FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 8
CERTIFICATION TEST REPORT

FOR

TABLET DEVICE

MODEL NUMBER: A1567

FCC ID: BCGA1567
IC: 579C-A1567

REPORT NUMBER: 14U18207-E8, Revision A

ISSUE DATE: SEPTEMBER 12, 2014

Prepared for
APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

Prepared by
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NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	09/02/14	Initial Issue	F. de Anda
A	09/12/14	Updated sections 5.2, 5.5, 9.1.2, and 9.2.2	F. de Anda

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS

COMPANY NAME: APPLE, INC.
1 INFINITE LOOP
CUPERTINO, CA 95014, U.S.A.

EUT DESCRIPTION: TABLET DEVICE

MODEL: A1567

SERIAL NUMBER: DLXMX08RG4M9 (Conducted); DLXMX00VG4MF (Radiated)

DATE TESTED: JULY 23, 2014 TO JULY 30, 2014

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

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

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

Approved & Released For
UL Verification Services Inc. By:

FRANCISCO DEANDA
EMC SUPERVISOR
UL Verification Services Inc.

Tested By:

FRANCISCO GUARNERO
EMC ENGINEER
UL Verification Services Inc.

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

3. FACILITIES AND ACCREDITATION

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

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

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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

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

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

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

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

4.3. MEASUREMENT UNCERTAINTY

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

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

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a tablet with multimedia functions (music, application support, and video), Cellular GSM/GPRS/EGPRS/CDMA2000 1xRTT/1x Advanced/EVDO Rev.A/EVDO Rev.B /WCDMA /HSPA+/DC-HSDPA/LTE FDD & Carrier Aggregation/TDD/TD-SCDMA radio, IEEE 802.11a/b/g/n/ac radio, and Bluetooth radio. The rechargeable battery is not user accessible.

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	10.81	12.05
2402 - 2480	Enhanced 8PSK	10.38	10.91

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain	
	Antenna B	Antenna C
2.4	-7.72	-1.55

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was 12B331.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case mode and channel used for 30-1000 MHz radiated and power line conducted emissions was including headset, AC charger and the mode and channel with the highest output power.

The EUT is a portable device that has three orientations; therefore X, Y and Z orientations have been investigated with AC adapter and Headset, and the worst case was found to be at Y (Landscape) position without AC adapter and headset.

EUT supports BT/BLE operation on antenna B or antenna C. Output power is same for both ports. Antenna C has higher gain than B; therefore, testing was performed on antenna C only.

Based on the manufacturer's attestation that the nominal output power is reduced as the data rate increases, the data rates tested represent the highest power and worst-case with respect to EMC performance.

Worst-case data rates were:

GFSK mode: 3-DH5
8PSK mode: 3-DH5

DQPSK mode has been verified to have the lowest power.

There are two vendors of the WiFi/Bluetooth radio modules: variant 1 and variant 2. The Wi-Fi/Bluetooth radio modules have the same mechanical outline (e.g., the same package dimension and pin-out layout), use the same on-board antenna matching circuit, have an identical antenna structure, and are built and tested to conform to the same specifications and to operate within the same tolerances.

Baseline testing was performed on the two variants to determine the worst case on all conducted power and radiated emissions.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC adapter	Apple	A1357	N/A	NA
Earphone	Apple	NA	NA	NA
Laptop	Apple	A1278	C02HJ0A7DTY4	NA
DC power supply	Sorensen	XT 15-4	1319A02780	NA

I/O CABLES (CONDUCTED TEST)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Antenna	1	SMA	Un-Shielded	0.2	To spectrum Analyzer
2	USB	1	USB	Shielded	1	N/A
3	DC	1	DC	Un-shielded	0.8	N/A

I/O CABLES (RADIATED ABOVE 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
None used						

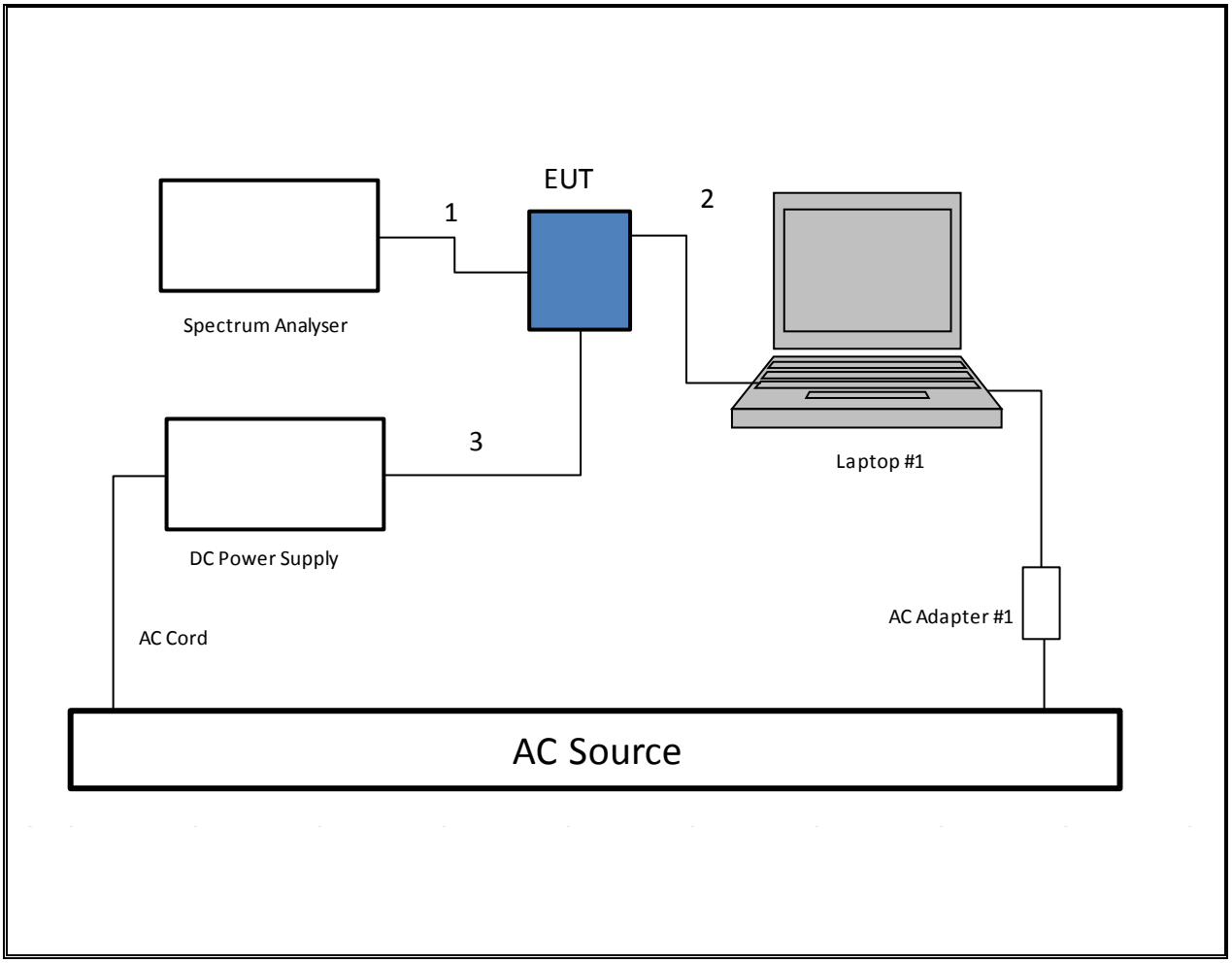
I/O CABLES (AC POWER CONDUCTED TEST and below 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	US115	Un-Shielded	0.8	NA
2	DC	1	lightning	Un-Shielded	1	NA
3	Audio	1	Jack	Un-Shielded	0.5	NA

TEST SETUP- CONDUCTED PORT

The EUT was tested connected to a host Laptop via USB cable adapter and spectrum analyzer to antenna port. Test software exercised the EUT.

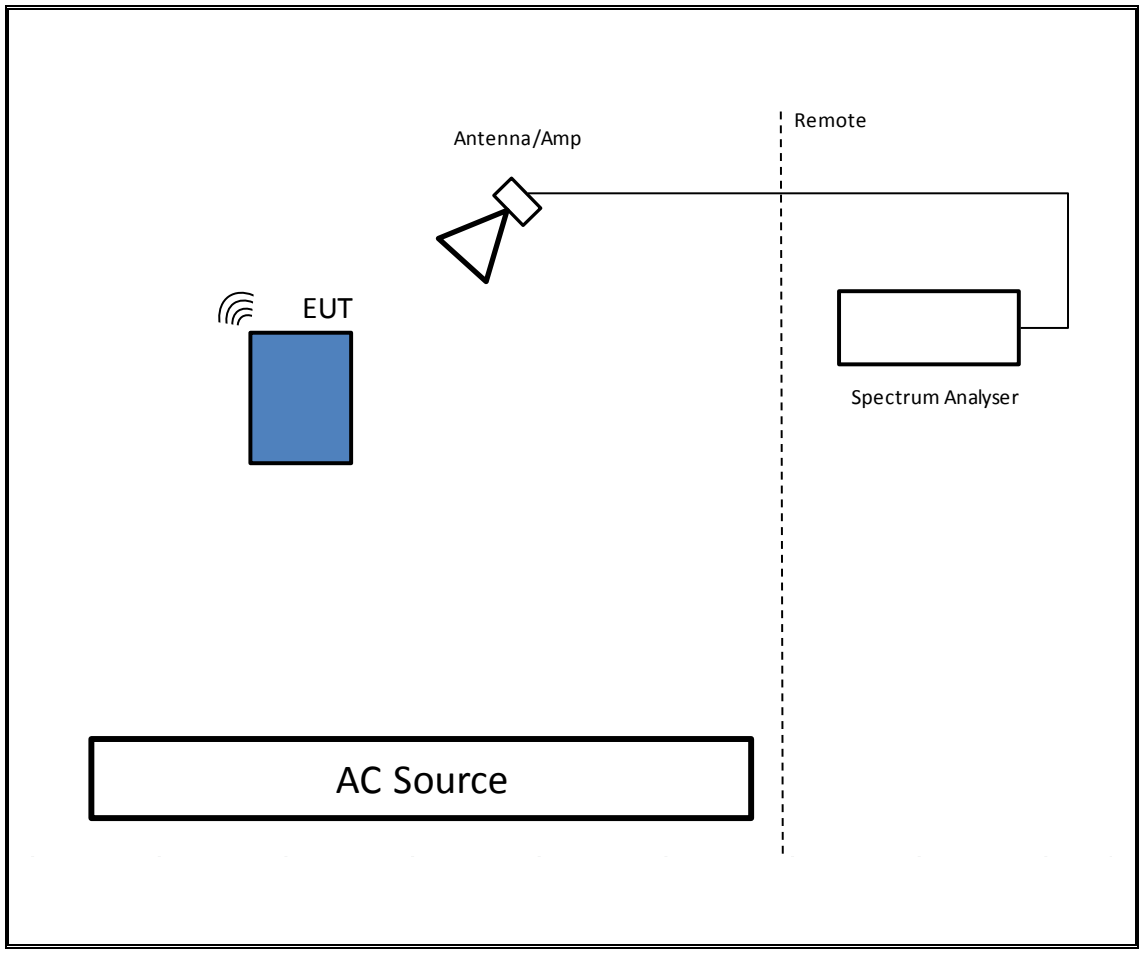
SETUP DIAGRAM



TEST SETUP- RADIATED-ABOVE 1 GHZ

The EUT was tested battery powered. Test software exercised the EUT.

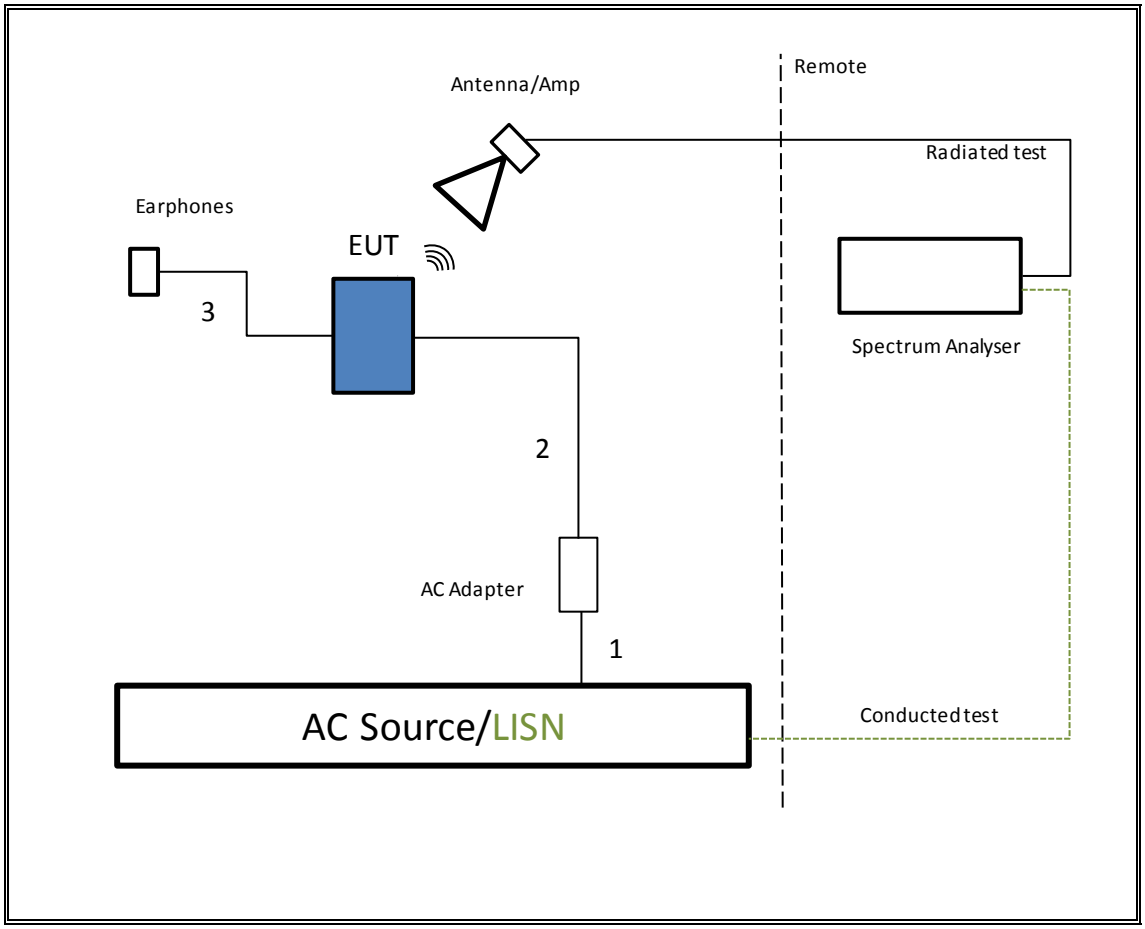
SETUP DIAGRAM



TEST SETUP- BELOW 1GHZ & AC LINE CONDUCTED TESTS

The EUT was tested with earphones connected and powered by AC adapter. Test software exercised the EUT.

SETUP DIAGRAM



6. TEST AND MEASUREMENT EQUIPMENT

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

TEST EQUIPMENT LIST				
Description	**Manufacturer**	**Model**	**Asset**	**Cal Due**
Antenna, Horn, 18 GHz	ETS Lindgren	3117	00165318	04/04/15
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	11/26/14
Wideband Power Sensor	Agilent	N1921A	F00360	09/30/14
Peak Power Meter	Agilent / HP	N1911A	F00025	05/06/15
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY53310593	05/07/15
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A-544	RENTAL	05/02/15
Antenna, Bilog, 2 GHz	Sunol Sciences	JB3	A051314-2	05/14/15
Preamplifier, 1300 MHz (T835)	Sonoma	310	N02891	12/30/14
Preamplifier, 26.5 GHz	Agilent / HP	8449B	F00167	03/25/15
EMI Test Receiver, 9 kHz-7 GHz	R & S	ESCI 7	F00092	09/05/14
LISN, 30 MHz	FCC	LISN-50/250-25-2	C00626	01/14/15
Filter, LPF 5GHz	Micro-Tronics	LPS17541	F00174	08/24/14
RF-Amplifier 1-18Ghz	Miteq	AFS42-00101800-25-s-	F00005	08/24/14

7. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01.

Output Power: KDB 558074 D01.

Power Spectral Density: KDB 558074 D01.

Out-of-band emissions in non-restricted bands: KDB 558074 D01.

Out-of-band emissions in restricted bands: KDB 558074 D01.

8. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

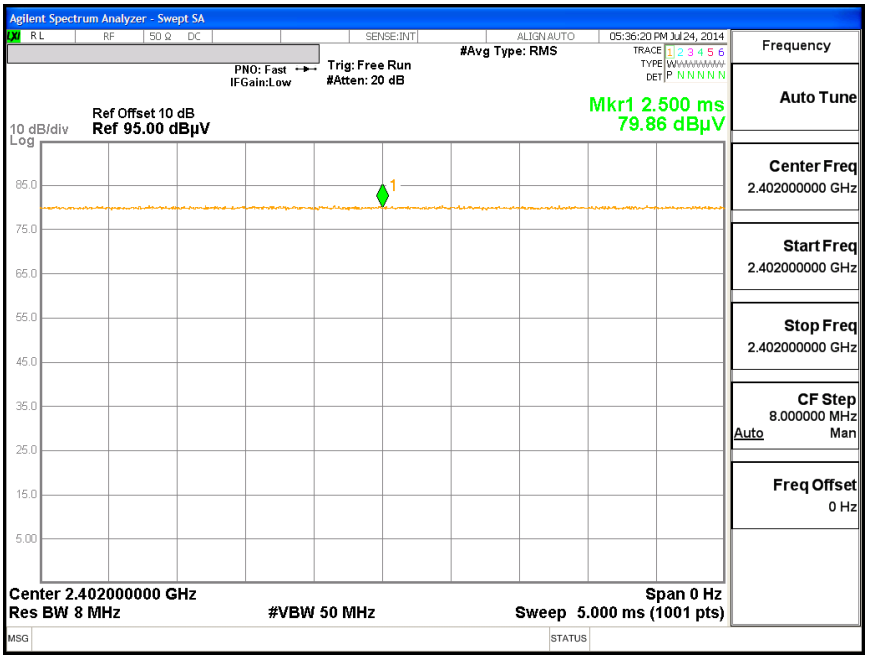
KDB 789033 Zero-Span Spectrum Analyzer Method.

8.1. ON TIME AND DUTY CYCLE RESULTS

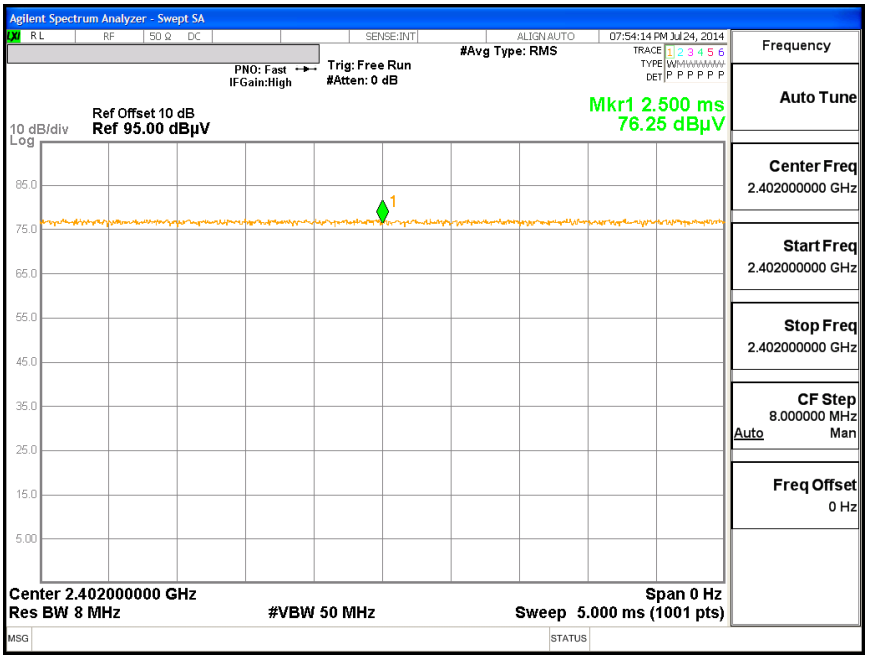
Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
GFSK	1.000	1.000	1.000	100.0%	0.000	1.000
8PSK	1.000	1.000	1.000	100.0%	0.000	1.000

8.2. DUTY CYCLE PLOTS

DUTY CYCLE BLE MODE GFSK



DUTY CYCLE BLE MODE 8PSK



9. ANTENNA PORT TEST RESULTS

9.1. BASIC DATA RATE GFSK MODULATION

9.1.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

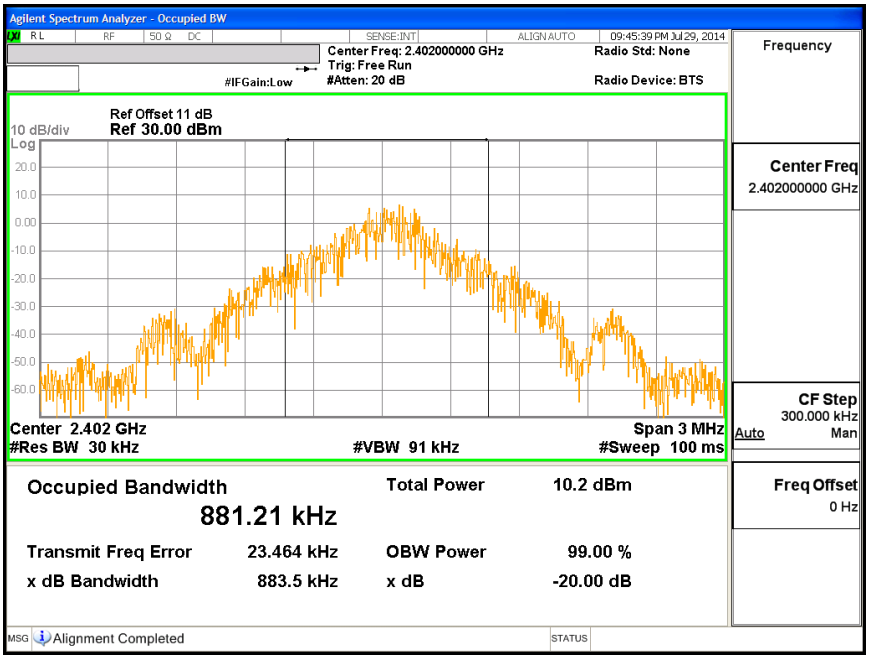
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

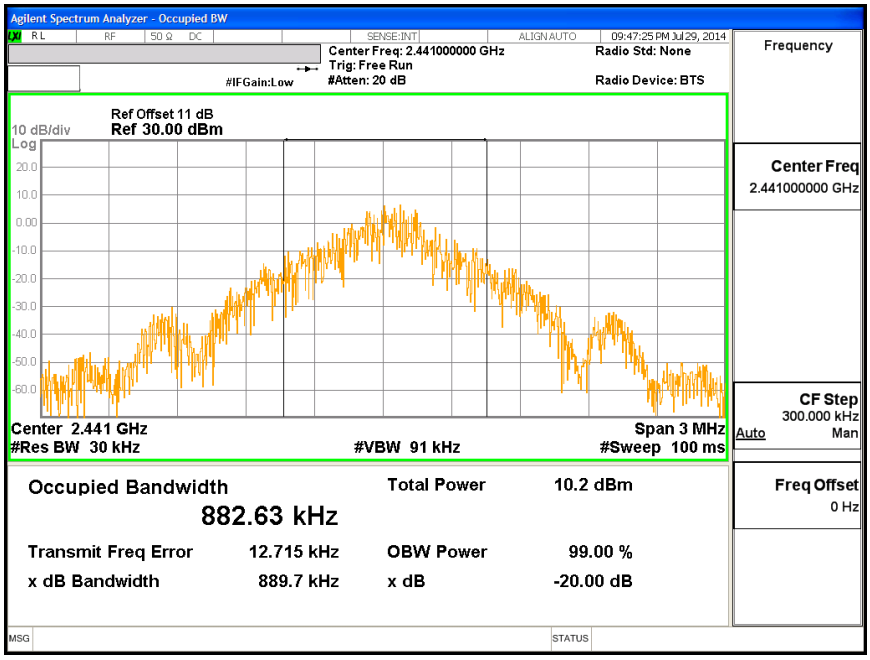
Channel	Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low	2402	883.5	881.21
Middle	2441	889.7	882.63
High	2480	870.01	910.06

20 dB AND 99% BANDWIDTH

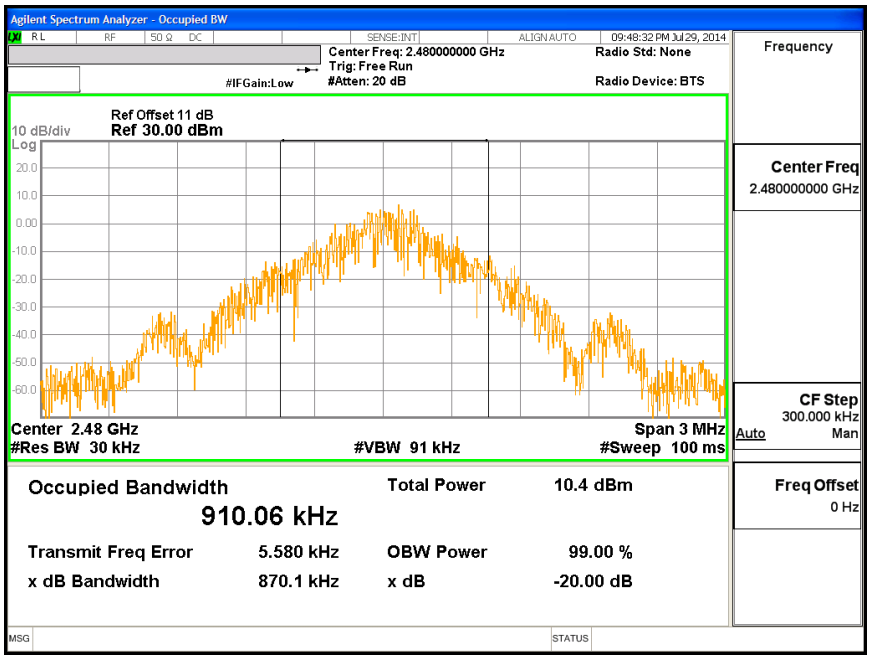
BANDWIDTH LOW CH



BANDWIDTH MID CH



BANDWIDTH HIGH CH



9.1.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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.

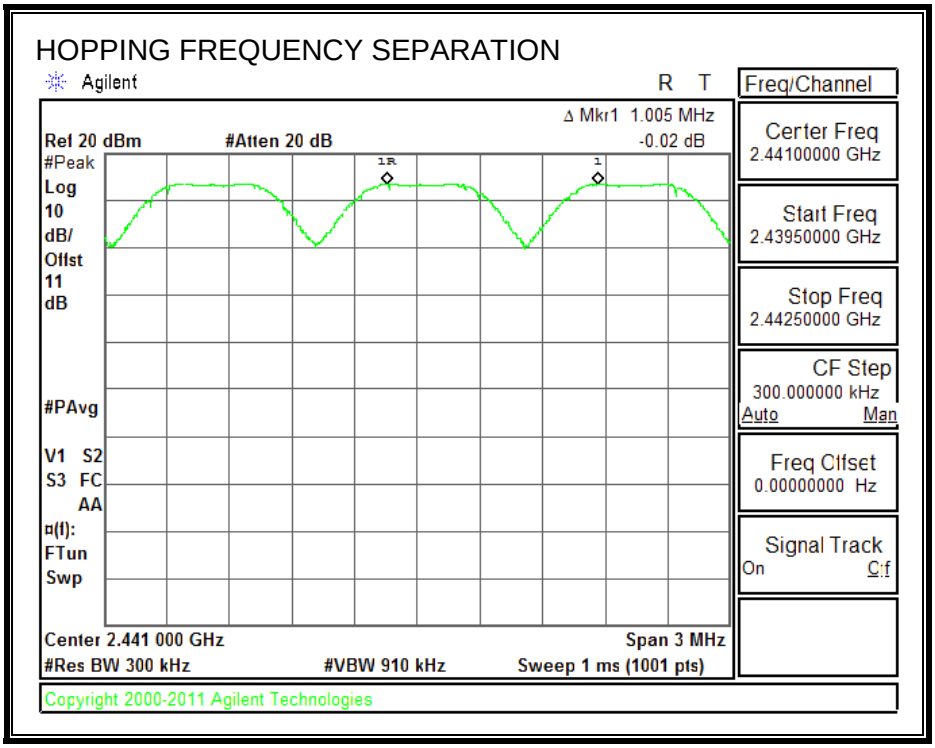
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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



9.1.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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.

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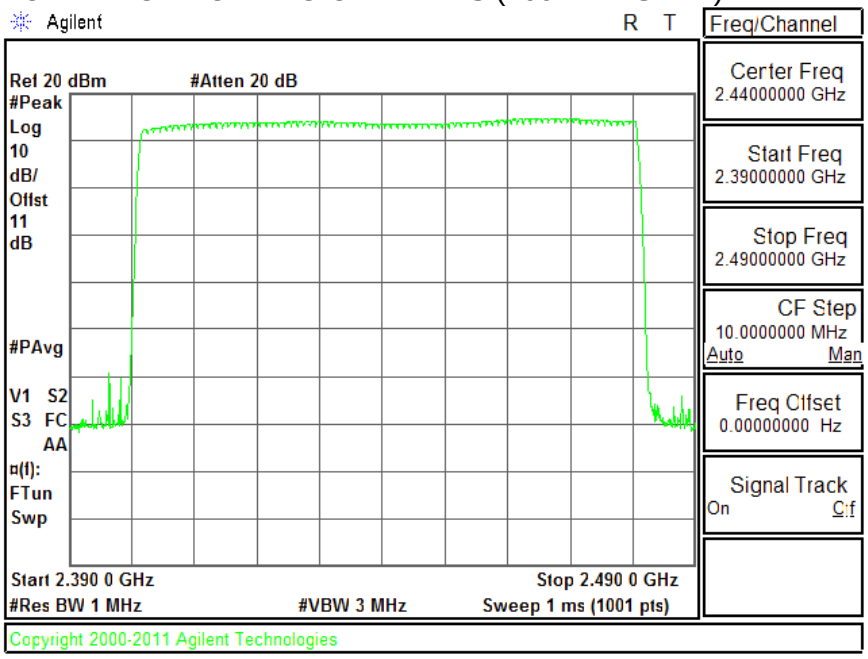
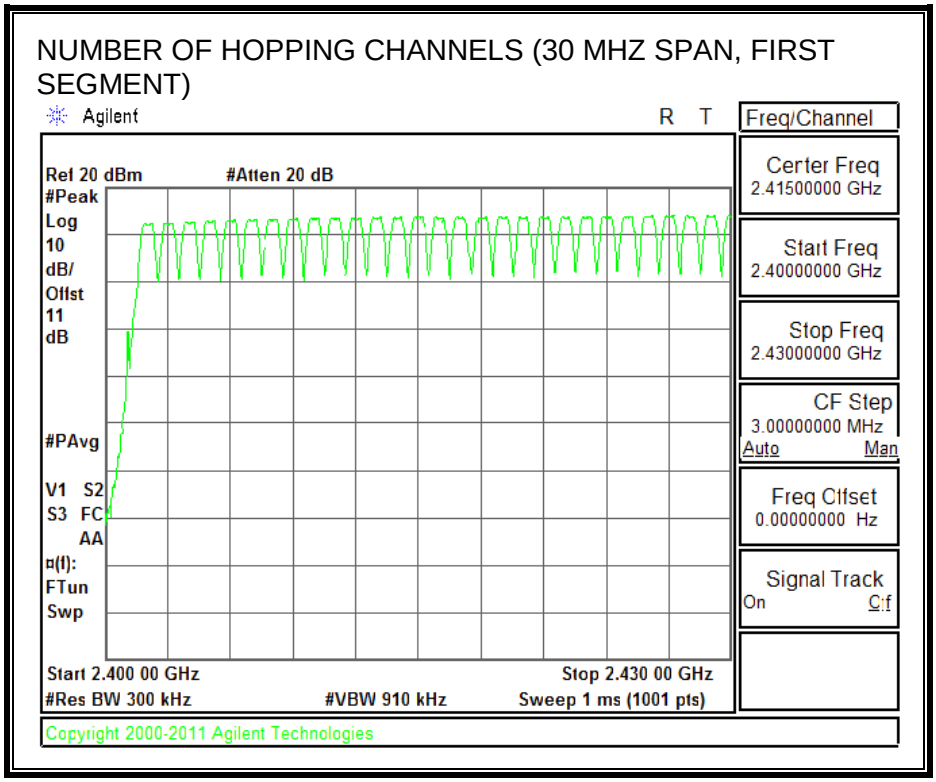
NUMBER OF HOPPING CHANNELS

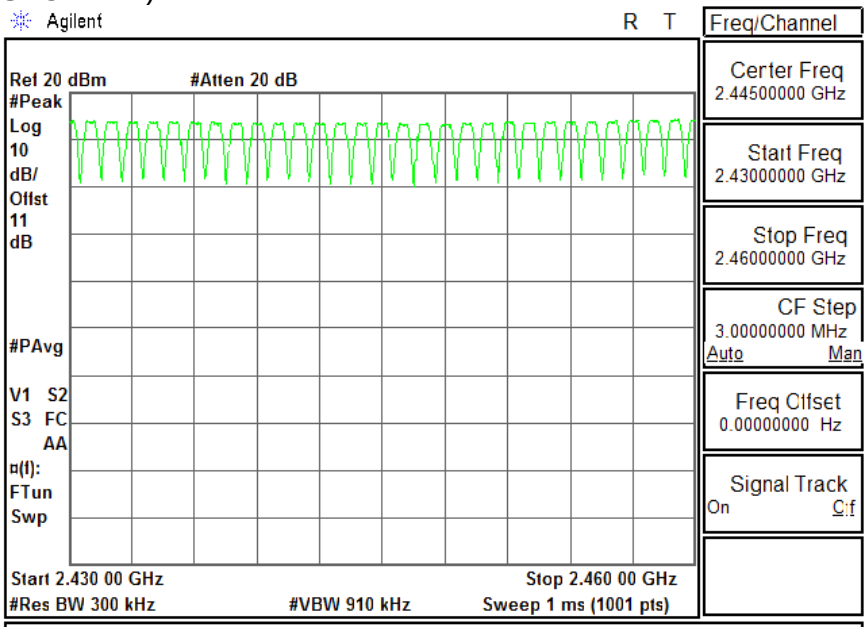
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



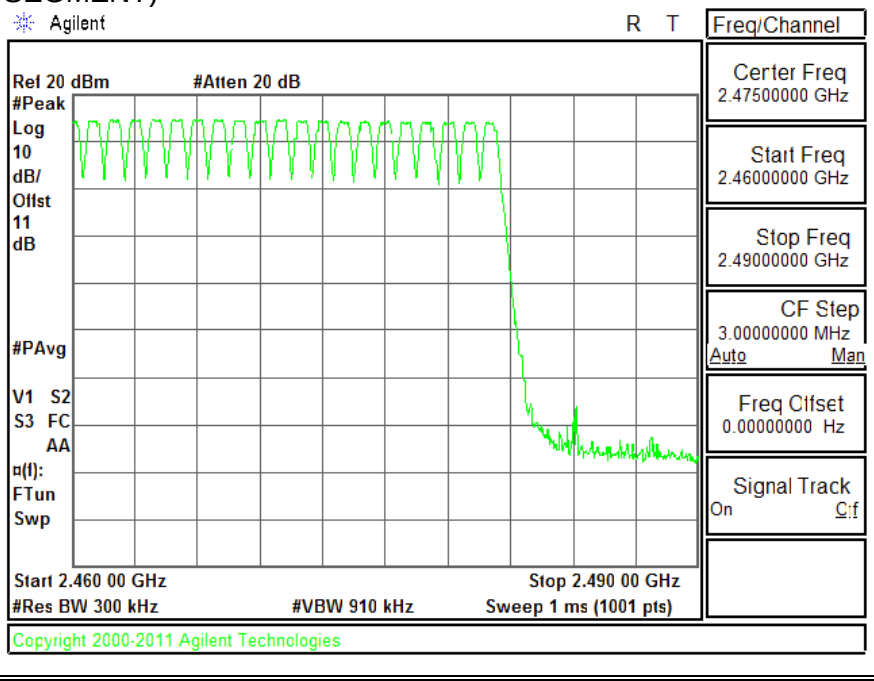
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



9.1.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

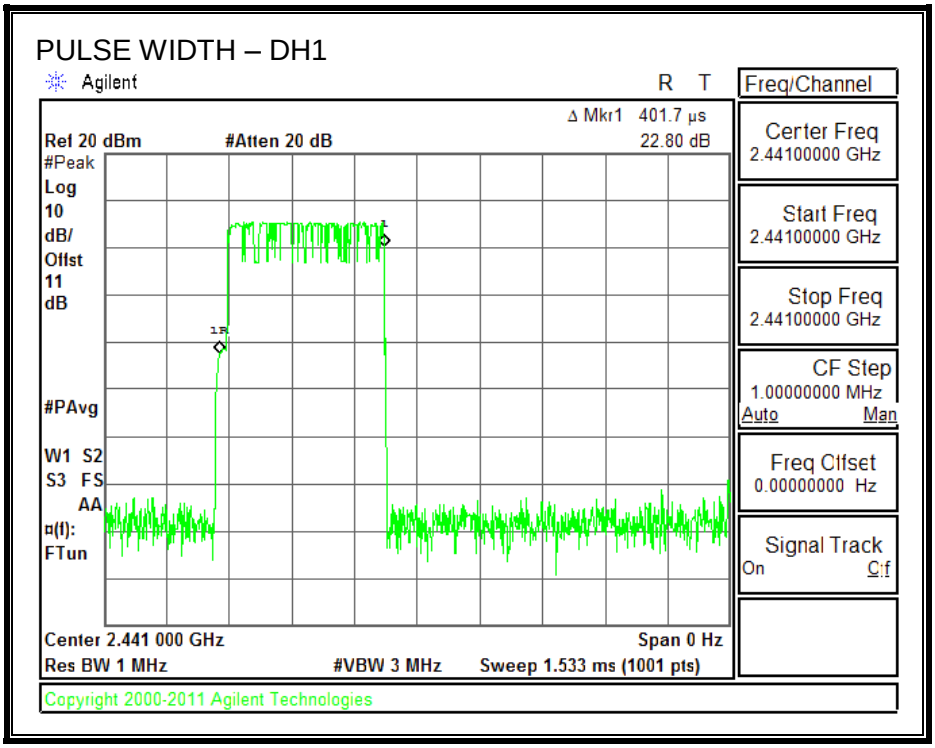
The transmitter output is connected to a spectrum analyzer. The span is set to 0 Hz, centered on a single, selected hopping channel. The width of a single pulse is measured in a fast scan. The number of pulses is measured in a 3.16 second scan, to enable resolution of each occurrence.

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.

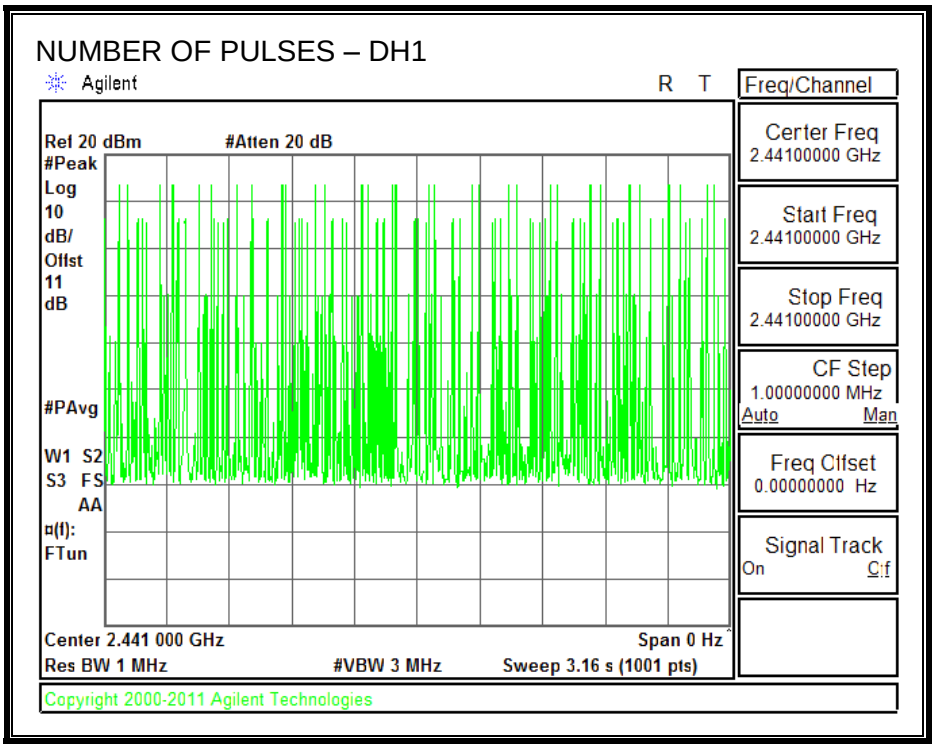
RESULTS

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	0.401	32	0.128	0.4	-0.272
DH3	1.64	15	0.246	0.4	-0.154
DH5	2.88	7	0.202	0.4	-0.198

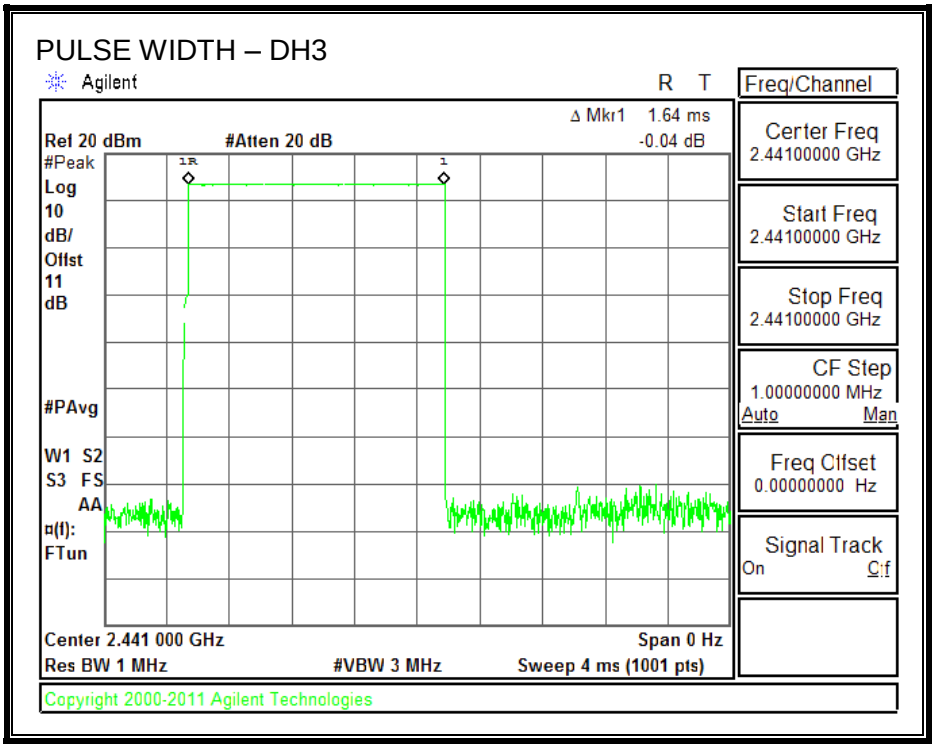
PULSE WIDTH - DH1



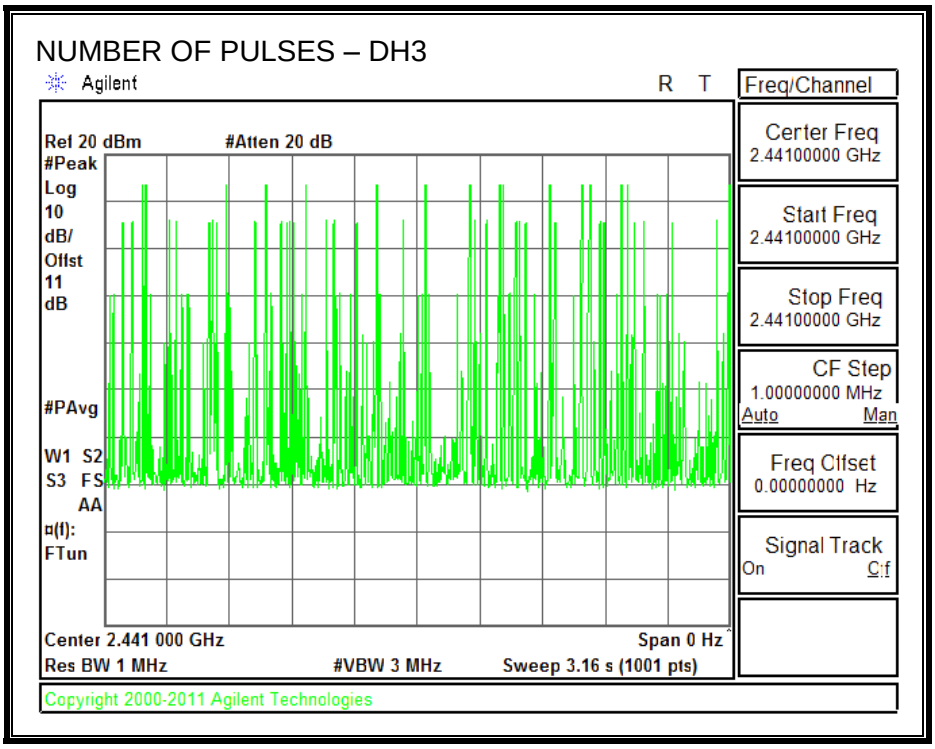
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



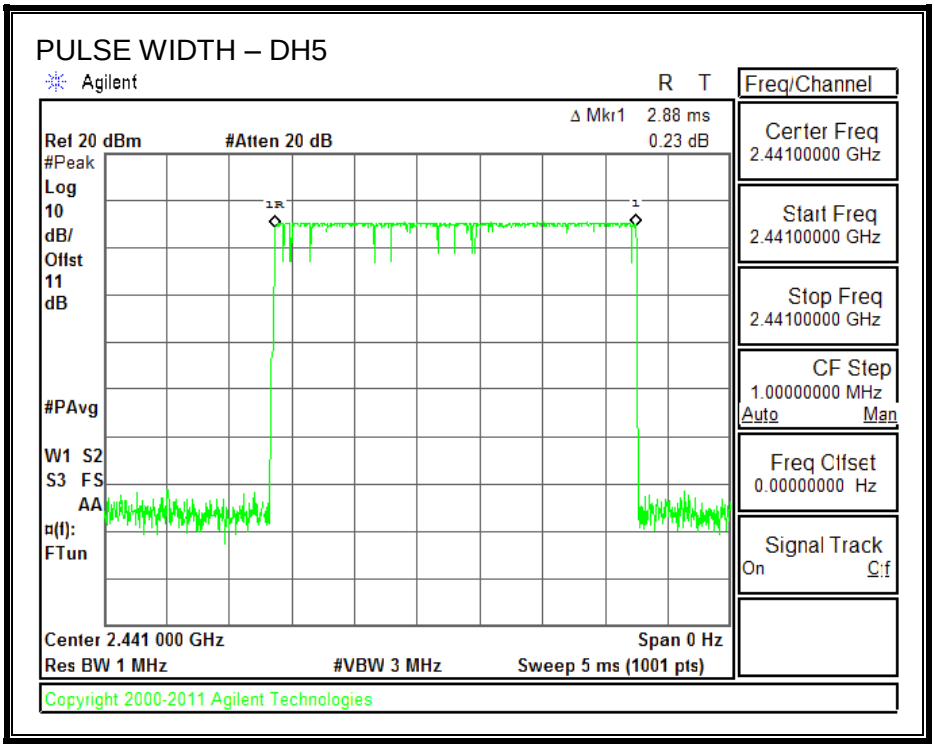
PULSE WIDTH – DH3



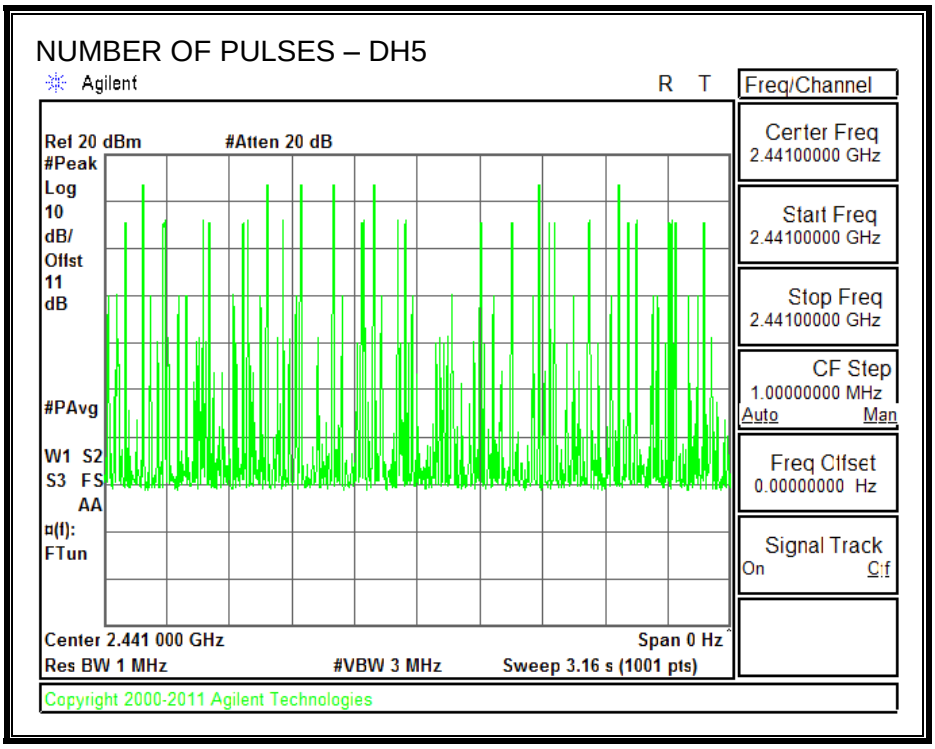
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



9.1.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

TEST PROCEDURE

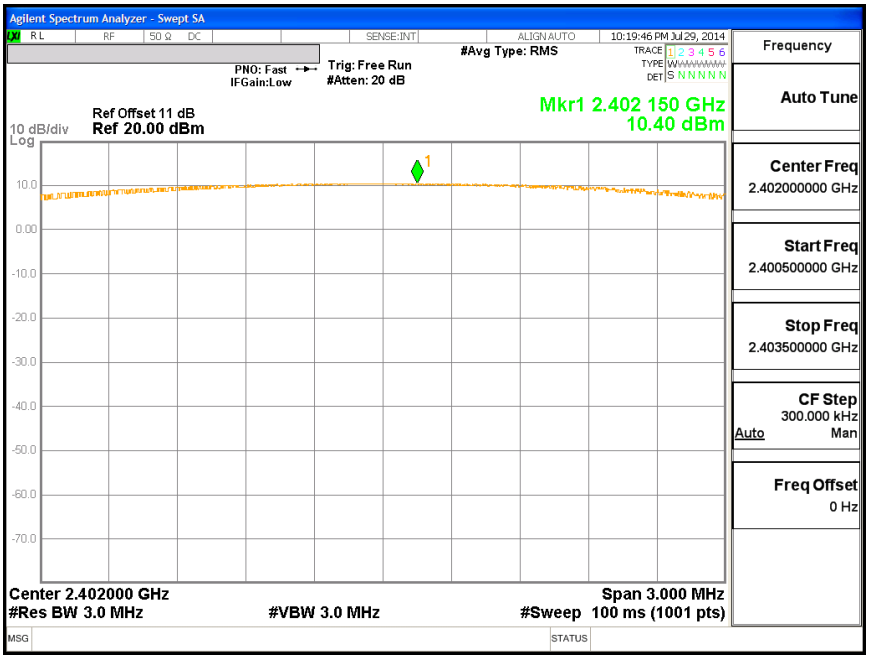
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

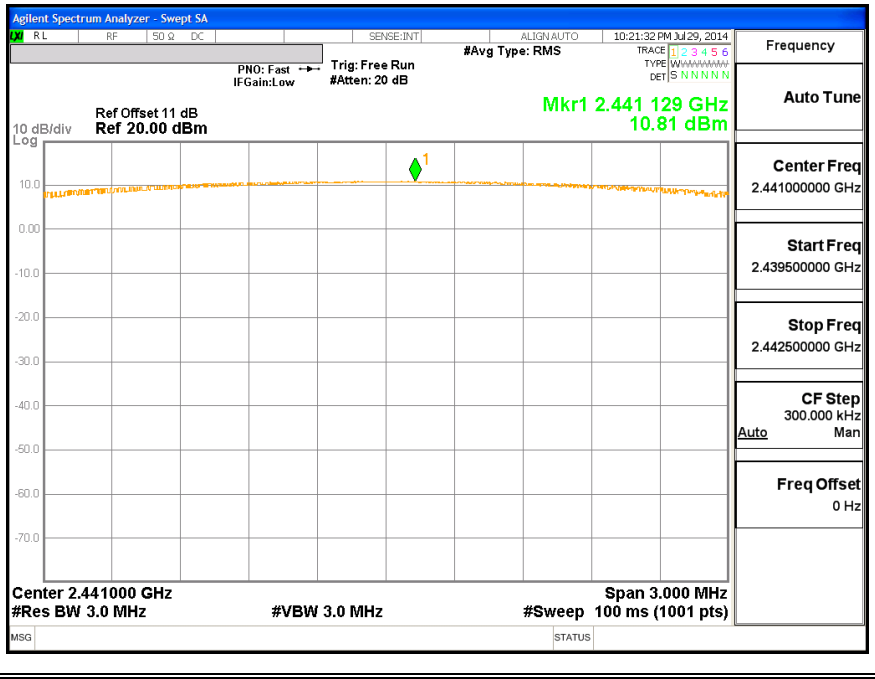
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.40	30	-19.60
Middle	2441	10.81	30	-19.19
High	2480	10.26	30	-19.74

OUTPUT POWER

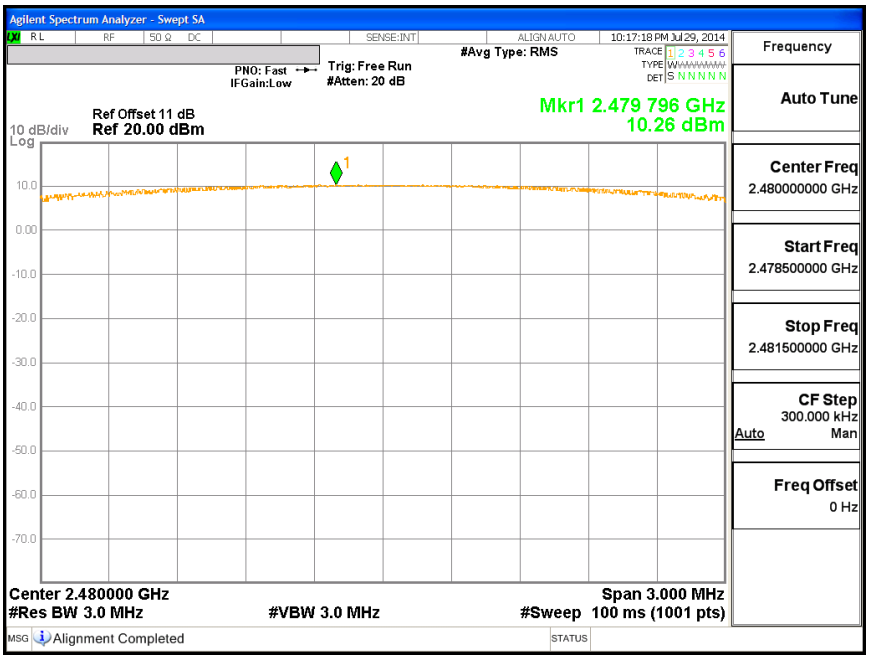
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



9.1.6. 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 11 dB (including 10 dB pad and 1 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	10.21
Middle	2441	10.30
High	2480	10.14

9.1.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

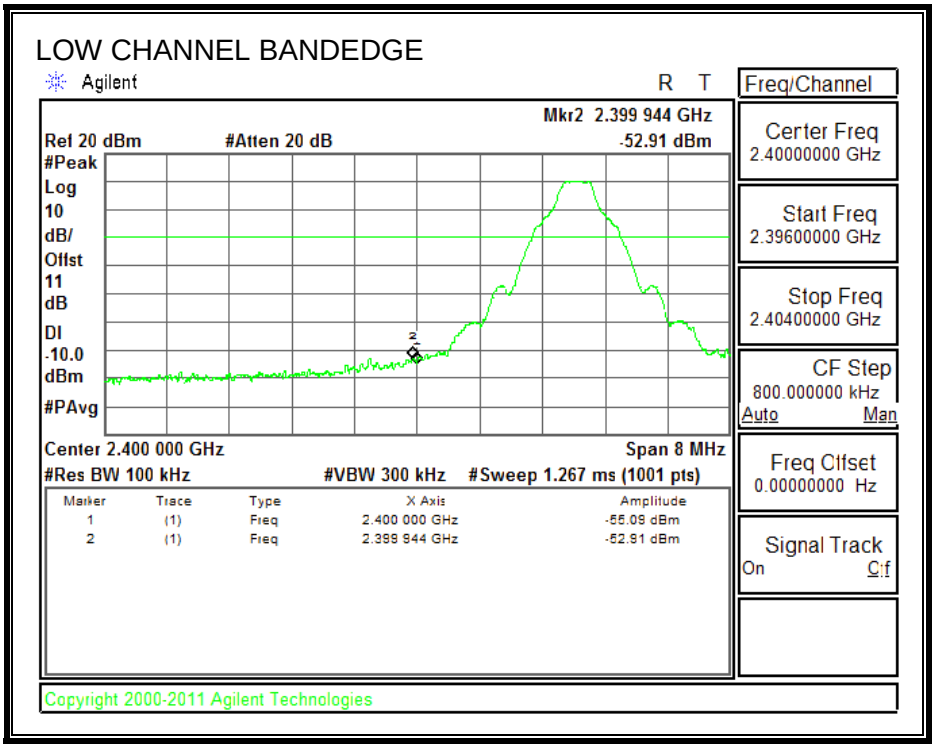
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

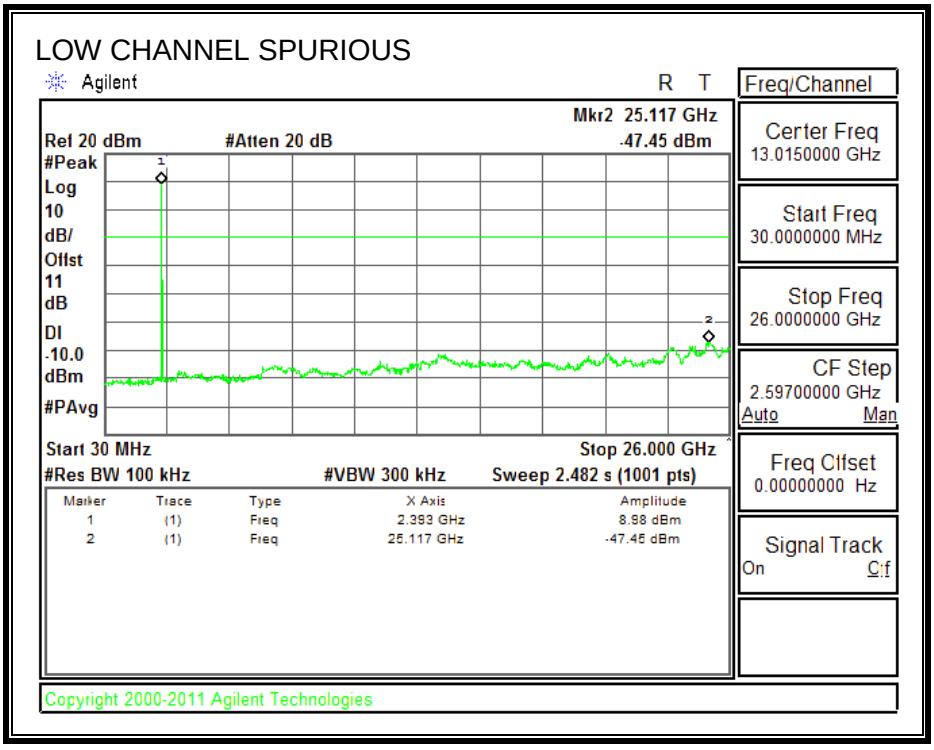
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

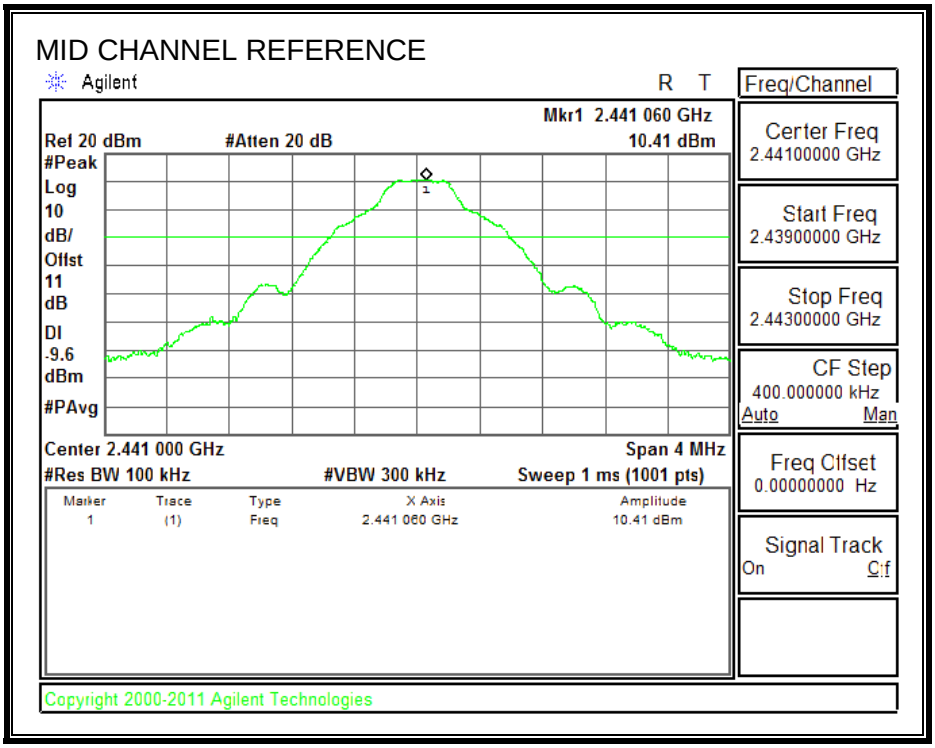
RESULTS

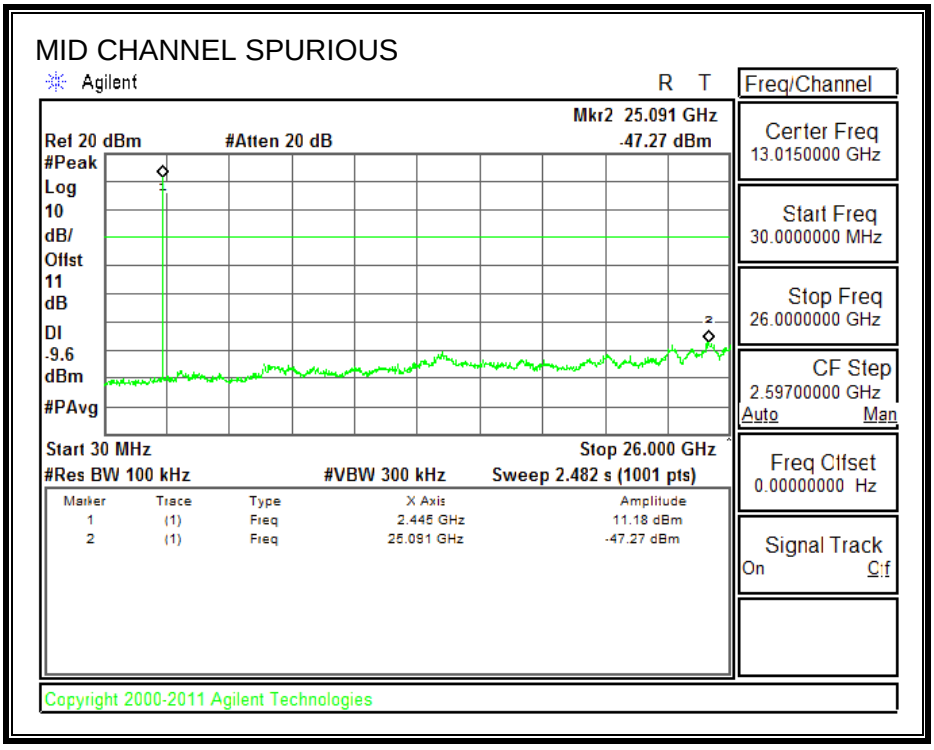
SPURIOUS EMISSIONS, LOW CHANNEL



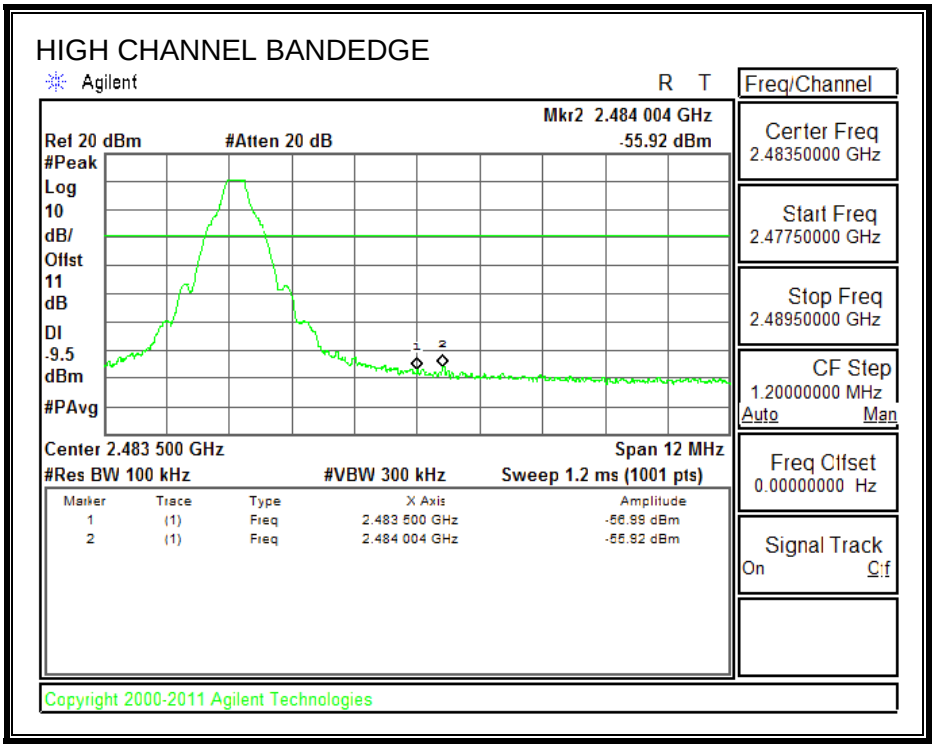


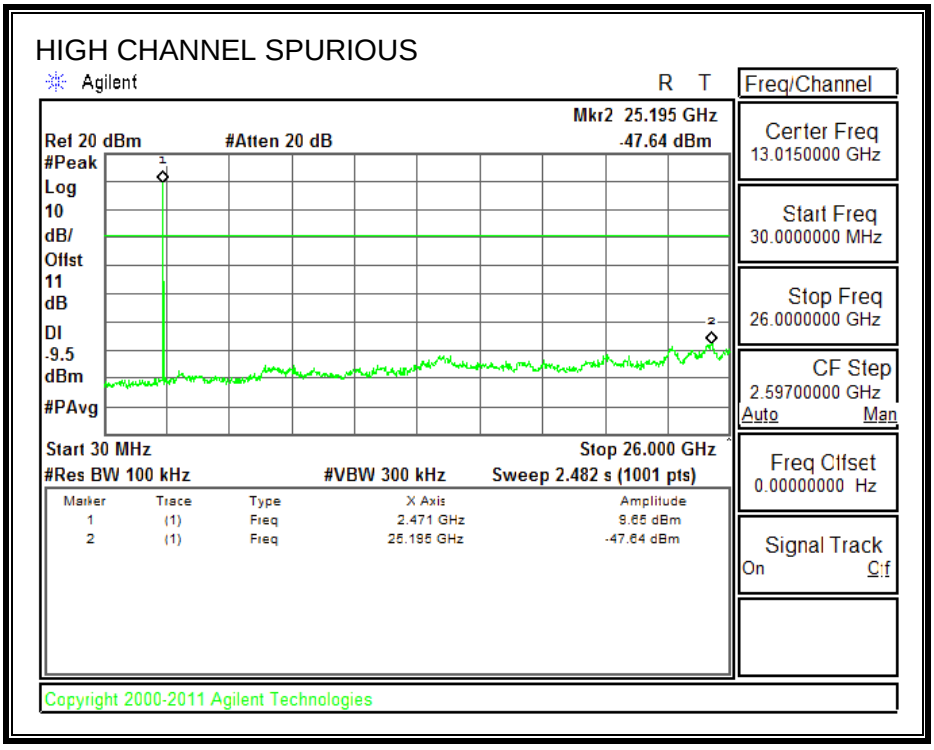
SPURIOUS EMISSIONS, MID CHANNEL





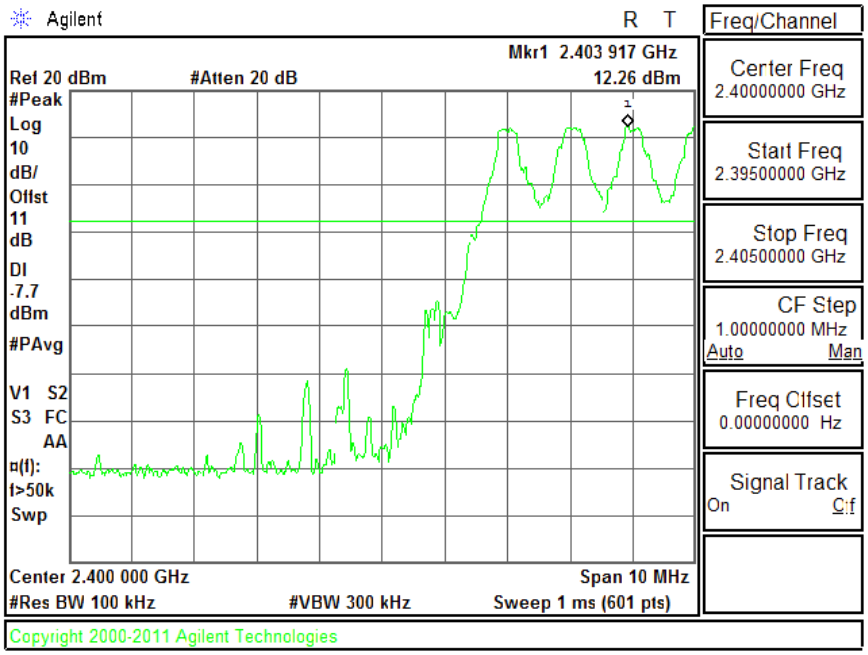
SPURIOUS EMISSIONS, HIGH CHANNEL



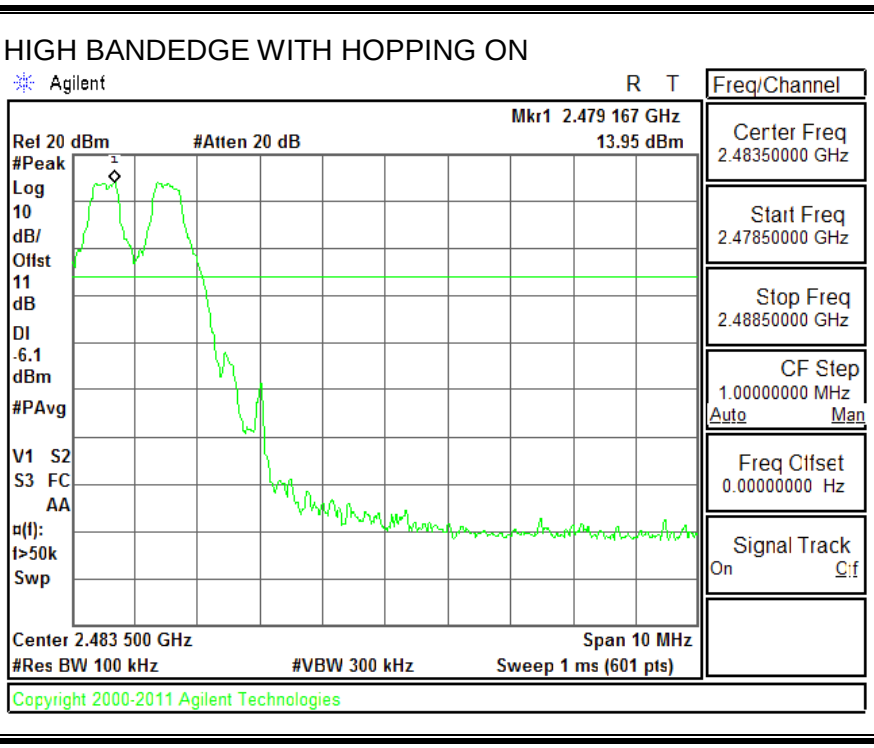


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



9.2. ENHANCED DATA RATE 8PSK MODULATION

9.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

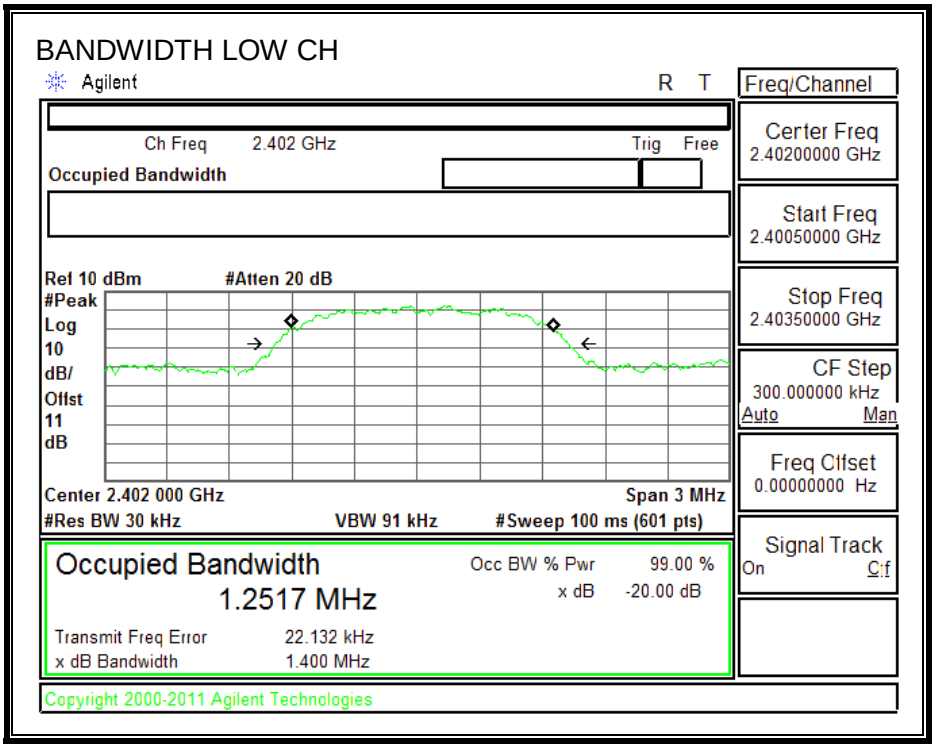
TEST PROCEDURE

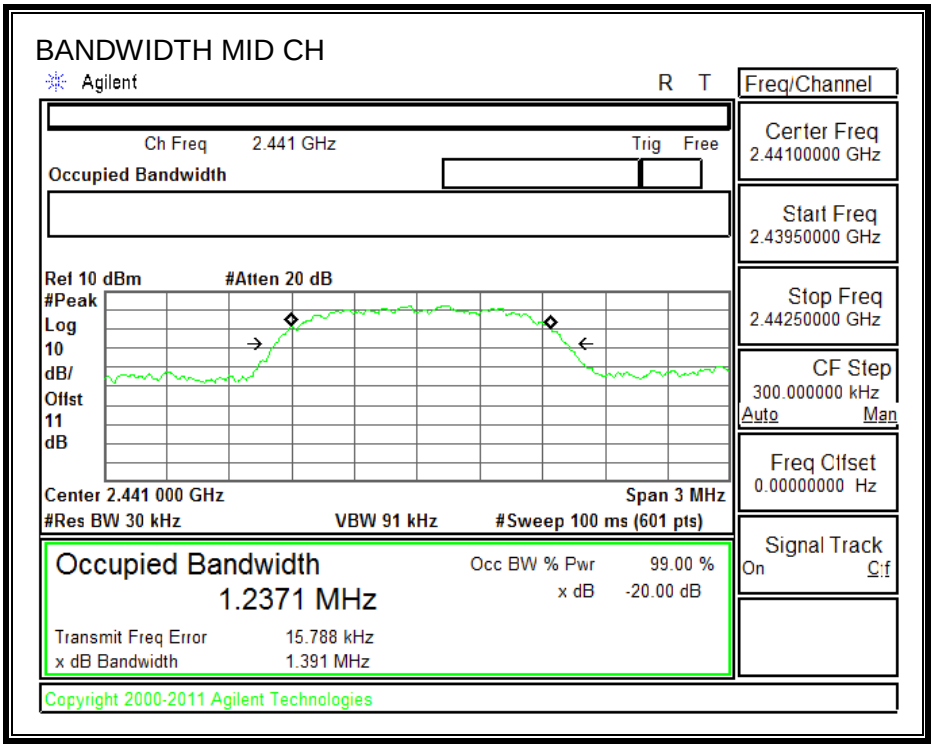
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

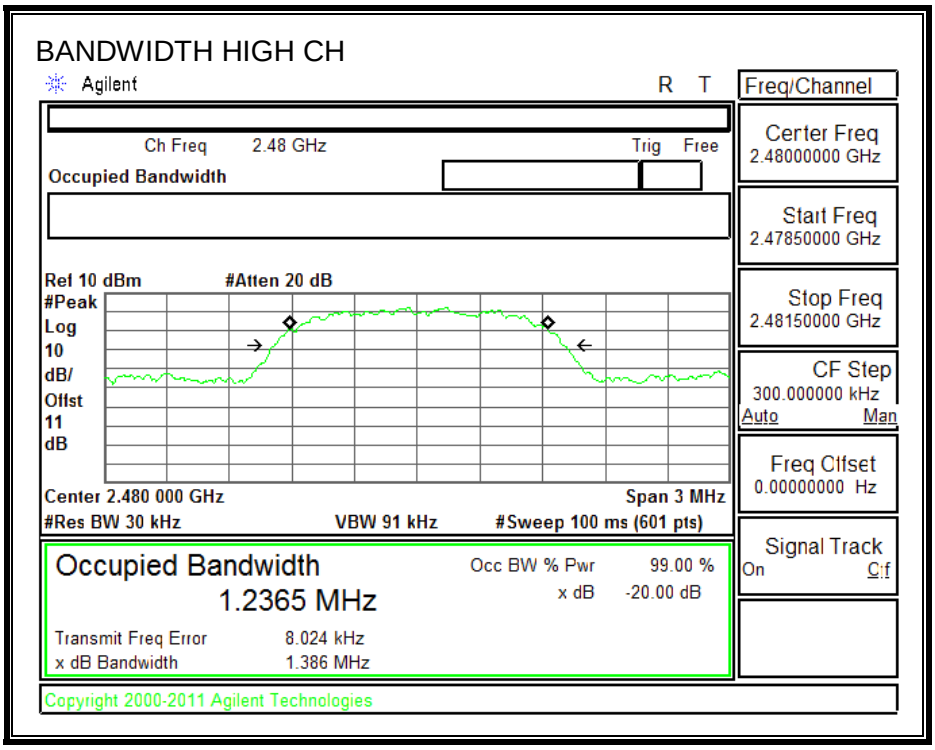
RESULTS

Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.400	1.236
Middle	2441	1.391	1.246
High	2480	1.386	1.244

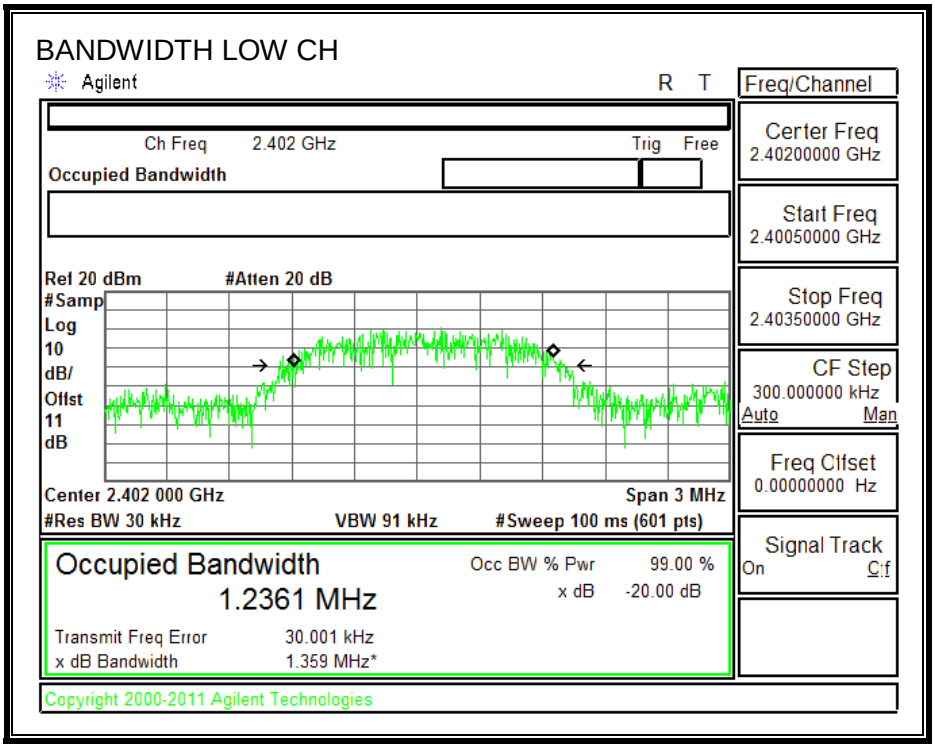
20 dB BANDWIDTH

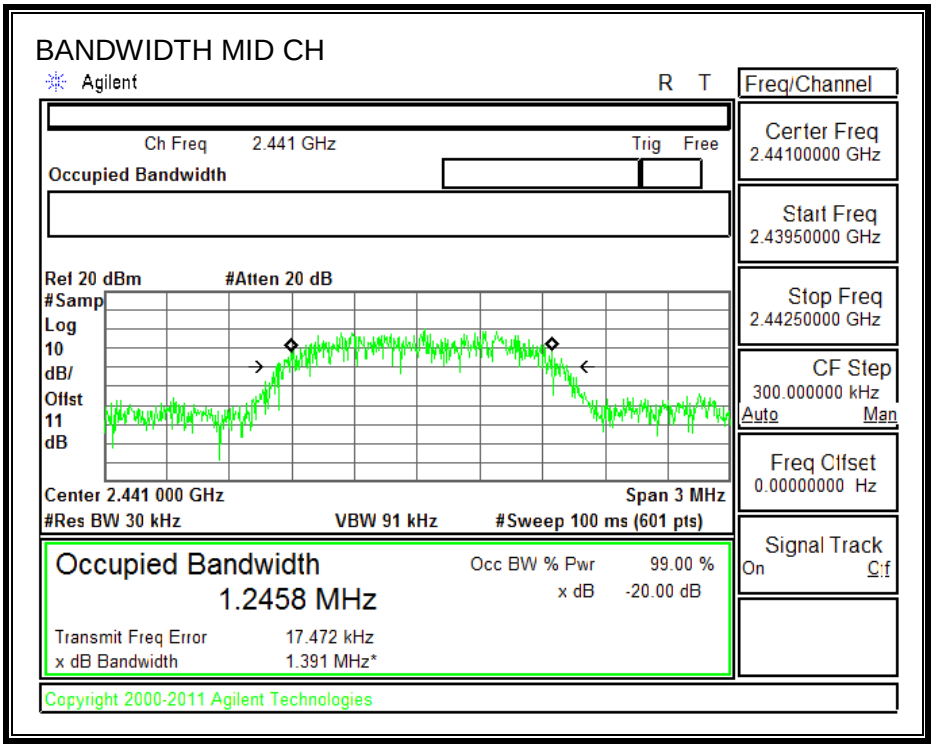


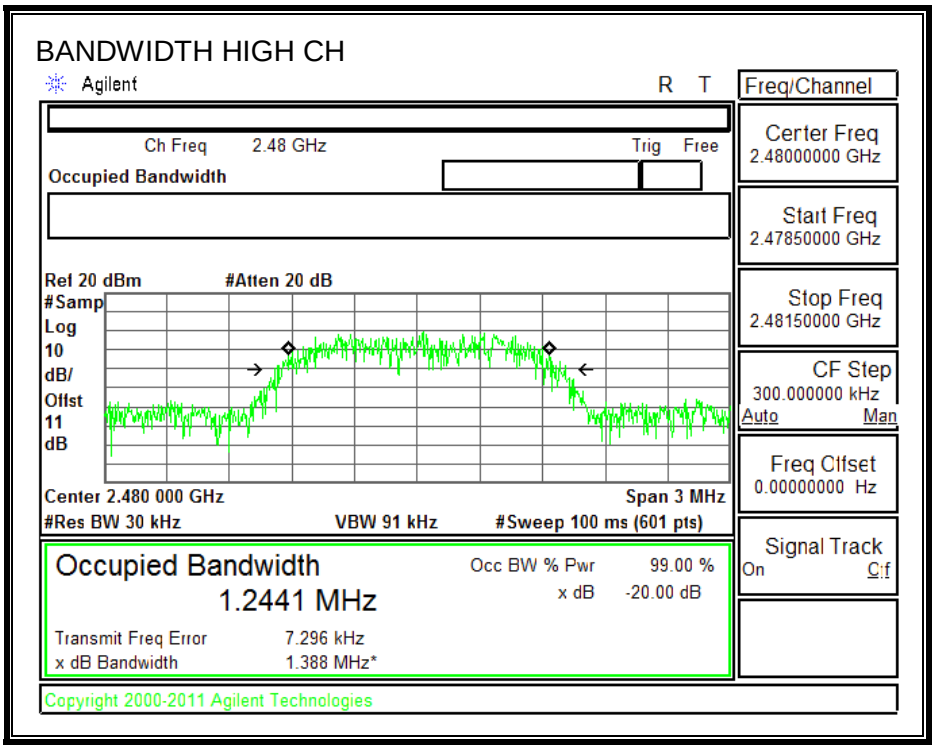




99% BANDWIDTH







9.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-210 A8.1 (b)

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.

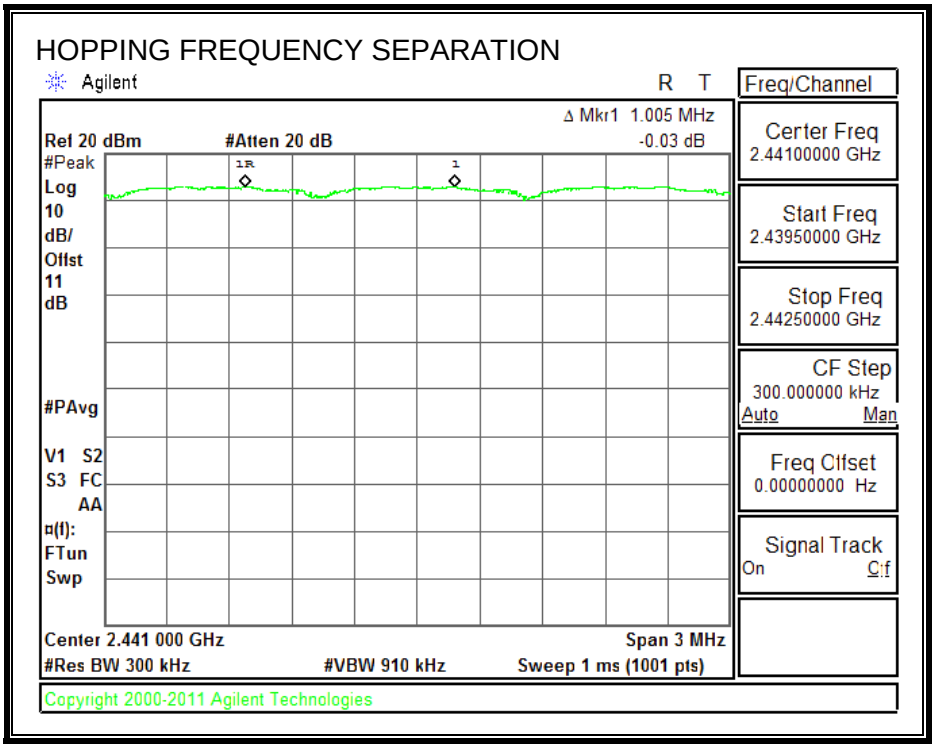
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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



9.2.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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

TEST PROCEDURE

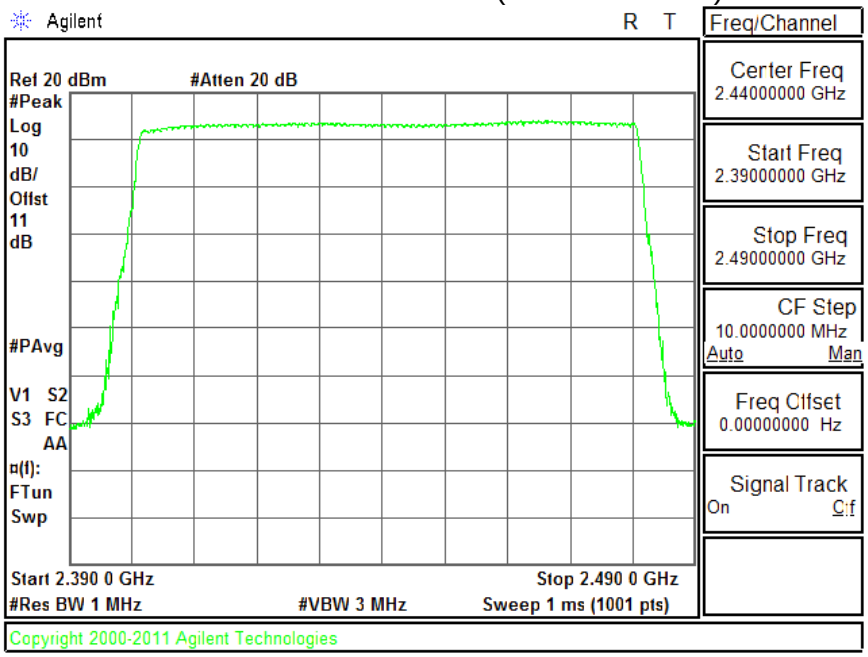
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

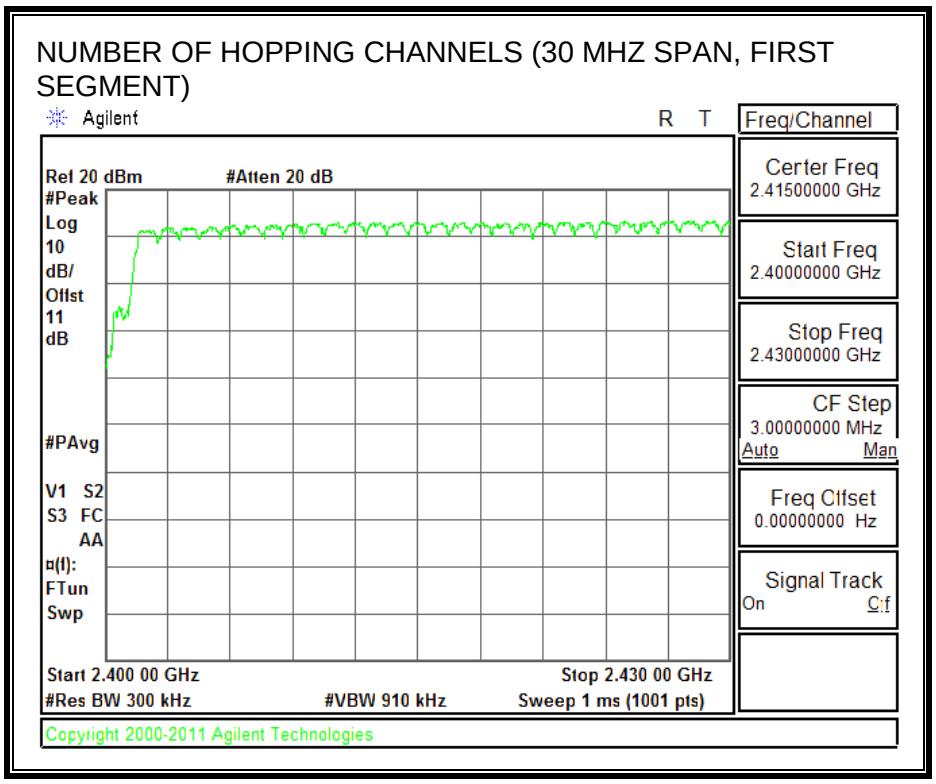
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS

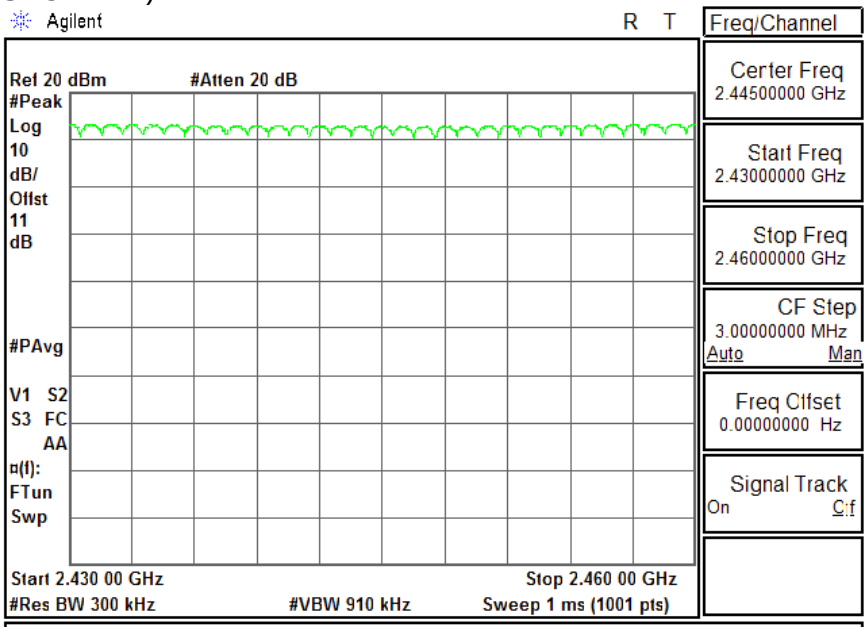
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



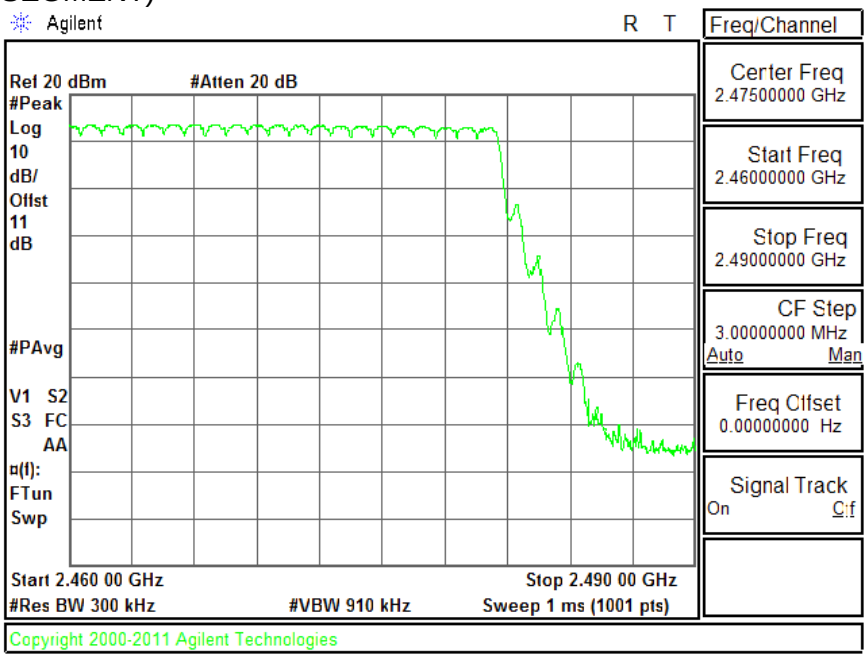
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



9.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-210 A8.1 (d)

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.

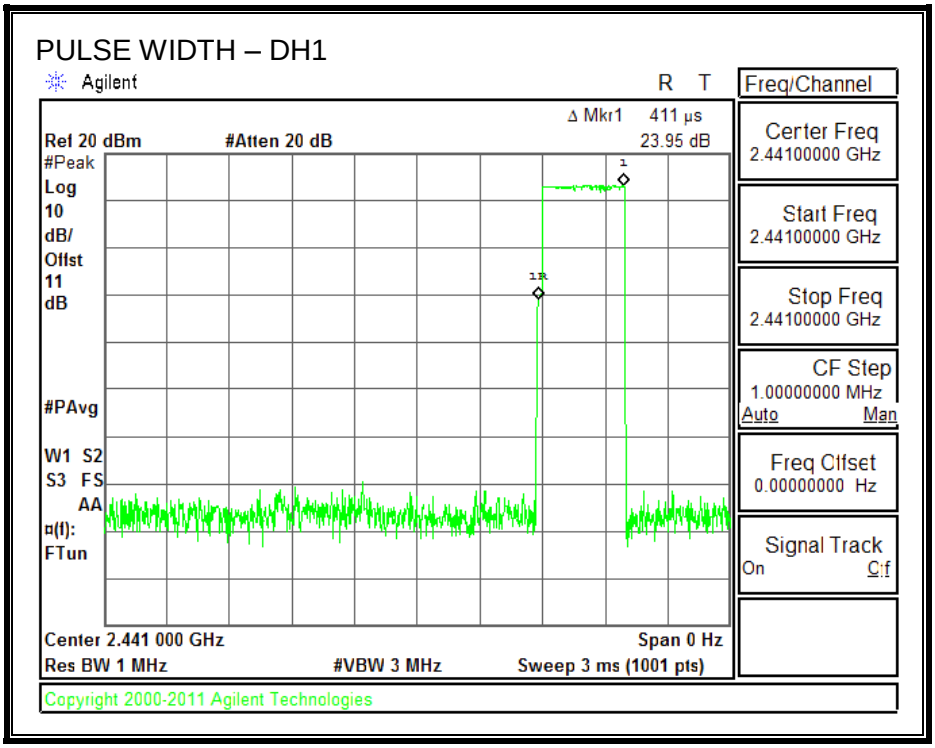
RESULTS

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

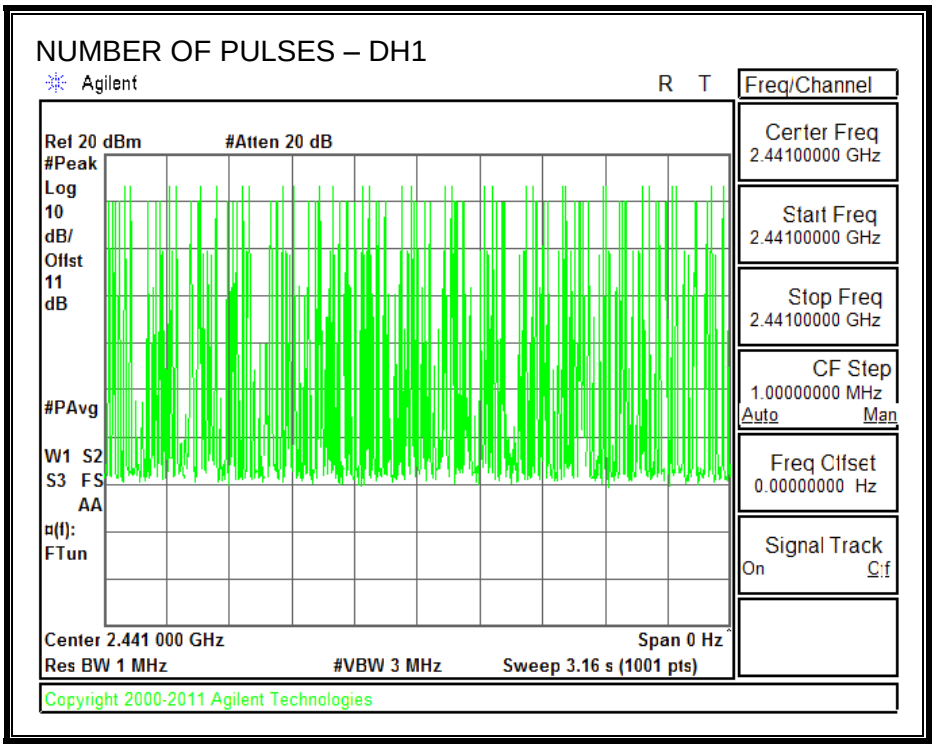
8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
3DH1	0.411	31	0.127	0.4	-0.273
3DH3	1.64	13	0.213	0.4	-0.187
3DH5	2.87	6	0.172	0.4	-0.228

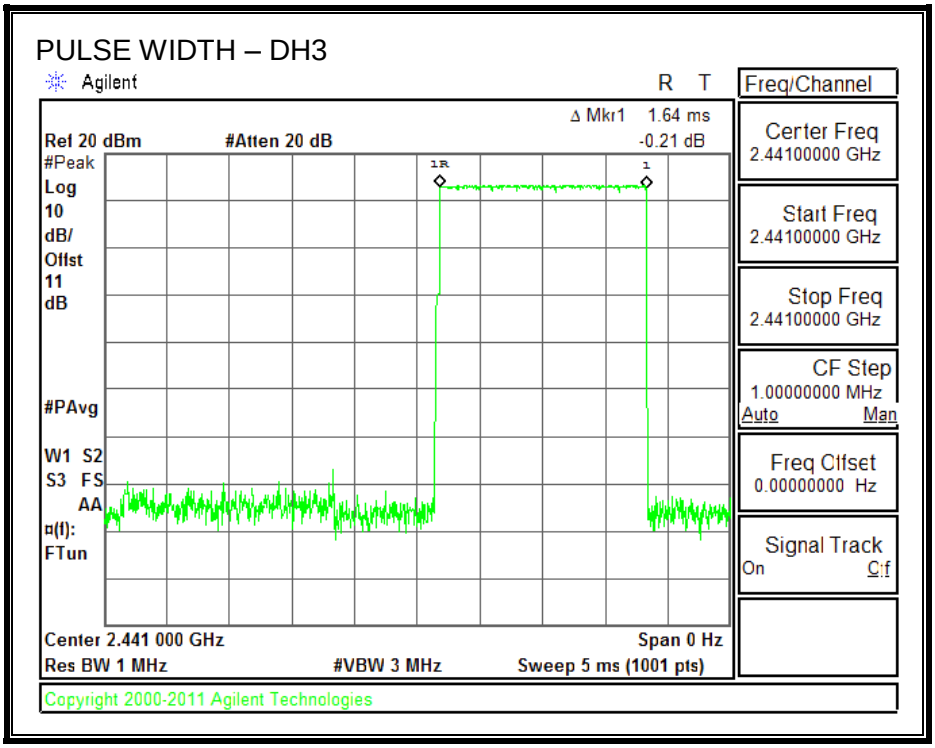
PULSE WIDTH - DH1



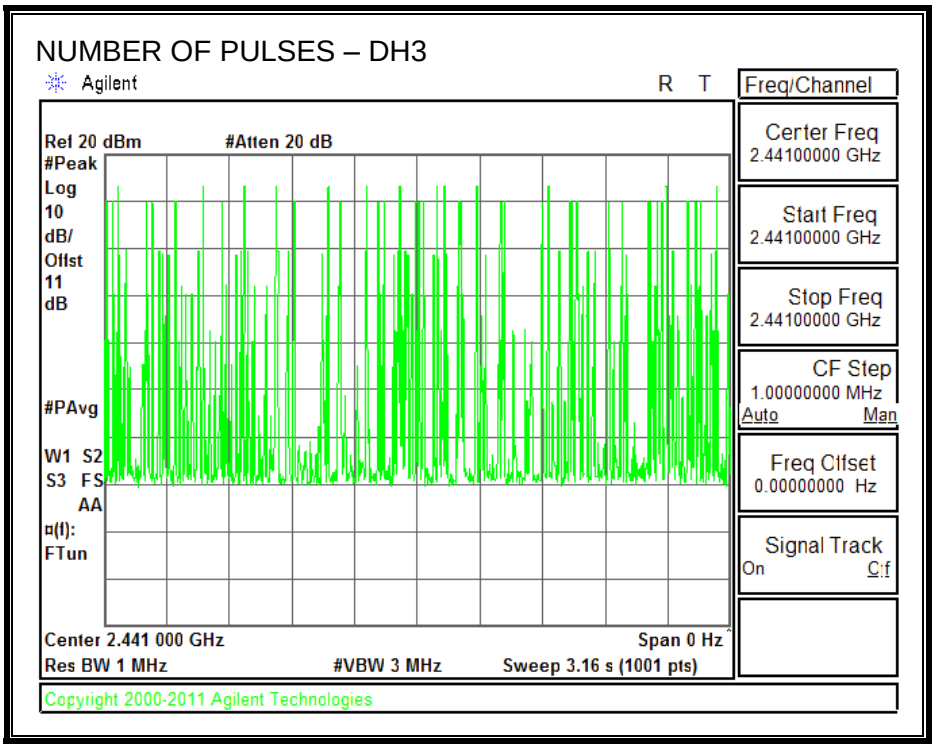
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



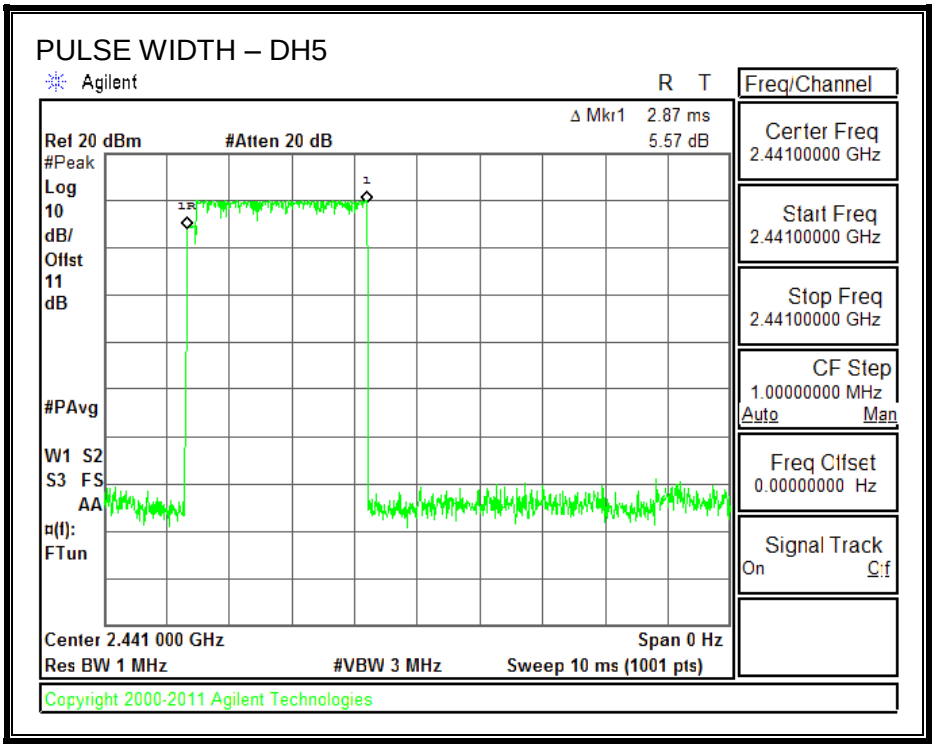
PULSE WIDTH – DH3



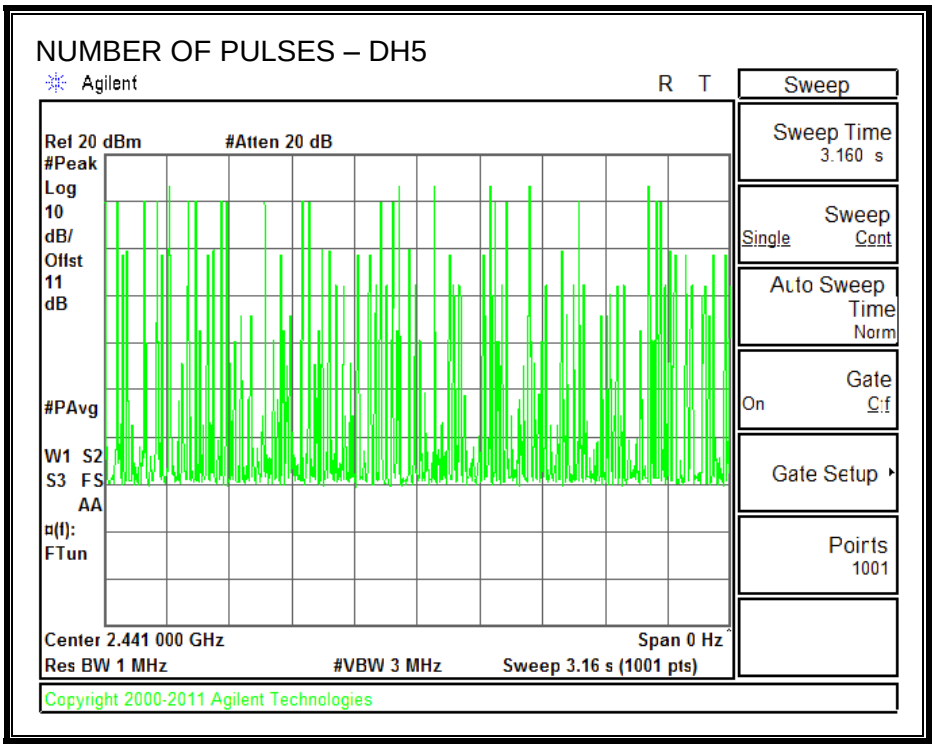
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



9.2.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-210 Issue 7 Clause A8.4

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

TEST PROCEDURE

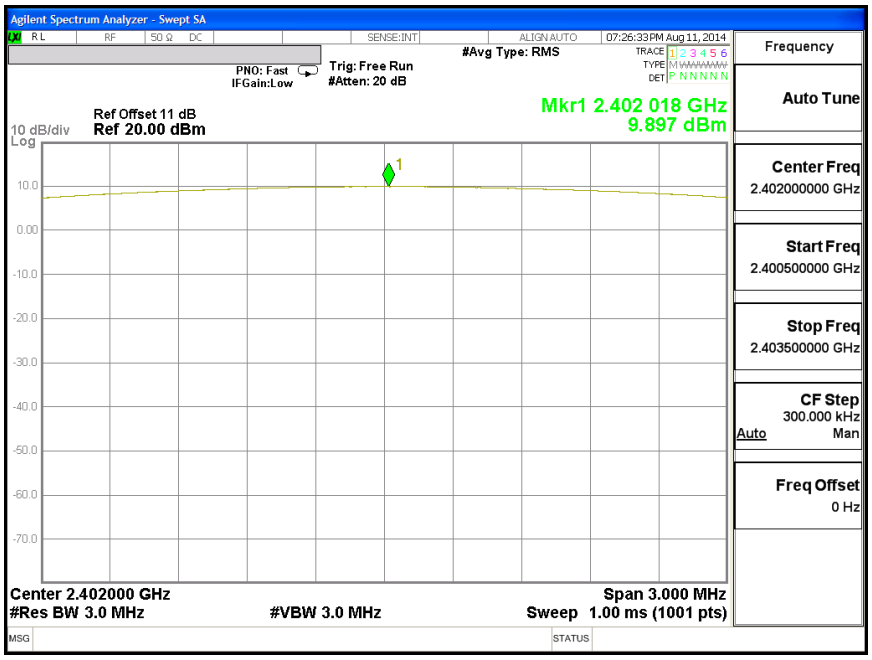
The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

RESULTS

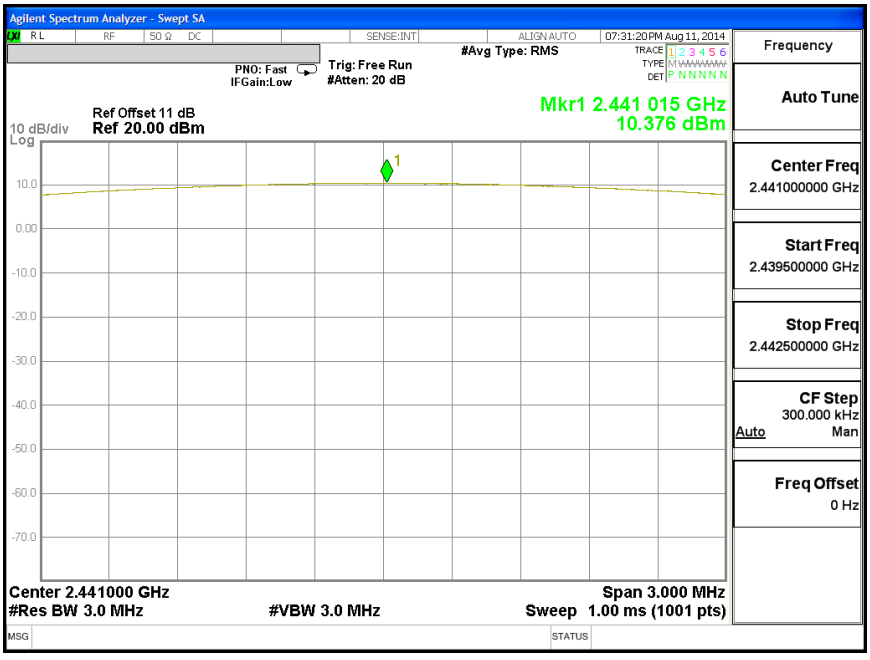
Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	9.90	30	-20.10
Middle	2441	10.38	30	-19.62
High	2480	10.18	30	-19.82

OUTPUT POWER

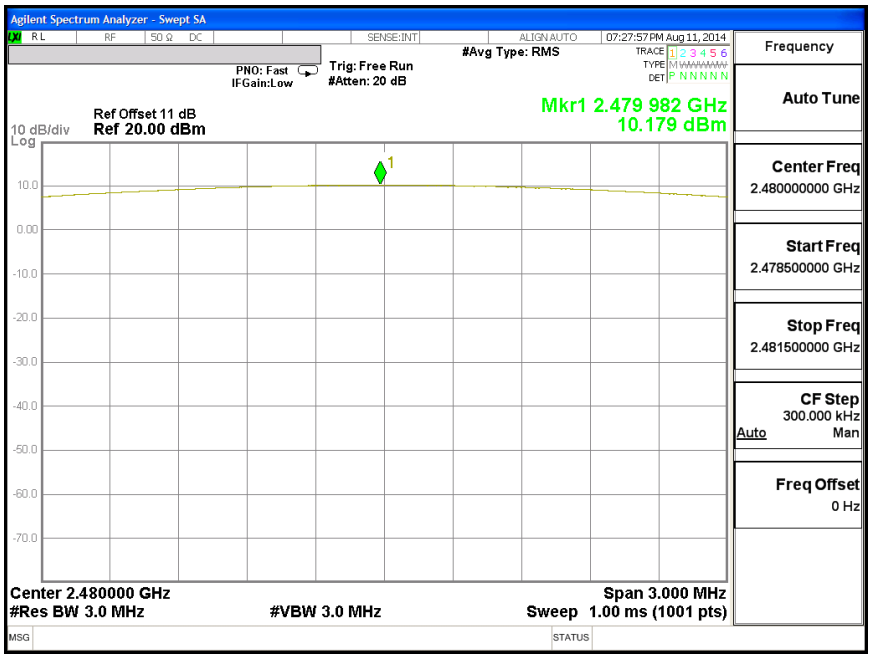
PEAK POWER LOW CH



PEAK POWER MID CH



PEAK POWER HIGH CH



9.2.6. 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 11 dB (including 10 dB pad and 1 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	7.90
Middle	2441	8.00
High	2480	7.73

9.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Limit = -20 dBc

TEST PROCEDURE

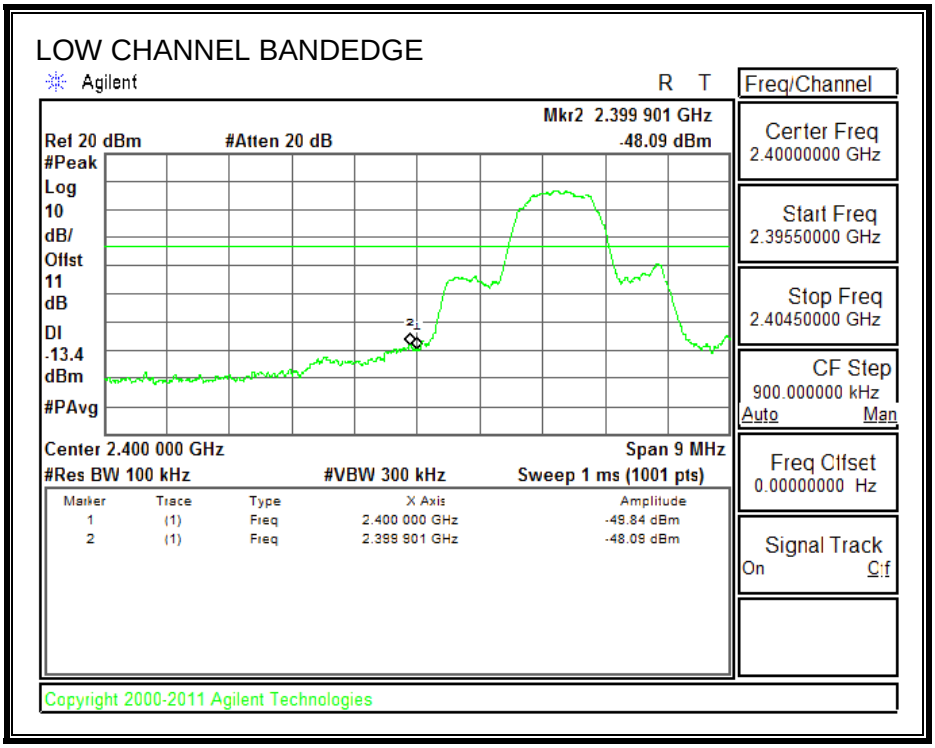
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

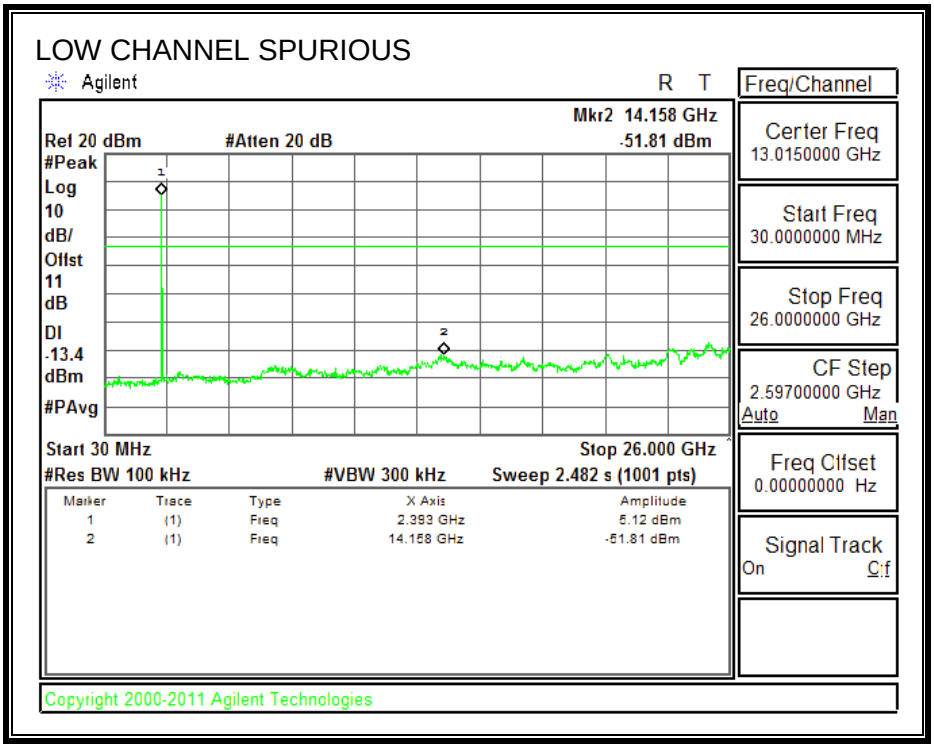
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

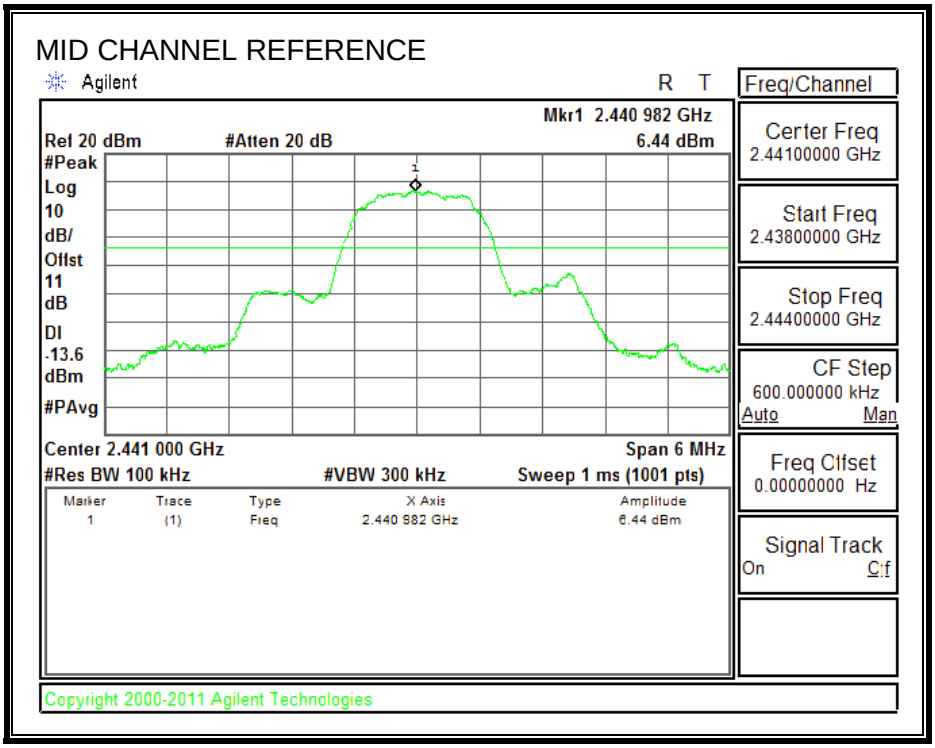
RESULTS

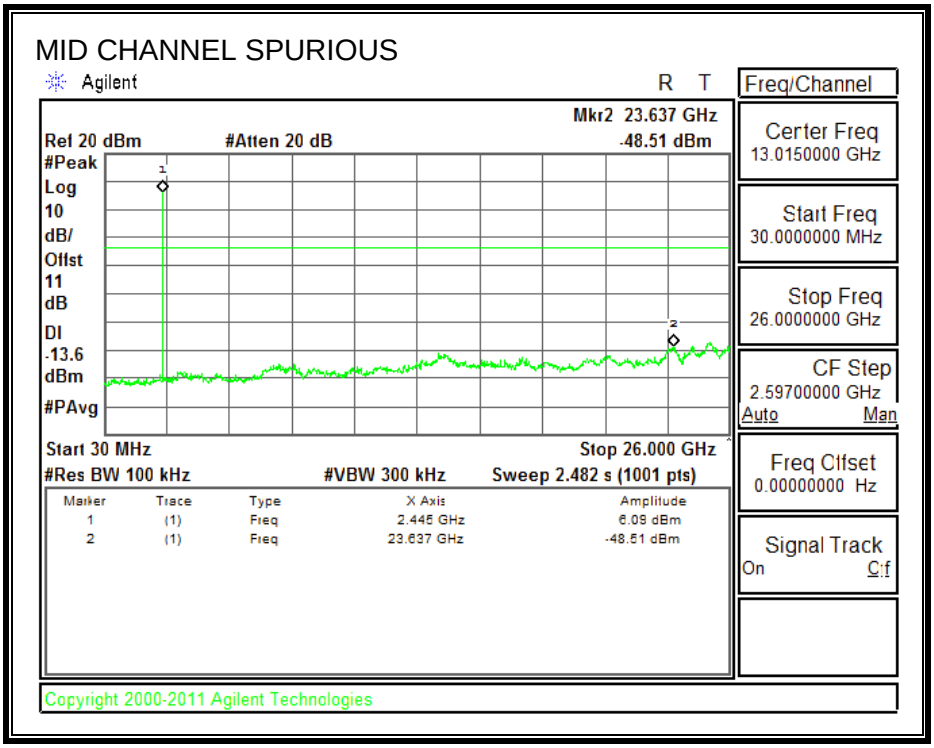
SPURIOUS EMISSIONS, LOW CHANNEL





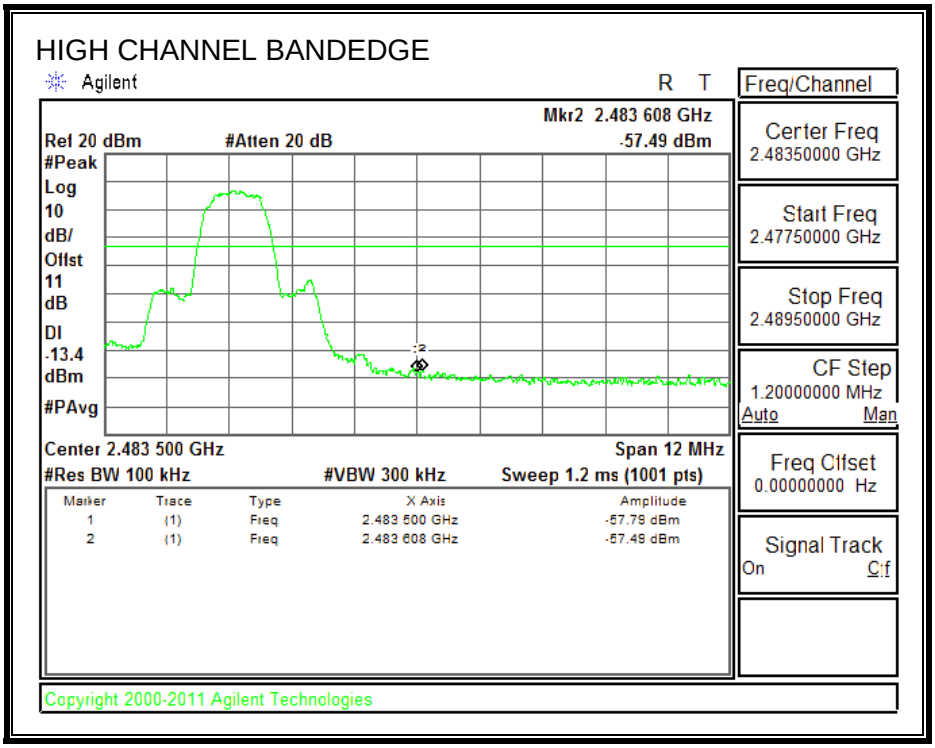
SPURIOUS EMISSIONS, MID CHANNEL



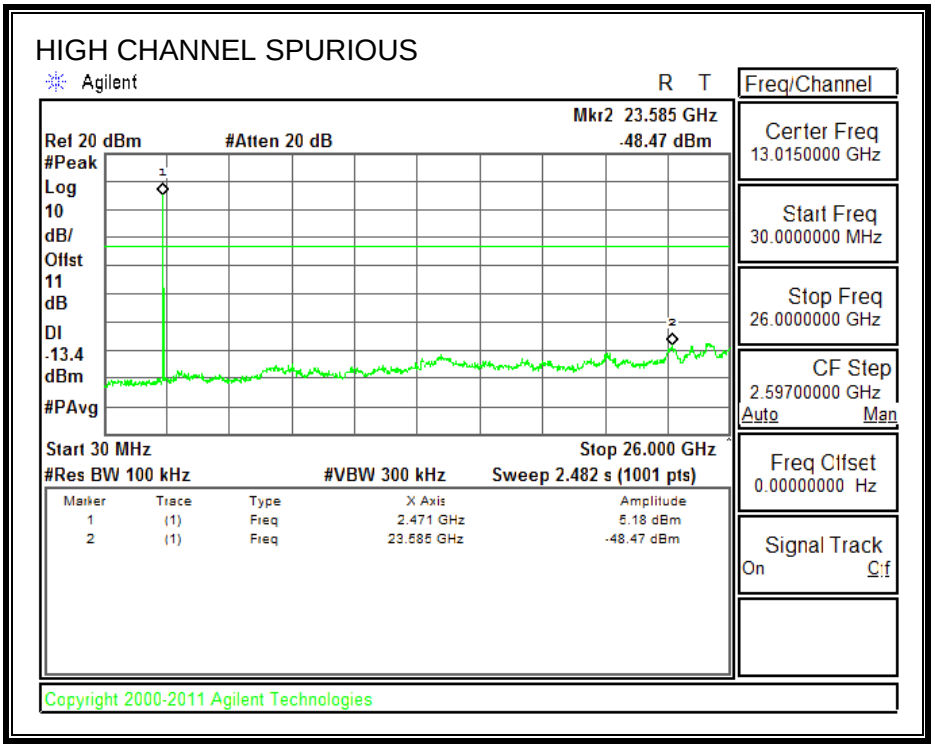


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

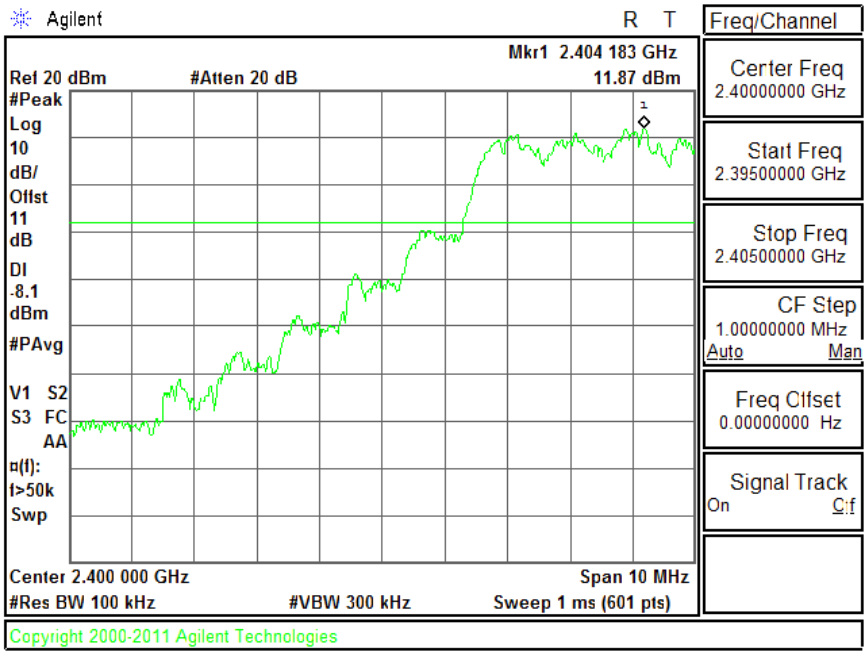


HIGH CHANNEL SPURIOUS

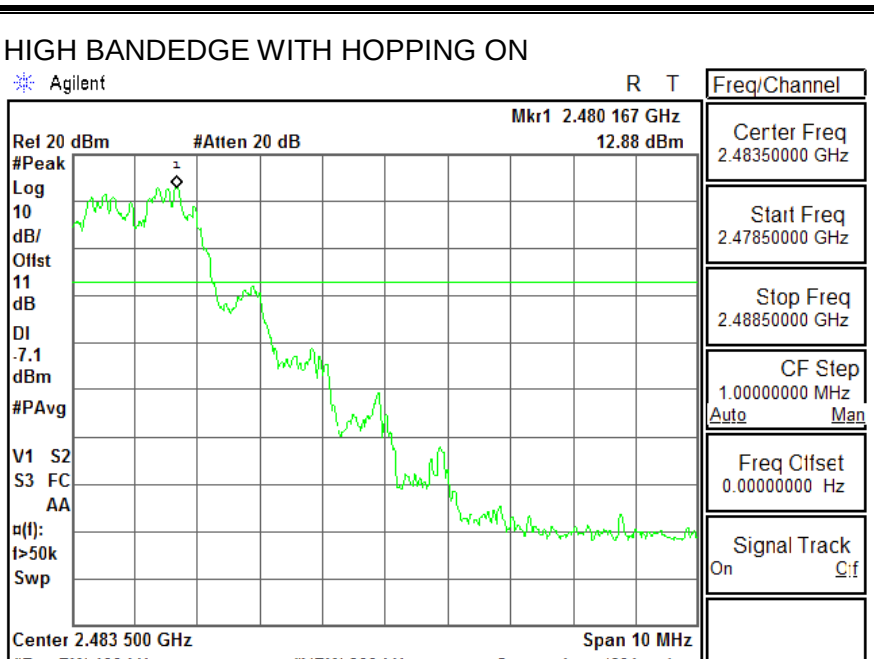


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter)

IC RSS-GEN Clause 6 (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. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 3 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

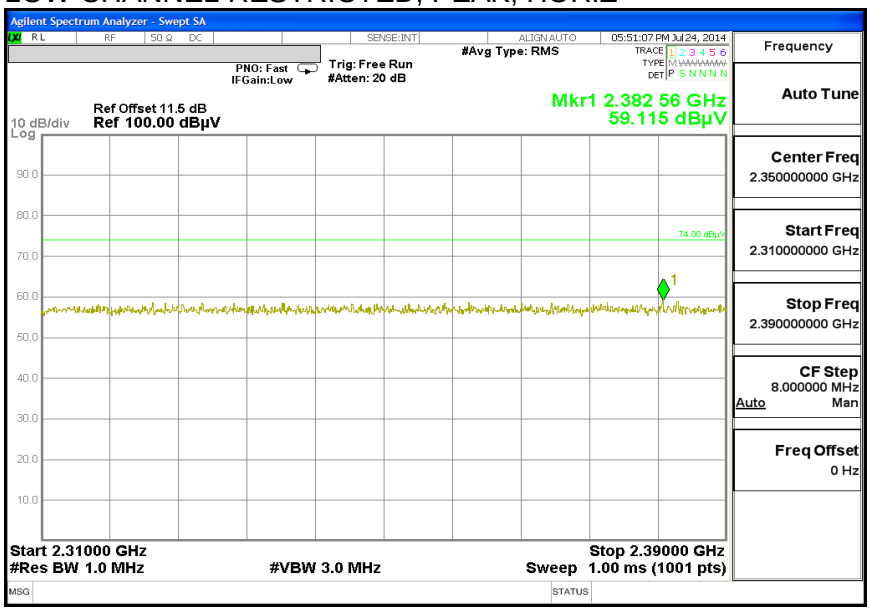
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

10.2. TRANSMITTER ABOVE 1GHz

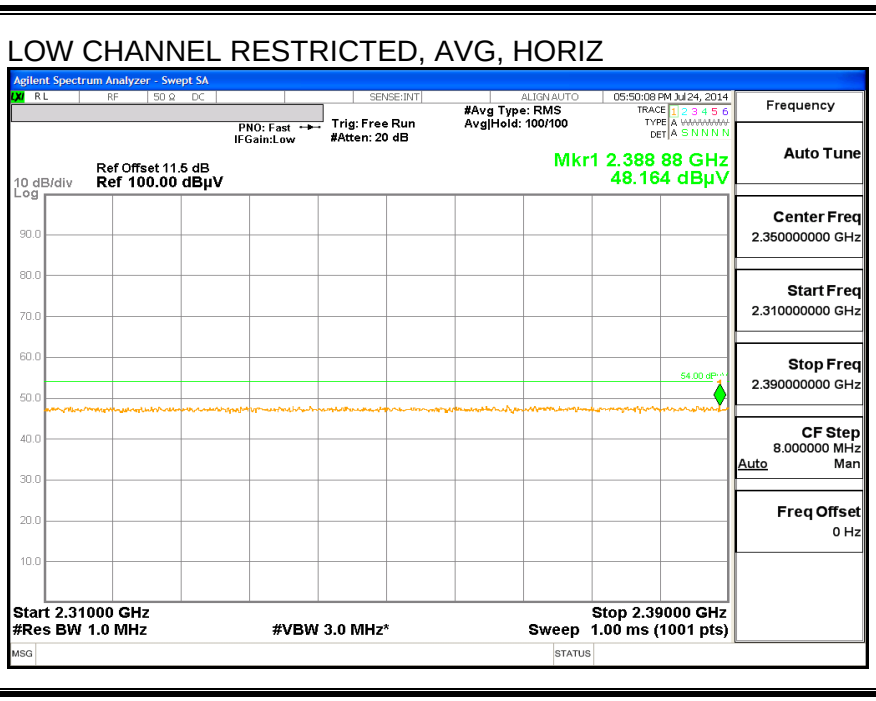
10.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

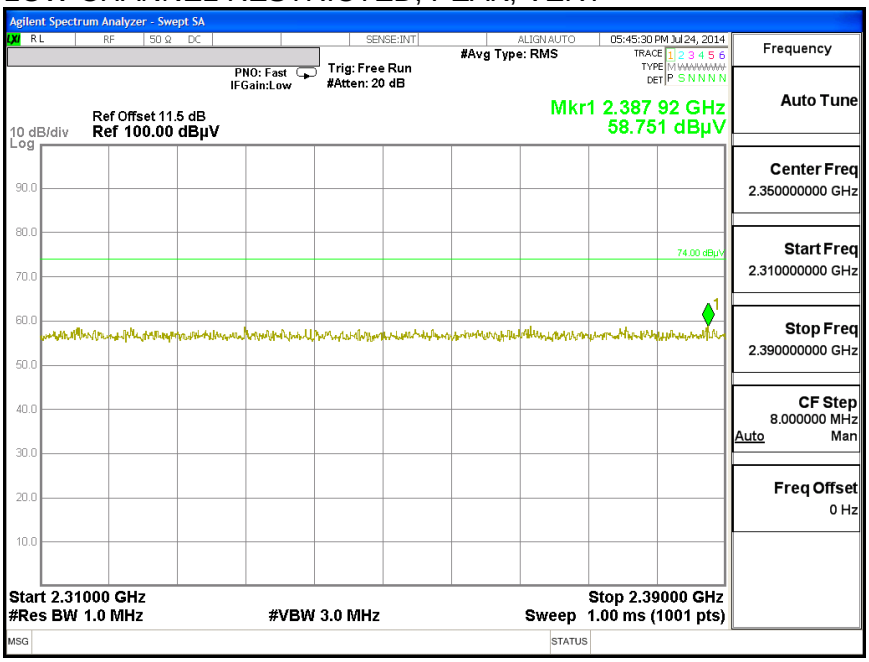


LOW CHANNEL RESTRICTED, AVG, HORIZ

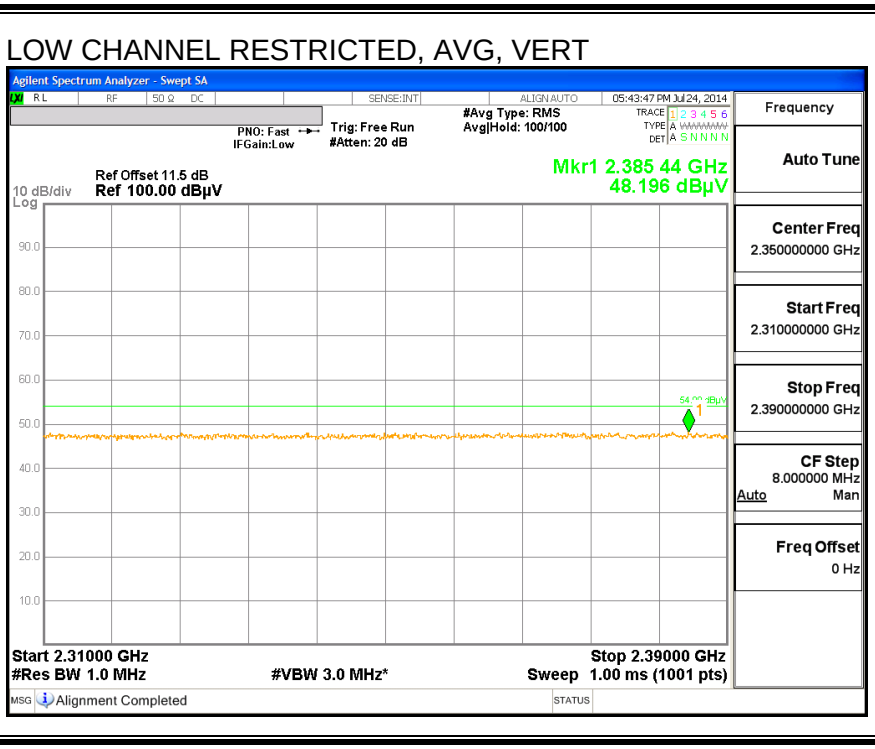


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT

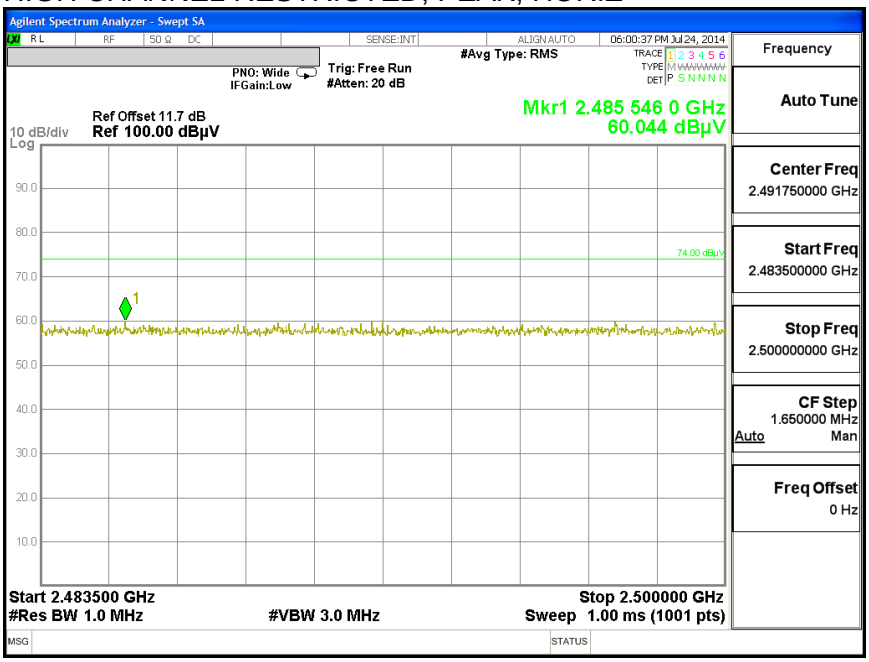


LOW CHANNEL RESTRICTED, AVG, VERT

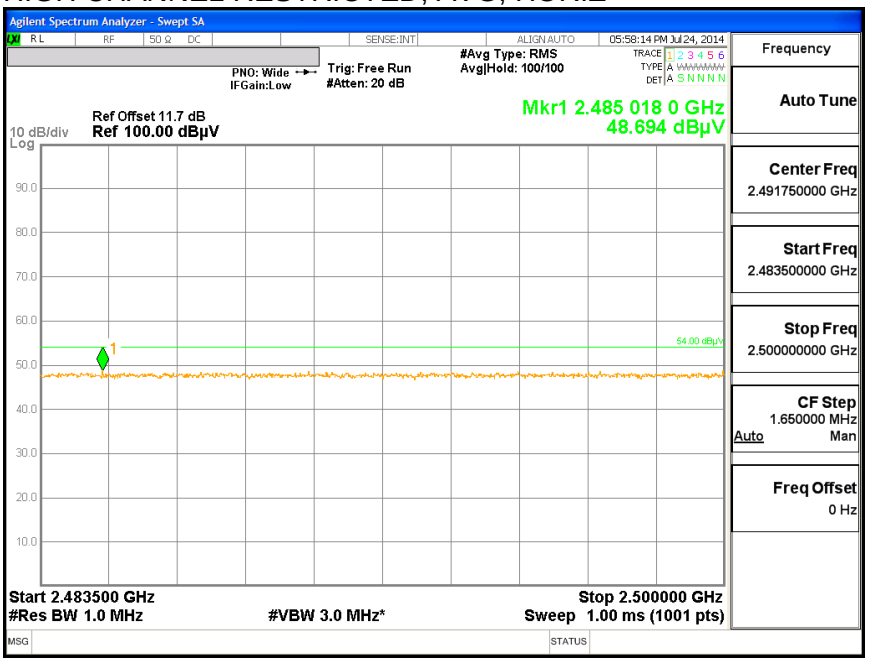


RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL RESTRICTED, PEAK, HORIZ

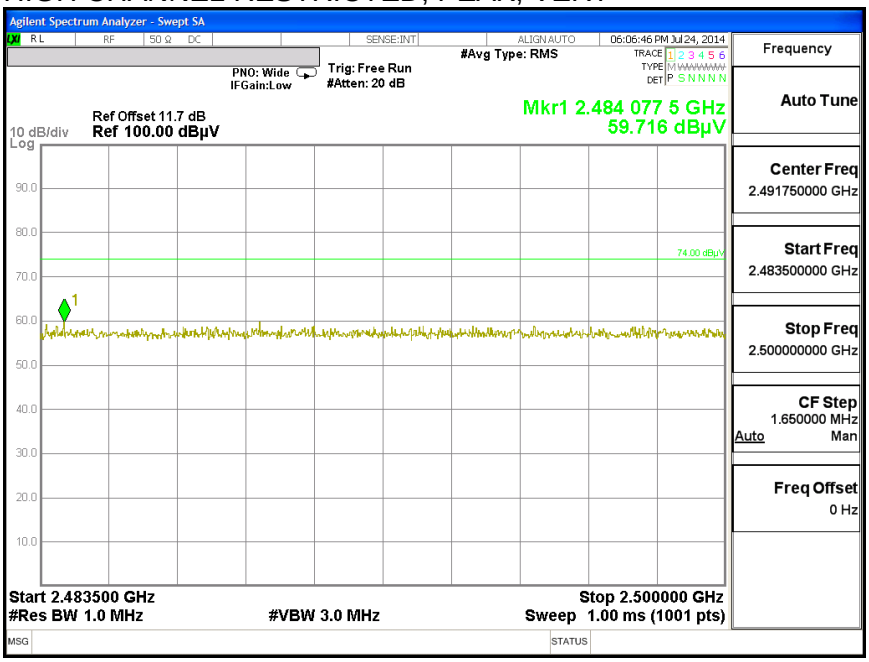


HIGH CHANNEL RESTRICTED, AVG, HORIZ

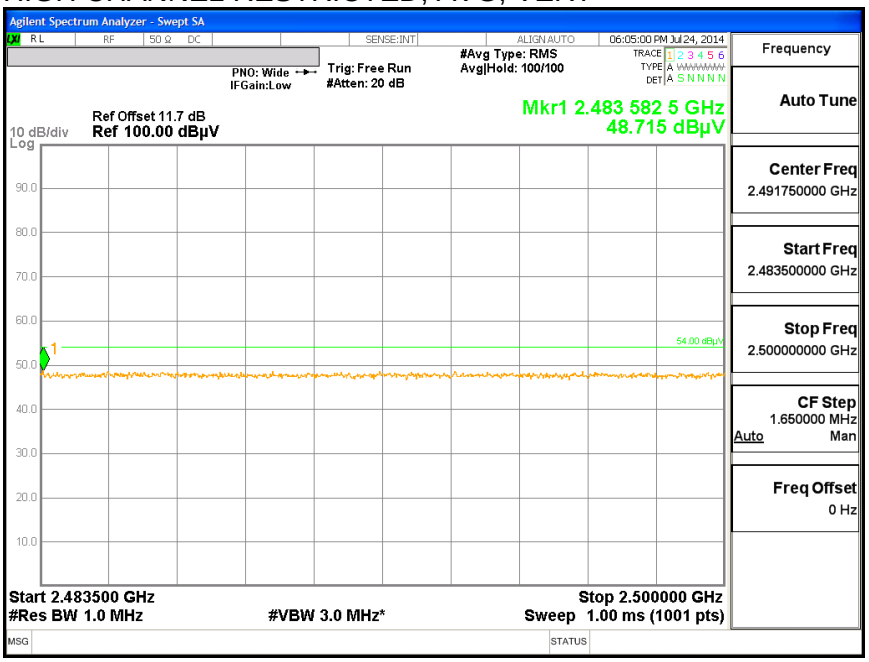


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT

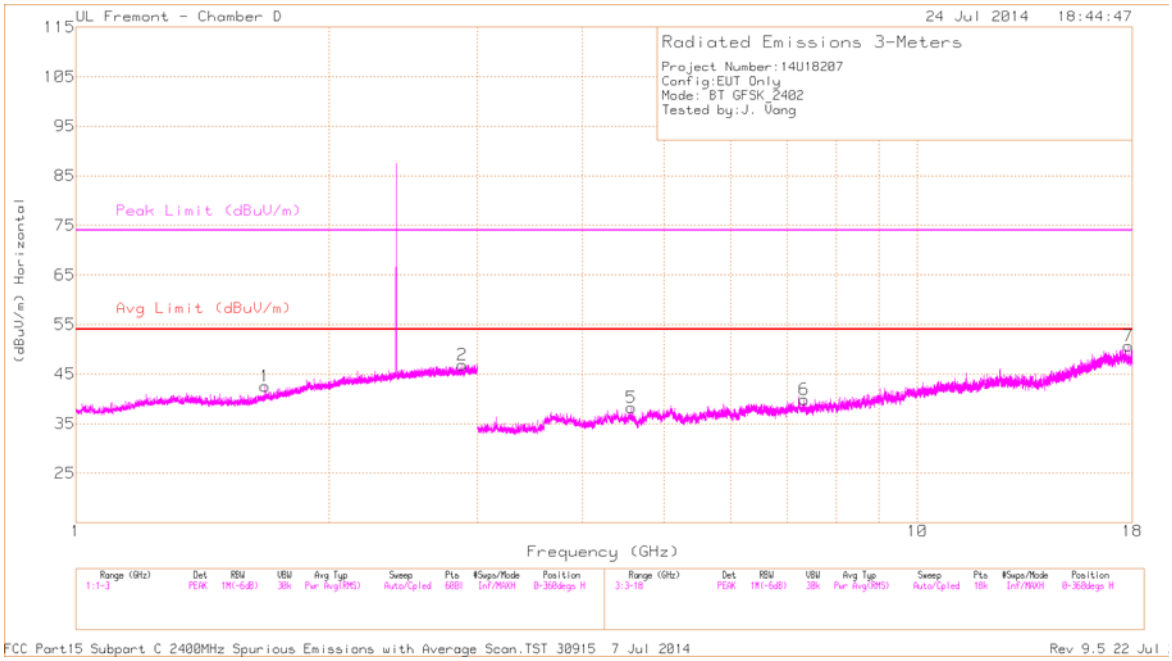


HIGH CHANNEL RESTRICTED, AVG, VERT

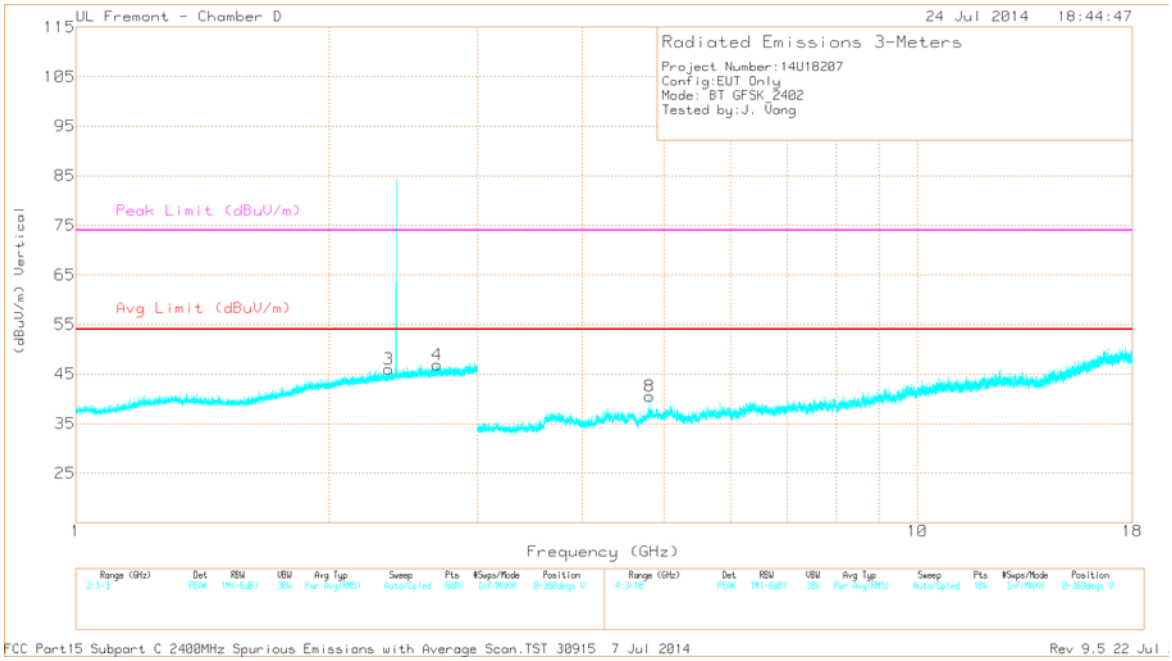


LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 1.677	41.13	PK3	28.8	-21.4	48.53	-	-	74	-25.47	305	363	H
	* 1.678	28.02	VB10	28.8	-21.4	35.42	54	-18.58	-	-	305	363	H
2	* 2.88	41.57	PK3	32.6	-20.1	54.07	-	-	74	-19.93	178	400	H
	* 2.878	28.18	VB10	32.6	-20.1	40.68	54	-13.32	-	-	178	400	H
3	* 2.353	41.76	PK3	32	-20.8	52.96	-	-	74	-21.04	156	284	V
	* 2.353	28.4	VB10	32	-20.8	39.6	54	-14.4	-	-	156	284	V
4	* 2.687	41.36	PK3	32.4	-20.1	53.66	-	-	74	-20.34	124	386	V
	* 2.685	28.42	VB10	32.4	-20.1	40.72	54	-13.28	-	-	124	386	V
5	* 4.569	38.2	PK3	34	-26.4	45.8	-	-	74	-28.2	183	102	H
	* 4.569	24.93	VB10	34	-26.4	32.53	54	-21.47	-	-	183	102	H
6	* 7.338	36.75	PK3	35.7	-25.2	47.25	-	-	74	-26.75	203	261	H
	* 7.338	23.96	VB10	35.7	-25.2	34.46	54	-19.54	-	-	203	261	H
7	* 17.818	35.24	PK3	41.5	-17.4	59.34	-	-	74	-14.66	93	132	H
	* 17.818	20.91	VB10	41.5	-17.4	45.01	54	-8.99	-	-	93	132	H
8	* 4.804	41.21	PK3	34.2	-27.1	48.31	-	-	74	-25.69	4	277	V
	* 4.804	32.82	VB10	34.2	-27.1	39.92	54	-14.08	-	-	4	277	V

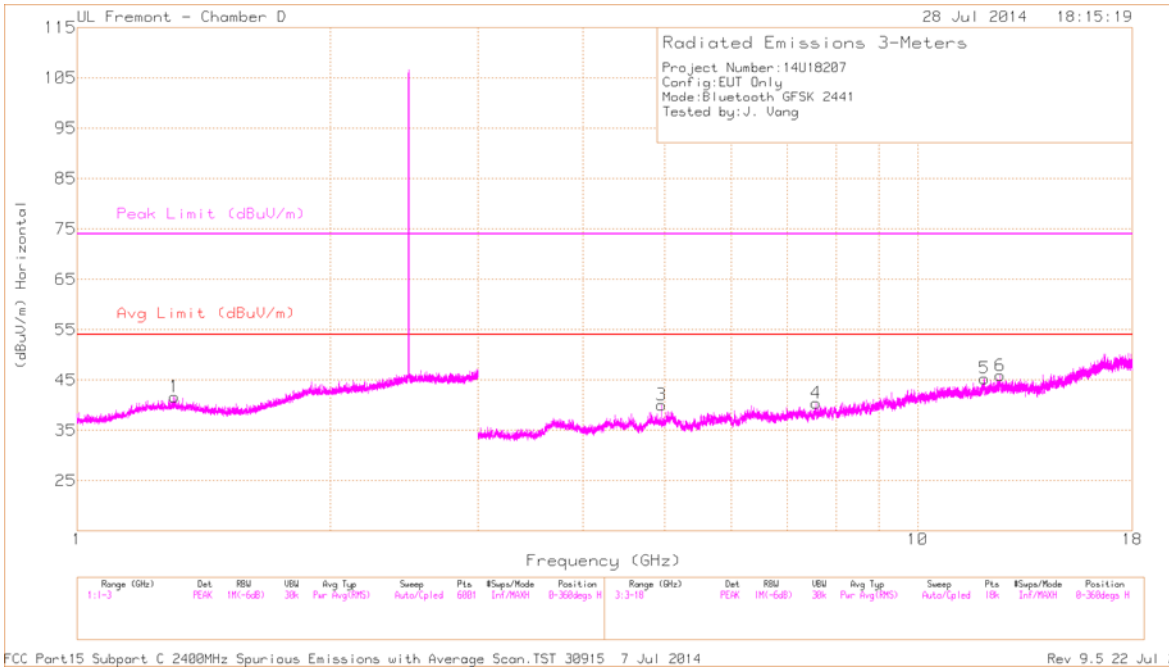
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

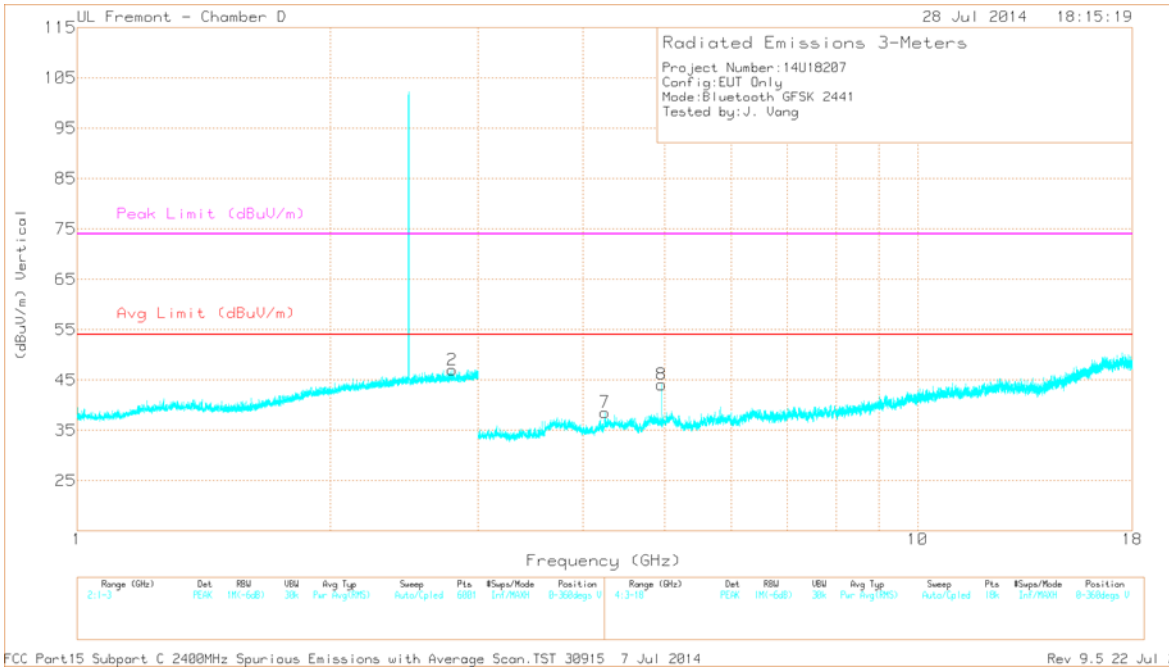
VB10Hz - FHSS Method: 10Hz Video Bandwidth

MID CHANNEL HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 1.306	42.12	PK3	28.8	-21.9	49.02	-	-	74	-24.98	31	136	H
	* 1.307	28.76	VB10	28.8	-21.9	35.66	54	-18.34	-	-	31	136	H
2	* 2.796	41.65	PK3	32.5	-20	54.15	-	-	74	-19.85	14	104	V
	* 2.796	28.26	VB10	32.5	-20	40.76	54	-13.24	-	-	14	104	V
3	* 4.96	40.87	PK3	34.2	-28.1	46.97	-	-	74	-27.03	44	116	H
	* 4.96	31.26	VB10	34.2	-28.1	37.36	54	-16.64	-	-	44	116	H
4	* 7.568	36.79	PK3	35.7	-25	47.49	-	-	74	-26.51	146	263	H
	* 7.567	23.69	VB10	35.7	-25	34.39	54	-19.61	-	-	146	263	H
5	* 12.004	34.97	PK3	38.8	-20.7	53.07	-	-	74	-20.93	146	325	H
	* 12.003	21.44	VB10	38.8	-20.7	39.54	54	-14.46	-	-	146	325	H
6	* 12.53	34.89	PK3	39.2	-20.7	53.39	-	-	74	-20.61	106	147	H
	* 12.53	21.85	VB10	39.2	-20.8	40.25	54	-13.75	-	-	106	147	H
7	* 4.25	38.39	PK3	33.6	-27.9	44.09	-	-	74	-29.91	253	351	V
	* 4.248	25.41	VB10	33.6	-27.9	31.11	54	-22.89	-	-	253	351	V
8	* 4.959	43.62	PK3	34.2	-28.1	49.72	-	-	74	-24.28	360	234	V
	* 4.96	37.36	VB10	34.2	-28.1	43.46	54	-10.54	-	-	360	234	V

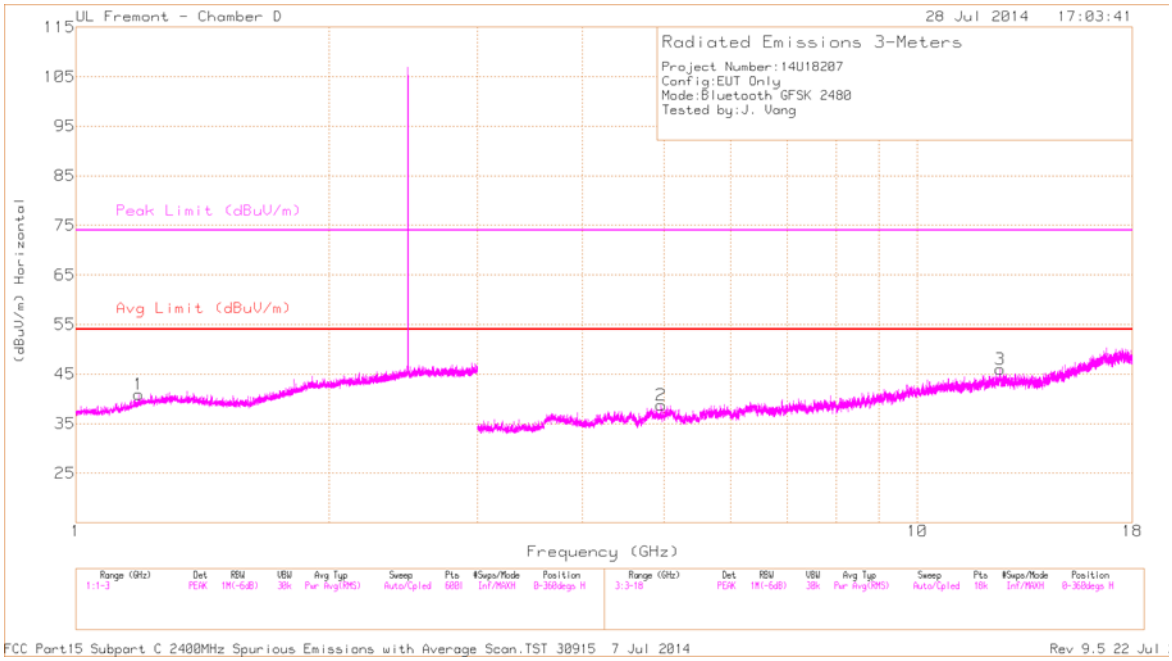
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

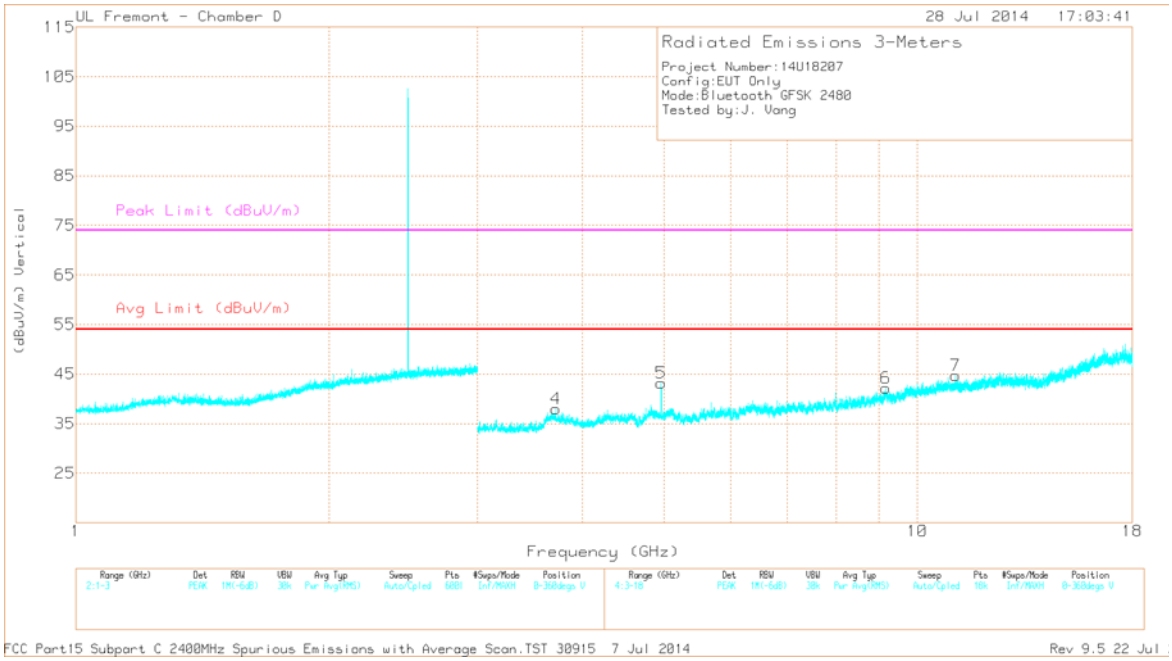
VB10Hz - FHSS Method: 10Hz Video Bandwidth

HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 1.187	41.98	PK3	28	-22	47.98	-	-	74	-26.02	239	295	H
	* 1.187	28.83	VB10	28	-22	34.83	54	-19.17	-	-	239	295	H
2	* 4.96	40.27	PK3	34.2	-28.1	46.37	-	-	74	-27.63	40	100	H
	* 4.96	30.11	VB10	34.2	-28.1	36.21	54	-17.79	-	-	40	100	H
3	* 12.54	34.54	PK3	39.2	-20.7	53.04	-	-	74	-20.96	139	230	H
	* 12.543	21.58	VB10	39.2	-20.8	39.98	54	-14.02	-	-	139	230	H
4	* 3.719	38.84	PK3	33.2	-28.2	43.84	-	-	74	-30.16	282	352	V
	* 3.719	25.49	VB10	33.2	-28.2	30.49	54	-23.51	-	-	282	352	V
5	* 4.96	43.11	PK3	34.2	-28.1	49.21	-	-	74	-24.79	3	263	V
	* 4.96	36.83	VB10	34.2	-28.1	42.93	54	-11.07	-	-	3	263	V
6	* 9.166	35.85	PK3	36.3	-21.6	50.55	-	-	74	-23.45	175	163	V
	* 9.164	21.92	VB10	36.3	-21.7	36.52	54	-17.48	-	-	175	163	V
7	* 11.097	35.6	PK3	38.1	-21	52.7	-	-	74	-21.3	21	205	V
	* 11.097	21.7	VB10	38.1	-21	38.8	54	-15.2	-	-	21	205	V

* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

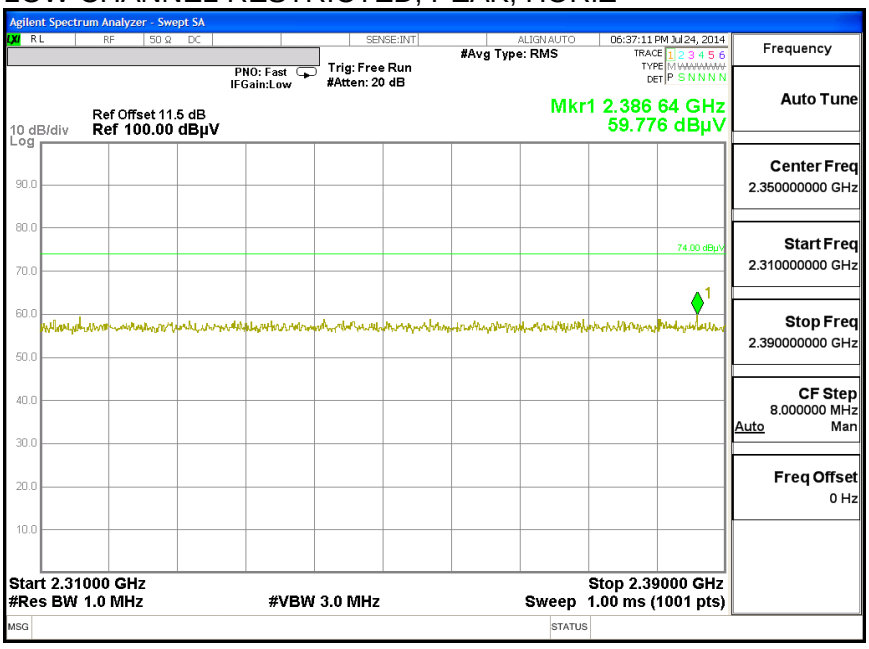
PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

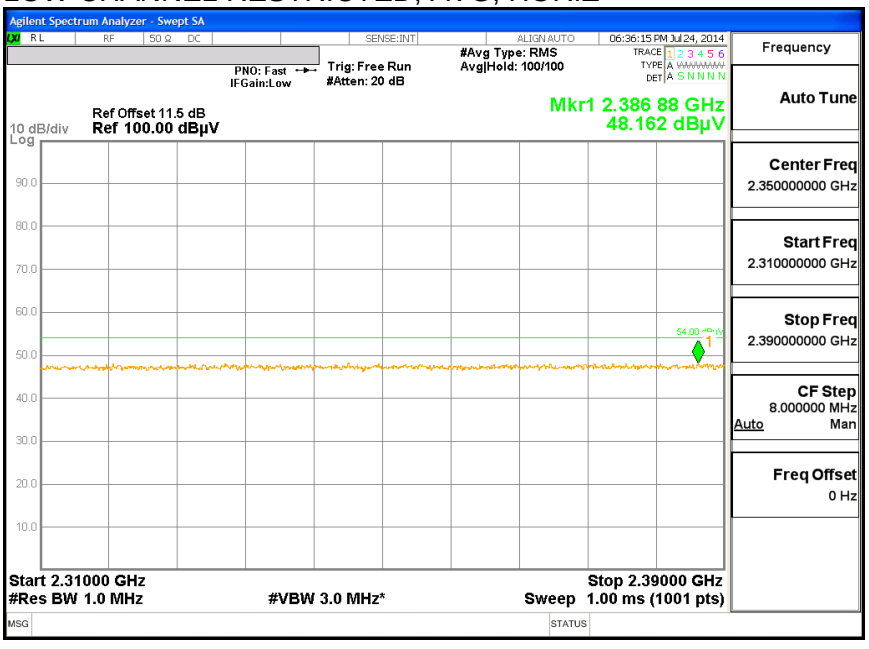
10.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL RESTRICTED, PEAK, HORIZ

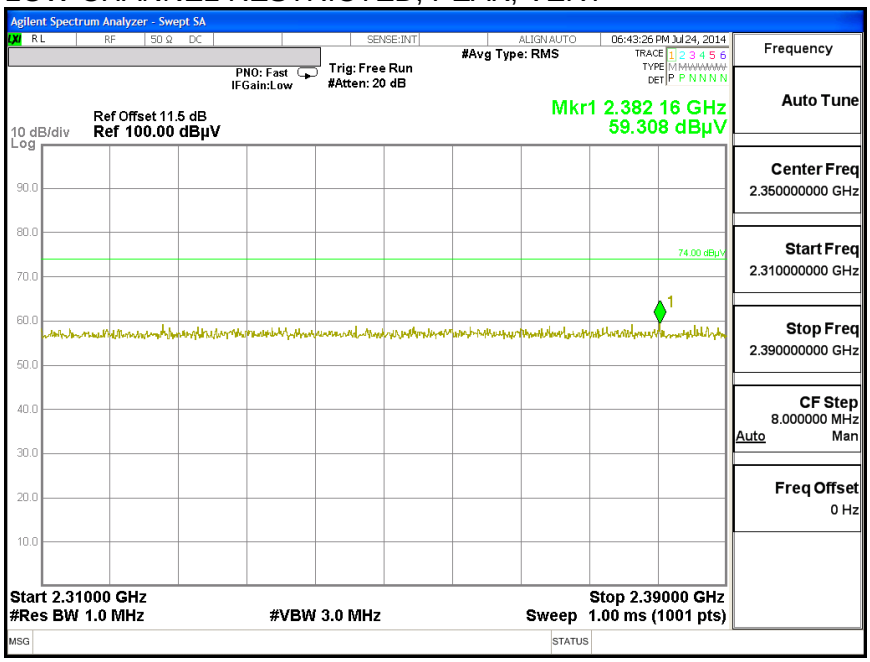


LOW CHANNEL RESTRICTED, AVG, HORIZ

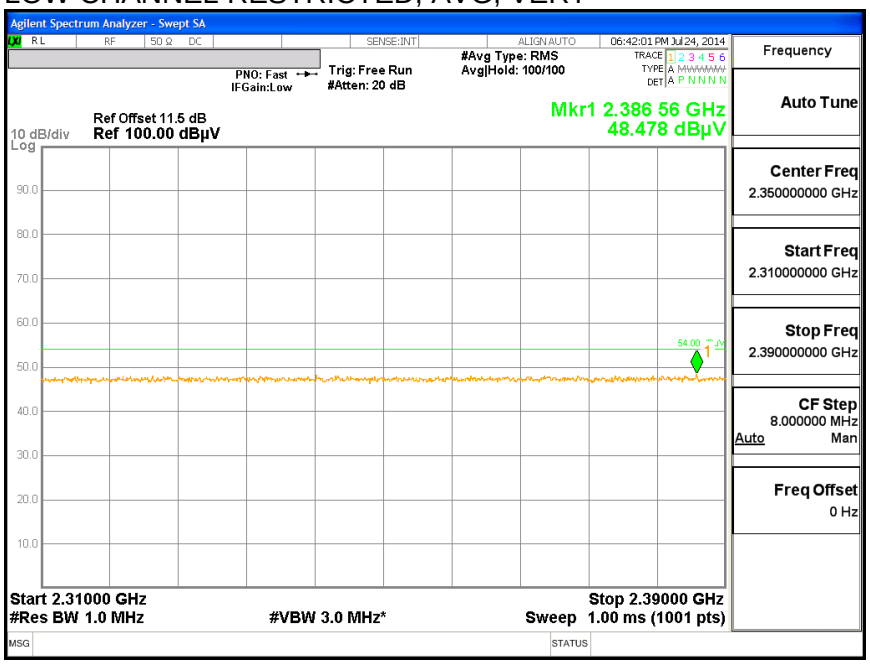


RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL RESTRICTED, PEAK, VERT

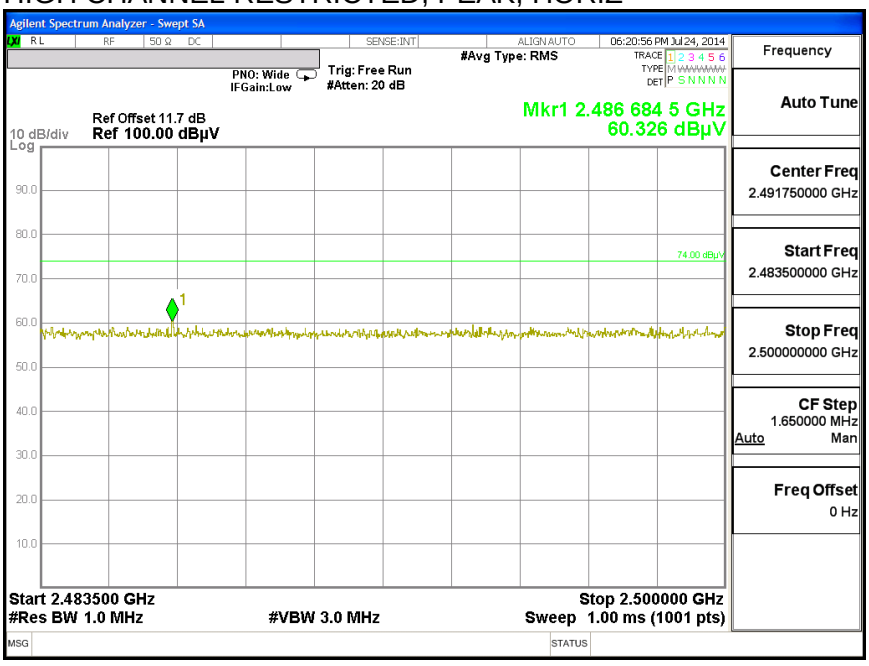


LOW CHANNEL RESTRICTED, AVG, VERT

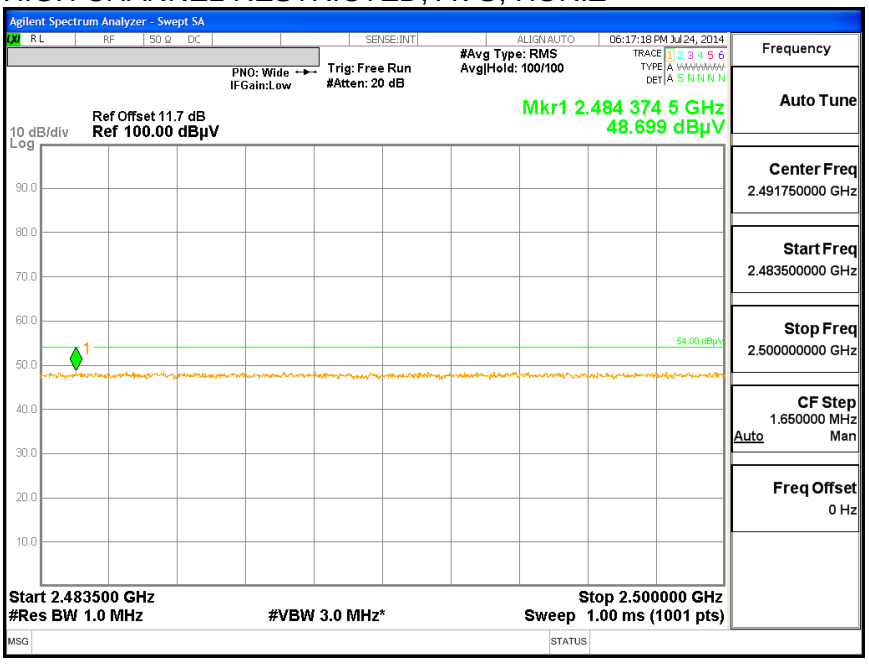


RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL

HIGH CHANNEL RESTRICTED, PEAK, HORIZ

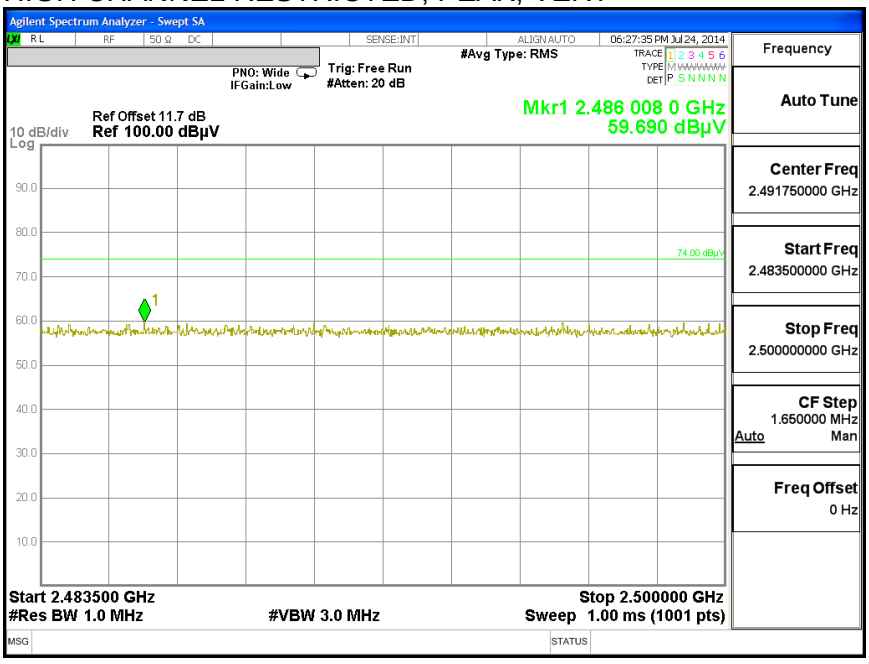


HIGH CHANNEL RESTRICTED, AVG, HORIZ

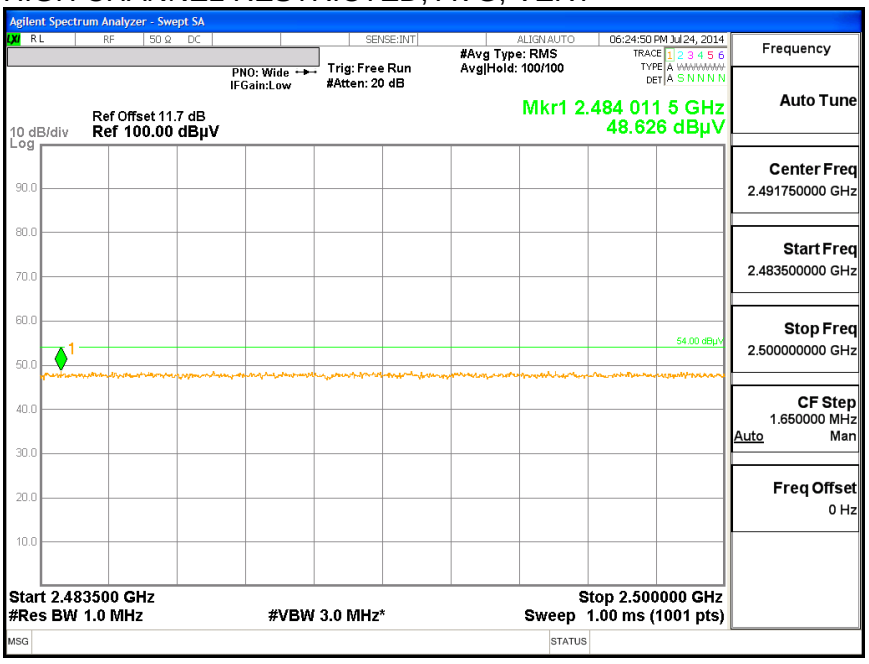


RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL RESTRICTED, PEAK, VERT

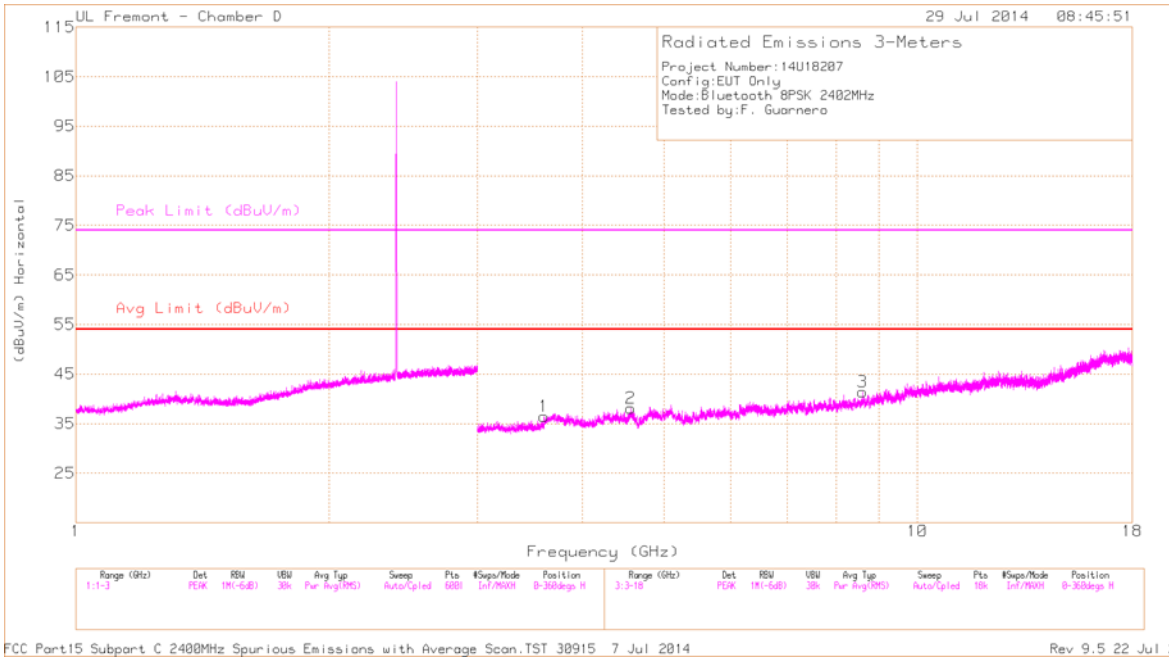


HIGH CHANNEL RESTRICTED, AVG, VERT

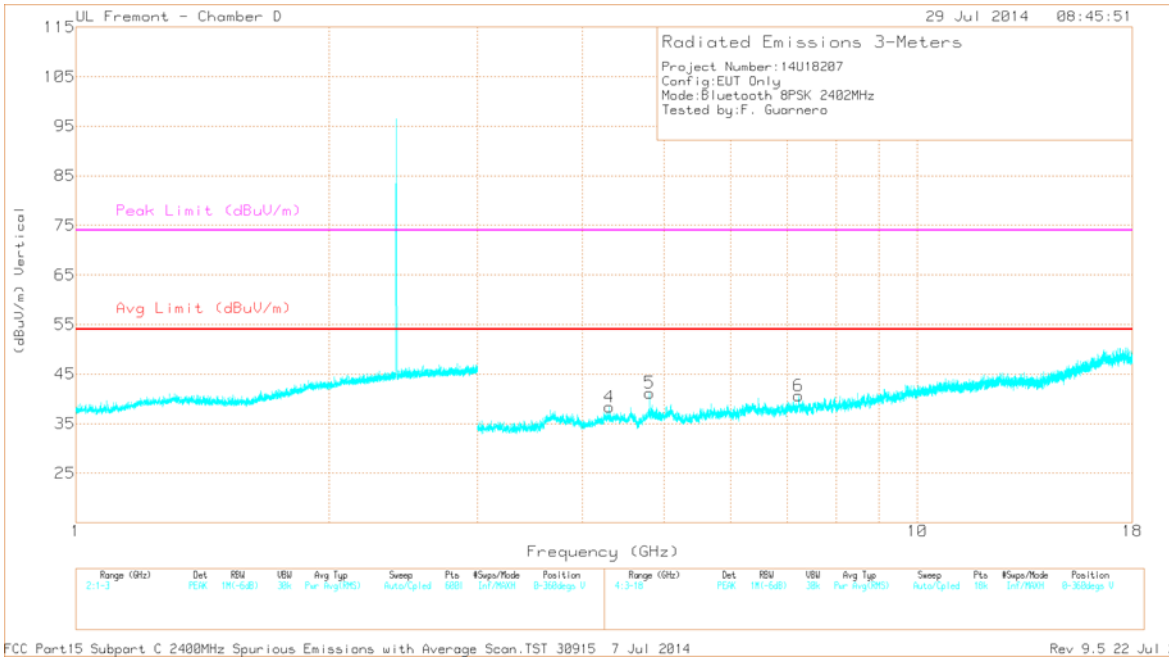


LOW CHANNEL HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 3.602	38.36	PK3	33.5	-28.8	43.06	-	-	74	-30.94	154	366	H
	* 3.601	25.74	VB10	33.5	-28.8	30.44	54	-23.56	-	-	154	366	H
2	* 4.565	37.67	PK3	34	-26.4	45.27	-	-	74	-28.73	157	362	H
	* 4.566	24.94	VB10	34	-26.4	32.54	54	-21.46	-	-	157	362	H
5	* 4.804	41.09	PK3	34.2	-27.1	48.19	-	-	74	-25.81	207	155	V
	* 4.804	32.21	VB10	34.2	-27.1	39.31	54	-14.69	-	-	207	155	V
4	* 4.301	37.99	PK3	33.7	-27.6	44.09	-	-	74	-29.91	208	159	V
	* 4.3	25.02	VB10	33.7	-27.6	31.12	54	-22.88	-	-	208	159	V
6	7.223	36.77	PK3	35.7	-24.9	47.57	-	-	-	-	214	155	V
3	8.611	34.58	PK3	35.9	-22.5	47.98	-	-	-	-	127	359	H

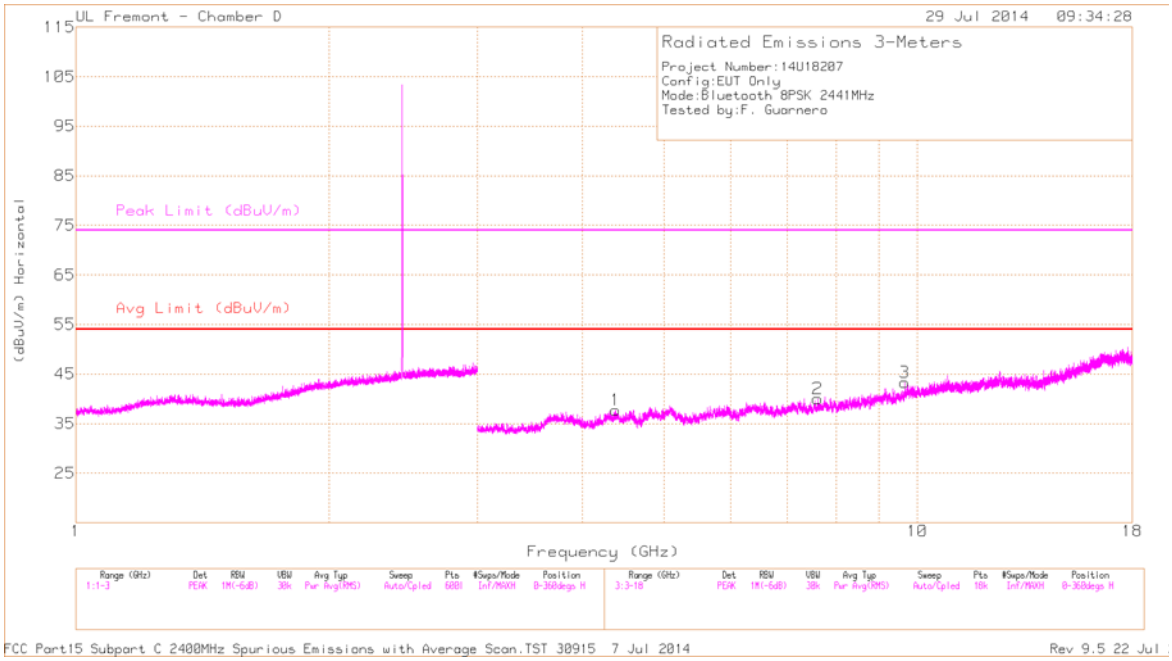
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

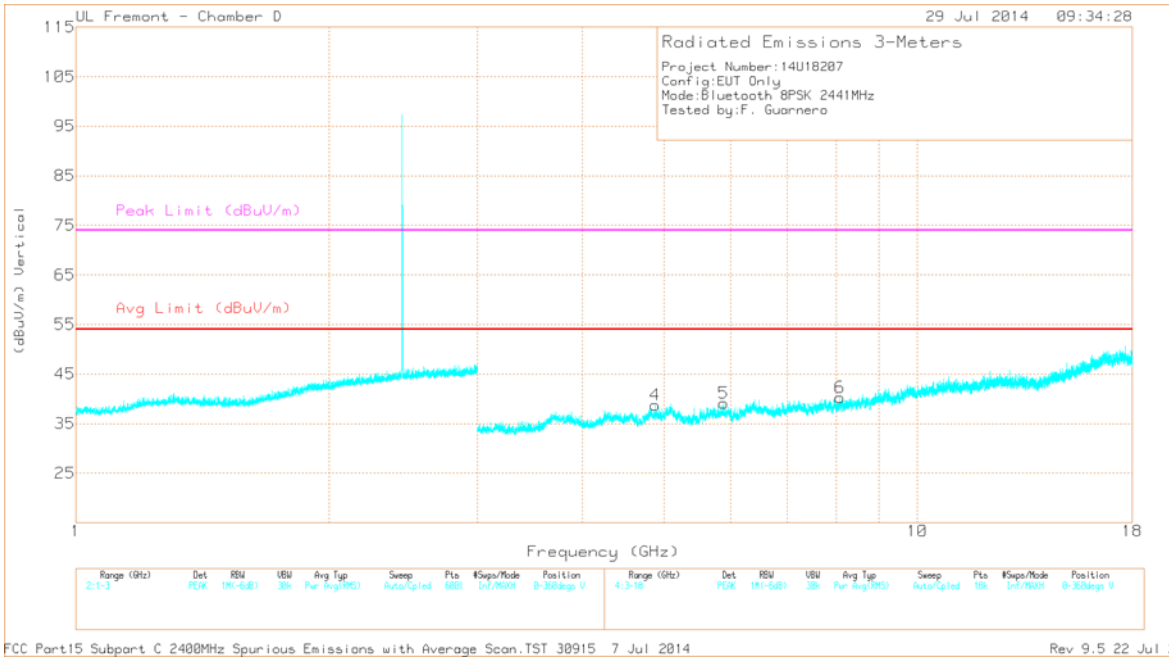
VB10Hz - FHSS Method: 10Hz Video Bandwidth

MID CHANNEL HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 4.358	42.47	PK3	33.8	-27.8	48.47	-	-	74	-25.53	281	358	H
	* 4.371	29.28	VB10	33.8	-27.9	35.18	54	-18.82	-	-	281	358	H
2	* 7.611	40.74	PK3	35.7	-24.9	51.54	-	-	74	-22.46	284	354	H
	* 7.611	28.13	VB10	35.7	-24.9	38.93	54	-15.07	-	-	284	354	H
4	* 4.882	43.06	PK3	34.2	-27.1	50.16	-	-	74	-23.84	29	143	V
	* 4.882	32.23	VB10	34.2	-27.1	39.33	54	-14.67	-	-	29	143	V
6	* 8.087	42	PK3	35.7	-24.2	53.5	-	-	74	-20.5	27	150	V
	* 8.087	28.4	VB10	35.7	-24.2	39.9	54	-14.1	-	-	27	150	V
5	5.884	42.22	PK3	35.1	-26.5	50.82	-	-	-	-	33	146	V
3	9.651	40.37	PK3	36.8	-21.9	55.27	-	-	-	-	288	354	H

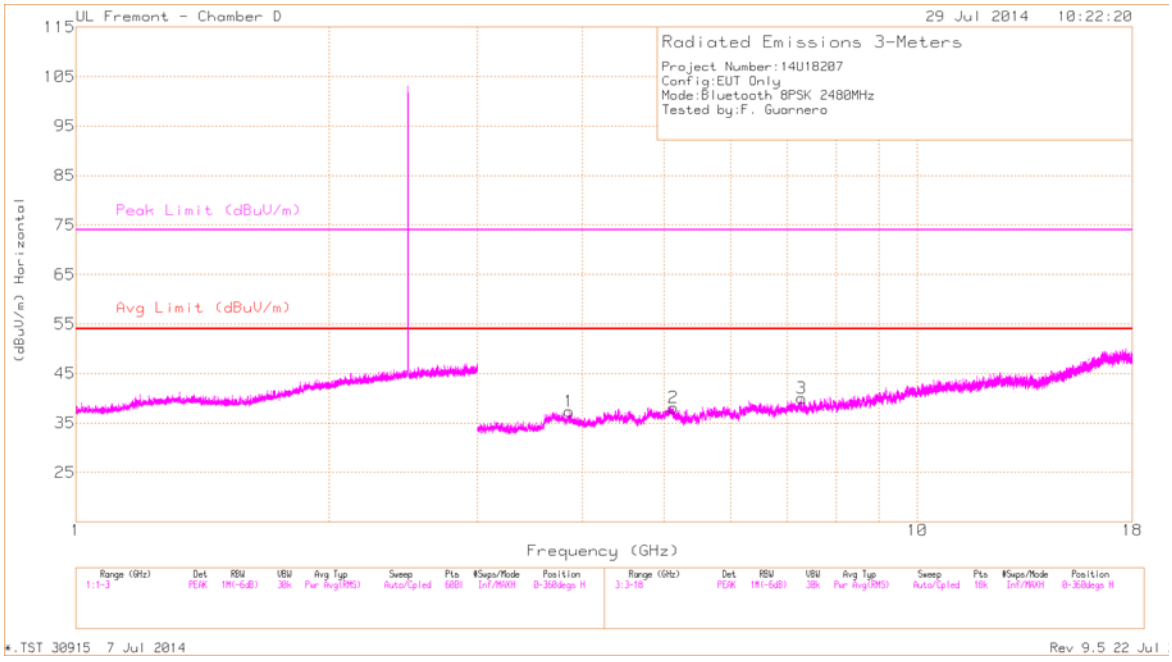
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

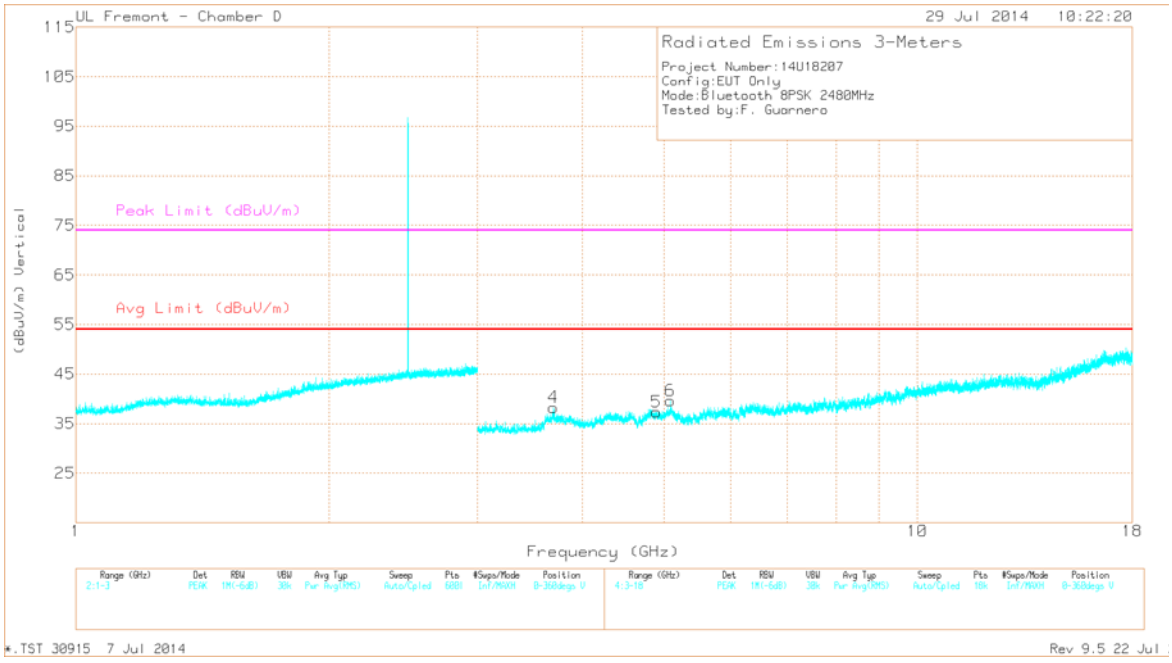
VB10Hz - FHSS Method: 10Hz Video Bandwidth

HIGH CHANNEL HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T344 (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	* 3.857	44.06	PK3	33.5	-28.8	48.76	-	-	74	-25.24	250	192	H
	* 3.857	30.45	VB10	33.5	-28.8	35.15	54	-18.85	-	-	250	192	H
2	* 5.126	41.95	PK3	34.3	-26.9	49.35	-	-	74	-24.65	254	195	H
	* 5.125	29.36	VB10	34.3	-26.8	36.86	54	-17.14	-	-	254	195	H
3	* 7.288	41.02	PK3	35.7	-24.8	51.92	-	-	74	-22.08	254	195	H
	* 7.286	28	VB10	35.7	-24.8	38.9	54	-15.1	-	-	254	195	H
4	* 3.693	37.9	PK3	33.2	-27.9	43.2	-	-	74	-30.8	205	185	V
	* 3.694	25.4	VB10	33.2	-27.9	30.7	54	-23.3	-	-	205	185	V
5	* 4.96	43.57	PK3	34.2	-28.1	49.67	-	-	74	-24.33	215	301	V
	* 4.96	32.17	VB10	34.2	-28.1	38.27	54	-15.73	-	-	215	301	V
6	* 5.091	42.29	PK3	34.3	-25.9	50.69	-	-	74	-23.31	226	116	V
	* 5.091	24.75	VB10	34.3	-25.9	33.15	54	-20.85	-	-	226	116	V

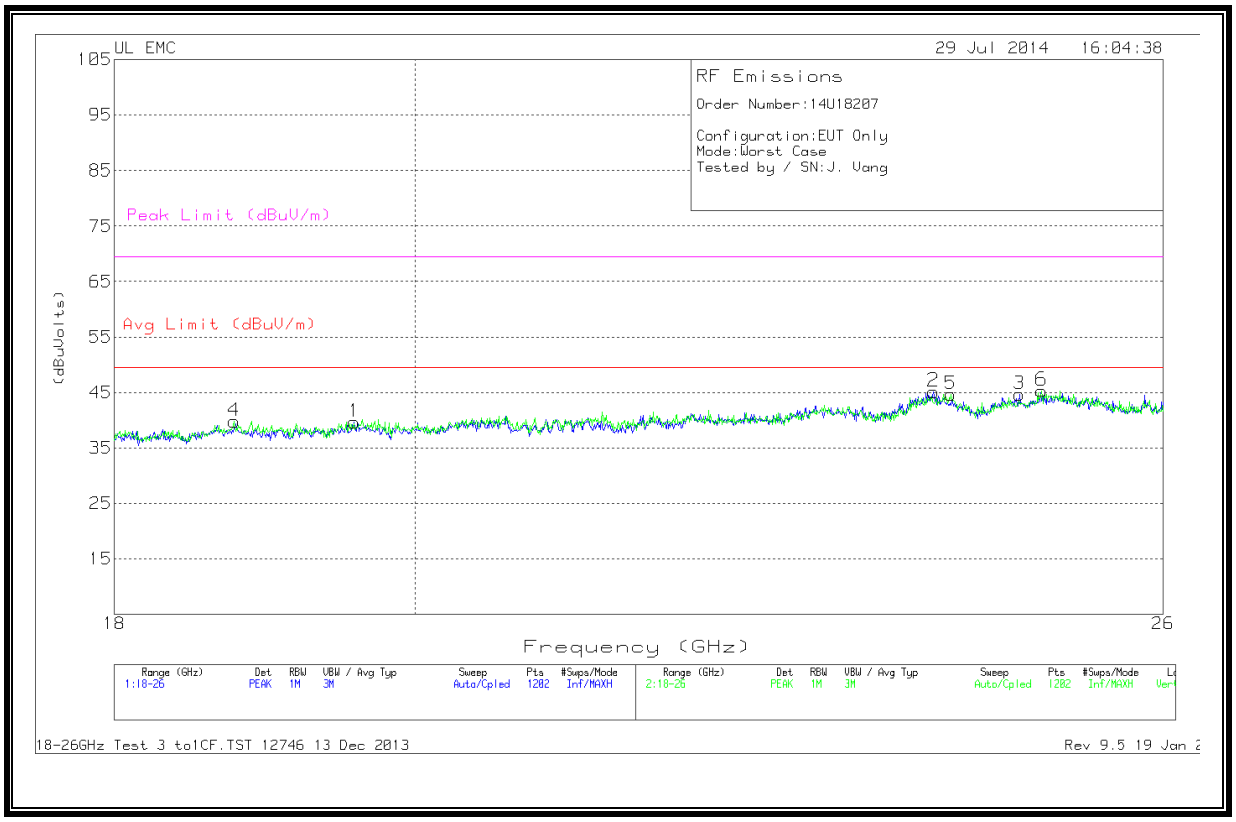
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

VB10Hz - FHSS Method: 10Hz Video Bandwidth

10.3. WORST-CASE ABOVE 18 GHz

SPURIOUS EMISSIONS 18 TO 26 GHz (WORST-CASE CONFIGURATION, HORIZONTAL & VERTICAL)



Note: GFSK, highest power mode used for test.

DATA

Trace Markers

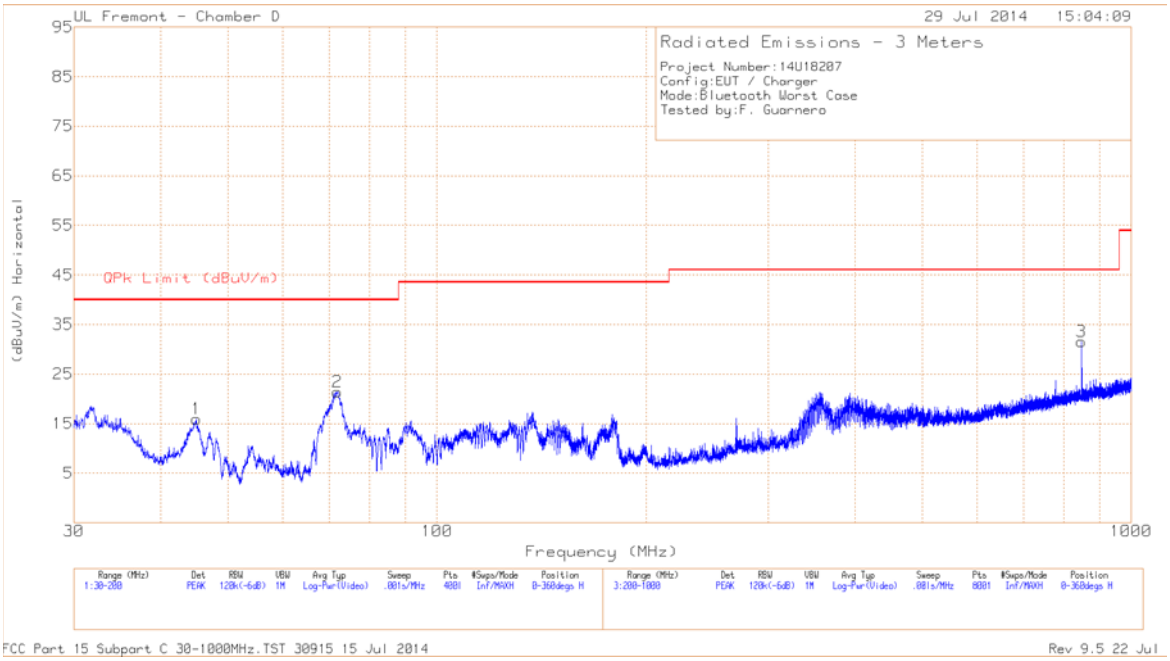
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T89 (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.579	40.77	PK	32.5	-24.1	-9.5	39.66	49.5	-9.83	69.5	-29.83
2	23.988	43.77	PK	33.6	-22.7	-9.5	45.16	49.5	-4.33	69.5	-24.33
3	24.721	43.07	PK	34	-22.9	-9.5	44.66	49.5	-4.83	69.5	-24.83
4	18.773	40.93	PK	32.5	-24.1	-9.5	39.83	49.5	-9.66	69.5	-29.66
5	24.135	43.17	PK	33.7	-22.7	-9.5	44.66	49.5	-4.83	69.5	-24.83
6	24.914	43.53	PK	34	-22.7	-9.5	45.33	49.5	-4.16	69.5	-24.167

PK - Peak detector

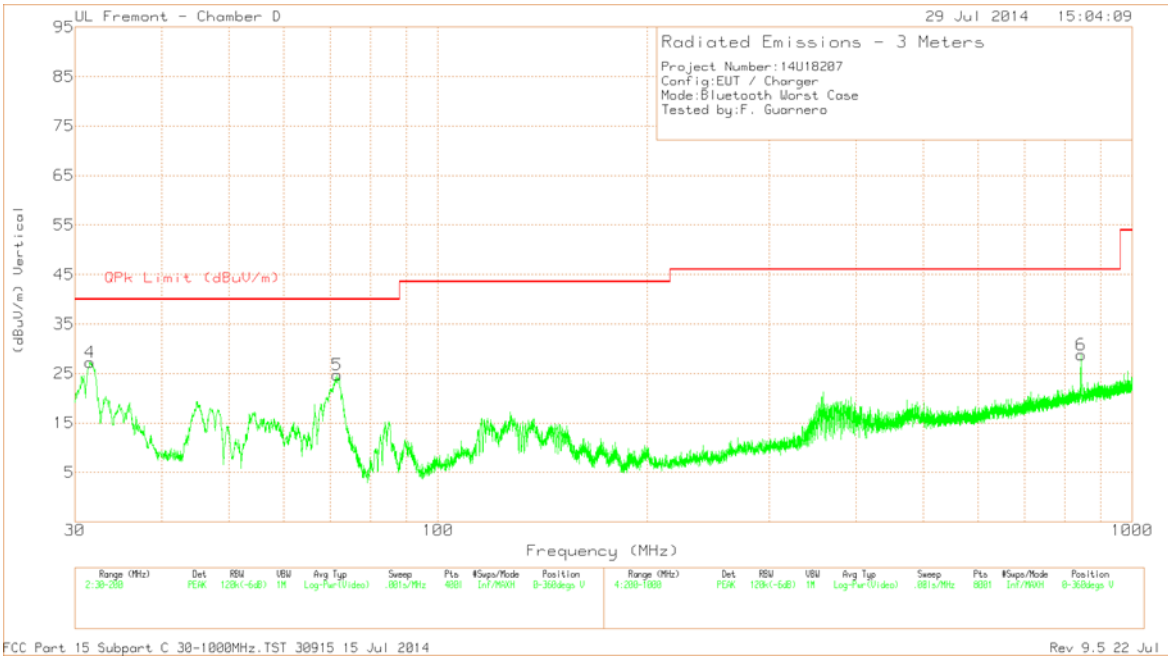
18-26GHz Test 3 to1CF.TST 12746 13 Dec 2013 Rev 9.5 19 Jan 2014

10.4. WORST-CASE BELOW 1 GHz SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)

HORIZONTAL PLOT



VERTICAL PLOT



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	Hybrid	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	31.53	38.69	PK	20.3	-31.7	27.29	40	-12.71	0-360	100	V
1	45.0025	37.48	PK	10.4	-31.9	15.98	40	-24.02	0-360	401	H
5	71.565	47.87	PK	8.2	-31.4	24.67	40	-15.33	0-360	100	V
2	71.8625	44.87	PK	8.2	-31.6	21.47	40	-18.53	0-360	201	H
6	844	35.75	PK	21.8	-28.8	28.75	46.02	-17.27	0-360	100	V
3	847.8	38.6	PK	21.8	-28.8	31.6	46.02	-14.42	0-360	201	H

PK - Peak detector

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

WORST EMISSIONS

Line-L1 .15 - 30MHz

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1 (dB)	LC Cables 1&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
1	.1545	40.47	PK	1.3	0	41.77	65.8	-24.03	-	-
2	.1545	31.58	Av	1.3	0	32.88	-	-	55.8	-22.92
3	.20175	40.54	PK	.9	0	41.44	63.5	-22.06	-	-
4	.20175	32.5	Av	.9	0	33.4	-	-	53.5	-20.1
5	.6045	44.85	PK	.3	0	45.15	56	-10.85	-	-
6	.6045	32.86	Av	.3	0	33.16	-	-	46	-12.84
7	1.635	35.39	PK	.2	.1	35.69	56	-20.31	-	-
8	1.635	25.53	Av	.2	.1	25.83	-	-	46	-20.17
9	2.571	34.77	PK	.2	.1	35.07	56	-20.93	-	-
10	2.571	24	Av	.2	.1	24.3	-	-	46	-21.7
11	8.0835	30.98	PK	.2	.1	31.28	60	-28.72	-	-
12	8.0835	20.45	Av	.2	.1	20.75	-	-	50	-29.25

PK - Peak detector

Av - average detection

Line-L2 .15 - 30MHz

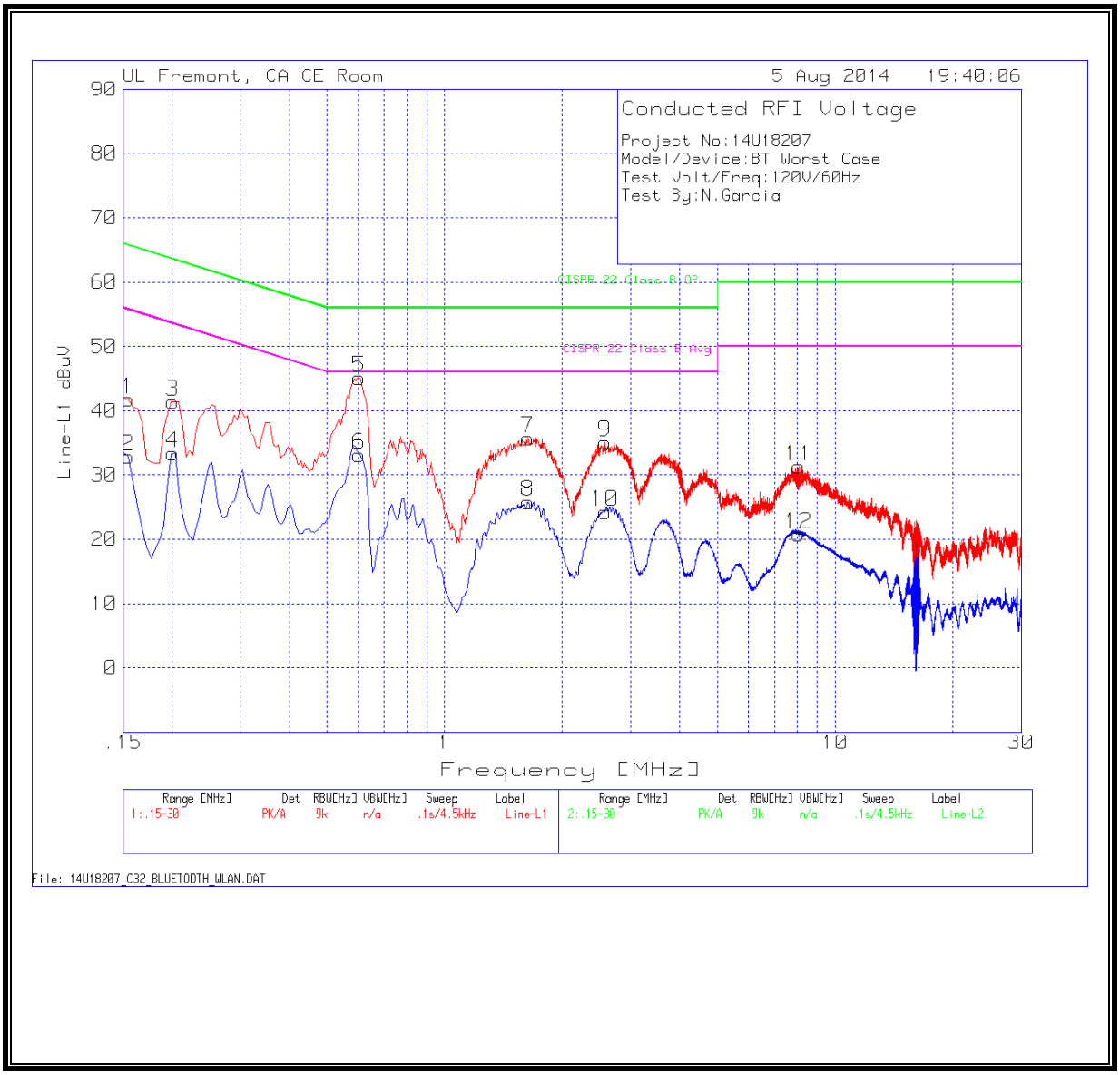
Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
13	.204	41.5	PK	1	0	42.5	63.4	-20.9	-	-
14	.204	28.94	Av	1	0	29.94	-	-	53.4	-23.46
15	.2535	41.38	PK	.7	0	42.08	61.6	-19.52	-	-
16	.2535	26.93	Av	.7	0	27.63	-	-	51.6	-23.97
17	.591	40.39	PK	.3	0	40.69	56	-15.31	-	-
18	.591	24.37	Av	.3	0	24.67	-	-	46	-21.33
19	.726	27.37	PK	.3	0	27.67	56	-28.33	-	-
20	.726	11.7	Av	.3	0	12	-	-	46	-34
21	2.3775	26.79	PK	.2	.1	27.09	56	-28.91	-	-
22	2.3775	10.06	Av	.2	.1	10.36	-	-	46	-35.64
23	8.0565	33.18	PK	.2	.1	33.48	60	-26.52	-	-
24	8.0565	21.96	Av	.2	.1	22.26	-	-	50	-27.74

PK - Peak detector

Av - average detection

LINE 1 RESULTS



LINE 2 RESULTS