FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 2

CERTIFICATION TEST REPORT

FOR

WIRELESS HEADSET

MODEL NUMBER: 425948

FCC ID: A94425948
IC: 3232A-425948

REPORT NUMBER: R11602267-E2

ISSUE DATE: MARCH 25, 2017

Prepared for
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NVLAP TESTING

NVLAP LAB CODE 200246-0

Revision History

Ver.	Issue Date	Revisions	Revised By
1	03/25/2017	Initial Issue	Brian Kiewra
2	2017-04-13	Added minimum declared channels in AFH mode.	Brian Kiewra
3	2017-06-06	Updated RSS-247 to Issue 2	Brian Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Bose Corporation
100 The Mountain
Framingham, MA 01701 USA

EUT DESCRIPTION: Wireless Headset

MODEL: 425948

SERIAL NUMBER: DP1-A320 and DP1-N001

DATE TESTED: 2017-03-03 to 2017-03-10

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA (ISED CANADA) RSS-247 Issue 2	Pass
INDUSTRY CANADA (ISED CANADA) RSS-GEN Issue 4	Pass

UL LLC 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 LLC 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 LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC 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, or any agency of the U.S. Government.

Approved & Released
For UL LLC By:

Chin Pang
WISE Senior Engineer
UL – Consumer Technology Division

Prepared By:

Brian T. Kiewra
EMC Engineer
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2. TEST METHODOLOGY

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

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA.

12 Laboratory Dr., RTP, NC 27709
☐ Chamber A
☐ Chamber C

2800 Suite B Perimeter Park Dr., Morrisville, NC 27560
☒ Chamber NORTH
☐ Chamber SOUTH

The onsite chambers (A & C) are covered under Industry Canada company address code 2180C with site numbers 2180C -1 through 2180C-2, respectively.

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at http://www.nist.gov/nvlap/.

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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
RF output power, conducted	±0.45 dB
Power Spectral Density, conducted	±1.50 dB
Unwanted Emissions, conducted	±2.94 dB
All emissions, radiated	±5.36 dB
Conducted Emissions (0.150 – 30MHz)	±3.65 dB
Temperature	±0.07 °C
Humidity	±2.26 %
DC and Low Frequency Voltages	±1.27 %

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Bluetooth/Bluetooth Low Energy transceiver.

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	8.85	7.67
2402 - 2480	DQPSK	7.17	5.21
2402 - 2480	Enhanced 8PSK	7.51	5.64

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an inverted-f antenna, with a maximum gain of 3.204 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 1.2.8.439M

The EUT driver software installed in the host support equipment during testing was 2.4.0.0

The test utility software used during testing was CSR BlueSuite, rev. 2.6.4.

5.5. WORST-CASE CONFIGURATION AND MODE

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.

The fundamental of the EUT was investigated in three orthogonal orientations X, Y and Z, it was determined that Z orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Z orientation.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T450s	PC-0A2UQS 16/01	NA
Power Supply	Lenovo	ADLX65NLC2A	11S45N0259Z1Z9743D21T	NA

I/O CABLES

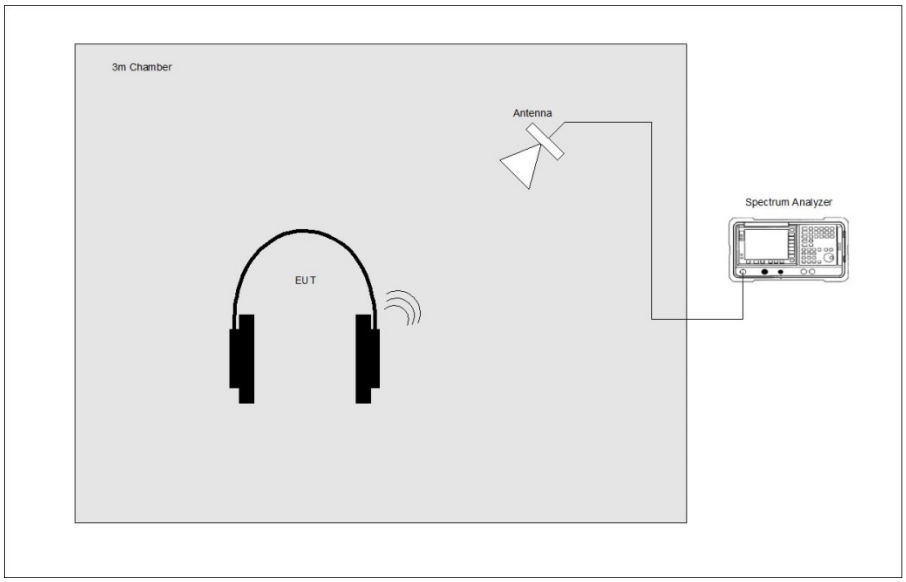
I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	Antenna	1	SMA	RF	<3m	None
1	USB	1	µUSB	USB	<3m	Used to configure EUT

TEST SETUP

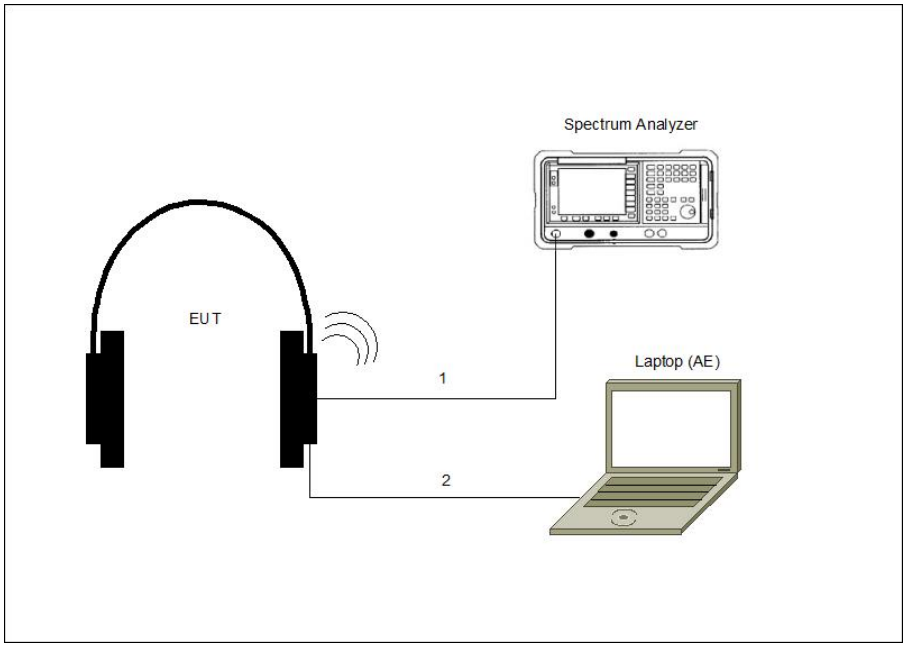
The EUT is installed as a standalone device.

SETUP DIAGRAM FOR TESTS

Radiated Setup



Antenna Port Conducted



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - North Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2016-12-28	2017-12-31
	30-1000 MHz				
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2016-06-27	2017-06-30
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2016-03-07	2017-03-31
	18-40 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2016-09-06	2017-09-06
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2016-10-04	2017-10-04
N-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2016-06-26	2017-06-30
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2016-08-28	2017-08-28
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2016-04-27	2017-04-30
	Receiver & Software				
SA0026	Spectrum Analyzer	Agilent	N9030A	2017-02-17	2018-07-28
SA0025 (18-40GHz)	Spectrum Analyzer	Agilent	N9030A	2016-03-17	2017-03-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 1				
72822 (SA0019)	Spectrum Analyzer	Agilent Technologies	E4446A	2016-08-25	2017-08-25
PWM004	RF Power Meter	Keysight Technologies	N1911A	2016-06-22	2017-06-22
PWS003	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2016-06-21	2017-06-21
139843	Temp/Humid/Pressure Meter	Control Co./Fisher	14-650-118	2016-02-19	2017-02-19
76022	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	N/A	N/A

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL077	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3476-240	2016-06-15	2017-06-30
HI0081	Environmental Meter	Springfield	91905	2016-04-26	2017-04-26
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2016-08-24	2017-08-24
PRE0101521 (75141)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2016-08-23	2017-08-23
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2016-06-09	2017-06-30
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Miscellaneous (if needed)				
MM0168	Multi-meter	Agilent	U1232A	2016-10-07	2017-10-31
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2016-06-04	2017-06-30
LISN008	LISN, 50-ohm/50-uH, 2-conductor, 25A (For support gear only.)	Solar Electronics	8012-50-R-24-BNC	2016-10-31	2017-10-31

7. MEASUREMENT METHODS

Duty Cycle: KDB 558074 Zero-Span Spectrum Analyzer Method

20 dB BW: ANSI C63.10 Section 6.9.2.

99% Occupied Bandwidth: ANSI C63.10-2013, Section 6.9.3

Hopping Frequency Separation: ANSI C63.10 Section 7.8.2

Number of Hopping Channels: ANSI C63.10 Section 7.8.3

Average Time of Occupancy: ANSI C63.10 Section 7.8.4

Output Power: ANSI C63.10 Section 7.8.5

Out-of-band emissions in non-restricted bands: ANSI C63.10 Section 7.8.6 & 7.8.8

Out-of-band emissions in restricted bands: ANSI C63.10:2013 Sections 6.3-6.6

Line Conducted Emissions: ANSI C63.10:2013 Sections 6.2

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

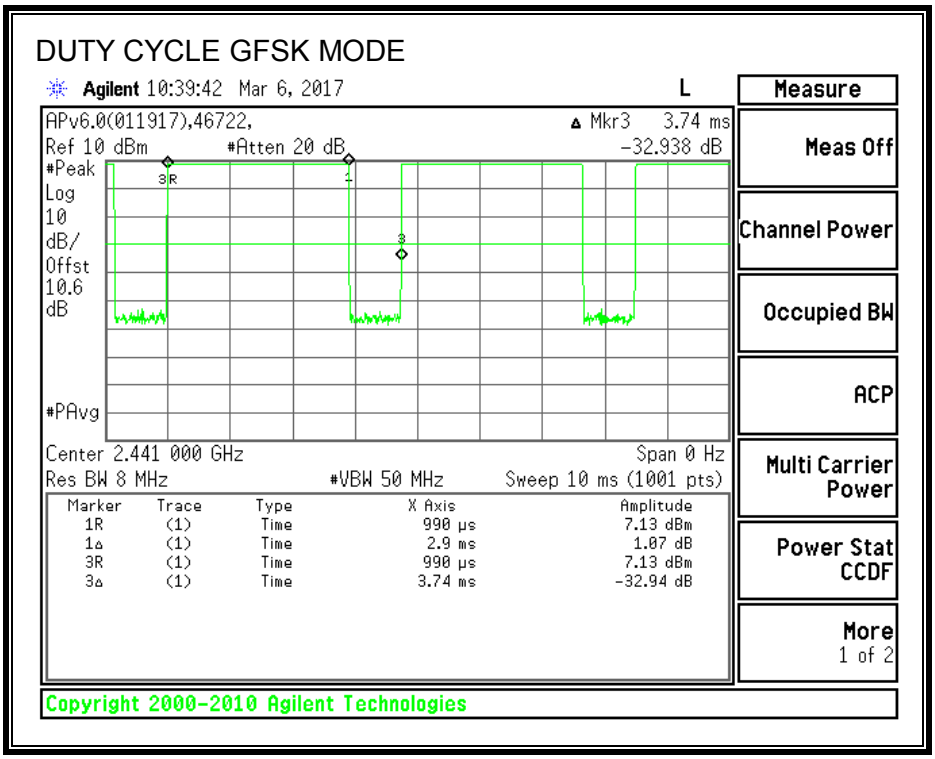
KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

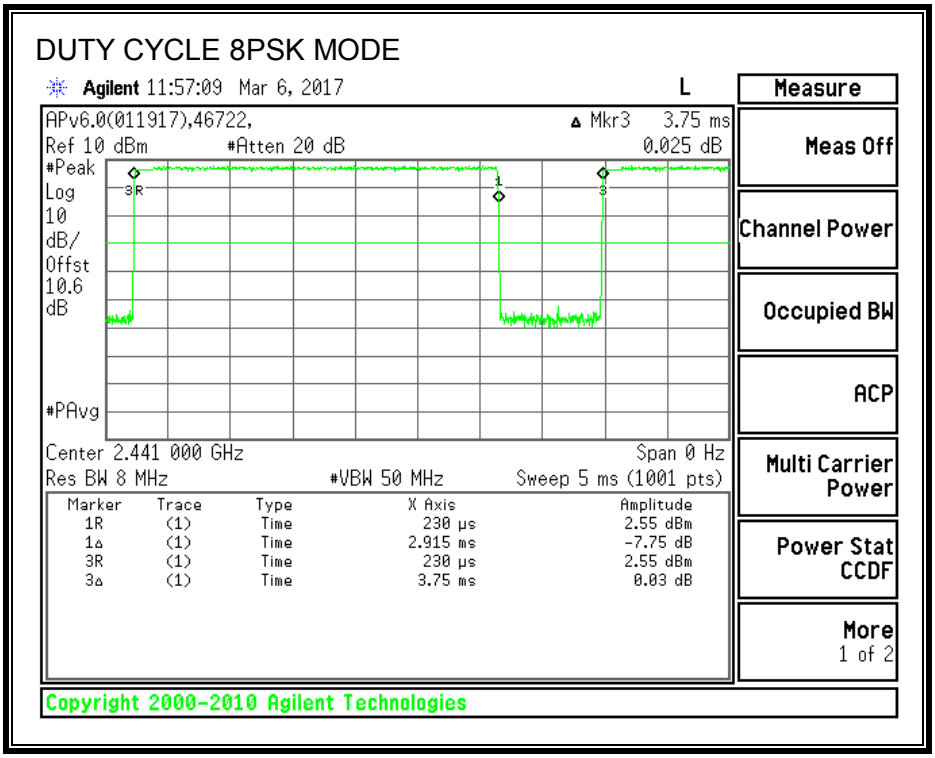
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4 GHz band (Hopping ON)						
Bluetooth GFSK	2.900	3.740	0.775	77.54%	2.21	0.345
Bluetooth 8PSK	2.915	3.750	0.777	77.73%	2.19	0.343

DUTY CYCLE PLOTS

HOPPING OFF



DUTY CYCLE 8PSK MODE



Test Information

Test Date: 2017-03-06

Project: 11602267

Tester: John Manser

8.2. BASIC DATA RATE GFSK MODULATION

8.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.
Test per FCC §15.247(a)(1); IC RSS-247 5.1 (1), RSS-Gen 6.6.

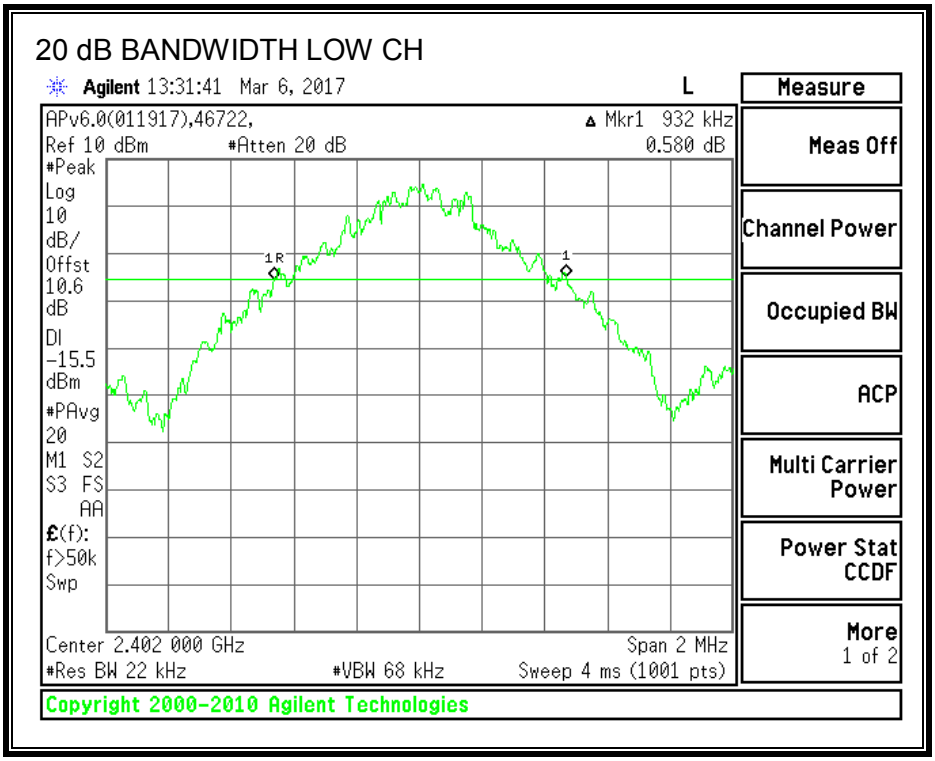
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

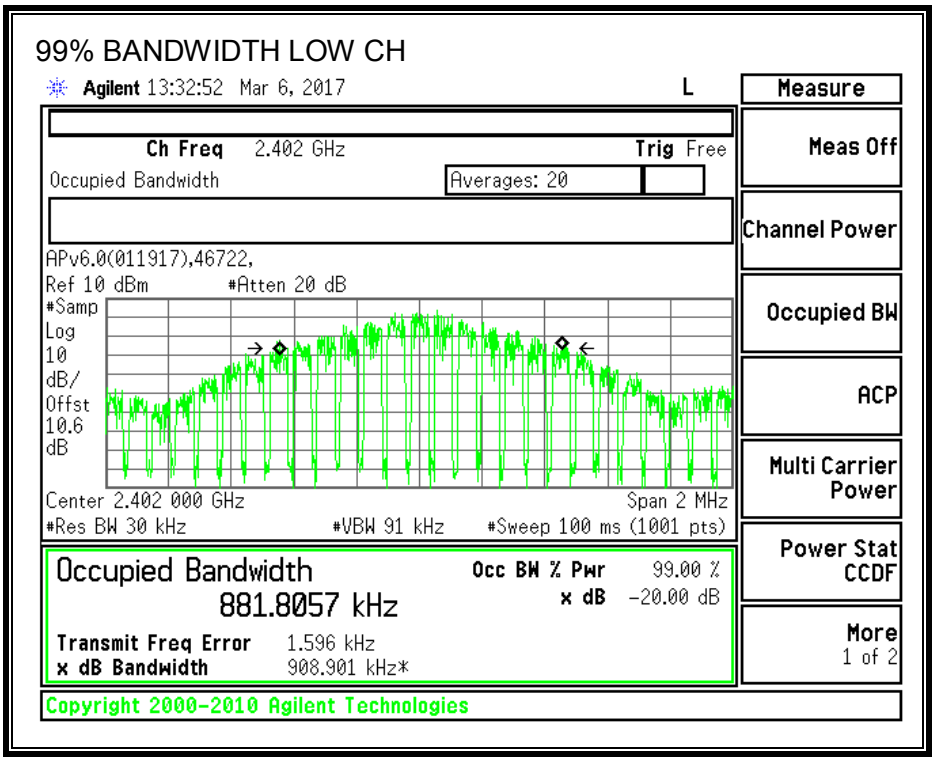
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	932	881.8057
Middle	2441	932	876.9638
High	2480	926	877.4947

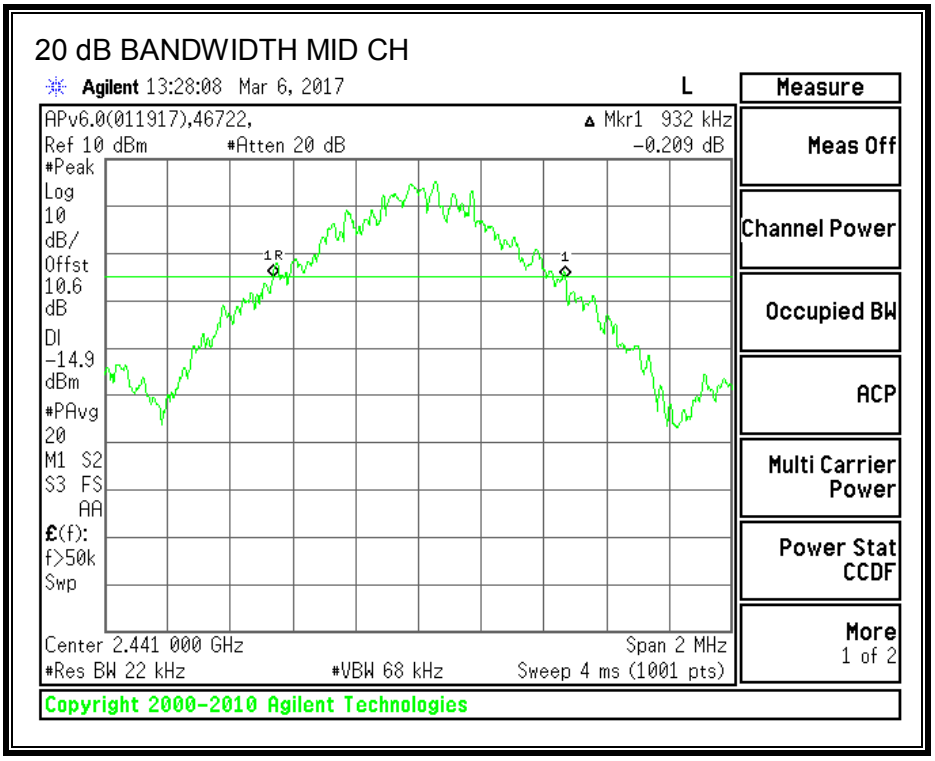
20 dB AND 99% BANDWIDTH



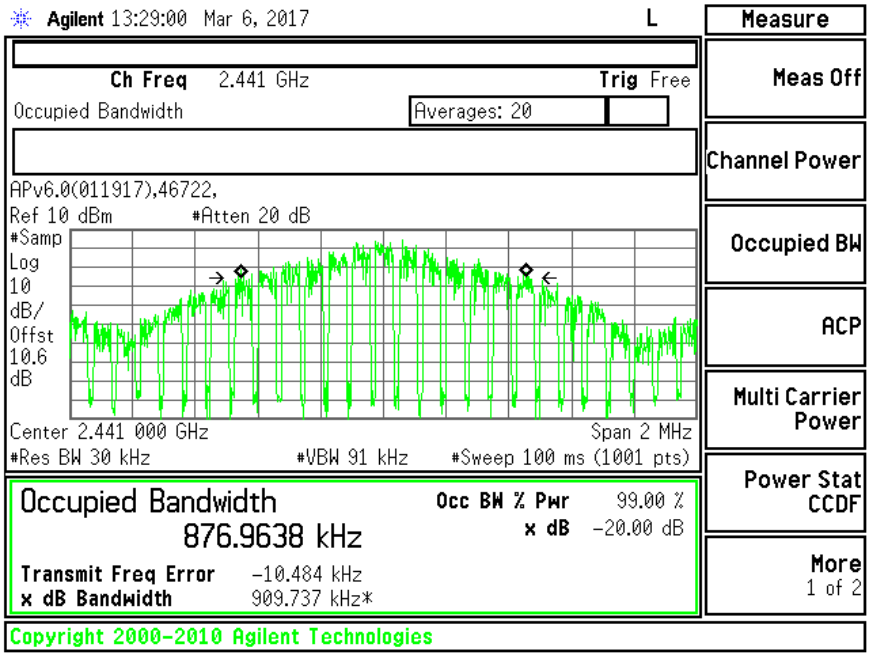
99% BANDWIDTH LOW CH



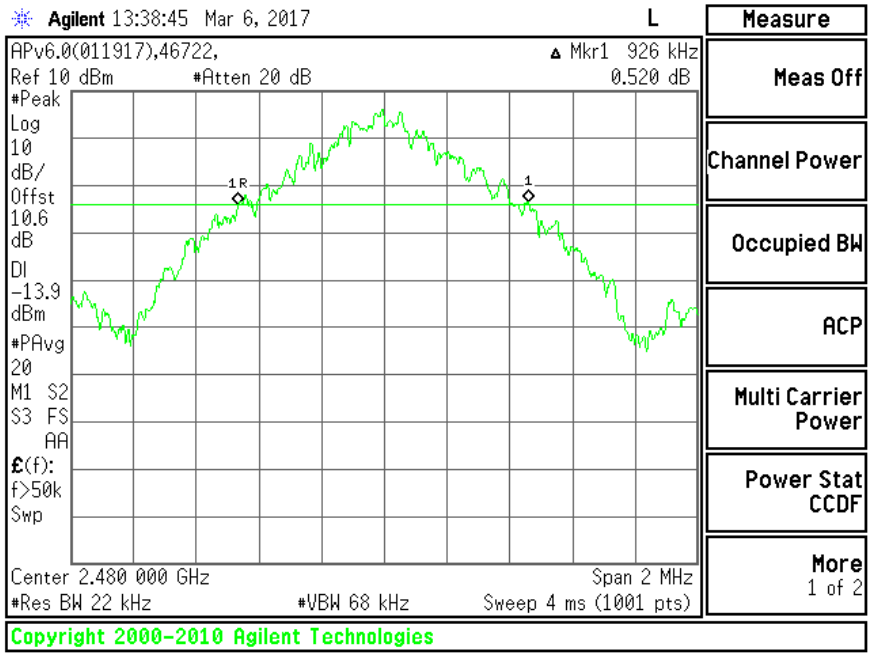
20 dB BANDWIDTH MID CH

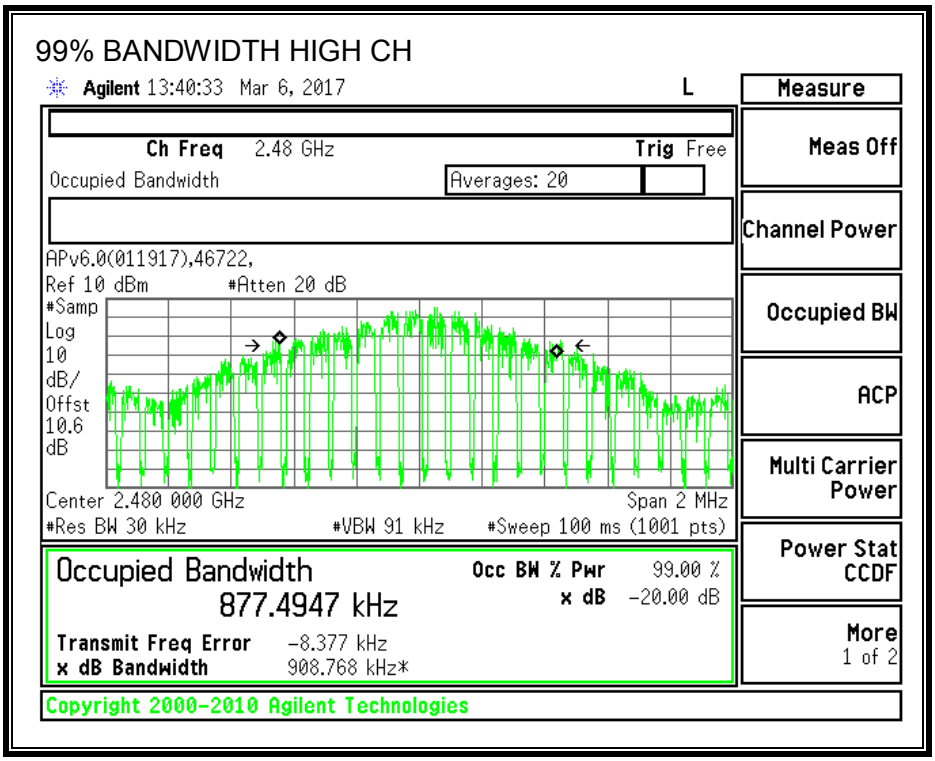


99% BANDWIDTH MID CH



20 dB BANDWIDTH HIGH CH





Test Information

Test Date: 2017-03-06

Project: 11602267

Tester: John Manser

8.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 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.

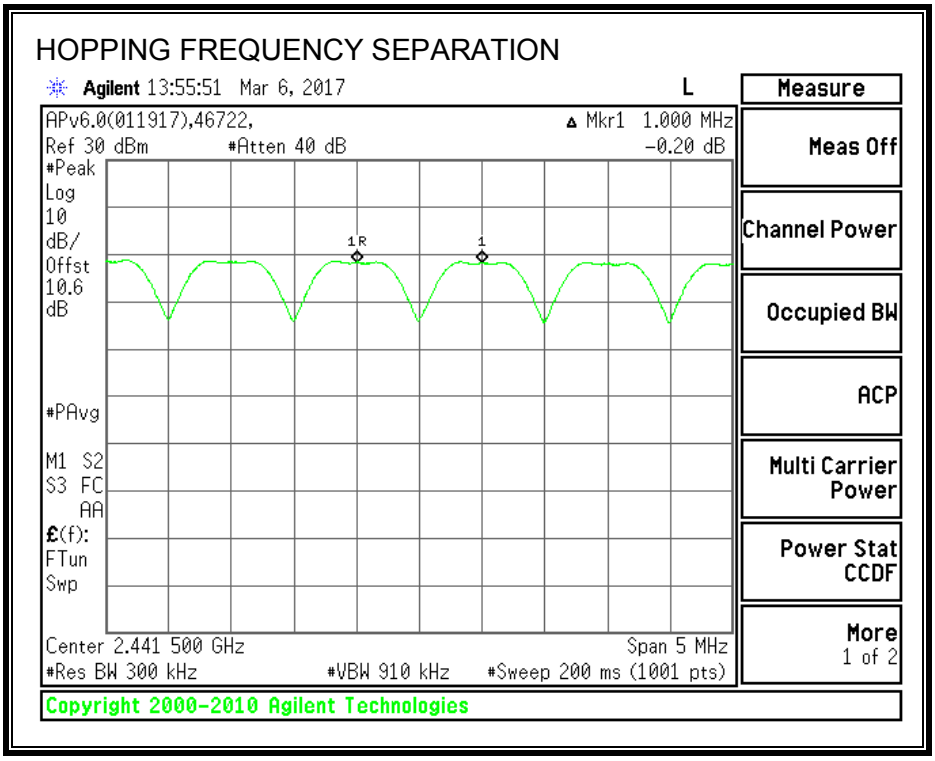
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



Ch. A (MHz)	Ch. B (MHz)	Ch. 1 to Ch. 2 Sep. (MHz)	Max. 20 dB BW (MHz)	Margin (MHz)
2441	2442	1.000	0.932	-0.068

Test Information

Test Date: 2017-03-06

Project: 11602267

Tester: John Manser

8.2.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 5.1 (4)

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

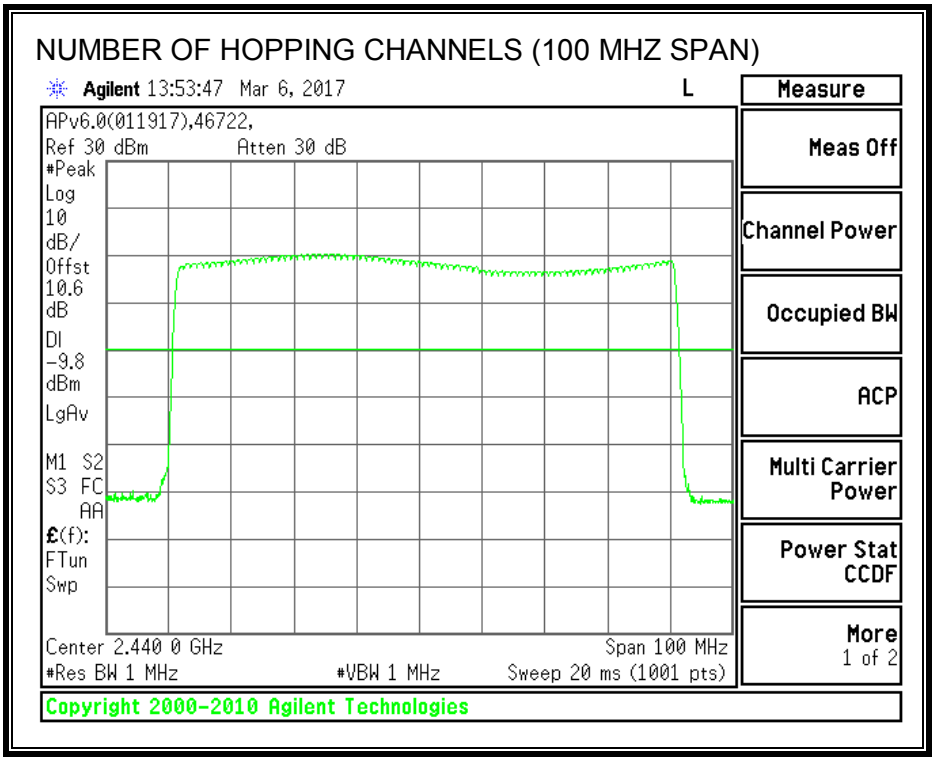
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

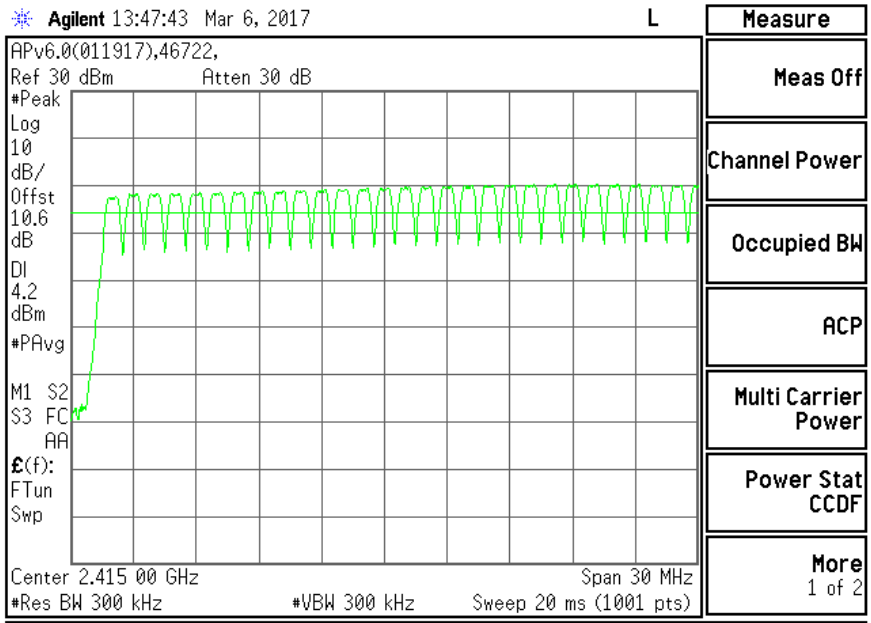
RESULTS

Normal Mode: 79 Channels observed.
AFH: 15 min declared.

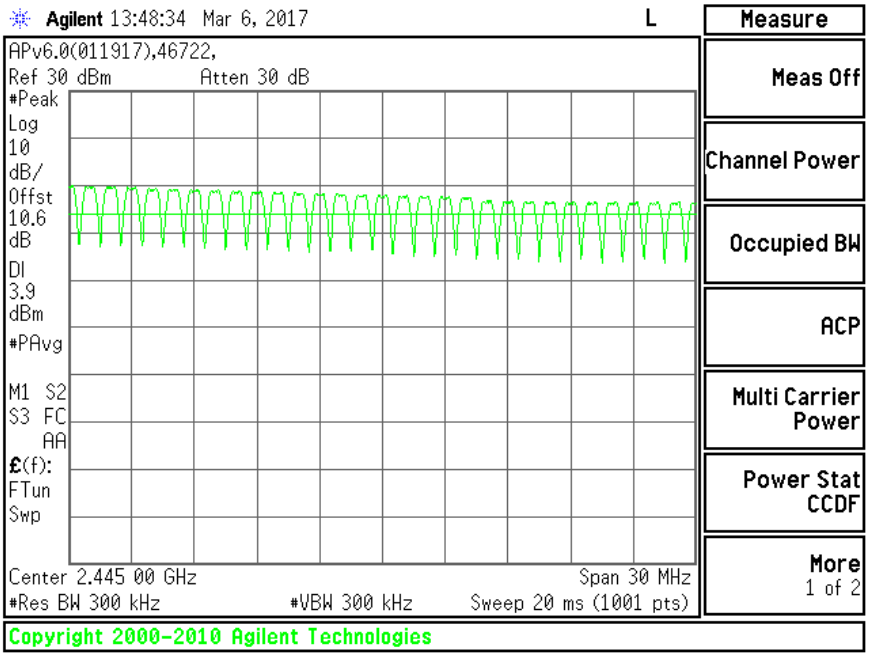
NUMBER OF HOPPING CHANNELS



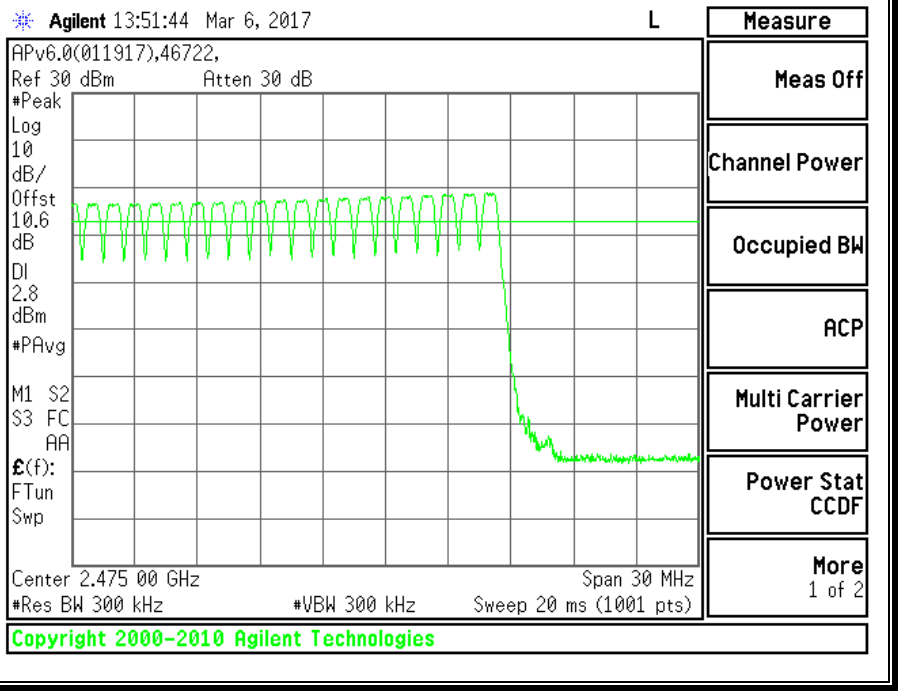
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



Test Information

Test Date: 2017-03-06

Project: 11602267

Tester: John Manser

8.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)
IC RSS-247 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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

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	0.403	32	0.129	0.4	-0.271
DH3	1.66	16	0.266	0.4	-0.134
DH5	2.908	10	0.291	0.4	-0.109
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	0.403	8	0.032	0.4	-0.368
DH3	1.66	4	0.066	0.4	-0.334
DH5	2.908	2.5	0.073	0.4	-0.327

Test Information
Test Date: 2017-03-06
Project: 11602267
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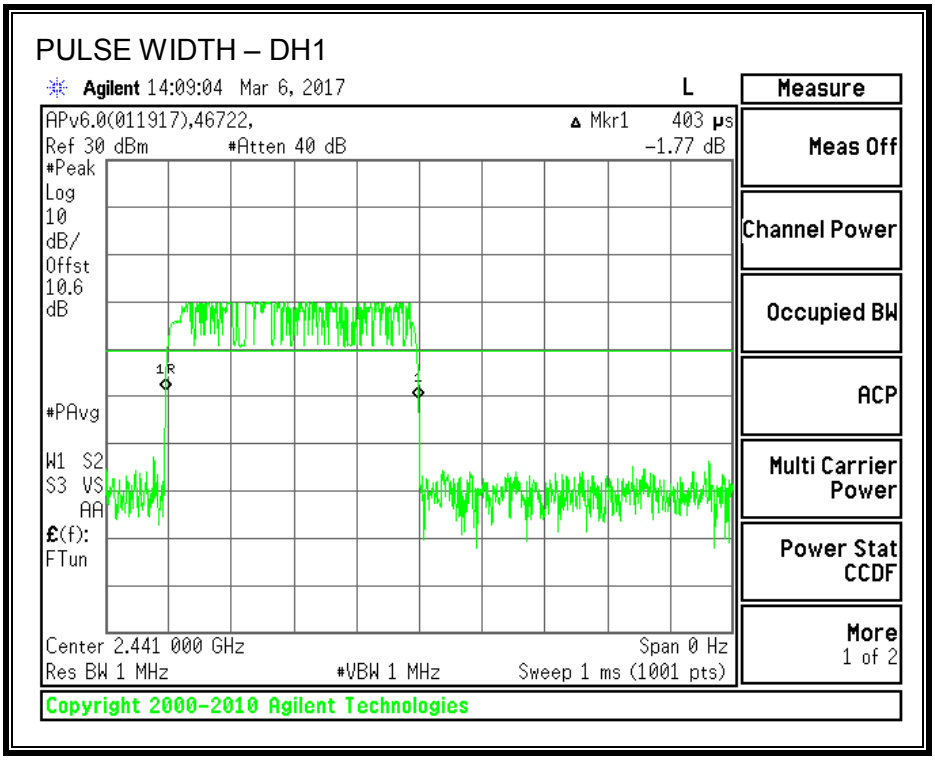
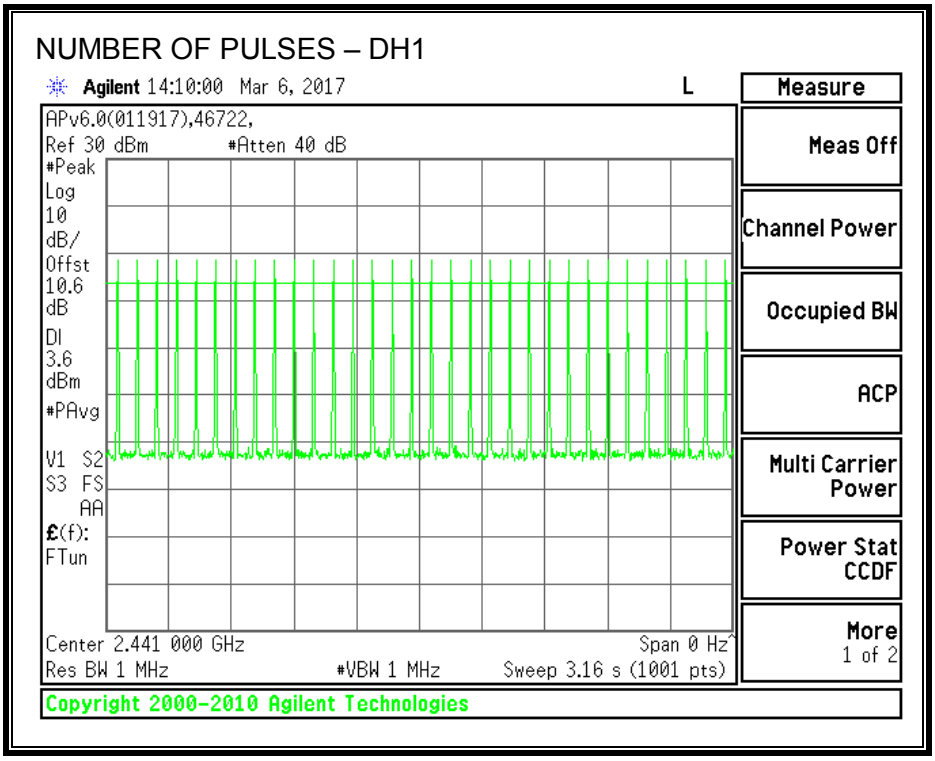
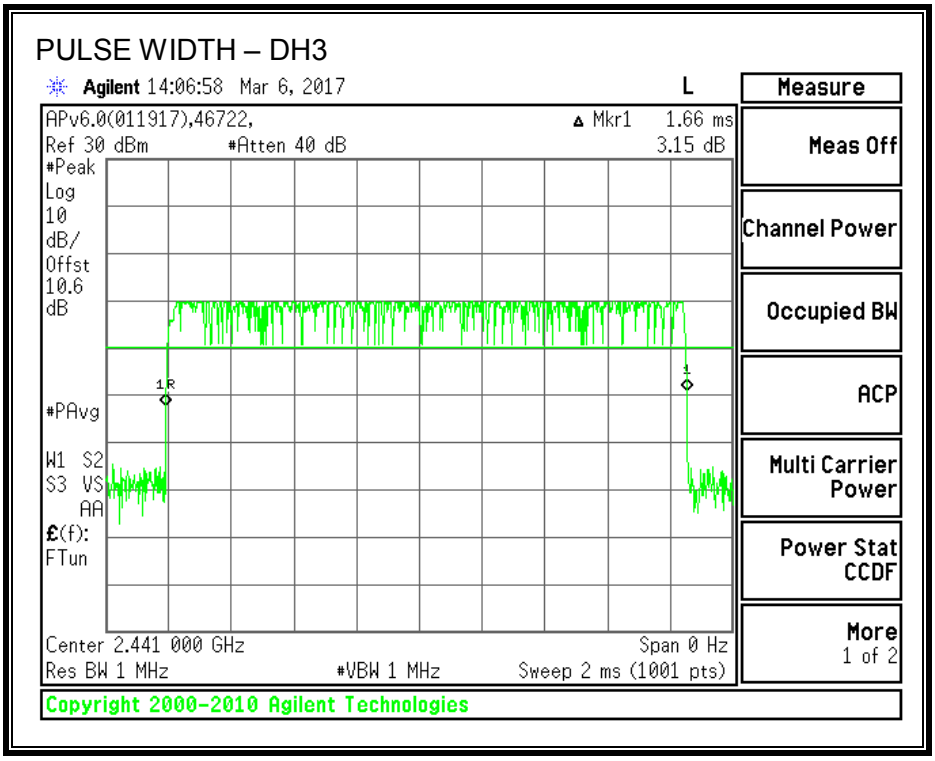
PULSE WIDTH - DH1



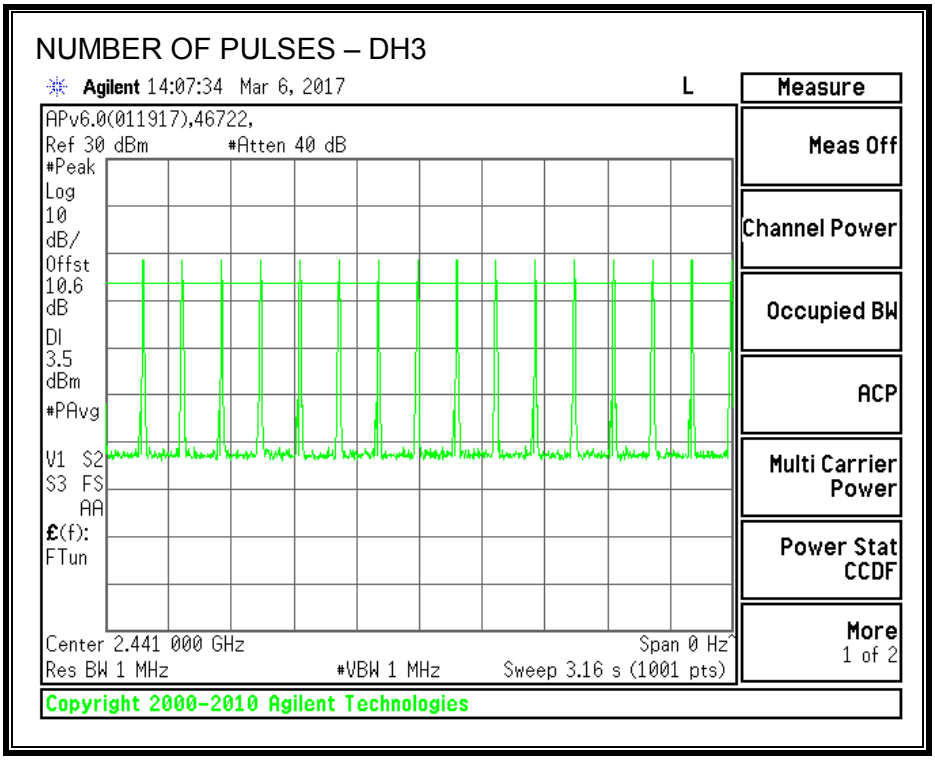
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



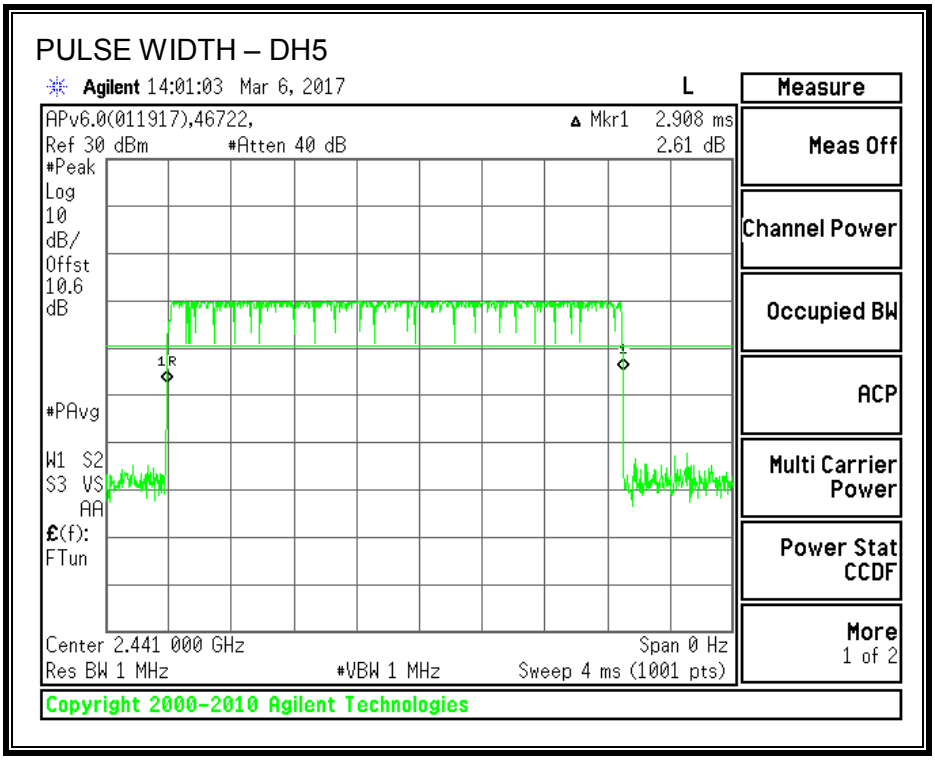
PULSE WIDTH – DH3



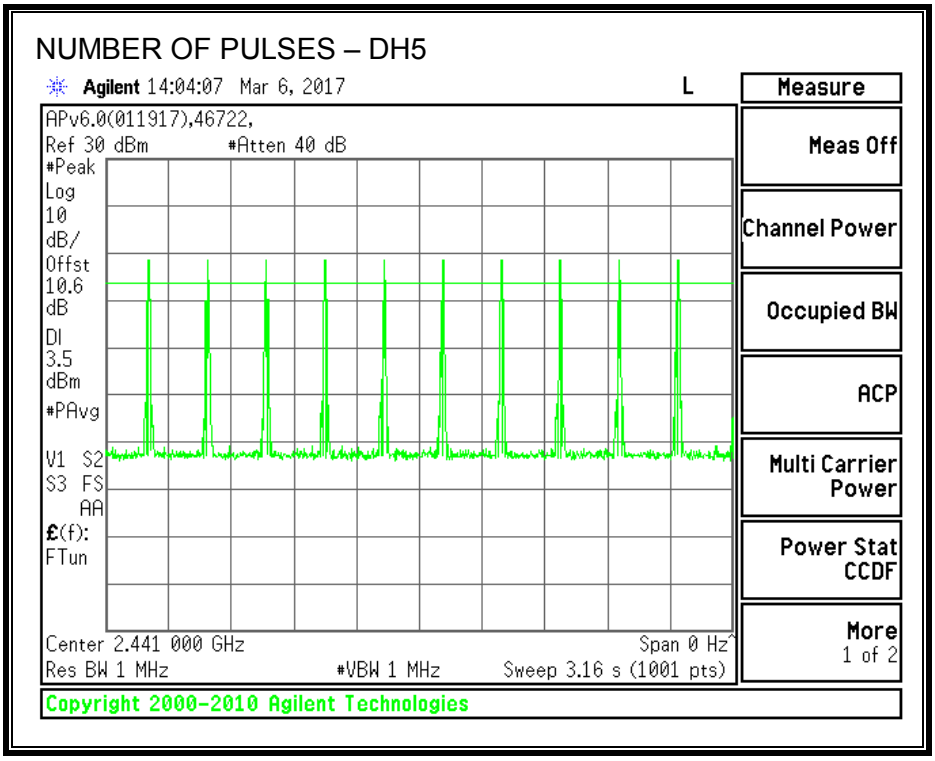
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.2.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247 5.4 (2)

For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	7.68	3.20	21	-13.32
Middle	2441	8.52	3.20	21	-12.48
High	2480	8.85	3.20	21	-12.15

TEST INFORMATION

Date 03/03/2017
Project No: 11602267
Tester: John Manser

8.2.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.6 dB (including 10 dB pad and 0.6 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.35
Middle	2441	8.20
High	2480	8.58

TEST INFORMATION

Date 03/03/2017
Project No: 11602267
Tester: John Manser

8.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

IC RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

TEST PROCEDURE

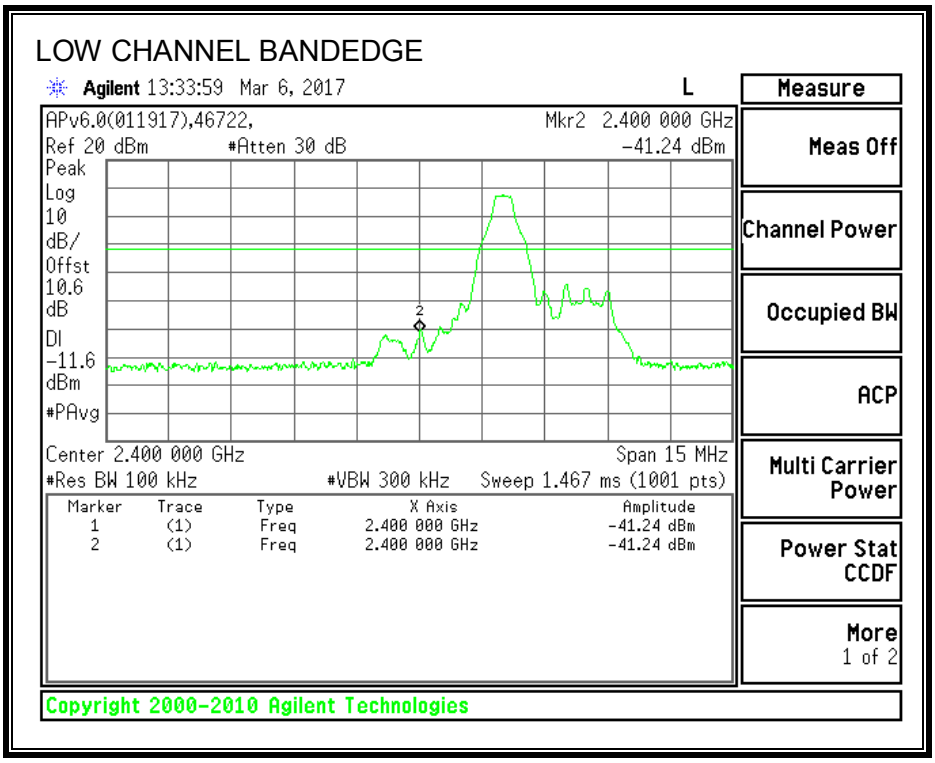
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

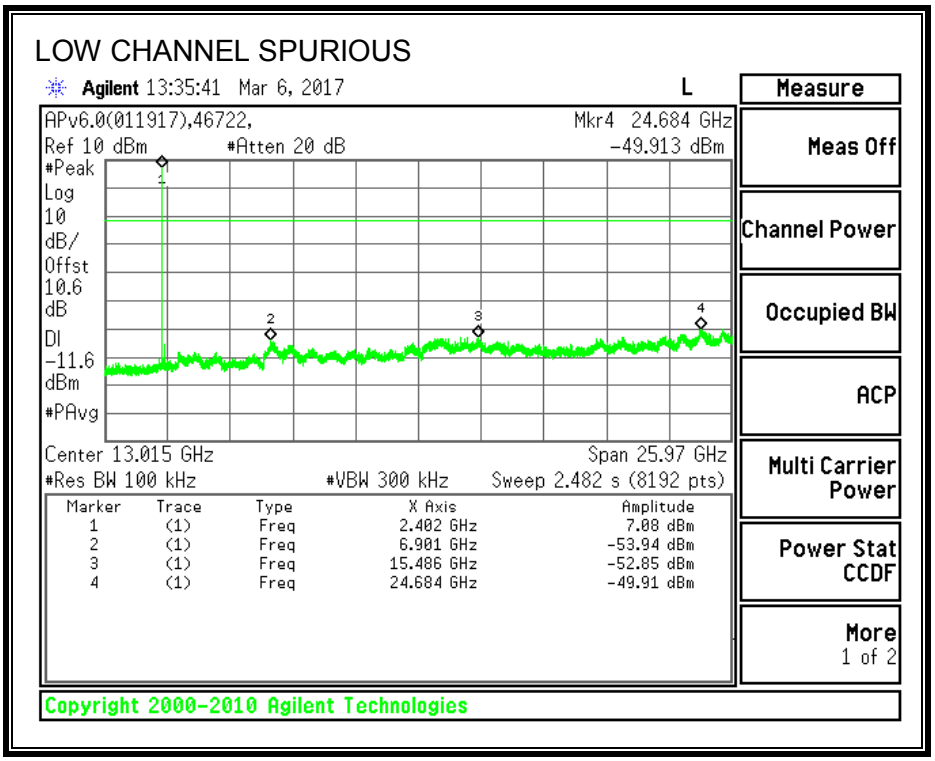
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

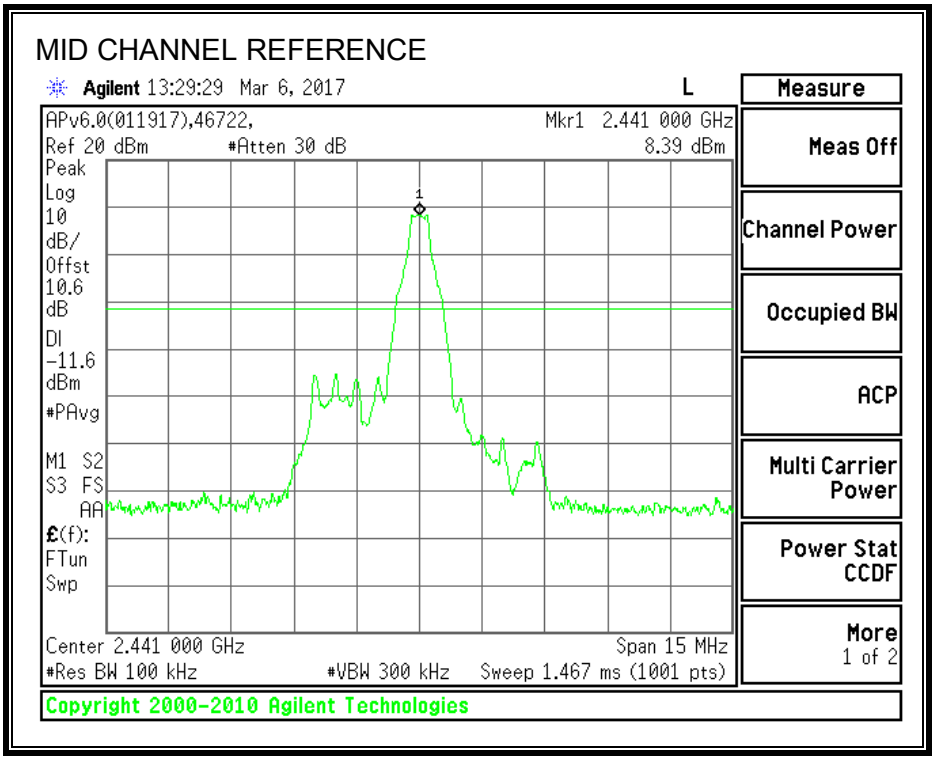
Test Information
Test Date: 2017-03-06
Project: 11602267
Tester: John Manser

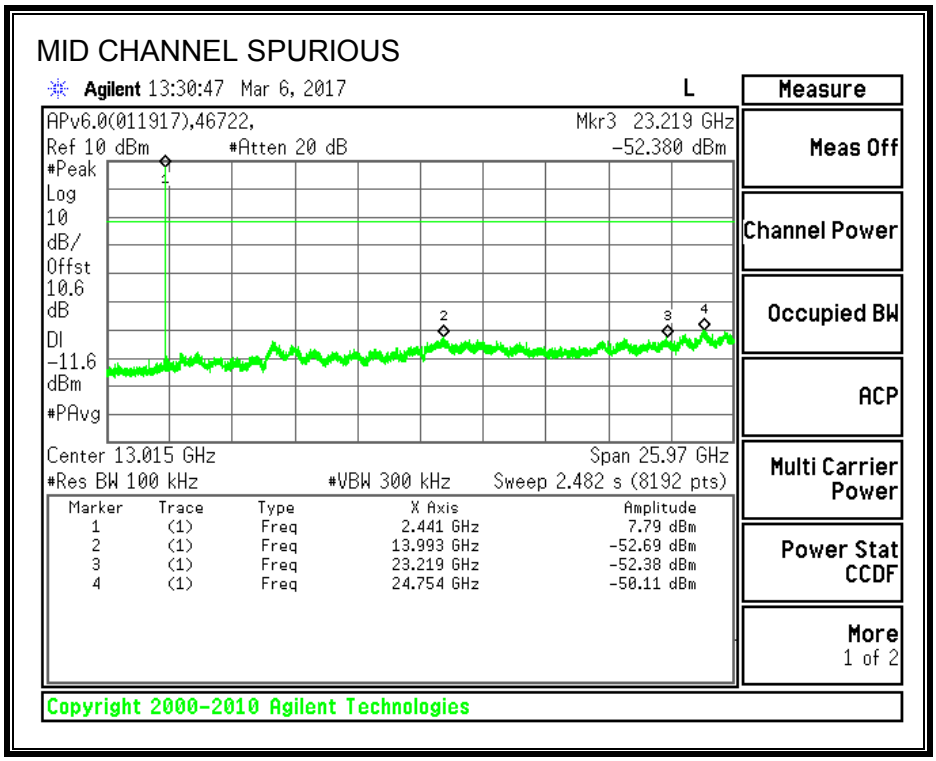
RESULTS
SPURIOUS EMISSIONS, LOW CHANNEL



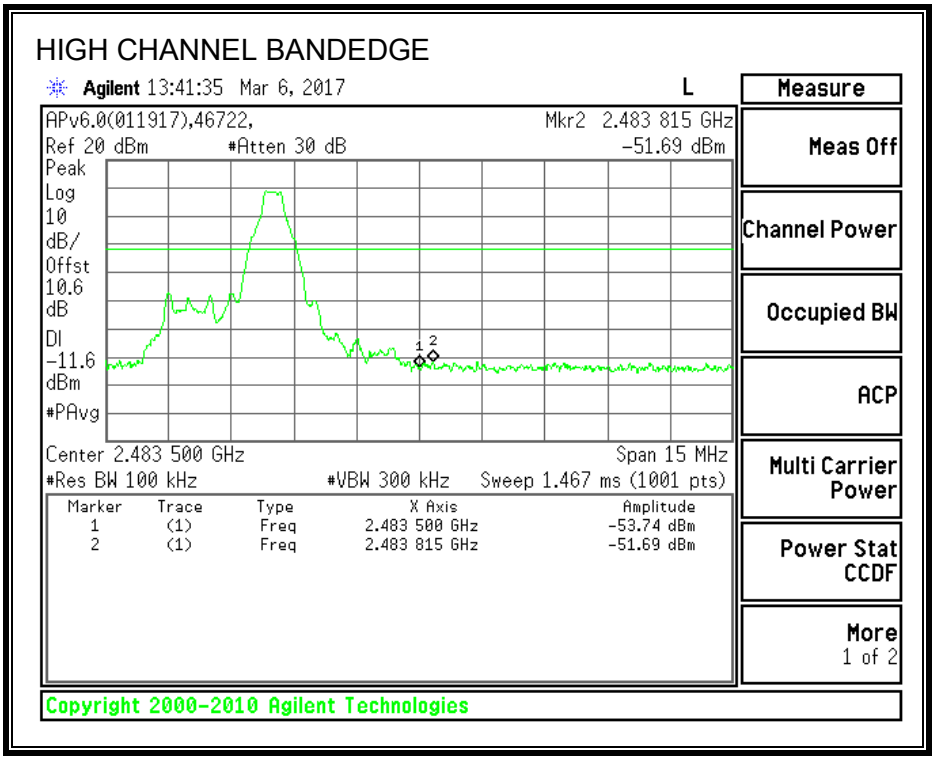


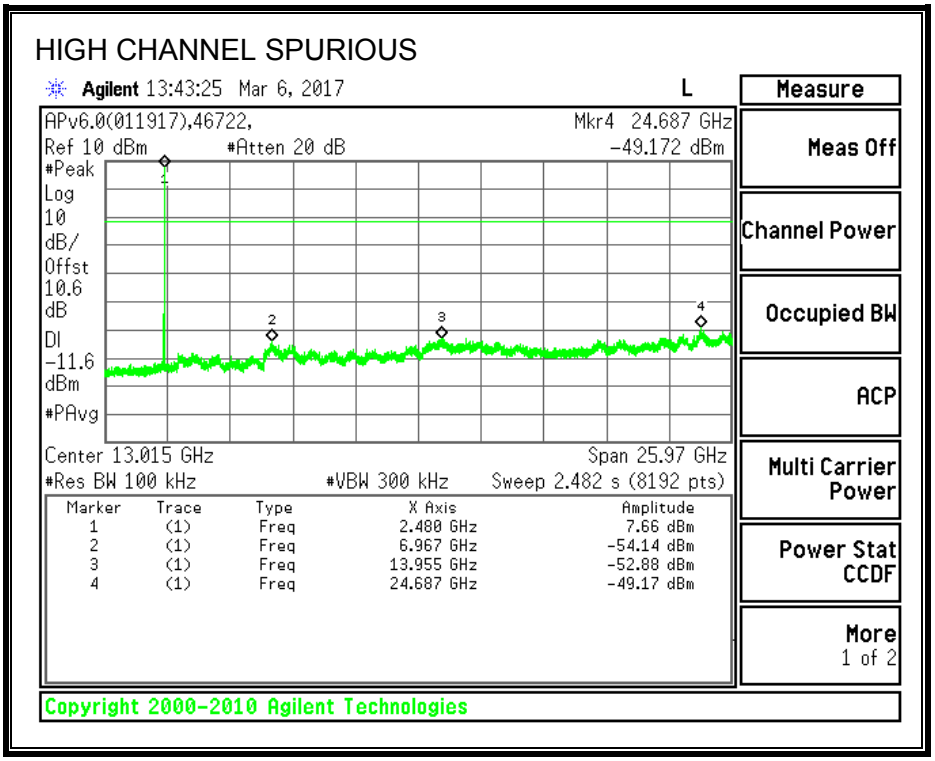
SPURIOUS EMISSIONS, MID CHANNEL





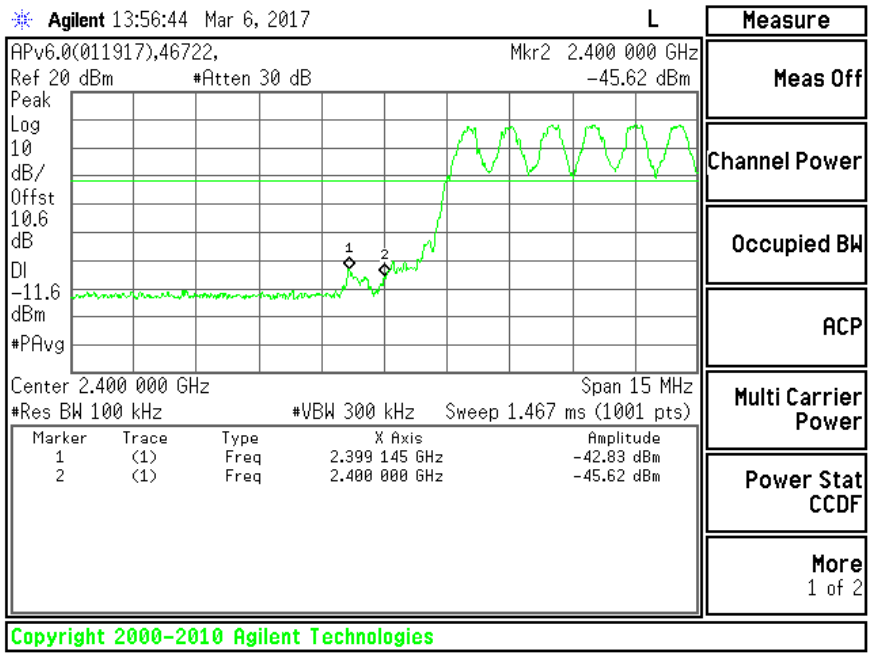
SPURIOUS EMISSIONS, HIGH CHANNEL



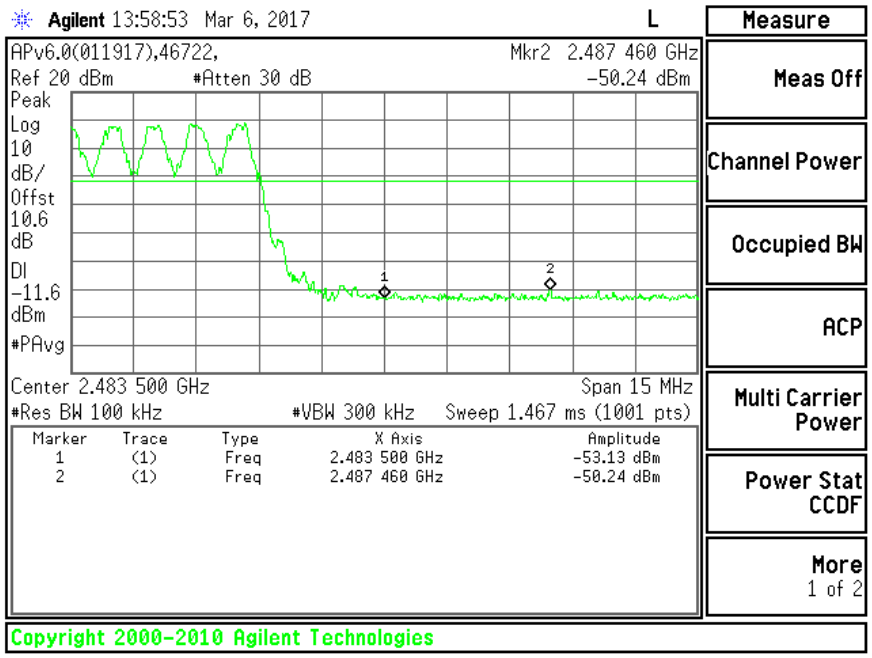


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



8.3. ENHANCED DATA RATE QPSK MODULATION

8.3.1. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

RESULTS

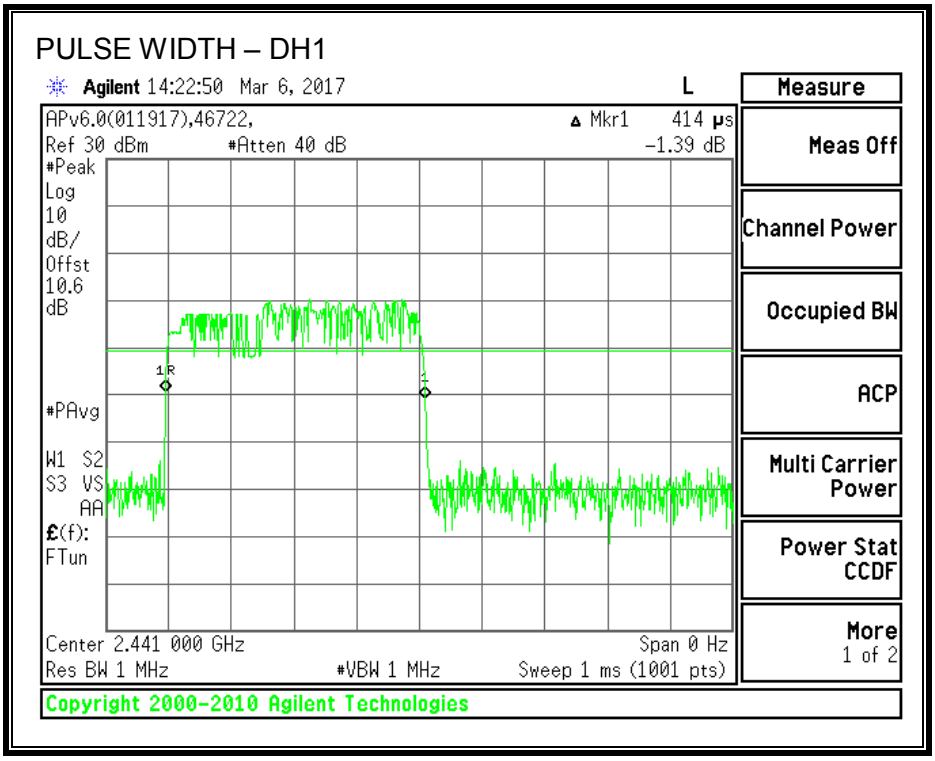
Time Of Occupancy = 10 * xx pulses * yy msec = zz msec

DQPSK Mode

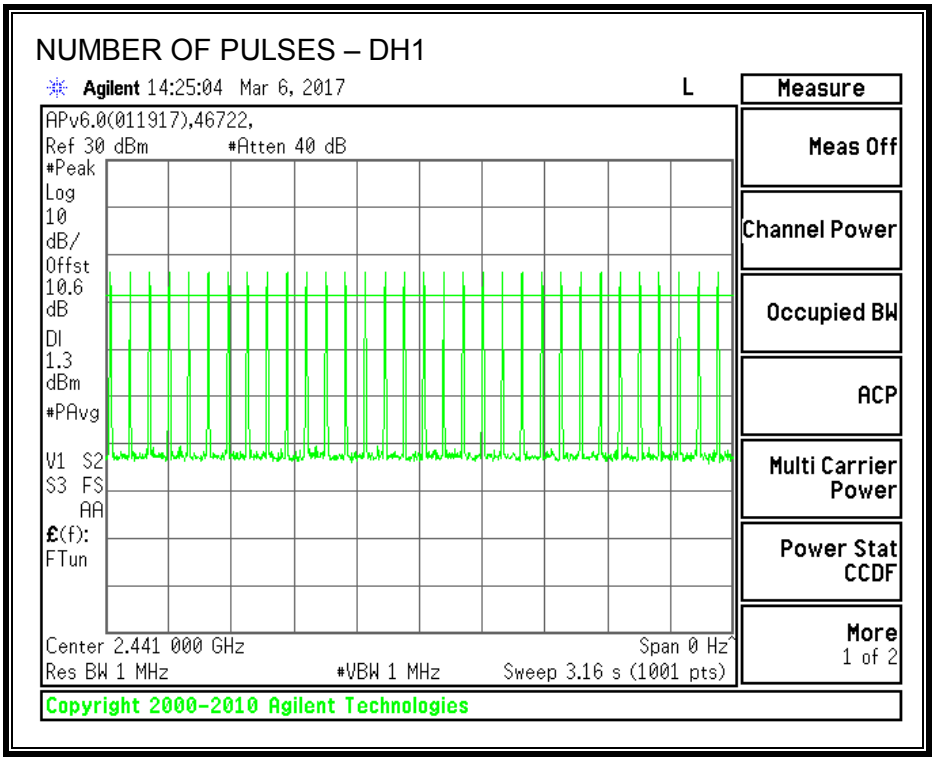
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
2DH1	0.414	32	0.132	0.4	-0.268
2DH3	1.666	16	0.267	0.4	-0.133
2DH5	2.916	11	0.321	0.4	-0.079

Test Information
Test Date: 2017-03-06
Project: 11602267
Tester: John Manser

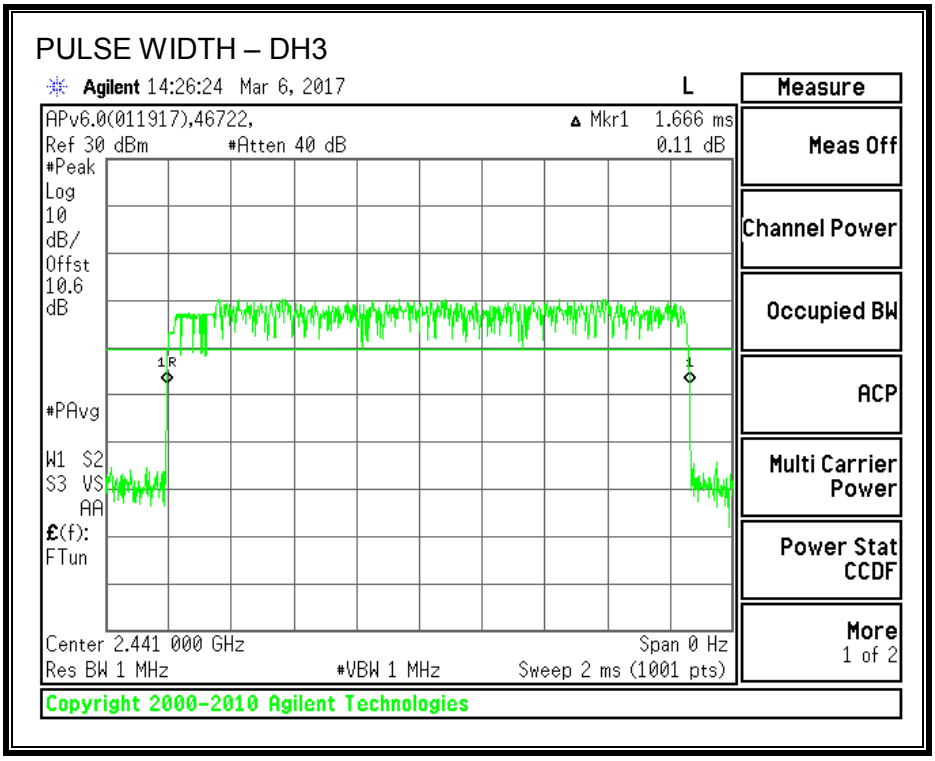
PULSE WIDTH - DH1



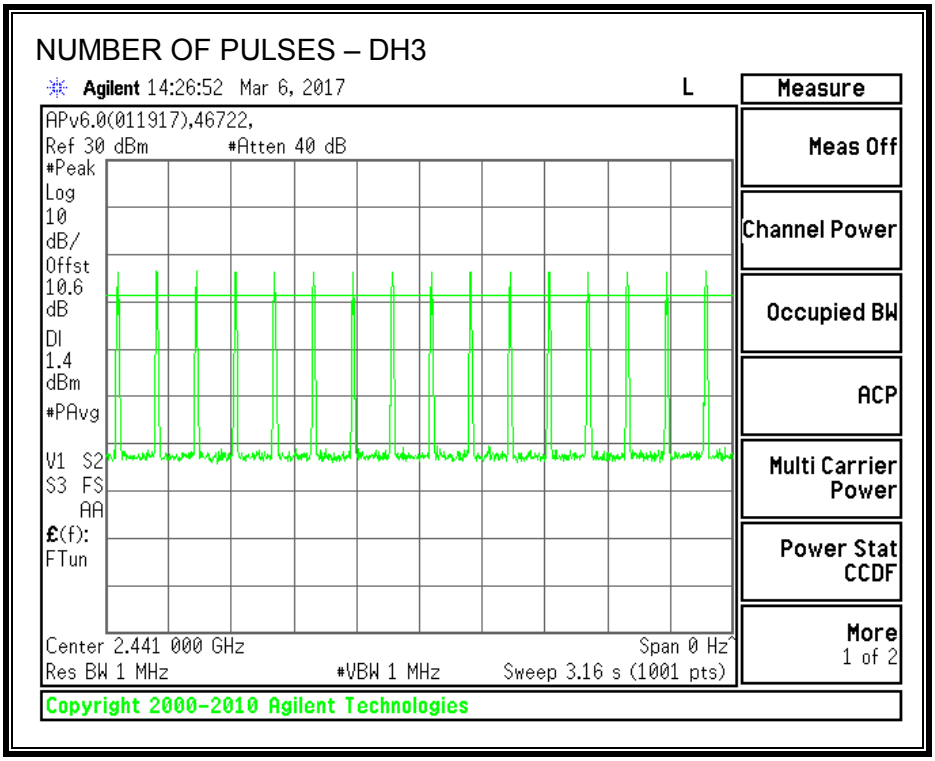
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



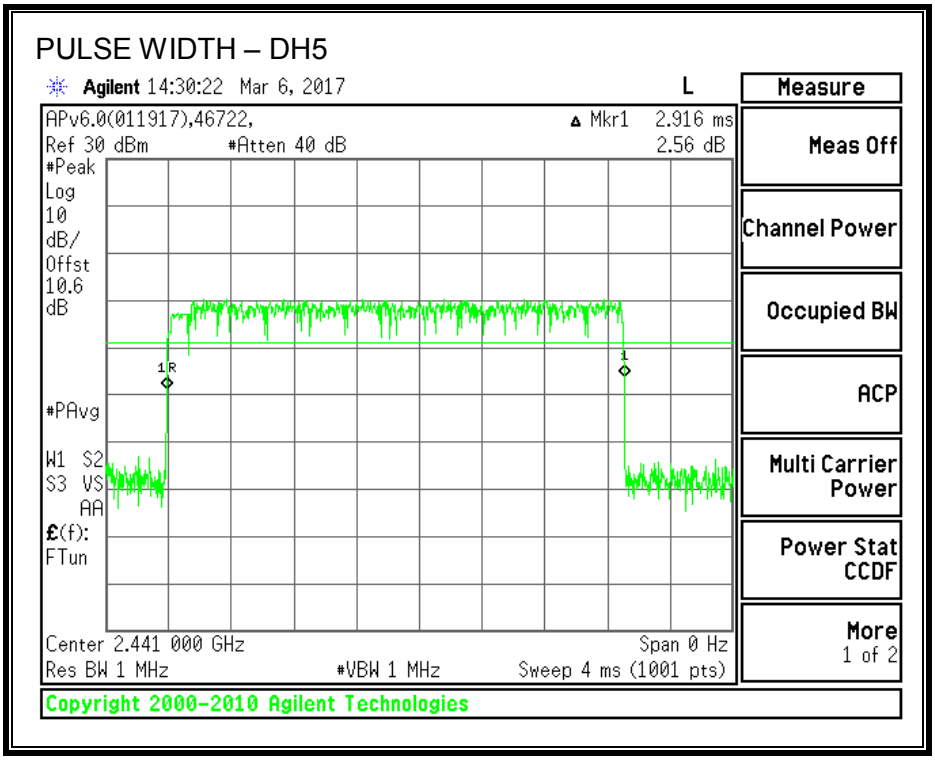
PULSE WIDTH – DH3



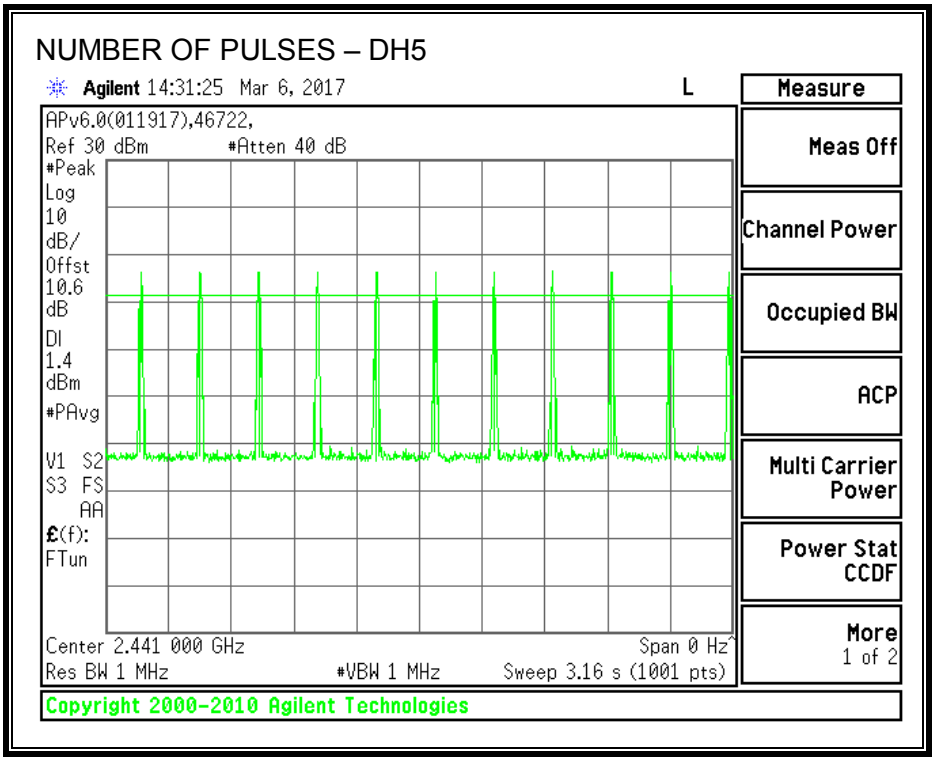
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.3.2. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247 5.4 (2)

For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	5.76	3.20	21	-15.24
Middle	2441	6.89	3.20	21	-14.11
High	2480	7.17	3.20	21	-13.83

TEST INFORMATION

Date 03/03/2017
Project No: 11602267
Tester: John Manser

8.3.3. AVERAGE

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.6 dB (including 10 dB pad and 0.6 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.40
Middle	2441	4.61
High	2480	4.90

TEST INFORMATION

Date 03/03/2017
Project No: 11602267
Tester: John Manser

8.4. ENHANCED DATA RATE 8PSK MODULATION

8.4.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.
est per FCC §15.247(a)(1); IC RSS-247 5.1 (1), RSS-Gen 6.6.

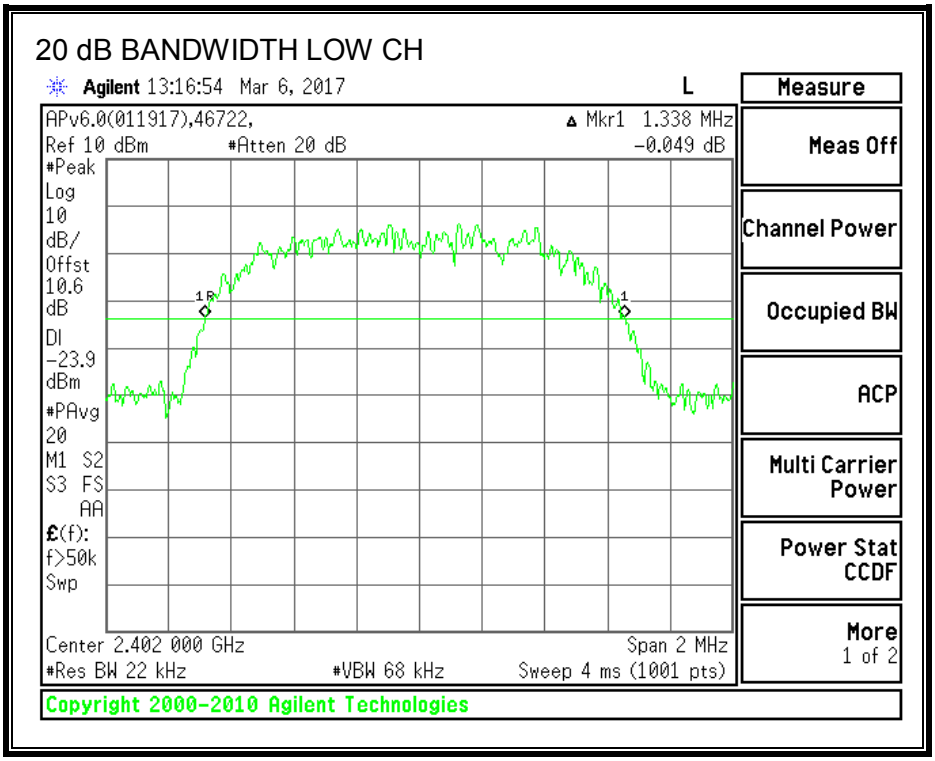
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

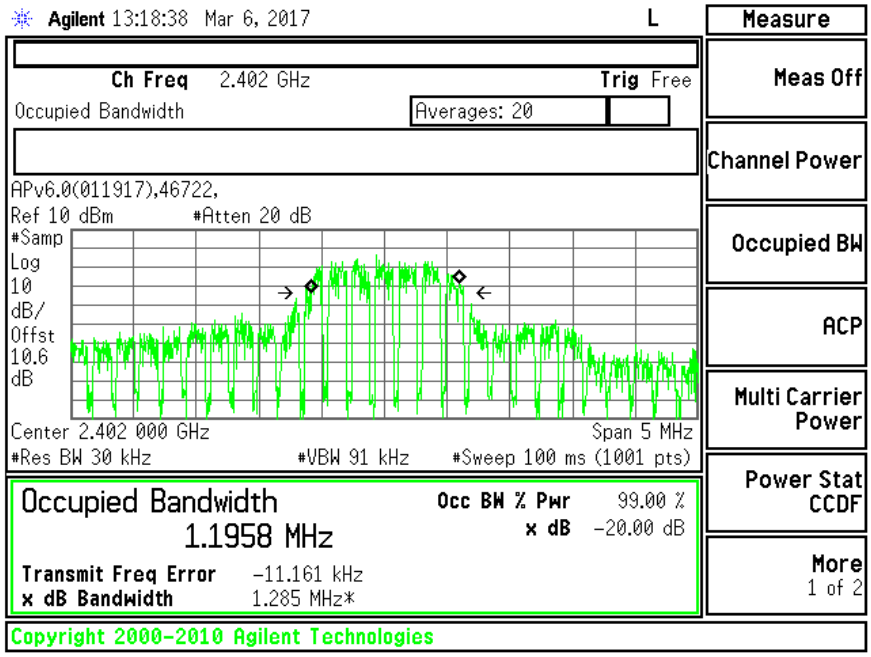
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1338	1195.8
Middle	2441	1324	1202.4
High	2480	1296	1207.9

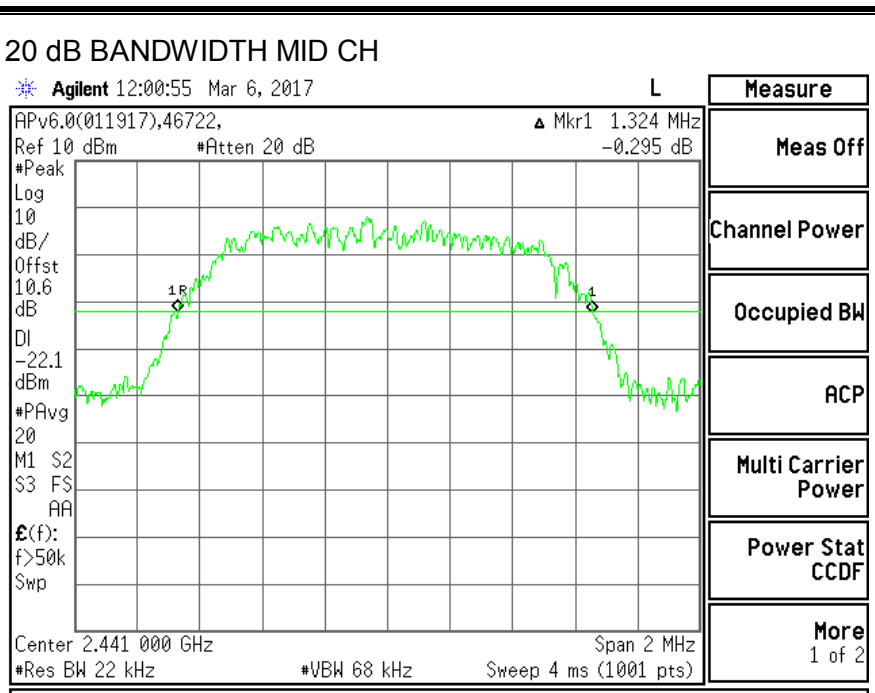
20 dB AND 99% BANDWIDTH



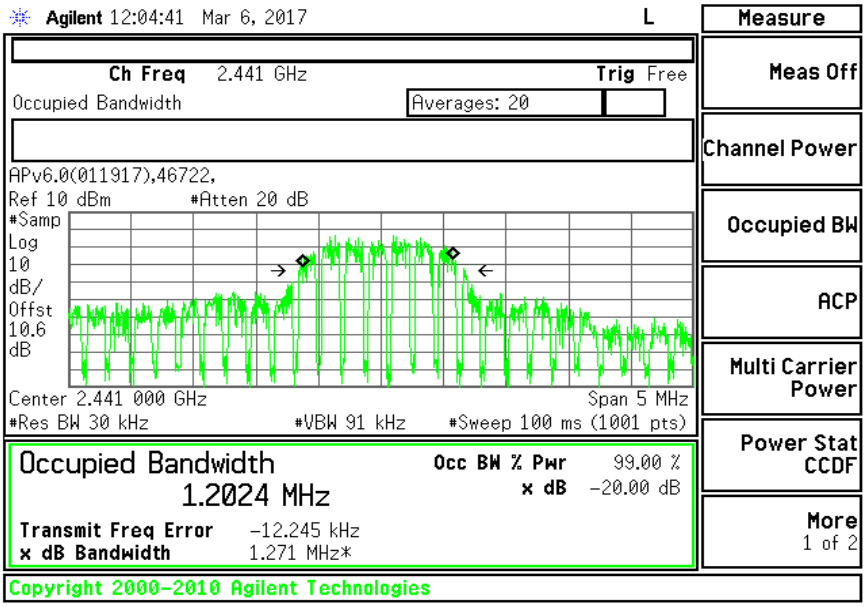
99% BANDWIDTH LOW CH



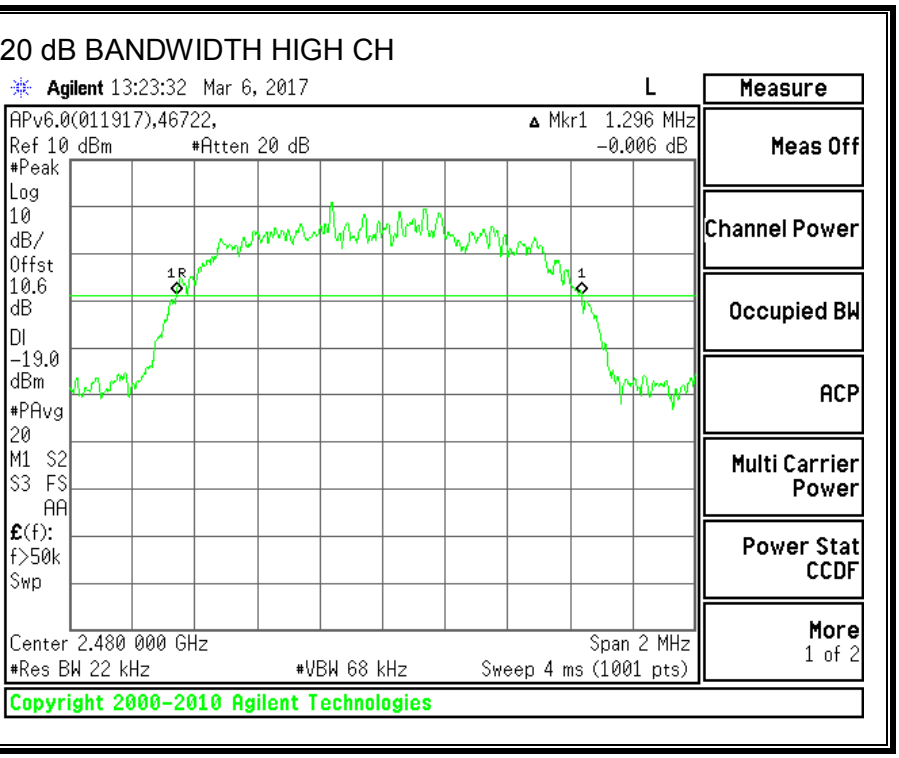
20 dB BANDWIDTH MID CH

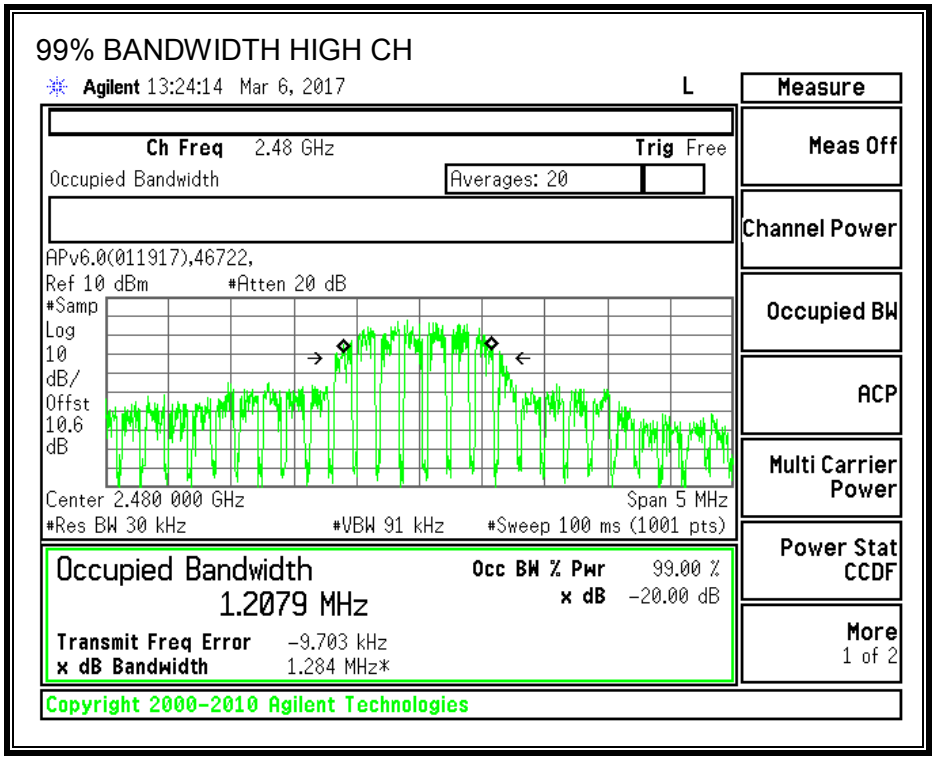


99% BANDWIDTH MID CH



20 dB BANDWIDTH HIGH CH





Test Information

Test Date: 2017-03-06

Project: 11602267

Tester: John Manser

8.4.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 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 hopping channel, whichever is greater.

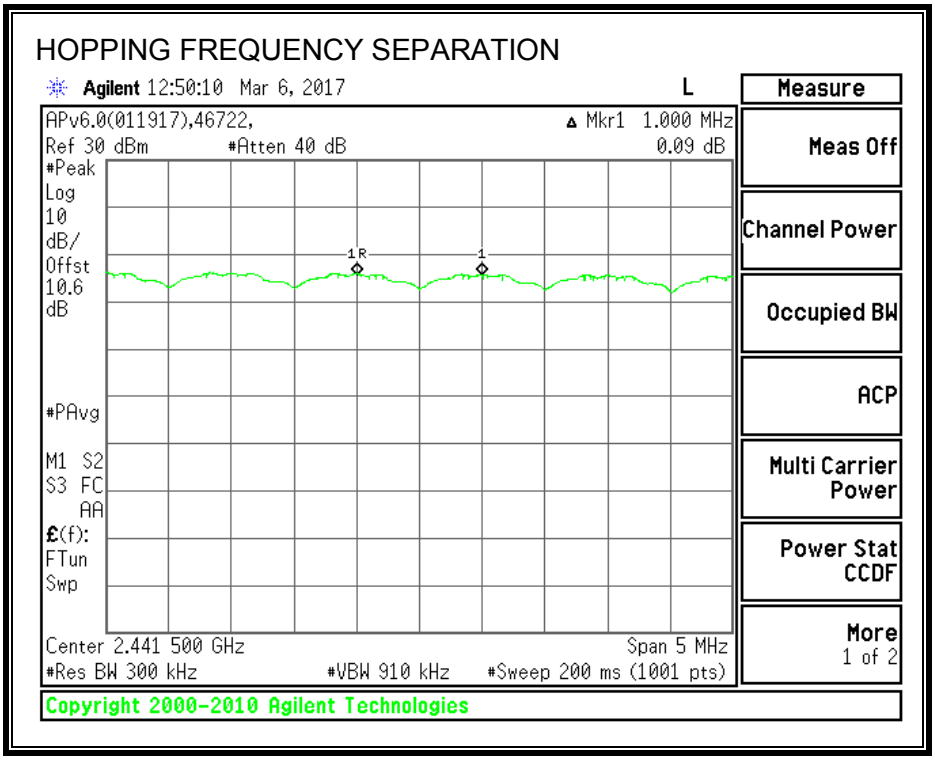
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



Ch. A (MHz)	Ch. B (MHz)	Ch. 1 to Ch. 2 Sep. (MHz)	Max. 20 dB BW (MHz)	Margin (MHz)
2441	2442	1.000	1.338	-0.338

TEST INFORMATION
Date: 2017-03-06
Project No: 11602267
Tester: John Manser

8.4.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 5.1 (4)

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

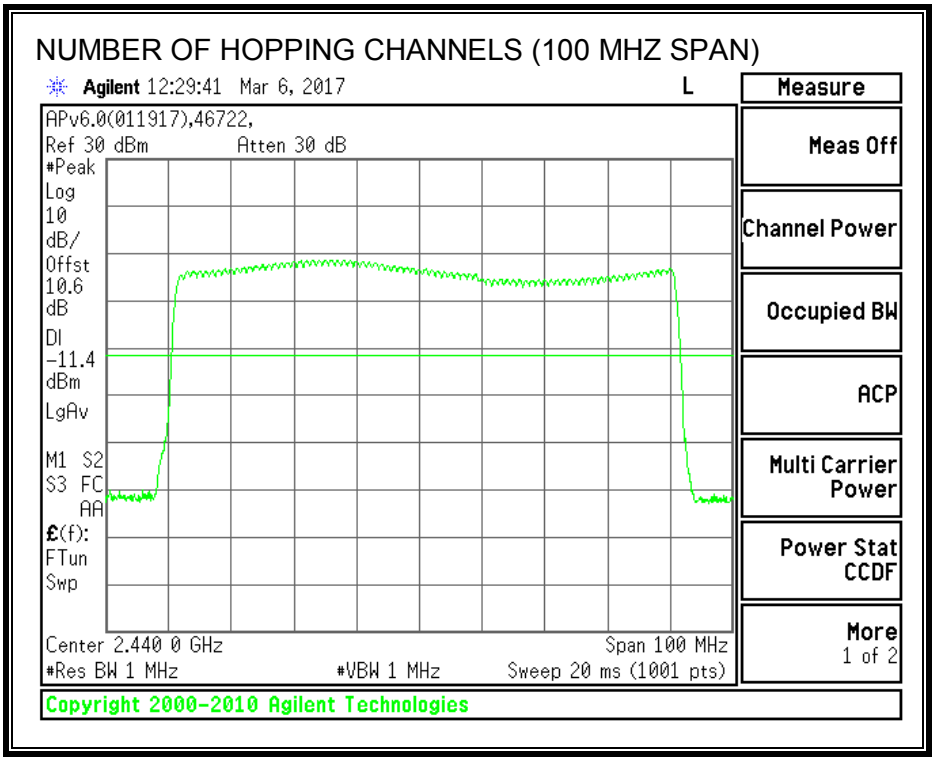
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

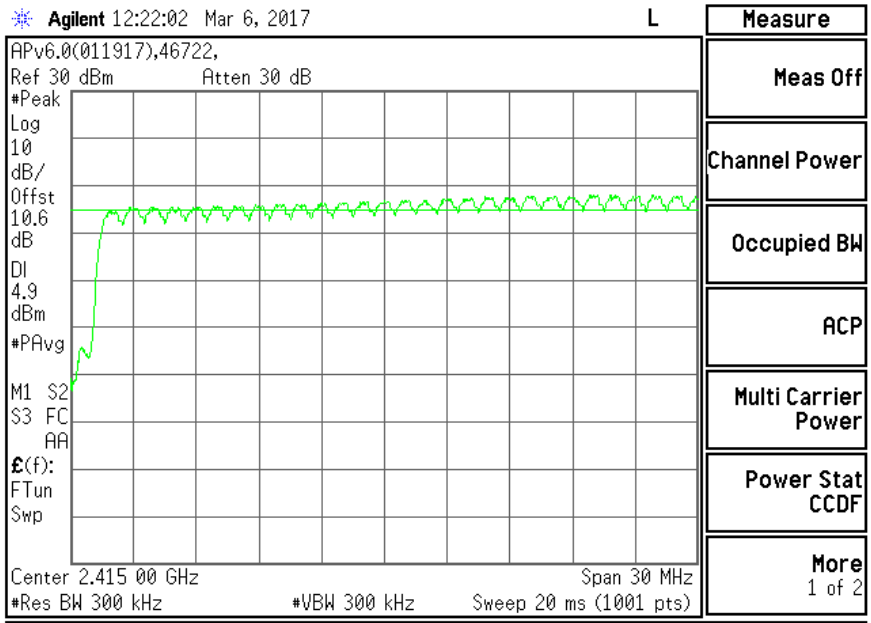
RESULTS

Normal Mode: 79 Channels observed.
AFH mode: 15 min declared.

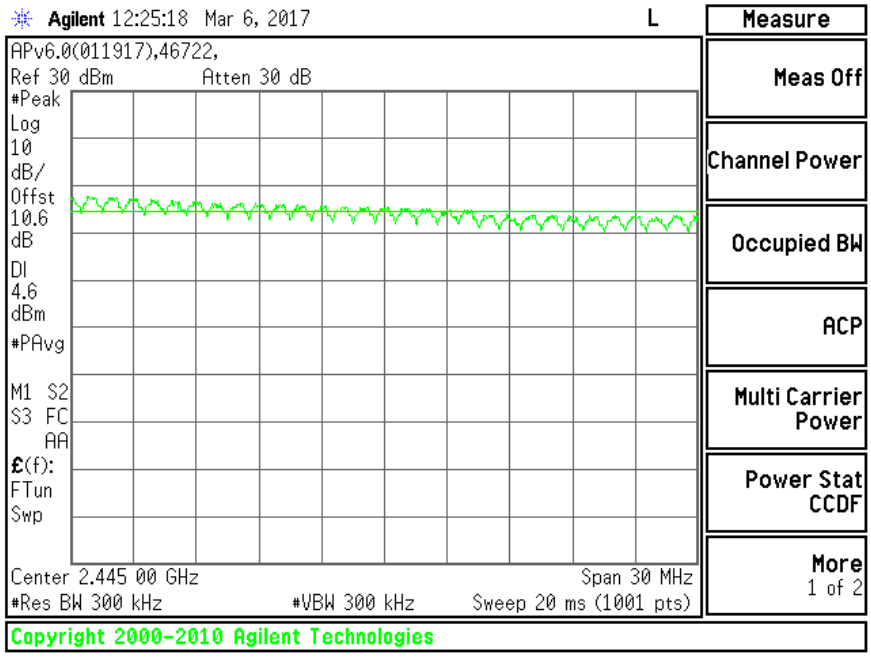
NUMBER OF HOPPING CHANNELS



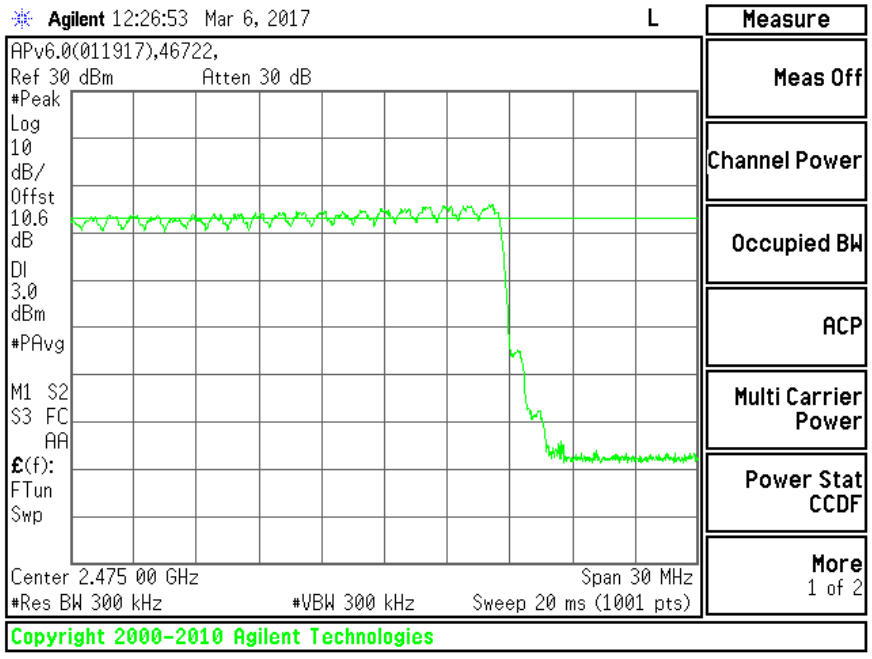
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



TEST INFORMATION
Date: 2017-03-06
Project No: 11602267
Tester: John Manser

8.4.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 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.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

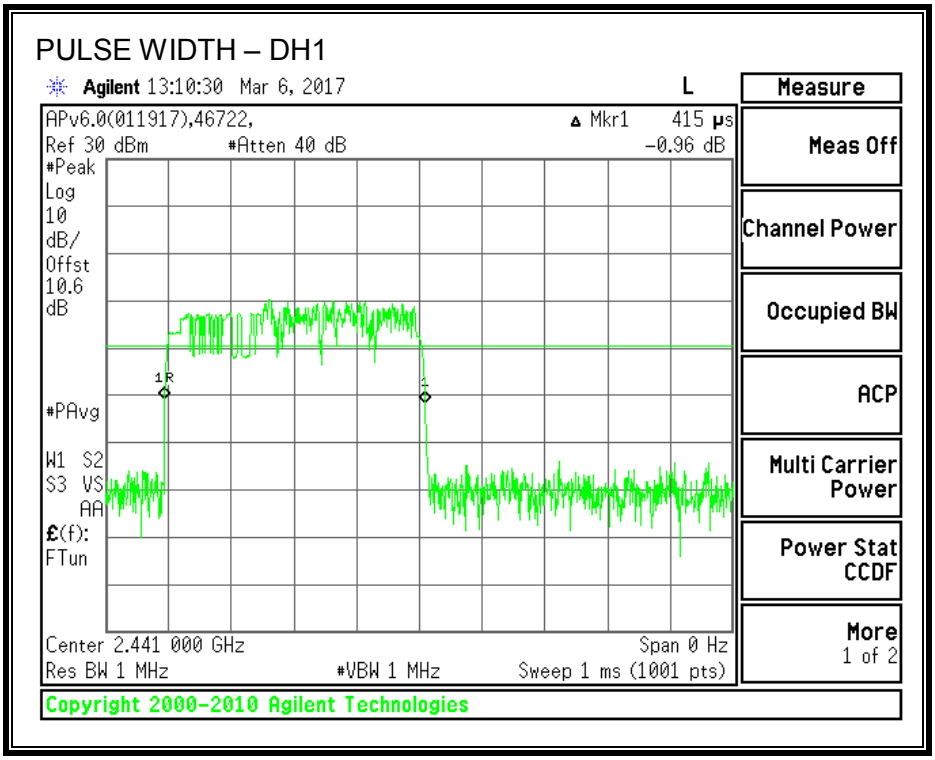
RESULTS

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

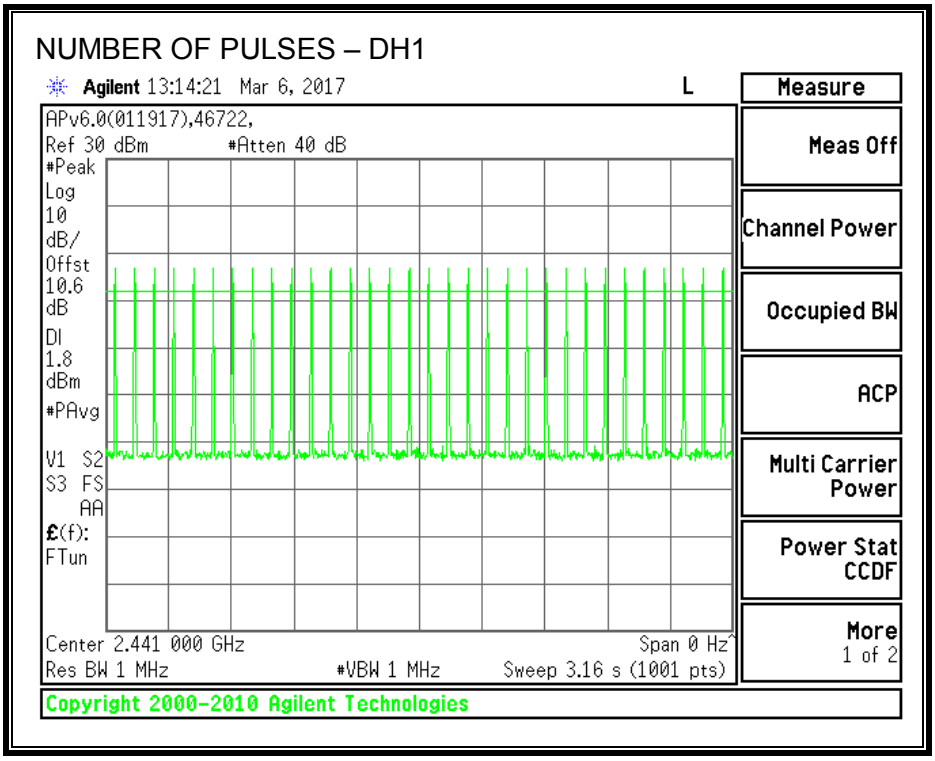
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
DH1	0.415	32	0.133	0.4	-0.267
DH3	1.664	16	0.266	0.4	-0.134
DH5	2.912	11	0.320	0.4	-0.080
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK AFH Mode					
DH1	0.415	8	0.033	0.4	-0.367
DH3	1.664	4	0.067	0.4	-0.333
DH5	2.912	2.75	0.080	0.4	-0.320

TEST INFORMATION
Date: 2017-03-06
Project No: 11602267
Tester: John Manser

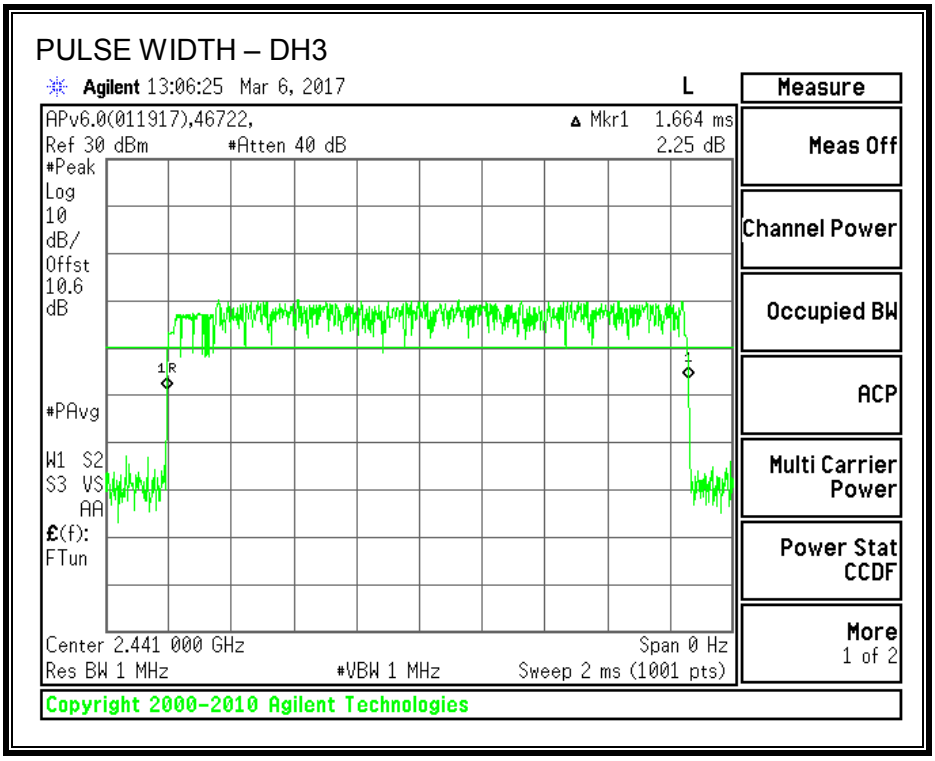
PULSE WIDTH - DH1



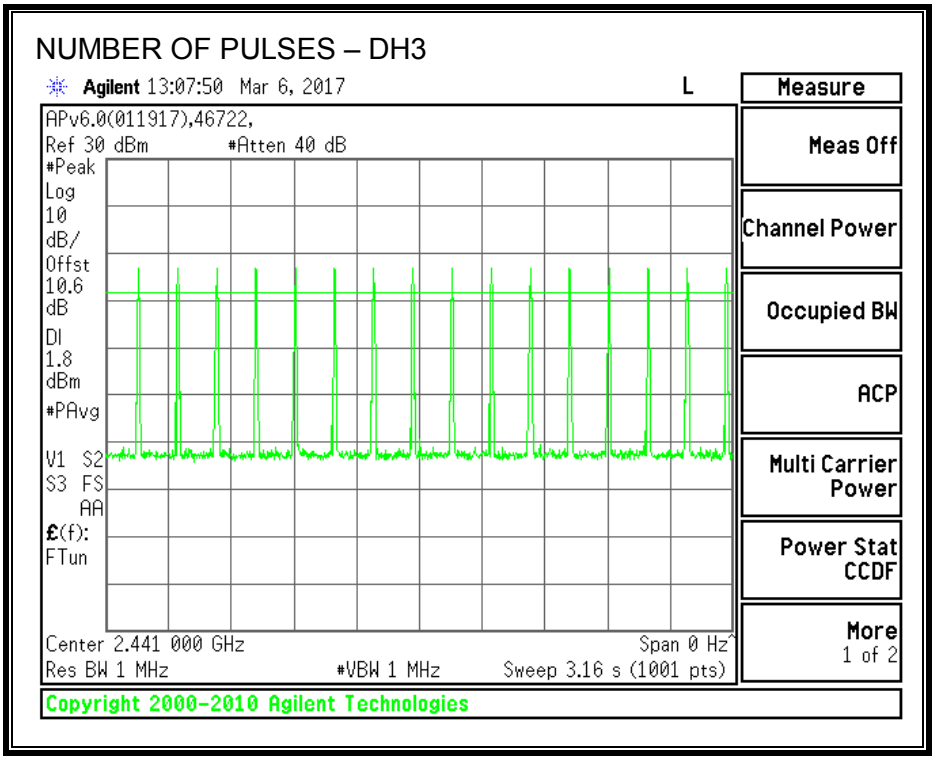
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



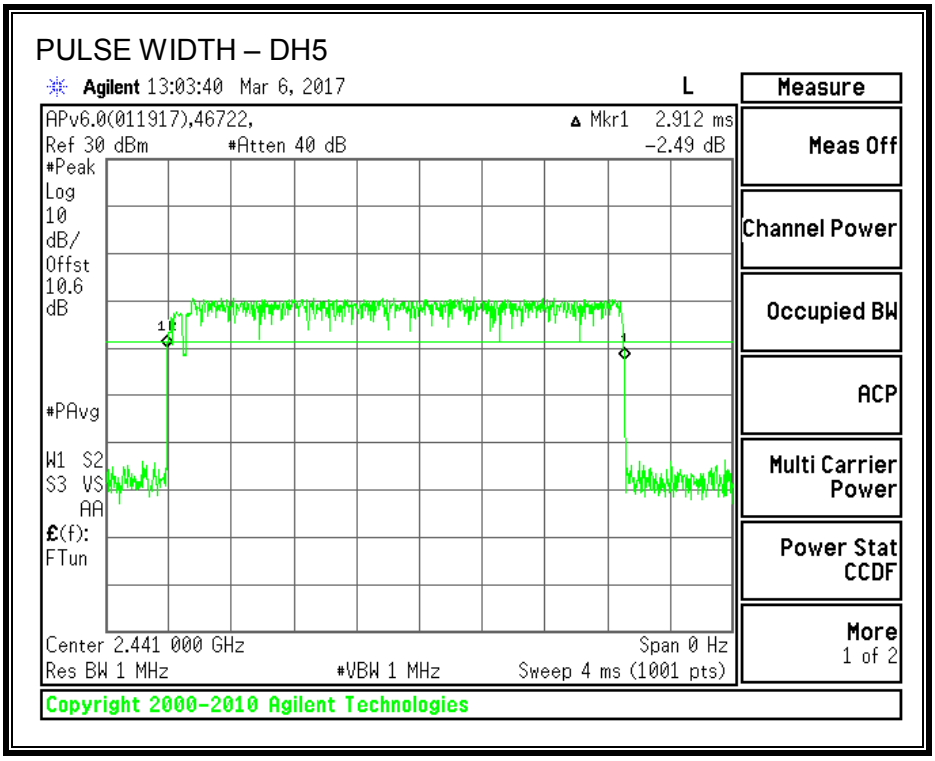
PULSE WIDTH – DH3



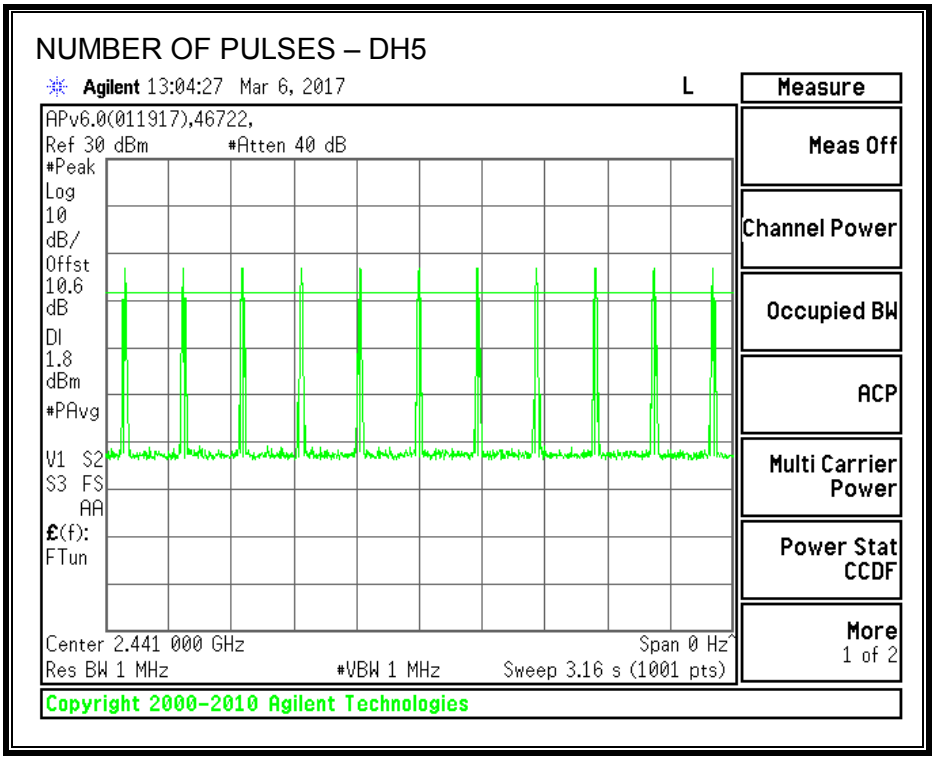
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.4.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

RSS-247 5.4 (2)

For frequency hopping systems operating in the band 2400-2483.5 MHz and employing at least 75 hopping channels, the maximum peak conducted output power shall not exceed 1 W; for all other frequency hopping systems in the band, the maximum peak conducted output power shall not exceed 0.125 W.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	6.11	3.20	21	-14.89
Middle	2441	7.17	3.20	21	-13.83
High	2480	7.51	3.20	21	-13.49

TEST INFORMATION

Date 03/03/2017
Project No: 11602267
Tester: John Manser

8.4.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.6 dB (including 10 dB pad and 0.6 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	3.39
Middle	2441	4.59
High	2480	4.88

TEST INFORMATION

Date 03/03/2017
Project No: 11602267
Tester: John Manser

8.4.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

IC RSS-247 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section A8.4 (4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

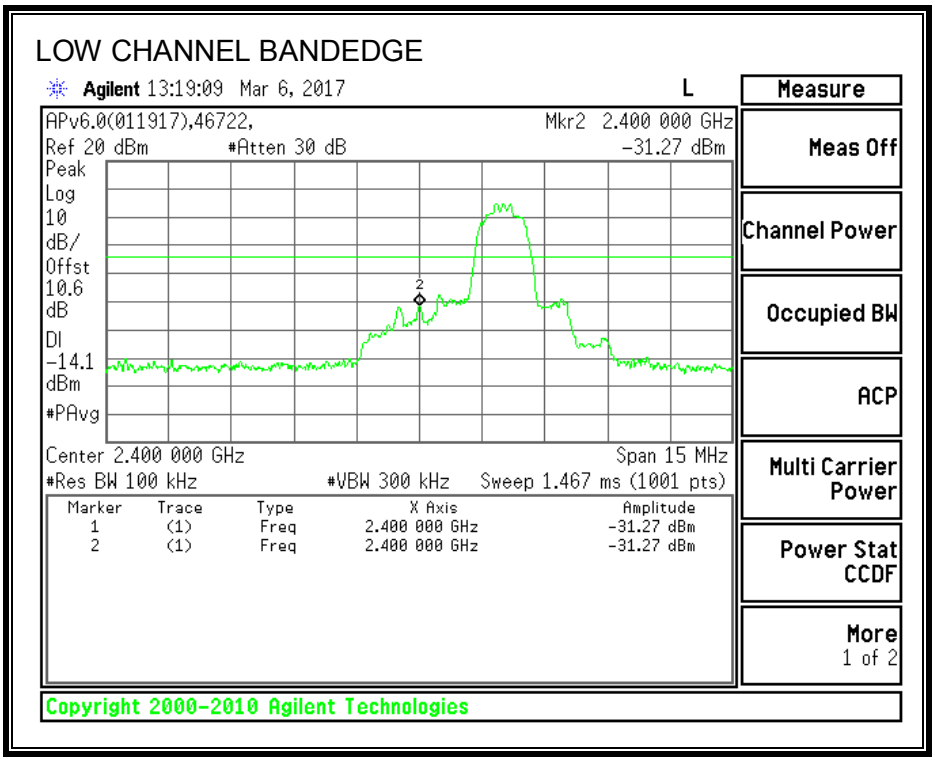
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

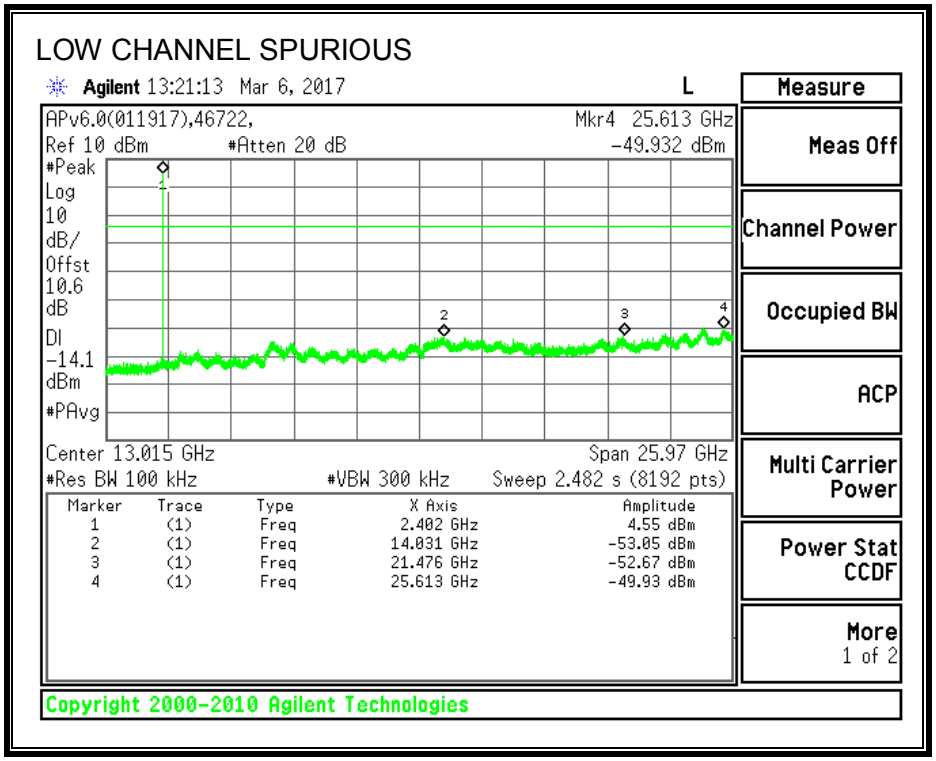
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

TEST INFORMATION

Date: 2017-03-06
Project No: 11602267
Tester: John Manser

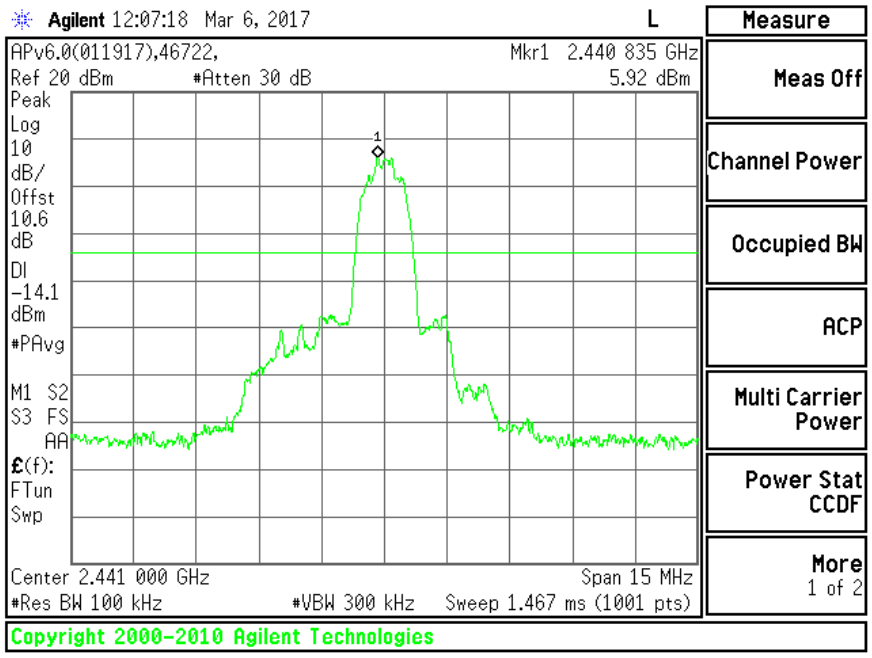
RESULTS
SPURIOUS EMISSIONS, LOW CHANNEL



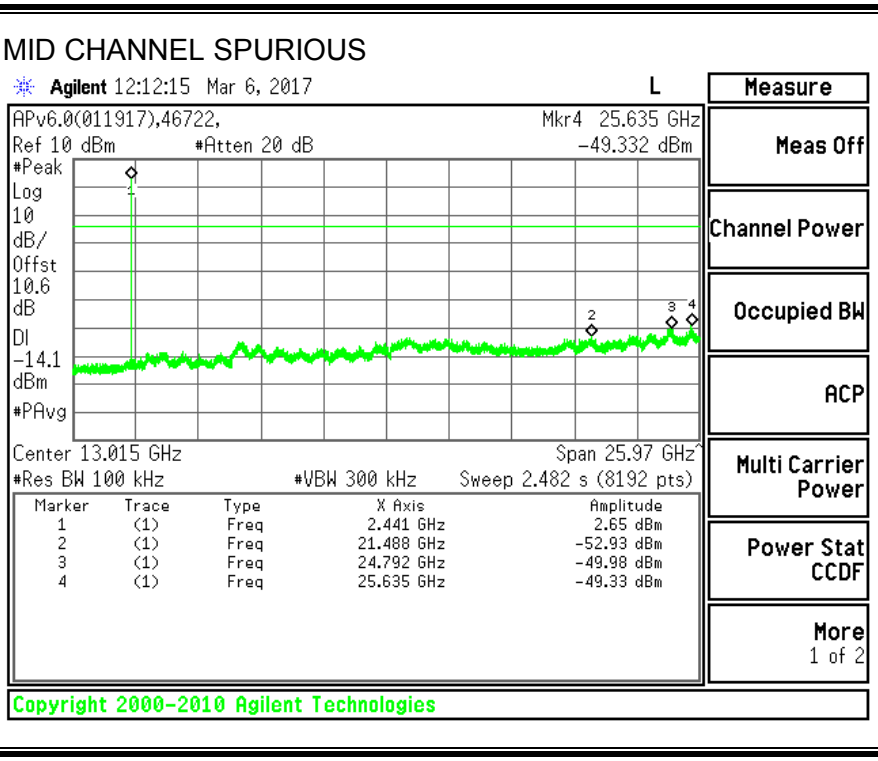


SPURIOUS EMISSIONS, MID CHANNEL

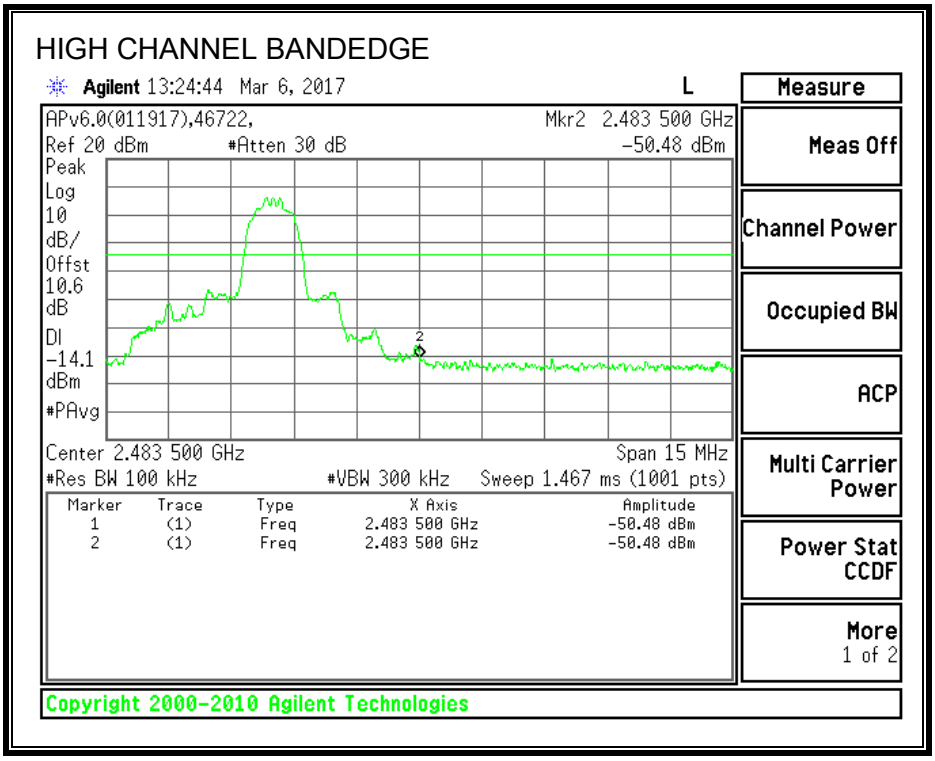
MID CHANNEL BANDEDGE

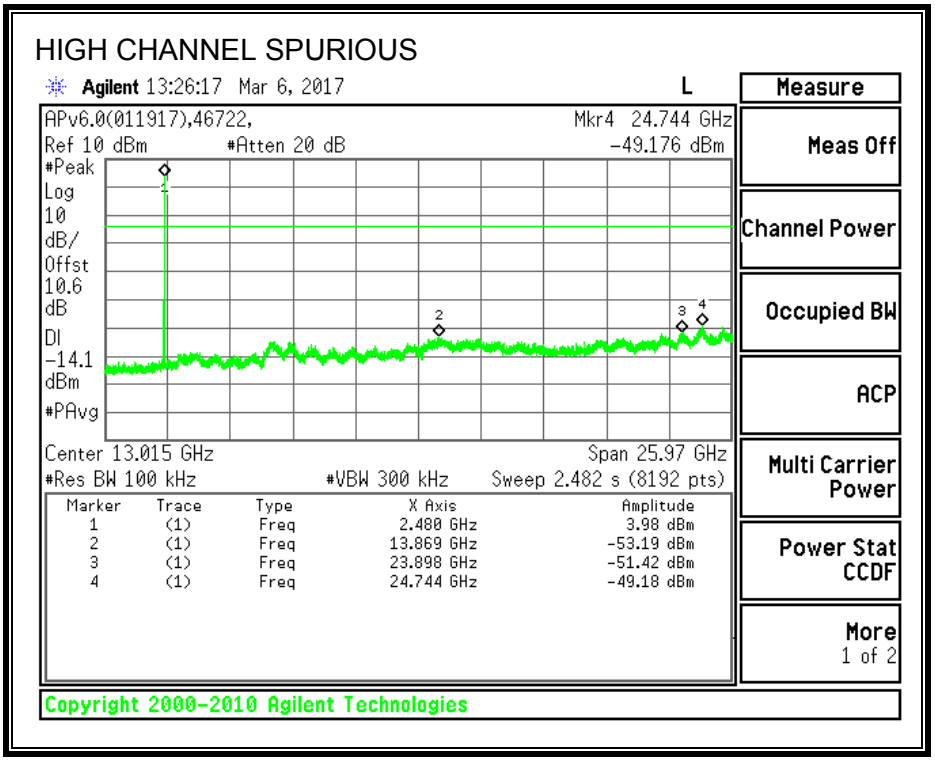


MID CHANNEL SPURIOUS



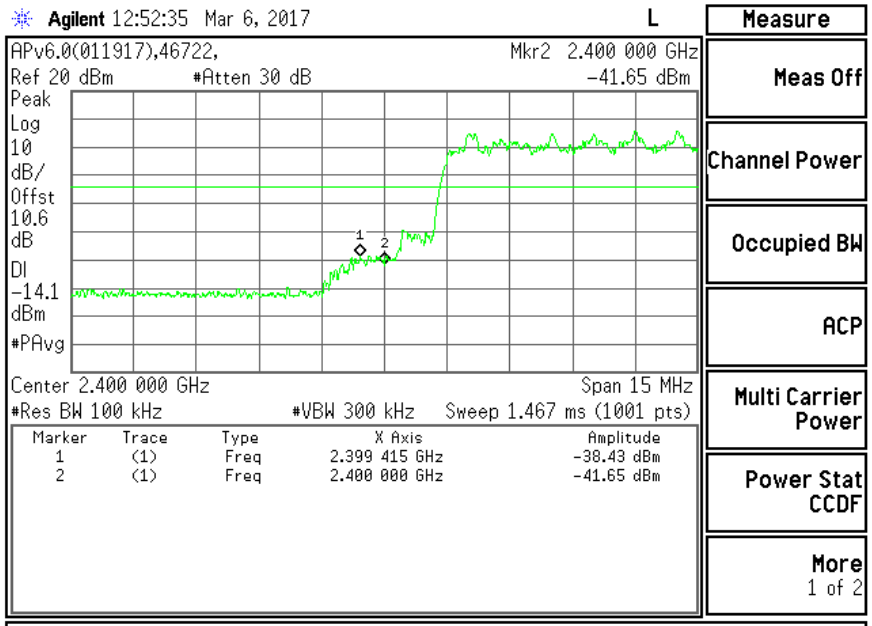
SPURIOUS EMISSIONS, HIGH CHANNEL



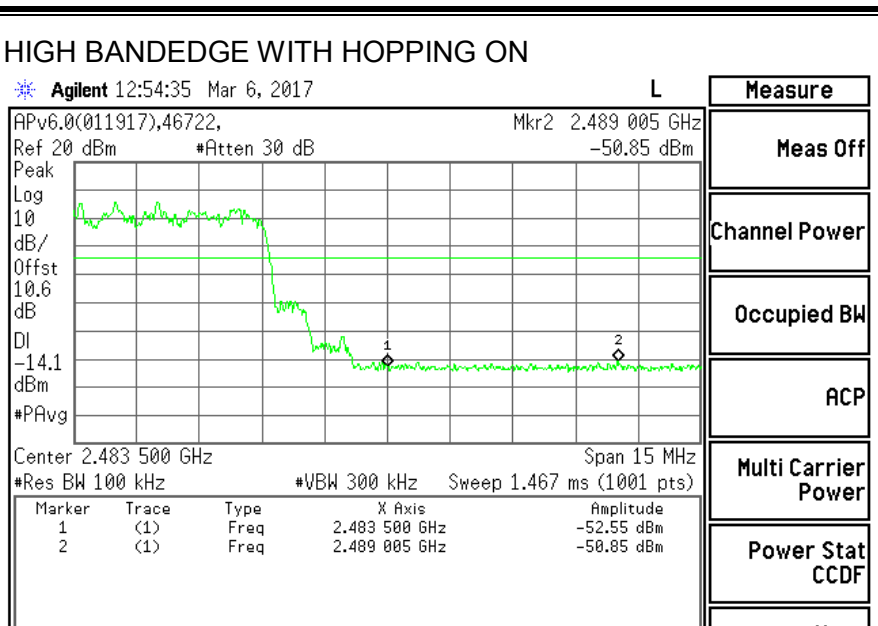


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205, §15.209, §15.247 (d)
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

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for below 1GHz measurements and 1.5 m above the ground plane for above 1GHz measurements. The antenna to EUT distance is 3 meters.

For measurements below 1 GHz the resolution bandwidth is set to 120 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements for the 30-1000 MHz range, 9 kHz for peak detection measurements or 9 kHz for quasi-peak detection measurements for the 0.15-30 MHz range and 200 Hz for peak detection measurements or 200 Hz for quasi-peak detection measurements for the 9 to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For peak measurements above 1 GHz, the resolution bandwidth is set to 1 MHz and the video bandwidth is set to 3 MHz. For average measurements above 1GHz, the resolution bandwidth and video bandwidth are set as described in ANSI C63.10:2013 for the applicable measurement. The particular averaging method used for this test program was by measuring using a Peak detector with the resolution bandwidth set to 1MHz and a reduced video bandwidth, based on $1/T_{on}$ where T_{on} is the transmit on time.

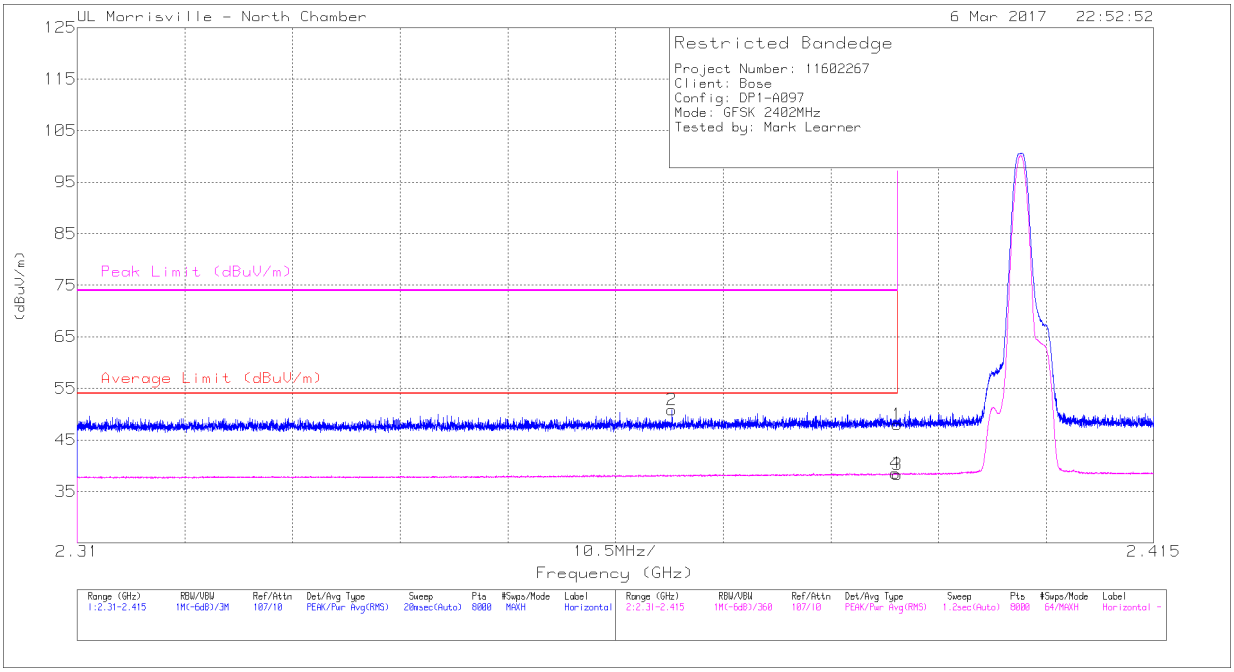
The spectrum from 9 kHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

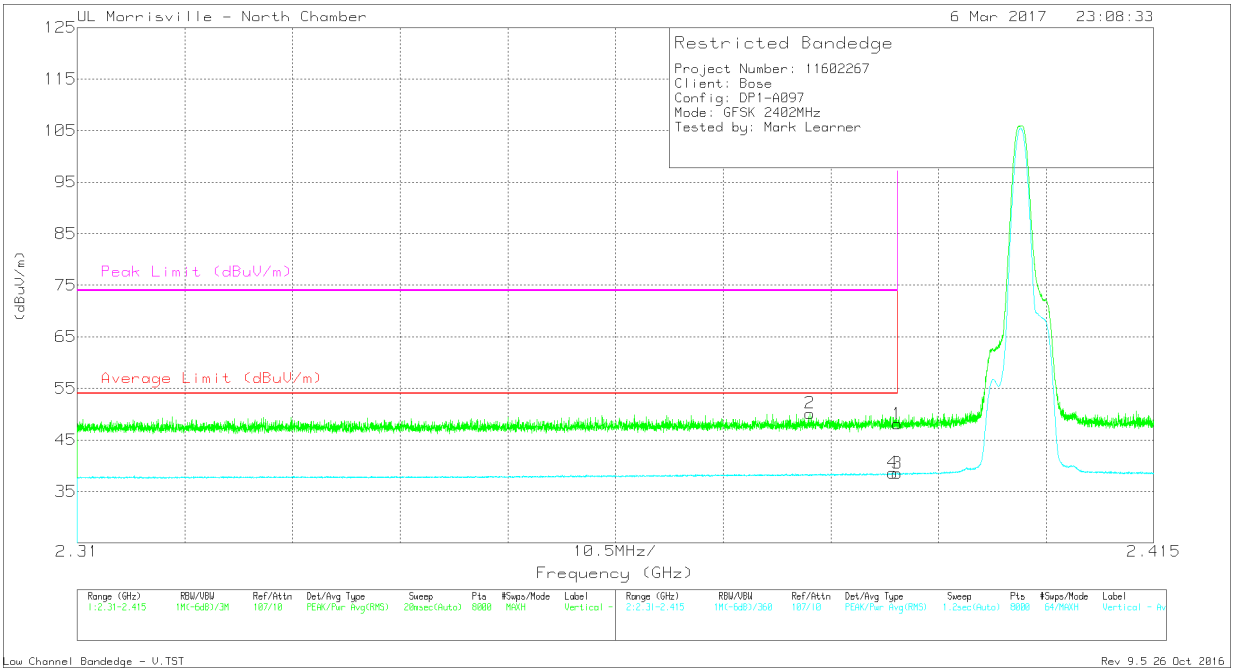
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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	40.39	Pk	32.1	-24.5	47.99	-	-	74	-26.01	46	112	H
2	* 2.368	43.41	Pk	31.9	-24.5	50.81	-	-	74	-23.19	46	112	H
3	* 2.39	30.71	V1TR	32.1	-24.5	38.31	54	-15.69	-	-	46	112	H
4	* 2.39	30.91	V1TR	32.1	-24.5	38.51	54	-15.49	-	-	46	112	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

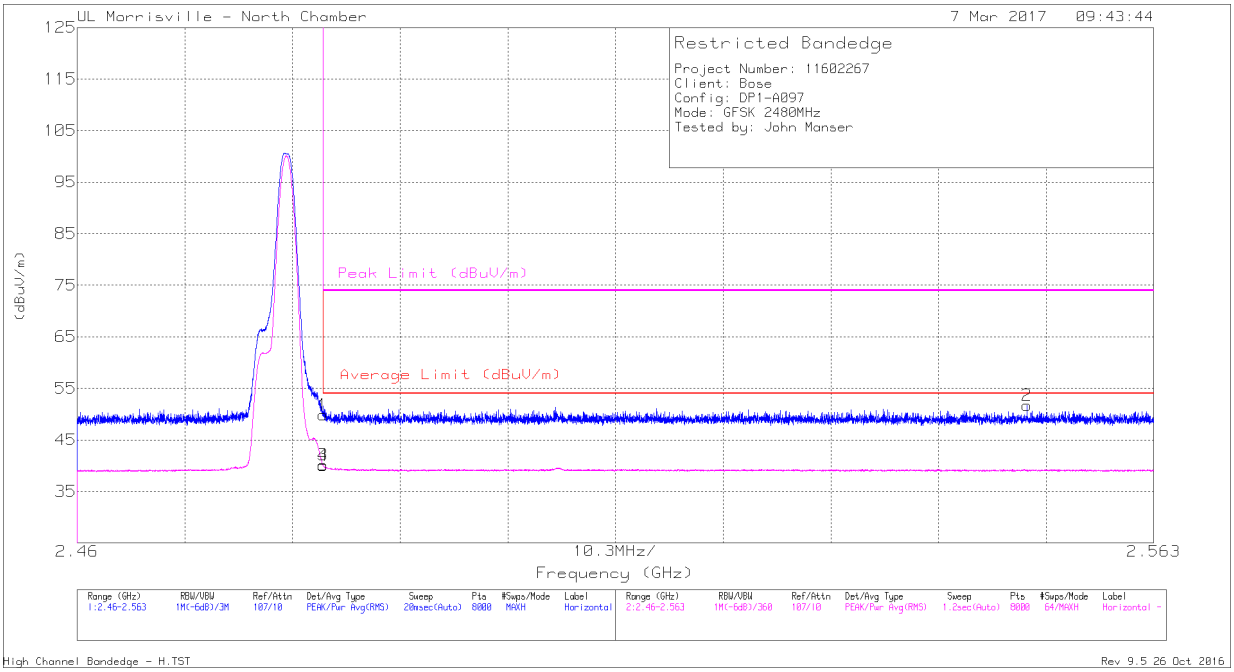
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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	40.52	Pk	32.1	-24.5	48.12	-	-	74	-25.88	290	124	V
2	* 2.381	42.66	Pk	32	-24.5	50.16	-	-	74	-23.84	290	124	V
3	* 2.39	30.94	V1TR	32.1	-24.5	38.54	54	-15.46	-	-	290	124	V
4	* 2.39	31.02	V1TR	32.1	-24.5	38.62	54	-15.38	-	-	290	124	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

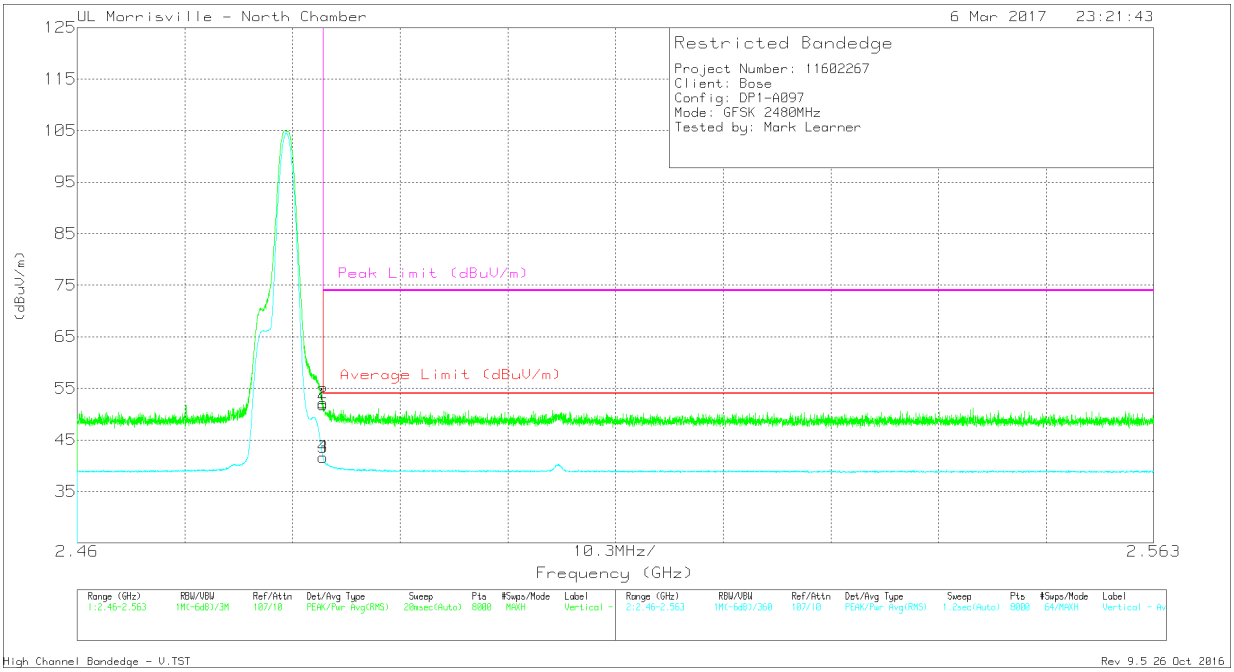
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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	41.83	Pk	32.3	-24.3	49.83	-	-	74	-24.17	266	268	H
3	* 2.484	32.14	V1TR	32.3	-24.3	40.14	54	-13.86	-	-	266	268	H
4	* 2.484	32	V1TR	32.3	-24.3	40	54	-14	-	-	266	268	H
2	2.551	43.79	Pk	32.3	-24.4	51.69	-	-	74	-22.31	266	268	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

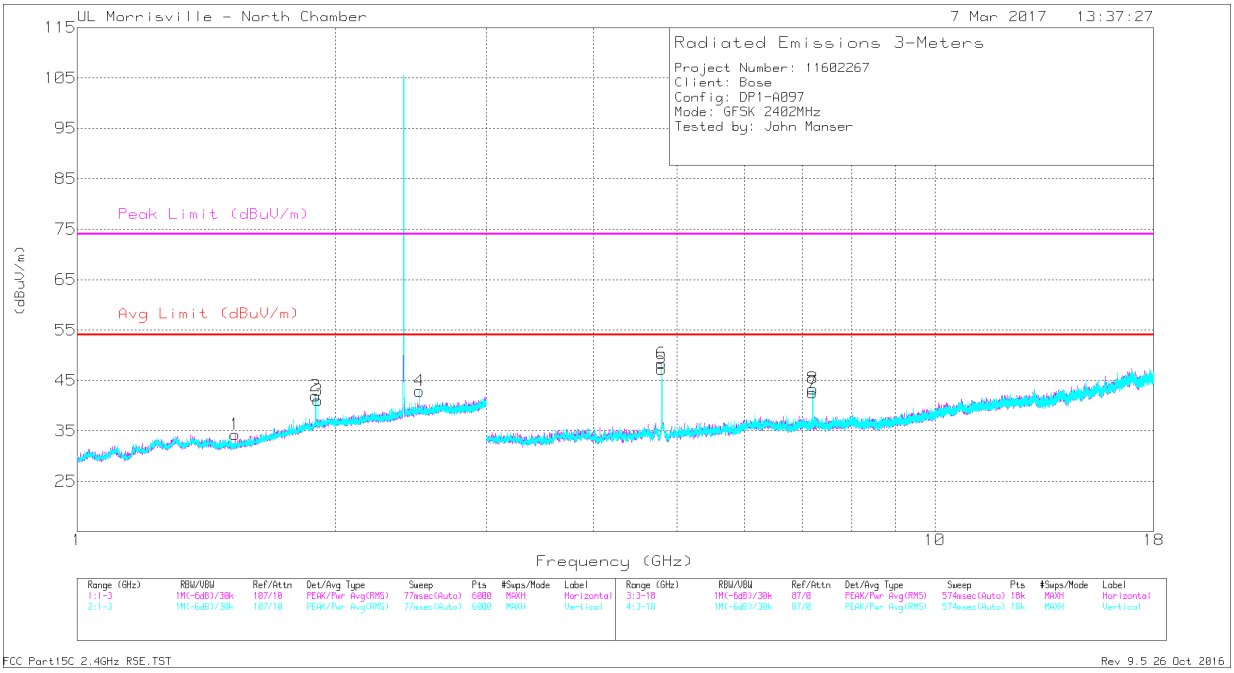


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	43.79	Pk	32.3	-24.3	51.79	-	-	74	-22.21	139	173	V
2	* 2.484	44.18	Pk	32.3	-24.3	52.18	-	-	74	-21.82	139	173	V
3	* 2.484	33.63	V1TR	32.3	-24.3	41.63	54	-12.37	-	-	139	173	V
4	* 2.484	33.67	V1TR	32.3	-24.3	41.67	54	-12.33	-	-	139	173	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

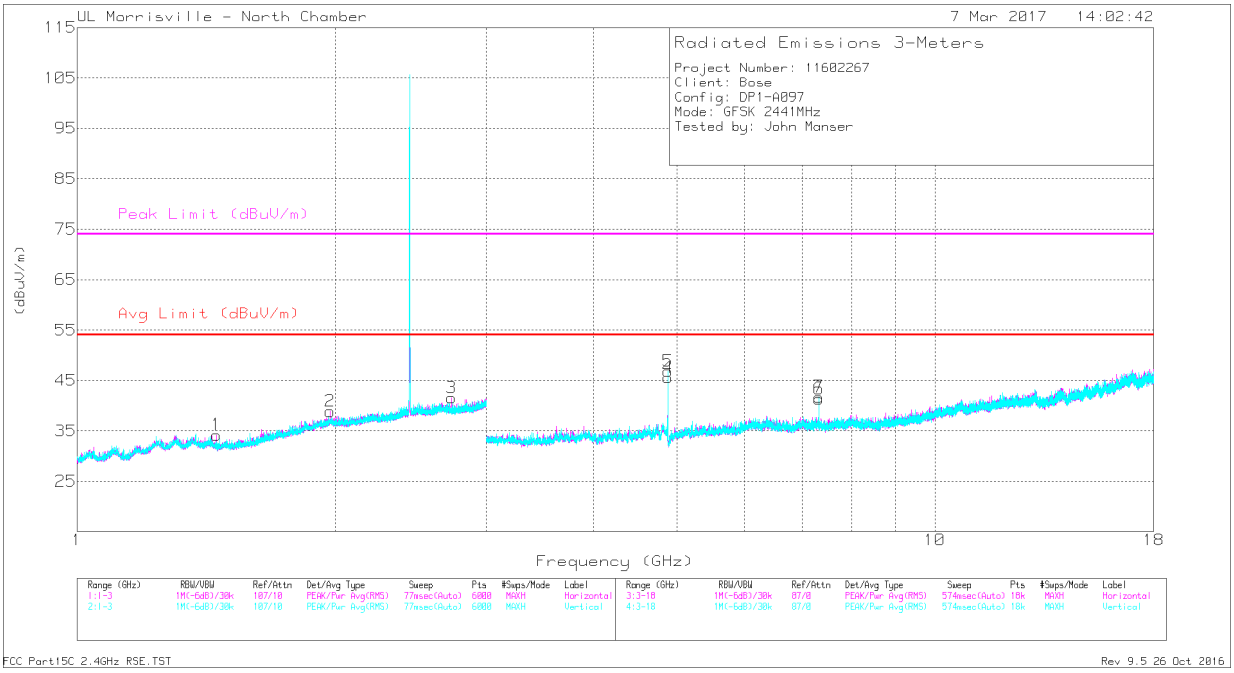
LOW CHANNEL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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
1	* 1.528	37.13	PK-U	27.9	-24.8	40.23	-	-	74	-33.77	11	304	H
	* 1.529	24.46	V1TR	27.9	-24.8	27.56	54	-26.44	-	-	11	304	H
5	* 4.804	48.69	PK-U	34	-31.7	50.99	-	-	74	-23.01	189	102	H
	* 4.804	43.56	V1TR	34	-31.7	45.86	54	-8.14	-	-	189	102	H
6	* 4.804	48.88	PK-U	34	-31.7	51.18	-	-	74	-22.82	179	128	V
	* 4.804	44.21	V1TR	34	-31.7	46.51	54	-7.49	-	-	179	128	V
2	1.897	35.2	Pk	31.1	-24.4	41.9	-	-	-	-	0-360	199	V
3	1.908	34.36	Pk	31.2	-24.5	41.06	-	-	-	-	0-360	199	V
4	2.506	35	Pk	32.3	-24.4	42.9	-	-	-	-	0-360	199	V
7	7.205	37.4	Pk	35.6	-30.4	42.6	-	-	-	-	0-360	199	H
8	7.206	38.19	Pk	35.6	-30.4	43.39	-	-	-	-	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

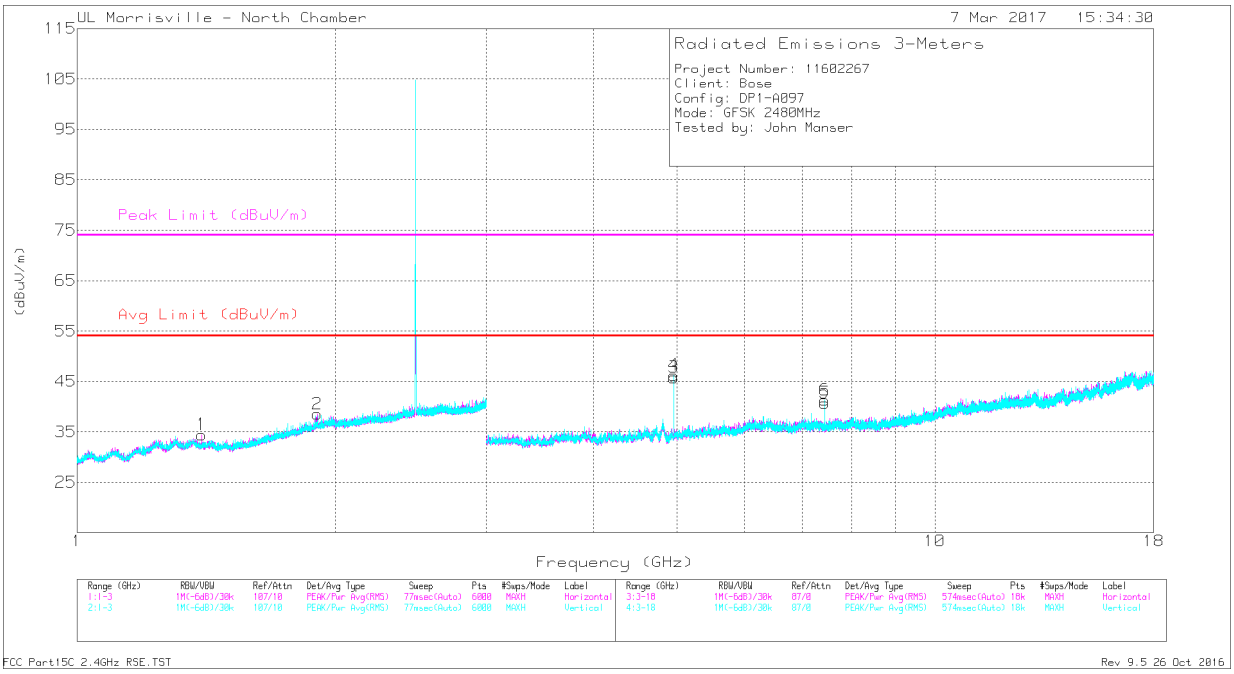
MID CHANNEL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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
1	* 1.451	35.55	PK-U	28.3	-25.1	38.75	-	-	74	-35.25	207	322	H
	* 1.451	24.32	V1TR	28.3	-25.1	27.52	54	-26.48	-	-	207	322	H
3	* 2.734	37.22	PK-U	32.2	-24	45.42	-	-	74	-28.58	64	159	H
	* 2.732	25.53	V1TR	32.2	-24	33.73	54	-20.27	-	-	64	159	H
4	* 4.882	47.1	PK-U	34.1	-31.6	49.6	-	-	74	-24.4	193	106	H
	* 4.882	42.61	V1TR	34.1	-31.6	45.11	54	-8.89	-	-	193	106	H
6	* 7.323	40.68	PK-U	35.5	-29.5	46.68	-	-	74	-27.32	38	184	H
	* 7.323	32.79	V1TR	35.5	-29.5	38.79	54	-15.21	-	-	38	184	H
5	* 4.882	47.32	PK-U	34.1	-31.6	49.82	-	-	74	-24.18	189	222	V
	* 4.882	43.27	V1TR	34.1	-31.6	45.77	54	-8.23	-	-	189	222	V
7	* 7.323	40.73	PK-U	35.5	-29.5	46.73	-	-	74	-27.27	80	316	V
	* 7.323	32.26	V1TR	35.5	-29.5	38.26	54	-15.74	-	-	80	316	V
2	1.972	31.77	Pk	31.6	-24.5	38.87	-	-	-	-	0-360	199	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

HIGH CHANNEL

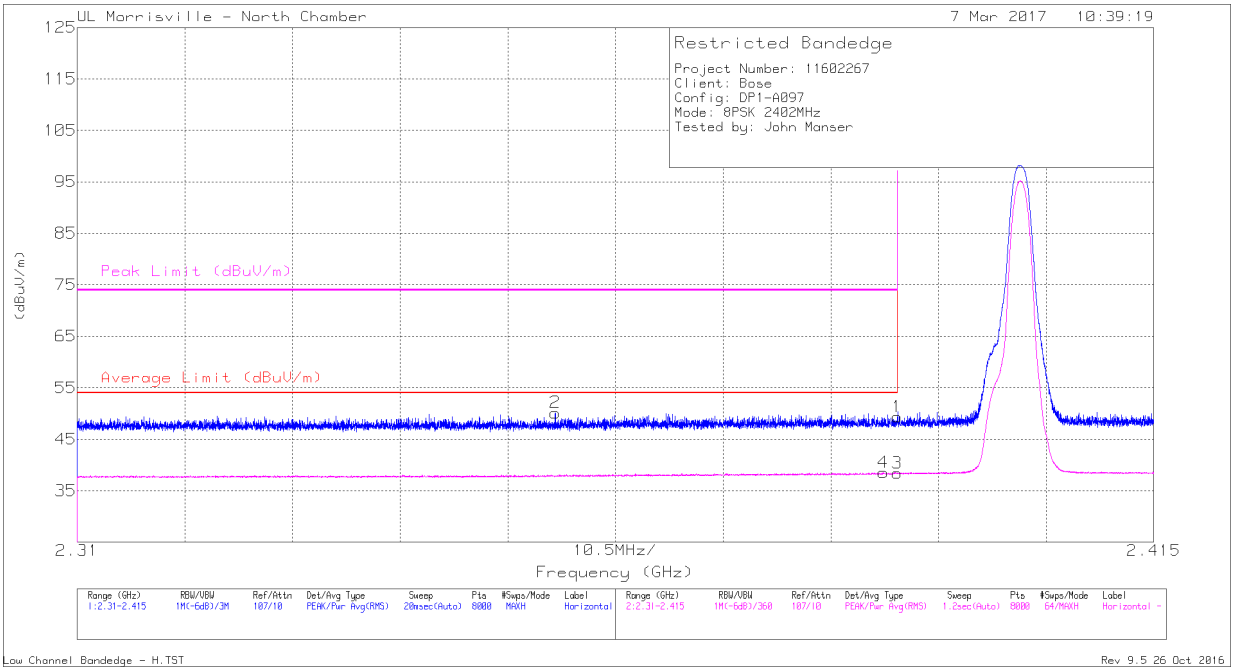


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (dB/m)	Amp/Cbl /Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.398	35.44	PK-U	28.9	-25.3	39.04	-	-	74	-34.96	250	223	H
	* 1.397	24.1	V1TR	28.9	-25.3	27.7	54	-26.3	-	-	250	223	H
3	* 4.96	47.05	PK-U	34.2	-32.5	48.75	-	-	74	-25.25	202	216	H
	* 4.96	42.61	V1TR	34.2	-32.5	44.31	54	-9.69	-	-	202	216	H
5	* 7.439	39.42	PK-U	35.5	-29.5	45.42	-	-	74	-28.58	185	205	H
	* 7.44	30.2	V1TR	35.5	-29.5	36.2	54	-17.8	-	-	185	205	H
4	* 4.96	48.11	PK-U	34.2	-32.5	49.81	-	-	74	-24.19	188	206	V
	* 4.96	43.92	V1TR	34.2	-32.5	45.62	54	-8.38	-	-	188	206	V
6	* 7.44	41.64	PK-U	35.5	-29.5	47.64	-	-	74	-26.36	257	198	V
	* 7.44	33.05	V1TR	35.5	-29.5	39.05	54	-14.95	-	-	257	198	V
2	1.904	31.81	Pk	31.1	-24.4	38.51	-	-	-	-	0-360	199	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

9.2.2. ENHANCED DATA RATE 8PSK MODULATION

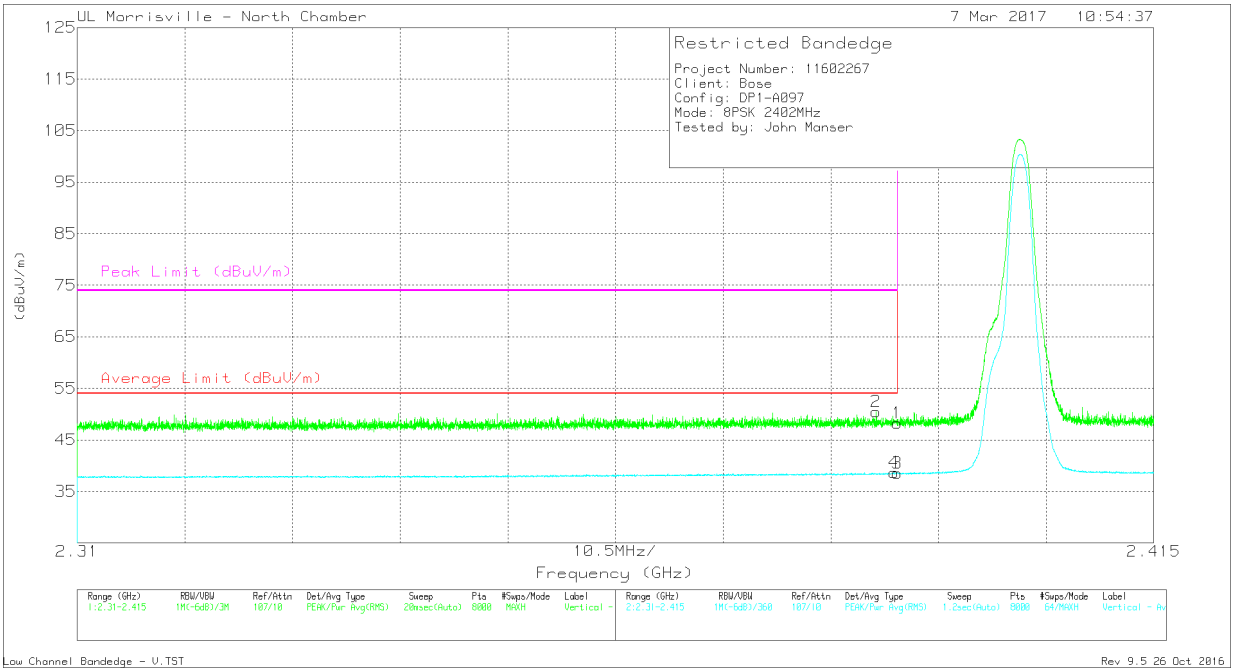
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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	41.73	Pk	32.1	-24.5	49.33	-	-	74	-24.67	40	109	H
2	* 2.357	42.96	Pk	31.8	-24.6	50.16	-	-	74	-23.84	40	109	H
3	* 2.39	30.79	V1TR	32.1	-24.5	38.39	54	-15.61	-	-	40	109	H
4	* 2.389	30.97	V1TR	32.1	-24.5	38.57	54	-15.43	-	-	40	109	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

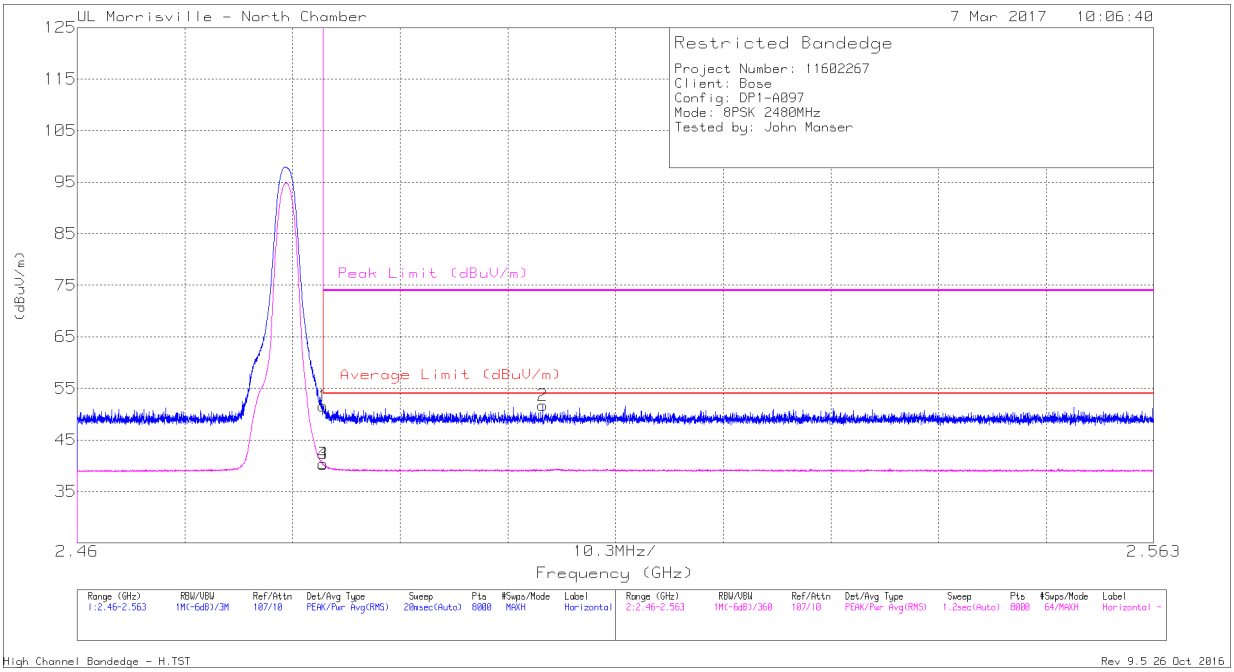
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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	40.67	Pk	32.1	-24.5	48.27	-	-	74	-25.73	288	146	V
2	* 2.388	42.85	Pk	32.1	-24.5	50.45	-	-	74	-23.55	288	146	V
3	* 2.39	30.92	V1TR	32.1	-24.5	38.52	54	-15.48	-	-	288	146	V
4	* 2.39	31.08	V1TR	32.1	-24.5	38.68	54	-15.32	-	-	288	146	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

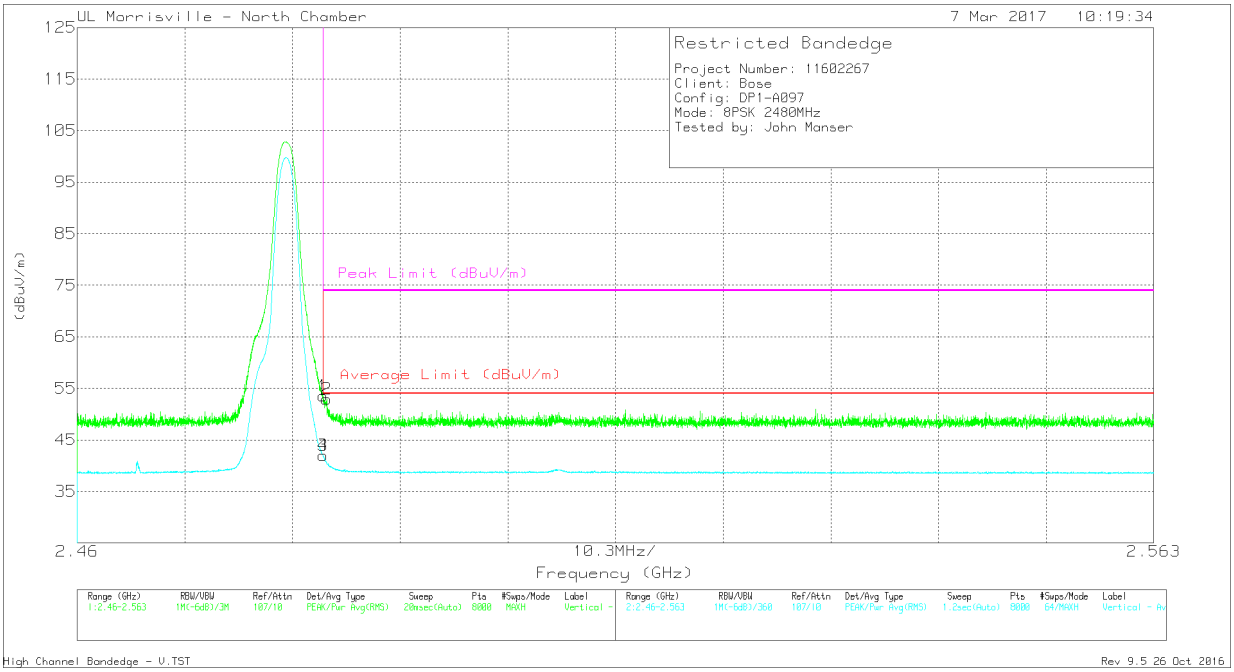
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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	43.6	Pk	32.3	-24.3	51.6	-	-	74	-22.4	264	271	H
3	* 2.484	32.34	V1TR	32.3	-24.3	40.34	54	-13.66	-	-	264	271	H
4	* 2.484	32.35	V1TR	32.3	-24.3	40.35	54	-13.65	-	-	264	271	H
2	2.505	43.68	Pk	32.3	-24.3	51.68	-	-	74	-22.32	264	271	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

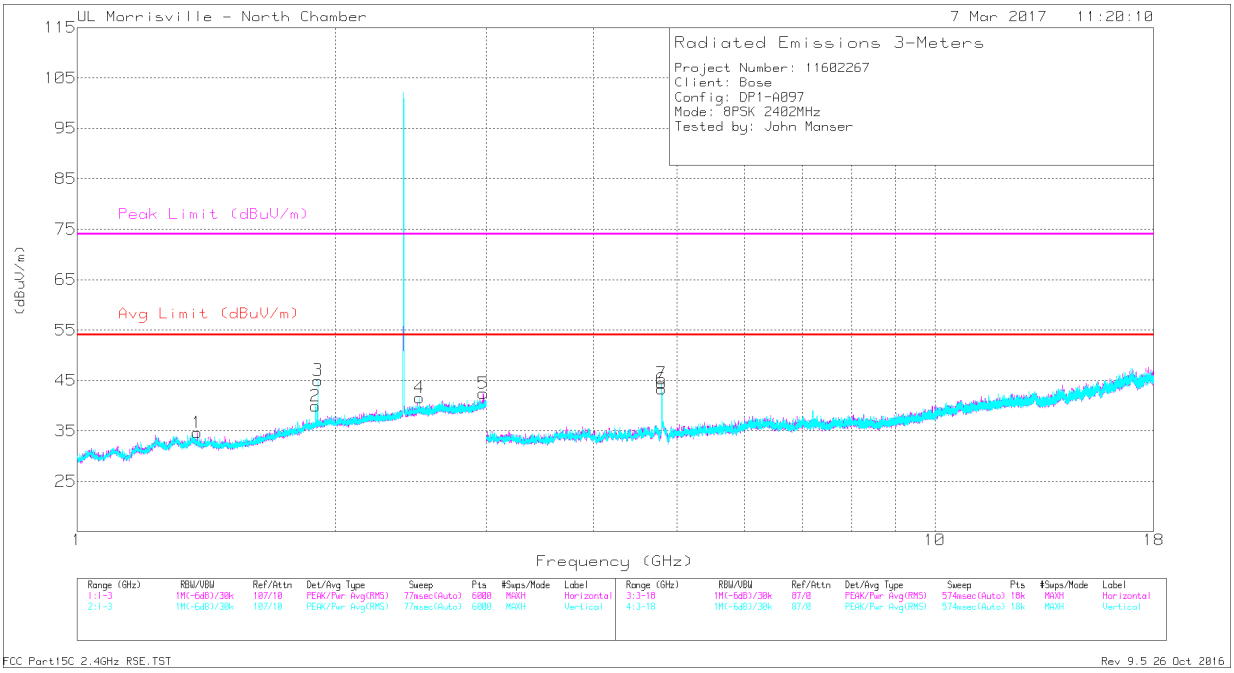


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	45.51	Pk	32.3	-24.3	53.51	-	-	74	-20.49	7	214	V
2	* 2.484	44.9	Pk	32.3	-24.3	52.9	-	-	74	-21.1	7	214	V
3	* 2.484	33.96	V1TR	32.3	-24.3	41.96	54	-12.04	-	-	7	214	V
4	* 2.484	33.96	V1TR	32.3	-24.3	41.96	54	-12.04	-	-	7	214	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

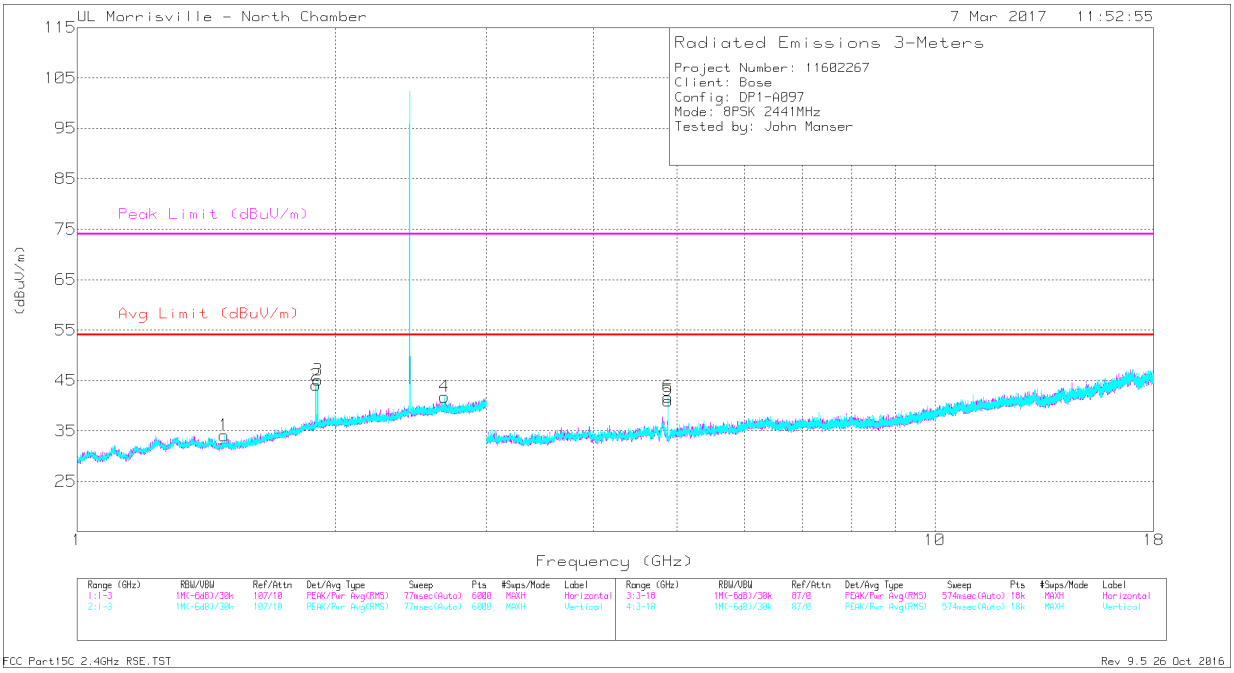
LOW CHANNEL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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
1	* 1.381	35.73	PK-U	28.9	-25.4	39.23	-	-	74	-34.77	226	170	H
	* 1.379	24.37	V1TR	28.9	-25.4	27.87	54	-26.13	-	-	226	170	H
6	* 4.804	44.59	PK-U	34	-31.7	46.89	-	-	74	-27.11	277	118	H
	* 4.804	36.21	V1TR	34	-31.7	38.51	54	-15.49	-	-	277	118	H
7	* 4.804	47.06	PK-U	34	-31.8	49.26	-	-	74	-24.74	173	102	V
	* 4.804	39.97	V1TR	34	-31.7	42.27	54	-11.73	-	-	173	102	V
5	2.975	33.13	Pk	32.5	-23.2	42.43	-	-	-	-	0-360	199	H
2	1.896	33.2	Pk	31.1	-24.4	39.9	-	-	-	-	0-360	102	V
3	1.908	38.31	Pk	31.2	-24.5	45.01	-	-	-	-	0-360	199	V
4	2.506	33.68	Pk	32.3	-24.4	41.58	-	-	-	-	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

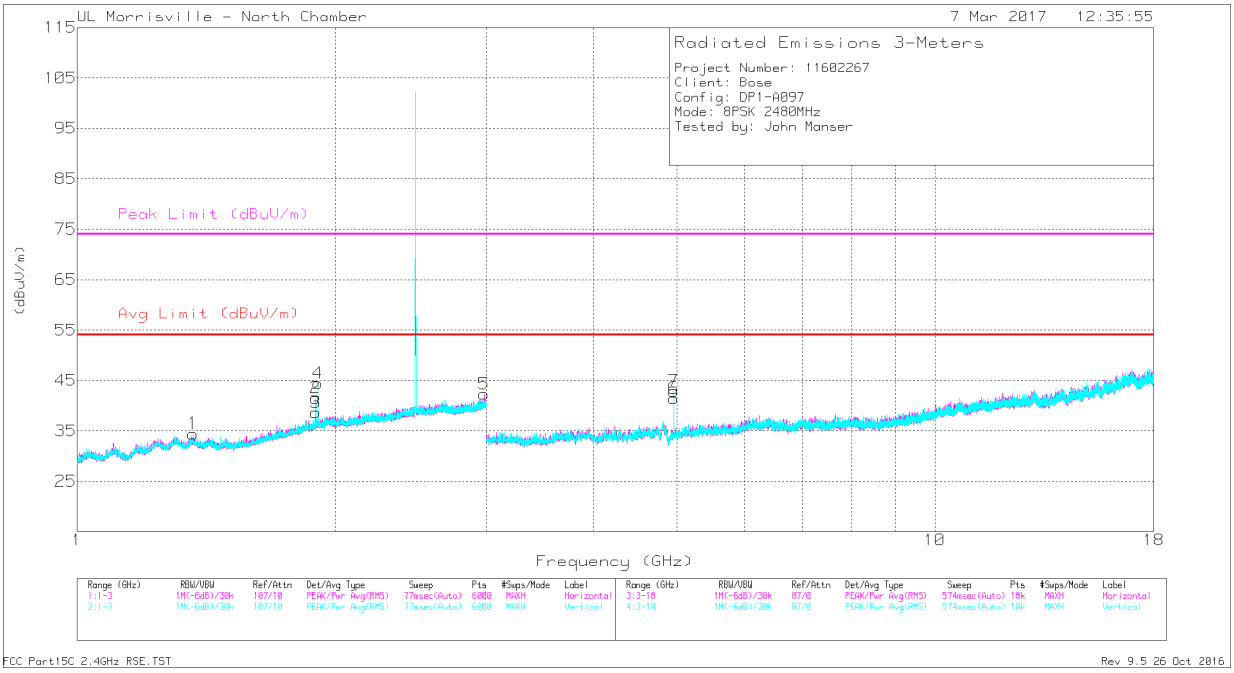
MID CHANNEL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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
5	* 4.882	43.75	PK-U	34.1	-31.6	46.25	-	-	74	-27.75	192	195	H
	* 4.882	35.83	V1TR	34.1	-31.6	38.33	54	-15.67	-	-	192	195	H
1	* 1.484	36.19	PK-U	28	-24.9	39.29	-	-	74	-34.71	92	190	V
	* 1.485	24.45	V1TR	28	-24.9	27.55	54	-26.45	-	-	92	190	V
4	* 2.682	37.66	PK-U	32.4	-24.1	45.96	-	-	74	-28.04	329	275	V
	* 2.682	25.98	V1TR	32.4	-24.1	34.28	54	-19.72	-	-	329	275	V
6	* 4.882	44.3	PK-U	34.1	-31.6	46.8	-	-	74	-27.2	200	195	V
	* 4.882	36.04	V1TR	34.1	-31.6	38.54	54	-15.46	-	-	200	195	V
2	1.897	37.39	Pk	31.1	-24.4	44.09	-	-	-	-	0-360	199	V
3	1.907	38.34	Pk	31.2	-24.5	45.04	-	-	-	-	0-360	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

HIGH CHANNEL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0072 (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
6	* 4.96	43.59	PK-U	34.2	-32.5	45.29	-	-	74	-28.71	199	181	H
	* 4.96	35.76	V1TR	34.2	-32.5	37.46	54	-16.54	-	-	199	181	H
1	* 1.364	36.27	PK-U	28.9	-25.4	39.77	-	-	74	-34.23	181	119	V
	* 1.365	24.79	V1TR	28.9	-25.4	28.29	54	-25.71	-	-	181	119	V
7	* 4.961	45.17	PK-U	34.2	-32.5	46.87	-	-	74	-27.13	188	215	V
	* 4.96	38.22	V1TR	34.2	-32.5	39.92	54	-14.08	-	-	188	215	V
3	1.897	31.98	Pk	31.1	-24.4	38.68	-	-	-	-	0-360	102	H
5	2.981	33.04	Pk	32.5	-23.2	42.34	-	-	-	-	0-360	199	H
2	1.896	34.82	Pk	31.1	-24.4	41.52	-	-	-	-	0-360	200	V
4	1.909	37.73	Pk	31.2	-24.5	44.43	-	-	-	-	0-360	200	V

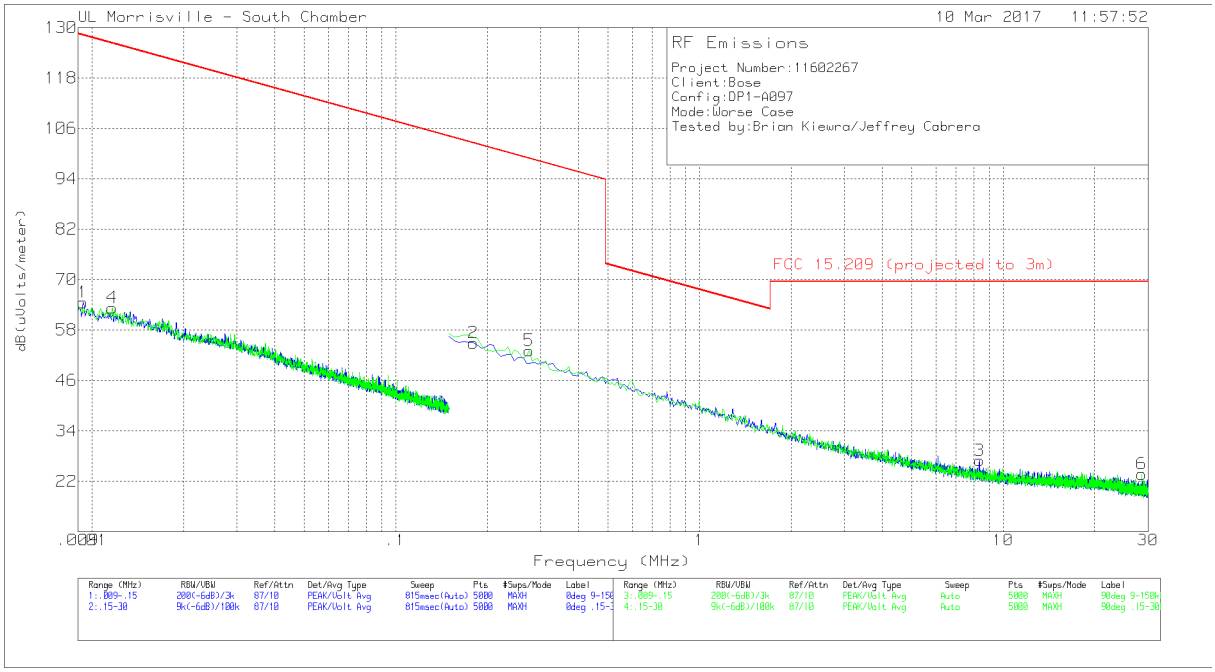
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK-U: Maximum Peak
V1TR: VB=1/Ton, RMS Average where: Ton is packet duration

9.3. WORST-CASE BELOW 1 GHz

SPURIOUS EMISSIONS 9kHz TO 30 MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (specification distance / test distance).

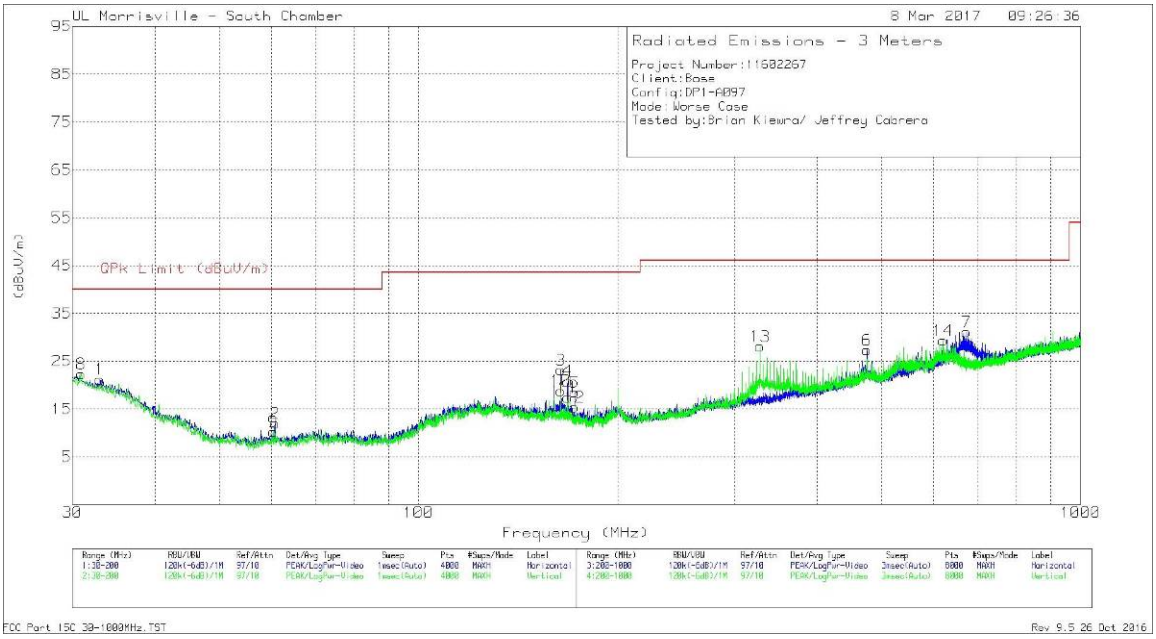
Although these tests were performed at a test site other than an open area test site, adequate comparison measurements were confirmed against an open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606.



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 (projected to 3m)	Margin (dB)	Azimuth (Degs)
1	.00936	45.44	Pk	19	.1	64.54	128.18	-63.64	0-360
4	.01166	45.6	Pk	17.6	.1	63.3	126.27	-62.97	0-360
2	.17986	44.15	Pk	10.7	.1	54.95	102.51	-47.56	0-360
5	.27539	42.38	Pk	10.6	.1	53.08	98.81	-45.73	0-360
3	8.34818	15.88	Pk	10.6	.5	26.98	69.54	-42.56	0-360
6	28.64361	14.55	Pk	8.3	.9	23.75	69.54	-45.79	0-360

Pk - Peak detector

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



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 164.0074	34.87	Qp	16.7	-30.5	21.07	43.52	-22.45	326	196	H
4	* 168.0008	35.7	Qp	16.4	-30.4	21.7	43.52	-21.82	164	153	H
5	* 171.9971	32.04	Qp	16.1	-30.4	17.74	43.52	-25.78	151	154	H
10	* 164.0115	28.82	Qp	16.7	-30.5	15.02	43.52	-28.5	40	113	V
11	* 168.0085	31.05	Qp	16.4	-30.4	17.05	43.52	-26.47	228	102	V
12	* 172.0006	27.45	Qp	16.1	-30.4	13.15	43.52	-30.37	37	132	V
13	* 328.0027	38.35	Qp	18.7	-29.5	27.55	46.02	-18.47	150	163	V
8	30.9352	28.85	Pk	25.3	-31.8	22.35	40	-17.65	0-360	102	V
1	33.0183	29.25	Pk	23.8	-31.8	21.25	40	-18.75	0-360	199	H
9	60.3103	29.73	Pk	11.9	-31.4	10.23	40	-29.77	0-360	102	V
2	60.6929	31.52	Pk	11.9	-31.4	12.02	40	-27.98	0-360	199	H
6	475.9359	34.21	Pk	22	-28.9	27.31	46.02	-18.71	0-360	198	H
14	620.0546	34.36	Pk	23.6	-28.6	29.36	46.02	-16.66	0-360	102	V
7	671.9613	35.08	Pk	24.4	-28.4	31.08	46.02	-14.94	0-360	102	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
Qp - Quasi-Peak detector