



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

CDMA/LTE PHONE + BLUETOOTH, & 2.4GHz DTS b/g/n

MODEL NUMBER: LG-VW820, VW820, LGVW820

FCC ID: ZNFVW820

REPORT NUMBER: 15I19783-E2

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Prepared for

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NVLAP LAB CODE 200065-0

Revision History

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: LG ELECTRONICS MOBILECOMM U.S.A., INC
EUT DESCRIPTION: CDMA/LTE PHONE + BLUETOOTH, & 2.4GHz DTS b/g/n
MODEL: LG-VW820, VW820, LGVW820
SERIAL NUMBER: 1MFX8 (Radiated), 1MLB5 (Conducted)
DATE TESTED: January 12-16, 2015

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	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.

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WISE LAB ENGINEER
UL VERIFICATION SERVICES INC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4-2009, FCC CFR 47 Part 2, and FCC CFR 47 Part 15C.

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(IC: 2324B-1)	☐ Chamber D(IC: 2324B-4)
☒ Chamber B(IC: 2324B-2)	☐ Chamber E(IC: 2324B-5)
☒ Chamber C(IC: 2324B-3)	☐ Chamber F(IC: 2324B-6)
	☐ Chamber G(IC: 2324B-7)
	☐ Chamber H(IC: 2324B-8)

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:

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

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 18000 MHz	4.94 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a CDMA/LTE PHONE + BLUETOOTH & 2.4GHz DTS b/g/n.

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	7.89	6.15
2402 - 2480	Enhanced 8PSK	8.14	6.52

Note: GFSK, Pi/4-DQPSK, 8PSK average Power are all investigated, The GFSK & 8PSK Power are the worst case. Testing is based on this mode to showing compliance. For average power data please refer to section 8.6.

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an FPCB antenna, with a maximum gain of -2.14dBi.

5.4. 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.

5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	LG	MCS-02WR	RA4Y1031433	N/A
Earphone	LG	N/A	N/A	N/A

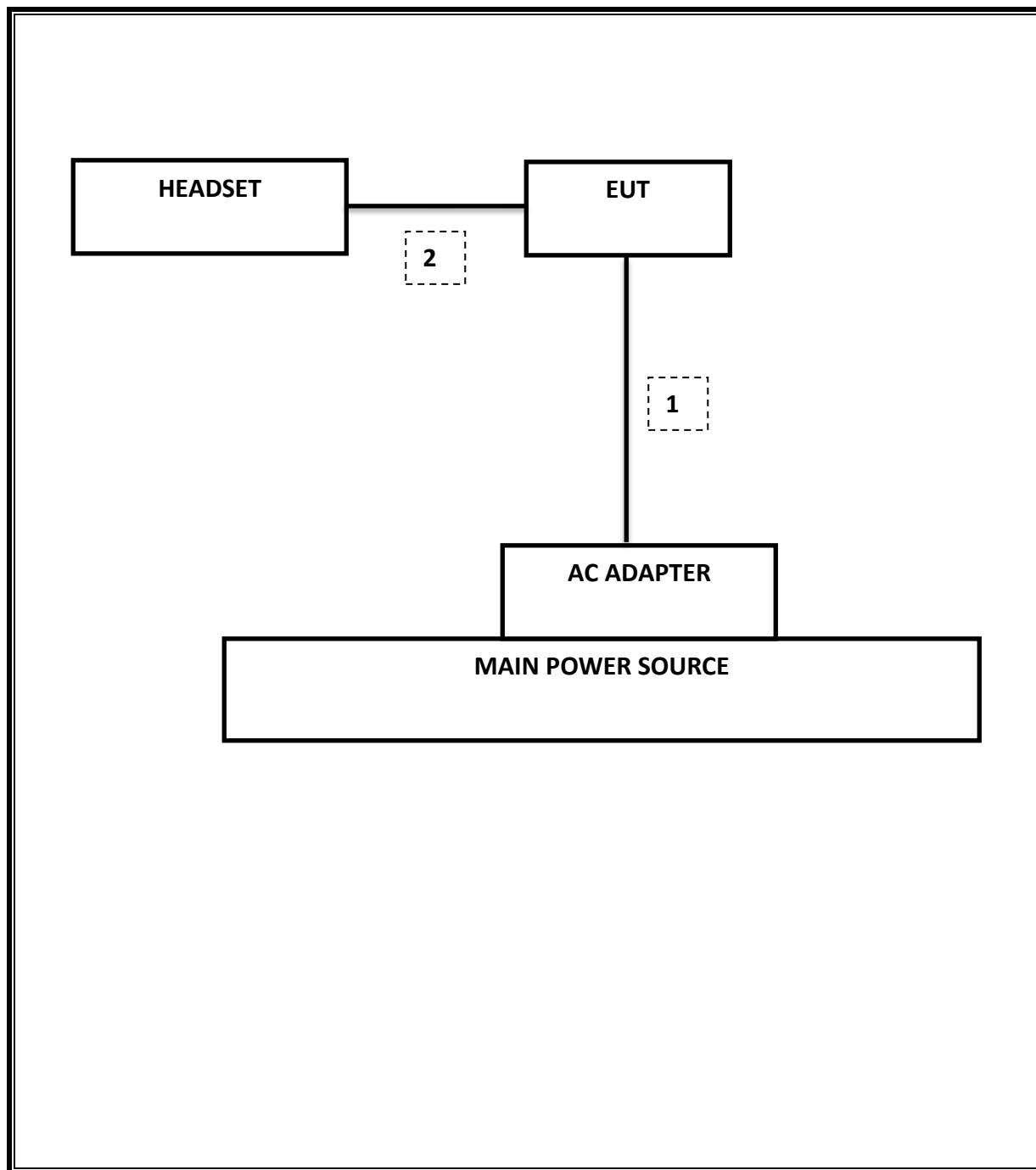
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	DC Power	1	Mini-USB	Shielded	1.2m	N/A
2	Audio	1	Mini-Jack	Unshielded	1m	N/A

TEST SETUP

The EUT is continuously communicating to the Bluetooth tester during the tests.
EUT was set in the Hidden menu mode to enable BT communications.

SETUP DIAGRAM FOR TESTS



6. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment List				
Description	Manufacturer	Model	Asset	Cal Due
Antenna, Biconolog, 30MHz-1 GHz	Sunol Sciences	JB1	C01171	02/13/15
Antenna, Horn, 18GHz	EMCO	3115	C00783	10/25/15
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	11/14/15
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	01/28/15
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	10/22/15
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C01069	12/20/15
CBT Bluetooth Tester	R & S	CBT	None	07/12/15
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/15
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/15
LISN, 30 MHz	FCC	50/250-25-2	C00626	01/14/15
Reject Filter, 2.4GHz	Micro-Tronics	BRM50702	N02684	CNR
Peak Power Meter	Agilent / HP	E4416A	C00963	12/13/15
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/13/15

Test Software List			
Description	Manufacturer	Model	Version
Radiated Software	UL	UL EMC	Version 9.5, 07/22/14
Conducted Software	UL	UL EMC	Version 9.5, 05/17/14
CLT Software	UL	UL RF	Version 1.0, 02/02/15
Antenna Port Software	UL	UL RF	Version 2.1.1.1, 1/20/15

7. SUMMARY TABLE

FCC Part Section	RSS Section(s)	Test Description	Test Limit	Test Condition	Test Result	Worst Case
2.1049	RSS-GEN 4.6	Occupied Band width (99%)	N/A	Conducted	Pass	1.22 MHz
2.1051, 15.247 (d)	RSS-210 A8.5	Band Edge / Conducted Spurious Emission	-20dBc		Pass	-31 dBm
15.247 (b)(1)	RSS-210 A8.4	TX conducted output power	<21dBm		Pass	8.14 dBm
15.247 (a)(1)	RSS-210 A8.1(b)	Hopping frequency separation	> 25KHz		Pass	1 MHz
15.247 (a)(1)(iii)	RSS-210 A8.1(d)	Number of Hopping channels	More than 15 non-overlapping channels		Pass	79 channels
15.247 (a)(1)(iii)	RSS-210 A8.1(d)	Avg Time of Occupancy	< 0.4sec		Pass	0.288 s
15.207 (a)	RSS-GEN 8.0	AC Power Line conducted emissions	Section 10	Radiated	Pass	47.55 dBuV(AV)
15.205, 15.209	RSS-210 Clause 2.6, RSS-210 Clause 6	Radiated Spurious Emission	< 54dBuV/m		Pass	40.31 dBuV/m

8. ANTENNA PORT TEST RESULTS

8.1. 20 dB AND 99% BANDWIDTH

LIMIT

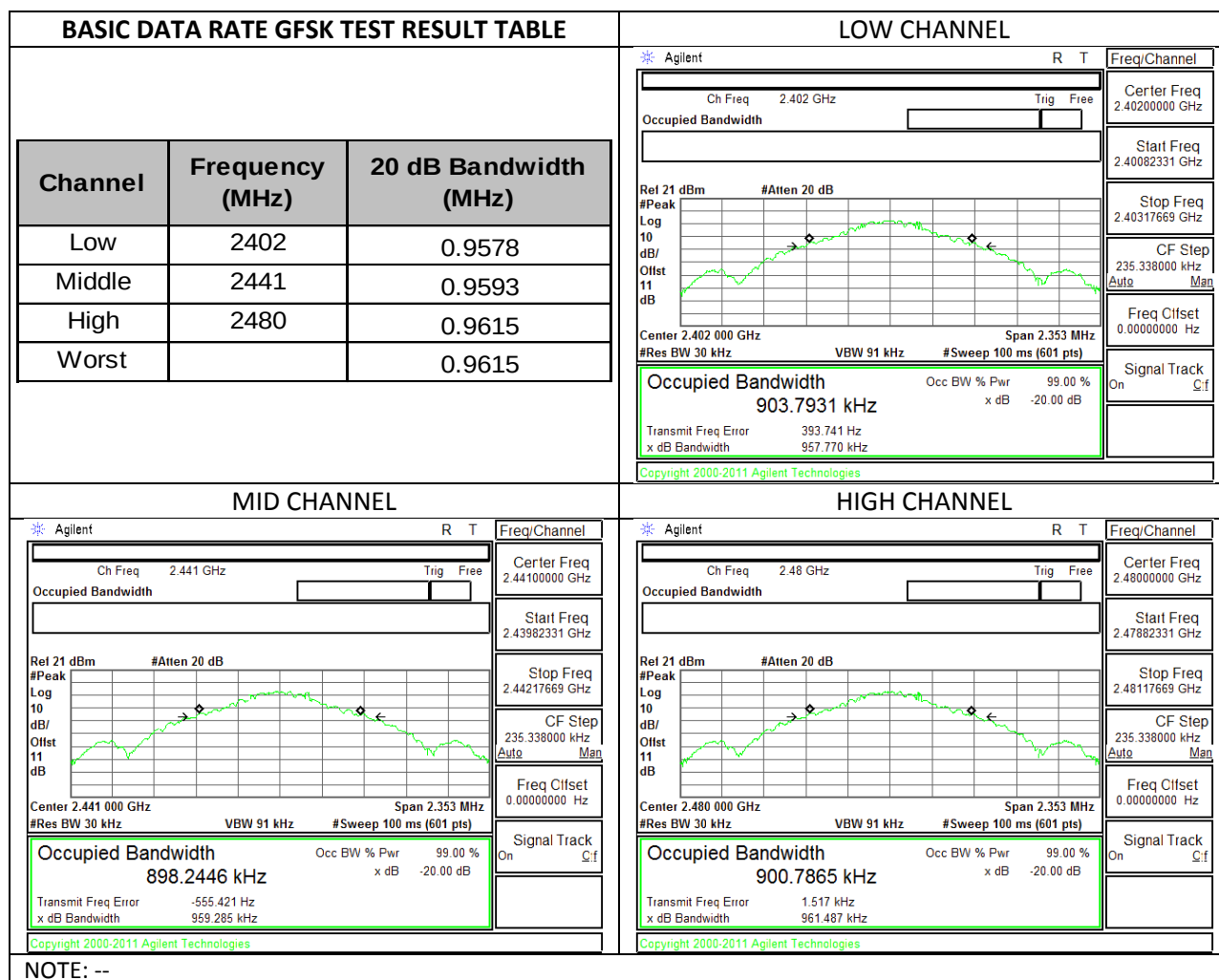
None; for reporting purposes only.

TEST PROCEDURE

DA 00-705: 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.

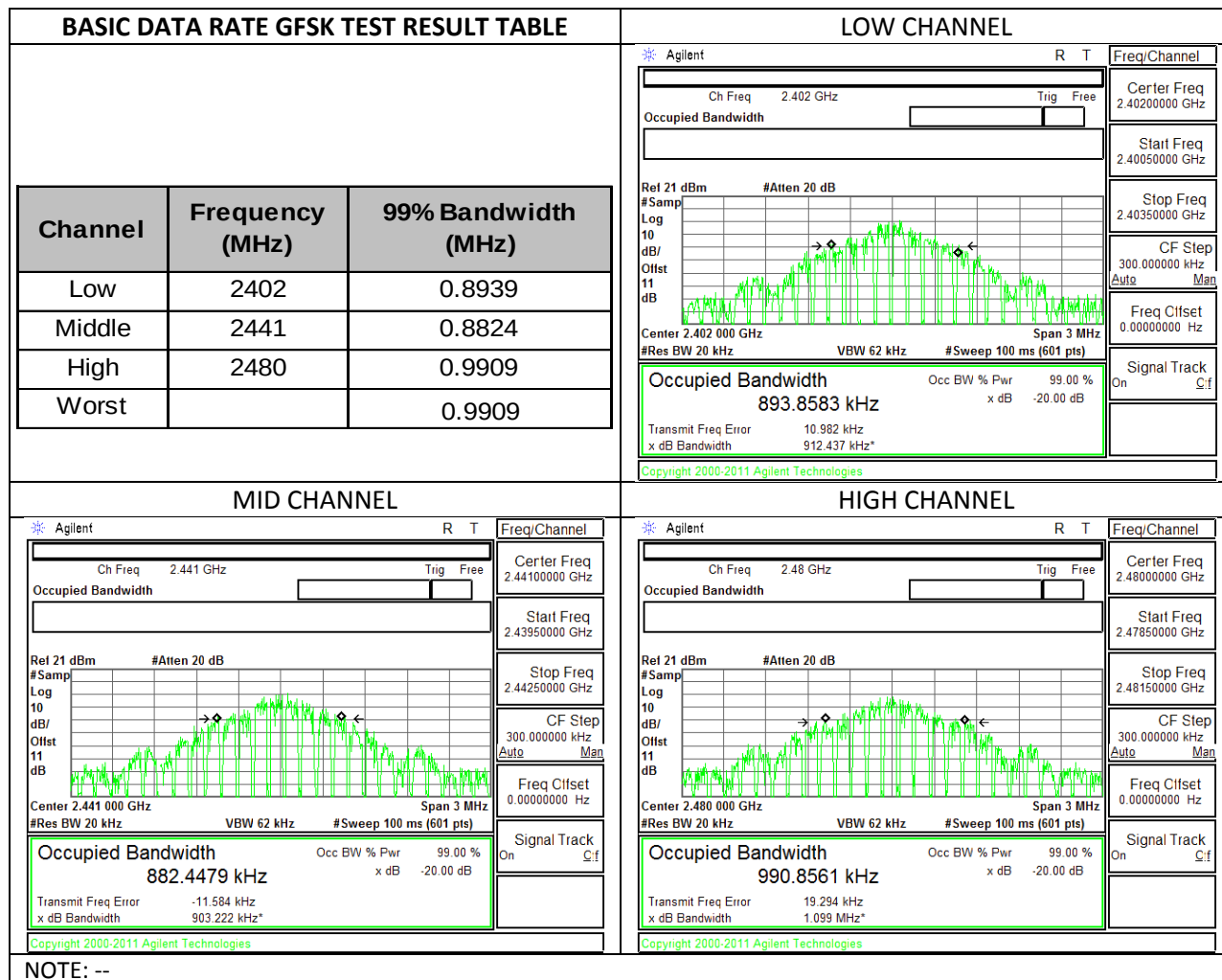
RESULTS

GFSK 20dB BANDWIDTH PLOTS AND TABLE



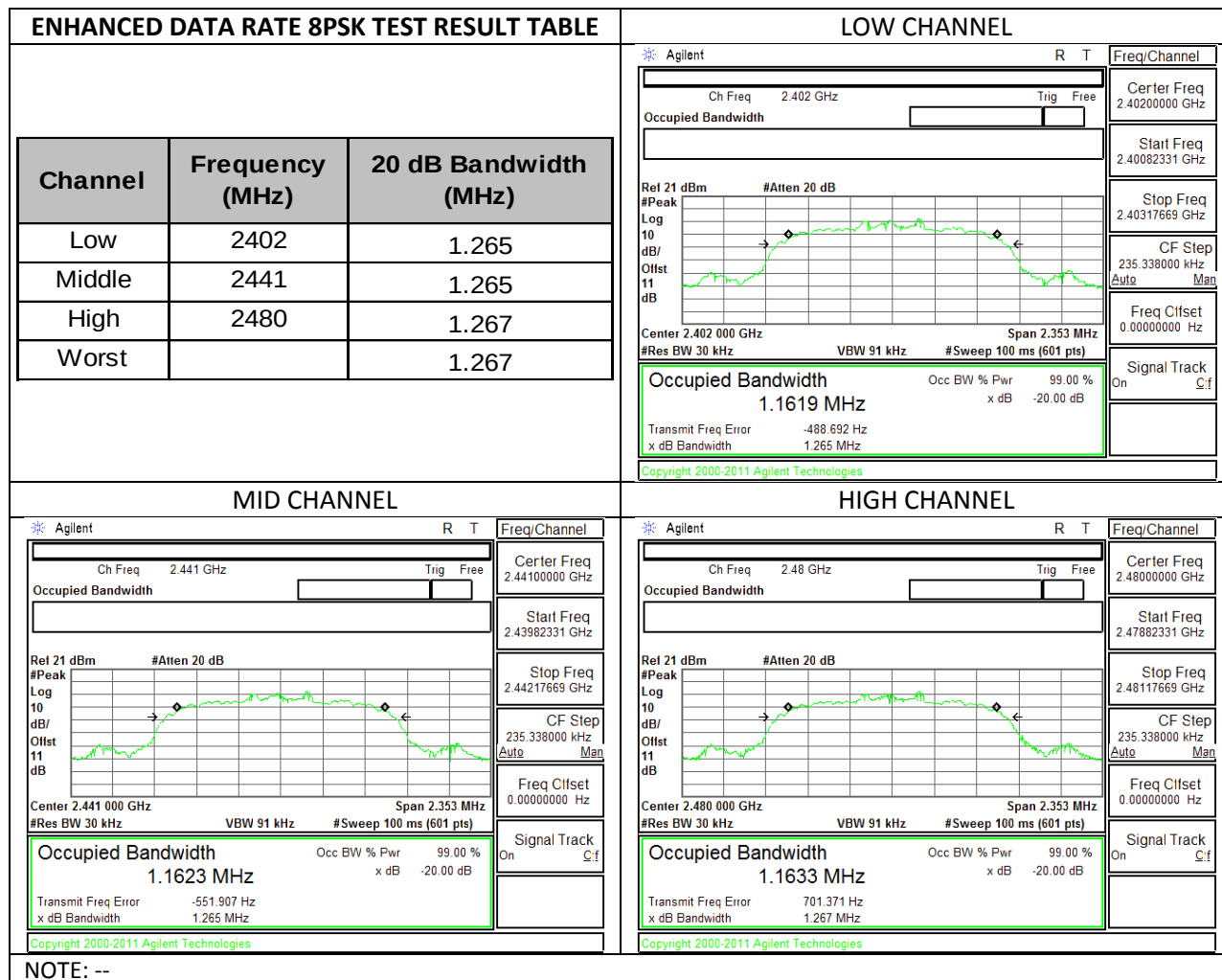
NOTE: --

GFSK 99% BANDWIDTH PLOTS AND TABLE



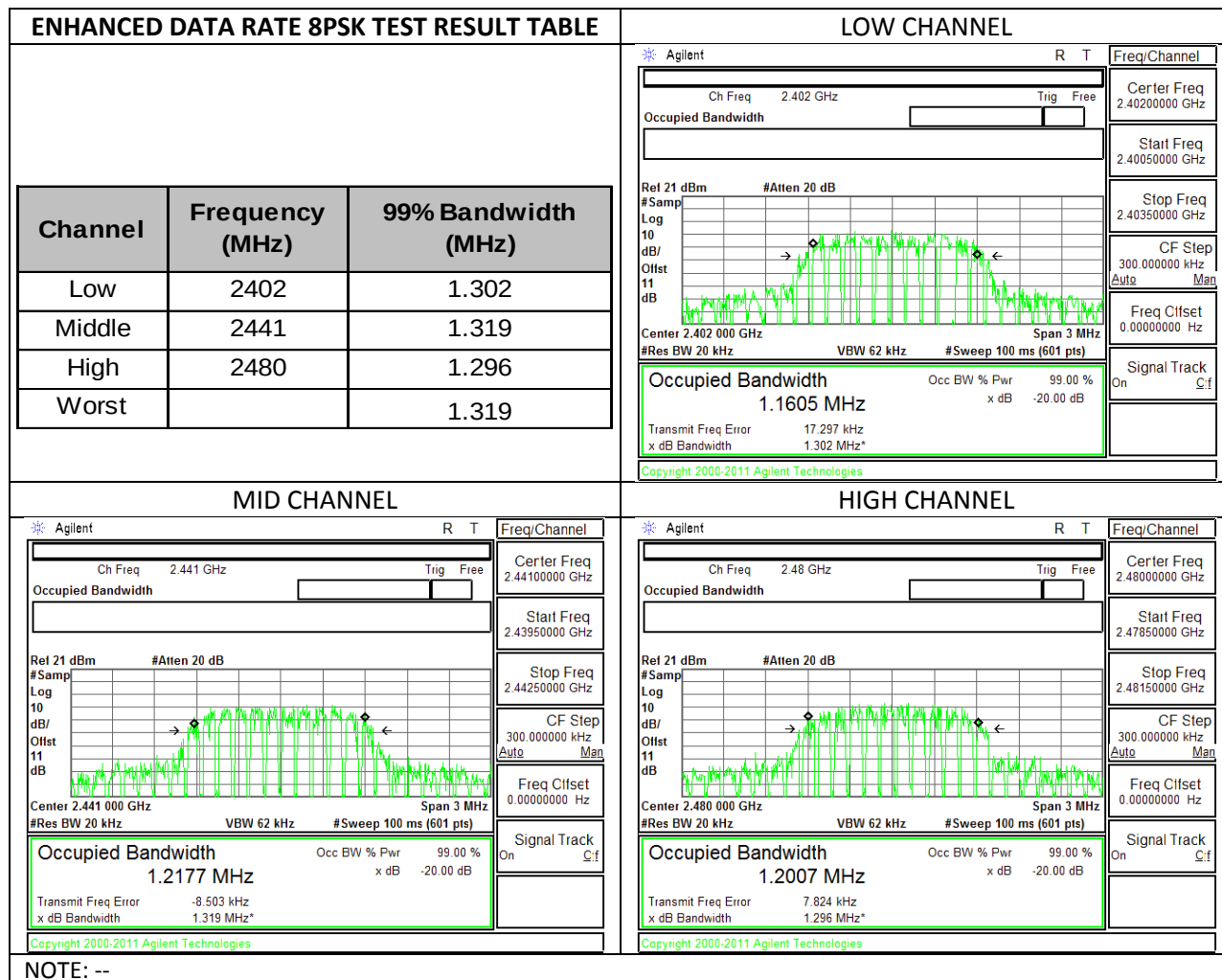
NOTE: --

8PSK 20dB BANDWIDTH PLOTS AND TABLE



NOTE: --

8PSK 99% BANDWIDTH PLOTS AND TABLE



NOTE: --

8.2. HOPPING FREQUENCY SEPARATION

LIMIT

FCC §15.247 (a) (1)

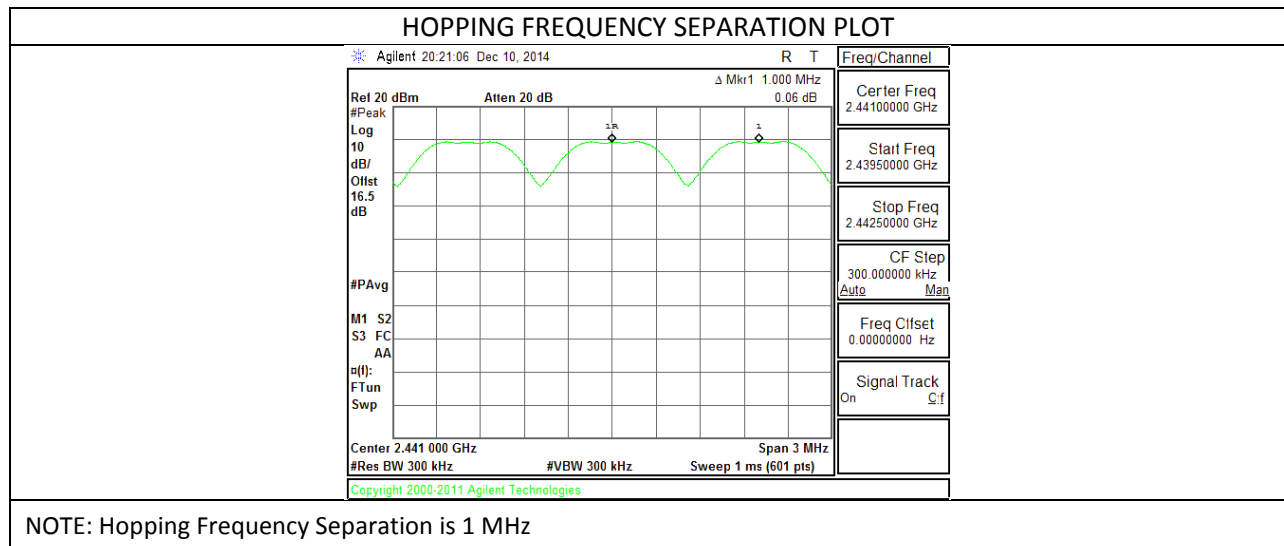
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

DA 00-705: The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS



8.3. NUMBER OF HOPPING CHANNELS

LIMIT

FCC §15.247 (a) (1) (iii)

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

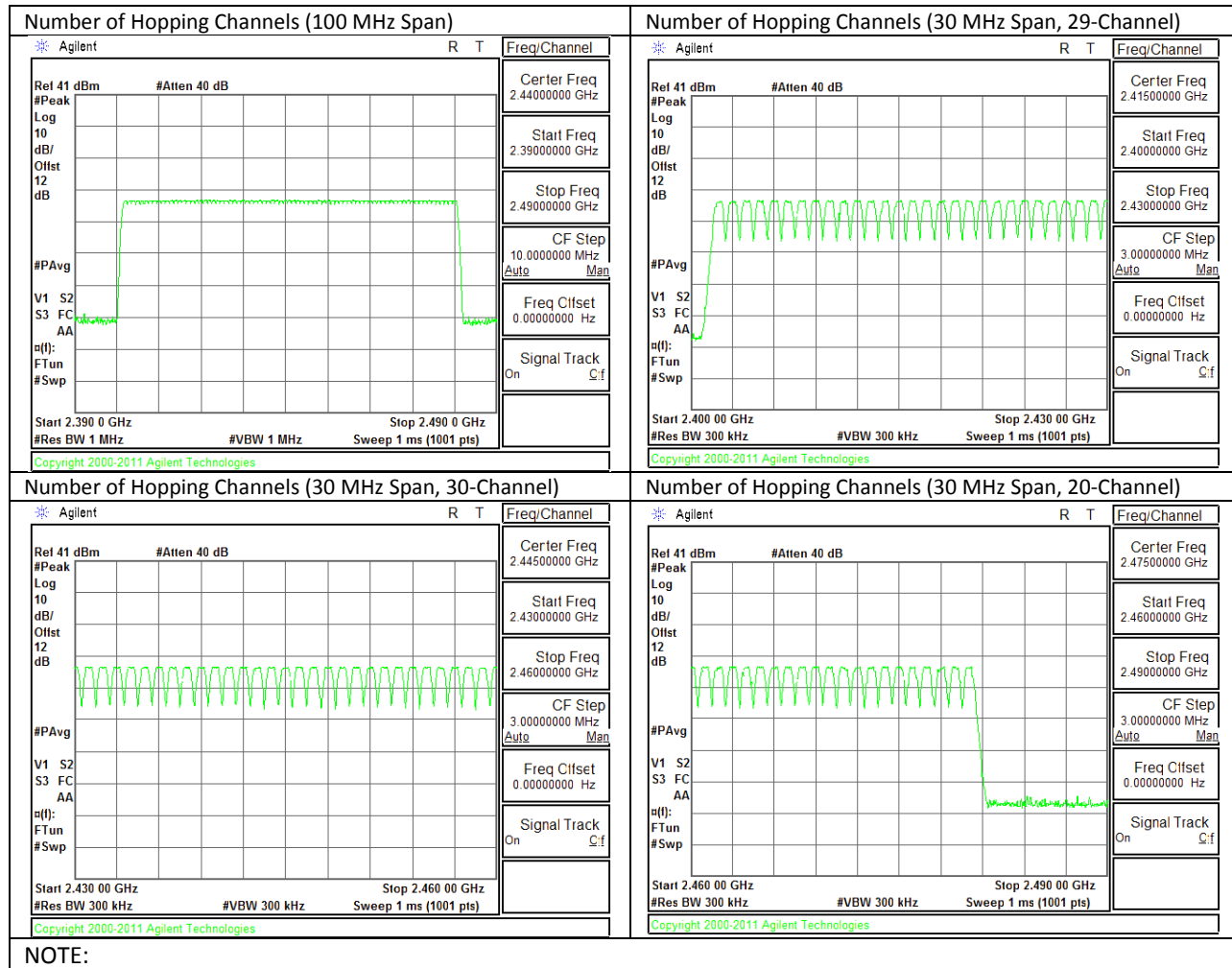
TEST PROCEDURE

DA 00-705: 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 PLOTS



8.4. AVERAGE TIME OF OCCUPANCY

LIMIT

FCC §15.247 (a) (1) (iii)

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.

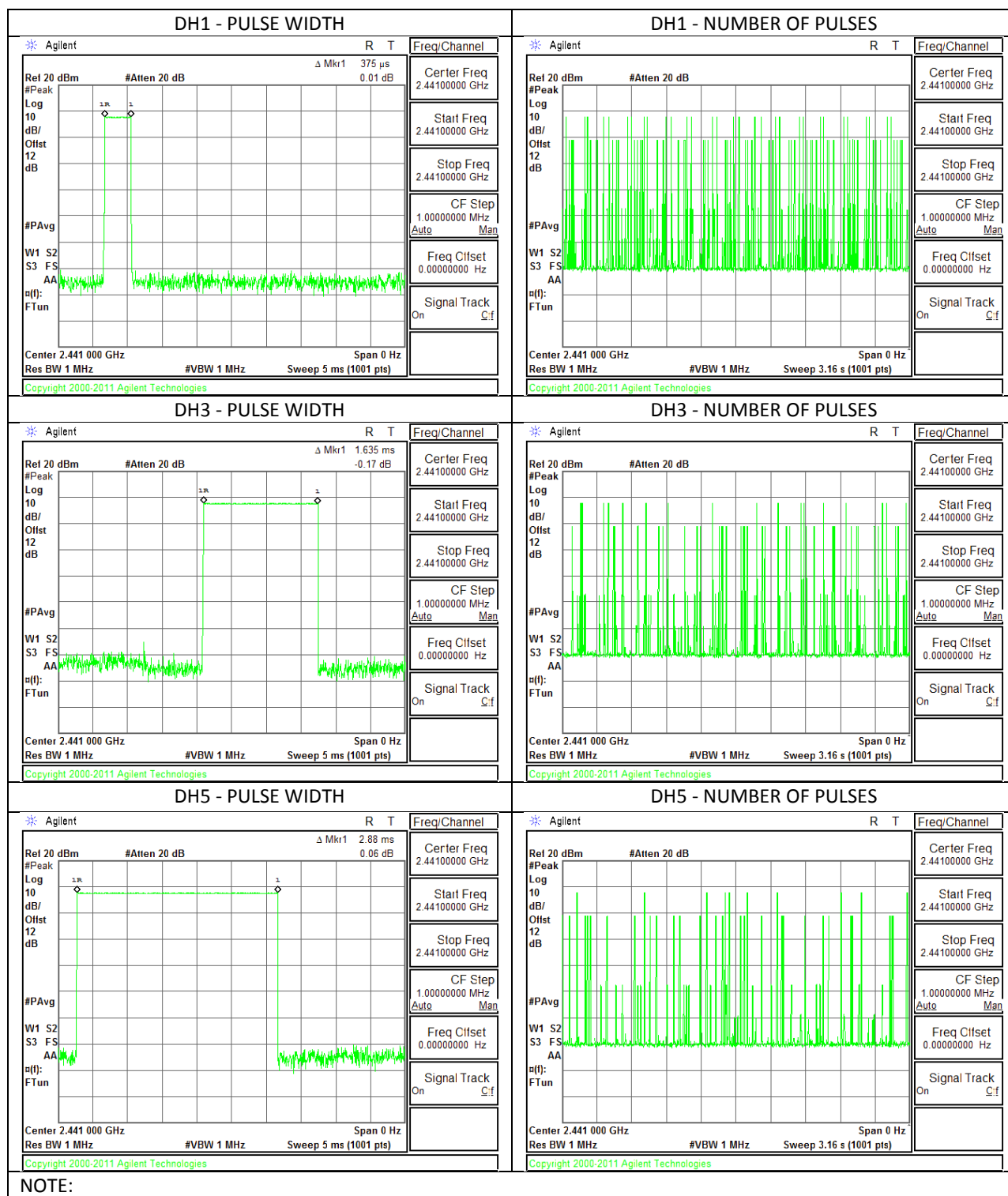
The average time of occupancy in the specified 31.6 second period (79 channels * 0.4 s) is equal to $10 * (\text{\# of pulses in 3.16 s}) * \text{pulse width}$.

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

RESULTS

AVERAGE TIME OF OCCUPANCY						
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	0.375	32.0	0.120	0.4	-0.280	
DH3	1.635	15.0	0.245	0.4	-0.155	
DH5	2.880	10.0	0.288	0.4	-0.112	
DH Packet	Pulse Width (sec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)	
GFSK AFH Mode						
DH1	0.000	0.0	0.000	0.4	-0.400	
DH3	0.375	8.0	0.030	0.4	-0.370	
DH5	1.635	3.8	0.061	0.4	-0.339	
NOTE: --						

PULSE WIDTH AND NUMBER OF PULSES IN 3.16 SECOND OBSERVATION PERIOD PLOTS



NOTE:

8.5. OUTPUT POWER

LIMIT

§15.247 (b) (1)

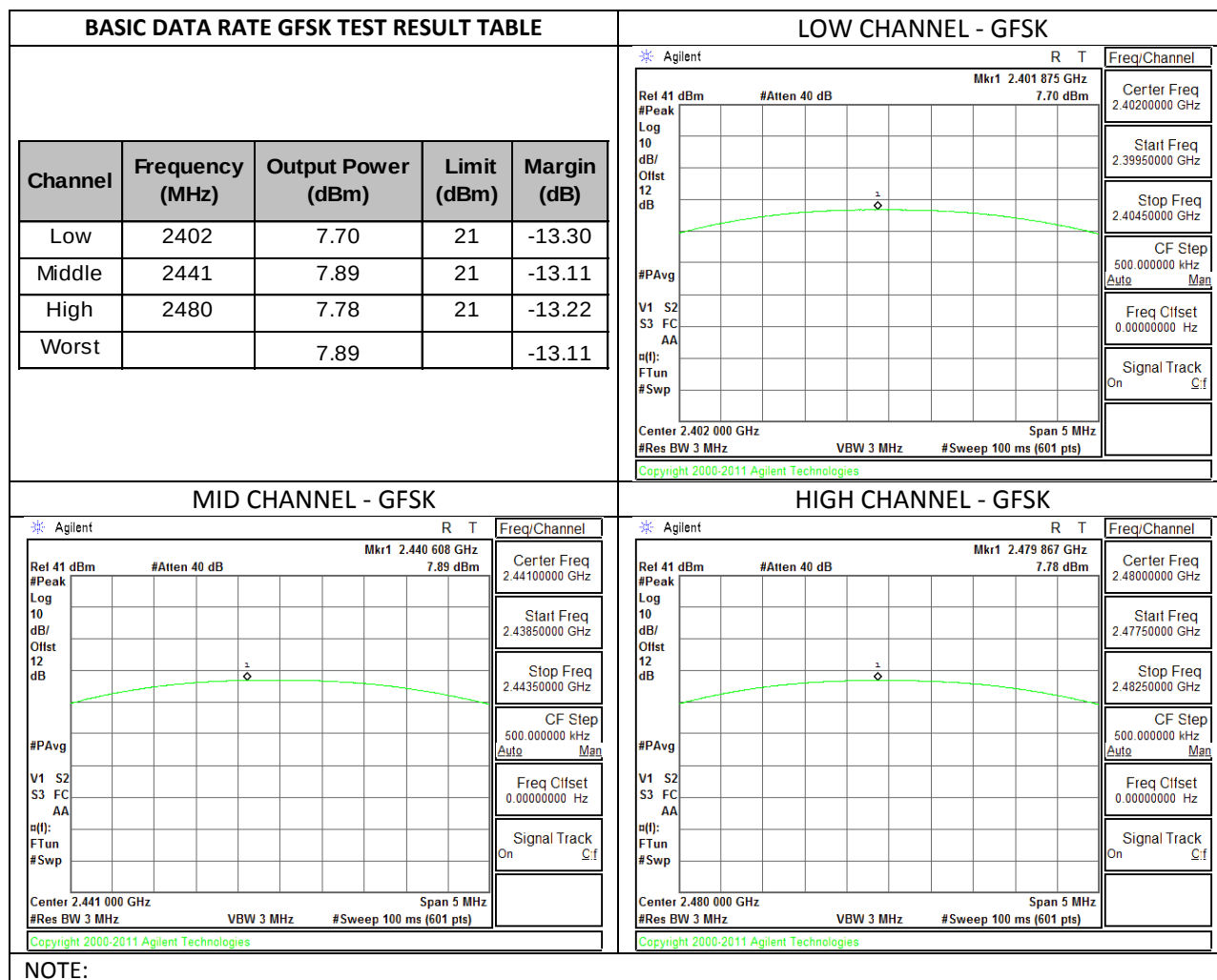
The maximum antenna gain is less than 6dBi, therefore the limit is 21 dBm.

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a spectrum analyzer the analyzer bandwidth is set to a value greater than the 20 dB bandwidth of the EUT.

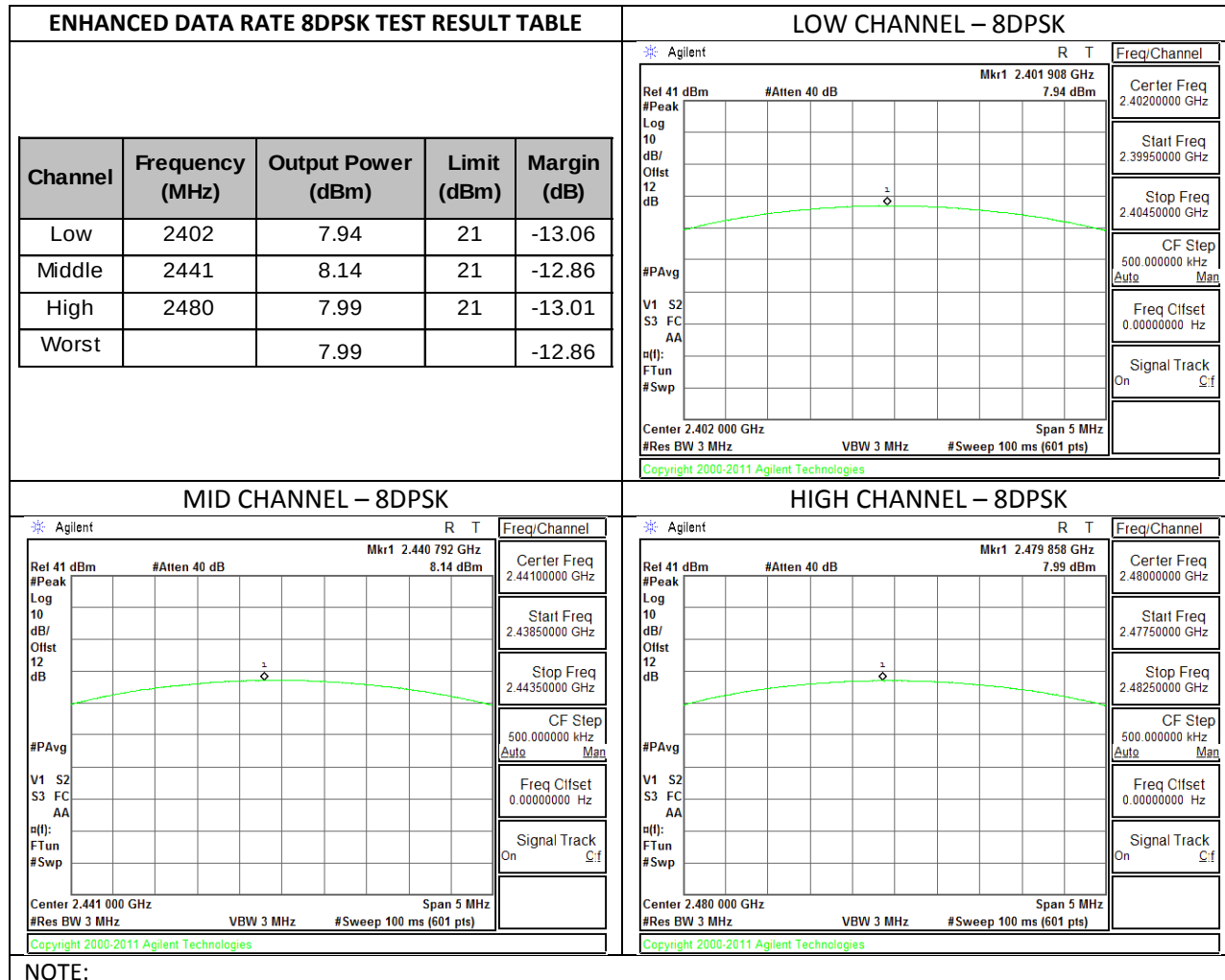
RESULTS

GFSK OUTPUT POWER PLOTS AND TABLE



NOTE:

8DPSK OUTPUT POWER PLOTS AND TABLE



NOTE:

8.6. AVERAGE POWER

LIMIT

None; for reporting purposes only.

TEST PROCEDURE

DA 00-705: The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.7 dB (including 10 dB pad and 0.7 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

RESULTS

BASIC DATA RATE GFSK		
Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	7.20
Middle	2441	7.50
High	2480	7.50
Worst		7.50

ENHANCED DATA RATE 8DPSK		
Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	4.60
Middle	2441	4.90
High	2480	4.90
Worst		4.90

NOTE: --

8.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

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.

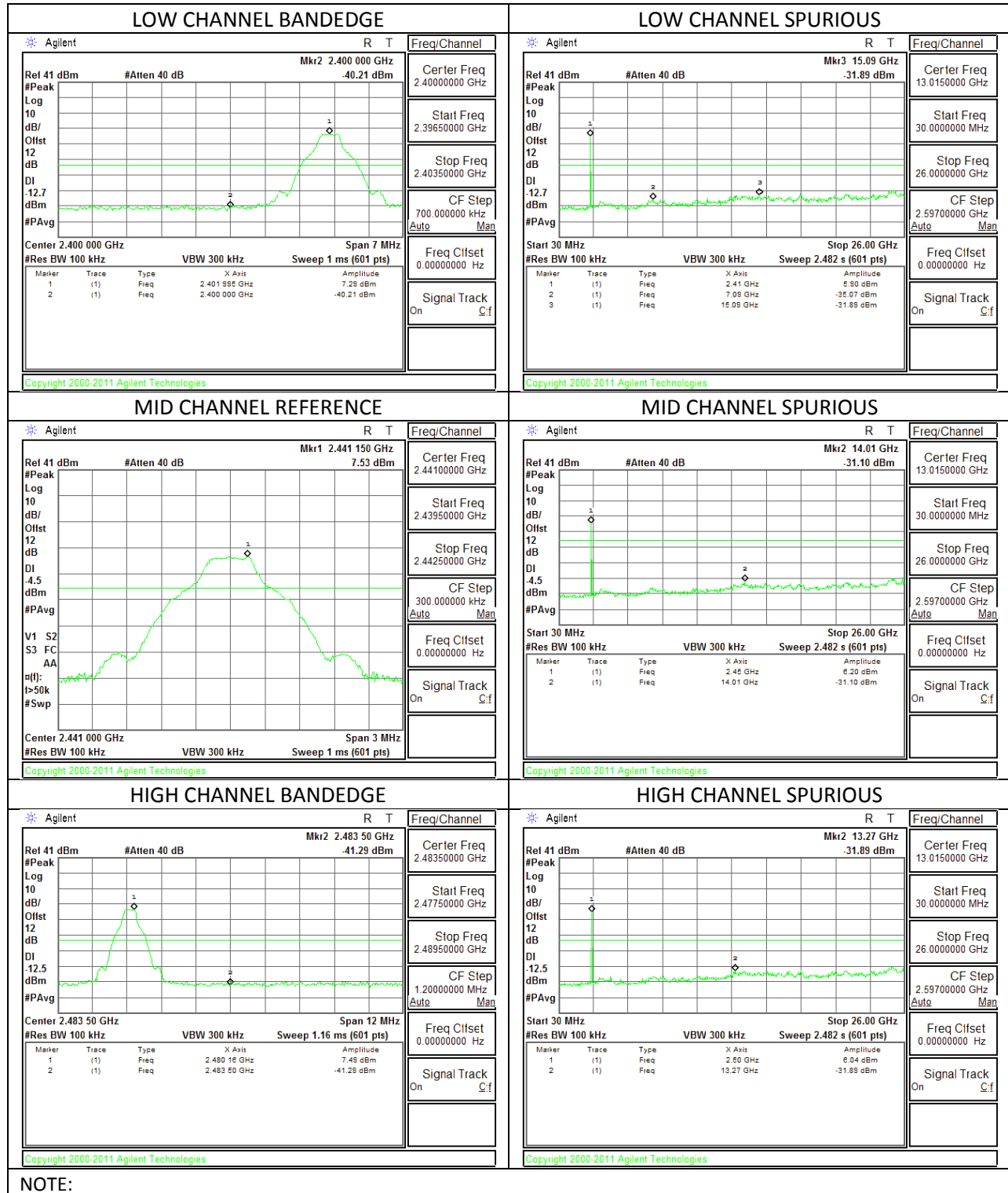
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

RESULTS

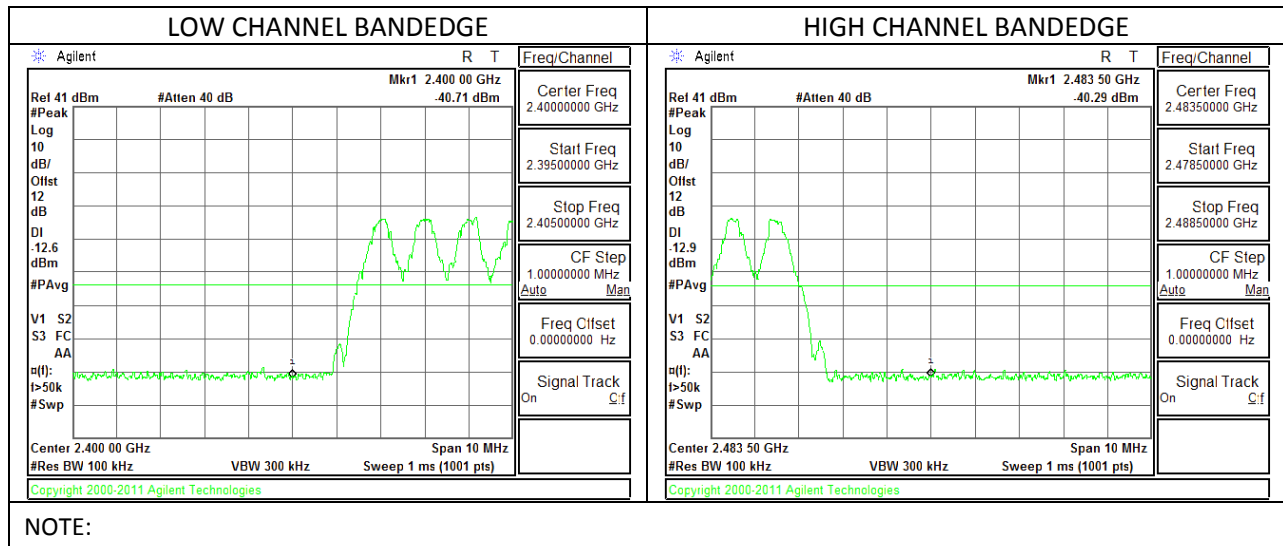
BASIC DATA RATE GFSK MODULATION NON-HOPPING MODE

GFSK - BANDEDGE AND SPURIOUS EMISSIONS PLOTS



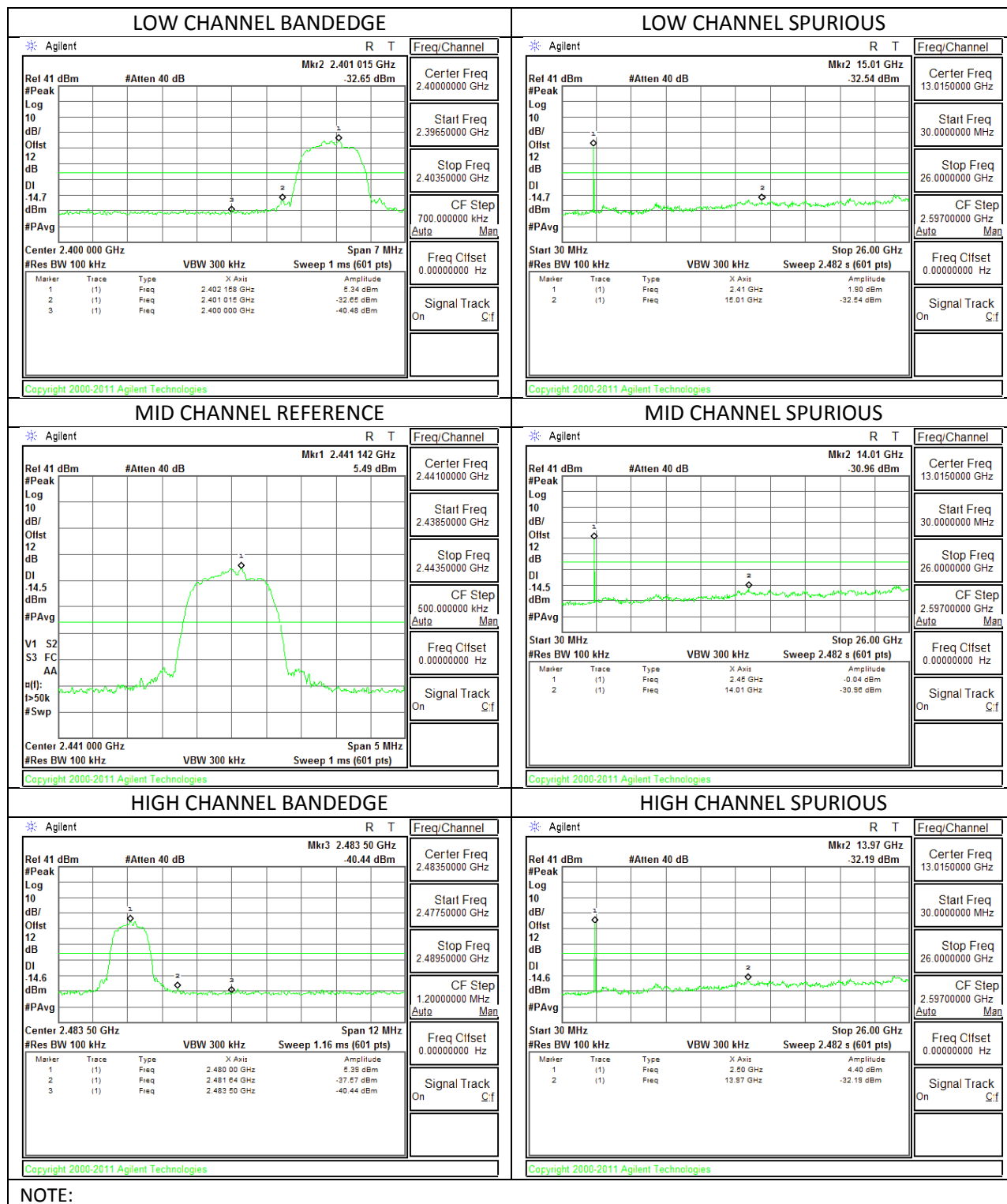
BASIC DATA RATE WITH GFSK HOPPING MODE

GFSK – BANDEDGE PLOTS



ENHANCED DATA RATE 8DPSK MODULATION NON-HOPPING MODE

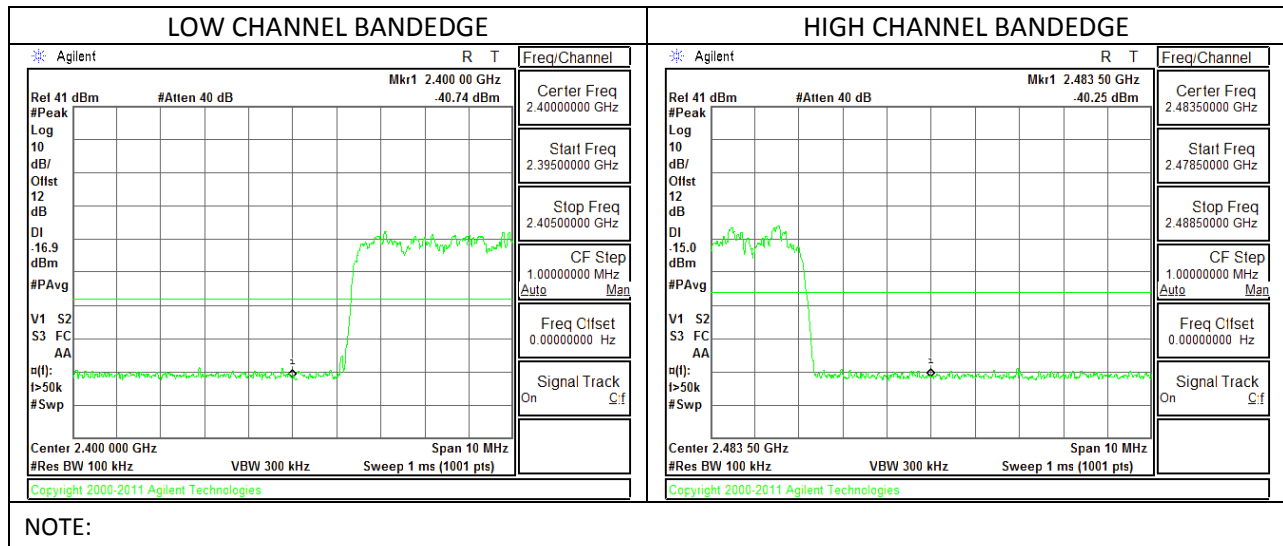
8DPSK - BANDEDGE AND SPURIOUS EMISSIONS PLOTS



NOTE:

ENHANCED DATA RATE WITH 8DPSK HOPPING MODE

8DPSK – BANDEDGE PLOTS



9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE LIMITS

FCC §15.205 and §15.209

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

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

For band edge measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 1/T (on time) for average measurement.
 $GFSK = 1/T = 1 / 0.0038S = 260Hz$.

The spectrum from 1GHzHz 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.

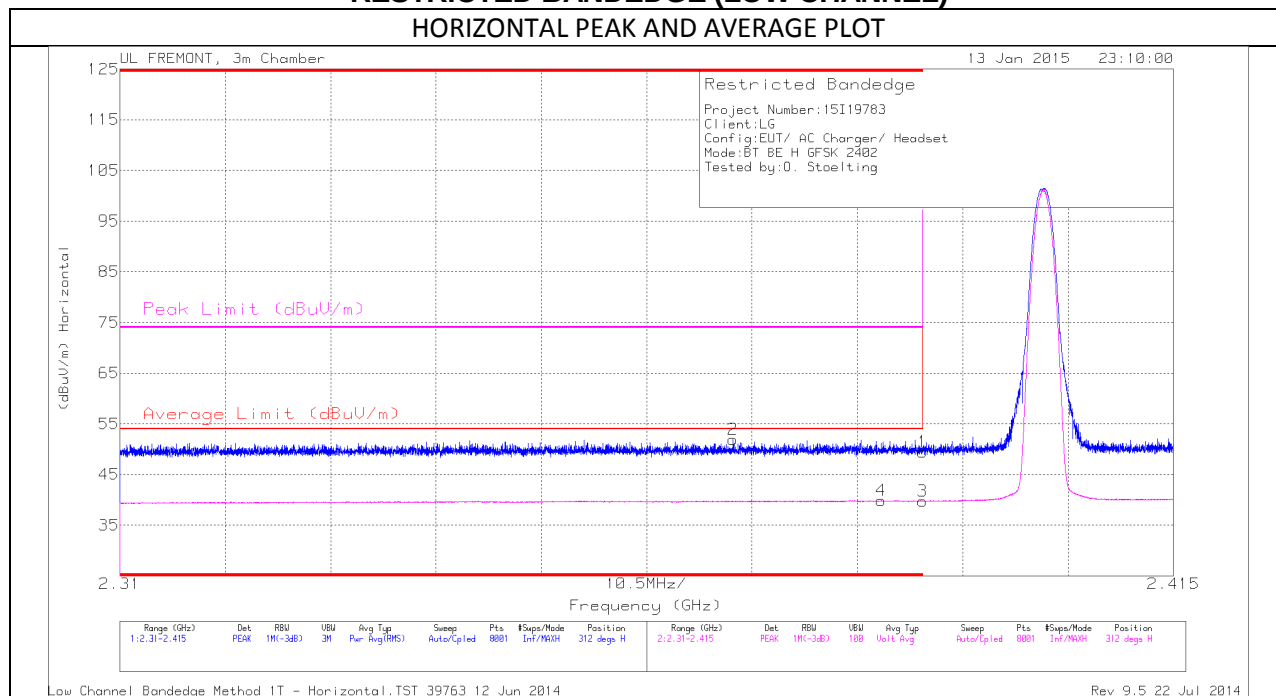
RESULTS

9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BASIC DATA RATE GFSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL VERTICAL PEAK AND AVERAGE DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filt r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.371	42.89	PK	32	-23	0	51.89	-	-	74	-22.11	312	398	H
4	* 2.386	30.87	VB1T	32.1	-23.1	0	39.87	54	-14.13	-	-	312	398	H
1	* 2.39	40.48	PK	32.1	-23.1	0	49.48	-	-	74	-24.52	312	398	H
3	* 2.39	30.73	VB1T	32.1	-23.1	0	39.73	54	-14.27	-	-	312	398	H

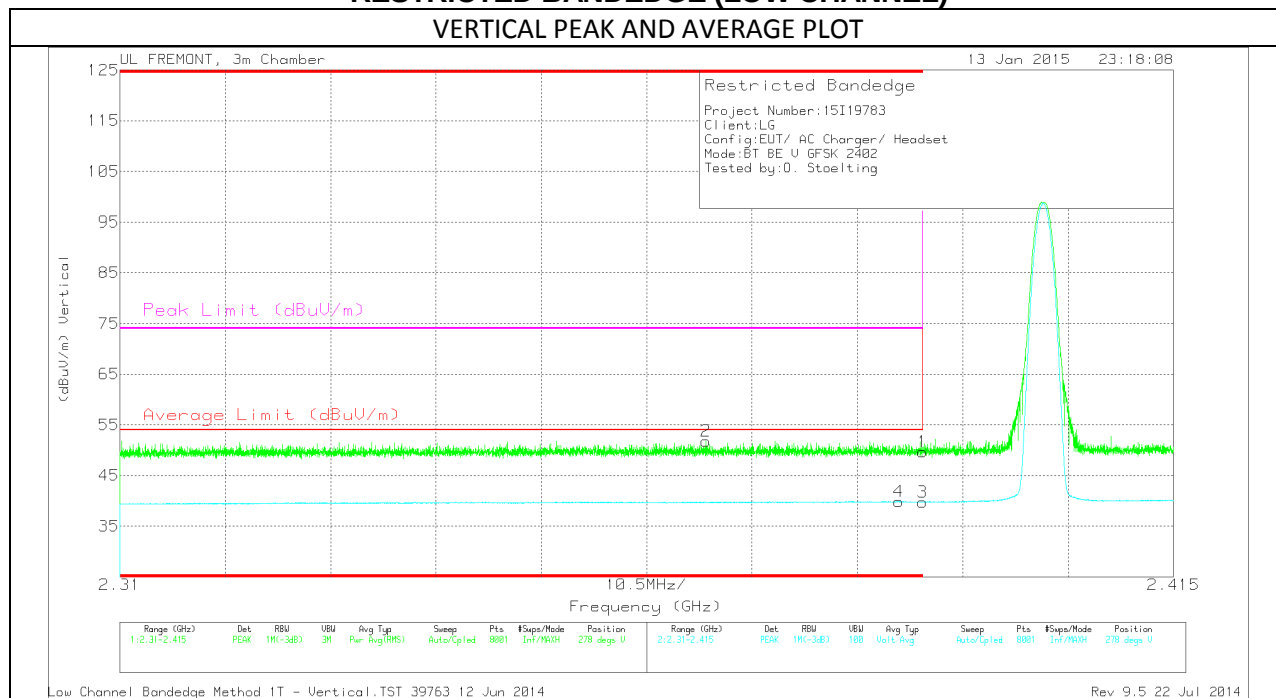
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

RESTRICTED BANDEDGE (LOW CHANNEL)

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL PEAK AND AVERAGE DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.368	42.93	PK	32	-23.1	0	51.83	-	-	74	-22.17	278	400	V
4	* 2.388	30.89	VB1T	32.1	-23.1	0	39.89	54	-14.11	-	-	278	400	V
1	* 2.39	40.68	PK	32.1	-23.1	0	49.68	-	-	74	-24.32	278	400	V
3	* 2.39	30.75	VB1T	32.1	-23.1	0	39.75	54	-14.25	-	-	278	400	V

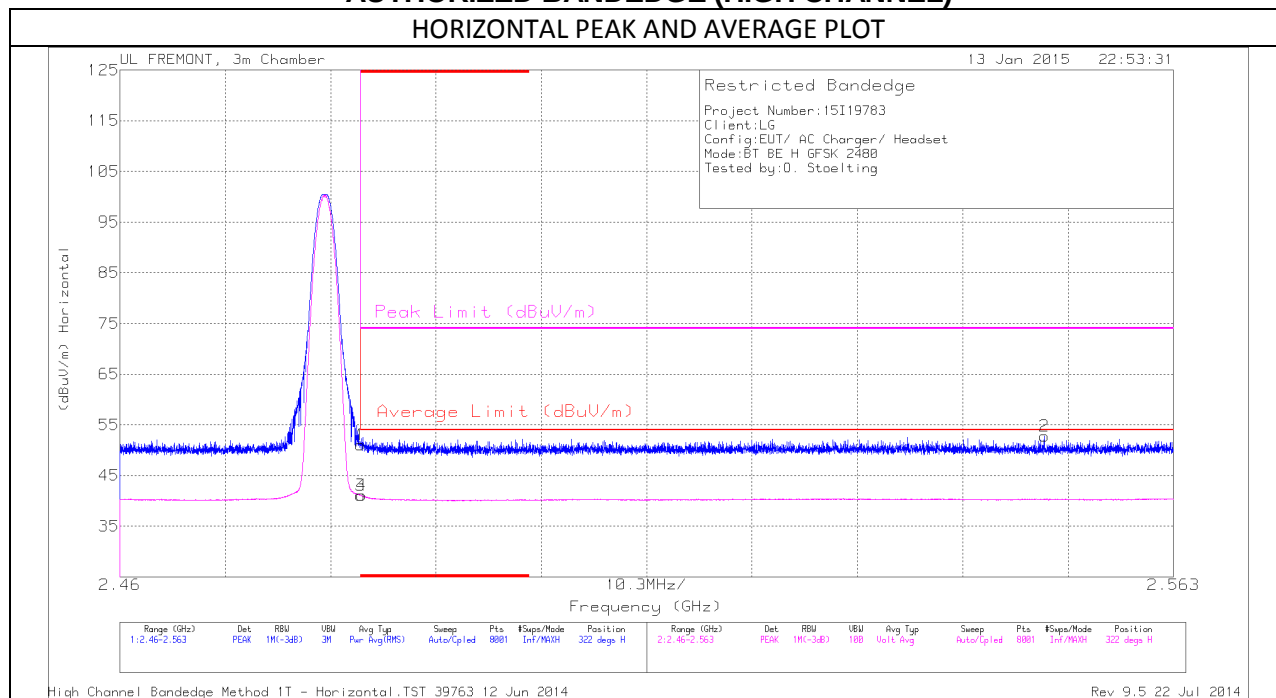
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL PEAK AND AVERAGE DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.49	PK	32.3	-22.8	0	50.99	-	-	74	-23.01	322	300	H
3	* 2.484	31.58	VB1T	32.3	-22.8	0	41.08	54	-12.92	-	-	322	300	H
4	* 2.484	31.64	VB1T	32.3	-22.8	0	41.14	54	-12.86	-	-	322	300	H
2	2.55	43.09	PK	32.4	-22.7	0	52.79	-	-	74	-21.21	322	300	H

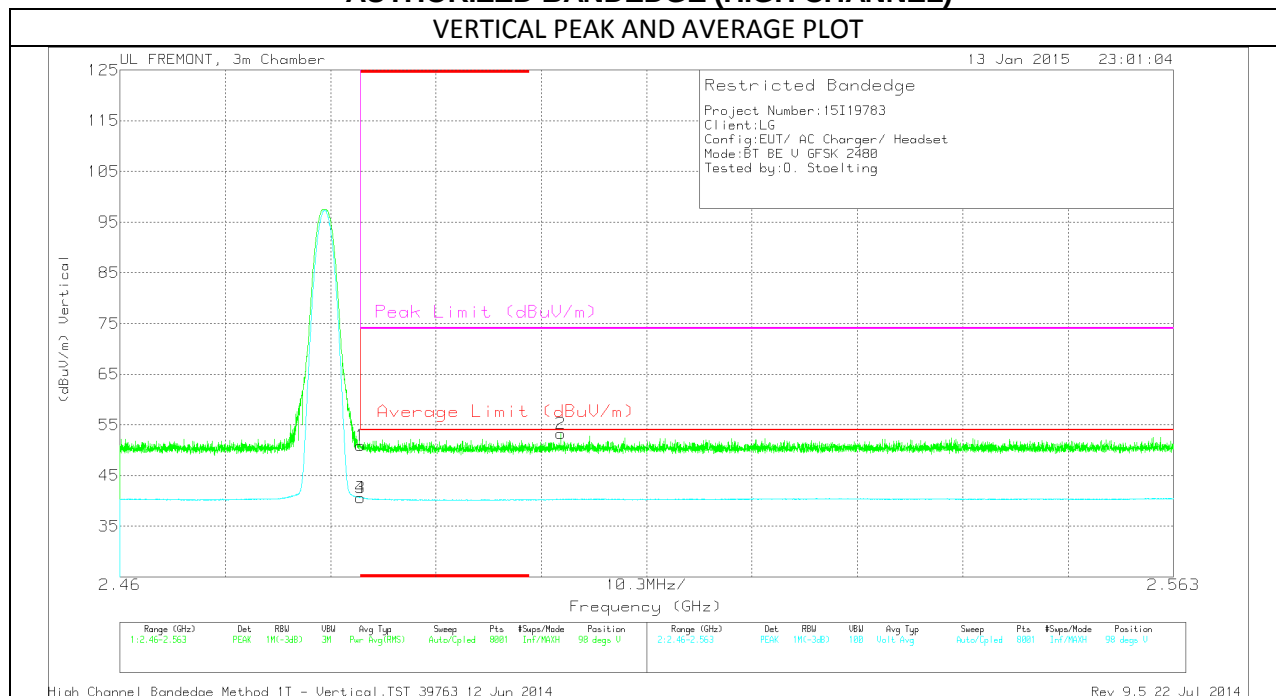
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

AUTHORIZED BANDEDGE (HIGH CHANNEL)

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL PEAK AND AVERAGE DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Filtr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.38	PK	32.3	-22.8	0	50.88	-	-	74	-23.12	98	386	V
3	* 2.484	31.15	VB1T	32.3	-22.8	0	40.65	54	-13.35	-	-	98	386	V
4	* 2.484	31.16	VB1T	32.3	-22.8	0	40.66	54	-13.34	-	-	98	386	V
2	2.503	43.79	PK	32.3	-22.8	0	53.29	-	-	74	-20.71	98	386	V

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

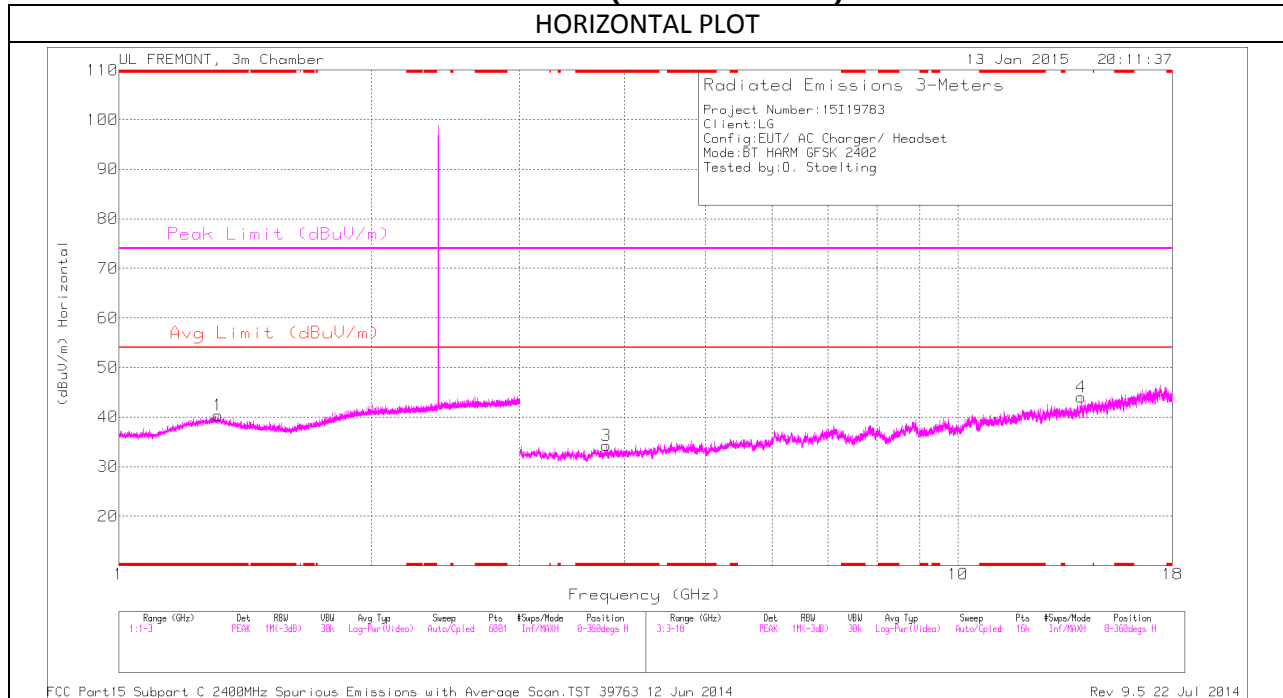
PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

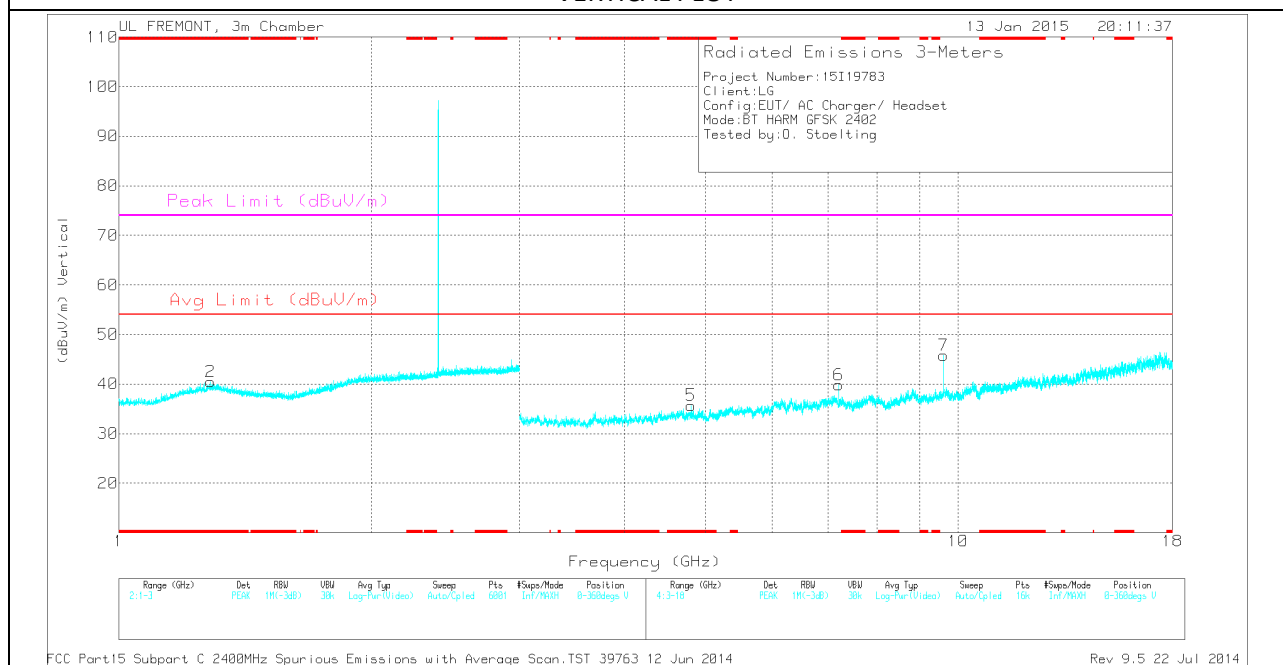
HARMONICS AND SPURIOUS EMISSIONS

SPURIOUS (LOW CHANNEL)

HORIZONTAL PLOT



VERTICAL PLOT



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

LOW CHANNEL DATA

TRACE MARKERS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Ftr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 1.286	34.12	PK	30.1	-23.7	0	40.52	-	-	74	-33.48	0-360	100	V
1	* 1.313	34.07	PK	30.1	-23.8	0	40.37	-	-	74	-33.63	0-360	100	H
3	* 3.809	32.23	PK	33.2	-31.2	0	34.23	-	-	74	-39.77	0-360	100	H
5	* 4.804	31.91	PK	34.1	-30.3	0	35.71	-	-	74	-38.29	0-360	100	V
4	14.013	32.59	PK	38.8	-27.4	0	43.99	-	-	-	-	0-360	200	H
6	7.205	33.49	PK	35.6	-29.2	0	39.89	-	-	-	-	0-360	100	V
7	9.608	34.42	PK	36.7	-25.3	0	45.82	-	-	-	-	0-360	200	V

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

PK - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Ftr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 3.81	41.37	PK3	33.2	-31.2	0	43.37	-	-	74	-30.63	259	196	H
* 3.809	27.99	VB1T	33.2	-31.2	0	29.99	54	-24.01	-	-	259	196	H
* 4.804	42.49	PK3	34.1	-30.3	0	46.29	-	-	74	-27.71	251	399	V
* 4.804	30.94	VB1T	34.1	-30.3	0	34.74	54	-19.26	-	-	251	399	V

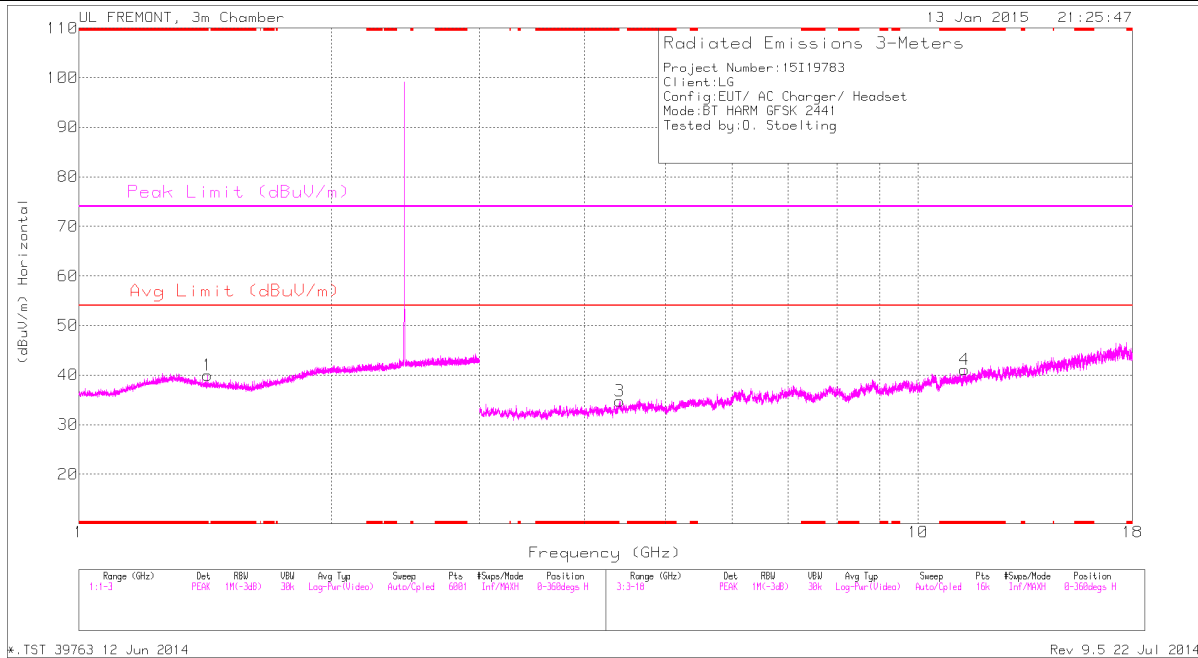
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

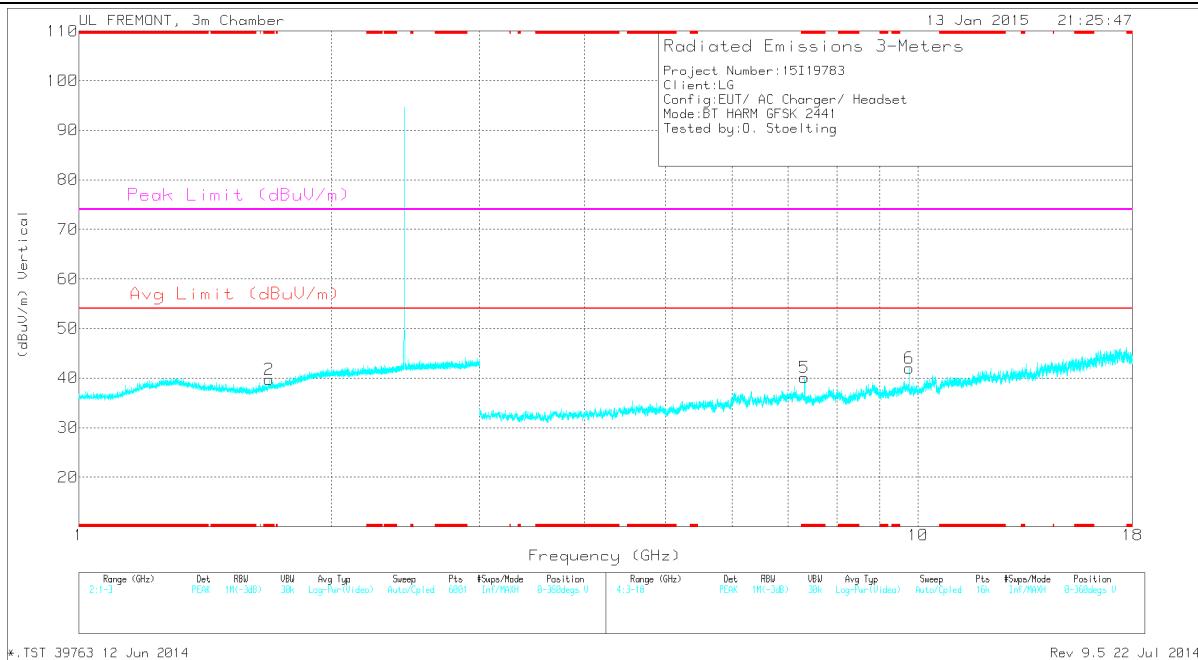
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

SPURIOUS (MID CHANNEL)

HORIZONTAL PLOT



VERTICAL PLOT



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

MID CHANNEL DATA

TRACE MARKERS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.423	34.69	PK	29	-23.7	0	39.99	-	-	74	-34.01	0-360	200	H
2	* 1.686	34.17	PK	28.9	-23.4	0	39.67	-	-	74	-34.33	0-360	200	V
4	* 11.351	29.07	PK	38	-26	0	41.07	-	-	74	-32.93	0-360	100	H
5	* 7.323	32.93	PK	35.6	-28.4	0	40.13	-	-	74	-33.87	0-360	100	V
3	4.412	31.24	PK	33.7	-30.2	0	34.74	-	-	-	-	0-360	100	H
6	9.764	31.08	PK	36.9	-26	0	41.98	-	-	-	-	0-360	200	V

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

PK - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 11.351	37.55	PK3	38	-26	0	49.55	-	-	74	-24.45	251	400	H
* 11.353	24.73	VB1T	38	-26	0	36.73	54	-17.27	-	-	251	400	H
* 7.323	40.98	PK3	35.6	-28.4	0	48.18	-	-	74	-25.82	263	106	V
* 7.323	30.02	VB1T	35.6	-28.4	0	37.22	54	-16.78	-	-	263	106	V
9.764	37.83	PK3	36.9	-26	0	48.73	-	-	-	-	322	223	V
9.764	27.69	VB1T	36.9	-26	0	38.59	-	-	-	-	322	223	V

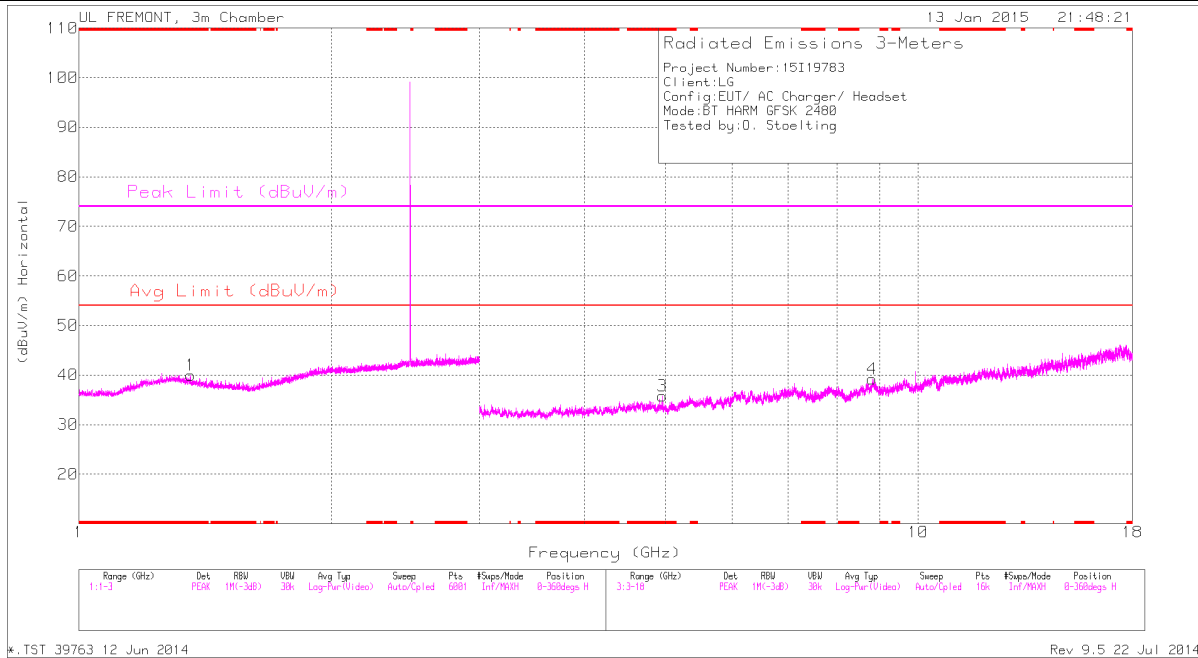
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

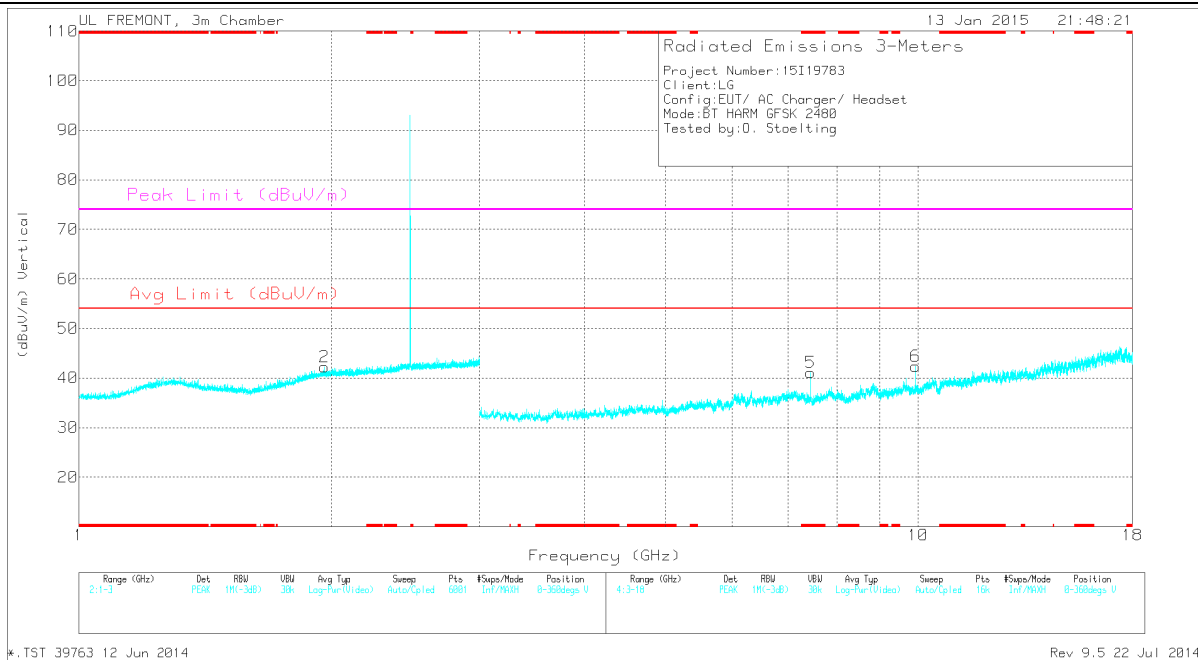
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

SPURIOUS (HIGH CHANNEL)

HORIZONTAL PLOT



VERTICAL PLOT



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HIGH CHANNEL DATA

TRACE MARKERS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.358	34.2	PK	29.6	-23.8	0	40	-	-	74	-34	0-360	200	H
3	* 4.959	32.73	PK	34	-31	0	35.73	-	-	74	-38.27	0-360	100	H
5	* 7.44	34.36	PK	35.7	-28.9	0	41.16	-	-	74	-32.84	0-360	100	V
2	1.962	34.07	PK	31.5	-23.3	0	42.27	-	-	-	-	0-360	100	V
4	8.819	29.82	PK	36	-26.6	0	39.22	-	-	-	-	0-360	100	H
6	9.919	31.07	PK	36.9	-25.6	0	42.37	-	-	-	-	0-360	200	V

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

PK - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 7.44	42.89	PK3	35.7	-28.9	0	49.69	-	-	74	-24.31	231	118	V
* 7.44	33.51	VB1T	35.7	-28.9	0	40.31	54	-13.69	-	-	231	118	V
9.918	37.02	PK3	36.9	-25.6	0	48.32	-	-	-	-	222	400	V
9.92	23.78	VB1T	36.9	-25.6	0	35.08	-	-	-	-	222	400	V

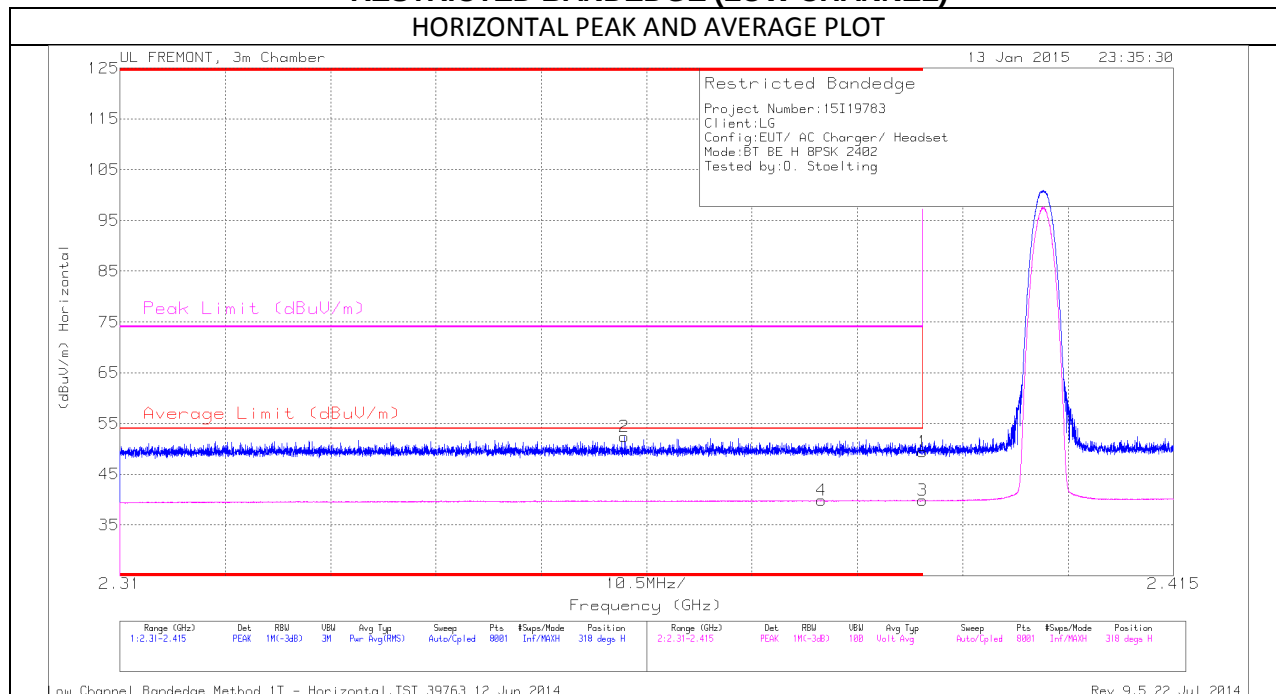
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

ENHANCED DATA RATE 8DPSK MODULATION

RESTRICTED BANDEDGE (LOW CHANNEL) HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL VERTICAL PEAK AND AVERAGE DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Filt r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.36	43.53	PK	32	-23.1	0	52.43	-	-	74	-21.57	318	396	H
4	* 2.38	30.87	VB1T	32.1	-23.1	0	39.87	54	-14.13	-	-	318	396	H
1	* 2.39	40.47	PK	32.1	-23.1	0	49.47	-	-	74	-24.53	318	396	H
3	* 2.39	30.84	VB1T	32.1	-23.1	0	39.84	54	-14.16	-	-	318	396	H

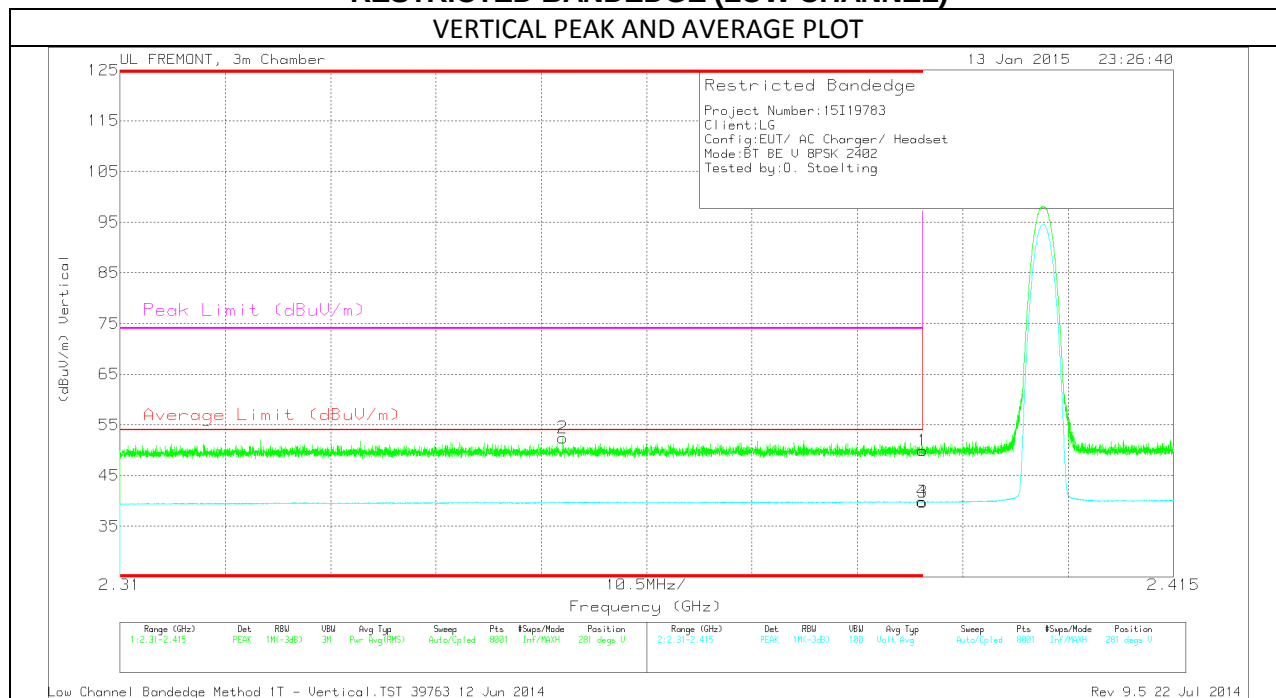
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

RESTRICTED BANDEDGE (LOW CHANNEL)

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL PEAK AND AVERAGE DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cb/Flt r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 2.354	43.56	PK	32	-23.1	0	52.46	-	-	74	-21.54	281	397	V
1	* 2.39	40.87	PK	32.1	-23.1	0	49.87	-	-	74	-24.13	281	397	V
3	* 2.39	30.8	VB1T	32.1	-23.1	0	39.8	54	-14.2	-	-	281	397	V
4	* 2.39	30.87	VB1T	32.1	-23.1	0	39.87	54	-14.13	-	-	281	397	V

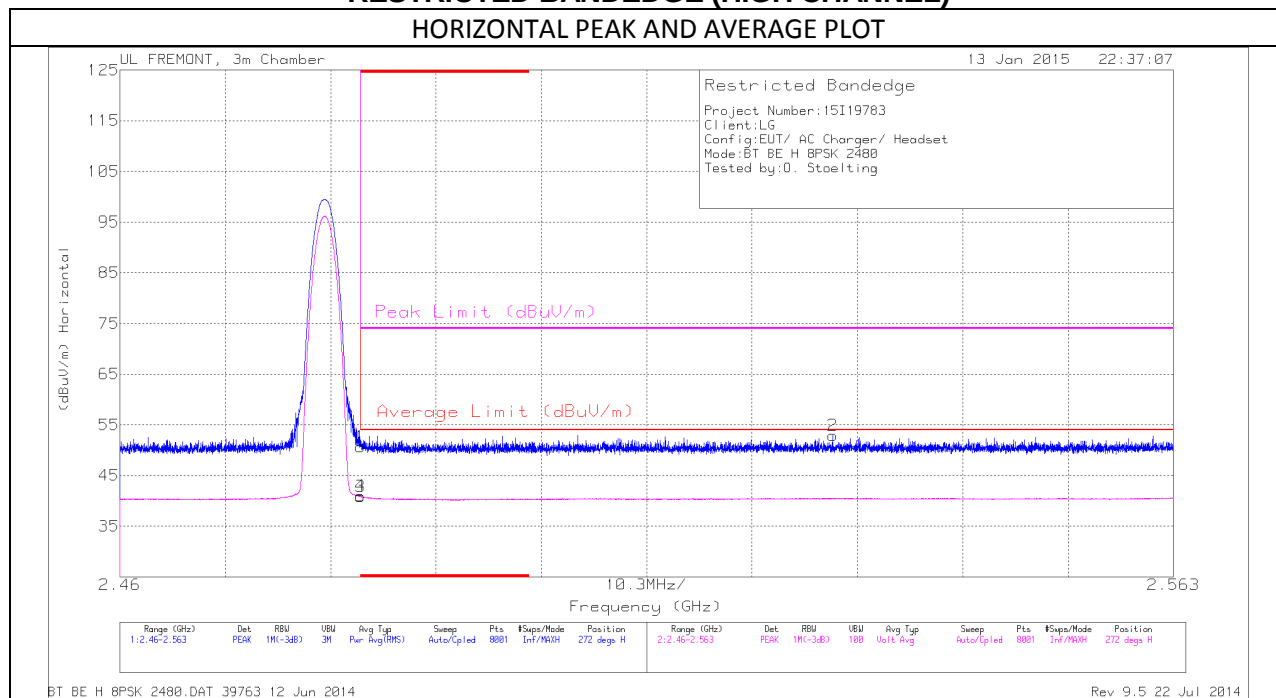
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

RESTRICTED BANDEDGE (HIGH CHANNEL)

HORIZONTAL PEAK AND AVERAGE PLOT



HORIZONTAL PEAK AND AVERAGE DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cb/Flt r/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	41.21	PK	32.3	-22.8	0	50.71	-	-	74	-23.29	272	103	H
3	* 2.484	31.38	VB1T	32.3	-22.8	0	40.88	54	-13.12	-	-	272	103	H
4	* 2.484	31.43	VB1T	32.3	-22.8	0	40.93	54	-13.07	-	-	272	103	H
2	2.53	43.11	PK	32.4	-22.6	0	52.91	-	-	74	-21.09	272	103	H

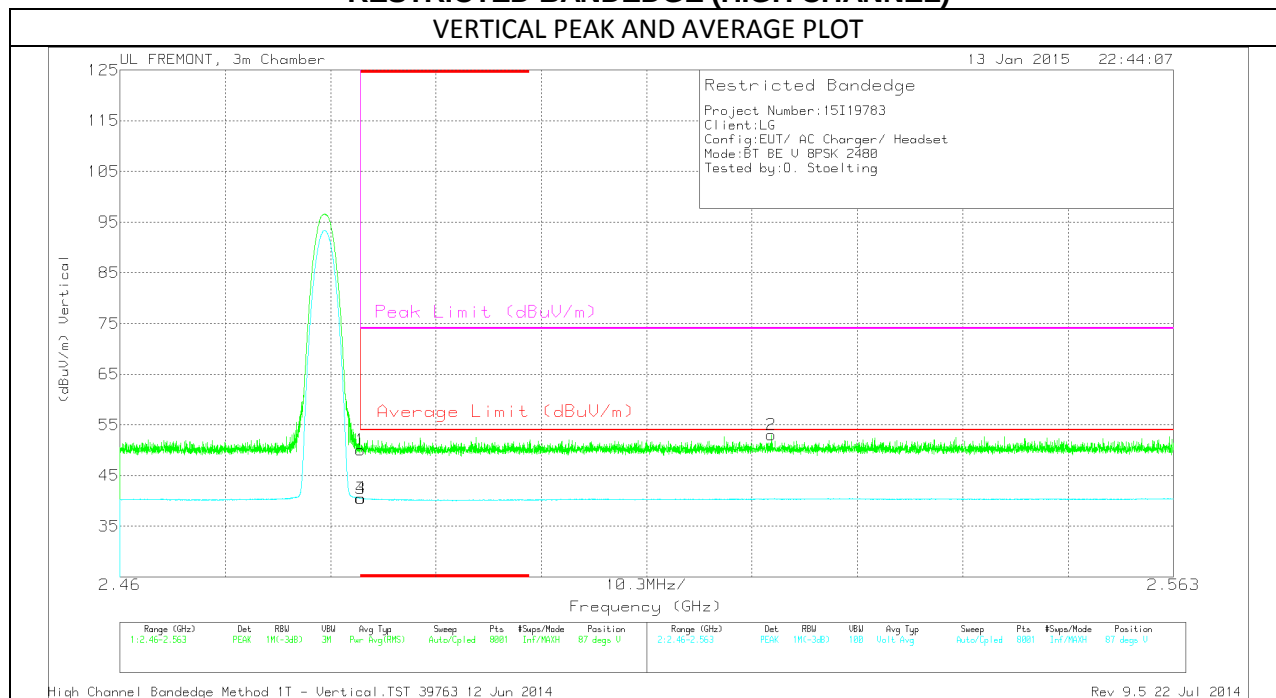
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

RESTRICTED BANDEDGE (HIGH CHANNEL)

VERTICAL PEAK AND AVERAGE PLOT



VERTICAL PEAK AND AVERAGE DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AFT119 (dB/m)	Amp/Cbl/Fitr/Pad (dB)	DC Corr (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	40.57	PK	32.3	-22.8	0	50.07	-	-	74	-23.93	87	290	V
3	* 2.484	31.01	VB1T	32.3	-22.8	0	40.51	54	-13.49	-	-	87	290	V
4	* 2.484	31.04	VB1T	32.3	-22.8	0	40.54	54	-13.46	-	-	87	290	V
2	2.524	43.32	PK	32.4	-22.7	0	53.02	-	-	74	-20.98	87	290	V

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

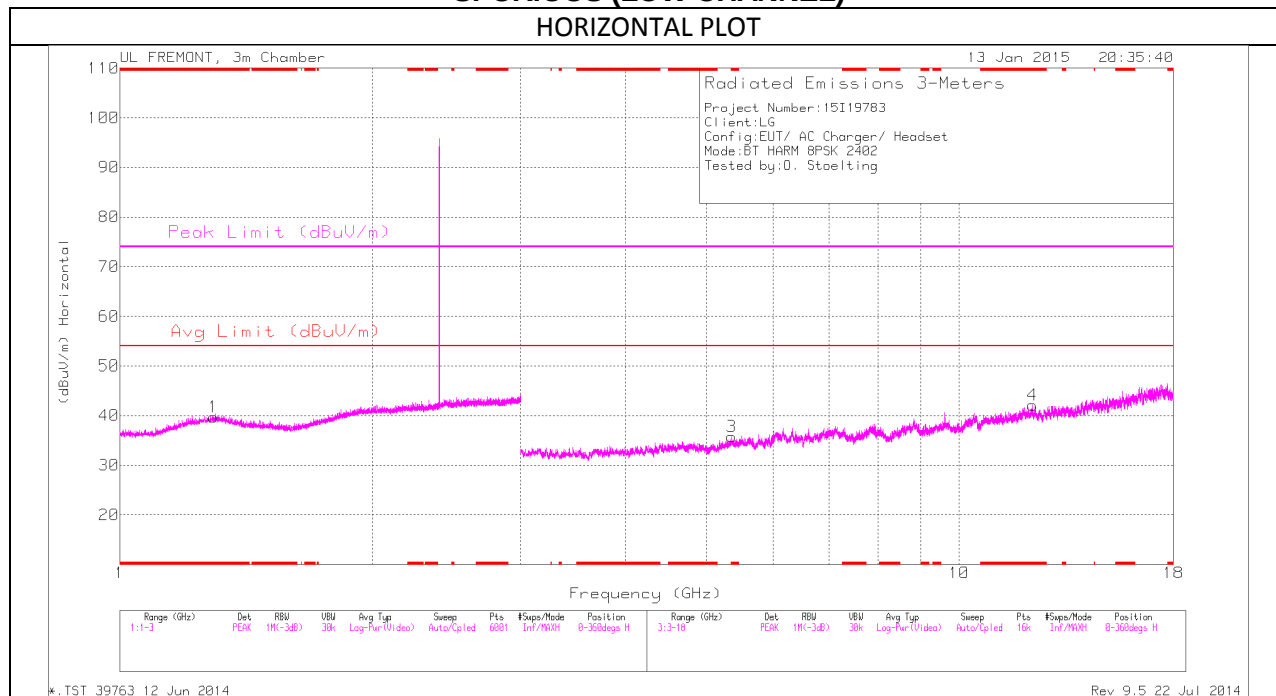
PK - Peak detector

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

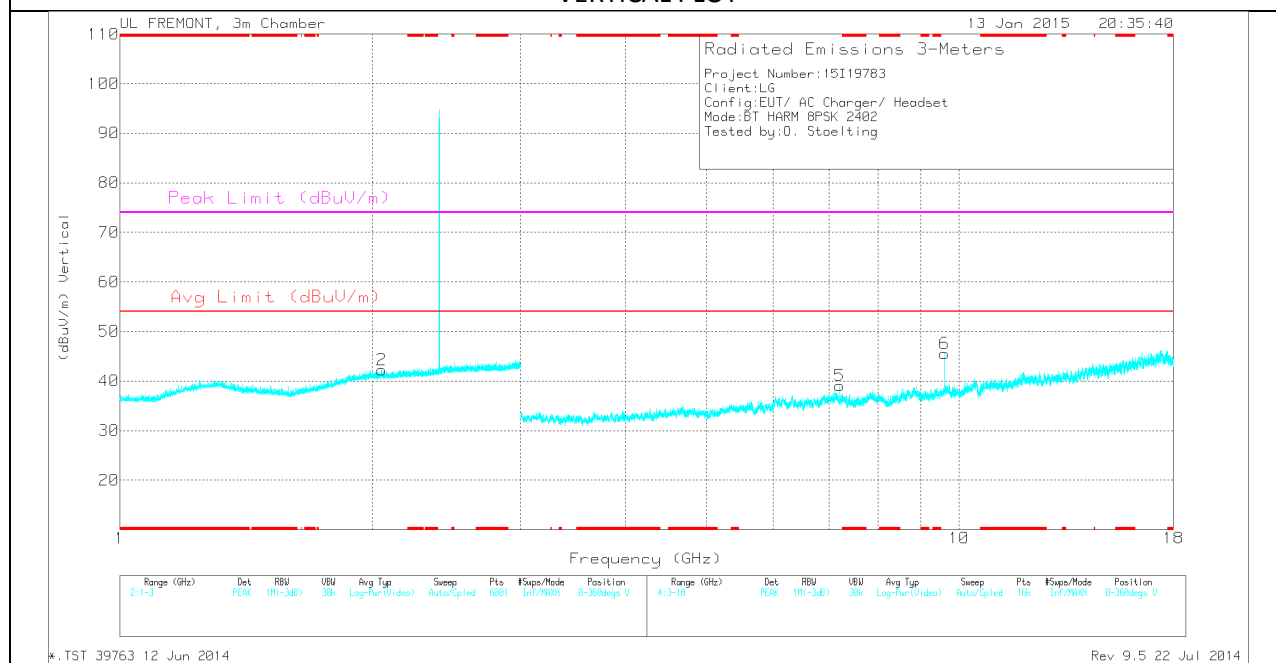
HARMONICS AND SPURIOUS EMISSIONS

SPURIOUS (LOW CHANNEL)

HORIZONTAL PLOT



VERTICAL PLOT



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

LOW CHANNEL DATA

TRACE MARKERS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.293	33.26	PK	30.2	-23.8	0	39.66	-	-	74	-34.34	0-360	100	H
3	* 5.355	31.31	PK	34.5	-30	0	35.81	-	-	74	-38.19	0-360	200	H
4	* 12.231	29.21	PK	39	-26.1	0	42.11	-	-	74	-31.89	0-360	200	H
2	2.051	33.7	PK	31.6	-23.1	0	42.2	-	-	-	-	0-360	200	V
5	7.206	32.65	PK	35.6	-29.2	0	39.05	-	-	-	-	0-360	100	V
6	9.608	34.19	PK	36.7	-25.3	0	45.59	-	-	-	-	0-360	200	V

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

PK - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 12.231	37.1	PK3	39	-26.1	0	50	-	-	74	-24	49	197	H
* 12.233	23.92	VB1T	39	-26.1	0	36.82	54	-17.18	-	-	49	197	H
7.206	40.49	PK3	35.6	-29.2	0	46.89	-	-	-	-	265	101	V
7.206	28.54	VB1T	35.6	-29.2	0	34.94	-	-	-	-	265	101	V
9.608	40.2	PK3	36.7	-25.3	0	51.6	-	-	-	-	123	291	V
9.608	33.25	VB1T	36.7	-25.3	0	44.65	-	-	-	-	123	291	V

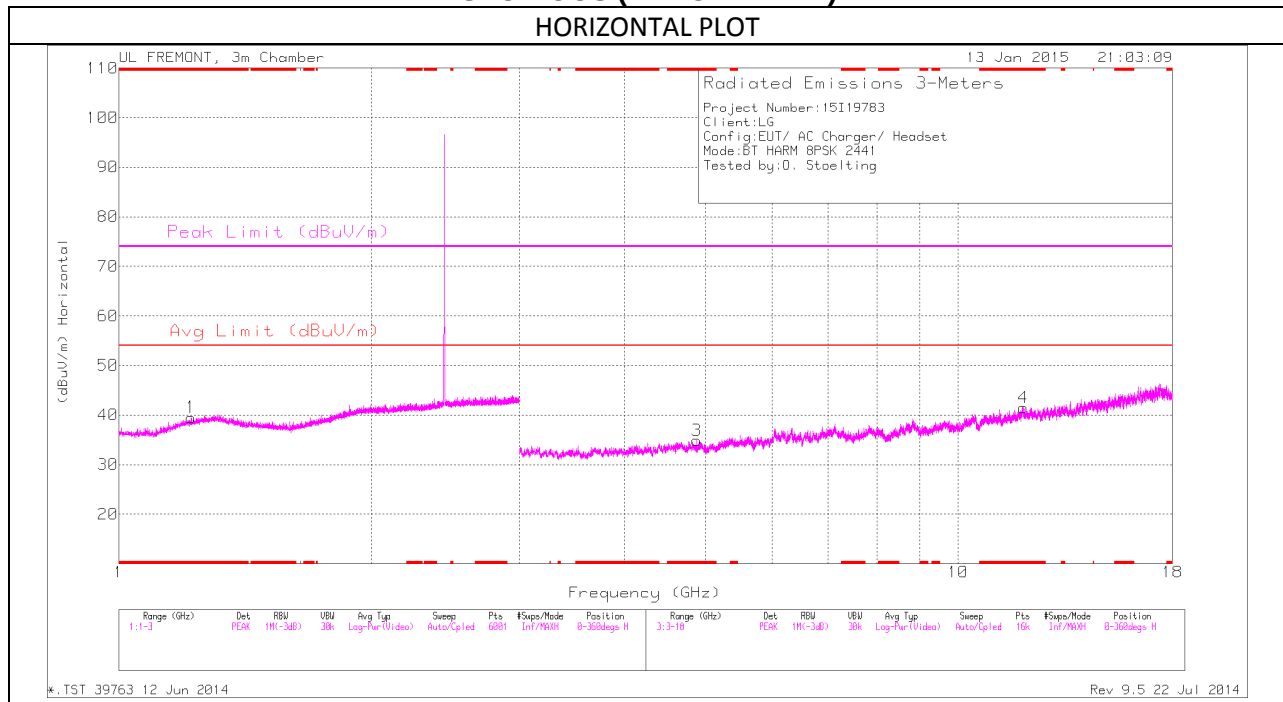
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

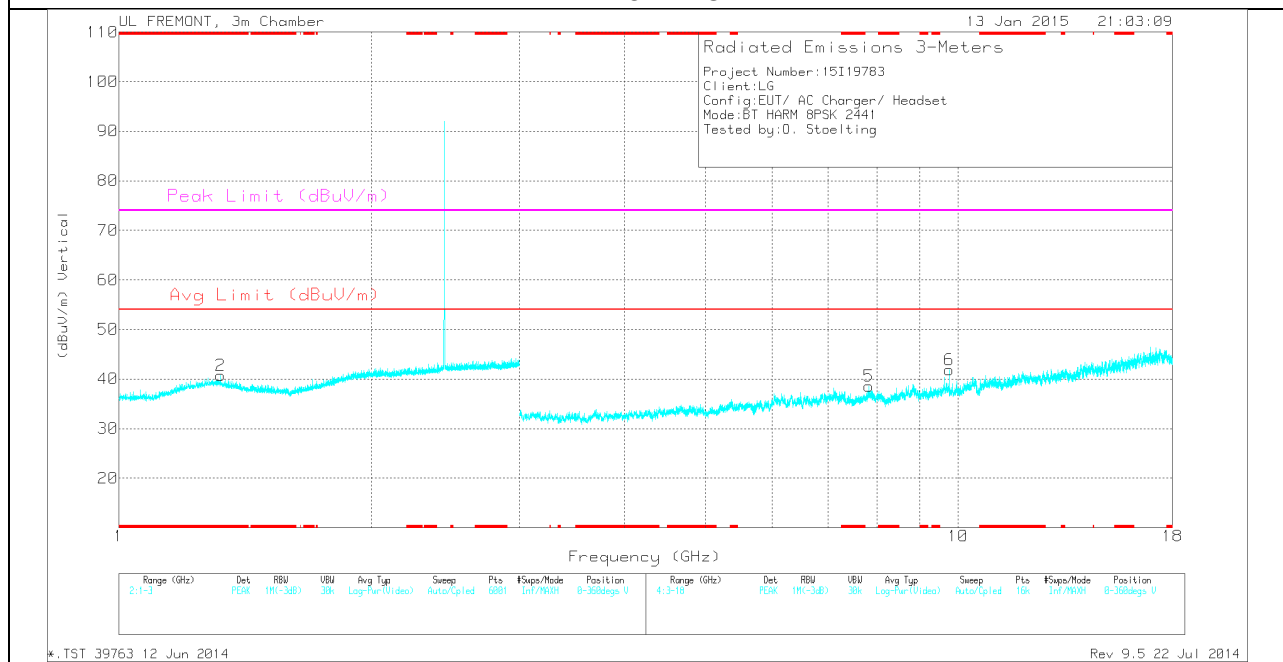
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

SPURIOUS (MID CHANNEL)

HORIZONTAL PLOT



VERTICAL PLOT



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

MID CHANNEL DATA

TRACE MARKERS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.218	33.92	PK	29.4	-23.8	0	39.52	-	-	74	-34.48	0-360	200	H
2	* 1.322	34.53	PK	30	-23.8	0	40.73	-	-	74	-33.27	0-360	100	V
3	* 4.882	30.97	PK	34	-30.1	0	34.87	-	-	74	-39.13	0-360	200	H
4	* 11.956	28.45	PK	39	-26	0	41.45	-	-	74	-32.55	0-360	200	H
5	7.825	30.56	PK	35.8	-27.8	0	38.56	-	-	-	-	0-360	100	V
6	9.764	30.92	PK	36.9	-26	0	41.82	-	-	-	-	0-360	200	V

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

PK - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cbl/Fitr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 11.955	38.13	PK3	39	-26.1	0	51.03	-	-	74	-22.97	260	180	H
* 11.954	24.58	VB1T	39	-26.1	0	37.48	54	-16.52	-	-	260	180	H
7.824	38.44	PK3	35.8	-27.9	0	46.34	-	-	-	-	11	188	V
7.826	26	VB1T	35.8	-27.8	0	34	-	-	-	-	11	188	V
9.764	38.53	PK3	36.9	-26	0	49.43	-	-	-	-	314	188	V
9.764	29.01	VB1T	36.9	-26	0	39.91	-	-	-	-	314	188	V

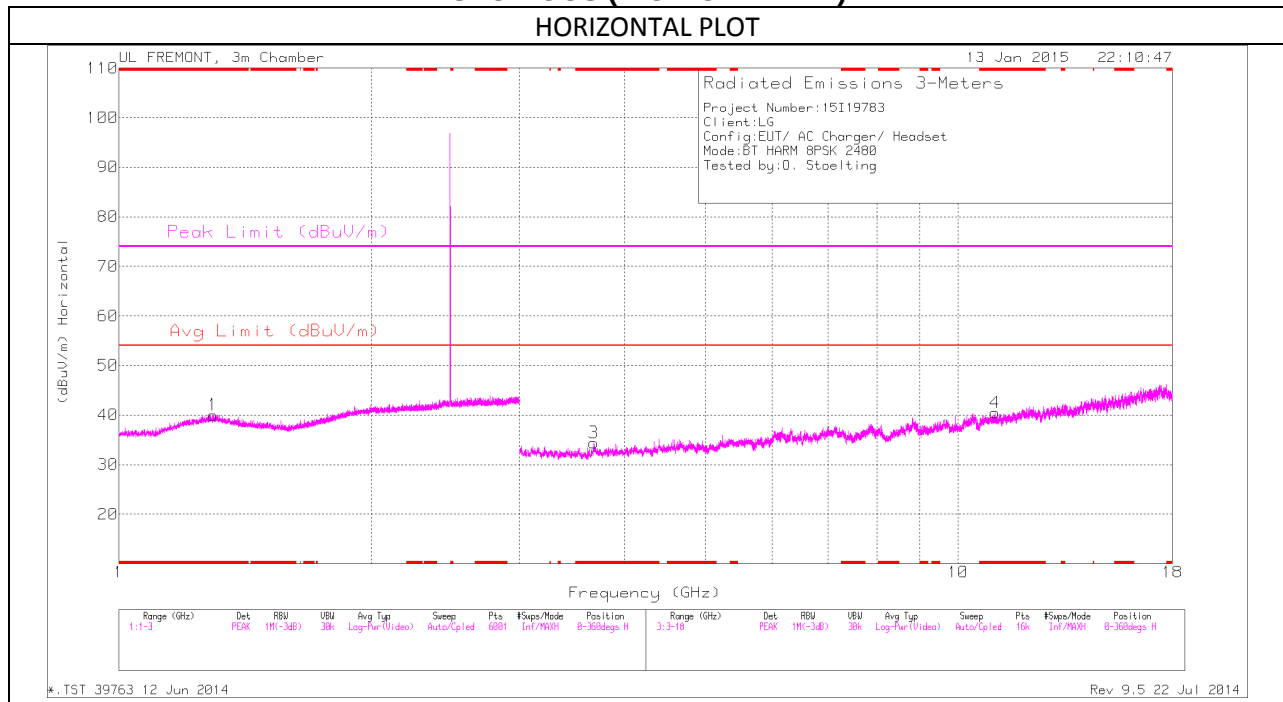
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

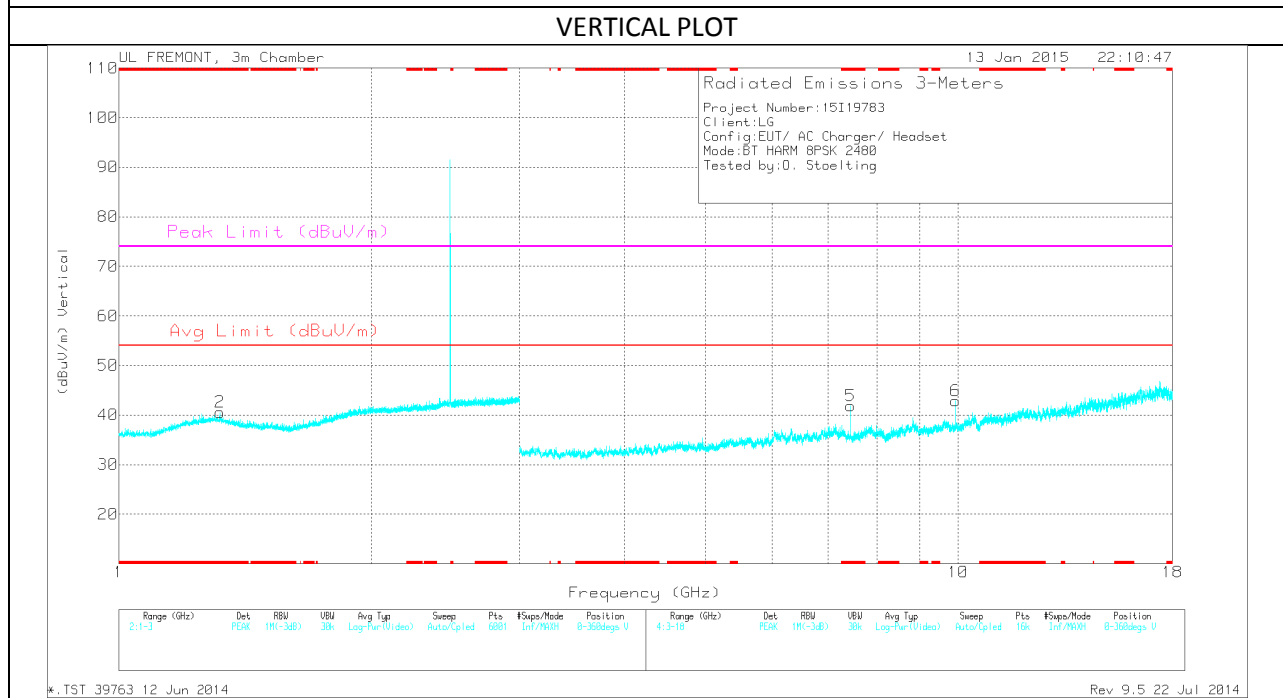
VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

SPURIOUS (HIGH CHANNEL)

HORIZONTAL PLOT



VERTICAL PLOT



Note: Emission was scanned up to 26GHz; No emissions were detected above the noise floor which was at least 20dB below the specification limit.

HIGH CHANNEL DATA

TRACE MARKERS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/Ftr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.295	33.63	PK	30.2	-23.8	0	40.03	-	-	74	-33.97	0-360	100	H
2	* 1.319	34.34	PK	30	-23.8	0	40.54	-	-	74	-33.46	0-360	100	V
3	* 3.682	31.94	PK	33.2	-30.7	0	34.44	-	-	74	-39.56	0-360	200	H
4	* 11.057	28.04	PK	37.9	-25.5	0	40.44	-	-	74	-33.56	0-360	100	H
5	* 7.44	35.03	PK	35.7	-28.9	0	41.83	-	-	74	-32.17	0-360	100	V
6	9.919	31.63	PK	36.9	-25.6	0	42.93	-	-	-	-	0-360	100	V

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

PK - Peak detector

Radiated Emissions

Frequency (GHz)	Meter Reading (dBuV)	Det	AF T119 (dB/m)	Amp/Cb/Ftr /Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
* 11.057	37.23	PK3	37.9	-25.5	0	49.63	-	-	74	-24.37	100	177	H
* 11.055	24.1	VB1T	37.9	-25.4	0	36.6	54	-17.4	-	-	100	177	H
* 7.44	42.11	PK3	35.7	-28.9	0	48.91	-	-	74	-25.09	223	104	V
* 7.44	31.14	VB1T	35.7	-28.9	0	37.94	54	-16.06	-	-	223	104	V
9.92	39.14	PK3	36.9	-25.6	0	50.44	-	-	-	-	211	108	V
9.92	30.34	VB1T	36.9	-25.6	0	41.64	-	-	-	-	211	108	V

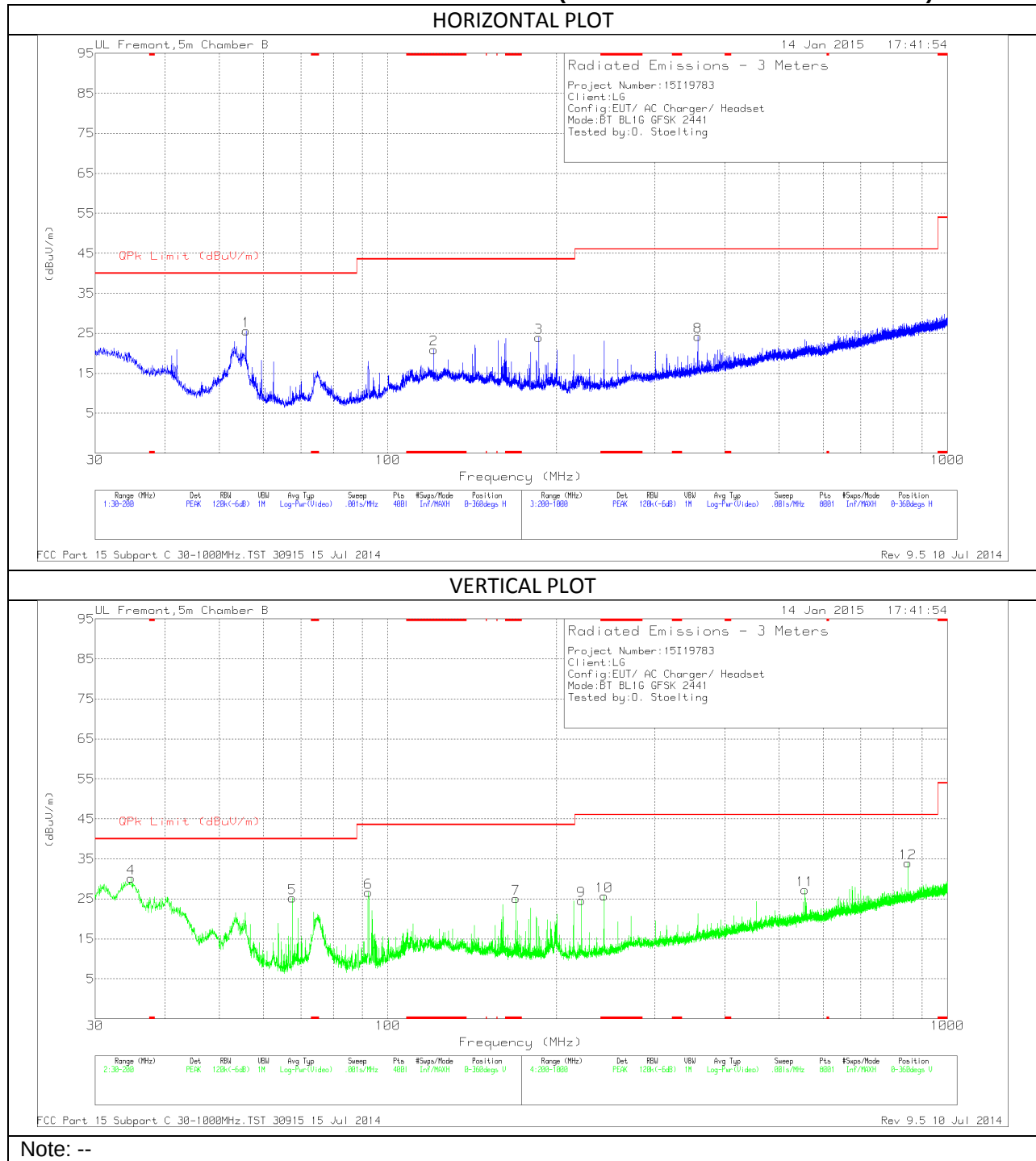
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

PK3 - FHSS Method: Maximum Peak

VB1T - FHSS Method: VB=1/Ton, Voltage Averaging Max Hold where: Ton is the duration of the packet

9.1. TRANSMITTER BELOW 1 GHz

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



BELOW 1 GHz TABLE

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AF T243 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
2	* 120.8225	34.67	PK	14.1	-27.8	20.97	43.52	-22.55	0-360	300	H
7	* 169.485	40.6	PK	11.7	-27.2	25.1	43.52	-18.42	0-360	101	V
10	* 243.4	40.54	PK	11.6	-26.4	25.74	46.02	-20.28	0-360	200	V
4	34.8025	41.27	PK	17.6	-28.7	30.17	40	-9.83	0-360	101	V
1	55.7975	46.86	PK	7.3	-28.5	25.66	40	-14.34	0-360	400	H
5	67.5275	45.6	PK	8	-28.4	25.2	40	-14.8	0-360	101	V
6	92.3688	46.52	PK	8.2	-28.1	26.62	43.52	-16.9	0-360	101	V
3	186.145	39.69	PK	11.3	-27	23.99	43.52	-19.53	0-360	400	H
9	221.6	40.49	PK	10.8	-26.7	24.59	46.02	-21.43	0-360	200	V
8	357.9	35.19	PK	14.8	-25.8	24.19	46.02	-21.83	0-360	300	H
11	556	34.15	PK	18.6	-25.5	27.25	46.02	-18.77	0-360	101	V
12	848.9	35.42	PK	22	-23.4	34.02	46.02	-12	0-360	101	V

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

PK - Peak detector

Note: --

10. AC POWER LINE CONDUCTED EMISSIONS

LIMITS AND PROCEDURE

LIMITS

FCC §15.207 (a)

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

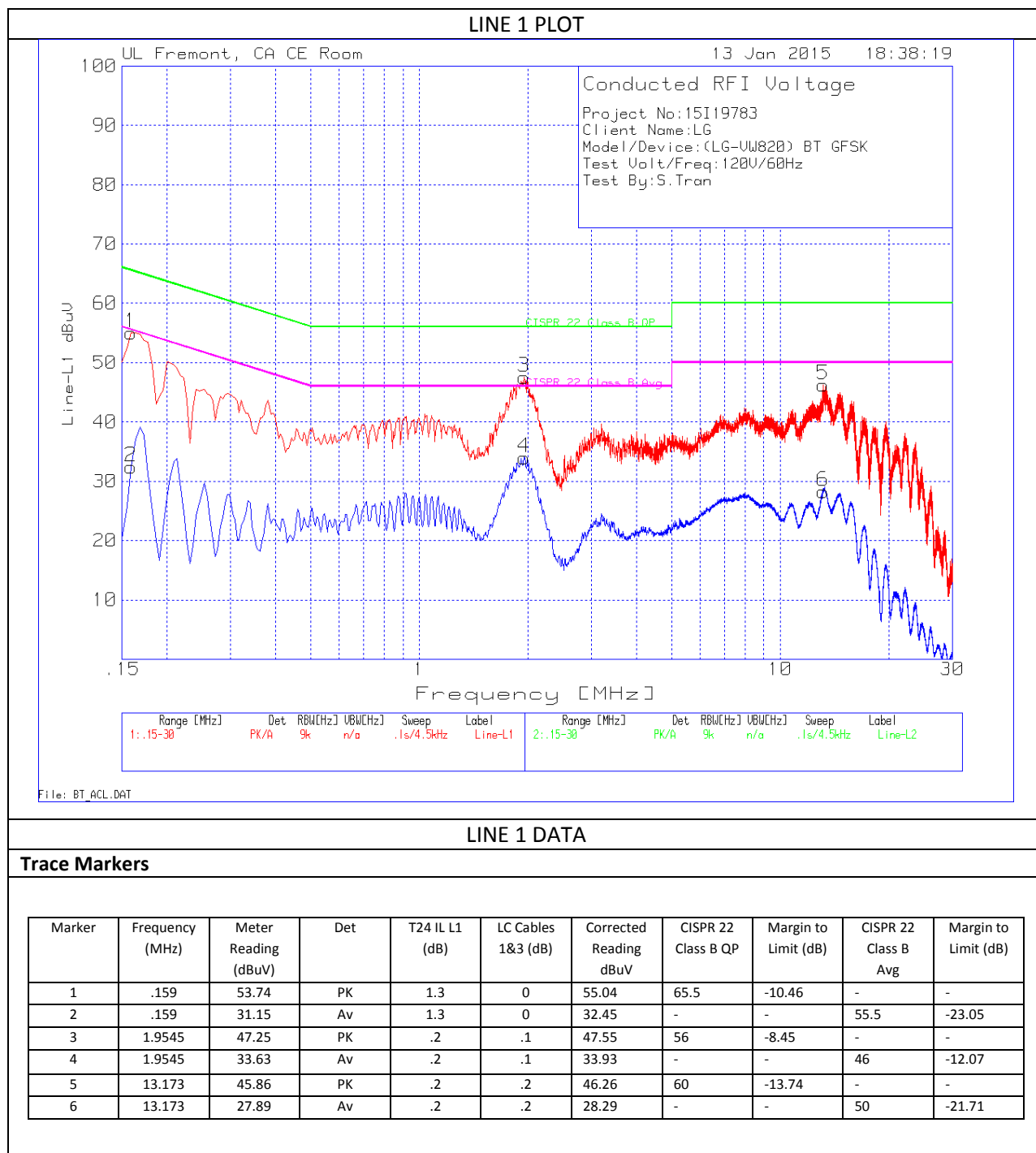
*Decreases with the logarithm of the frequency.

TEST PROCEDURE

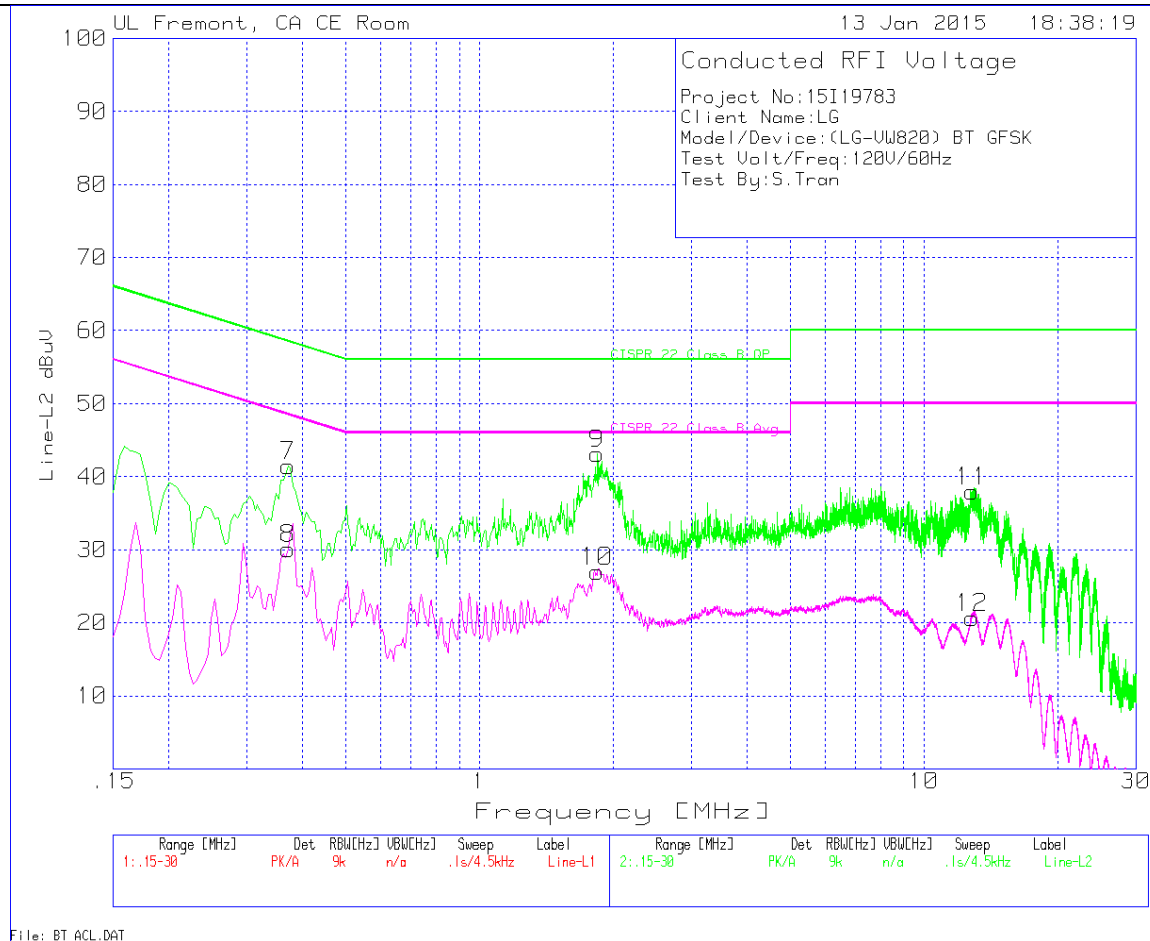
ANSI C63.4 - 2009

RESULTS

6 WORST EMISSIONS



LINE 2 PLOT



LINE 2 DATA

Trace Markers

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	T24 IL L2 (dB)	LC Cables 2&3 (dB)	Corrected Reading dBuV	CISPR 22 Class B QP	Margin to Limit (dB)	CISPR 22 Class B Avg	Margin to Limit (dB)
7	.3705	40.99	PK	.5	0	41.49	58.5	-17.01	-	-
8	.3705	29.57	Av	.5	0	30.07	-	-	48.5	-18.43
9	1.842	42.79	PK	.2	.1	43.09	56	-12.91	-	-
10	1.842	26.71	Av	.2	.1	27.01	-	-	46	-18.99
11	12.831	37.45	PK	.3	.2	37.95	60	-22.05	-	-
12	12.831	20.22	Av	.3	.2	20.72	-	-	50	-29.28