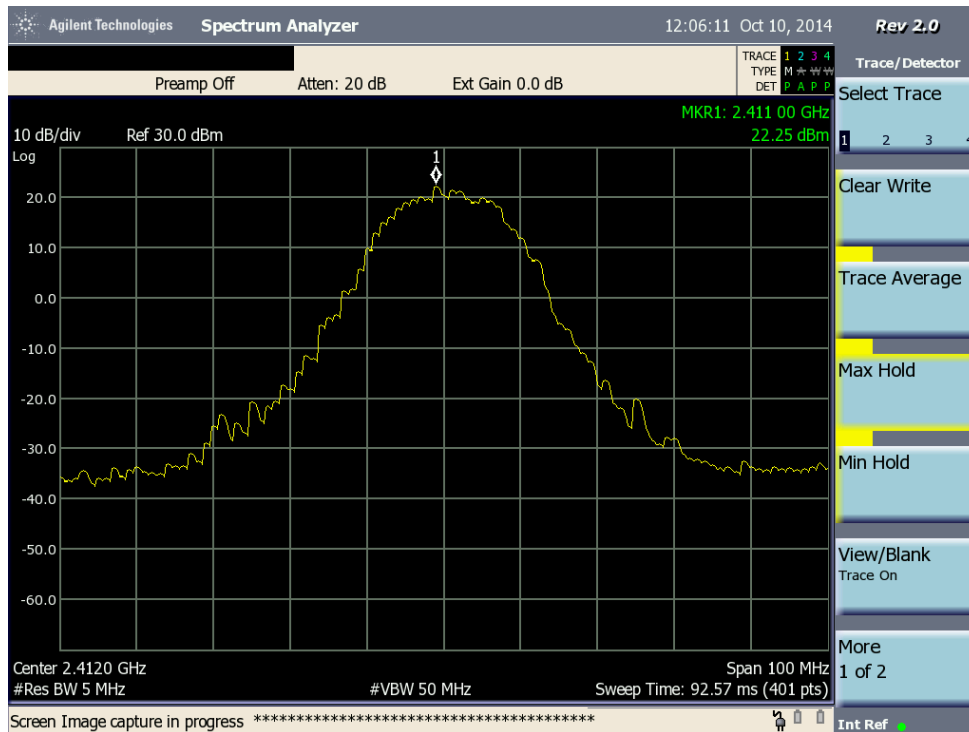


FIGURE 20: 802.11g Peak Power (Ch1 shown, Ch6 & 11 similar)

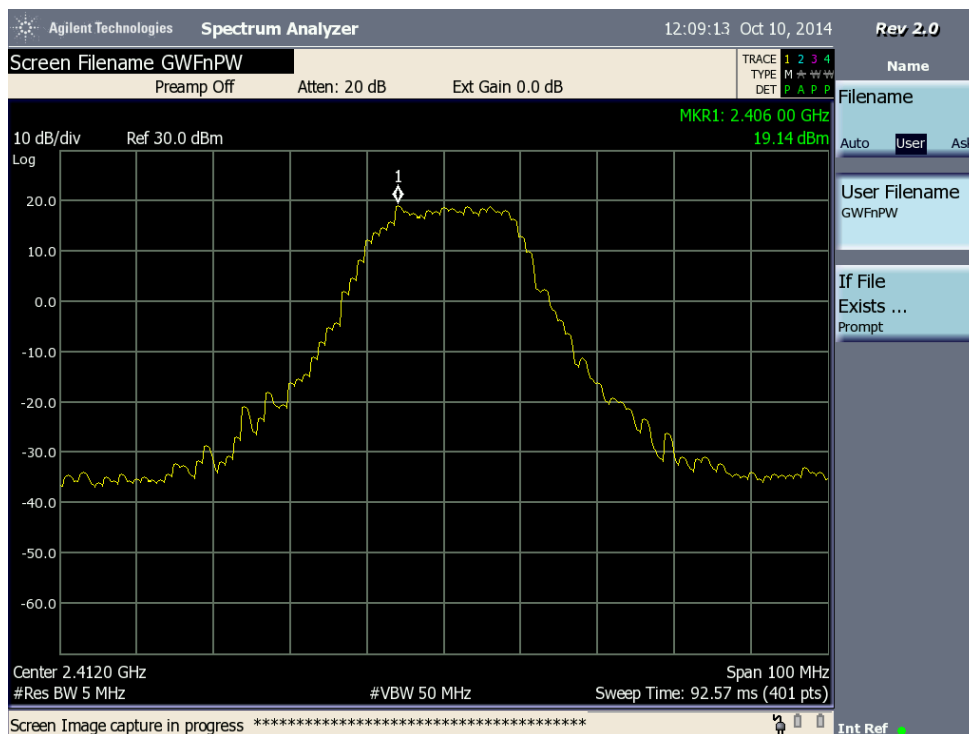


FIGURE 21: 802.11n Peak Power (Ch1 shown, Ch6 & 11 similar)

6 POWER SPECTRAL DENSITY PER FCC PART 15.247 (D) – 802.11B/G/N

6.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/10/14
Test Engineer:	D.E. Waldbeser
Temperature	23°C
Humidity:	41%

6.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

6.3 TEST SET UP PHOTO(S)

Refer to section 1.10 (Figure1).

6.4 LIMITS/REQUIREMENTS

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous

transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

6.5 TEST DESCRIPTION AND PROCEDURE

The EUT antenna port is connected to the spectrum analyzer. The power spectral density is measured at the center peak of the selected channel. Measurements are performed at each of the low, mid and high frequencies in the band.

6.6 TEST DATA TABLES

Channel	Freq. (MHz)	MPSD (dBm/3 kHz)			CPSD (dBm/3 kHz)			Margin = 8 - CPSD (dB)			Result
		b	g	n	b	g	n	b	g	n	
1	2412	-10	-10	-13	-9.3	-9.3	-12.3	17.3	17.3	20.3	Passed
6	2437	-10	-10	-13	-9.3	-9.3	-12.3	17.3	17.3	20.3	Passed
11	2462	-10	-10	-13	-9.3	-9.3	-12.3	17.3	17.3	20.3	Passed

MPSD = Measured Power Spectral Density CPSD = Corrected Power Spectral Density = MPSD + Cable Loss (0.7 dB)

6.7 POWER SPECTRAL DENSITY PLOTS

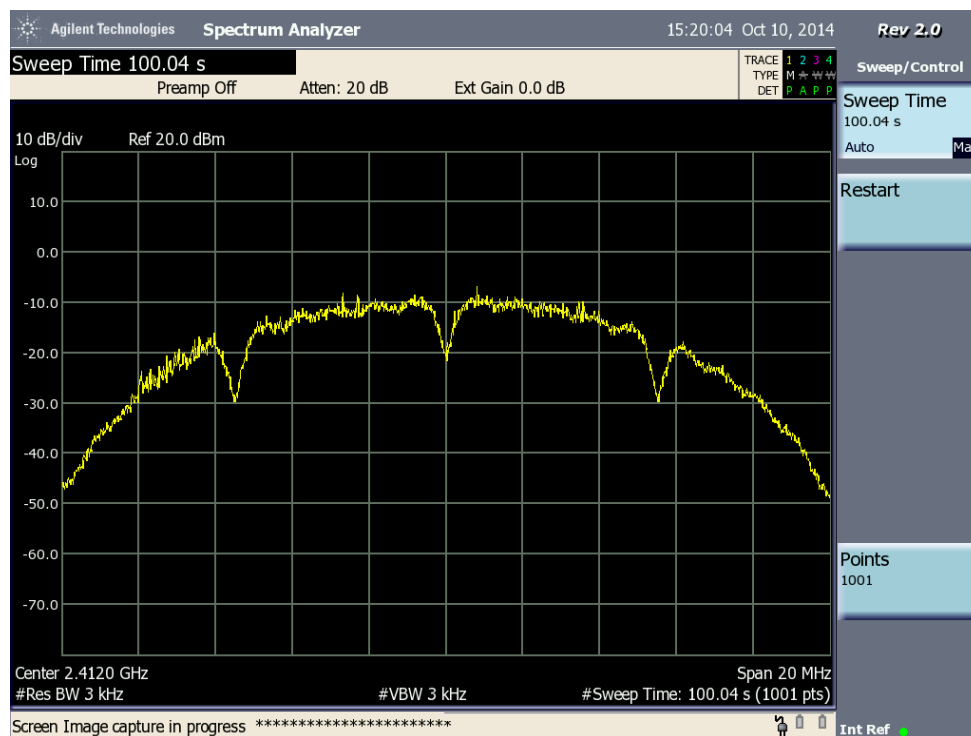


FIGURE 22: 802.11b Power Spectral Density (Ch1 shown, Ch6 & 11 similar)

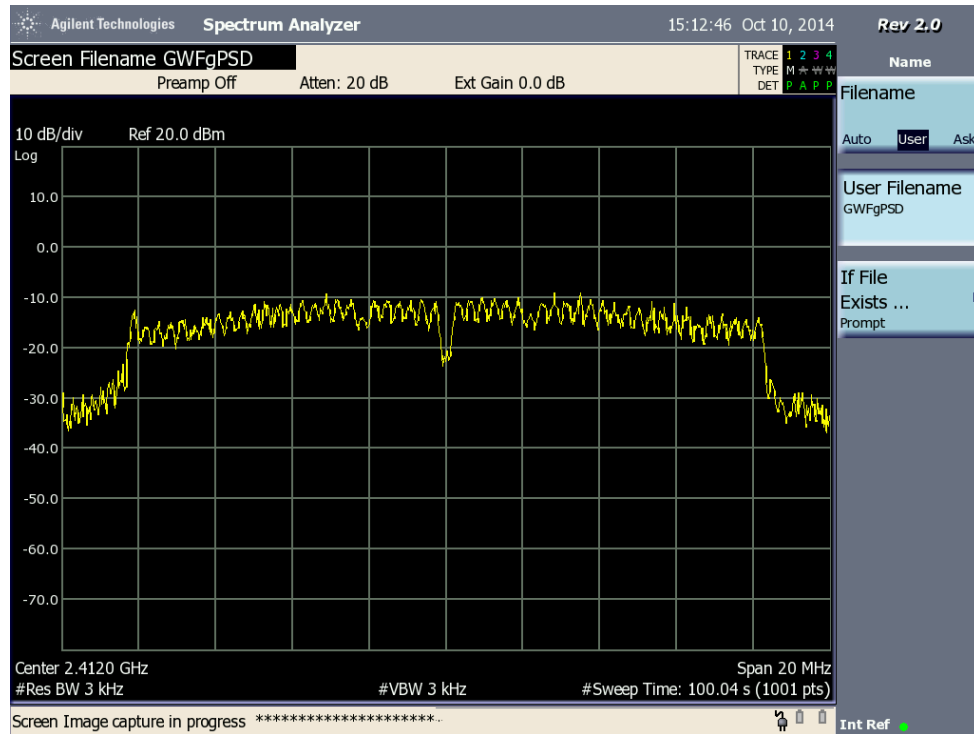


FIGURE 23: 802.11g Power Spectral Density (Ch1 shown, Ch6 & 11 similar)

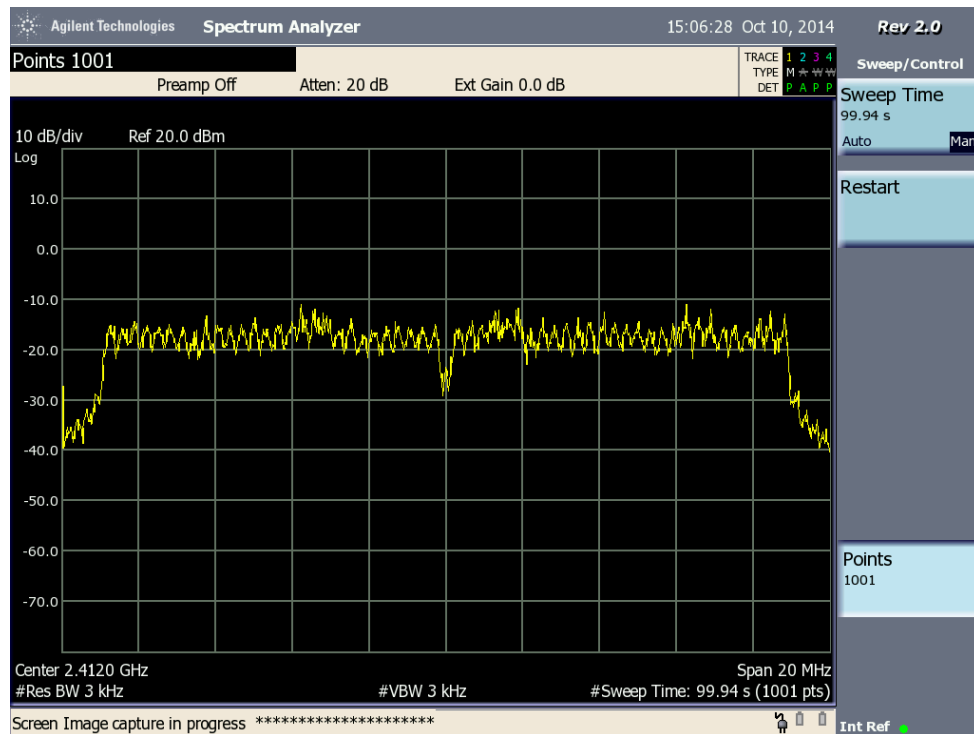


FIGURE 24: 802.11n Power Spectral Density (Ch1 shown, Ch6 & 11 similar)

7 LOWER/UPPER BAND EDGE PER FCC PART 15 SECTION 15.247 (D) – 802.11B/G/N

7.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/10/14, 10/13/14
Test Engineer:	D.E. Waldbeser
Temperature	23°C avg
Humidity:	41% avg.

7.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

7.3 TEST SET UP PHOTO(S)

Refer to section 1.10 (Figure1).

7.4 LIMITS/REQUIREMENTS

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.

7.5 TEST DESCRIPTION AND PROCEDURE

Using the conducted test method, the band edge measurement was made at the peak level of the emission at the band edge (outside of the operating band) relative to the center peak of the operating frequency channel by using marker delta function. The span was set to be wide enough to capture the highest peak level of the operating channel to the band edge.

7.6 TEST PLOTS

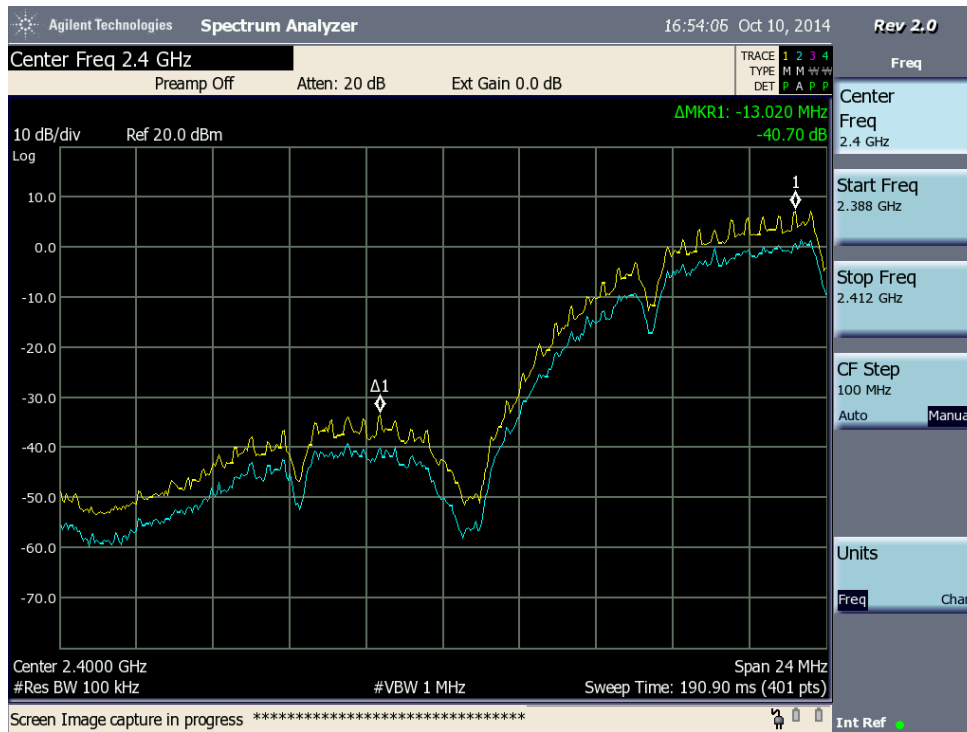


FIGURE 25: 802.11b Ch1 Lower Band Edge

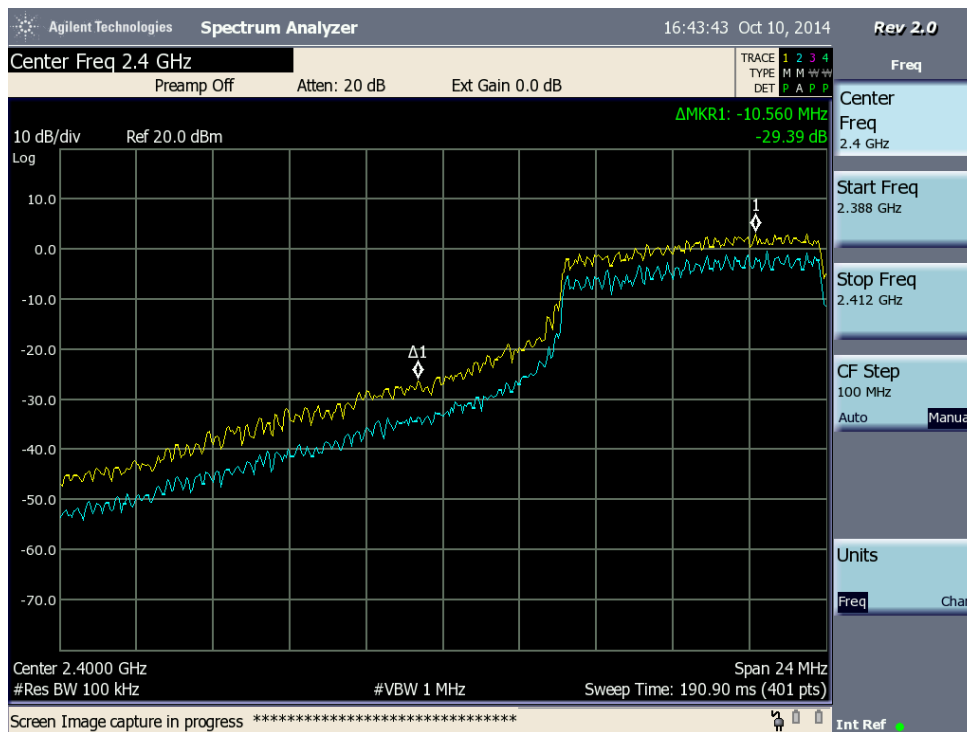


FIGURE 26: 802.11g Ch1 Lower Band Edge

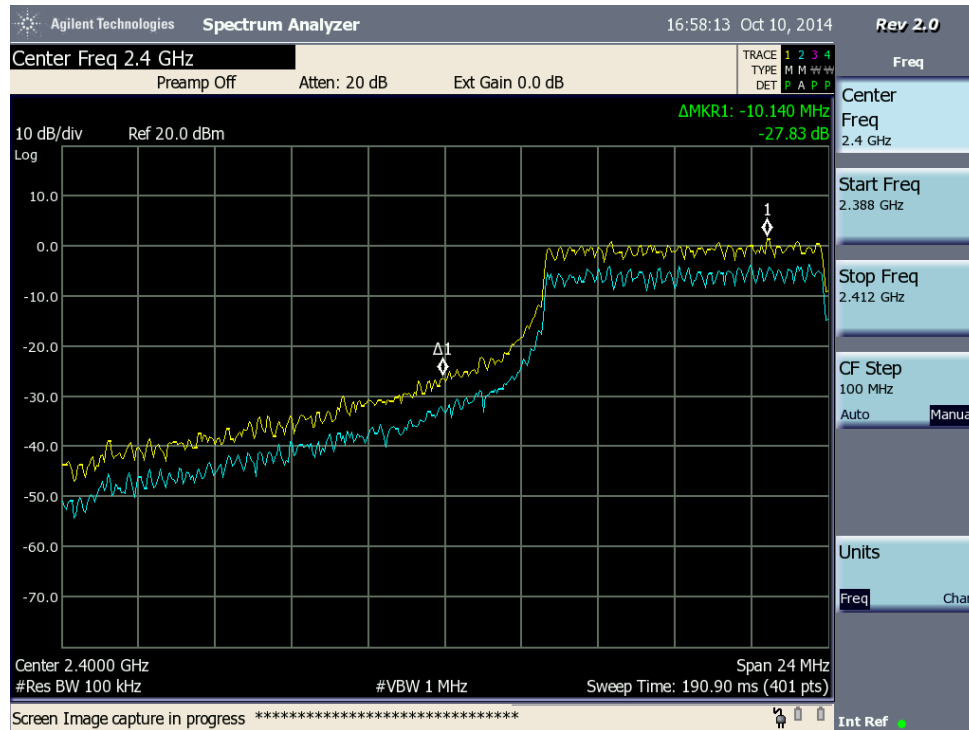


FIGURE 27: 802.11n Ch1 Lower Band Edge

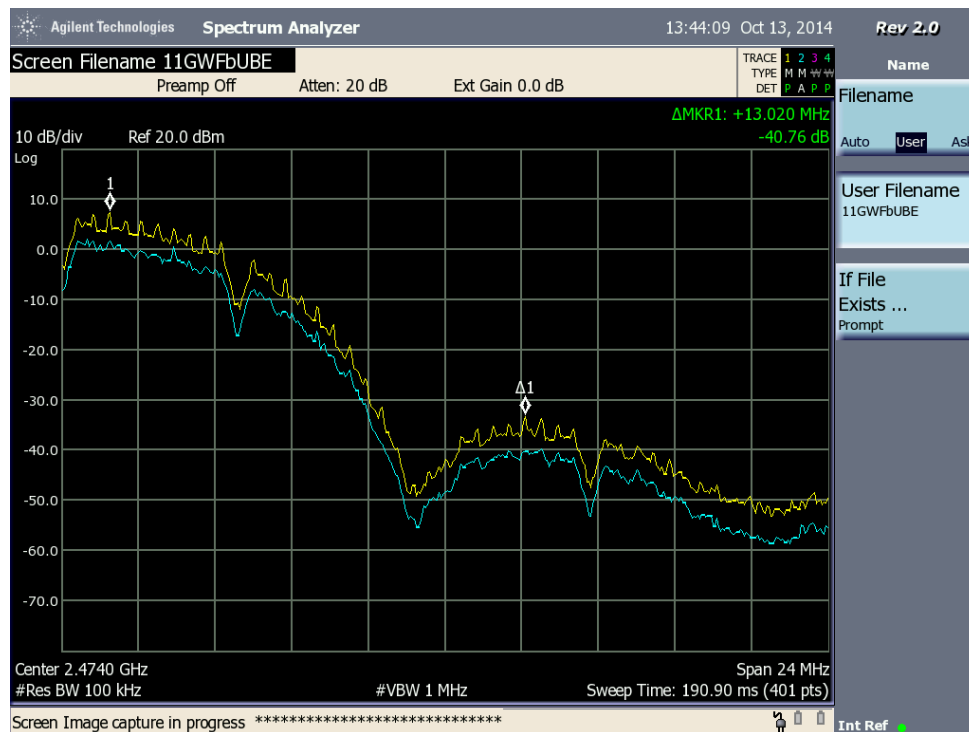


FIGURE 28: 802.11b Ch11 Upper Band Edge

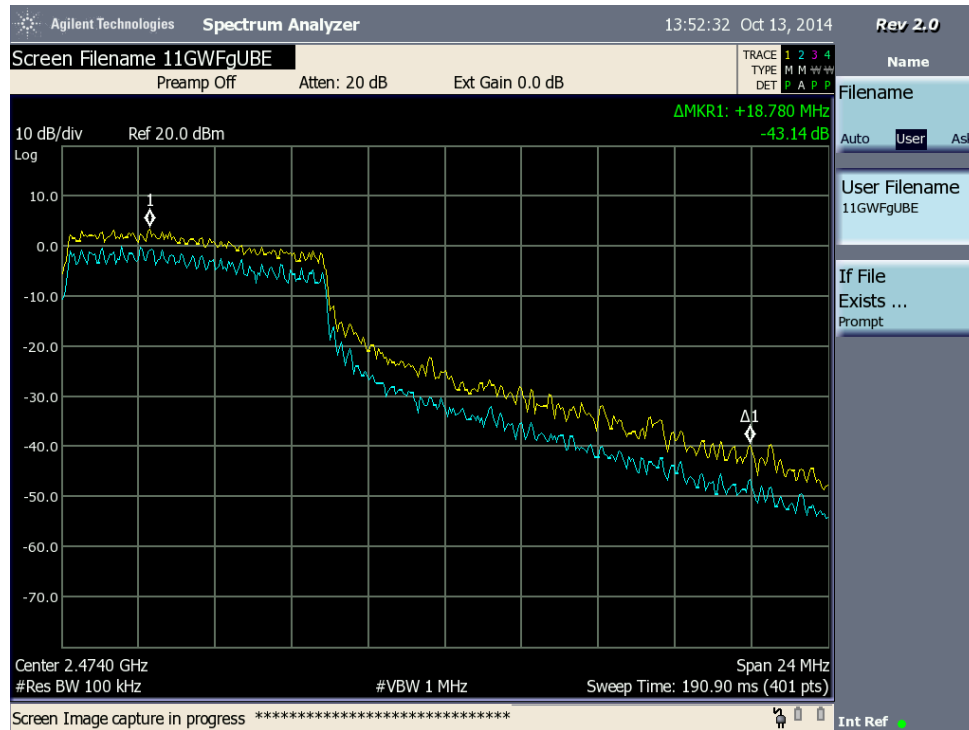


FIGURE 29: 802.11g Ch11 Upper Band Edge

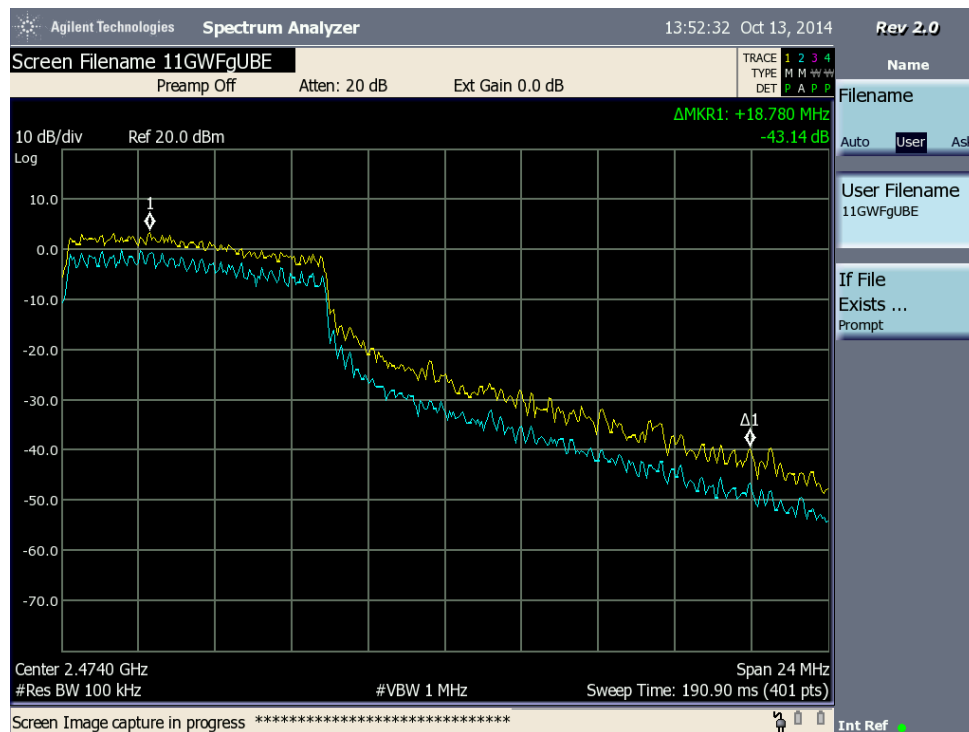


FIGURE 30: 802.11n Ch11 Upper Band Edge

8 OCCUPIED BANDWIDTH PER FCC PART 2 SECTION 2.1049 (H) – 802.11B/G/N

8.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/14/14
Test Engineer:	D.E. Waldbeser
Temperature	23°C
Humidity:	41%

8.1 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

8.1 TEST SET UP PHOTO(S)

Refer to section 1.10 (Figure1).

8.2 LIMITS/REQUIREMENTS

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated.

8.3 TEST DESCRIPTION AND PROCEDURE

Using the conducted test method, the occupied bandwidth measurement was made utilizing the CSA Analyzer's OBW function. The span was set to be wide enough to capture the entire operating channel.

8.4 TEST PLOTS

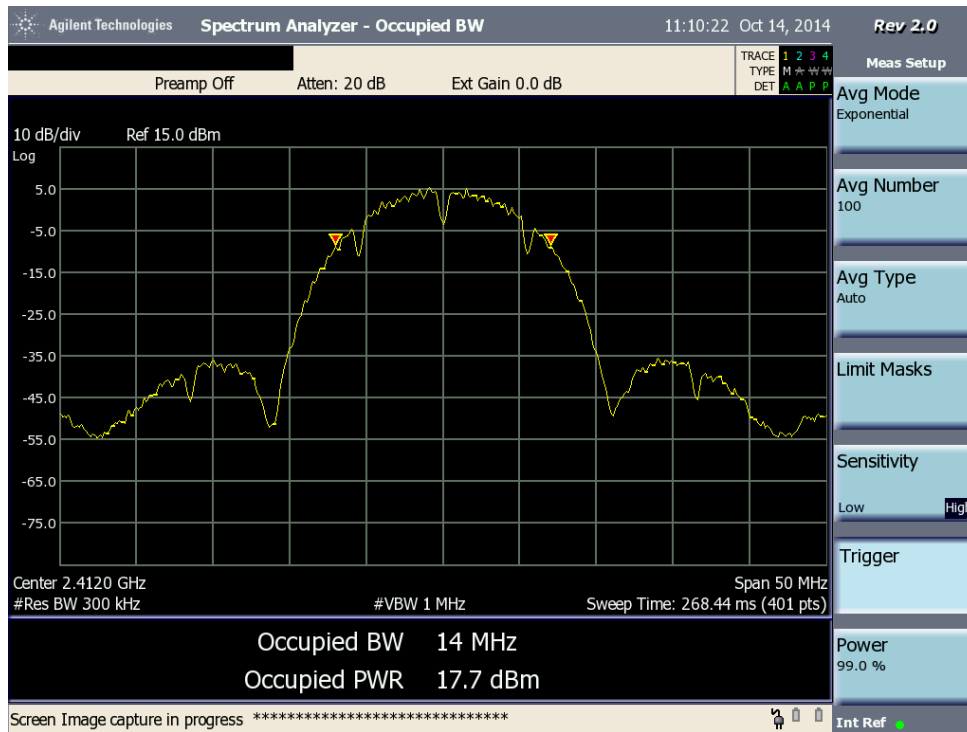


FIGURE 31: 802.11b Occupied Bandwidth (Ch1 shown, Ch6 & 11 similar)

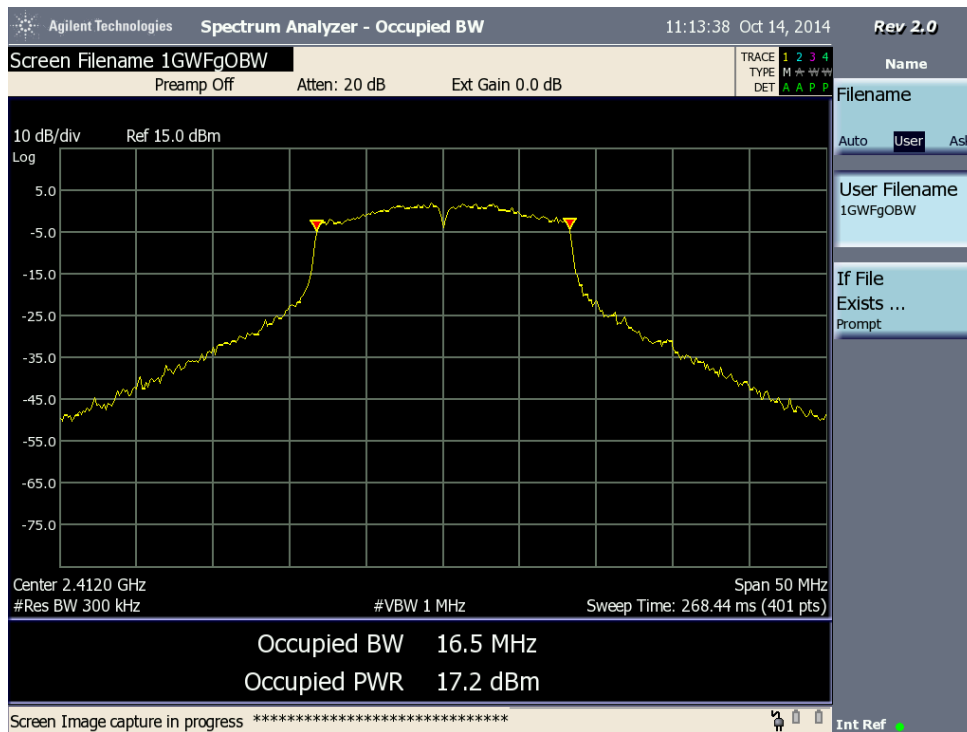


FIGURE 32: 802.11g Occupied Bandwidth (Ch1 shown, Ch6 & 11 similar)

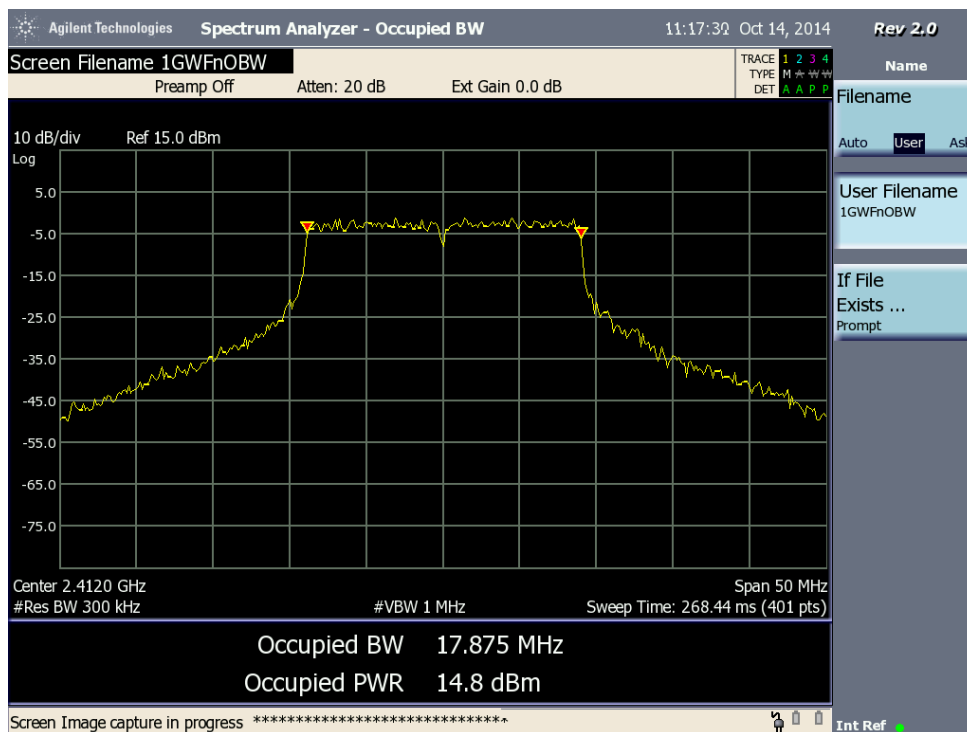


FIGURE 33: 802.11n Occupied Bandwidth (Ch1 shown, Ch6 & 11 similar)

9 MINIMUM 6 DB BANDWIDTH PER FCC PART 15.247 (A)(2) – BLUETOOTH 2.0 + EDR

9.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/20-21/14
Test Engineer:	D.E. Waldbeser
Temperature	21°C avg
Humidity:	48% avg

9.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

9.3 TEST SET UP PHOTO(S)

Refer to Section 1.10 (Figure1).

9.4 LIMITS/REQUIREMENTS

Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

9.5 TEST DESCRIPTION AND PROCEDURE

The EUT is connected to the spectrum analyzer by disconnecting the internal antenna cable from the PCB MHF connector and attaching a suitable patch cable. The minimum 6dB bandwidth is determined by measuring the width of the carrier signal between the lowest frequency and the highest frequency of the carrier signal where the level is 6dB below the maximum signal power. The EUT is set to transmit single channel, modulated and maximum controlled power output. The test is performed at or near the low, mid and high channel of the operating band.

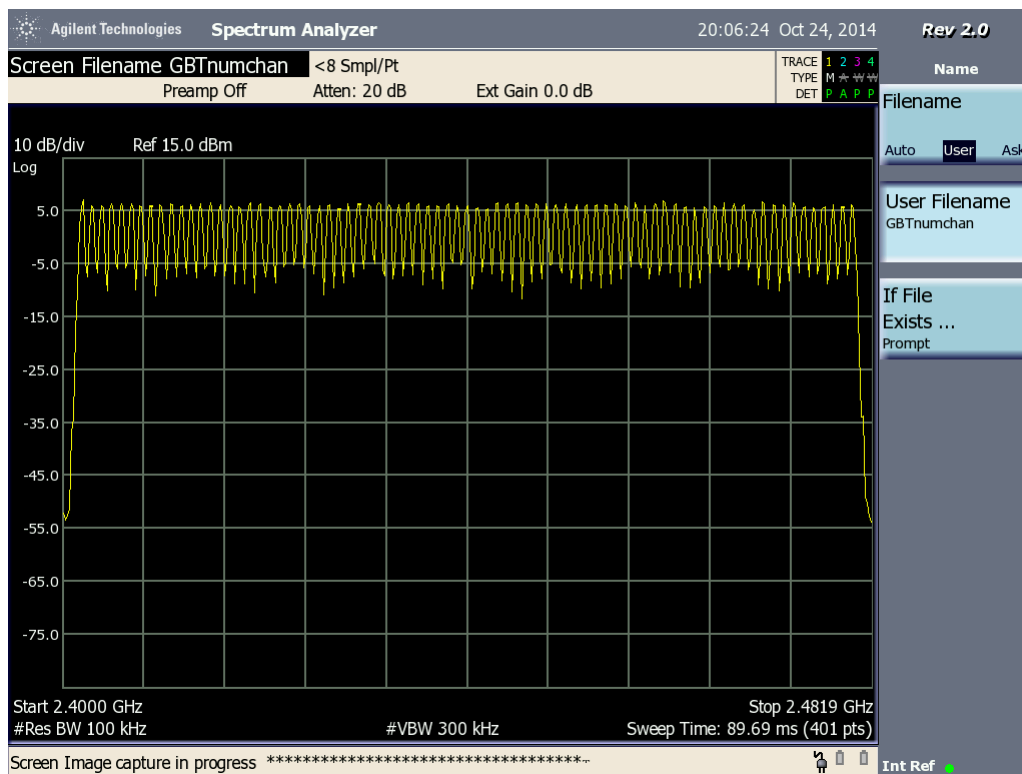


FIGURE 34: Bluetooth 2.0 + EDR Channels (79)

9.6 6DB BANDWIDTH MEASUREMENT TEST DATA

Channel	Freq. (MHz)	Measured 6dB BW (MHz)		Result
		gfsk	edr	
0	2402	0.5	1.09	Pass
20	2442	0.53	1.09	Pass
39	2480	0.5	1.09	Pass

9.7 6DB BANDWIDTH MEASUREMENT PLOTS

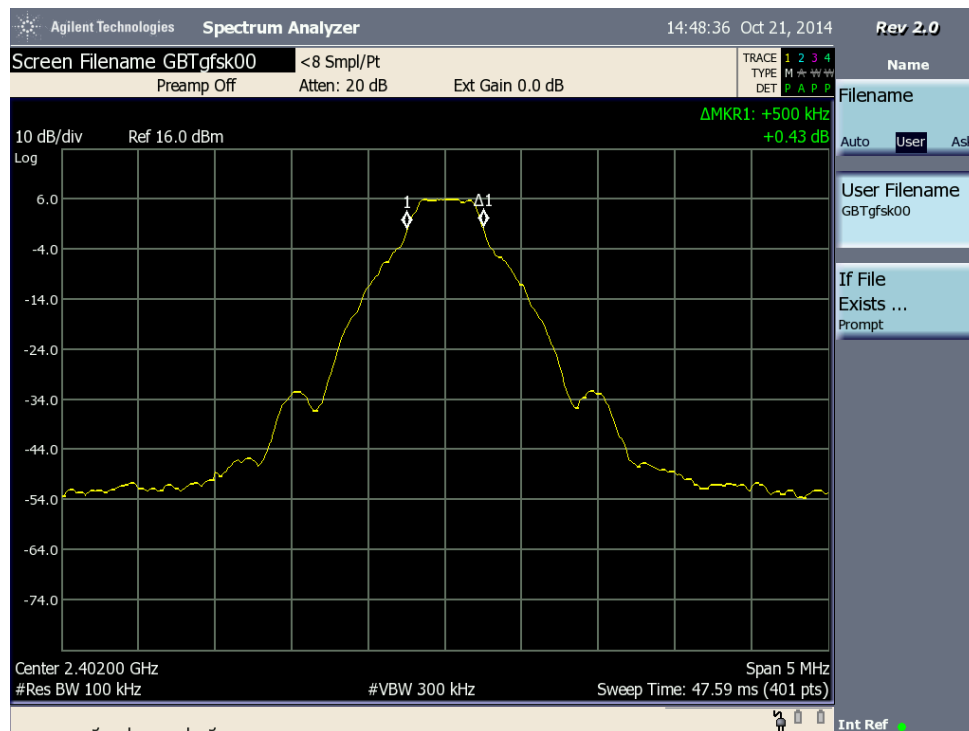


FIGURE 35: 6dB GFSK bandwidth (Ch0 shown, Ch20 & 39 similar)

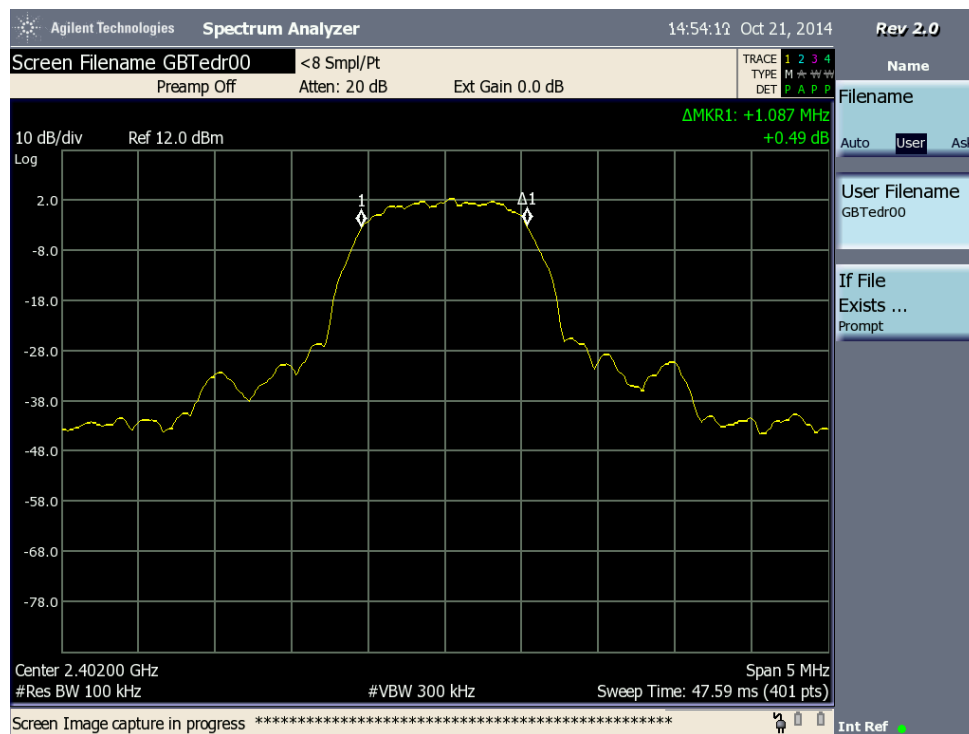


FIGURE 36: 6dB EDR bandwidth (Ch0 shown, Ch20 & 39 similar)

9.1 CARRIER FREQUENCY SEPARATION PLOT

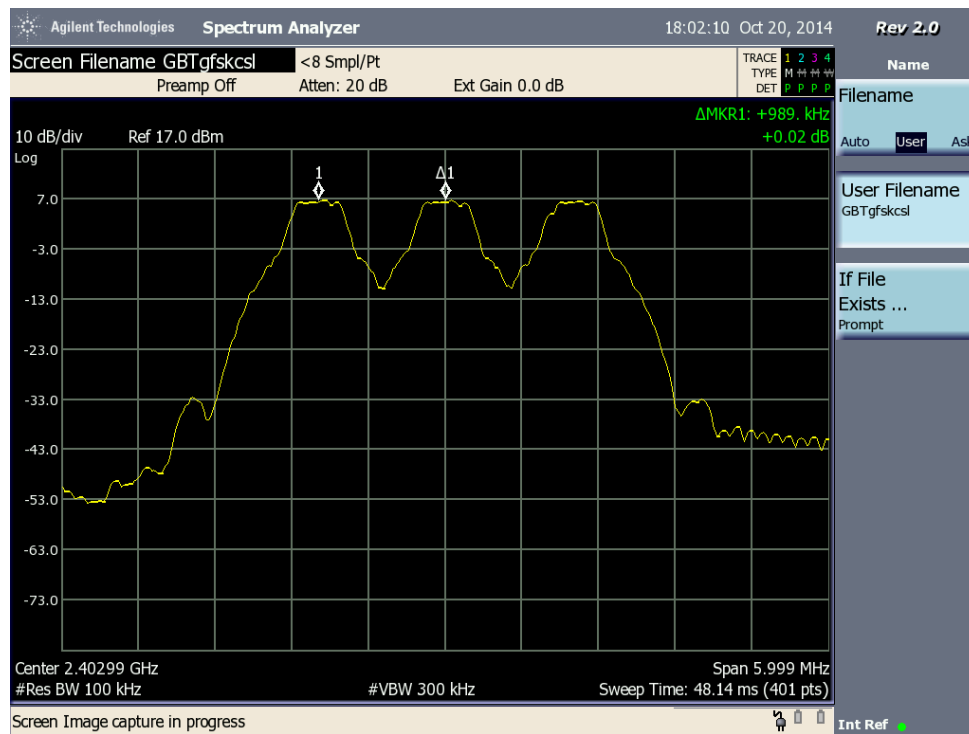


FIGURE 37: GFSK Carrier Frequency Separation 1 MHz (Ch0, 1 & 2)

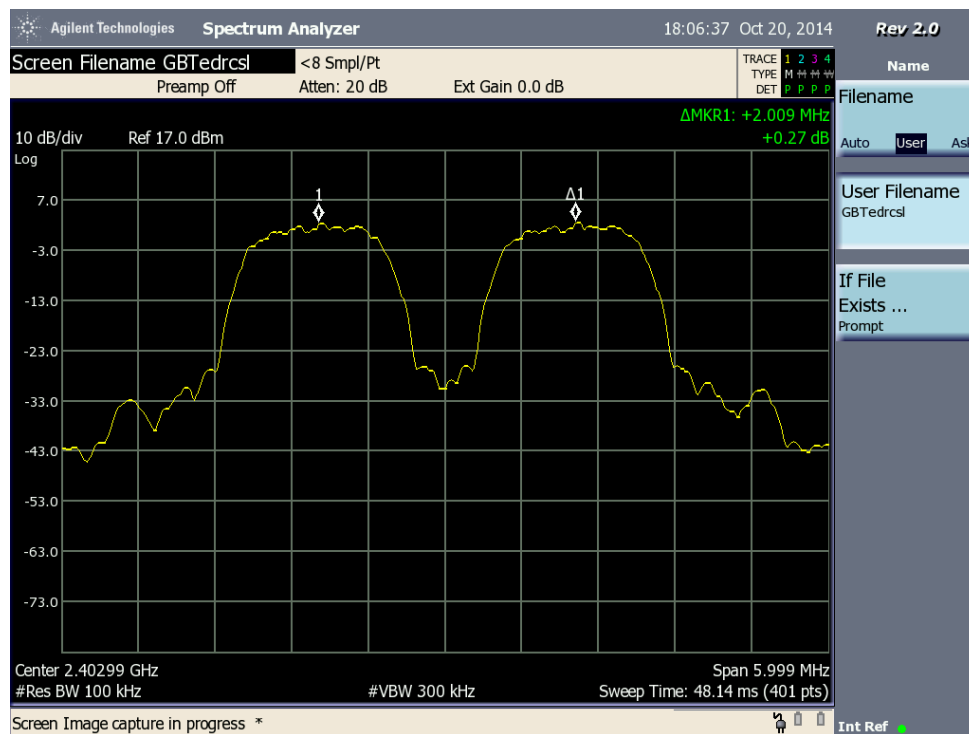


FIGURE 38: EDR Carrier Frequency Separation 1 MHz (Ch0 & 2 shown)

10 PEAK CONDUCTED OUTPUT POWER PER FCC PART 15.247 (B)(3) – BLUETOOTH 2.0 + EDR

10.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/21/14
Test Engineer:	D.E. Waldbeser
Temperature	23°C
Humidity:	41%

10.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

10.3 TEST SET UP PHOTO(S)

Refer to section 1.10 (Figure 1)

10.4 LIMITS/REQUIREMENTS

- (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
 (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

10.5 TEST DESCRIPTION AND PROCEDURE

The EUT antenna port is connected to the spectrum analyzer. The maximum peak conducted output power was measured at the center peak of the selected channel. Measurements are performed at each of the low, mid and high frequencies in the band.

10.6 TEST DATA TABLES

Channel	Freq. (MHz)	MPP (dBm)		CPP (dBm)		Margin = 30 - CPP (dB)		Result
		gfsk	edr	gfsk	edr	gfsk	edr	
0	2412	6.6	2.5	7.3	3.2	22.7	26.8	Passed
20	2442	7.1	3.3	7.8	4	22.9	26	Passed
39	2480	7	3.4	7.7	4.1	22.3	25.9	Passed

MPP = Measured Peak Power

CPP = Corrected Peak Power = MPP + Cable Loss (0.7 dB)

10.1 PEAK POWER PLOTS

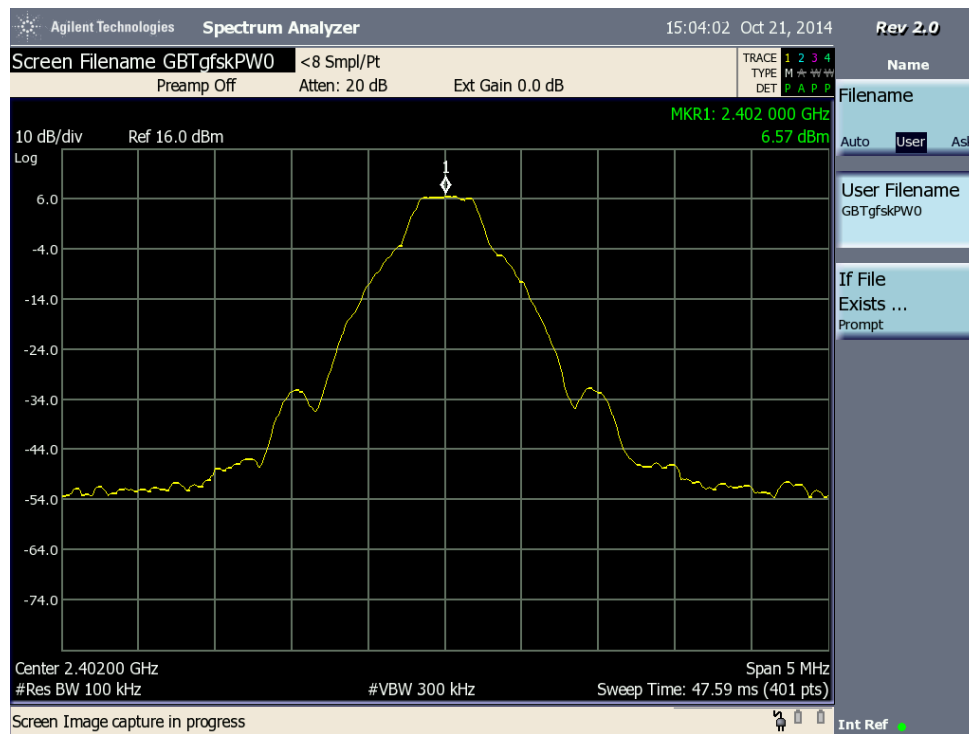


FIGURE 39: GFSK Peak Power (Ch0 shown, Ch20 & 39 similar)

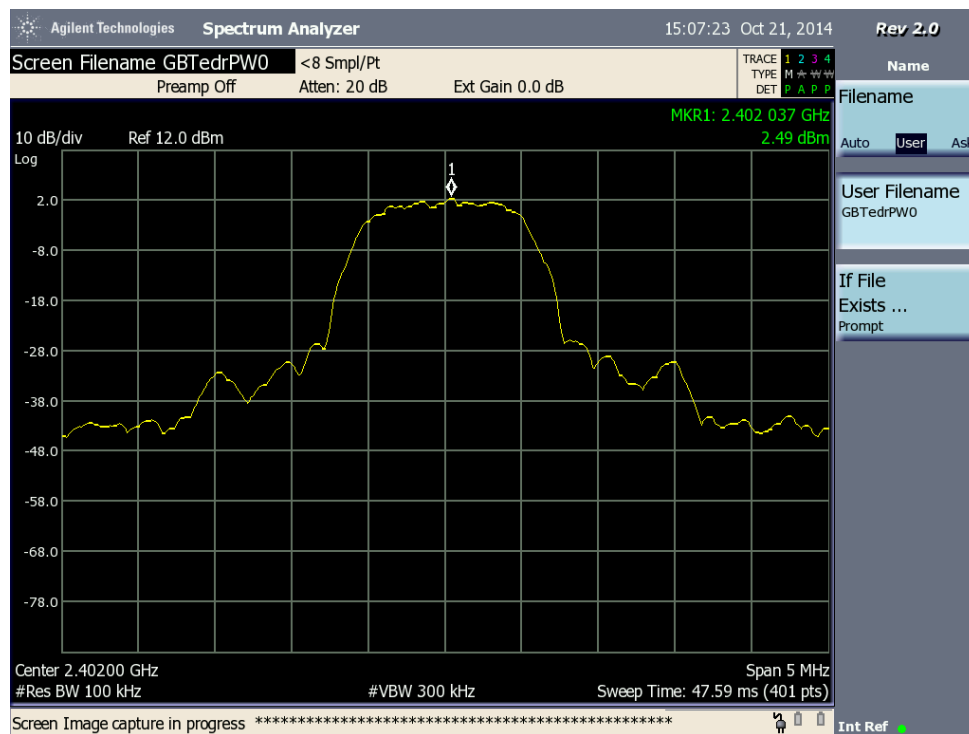


FIGURE 40: EDR Peak Power (Ch0 shown, Ch20 & 39 similar)

11 POWER SPECTRAL DENSITY PER FCC PART 15.247 (D) – BLUETOOTH 2.0 + EDR

11.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/21/14
Test Engineer:	D.E. Waldbeser
Temperature	23°C
Humidity:	41%

11.3 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

11.6 TEST SET UP PHOTO(S)

Refer to section 1.10 (Figure1).

11.7 LIMITS/REQUIREMENTS

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

11.8 TEST DESCRIPTION AND PROCEDURE

The EUT antenna port is connected to the spectrum analyzer. The power spectral density is measured at the center peak of the selected channel. Measurements are performed at each of the low, mid and high frequencies in the band.

11.9 TEST DATA TABLES

Channel	Freq. (MHz)	MPSD (dBm/3 kHz)		CPSD (dBm/3 kHz)		Margin = 8 - CPSD (dB)		Result
		gfsk	edr	gfsk	edr	gfsk	edr	
0	2402	-4.1	-11.8	-3.4	-11.1	11.4	19.1	Passed
20	2442	-3.9	-13.5	-3.2	-12.8	11.2	20.8	Passed
39	2480	-4	-11.1	-3.3	-10.4	11.3	18.4	Passed

MPSD = Measured Power Spectral Density CPSD = Corrected Power Spectral Density = MPSD + Cable Loss (0.7 dB)

11.10 POWER SPECTRAL DENSITY PLOTS

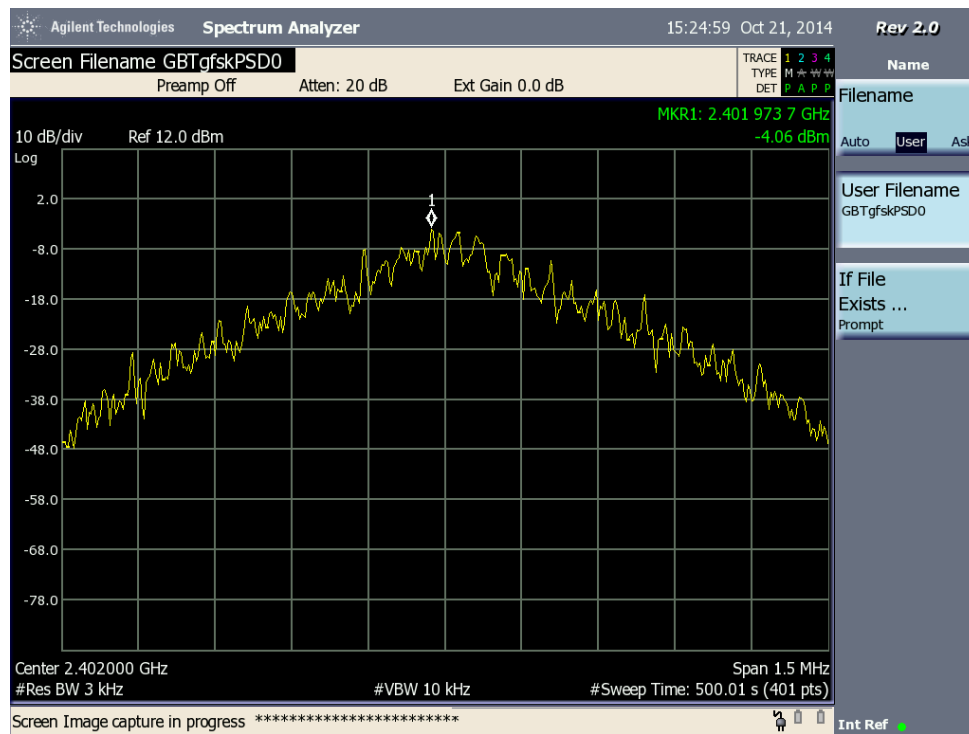


FIGURE 41: GFSK Power Spectral Density (Ch0 shown, Ch20 & 39 similar)

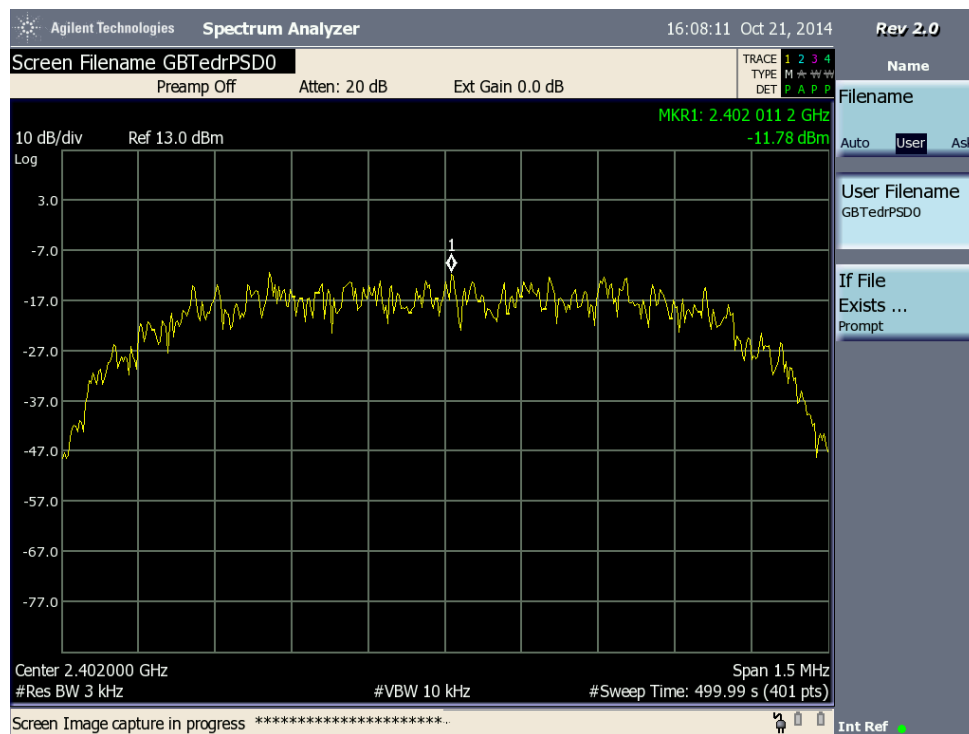


FIGURE 42: EDR Power Spectral Density (Ch0 shown, Ch20 & 39 similar)

12 LOWER/UPPER BAND EDGE PER FCC PART 15 SECTION 15.247 (D) – BLUETOOTH 2.0 + EDR

12.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	EMC Lab 2A
Test Date:	10/21-22/14
Test Engineer:	D.E. Waldbeser
Temperature	23°C avg
Humidity:	41% avg.

12.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

12.3 TEST SET UP PHOTO(S)

Refer to section 1.10 (Figure1).

12.4 LIMITS/REQUIREMENTS

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.

12.5 TEST DESCRIPTION AND PROCEDURE

Using the conducted test method, the band edge measurement was made at the peak level of the emission at the band edge (outside of the operating band) relative to the center peak of the operating frequency channel by using marker delta function. The span was set to be wide enough to capture the highest peak level of the operating channel to the band edge.

12.6 TEST PLOTS

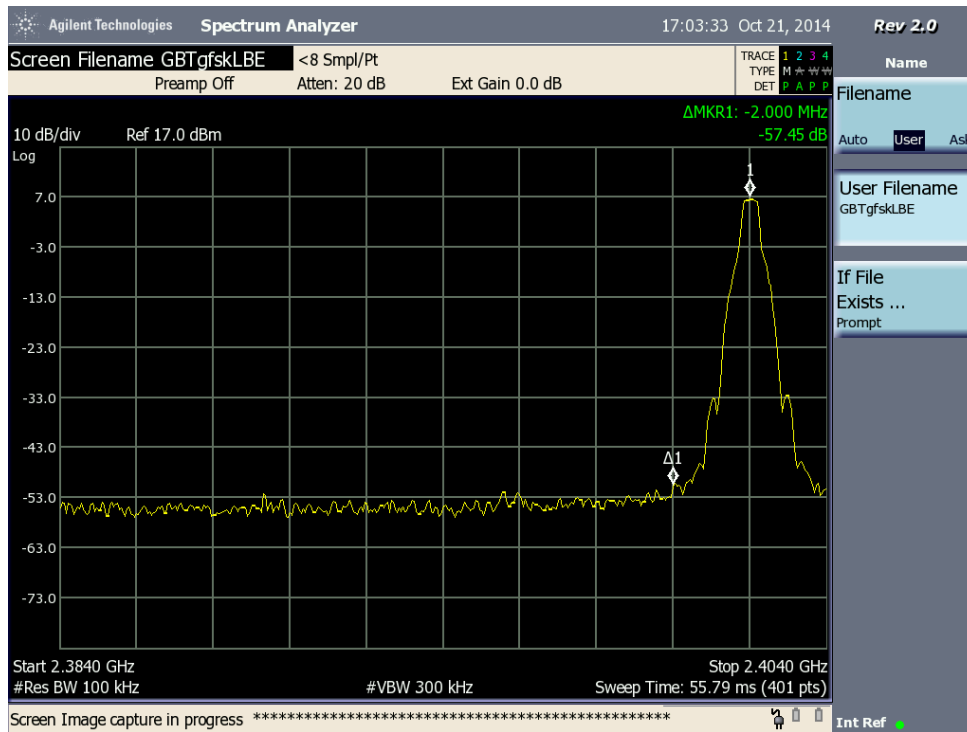


FIGURE 43: GFSK Ch0 Lower Band Edge

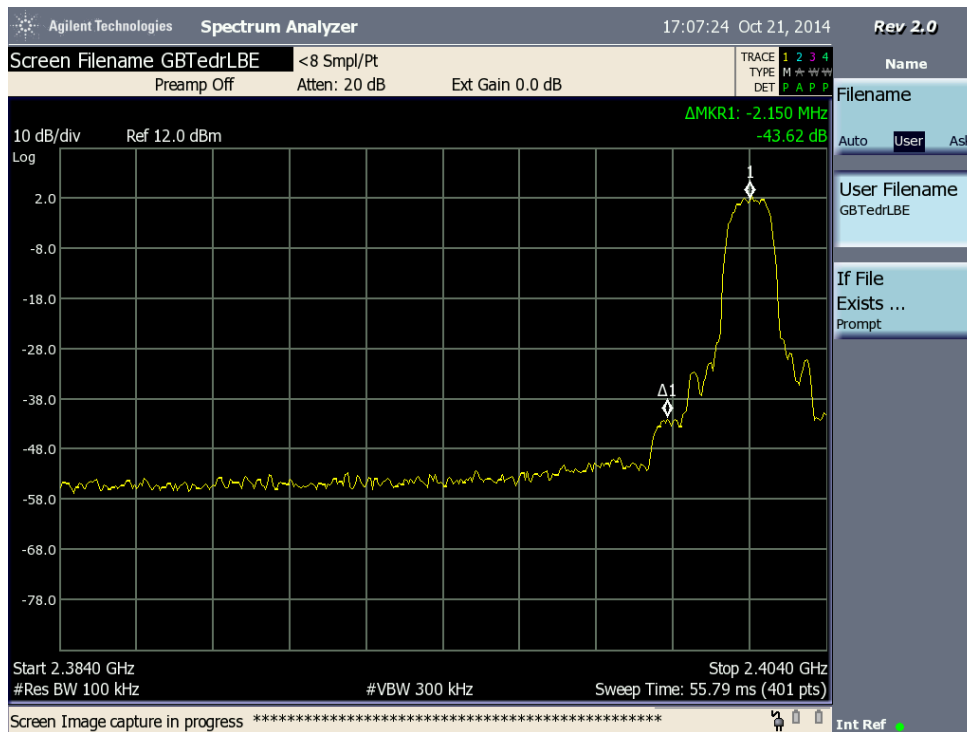


FIGURE 44: EDR Ch0 Lower Band Edge

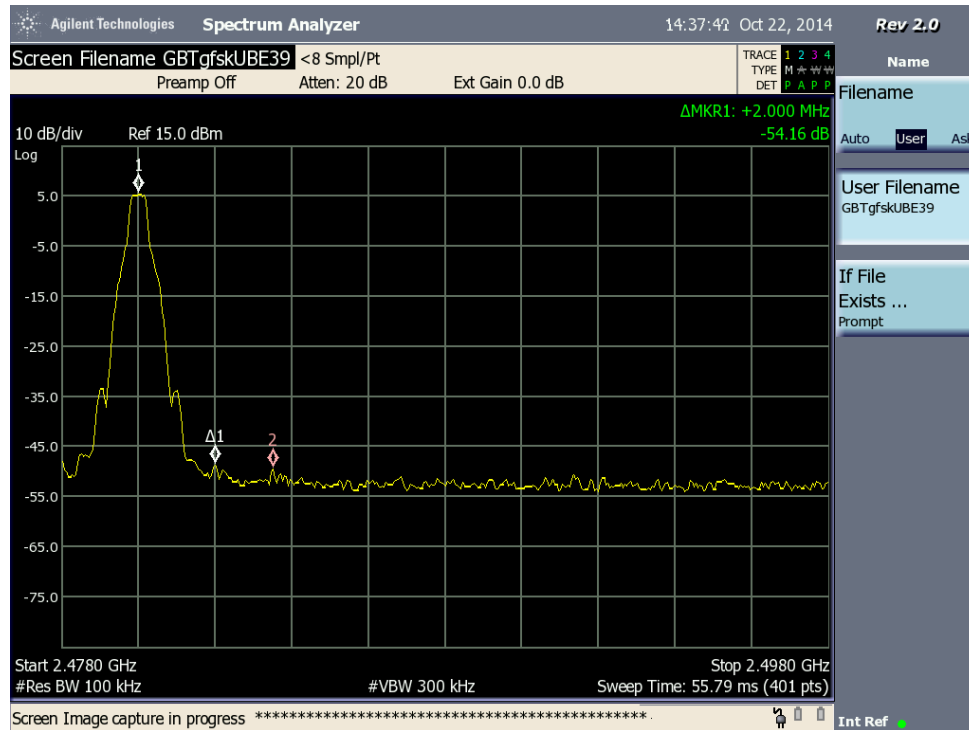


FIGURE 45: GFSK Ch39 Upper Band Edge

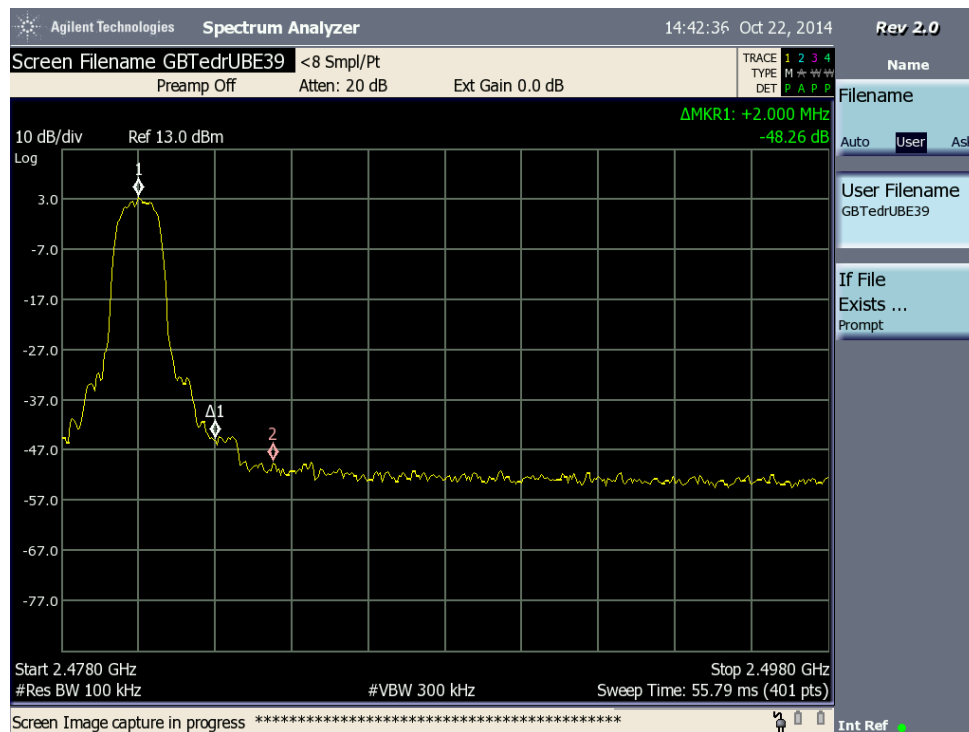


FIGURE 46: EDR Ch39 Upper Band Edge

13 OCCUPIED BANDWIDTH PER FCC PART 2 SECTION 2.1049 (H) – BLUETOOTH 2.0 + EDR

13.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	Semi-Anechoic Chamber
Test Date:	10/21/14
Test Engineer:	D.E. Waldbeser
Temperature	23°C
Humidity:	41%

13.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
CSA Spectrum Analyzer	Agilent	N1996A	MY45371881	1/17/15	2 yr

13.3 TEST SET UP PHOTO(S)

Refer to section 1.10 (Figure1).

13.4 LIMITS/REQUIREMENTS

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission. Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated.

13.5 TEST DESCRIPTION AND PROCEDURE

Using the conducted test method, the occupied bandwidth measurement was made utilizing the CSA Analyzer's OBW function. The span was set to be wide enough to capture the entire operating channel.

13.6 TEST PLOTS

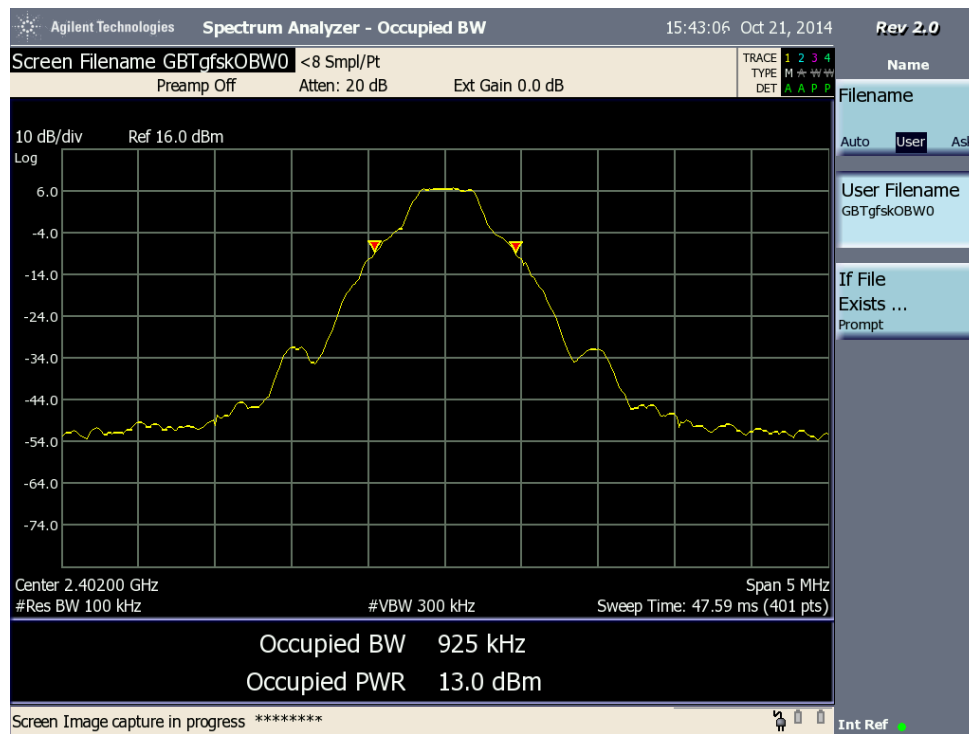


FIGURE 47: GFSK Occupied Bandwidth (Ch0 shown, Ch20 & 39 similar)

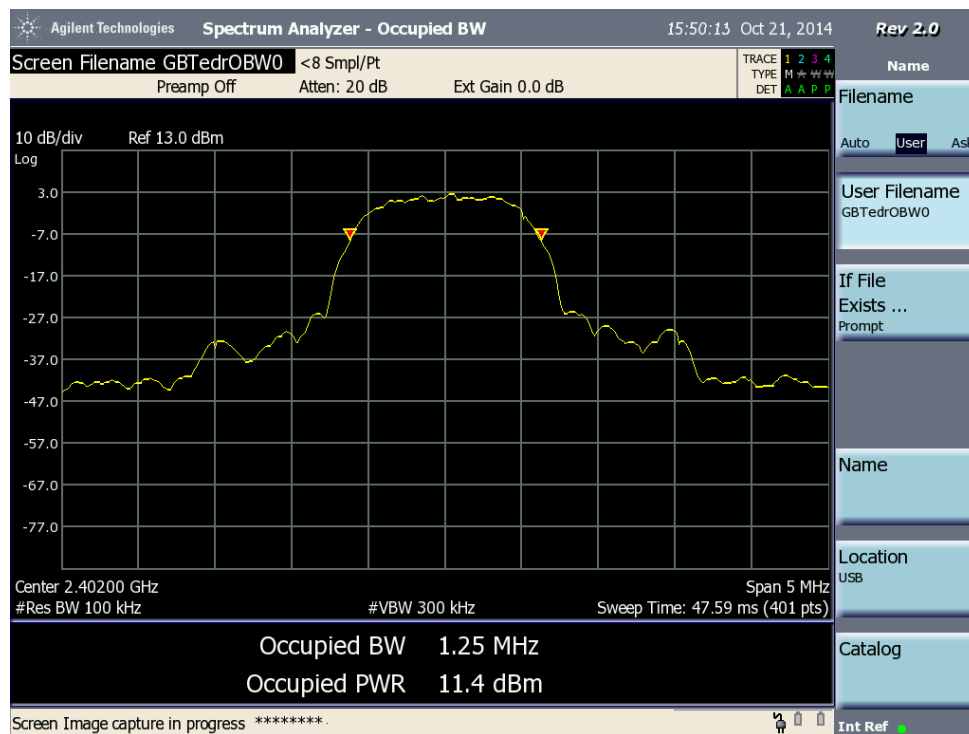


FIGURE 48: EDR Occupied Bandwidth (Ch0 shown, Ch20 & 39 similar)

14 SPURIOUS & RESTRICTED BANDS EMISSIONS PER FCC PART 15 SECTIONS 15.209 & 15.205

14.1 ADMINISTRATIVE AND ENVIRONMENTAL DETAILS

Site Used:	Semi-Anechoic Chamber
Test Date:	10/21/2014
Test Engineer:	D.E. Waldbeser
Temperature	20°C
Humidity:	47%

14.2 TEST EQUIPMENT

Equipment Description	Manufacturer	Model Name	Serial Number	Calibration Due Date	Calibration Interval
EMC Analyzer	Agilent	E7405A	US40240257	5/30/15	2 yr
Amplifier	Gigatronics	GT-1040A	1116009	N/A	N/A
Amplifier	Agilent	83051	9025	N/A	N/A
Active Loop Antenna	EMCO	6502	1071/1001	10/14/16	2 yr
Biconical Antenna	EMCO	3104	3459	10/14/16	2 yr
Log-Periodic Antenna	EMCO	3146	9510-4202	6/16/16	2 yr
DRG Horn Antenna	EMCO	3115	3643A00028	10/14/16	2 yr
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170267	10/16/16	2 yr

14.3 TEST SET UP PHOTO(S)

Refer to section 1.10 (Figure2 – 4)

14.4 LIMITS/REQUIREMENTS

FCC Part 15 section 15.209 Radiated emission limits

Frequency (MHz)	Field strength Average (microvolts/meter)	Field strength Average (dBuV/meter)	Field strength Peak (dBuV/meter)	Measurement distance (meters)
30-88	100	40	60	3
88-216	150	43.5	63.5	3
216-960	200	46	66	3
Above 960	500	54	74	3

FCC Part 15 section 15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	
13.36-13.41			

14.5 TEST DESCRIPTION AND PROCEDURE

For radiated emissions, the packaged EUT was placed 80 cm above the ground plane on a non-conducting table. The transmit and receive configuration of the EUT was controlled by the same means as the conducted tests. 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)).

14.6 SPURIOUS EMISSIONS PLOTS

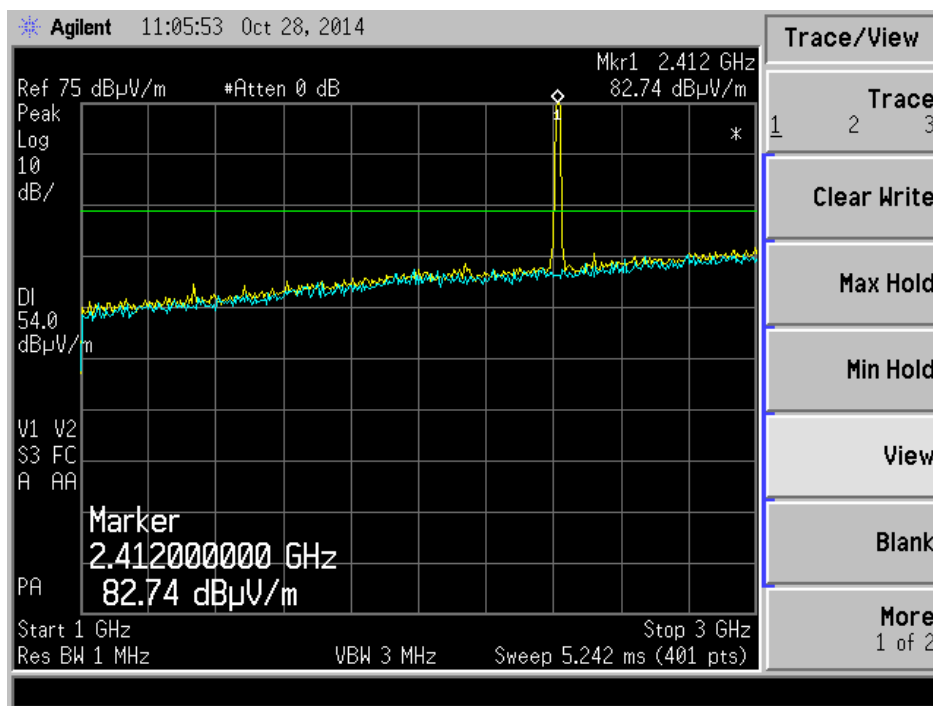


FIGURE 49: DRG Horn, Horizontal Polarization: 802.11b/g/n (Ch1 shown, Ch6 & 11 similar)
Blue trace – EUT off, Yellow trace – EUT on

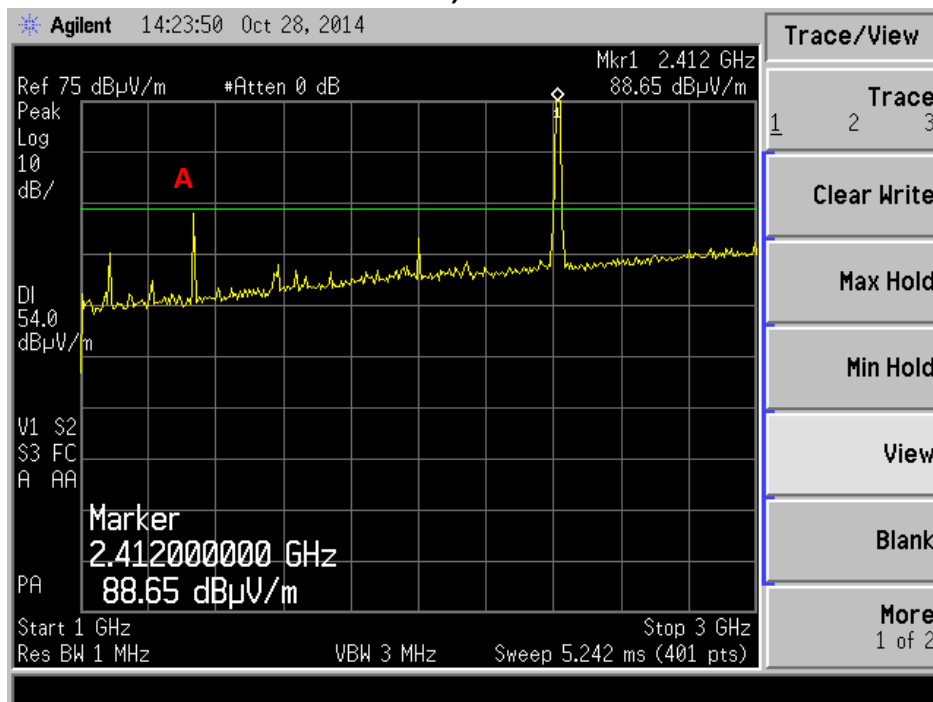


FIGURE 50: DRG Horn, Vertical Polarization: 802.11b/g/n (Ch1 shown, Ch6 & 11 similar)
A = ambient (laptop)



FIGURE 51: Log-Periodic, Horizontal Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on, Magenta – chamber background

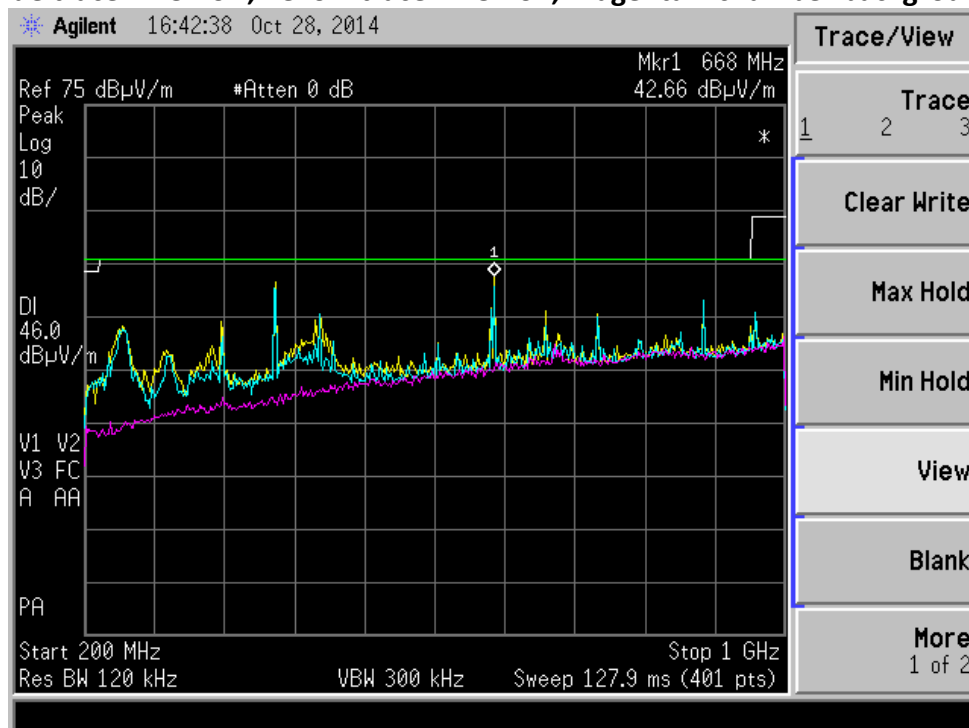


FIGURE 52: Log-Periodic, Vertical Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on, Magenta – chamber background



FIGURE 53: Biconical, Horizontal Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on



FIGURE 54: Biconical, Vertical Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on



FIGURE 55: Active Loop, Horizontal Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on



FIGURE 56: Active Loop, Vertical Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on

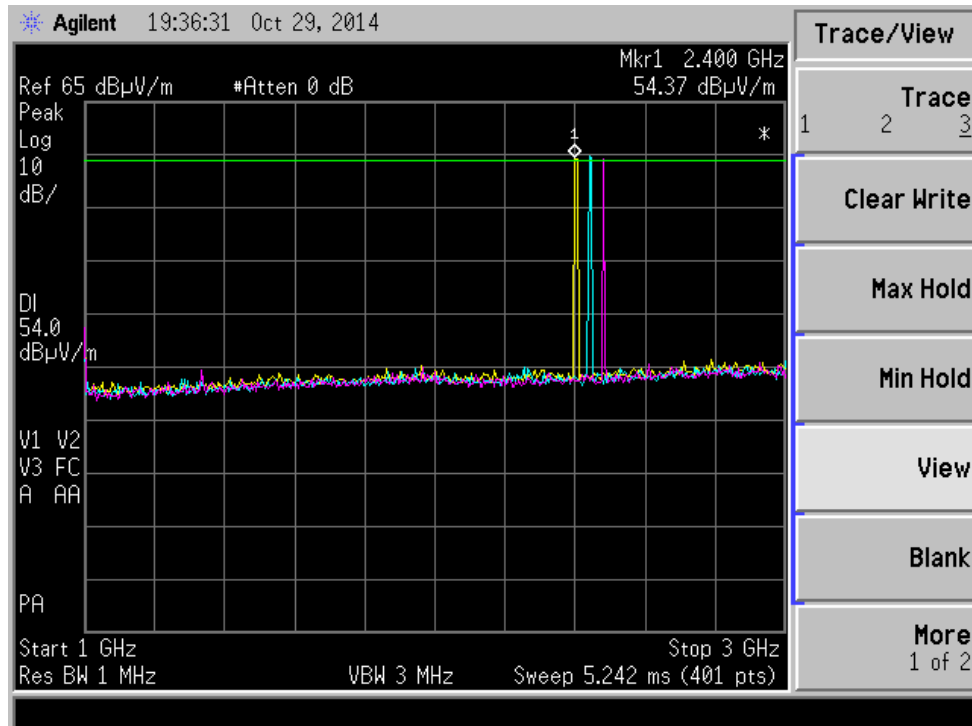


FIGURE 57: DRG Horn, Horizontal Polarization: BT Ch0, 20, 39

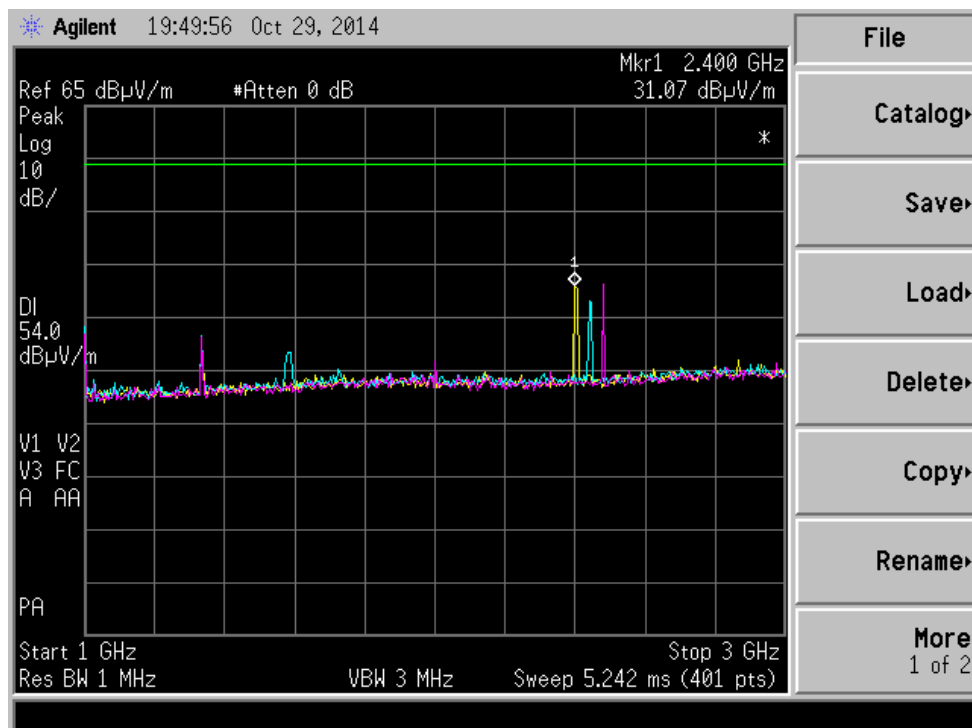


FIGURE 58: DRG Horn, Vertical Polarization: BT Ch0, 20, 39

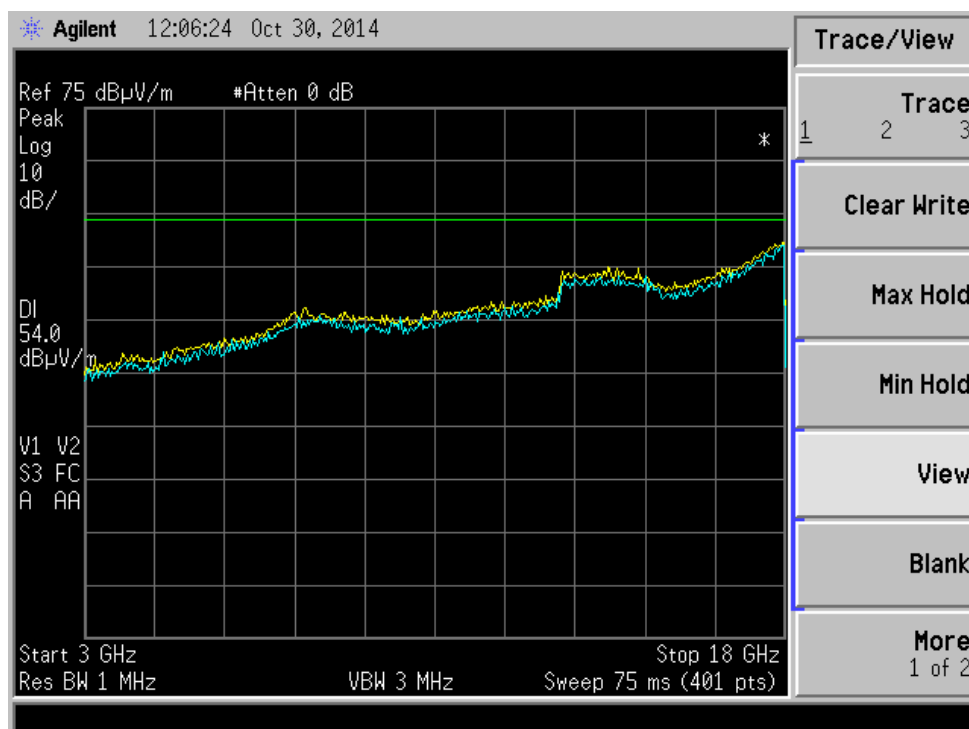


FIGURE 59: DRG Horn, Horizontal Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on



FIGURE 60: DRG Horn, Vertical Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on

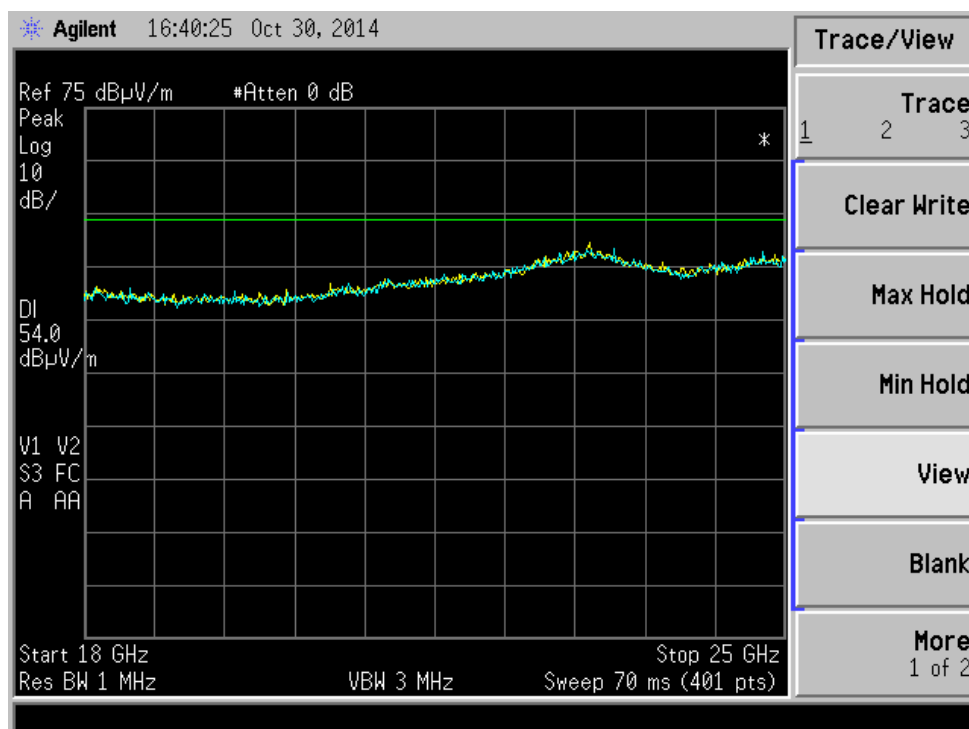


FIGURE 61: 15-40GHz Horn, Horizontal Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on

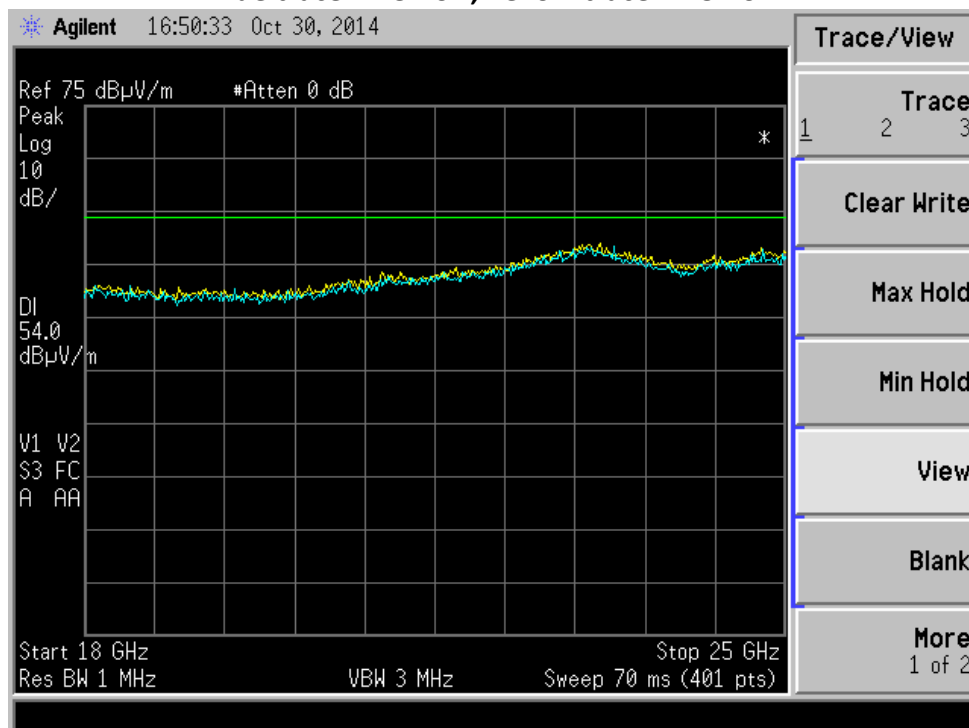


FIGURE 62: 15-40GHz Horn, Vertical Polarization: 802.11 & BT
Blue trace – EUT off, Yellow trace – EUT on

15 GAIN OF TRANSMISSION ANTENNA PER FCC PART 15.247 (B)(4)

15.1 LIMITS/REQUIREMENTS

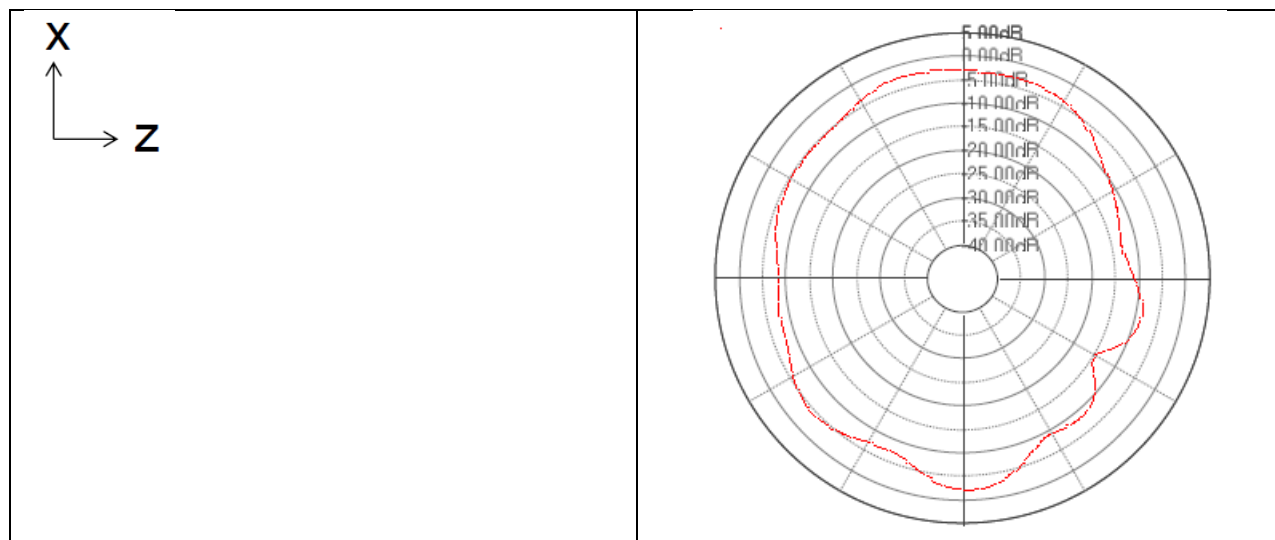
(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi.

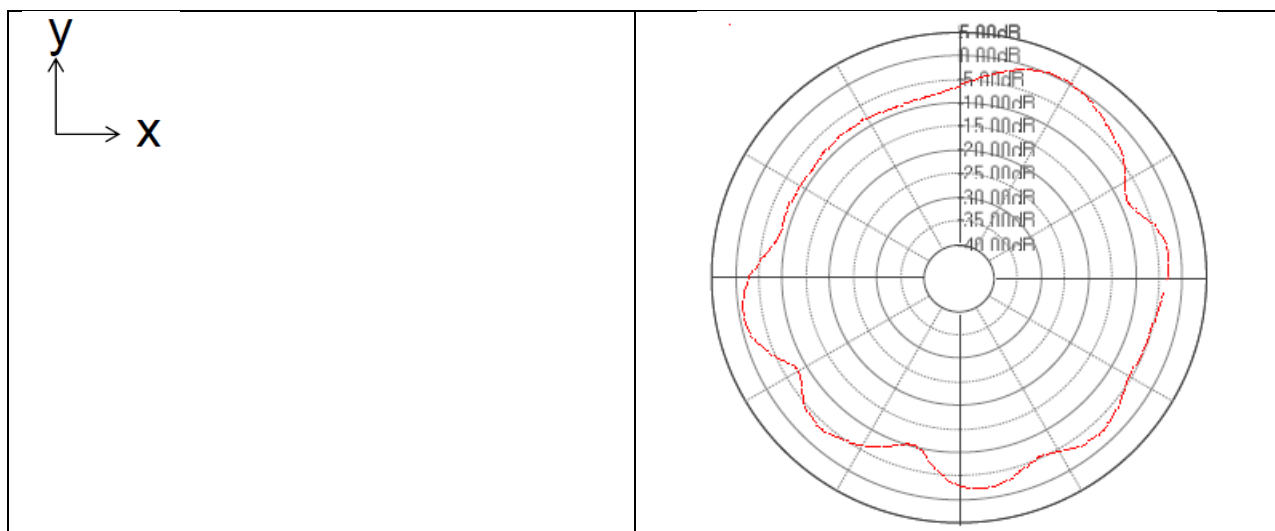
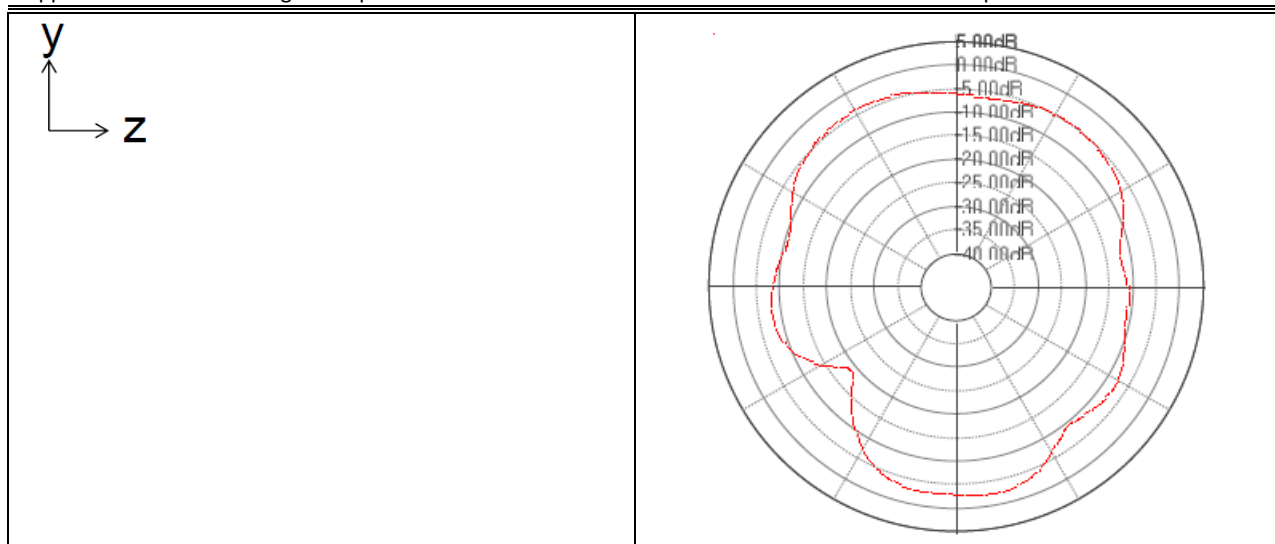
The EUT antenna used, , has a stated gain over the band of ± 0.5 dBi.

ODG Antenna Specification

WIFI antenna

Electrical	
Operation frequency (GHz)	2.4-2.5
Antenna peak gain (dBi)	0
Antenna average gain (dBi)	-5
Antenna efficiency (%)	36.5
Radiation pattern	Omni
Maximum input power (W)	2
Mechanical	
Antenna element size (mm)	45.7 (L) x 5.7 (W) x 0.15 (T)
Coax cable	Micro-coax 0.81 mm
Connector	MFH III male / Right angle





16 APPENDIX

16.1 EUT TECHNICAL SPECIFICATIONS

Manufacturer:	Osterhout Design Group		
General Description:	The R-6 Smart Glasses offers immersive 3D HD viewing of stored or streaming video content, with stereo audio, in a static setting, or in a head orientation tracking augmented vision mode.		
EUT Name:	Smart Glasses	Model:	R-6
Dimensions:	15mm x 17mm x 5.5mm	Serial Number:	
Operating Frequency:	2.400 GHz- 2.4835 GHz	Power Cord Type:	☐ Shielded ☐ Un-Shielded

16.2 EUT PHOTOS



FIGURE 63: Front Oblique View



FIGURE 64: Rear Oblique View