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

CERTIFICATION TEST REPORT

FOR

WIRELESS HEADSET

MODEL NUMBER: 419811

FCC ID: A94419811
IC: 3232A-419811

REPORT NUMBER: R10991036-E1

ISSUE DATE: 2016-01-28

Prepared for
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Revision History

Ver.	Issue Date	Revisions	Revised By
1	2015-12-18	Initial Issue	Mark Nolting
2	2016-01-11	Revised page 97 to clarify average measurement method. Revised page 99 to include new plot for Low Channel vertical band edge and deleted duty cycle references on pages 102-104 and 109-111.	Mark Nolting
3	2016-01-19	Revised page 97 to clarify average measurement method.	Mark Nolting
4	2016-01-28	Revised page 97 to clarify average measurement method.	Mark Nolting

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Bose Corp.
100 The Mountain Rd.
Framingham, Massachusetts, 01701, USA

EUT DESCRIPTION: Wireless Headset

MODEL: 419811

SERIAL NUMBER: DP2-A097 (Radiated sample);
DP2-C004 (Antenna-port sample)

DATE TESTED: 2015-10-30 to 2016-01-11

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 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, any agency of the Federal Government, or any agency of any government.

Approved & Released
For UL LLC By:

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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, RSS-247 Issue 1.

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 and 2800 Suite B Perimeter Park Dr., Morrisville, NC 27560.

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 are covered under Industry Canada company address code 2180C with site numbers 2180C -1 through 2180C-4, 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
Total RF power, conducted	+/-	0.45
RF power density, conducted	+/-	1.50
Spurious emissions, conducted	+/-	2.94
All emissions, radiated up to 18 GHz	+/-	5.36
Temperature	+/-	0.07
Humidity	+/-	2.26
DC and low frequency voltages	+/-	1.27
Conducted Disturbance, 0.15 to 30 MHz	+/-	2.37

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a Wireless Headset that contains Bluetooth 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	8.27	6.71
2402 - 2480	DQPSK	6.72	4.70
2402 - 2480	Enhanced 8PSK	7.04	5.06

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an Inverted F trace antenna, with a maximum gain of 7.23 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 0.3.4-r184

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

The test utility software, BlueTest3, used during testing was 2.6.2

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated-emissions testing 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,Z. It was determined that X orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X orientation.

For Enhanced Data rate modes, 8DPSK is considered worst-case and only select tests were performed for the DQPSK mode. Additionally, unless noted in the test report, all tests were performed with the DH5 packet size as this was considered worst-case.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T-410	R8K07LR	N/A
AC Adapter	Lenovo	ADLX65NLT2A	36RGT7	N/A

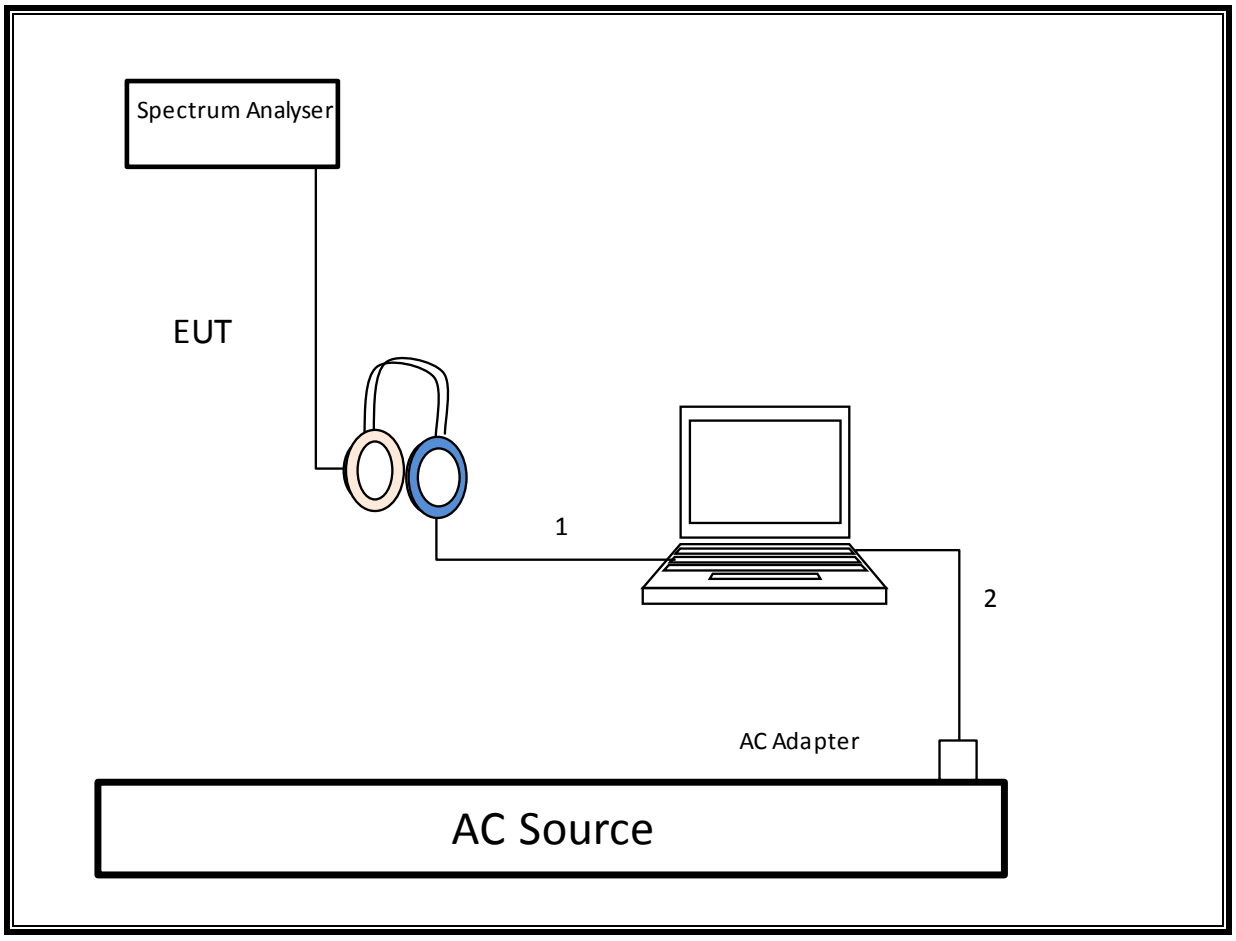
I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	USB	1	Micro USB	Unshielded	0.33	For USB charging cable.
2	Audio	1	3.5mm audio	Unshielded	1.2	For back-up audio cable.

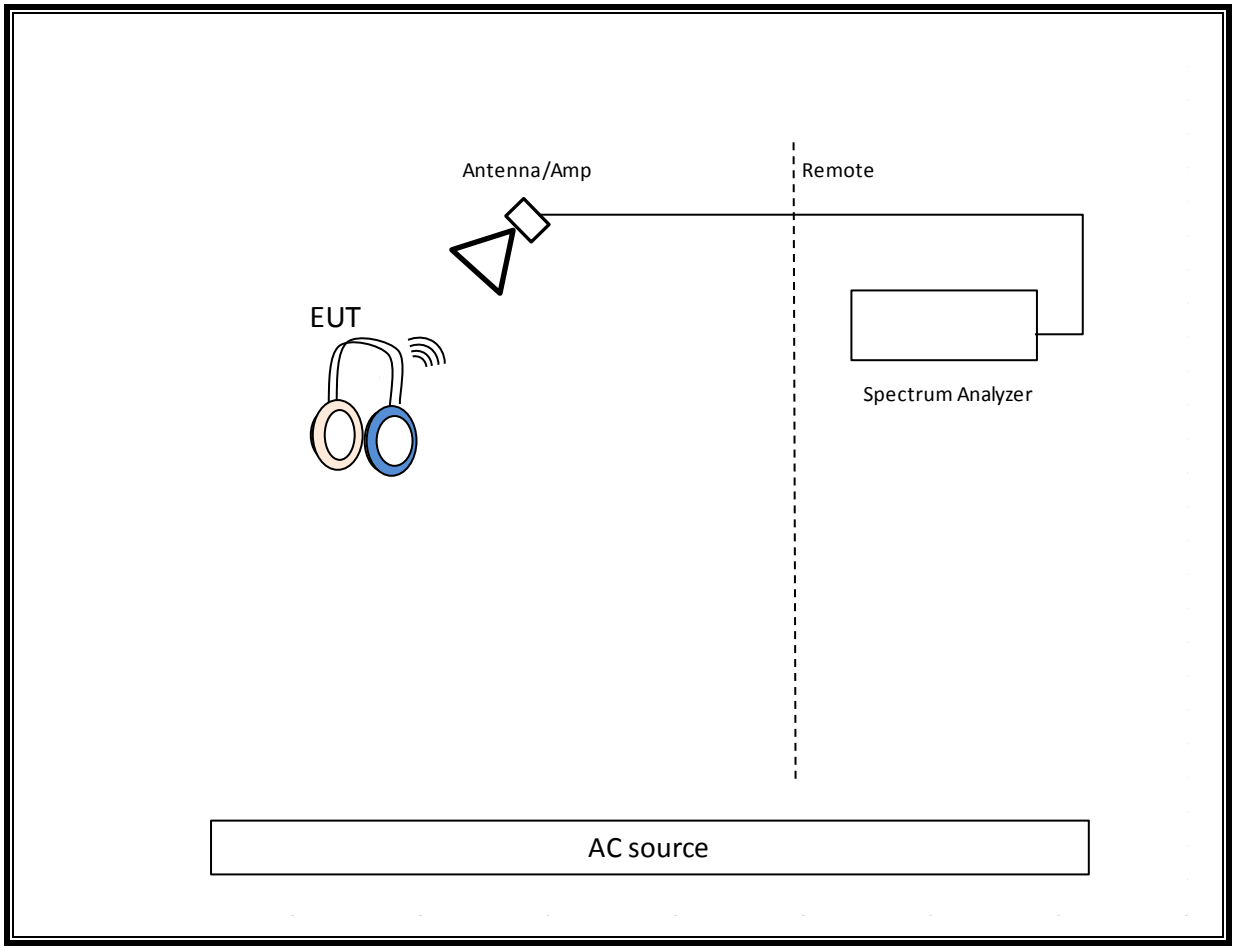
TEST SETUP

The EUT is set up as a stand-alone device during radiated-emissions testing. For convenience, the device is connected to a laptop PC via a USB cable to configure the device for test during antenna-port measurements. Test software exercised the radio portion of the device.

SETUP DIAGRAM FOR CONDUCTED TESTS



SETUP DIAGRAM FOR RADIATED TESTS



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 - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0074	Hybrid Broadband Antenna, 30-1000MHz	Sunol Sciences Corp.	JB3	2015-06-10	2016-06-30
AT0069	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2015-02-17	2016-02-29
S-SAC02	Gain-loss string: 30-1000MHz	Various	Various	2015-06-09	2016-06-30
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2015-08-22	2016-08-31
SA0026	Spectrum Analyzer	Agilent	N9030A	2015-03-27	2016-03-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
HI0050	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2015-07-01	2016-07-31

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (RTP – Chamber C)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2015-08-27	2016-08-31
C-SAC03	Gain-loss string: 18-40GHz	Various	Various	2015-09-27	2016-09-30
SA0025	Spectrum Analyzer	Keysite	N9030A	2015-03-27	2016-03-31
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
HI0034	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2015-03-23	2016-03-31

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0020	Spectrum Analyzer	Agilent Technologies	E4446	2015-02-26	2016-02-29
PWS004	Power Sensor, 50MHz to 6 GHz	Keysight Technologies	E9323A	2015-06-05	2016-06-05
PWM004	Power Meter, 50MHz to 6 GHz	Keysight Technologies	N1911A	2015-06-08	2016-06-08
T1023	Power Sensor, 10MHz to 6 GHz	ETS Lindgren	7002-006	2015-10-01	2016-10-01
MM0168	Digital Multimeter	Agilent Technologies	U1232A	2015-08-17	2016-08-31
76023	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2015-05-13	2016-05-31
43733	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2014-03-24	2016-03-31

7. ANTENNA PORT TEST RESULTS

8. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

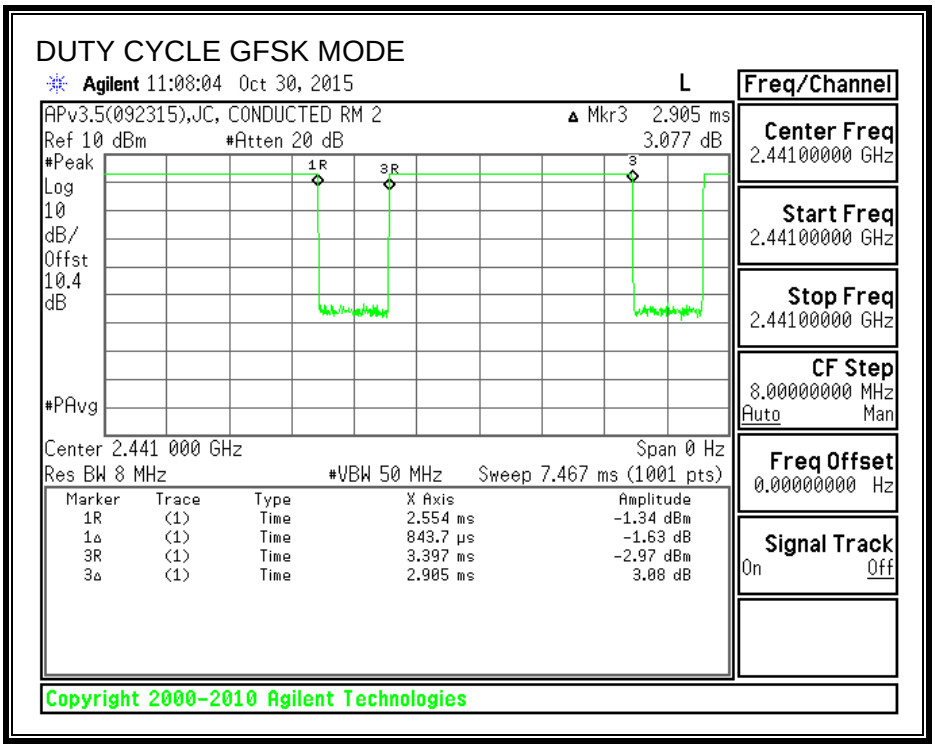
KDB 558074 Zero-Span Spectrum Analyzer Method.

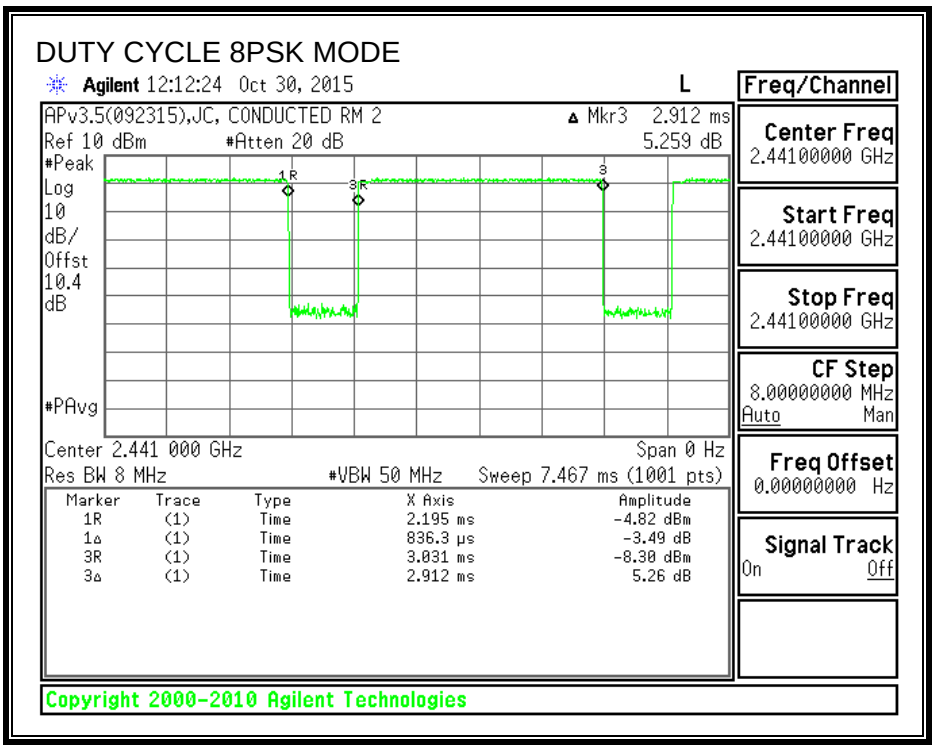
8.1. ON TIME AND DUTY CYCLE RESULTS

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 OFF)						
Bluetooth GFSK	2.905	3.7487	0.775	77.49%	1.11	0.344
Bluetooth 8PSK	2.912	3.7483	0.777	77.69%	1.10	0.343

8.2. DUTY CYCLE PLOTS

HOPPING OFF





8.3. BASIC DATA RATE GFSK MODULATION

8.3.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

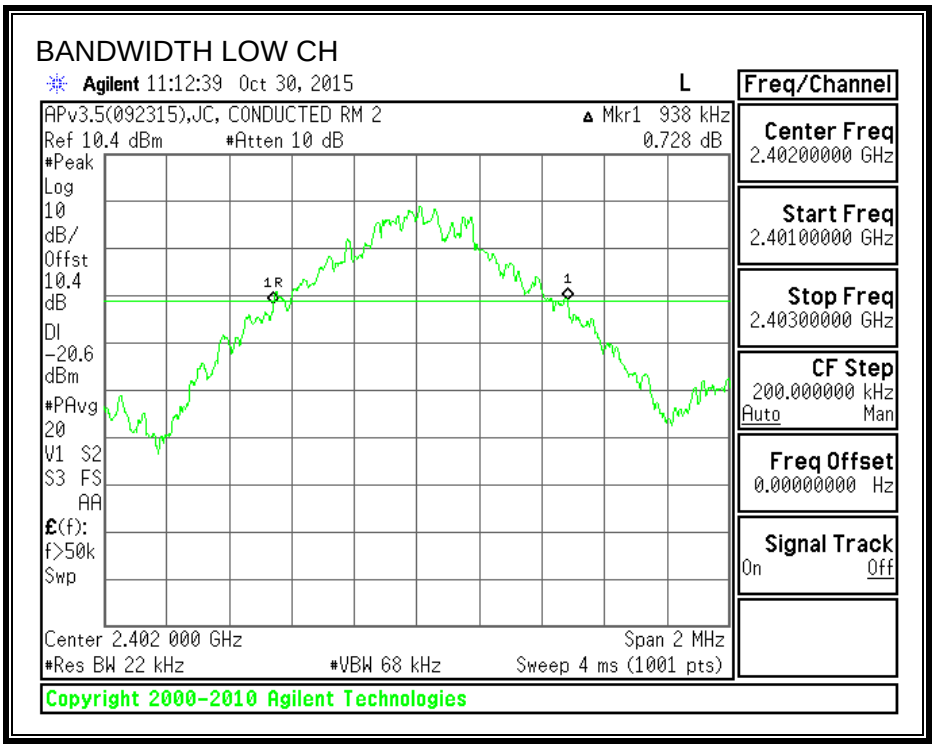
TEST PROCEDURE

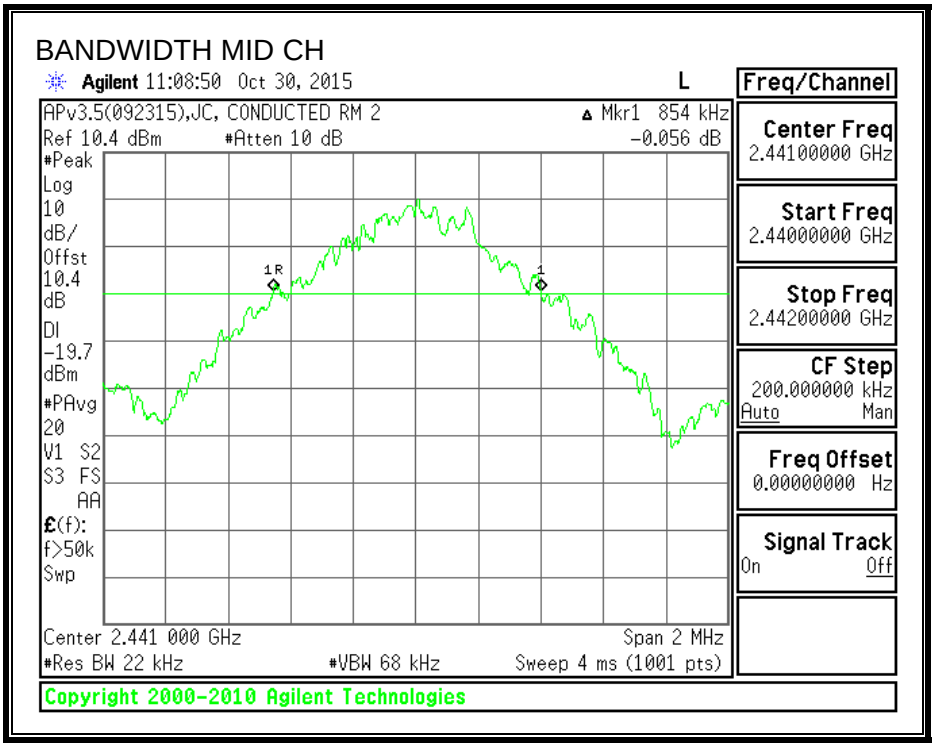
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1-5% of the 20 dB bandwidth and 99% Occupied Bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

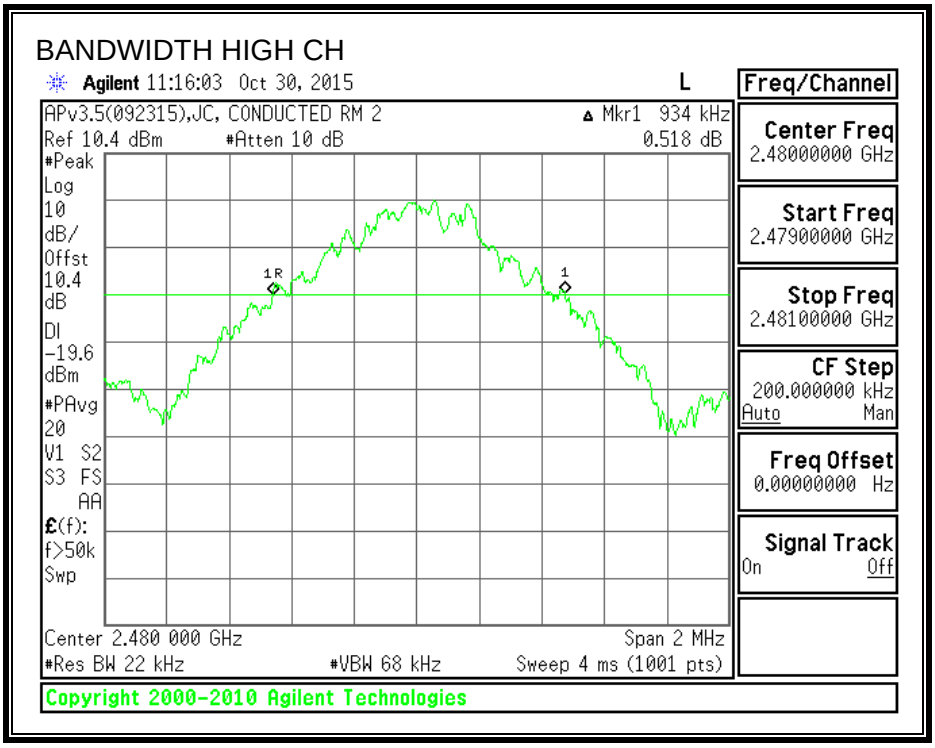
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	938	882.1337
Middle	2441	854	880.9537
High	2480	934	879.2470

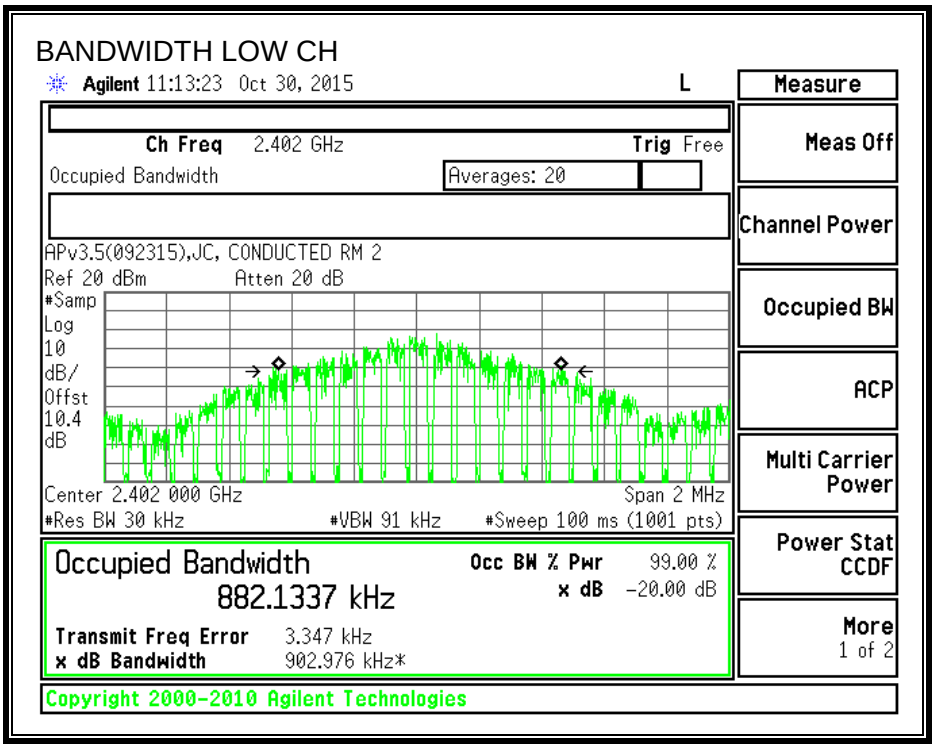
20 dB BANDWIDTH

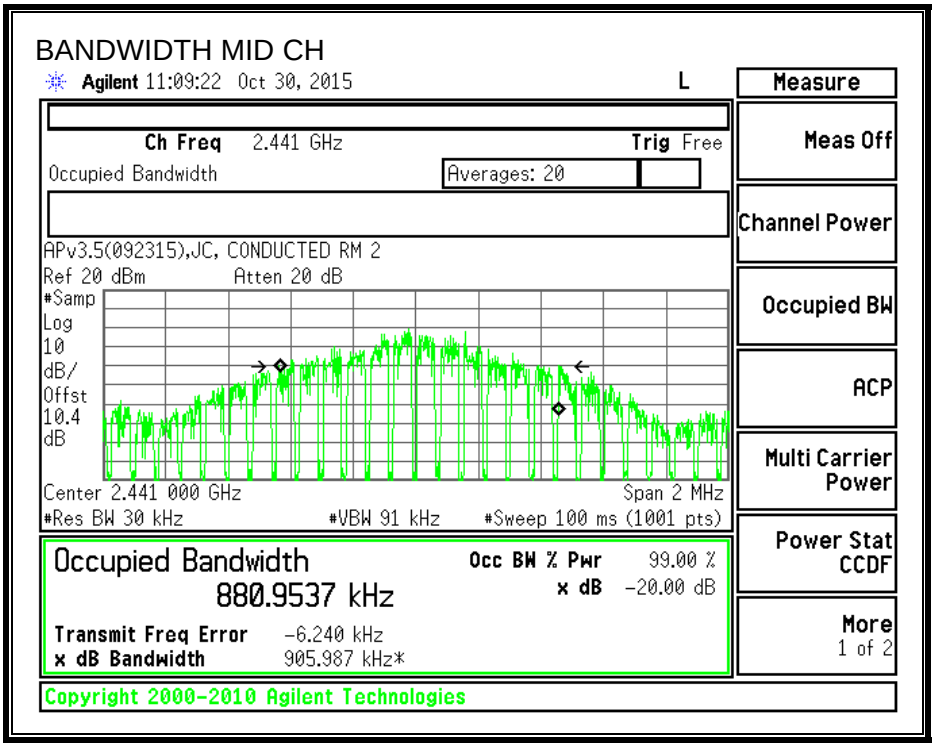


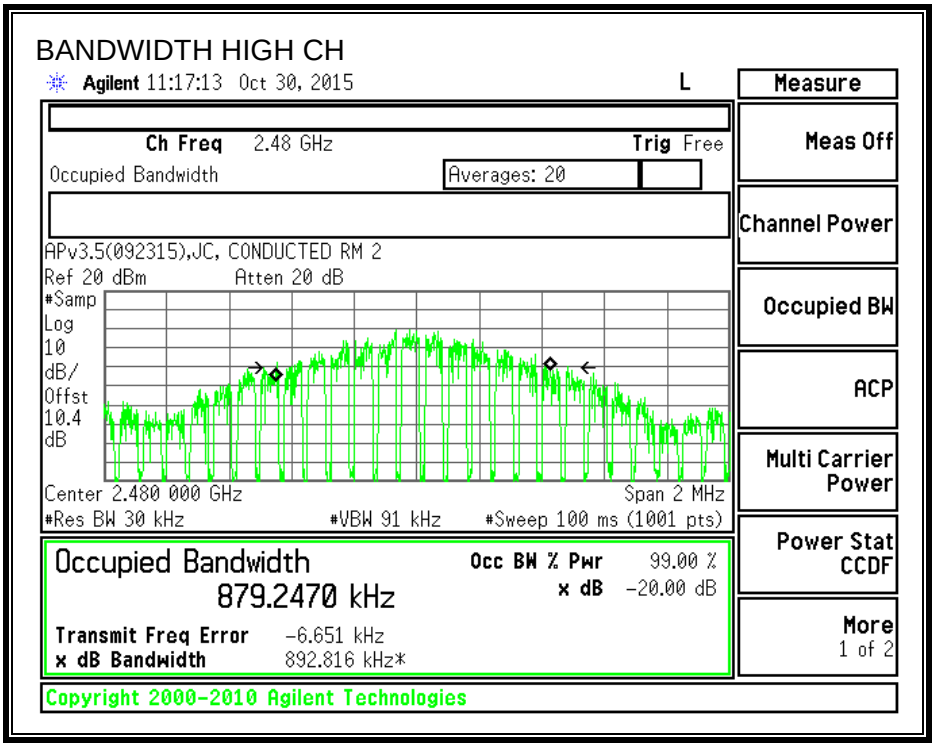




99% BANDWIDTH







8.3.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 A5.1 (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.

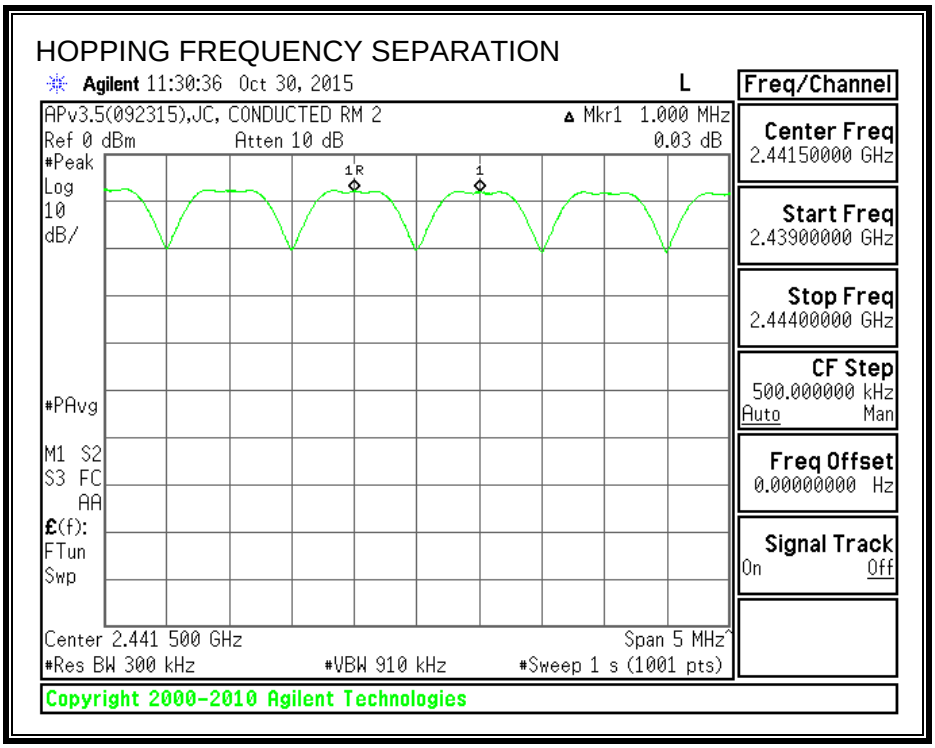
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 3x RBW. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



8.3.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 A5.1 (4)

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

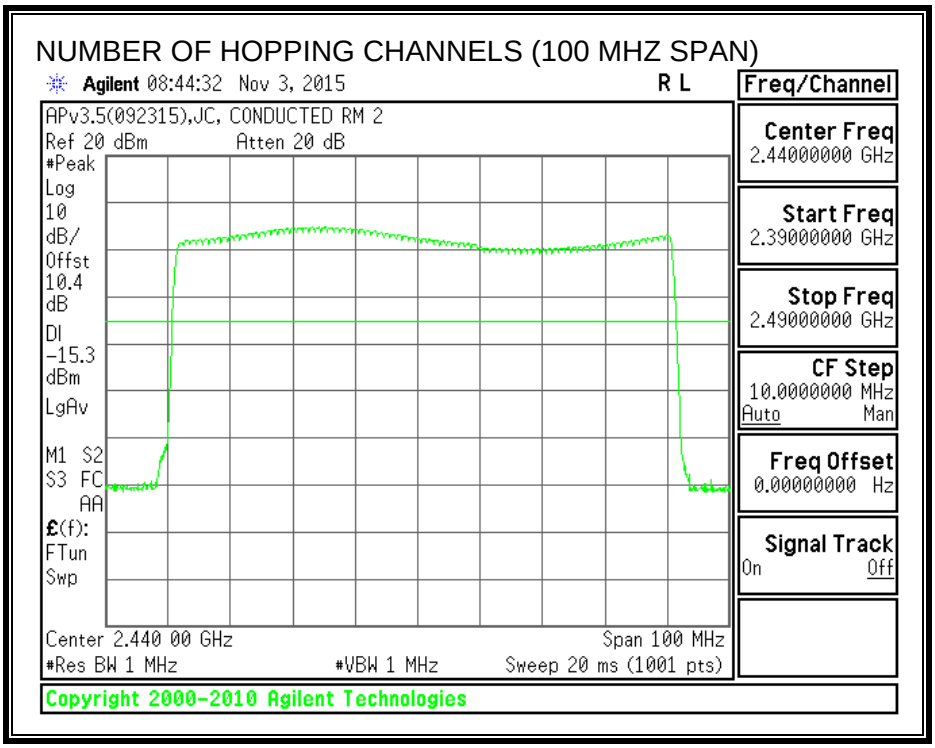
TEST PROCEDURE

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 for visibility of the entire span. Then, smaller spans are set to more clearly identify the channels. The RBW is set to 30% of the channel spacing (approx. 300 kHz). The analyzer is set to Max Hold.

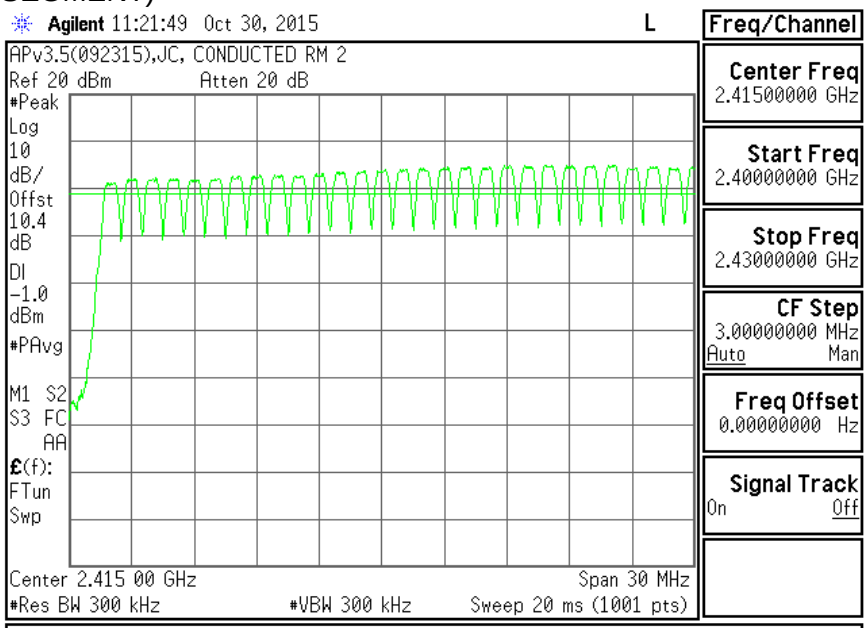
RESULTS

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

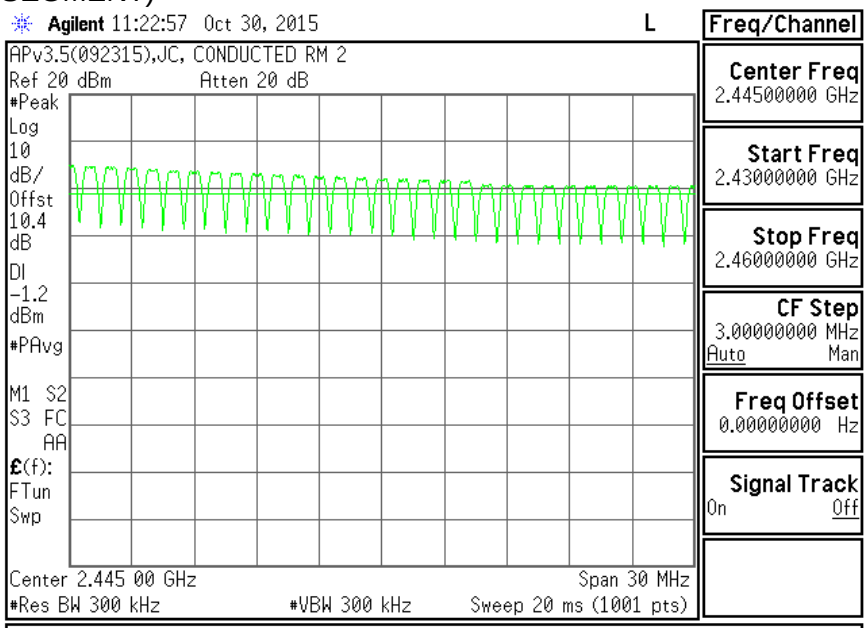
NUMBER OF HOPPING CHANNELS



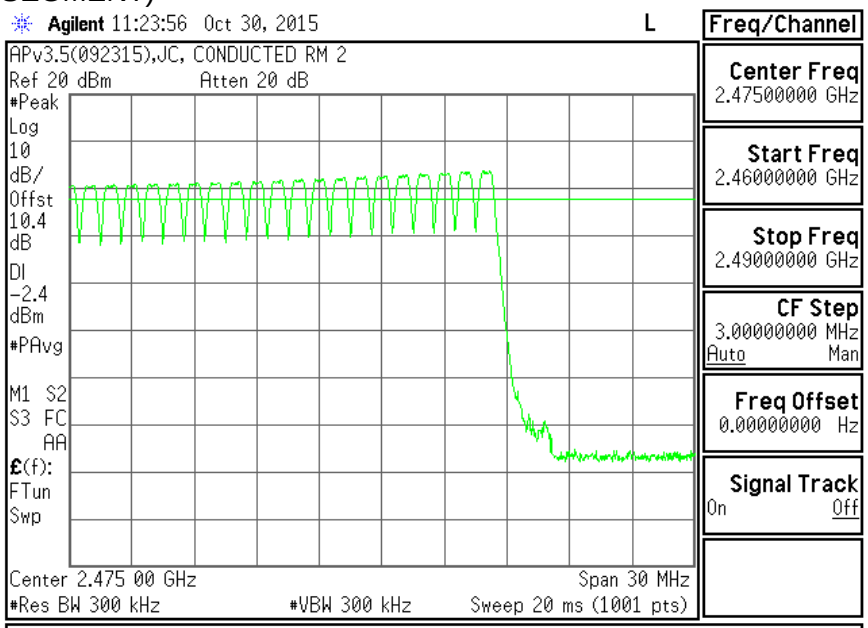
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



8.3.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 A5.1 (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.

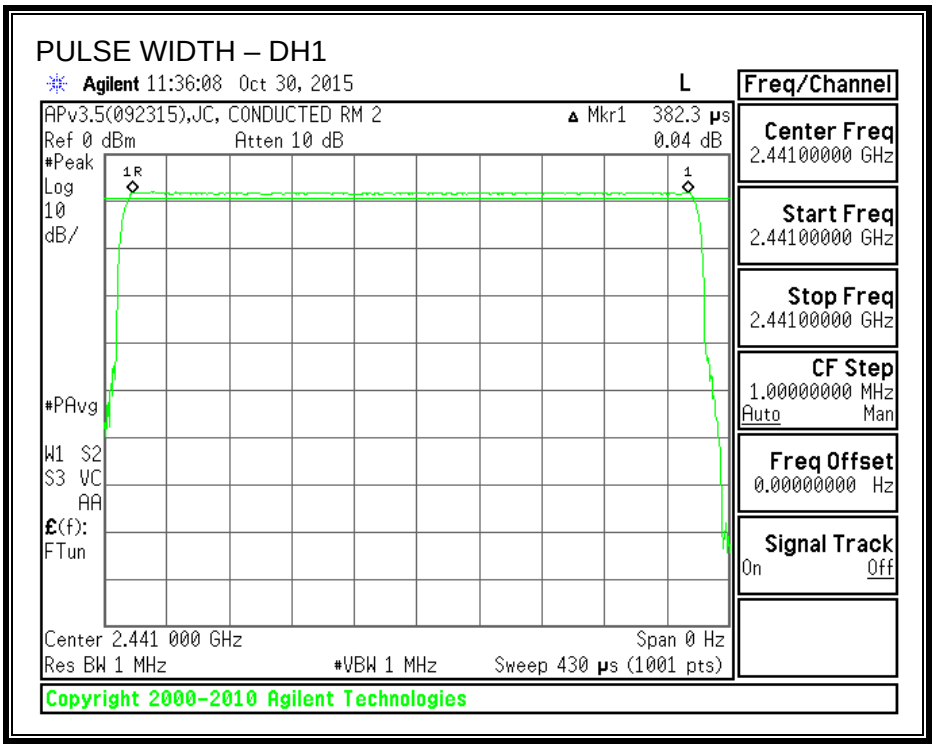
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to 10 * (# of pulses in 3.16 s) * pulse width.

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.

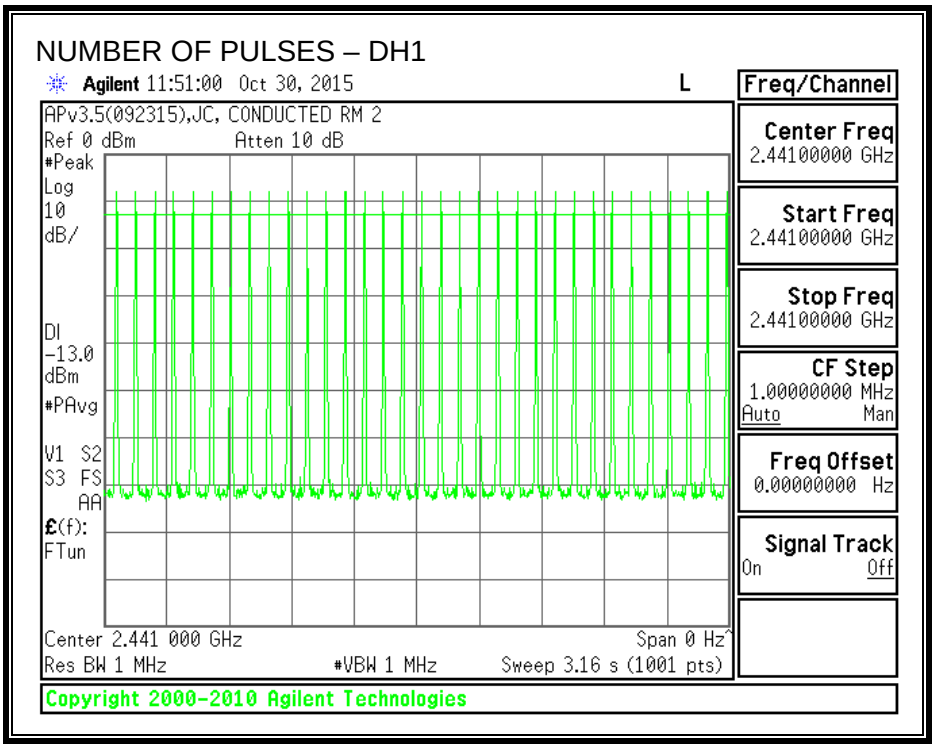
RESULTS

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	0.382	33	0.126	0.4	-0.274
DH3	1.645	17	0.280	0.4	-0.120
DH5	2.888	11	0.318	0.4	-0.082
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	0.382	8.25	0.032	0.4	-0.368
DH3	1.645	4.25	0.070	0.4	-0.330
DH5	2.888	2.75	0.079	0.4	-0.321

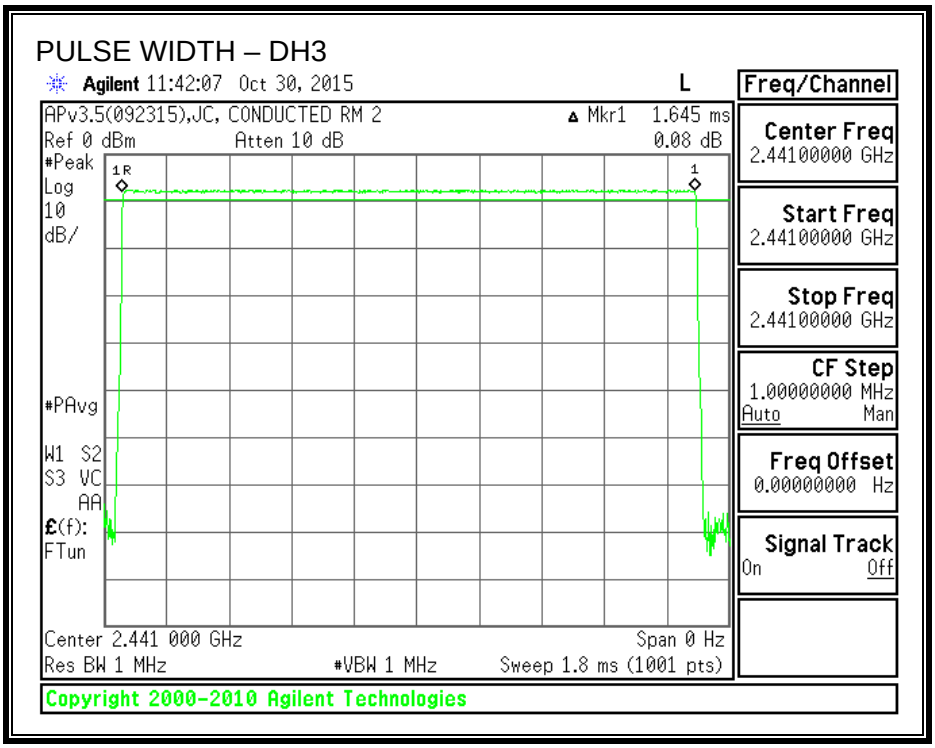
PULSE WIDTH - DH1



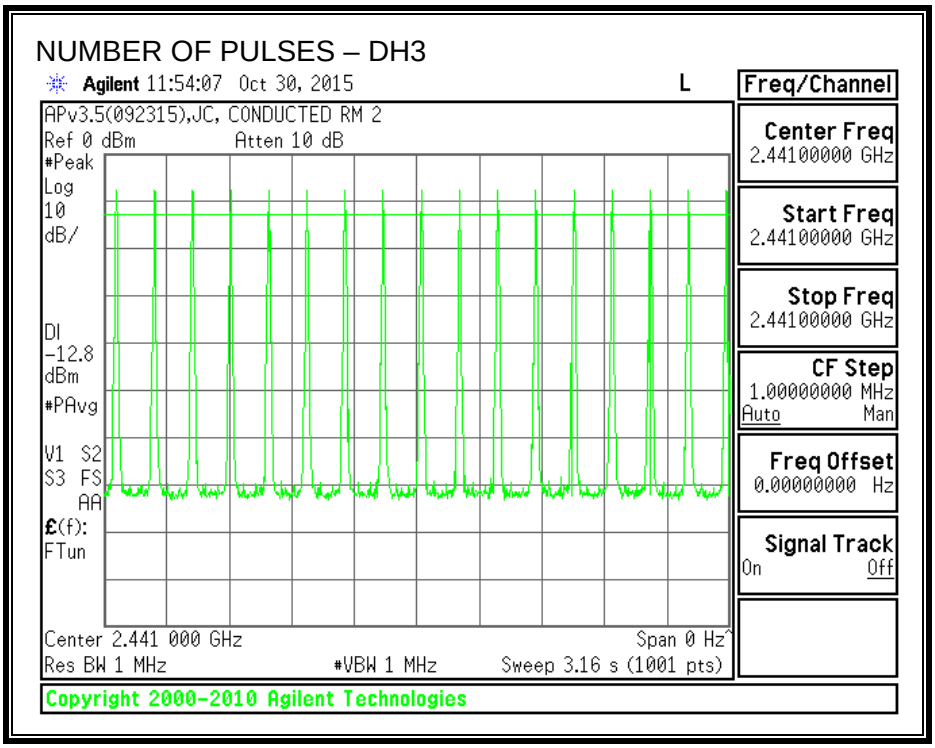
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



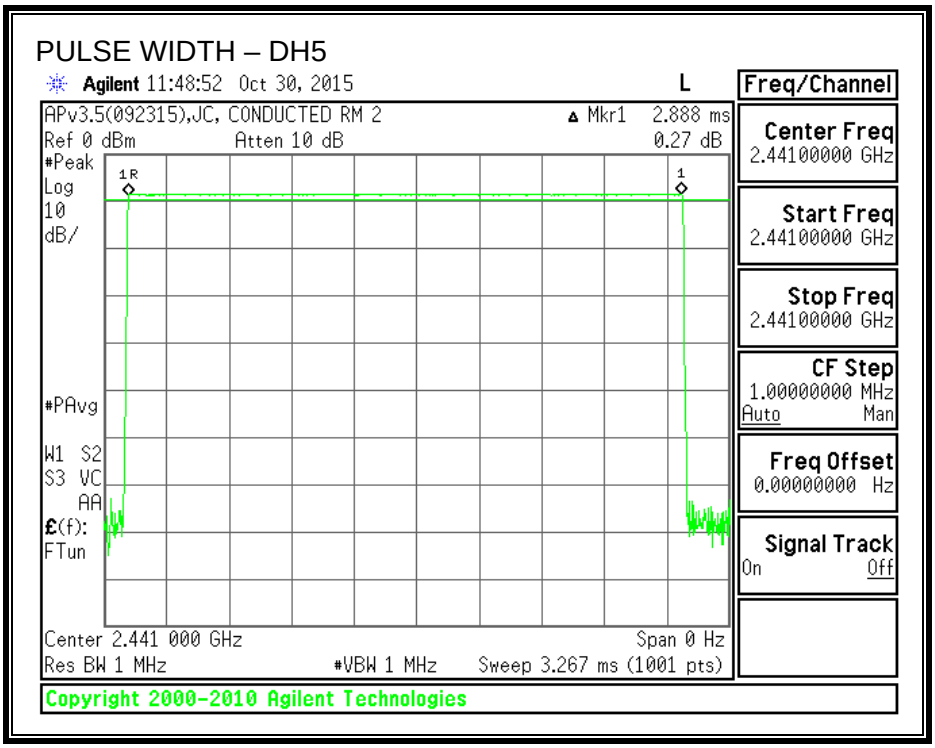
PULSE WIDTH – DH3



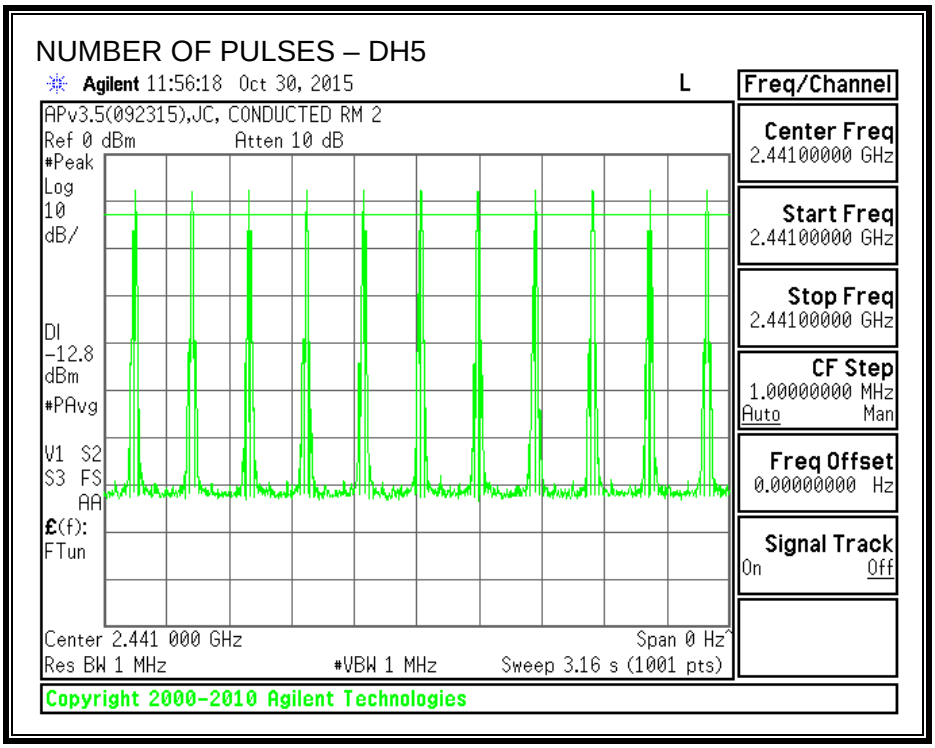
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.3.5. 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 Clause A5.4 (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 was connected to a power meter equipped with a power sensor capable of measuring peak power. The cable assembly insertion loss of 10.4 dB (including 10 dB pad and 0.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

For 75 or more hopping channels

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	7.05	7.23	28.8	-21.72
Middle	2441	7.86	7.23	28.8	-20.91
High	2480	8.27	7.23	28.8	-20.50

8.3.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter and a gated average power measurement was performed. The cable assembly insertion loss of 10.4 dB (including 10 dB pad and 0.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	6.71
Middle	2441	7.52
High	2480	8.05

8.3.7. 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 A5.5

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

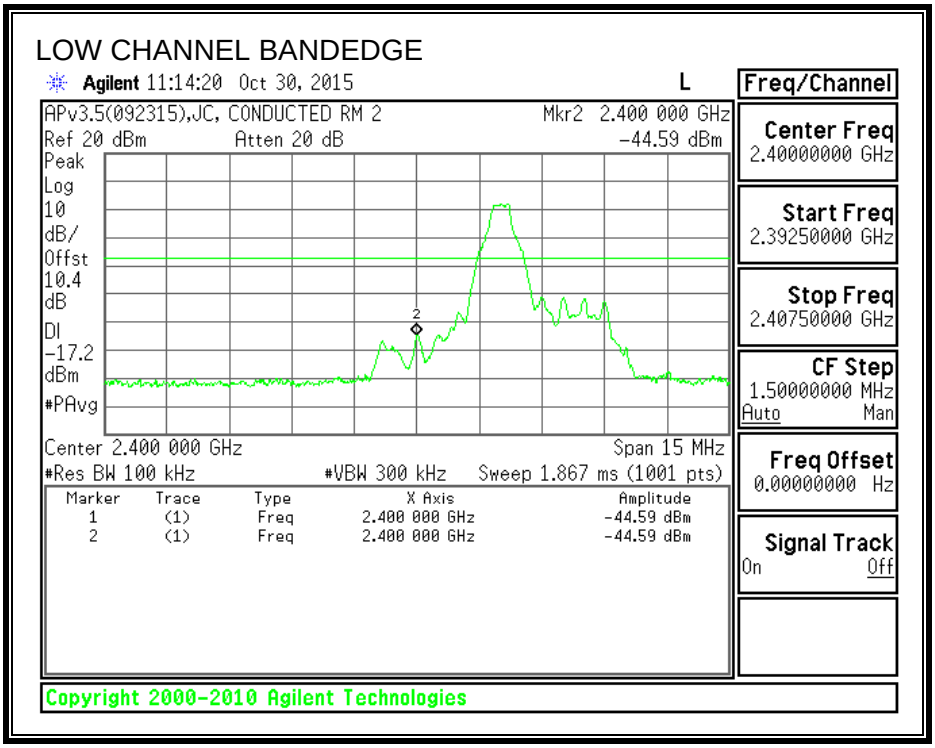
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

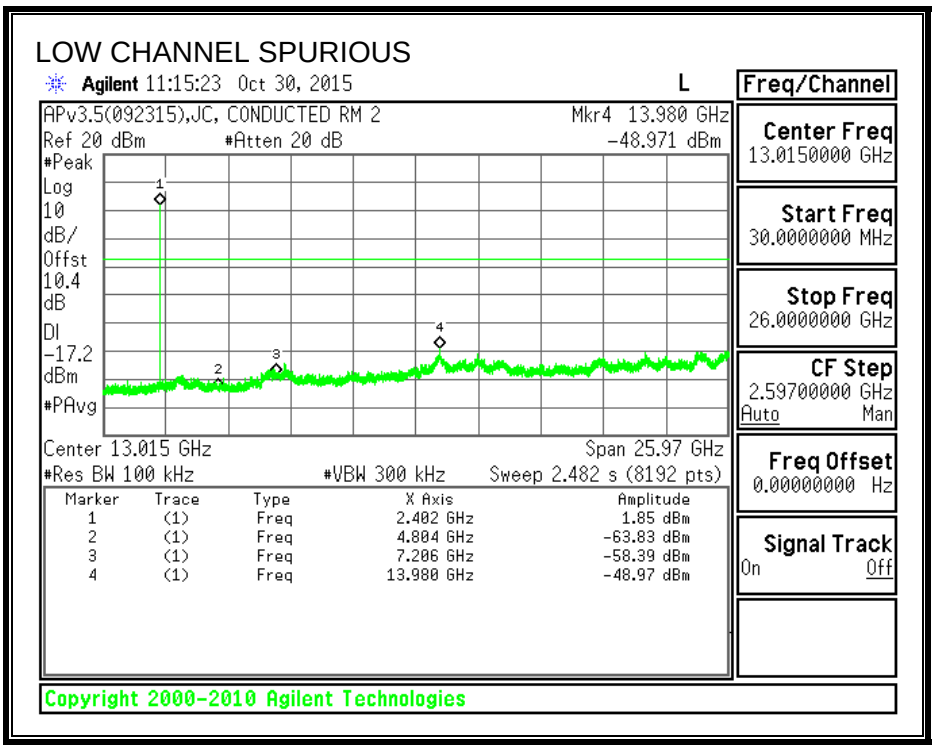
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

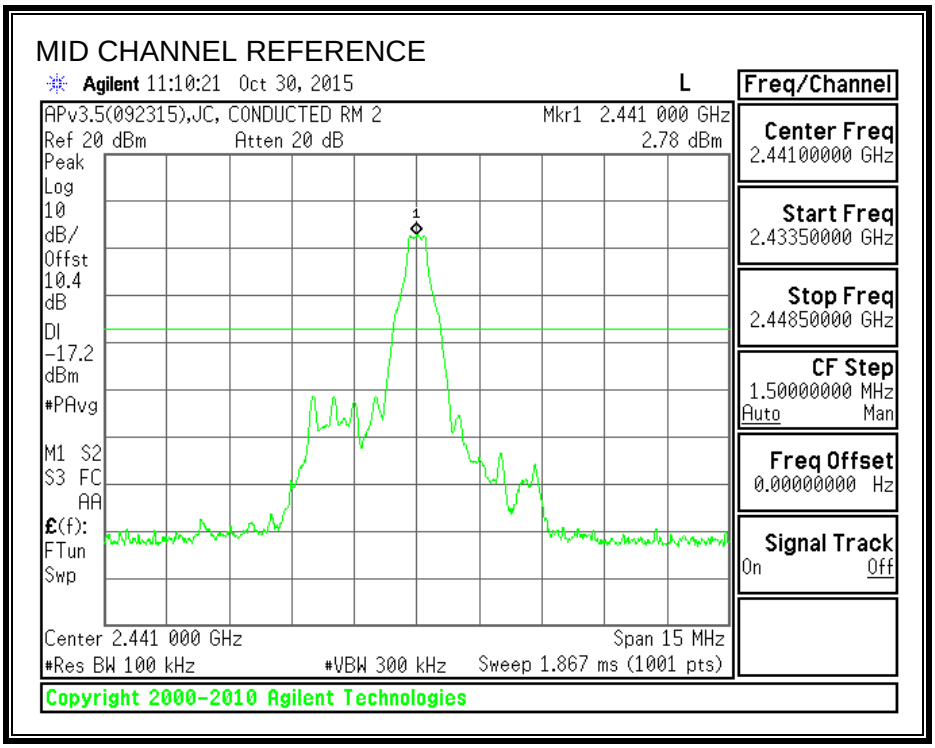
SPURIOUS EMISSIONS, LOW CHANNEL

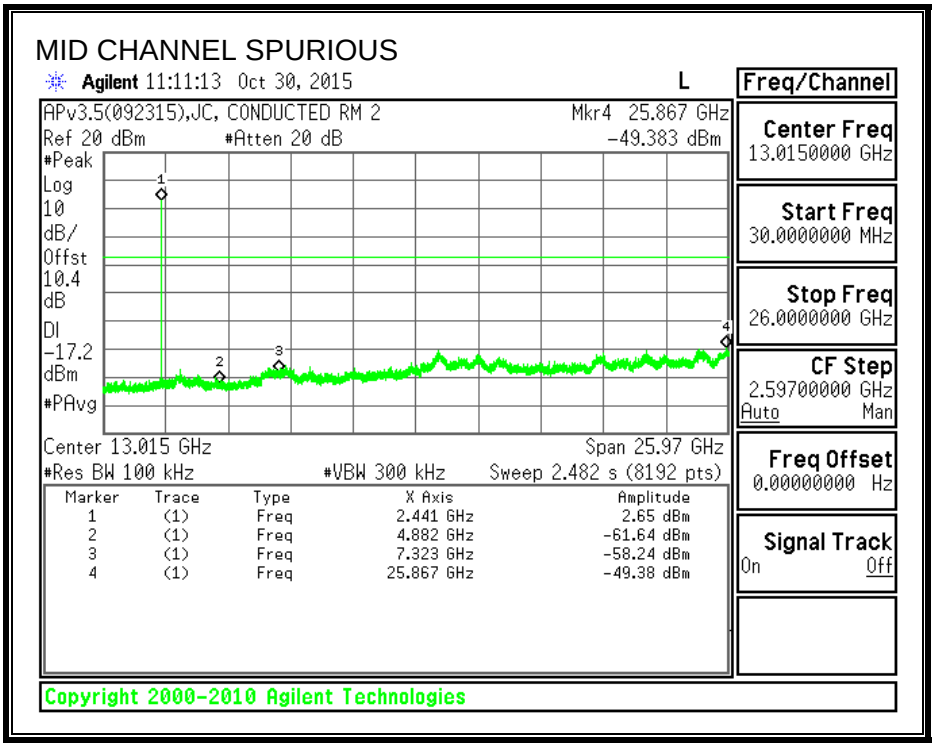


LOW CHANNEL SPURIOUS

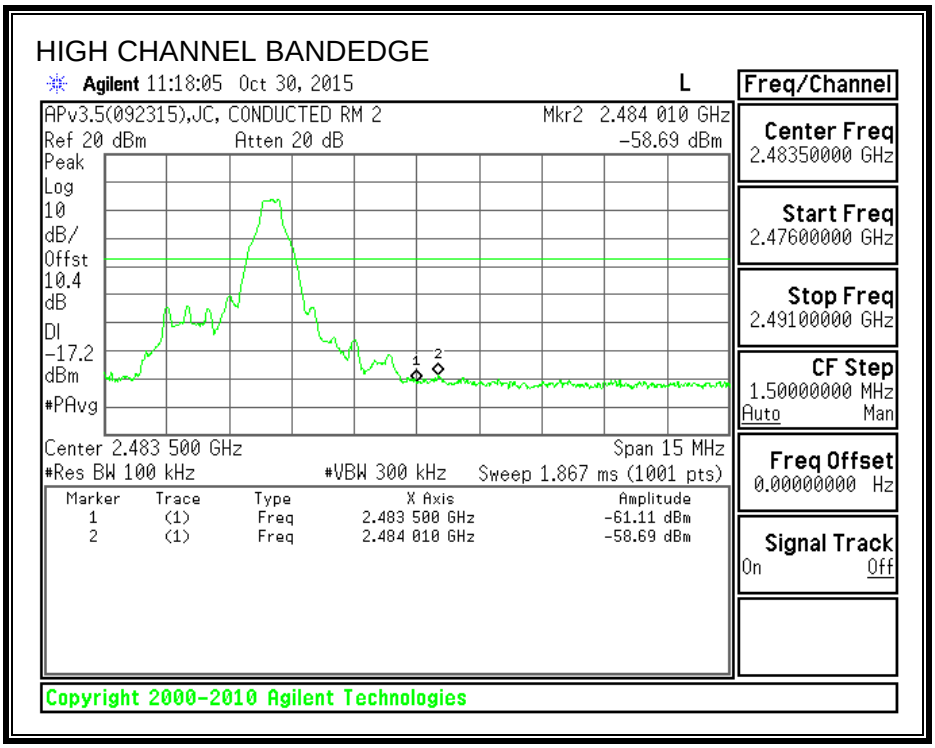


SPURIOUS EMISSIONS, MID CHANNEL

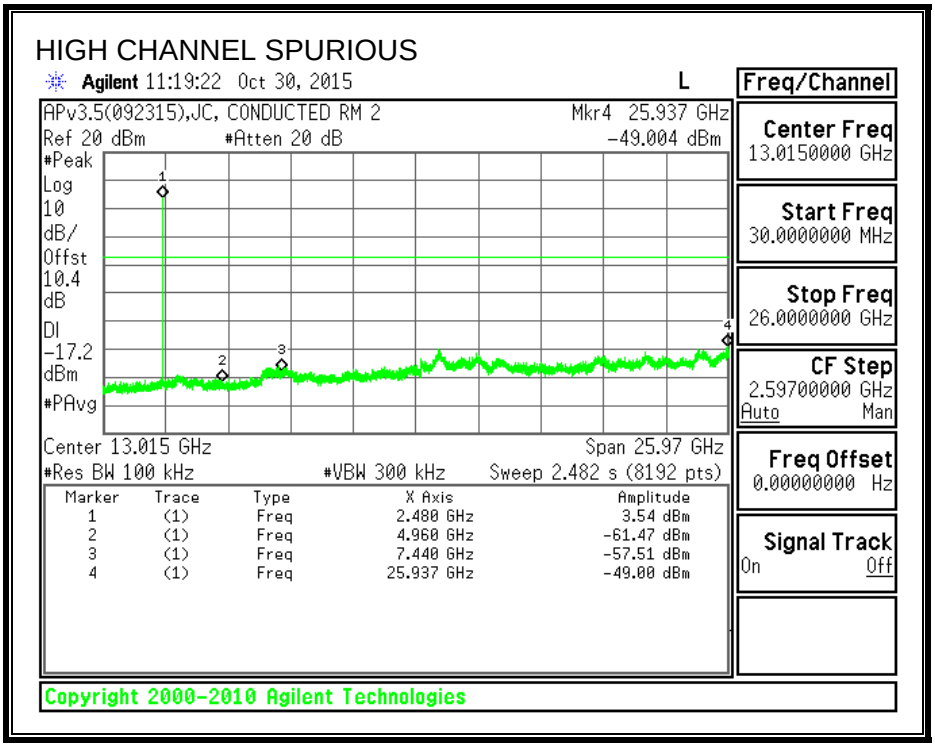




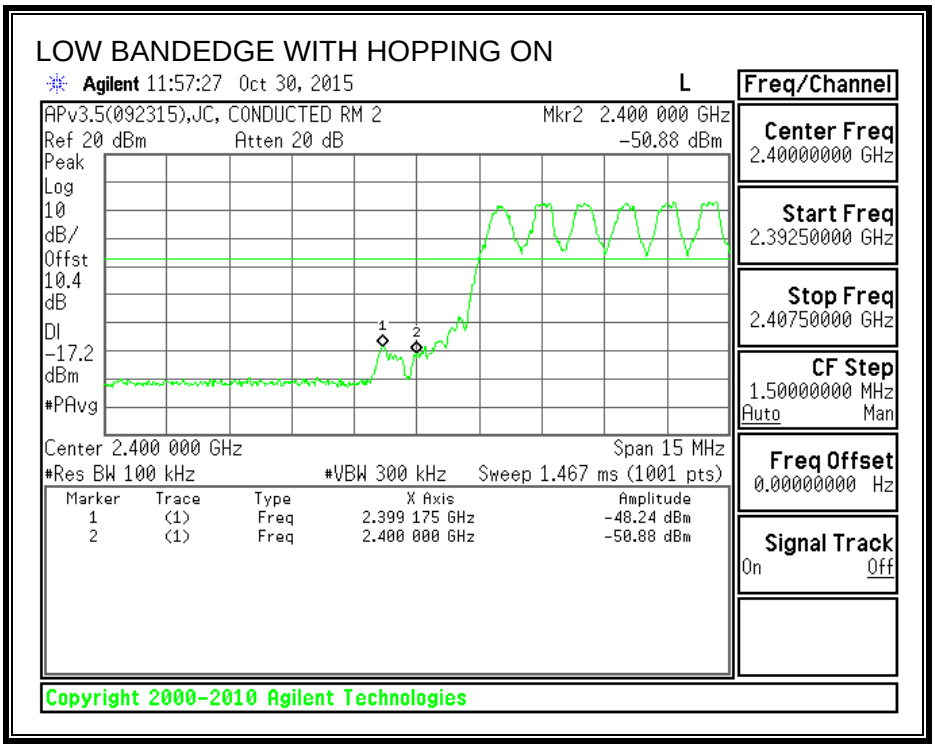
SPURIOUS EMISSIONS, HIGH CHANNEL



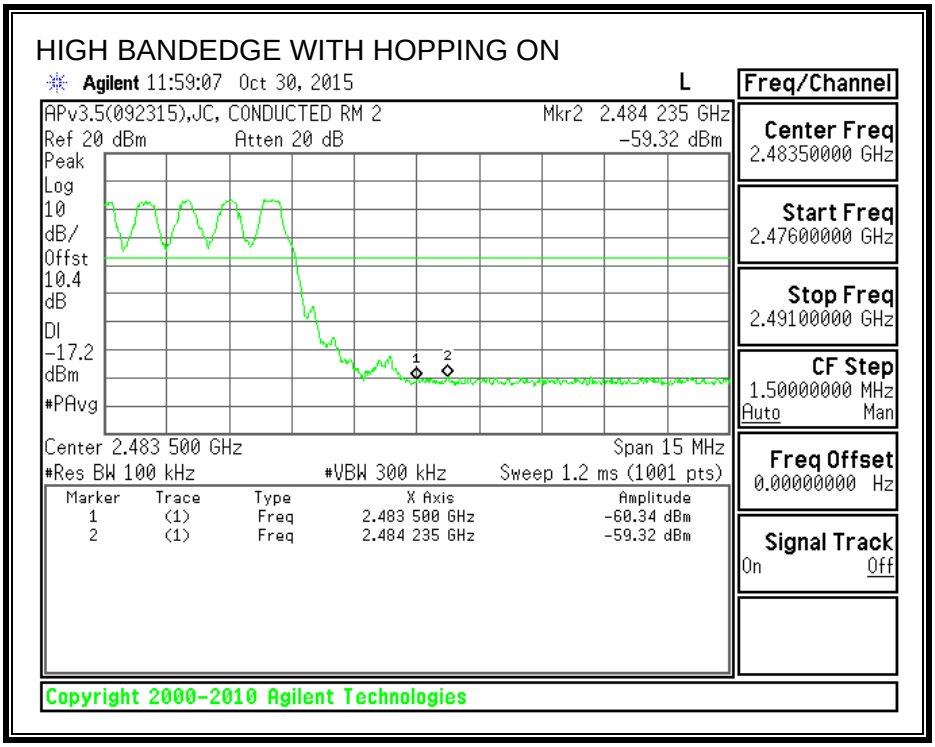
HIGH CHANNEL SPURIOUS



SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



8.4. ENHANCED DATA RATE QPSK MODULATION

8.4.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

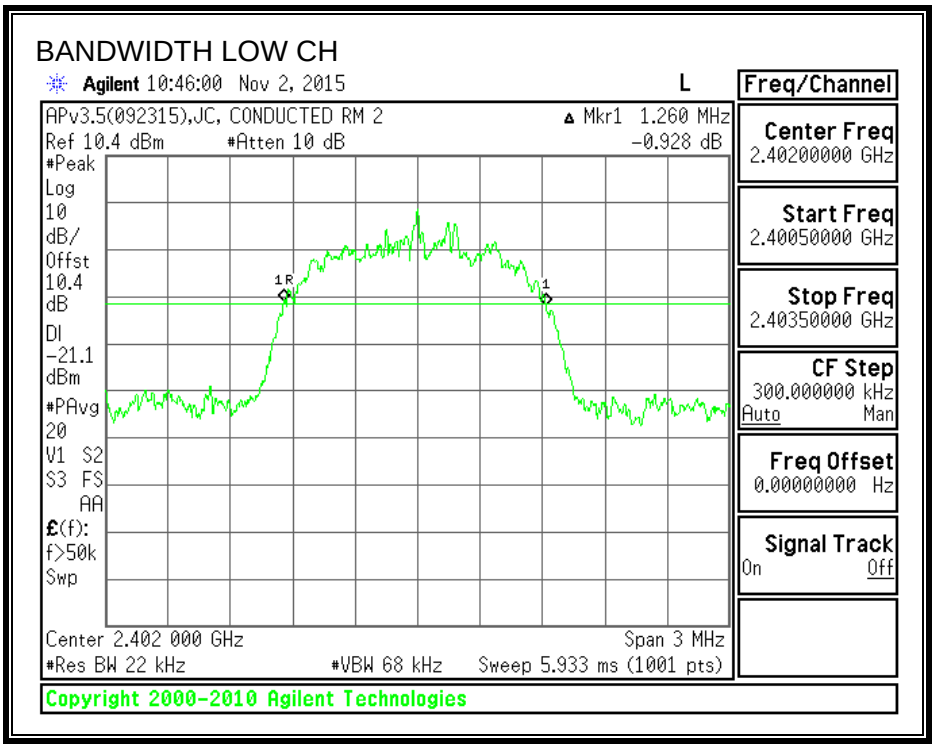
TEST PROCEDURE

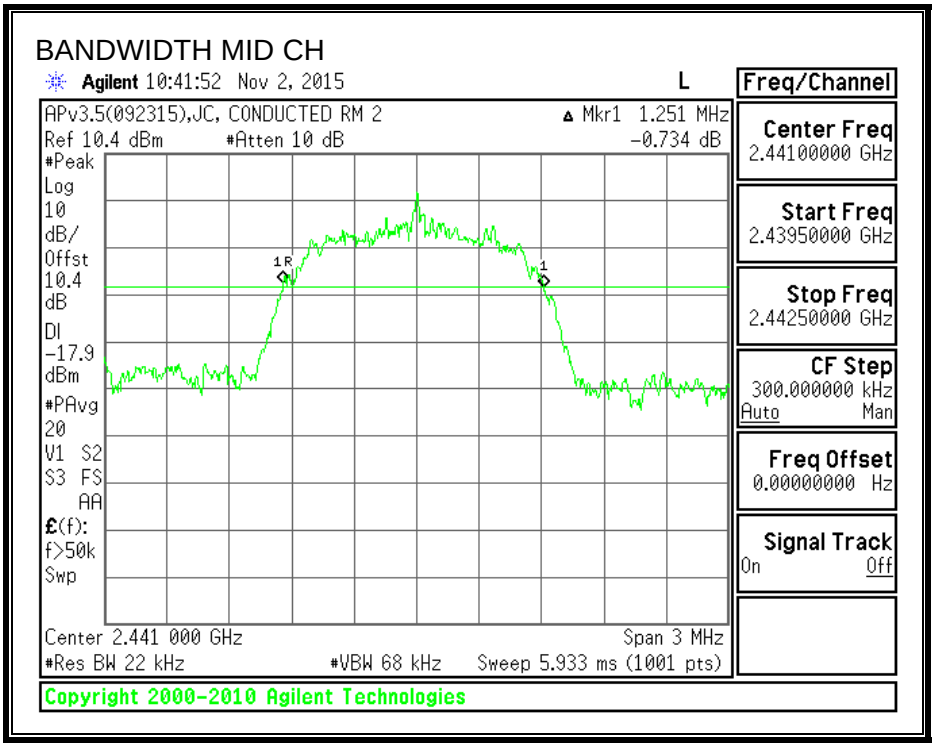
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1-5% of the 20 dB bandwidth and 99% Occupied Bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

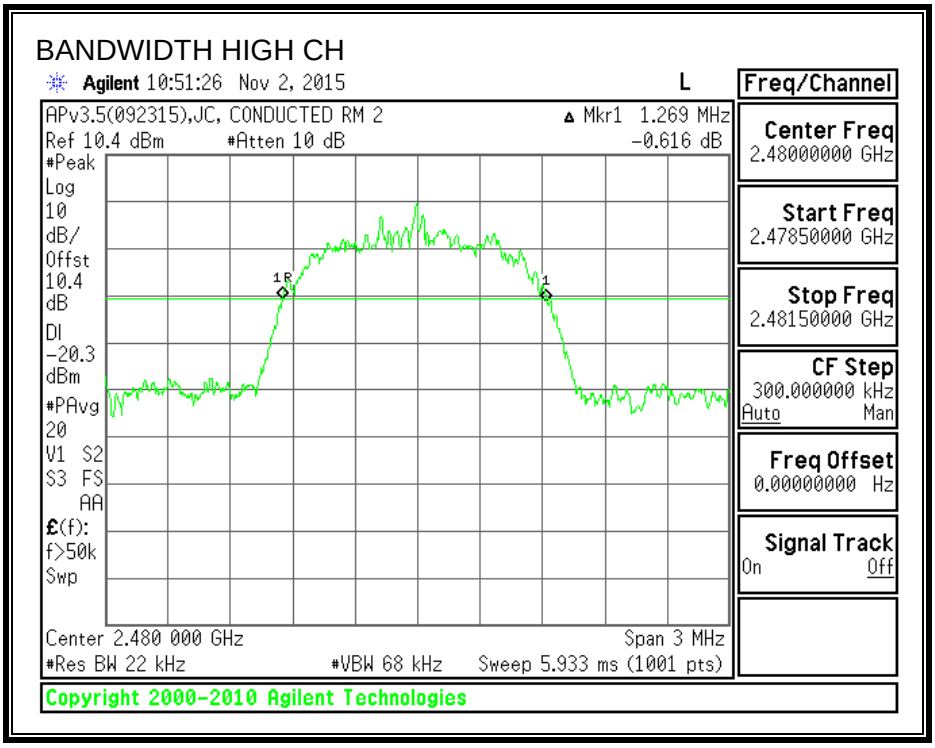
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1260	1204.5
Middle	2441	1251	1212.7
High	2480	1269	1213.5

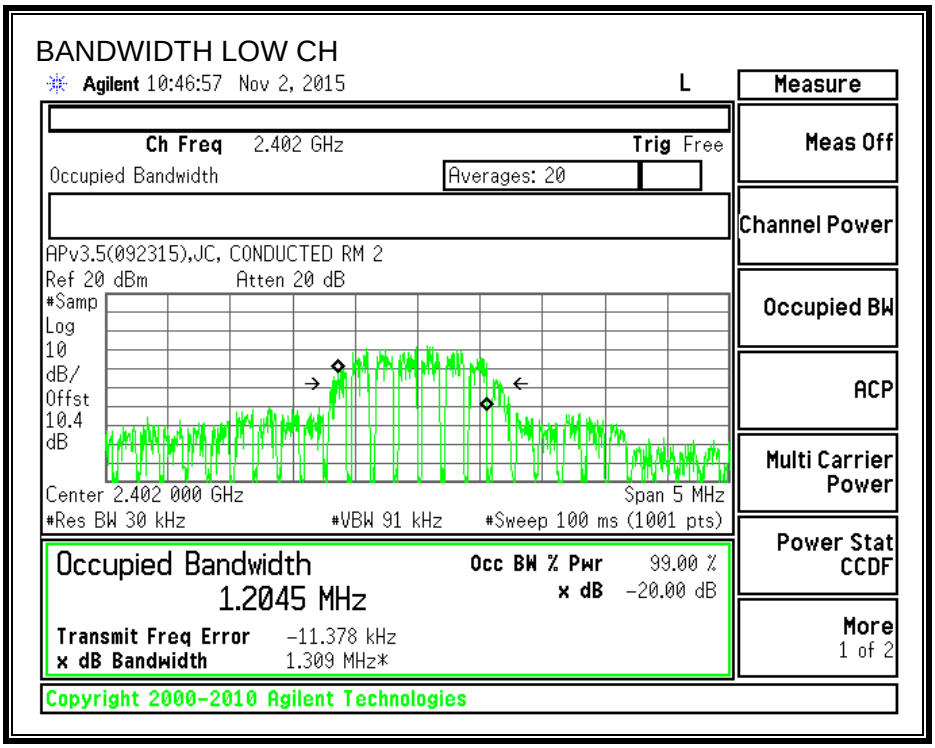
20 dB BANDWIDTH

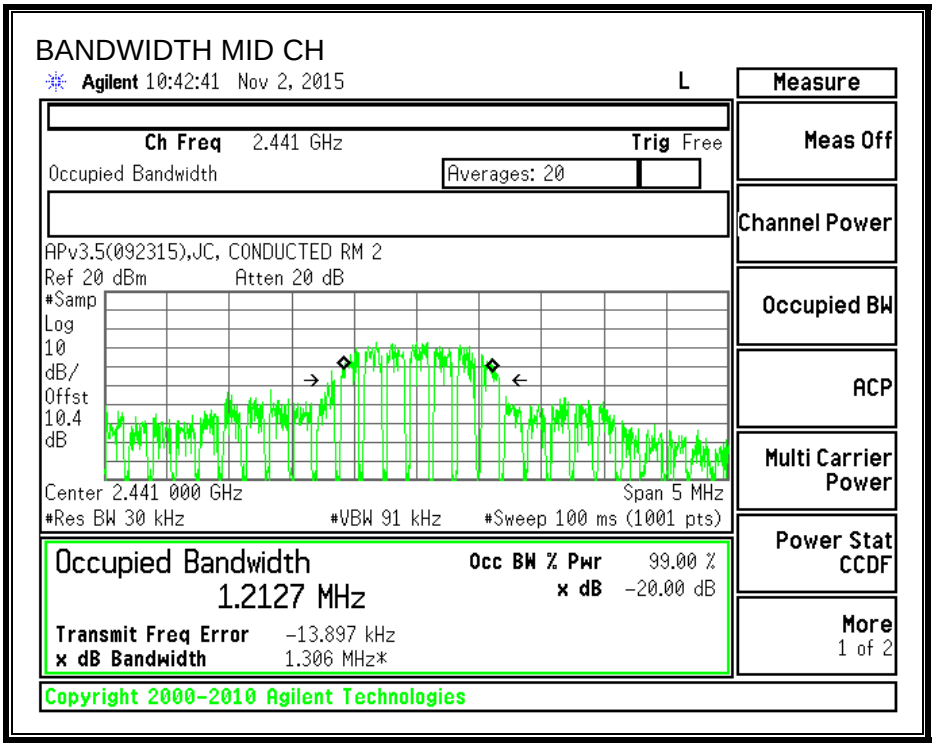


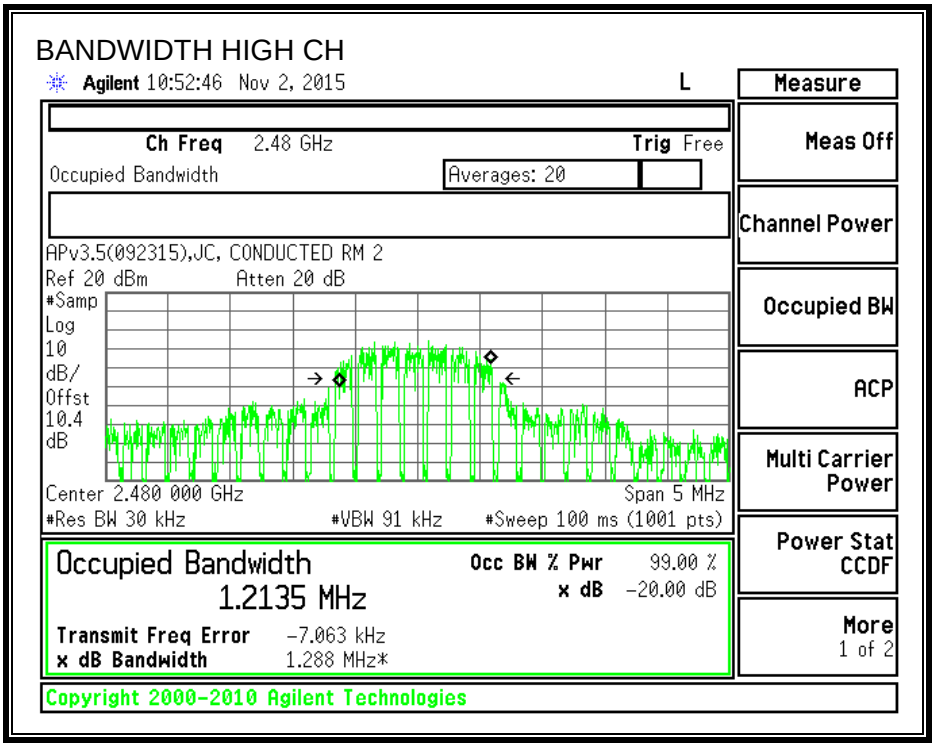




99% BANDWIDTH







8.4.2. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 A5.1 (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.

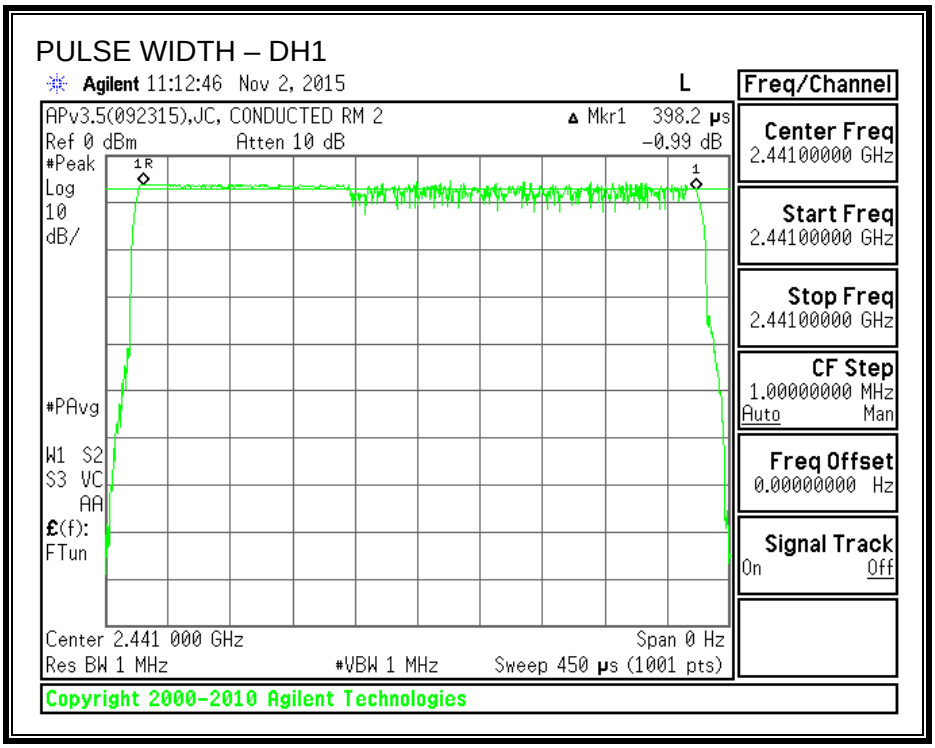
RESULTS

DQPSK Mode

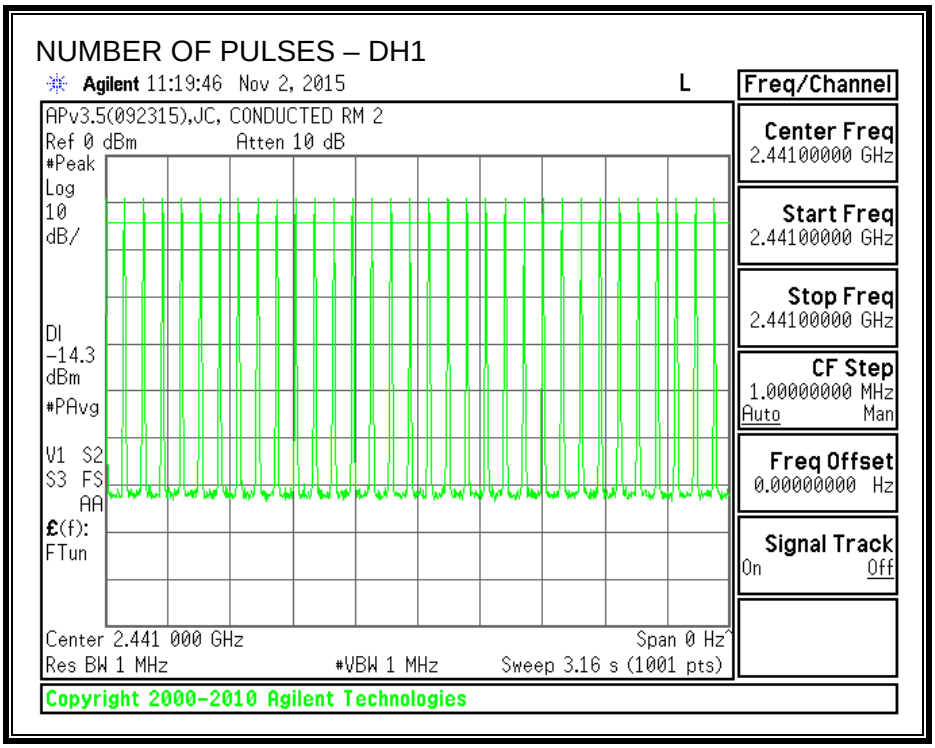
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.398	33	0.131	0.4	-0.269
DH3	1.648	17	0.280	0.4	-0.120
DH5	2.896	11	0.319	0.4	-0.081

Note: for AFH (DQPSK) 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 31 demonstrates compliance with channel occupancy when AFH is employed.

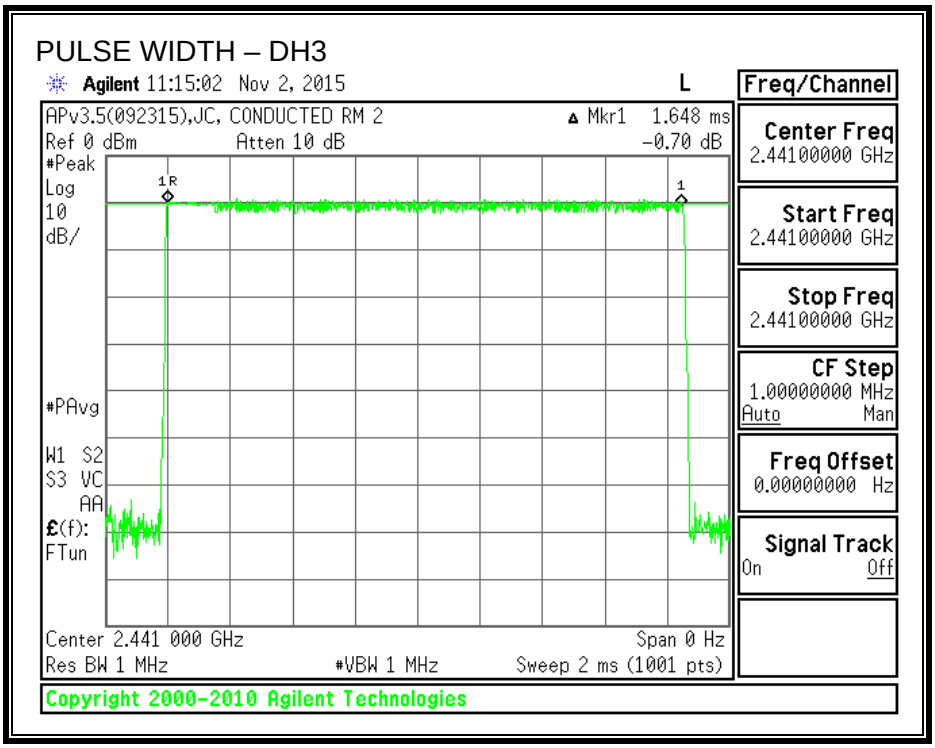
PULSE WIDTH - DH1



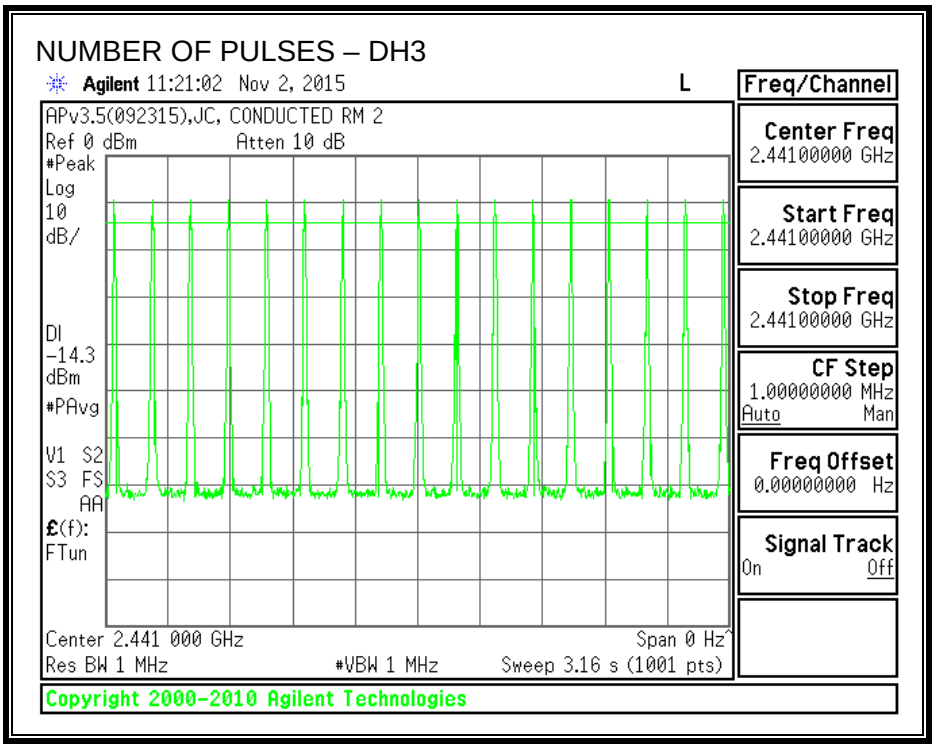
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



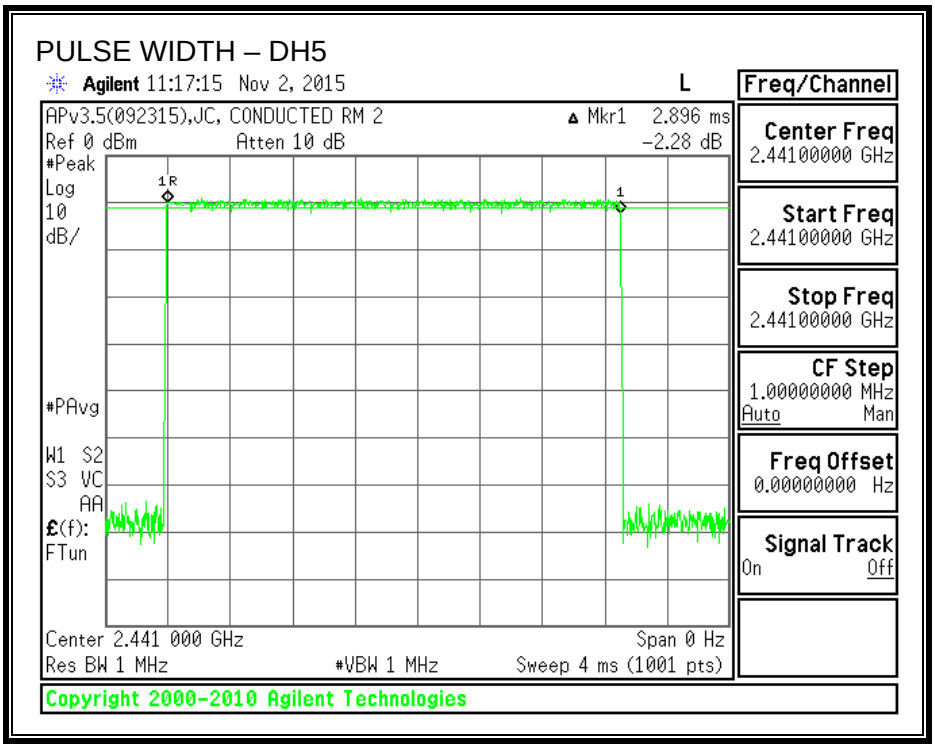
PULSE WIDTH – DH3



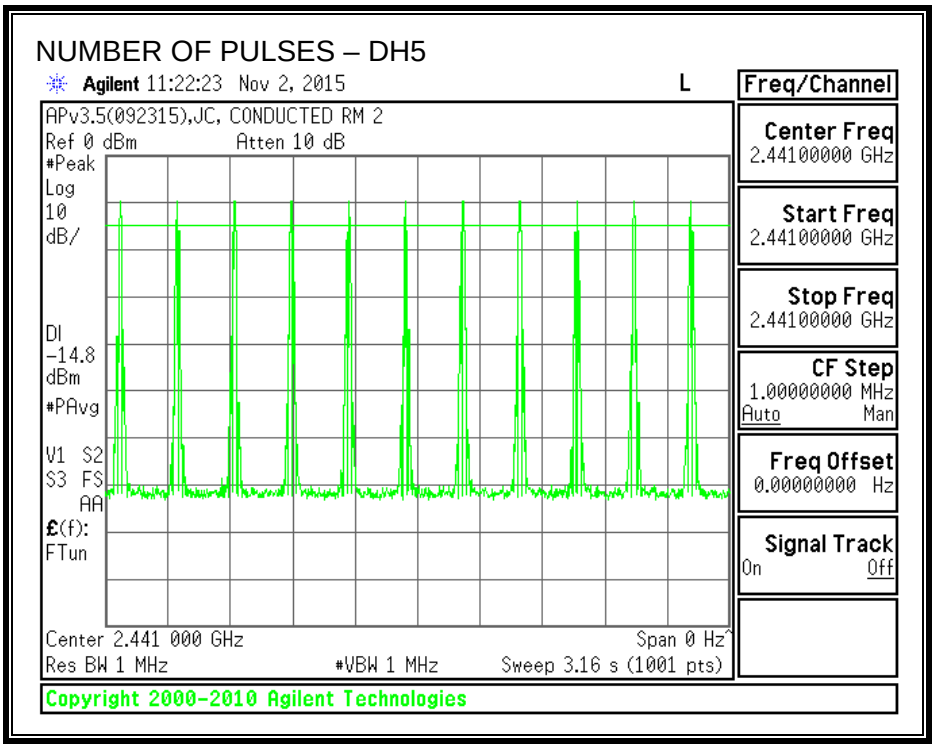
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.4.3. 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 Clause A5.4 (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 was connected to a power meter equipped with a power sensor capable of measuring peak power. The cable assembly insertion loss of 10.4 dB (including 10 dB pad and 0.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

For DQPSK mode, the channel separation was limited to 2/3 the 20 dB bandwidth. Therefore, the output power was limited to 125 mW. This was based on the channel separation measurements for the 8PSK mode.

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	5.22	7.23	19.8	-14.55
Middle	2441	6.24	7.23	19.8	-13.53
High	2480	6.72	7.23	19.8	-13.05

8.4.4. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter and a gated average power measurement was performed. The cable assembly insertion loss of 10.4 dB (including 10 dB pad and 0.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	2.81
Middle	2441	3.98
High	2480	4.42

8.5. ENHANCED DATA RATE 8PSK MODULATION

8.5.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

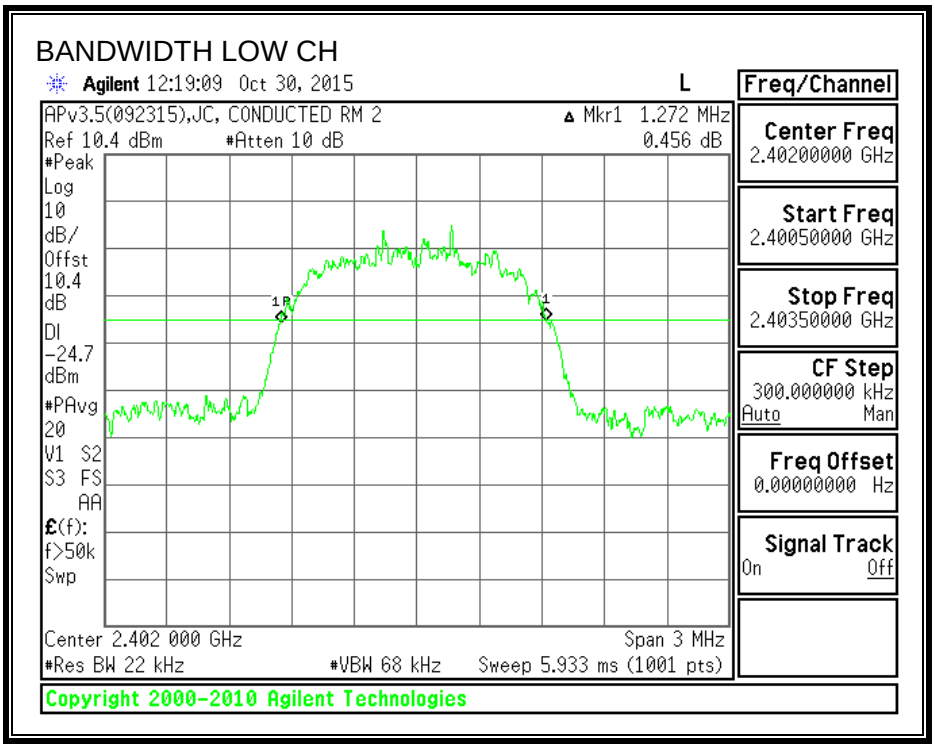
TEST PROCEDURE

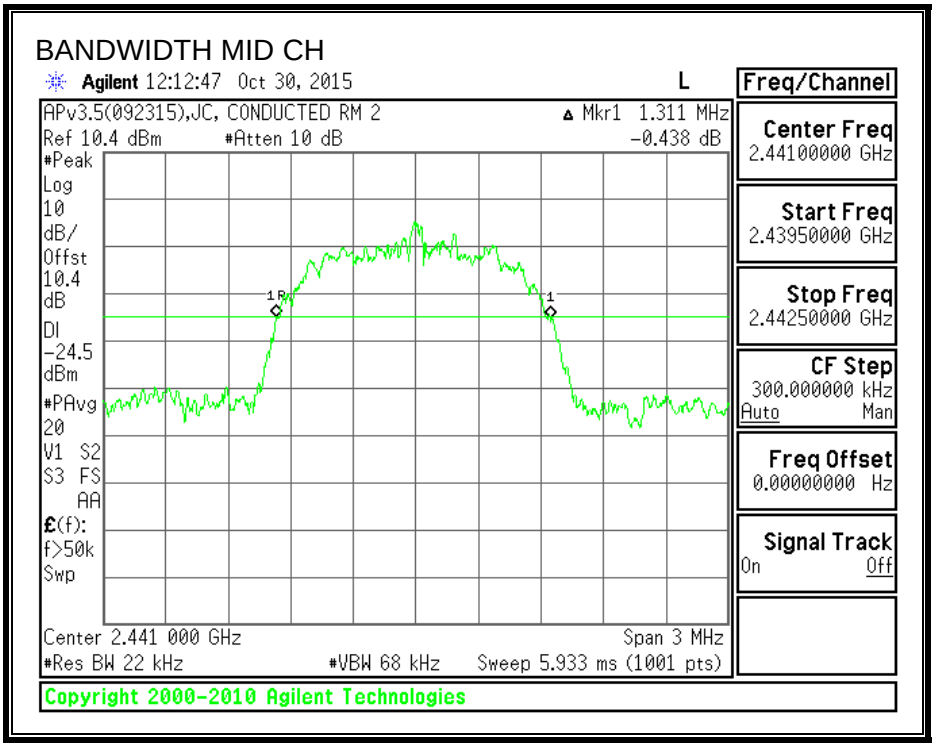
The transmitter output is connected to a spectrum analyzer. The RBW is set to 1-5% of the 20 dB bandwidth and 99% Occupied Bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

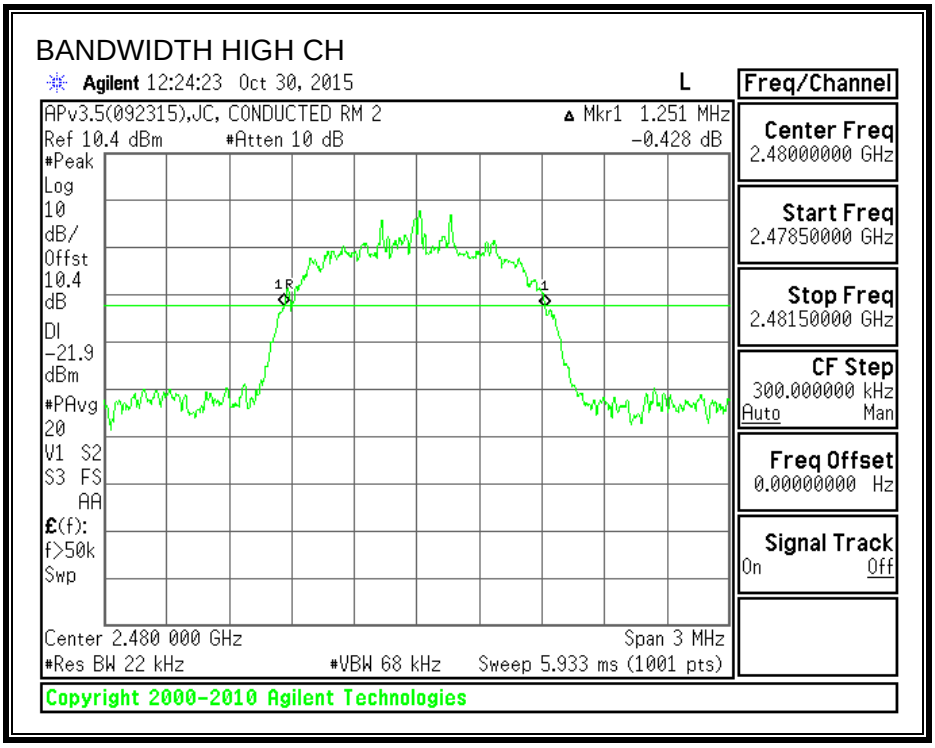
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	1272	1206.0
Middle	2441	1311	1214.3
High	2480	1251	1208.5

20 dB BANDWIDTH

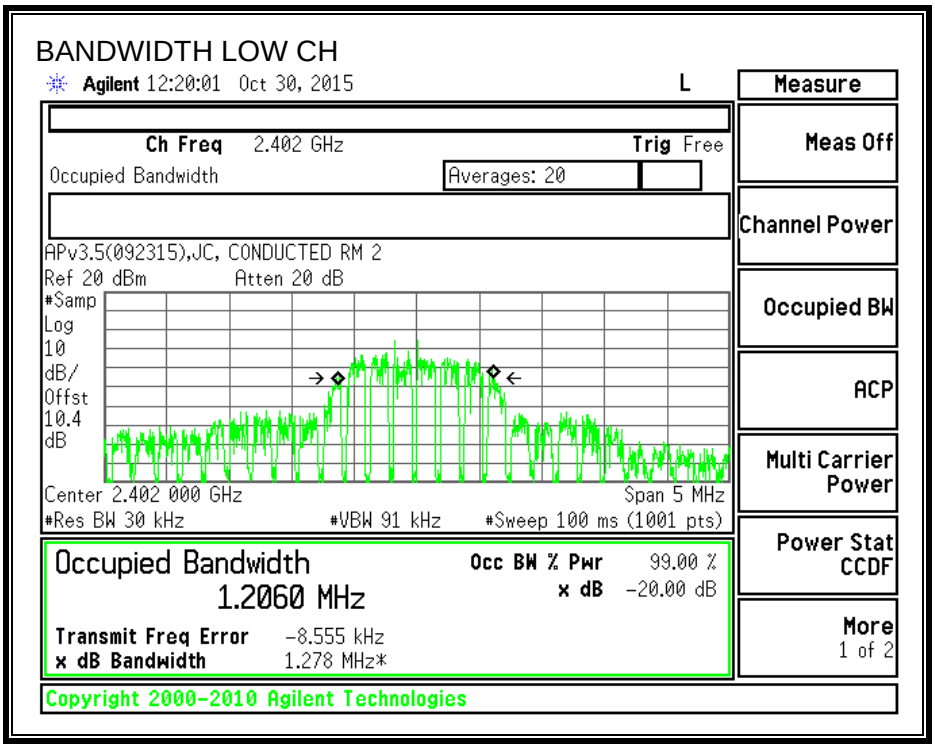


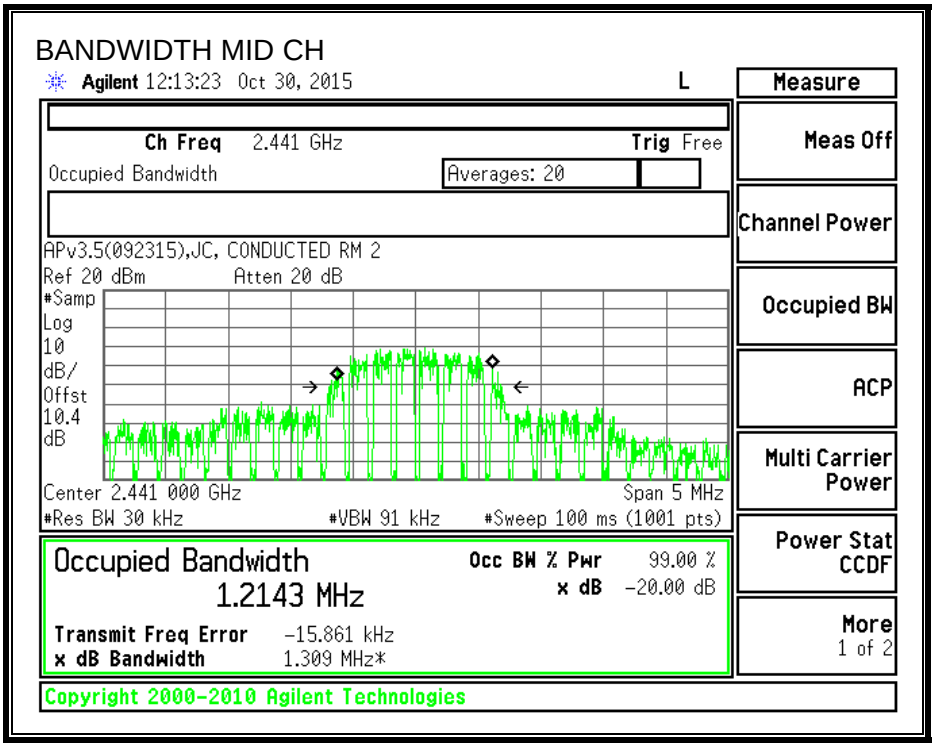


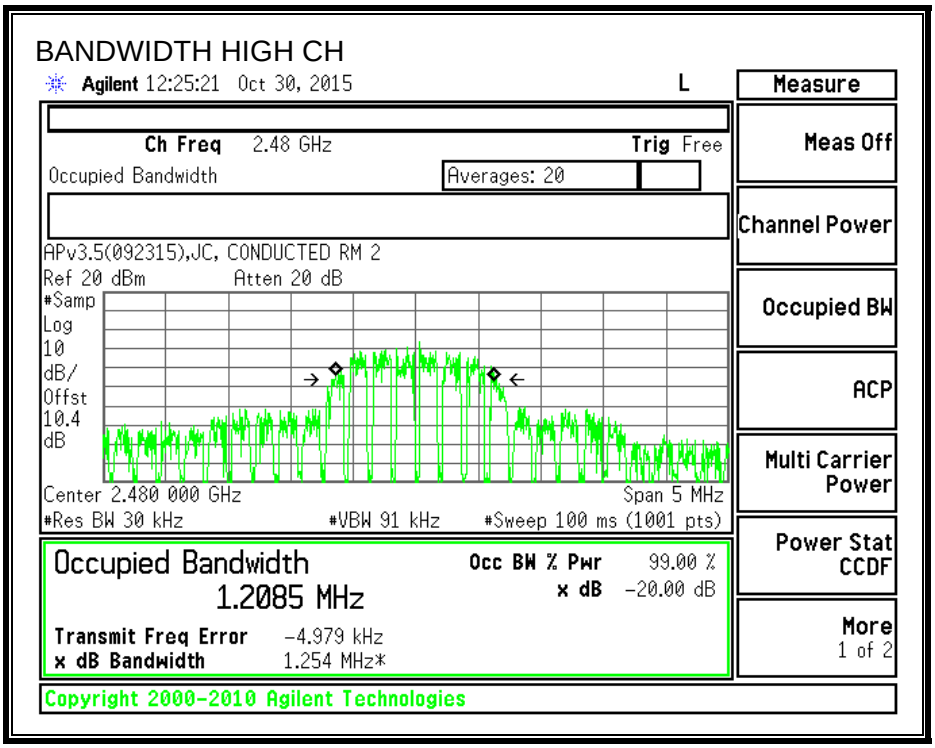
BANDWIDTH HIGH CH



99% BANDWIDTH







8.5.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 A5.1 (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.

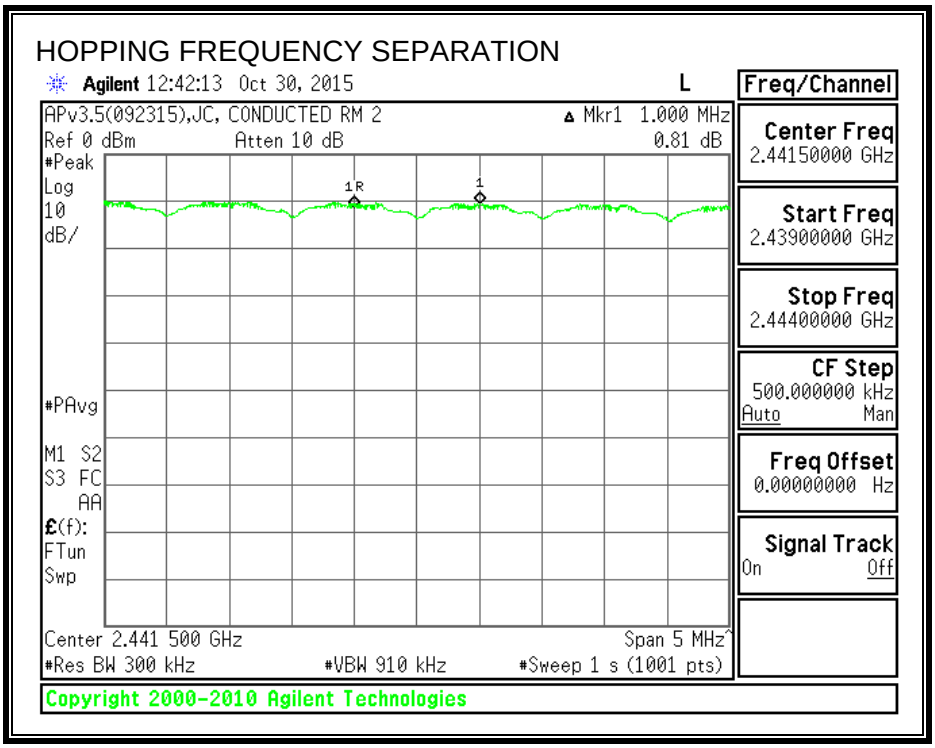
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION



Note – The channel hopping separation of 1MHz is less than the 20 dB bandwidth (approx. 1.3 MHz). However, the output power is less than 125 mW and the channel separation is greater than 2/3 the 20 dB bandwidth (approx. 867 kHz).

8.5.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 A5.1 (4)

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

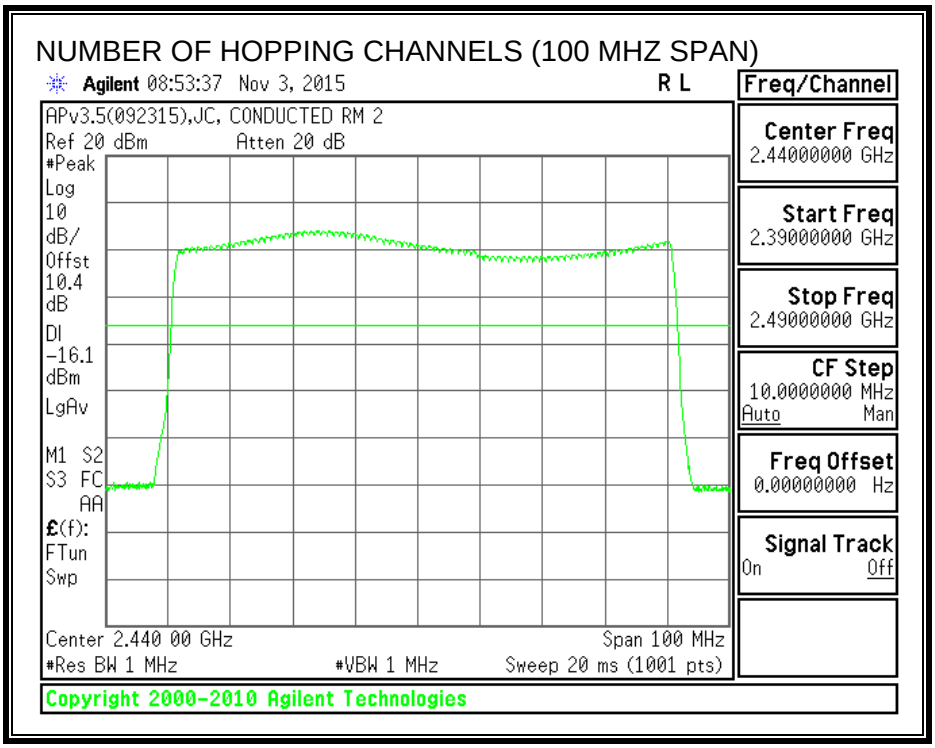
TEST PROCEDURE

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 for visibility of the entire span. Then, smaller spans are set to more clearly identify the channels. The RBW is set to 30% of the channel spacing (approx. 300 kHz). The analyzer is set to Max Hold.

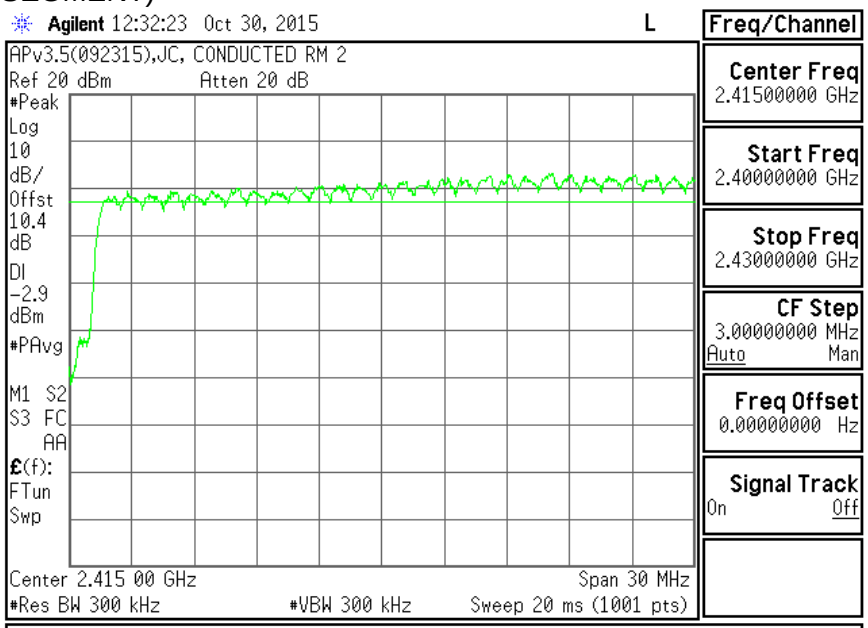
RESULTS

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

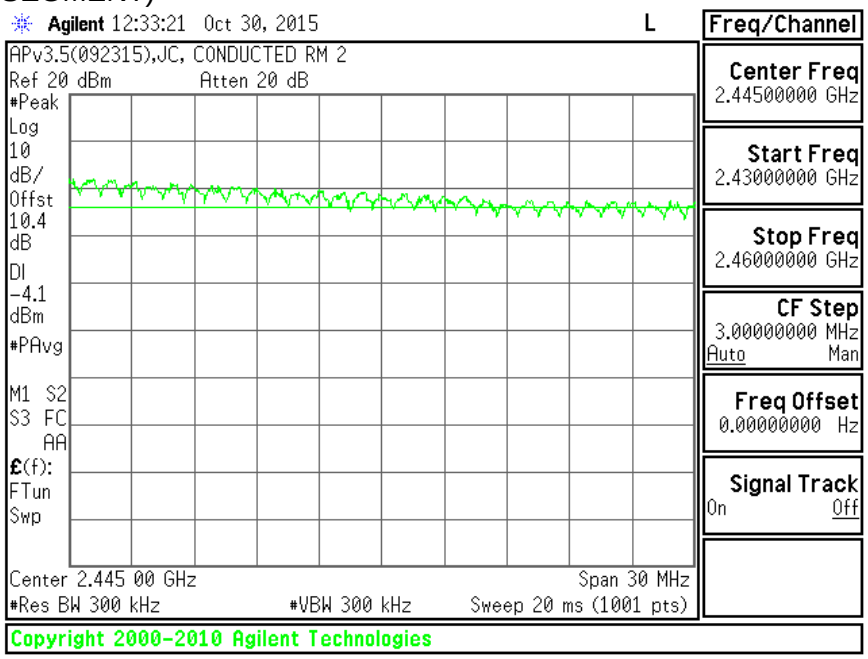
NUMBER OF HOPPING CHANNELS



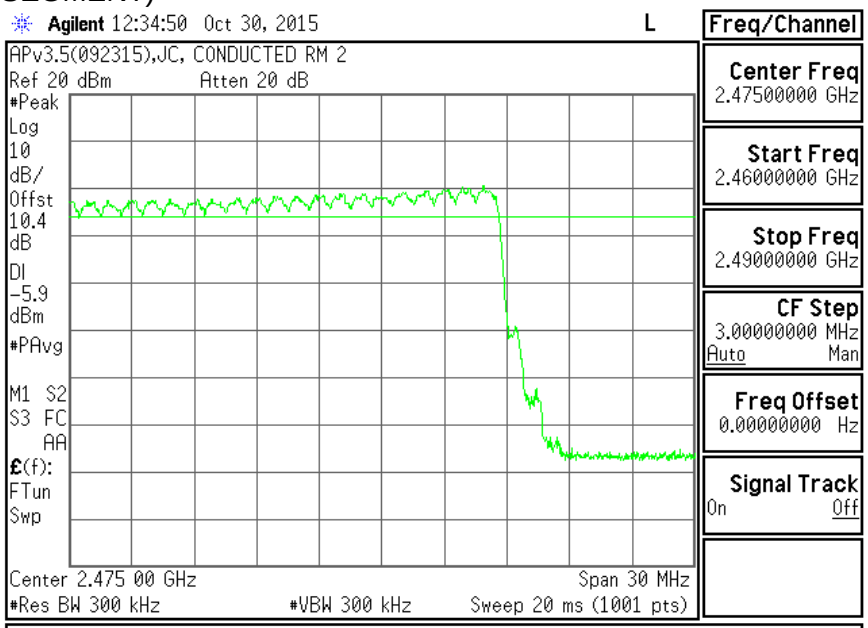
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



8.5.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 A5.1 (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

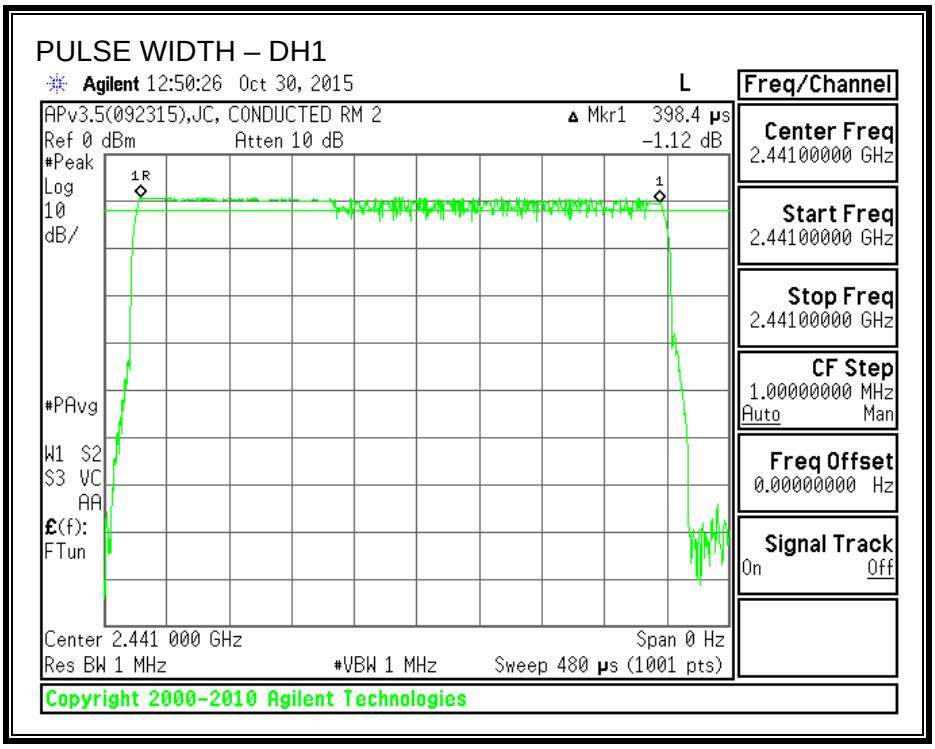
Time Of Occupancy = 10 * xx pulses * yy msec = zz msec

8PSK (EDR) Mode

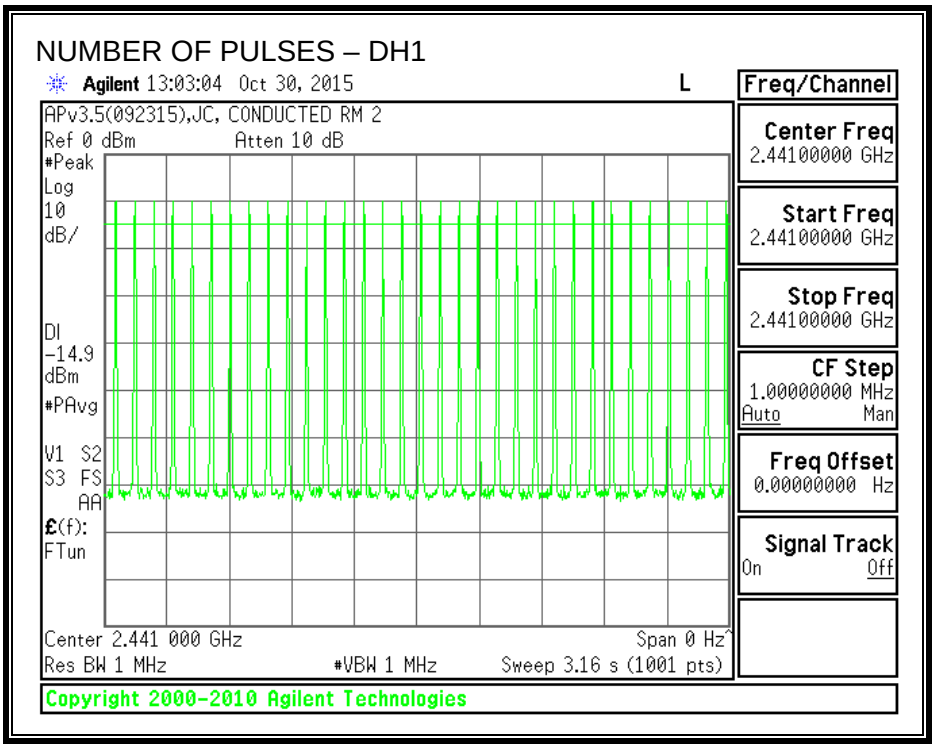
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
DH1	0.398	33	0.131	0.4	-0.269
DH3	1.643	16	0.263	0.4	-0.137
DH5	2.894	11	0.318	0.4	-0.082

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 31 demonstrates compliance with channel occupancy when AFH is employed.

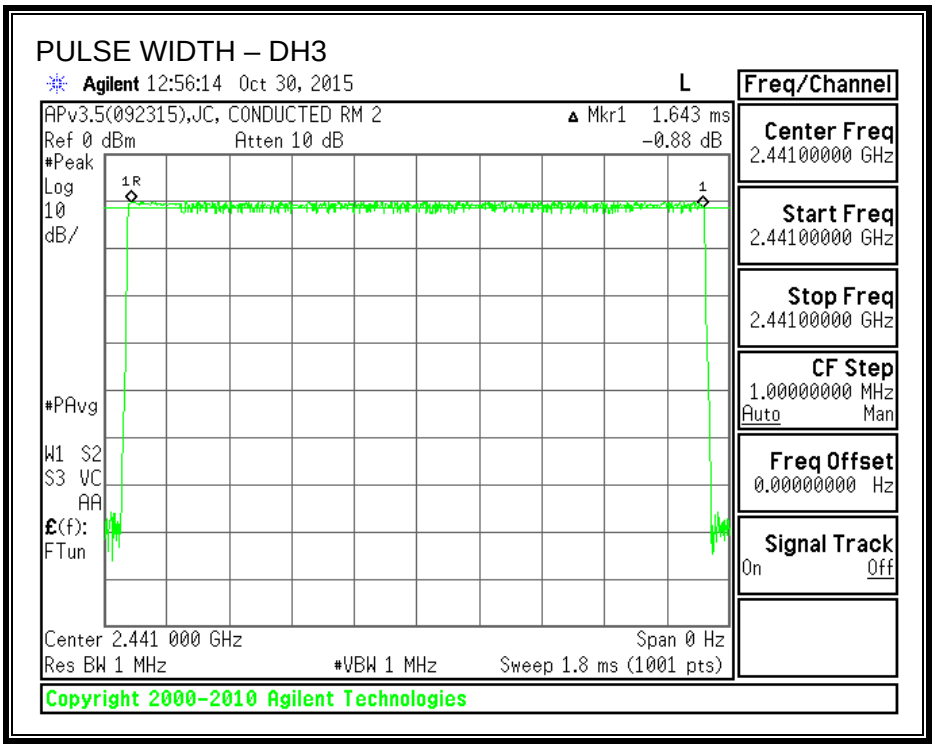
PULSE WIDTH - DH1



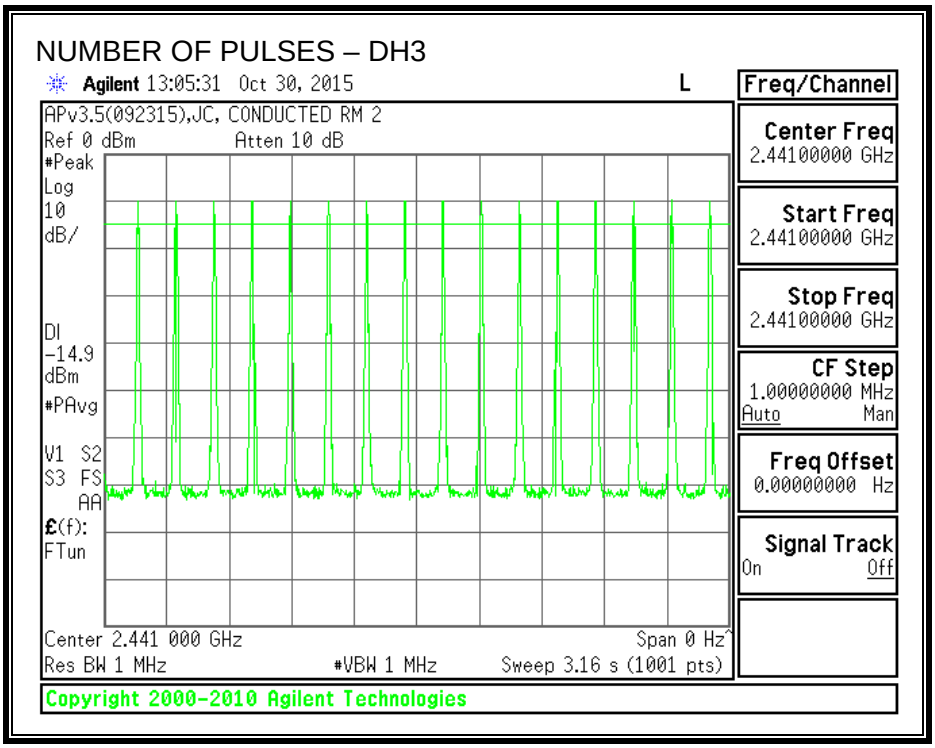
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



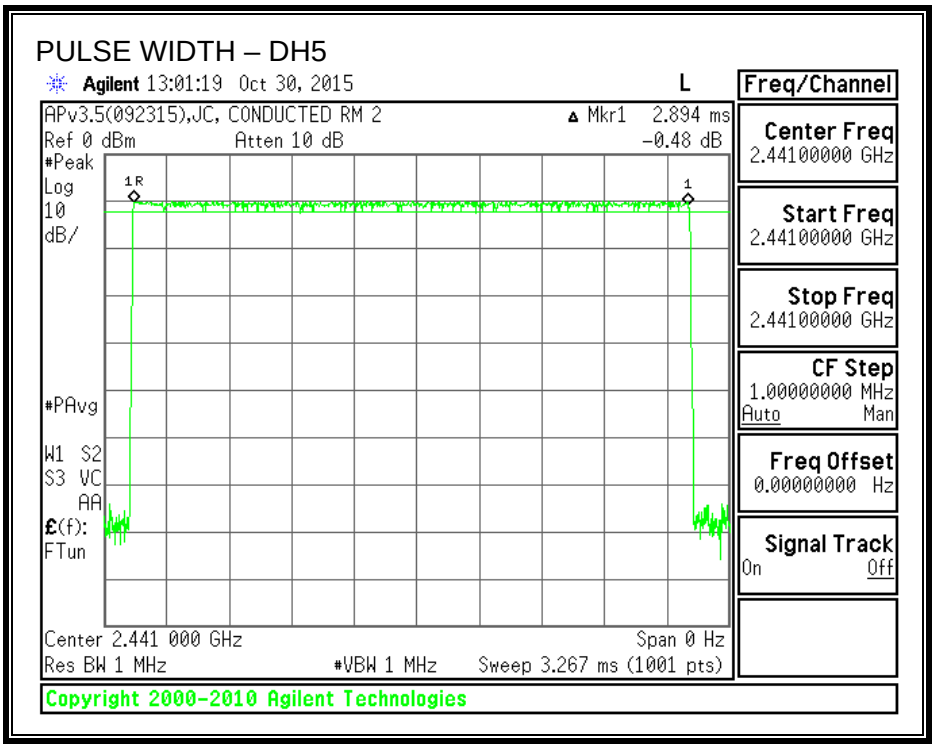
PULSE WIDTH – DH3



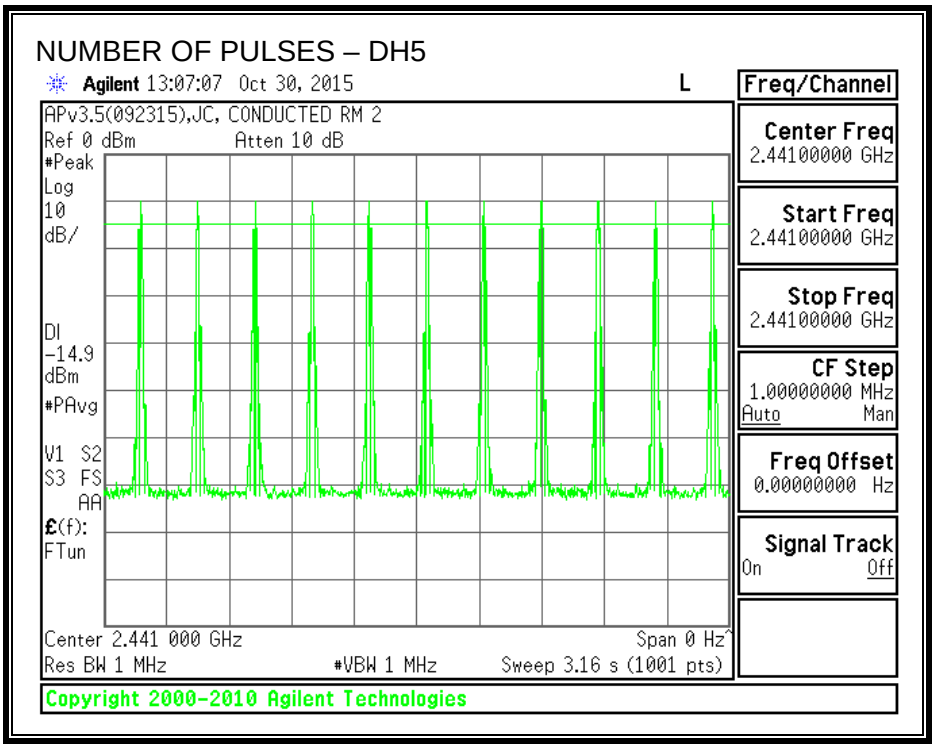
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



8.5.5. 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 Clause A5.4 (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 was connected to a power meter equipped with a power sensor capable of measuring peak power. The cable assembly insertion loss of 10.4 dB (including 10 dB pad and 0.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

For 8DPSK mode, the channel separation was limited to 2/3 the 20 dB bandwidth. Therefore, the output power was limited to 125 mW.

Channel	Frequency (MHz)	Output Power (dBm)	Directional Gain (dBi)	Limit (dBm)	Margin (dB)
Low	2402	5.53	7.23	19.8	-14.24
Middle	2441	6.52	7.23	19.8	-13.25
High	2480	7.04	7.23	19.8	-12.73

8.5.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter and a gated average power measurement was performed. The cable assembly insertion loss of 10.4 dB (including 10 dB pad and 0.4 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	2.78
Middle	2441	3.95
High	2480	4.41

8.5.7. 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 A5.5

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

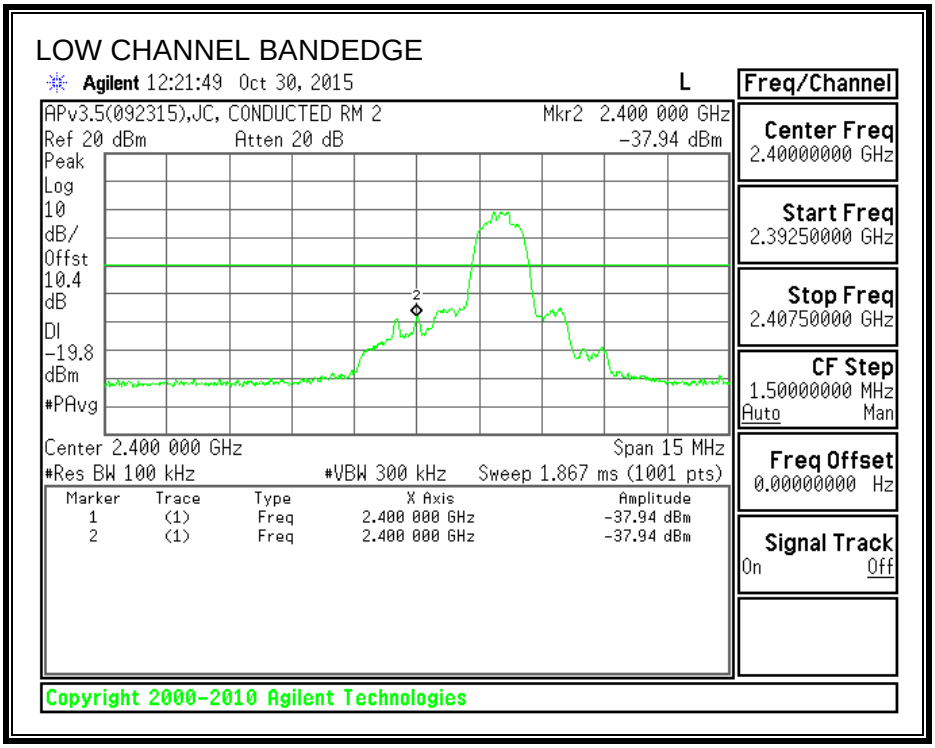
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

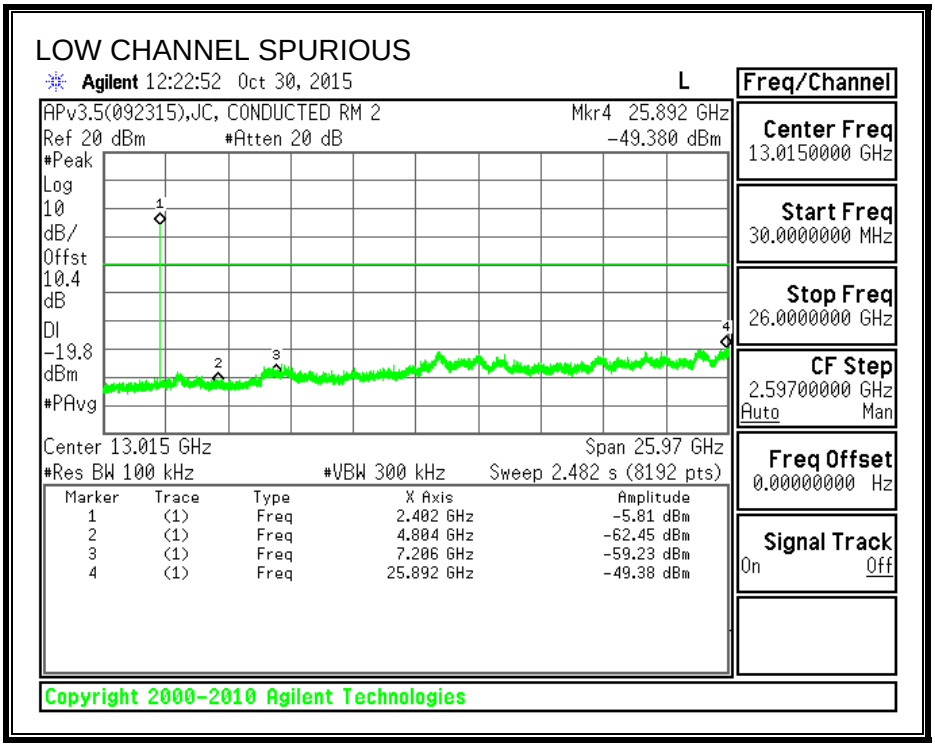
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

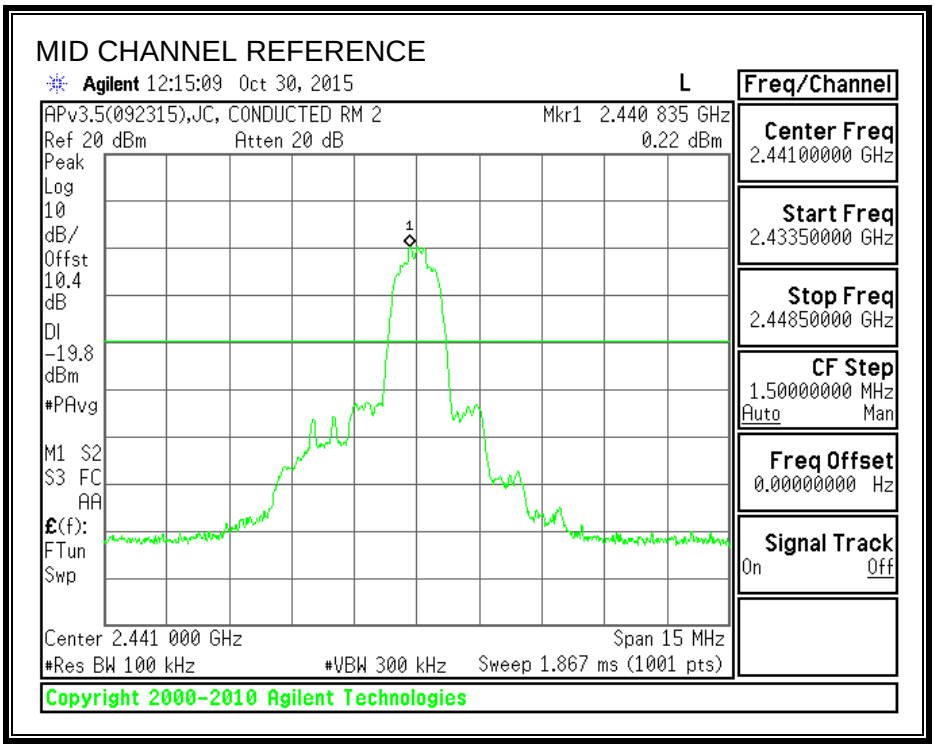
RESULTS

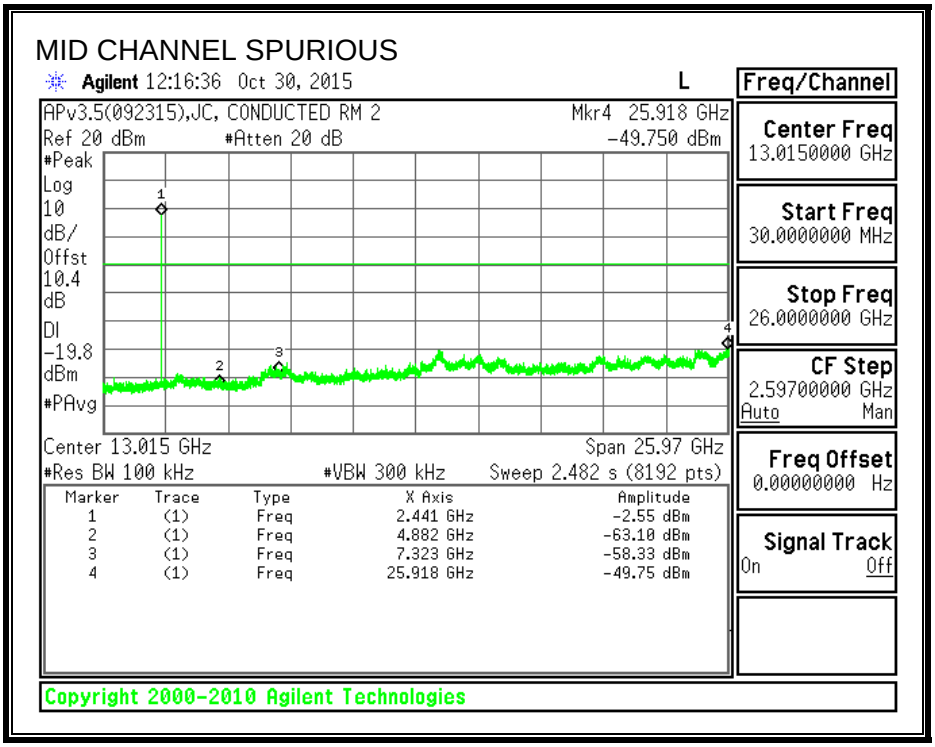
SPURIOUS EMISSIONS, LOW CHANNEL



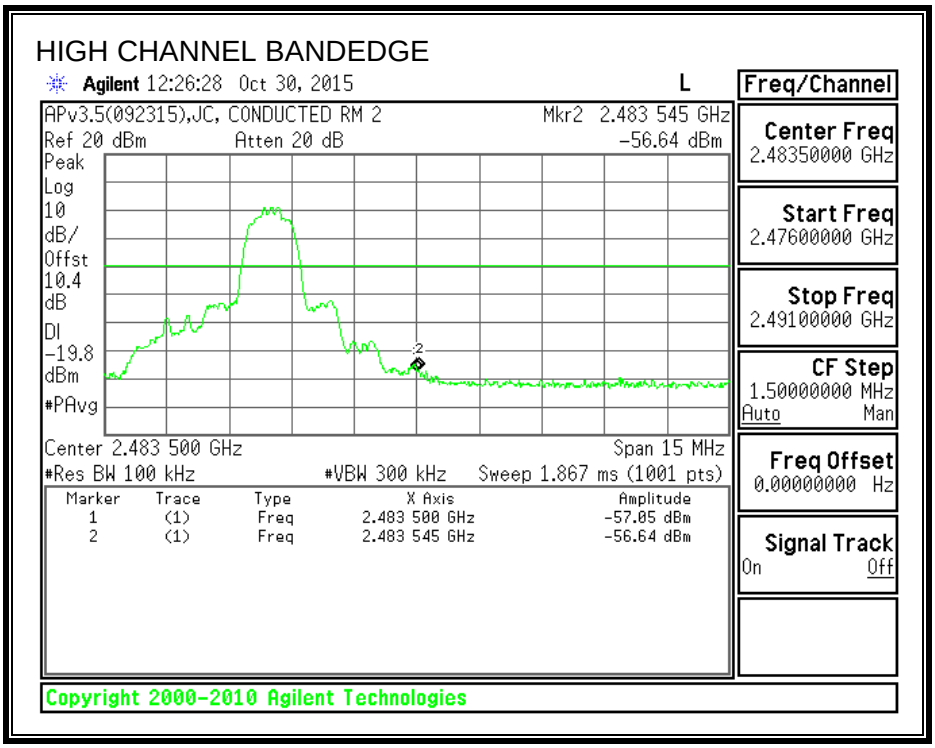


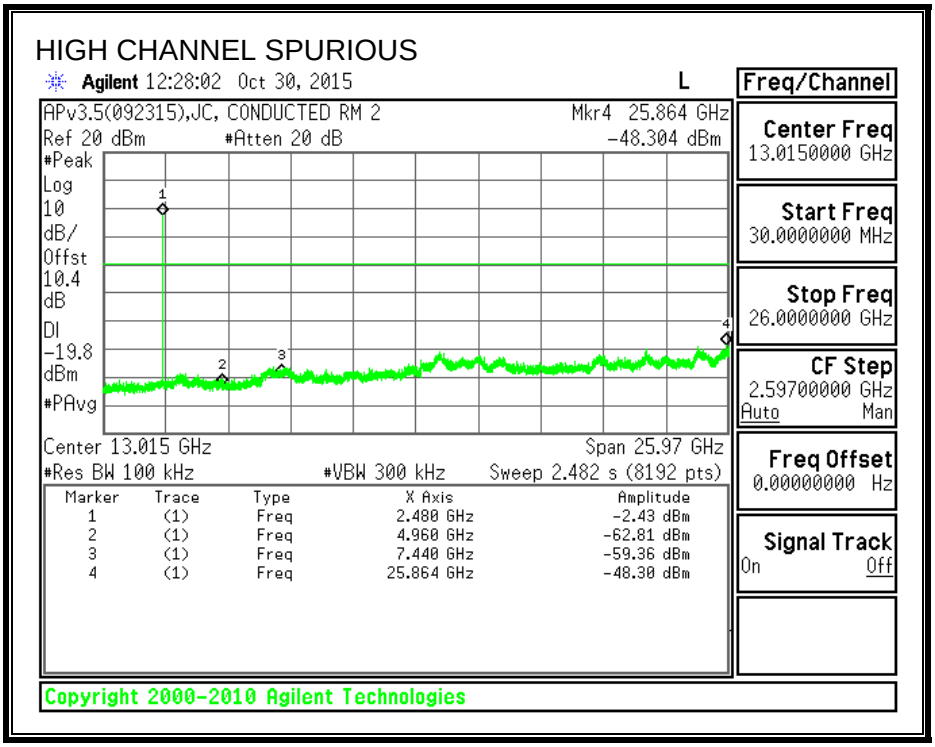
SPURIOUS EMISSIONS, MID CHANNEL



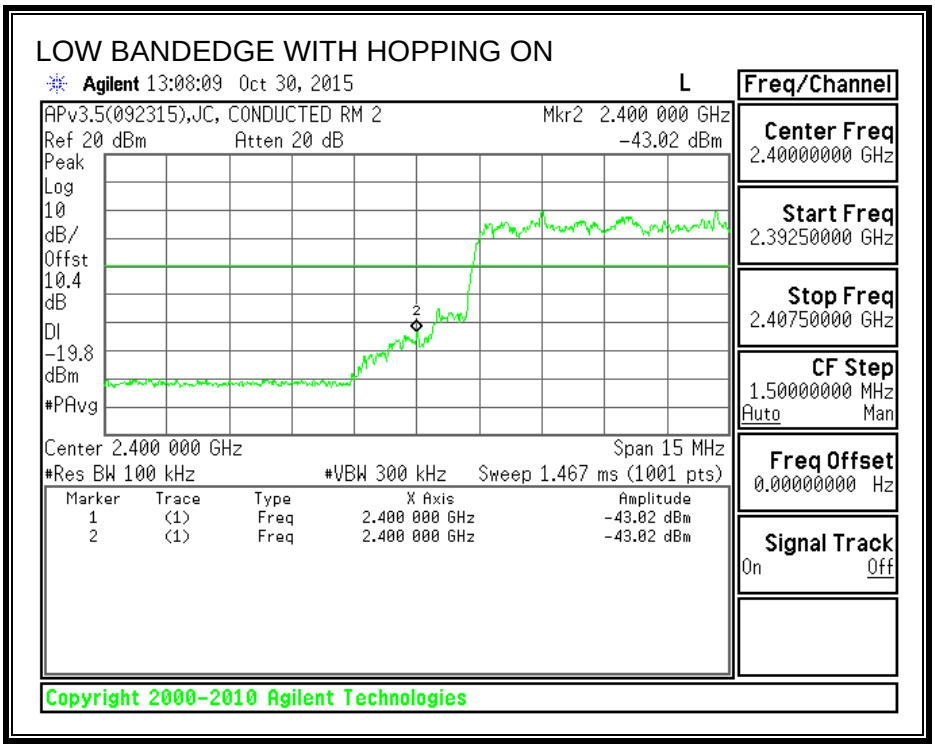


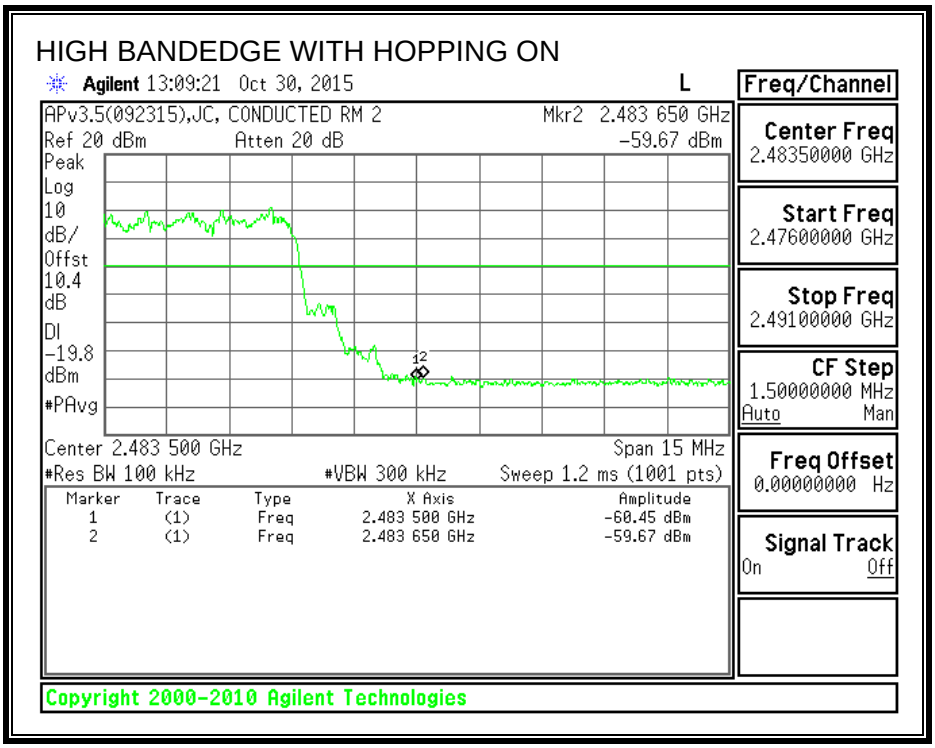
SPURIOUS EMISSIONS, HIGH CHANNEL





SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON





9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN Clause 8.9 (Transmitter)

IC RSS-GEN Clause 7.1.2 (Receiver)

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. 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.

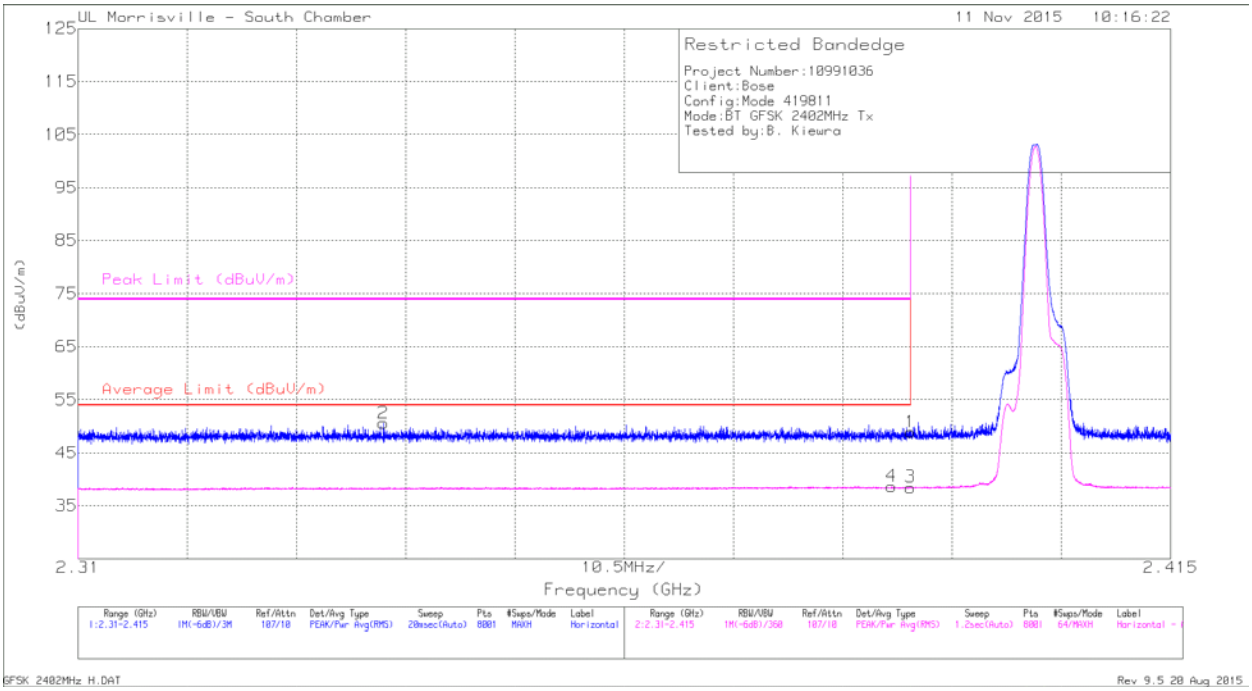
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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

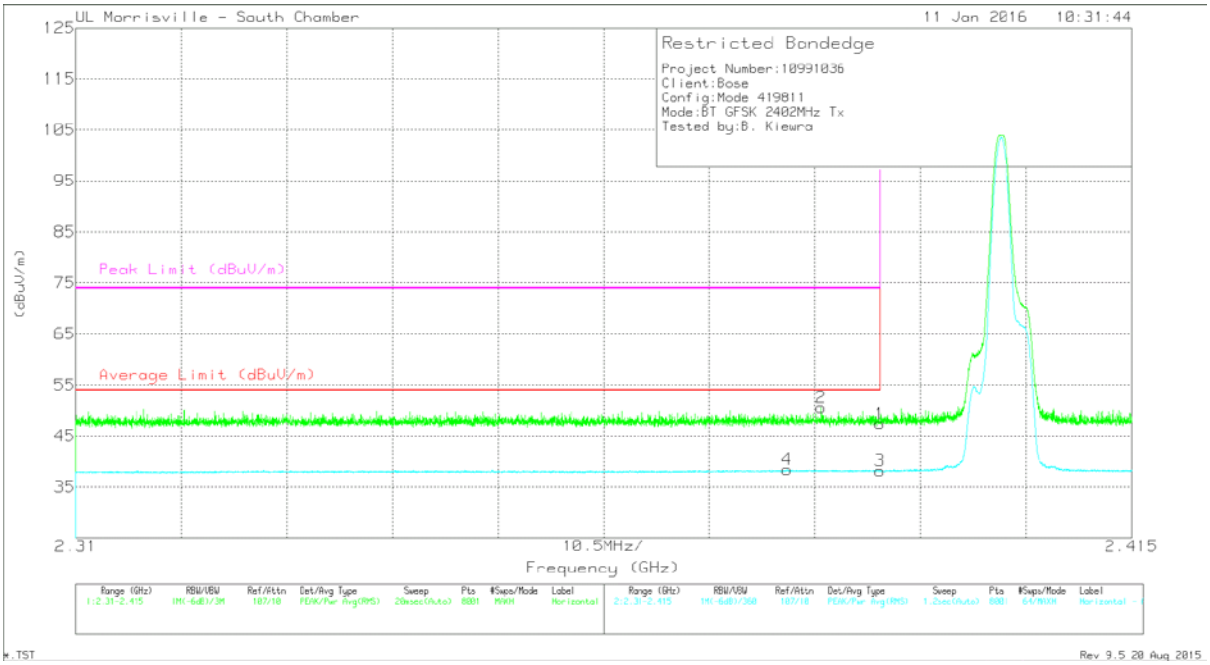
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	41.64	Pk	32	-24.8	48.84	-	-	74	-25.16	247	152	H
2	* 2.339	43.47	Pk	31.9	-24.8	50.57	-	-	74	-23.43	247	152	H
3	* 2.39	31.28	V1TR	32	-24.8	38.48	54	-15.52	-	-	247	152	H
4	* 2.388	31.47	V1TR	32	-24.8	38.67	54	-15.33	-	-	247	152	H

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

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

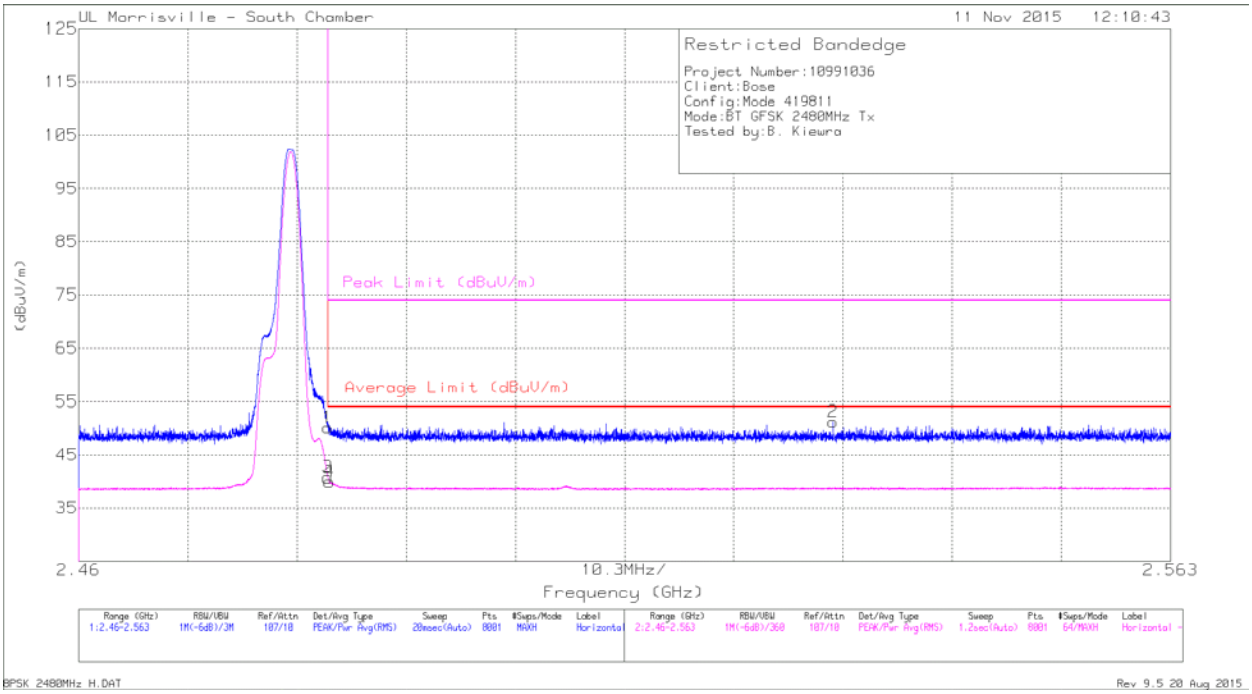


Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	40.18	Pk	32	-24.8	47.38	-	-	74	-26.62	14	124	V
2	* 2.384	43.25	Pk	32	-24.7	50.55	-	-	74	-23.45	14	124	V
3	* 2.39	30.96	V1TR	32	-24.8	38.16	54	-15.84	-	-	14	124	V
4	* 2.381	31.14	V1TR	32	-24.7	38.44	54	-15.56	-	-	14	124	V

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

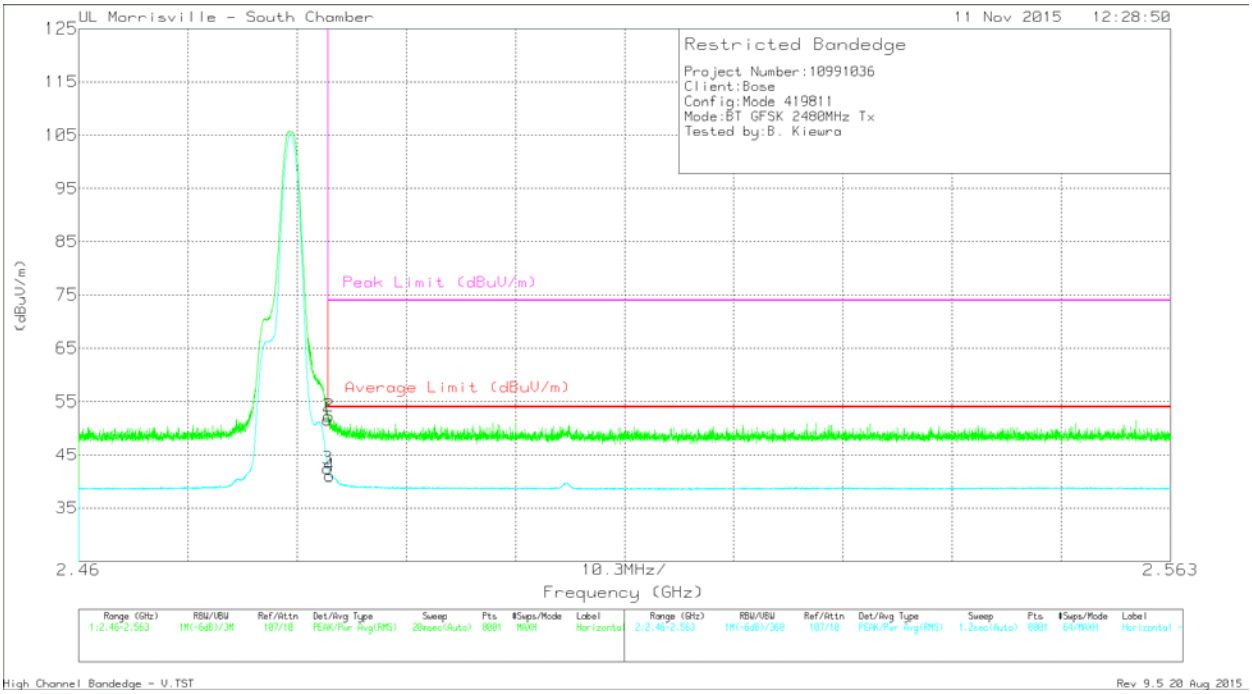
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	42.69	Pk	32.1	-24.7	50.09	-	-	74	-23.91	240	146	H
2	2.531	43.76	Pk	32.1	-24.7	51.16	-	-	74	-22.84	240	146	H
3	* 2.484	33.35	V1TR	32.1	-24.7	40.75	54	-13.25	-	-	240	146	H
4	* 2.484	32.51	V1TR	32.1	-24.7	39.91	54	-14.09	-	-	240	146	H

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

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	44.21	Pk	32.1	-24.7	51.61	-	-	74	-22.39	6	107	V
2	* 2.484	44.88	Pk	32.1	-24.7	52.28	-	-	74	-21.72	6	107	V
3	* 2.484	35.03	V1TR	32.1	-24.7	42.43	54	-11.57	-	-	6	107	V
4	* 2.484	33.68	V1TR	32.1	-24.7	41.08	54	-12.92	-	-	6	107	V

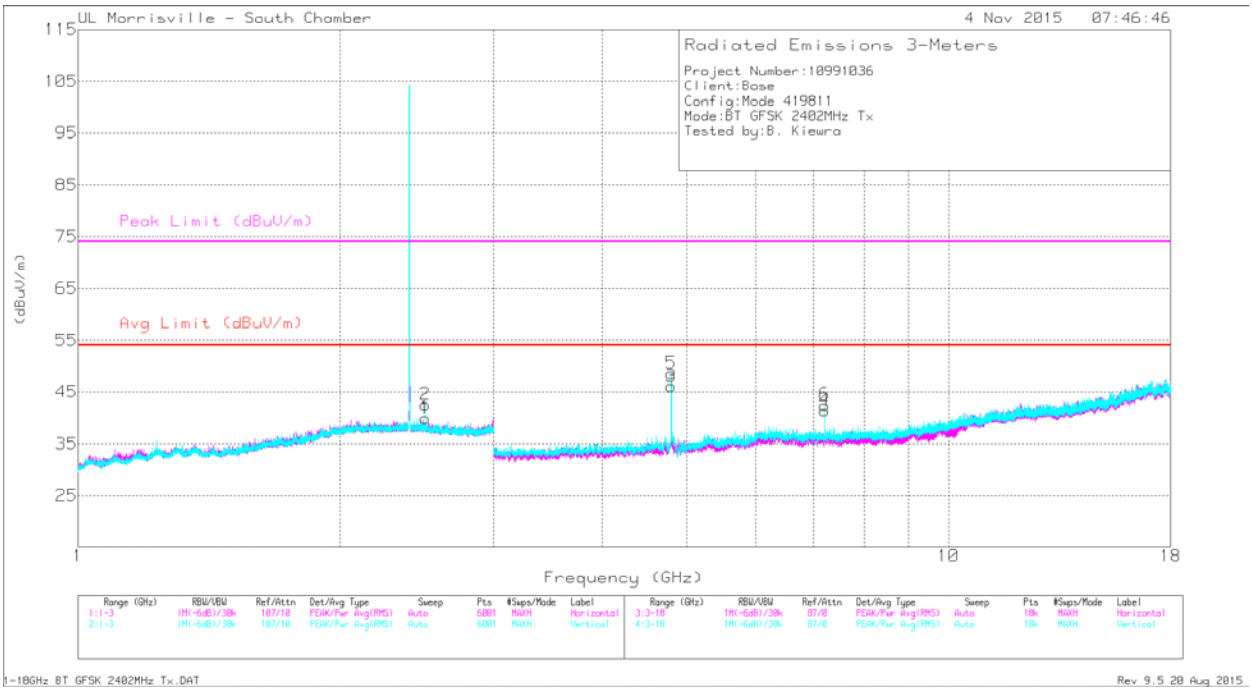
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TR - VB=1/Ton, where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

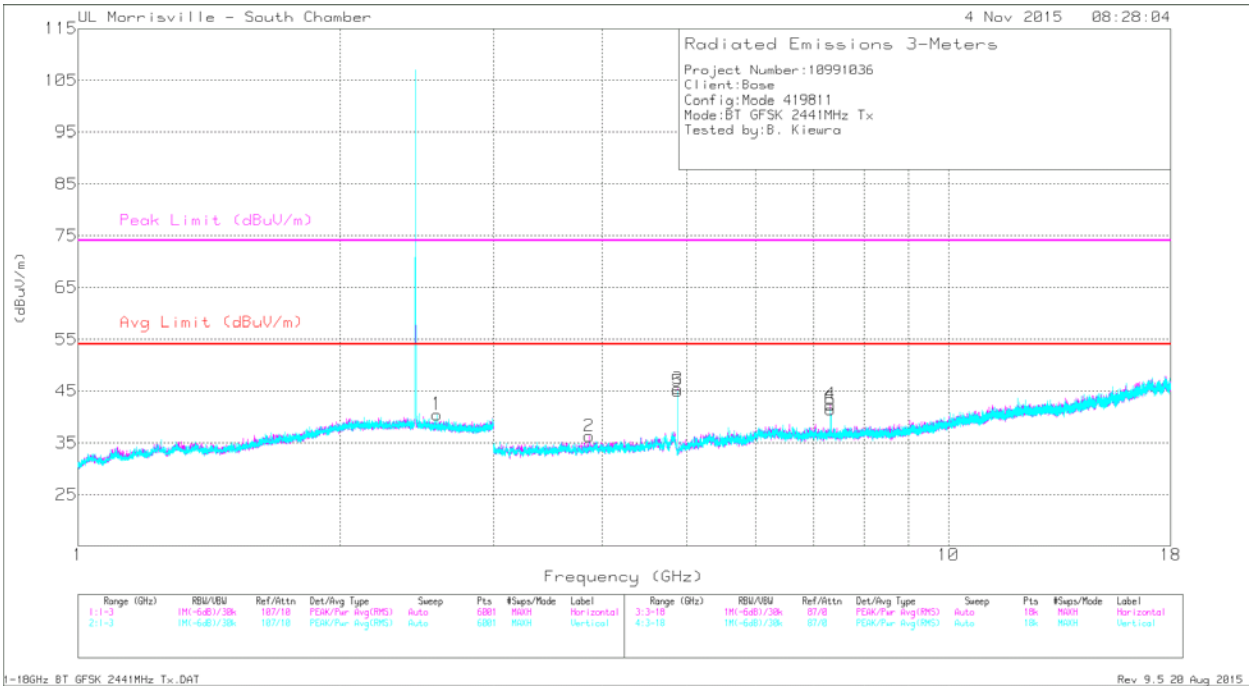
1-18GHz Low Channel



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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
3	* 4.804	48.84	PK1	34	-31.7	51.14	-	-	74	-22.86	175	117	H
	* 4.804	44.57	V1TR	34	-31.7	46.87	54	-7.13	-	-	175	117	H
5	* 4.804	49.18	PK1	34	-31.7	51.48	-	-	74	-22.52	243	110	V
	* 4.804	43.86	V1TR	34	-31.7	46.16	54	-7.84	-	-	243	110	V
1	2.506	32.67	Pk	32.1	-24.8	39.97	-	-	74	-34.03	0-360	102	H
2	2.506	35.24	Pk	32.1	-24.8	42.54	-	-	74	-31.46	0-360	102	V
4	7.206	34.66	Pk	35.5	-28.7	41.46	-	-	74	-32.54	0-360	102	H
6	7.206	35.7	Pk	35.5	-28.7	42.5	-	-	74	-31.5	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK1 - Maximum Peak
V1TR - VB=1/Ton, where: Ton is packet duration

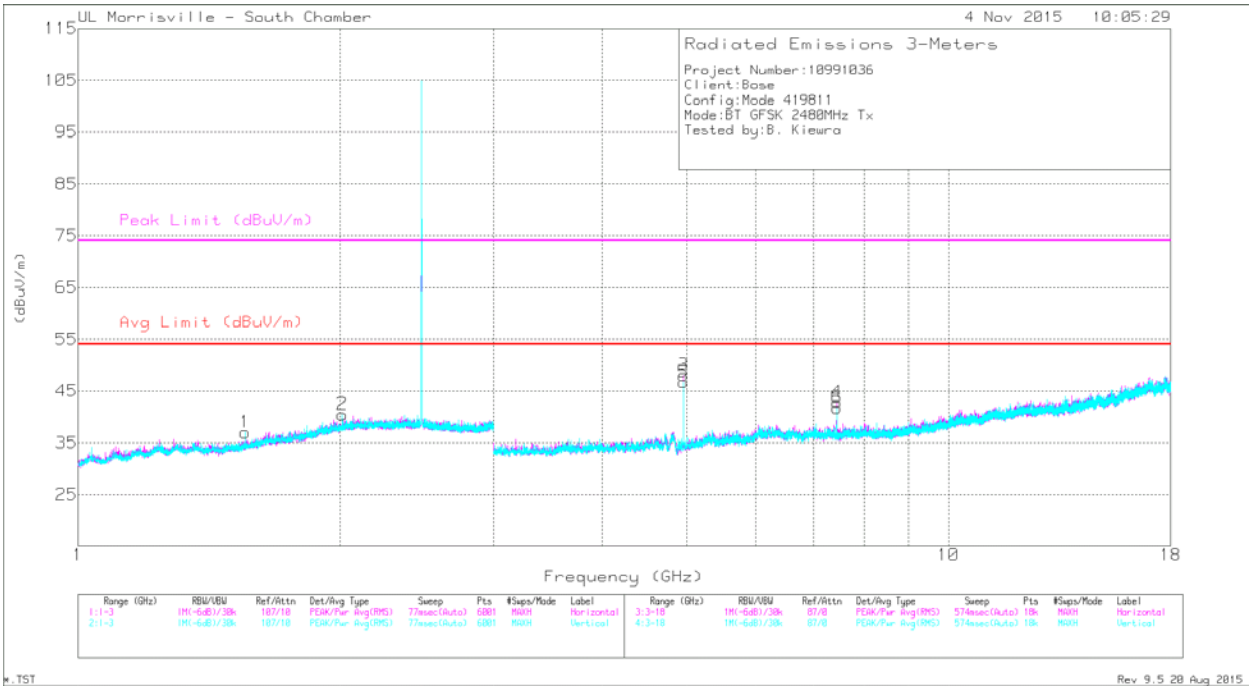
1-18GHz Mid Channel



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	* 3.867	40.58	PK1	33.2	-32.8	40.98	-	-	74	-33.02	173	245	H
	* 3.868	29.29	V1TR	33.2	-32.8	29.69	54	-24.31	-	-	173	245	H
3	* 4.882	47.75	PK1	33.9	-31.5	50.15	-	-	74	-23.85	172	143	H
	* 4.882	43.12	V1TR	33.9	-31.5	45.52	54	-8.48	-	-	172	143	H
4	* 7.323	41.42	PK1	35.5	-28.4	48.52	-	-	74	-25.48	266	102	H
	* 7.323	33.48	V1TR	35.5	-28.4	40.58	54	-13.42	-	-	266	102	H
5	* 4.882	45.93	PK1	33.9	-31.5	48.33	-	-	74	-25.67	77	108	V
	* 4.882	42.11	V1TR	33.9	-31.5	44.51	54	-9.49	-	-	77	108	V
6	* 7.323	40.87	PK1	35.5	-28.4	47.97	-	-	74	-26.03	63	139	V
	* 7.323	32.24	V1TR	35.5	-28.4	39.34	54	-14.66	-	-	63	139	V
1	2.584	33.59	Pk	32.2	-25.3	40.49	-	-	74	-33.51	0-360	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK1 - Maximum Peak
V1TR - VB=1/Ton, where: Ton is packet duration

1-18GHz High Channel

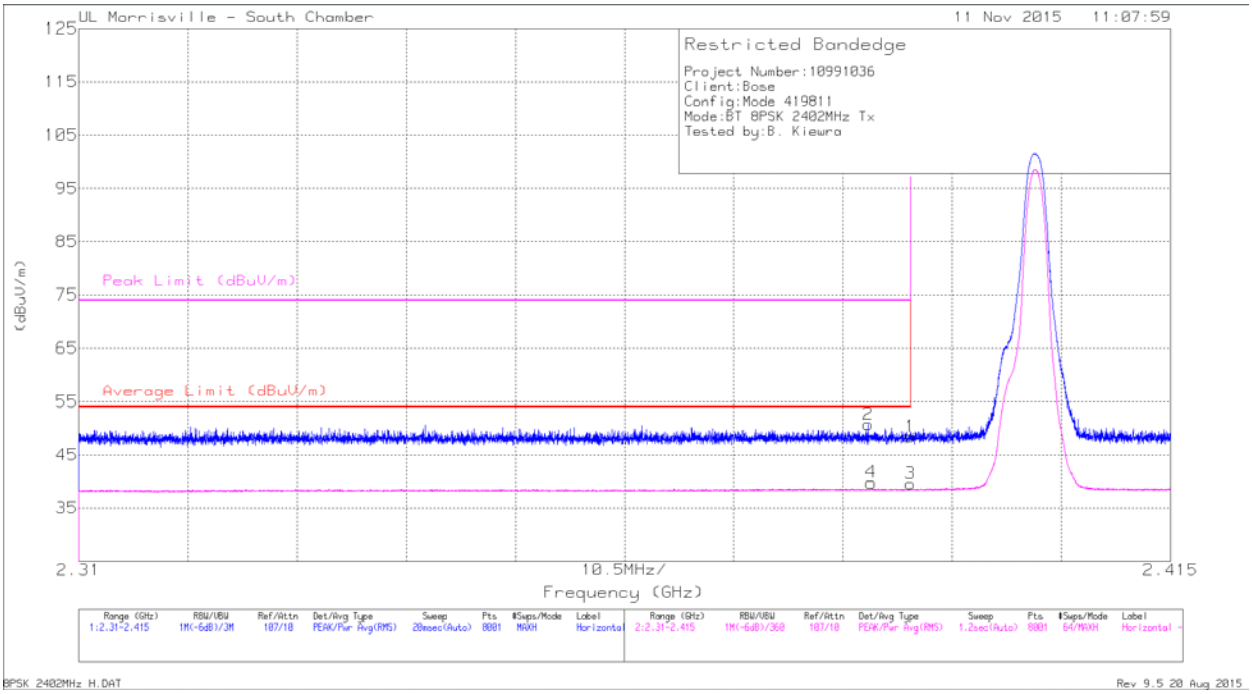


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.556	36.27	PK1	28.2	-22.6	41.87	-	-	74	-32.13	300	247	V
	* 1.557	23.8	V1TR	28.2	-22.6	29.4	54	-24.6	-	-	300	247	V
3	* 4.96	48.15	PK1	33.9	-31.6	50.45	-	-	74	-23.55	244	108	H
	* 4.96	44.08	V1TR	33.9	-31.6	46.38	54	-7.62	-	-	244	108	H
4	* 7.441	39.75	PK1	35.6	-28.7	46.65	-	-	74	-27.35	254	137	H
	* 7.44	30.7	V1TR	35.6	-28.7	37.6	54	-16.4	-	-	254	137	H
5	* 4.96	46.51	PK1	33.9	-31.6	48.81	-	-	74	-25.19	66	117	V
	* 4.96	41.01	V1TR	33.9	-31.6	43.31	54	-10.69	-	-	66	117	V
6	* 7.44	40.29	PK1	35.6	-28.7	47.19	-	-	74	-26.81	71	103	V
	* 7.44	31.69	V1TR	35.6	-28.7	38.59	54	-15.41	-	-	71	103	V
2	2.012	32.08	Pk	31.3	-22.9	40.48	-	-	74	-33.52	0-360	102	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK1 - Maximum Peak
V1TR - VB=1/Ton, where: Ton is packet duration

9.2.2. ENHANCED DATA RATE 8PSK MODULATION

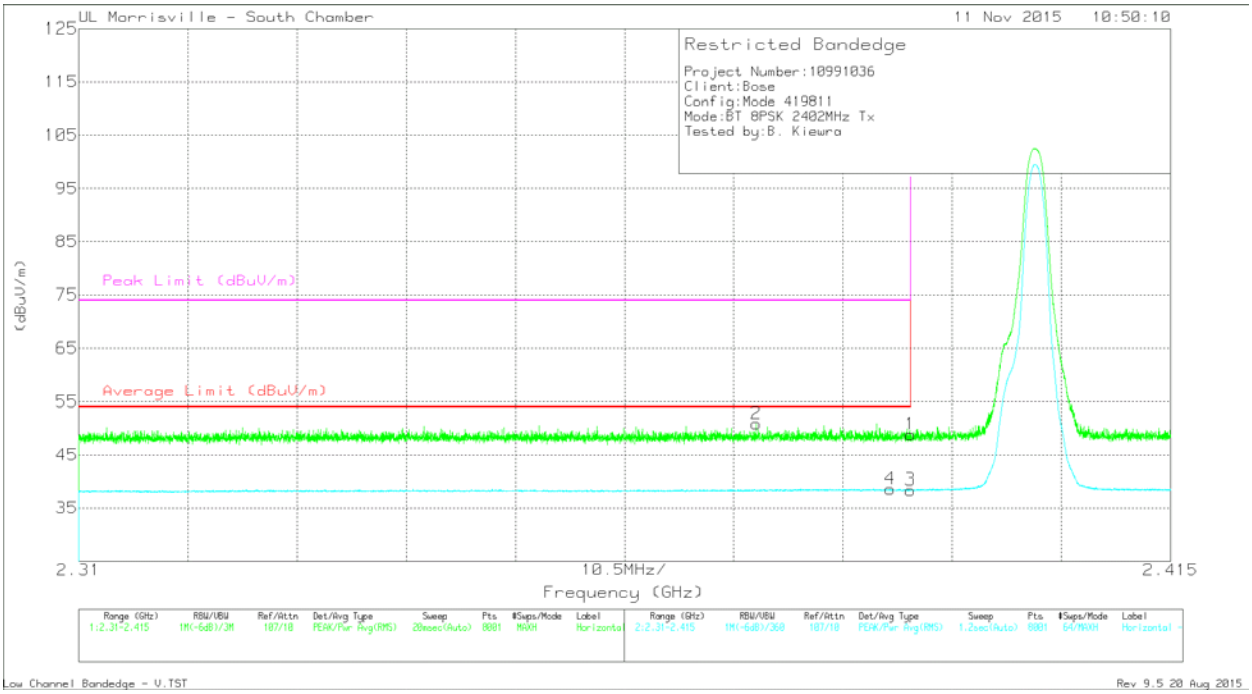
RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	41.14	Pk	32	-24.8	48.34	-	-	74	-25.66	242	130	H
2	* 2.386	43.46	Pk	32	-24.8	50.66	-	-	74	-23.34	242	130	H
3	* 2.39	31.22	V1TR	32	-24.8	38.42	54	-15.58	-	-	242	130	H
4	* 2.386	31.45	V1TR	32	-24.8	38.65	54	-15.35	-	-	242	130	H

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

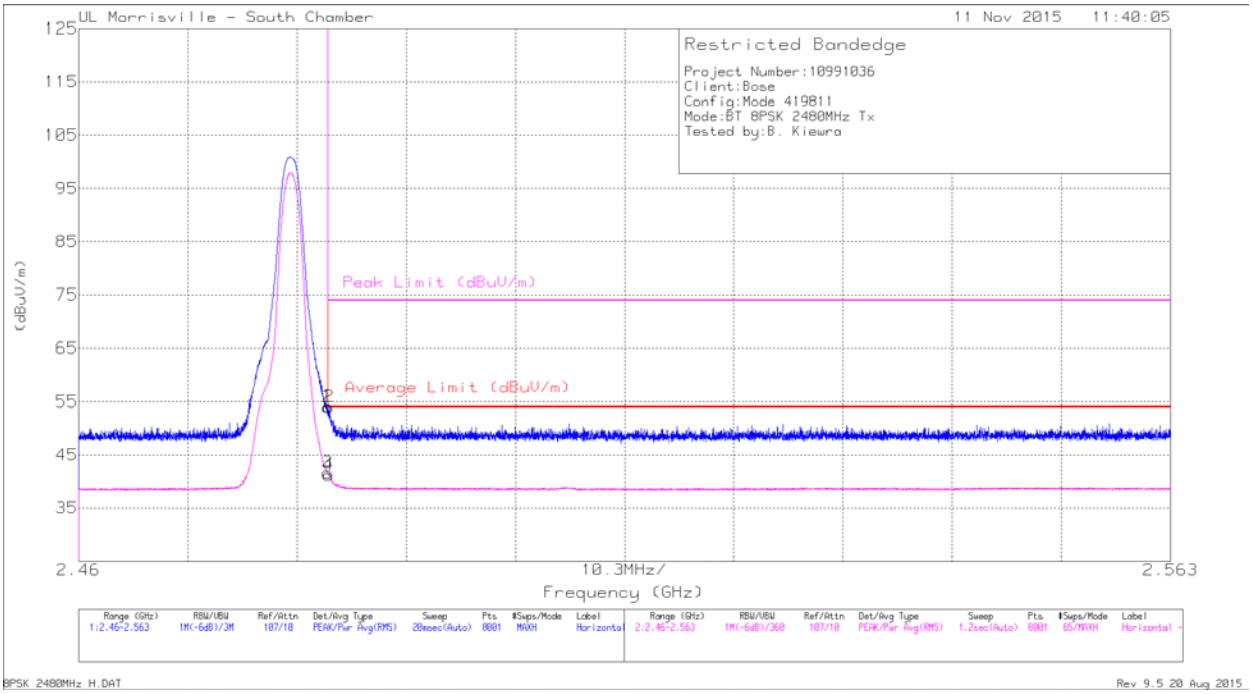
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	41.6	Pk	32	-24.8	48.8	-	-	74	-25.2	15	127	V
2	* 2.375	43.65	Pk	32	-24.8	50.85	-	-	74	-23.15	15	127	V
3	* 2.39	31.2	V1TR	32	-24.8	38.4	54	-15.6	-	-	15	127	V
4	* 2.388	31.41	V1TR	32	-24.8	38.61	54	-15.39	-	-	15	127	V

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

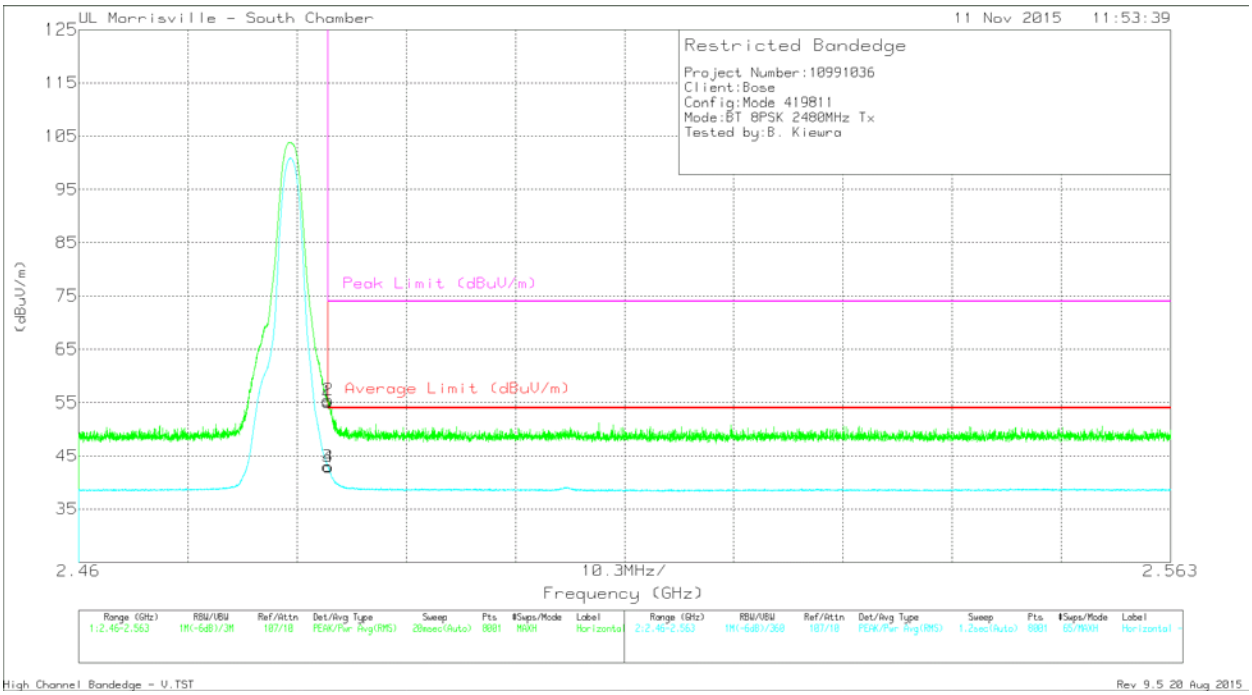
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	46.66	Pk	32.1	-24.7	54.06	-	-	74	-19.94	238	116	H
2	* 2.484	46.57	Pk	32.1	-24.7	53.97	-	-	74	-20.03	238	116	H
3	* 2.484	34.21	V1TR	32.1	-24.7	41.61	54	-12.39	-	-	238	116	H
4	* 2.484	33.74	V1TR	32.1	-24.7	41.14	54	-12.86	-	-	238	116	H

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

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	47.67	Pk	32.1	-24.7	55.07	-	-	74	-18.93	21	117	V
2	* 2.484	48.01	Pk	32.1	-24.7	55.41	-	-	74	-18.59	21	117	V
3	* 2.484	35.59	V1TR	32.1	-24.7	42.99	54	-11.01	-	-	21	117	V
4	* 2.484	35.48	V1TR	32.1	-24.7	42.88	54	-11.12	-	-	21	117	V

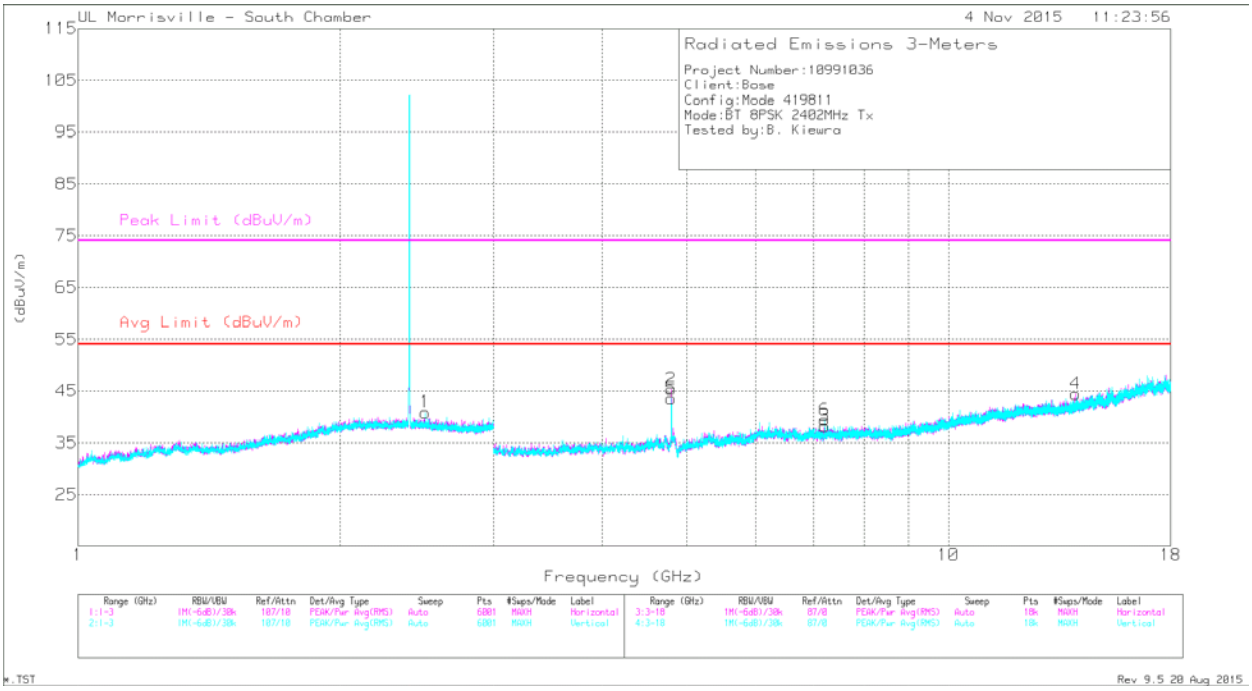
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TR - VB=1/Ton, where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

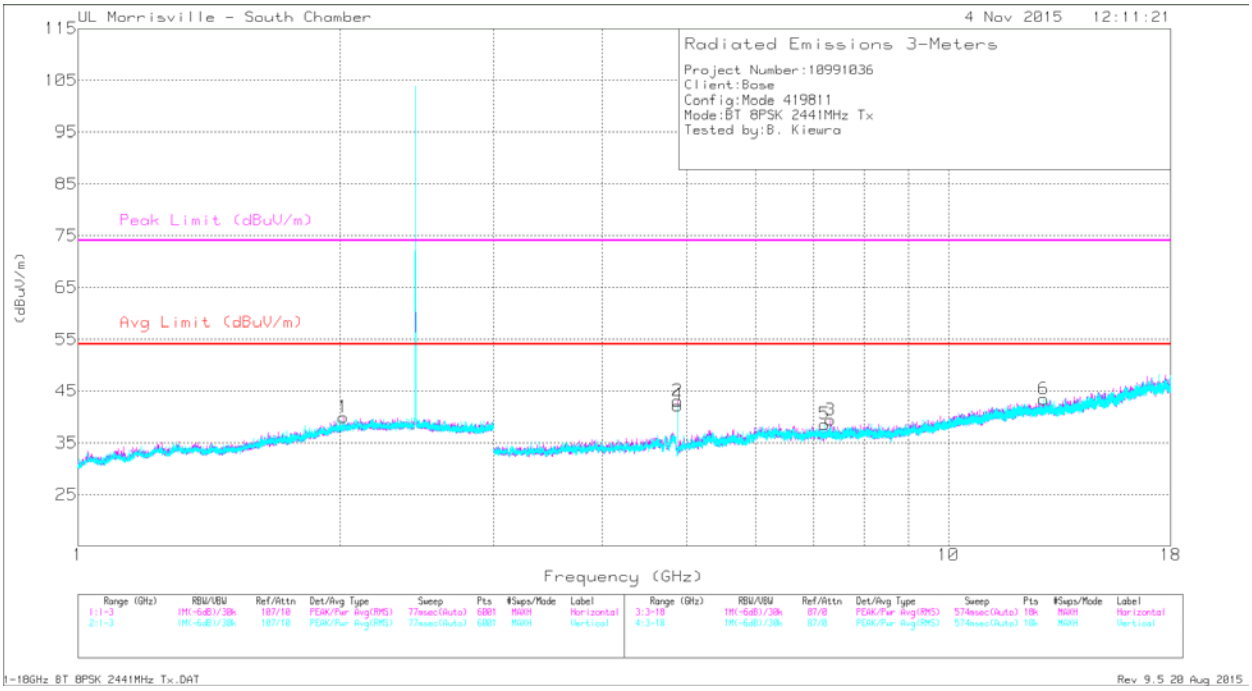
1-18GHz Low Channel



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	* 4.804	47.25	PK1	34	-31.7	49.55	-	-	74	-24.45	16	151	H
	* 4.804	39.56	V1TR	34	-31.7	41.86	54	-12.14	-	-	16	151	H
5	* 4.804	46.87	PK1	34	-31.7	49.17	-	-	74	-24.83	7	108	V
	* 4.804	39.59	V1TR	34	-31.7	41.89	54	-12.11	-	-	7	108	V
1	2.506	33.58	Pk	32.1	-24.8	40.88	-	-	74	-33.12	0-360	102	V
3	7.206	31.45	Pk	35.5	-28.7	38.25	-	-	74	-35.75	0-360	199	H
6	7.206	32.62	Pk	35.5	-28.7	39.42	-	-	74	-34.58	0-360	199	V
4	13.99	30.61	Pk	39.1	-25.3	44.41	-	-	74	-29.59	0-360	102	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK1 - Maximum Peak
V1TR - VB=1/Ton, where: Ton is packet duration

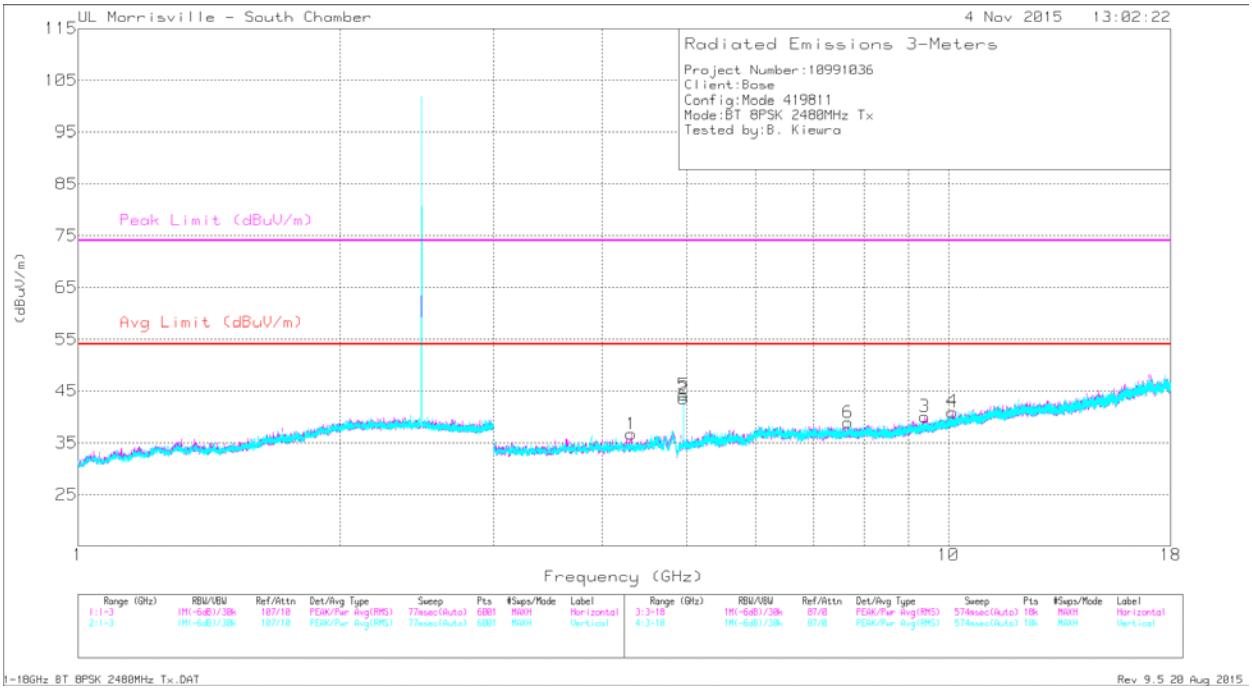
1-18GHz Mid Channel



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (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	* 4.882	45.69	PK1	33.9	-31.5	48.09	-	-	74	-25.91	178	123	H
	* 4.882	38.19	V1TR	33.9	-31.5	40.59	54	-13.41	-	-	178	123	H
3	* 7.322	37.67	PK1	35.5	-28.4	44.77	-	-	74	-29.23	270	153	H
	* 7.323	26.86	V1TR	35.5	-28.4	33.96	54	-20.04	-	-	270	153	H
4	* 4.882	44.88	PK1	33.9	-31.5	47.28	-	-	74	-26.72	77	120	V
	* 4.882	37.22	V1TR	33.9	-31.5	39.62	54	-14.38	-	-	77	120	V
1	2.016	31.56	Pk	31.3	-22.9	39.96	-	-	74	-34.04	0-360	102	H
5	7.208	31.81	Pk	35.5	-28.7	38.61	-	-	74	-35.39	0-360	199	V
6	12.871	29.47	Pk	39.3	-25.3	43.47	-	-	74	-30.53	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK1 - Maximum Peak
V1TR - VB=1/Ton, where: Ton is packet duration

1-18GHz High Channel

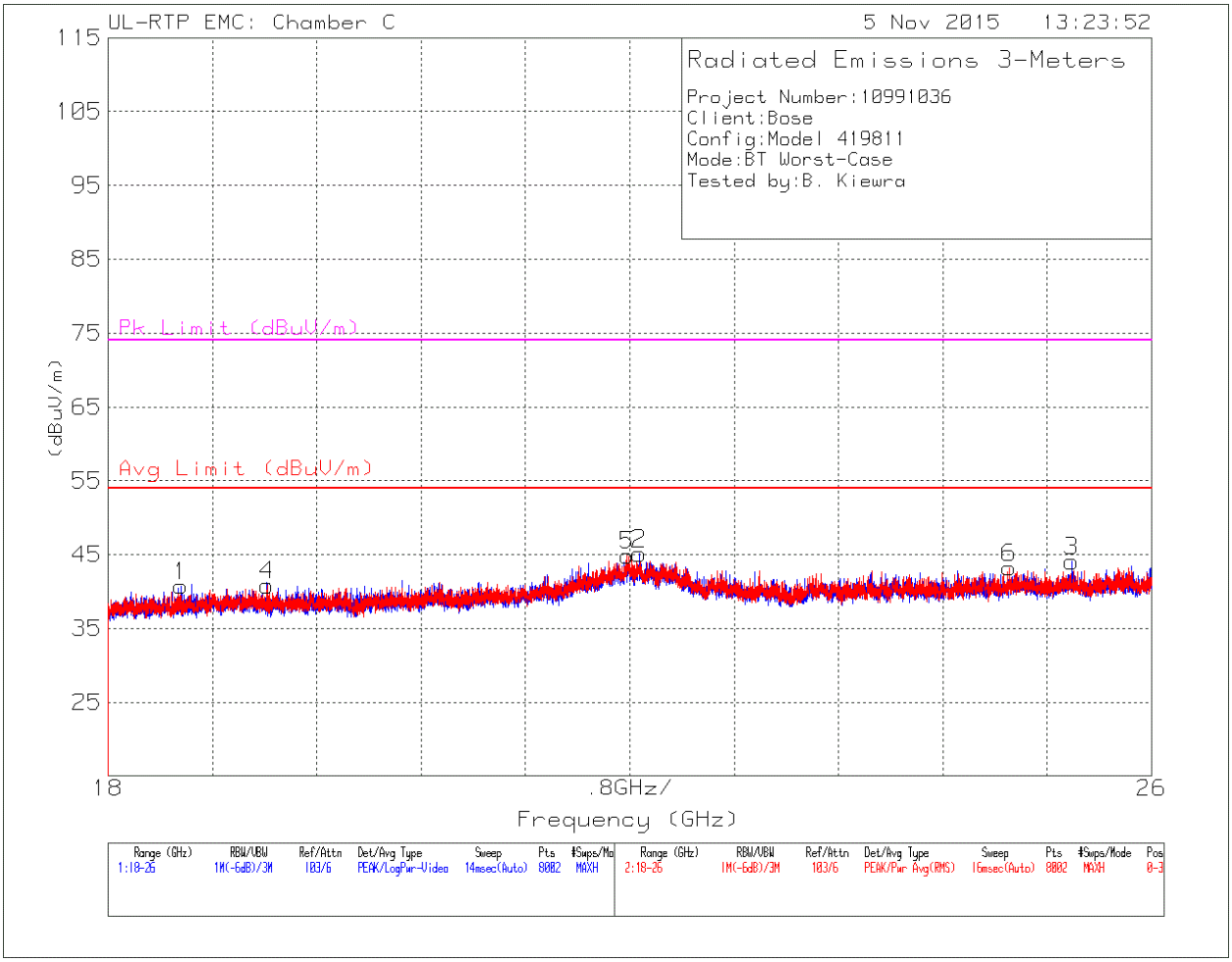


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF AT0069 (dB/m)	Amp/Cbl/ fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.319	40.82	PK1	33.4	-32.5	41.72	-	-	74	-32.28	0	101	H
	* 4.32	29.09	V1TR	33.4	-32.5	29.99	54	-24.01	-	-	0	101	H
2	* 4.96	45.75	PK1	33.9	-31.6	48.05	-	-	74	-25.95	153	126	H
	* 4.96	38.05	V1TR	33.9	-31.6	40.35	54	-13.65	-	-	153	126	H
3	* 9.395	35.73	PK1	36.6	-27.3	45.03	-	-	74	-28.97	200	174	H
	* 9.397	24.09	V1TR	36.6	-27.2	33.49	54	-20.51	-	-	200	174	H
5	* 4.96	46.5	PK1	33.9	-31.6	48.8	-	-	74	-25.2	75	108	V
	* 4.96	38.86	V1TR	33.9	-31.6	41.16	54	-12.84	-	-	75	108	V
6	* 7.668	36.52	PK1	35.7	-28.2	44.02	-	-	74	-29.98	271	384	V
	* 7.668	24.91	V1TR	35.7	-28.2	32.41	54	-21.59	-	-	271	384	V
4	10.104	29.99	Pk	37.2	-26.2	40.99	-	-	74	-33.01	0-360	101	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
Pk - Peak detector
PK1 - Maximum Peak
V1TR - VB=1/Ton, where: Ton is packet duration

9.2.3. WORST-CASE 18-26GHz

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



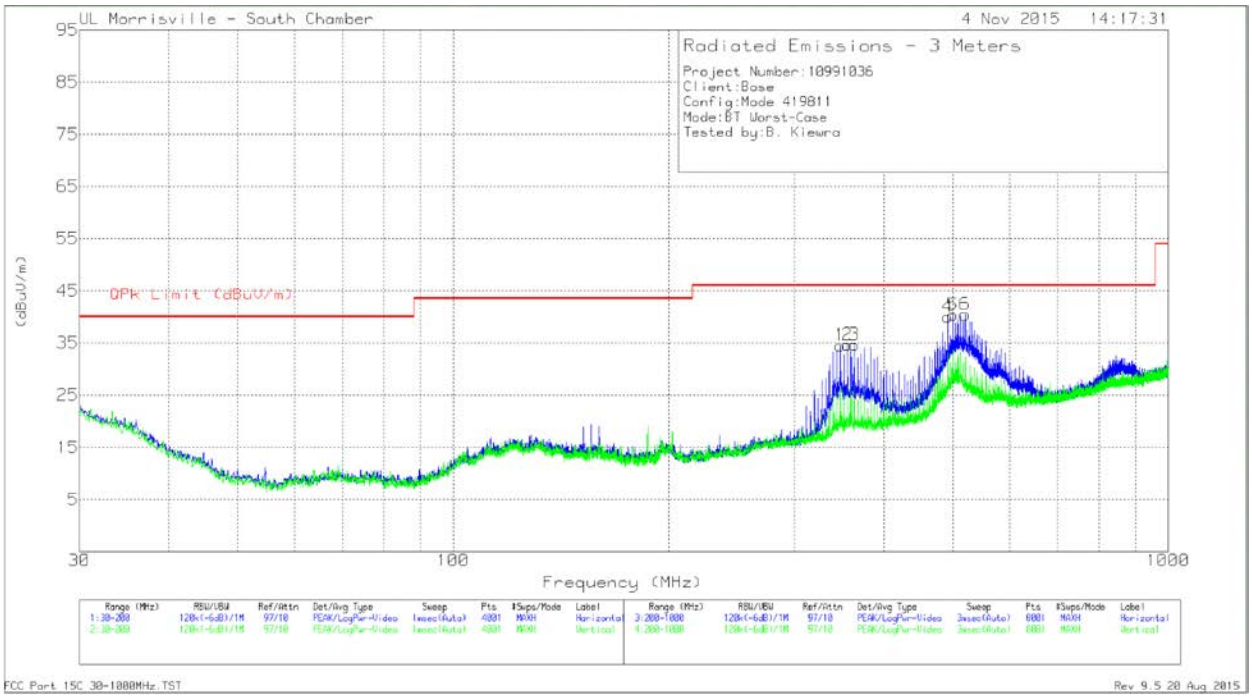
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	*18.559	49.66	Pk	32.4	-41.3	40.76	54	-13.24	74	-33.24	0-360	175	H
2	*22.074	49.21	Pk	36.6	-40.7	45.11	54	-8.89	74	-28.89	0-360	225	H
3	25.387	48.21	Pk	34	-38.1	44.11	-	-	74	-29.89	0-360	150	H
4	*19.22	49.57	Pk	32.5	-41.2	40.87	54	-13.13	74	-33.13	0-360	200	V
5	21.981	48.88	Pk	36.6	-40.6	44.88	-	-	74	-29.12	0-360	101	V
6	24.909	48.14	Pk	33.7	-38.6	43.24	-	-	74	-30.76	0-360	175	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

9.3. WORST-CASE BELOW 1 GHz

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



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF AT0074 (dB/m)	Port 0 Factors	DC Corr (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	348	44.74	Pk	19.2	-29.4	0	34.54	46.02	-11.48	0-360	102	H
2	356	44.54	Pk	19.5	-29.4	0	34.64	46.02	-11.38	0-360	102	H
3	364	44.36	Pk	19.7	-29.4	0	34.66	46.02	-11.36	0-360	102	H
4	492	46.78	Pk	22.1	-28.9	0	39.98	46.02	-6.04	0-360	199	H
5	500.0202	45.87	Qp	22.1	-28.8	0	39.17	46.02	-6.85	119	185	H
6	520.0053	46.55	Qp	22.2	-28.8	0	39.95	46.02	-6.07	125	186	H

Pk - Peak detector

Qp - Quasi-Peak detector

END OF REPORT