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

CERTIFICATION TEST REPORT

FOR

CELLULAR PHONE WITH BLUETOOTH AND WLAN RADIOS

MODEL NUMBER: A1662

FCC ID: BCG-E2945A
IC: 579C-E2945A

REPORT NUMBER: 15U21634-E2V2

ISSUE DATE: JANUARY 28, 2016

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
V1	01/22/2016	Initial Review	M. Mekuria
V2	01/28/2016	Revised report to address TCB's questions	T. Chu

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: CELLULAR PHONE WITH BLUETOOTH AND WLAN RADIOS

MODEL: A1662

SERIAL NUMBER: C39Q3008GR1X

DATE TESTED: AUGUST 25, 2015 to DECEMBER 10, 2015

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

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

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

Approved & Released For
UL Verification Services Inc. By:

MENGISTU MEKURIA
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Tested By:

ERIC Yu
EMC ENGINEER
UL VERIFICATION SERVICES INC.

2. TEST METHODOLOGY

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

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

The above test sites and facilities are covered under FCC Test Firm Registration # 208313. Chambers A through H are covered under Industry Canada company address code 2324B with site numbers 2324B -1 through 2324B-8, respectively.

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, Model A1662 is a mobile phone with multimedia functions (music, application support, and video), cellular GSM/GPRS/EGPRS/CDMA/WCDMA/HSPA+/DC-HSDPA/LTE radio, IEEE 802.11a/b/g/n/ac radio, Bluetooth radio and NFC. 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	11.82	15.21
2402 - 2480	DQPSK	10.72	11.80
2402 - 2480	Enhanced 8PSK	10.76	11.91

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Band (GHz)	Antenna Gain (dBi)
2.4	-0.90

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was BlueTool version 1.8.8.6.

5.5. WORST-CASE CONFIGURATION AND MODE

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

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

Worst-case data rates were:

GFSK mode: 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.

For simultaneous transmission of multiple channels from the same antenna in the 2.4GHz and 5GHz bands, tests were conducted for various configurations having the highest power, least separation in frequencies and widest operation bandwidths. No noticeable new emission was found.

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Dell	Latitude 3540	6LNG802	N/A
Laptop AC/DC adapter	Dell	FA90PE1-00	CN-0CM889-73245-95L-4954-A00	N/A
Earphone	Apple	NA	NA	N/A
EUT AC/DC adapter	Apple	A1385	D293062F3WVDHLHCF	N/A

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	AC	1	AC	Un-shielded	3	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 (RADAITED BELOW 1 GHZ)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Headphones Jack	1	3.5mm Audio	Shielded	0.9	N/A
2	AC	1	AC	Un-shielded	3	N/A

I/O CABLES (AC LINE CONDUCTED: AC/DC ADAPTER)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Headphones Jack	1	3.5mm Audio	Shielded	0.9	N/A
2	AC	1	AC	Un-shielded	3	N/A

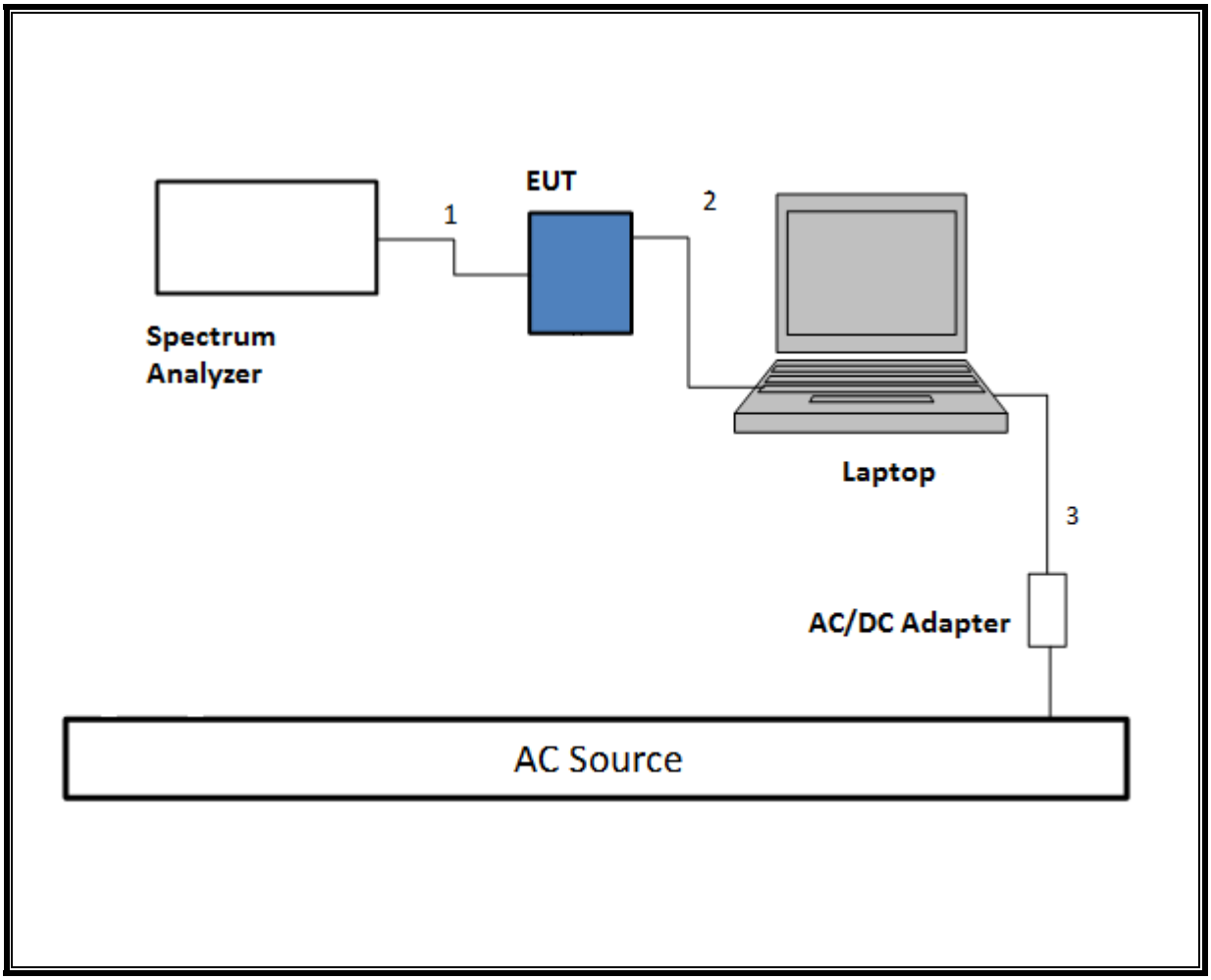
I/O CABLES (AC LINE CONDUCTED: LAPTOP CONFIGUARTION)

I/O Cable List						
Cable No	Port	# of identical	Connector Type	Cable Type	Cable Length (m)	Remarks
1	Headphones Jack	1	3.5mm Audio	Shielded	0.9	N/A
2	USB	1	USB	Shielded	1	N/A
3	AC	1	AC	Un-shielded	3	N/A

TEST SETUP - CONDUCTED TESTS

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

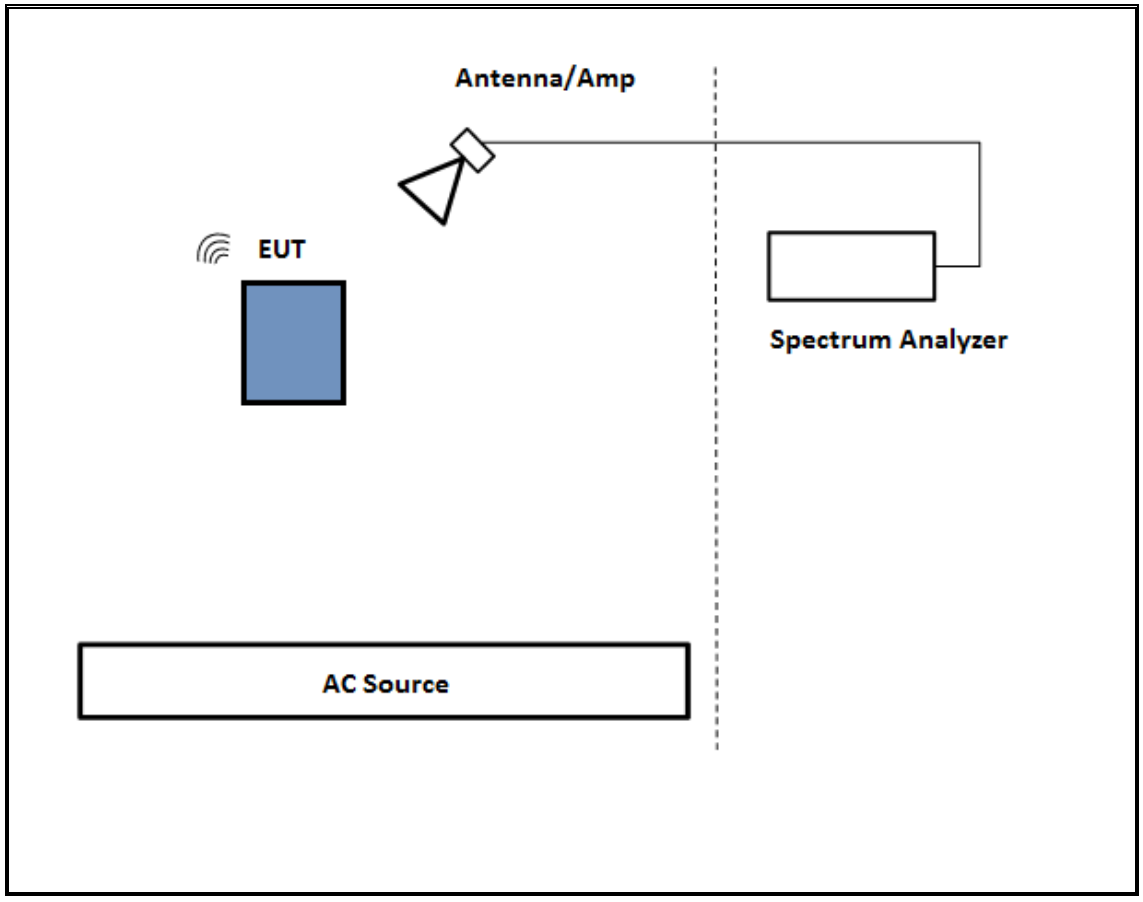
SETUP DIAGRAM



TEST SETUP- RADIATED-ABOVE 1 GHZ

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

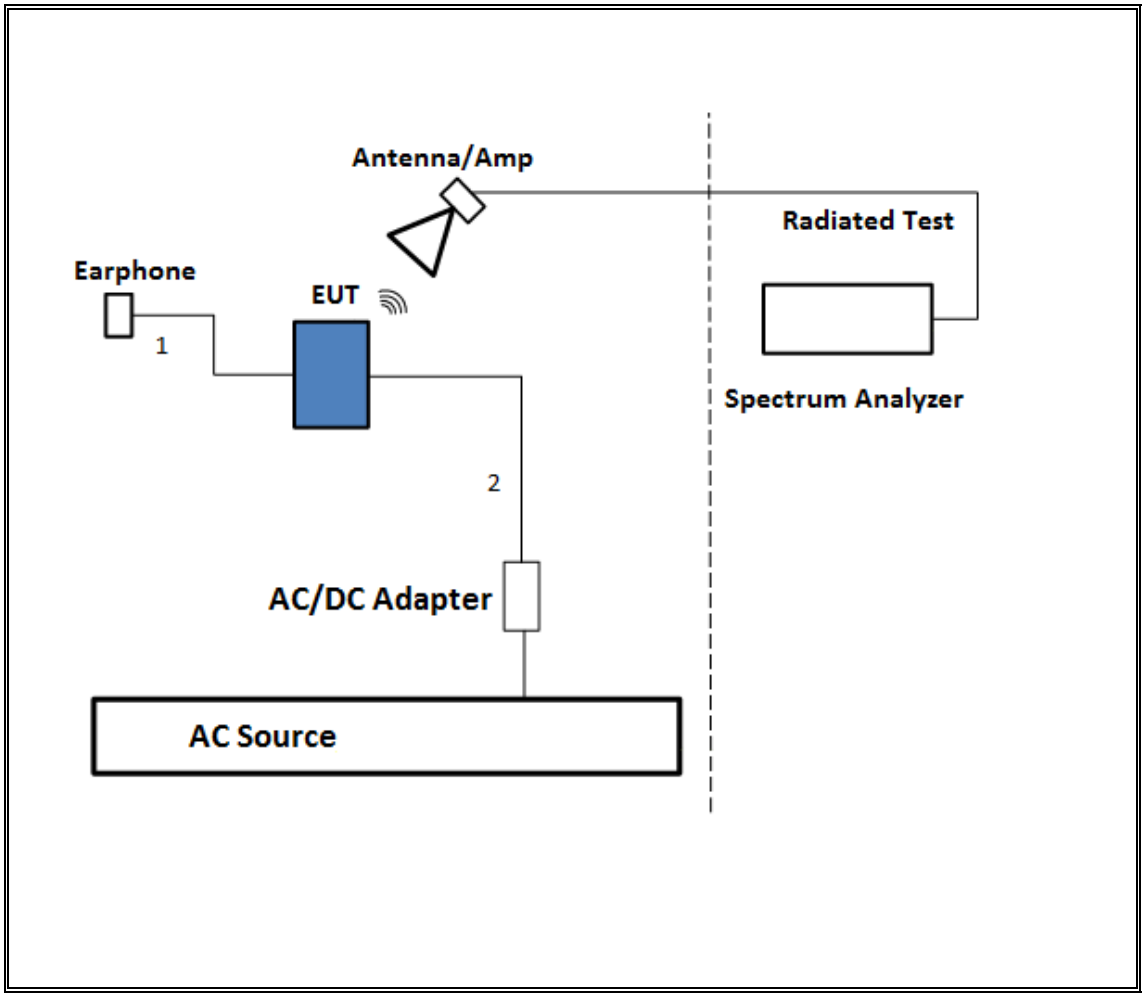
SETUP DIAGRAM



TEST SETUP- BELOW 1GHz

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

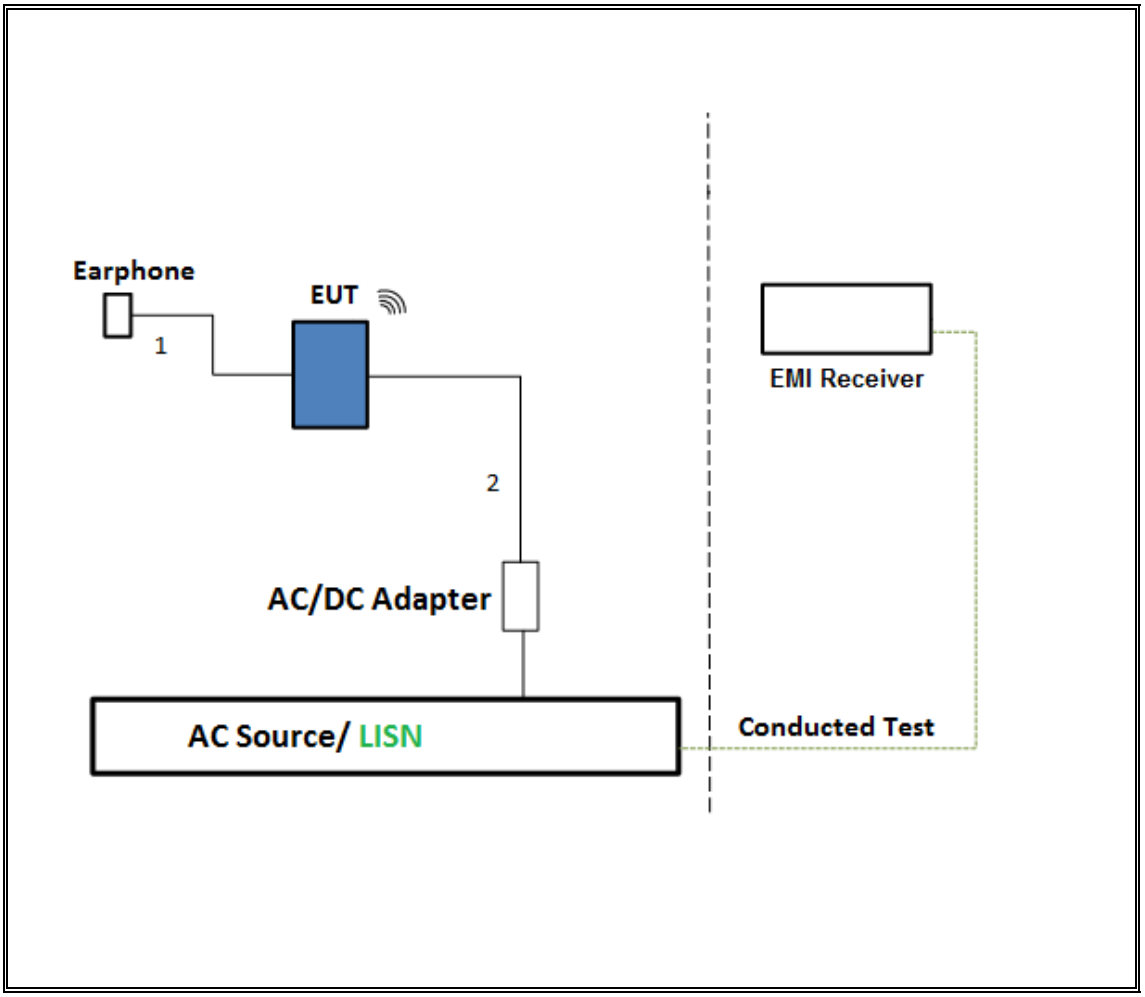
SETUP DIAGRAM



TEST SETUP- AC LINE CONDUCTED: AC/DC ADAPTER

The EUT was tested with earphone connected and powered by AC/DC adapter via USB cable. Test software exercised the EUT.

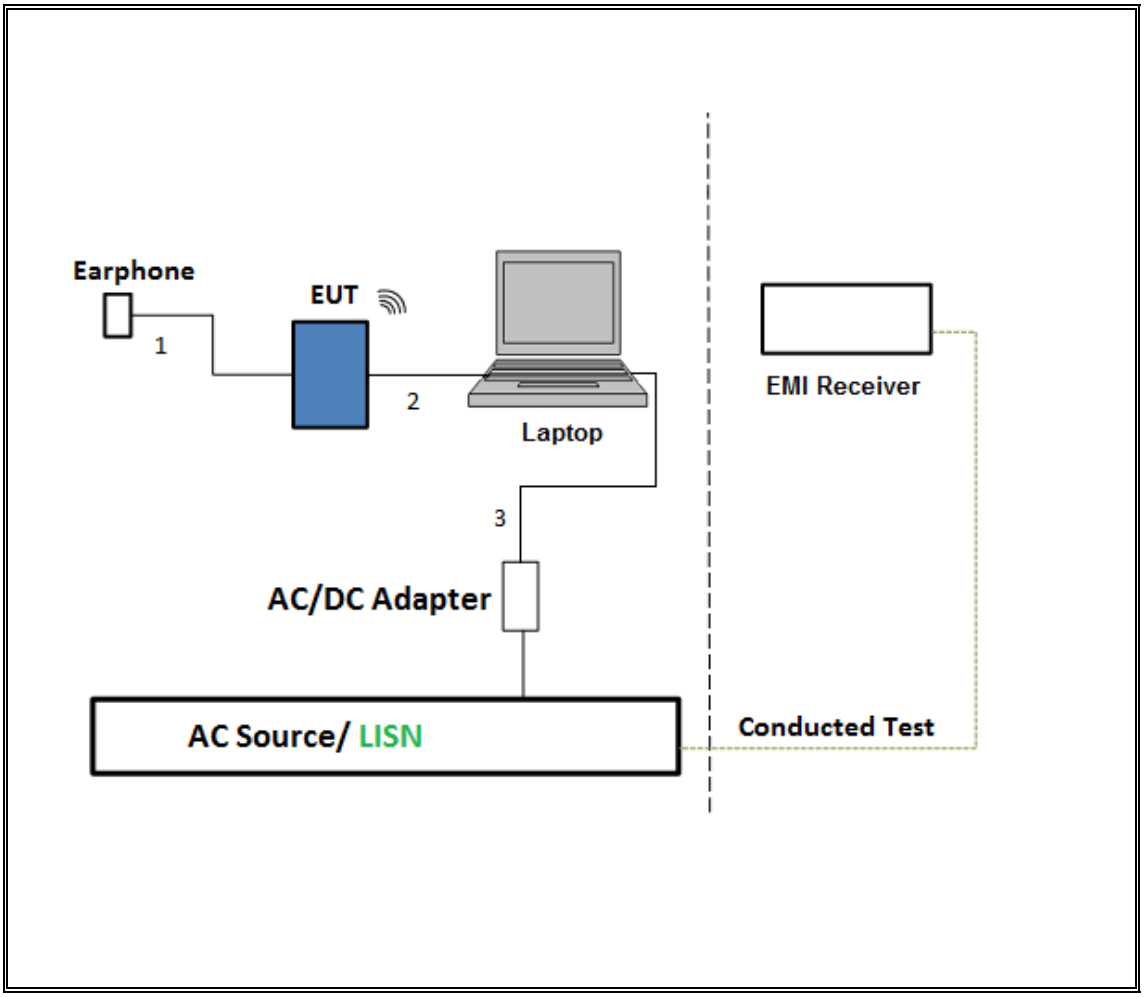
SETUP DIAGRAM



TEST SETUP- AC LINE CONDUCTED: LAPTOP CONFIGURATION

The EUT was tested with earphone connected and powered by host PC via USB cable. 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**	**Cal Date**	**Cal Due**
Antenna, Horn 1-18GHz	ETS Lindgren	3117	2/10/2015	2/10/2016
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB3	1/14/2015	1/14/2016
Amplifier, 1 - 18GHz	Miteq	AFS42-00101800-25-S-42	6/2/2015	6/2/2016
Amplifier, 10KHz to 1GHz, 32dB	Sonoma	310N	6/9/2015	6/9//2016
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	6/11/2015	6/11/2016
Antenna, Broadband Hybrid, 30MHz to 2000MHz	Sunol Sciences	JB1	2/13/2015	2/13/2016
Spectrum Analyzer, PXA, 3Hz to 44GHz	Agilent	N9030A	2/20/2015	2/20/2016
Power Meter, P-series single channel	Agilent	N1911A	4/7/2015	4/7/2016
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Agilent	N1921A	2/27/2015	2/27/2016
Antenna, Horn 18 to 26.5GHz	ARA	MWH-1826	12/17/2014	12/17/2015
Spectrum Analyzer, 40 GHz	Agilent	8564E	8/14/2015	8/14/2016
Amplifier, 1 to 26.5GHz, 23.5dB Gain minimum	Agilent	8449B	6/29/2015	6/29/2016
AC Line Conducted				
EMI Test Receiver 9Khz-7GHz	Rohde & Schwarz	ECSI7	08/07/15	08/07/16
LISN for Conducted Emissions CISPR-16	FCC	50/250-25-2	01/16/15	01/16/16
Power Cable, Line Conducted Emissions ANSI 63.4	U L	PG1	7/28/2015	7/28/2016
UL SOFTWARE				
* Radiated Software	UL	UL EMC	Ver 9.5, July 22, 2014	
* Conducted Software	UL	UL EMC	Ver 2.2, March 31, 2015	
* AC Line Conducted Software	UL	UL EMC	Ver 9.5, April 3, 2015	

Note: * indicates automation software version used in the compliance certification testing

7. ANTENNA PORT TEST RESULTS

7.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

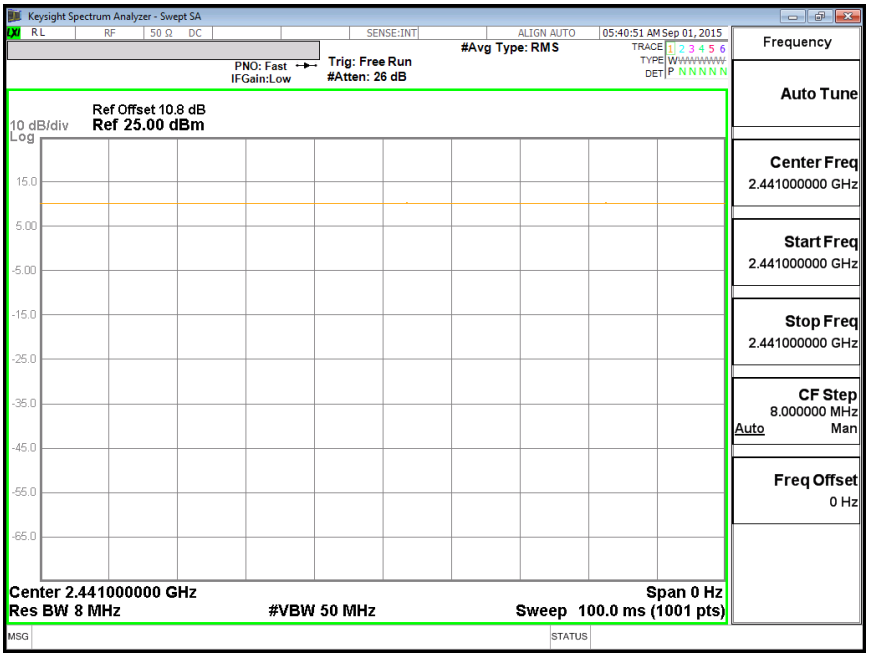
ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
Bluetooth GFSK	100.000	100.000	1.000	100.00%	0.00	0.010
Bluetooth 8PSK	100.000	100.000	1.000	100.00%	0.00	0.010

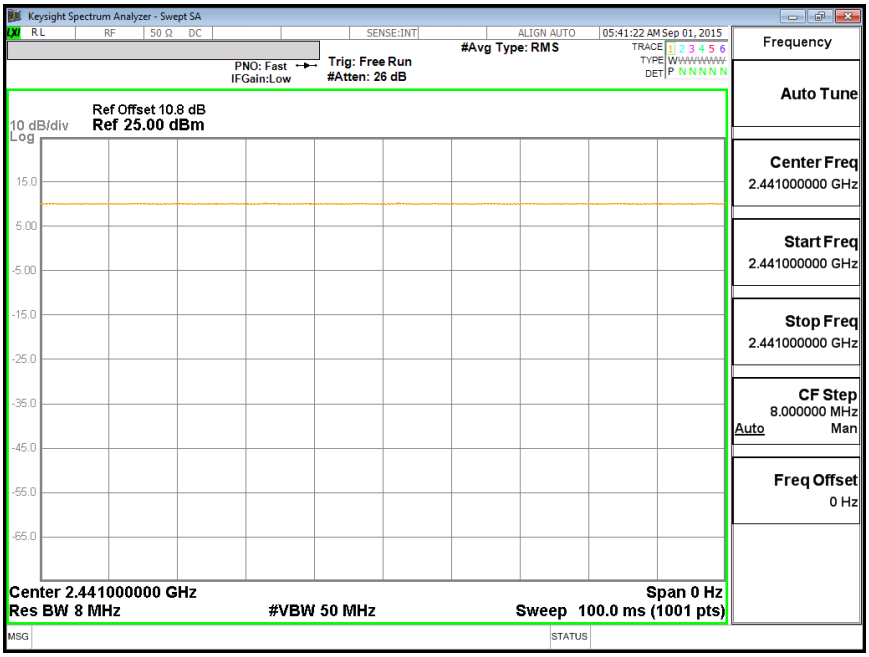
DUTY CYCLE PLOTS

HOPPING OFF

DUTY CYCLE GFSK MODE



DUTY CYCLE 8PSK MODE



7.2. BASIC DATA RATE GFSK MODULATION

7.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

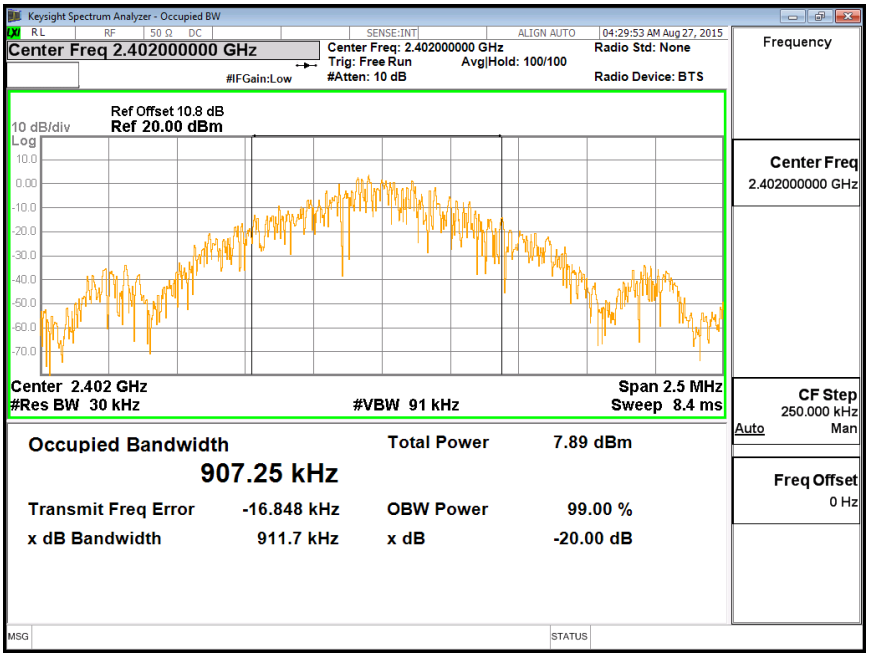
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

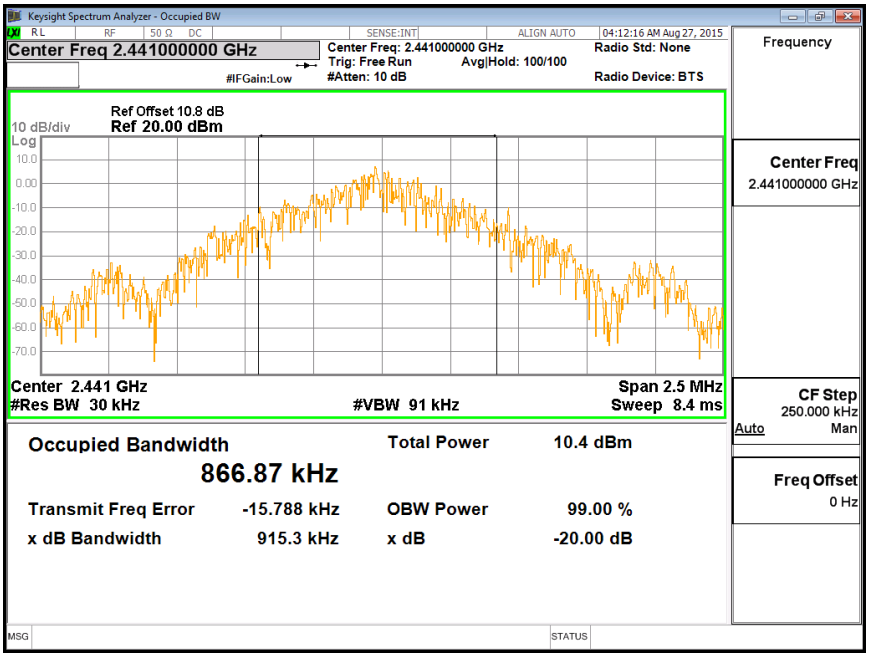
Channel	Frequency (MHz)	20 dB Bandwidth (KHz)	99% Bandwidth (KHz)
Low	2402	911.7	907.25
Middle	2441	915.3	866.87
High	2480	915.8	857.63

20 dB AND 99% BANDWIDTH

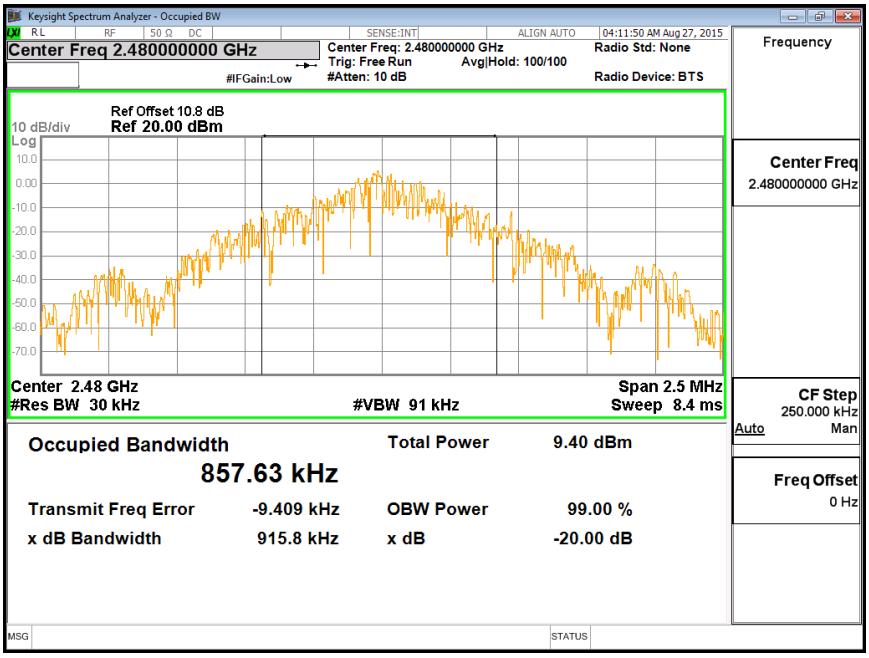
BANDWIDTH LOW CH



BANDWIDTH MID CH



BANDWIDTH HIGH CH



7.2.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 (5.1) (2)

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

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

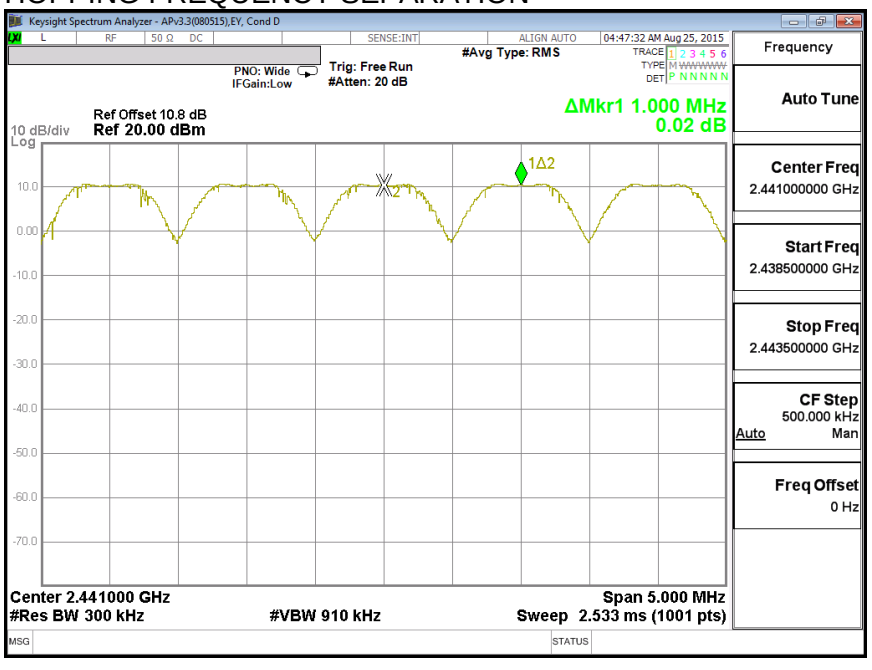
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 910 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION

HOPPING FREQUENCY SEPARATION



7.2.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 (5.1) (4)

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

TEST PROCEDURE

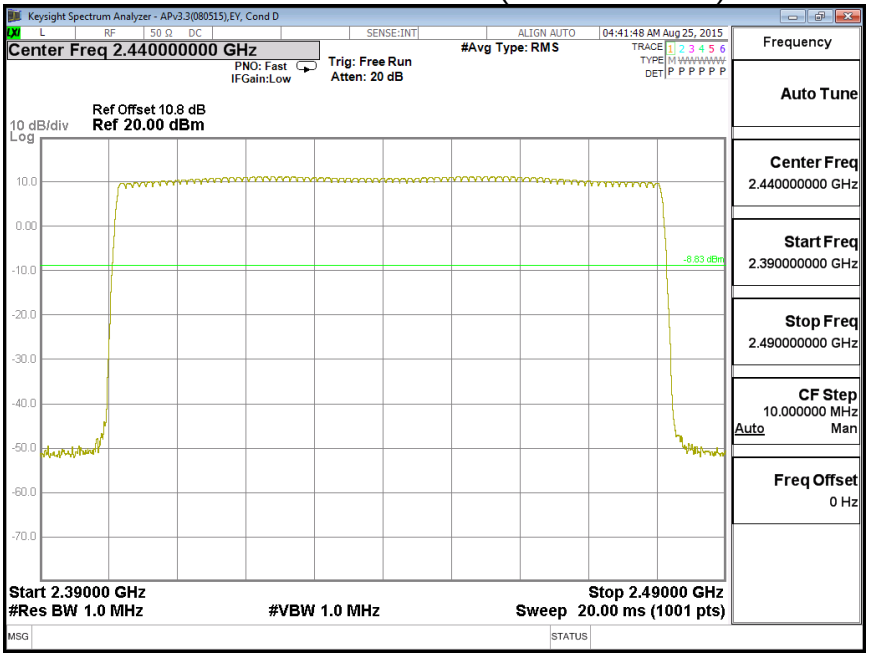
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

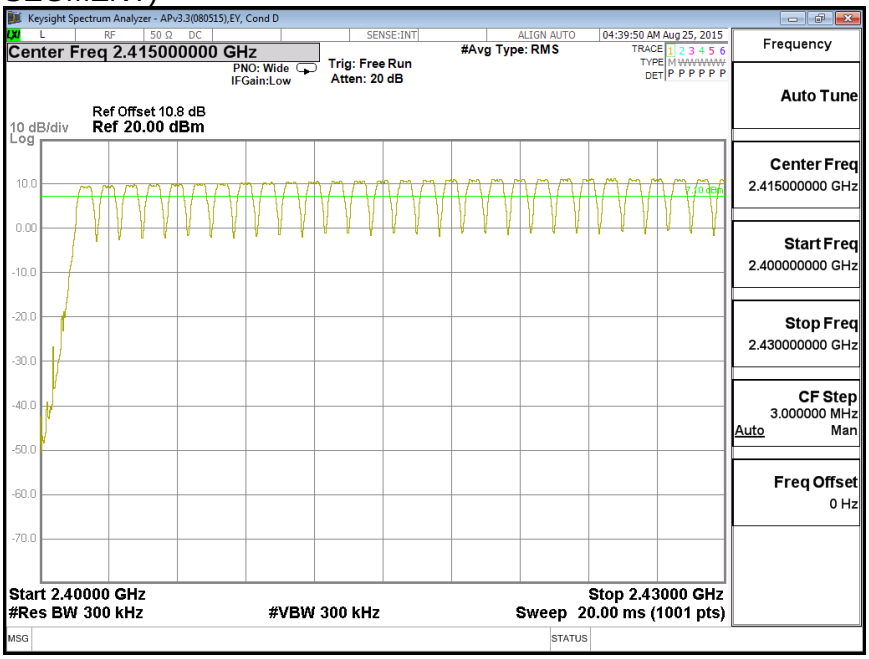
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS

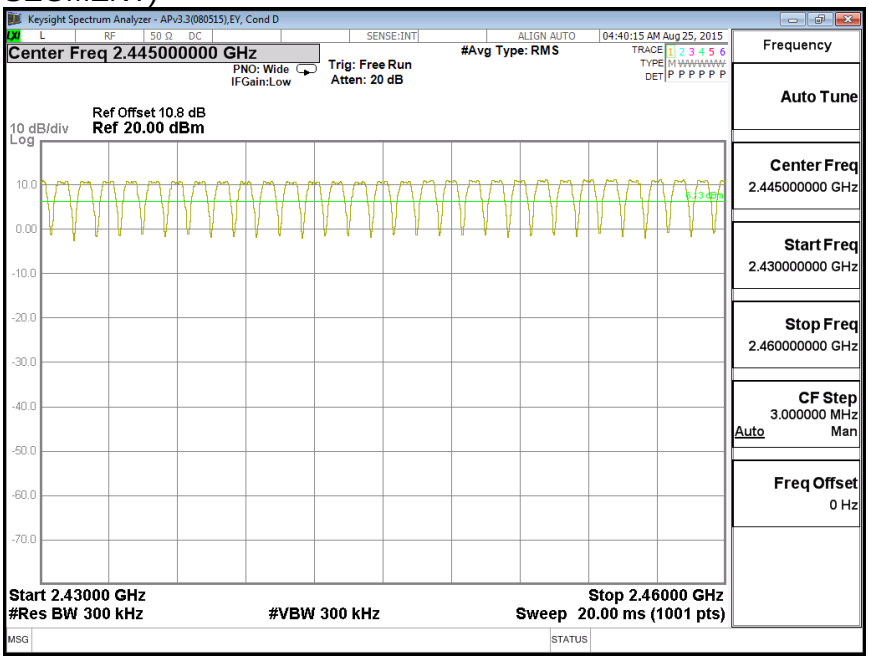
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



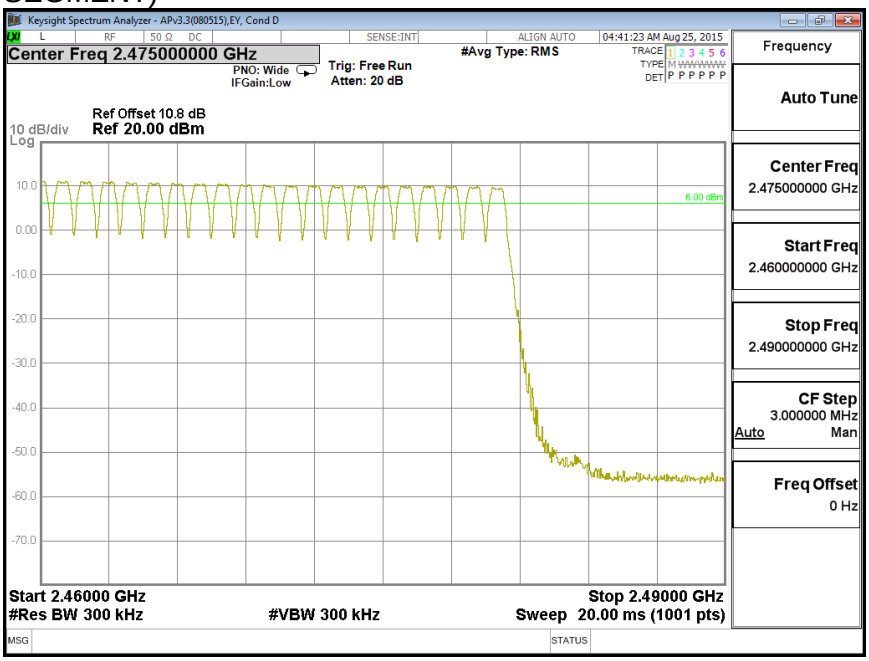
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



7.2.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 (5.1) (4)

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

TEST PROCEDURE

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

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

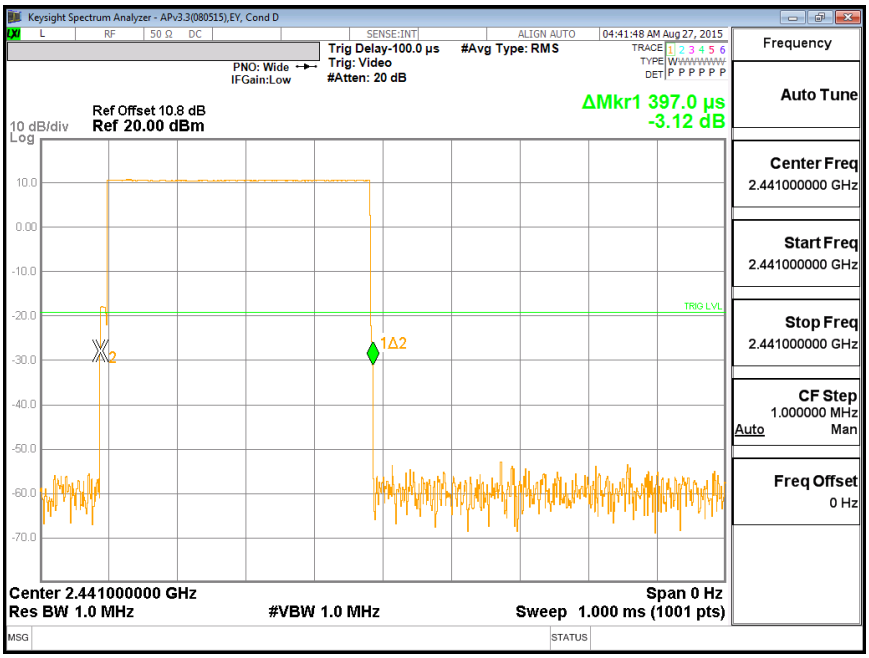
For AFH mode, the average time of occupancy in the specified 8 second period (20 channels * 0.4 seconds) is equal to 10 * (# of pulses in 0.8 s) * pulse width.

RESULTS

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.397	32	0.127	0.4	-0.273
DH3	1.652	18	0.297	0.4	-0.103
DH5	2.904	13	0.378	0.4	-0.022

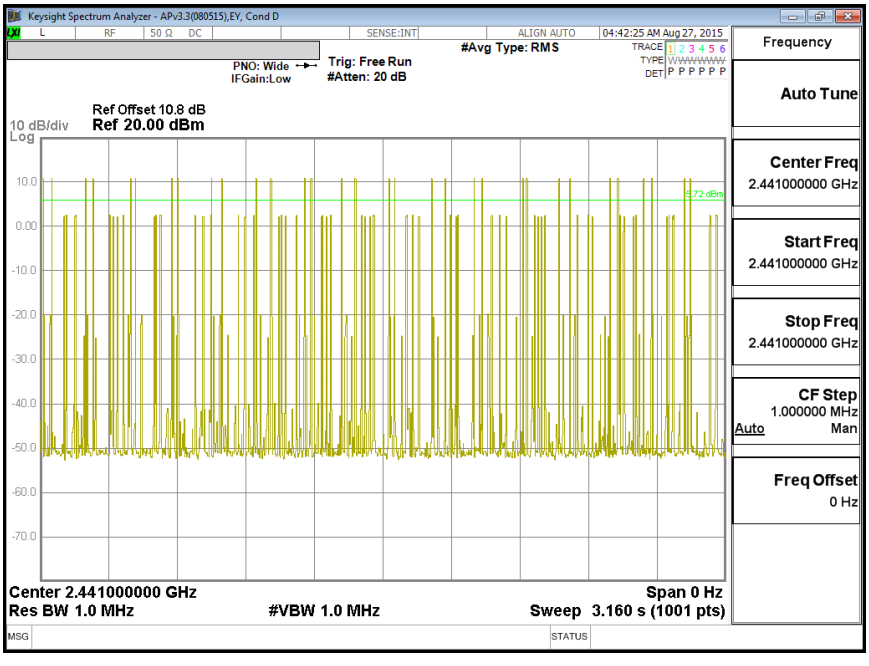
PULSE WIDTH - DH1

PULSE WIDTH – DH1

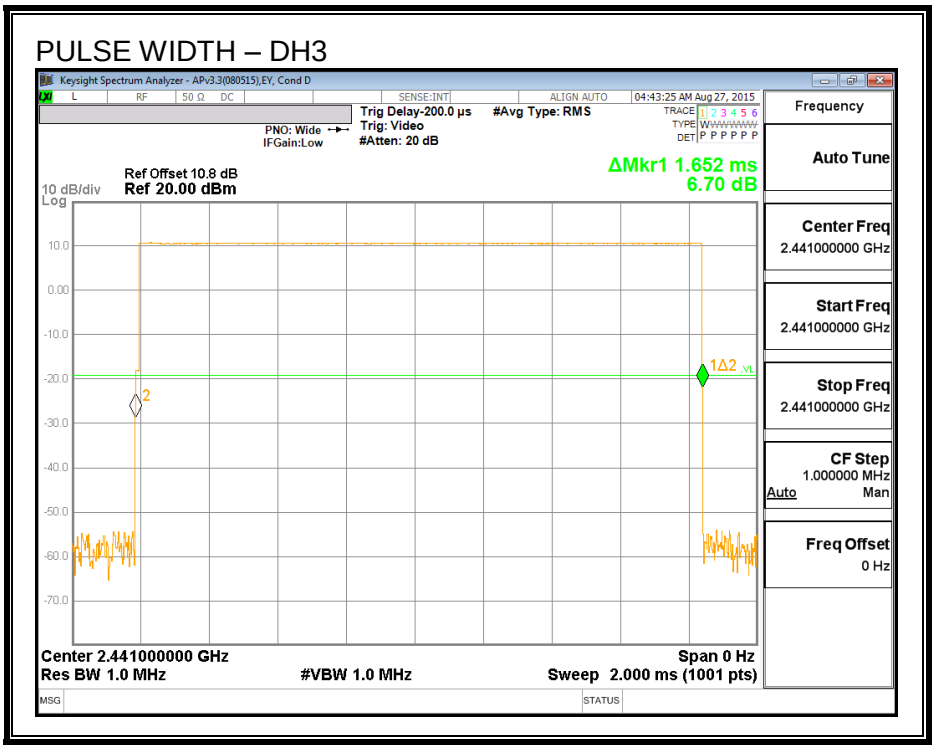


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1

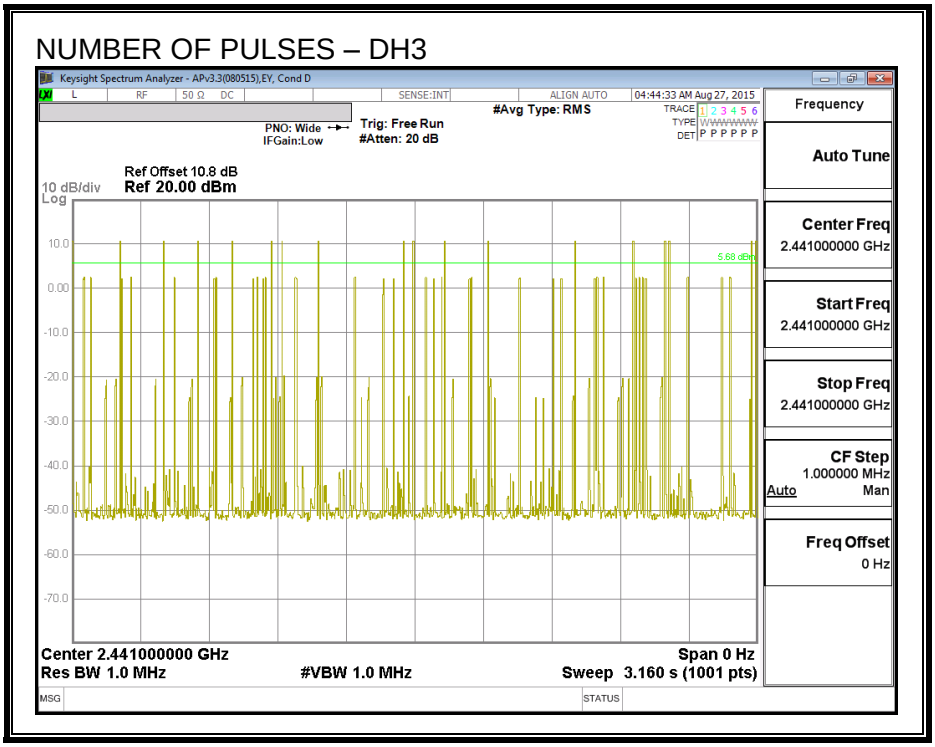
NUMBER OF PULSES – DH1



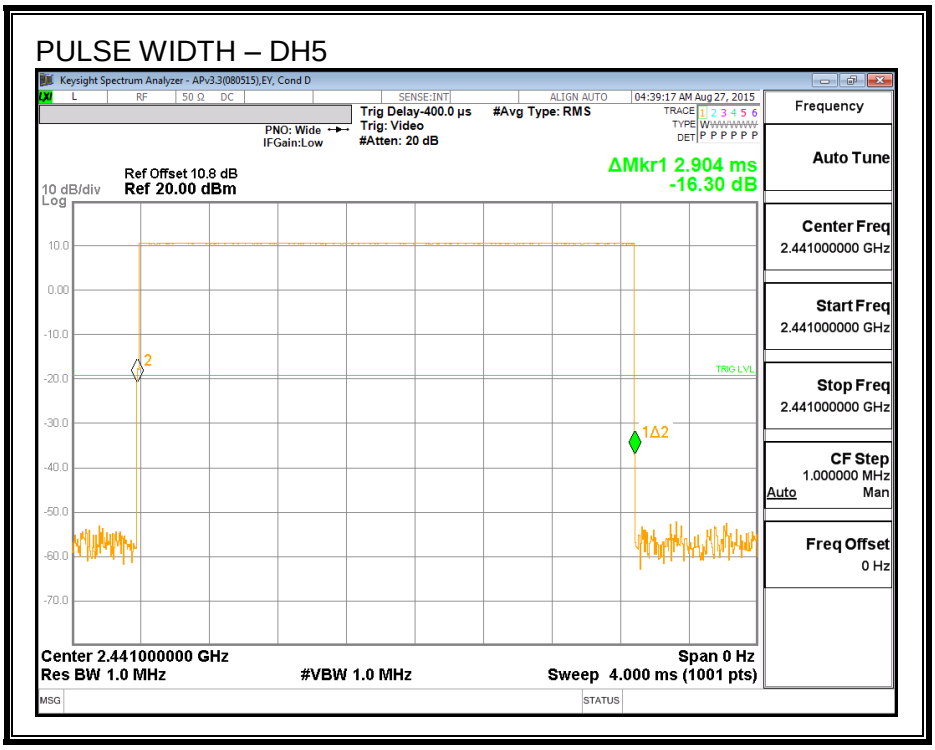
PULSE WIDTH – DH3



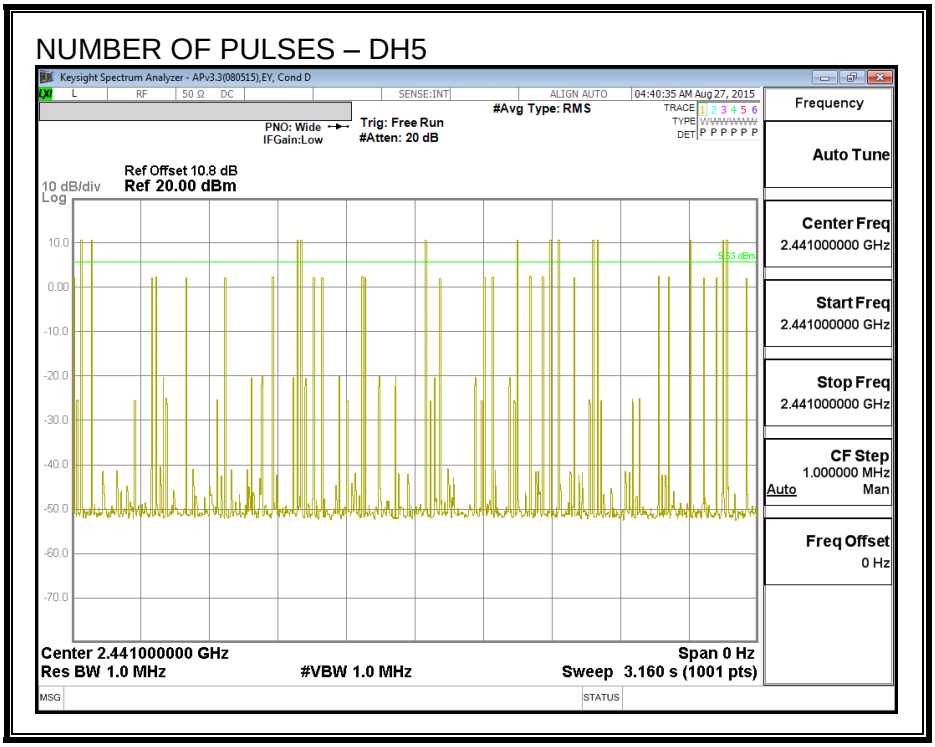
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



7.2.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-247 (5.4) (2)

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

TEST PROCEDURE

The transmitter output is connected to a wideband peak and average power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	11.43	30	-18.57
Middle	2441	11.82	30	-18.18
High	2480	11.06	30	-18.94

7.2.6. 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	11.10
Middle	2441	11.50
High	2480	10.73

7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

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.

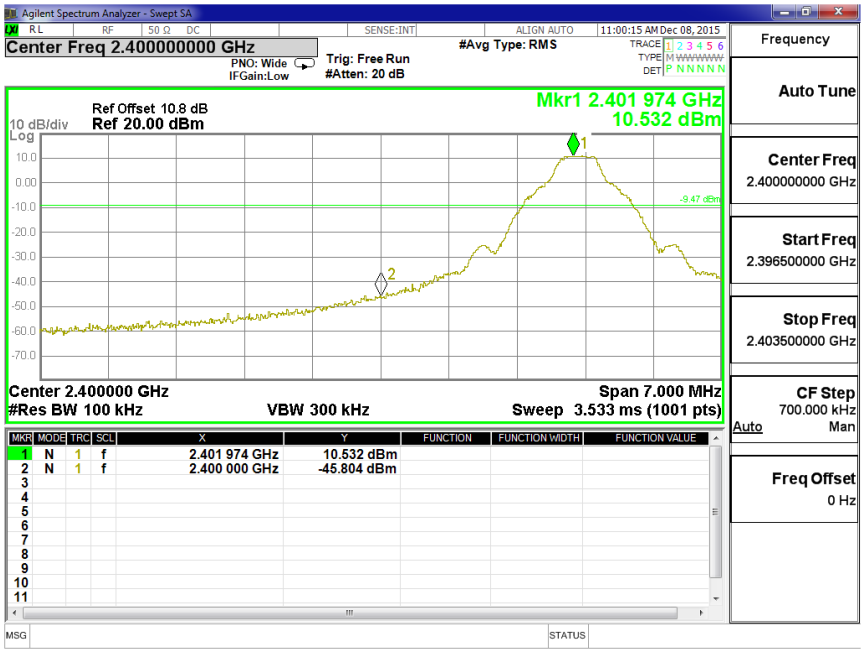
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

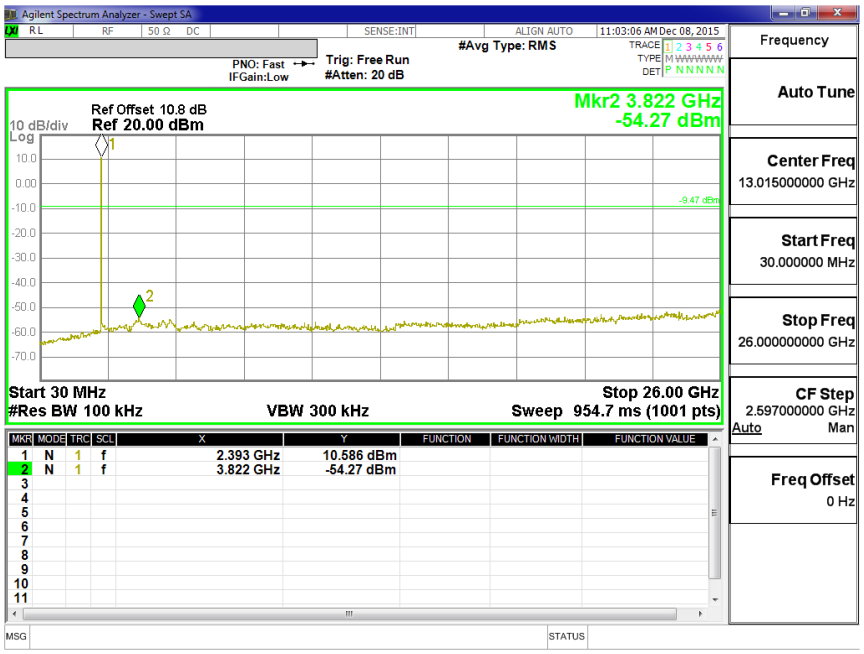
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

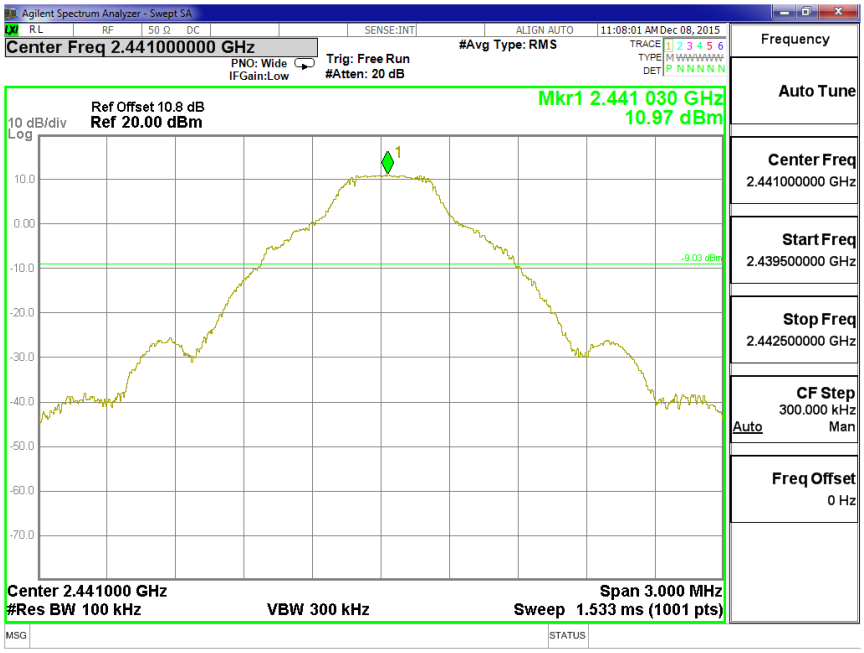


LOW CHANNEL SPURIOUS

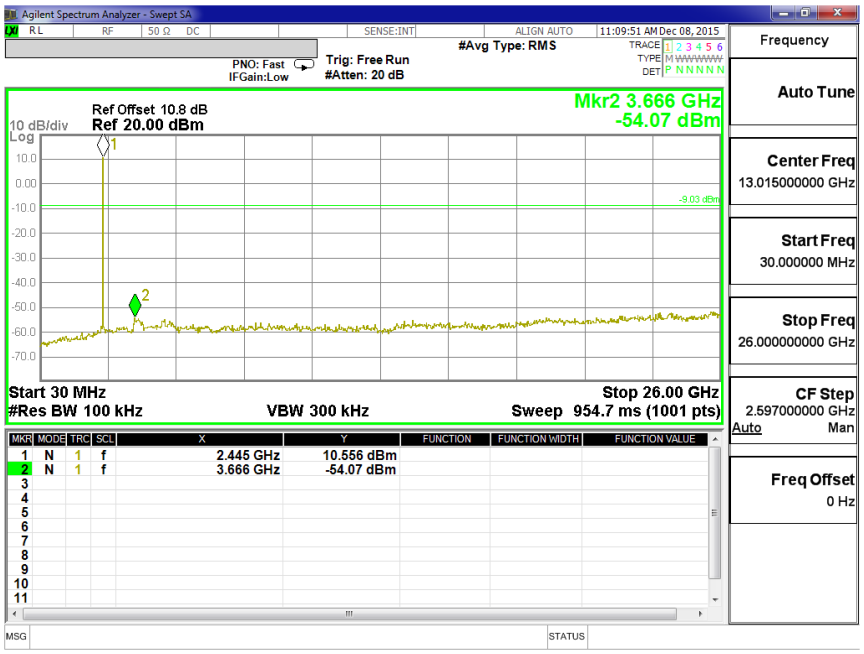


SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL

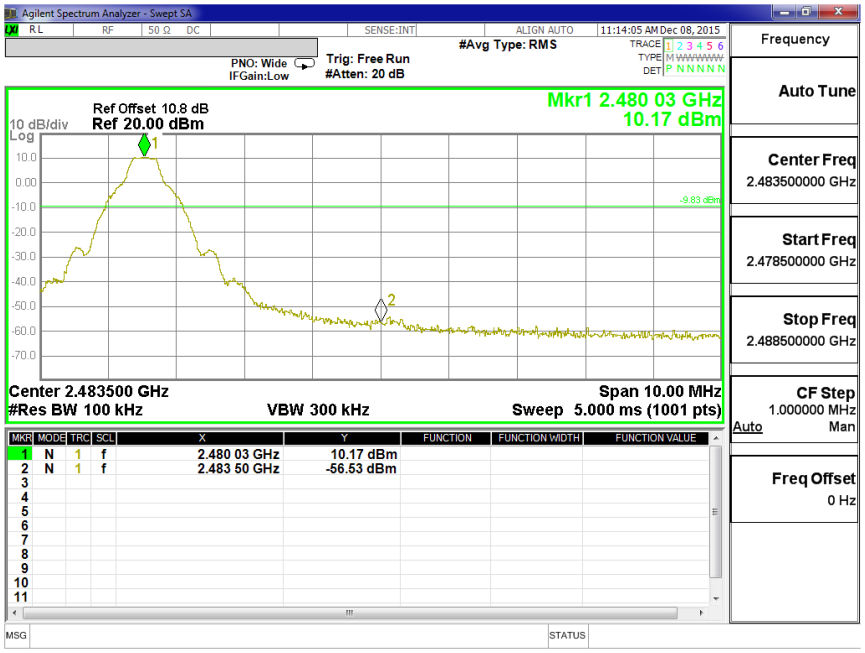


MID CHANNEL SPURIOUS

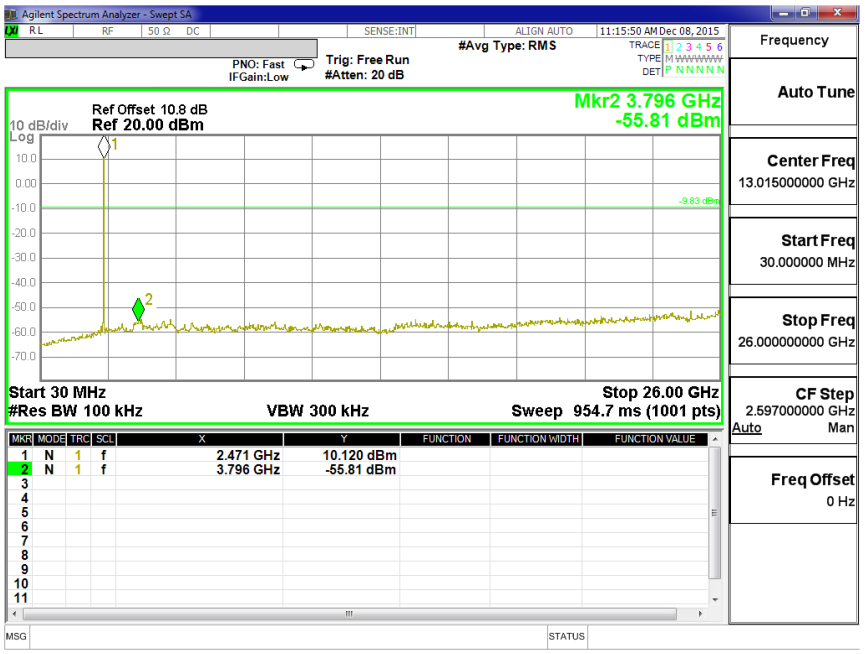


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

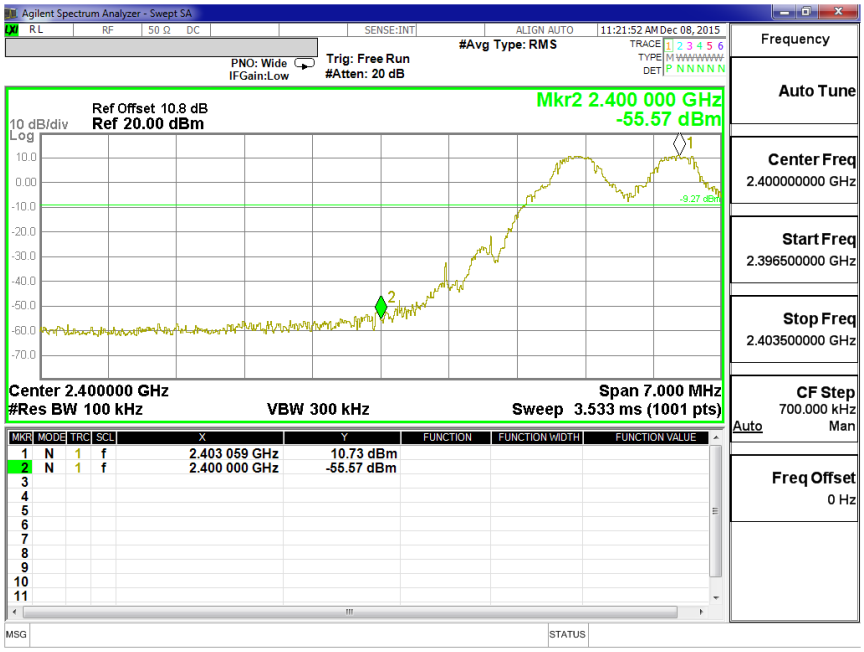


HIGH CHANNEL SPURIOUS

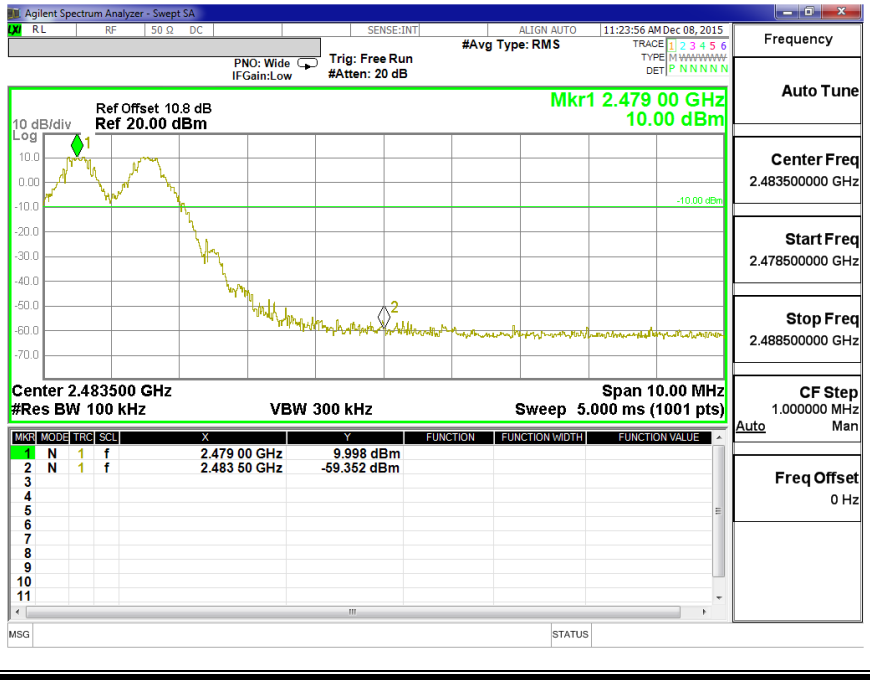


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



7.3. ENHANCED DATA RATE QPSK MODULATION

7.3.1. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-247 (5.4) (2)

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

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 wideband peak and average power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.30	21	-10.67
Middle	2441	10.72	21	-10.25
High	2480	10.22	21	-10.75

7.3.2. 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	8.06
Middle	2441	8.46
High	2480	8.01

7.4. ENHANCED DATA RATE 8PSK MODULATION

7.4.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

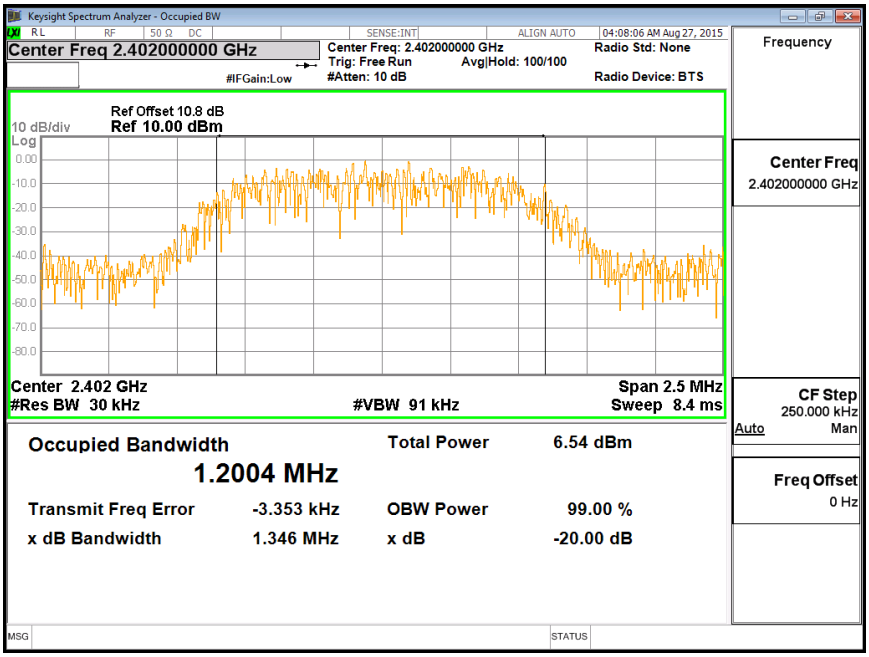
The transmitter output is connected to a spectrum analyzer. The RBW is set to ≥ 1% of the 20 dB bandwidth. The VBW is set to ≥ RBW. The sweep time is coupled.

RESULTS

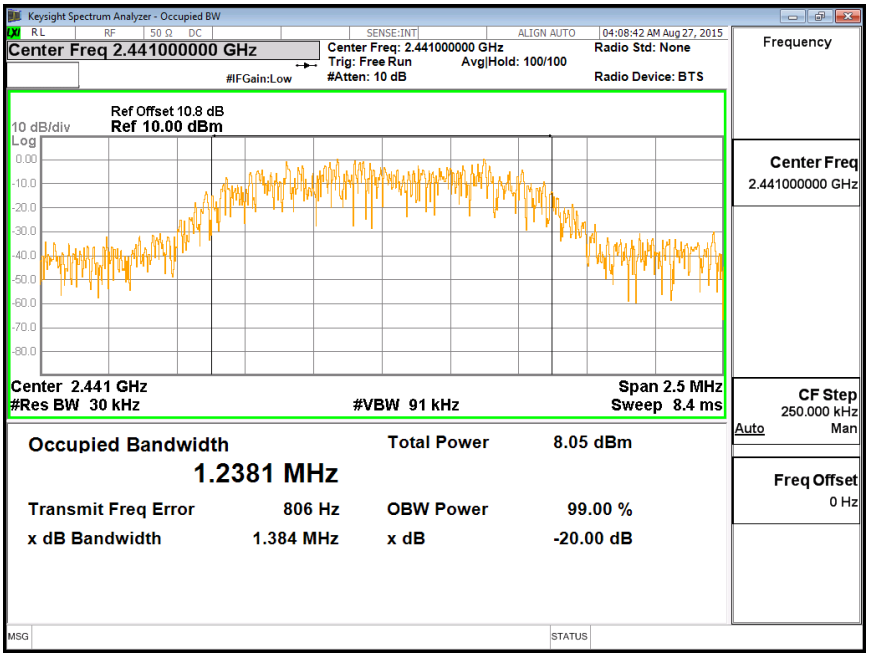
Channel	Frequency (MHz)	20 dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.346	1.2004
Middle	2441	1.384	1.2381
High	2480	1.384	1.2350

20 dB AND 99% BANDWIDTH

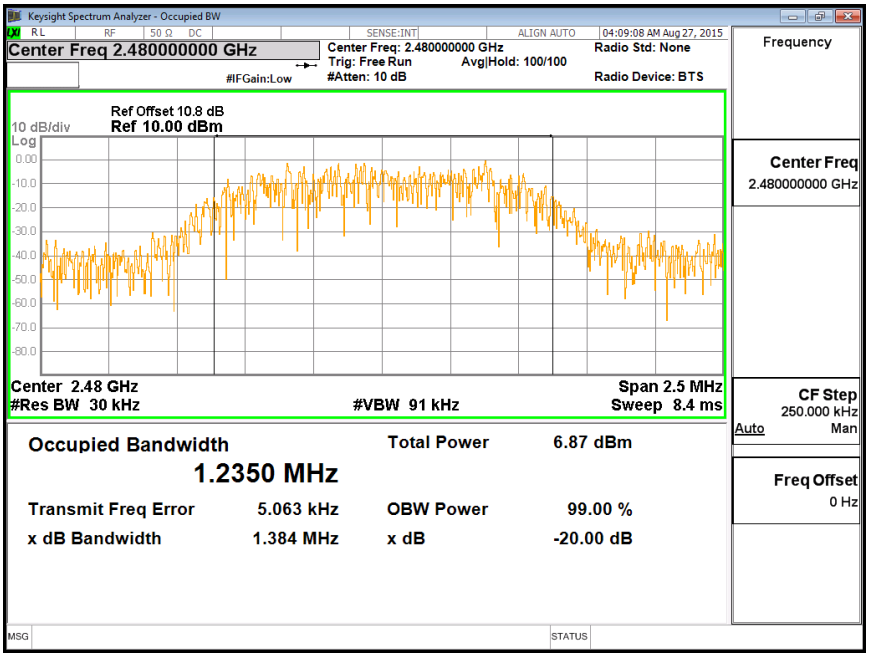
BANDWIDTH LOW CH



BANDWIDTH MID CH



BANDWIDTH HIGH CH



7.4.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

IC RSS-247 (5.1) (2)

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

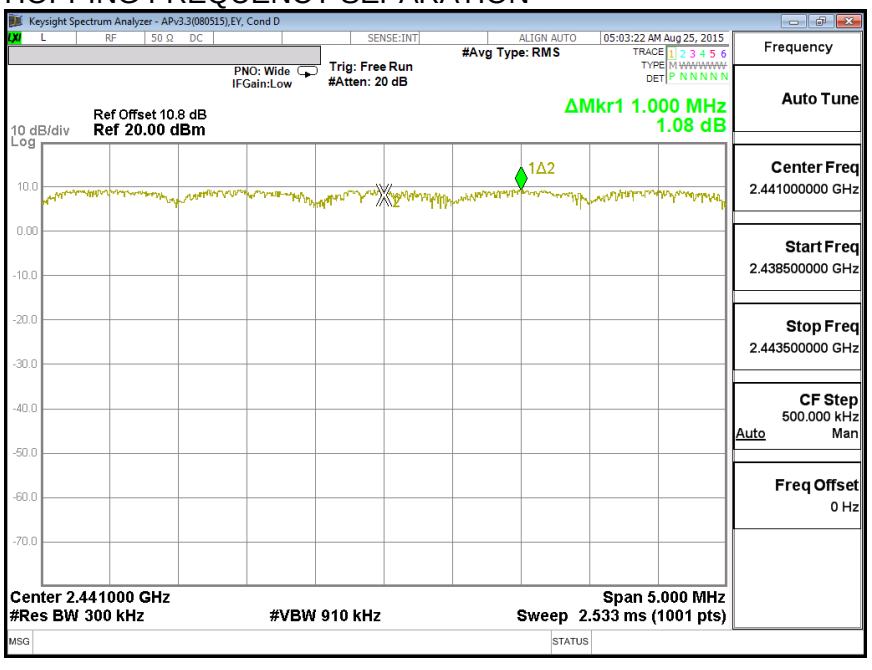
TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 910 kHz. The sweep time is coupled.

RESULTS

HOPPING FREQUENCY SEPARATION

HOPPING FREQUENCY SEPARATION



7.4.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 (5.1) (4)

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

TEST PROCEDURE

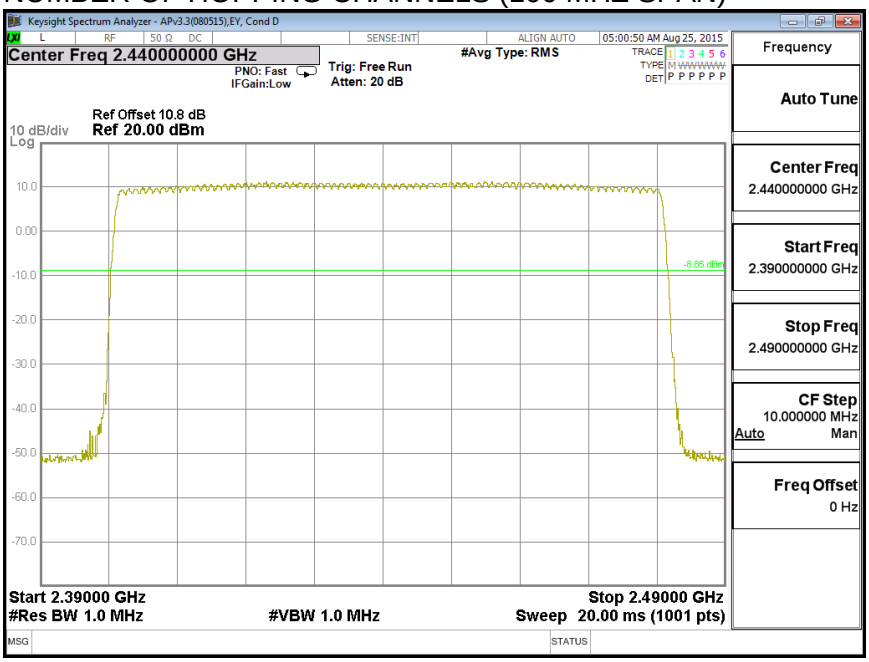
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

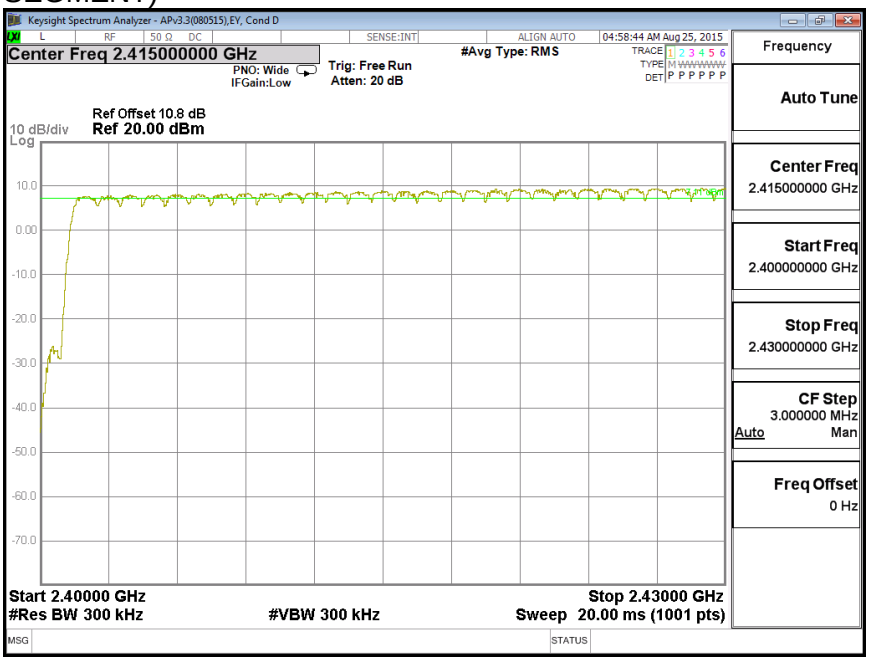
Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS

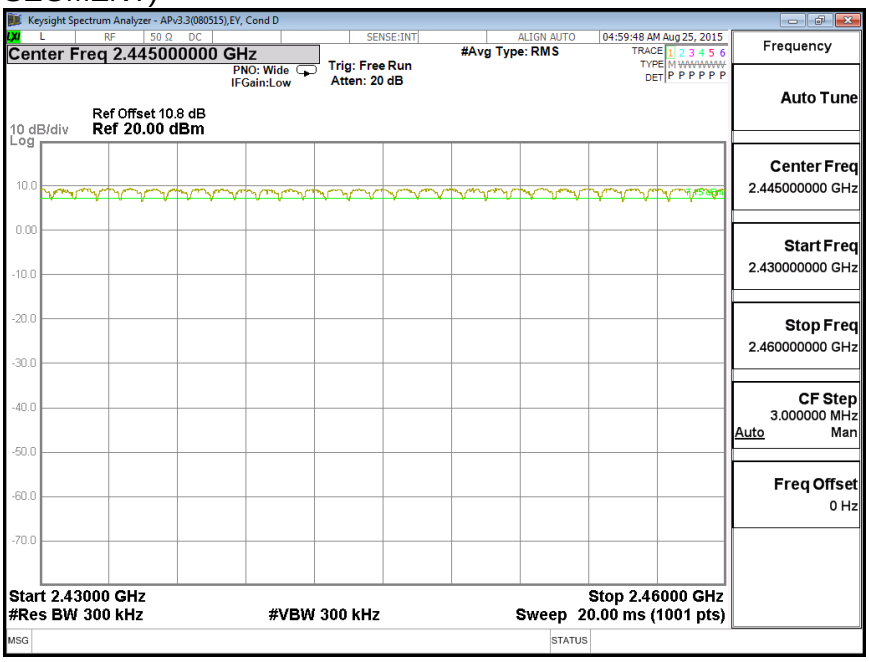
NUMBER OF HOPPING CHANNELS (100 MHZ SPAN)



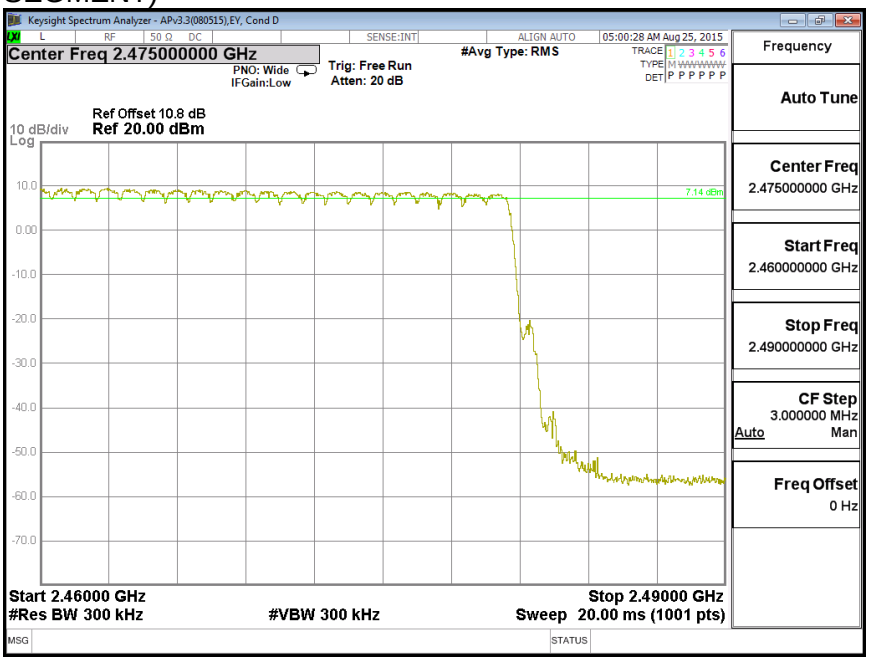
NUMBER OF HOPPING CHANNELS (30 MHZ SPAN, FIRST SEGMENT)



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



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



7.4.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

IC RSS-247 (5.1) (4)

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

TEST PROCEDURE

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

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

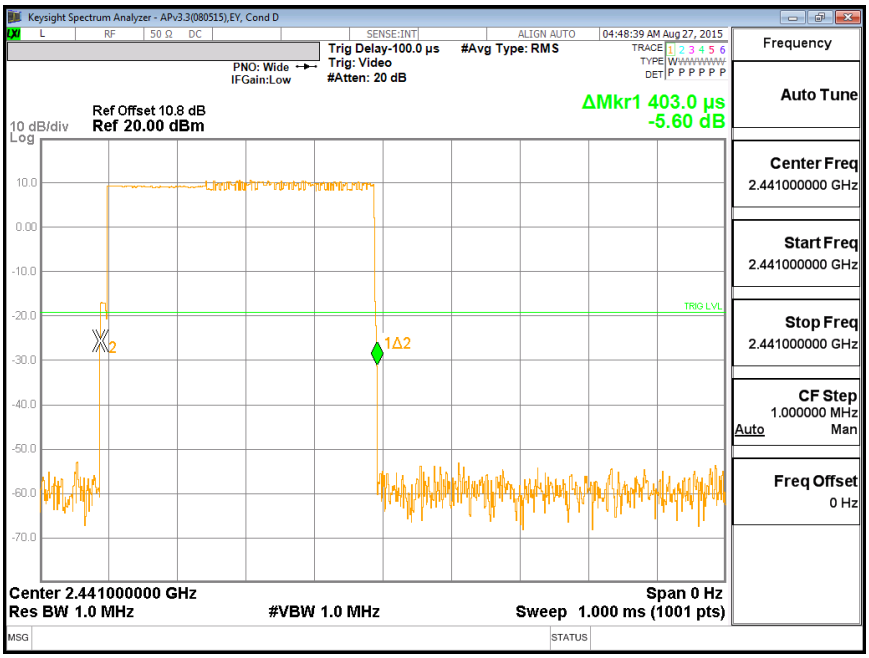
RESULTS

8PSK (EDR) Mode

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of (sec)	Limit (sec)	Margin (sec)
3DH1	0.403	32	0.129	0.4	-0.271
3DH3	1.654	18	0.298	0.4	-0.102
3DH5	2.908	12	0.349	0.4	-0.051

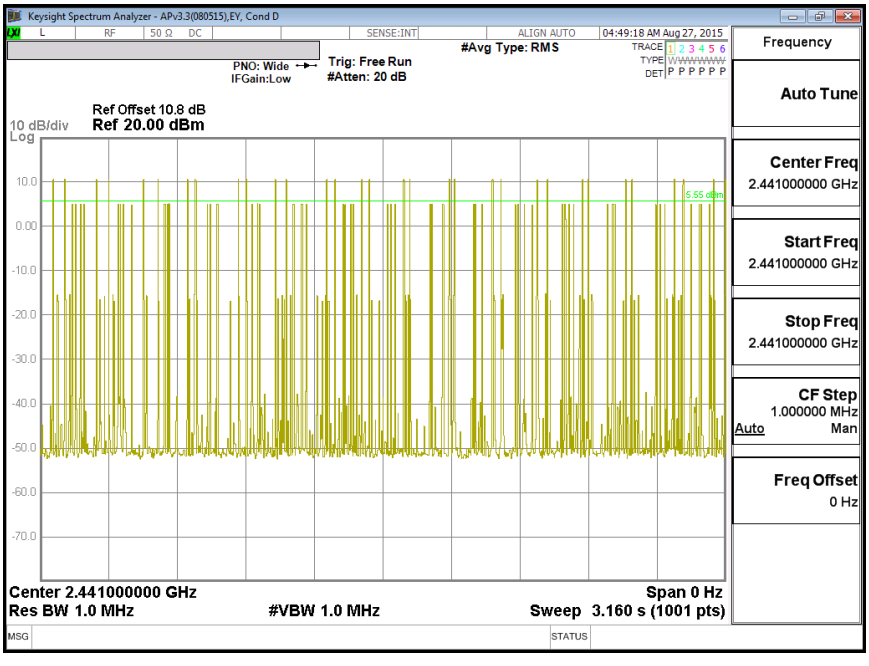
`PULSE WIDTH - 3DH1

PULSE WIDTH – 3DH1

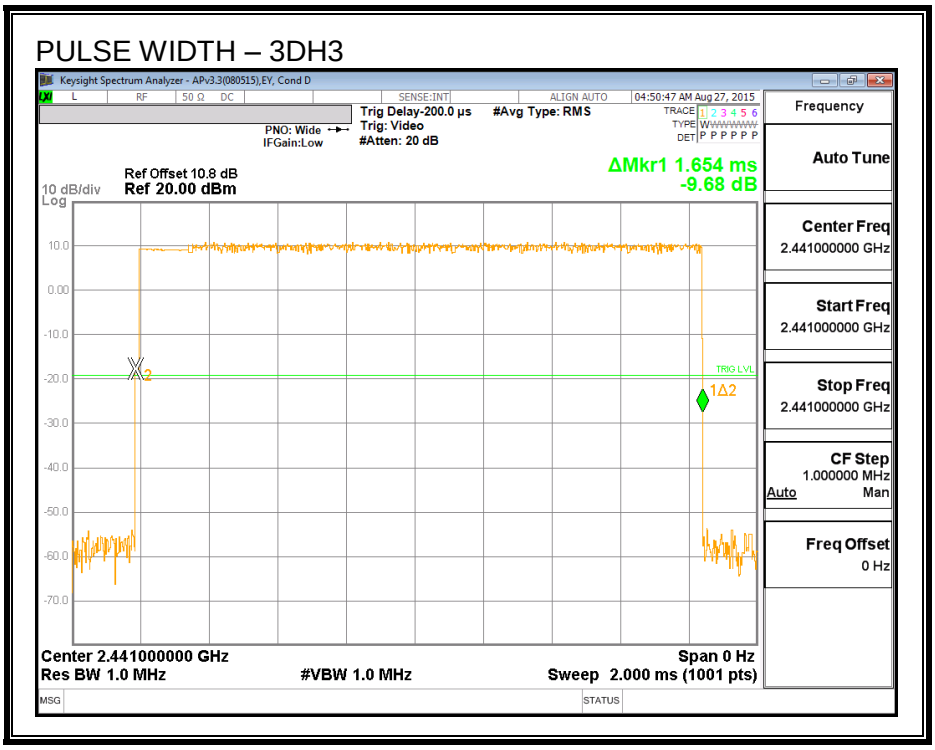


NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH1

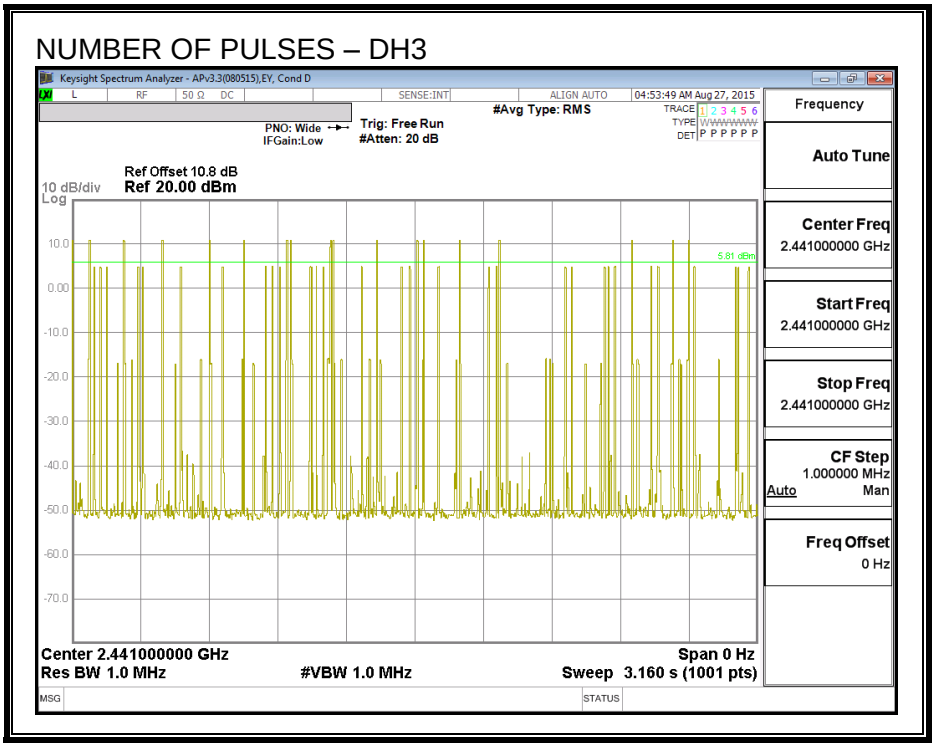
NUMBER OF PULSES – 3DH1



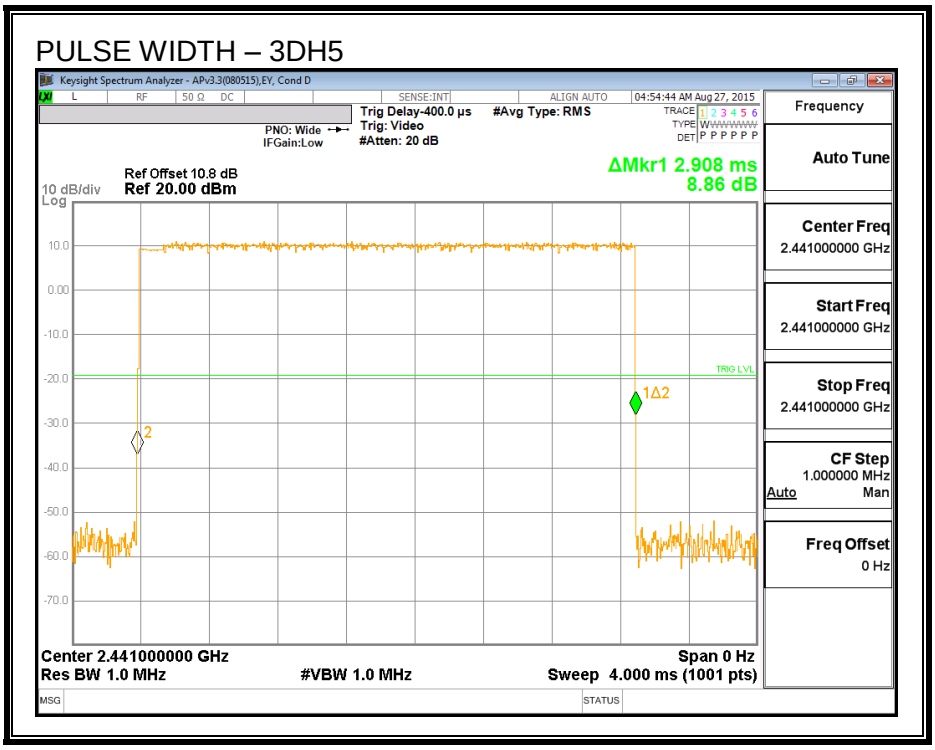
PULSE WIDTH – 3DH3



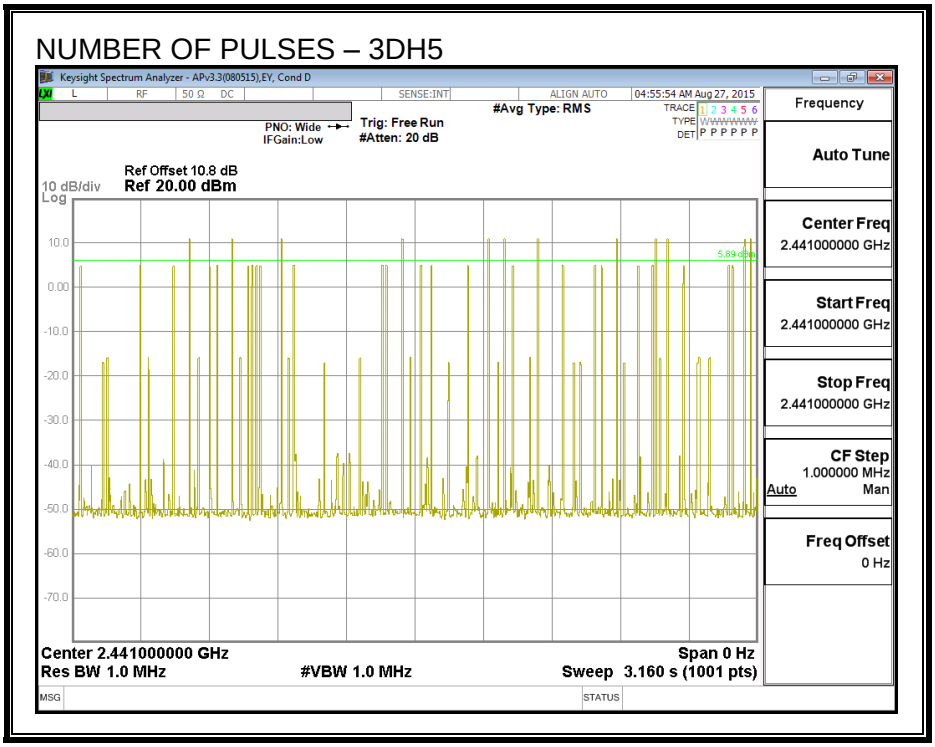
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH3



PULSE WIDTH – 3DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH5



7.4.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

RSS-247 (5.4) (2)

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

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 wideband peak and average power meter.

RESULTS

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	10.33	21	-10.64
Middle	2441	10.76	21	-10.21
High	2480	10.28	21	-10.69

7.4.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 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	8.08
Middle	2441	8.50
High	2480	8.06

7.4.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

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.

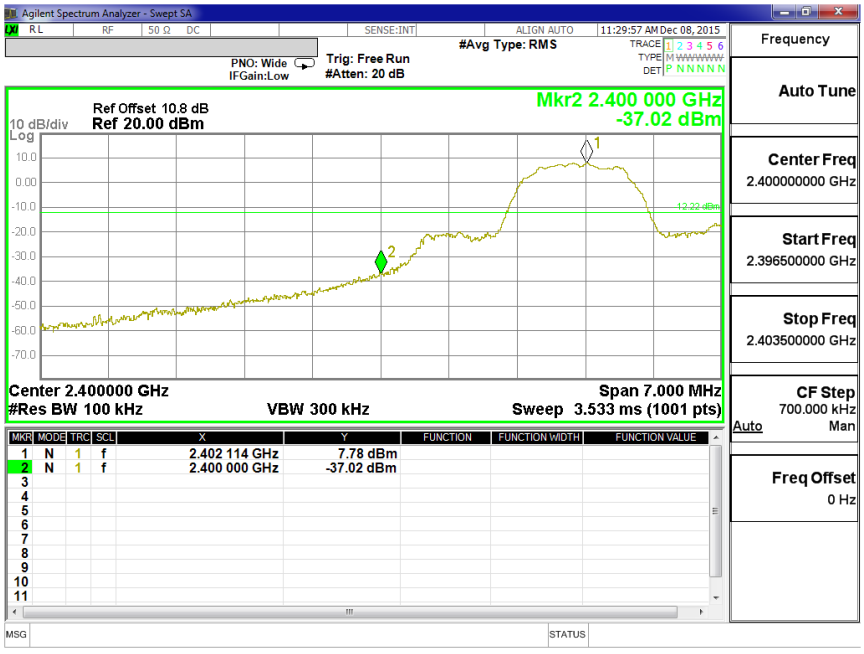
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

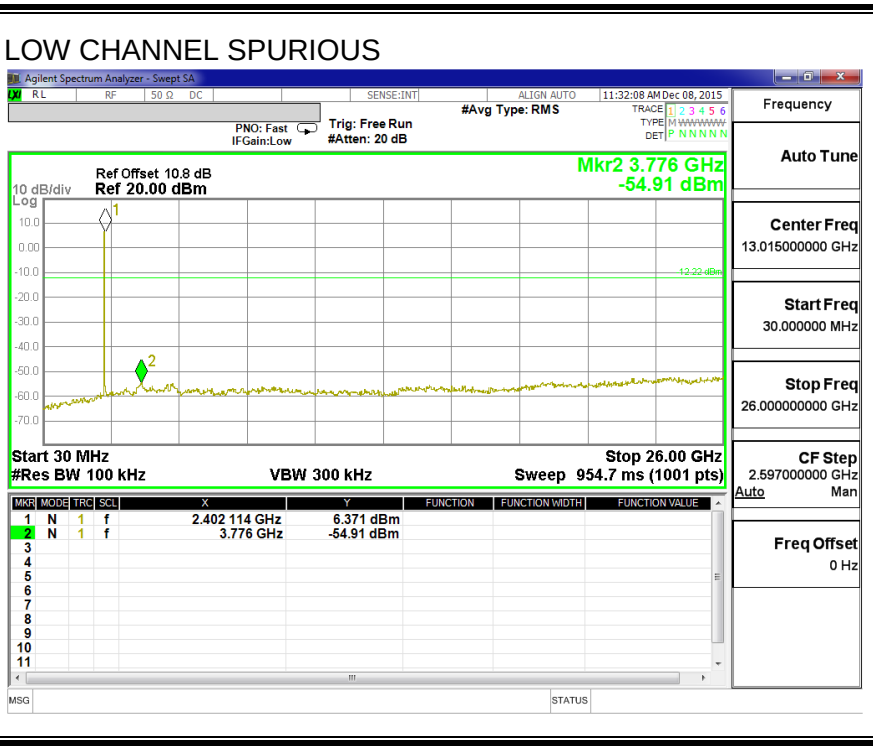
RESULTS

SPURIOUS EMISSIONS, LOW CHANNEL

LOW CHANNEL BANDEDGE

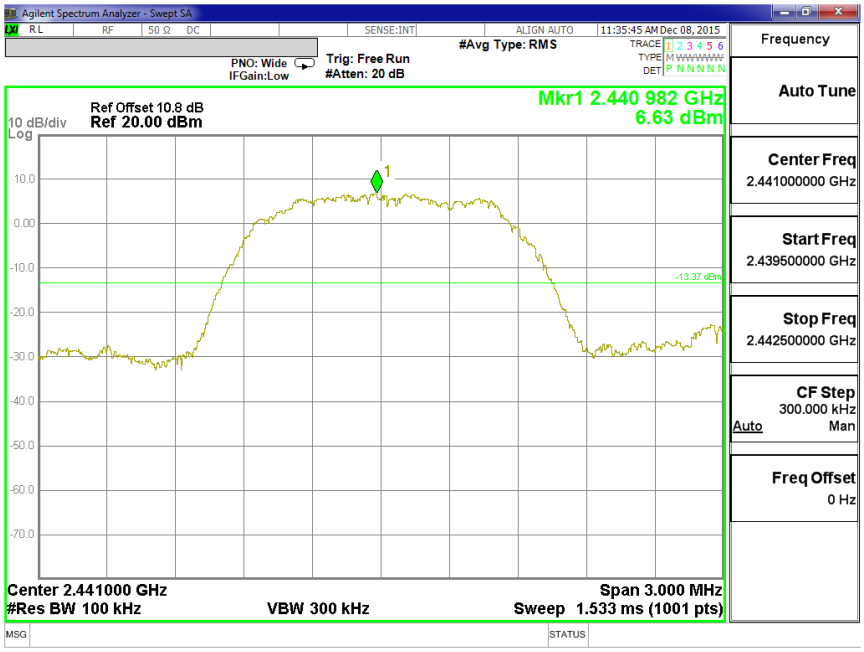


LOW CHANNEL SPURIOUS

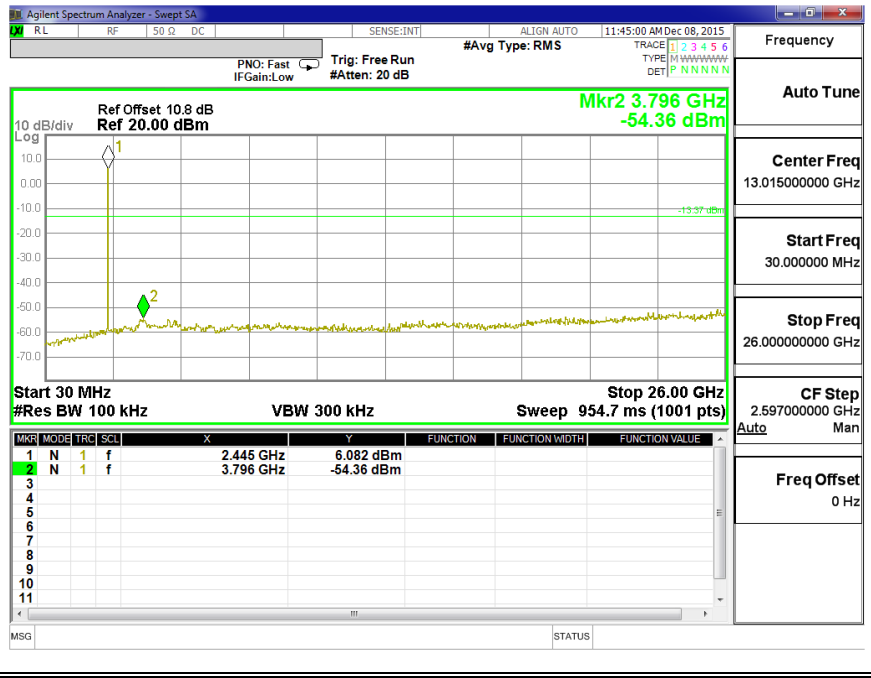


SPURIOUS EMISSIONS, MID CHANNEL

MID CHANNEL

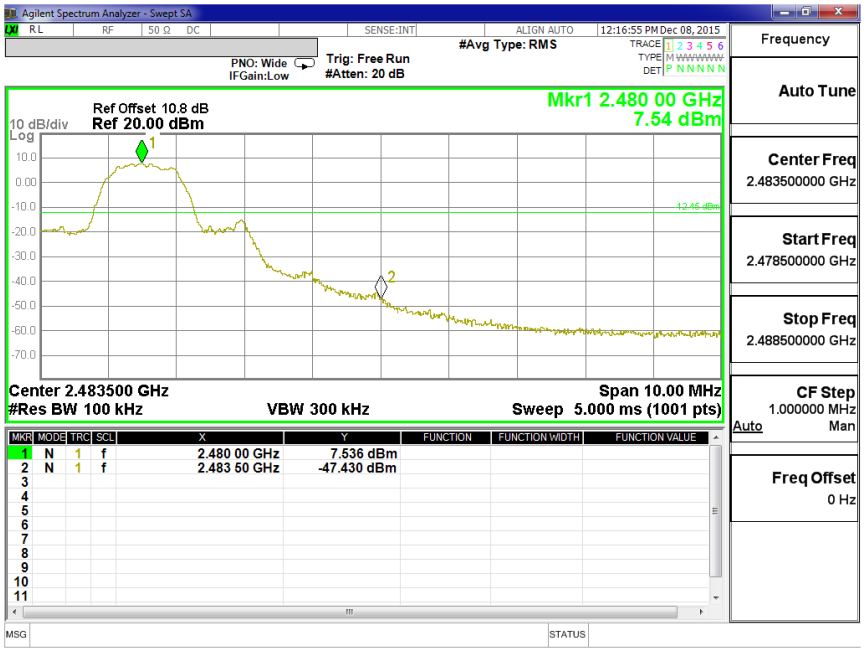


MID CHANNEL SPURIOUS

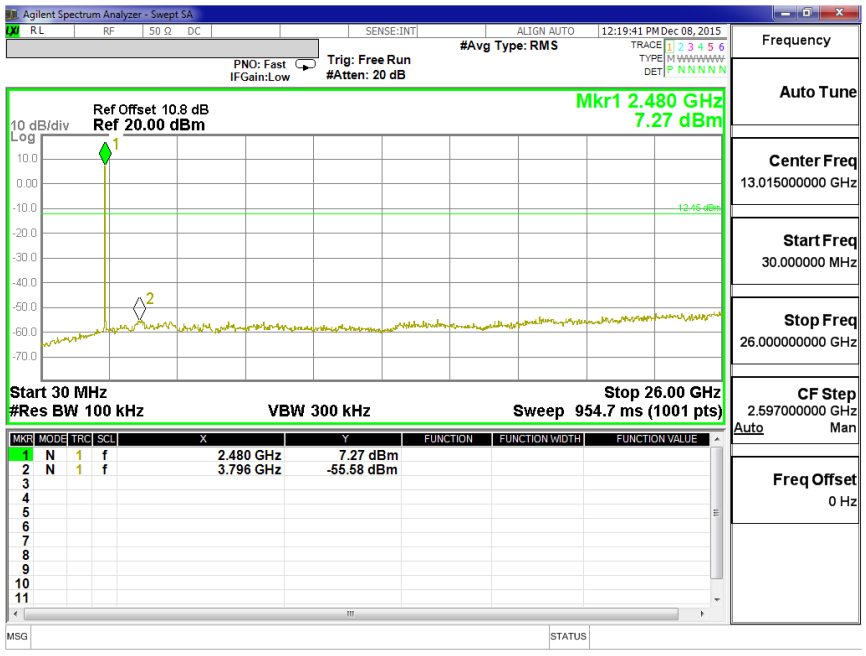


SPURIOUS EMISSIONS, HIGH CHANNEL

HIGH CHANNEL BANDEDGE

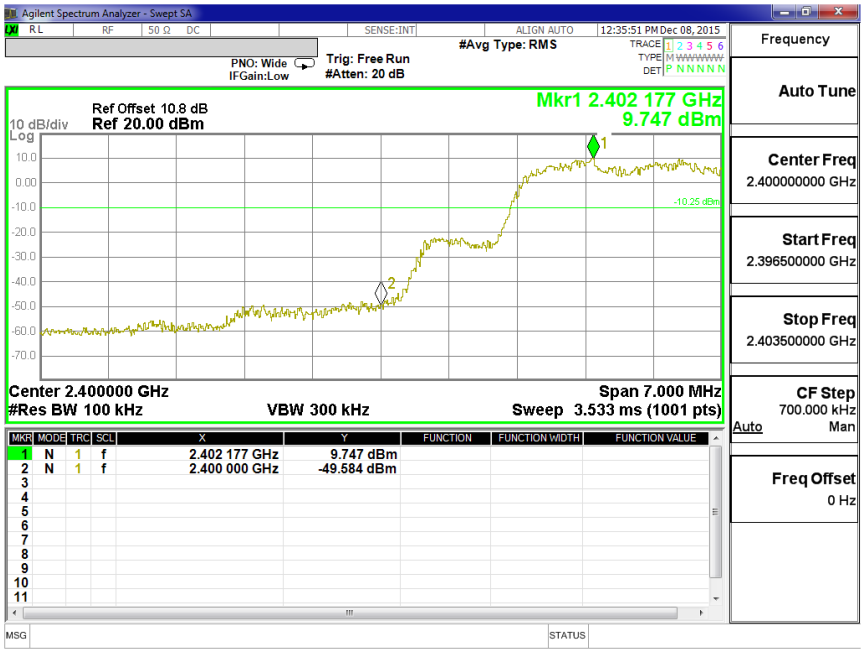


HIGH CHANNEL SPURIOUS

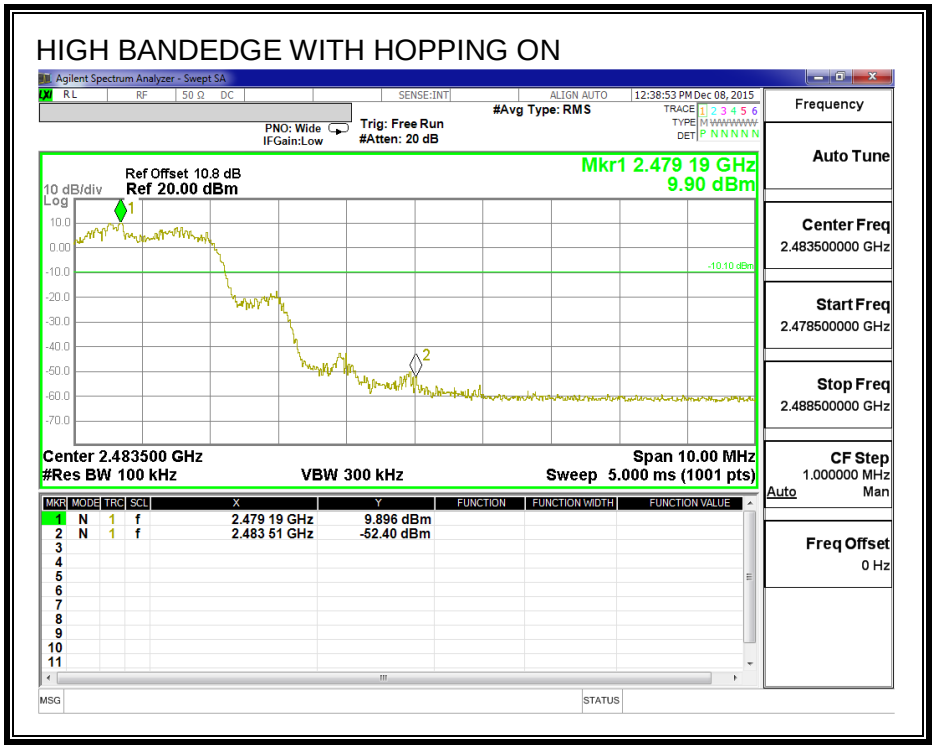


SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

LOW BANDEDGE WITH HOPPING ON



HIGH BANDEDGE WITH HOPPING ON



8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN, Section 8.9 and 8.10.

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 measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. 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 1 MHz resolution bandwidth with 1/T (10 Hz) video bandwidth with peak detector 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.

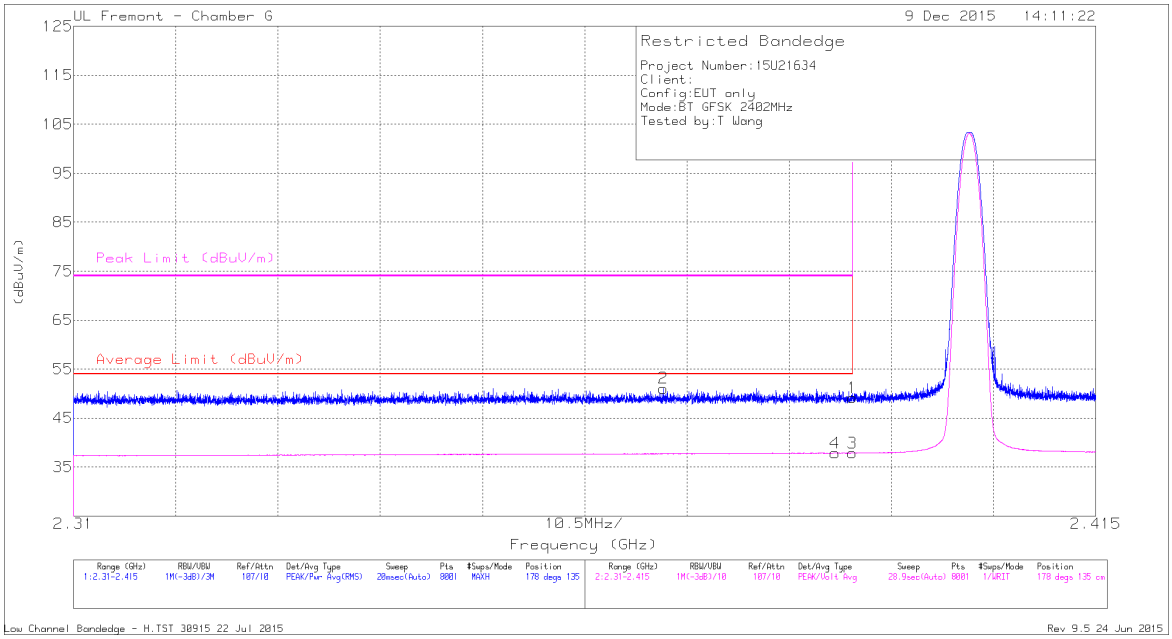
RESULTS

8.2. TRANSMITTER ABOVE 1 GHz

8.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL HORIZONTAL PLOT



DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	41.78	Pk	31.9	-24.5	49.18	-	-	74	-24.82	178	135	H
2	* 2.371	43.8	Pk	31.8	-24.5	51.1	-	-	74	-22.9	178	135	H
3	* 2.39	30.45	VA1T	31.9	-24.5	37.85	54	-16.15	-	-	178	135	H
4	* 2.388	30.57	VA1T	31.8	-24.5	37.87	54	-16.13	-	-	178	135	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

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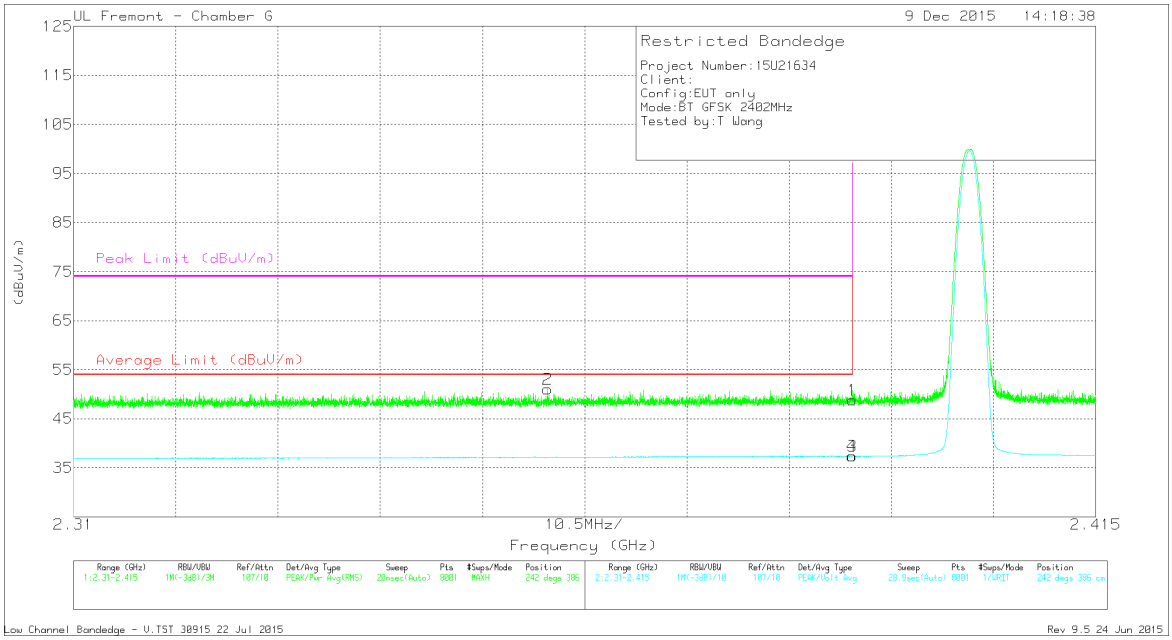
RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL VERTICAL PLOT



DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	41.38	Pk	31.9	-24.5	48.78	-	-	74	-25.22	242	386	V
2	* 2.359	43.8	Pk	31.7	-24.5	51	-	-	74	-23	242	386	V
3	* 2.39	29.94	VA1T	31.9	-24.5	37.34	54	-16.66	-	-	242	386	V
4	* 2.39	29.96	VA1T	31.9	-24.5	37.36	54	-16.64	-	-	242	386	V

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

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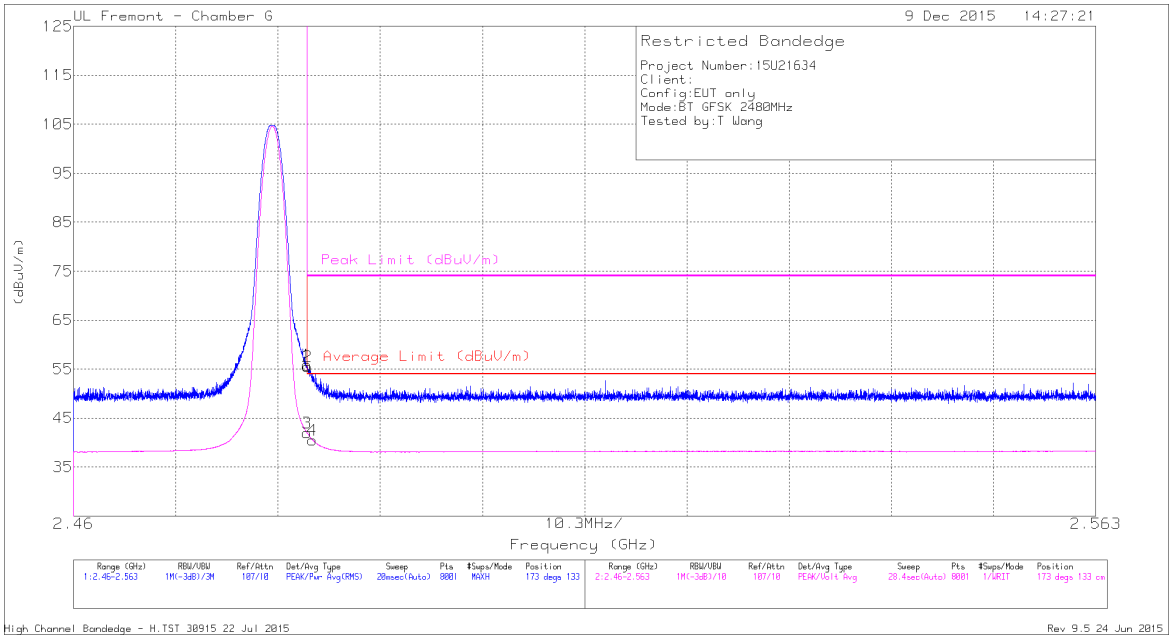
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL HORIZONTAL PLOT



DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	48.02	Pk	32.3	-24.5	55.82	-	-	74	-18.18	173	133	H
2	* 2.484	47.65	Pk	32.3	-24.5	55.45	-	-	74	-18.55	173	133	H
3	* 2.484	34.22	VA1T	32.3	-24.5	42.02	54	-11.98	-	-	173	133	H
4	* 2.484	32.72	VA1T	32.3	-24.5	40.52	54	-13.48	-	-	173	133	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

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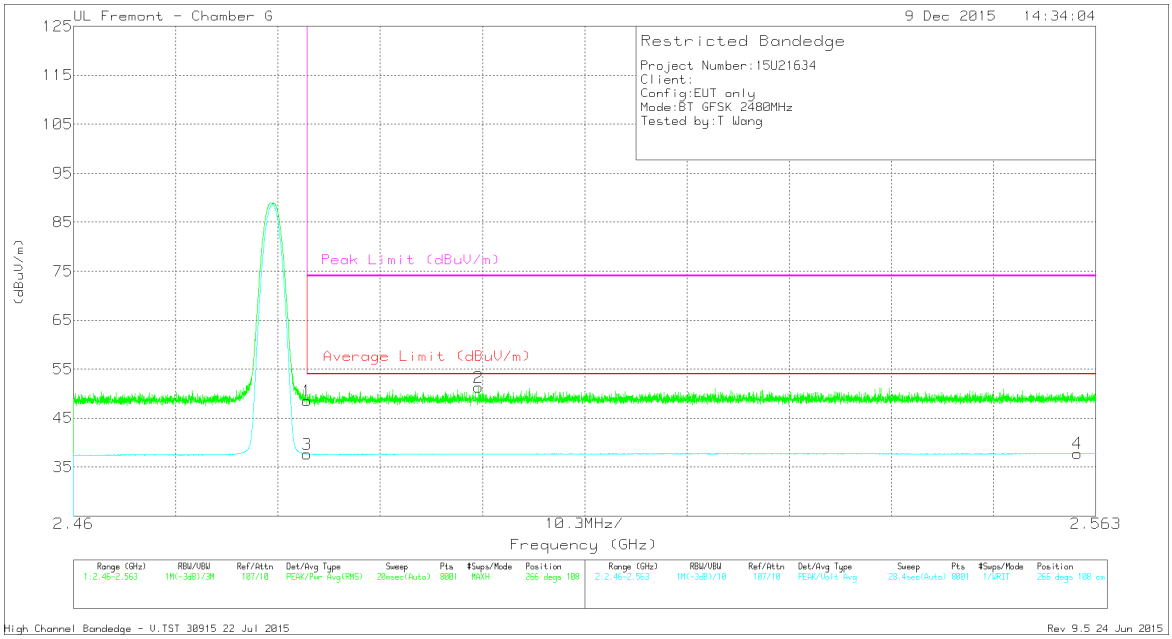
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL VERTICAL PLOT



DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (dB/m)	Amp/Cbl/ Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	40.75	Pk	32.3	-24.5	48.55	-	-	74	-25.45	266	108	V
3	* 2.484	29.85	VA1T	32.3	-24.5	37.65	54	-16.35	-	-	266	108	V
2	2.501	43.54	Pk	32.3	-24.5	51.34	-	-	74	-22.66	266	108	V
4	2.561	29.91	VA1T	32.4	-24.5	37.81	54	-16.19	-	-	266	108	V

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

High Channel Bandedge - V.TST 30915 22 Jul 2015

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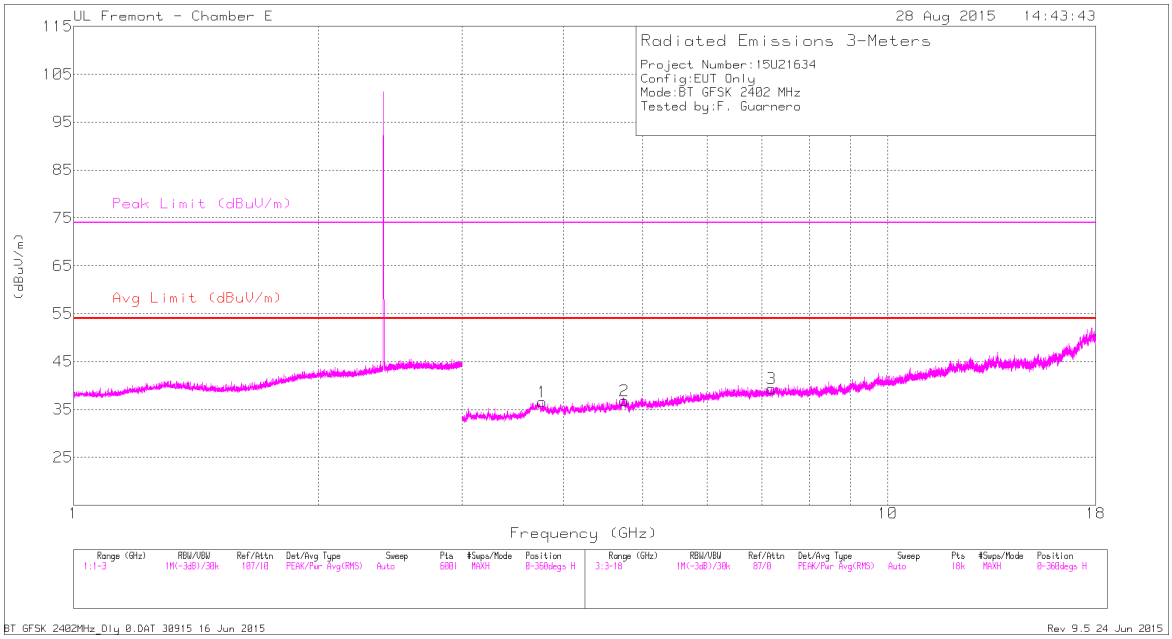
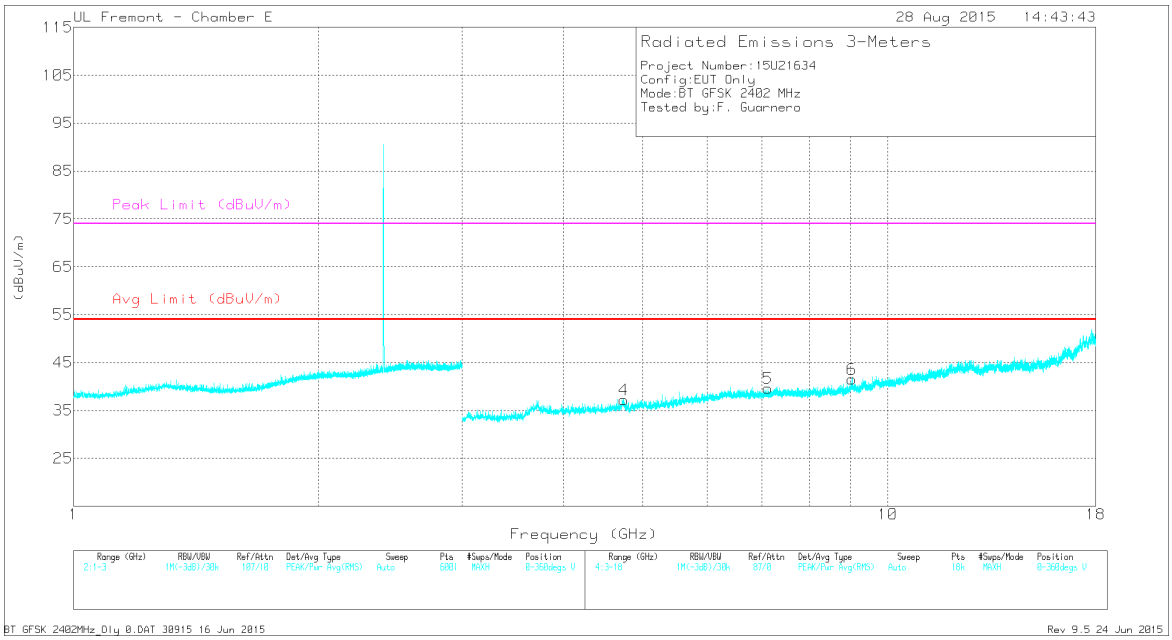
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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
* 3.766	41.78	PK3	33.1	-32.1	42.78	-	-	74	-31.22	8	127	H
* 3.765	29.02	VA1T	33.1	-32	30.12	54	-23.88	-	-	8	127	H
* 4.803	41.65	PK3	34	-32.7	42.95	-	-	74	-31.05	272	131	H
* 4.802	28.98	VA1T	34	-32.7	30.28	54	-23.72	-	-	272	131	H
* 4.803	41.62	PK3	34	-32.7	42.92	-	-	74	-31.08	63	220	V
* 4.804	30.27	VA1T	34	-32.7	31.57	54	-22.43	-	-	63	220	V
* 9.035	39.51	PK3	36.2	-28.1	47.61	-	-	74	-26.39	89	333	V
* 9.032	26.62	VA1T	36.2	-28	34.82	54	-19.18	-	-	89	333	V
7.207	40.35	PK3	35.6	-30.3	45.65	-	-	-	-	105	158	H
7.207	40.49	PK3	35.6	-30.3	45.79	-	-	-	-	208	238	V

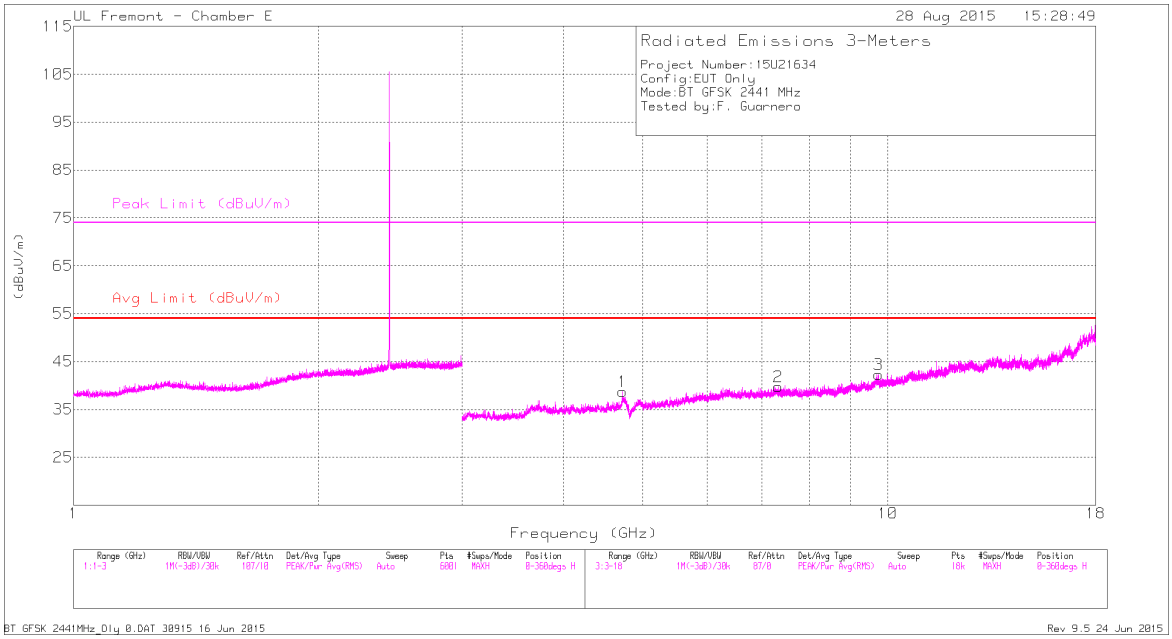
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

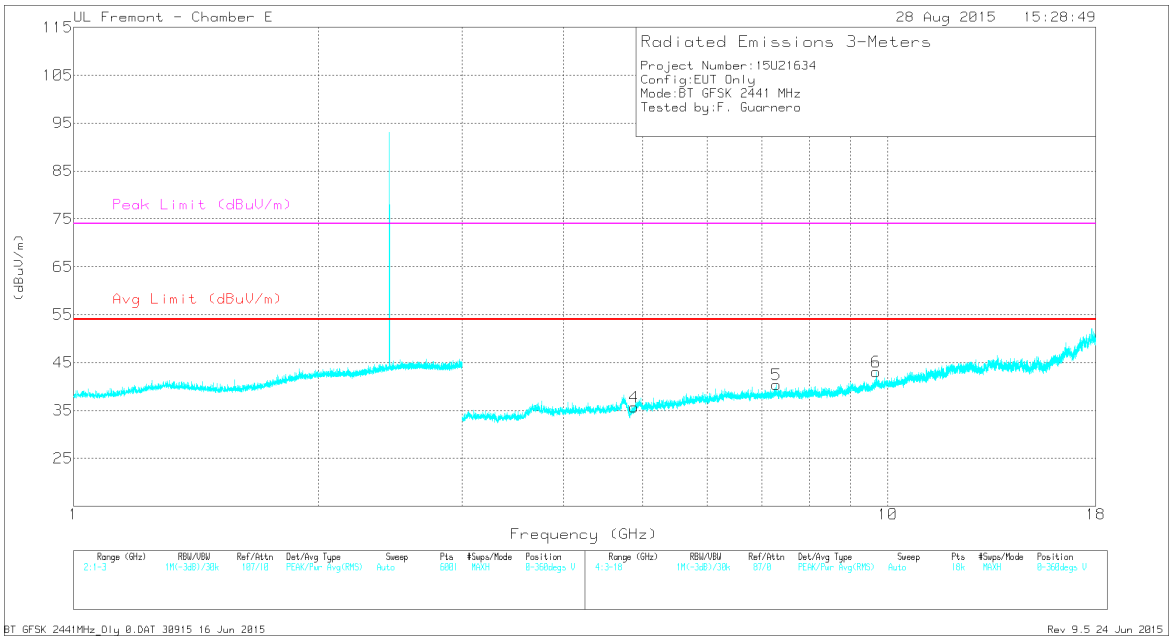
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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
* 4.722	44.06	PK3	33.9	-32.3	45.66	-	-	74	-28.34	348	151	H
* 4.72	30.91	VA1T	33.9	-32.3	32.51	54	-21.49	-	-	348	151	H
* 7.333	40.83	PK3	35.6	-30.6	45.83	-	-	74	-28.17	4	212	H
* 7.331	28.1	VA1T	35.6	-30.7	33	54	-21	-	-	4	212	H
* 4.881	39.87	PK3	34	-32.5	41.37	-	-	74	-32.63	158	133	V
* 4.882	27.58	VA1T	34	-32.5	29.08	54	-24.92	-	-	158	133	V
* 7.299	40.81	PK3	35.6	-30.1	46.31	-	-	74	-27.69	228	333	V
* 7.298	27.75	VA1T	35.6	-30.1	33.25	54	-20.75	-	-	228	333	V
9.68	25.76	VA1T	36.8	-27.1	35.46	-	-	-	-	209	115	V
9.683	38.34	PK3	36.8	-27.1	48.04	-	-	-	-	209	115	V
9.766	38.75	PK3	36.8	-28	47.55	-	-	-	-	36	191	H

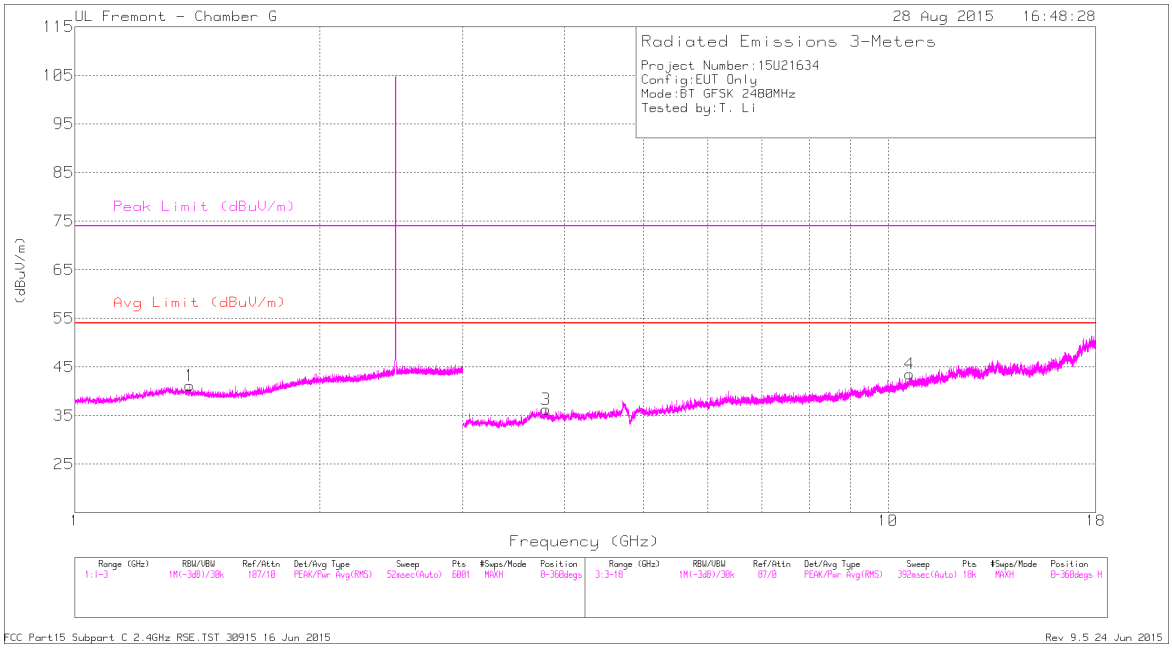
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

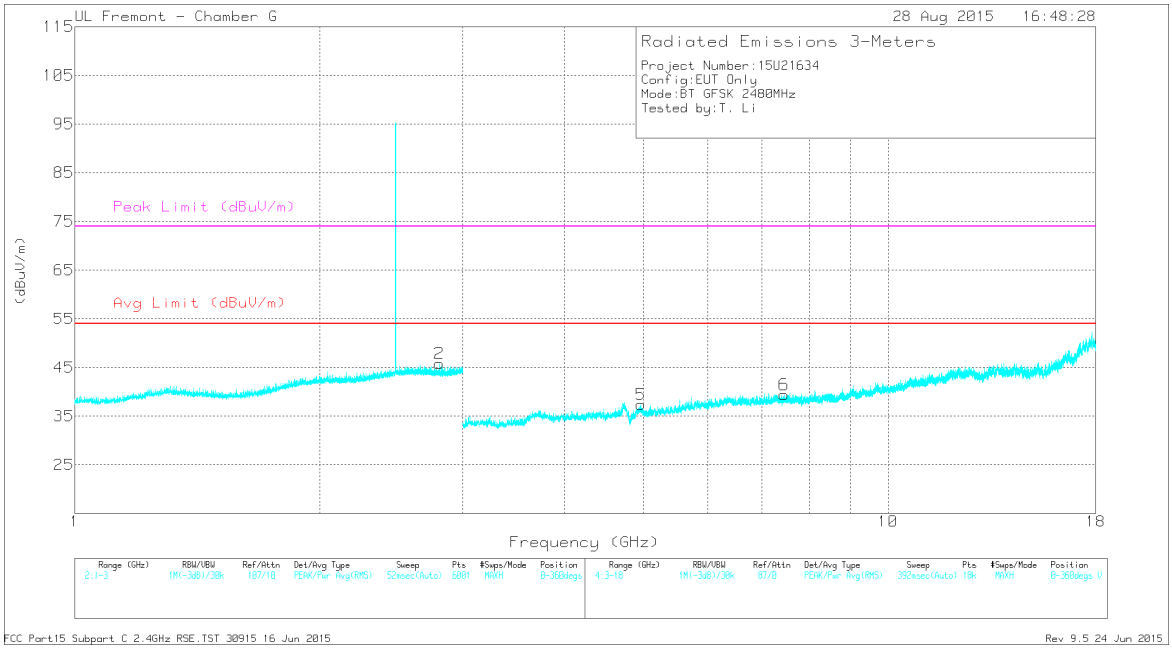
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	* 1.385	44.12	PK3	28.9	-25.5	47.52	-	-	74	-26.48	118	216	H
	* 1.383	30.91	VA1T	28.9	-25.5	34.31	54	-19.69	-	-	118	216	H
2	* 2.809	43.92	PK3	32.3	-24.4	51.82	-	-	74	-22.18	113	131	V
	* 2.809	30.44	VA1T	32.3	-24.4	38.34	54	-15.66	-	-	113	131	V
3	* 3.794	42.72	PK3	33.1	-32.4	43.42	-	-	74	-30.58	297	211	H
	* 3.795	29.59	VA1T	33.1	-32.4	30.29	54	-23.71	-	-	297	211	H
4	* 10.632	38.5	PK3	37.8	-26.3	50	-	-	74	-24	199	127	H
	* 10.63	25.2	VA1T	37.8	-26.3	36.7	54	-17.3	-	-	199	127	H
5	* 4.969	43.2	PK3	34.2	-32.4	45	-	-	74	-29	164	312	V
	* 4.967	29.92	VA1T	34.2	-32.4	31.72	54	-22.28	-	-	164	312	V
6	* 7.45	41.19	PK3	35.5	-30.5	46.19	-	-	74	-27.81	235	127	V
	* 7.447	28.15	VA1T	35.5	-30.6	33.05	54	-20.95	-	-	235	127	V

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

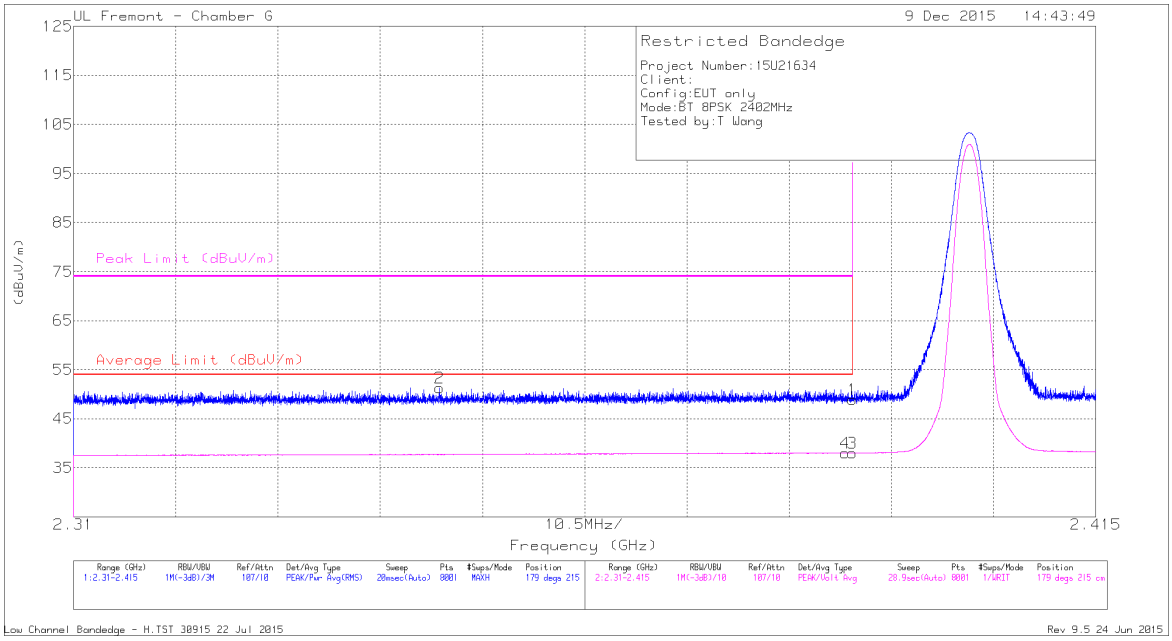
PK3 - FHSS Method: Maximum Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

8.2.2. ENHANCED DATA RATE 8PSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

LOW CHANNEL HORIZONTAL PLOT



DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	41.57	Pk	31.9	-24.5	48.97	-	-	74	-25.03	179	215	H
2	* 2.348	44.05	Pk	31.7	-24.5	51.25	-	-	74	-22.75	179	215	H
3	* 2.39	30.57	VA1T	31.9	-24.5	37.97	54	-16.03	-	-	179	215	H
4	* 2.389	30.64	VA1T	31.9	-24.5	38.04	54	-15.96	-	-	179	215	H

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

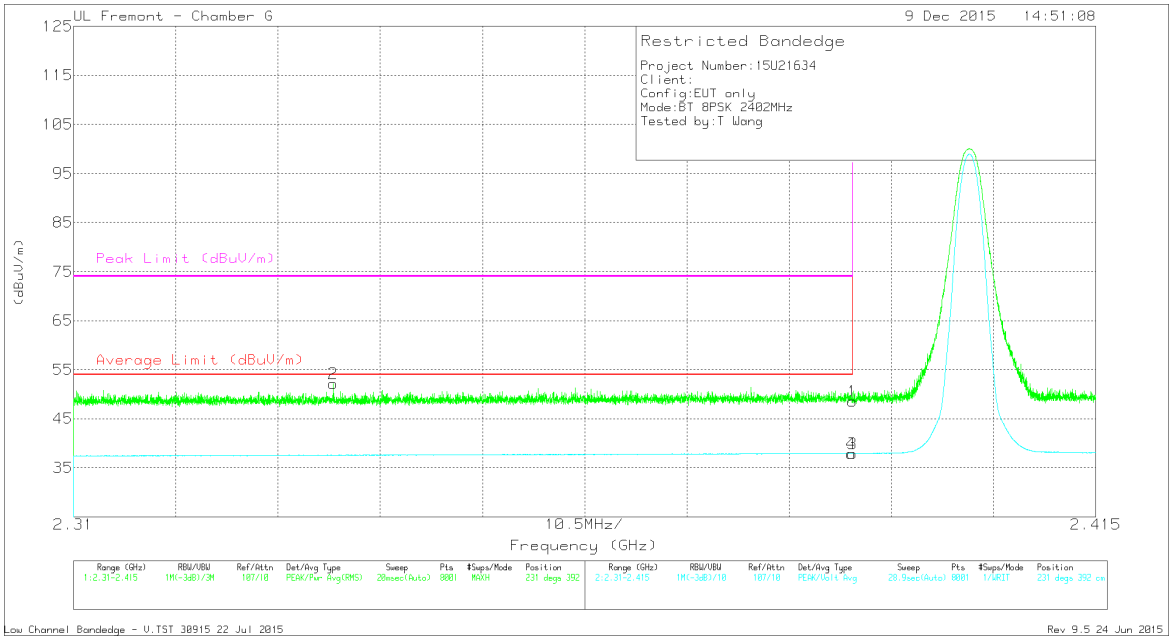
Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

Low Channel Bandedge - H.TST 30915 22 Jul 2015

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)

LOW CHANNEL VERTICAL PLOT



DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	41.17	Pk	31.9	-24.5	48.57	-	-	74	-25.43	231	392	V
2	* 2.337	45.06	Pk	31.7	-24.6	52.16	-	-	74	-21.84	231	392	V
3	* 2.39	30.47	VA1T	31.9	-24.5	37.87	54	-16.13	-	-	231	392	V
4	* 2.39	30.52	VA1T	31.9	-24.5	37.92	54	-16.08	-	-	231	392	V

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

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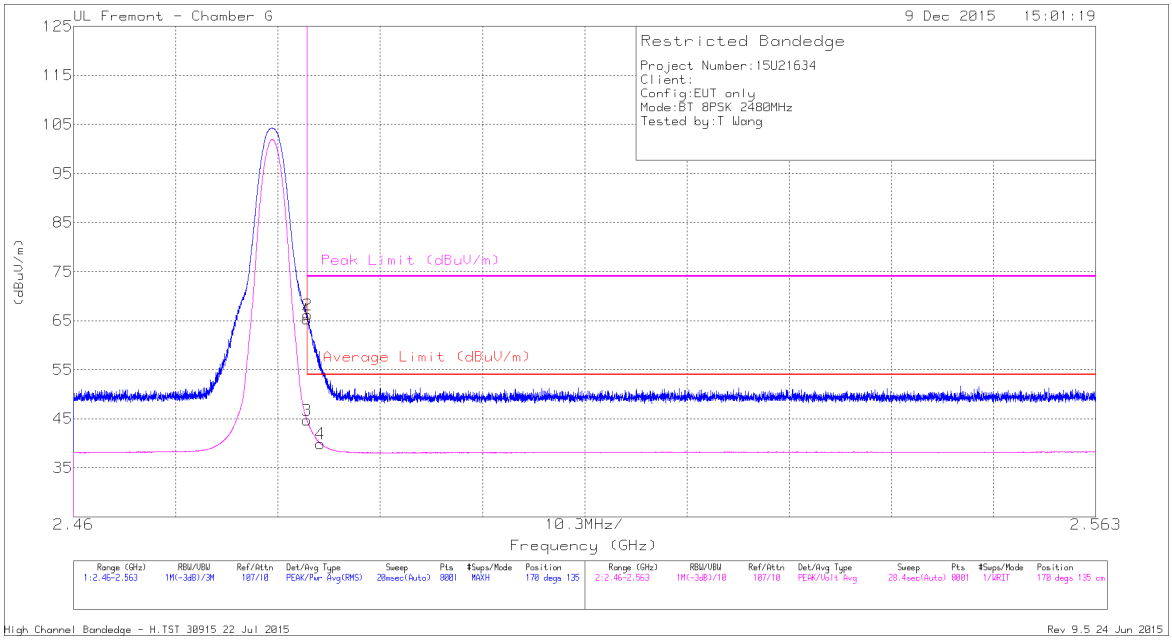
RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)

HIGH CHANNEL HORIZONTAL PLOT



DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	57.54	Pk	32.3	-24.5	65.34	-	-	74	-8.66	170	135	H
2	* 2.484	58.33	Pk	32.3	-24.5	66.13	-	-	74	-7.87	170	135	H
3	* 2.484	36.91	VA1T	32.3	-24.5	44.71	54	-9.29	-	-	170	135	H
4	* 2.485	32.12	VA1T	32.3	-24.5	39.92	54	-14.08	-	-	170	135	H

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

Pk - Peak detector

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

High Channel Bandedge - H.TST 30915 22 Jul 2015

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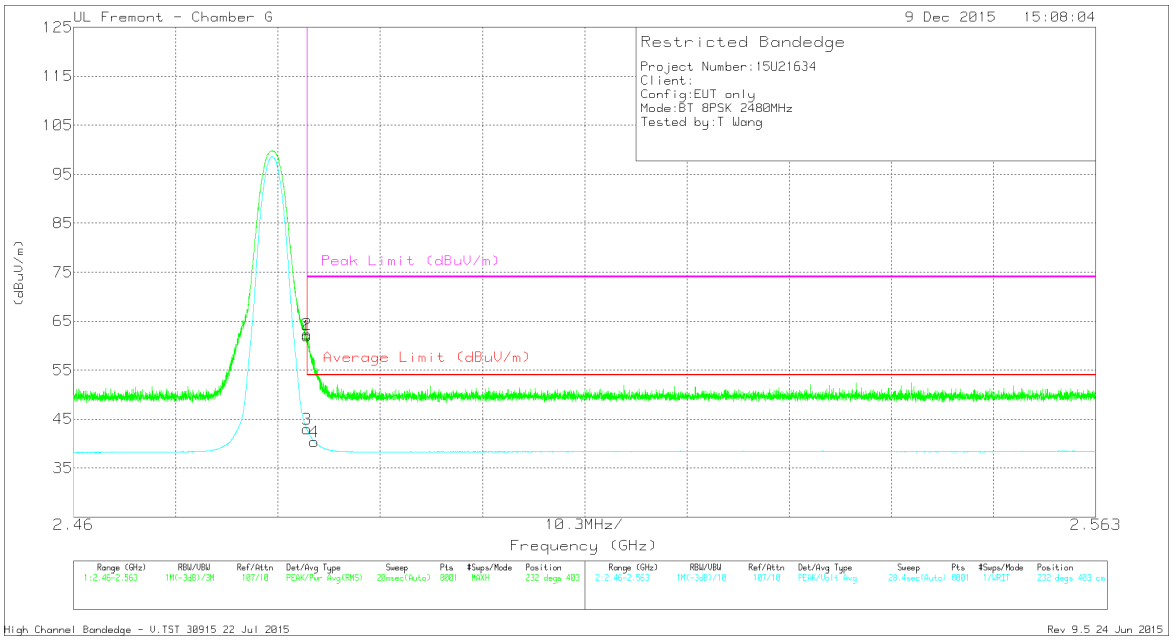
RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)

HIGH CHANNEL VERTICAL PLOT



DATA

Trace Markers

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	54.12	Pk	32.3	-24.5	61.92	-	-	74	-12.08	232	403	V
2	* 2.484	54.53	Pk	32.3	-24.5	62.33	-	-	74	-11.67	232	403	V
3	* 2.484	35.11	VA1T	32.3	-24.5	42.91	54	-11.09	-	-	232	403	V
4	* 2.484	32.6	VA1T	32.3	-24.5	40.4	54	-13.6	-	-	232	403	V

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

Pk - Peak detector

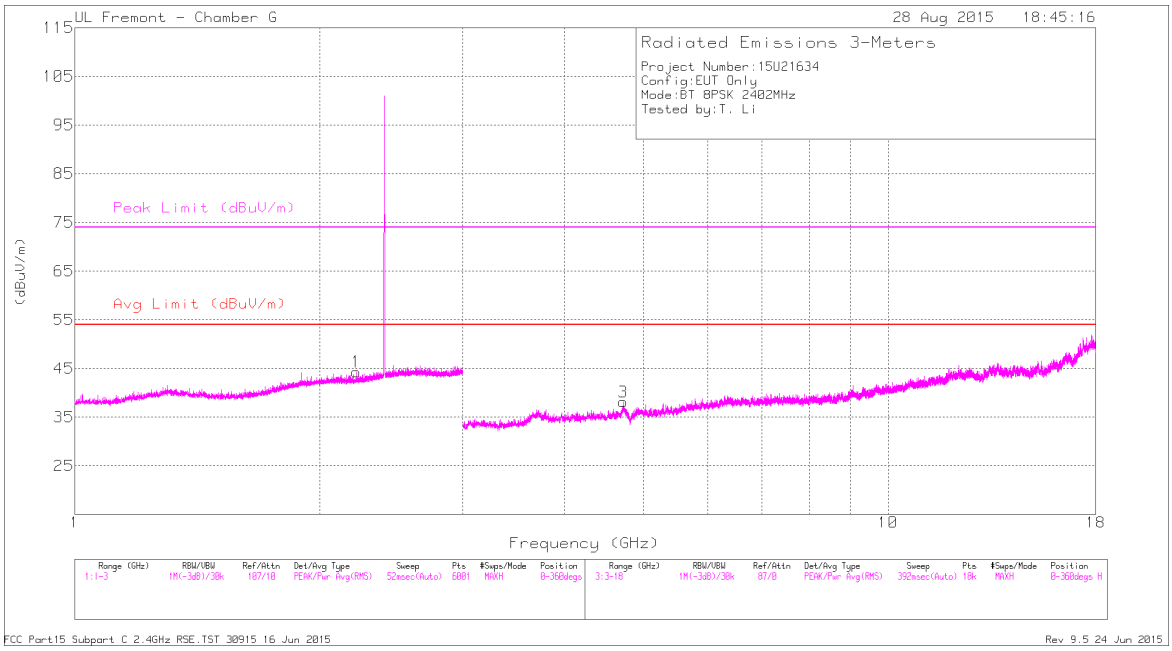
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

High Channel Bandedge - V.TST 30915 22 Jul 2015

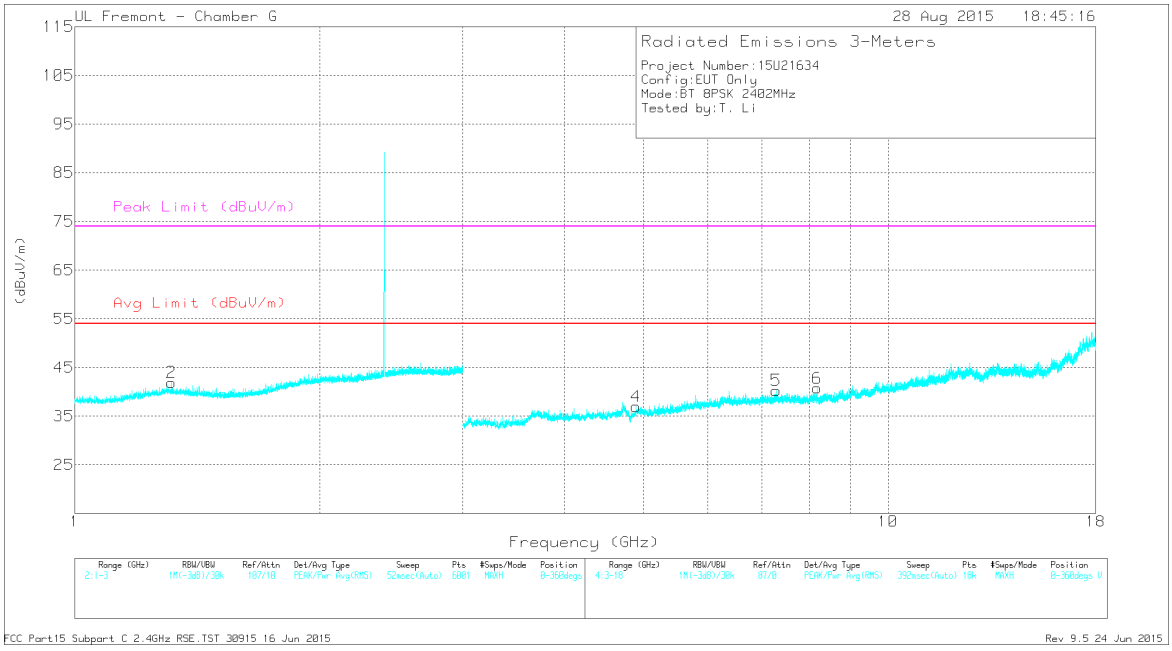
Rev 9.5 24 Jun 2015

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL HORIZONTAL PLOT



LOW CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	* 2.217	42.67	PK3	31.2	-24.7	49.17	-	-	74	-24.83	200	317	H
	* 2.218	29.55	VA1T	31.2	-24.7	36.05	54	-17.95	-	-	200	317	H
2	* 1.313	44.21	PK3	29.3	-25.6	47.91	-	-	74	-26.09	177	196	V
	* 1.314	30.95	VA1T	29.3	-25.6	34.65	54	-19.35	-	-	177	196	V
3	* 4.724	44.32	PK3	33.9	-32.3	45.92	-	-	74	-28.08	66	238	H
	* 4.721	30.87	VA1T	33.9	-32.3	32.47	54	-21.53	-	-	66	238	H
4	* 4.897	41.39	PK3	34.1	-32.5	42.99	-	-	74	-31.01	118	201	V
	* 4.897	28.75	VA1T	34.1	-32.5	30.35	54	-23.65	-	-	118	201	V
5	* 7.283	40.42	PK3	35.6	-29.7	46.32	-	-	74	-27.68	111	292	V
	* 7.285	27.57	VA1T	35.6	-29.8	33.37	54	-20.63	-	-	111	292	V
6	* 8.182	39.6	PK3	35.7	-29.3	46	-	-	74	-28	102	356	V
	* 8.178	26.78	VA1T	35.7	-29.3	33.18	54	-20.82	-	-	102	356	V

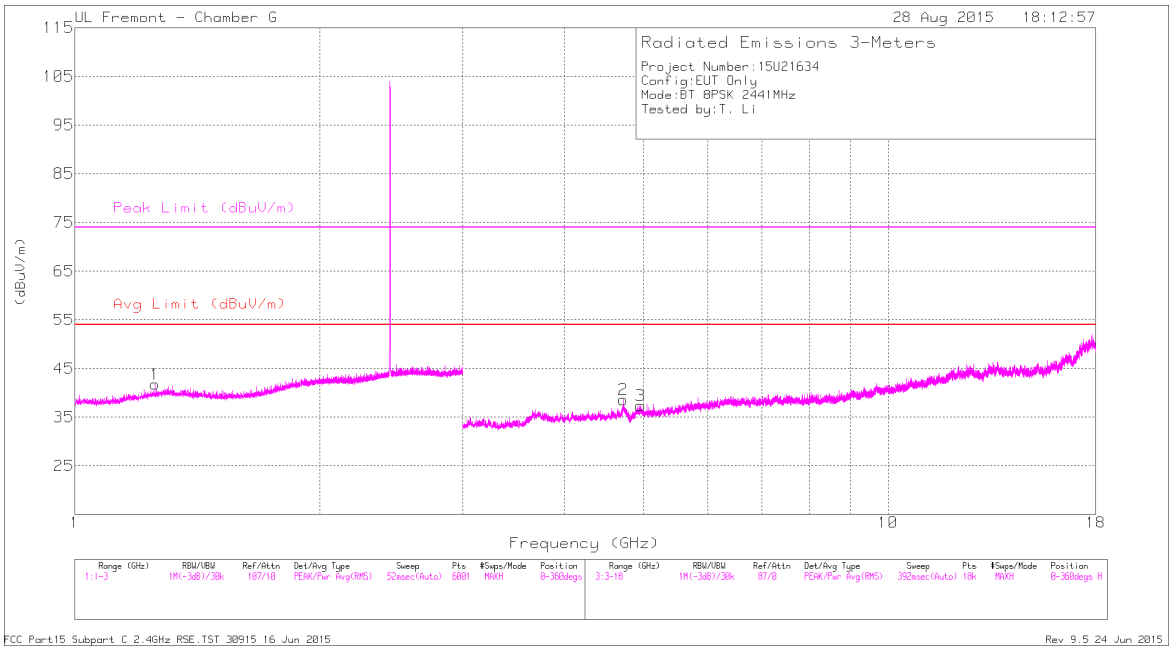
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

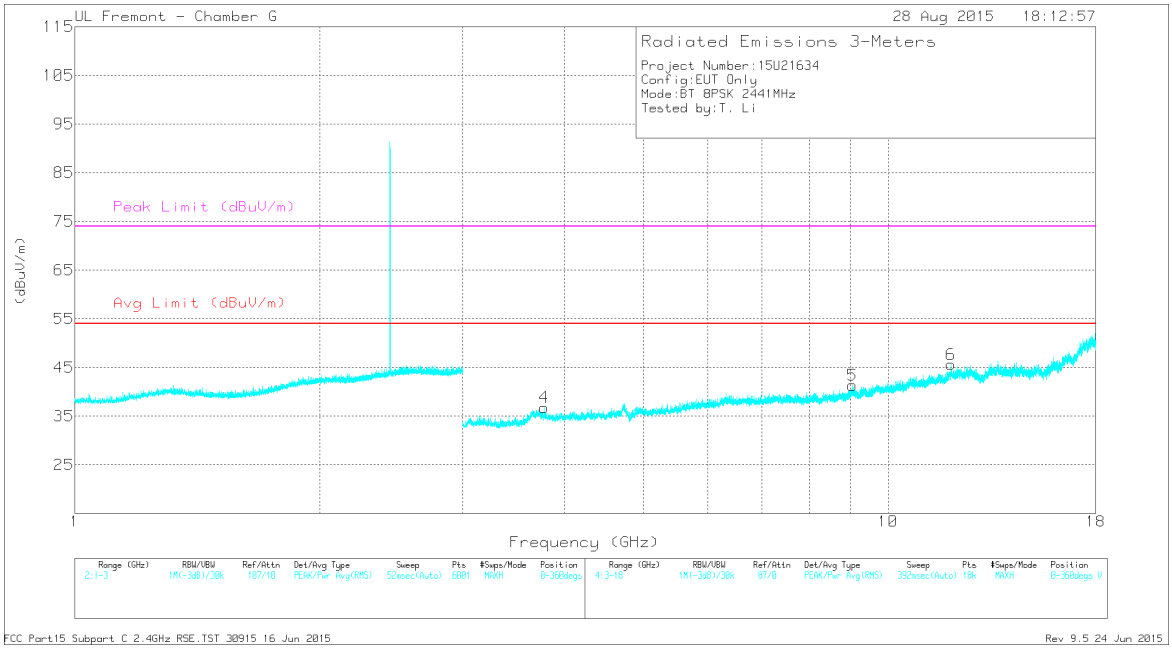
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

MID CHANNEL HORIZONTAL PLOT



MID CHANNEL VERTICAL PLOT



DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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	* 1.254	44.46	PK3	28.9	-25.7	47.66	-	-	74	-26.34	28	267	H
	* 1.255	30.79	VA1T	28.9	-25.7	33.99	54	-20.01	-	-	28	267	H
2	* 4.723	43.69	PK3	33.9	-32.3	45.29	-	-	74	-28.71	150	337	H
	* 4.722	30.37	VA1T	33.9	-32.3	31.97	54	-22.03	-	-	150	337	H
3	* 4.96	43.07	PK3	34.1	-32.4	44.77	-	-	74	-29.23	241	259	H
	* 4.963	29.96	VA1T	34.2	-32.4	31.76	54	-22.24	-	-	241	259	H
4	* 3.779	41.43	PK3	33.1	-32.2	42.33	-	-	74	-31.67	94	313	V
	* 3.78	28.89	VA1T	33.1	-32.2	29.79	54	-24.21	-	-	94	313	V
5	* 9.043	39.35	PK3	36.2	-28.1	47.45	-	-	74	-26.55	155	290	V
	* 9.043	26.5	VA1T	36.2	-28.1	34.6	54	-19.4	-	-	155	290	V
6	* 11.949	38.26	PK3	38.8	-24.9	52.16	-	-	74	-21.84	193	342	V
	* 11.95	24.9	VA1T	38.8	-24.9	38.8	54	-15.2	-	-	193	342	V

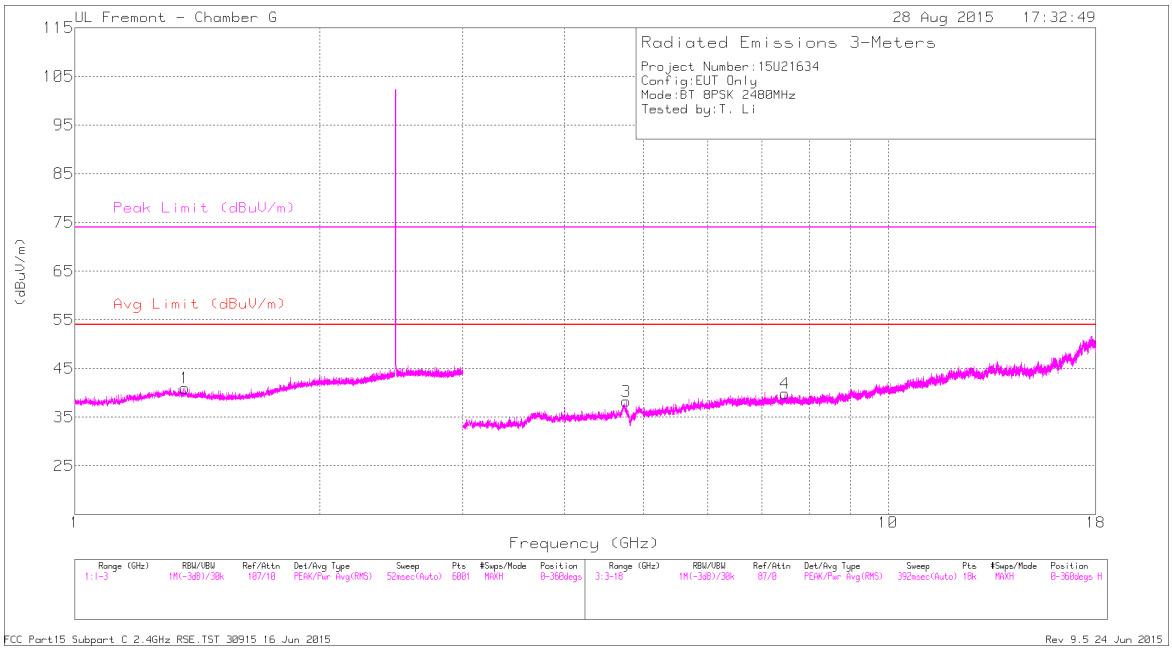
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

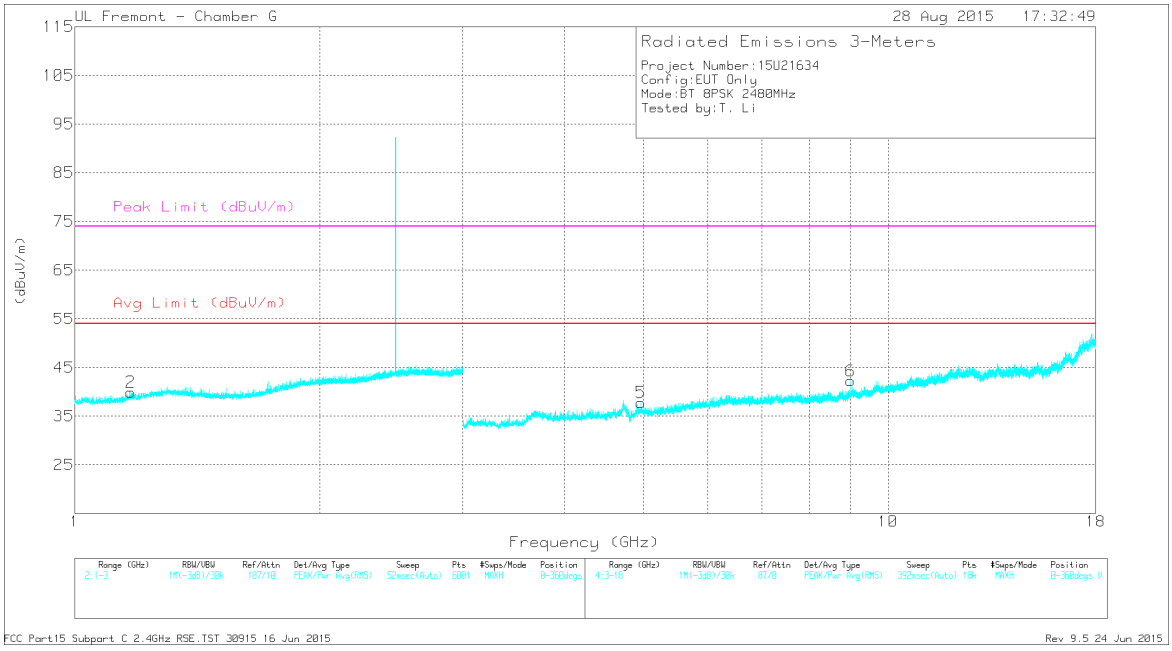
VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

HARMONICS AND SPURIOUS EMISSIONS

HIGH CHANNEL HORIZONTAL PLOT



HIGH CHANNEL VERTICAL PLOT



DATA

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T862 (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
* 1.363	44.84	PK3	29	-25.5	48.34	-	-	74	-25.66	161	219	H
* 1.366	31.01	VA1T	29	-25.5	34.51	54	-19.49	-	-	161	219	H
* 1.171	44.16	PK3	28	-25.7	46.46	-	-	74	-27.54	110	127	V
* 1.171	31.15	VA1T	28.1	-25.7	33.55	54	-20.45	-	-	110	127	V
* 4.768	43.82	PK3	34	-32.5	45.32	-	-	74	-28.68	0	152	H
* 4.769	31.21	VA1T	34	-32.5	32.71	54	-21.29	-	-	0	152	H
* 7.474	40.75	PK3	35.5	-30.1	46.15	-	-	74	-27.85	71	169	H
* 7.471	27.86	VA1T	35.5	-30.1	33.26	54	-20.74	-	-	71	169	H
* 4.965	42.94	PK3	34.2	-32.4	44.74	-	-	74	-29.26	270	218	V
* 4.965	30.07	VA1T	34.2	-32.4	31.87	54	-22.13	-	-	270	218	V
8.997	26.65	VA1T	36.2	-28.7	34.15	-	-	-	-	115	306	V
8.999	40.12	PK3	36.2	-28.6	47.72	-	-	-	-	115	306	V

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

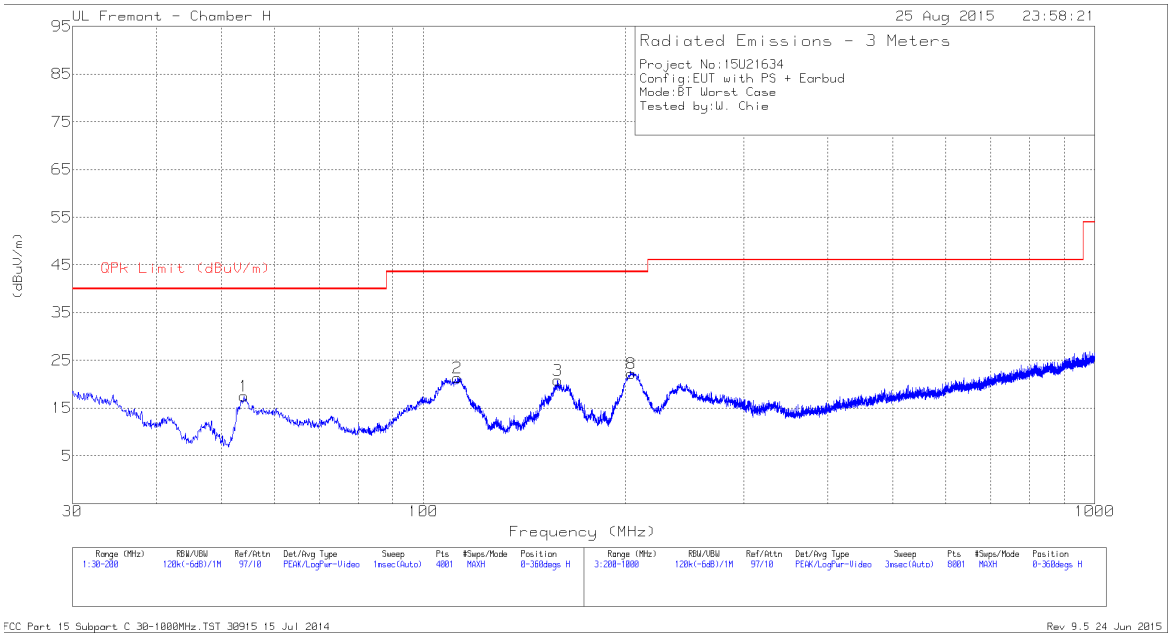
PK3 - FHSS Method: Maximum Peak

VA1T - FHSS: Linear Voltage Average VB=1/Ton where: Ton is transmit duration

8.3. WORST-CASE BELOW 1 GHz

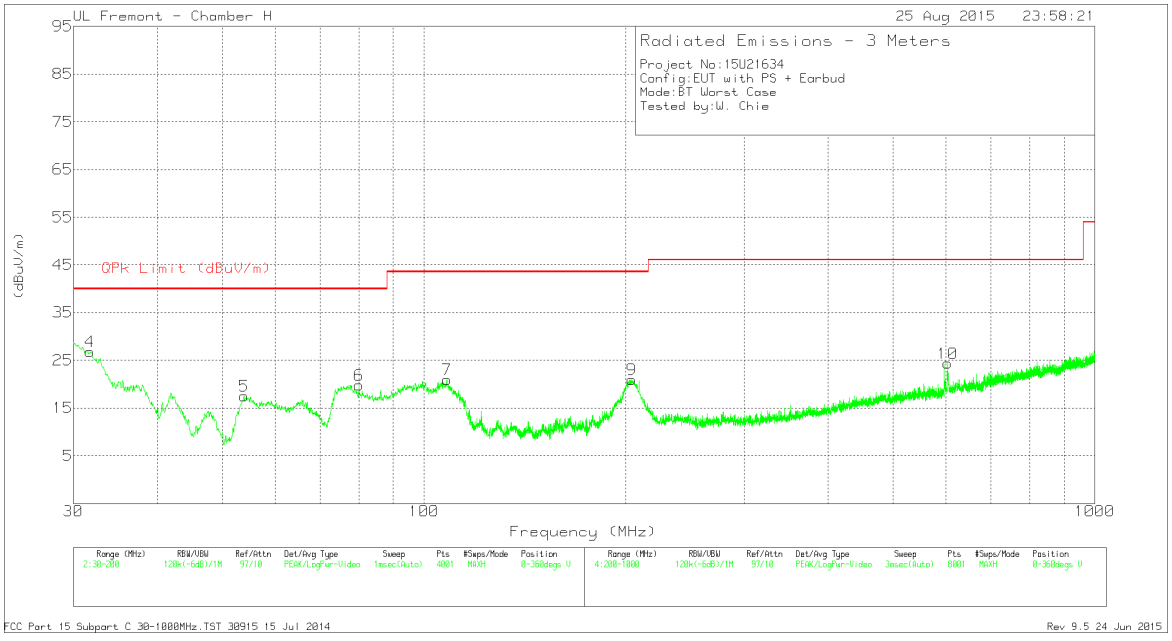
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, HORIZONTAL)

HORIZONTAL PLOT



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

VERTICAL PLOT



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T900 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 112.4925	38.88	Pk	12.9	-30.4	21.38	43.52	-22.14	0-360	301	H
7	* 108.2213	39.4	Pk	12.1	-30.5	21	43.52	-22.52	0-360	100	V
4	31.785	37.32	Pk	20.8	-31.3	26.82	40	-13.18	0-360	100	V
5	53.885	41.19	Pk	7.2	-30.9	17.49	40	-22.51	0-360	100	V
1	54.055	41.18	Pk	7.2	-30.9	17.48	40	-22.52	0-360	401	H
6	80.0225	42.73	Pk	7.8	-30.7	19.83	40	-20.17	0-360	100	V
3	158.3925	38.72	Pk	12.1	-30	20.82	43.52	-22.7	0-360	201	H
9	203.9	39.42	Pk	11.2	-29.7	20.92	43.52	-22.6	0-360	100	V
8	204	40.79	Pk	11.2	-29.7	22.29	43.52	-21.23	0-360	201	H
10	603.9	33.45	Pk	18.8	-27.9	24.35	46.02	-21.67	0-360	100	V

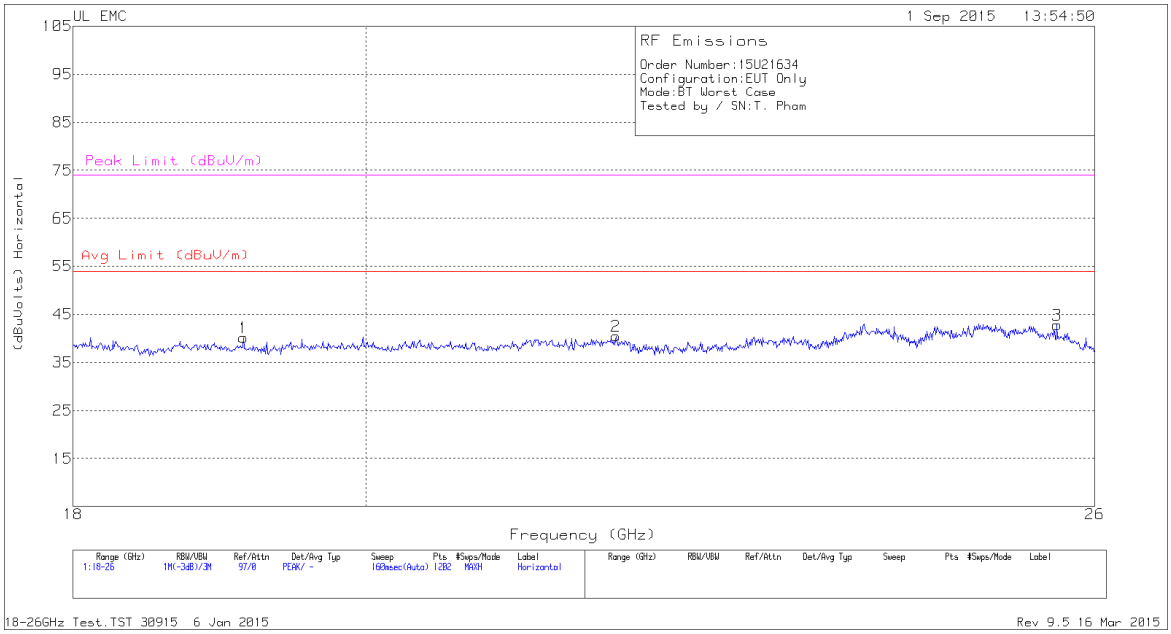
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

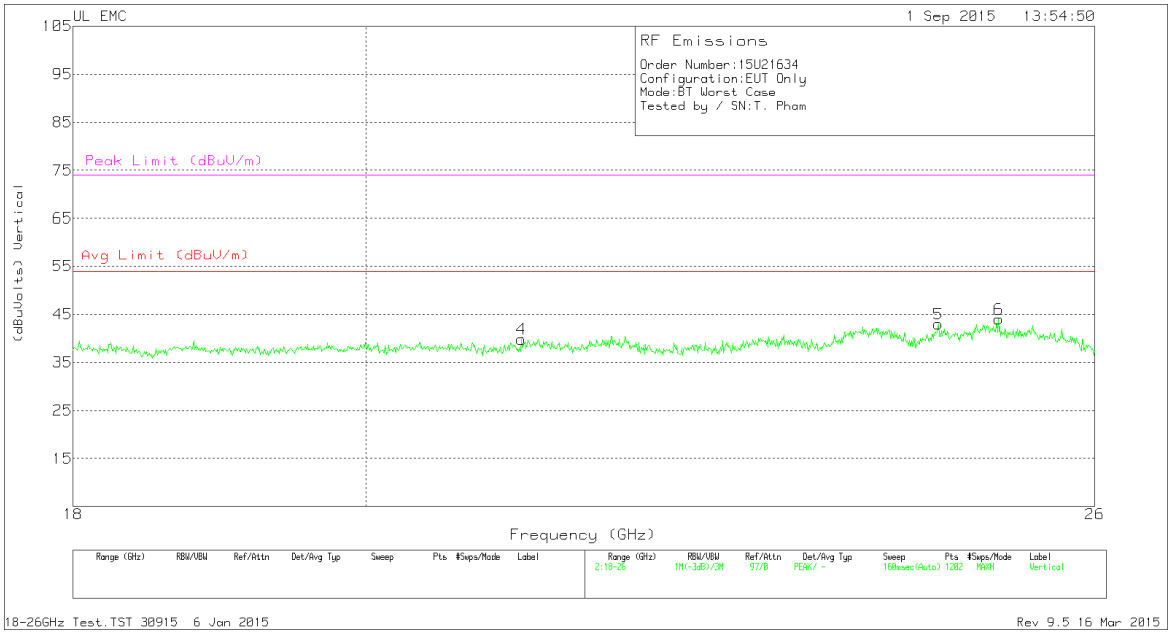
8.4. WORST-CASE ABOVE 18 GHz

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

HORIZONTAL PLOT



VERTICAL PLOT



Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	T89 AF (dB/m)	Amp/Cbl (dB)	Dist Corr (dB)	Corrected Reading (dBuVolts)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)
1	19.139	42.17	Pk	32.2	-24.7	-9.5	40.16	54	-13.83	74	-33.83
2	21.883	41.9	Pk	33.3	-25.2	-9.5	40.5	54	-13.5	74	-33.5
3	25.647	43.33	Pk	34.1	-25.1	-9.5	42.83	54	-11.16	74	-31.16
4	21.151	41.73	Pk	32.9	-25.3	-9.5	39.83	54	-14.16	74	-34.16
5	24.575	42.6	Pk	33.9	-24	-9.5	43	54	-11	74	-31
6	25.114	44.1	Pk	33.9	-24.5	-9.5	44	54	-10	74	-30

Pk - Peak detector

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	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 C63.10.

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

9.1. EUT POWERED BY AC/DC ADAPTER VIA USB CABLE

Line-L1 .15 - 30MHz

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.168	45.37	Pk	1.2	0	46.57	65.06	-18.49		
2	.168	24.34	Av	1.2	0	25.54	-	-	55.06	-29.52
3	.8025	44.25	Pk	.3	0	44.55	56	-11.45		
4	.807	27.15	Av	.3	0	27.45	-	-	46	-18.55
5	1.464	29.33	Pk	.2	.1	29.63	56	-26.37		
6	1.4685	16.8	Av	.2	.1	17.1	-	-	46	-28.9
7	6.0855	29.03	Pk	.2	.1	29.33	60	-30.67		
8	6.0855	18.76	Av	.2	.1	19.06	-	-	50	-30.94
9	26.601	22.07	Pk	.3	.3	22.67	60	-37.33		
10	26.60775	10.22	Av	.3	.3	10.82	-	-	50	-39.18

Line-L2 .15 - 30MHz

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
11	.1635	44.48	Pk	1.3	0	45.78	65.28	-19.5		
12	.168	24.23	Av	1.3	0	25.53	-	-	55.06	-29.53
13	.8025	42.65	Pk	.3	0	42.95	56	-13.05		
14	.8025	29.44	Av	.3	0	29.74	-	-	46	-16.26
15	1.491	29.03	Pk	.2	.1	29.33	56	-26.67		
16	1.473	17.98	Av	.2	.1	18.28	-	-	46	-27.72
17	6.9405	28.13	Pk	.2	.1	28.43	60	-31.57		
18	6.918	18.03	Av	.2	.1	18.33	-	-	50	-31.67
19	25.8225	18.19	Pk	.3	.3	18.79	60	-41.21		
20	25.818	8.13	Av	.3	.3	8.73	-	-	50	-41.27

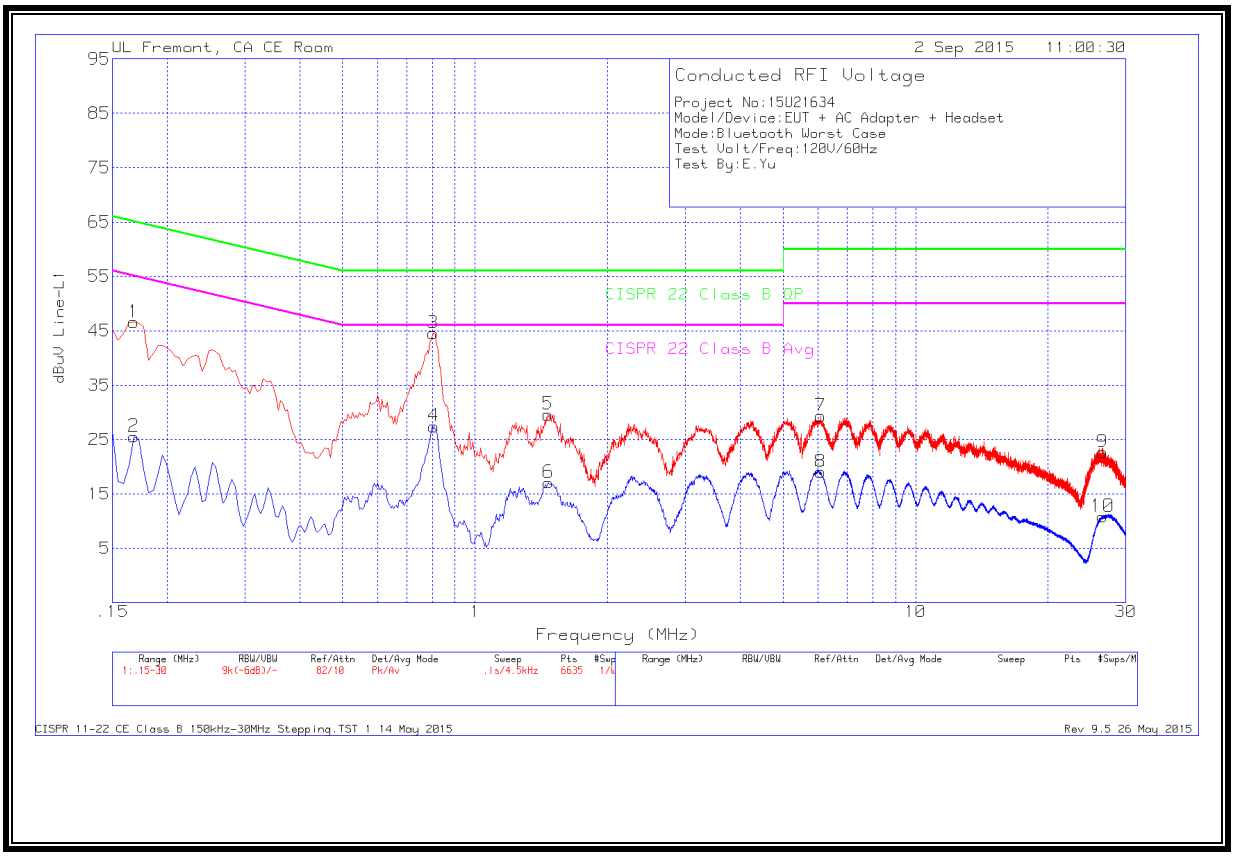
Pk - Peak detector

Av - Average detection

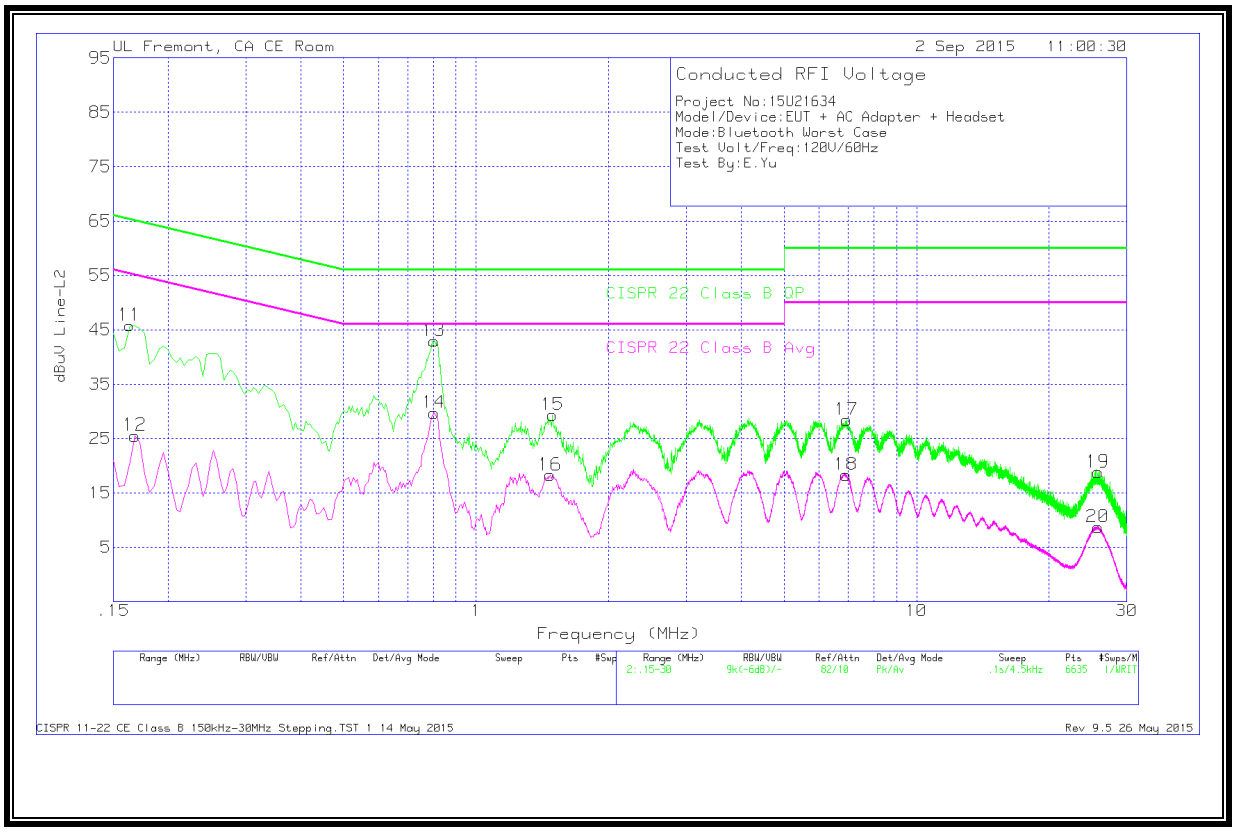
CISPR 11-22 CE Class B 150kHz-30MHz Stepping.TST 1 14 May 2015

Rev 9.5 26 May 2015

LINE 1 RESULTS



LINE 2 RESULTS



9.2. EUT POWERED BY HOST PC VIA USB CABLE

Line-L1 .15 - 30MHz

Range 1: Line-L1 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L1	LC Cables 1&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
1	.168	53.07	Pk	1.2	0	54.27	65.06	-10.79		
2	.168	36.87	Av	1.2	0	38.07	-	-	55.06	-16.99
3	.4155	30.66	Pk	.4	0	31.06	57.54	-26.48		
4	.42	25.58	Av	.4	0	25.98	-	-	47.45	-21.47
5	5.559	24.89	Pk	.2	.1	25.19	60	-34.81		
6	5.559	9.54	Av	.2	.1	9.84	-	-	50	-40.16
7	13.614	31.3	Pk	.2	.2	31.7	60	-28.3		
8	13.578	18.45	Av	.2	.2	18.85	-	-	50	-31.15
9	18.0915	24.35	Pk	.3	.2	24.85	60	-35.15		
10	18.096	11.92	Av	.3	.2	12.42	-	-	50	-37.58

Line-L2 .15 - 30MHz

Range 2: Line-L2 .15 - 30MHz

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2	LC Cables 2&3	Corrected Reading dBuV	CISPR 22 Class B QP	Margin (dB)	CISPR 22 Class B Avg	Margin (dB)
11	.168	52.18	Pk	1.3	0	53.48	65.06	-11.58		
12	.1635	31.62	Av	1.3	0	32.92	-	-	55.28	-22.36
13	.411	34	Pk	.4	0	34.4	57.63	-23.23		
14	.411	26.98	Av	.4	0	27.38	-	-	47.63	-20.25
15	4.596	27.5	Pk	.2	.1	27.8	56	-28.2		
16	4.5915	11.42	Av	.2	.1	11.72	-	-	46	-34.28
17	13.9875	36.01	Pk	.2	.2	36.41	60	-23.59		
18	13.974	21.09	Av	.2	.2	21.49	-	-	50	-28.51
19	17.124	36.07	Pk	.3	.2	36.57	60	-23.43		
20	17.124	12.44	Av	.3	.2	12.94	-	-	50	-37.06

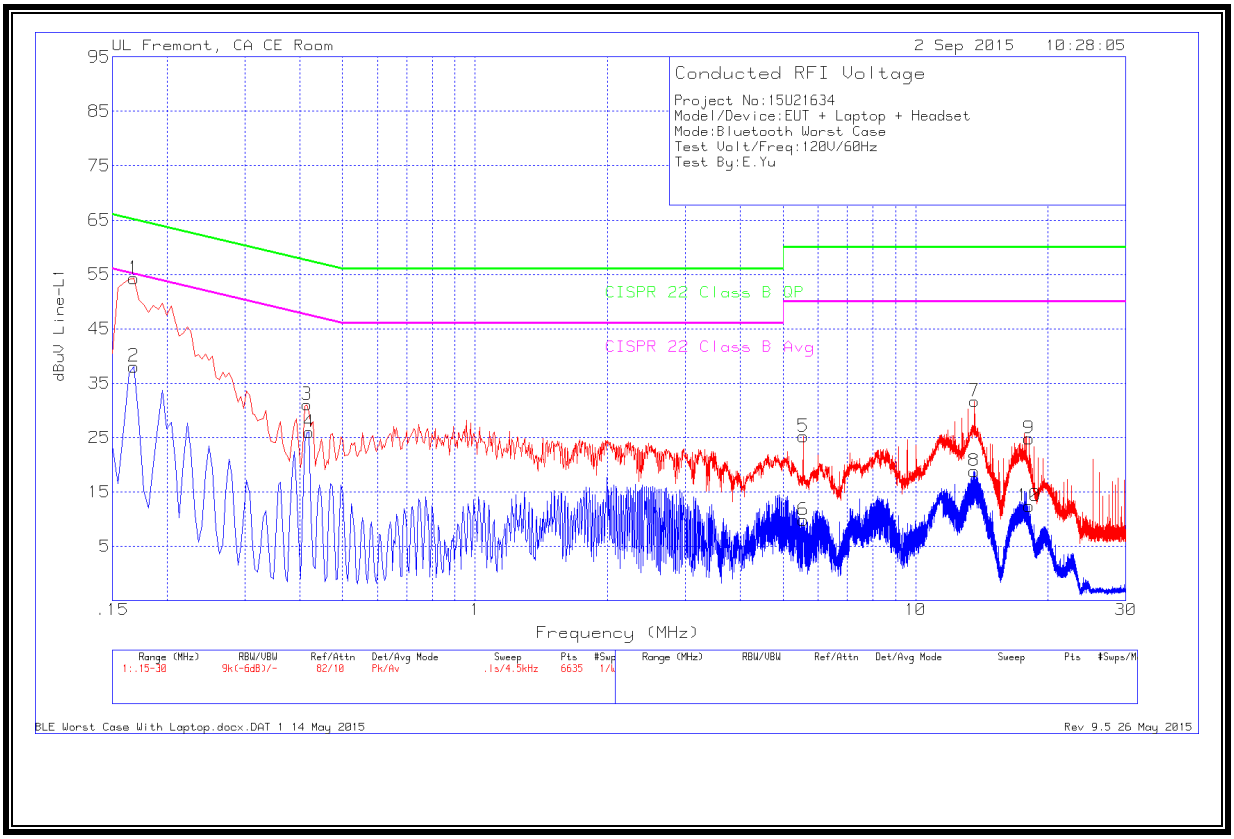
Pk - Peak detector

Av - Average detection

BLE Worst Case With Laptop.docx.DAT 1 14 May 2015

Rev 9.5 26 May 2015

LINE 1 RESULTS



LINE 2 RESULTS