FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 1

CERTIFICATION TEST REPORT

FOR

802.11a/g/n/ac 3X3 WLAN + Bluetooth PCI-E Custom Combination Card

MODEL NUMBER: BCM943602BAED

FCC ID: QDS-BRCM1088
IC ID: 4324A-BRCM1088

REPORT NUMBER: 15U20284-E4, Revision A

ISSUE DATE: JUNE 16, 2015

Prepared for
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	06/09/15	Initial Issue	F. Ibrahim
A	06/16/15	Revised sections 5.5 and 11	F. Ibrahim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: BROADCOM CORPORATION
190 MATHILDA PLACE
SUNNYVALE, CA 94086, U.S.A.

EUT DESCRIPTION: 802.11a/g/n/ac 3X3 WLAN + Bluetooth PCI-E Custom Combination Card

MODEL: BCM943602BAED

SERIAL NUMBER: P104 SN: 159 (Radiated Sample) and SN: 189 and 2205001201 (Conducted Sample)

DATE TESTED: MARCH 14 - JUNE 3, 2015

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-247 Issue 1	Pass
INDUSTRY CANADA RSS-GEN Issue 4	Pass

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Verification Services Inc. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Verification Services Inc. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Verification Services Inc. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Verification Services Inc. By:

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PROGRAM MANAGER
UL Verification Services Inc.

Tested By:

LIEU NGUYEN
EMC LAB ENGINEER
UL Verification Services Inc.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, RSS-GEN Issue 4, and RSS-247 Issue 1.

Deviation from the above cited ANSI C63.10 standard: the EUT was test at 0.8 m height for all radiated testing.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 and 47266 Benicia Street, Fremont, California, USA. Line conducted emissions are measured only at the 47173 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

47173 Benicia Street	47266 Benicia Street
☐ Chamber A	☐ Chamber D
☒ Chamber B	☐ Chamber E
☐ Chamber C	☐ Chamber F

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at http://ts.nist.gov/standards/scopes/2000650.htm.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	±3.52 dB
Radiated Disturbance, 30 to 1000 MHz	±4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11a/g/n/ac 3X3 WLAN + Bluetooth PCI-E Custom Combination Card.

The radio module is manufactured by Broadcom.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2402 - 2480	Basic GFSK	8.90	7.76
2402 - 2480	Enhanced 8PSK	5.61	3.64

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The EUT utilizes an 802.11a/b/g/n/ac WLAN/BT antenna with a maximum gain of 3.33 dBi for BT.

5.4. SOFTWARE AND DRIVER

The EUT driver software installed during testing was Broadcom, Ver. 5.6.0.9020.

The test utility software used during testing was Broadcom Bluetooth, Ver. 1.8.37.6.

5.5. WORST-CASE CONFIGURATION AND MODE

X, Y, & Z investigation was performed and Y orientation was found to be worst-case, therefore, all final radiated emissions was performed using Y orientation. See setup photos section for details.

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Chain J1 (WiFi 3) is used for testing BT.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	G560	CB06427681	DoC
AC Adapter	Lenovo	ADP65 KH B	206337	DoC
Catalyst PCIe. Board	Enterprises Inc.	NA	NA	N/A
Laptop	Dell	Latitude E6400	6MYFMJ1	DoC
AC Adapter	Dell	PA2 /CF745	CN-0CF745-48661	DoC
Catalyst PCIe. Board	Enterprises Inc.	NA	NA	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC	1	US 115V	Unshielded	1.0m	NA
2	DC	1	DC	Unshielded	0.8m	NA
3	USB	1	USB	Unshielded	0.8m	NA

TEST SETUP

The EUT was tested as an external module that installed on an USB to test JIG board connected to a host Laptop PC via USB cable. Test software exercised the radio card.

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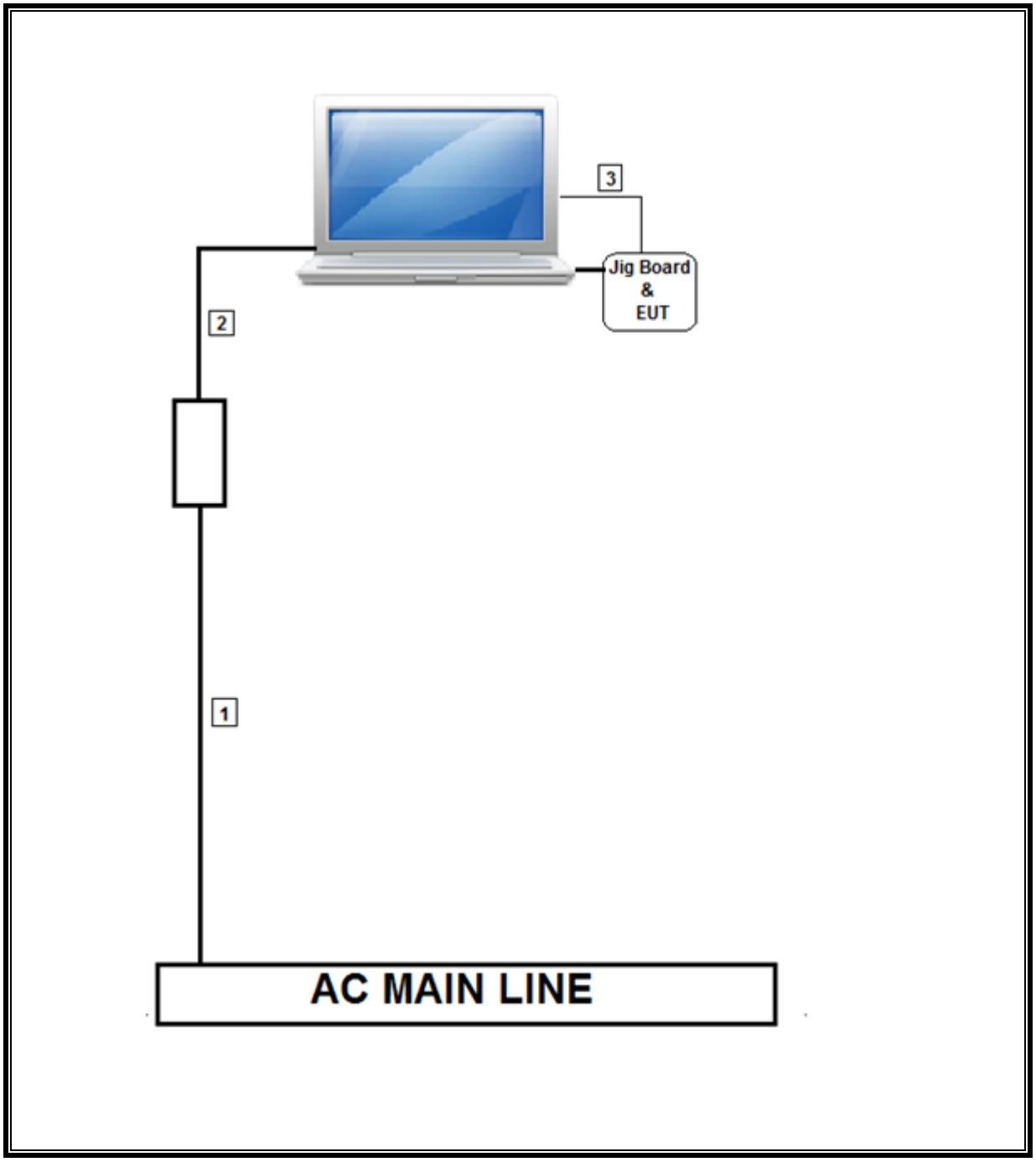
SETUP DIAGRAM FOR TESTS



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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List					
Description	**Manufacturer**	**Model**	**Asset**	**Cal Date**	**Cal Due**
Radiated Software	UL	UL-EMC	Ver 9.5 July 22 2014		
Line Conducted Software	UL	UL EMC	Ver 9.5, May 17, 2012		
Spectrum Analyzer, 3 Hz-44GHz	Agilent	N9030A	T907	07/05/14	07/05/15
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	T243	12/08/14	12/08/15
Antenna, Horn, 18 GHz	ETS Lindgren	3117	T345	03/05/15	03/05/16
Preamplifier, 1300 MHz	Agilent / HP	8447D	T10	01/16/15	01/16/16
EMI Test Receiver	Rohde & Schwarz	ECSI 7	212	08/14/14	08/14/15
Silver Box Amplifier	Miteq	AFS42-0010180	T740	08/30/14	08/30/15
Power Sensor	Agilent	E9323A	T378	08/07/14	08/07/15
Power Meter	Agilent	N1911A	T377	06/30/14	06/30/15
Spectrum Analyzer	HP	8564	T106	08/06/14	08/06/15
Preamplifier, 1-26.5GHz	Agilent	8449B	T404	04/06/15	04/06/16
Broadband Preamplifier	Miteq	NSP4000-SP2	T88	09/03/14	09/03/15
Antenna Horn 18-26GHz	A.R.A	MMI1826	T89	12/17/14	12/17/15
LISN for Conducted Emissions	FCC	50/250-25-2	24	01/16/15	01/16/16

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7. MEASUREMENT METHODS

For FCC testing:

AC Power-line conducted emissions: ANSI C63.10-2009, Section 6.2.

Radiated emissions: ANSI C63.10-2009, Sections 6.5 and 6.6.

Conducted TX spurious emissions: ANSI C63.10-2009, Section 5.5, 5.6 & 7.7.10.

Occupied bandwidth (20 dB): ANSI C63.10-2009, Section 6.9.1.

Band-edge measurements for RF conducted emissions: ANSI C63.10-2009, Section 7.7.9

Carrier frequency separation: ANSI C63.10-2009, Section 7.7.2

Number of hopping frequencies: ANSI C63.10-2009, Section 7.7.3.

Average time of occupancy (dwell time): ANSI C63.10-2009, Section 7.7.4.

Peak output power: ANSI C63.10-2009, Section 6.10.1.

On time and duty cycle: KDB 558074, Section 6.0.

For IC testing:

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

Radiated emissions: ANSI C63.10-2013, Sections 6.5 and 6.6.

Conducted TX spurious emissions: ANSI C63.10-2013, Sections 5.5, 5.6 & 7.8.8.

Conducted RX spurious emissions: ANSI C63.4-2014, Sections 12.2

Occupied bandwidth (20 dB): ANSI C63.10-2013, Sections 6.9.2.

Occupied bandwidth (99% dB): ANSI C63.10-2013, Sections 6.9.3.

Band-edge measurements for RF conducted emissions: ANSI C63.10-2013, Sections 6.10.

Carrier frequency separation: ANSI C63.10-2013, Sections 7.8.2.

Number of hopping frequencies: ANSI C63.10-2013, Sections 7.8.3.

Average time of occupancy (dwell time): ANSI C63.10-2013, Sections 7.8.4.

Peak output power: ANSI C63.10-2013, Sections 7.8.5.

On time and duty cycle: ANSI C63.10-2013, Section 11.6.

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8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4 GHz band (Hopping OFF)						
Bluetooth GFSK	1.000	1.000	1.000	100.00%	0.00	0.010
Bluetooth 8PSK	1.000	1.000	1.000	100.00%	0.00	0.010

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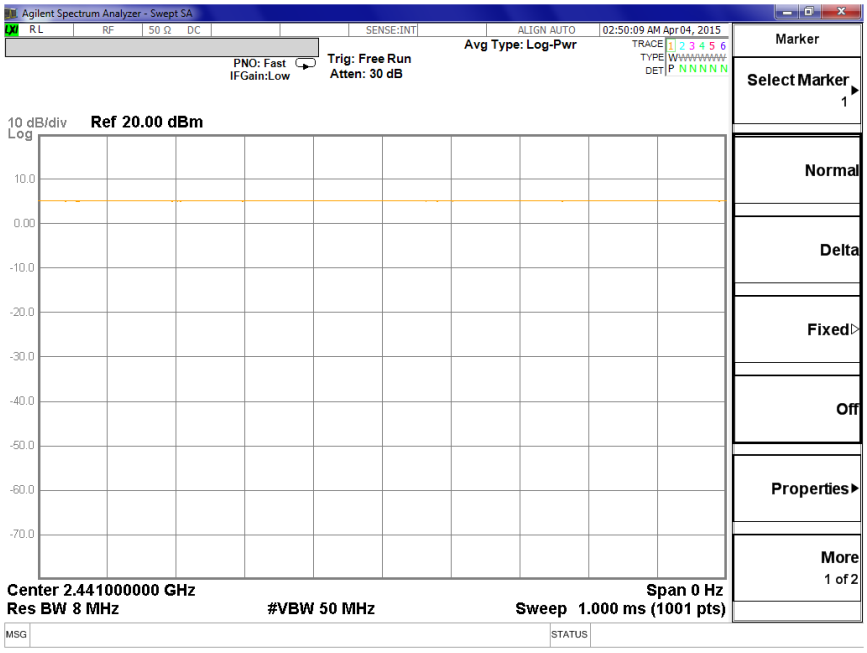
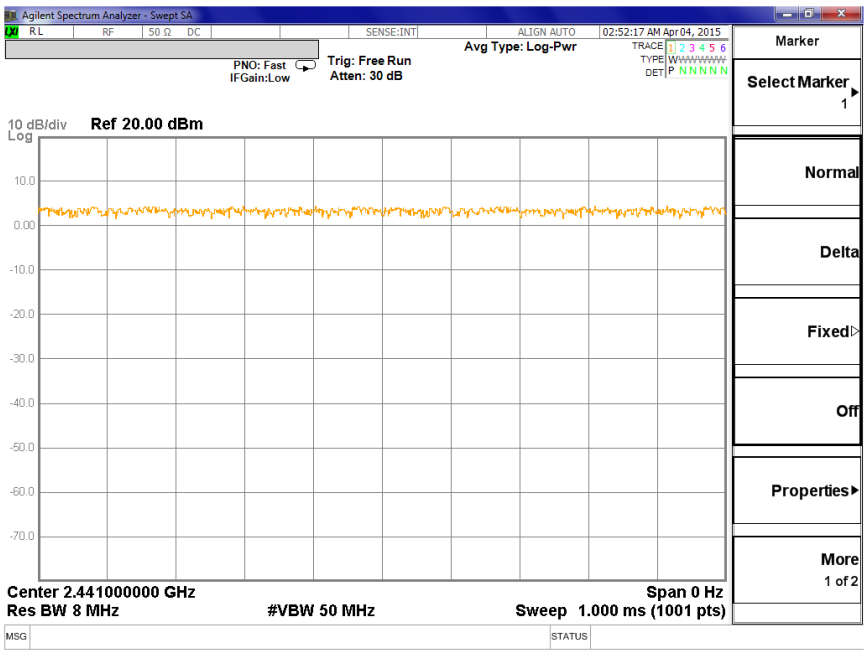
DUTY CYCLE PLOTS

HOPPING OFF

DUTY CYCLE GFSK MODE



DUTY CYCLE 8PSK MODE



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8.2. BASIC DATA RATE GFSK MODULATION

8.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	938.3	894.0798
Middle	2441	938.3	892.0686
High	2480	938.3	894.1995

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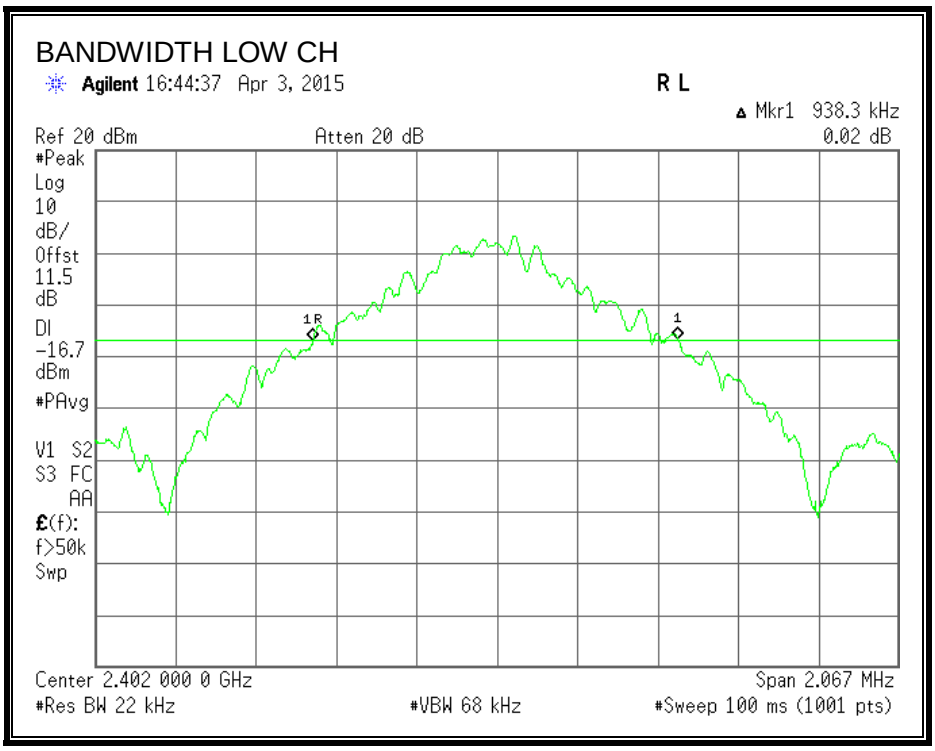
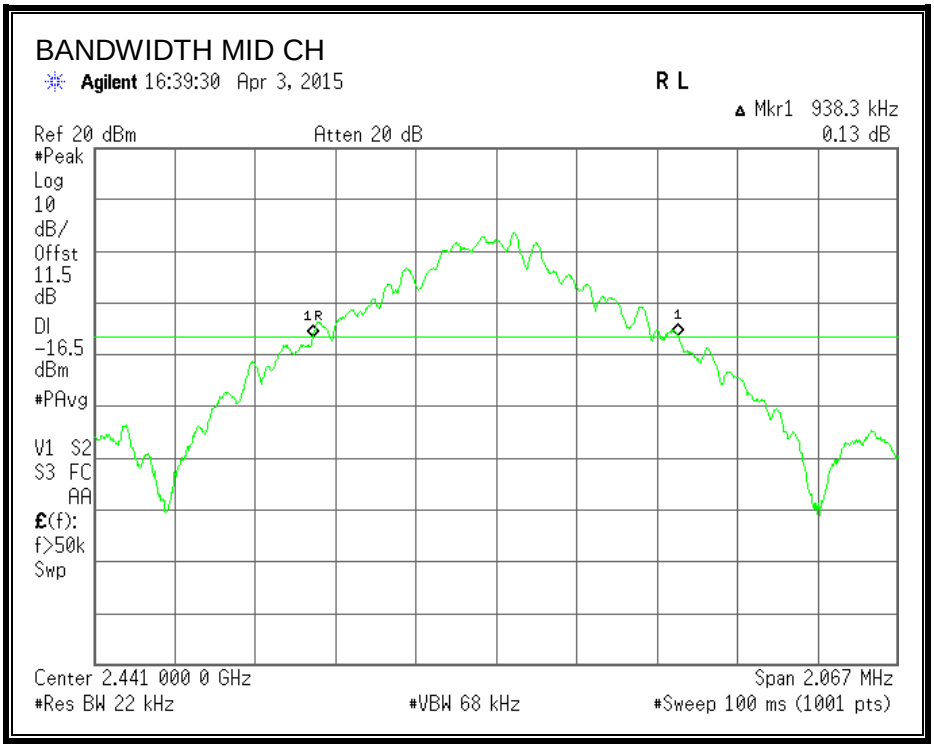
20 dB BANDWIDTH





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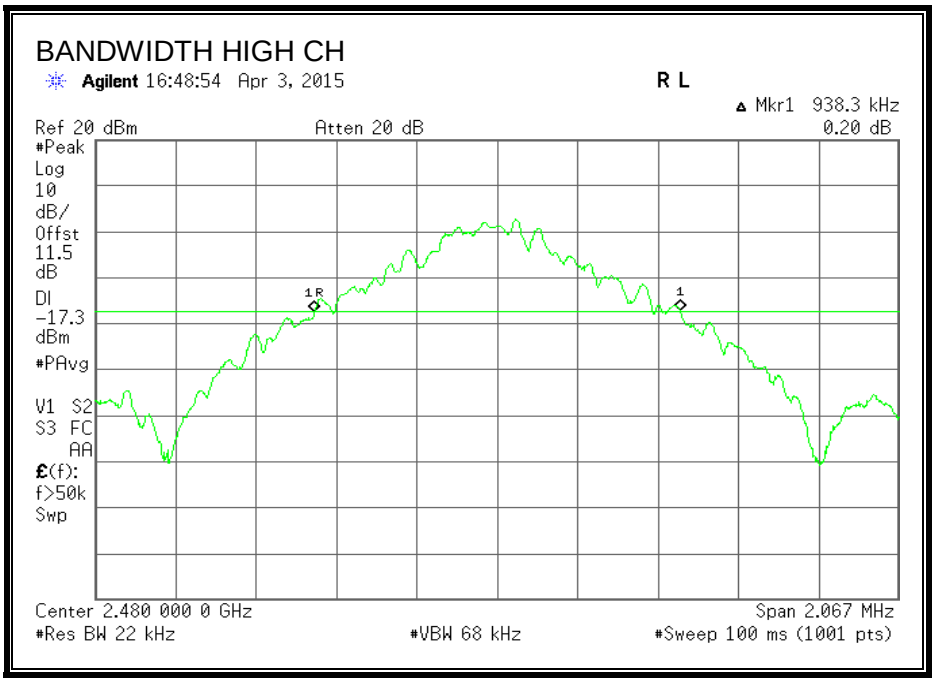
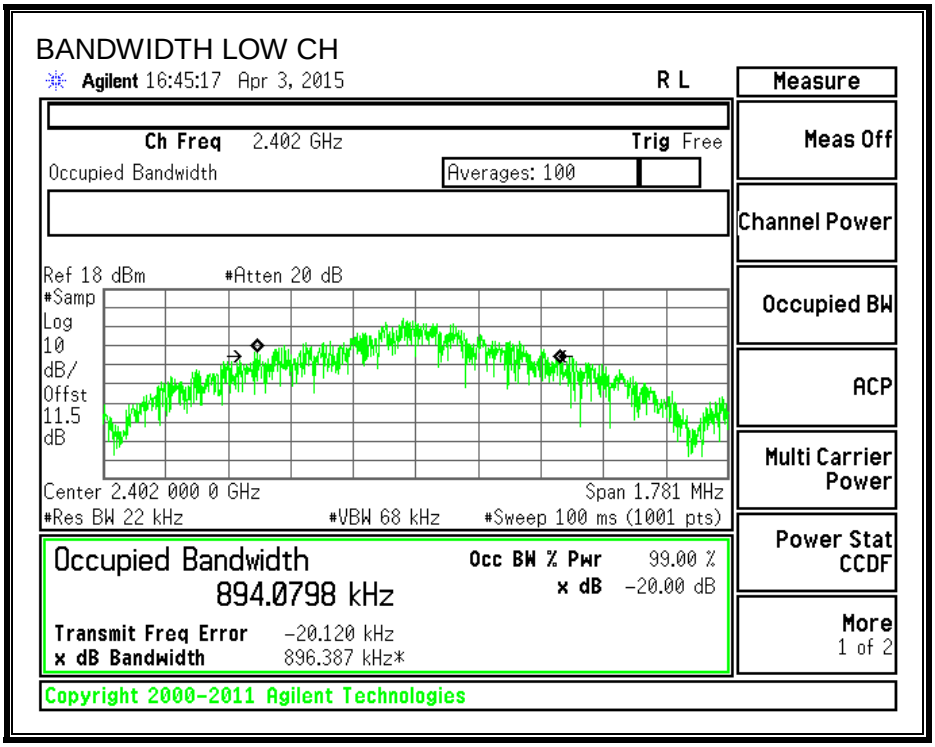


99% BANDWIDTH



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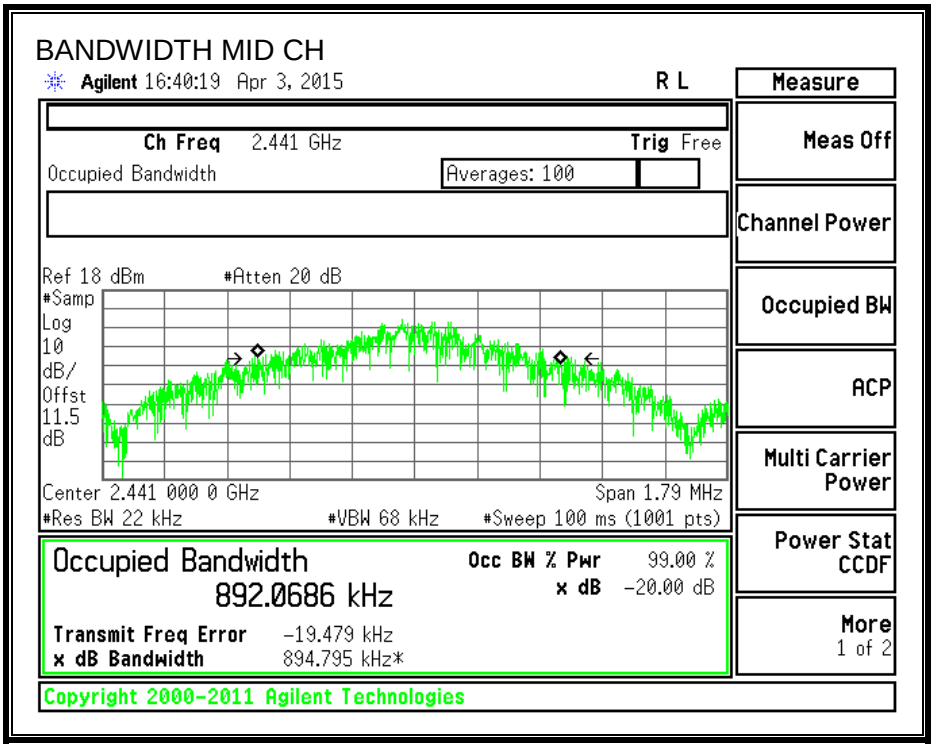
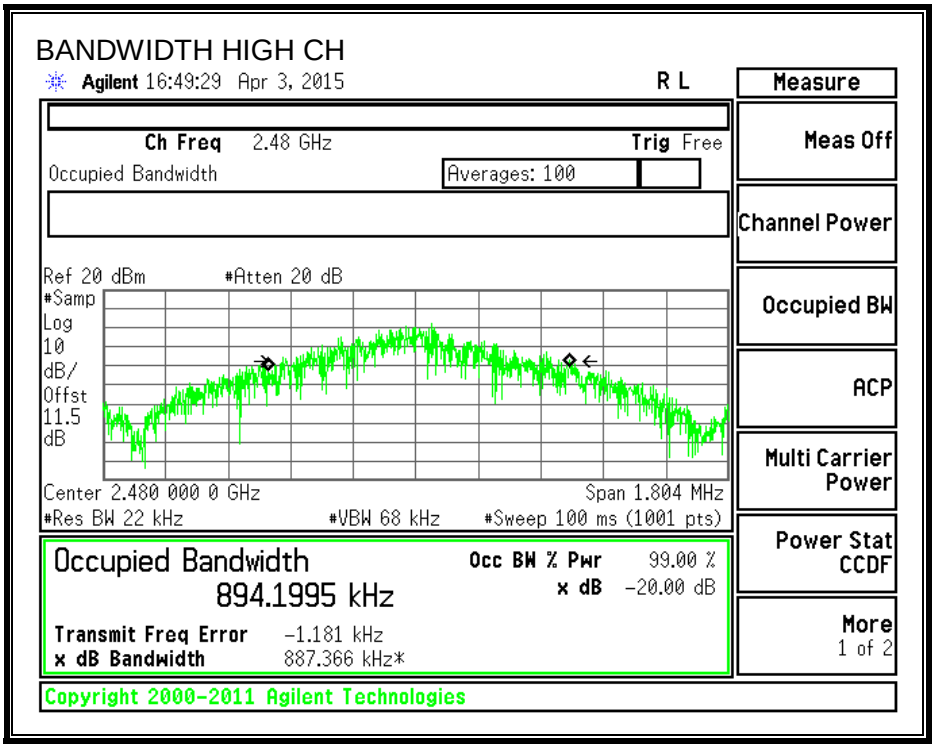
BANDWIDTH MID CH



BANDWIDTH HIGH CH



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8.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 Clause 5.1 (2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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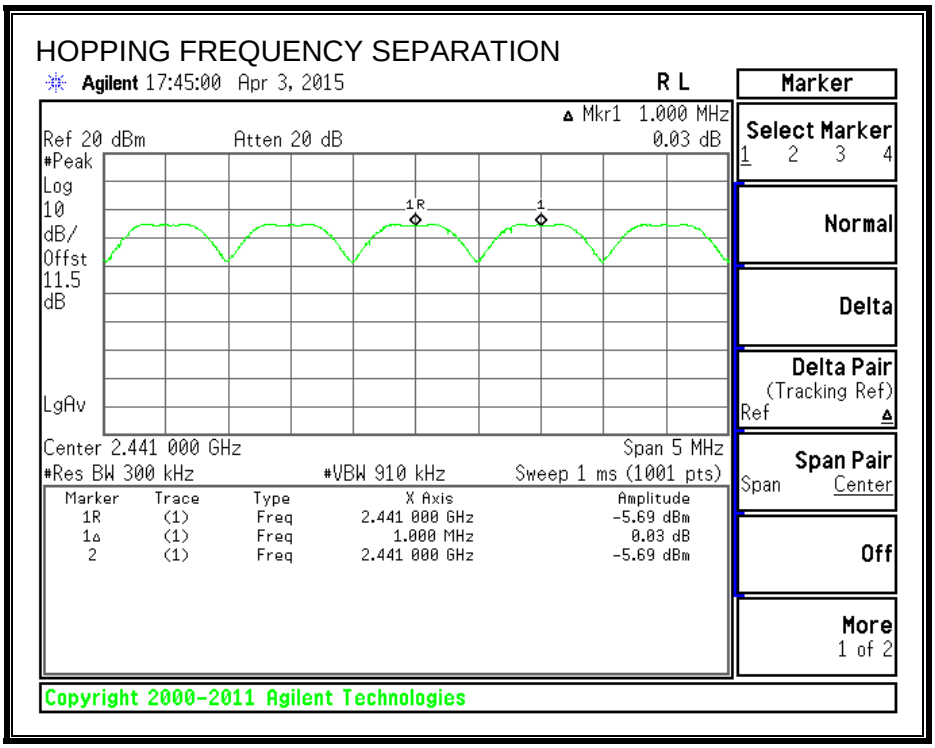
RESULTS

HOPPING FREQUENCY SEPARATION



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8.2.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 Clause 5.1(4)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

RESULTS

Normal Mode: 79 Channels were observed.
AFH Mode: 20 Channels were declared by the client.

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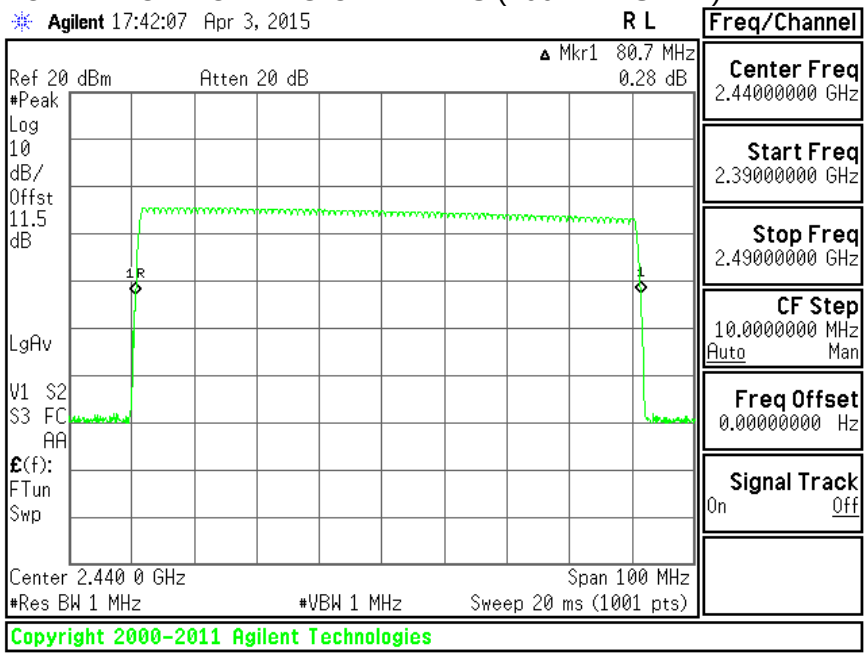
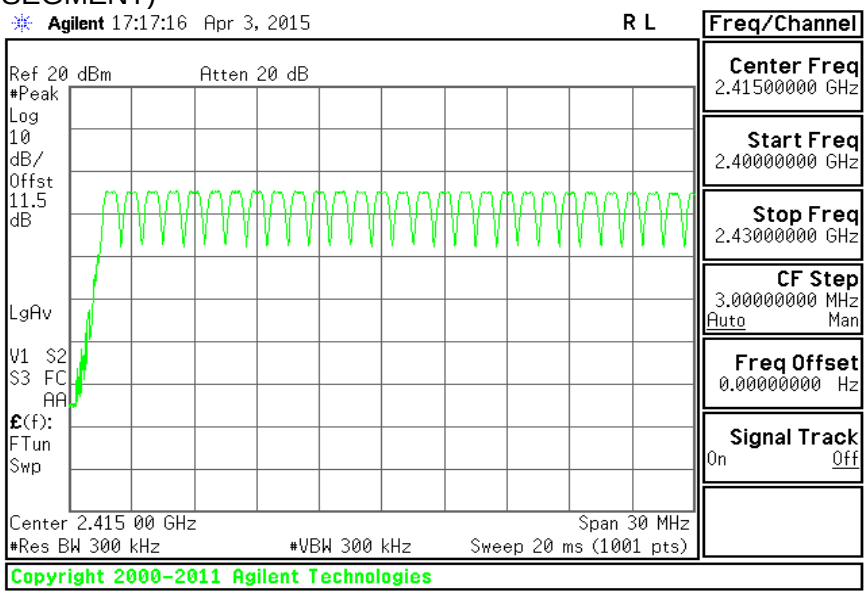
NUMBER OF HOPPING CHANNELS

NUMBER OF HOPPING CHANNELS (100 MHz SPAN)



NUMBER OF HOPPING CHANNELS (30 MHz SPAN, FIRST SEGMENT)



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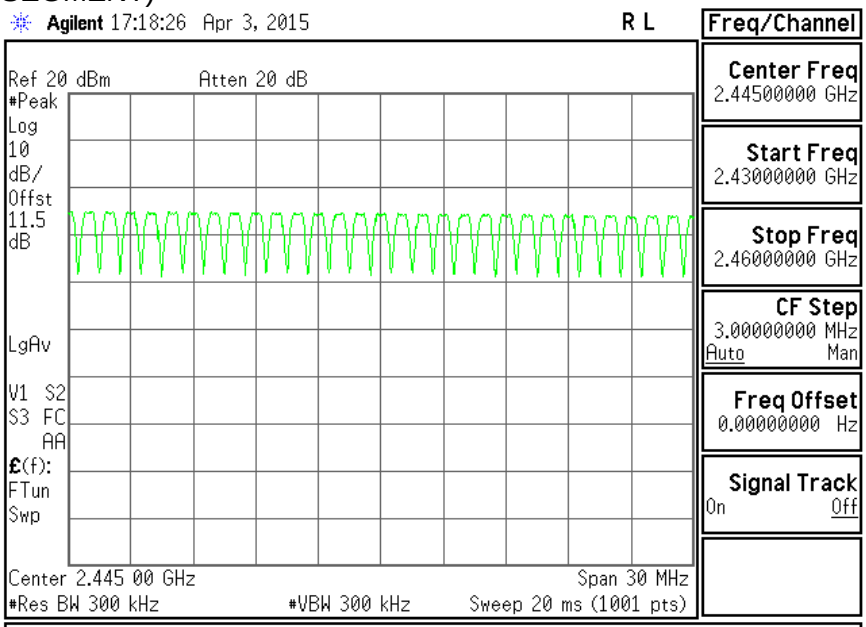
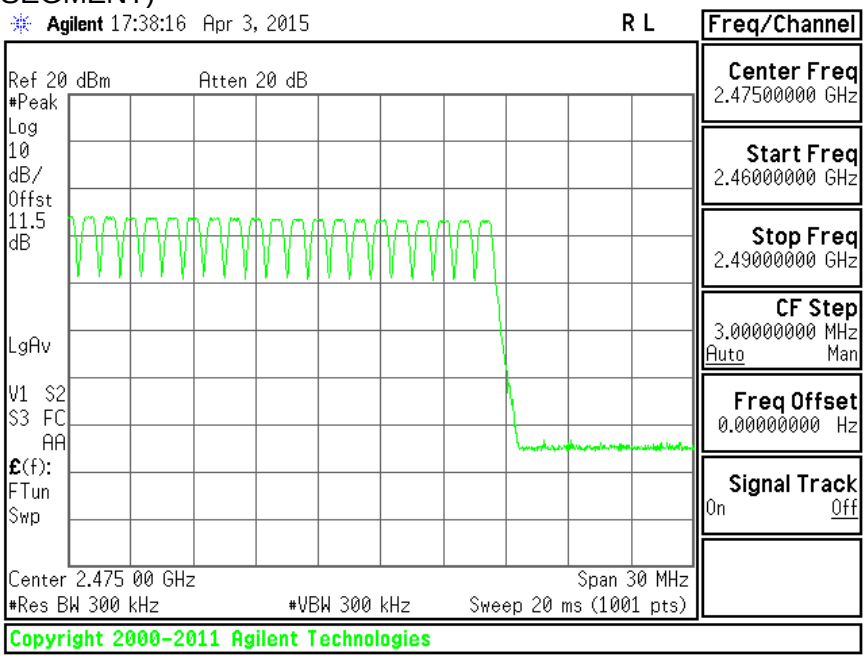
NUMBER OF HOPPING CHANNELS (30 MHz SPAN, SECOND SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHz SPAN, THIRD SEGMENT)



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8.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 Clause 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

RESULTS

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.409	32.00	0.131	0.4	-0.269
DH3	1.656	15.00	0.248	0.4	-0.152
DH5	2.892	9.00	0.260	0.4	-0.140
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.409	8.00	0.033	0.4	-0.367
DH3	1.656	3.75	0.062	0.4	-0.338
DH5	2.892	2.25	0.065	0.4	-0.335

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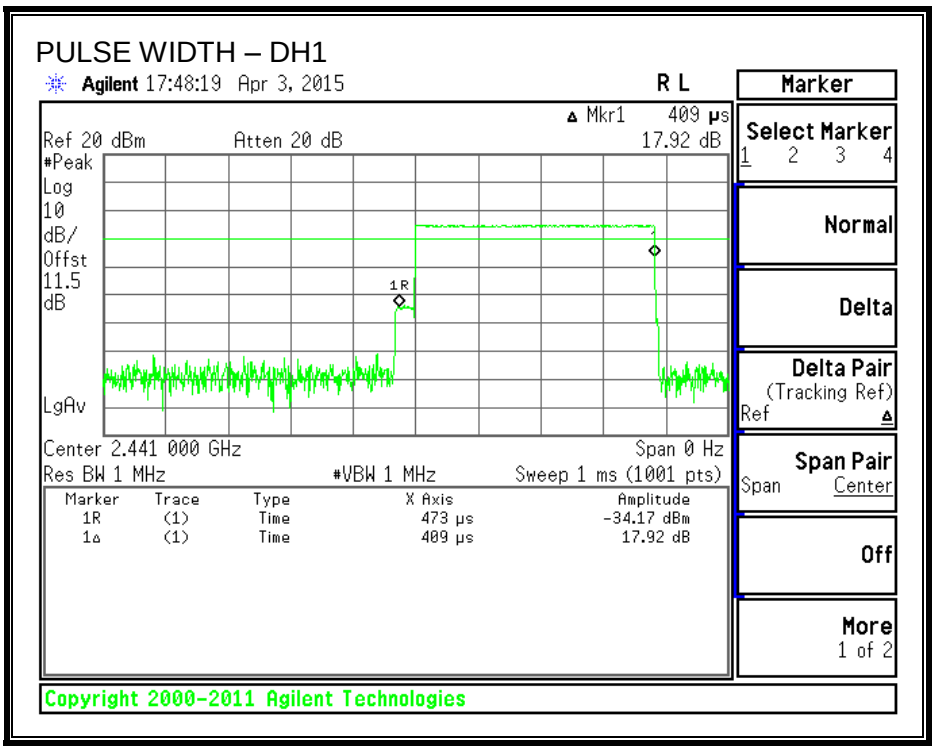
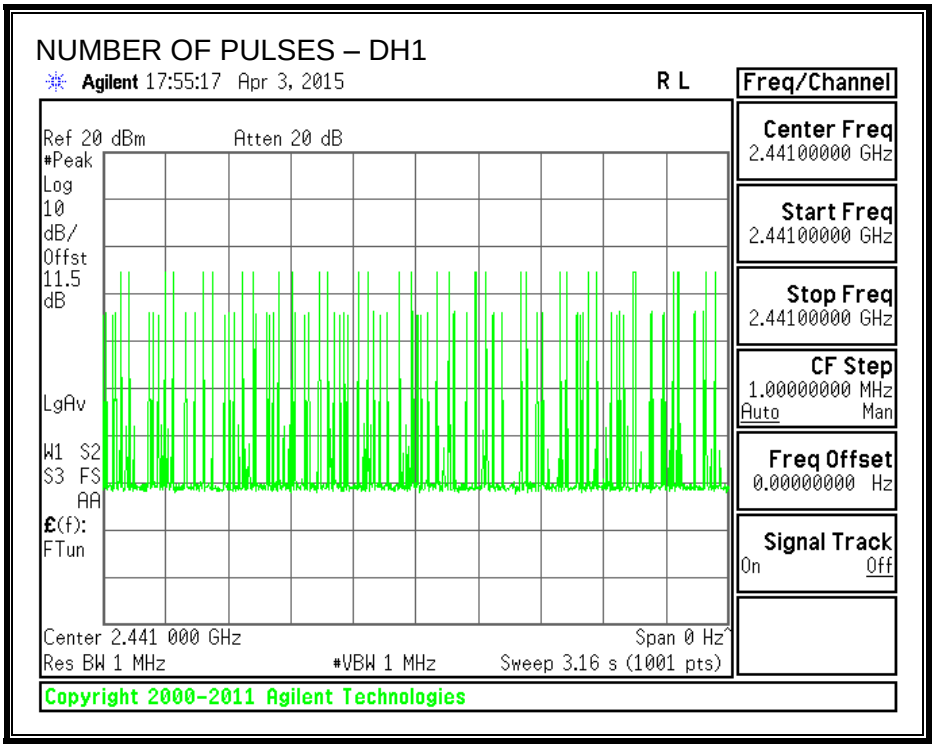
PULSE WIDTH - DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



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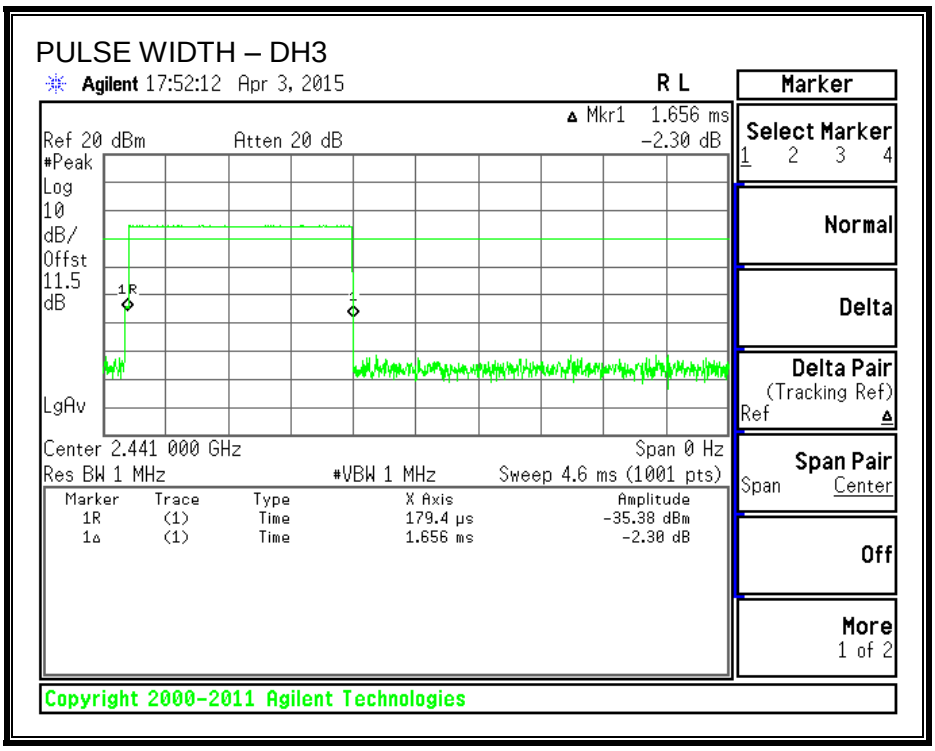
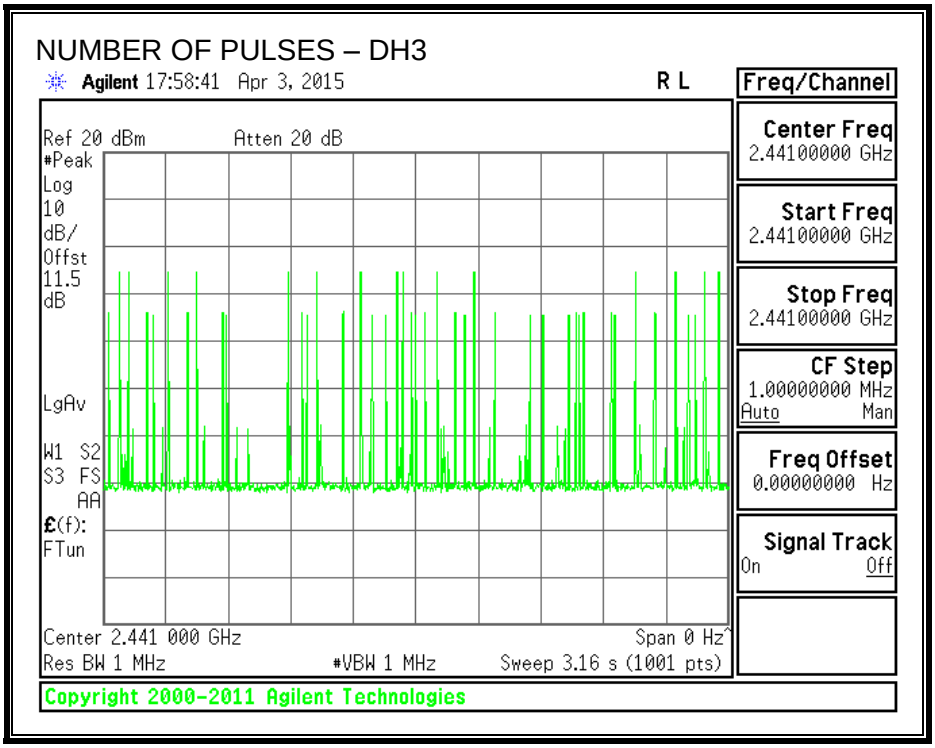
PULSE WIDTH – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



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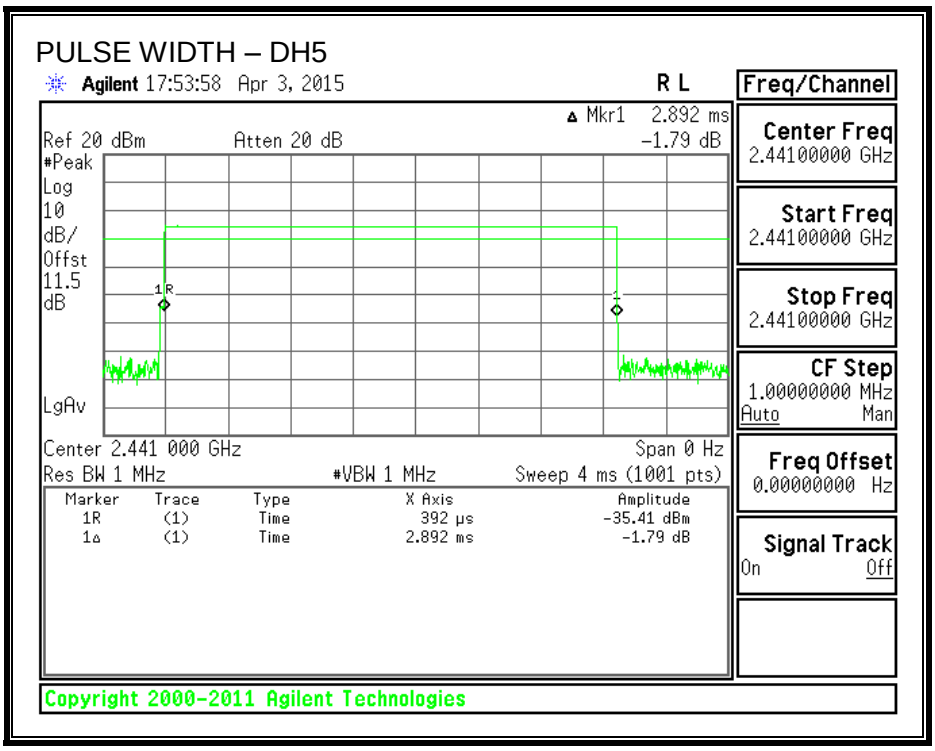
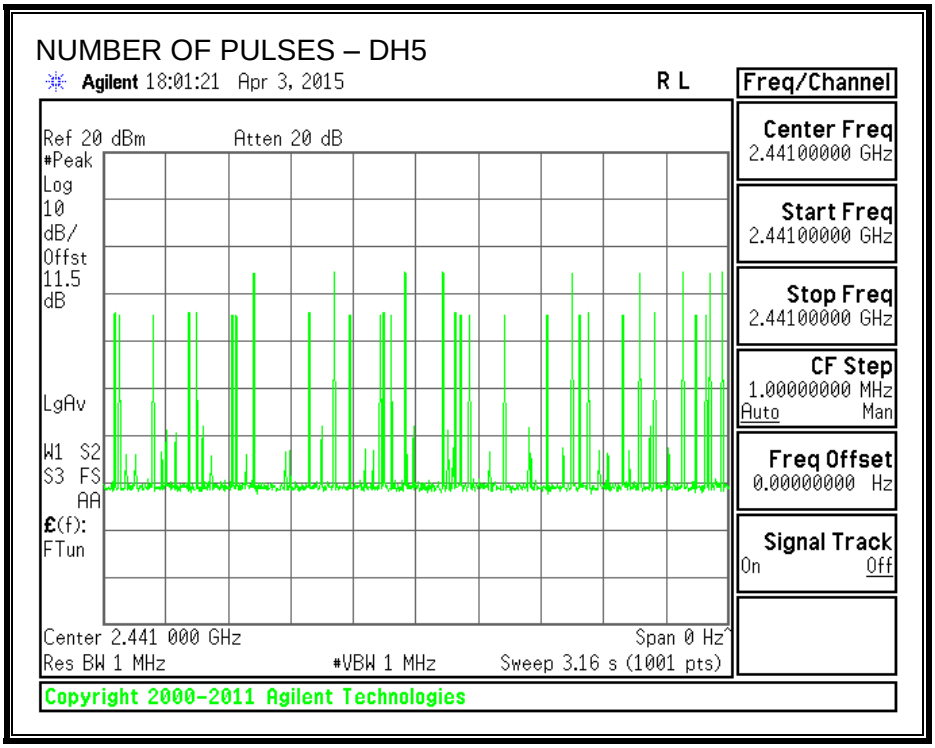
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



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8.2.5. PEAK OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-247 Clause 5.4(2)

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.63	30	-21.37
Middle	2441	8.90	30	-21.10
High	2480	8.69	30	-21.31

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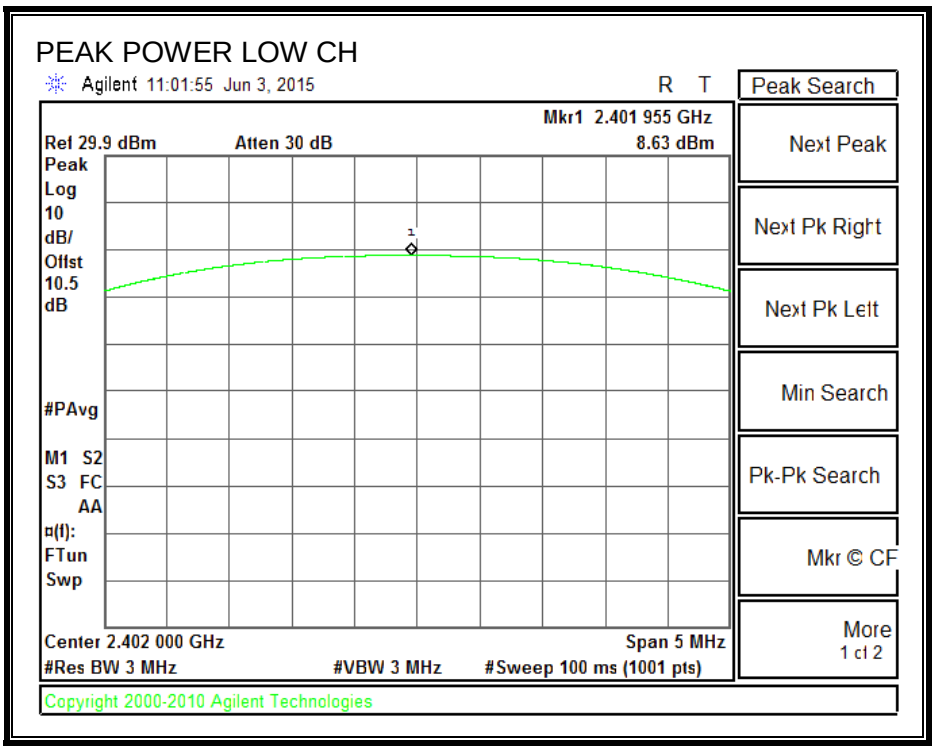
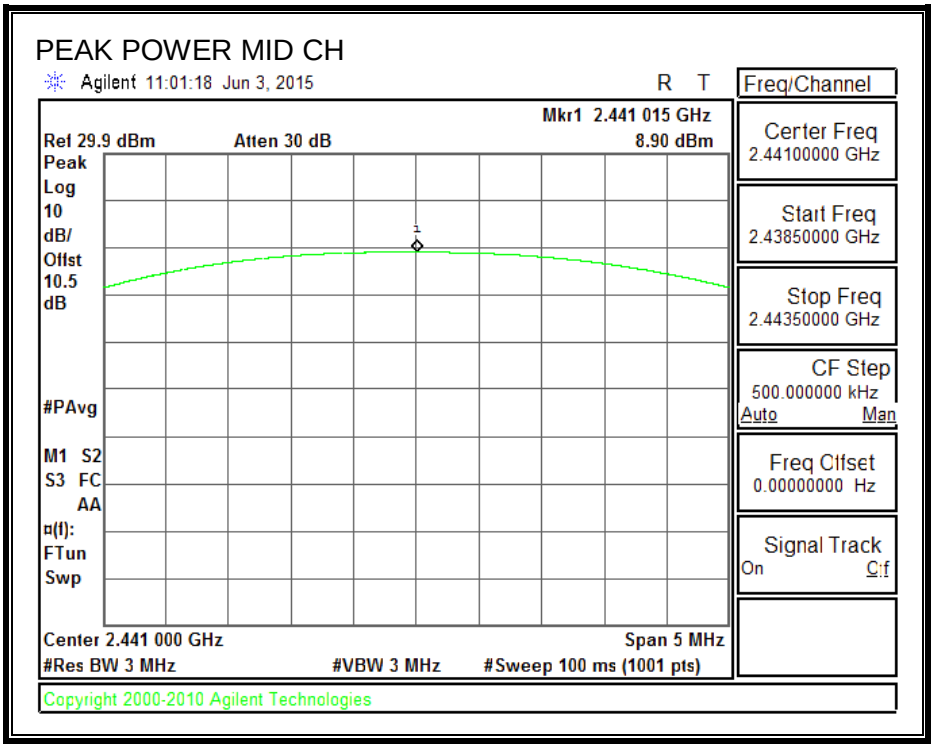
OUTPUT POWER





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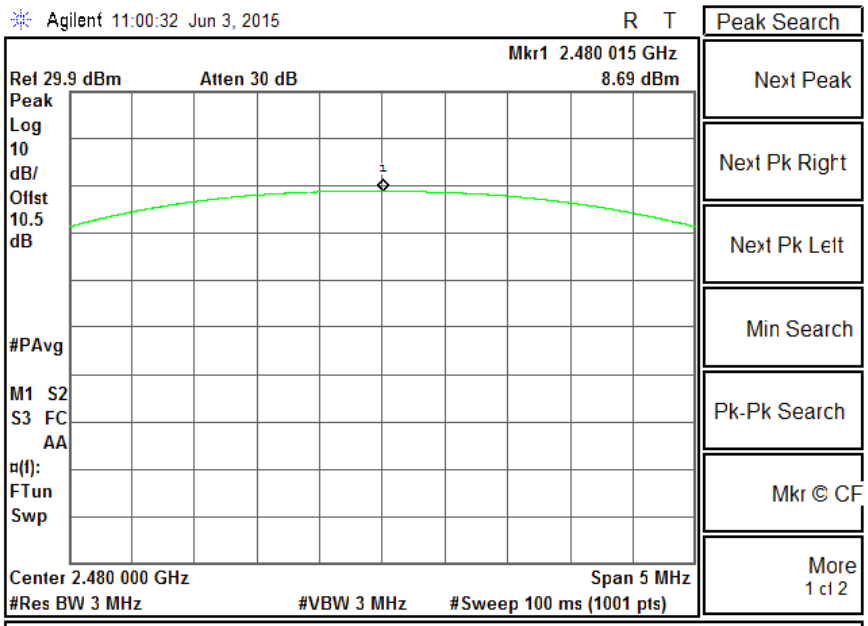
PEAK POWER HIGH CH



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8.2.6. AVERAGE OUTPUT POWER

LIMIT

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.15
Middle	2441	6.32
High	2480	5.56

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8.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 Clause 5.5

Limit = -20 dBc

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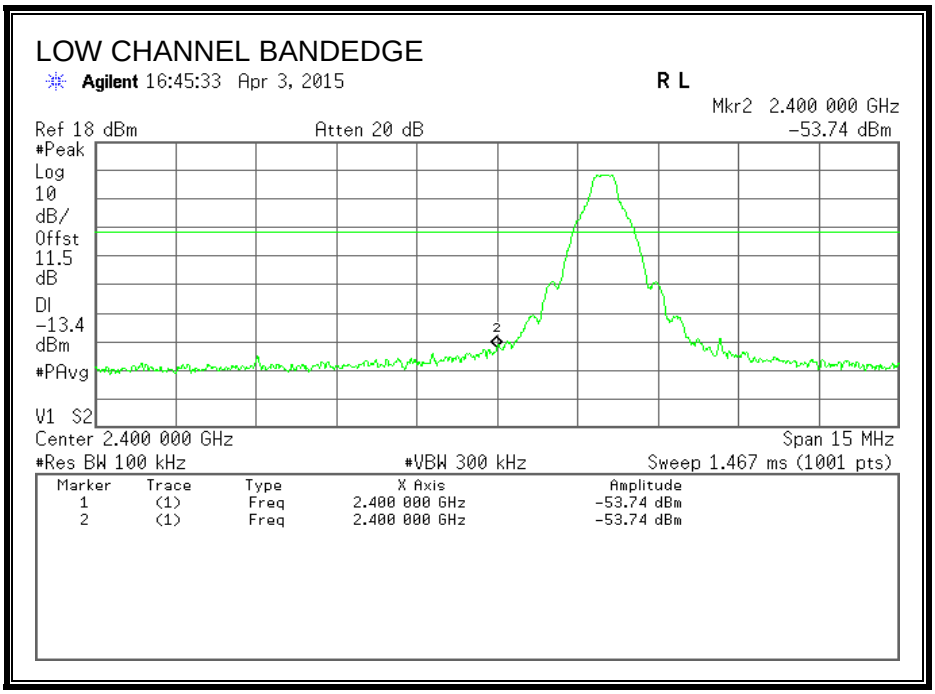
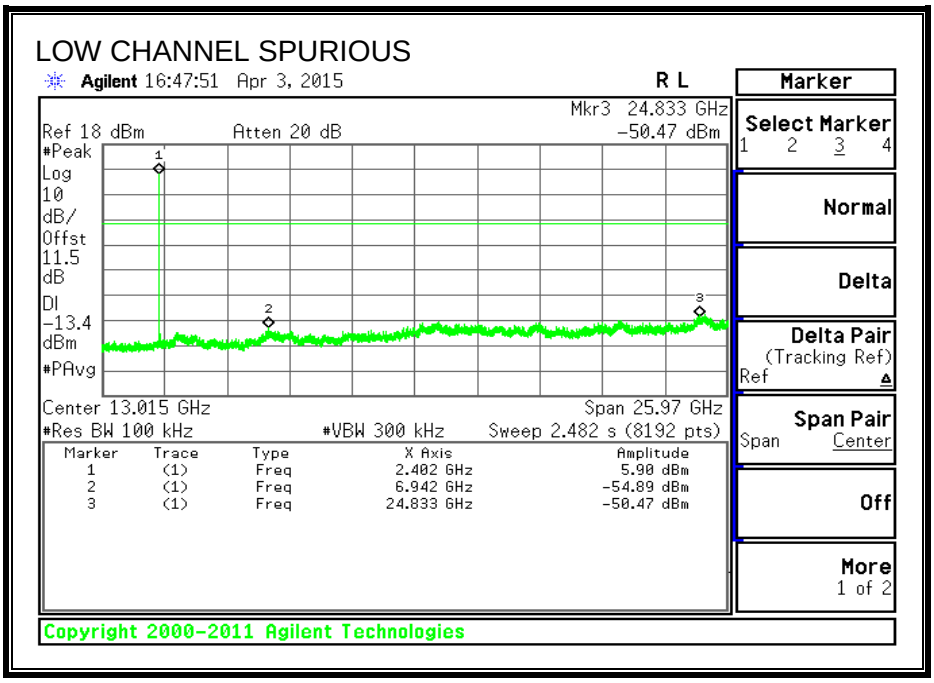
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL





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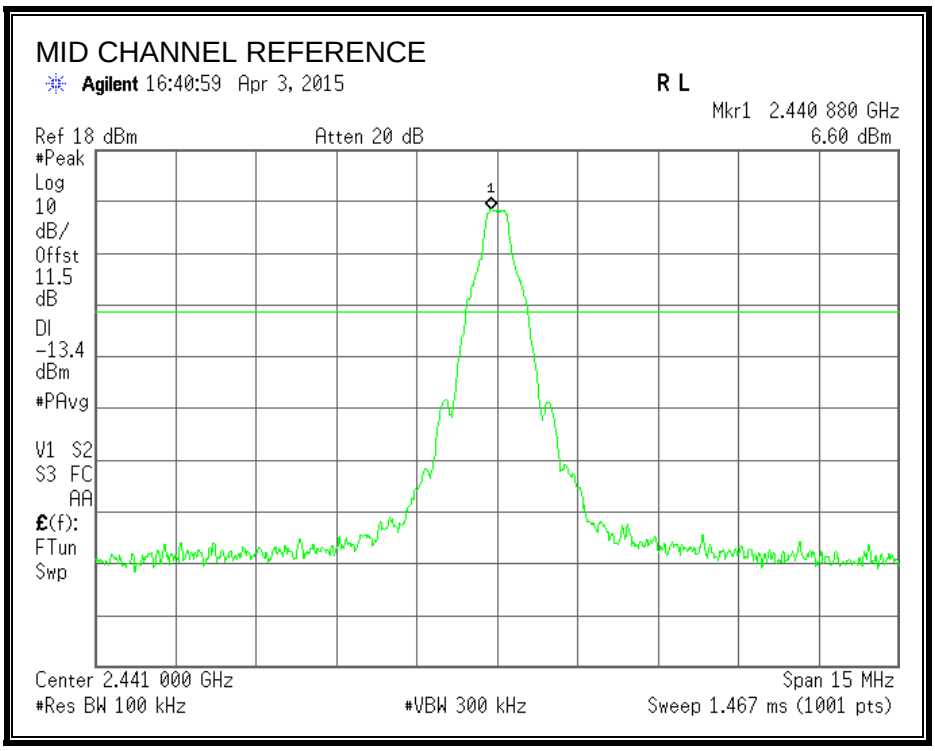
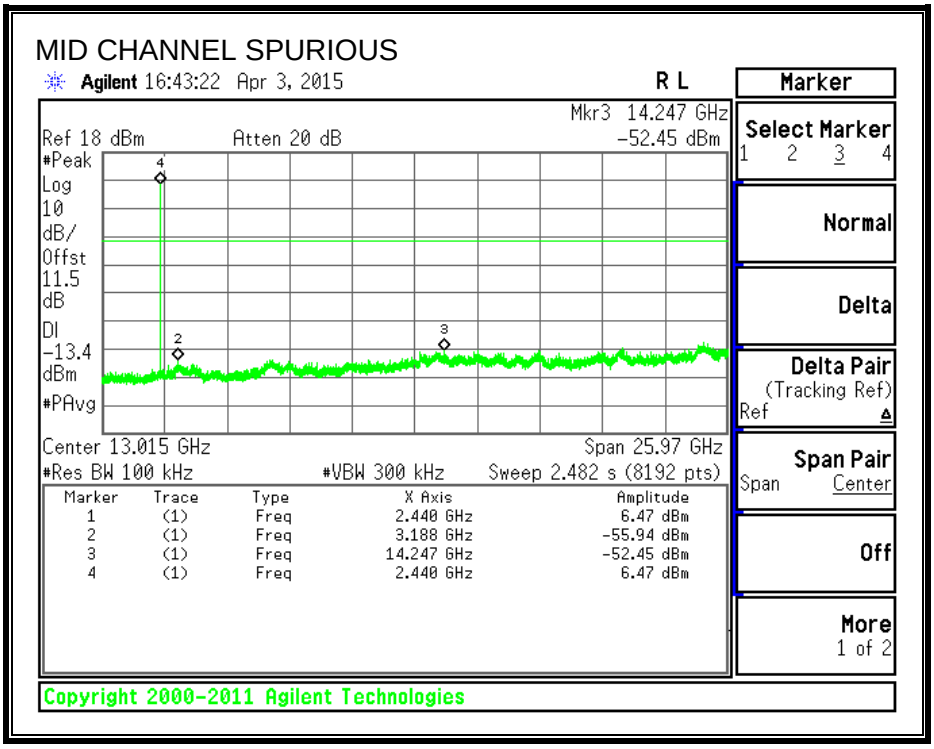
SPURIOUS EMISSIONS, MID CHANNEL





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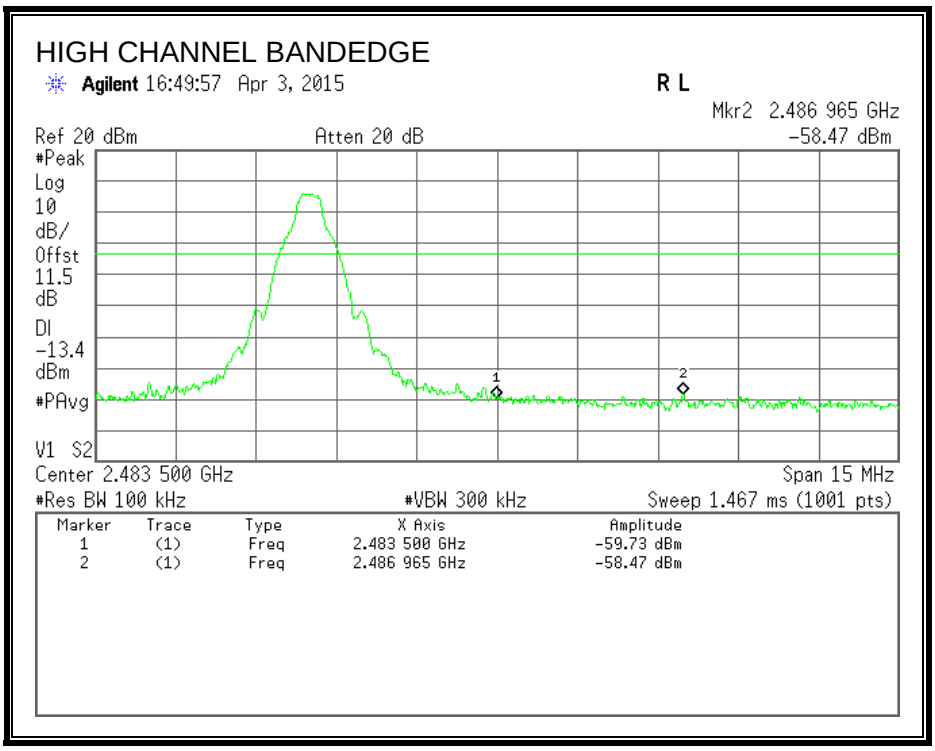
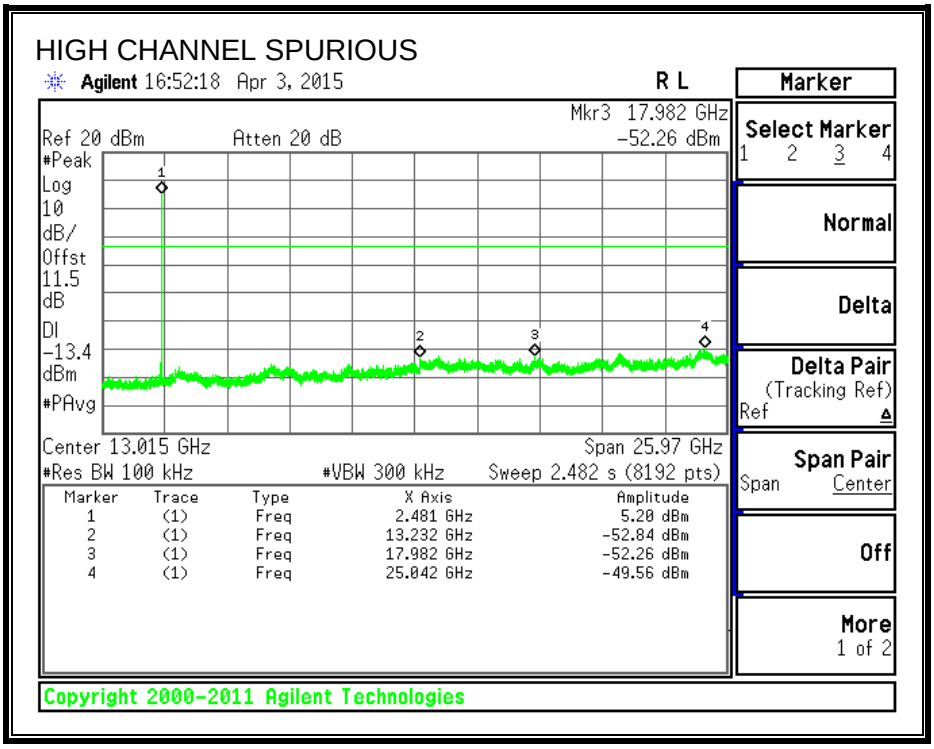
SPURIOUS EMISSIONS, HIGH CHANNEL





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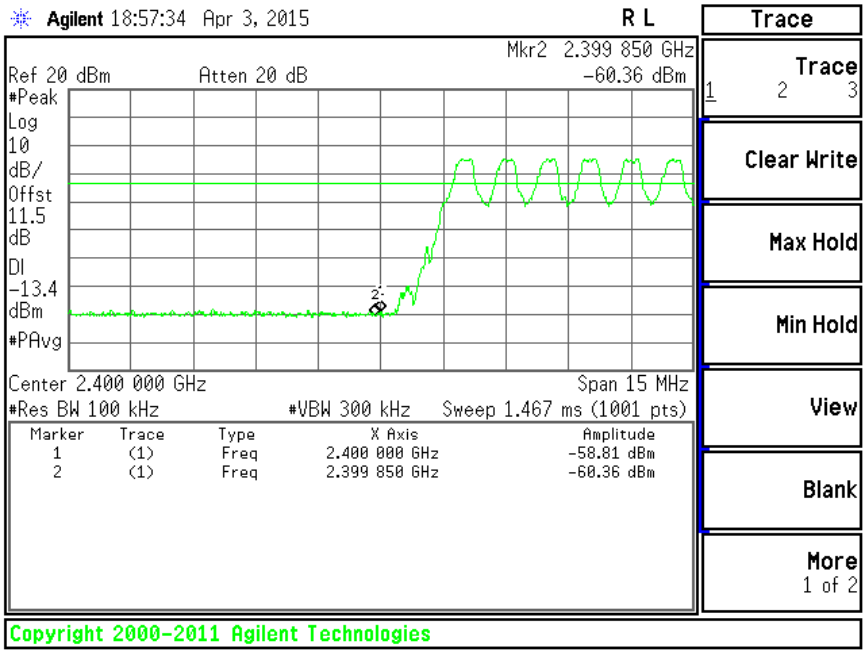
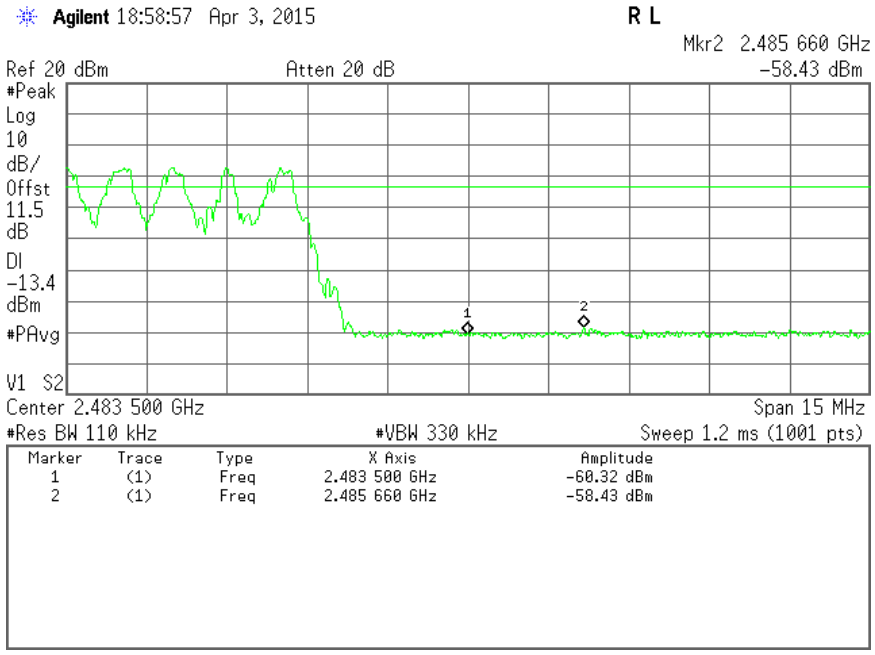
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



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8.3. ENHANCED DATA RATE 8PSK MODULATION

8.3.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.370	1.2262
Middle	2441	1.370	1.2280
High	2480	1.367	1.2283

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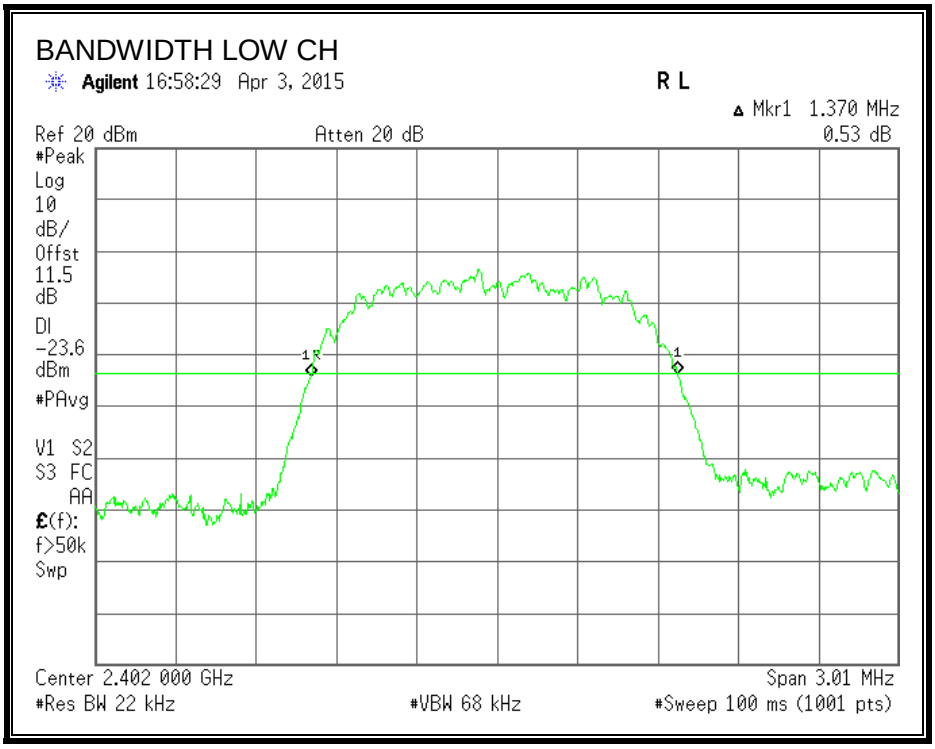
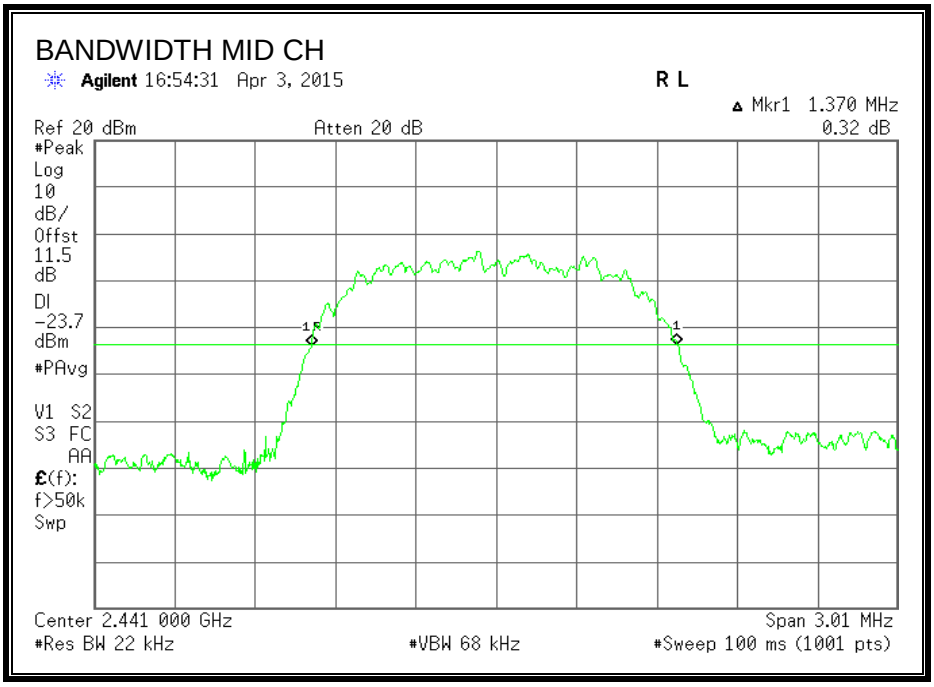
20 dB BANDWIDTH





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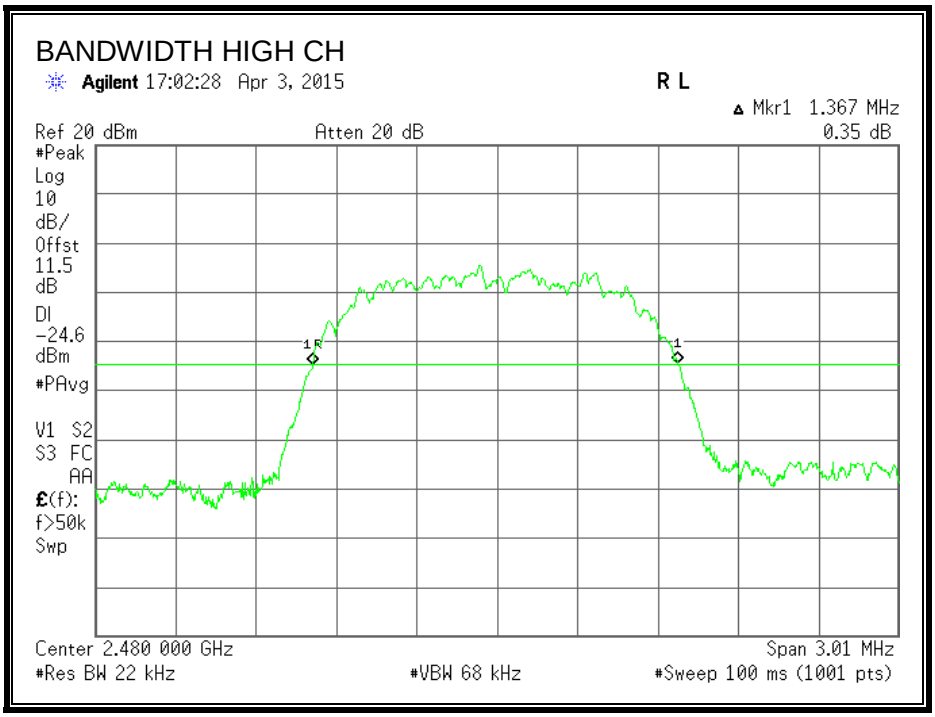
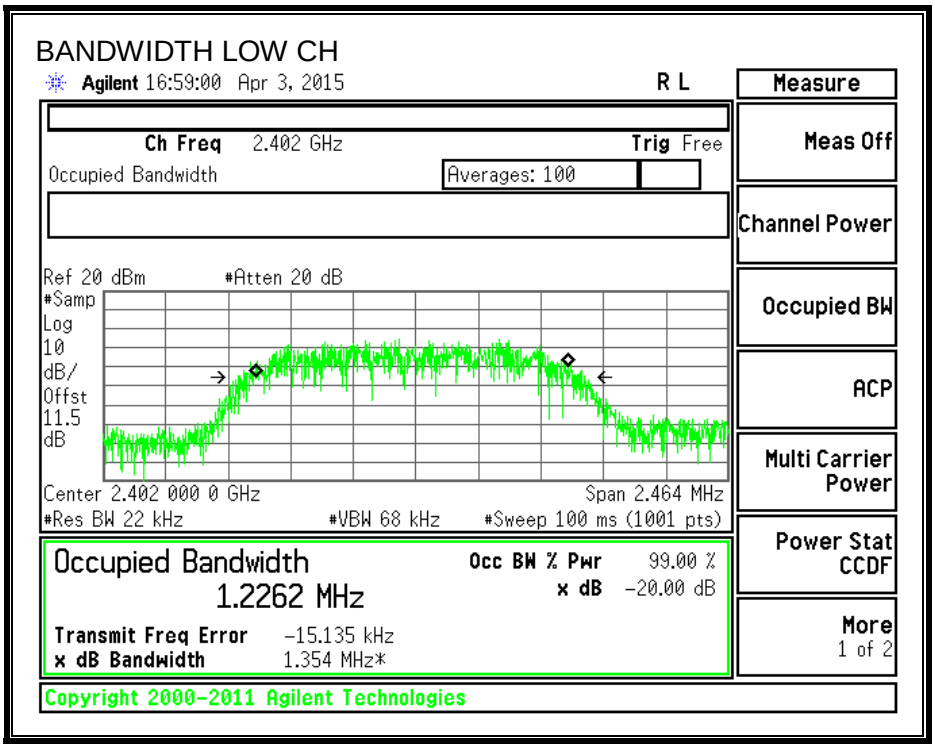


99% BANDWIDTH



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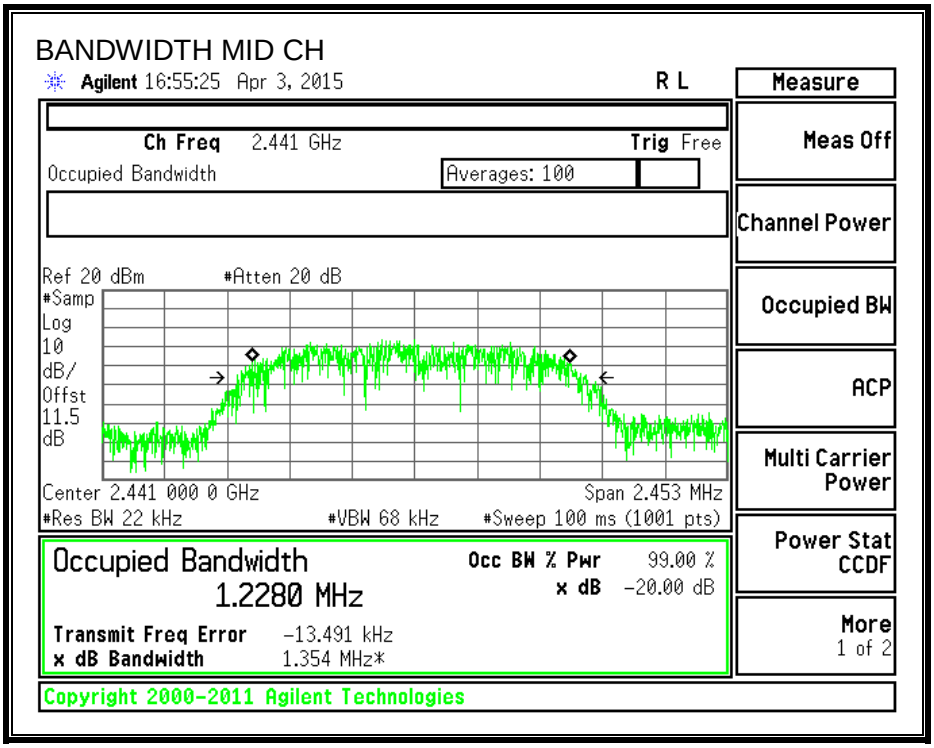
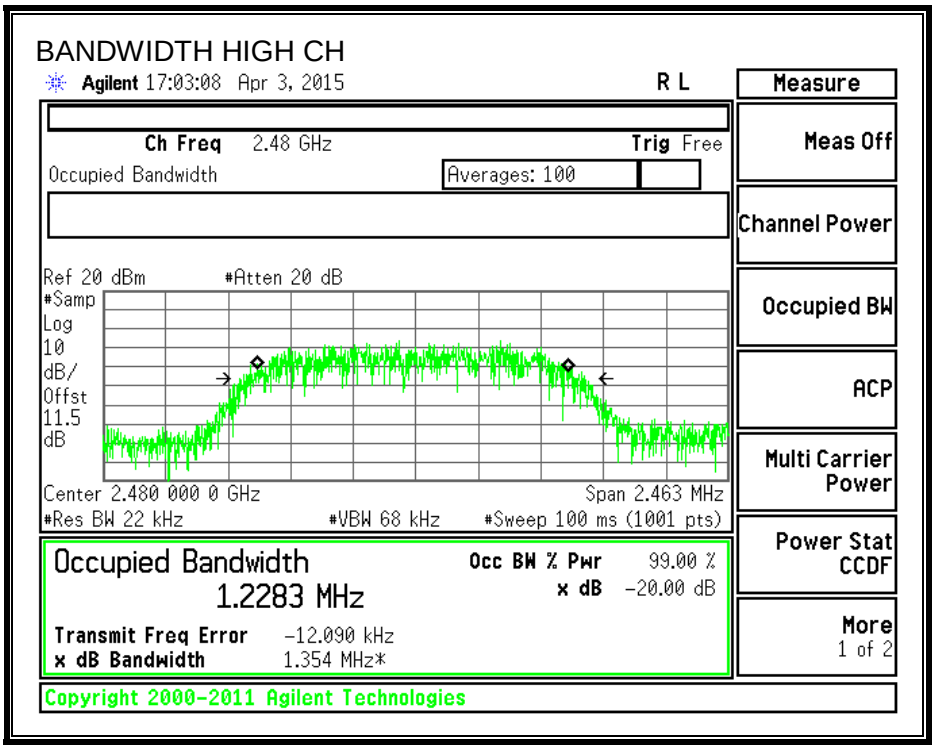
BANDWIDTH MID CH



BANDWIDTH HIGH CH



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8.3.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 Clause 5.1(2)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hoping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

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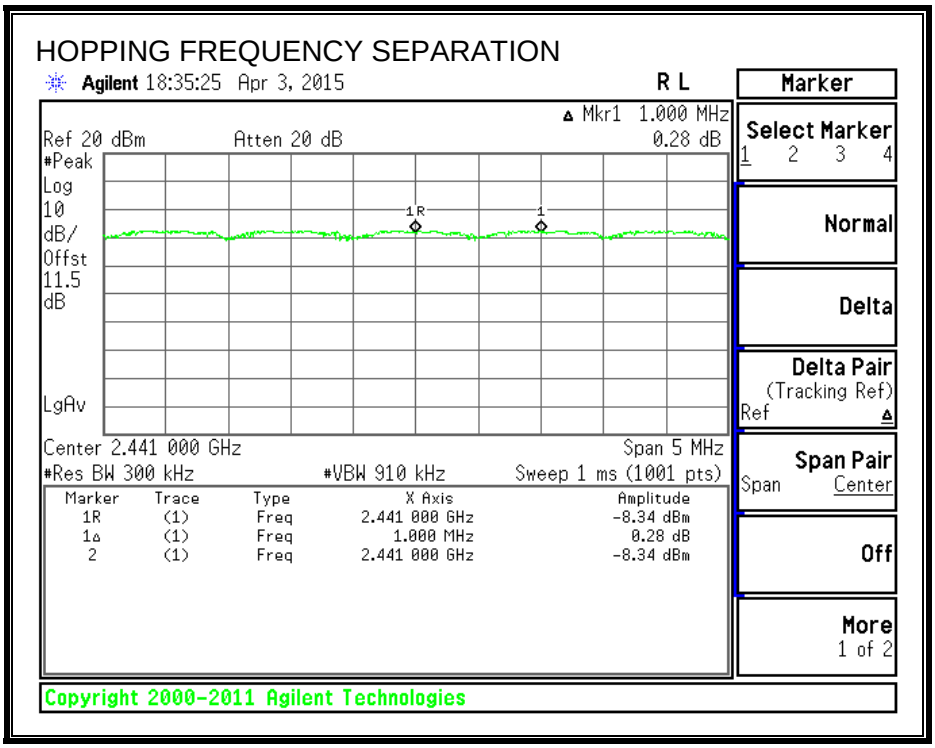
RESULTS

HOPPING FREQUENCY SEPARATION



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8.3.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 Clause 5.1(4)

Frequency hopping systems in the 2400 – 2483.5 MHz band shall use at least 15 non-overlapping channels.

RESULTS

Normal Mode: 79 Channels were observed.
AFH Mode: 20 channels were declared by the client.

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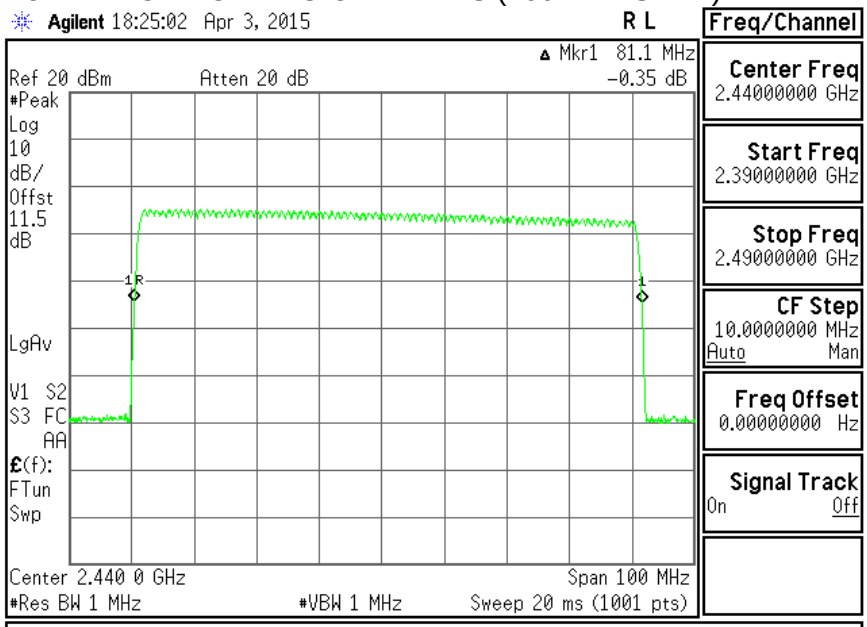
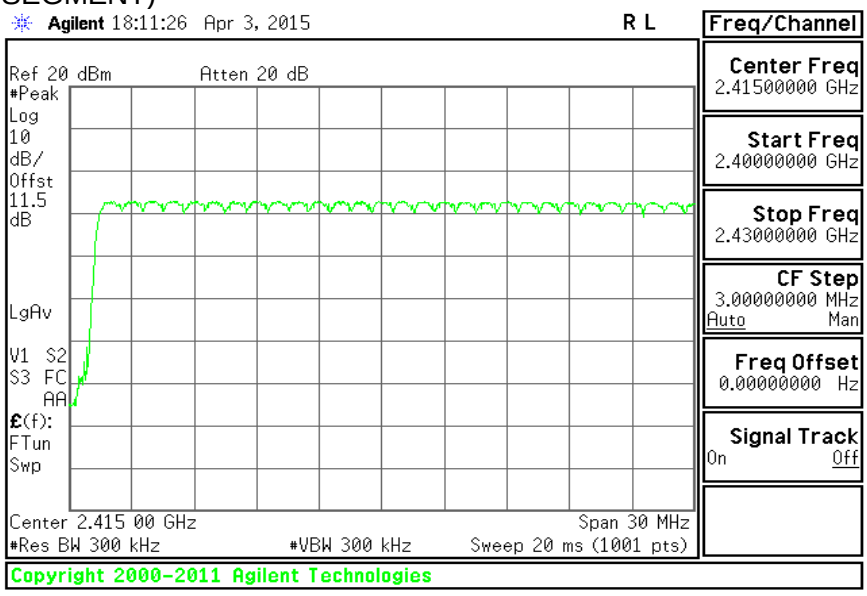
NUMBER OF HOPPING CHANNELS

NUMBER OF HOPPING CHANNELS (100 MHz SPAN)



NUMBER OF HOPPING CHANNELS (30 MHz SPAN, FIRST SEGMENT)



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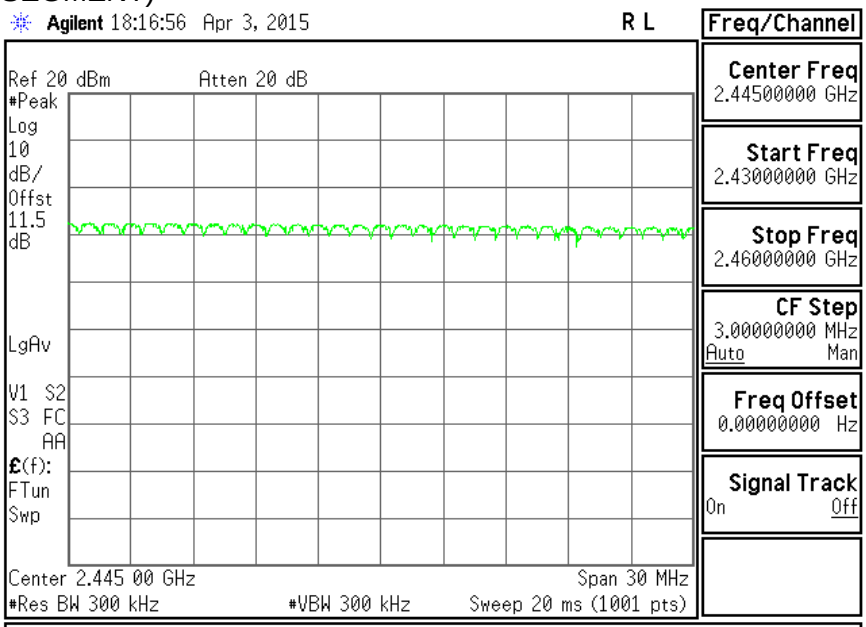
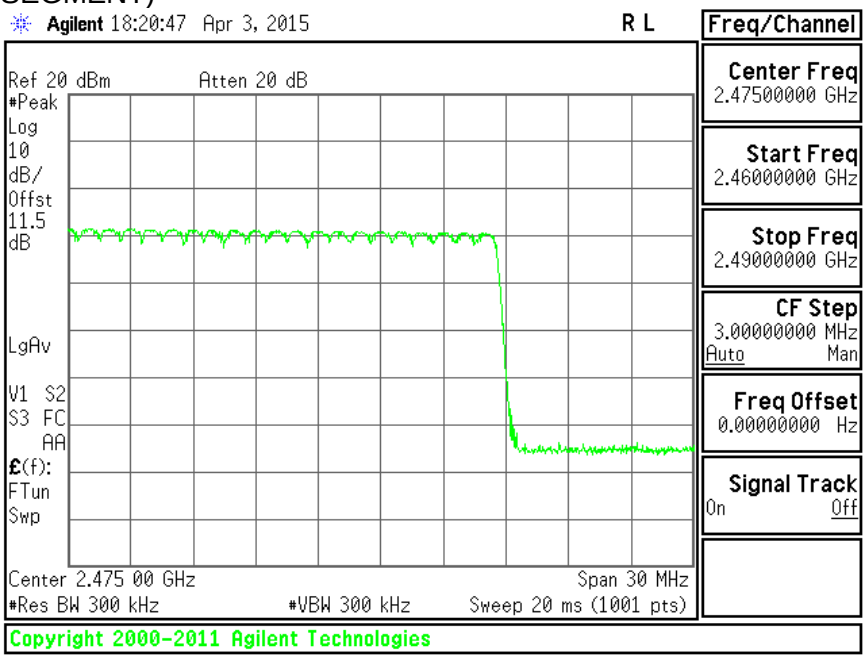
NUMBER OF HOPPING CHANNELS (30 MHz SPAN, SECOND SEGMENT)



NUMBER OF HOPPING CHANNELS (30 MHz SPAN, THIRD SEGMENT)



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8.3.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 Clause 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

RESULTS

Time Of Occupancy = 10 * xx pulses * yy msec = zz msec

8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.387	32	0.124	0.4	-0.276
DH3	1.640	16	0.262	0.4	-0.138
DH5	2.888	12	0.347	0.4	-0.053

Note: for AFH (8PSK) mode, please refer to the results of AFH (GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate on page 24 demonstrates compliance with channel occupancy when AFH is employed.

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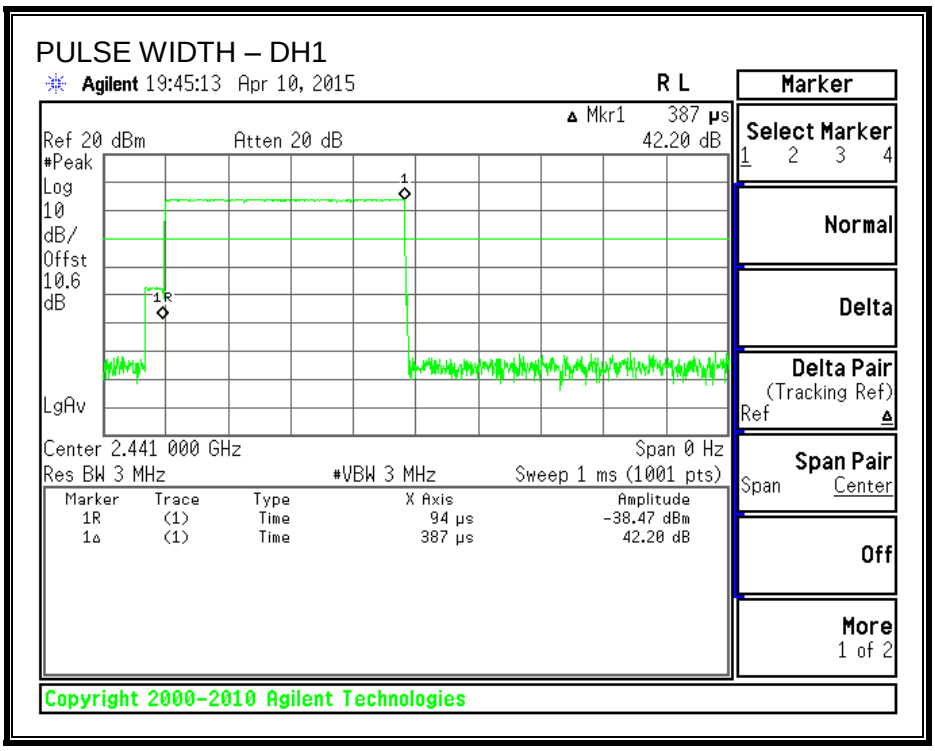
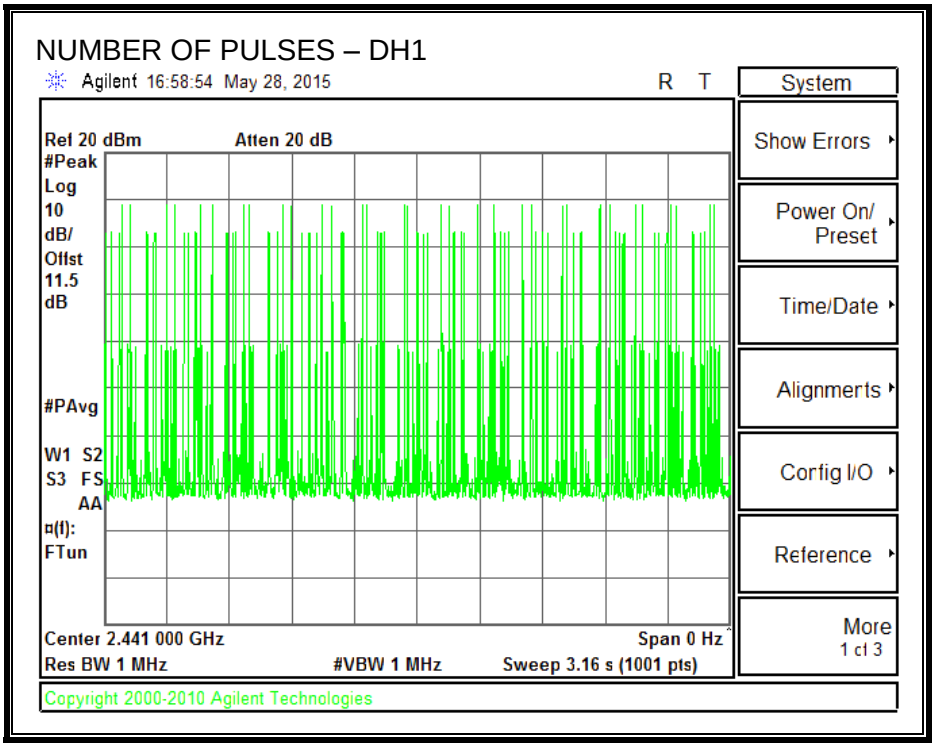
PULSE WIDTH - DH1



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



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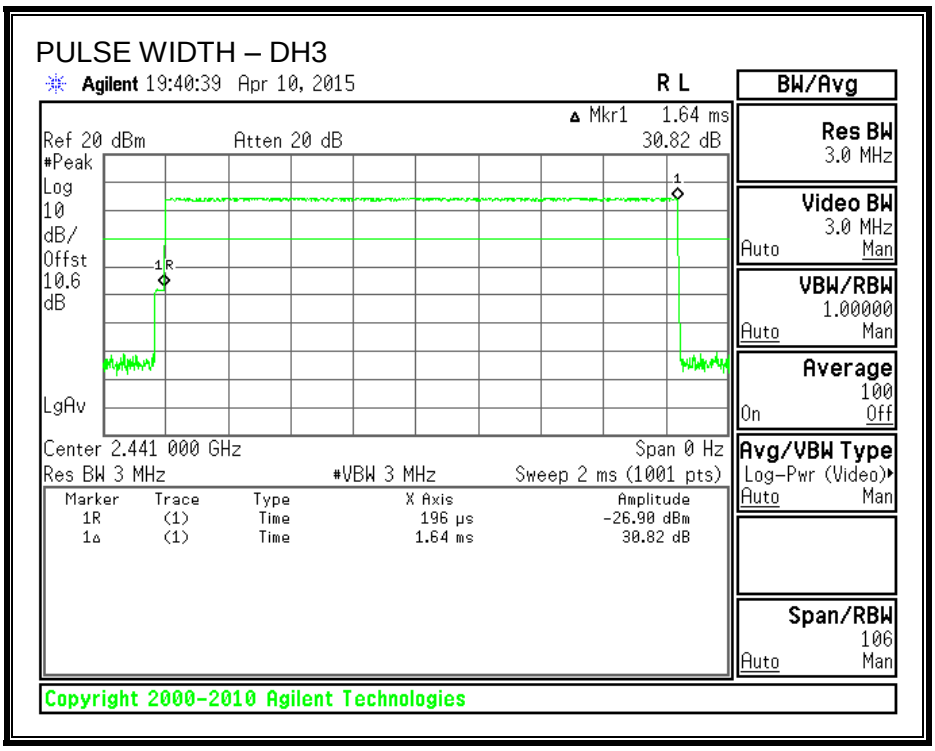
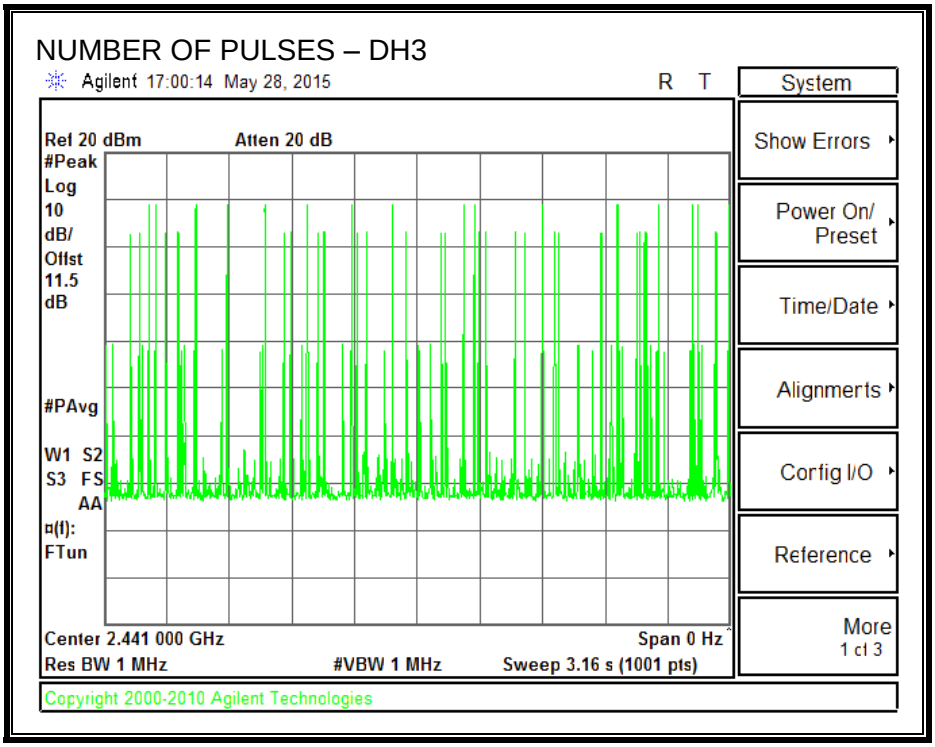
PULSE WIDTH – DH3



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



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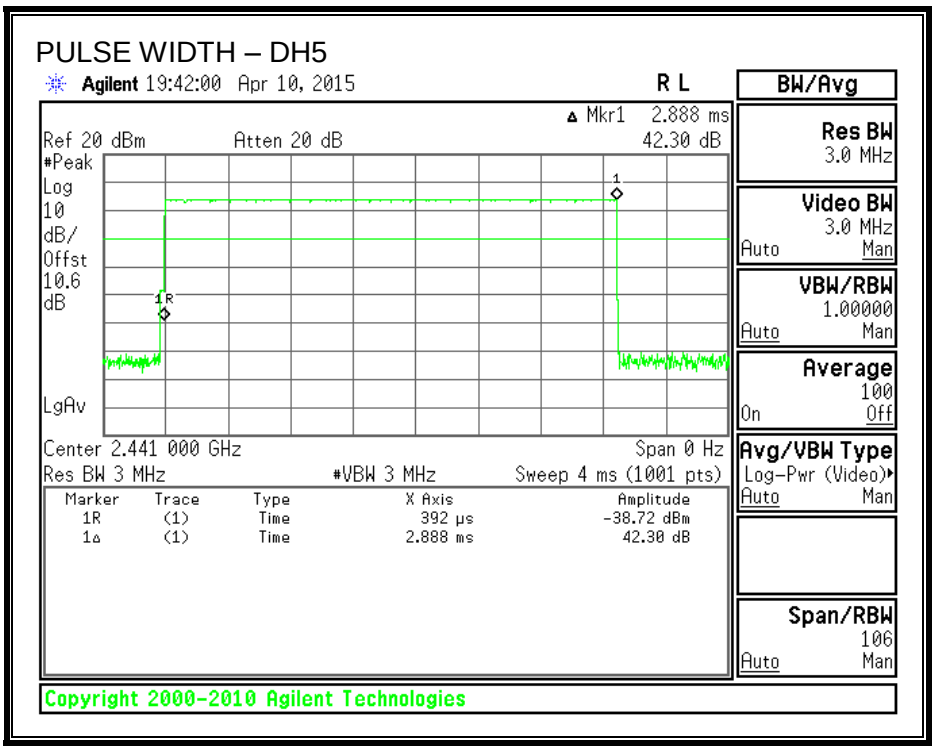
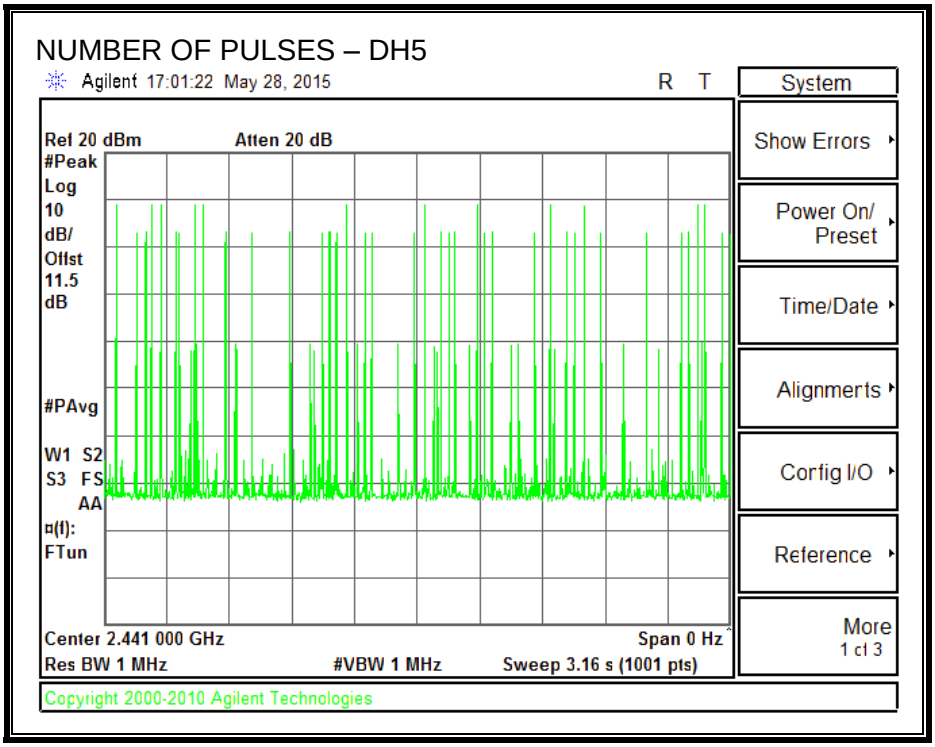
PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



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8.3.5. PEAK OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-247 Clause 5.4

The maximum antenna gain is less than 6 dBi, therefore the limit is 30 dBm.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	5.61	21.97	-16.36
Middle	2441	5.33	21.97	-16.64
High	2480	4.49	21.97	-17.48

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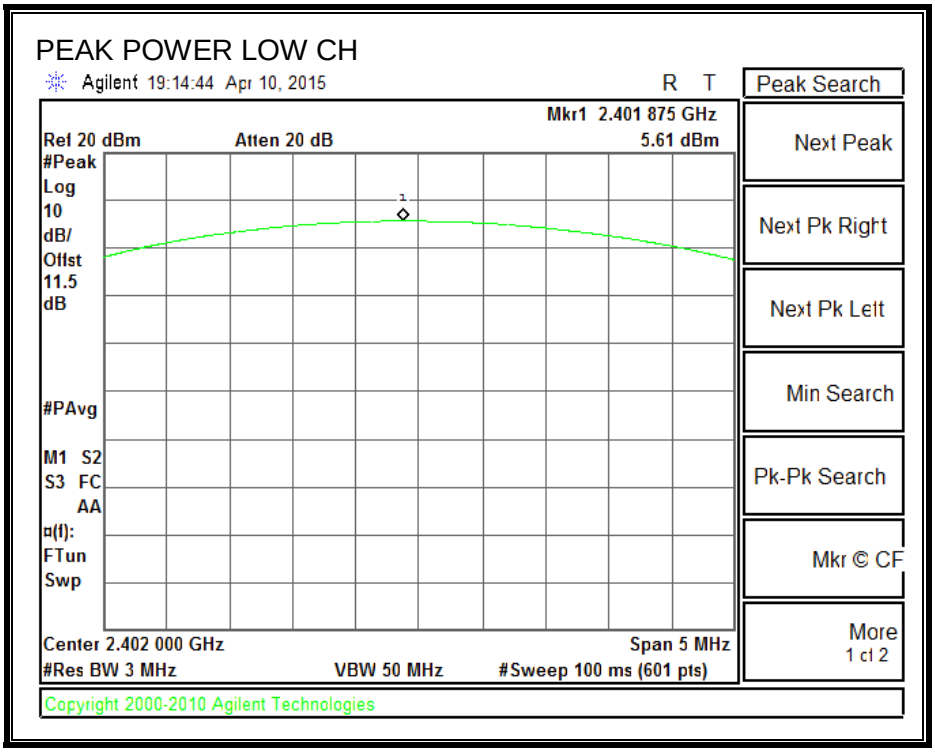
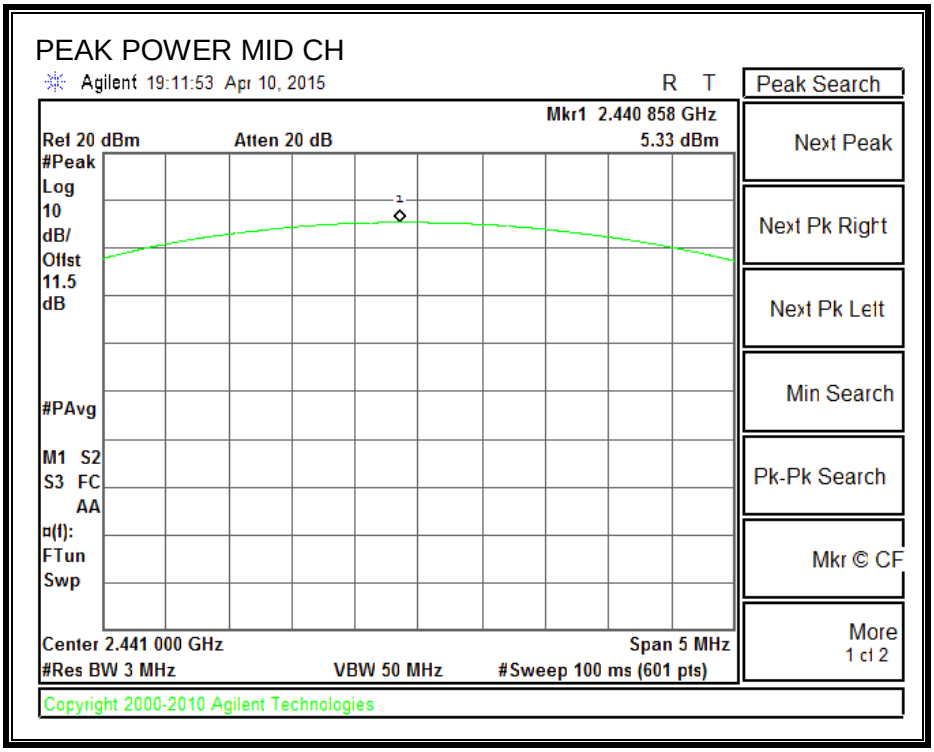
OUTPUT POWER





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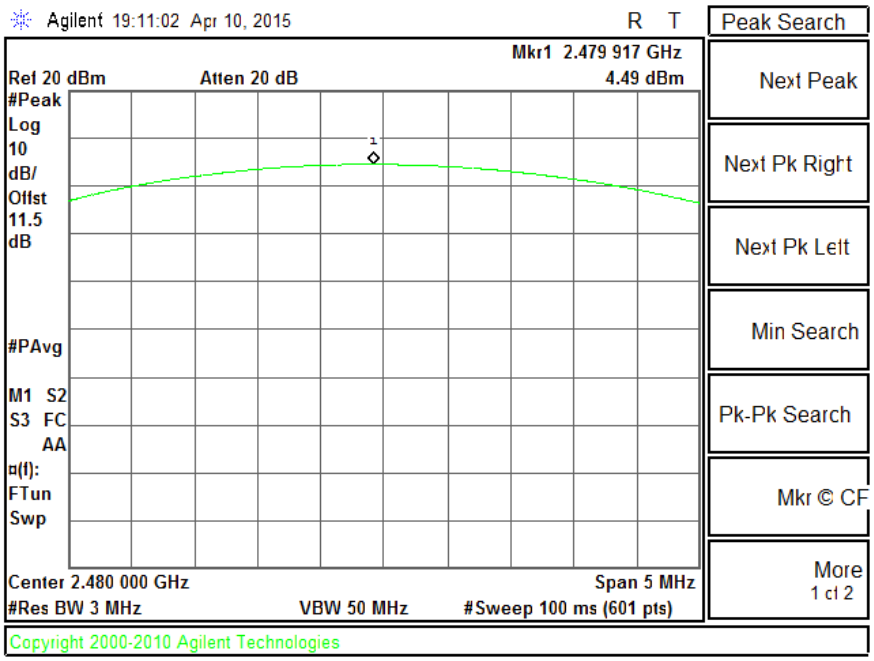
PEAK POWER HIGH CH



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8.3.6. AVERAGE OUTPUT POWER

LIMIT

None; for reporting purposes only.

RESULTS

The cable assembly insertion loss of 10.5dB was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.00
Middle	2441	3.10
High	2480	2.95

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8.3.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 Clause 5.5

Limit = -20 dBc

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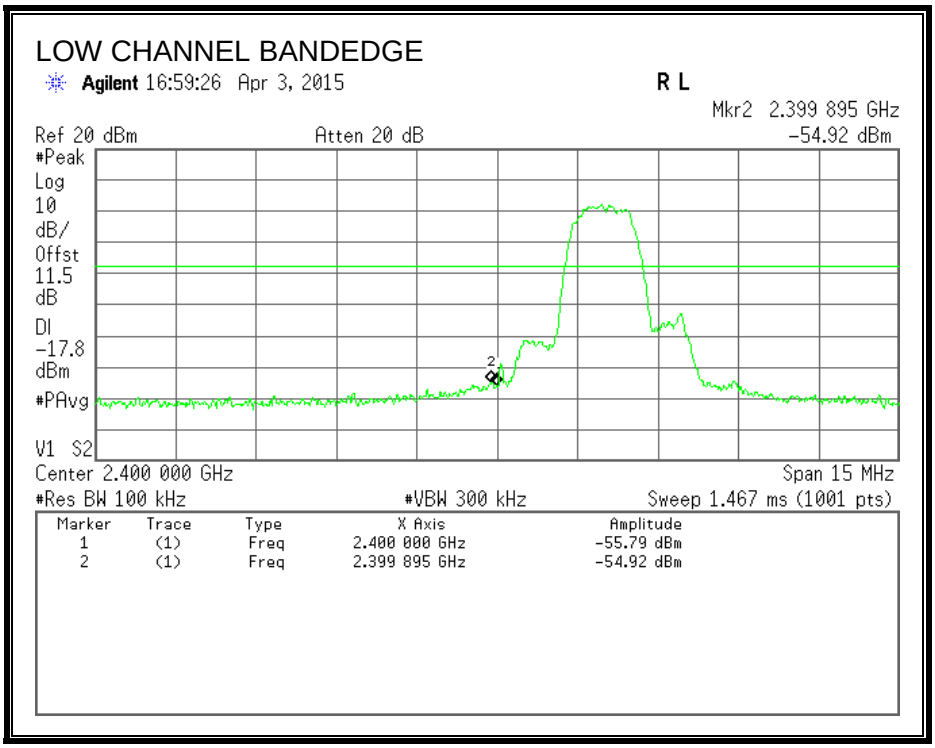
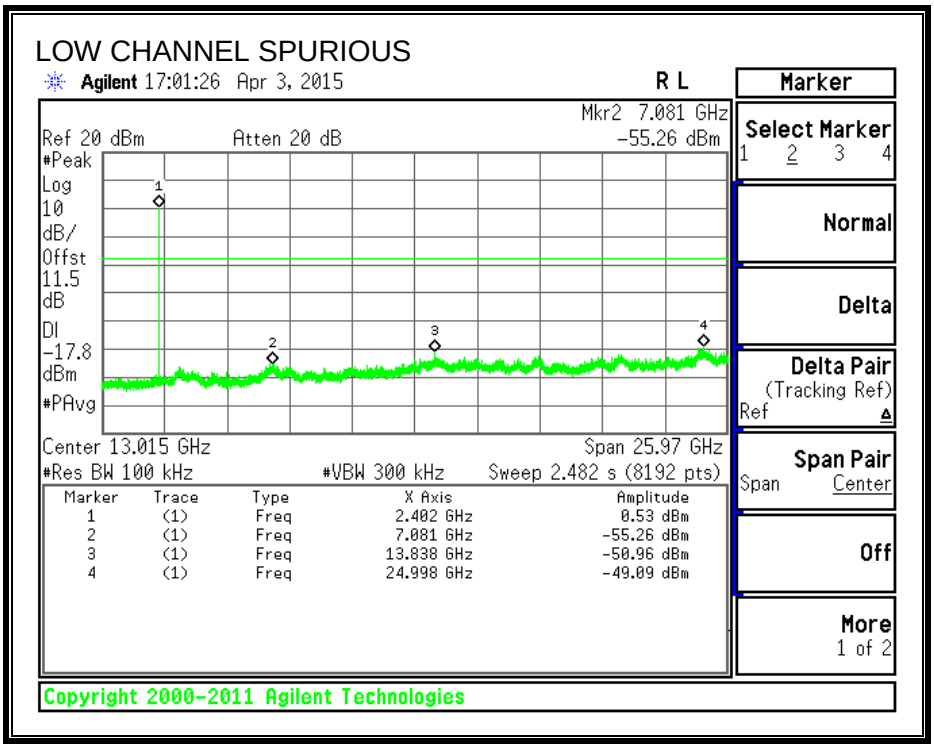
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL





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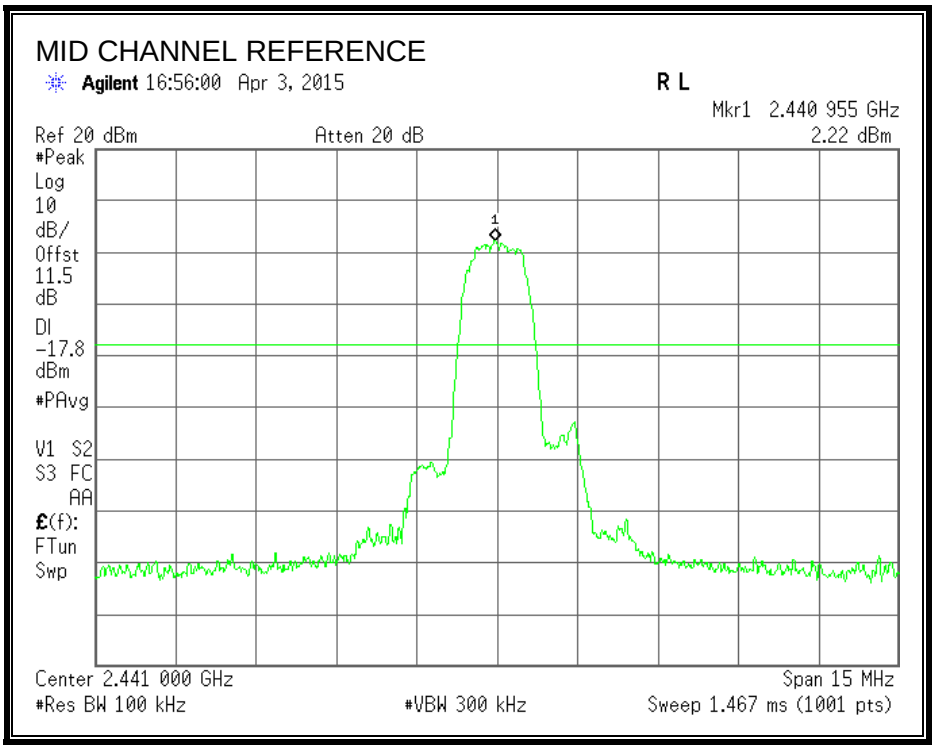
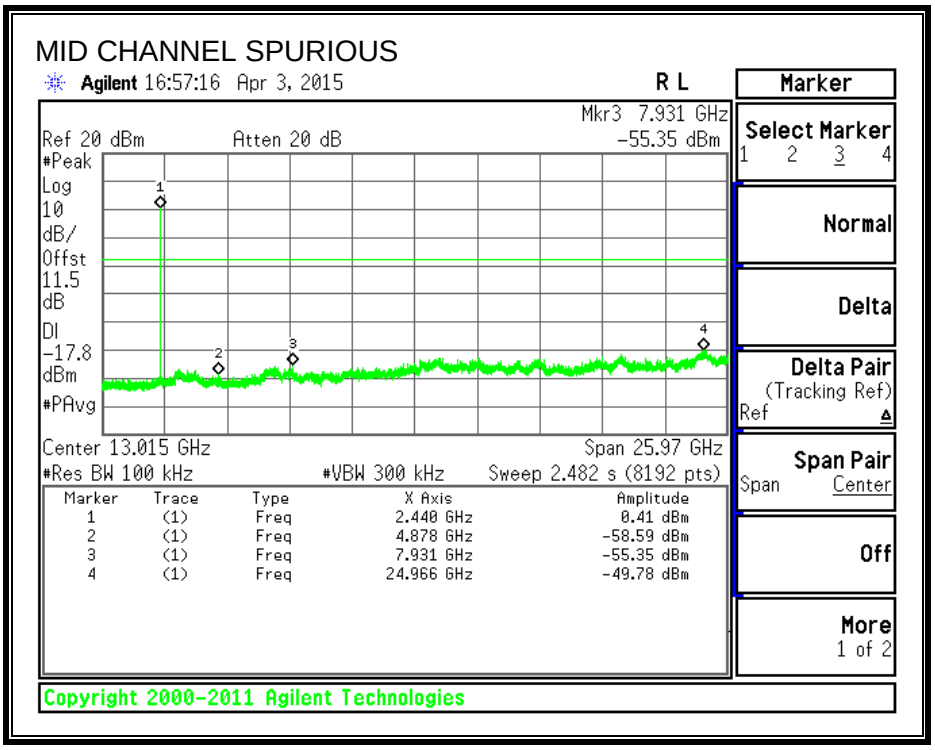
SPURIOUS EMISSIONS, MID CHANNEL





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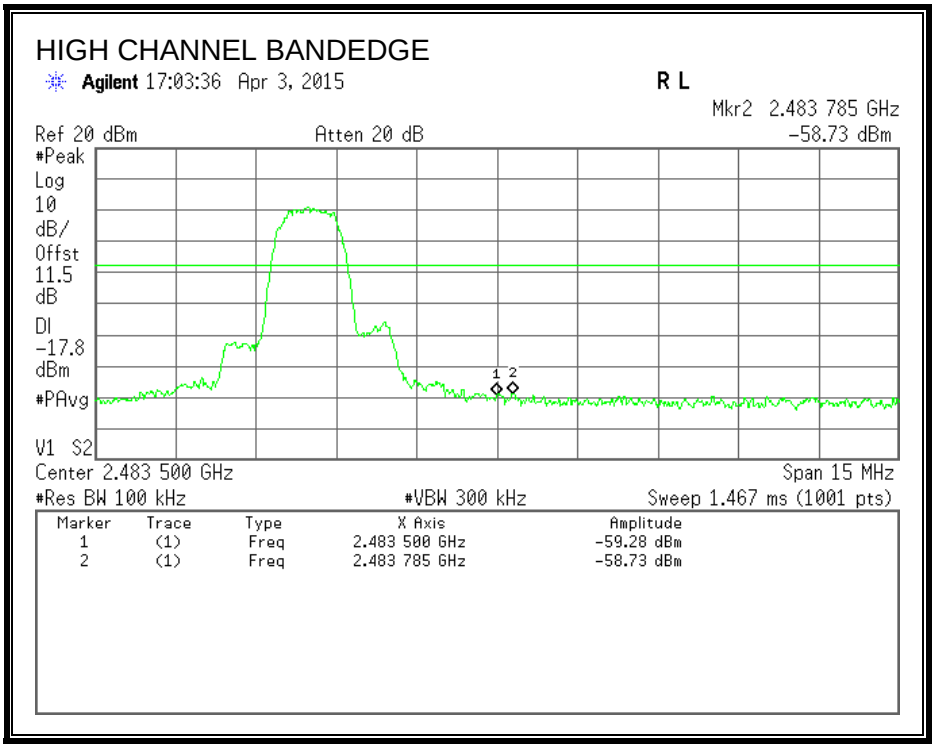
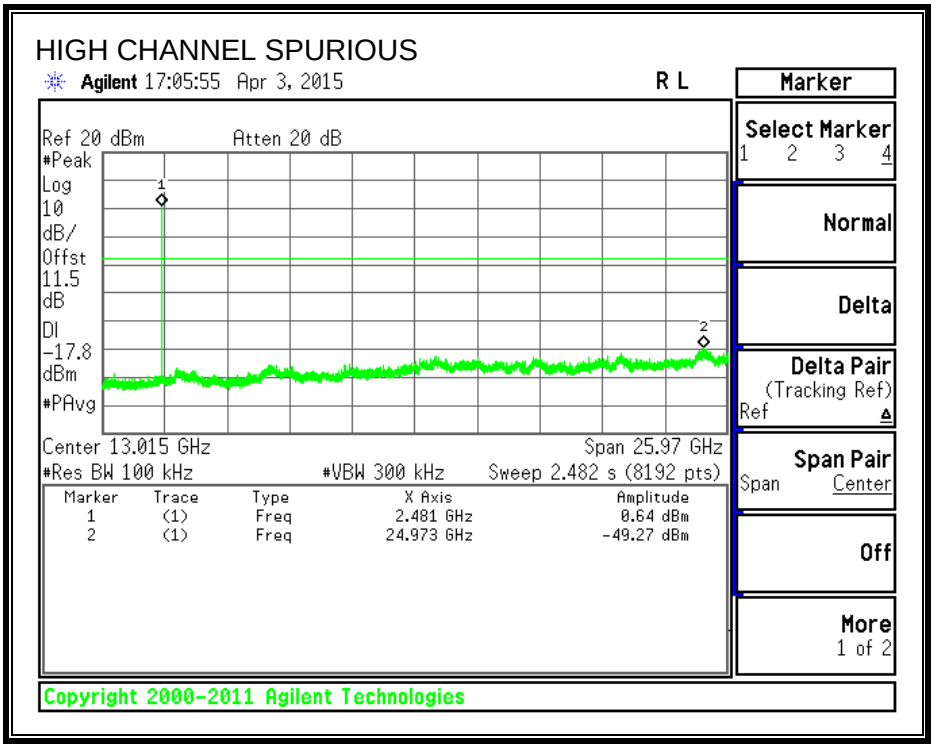
SPURIOUS EMISSIONS, HIGH CHANNEL





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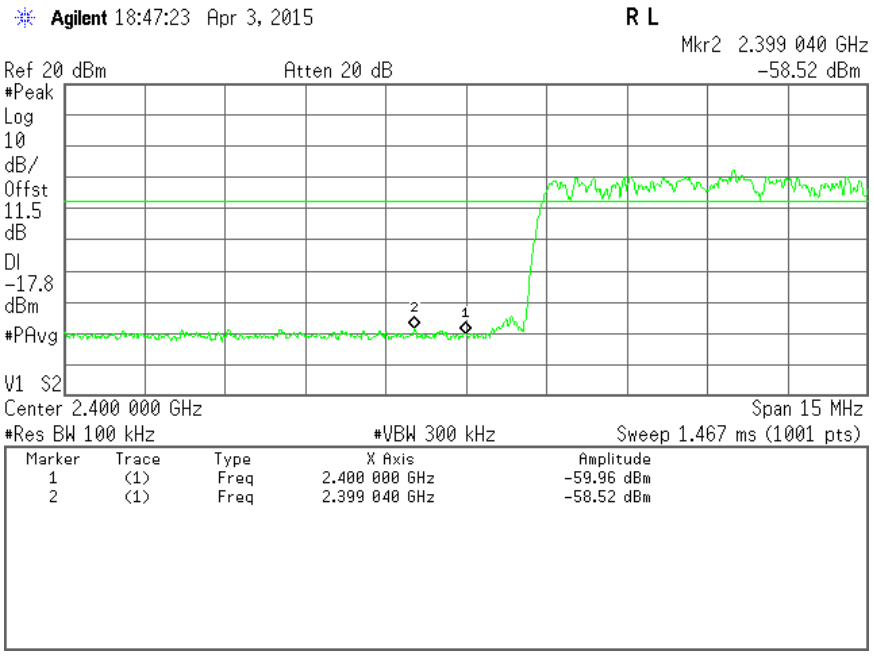
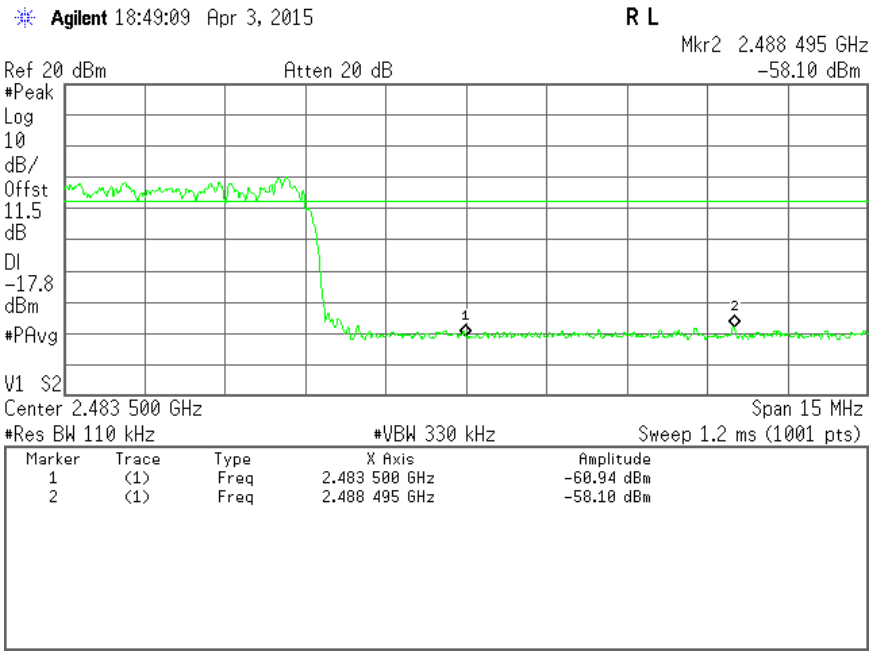
SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



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8.4. CONDUCTED RX SPURIOUS EMISSIONS

LIMITS

IC RSS GEN Issue 4, Clause 7.1.3

Receiver-spurious emissions at any discrete frequency shall not exceed 2 nW in the band 30-1000 MHz, nor 5 nW above 1000MHz.

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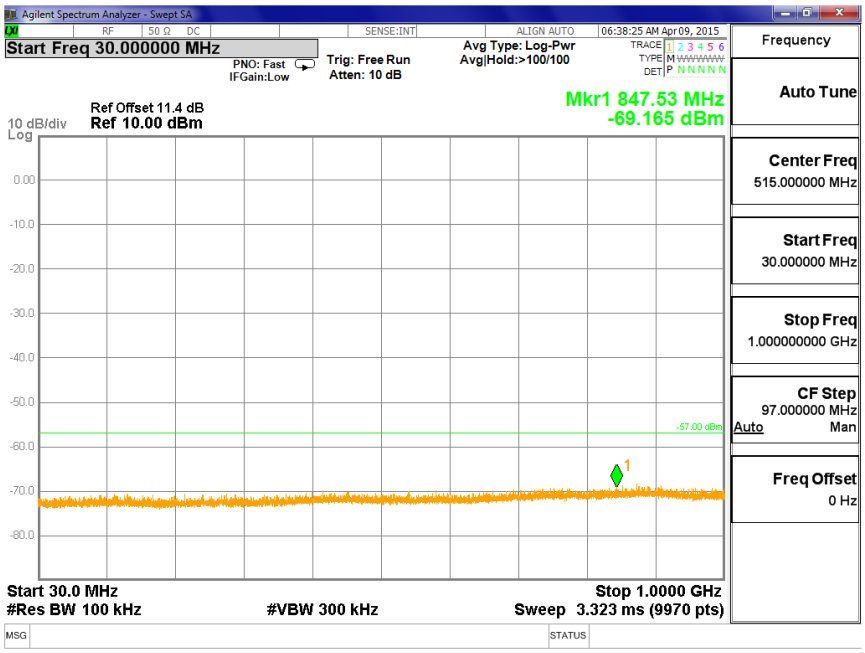
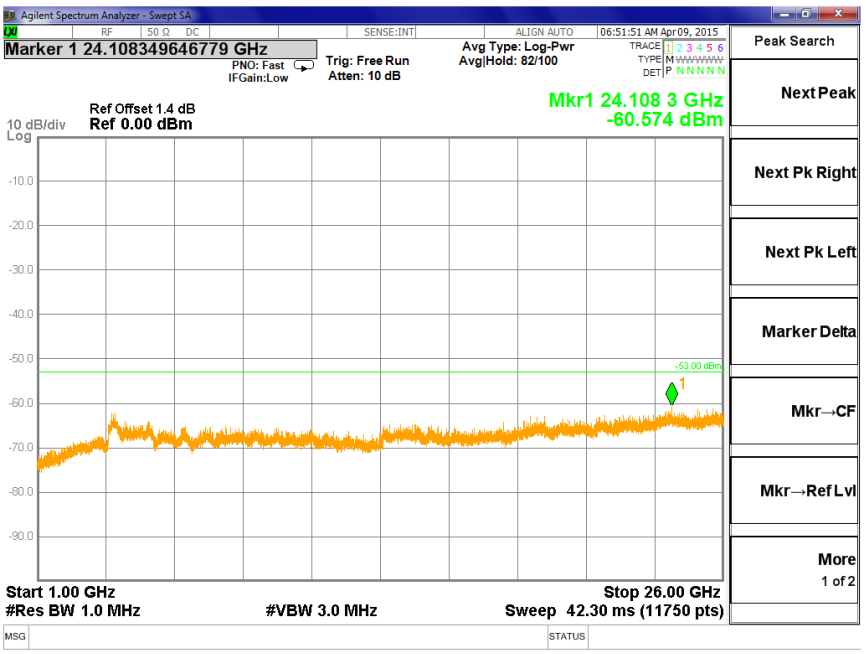
RESULTS

RX SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL 30 to 1000MHz



MID CHANNEL 1GHz to 26GHz



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8.5. COLOCATION

The below table shows potential intermodulation frequencies due to Bluetooth and 5GHz WLAN simultaneous transmission.

Modes	A	B	A + B	A - B	2A + B	A + 2B	A - 2B
8PSK + 11a 5.3 band	2441	5260	7701	2819	10142	12961	8079
8PSK + 11a 5.6 band	2441	5580	8021	3139	10462	13601	8719
8PSK + 11a 5.8 band	2441	5785	8226	3344	10667	14011	9129

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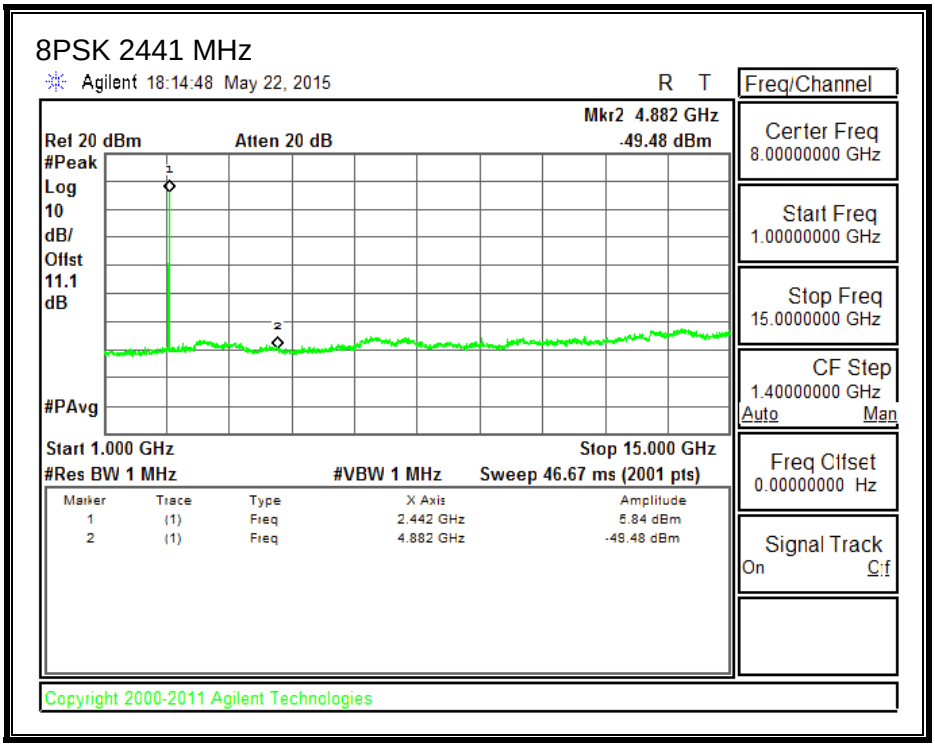
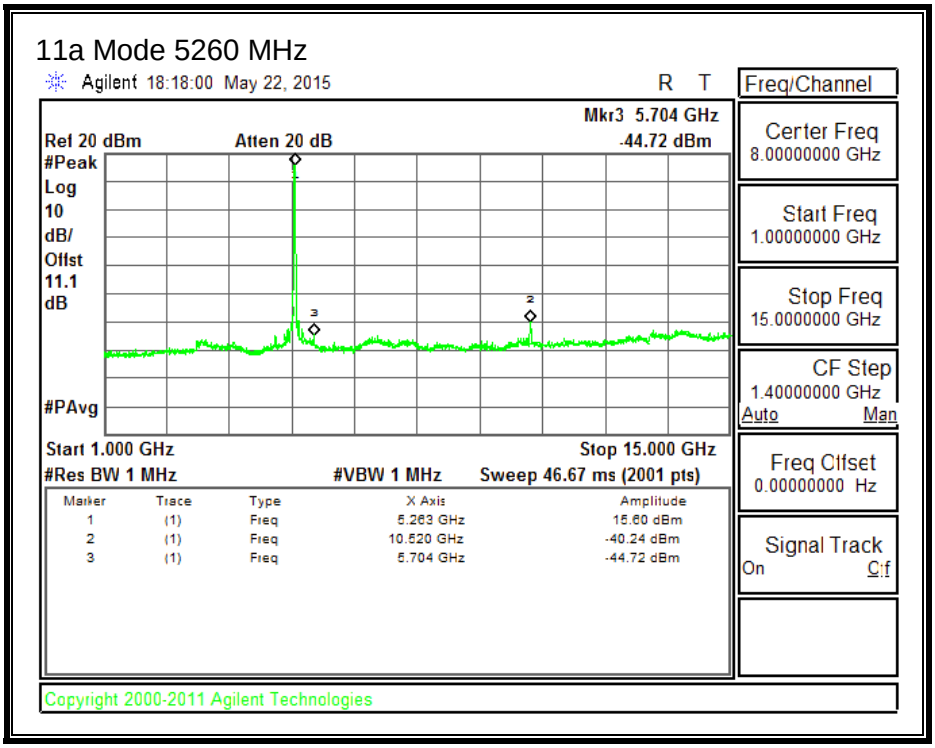
8PSK and 802.11a Mode 5.3 GHz





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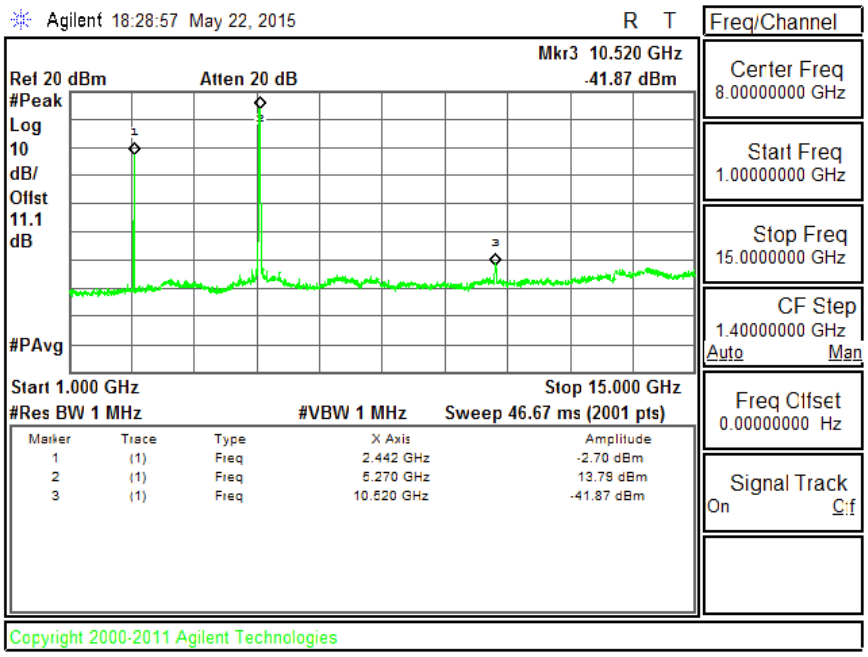
8PSK 2441 MHz and 11a Mode 5260 MHz



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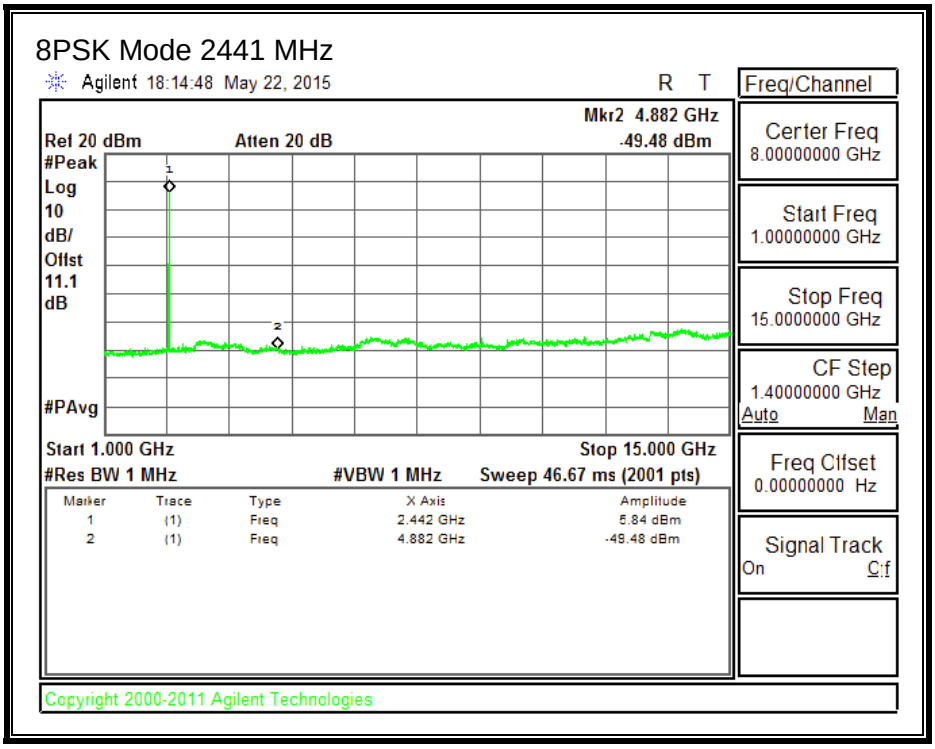
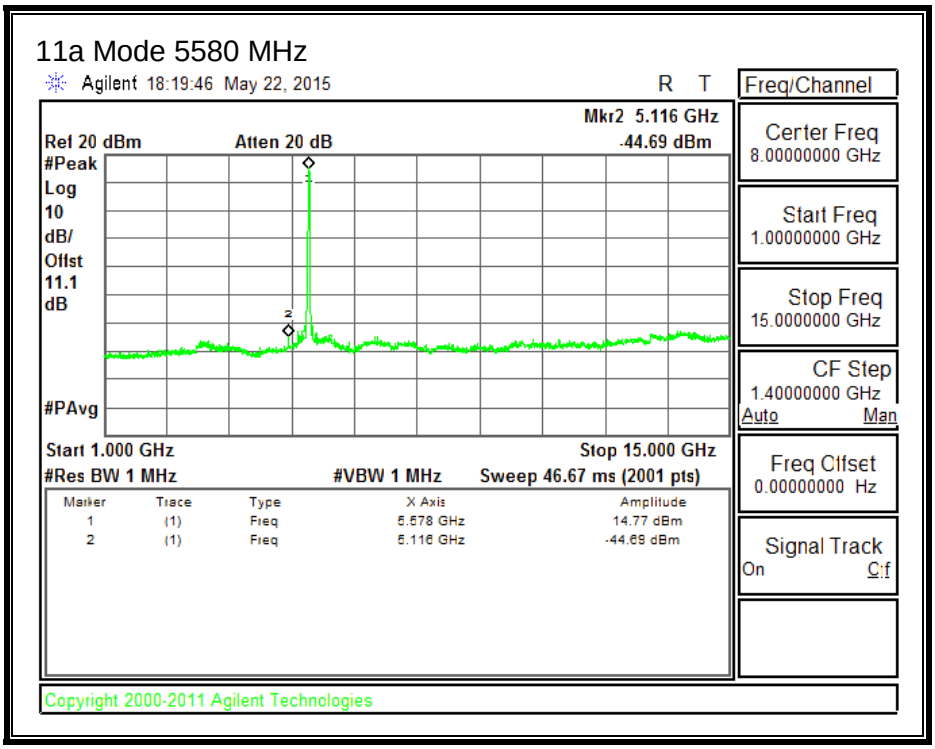
8PSK Mode and 802.11a Mode 5.6 GHz





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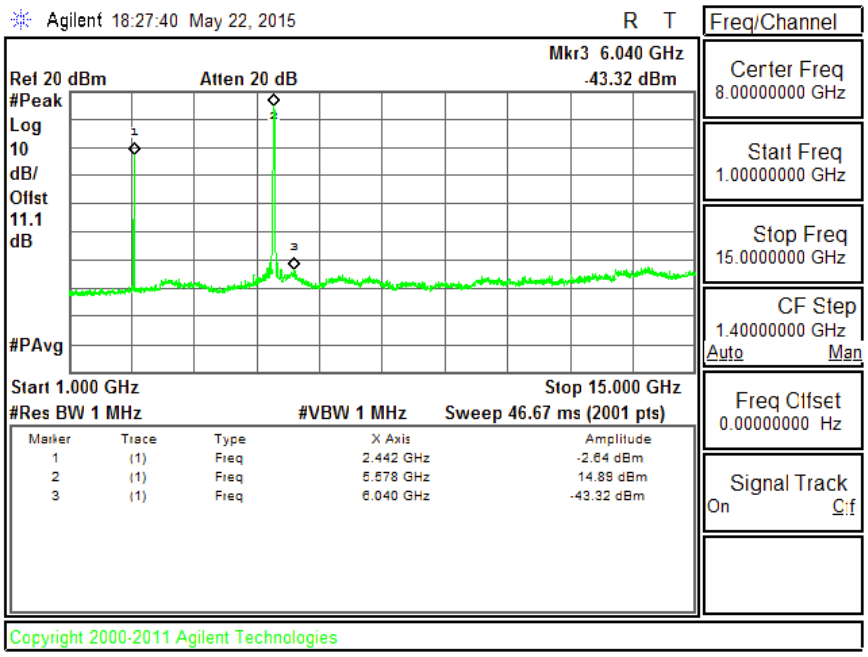
8PSK Mode 2441 MHz and 11a Mode 5580 MHz



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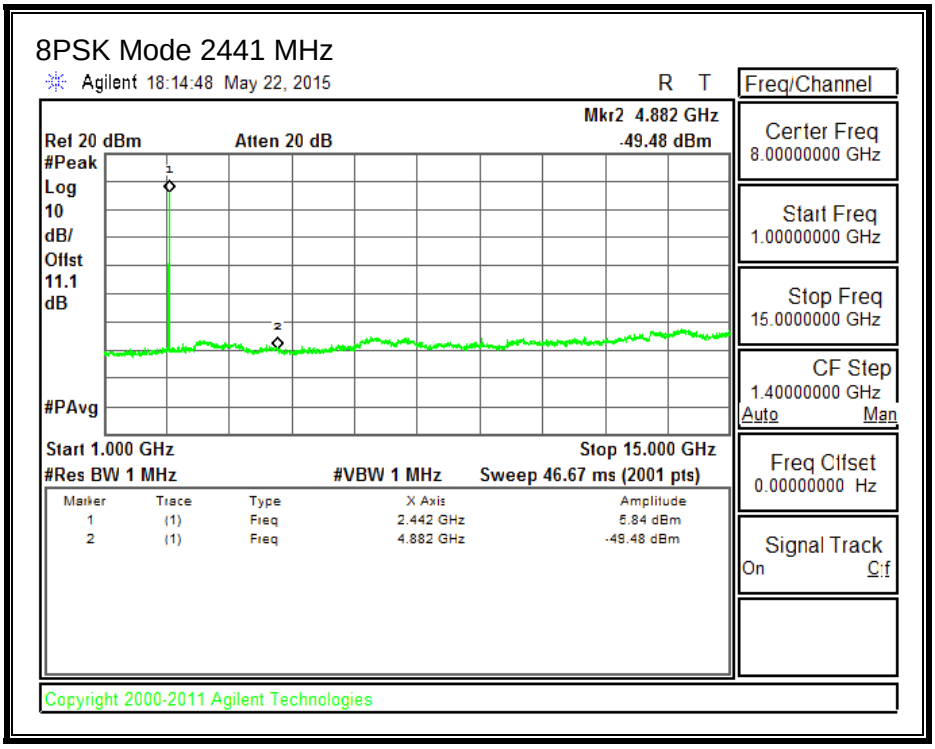
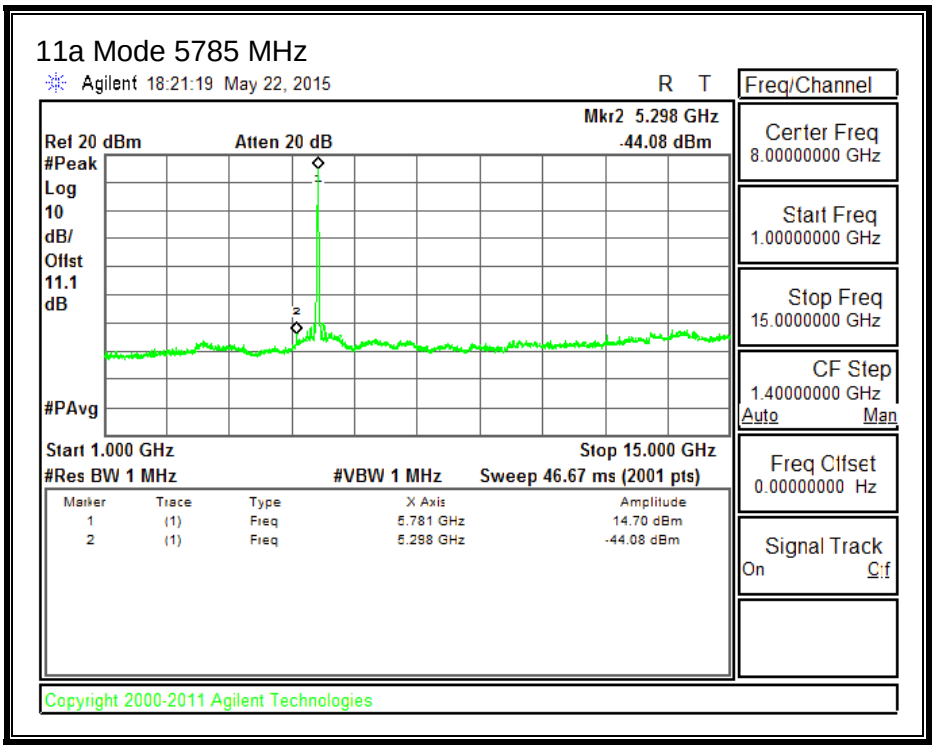
8PSK Mode and 802 11a Mode 5.8 GHz





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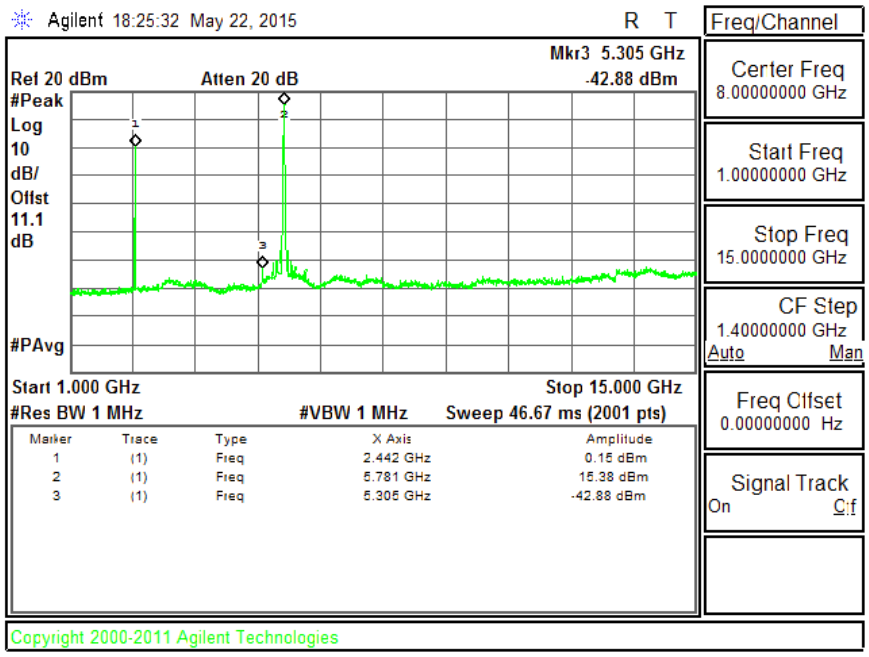
8PSK Mode 2441 MHz and 11a Mode 5580 MHz



For the co-located test, no other emissions were found after being investigated from the conducted measurement with all different combination frequencies between BT & 5GHz bands.

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9. RADIATED TEST RESULTS

9.1. LIMITS

FCC §15.205 and §15.209

IC RSS-GEN Clause 8.9 (Transmitter)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

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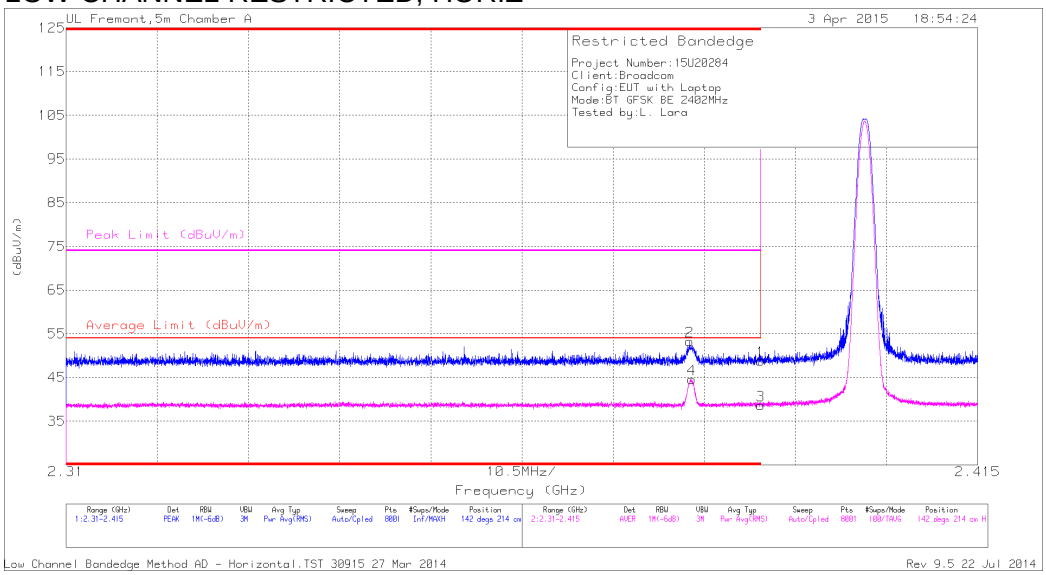
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)

LOW CHANNEL RESTRICTED, HORIZ



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.02	PK	32	-22.2	48.82	-	-	74	-25.18	142	214	H
2	* 2.382	43.62	PK	31.9	-22.3	53.22	-	-	74	-20.78	142	214	H
3	* 2.39	28.84	RMS	32	-22.2	38.64	54	-15.36	-	-	142	214	H
4	* 2.382	35.03	RMS	31.9	-22.3	44.63	54	-9.37	-	-	142	214	H

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

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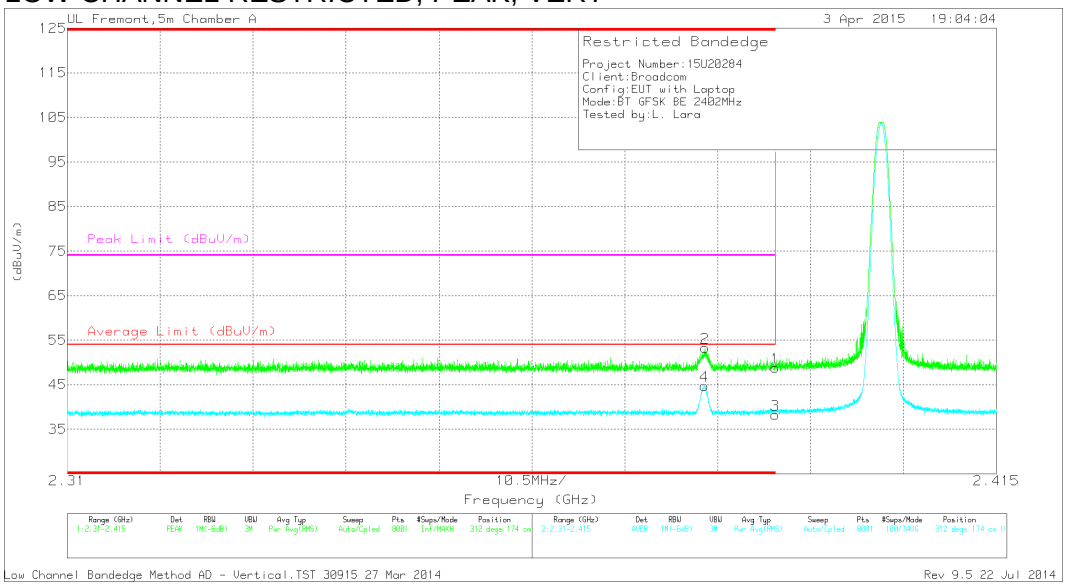
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.382	43.66	PK	31.9	-22.3	53.26	-	-	74	-20.74	312	174	V
4	* 2.382	35.11	RMS	31.9	-22.3	44.71	54	-9.29	-	-	312	174	V
1	* 2.39	39.02	PK	32	-22.2	48.82	-	-	74	-25.18	312	174	V
3	* 2.39	28.49	RMS	32	-22.2	38.29	54	-15.71	-	-	312	174	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

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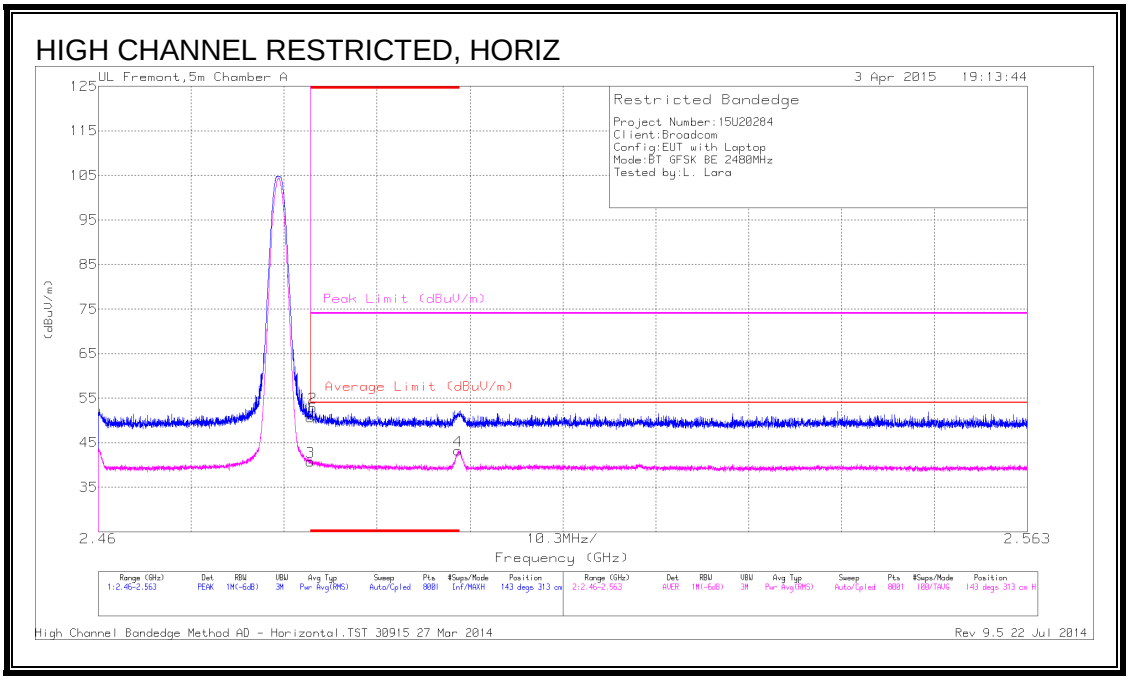
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.5	PK	32.1	-21.9	50.7	-	-	74	-23.3	143	313	H
2	* 2.484	42.69	PK	32.1	-21.9	52.89	-	-	74	-21.11	143	313	H
3	* 2.484	30.53	RMS	32.1	-21.9	40.73	54	-13.27	-	-	143	313	H
4	* 2.5	33.08	RMS	32.1	-22	43.18	54	-10.82	-	-	143	313	H

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

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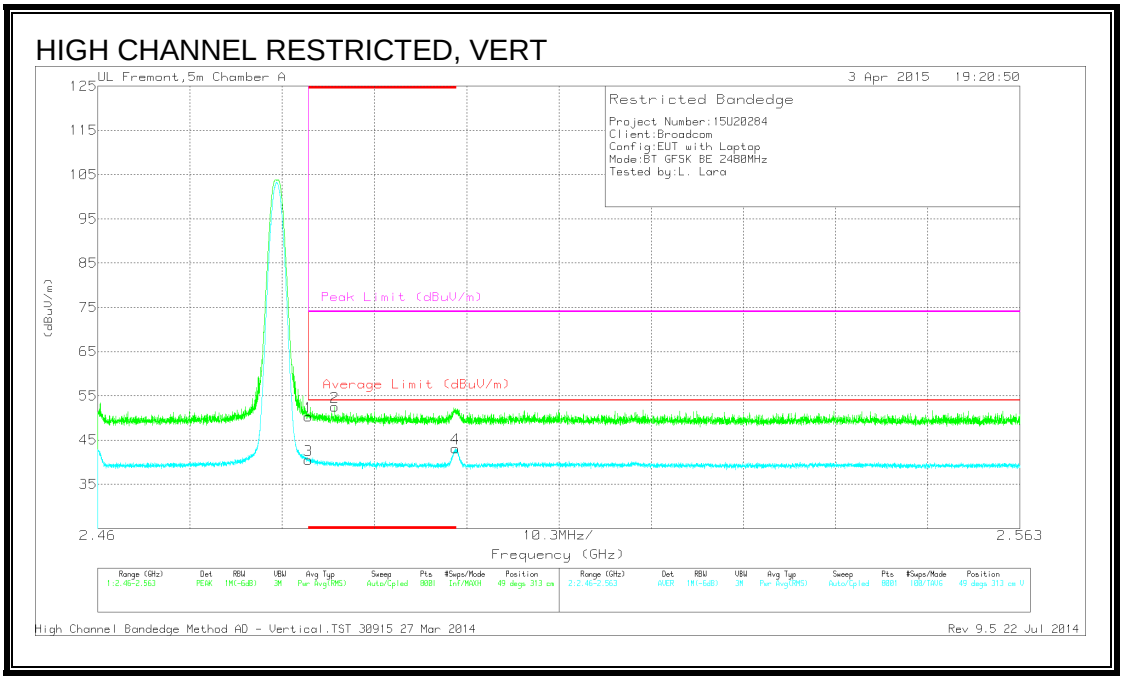
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.14	PK	32.1	-21.9	50.34	-	-	74	-23.66	49	313	V
3	* 2.484	30.29	RMS	32.1	-21.9	40.49	54	-13.51	-	-	49	313	V
2	* 2.486	42.38	PK	32.1	-21.9	52.58	-	-	74	-21.42	49	313	V
4	* 2.5	33.05	RMS	32.1	-22	43.15	54	-10.85	-	-	49	313	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

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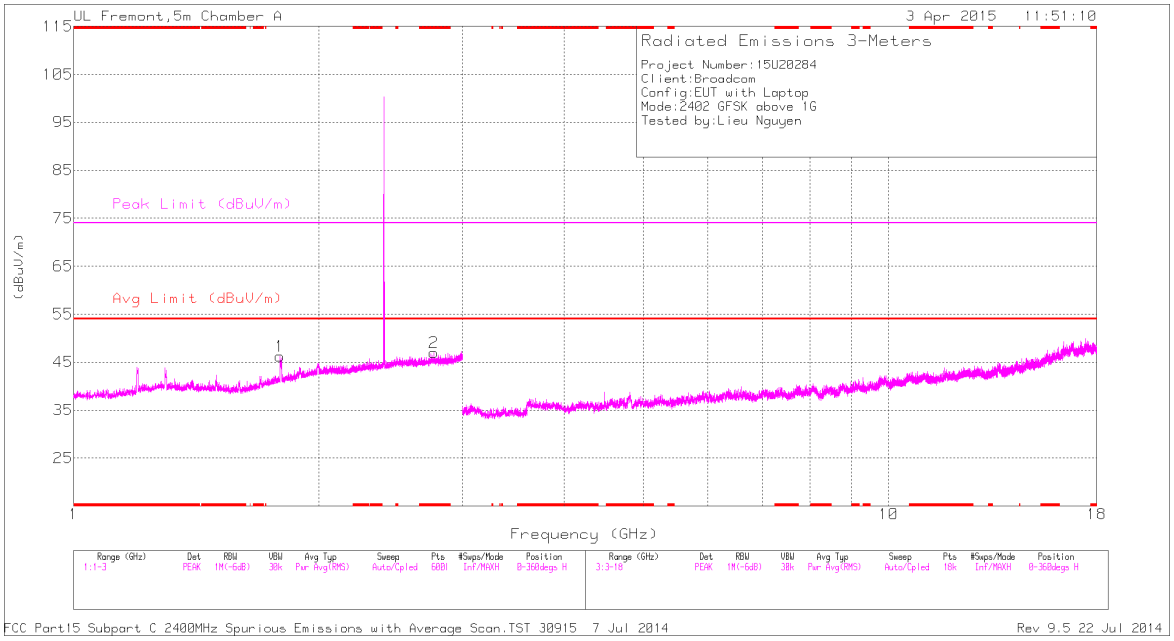
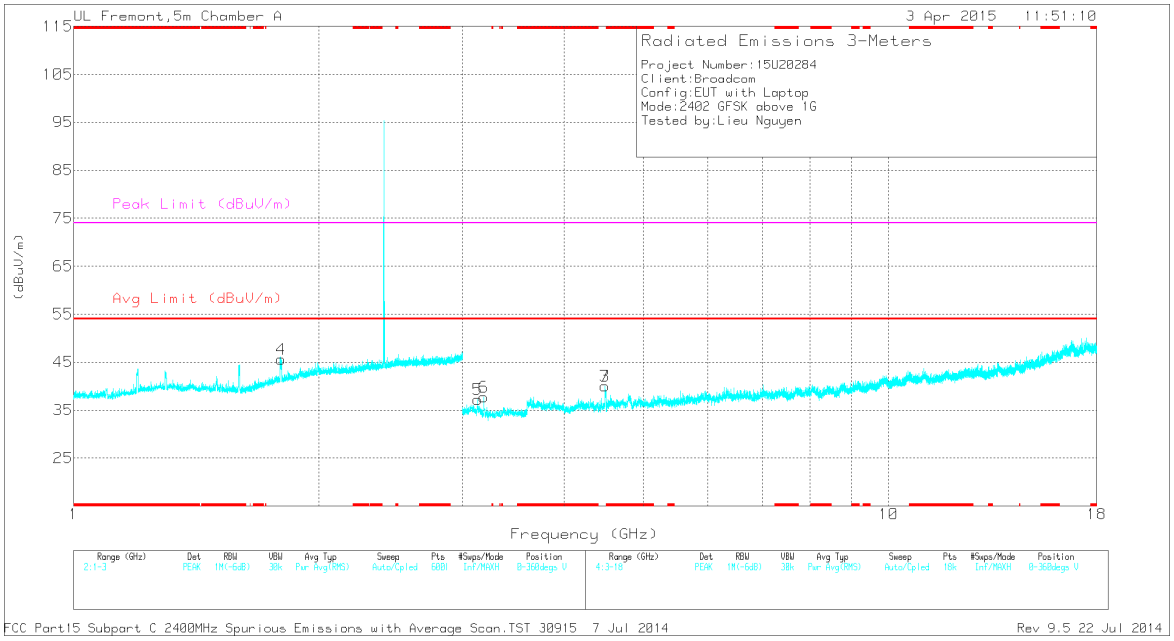
HARMONICS AND SPURIOUS EMISSIONS

GFSK, LOW CHANNEL – 2402 MHz

HORIZONTAL



VERTICAL



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GFSK, LOW CHANNEL – 2402 MHz, DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.768	43.31	PK2	32.4	-21.6	54.11	-	-	74	-19.89	122	114	H
	* 2.767	30.82	MAv1	32.4	-21.6	41.62	54	-12.38	-	-	122	114	H
1	1.792	39.47	PK	29.9	-23.1	46.27	-	-	-	-	0-360	100	H
4	1.798	38.78	PK	30	-23.2	45.58	-	-	-	-	0-360	201	V
5	3.133	33.52	PK	32.9	-29.2	37.22	-	-	-	-	0-360	100	V
6	3.185	35.38	PK	32.7	-30.3	37.78	-	-	-	-	0-360	100	V
3	4.483	35.28	PK	33.8	-29.1	39.98	-	-	-	-	0-360	201	V
7	4.483	35.28	PK	33.8	-29.1	39.98	-	-	-	-	0-360	201	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

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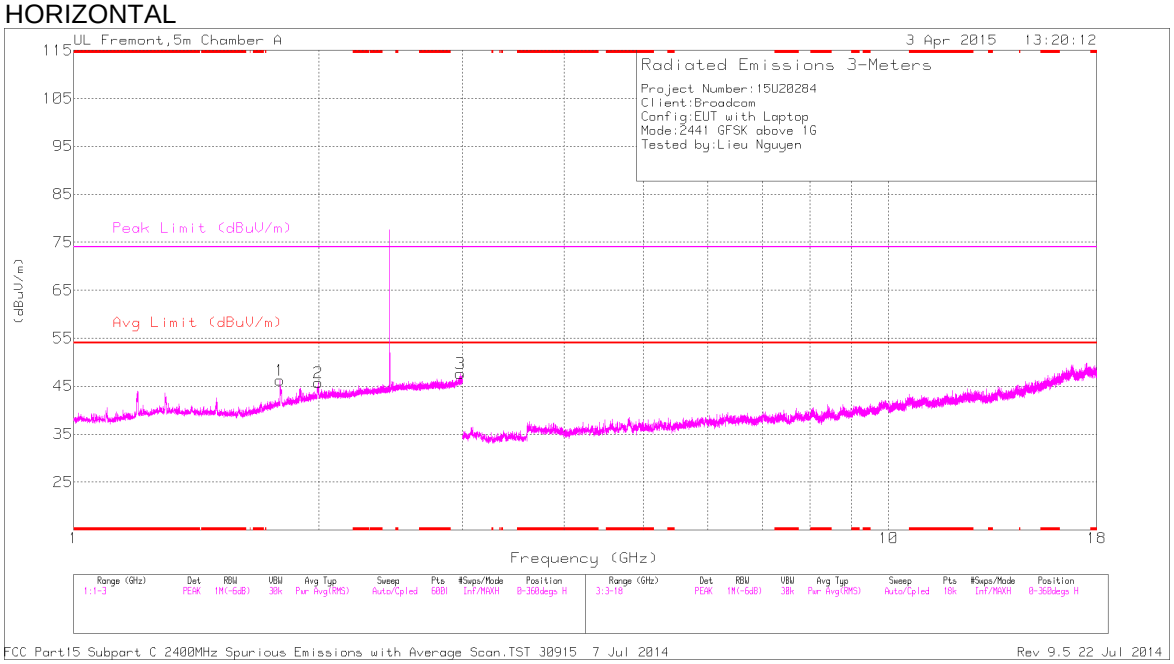
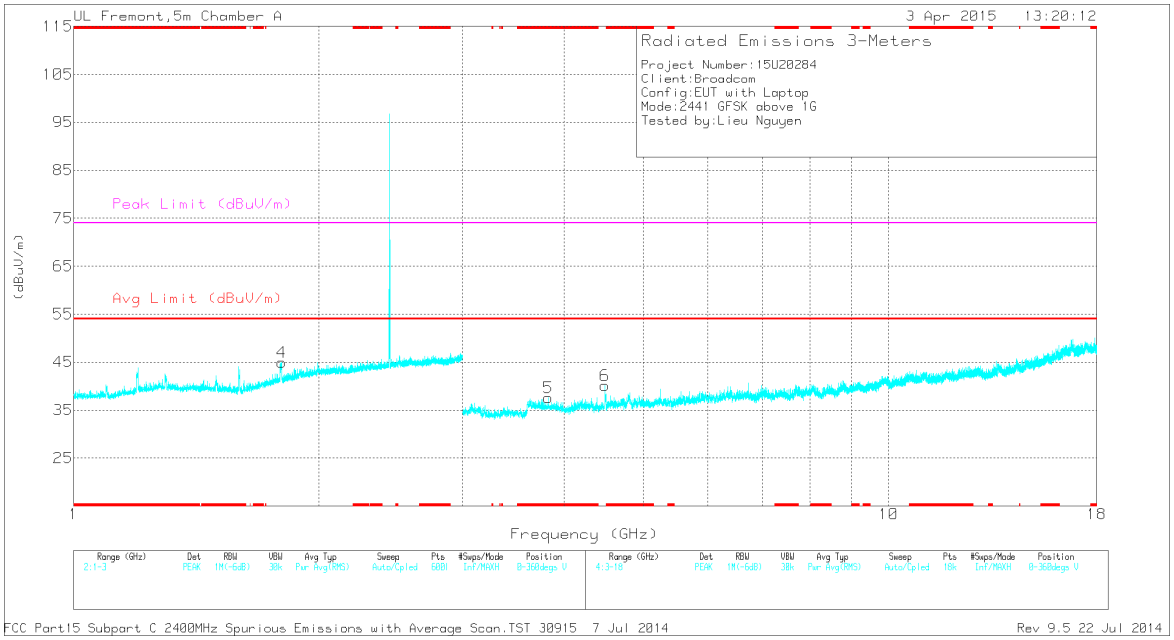
GFSK, MID CHANNEL – 2441 MHz

HORIZONTAL



VERTICAL



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GFSK, MID CHANNEL – 2441 MHz, DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	* 3.82	41.76	PK2	33.4	-29.6	0	45.56	-	-	74	-28.44	208	118	V
	* 3.823	29.3	MAv1	33.4	-29.5	0	33.2	54	-20.8	-	-	208	118	V
1	1.792	39.41	PK	29.9	-23.1	0	46.21	-	-	-	-	0-360	100	H
4	1.799	38.12	PK	30	-23.1	0	45.02	-	-	-	-	0-360	201	V
2	1.997	37.39	PK	31.1	-22.8	0	45.69	-	-	-	-	0-360	201	H
3	2.982	36.13	PK	32.8	-21.3	0	47.63	-	-	-	-	0-360	100	H
6	4.482	35.42	PK	33.8	-29.1	0	40.12	-	-	-	-	0-360	100	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

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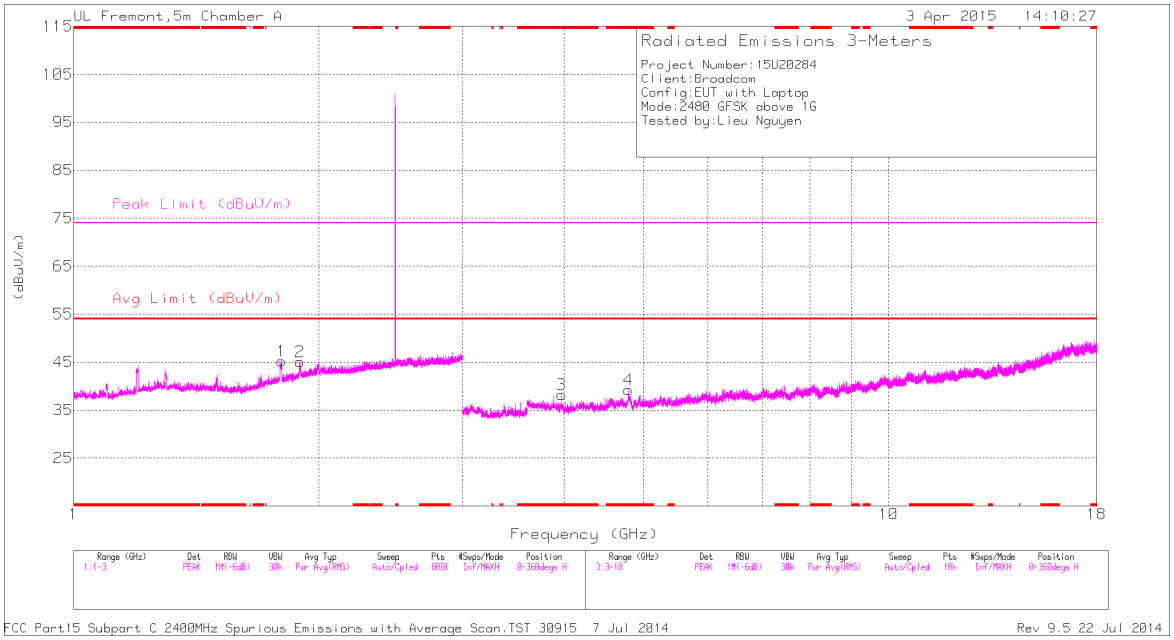
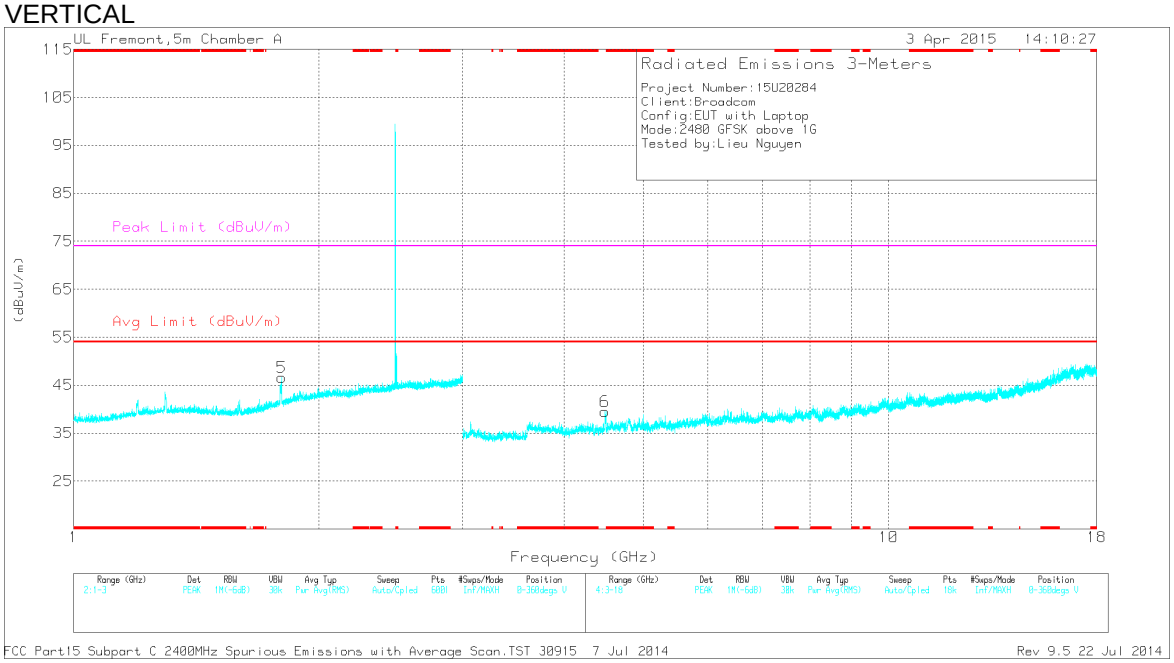
GFSK, HIGH CHANNEL – 2480 MHz

HORIZONTAL



VERTICAL



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GFSK, HIGH CHANNEL – 2480 MHz, DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 3.968	41.4	PK2	33.4	-29.5	0	45.3	-	-	74	-28.7	151	209	H
	* 3.968	29.64	MAv1	33.4	-29.5	0	33.54	54	-20.46	-	-	151	209	H
4	* 4.8	40.78	PK2	34	-28.4	0	46.38	-	-	74	-27.62	4	277	H
	* 4.799	28.9	MAv1	34	-28.4	0	34.5	54	-19.5	-	-	4	277	H
1	1.799	38.29	PK	30	-23.1	0	45.19	-	-	-	-	0-360	100	H
5	1.799	39.67	PK	30	-23.1	0	46.57	-	-	-	-	0-360	201	V
2	1.895	37.44	PK	30.8	-23.1	0	45.14	-	-	-	-	0-360	100	H
6	4.482	34.85	PK	33.8	-29.1	0	39.55	-	-	-	-	0-360	201	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

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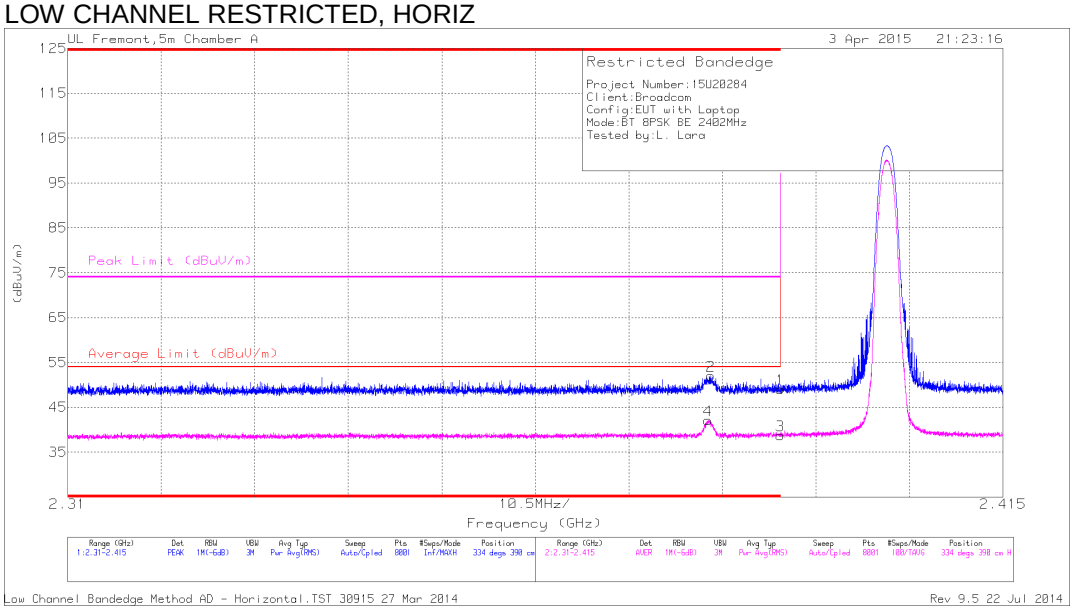
9.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, HORIZ



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.382	42.45	PK	31.9	-22.3	52.05	-	-	74	-21.95	334	390	H
4	* 2.382	32.5	RMS	31.9	-22.3	42.1	54	-11.9	-	-	334	390	H
1	* 2.39	39.23	PK	32	-22.2	49.03	-	-	74	-24.97	334	390	H
3	* 2.39	28.98	RMS	32	-22.2	38.78	54	-15.22	-	-	334	390	H

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

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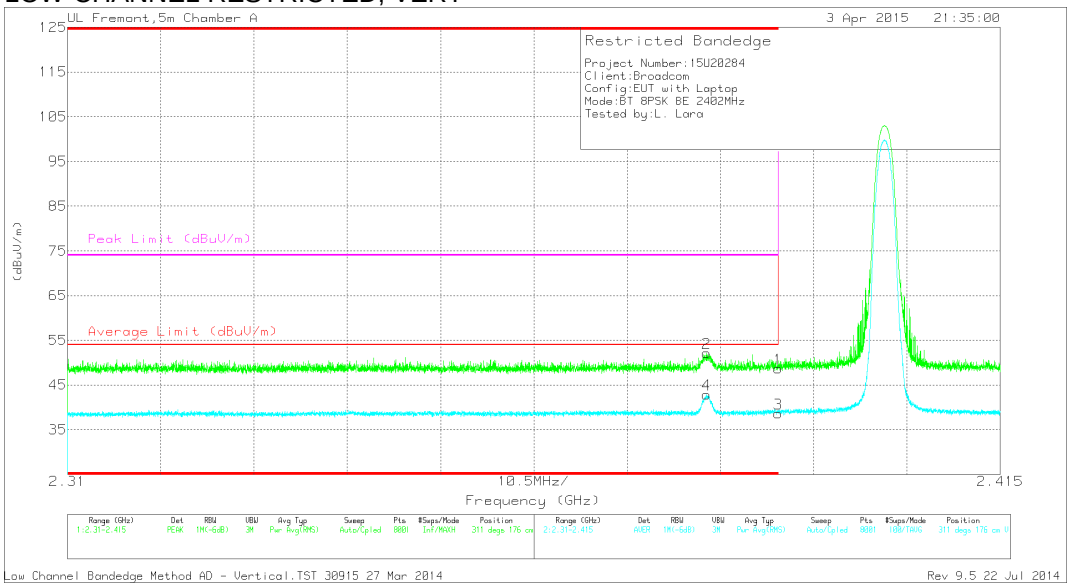
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, VERT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.382	42.51	PK	31.9	-22.3	52.11	-	-	74	-21.89	311	176	V
4	* 2.382	33.3	RMS	31.9	-22.3	42.9	54	-11.1	-	-	311	176	V
1	* 2.39	38.84	PK	32	-22.2	48.64	-	-	74	-25.36	311	176	V
3	* 2.39	28.86	RMS	32	-22.2	38.66	54	-15.34	-	-	311	176	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

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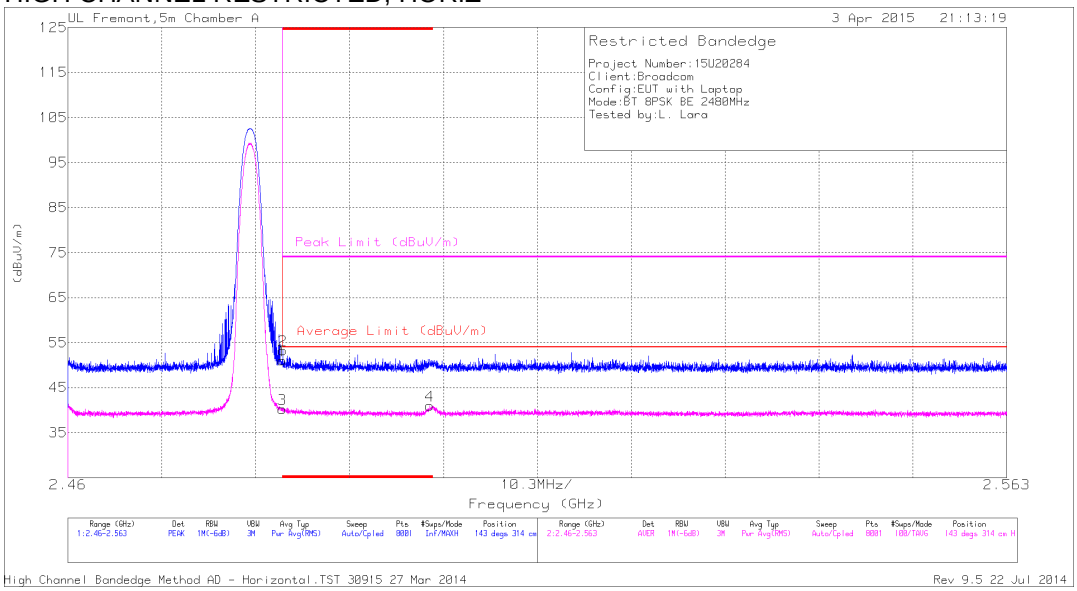
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, HORIZ



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.87	PK	32.1	-21.9	51.07	-	-	74	-22.93	143	314	H
2	* 2.484	43.03	PK	32.1	-21.9	53.23	-	-	74	-20.77	143	314	H
3	* 2.484	29.98	RMS	32.1	-21.9	40.18	54	-13.82	-	-	143	314	H
4	* 2.5	30.85	RMS	32.1	-22	40.95	54	-13.05	-	-	143	314	H

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

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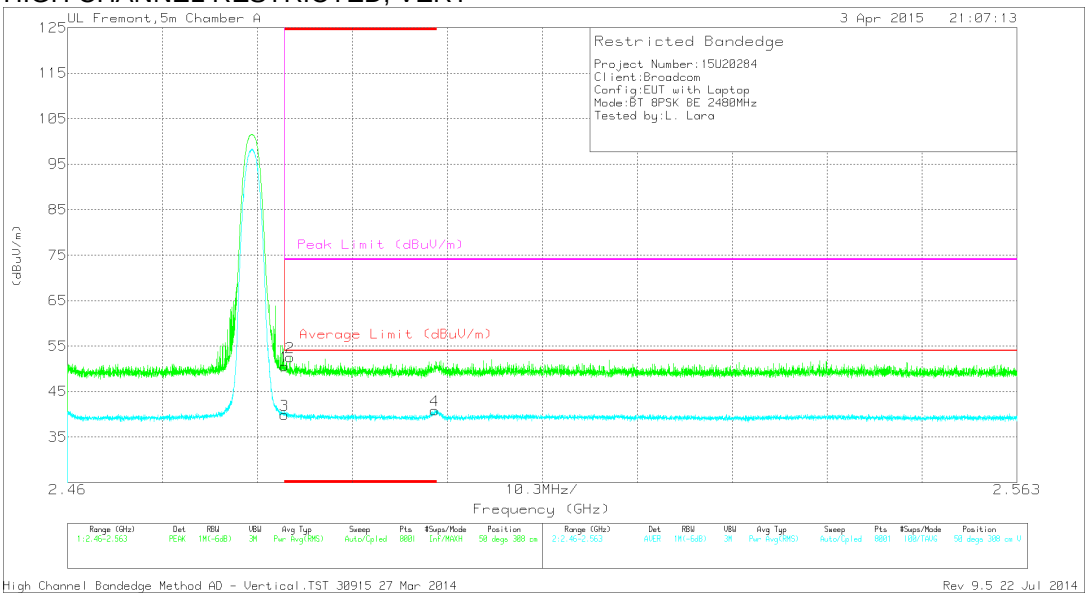
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, VERT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.31	PK	32.1	-21.9	50.51	-	-	74	-23.49	50	308	V
2	* 2.484	42.37	PK	32.1	-21.9	52.57	-	-	74	-21.43	50	308	V
3	* 2.484	29.65	RMS	32.1	-21.9	39.85	54	-14.15	-	-	50	308	V
4	* 2.5	30.78	RMS	32.1	-22	40.88	54	-13.12	-	-	50	308	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

RMS - RMS detection

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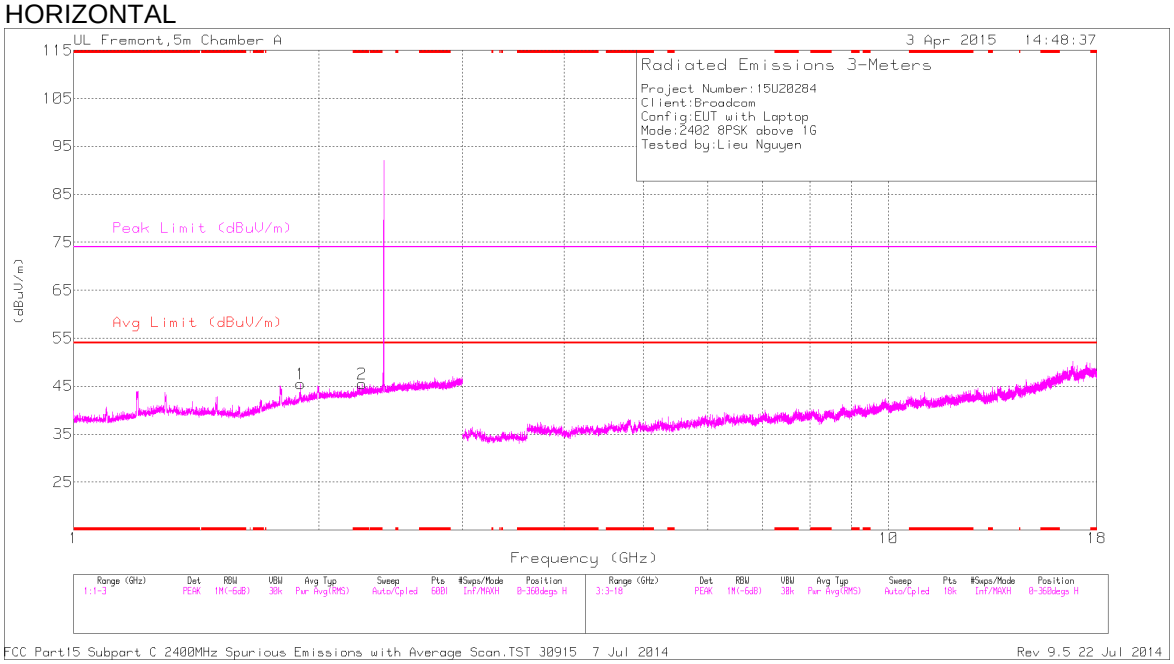
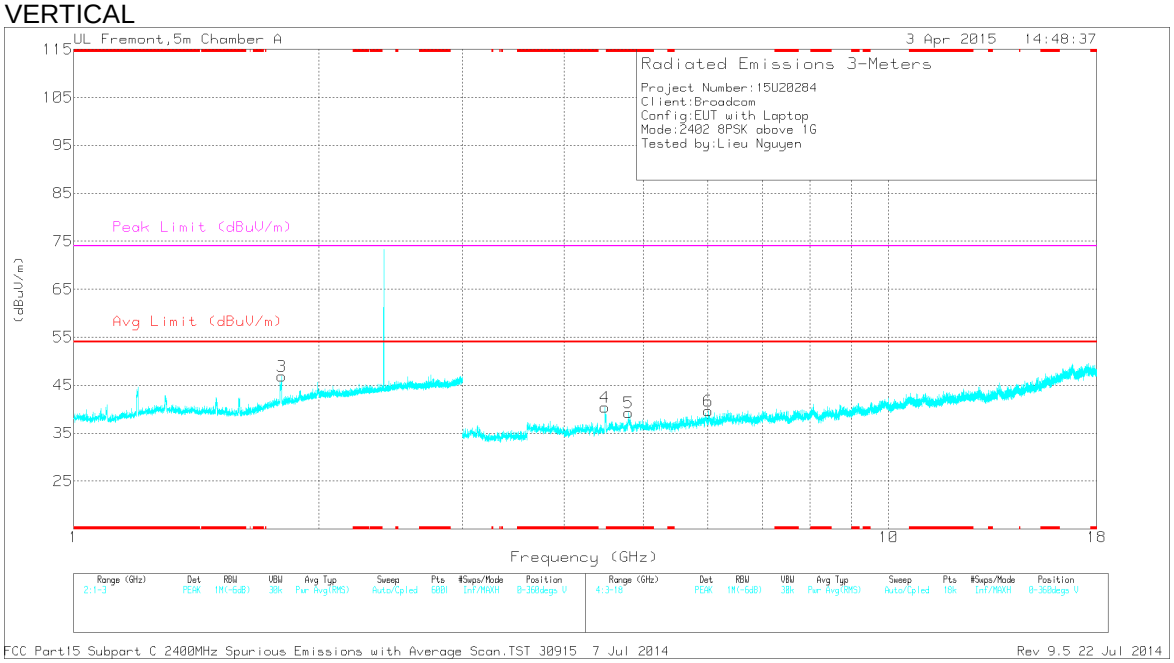
HARMONICS AND SPURIOUS EMISSIONS

8PSK, LOW CHANNEL – 2402 MHz

HORIZONTAL



VERTICAL



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8PSK, LOW CHANNEL - 2402 MHz, DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.26	43.49	PK2	31.6	-22.4	0	52.69	-	-	74	-21.31	328	231	H
	* 2.262	31.04	MAv1	31.6	-22.4	0	40.24	54	-13.76	-	-	328	231	H
5	* 4.796	39.88	PK2	34	-28.4	0	45.48	-	-	74	-28.52	251	111	V
	* 4.797	28.93	MAv1	34	-28.4	0	34.53	54	-19.47	-	-	251	111	V
3	1.799	39.97	PK	30	-23.1	0	46.87	-	-	-	-	0-360	201	V
1	1.899	37.73	PK	30.8	-23.1	0	45.43	-	-	-	-	0-360	100	H
4	4.482	35.7	PK	33.8	-29.1	0	40.4	-	-	-	-	0-360	201	V
6	6.01	31.96	PK	35.4	-27.7	0	39.66	-	-	-	-	0-360	100	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

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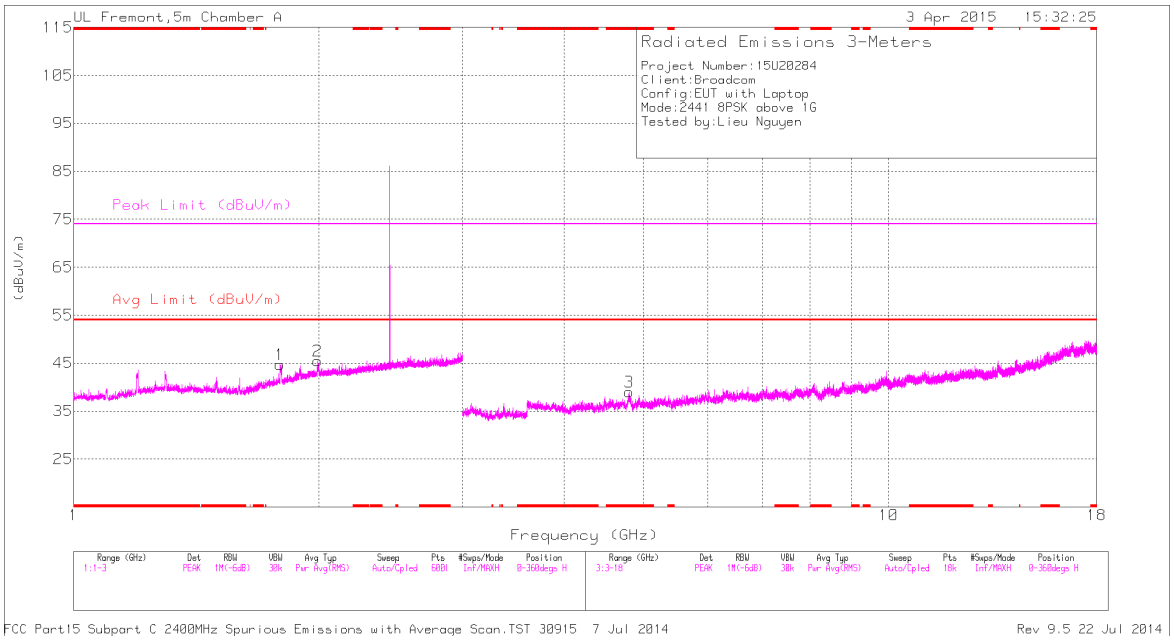
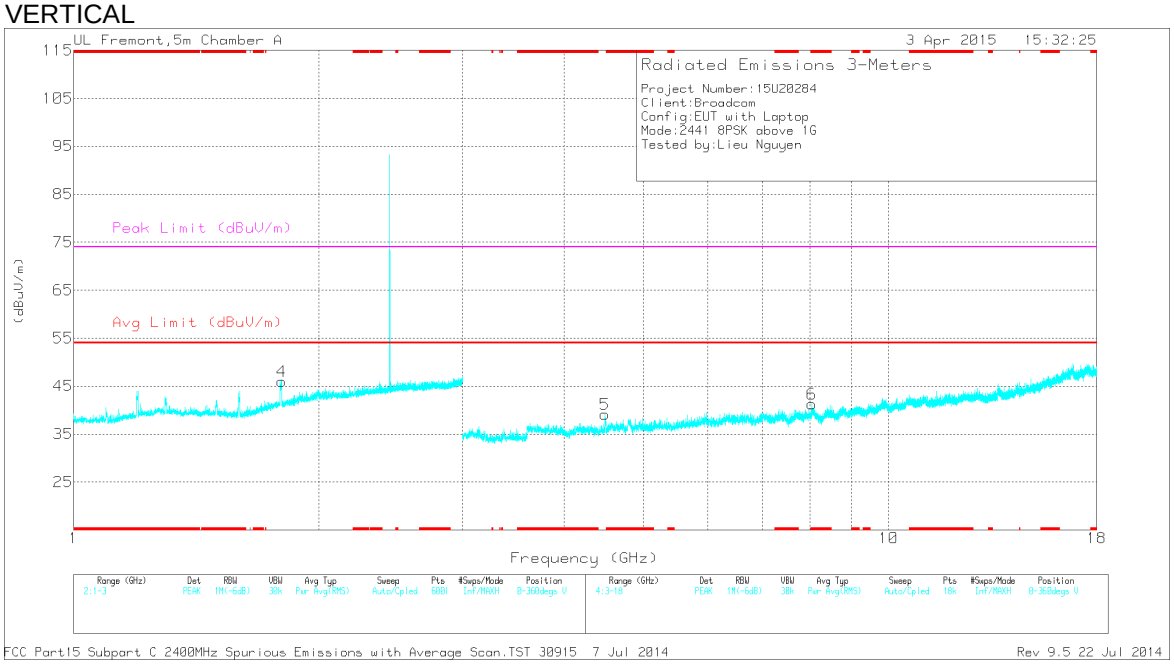
8PSK, MID CHANNEL – 2441MHz

HORIZONTAL



VERTICAL



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8PSK, MID CHANNEL – 2441MHz, DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 4.804	40.31	PK2	34	-28.4	0	45.91	-	-	74	-28.09	30	164	H
	* 4.806	28.43	MAv1	34	-28.4	0	34.03	54	-19.97	-	-	30	164	H
6	* 8.05	36.22	PK2	35.7	-24	0	47.92	-	-	74	-26.08	0	300	V
	* 8.05	24.64	MAv1	35.7	-24	0	36.34	54	-17.66	-	-	0	300	V
1	1.792	37.92	PK	29.9	-23.1	0	44.72	-	-	-	-	0-360	100	H
4	1.799	39.12	PK	30	-23.1	0	46.02	-	-	-	-	0-360	201	V
2	1.991	37.14	PK	31.1	-22.8	0	45.44	-	-	-	-	0-360	201	H
5	4.487	34.27	PK	33.9	-29	0	39.17	-	-	-	-	0-360	201	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

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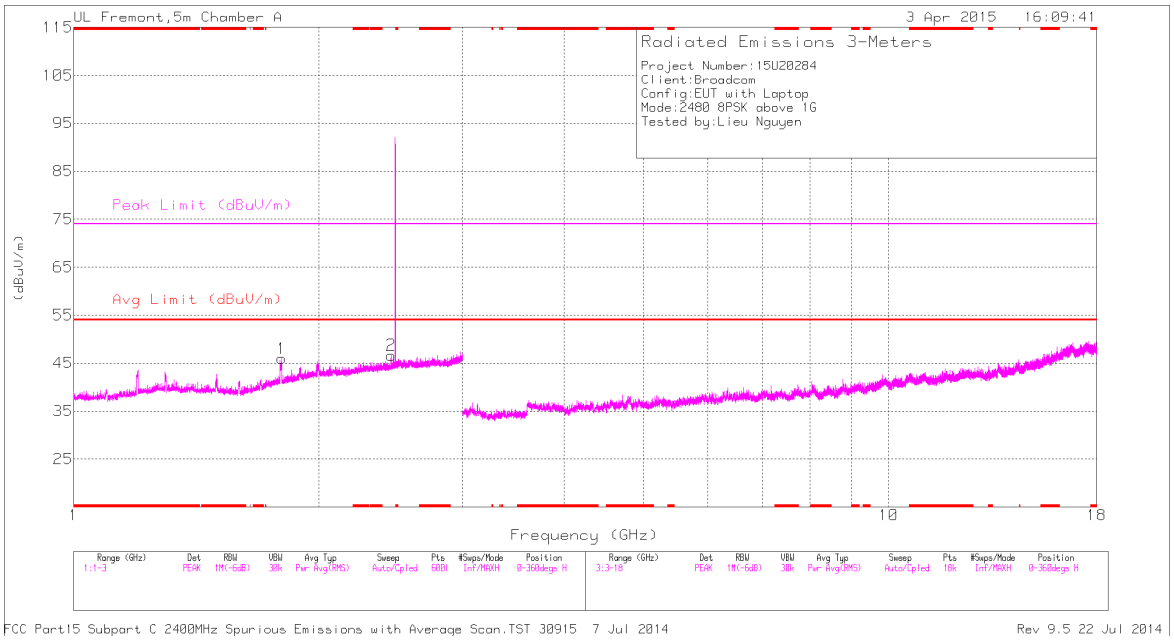
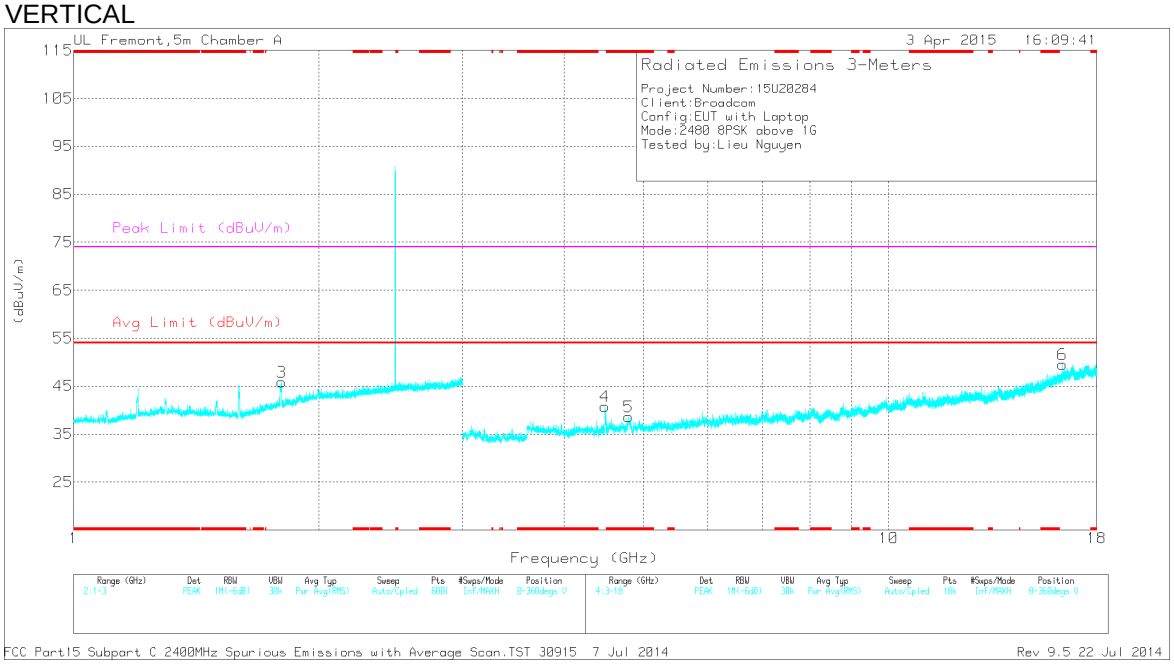
8PSK, HIGH CHANNEL – 2480 MHz

HORIZONTAL



VERTICAL



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8PSK, HIGH CHANNEL – 2480 MHz, DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T136 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
5	* 4.795	40.24	PK2	34	-28.4	0	45.84	-	-	74	-28.16	48	372	V
	* 4.794	28.59	MAv1	34	-28.4	0	34.19	54	-19.81	-	-	48	372	V
1	1.799	39.05	PK	30	-23.1	0	45.95	-	-	-	-	0-360	100	H
3	1.799	38.9	PK	30	-23.1	0	45.8	-	-	-	-	0-360	201	V
2	2.451	36.78	PK	32	-22.1	0	46.68	-	-	-	-	0-360	201	H
4	4.482	36.13	PK	33.8	-29.1	0	40.83	-	-	-	-	0-360	201	V
6	16.344	26.9	PK	41.3	-18.7	0	49.5	-	-	-	-	0-360	201	V

* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK - Peak detector

MAv1 - KDB558074 Option 1 Maximum RMS Average

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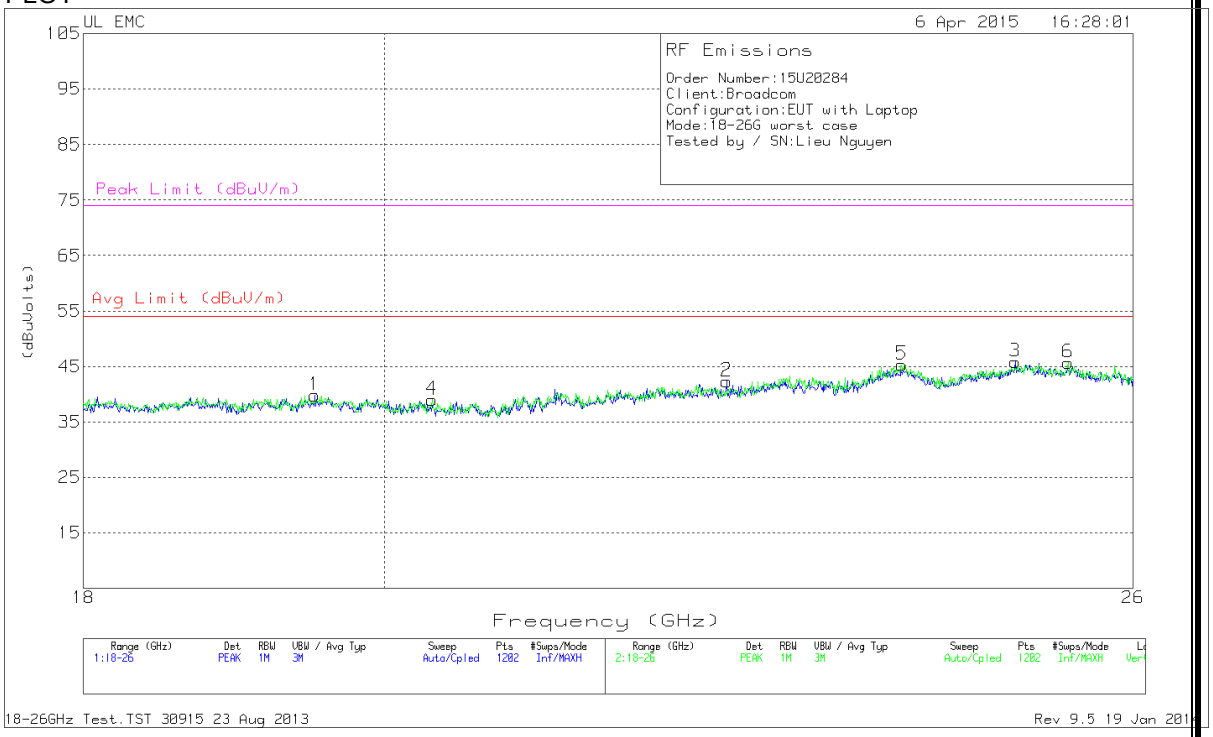
9.3. WORST-CASE 18_26 GHz

SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION)

PLOT



Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.519	40.83	PK	32.8	-24.3	-9.5	39.83	54	-14.16	74	-34.16
2	22.55	41.83	PK	33.7	-23.7	-9.5	42.33	54	-11.66	74	-31.66
3	24.948	43.43	PK	34.5	-22.6	-9.5	45.83	54	-8.16	74	-28.16
4	20.338	39.5	PK	32.9	-23.9	-9.5	39	54	-15	74	-35
5	23.975	43.23	PK	34.2	-22.6	-9.5	45.33	54	-8.66	74	-28.66
6	25.414	43.47	PK	34.6	-22.9	-9.5	45.66	54	-8.33	74	-28.33

PK - Peak detector

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9.4. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)

EMISSIONS DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T130 (dB/m)	Amp/Cbl (dB/m)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 171.3125	45.92	PK	11.7	-30.1	27.52	43.52	-16	0-360	200	H
8	52.78	52.82	PK	7.3	-30.9	29.22	40	-10.78	0-360	101	V
9	99.615	43.45	PK	9.3	-30.6	22.15	43.52	-21.37	0-360	101	V
1	99.9125	45.04	PK	9.4	-30.6	23.84	43.52	-19.68	0-360	300	H
3	199.1646	56.76	QP	12.5	-29.9	39.36	43.52	-4.16	1	100	H
10	199.15	49.43	PK	12.5	-29.9	32.03	43.52	-11.49	0-360	101	V
11	298.7	40.1	PK	13.3	-29.4	24	46.02	-22.02	0-360	200	V
4	298.8	49.3	PK	13.3	-29.4	33.2	46.02	-12.82	0-360	101	H
12	398.3	38.48	PK	15.2	-29.1	24.58	46.02	-21.44	0-360	101	V
5	399.7	42.09	PK	15.2	-29.1	28.19	46.02	-17.83	0-360	101	H
13	499.7	40.08	PK	17.6	-28.7	28.98	46.02	-17.04	0-360	101	V
14	499.7	40.08	PK	17.6	-28.7	28.98	46.02	-17.04	0-360	101	V
6	499.8	41.37	PK	17.6	-28.7	30.27	46.02	-15.75	0-360	200	H
7	799.5	36.19	PK	21.3	-28.2	29.29	46.02	-16.73	0-360	101	H

PK - Peak detector

QP - Quasi-Peak detector

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10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-GEN Clause 8.8

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	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.

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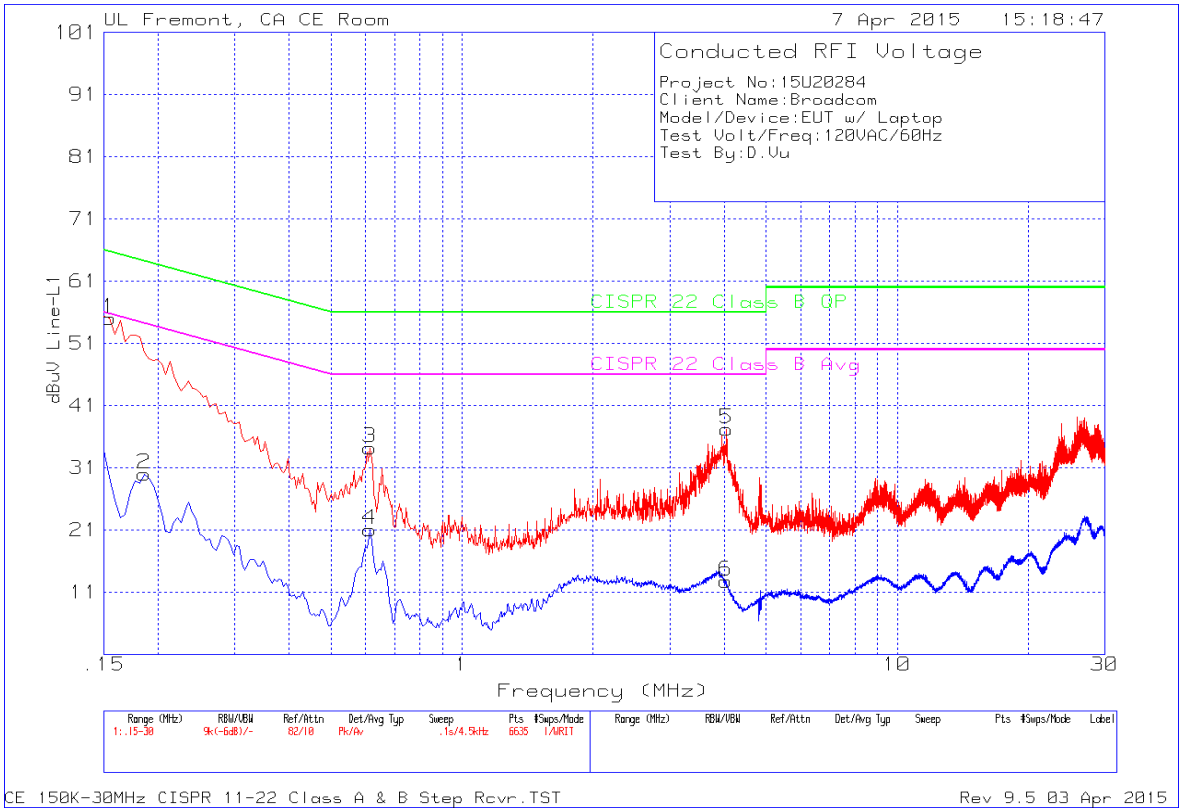
6 WORST EMISSIONS

LINE 1 RESULTS

PLOT



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Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	0.1545	53.74	Pk	1.3	0	55.04	-	-	55.75	-0.71
2	0.186	29.02	Av	1	0	30.02	64.21	-34.19	54.21	-24.19
3	0.6135	33.92	Pk	0.3	0	34.22	-	-	46	-11.78
4	0.6135	20.76	Av	0.3	0	21.06	56	-34.94	46	-24.94
5	4.056	36.91	Pk	0.2	0.1	37.21	-	-	46	-8.79
6	4.0335	12.49	Av	0.2	0.1	12.79	56	-43.21	46	-33.21

Range 1: Line-L1 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
0.15338	29.34	Ca	1.4	0	30.74	-	-	55.81	-25.07

Pk - Peak detector
Av - Average detection
Ca - CISPR average detection

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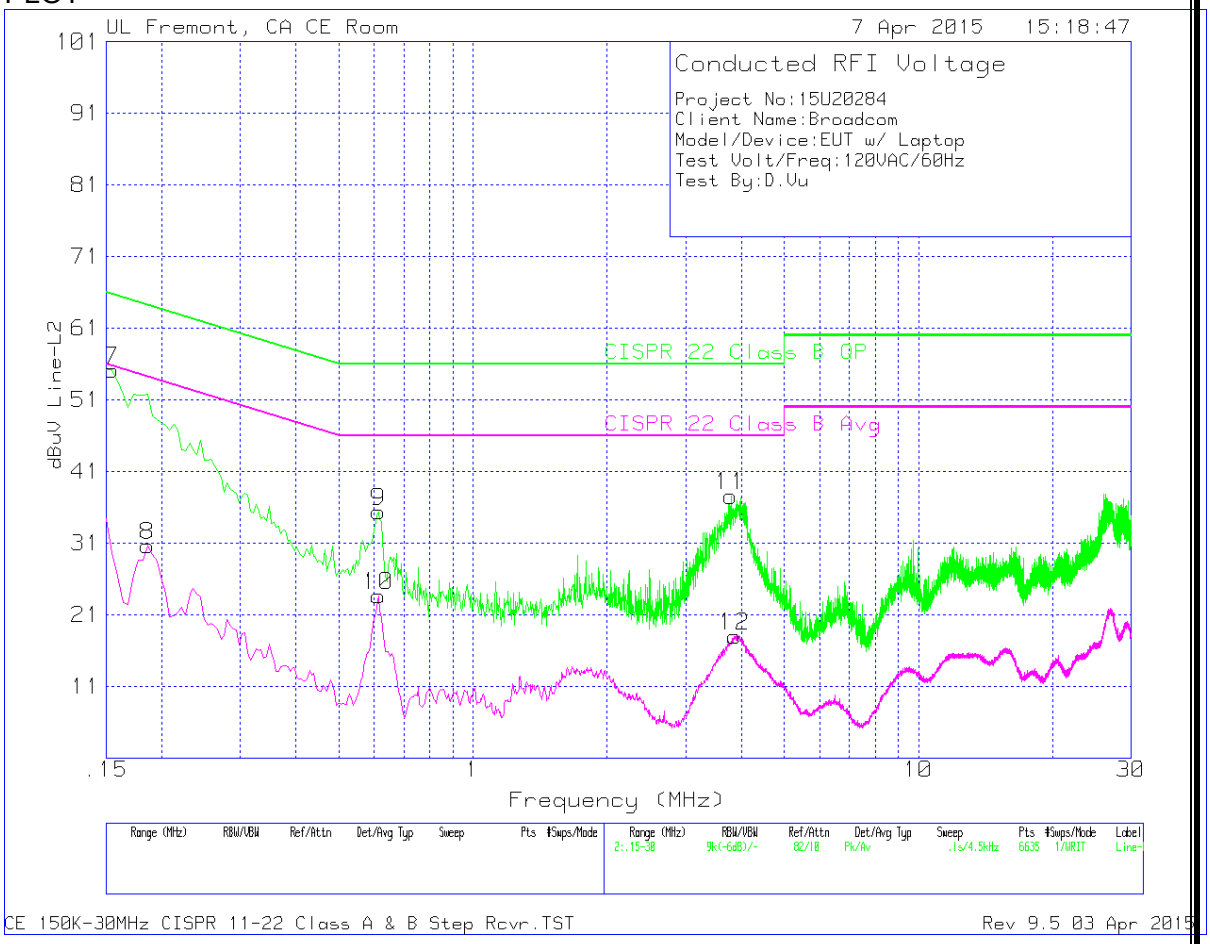
LINE 2 RESULTS

PLOT



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Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
7	0.1545	53.77	Pk	1.4	0	55.17	-	-	55.75	-0.58
8	0.186	29.54	Av	1.1	0	30.64	64.21	-33.57	54.21	-23.57
9	0.6135	35.09	Pk	0.3	0	35.39	-	-	46	-10.61
10	0.6135	23.35	Av	0.3	0	23.65	56	-32.35	46	-22.35
11	3.7905	37.3	Pk	0.2	0.1	37.6	-	-	46	-8.4
12	3.867	17.7	Av	0.2	0.1	18	56	-38	46	-28

Range 2: Line-L2 .15 - 30MHz

Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
0.15338	28.83	Ca	1.5	0	30.33	-	-	55.81	-25.48

Pk - Peak detector
Av - Average detection
Ca - CISPR average detection

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