



**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 NUMBERS: A1723, A1724

**FCC ID: BCG-E3042A
IC: 579C-E3042A**

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

Prepared by
UL VERIFICATION SERVICES INC.
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP[®]

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Revision History

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| V1 | 01/22/2016 | Initial Review | M. Mekuria |
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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

MODELS: A1723, A1724

SERIAL NUMBER: C39Q4026GR20 (Radiated) C39QG04YGX9X (Conducted)

DATE TESTED: AUGUST 25, 2015 - 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

MENGISTU MEKURIA
SENIOR ENGINEER
UL VERIFICATION SERVICES INC.

Tested By:

Eric Yu

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 |
|------------------------------------|---|
| <input type="checkbox"/> Chamber A | <input type="checkbox"/> Chamber D |
| <input type="checkbox"/> Chamber B | <input type="checkbox"/> Chamber E |
| <input type="checkbox"/> Chamber C | <input type="checkbox"/> Chamber F |
| | <input type="checkbox"/> Chamber G |
| | <input checked="" type="checkbox"/> 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:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

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 A1723 and A1724 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 | 11.73 | 14.89 |
| 2402 - 2480 | Enhanced 8PSK | 10.83 | 12.11 |

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 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 WiFi/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, 5GHz and Cellular 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 | Apple | MacBook Pro | 73043BDQAGU | N/A |
| Laptop AC/DC adapter | Apple | A1172 | MV7211FJAX4XA | N/A |
| Earphone | Apple | NA | NA | N/A |
| EUT AC/DC adapter | Apple | A1357 | W010A051 | 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 (RADIATED 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 |

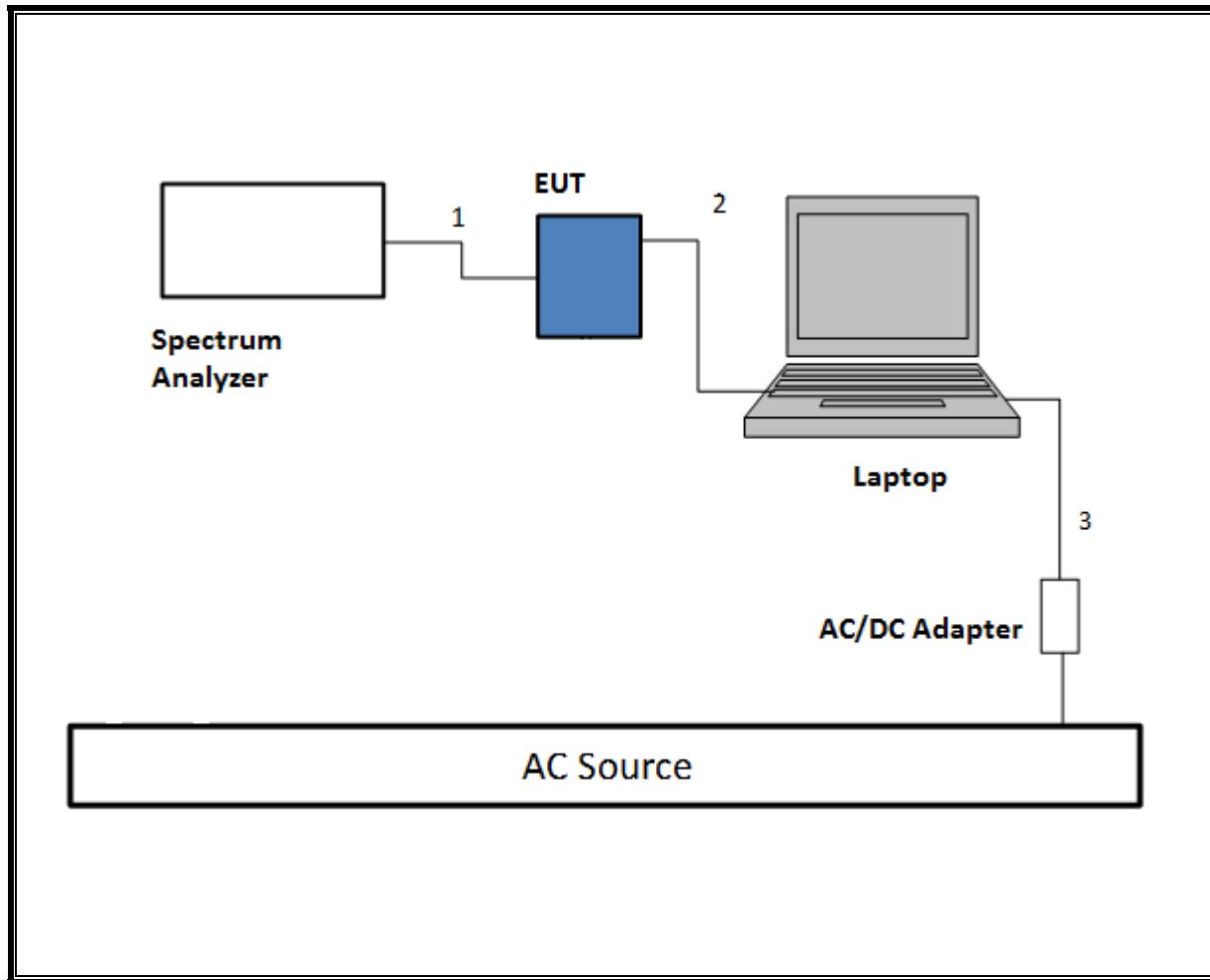
I/O CABLES (AC LINE CONDUCTED: LAPTOP CONFIGUARTION)

| 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.

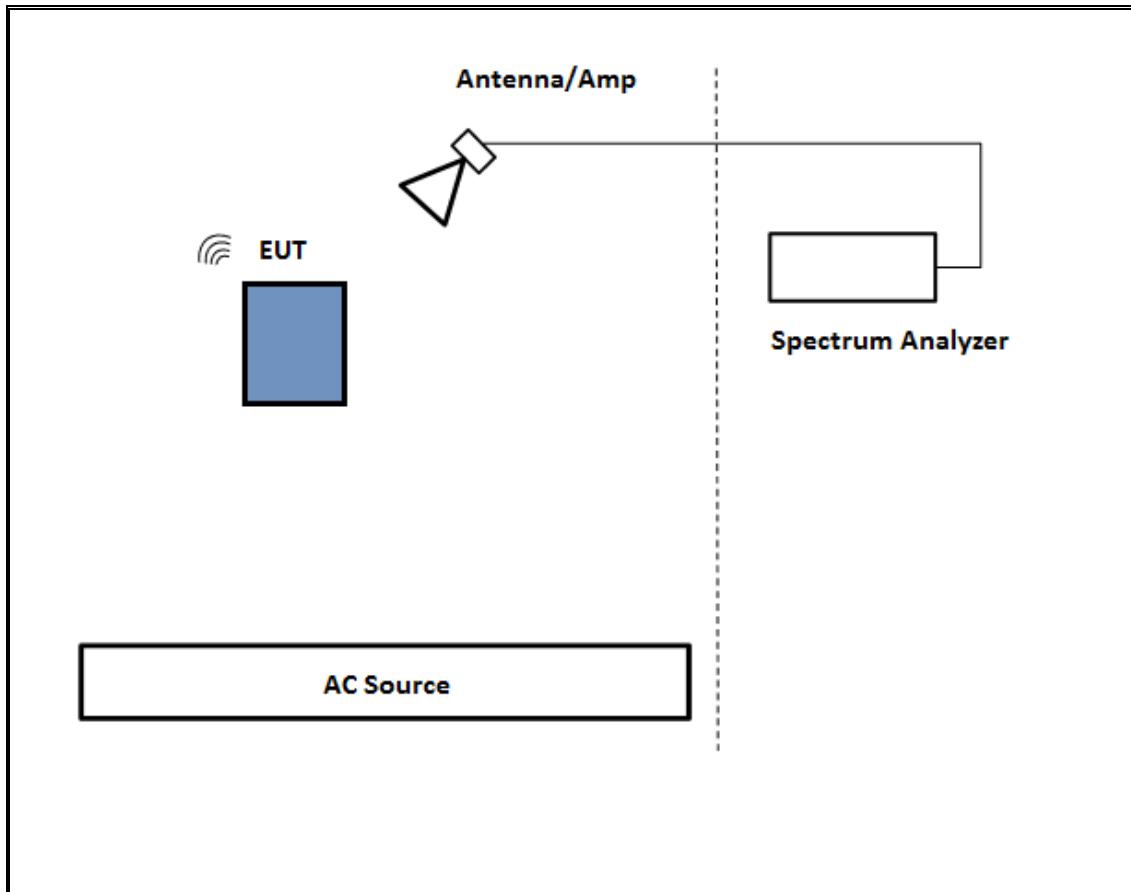
SETUP DIAGRAM



TEST SETUP- RADIATED-ABOVE 1 GHZ

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

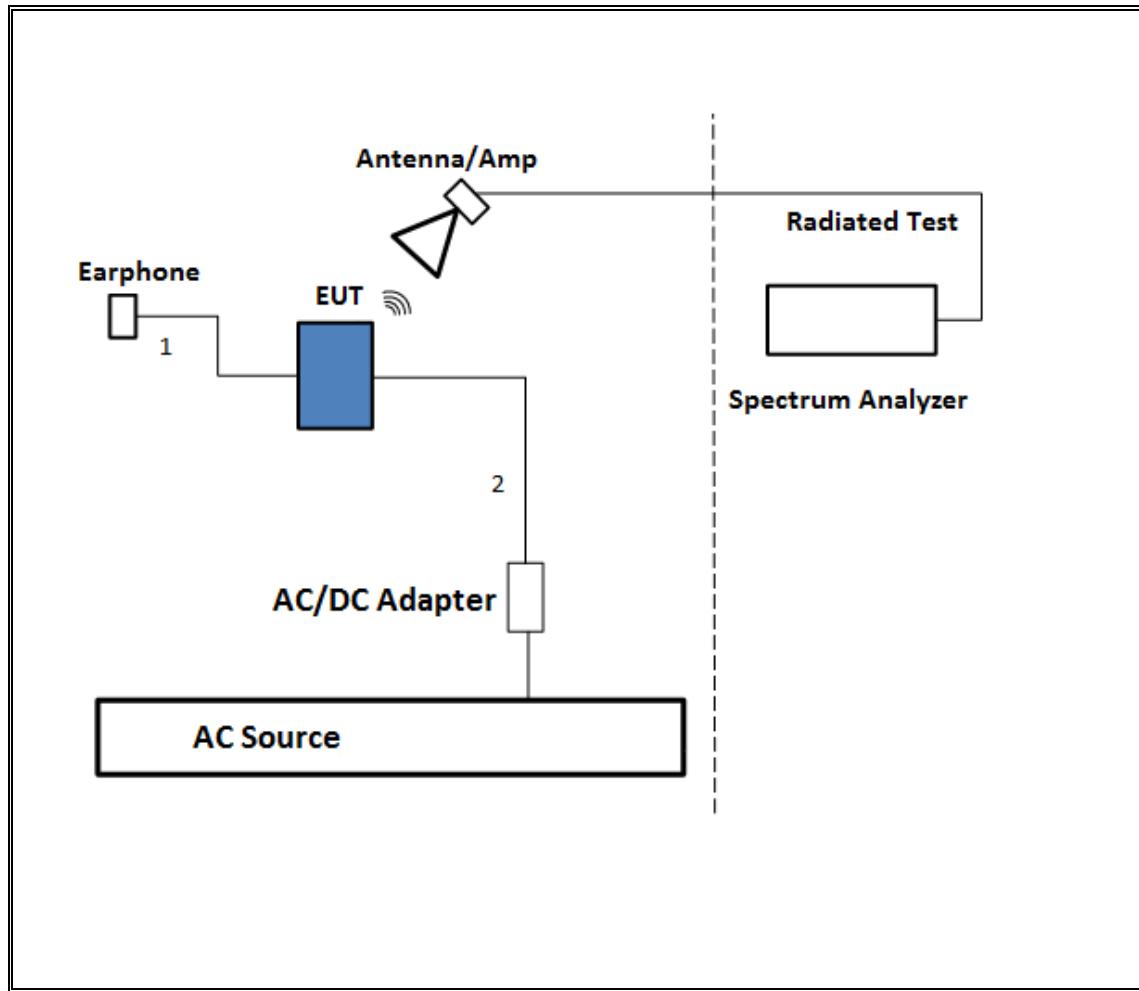
SETUP DIAGRAM



TEST SETUP- BELOW 1GHz

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

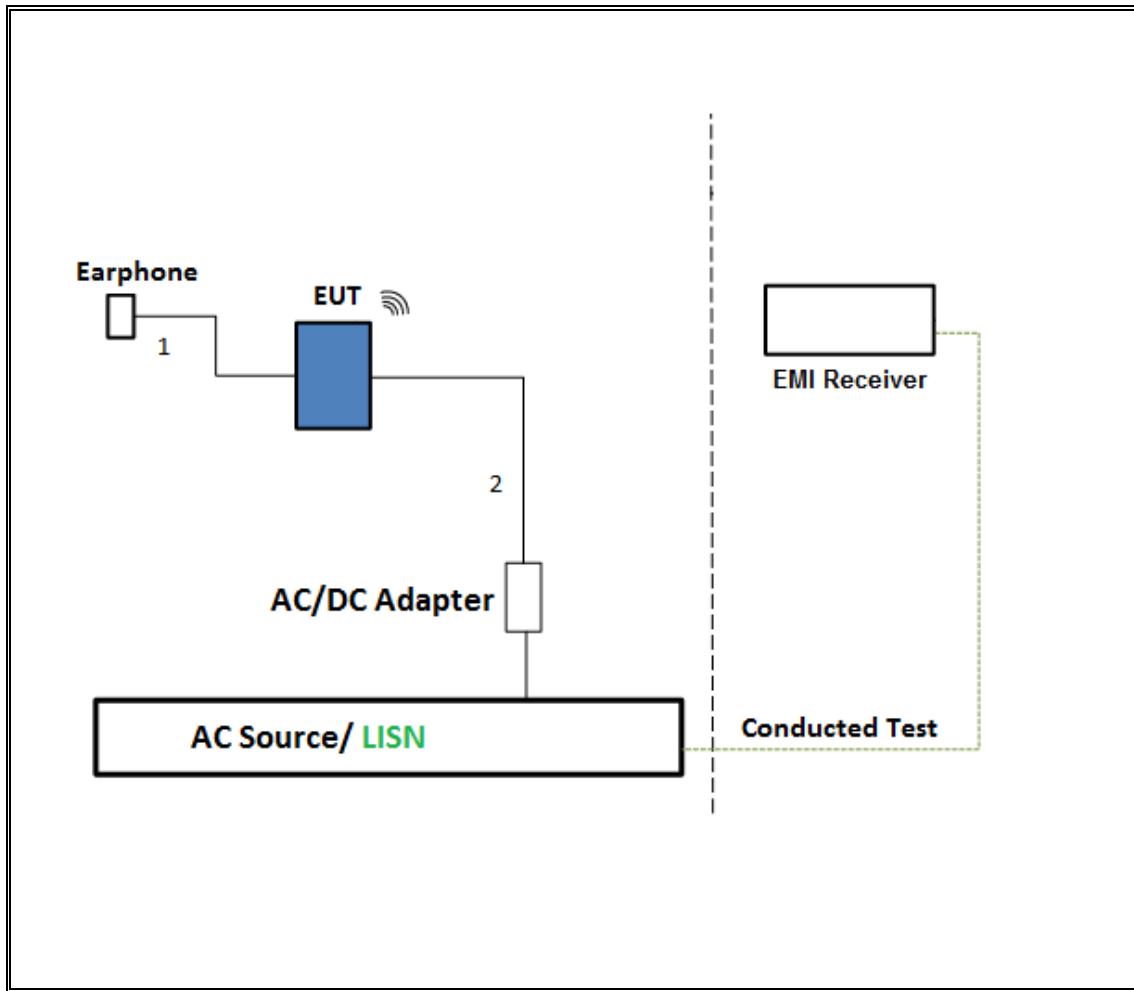
SETUP DIAGRAM



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.

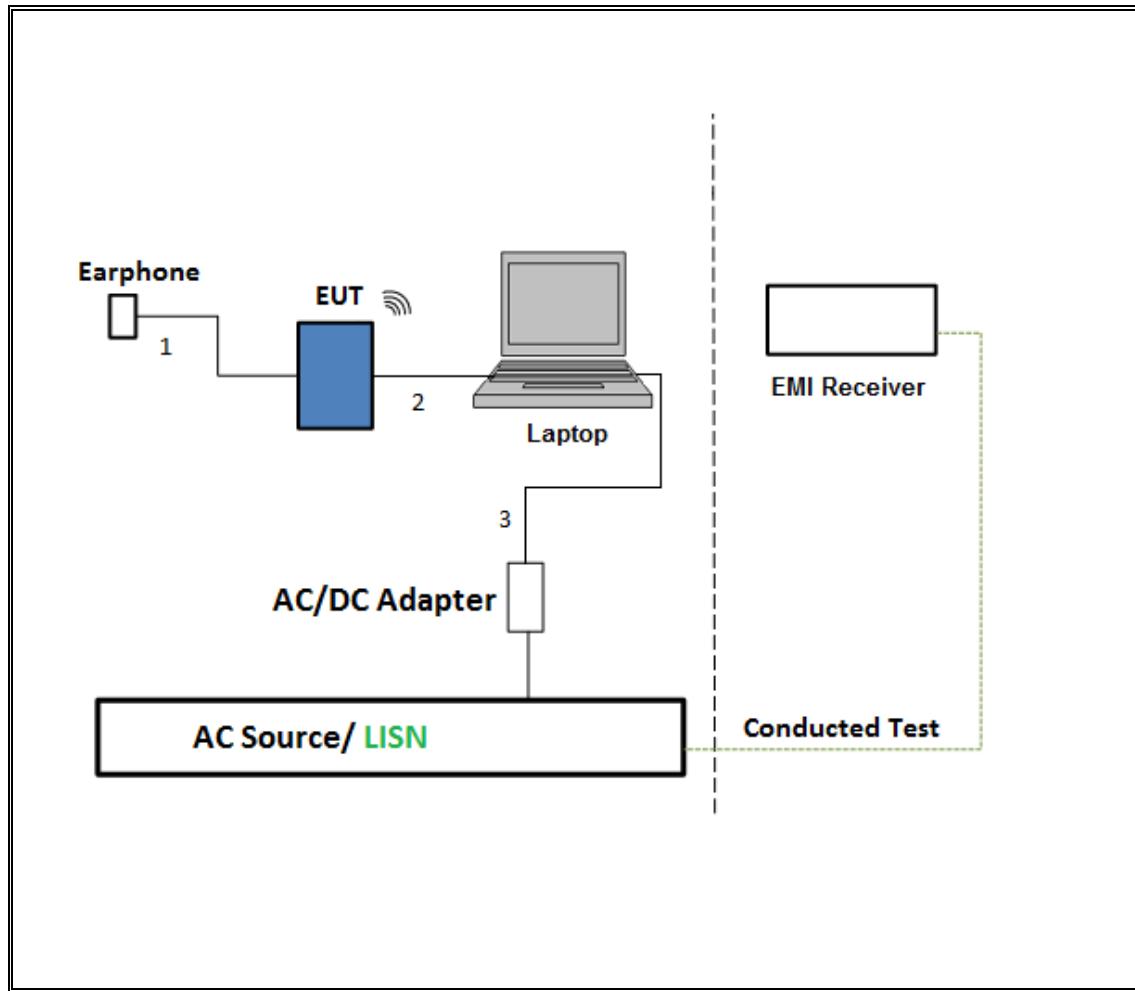
SETUP DIAGRAM



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 |
| Amplifier, 10KHz to 1GHz, 32dB | Sonoma | 310N | 6/9/2015 | 6/9/2016 |
| Antenna, Broadband Hybrid, 30MHz to 2000MHz | Sunol Sciences | JB3 | 1/14/2015 | 1/14/2016 |
| 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 |
| Amplifier, 1 - 18GHz | Miteq | AFS42-00101800-25-S-42 | 6/2/2015 | 6/2/2016 |
| 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 | 09/16/14 | 09/16/15 |
| 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 | UL | PG1 | 7/28/2014 | 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

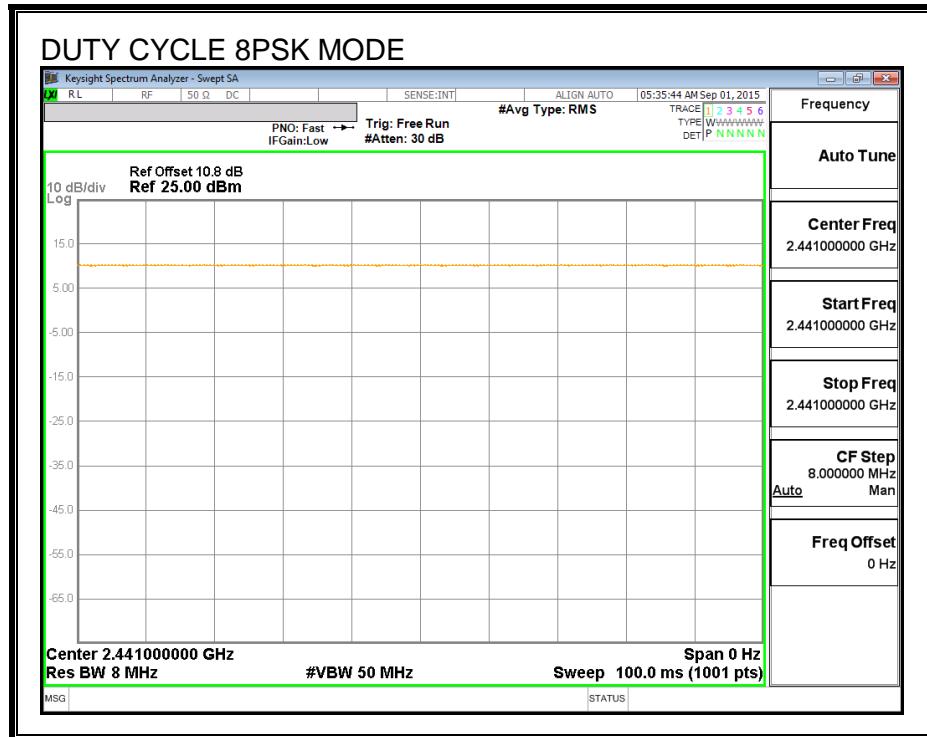
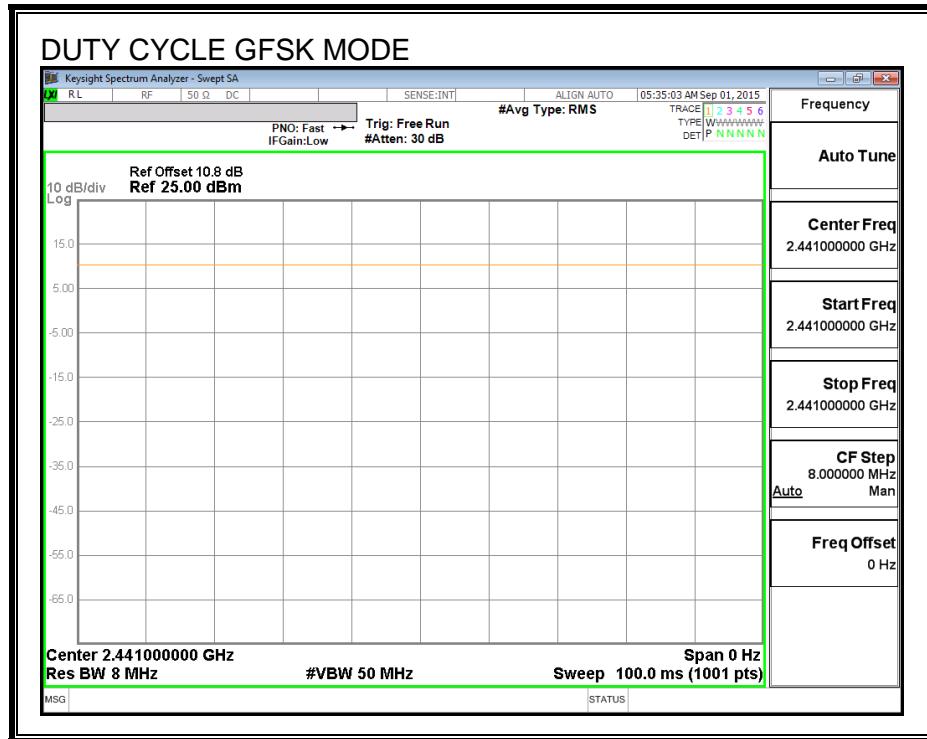
KDB 558074 Zero-Span Spectrum Analyzer Method.

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



7.2. BASIC DATA RATE GFSK MODULATION

7.2.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

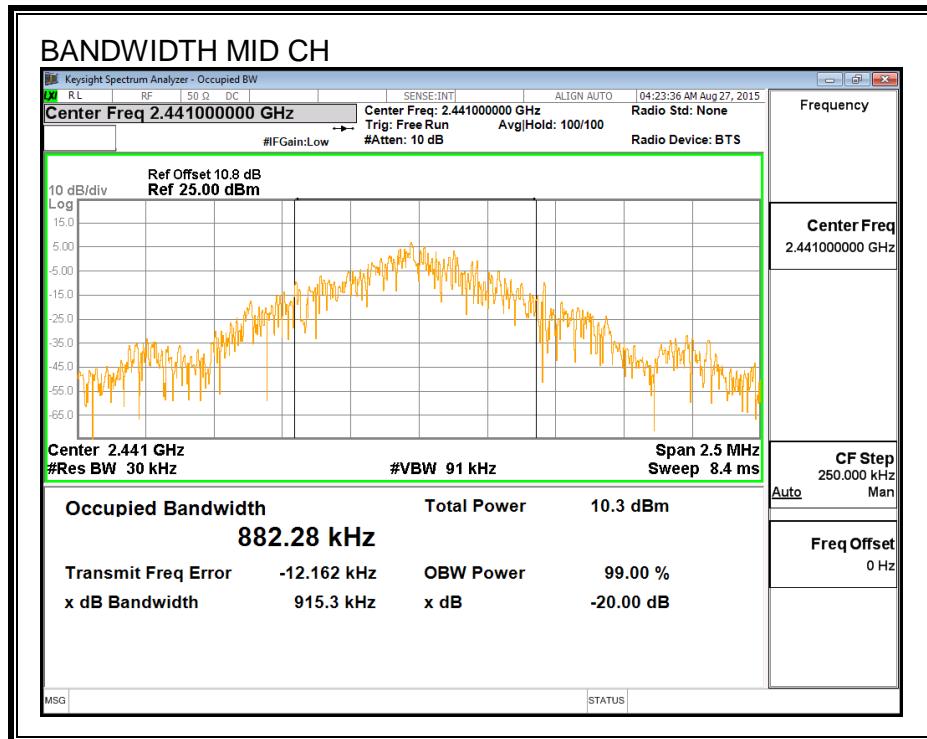
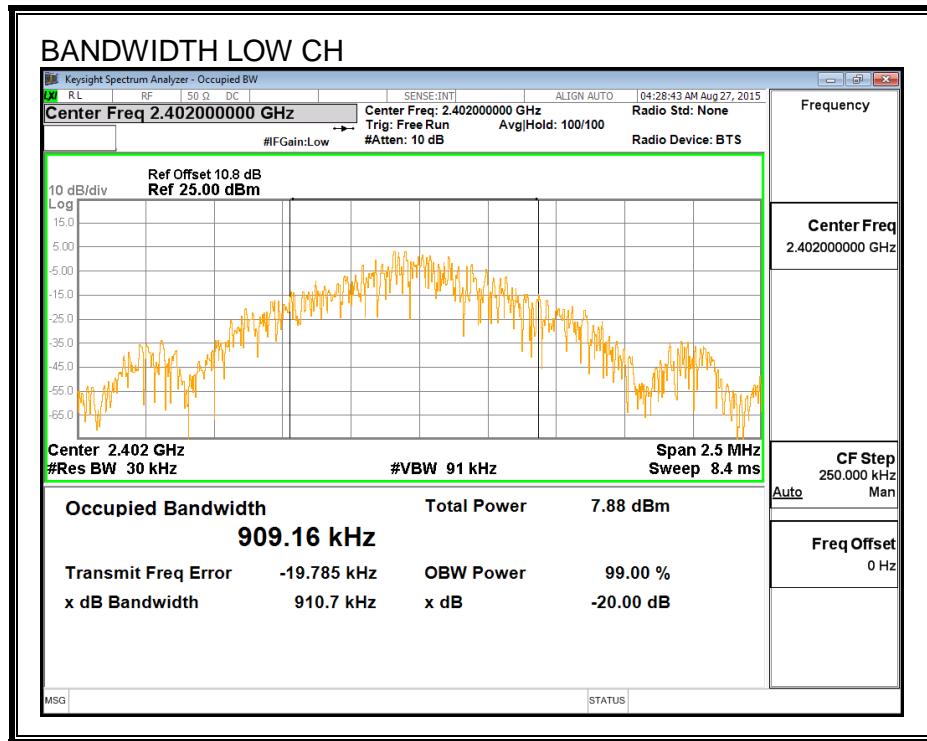
TEST PROCEDURE

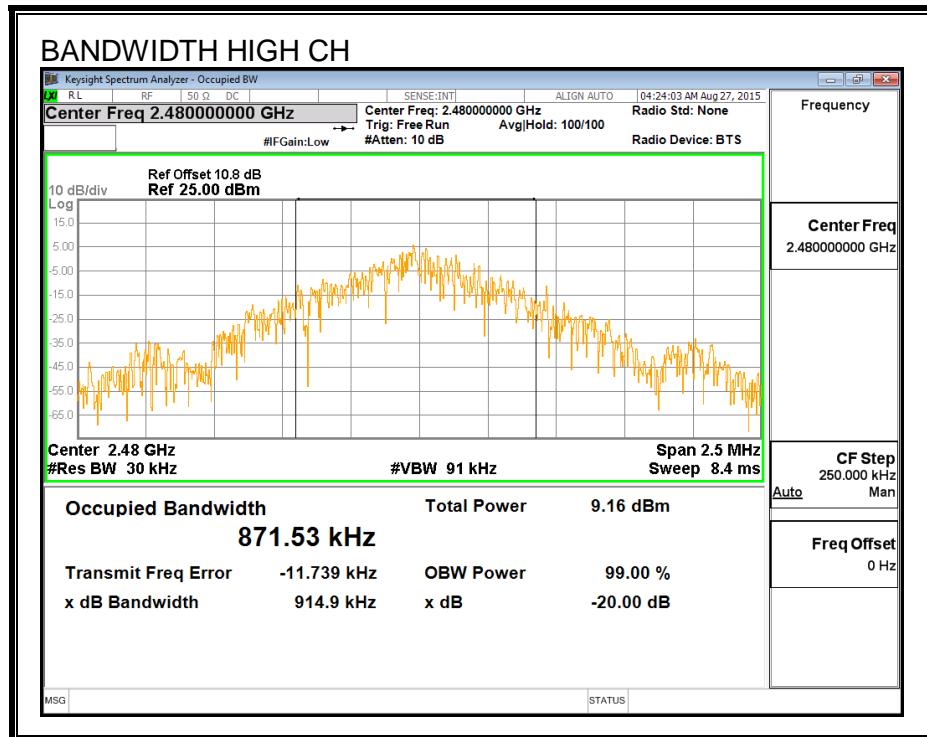
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

| Channel | Frequency (MHz) | 20 dB Bandwidth (KHz) | 99% Bandwidth (KHz) |
|---------|--------------------|--------------------------|------------------------|
| Low | 2402 | 910.7 | 909.16 |
| Middle | 2441 | 915.3 | 882.28 |
| High | 2480 | 914.9 | 871.53 |

20 dB AND 99% BANDWIDTH





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 hopping channel, whichever is greater.

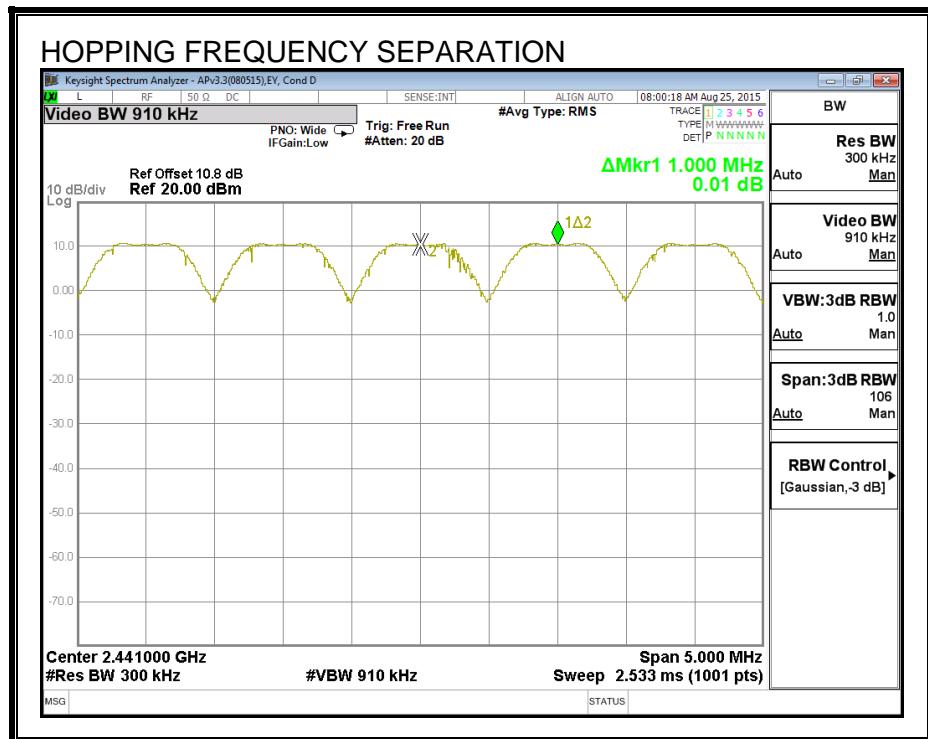
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

RESULTS

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.

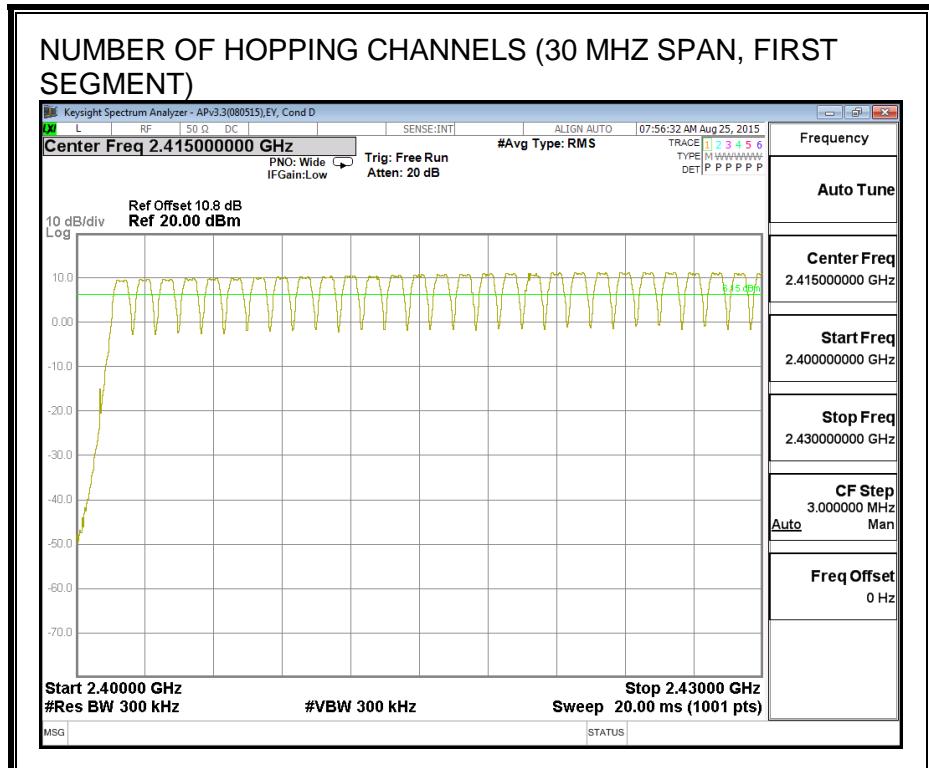
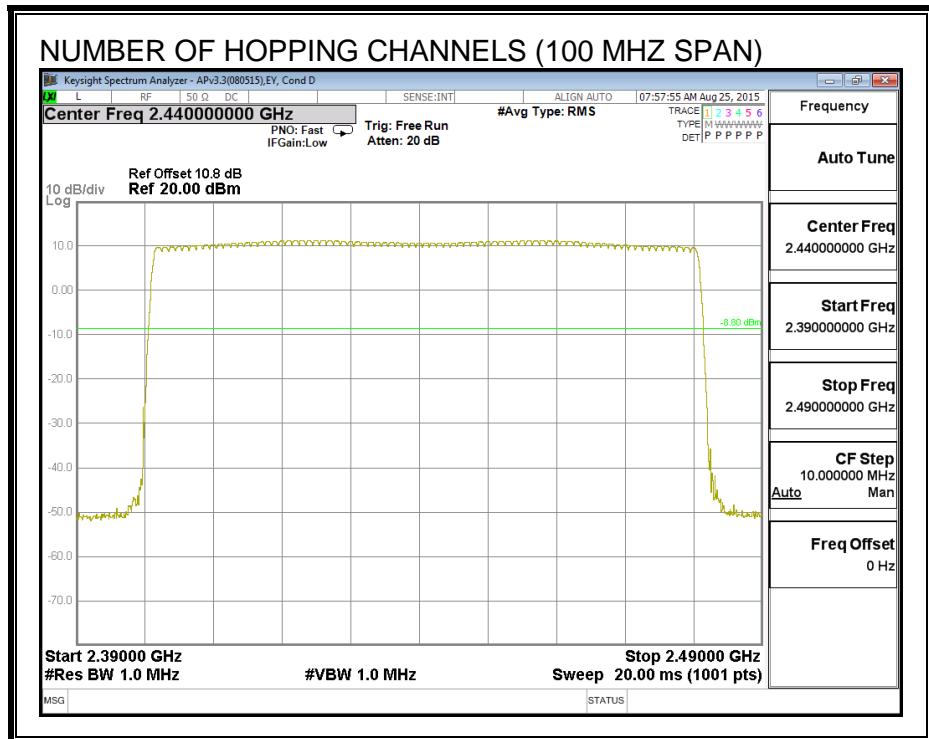
TEST PROCEDURE

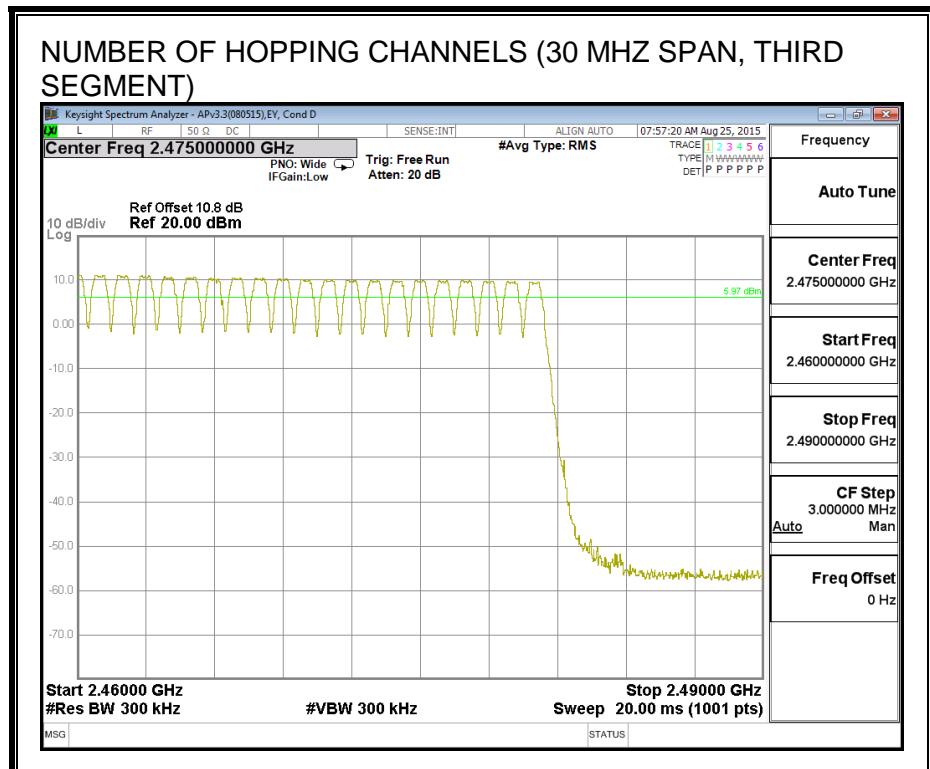
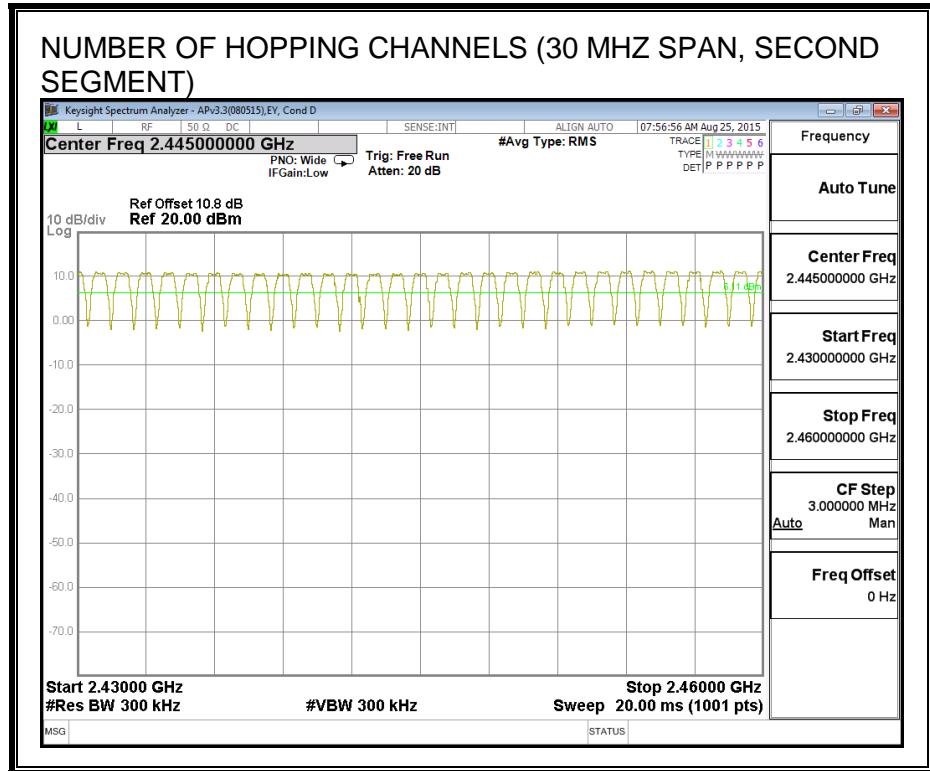
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS





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 $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

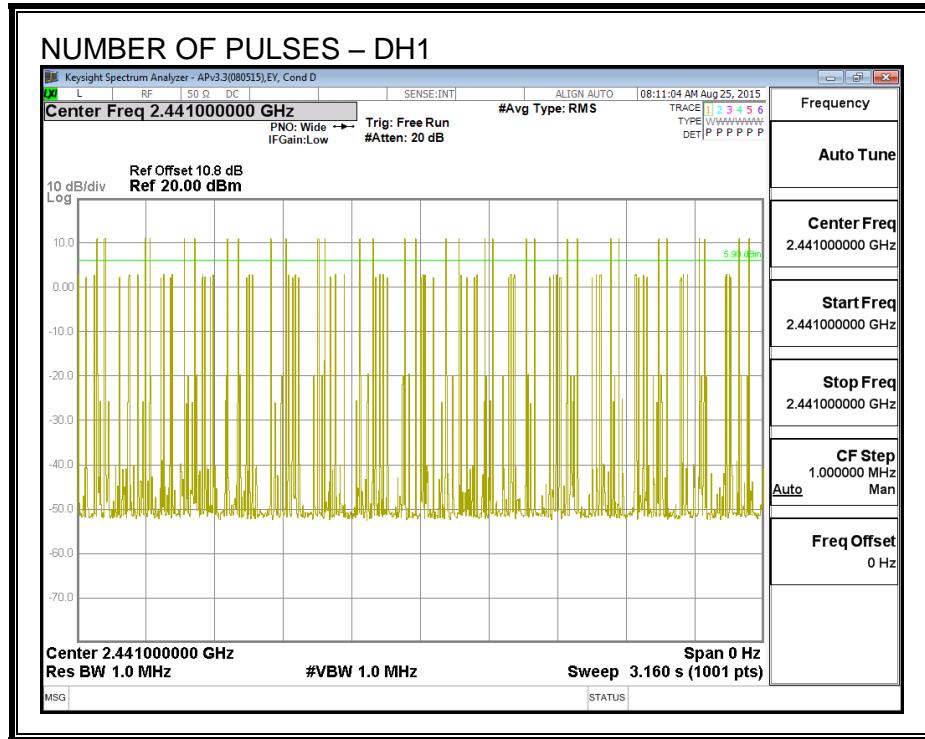
RESULTS

| 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 | 0.406 | 32 | 0.130 | 0.4 | -0.270 |
| DH3 | 1.652 | 18 | 0.297 | 0.4 | -0.103 |
| DH5 | 2.904 | 12 | 0.348 | 0.4 | -0.052 |

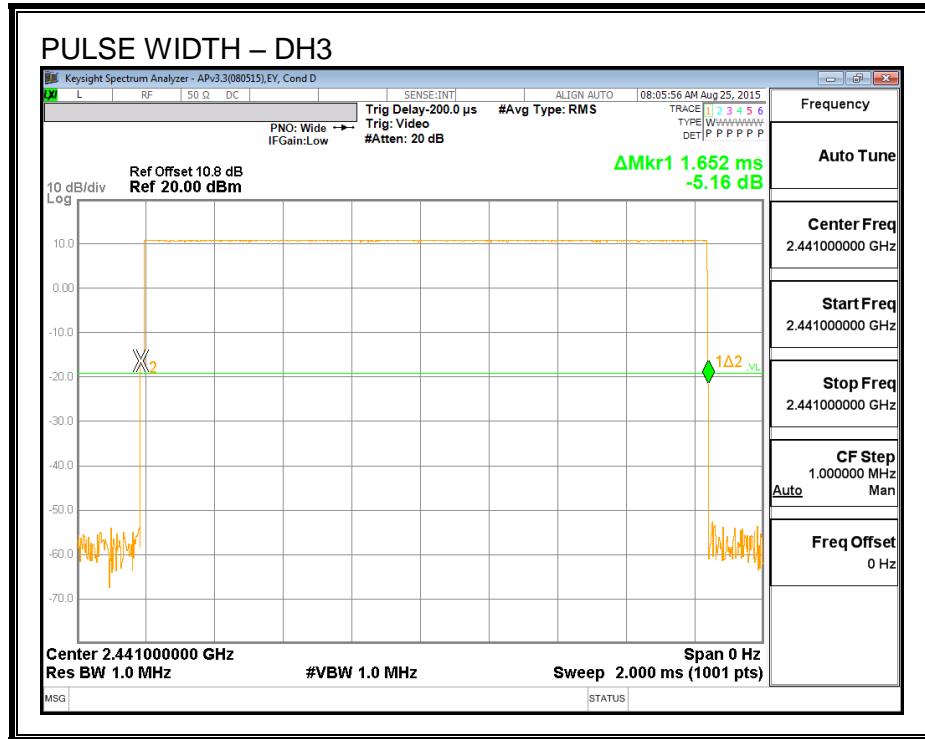
PULSE WIDTH - DH1



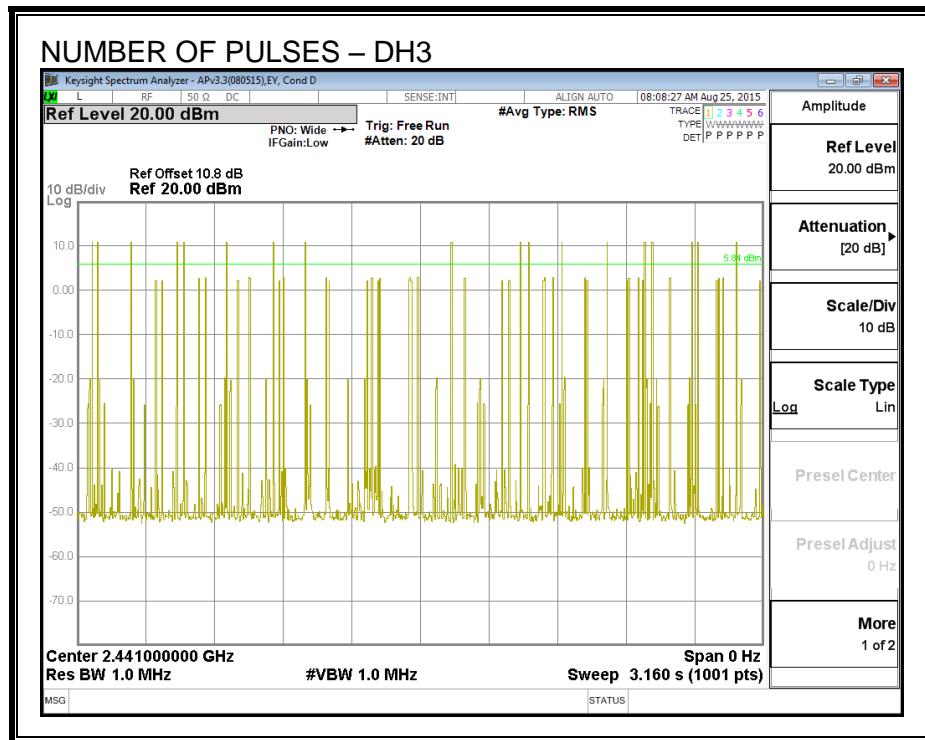
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH1



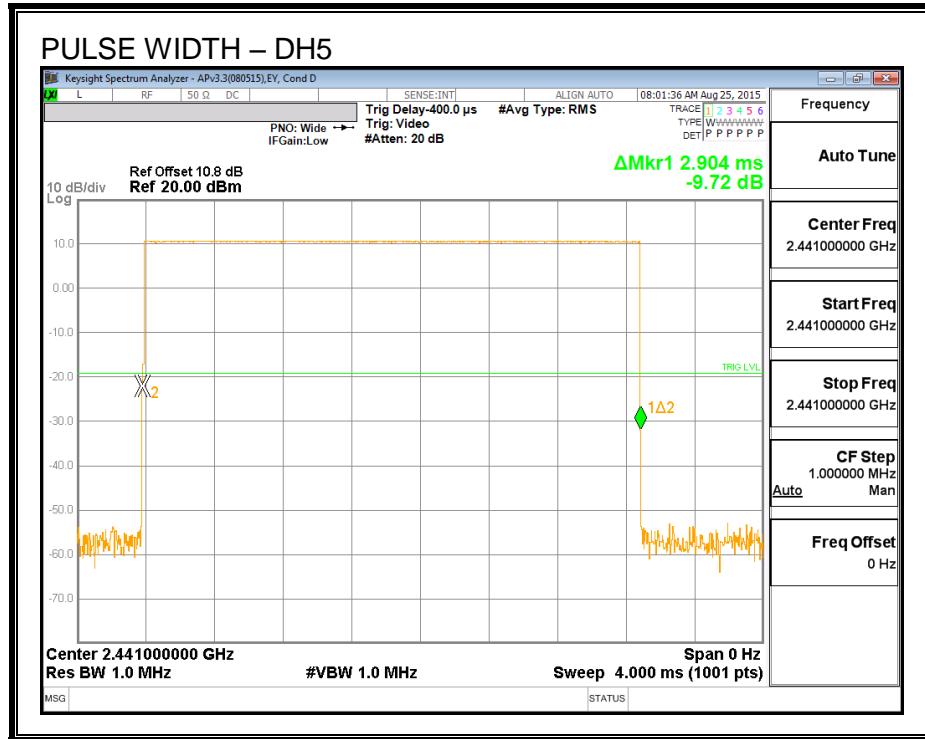
PULSE WIDTH – DH3



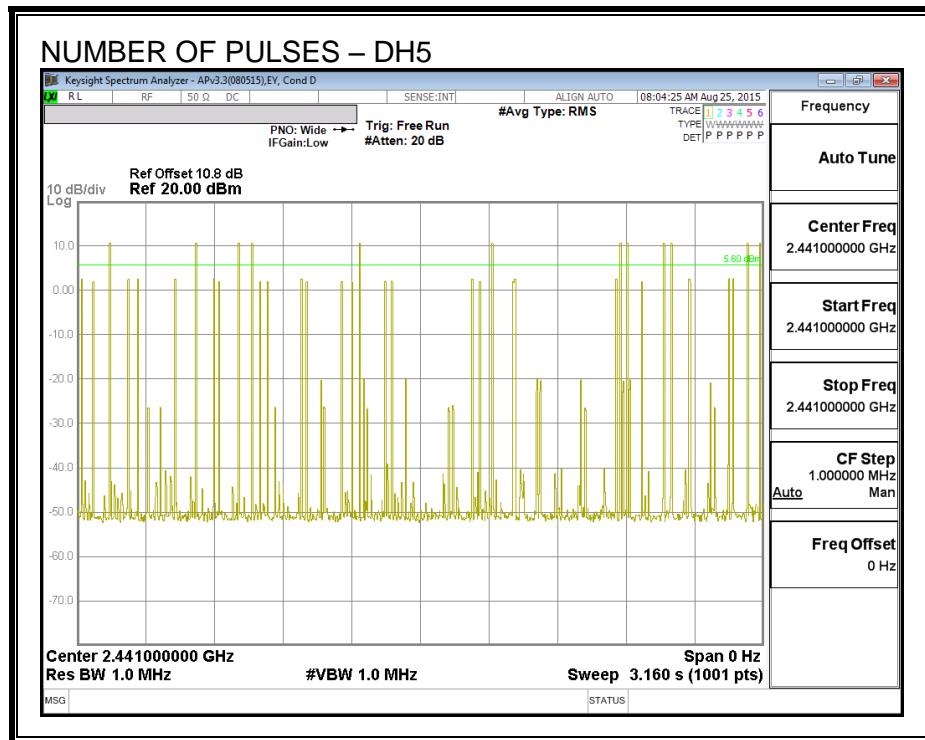
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH3



PULSE WIDTH – DH5



NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – DH5



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 | 11.36 | 30 | -18.64 |
| Middle | 2441 | 11.73 | 30 | -18.27 |
| High | 2480 | 11.32 | 30 | -18.68 |

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 0.8 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 | 11.05 |
| Middle | 2441 | 11.48 |
| High | 2480 | 11.03 |

7.2.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

Limit = -20 dBc

TEST PROCEDURE

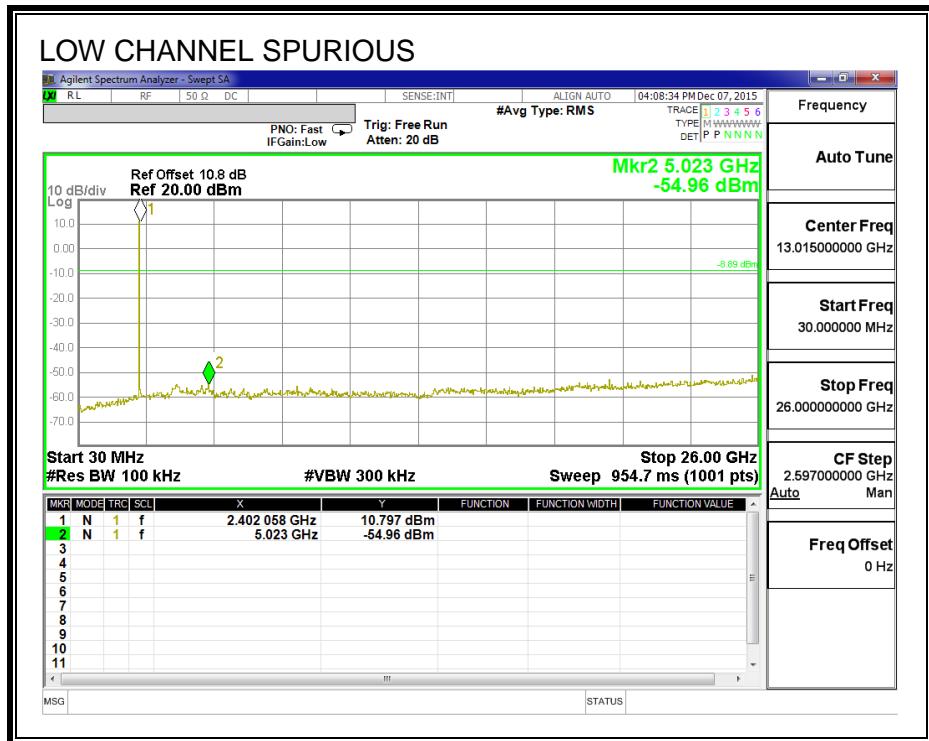
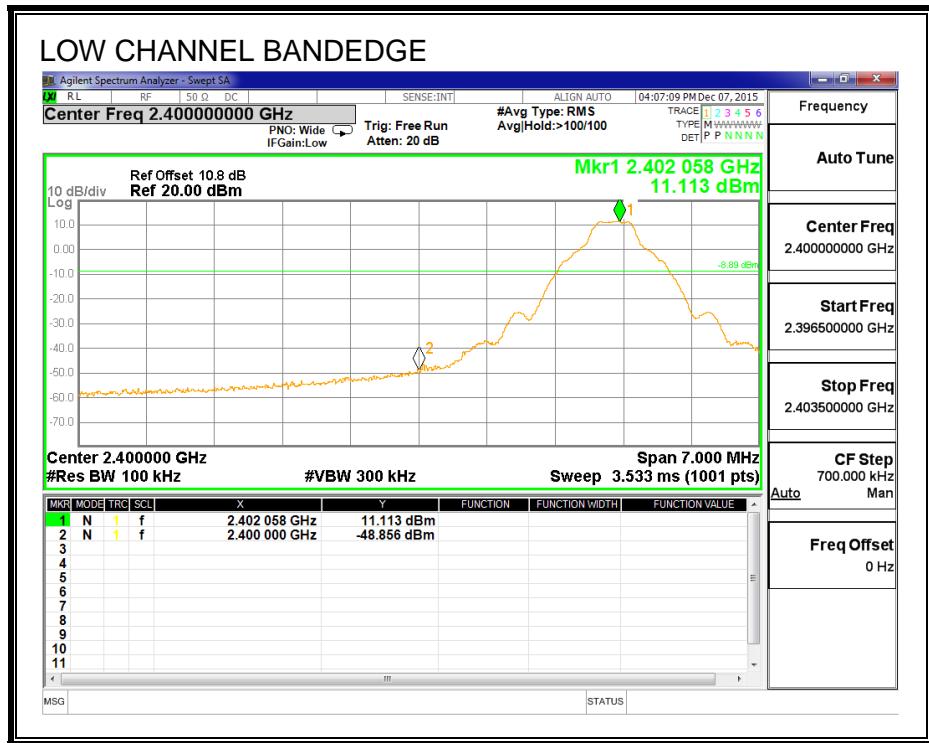
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

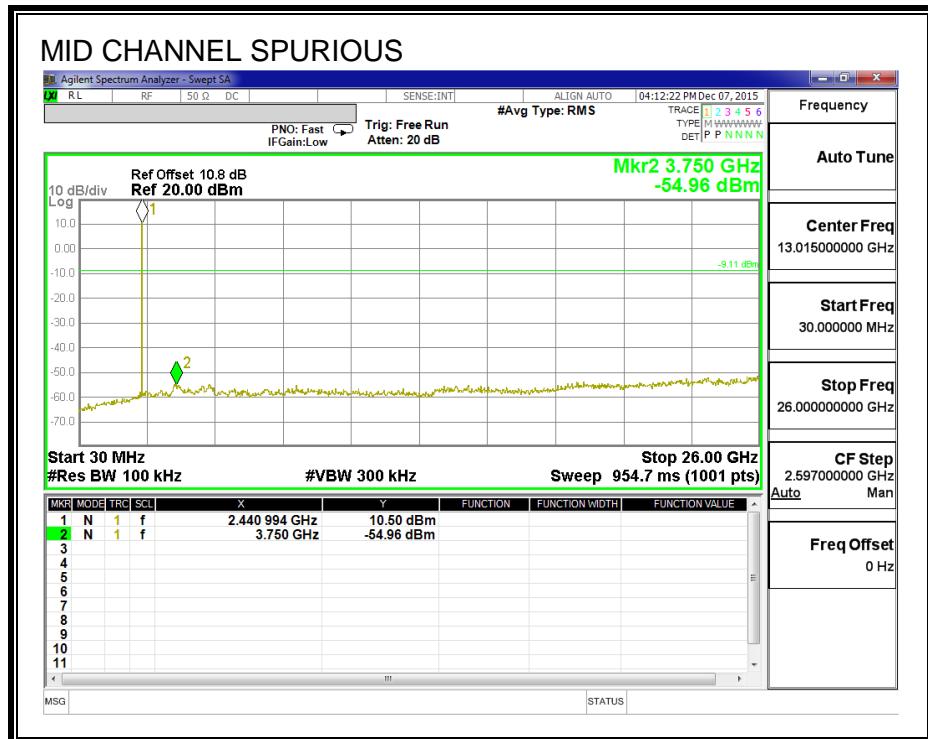
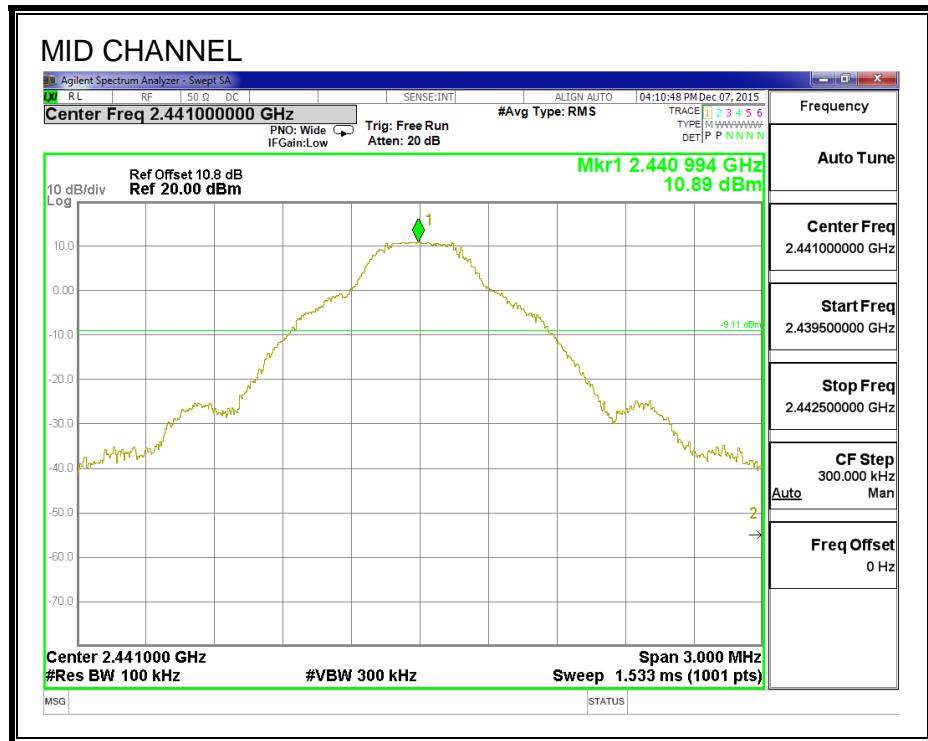
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

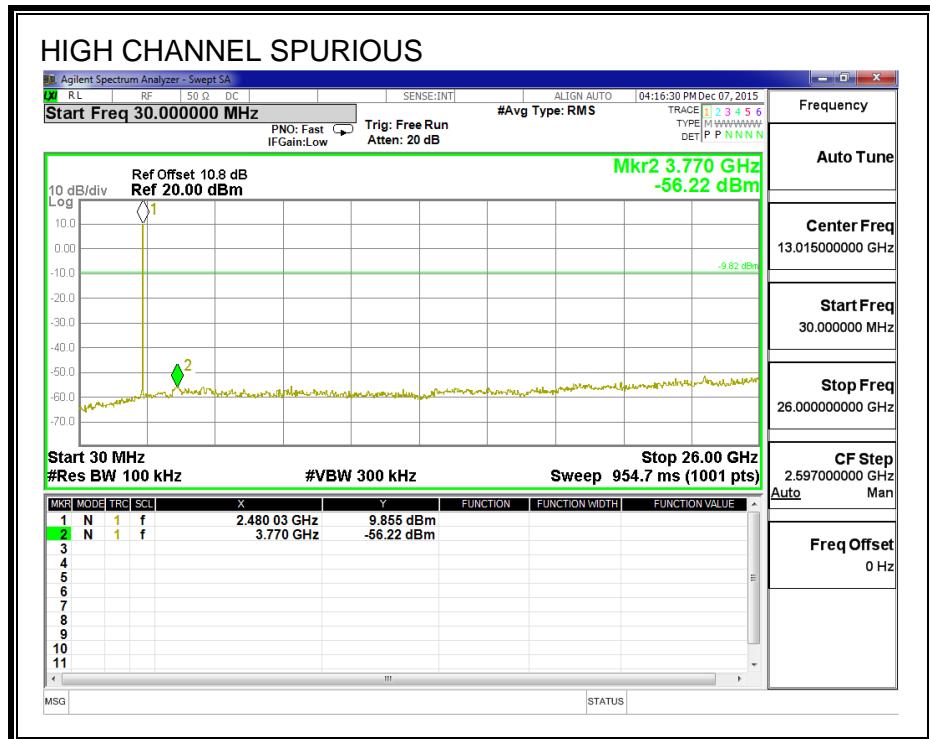
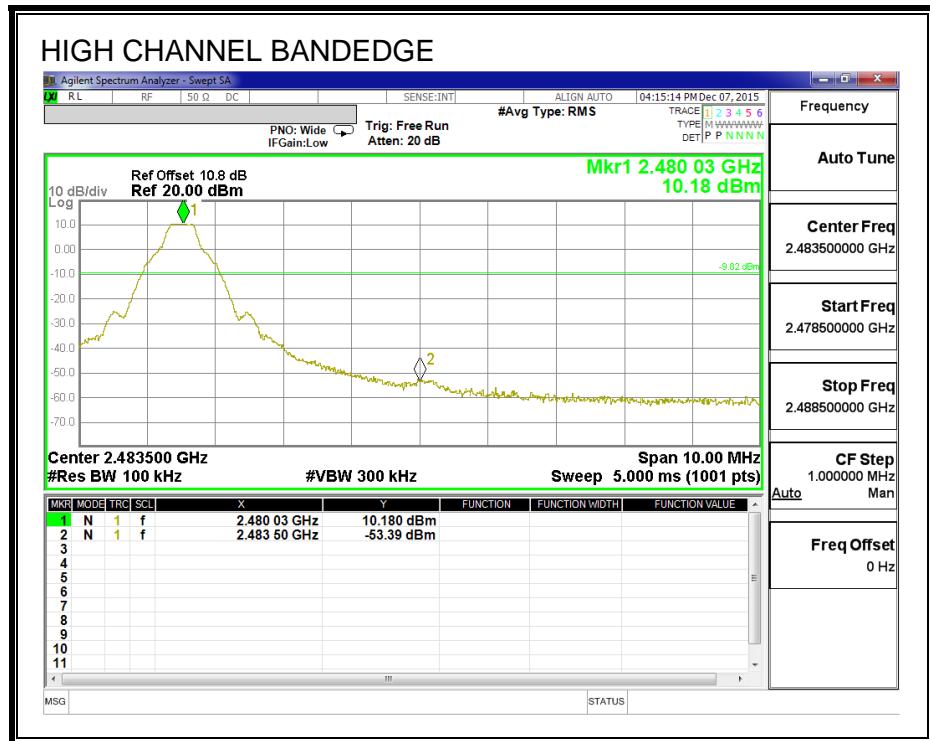
SPURIOUS EMISSIONS, LOW CHANNEL



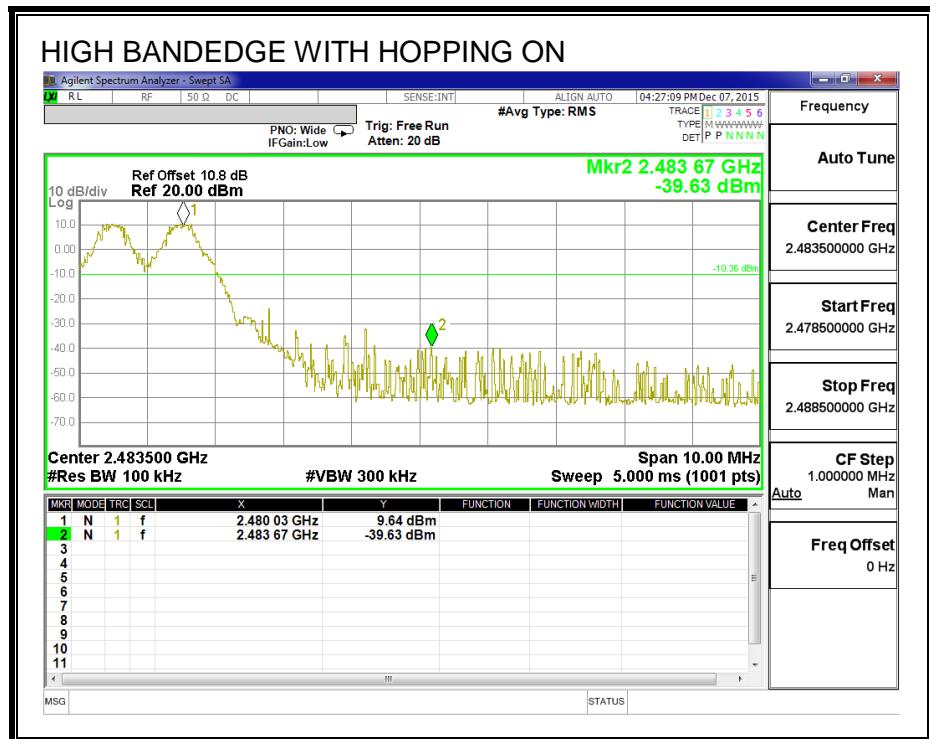
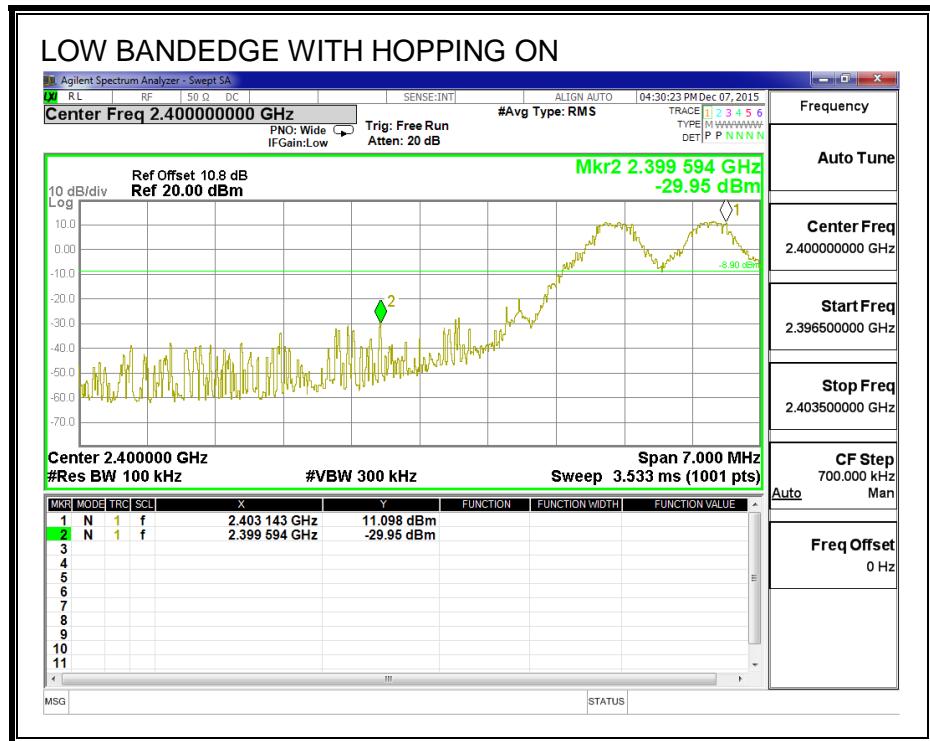
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



SPURIOUS BANDEDGE EMISSIONS 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 | 9.83 | 21 | -11.14 |
| Middle | 2441 | 10.79 | 21 | -10.18 |
| High | 2480 | 9.96 | 21 | -11.01 |

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 0.8 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 | 7.65 |
| Middle | 2441 | 8.46 |
| High | 2480 | 7.75 |

7.4. ENHANCED DATA RATE 8PSK MODULATION

7.4.1. 20 dB AND 99% BANDWIDTH

LIMIT

None; for reporting purposes only.

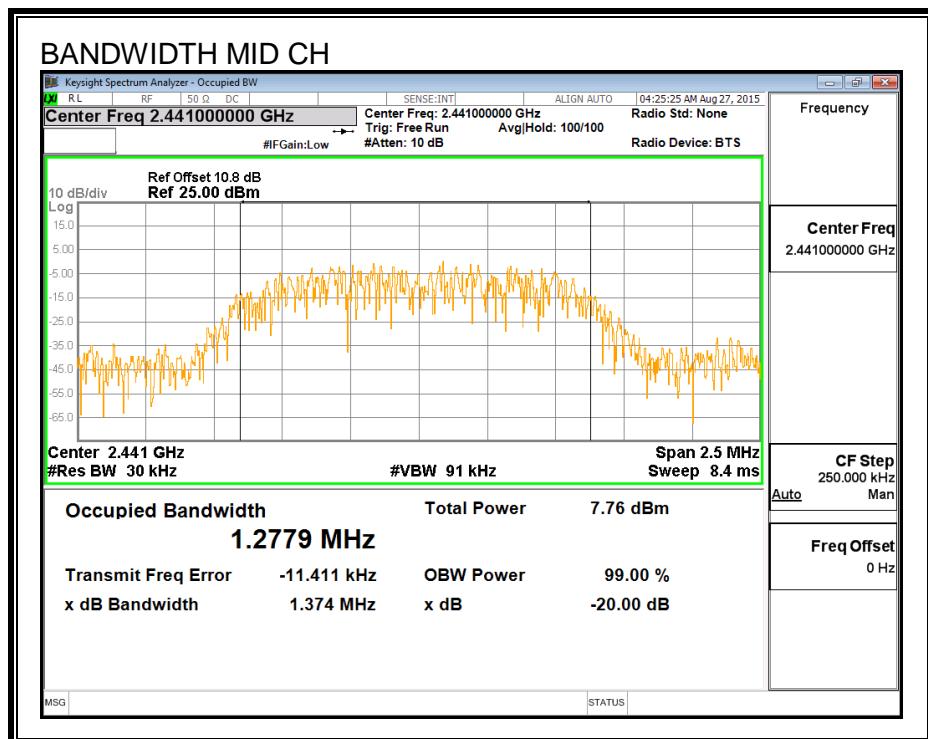
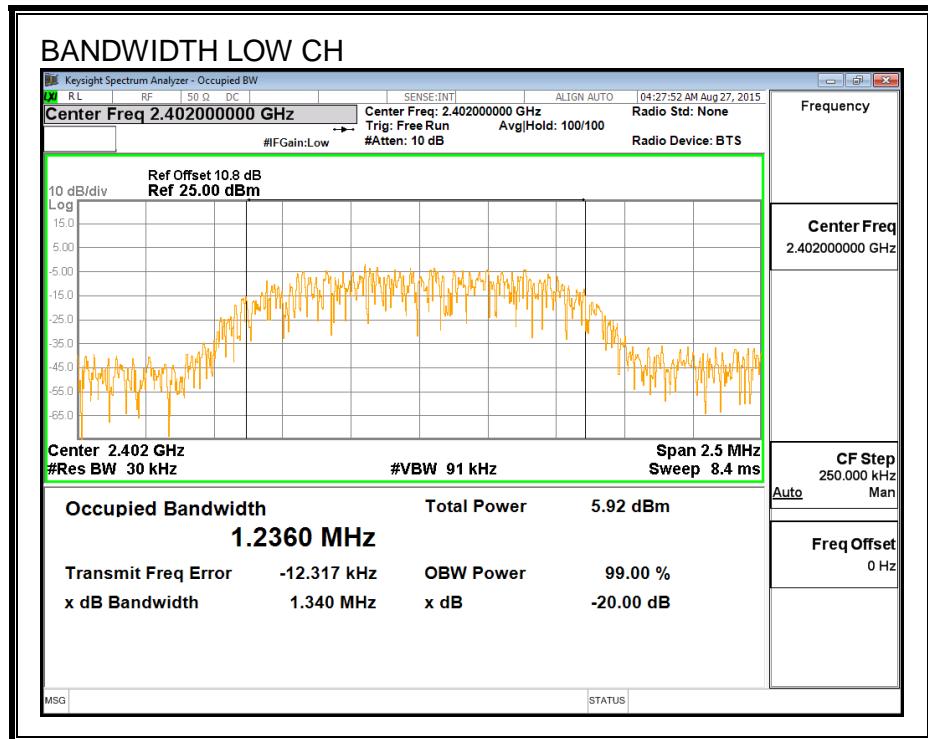
TEST PROCEDURE

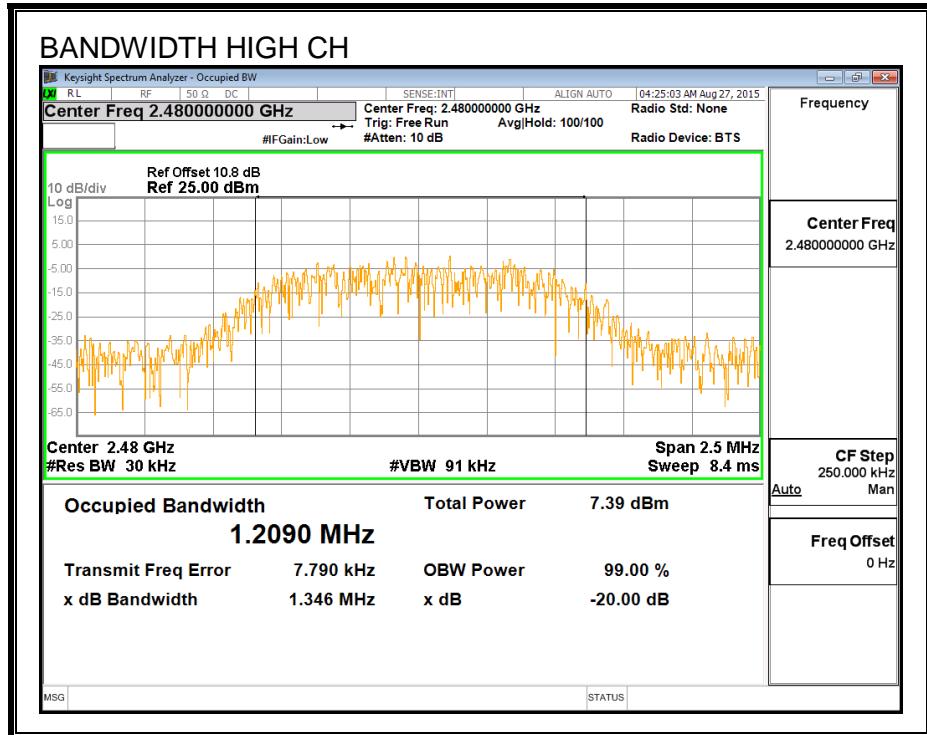
The transmitter output is connected to a spectrum analyzer. The RBW is set to $\geq 1\%$ of the 20 dB bandwidth. The VBW is set to \geq RBW. The sweep time is coupled.

RESULTS

| Channel | Frequency (MHz) | 20 dB Bandwidth (MHz) | 99% Bandwidth (MHz) |
|---------|--------------------|--------------------------|------------------------|
| Low | 2402 | 1.340 | 1.2360 |
| Middle | 2441 | 1.374 | 1.2779 |
| High | 2480 | 1.346 | 1.2090 |

20 dB AND 99% BANDWIDTH





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 hopping channel, whichever is greater.

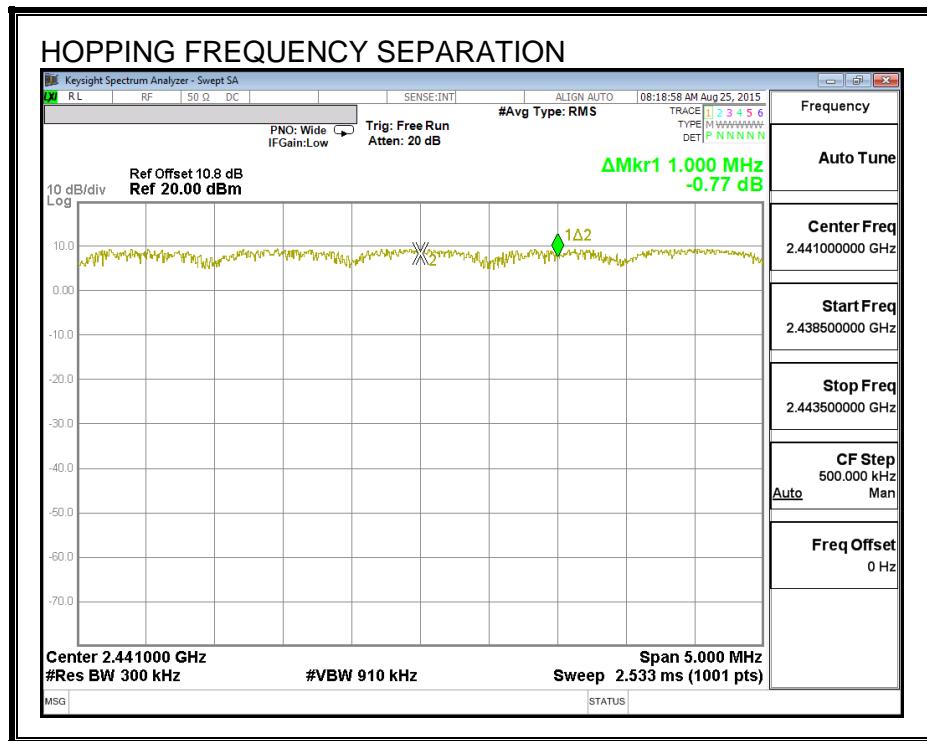
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

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

RESULTS

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.

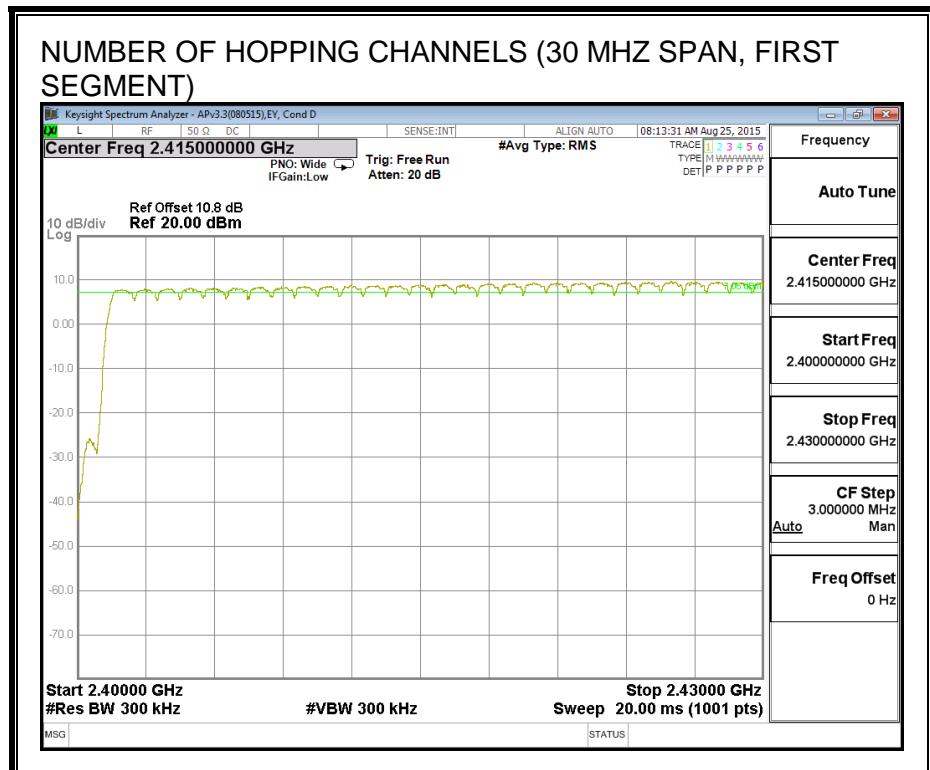
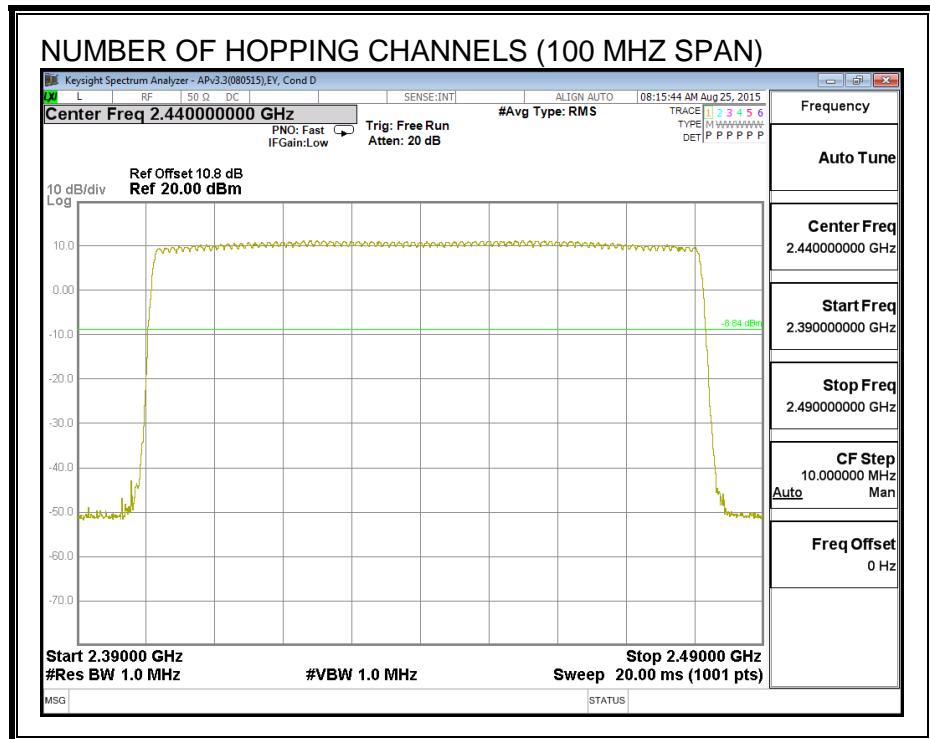
TEST PROCEDURE

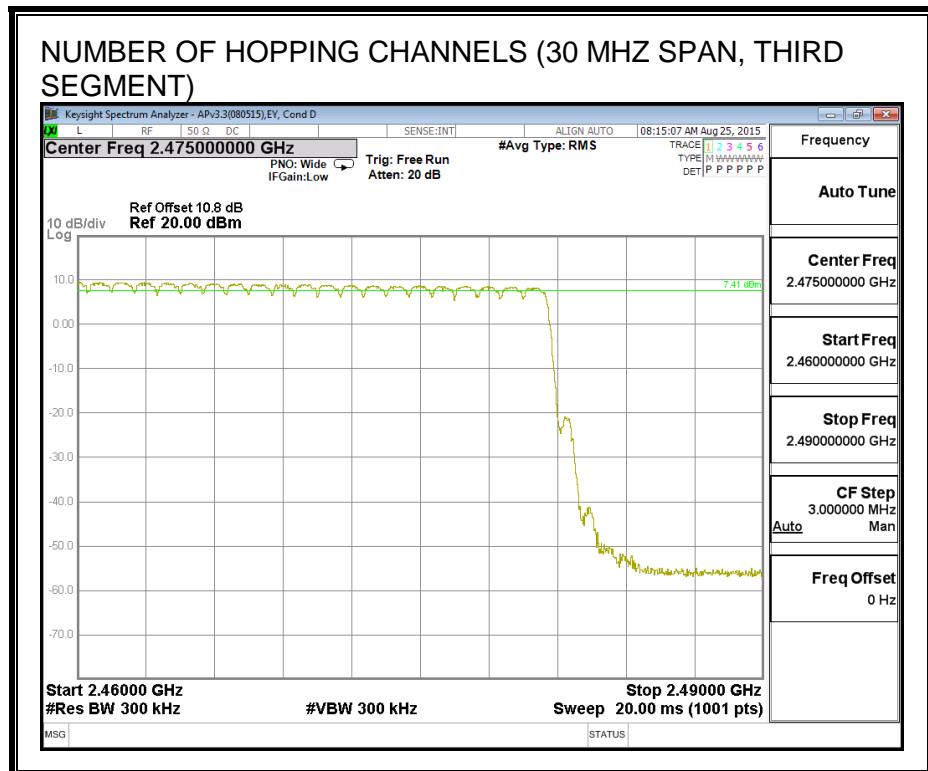
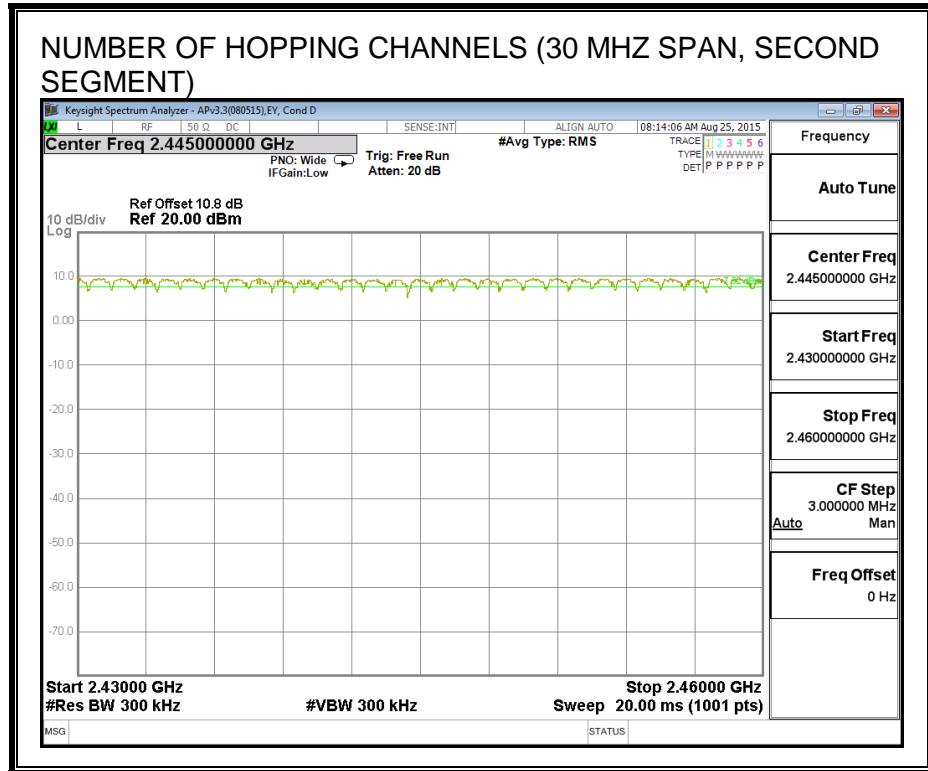
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

Normal Mode: 79 Channels observed.

NUMBER OF HOPPING CHANNELS





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 $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

RESULTS

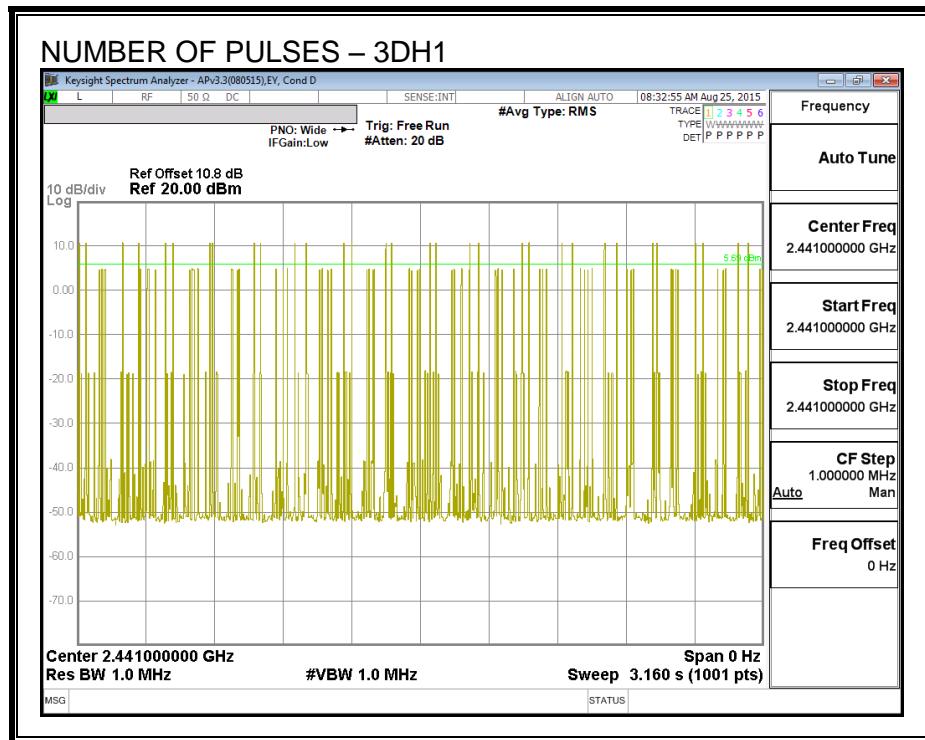
8PSK (EDR) Mode

| DH Packet | Pulse Width (msec) | Number of Pulses in 3.16 seconds | Average Time of (sec) | Limit (sec) | Margin (sec) |
|-----------|--------------------|----------------------------------|-----------------------|-------------|--------------|
| 3DH1 | 0.404 | 32 | 0.129 | 0.4 | -0.271 |
| 3DH3 | 1.654 | 18 | 0.298 | 0.4 | -0.102 |
| 3DH5 | 2.904 | 13 | 0.378 | 0.4 | -0.022 |

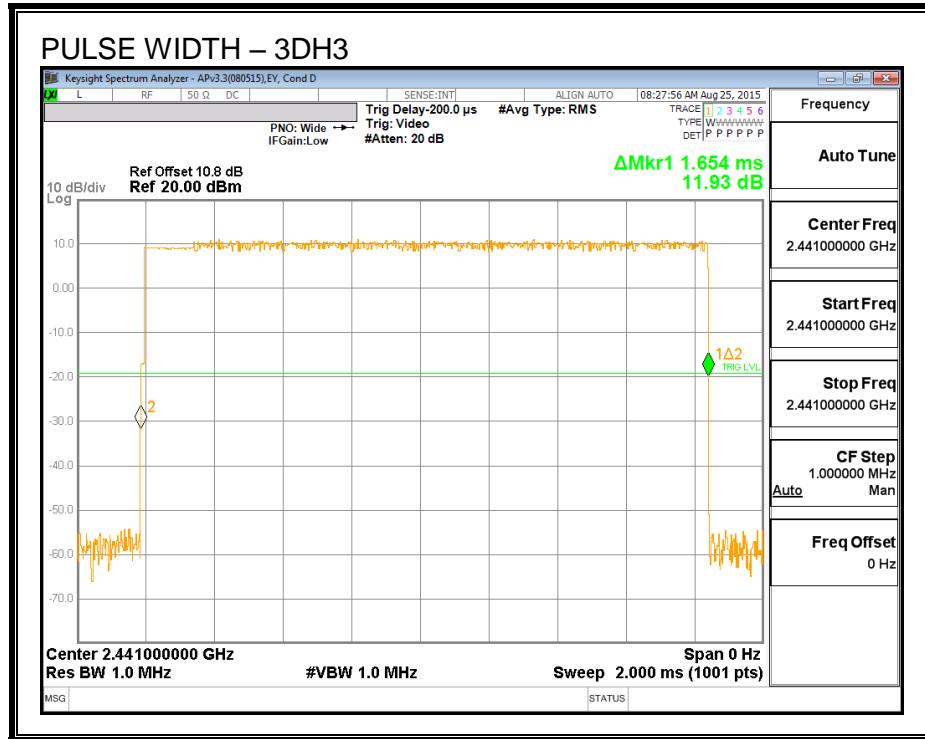
PULSE WIDTH - 3DH1



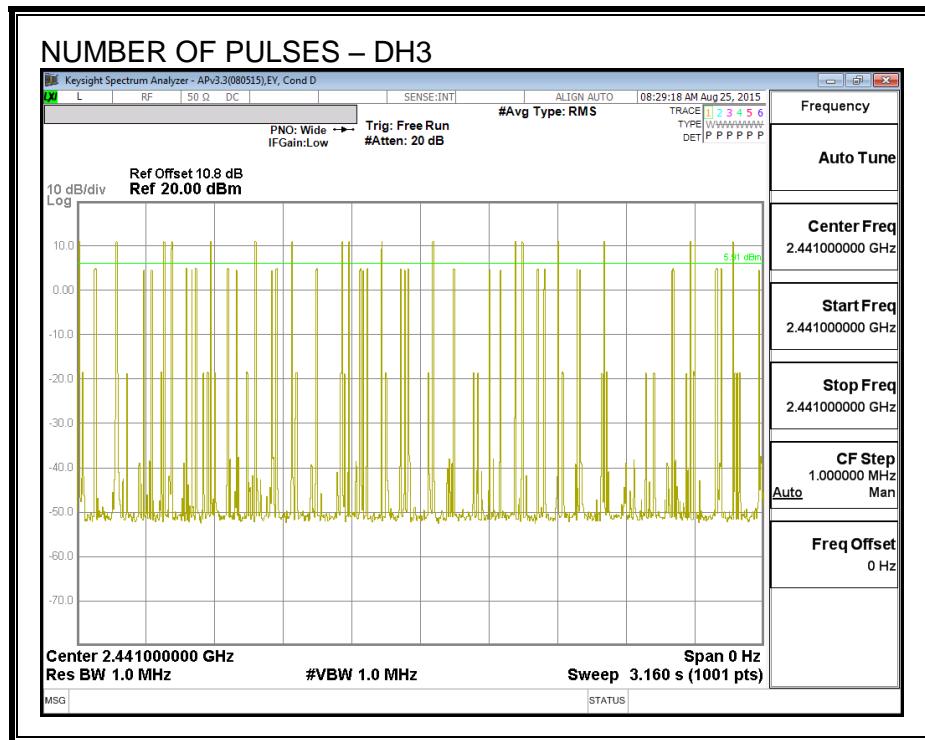
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH1



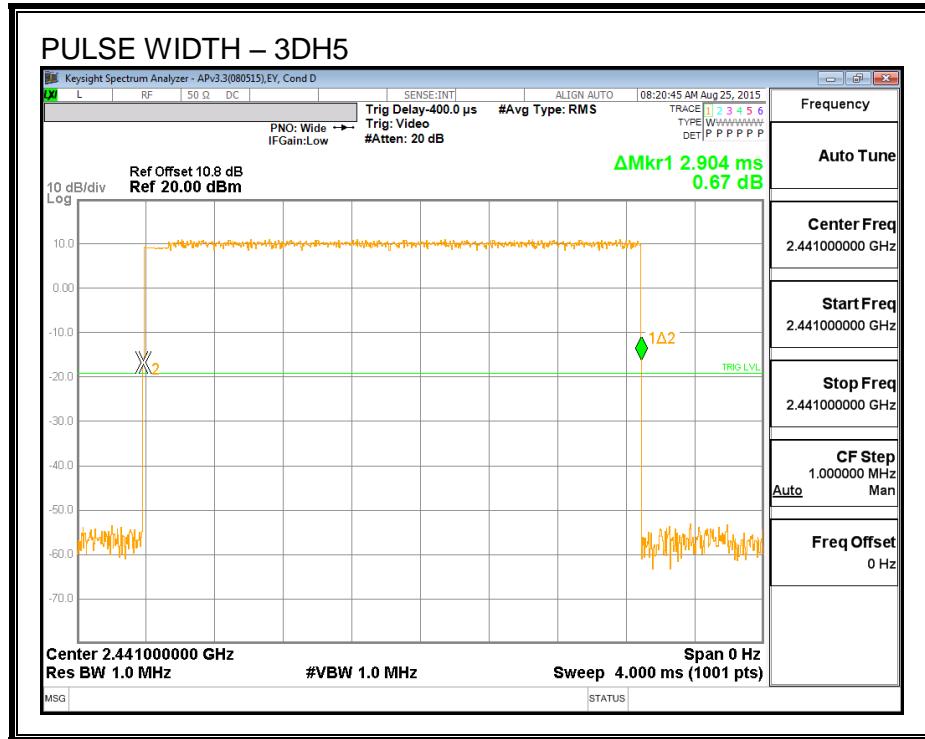
PULSE WIDTH – 3DH3



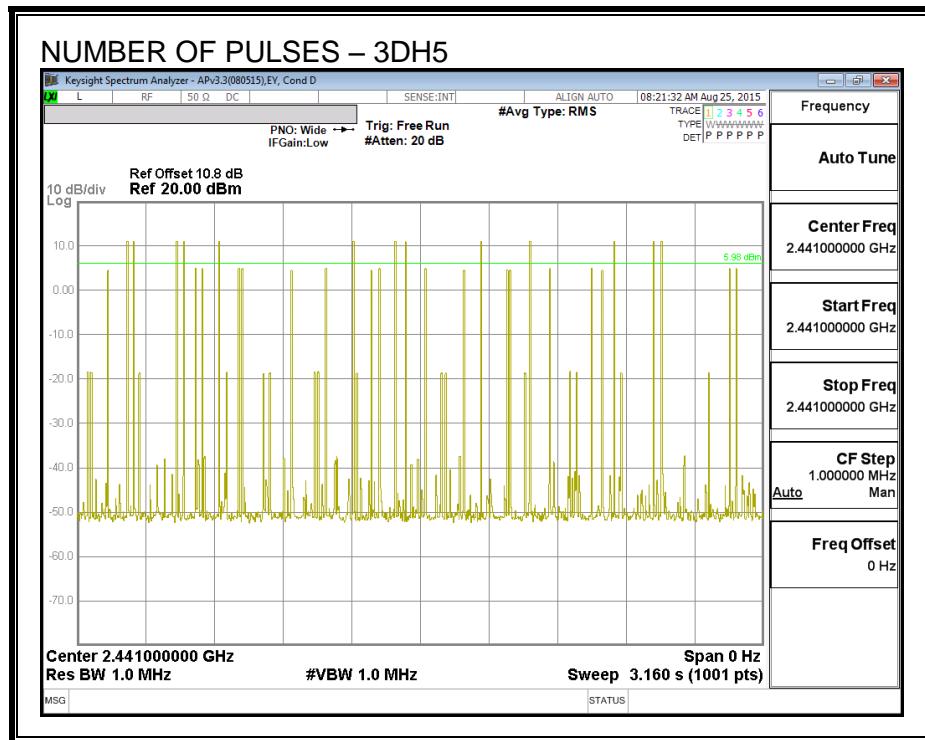
NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD – 3DH3



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 | 9.87 | 21 | -11.10 |
| Middle | 2441 | 10.83 | 21 | -10.14 |
| High | 2480 | 9.99 | 21 | -10.98 |

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 0.8 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 | 7.68 |
| Middle | 2441 | 8.49 |
| High | 2480 | 7.77 |

7.4.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

IC RSS-247 (5.5)

Limit = -20 dBc

TEST PROCEDURE

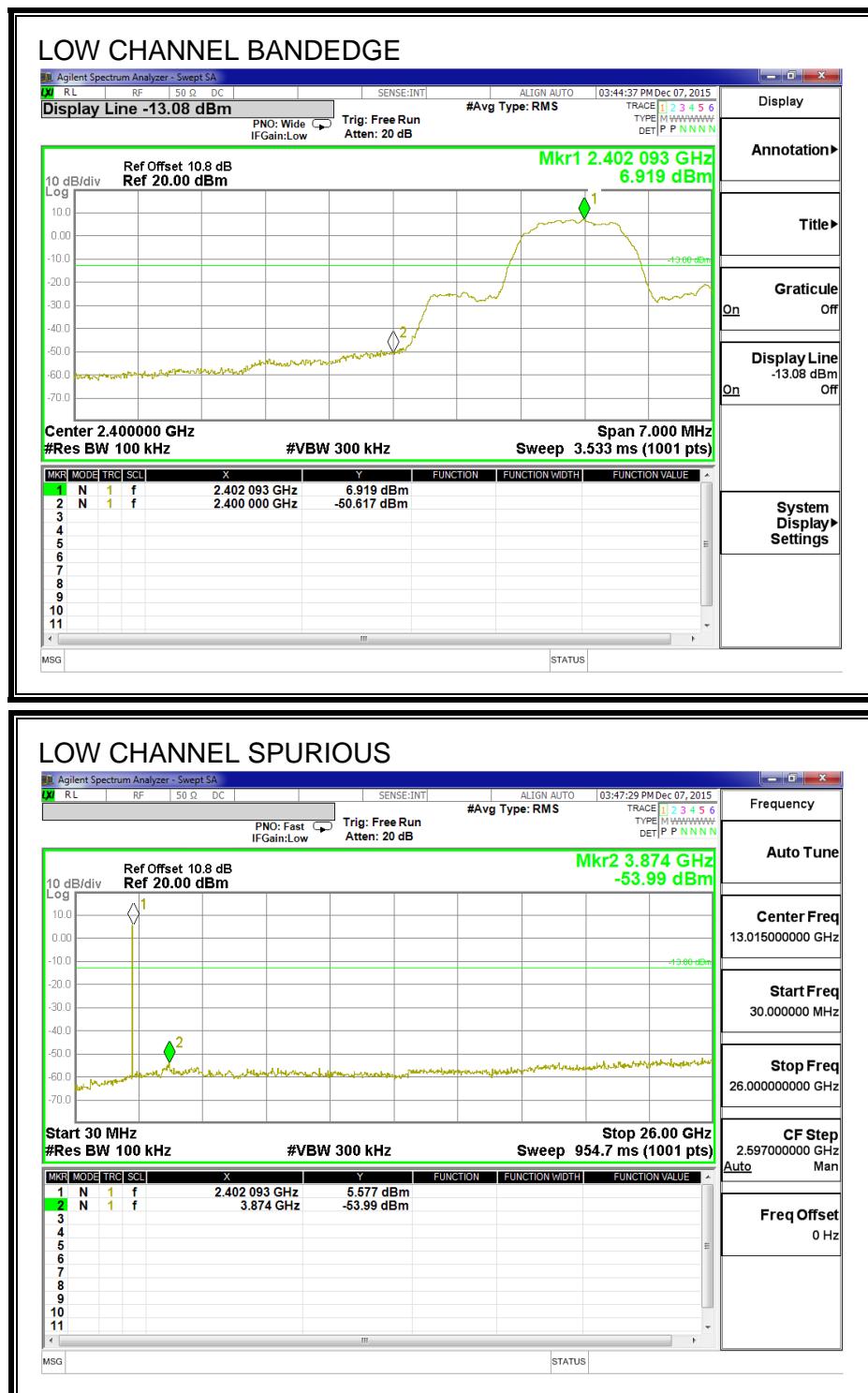
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

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

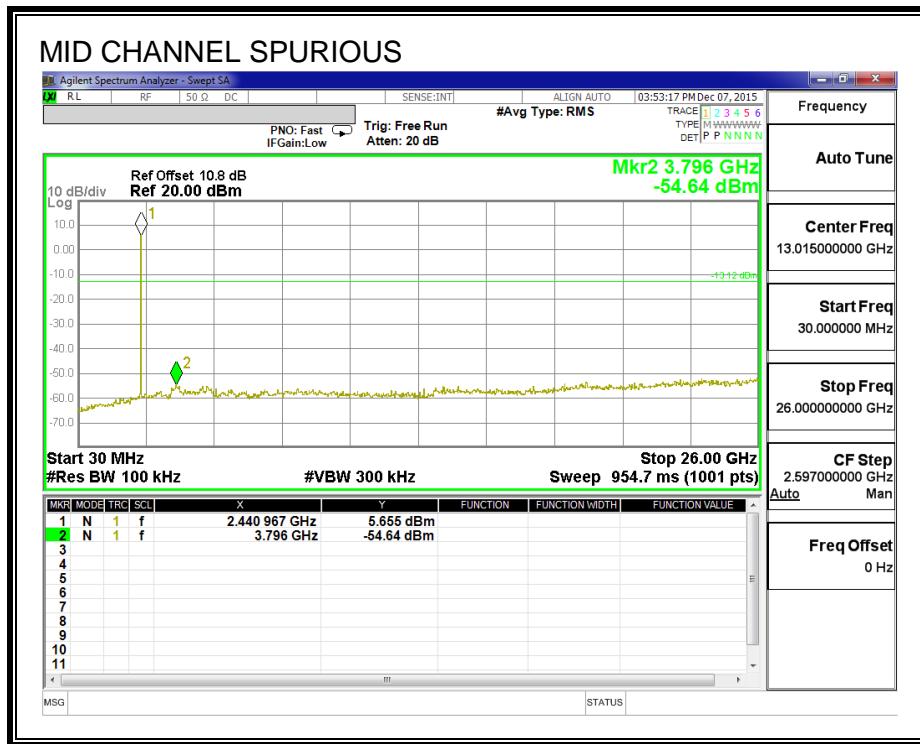
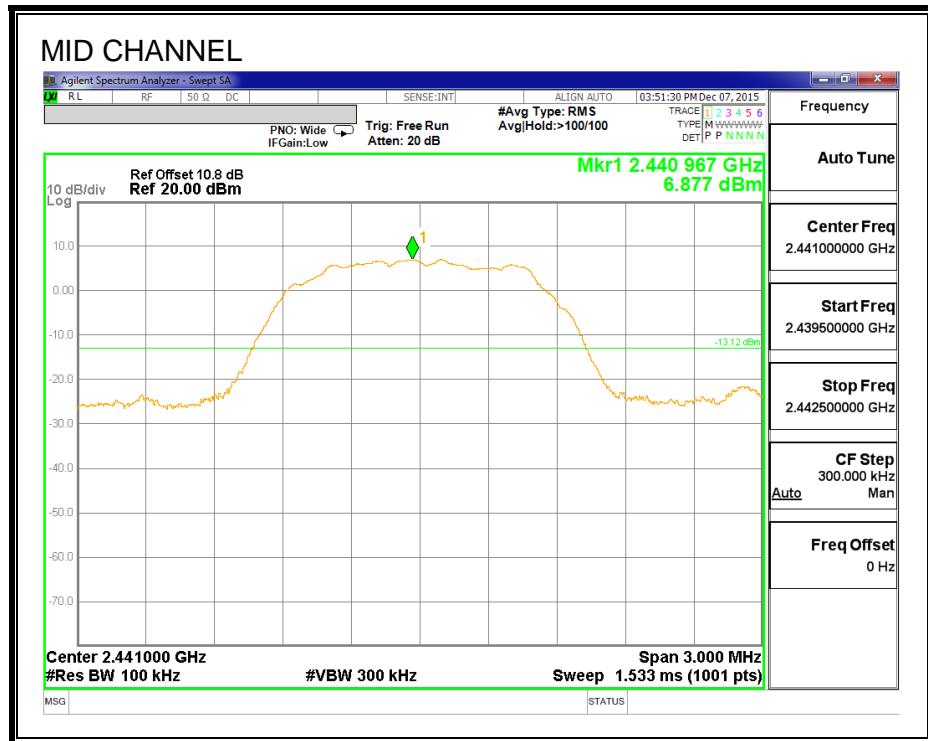
The bandedges at 2.4 and 2.4835 GHz are investigated with the transmitter set to the normal hopping mode.

RESULTS

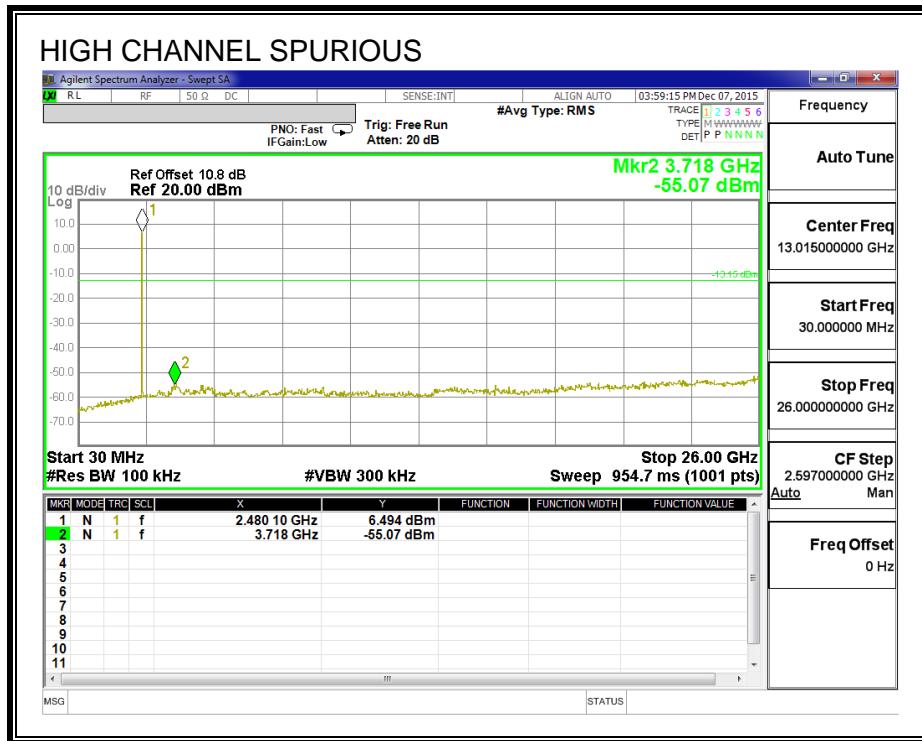
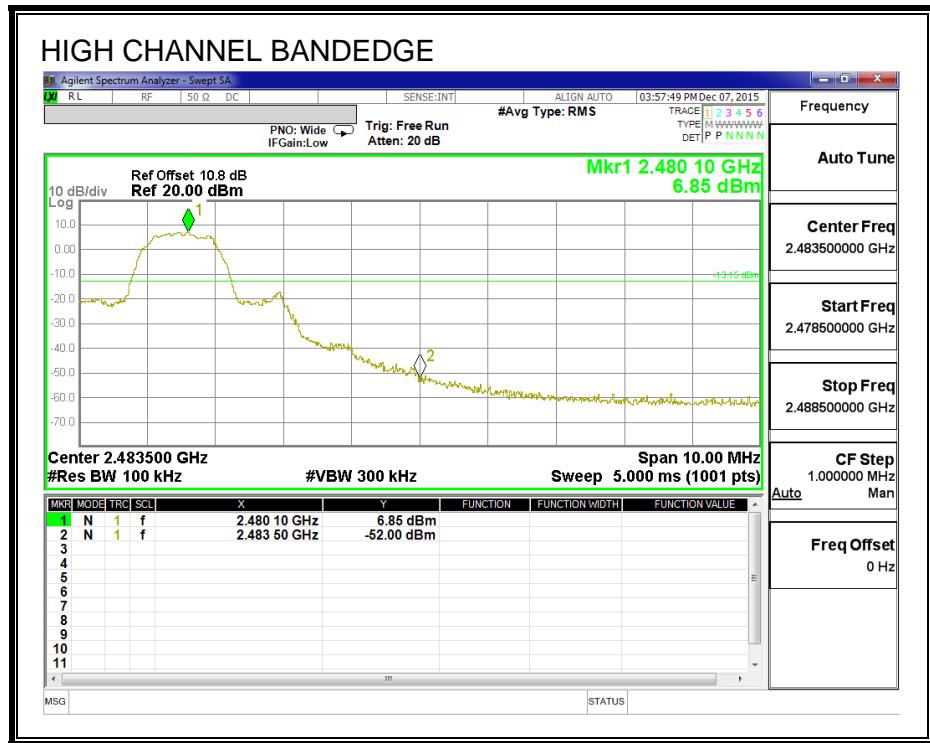
SPURIOUS EMISSIONS, LOW CHANNEL



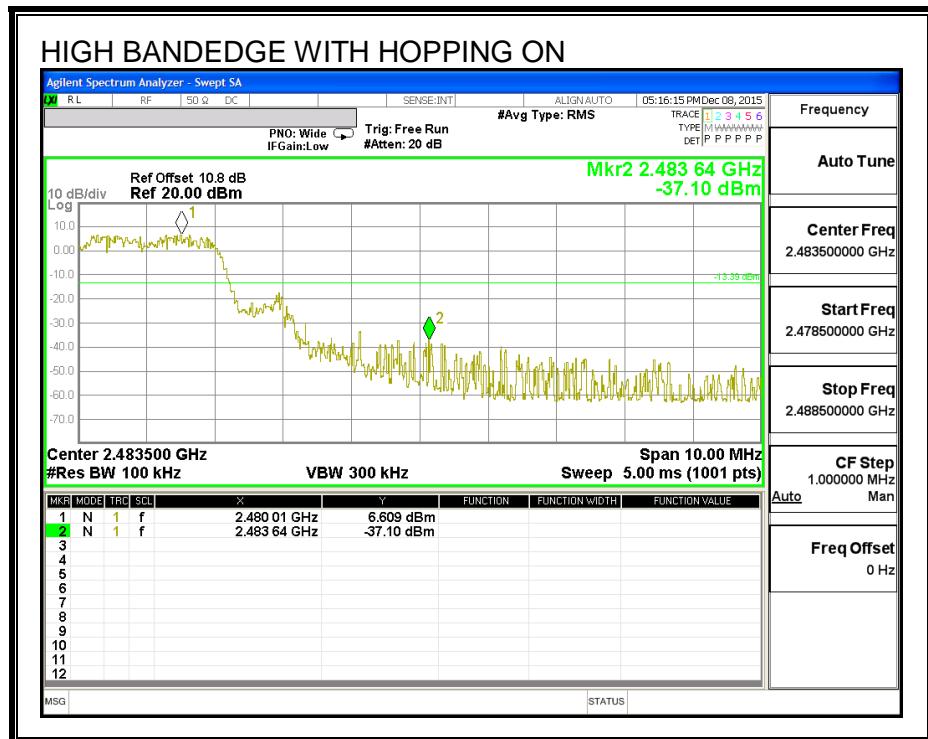
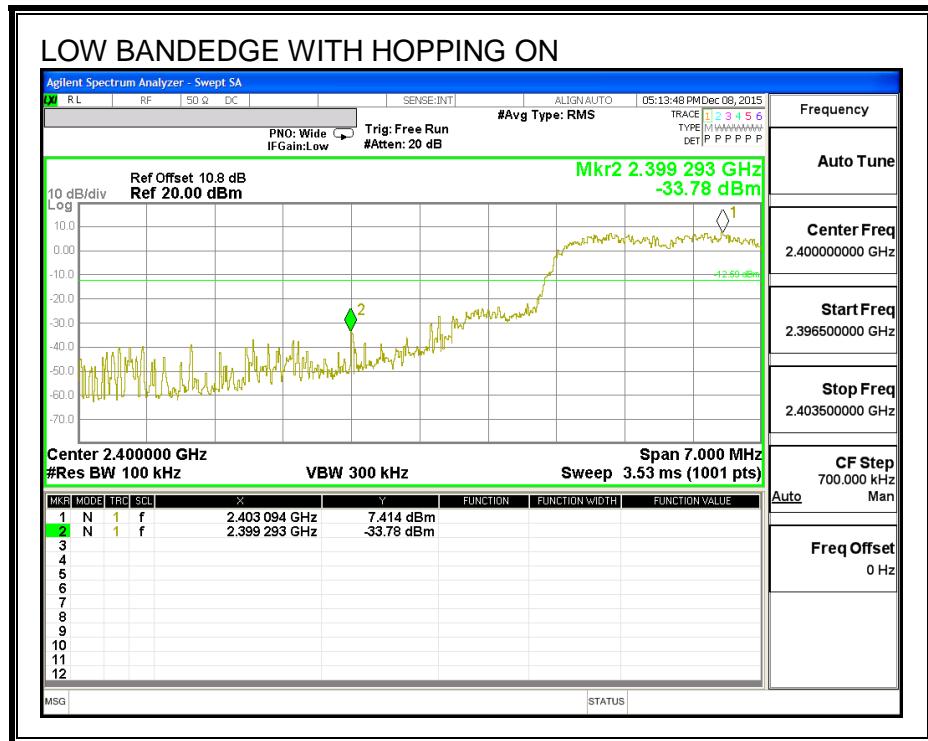
SPURIOUS EMISSIONS, MID CHANNEL



SPURIOUS EMISSIONS, HIGH CHANNEL



SPURIOUS BANDEDGE EMISSIONS 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.

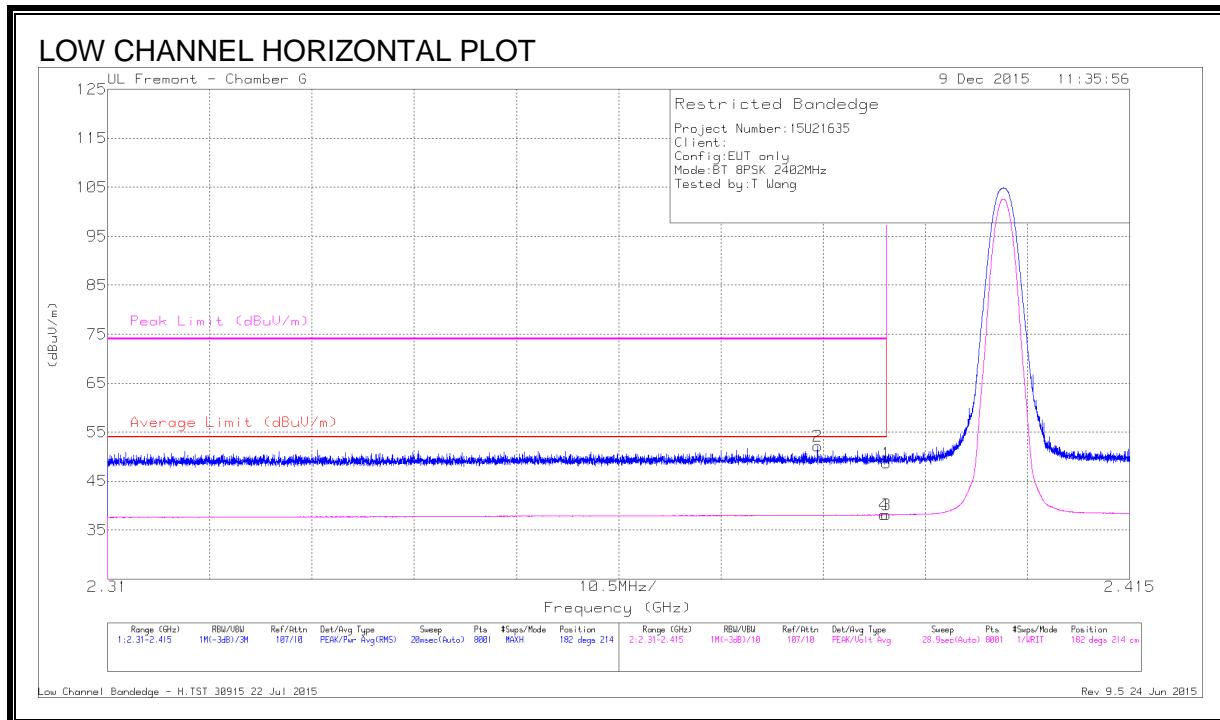
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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



DATA

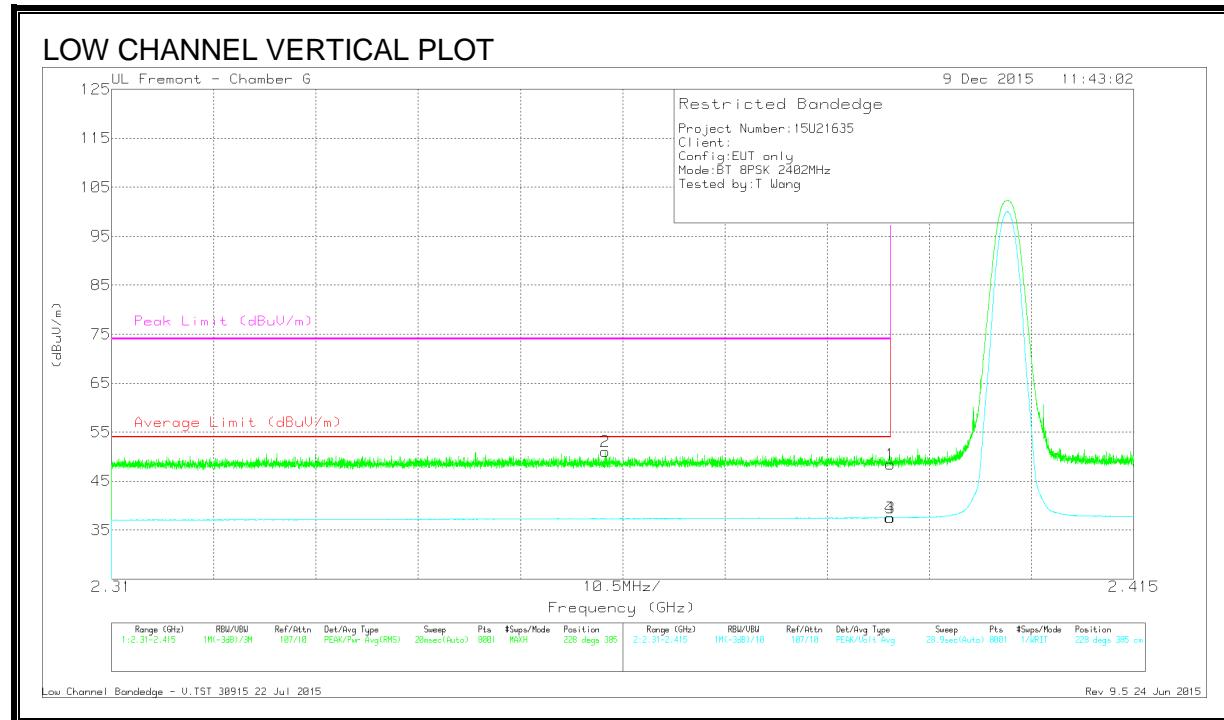
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.39 | 41.26 | Pk | 31.9 | -24.5 | 48.66 | - | - | 74 | -25.34 | 182 | 214 | H |
| 2 | * 2.383 | 44.85 | Pk | 31.8 | -24.5 | 52.15 | - | - | 74 | -21.85 | 182 | 214 | H |
| 3 | * 2.39 | 30.67 | VA1T | 31.9 | -24.5 | 38.07 | 54 | -15.93 | - | - | 182 | 214 | H |
| 4 | * 2.39 | 30.71 | VA1T | 31.9 | -24.5 | 38.11 | 54 | -15.89 | - | - | 182 | 214 | 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

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



DATA

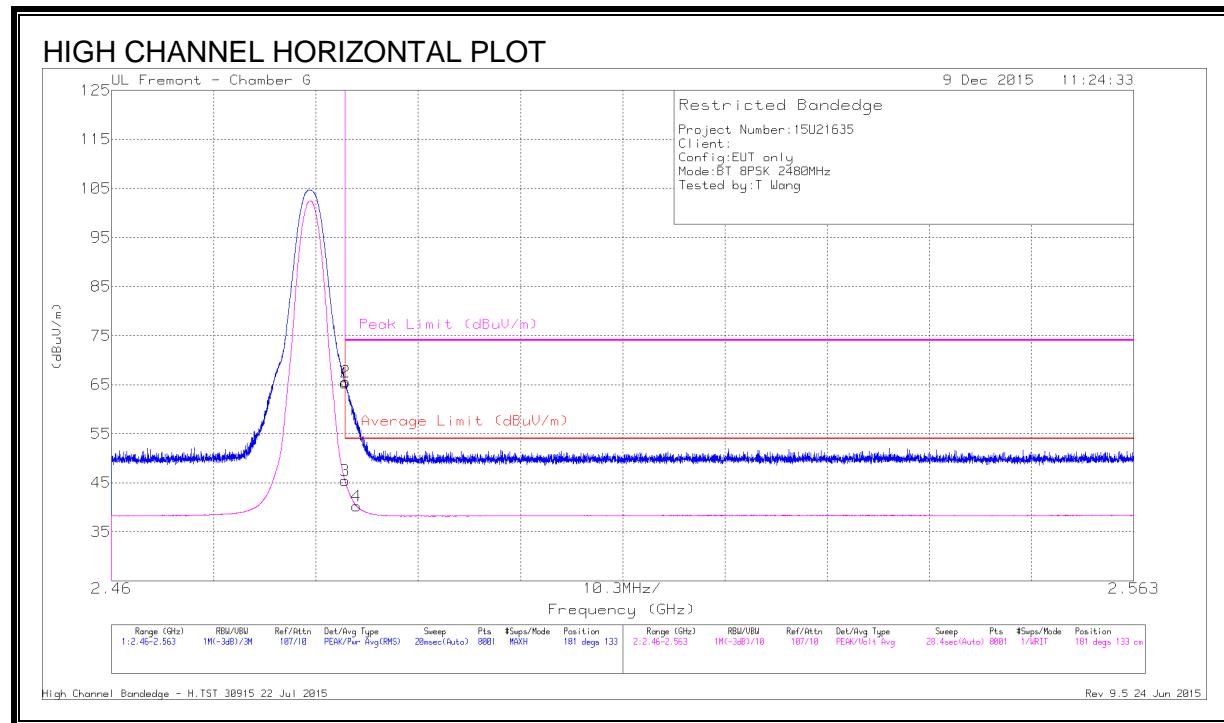
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.39 | 41.06 | Pk | 31.9 | -24.5 | 48.46 | - | - | 74 | -25.54 | 228 | 385 | V |
| 2 | * 2.361 | 43.81 | Pk | 31.7 | -24.5 | 51.01 | - | - | 74 | -22.99 | 228 | 385 | V |
| 3 | * 2.39 | 30.12 | VA1T | 31.9 | -24.5 | 37.52 | 54 | -16.48 | - | - | 228 | 385 | V |
| 4 | * 2.39 | 30.13 | VA1T | 31.9 | -24.5 | 37.53 | 54 | -16.47 | - | - | 228 | 385 | 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

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



DATA

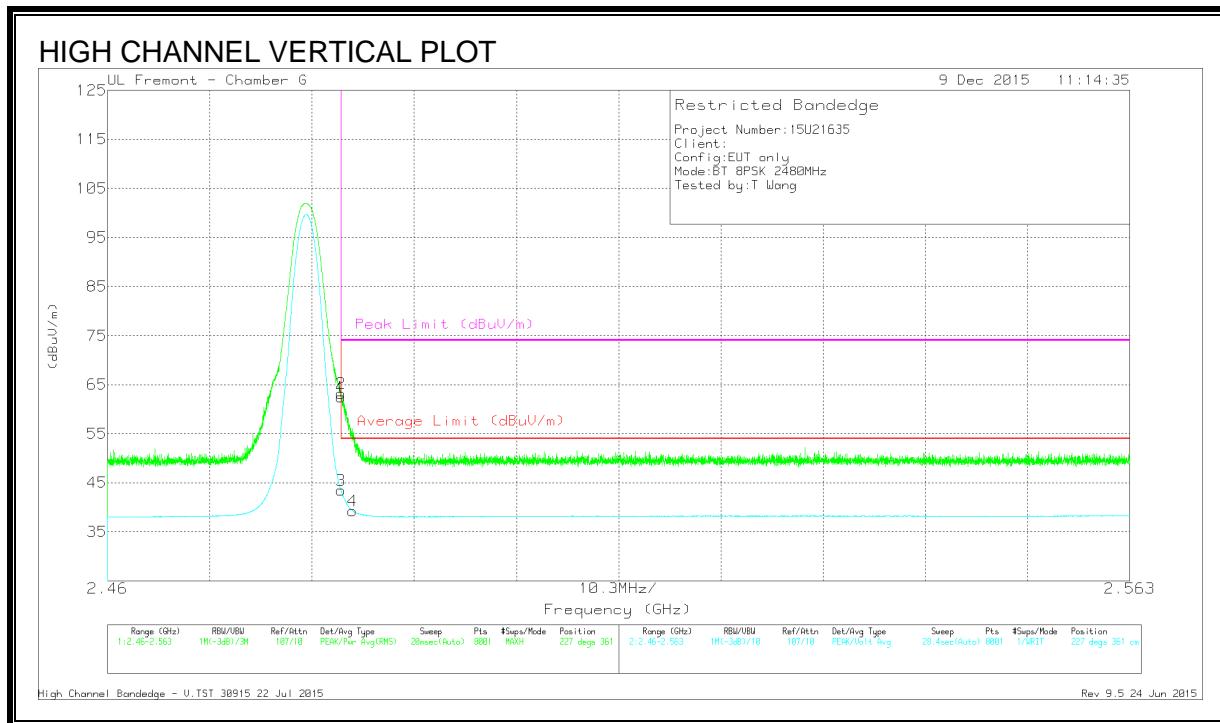
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.484 | 57.57 | Pk | 32.3 | -24.5 | 65.37 | - | - | 74 | -8.63 | 181 | 133 | H |
| 2 | * 2.484 | 57.82 | Pk | 32.3 | -24.5 | 65.62 | - | - | 74 | -8.38 | 181 | 133 | H |
| 3 | * 2.484 | 37.61 | VA1T | 32.3 | -24.5 | 45.41 | 54 | -8.59 | - | - | 181 | 133 | H |
| 4 | * 2.485 | 32.48 | VA1T | 32.3 | -24.5 | 40.28 | 54 | -13.72 | - | - | 181 | 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

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



DATA

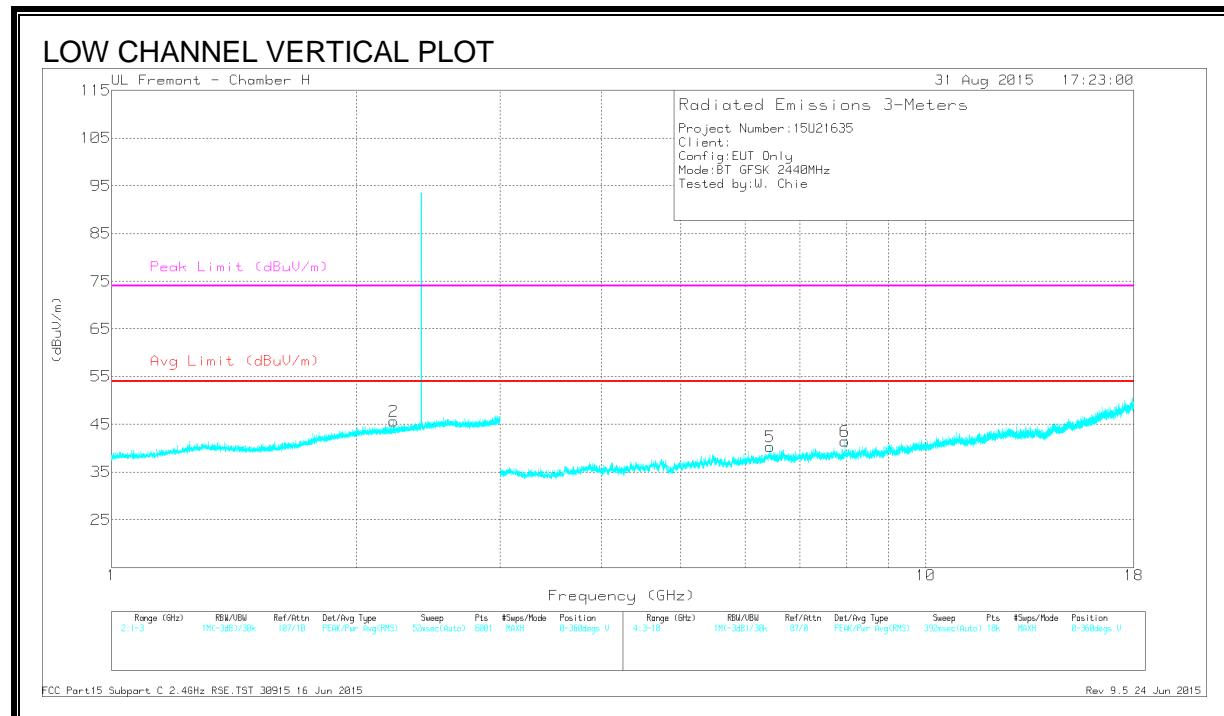
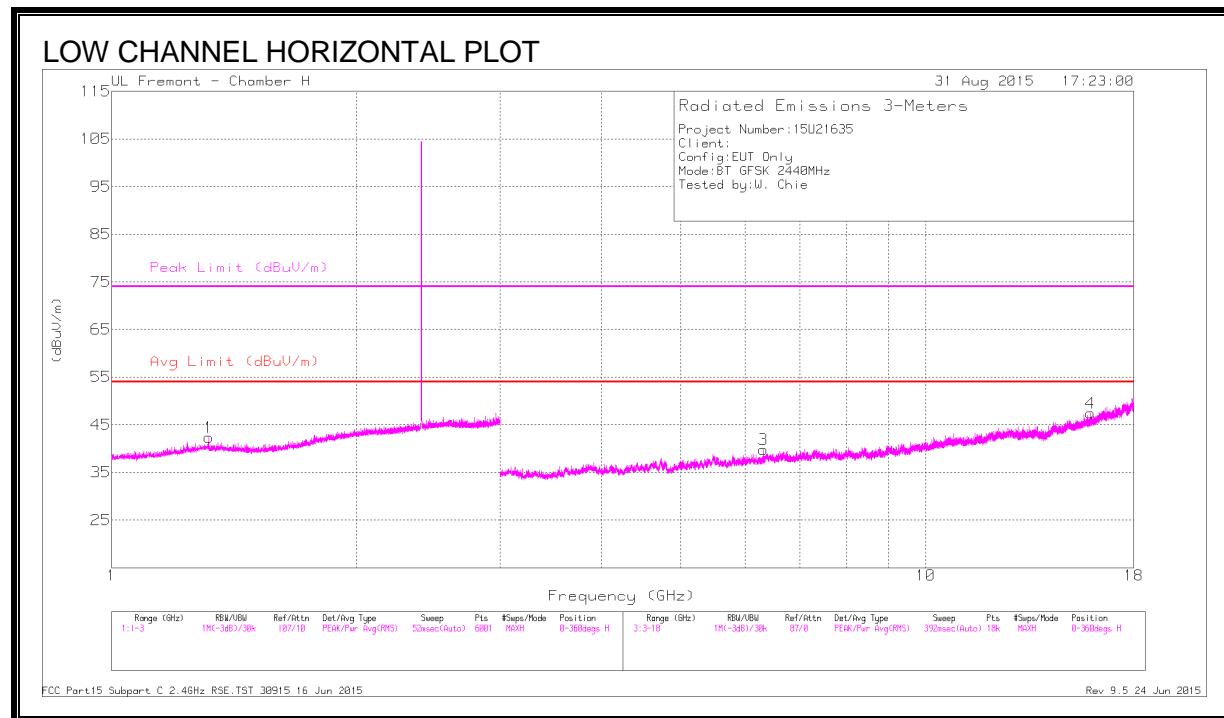
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.484 | 54.67 | Pk | 32.3 | -24.5 | 62.47 | - | - | 74 | -11.53 | 227 | 361 | V |
| 2 | * 2.484 | 55.4 | Pk | 32.3 | -24.5 | 63.2 | - | - | 74 | -10.8 | 227 | 361 | V |
| 3 | * 2.484 | 35.69 | VA1T | 32.3 | -24.5 | 43.49 | 54 | -10.51 | - | - | 227 | 361 | V |
| 4 | * 2.485 | 31.46 | VA1T | 32.3 | -24.5 | 39.26 | 54 | -14.74 | - | - | 227 | 361 | 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

HARMONICS AND SPURIOUS EMISSIONS



DATA

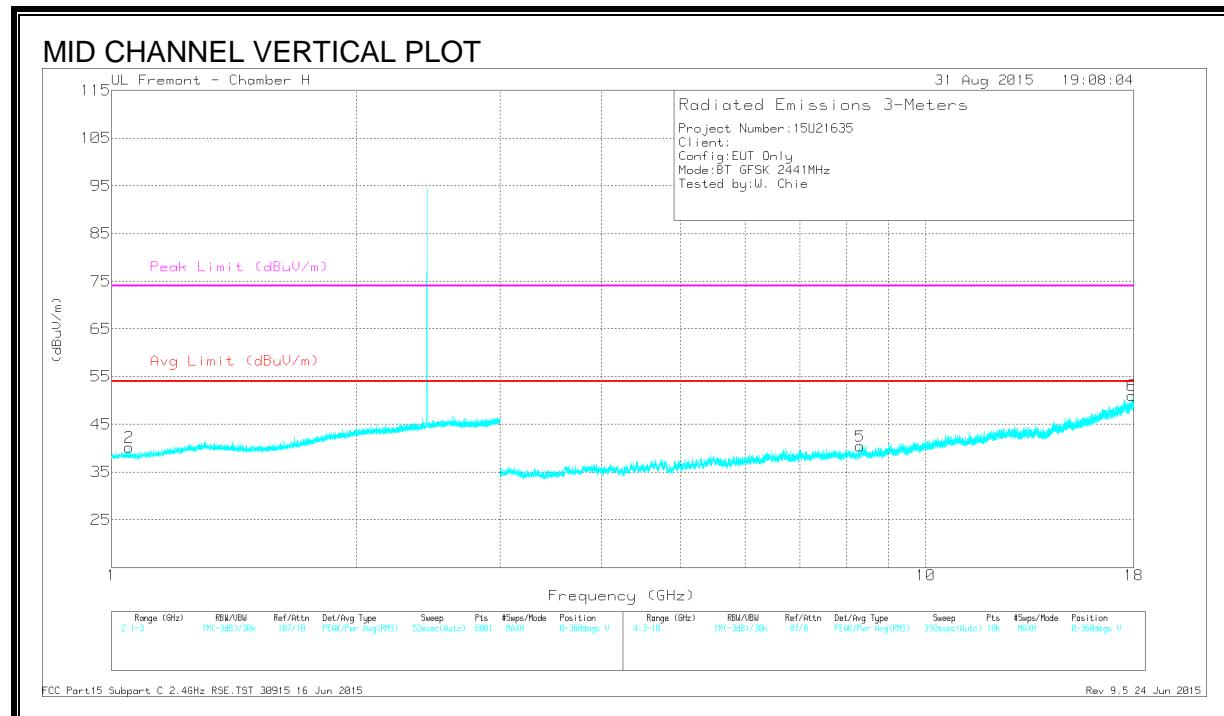
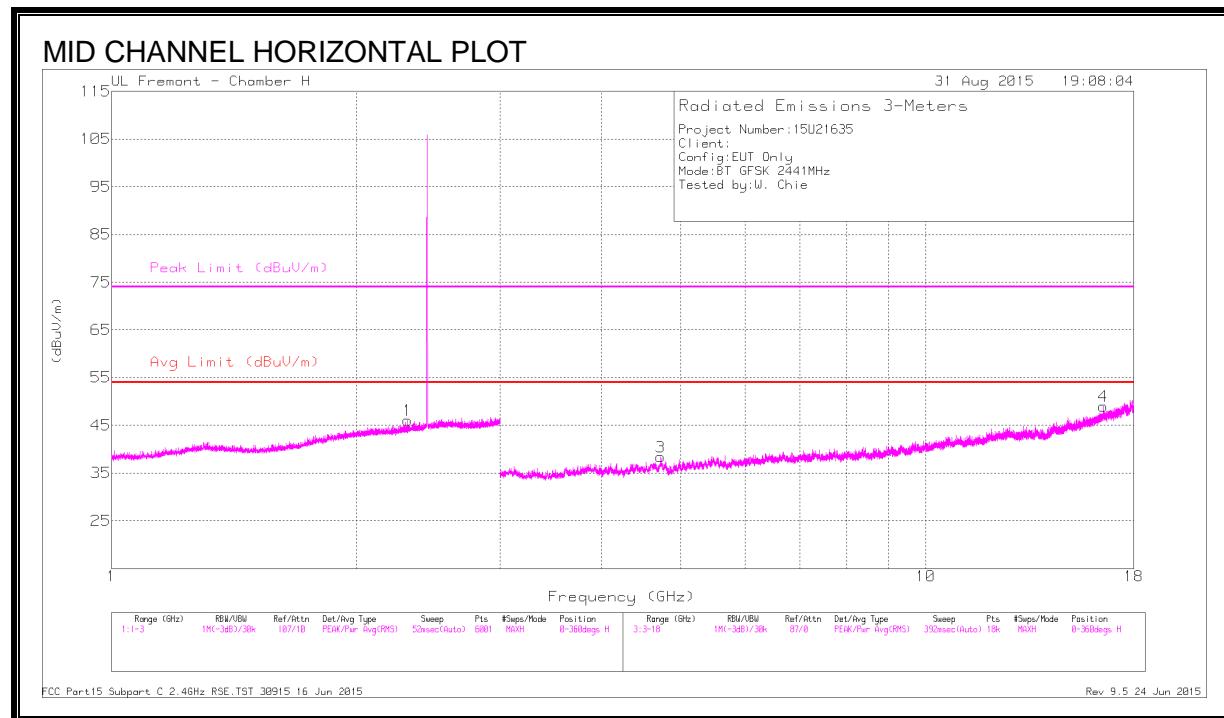
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T863 (dB/m) | Amp/Cbl/ Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|------------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 1.321 | 43.98 | PK3 | 28.9 | -24.8 | 48.08 | - | - | 74 | -25.92 | 51 | 260 | H |
| | * 1.311 | 30.69 | VA1T | 28.9 | -24.8 | 34.79 | 54 | -19.21 | - | - | 51 | 260 | H |
| 2 | * 2.222 | 43.44 | PK3 | 31.5 | -23.7 | 51.24 | - | - | 74 | -22.76 | 247 | 363 | V |
| | * 2.22 | 30.24 | VA1T | 31.5 | -23.6 | 38.14 | 54 | -15.86 | - | - | 247 | 363 | V |
| 4 | * 15.931 | 36.04 | PK3 | 41 | -23 | 54.04 | - | - | 74 | -19.96 | 184 | 208 | H |
| | * 15.933 | 23 | VA1T | 41 | -23 | 41 | 54 | -13 | - | - | 184 | 208 | H |
| 3 | 6.316 | 40.93 | PK3 | 35.5 | -30.4 | 46.03 | - | - | - | - | 235 | 213 | H |
| 5 | 6.439 | 40.41 | PK3 | 35.7 | -29.1 | 47.01 | - | - | - | - | 214 | 127 | V |
| 6 | 7.957 | 38.79 | PK3 | 35.9 | -28 | 46.69 | - | - | - | - | 236 | 182 | 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



DATA

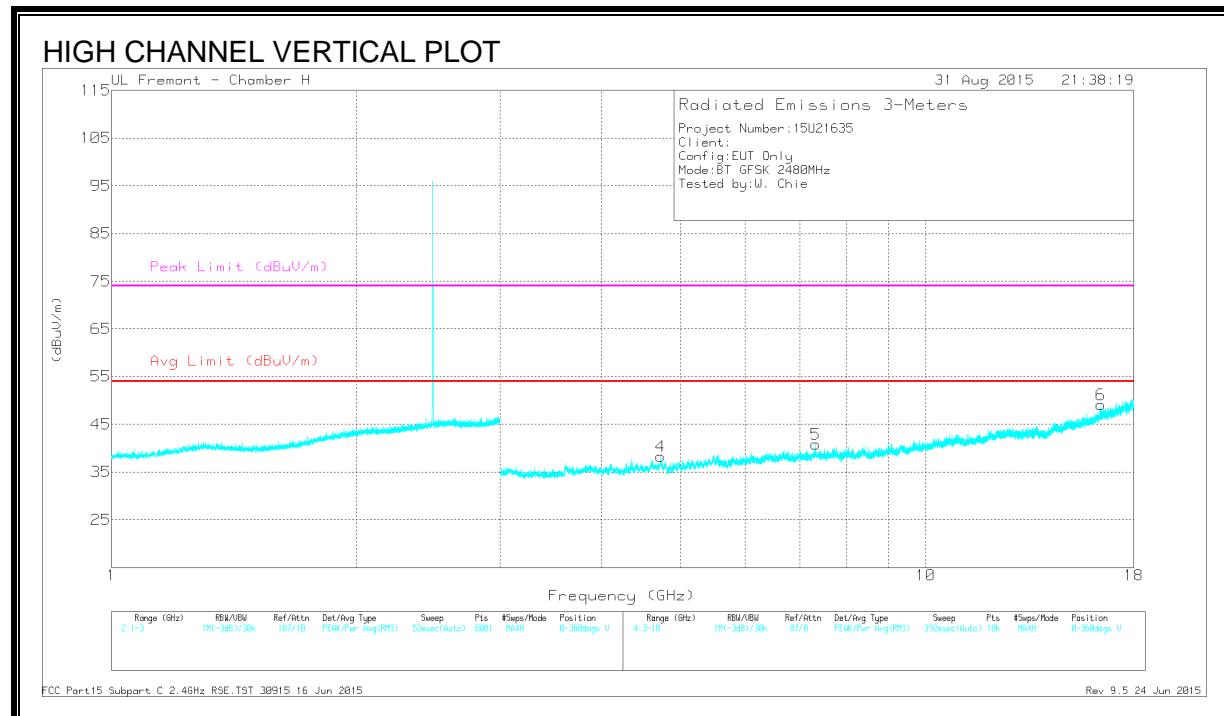
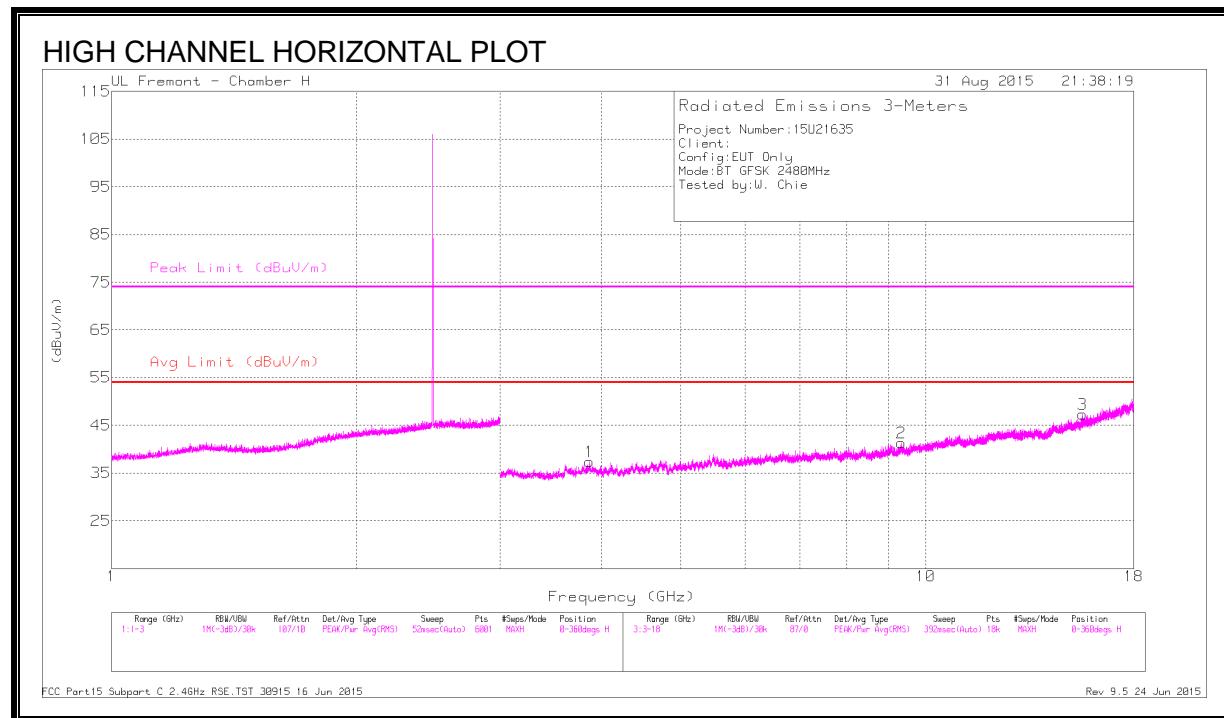
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T863 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 2 | * 1.053 | 44 | PK3 | 27 | -24.9 | 46.1 | - | - | 74 | -27.9 | 314 | 290 | V |
| | * 1.05 | 30.78 | VA1T | 27 | -24.8 | 32.98 | 54 | -21.02 | - | - | 314 | 290 | V |
| 3 | * 4.726 | 41.27 | PK3 | 34.2 | -30.6 | 44.87 | - | - | 74 | -29.13 | 107 | 120 | H |
| | * 4.726 | 28.33 | VA1T | 34.2 | -30.6 | 31.93 | 54 | -22.07 | - | - | 107 | 120 | H |
| 5 | * 8.307 | 38.18 | PK3 | 35.9 | -27.4 | 46.68 | - | - | 74 | -27.32 | 19 | 378 | V |
| | * 8.307 | 25.08 | VA1T | 35.9 | -27.4 | 33.58 | 54 | -20.42 | - | - | 19 | 378 | V |
| 6 | * 17.911 | 33.24 | PK3 | 41.8 | -18.1 | 56.94 | - | - | 74 | -17.06 | 256 | 155 | V |
| | * 17.912 | 20.8 | VA1T | 41.8 | -18.1 | 44.5 | 54 | -9.5 | - | - | 256 | 155 | V |
| 1 | 2.31 | 43.64 | PK3 | 31.8 | -23.5 | 51.94 | - | - | - | - | 285 | 174 | H |
| 4 | 16.51 | 36.38 | PK3 | 41.9 | -22.3 | 55.98 | - | - | - | - | 199 | 137 | 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



DATA

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T863 (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 | * 3.861 | 42.42 | PK3 | 33.5 | -31.2 | 44.72 | - | - | 74 | -29.28 | 223 | 269 | H |
| | * 3.864 | 29.21 | VA1T | 33.5 | -31.2 | 31.51 | 54 | -22.49 | - | - | 223 | 269 | H |
| 2 | * 9.334 | 36.79 | PK3 | 36.4 | -25.6 | 47.59 | - | - | 74 | -26.41 | 356 | 148 | H |
| | * 9.336 | 23.95 | VA1T | 36.4 | -25.6 | 34.75 | 54 | -19.25 | - | - | 356 | 148 | H |
| 3 | * 15.561 | 36.2 | PK3 | 40.8 | -24 | 53 | - | - | 74 | -21 | 130 | 195 | H |
| | * 15.562 | 23.25 | VA1T | 40.8 | -24 | 40.05 | 54 | -13.95 | - | - | 130 | 195 | H |
| 4 | * 4.725 | 41.28 | PK3 | 34.2 | -30.6 | 44.88 | - | - | 74 | -29.12 | 265 | 249 | V |
| | * 4.727 | 28.36 | VA1T | 34.2 | -30.6 | 31.96 | 54 | -22.04 | - | - | 265 | 249 | V |
| 5 | * 7.32 | 39.29 | PK3 | 36 | -28.2 | 47.09 | - | - | 74 | -26.91 | 82 | 389 | V |
| | * 7.321 | 26.22 | VA1T | 36 | -28.2 | 34.02 | 54 | -19.98 | - | - | 82 | 389 | V |
| 6 | 16.399 | 35.86 | PK3 | 41.6 | -22.3 | 55.16 | - | - | - | - | 144 | 291 | V |

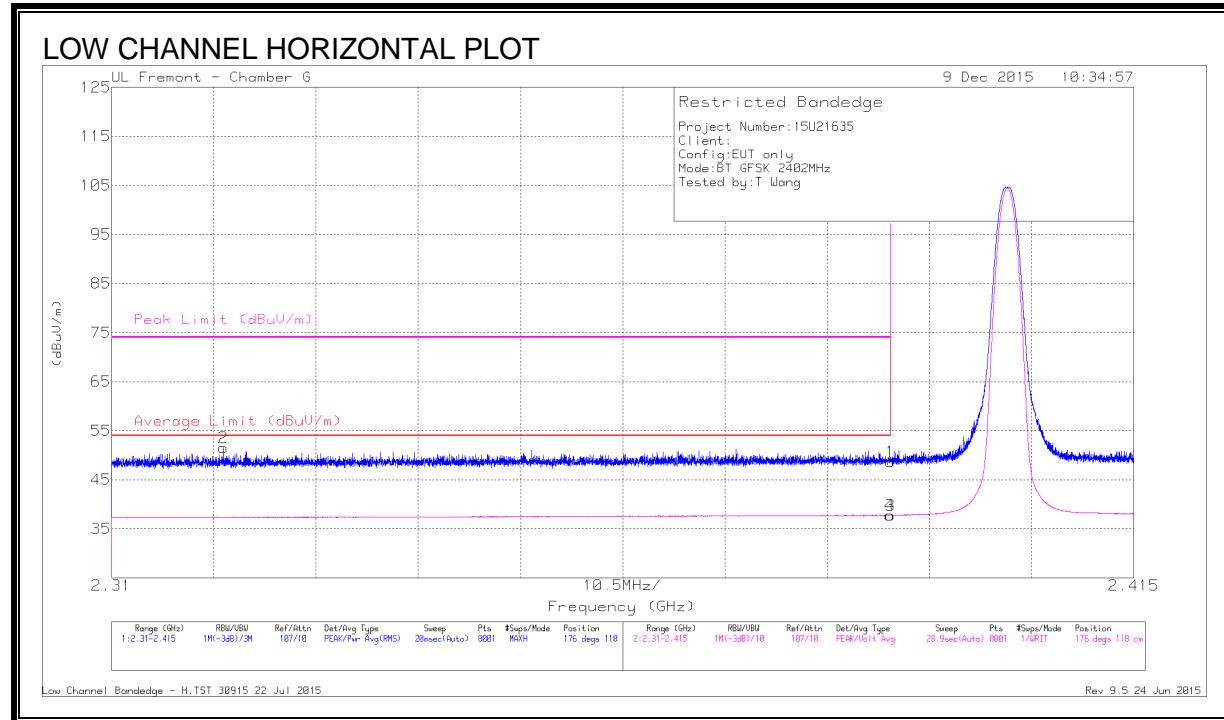
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

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)



DATA

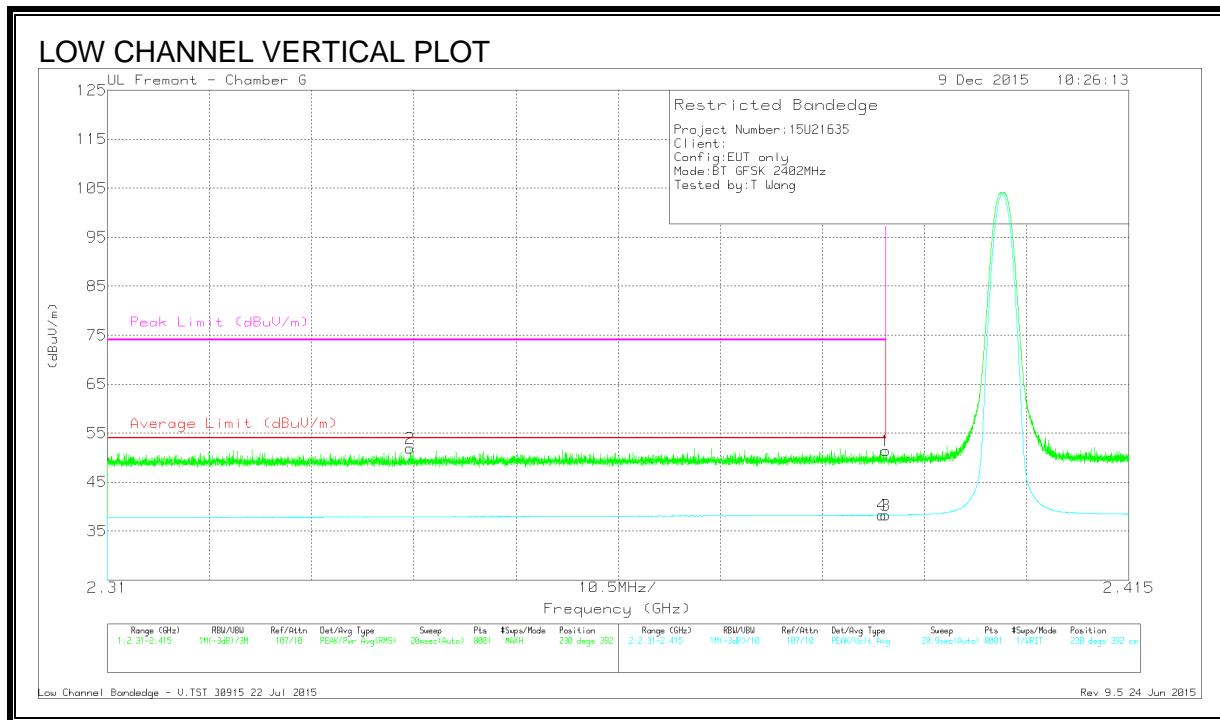
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 2 | * 2.321 | 44.54 | Pk | 31.6 | -24.6 | 51.54 | - | - | 74 | -22.46 | 176 | 118 | H |
| 1 | * 2.39 | 41.28 | Pk | 31.9 | -24.5 | 48.68 | - | - | 74 | -25.32 | 176 | 118 | H |
| 3 | * 2.39 | 30.37 | VA1T | 31.9 | -24.5 | 37.77 | 54 | -16.23 | - | - | 176 | 118 | H |
| 4 | * 2.39 | 30.39 | VA1T | 31.9 | -24.5 | 37.79 | 54 | -16.21 | - | - | 176 | 118 | 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

RESTRICTED BANDEDGE (LOW CHANNEL, VERTICAL)



DATA

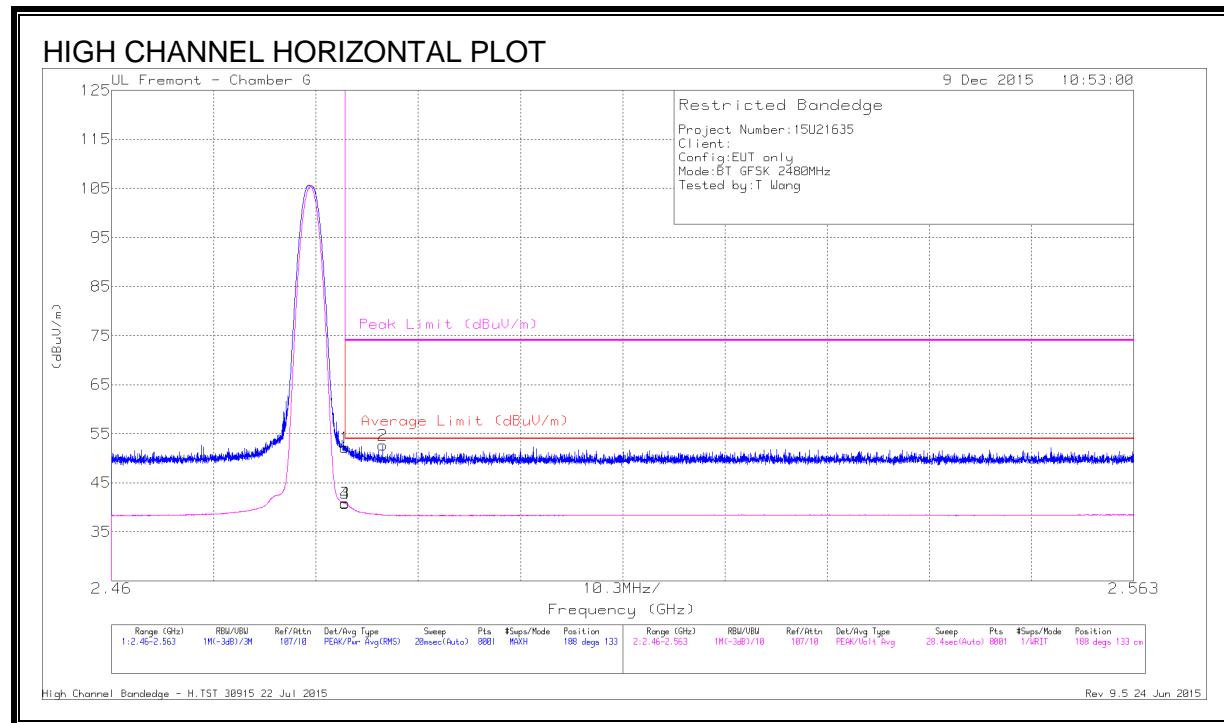
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|---------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.39 | 44 | Pk | 31.9 | -24.5 | 51.4 | - | - | 74 | -22.6 | 230 | 392 | V |
| 2 | * 2.341 | 44.78 | Pk | 31.7 | -24.6 | 51.88 | - | - | 74 | -22.12 | 230 | 392 | V |
| 3 | * 2.39 | 30.84 | VA1T | 31.9 | -24.5 | 38.24 | 54 | -15.76 | - | - | 230 | 392 | V |
| 4 | * 2.39 | 30.85 | VA1T | 31.9 | -24.5 | 38.25 | 54 | -15.75 | - | - | 230 | 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

RESTRICTED BANDEDGE (HIGH CHANNEL, HORIZONTAL)



DATA

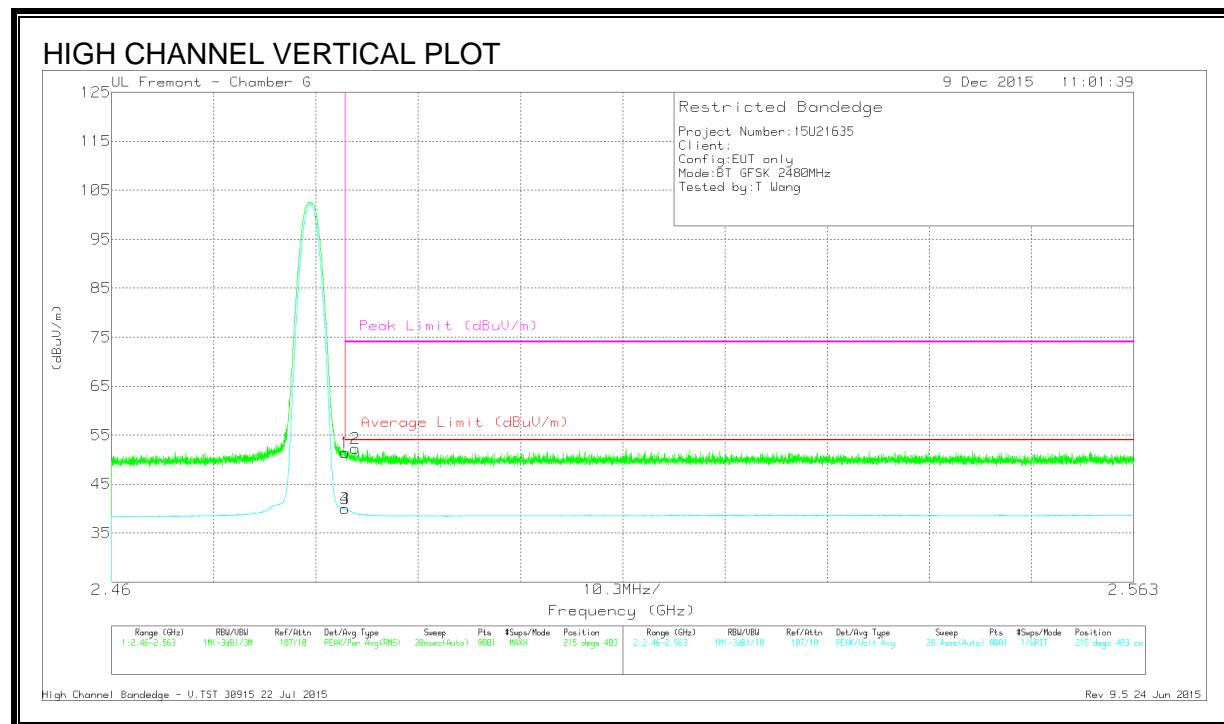
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.484 | 44.34 | Pk | 32.3 | -24.5 | 52.14 | - | - | 74 | -21.86 | 188 | 133 | H |
| 3 | * 2.484 | 33 | VA1T | 32.3 | -24.5 | 40.8 | 54 | -13.2 | - | - | 188 | 133 | H |
| 4 | * 2.484 | 32.99 | VA1T | 32.3 | -24.5 | 40.79 | 54 | -13.21 | - | - | 188 | 133 | H |
| 2 | * 2.487 | 44.8 | Pk | 32.3 | -24.5 | 52.6 | - | - | 74 | -21.4 | 188 | 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

RESTRICTED BANDEDGE (HIGH CHANNEL, VERTICAL)



DATA

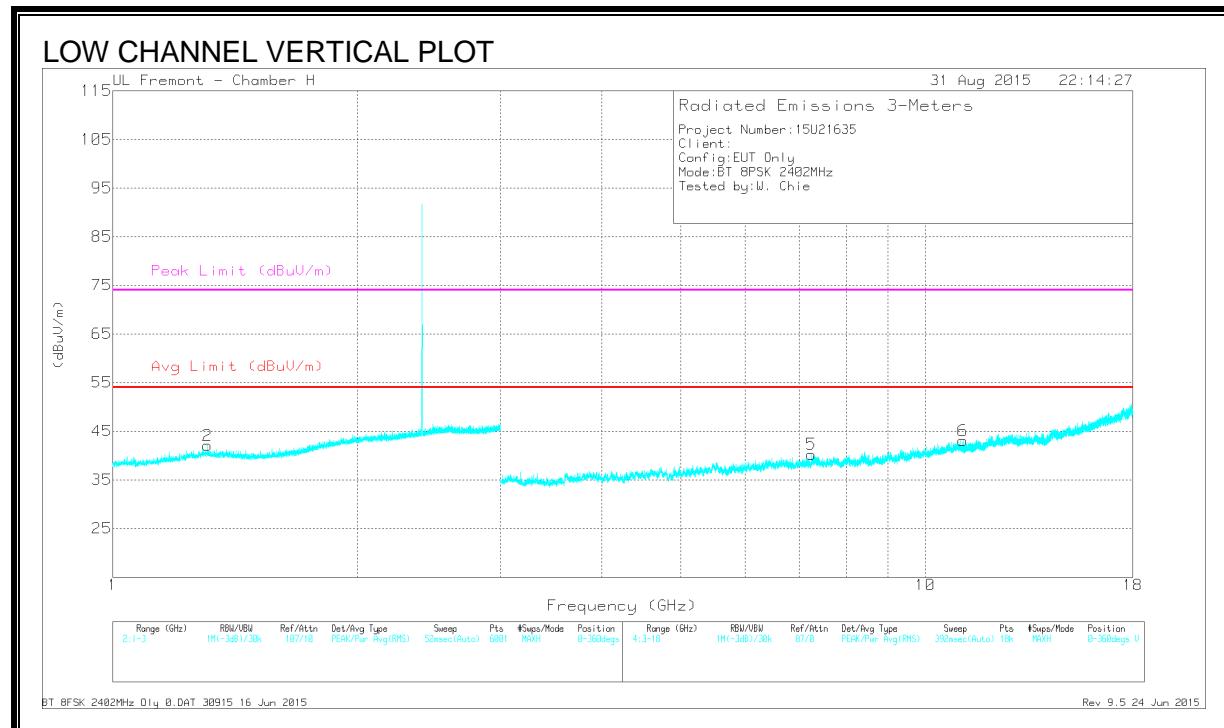
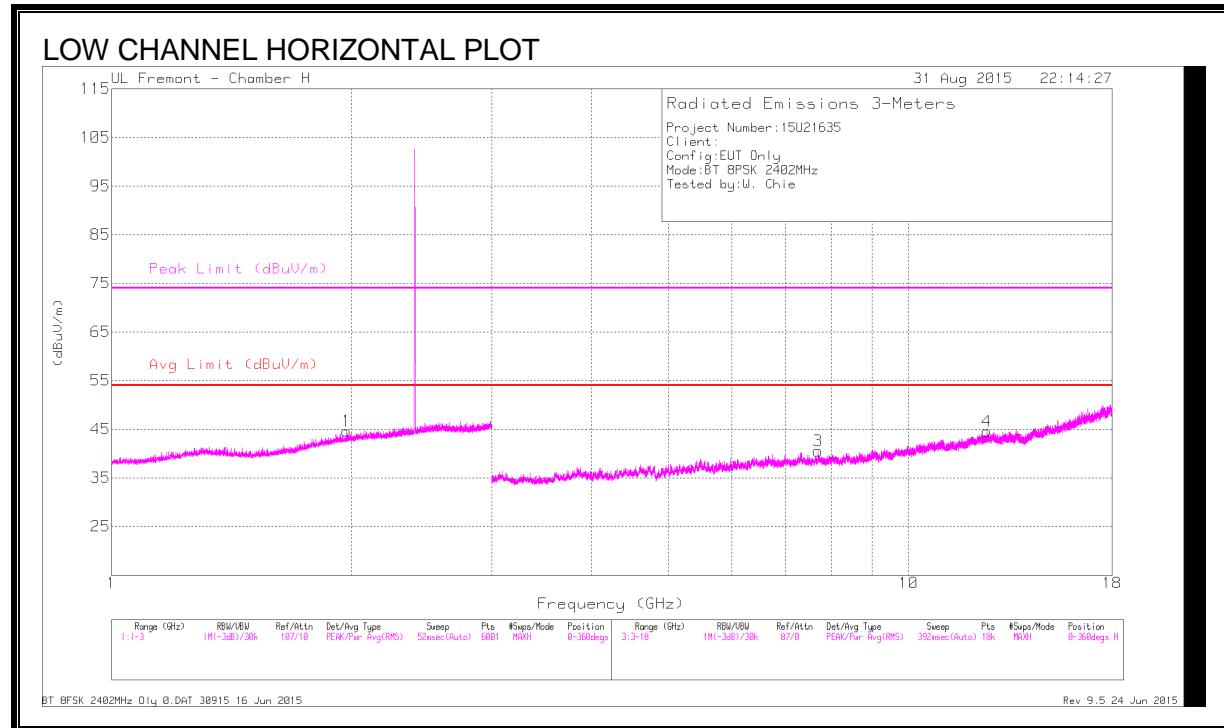
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T862 (dB/m) | Amp/Cbl/Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Average Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|-----------------------|----------------------------|------------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.484 | 43.58 | Pk | 32.3 | -24.5 | 51.38 | - | - | 74 | -22.62 | 215 | 403 | V |
| 3 | * 2.484 | 32.17 | VA1T | 32.3 | -24.5 | 39.97 | 54 | -14.03 | - | - | 215 | 403 | V |
| 4 | * 2.484 | 32.17 | VA1T | 32.3 | -24.5 | 39.97 | 54 | -14.03 | - | - | 215 | 403 | V |
| 2 | * 2.485 | 44.44 | Pk | 32.3 | -24.5 | 52.24 | - | - | 74 | -21.76 | 215 | 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

HARMONICS AND SPURIOUS EMISSIONS



DATA

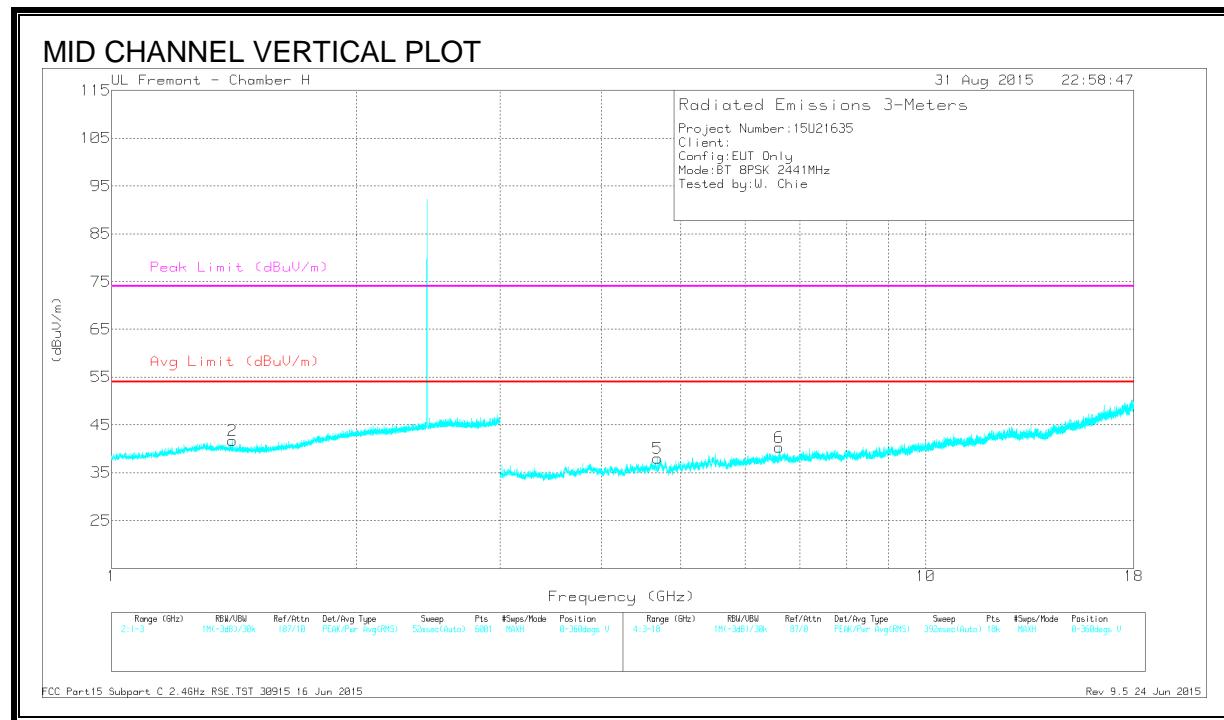
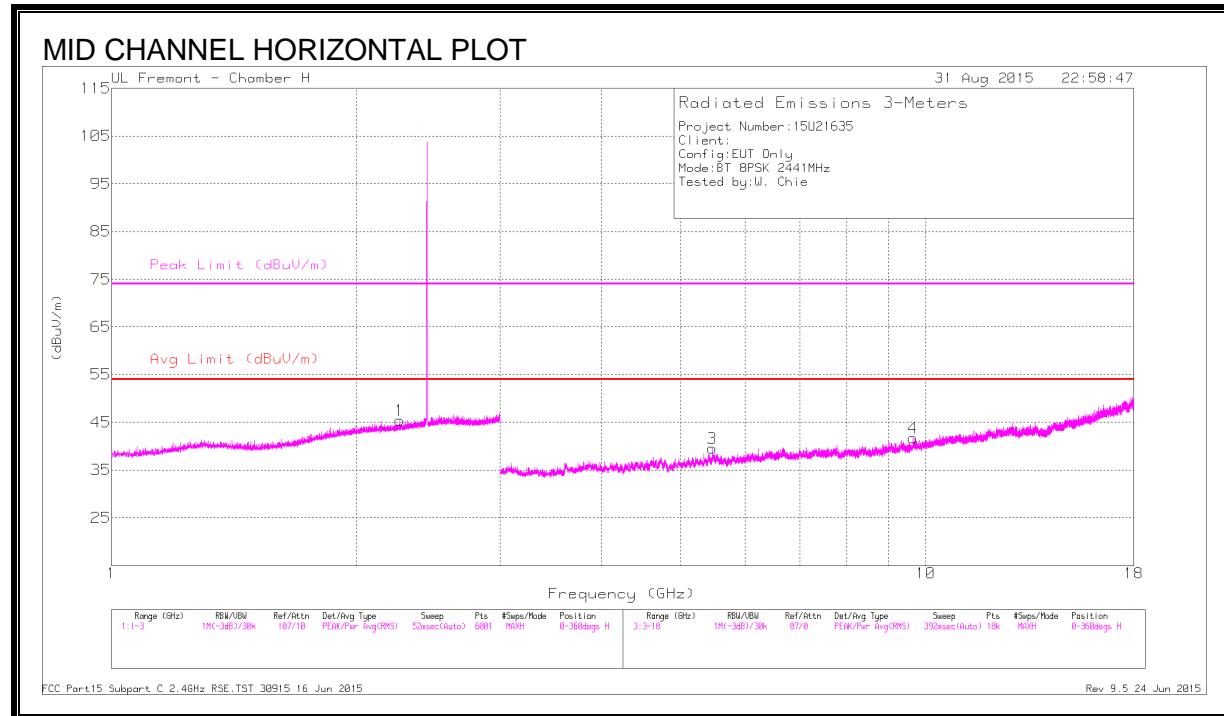
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T863 (dB/m) | Amp/Cbl/ Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|------------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 2 | * 1.309 | 44.22 | PK3 | 28.9 | -24.8 | 48.32 | - | - | 74 | -25.68 | 52 | 339 | V |
| | * 1.308 | 30.74 | VA1T | 28.9 | -24.8 | 34.84 | 54 | -19.16 | - | - | 52 | 339 | V |
| 3 | * 7.702 | 38.72 | PK3 | 35.9 | -27.8 | 46.82 | - | - | 74 | -27.18 | 271 | 217 | H |
| | * 7.705 | 25.83 | VA1T | 35.9 | -27.7 | 34.03 | 54 | -19.97 | - | - | 271 | 217 | H |
| 4 | * 12.541 | 37.14 | PK3 | 39.3 | -25 | 51.44 | - | - | 74 | -22.56 | 153 | 167 | H |
| | * 12.542 | 23.5 | VA1T | 39.3 | -25 | 37.8 | 54 | -16.2 | - | - | 153 | 167 | H |
| 6 | * 11.126 | 36.52 | PK3 | 37.8 | -25.2 | 49.12 | - | - | 74 | -24.88 | 67 | 123 | V |
| | * 11.127 | 23.55 | VA1T | 37.8 | -25.2 | 36.15 | 54 | -17.85 | - | - | 67 | 123 | V |
| 1 | 1.971 | 43.98 | PK3 | 31.1 | -24 | 51.08 | - | - | - | - | 112 | 167 | H |
| 5 | 7.237 | 40.27 | PK3 | 35.9 | -29.6 | 46.57 | - | - | - | - | 129 | 180 | 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



DATA

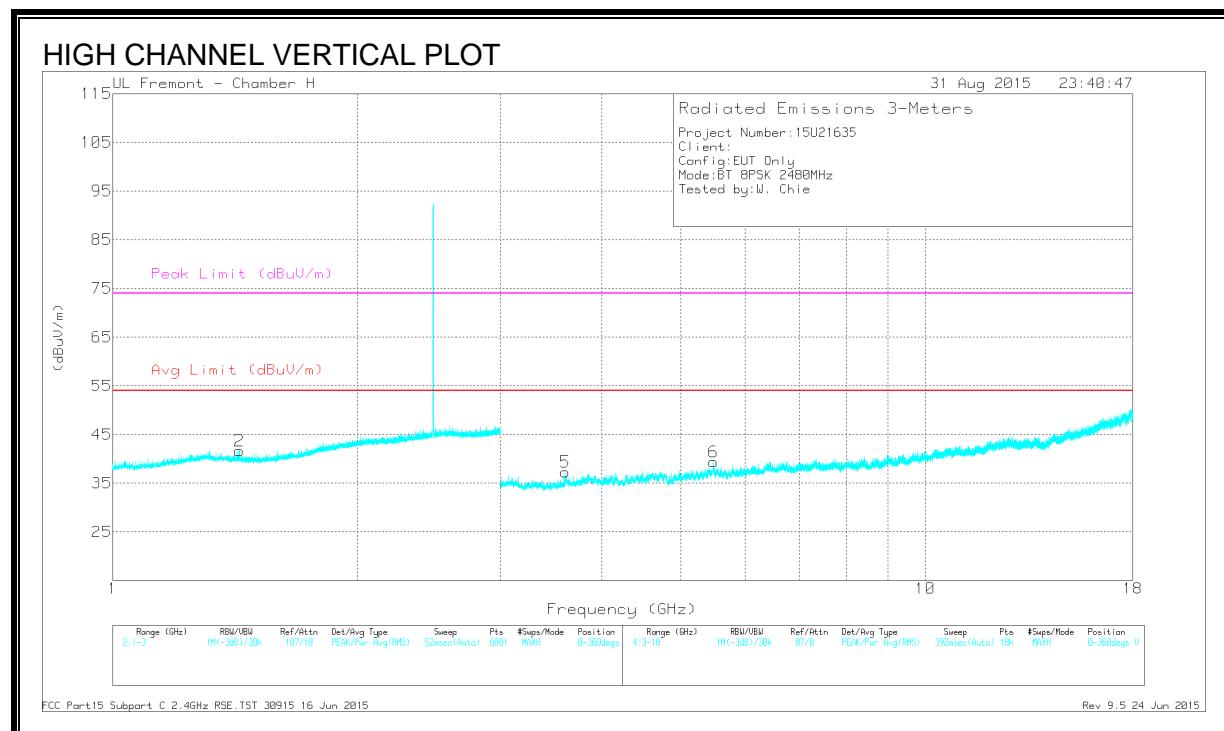
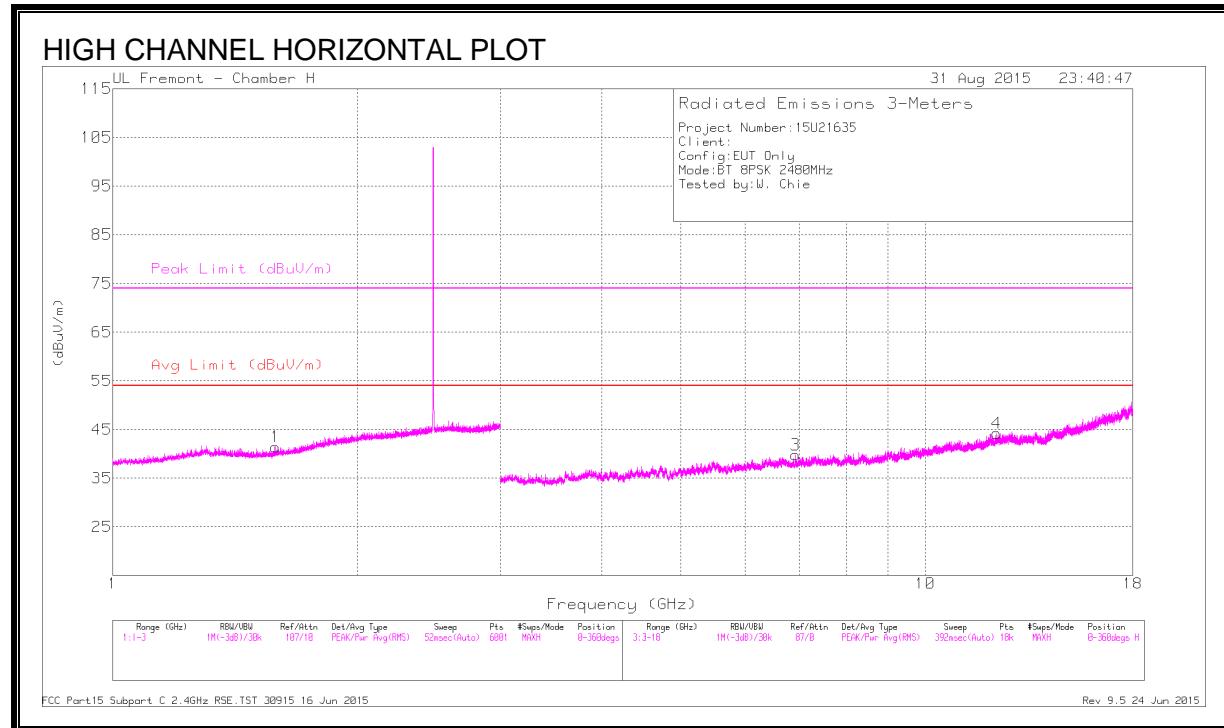
| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T863 (dB/m) | Amp/Cbl/ Fltr/Pad (dB) | Corrected Reading (dBuV/m) | Avg Limit (dBuV/m) | Margin (dB) | Peak Limit (dBuV/m) | PK Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|------|----------------|------------------------|----------------------------|--------------------|-------------|---------------------|----------------|----------------|-------------|----------|
| 1 | * 2.262 | 43.29 | PK3 | 31.6 | -23.6 | 51.29 | - | - | 74 | -22.71 | 231 | 217 | H |
| | * 2.261 | 30.18 | VA1T | 31.6 | -23.6 | 38.18 | 54 | -15.82 | - | - | 231 | 217 | H |
| 2 | * 1.41 | 44.29 | PK3 | 28.5 | -24.5 | 48.29 | - | - | 74 | -25.71 | 132 | 284 | V |
| | * 1.41 | 30.58 | VA1T | 28.5 | -24.5 | 34.58 | 54 | -19.42 | - | - | 132 | 284 | V |
| 5 | * 4.686 | 41.45 | PK3 | 34.1 | -30.7 | 44.85 | - | - | 74 | -29.15 | 128 | 211 | V |
| | * 4.687 | 27.79 | VA1T | 34.1 | -30.7 | 31.19 | 54 | -22.81 | - | - | 128 | 211 | V |
| 3 | 5.47 | 40.66 | PK3 | 35.4 | -30.4 | 45.66 | - | - | - | - | 165 | 266 | H |
| 6 | 6.608 | 40.87 | PK3 | 35.8 | -30.1 | 46.57 | - | - | - | - | 183 | 240 | V |
| 4 | 9.648 | 36.52 | PK3 | 36.7 | -25.3 | 47.92 | - | - | - | - | 153 | 249 | 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



DATA

| Marker | Frequency (GHz) | Meter Reading (dBuV) | Det | AF T863 (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 | * 1.584 | 43.93 | PK3 | 28.4 | -24.2 | 48.13 | - | - | 74 | -25.87 | 169 | 216 | H |
| | * 1.586 | 30.47 | VA1T | 28.4 | -24.2 | 34.67 | 54 | -19.33 | - | - | 169 | 216 | H |
| 4 | * 12.237 | 35.77 | PK3 | 39.1 | -24.4 | 50.47 | - | - | 74 | -23.53 | 206 | 155 | H |
| | * 12.235 | 23.02 | VA1T | 39.1 | -24.4 | 37.72 | 54 | -16.28 | - | - | 206 | 155 | H |
| 5 | * 3.608 | 41.22 | PK3 | 33 | -31.7 | 42.52 | - | - | 74 | -31.48 | 206 | 155 | V |
| | * 3.609 | 28.97 | VA1T | 33 | -31.7 | 30.27 | 54 | -23.73 | - | - | 206 | 155 | V |
| 2 | 1.432 | 44.26 | PK3 | 28.4 | -24.5 | 48.16 | - | - | - | - | 232 | 189 | V |
| 6 | 5.486 | 40.49 | PK3 | 35.5 | -30.3 | 45.69 | - | - | - | - | 159 | 386 | V |
| 3 | 6.927 | 41.59 | PK3 | 35.8 | -30.1 | 47.29 | - | - | - | - | 274 | 200 | H |

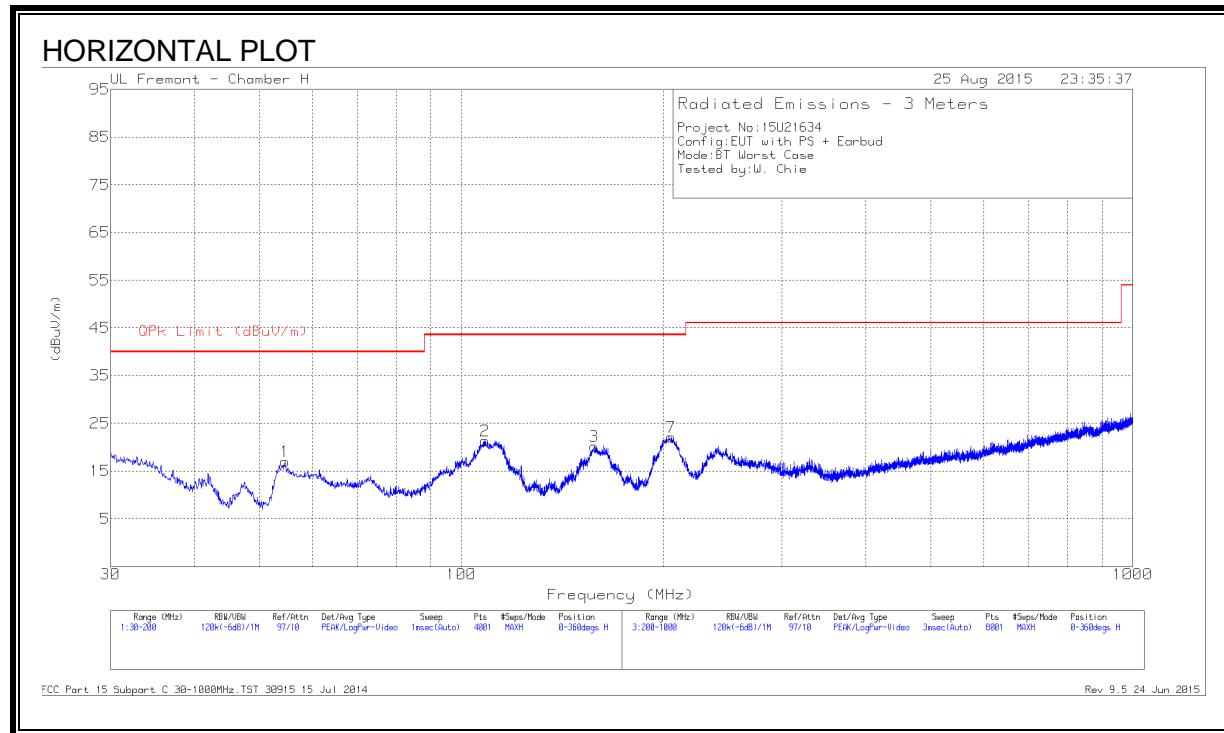
* - indicates frequency in CFR 47, Part 15 and Industry Canada RSS-Restricted Band.

PK3 - FHSS Method: Maximum Peak

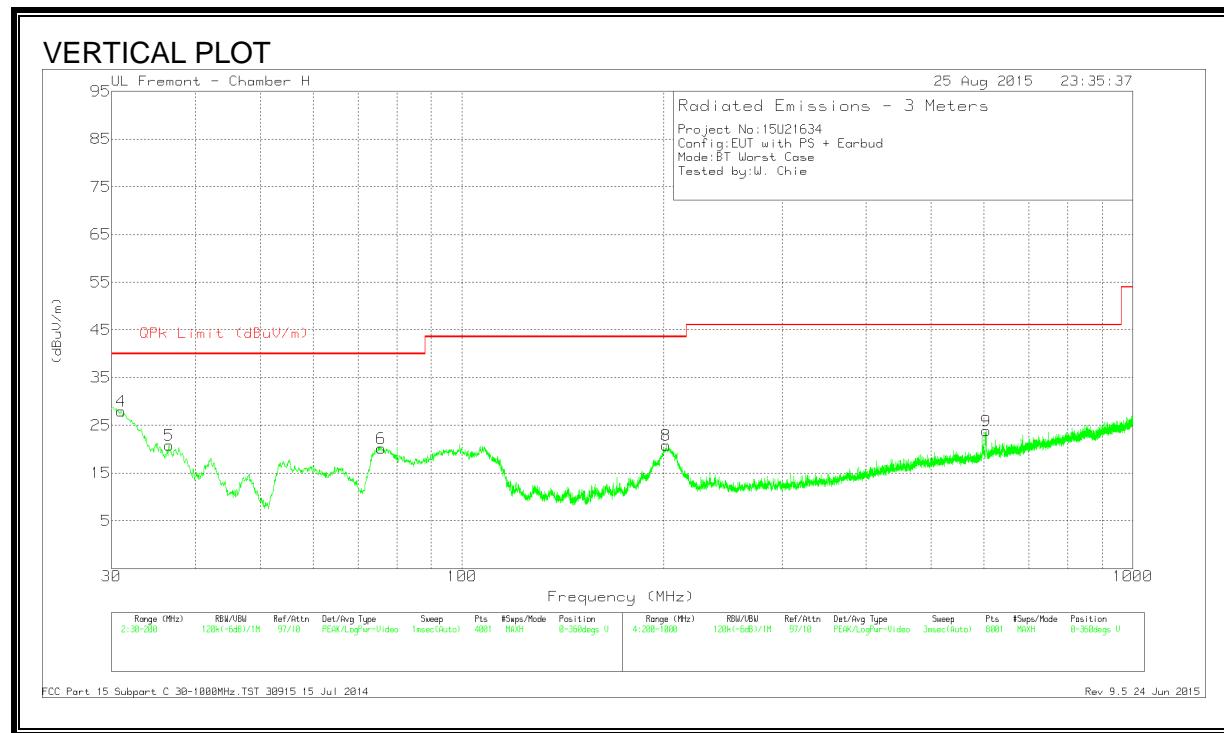
VA1T - FHSS: Linear Voltage Average $VB=1/Ton$ where: Ton is transmit duration

8.3. WORST-CASE BELOW 1 GHz

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



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



DATA

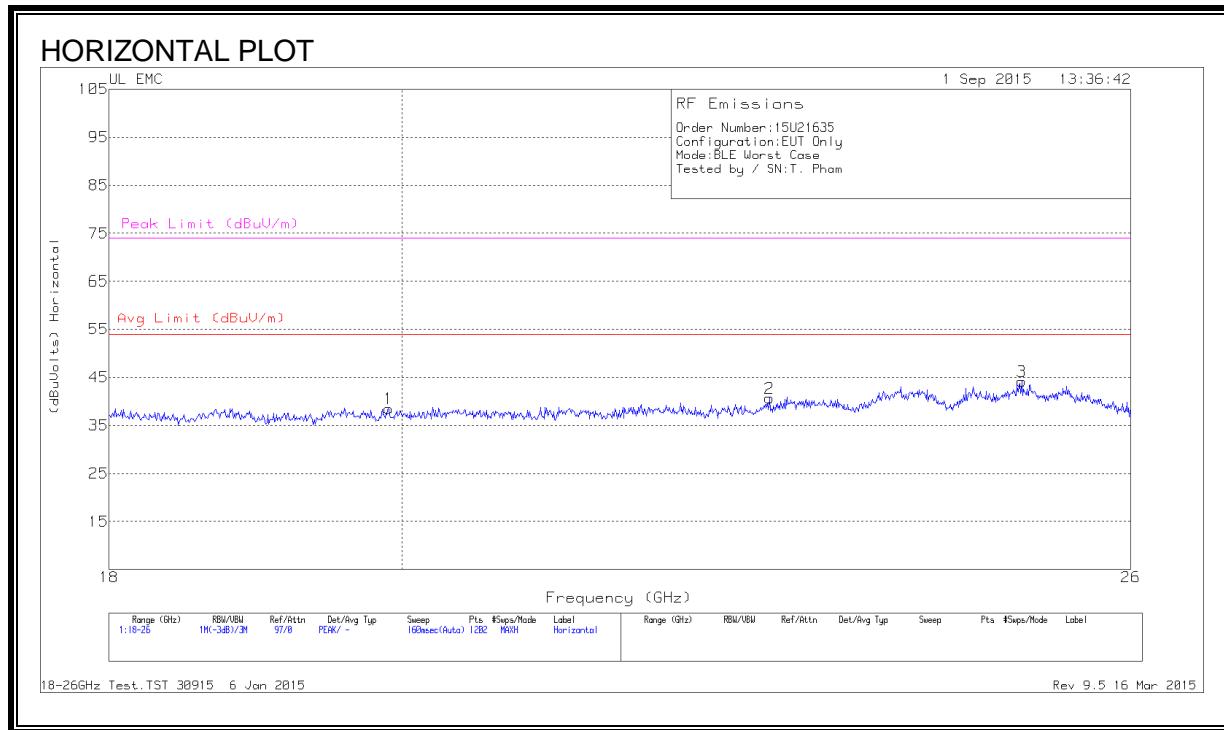
| Marker | Frequency (MHz) | Meter Reading (dBuV) | Det | AF T900 (dB/m) | Amp/Cbl (dB) | Corrected Reading (dBuV/m) | QPk Limit (dBuV/m) | Margin (dB) | Azimuth (Degs) | Height (cm) | Polarity |
|--------|-----------------|----------------------|-----|----------------|--------------|----------------------------|--------------------|-------------|----------------|-------------|----------|
| 2 | * 108.54 | 39.56 | Pk | 12.2 | -30.4 | 21.36 | 43.52 | -22.16 | 0-360 | 301 | H |
| 4 | 31.02 | 38.29 | Pk | 21 | -31.3 | 27.99 | 40 | -12.01 | 0-360 | 100 | V |
| 5 | 36.5875 | 34.89 | Pk | 17.2 | -31.2 | 20.89 | 40 | -19.11 | 0-360 | 100 | V |
| 1 | 54.6075 | 40.77 | Pk | 7.2 | -31 | 16.97 | 40 | -23.03 | 0-360 | 401 | H |
| 6 | 75.815 | 42.71 | Pk | 8.2 | -30.7 | 20.21 | 40 | -19.79 | 0-360 | 100 | V |
| 3 | 157.7125 | 38.09 | Pk | 12.1 | -30 | 20.19 | 43.52 | -23.33 | 0-360 | 201 | H |
| 8 | 201.6 | 38.59 | Pk | 11.9 | -29.7 | 20.79 | 43.52 | -22.73 | 0-360 | 100 | V |
| 7 | 205.5 | 41.01 | Pk | 10.8 | -29.7 | 22.11 | 43.52 | -21.41 | 0-360 | 100 | H |
| 9 | 604.3 | 33.04 | Pk | 18.8 | -28 | 23.84 | 46.02 | -22.18 | 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)



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 | 19.905 | 40.2 | Pk | 32.9 | -25.1 | -9.5 | 38.5 | 54 | -15.5 | 74 | -35.5 |
| 2 | 22.829 | 42.07 | Pk | 33.3 | -25.2 | -9.5 | 40.66 | 54 | -13.33 | 74 | -33.33 |
| 3 | 25.001 | 44.07 | Pk | 34.2 | -24.6 | -9.5 | 44.16 | 54 | -9.83 | 74 | -29.83 |
| 4 | 21.823 | 41.47 | Pk | 33.3 | -24.6 | -9.5 | 40.66 | 54 | -13.33 | 74 | -33.33 |
| 5 | 24.135 | 43.57 | Pk | 33.4 | -24.3 | -9.5 | 43.16 | 54 | -10.83 | 74 | -30.83 |
| 6 | 25.394 | 43.77 | Pk | 33.7 | -24.3 | -9.5 | 43.66 | 54 | -10.33 | 74 | -30.33 |

Pk - Peak detector

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

| Frequency of Emission (MHz) | Conducted Limit (dB μ V) | |
|-----------------------------|------------------------------|------------|
| | 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 | .1635 | 40.19 | Pk | 1.2 | 0 | 41.39 | 65.28 | -23.89 | - | - |
| 2 | .1635 | 22.77 | Av | 1.2 | 0 | 23.97 | - | - | 55.28 | -31.31 |
| 3 | .7935 | 42.16 | Pk | .3 | 0 | 42.46 | 56 | -13.54 | - | - |
| 4 | .798 | 30.54 | Av | .3 | 0 | 30.84 | - | - | 46 | -15.16 |
| 5 | 2.2695 | 32.5 | Pk | .2 | .1 | 32.8 | 56 | -23.2 | - | - |
| 6 | 2.265 | 20.49 | Av | .2 | .1 | 20.79 | - | - | 46 | -25.21 |
| 7 | 23.9955 | 45.37 | Pk | .3 | .2 | 45.87 | 60 | -14.13 | - | - |
| 8 | 23.9955 | 41.3 | Av | .3 | .2 | 41.8 | - | - | 50 | -8.2 |

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) |
|--------|-----------------|----------------------|-----|-----------|---------------|------------------------|---------------------|-------------|----------------------|-------------|
| 9 | .168 | 43.22 | Pk | 1.3 | 0 | 44.52 | 65.06 | -20.54 | - | - |
| 10 | .168 | 23.89 | Av | 1.3 | 0 | 25.19 | - | - | 55.06 | -29.87 |
| 11 | .807 | 43.91 | Pk | .3 | 0 | 44.21 | 56 | -11.79 | - | - |
| 12 | .8115 | 25.88 | Av | .3 | 0 | 26.18 | - | - | 46 | -19.82 |
| 13 | 1.482 | 29.86 | Pk | .2 | .1 | 30.16 | 56 | -25.84 | - | - |
| 14 | 1.4865 | 17.53 | Av | .2 | .1 | 17.83 | - | - | 46 | -28.17 |
| 15 | 23.9955 | 46.7 | Pk | .3 | .2 | 47.2 | 60 | -12.8 | - | - |
| 16 | 23.9955 | 41.45 | Av | .3 | .2 | 41.95 | - | - | 50 | -8.05 |

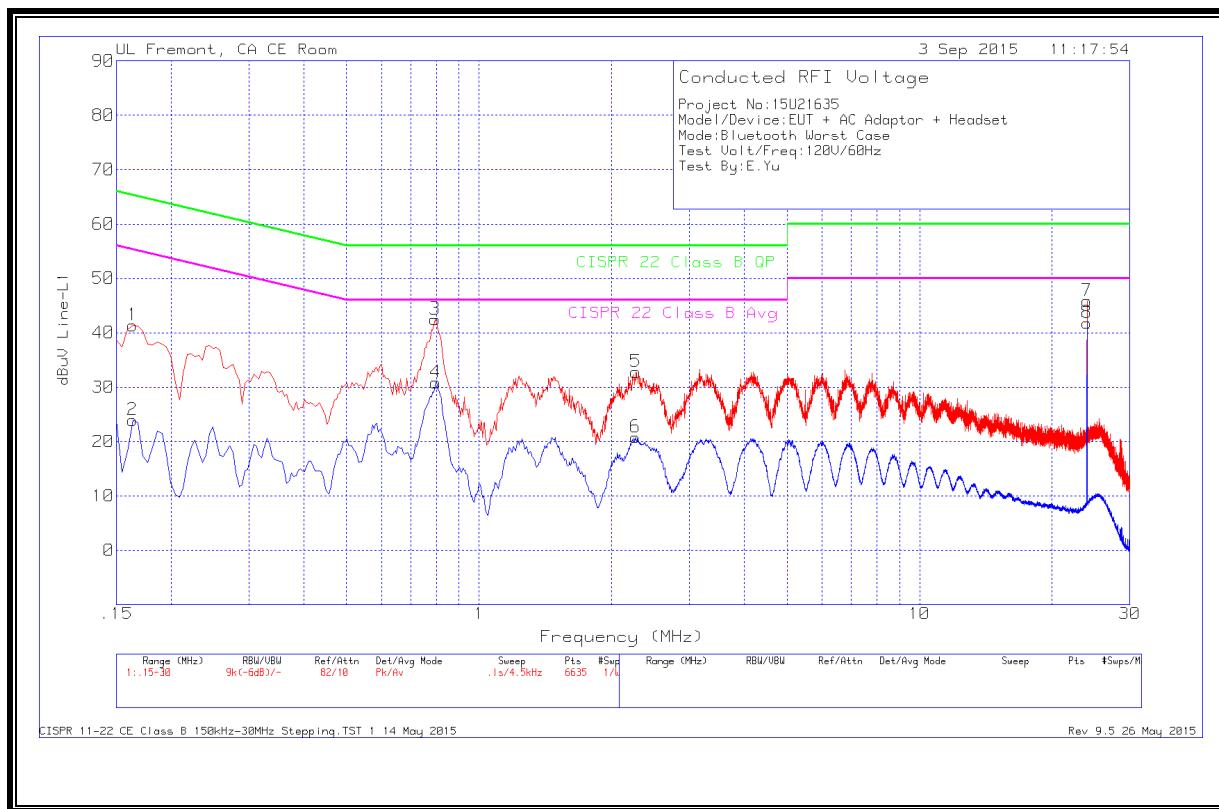
Pk - Peak detector

Av - Average detection

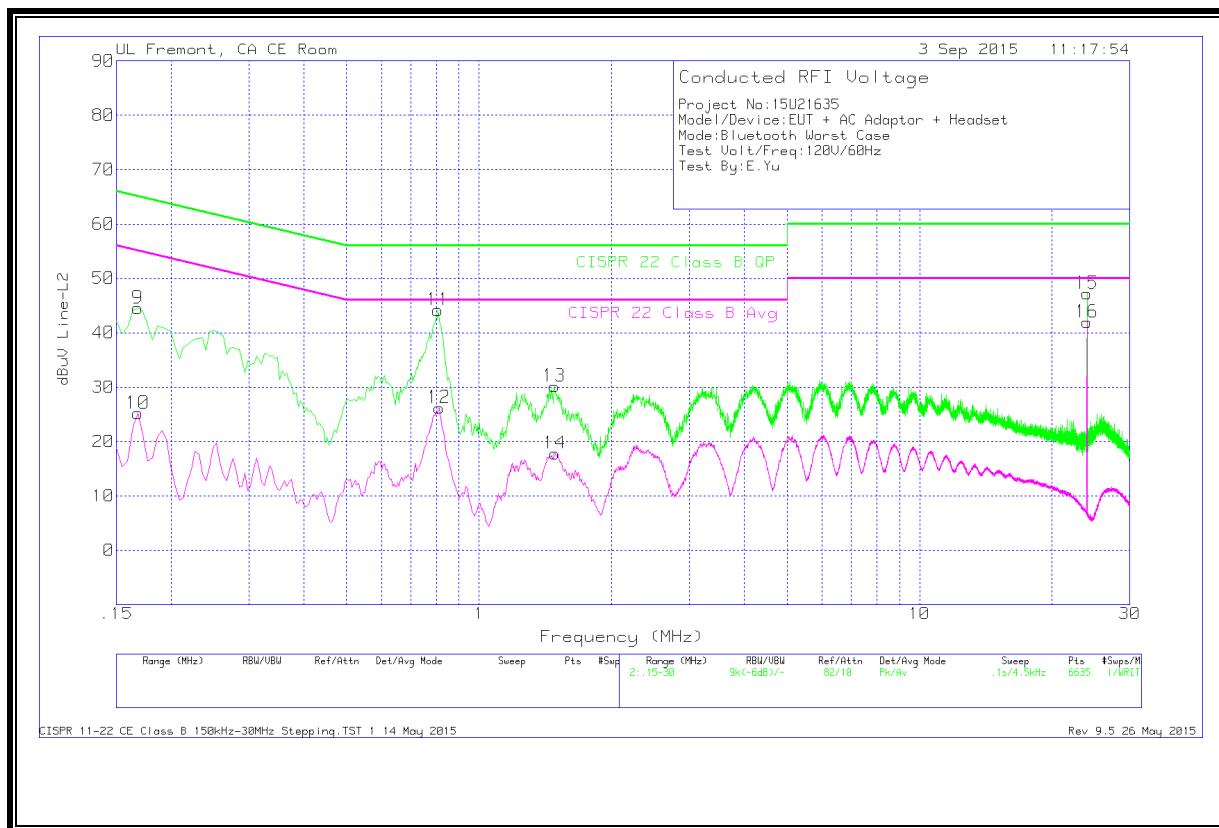
CISPR 11-22 CE Class B 150kHz-30MHz Stepping.TST 1 14 May 2015

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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 | 54.61 | Pk | 1.2 | 0 | 55.81 | 65.06 | -9.25 | - | - |
| 2 | .168 | 38.26 | Av | 1.2 | 0 | 39.46 | - | - | 55.06 | -15.6 |
| 3 | .4155 | 30.85 | Pk | .4 | 0 | 31.25 | 57.54 | -26.29 | - | - |
| 4 | .4155 | 27.65 | Av | .4 | 0 | 28.05 | - | - | 47.54 | -19.49 |
| 5 | 1.2705 | 26.45 | Pk | .2 | .1 | 26.75 | 56 | -29.25 | - | - |
| 6 | 1.2705 | 14.77 | Av | .2 | .1 | 15.07 | - | - | 46 | -30.93 |
| 7 | 9.24 | 26.46 | Pk | .2 | .1 | 26.76 | 60 | -33.24 | - | - |
| 8 | 9.24 | 10.63 | Av | .2 | .1 | 10.93 | - | - | 50 | -39.07 |
| 9 | 13.4835 | 31.64 | Pk | .2 | .2 | 32.04 | 60 | -27.96 | - | - |
| 10 | 13.4835 | 17.81 | Av | .2 | .2 | 18.21 | - | - | 50 | -31.79 |
| 11 | 23.9955 | 23.55 | Pk | .3 | .2 | 24.05 | 60 | -35.95 | - | - |
| 12 | 23.9955 | 22.24 | Av | .3 | .2 | 22.74 | - | - | 50 | -27.26 |

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) |
|--------|-----------------|----------------------|-----|-----------|---------------|------------------------|---------------------|-------------|----------------------|-------------|
| 13 | .1635 | 51.63 | Pk | 1.3 | 0 | 52.93 | 65.28 | -12.35 | - | - |
| 14 | .1635 | 33.44 | Av | 1.3 | 0 | 34.74 | - | - | 55.28 | -20.54 |
| 15 | .411 | 33.98 | Pk | .4 | 0 | 34.38 | 57.63 | -23.25 | - | - |
| 16 | .411 | 28.87 | Av | .4 | 0 | 29.27 | - | - | 47.63 | -18.36 |
| 17 | 6.0675 | 31.24 | Pk | .2 | .1 | 31.54 | 60 | -28.46 | - | - |
| 18 | 6.0675 | 6.6 | Av | .2 | .1 | 6.9 | - | - | 50 | -43.1 |
| 19 | 17.259 | 34.83 | Pk | .3 | .2 | 35.33 | 60 | -24.67 | - | - |
| 20 | 17.259 | 12.56 | Av | .3 | .2 | 13.06 | - | - | 50 | -36.94 |
| 21 | 23.9955 | 25.61 | Pk | .3 | .2 | 26.11 | 60 | -33.89 | - | - |
| 22 | 23.9955 | 24.21 | Av | .3 | .2 | 24.71 | - | - | 50 | -25.29 |

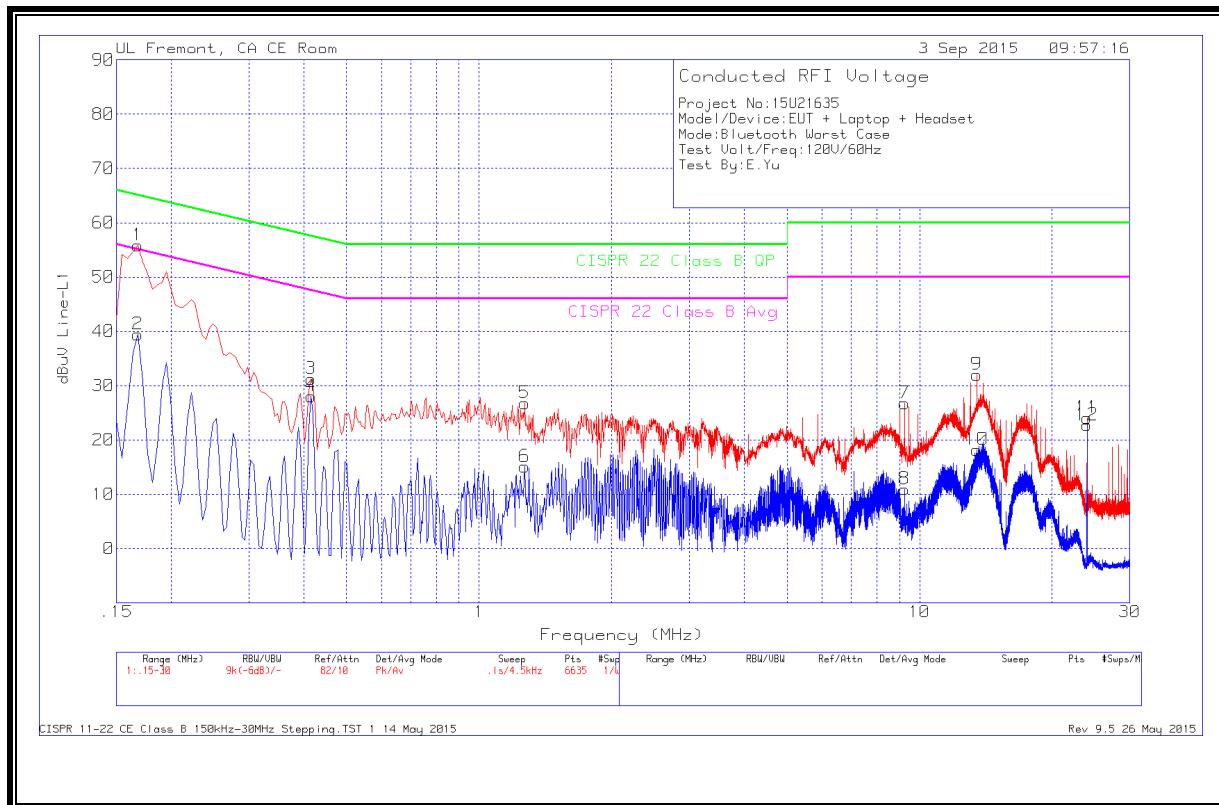
Pk - Peak detector

Av - Average detection

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LINE 1 RESULTS



LINE 2 RESULTS

