



FCC 47 CFR PART 15 SUBPART C

CERTIFICATION TEST REPORT

FOR

WIRELESS INPUT DEVICE

MODEL NUMBER: 1698

FCC ID: C3K1698

REPORT NUMBER: R10778321-E1A

ISSUE DATE: 2015-07-02

Prepared for
**MICROSOFT CORPORATION
ONE MICROSOFT WAY
REDMOND, WA 98052, U.S.A.**

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NVLAP Lab code: 200246-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	2015-06-04	Initial Issue	Jeff Moser
1	2015-06-29	Revised worst-case power information on page 8.	Jeff Moser
2	2015-07-02	Revised unit designations on Radiated plots	Jeff Moser

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: MICROSOFT CORPORATION
ONE MICROSOFT WAY
REDMOND, WA 98052, U.S.A.

EUT DESCRIPTION: WIRELESS INPUT DEVICE

MODEL: 1698

SERIAL NUMBER: Conducted 1, Radiated 1

DATE TESTED: 2015-05-14 to 2015-05-19

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

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

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

Approved & Released
For UL LLC By:



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UL VS – Consumer Technology Division

Prepared By:



Jeff Moser
EMC Program Manager
UL LLC – Consumer Technology Division

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 C63.10-2009.

Note – Radiated testing above 1GHz was performed on a 1.5m table height, per ANSI C63.10: 2013. All other testing was performed per ANSI C63.10: 2009.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Dr., Research Triangle Park, NC 27709, USA.

12 Laboratory Dr., RTP, NC 27709	
☐	Chamber A
☒	Chamber C

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0. The full scope of accreditation can be viewed at <http://ts.nist.gov/standards/scopes/2002460.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:

Test	Uncertainty
Total RF power, conducted	+/- 0.45 dB
RF power density, conducted	+/- 1.5 dB
Spurious emissions, conducted	+/- 1.46 dB
Radiated Emissions (30-1000 MHz)	+/- 6.04 dB (3m)
Radiated Emissions (1-6 GHz)	+/- 5.96 dB
Radiated Emissions (6-18 GHz)	+/- 6.10 dB
Radiated Emissions (18-26 GHz)	+/- 6.81 dB

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an 802.11a/g/n transceiver, model 1698.

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)
2412 - 2462	802.11g	19.05	80.35
2412 - 2462	802.11n HT20	19.25	84.14

The transmitter has a maximum average conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2412 - 2462	802.11g	8.12	6.49
2412 - 2462	802.11n HT20	8.48	7.05

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an integral antenna, with a maximum gain of -0.3 dBi.

5.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was R74.

The test utility software used during testing was Atheros ART2 ver 2.3.

5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions 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 as provided by the client and verified by UL were:

802.11g mode: 6 Mbps

802.11n HT20mode: MCS0

5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	T440	N/A	TP00050A
AC/DC adapter	Lenovo	DCWP MMC 170W 20V	N/A	
External DC Source	Circuit Specialist	CS13005X5	-	-

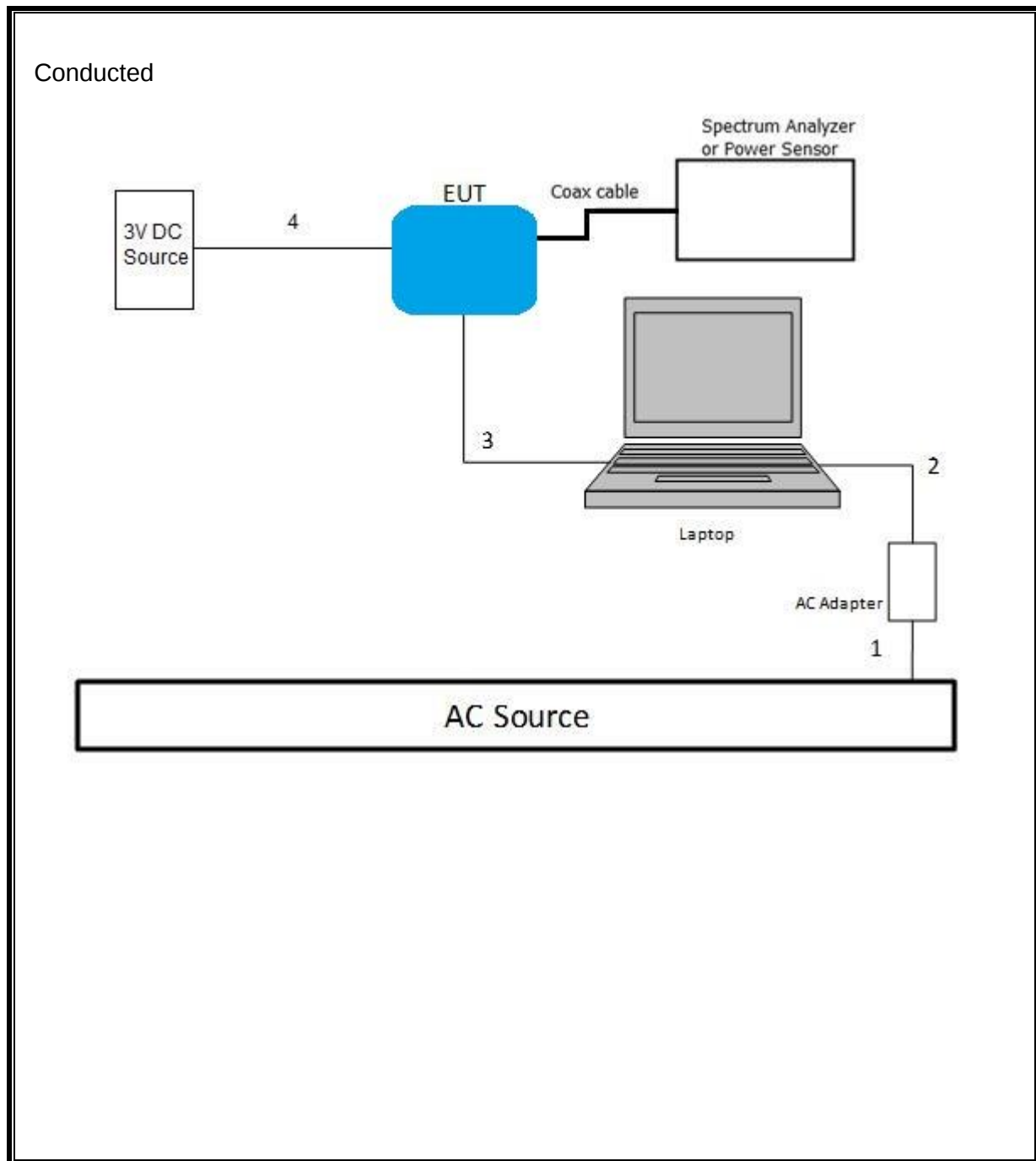
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC - 3 Prong	Unshielded	<3	None.
2	DC	1	DC - Barrel	Shielded	<3	None.
3	USB	1	USB	Shielded	<3	None.
4	DC	1	NA	Unshielded	<3	External DC source during conducted testing.

TEST SETUP

The EUT was configured as table top equipment during the tests. During Conducted Emissions testing, the EUT was connected to a laptop to change modes/channels and the EUT was powered by an external power source. During Radiated testing, the EUT was tested as a stand alone device. The EUT was set for the proper channel/mode, then the laptop was removed from the test site. Test software exercised the radio card.

SETUP DIAGRAM FOR TESTS



Radiated



AC Source

6. TEST AND MEASUREMENT EQUIPMENT

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

Radiated Disturbance Emissions (E-field) – Chamber C

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	30-1000 MHz Range				
AT0066	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB1	2014-07-10	2015-07-31
	1-18 GHz				
AT0062	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2014-07-22	2015-07-31
	18-40 GHz (calibrated as set)				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2014-07-23	2015-07-31
	Gain-Loss Chains				
SAC_G (Hybrid) 30-1000MHz	Gain-Loss string for Hybrid antenna at 3m	Various	Various	2015-01-26	2016-01-31
SAC_G (BOM) 1-18GHz	Gain-Loss string for Hybrid antenna at 3m	Various	Various	2015-01-26	2016-01-31
SAC_G (BOM) 18-40GHz	Gain-Loss string for Hybrid antenna at 3m	Various	Various	2015-01-26	2016-01-31
	Receiver & Software				
SA0018	Spectrum Analyzer	Agilent	N9030A	2014-06-24	2015-06-30
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
HI0034	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2015-03-23	2016-03-31
HPF009	1GHz High-pass Filter	Micro-Tronics	HPM17672	2015-01-28	2016-01-31

Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
SA0020	Spectrum Analyzer	Agilent Technologies	E4446	2014-06-12	2015-06-30
PSENSOR001	RF Power Meter Sensor Head	Rohde & Schwartz	NRP-Z81 (w/ NRP-Z3 USB adapter)	2014-09-03	2015-09-30
MM0143	Digital Multimeter	Fluke	175	2014-09-04	2016-09-30
HI0034	Temp/Humid/Pressure Meter	Cole-Parmer	99760-00	2015-03-23	2016-03-31

7. MEASUREMENT METHODS

6 dB BW: KDB 558074 D01 v03r02, Section 8.1.

Output Power: KDB 558074 D01 v03r02, Section 9.1.2.

Output Power: KDB 558074 D01 v03r02, Section 9.2.3.1.

Power Spectral Density: KDB 558074 D01 v03r02, Section 10.2.

Out-of-band emissions in non-restricted bands: KDB 558074 D01 v03r02, Section 11.0.

Out-of-band emissions in restricted bands: KDB 558074 D01 v03r02, Section 12.0.

8. ANTENNA PORT TEST RESULTS

8.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

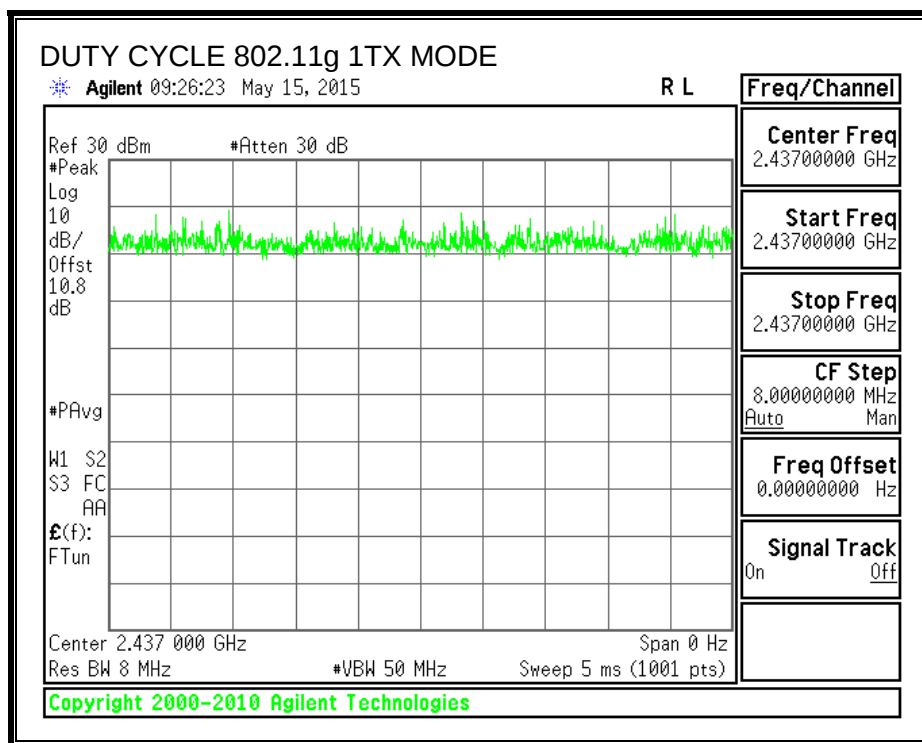
KDB 558074 Zero-Span Spectrum Analyzer Method.

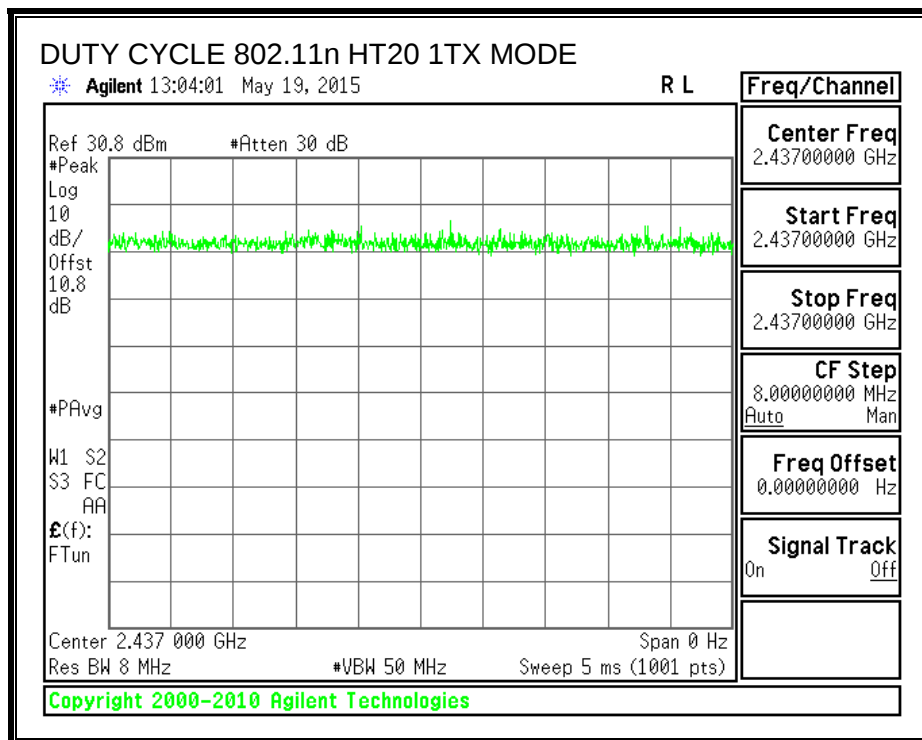
ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
802.11g 1TX	1.000	1.000	1.000	100.00%	0.00	0.010
802.11n HT20 1TX	1.000	1.000	1.000	100.00%	0.00	0.010

DUTY CYCLE PLOTS

2.4 GHz BAND





8.2. 802.11g MODE IN THE 2.4 GHz BAND

8.2.1. 6 dB BANDWIDTH

LIMITS

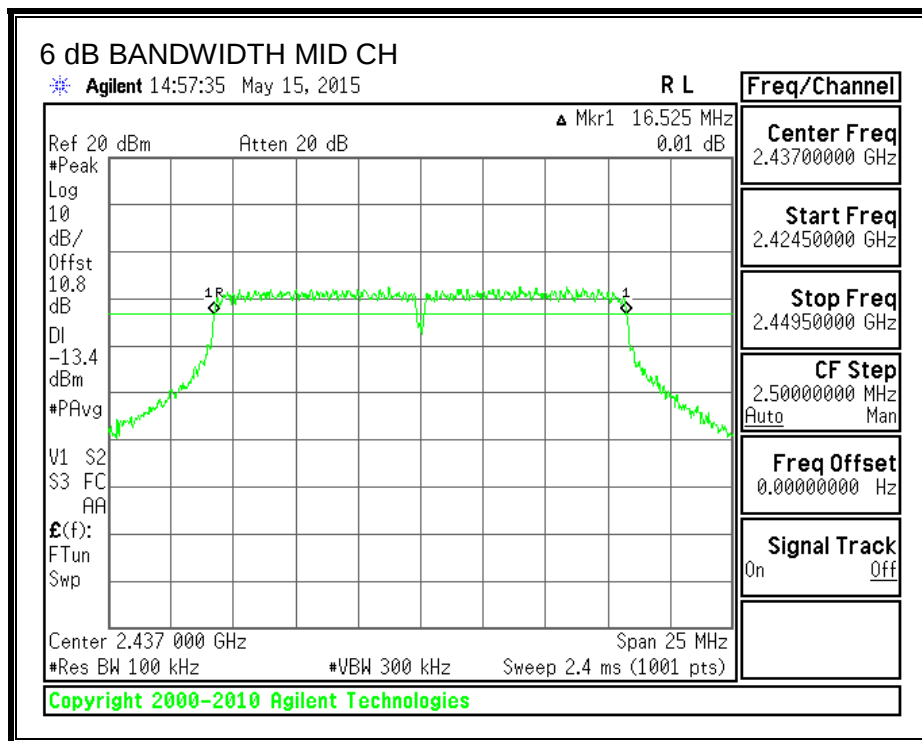
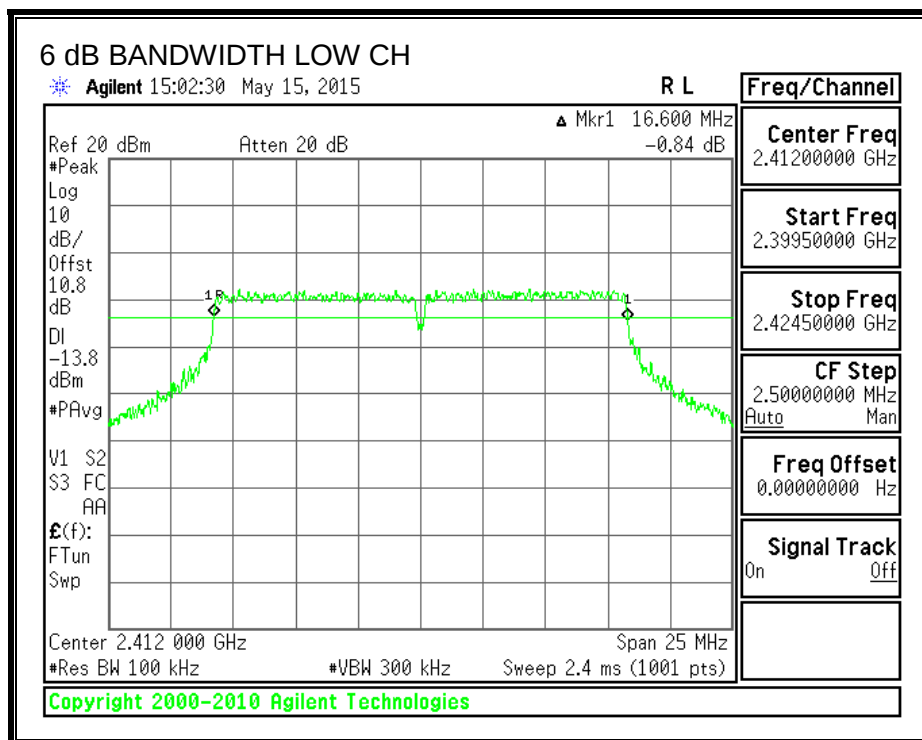
FCC §15.247 (a) (2)

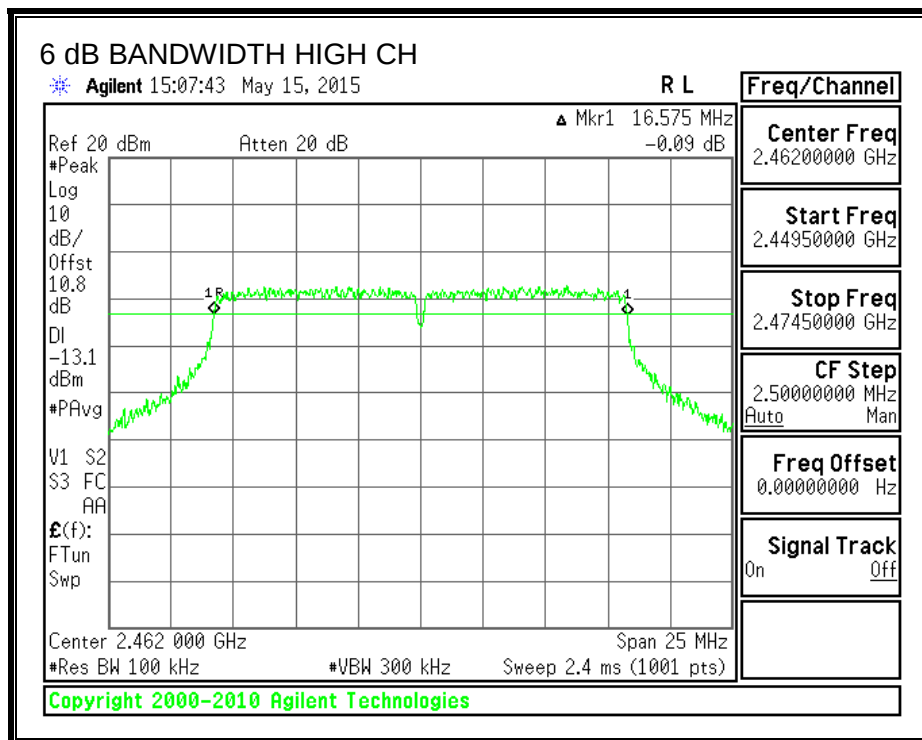
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	16.600	0.5
Mid	2437	16.525	0.5
High	2462	16.575	0.5

6 dB BANDWIDTH





8.2.2. 99% BANDWIDTH

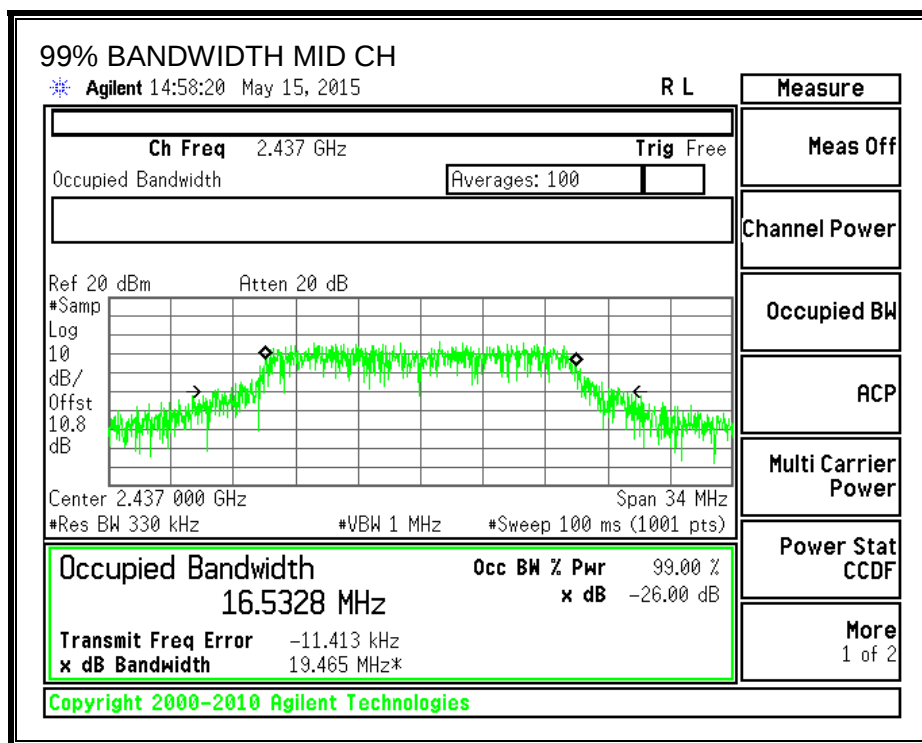
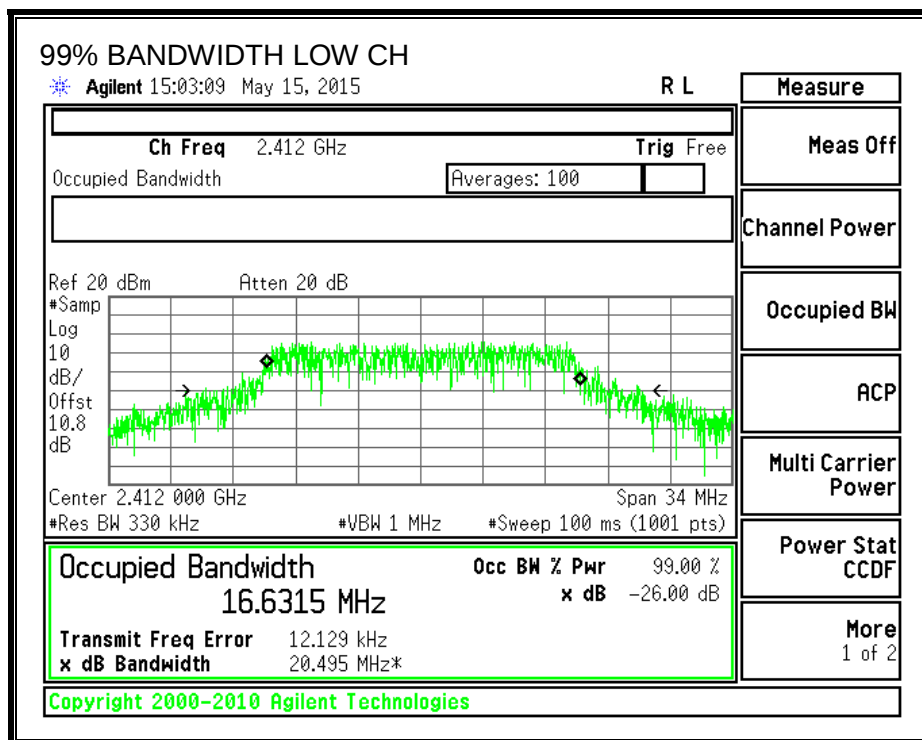
LIMITS

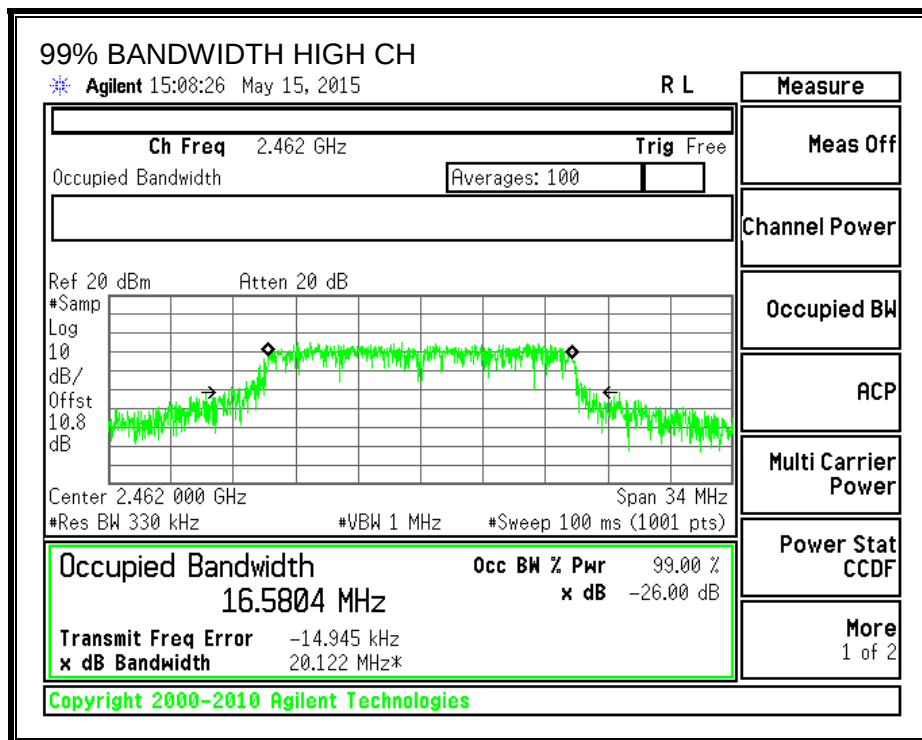
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	16.6315
Mid	2437	16.5328
High	2462	16.5804

99% BANDWIDTH





8.2.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	2412	8.10
Mid	2437	8.12
High	2462	8.03

8.2.4. OUTPUT POWER

LIMITS

FCC §15.247

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	-0.30	30.00	30	36	30.00
Mid	2437	-0.30	30.00	30	36	30.00
High	2462	-0.30	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	19.03	19.03	30.00	-10.97
Mid	2437	19.05	19.05	30.00	-10.95
High	2462	18.97	18.97	30.00	-11.03

8.2.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

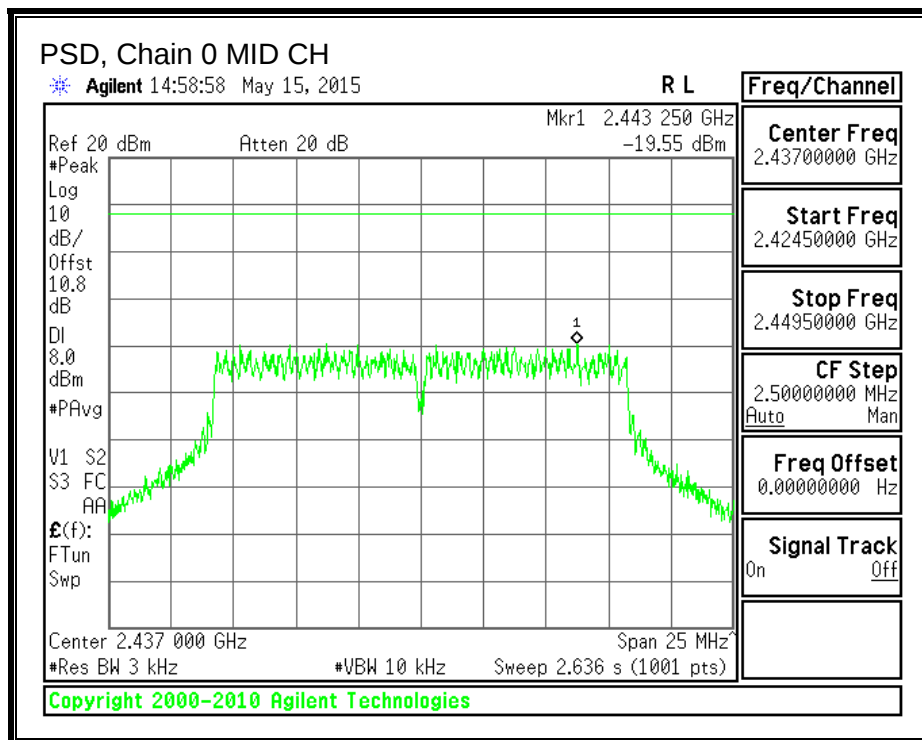
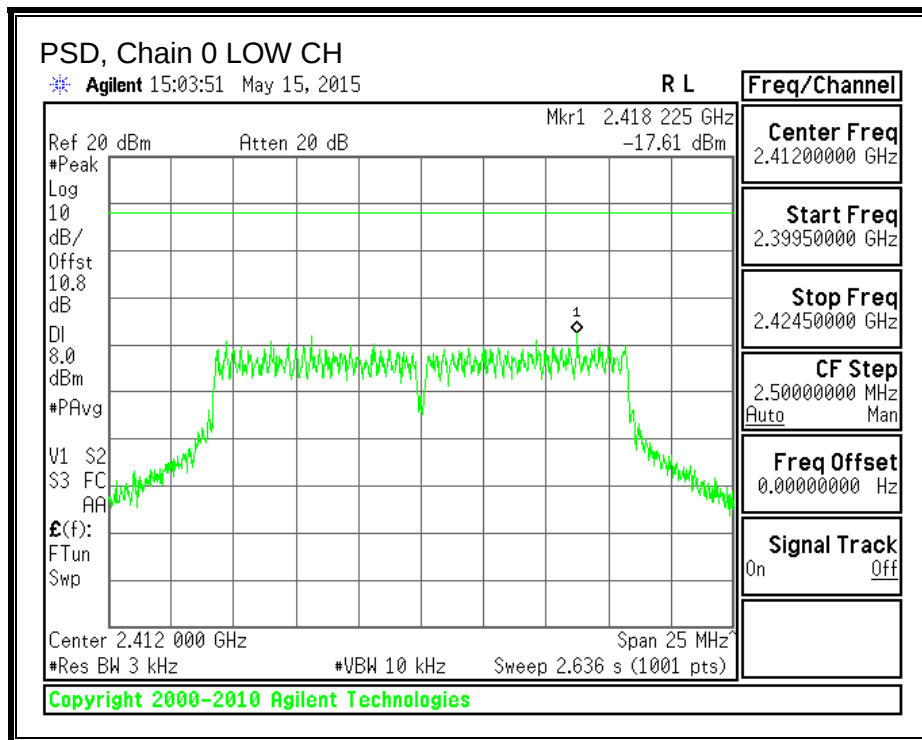
RESULTS

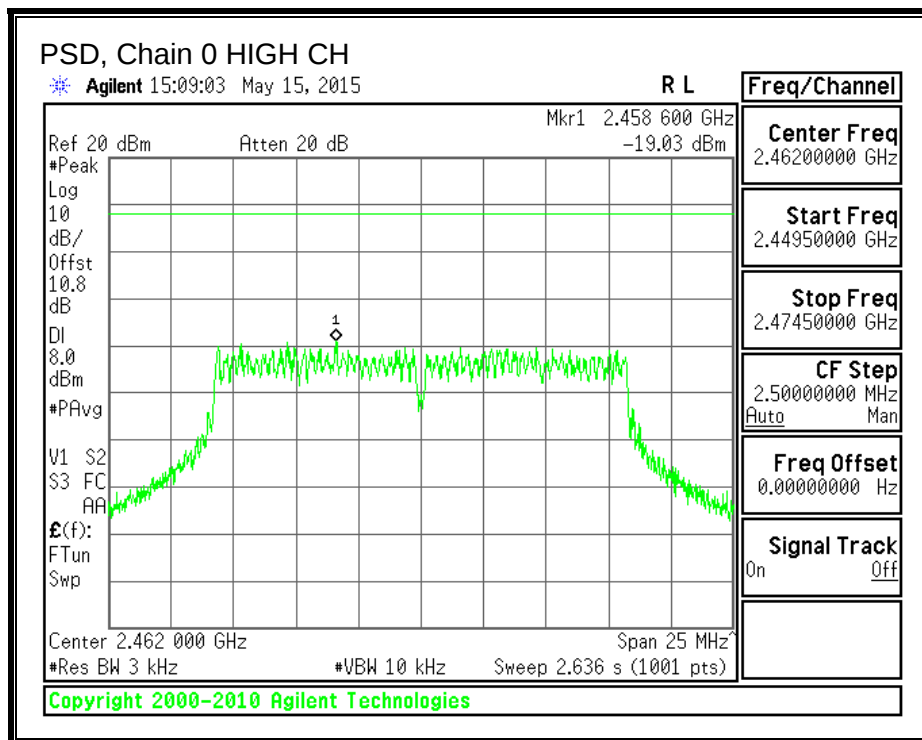
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Total Corr'd PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-17.61	-17.61	8.0	-25.6
Mid	2437	-19.55	-19.55	8.0	-27.6
High	2462	-19.03	-19.03	8.0	-27.0

PSD, Chain 0





8.2.6. OUT-OF-BAND EMISSIONS

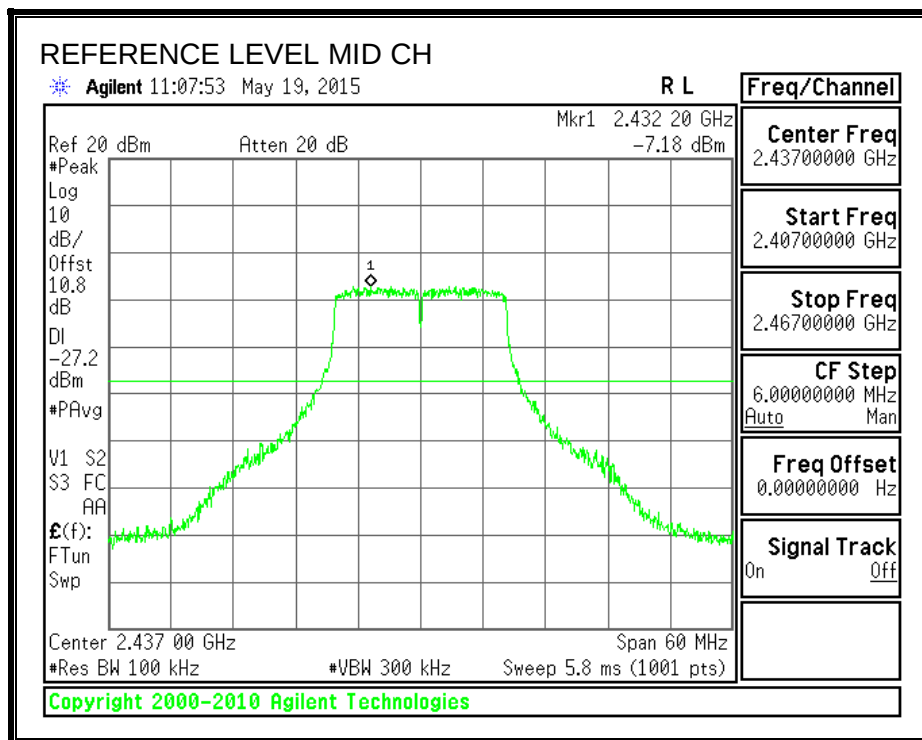
LIMITS

FCC §15.247 (d)

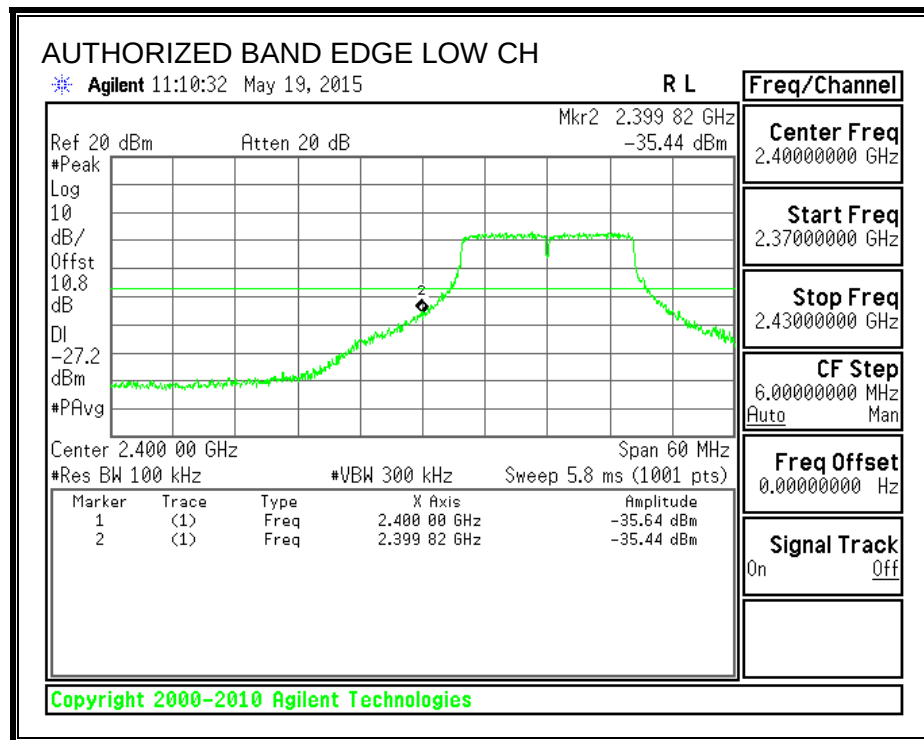
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

RESULTS

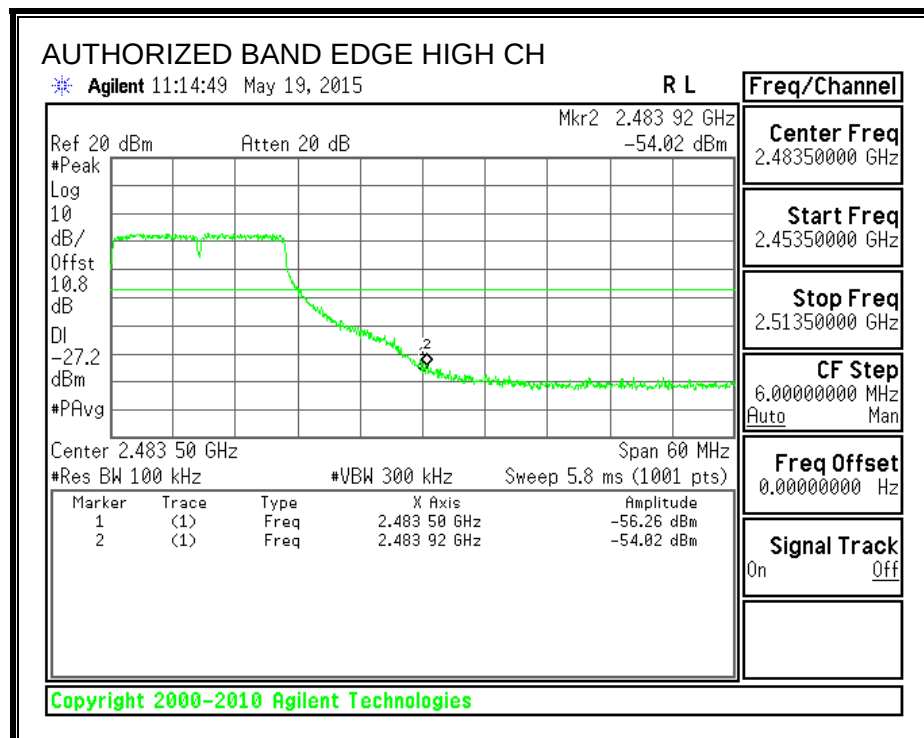
IN-BAND REFERENCE LEVEL



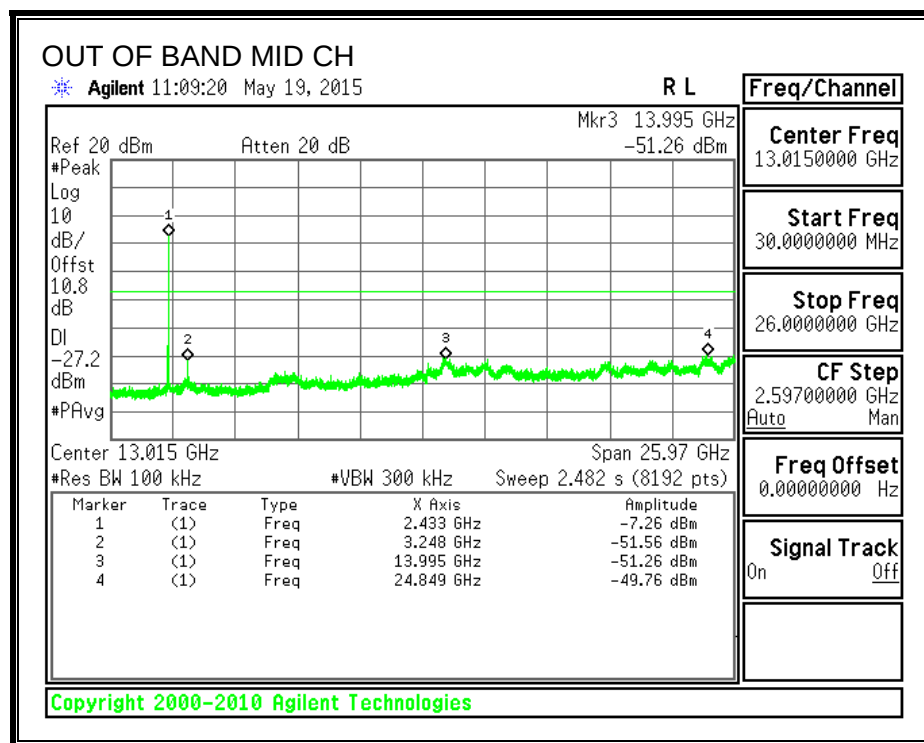
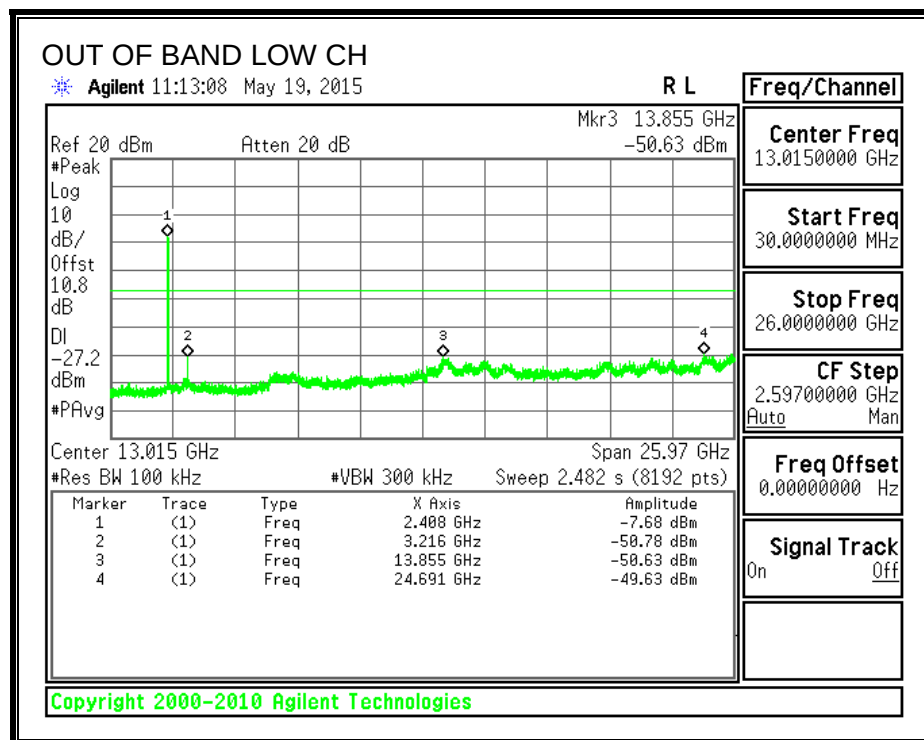
LOW CHANNEL BANDEDGE

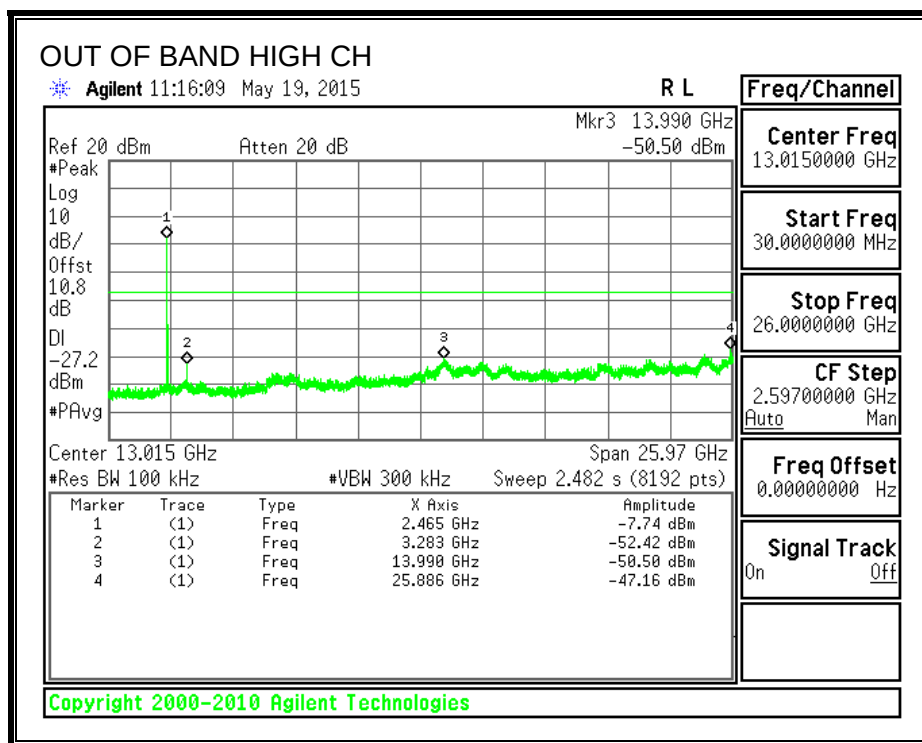


HIGH CHANNEL BANDEDGE



OUT-OF-BAND EMISSIONS





8.3. 802.11n HT20 MODE IN THE 2.4 GHZ BAND

8.3.1. 6 dB BANDWIDTH

LIMITS

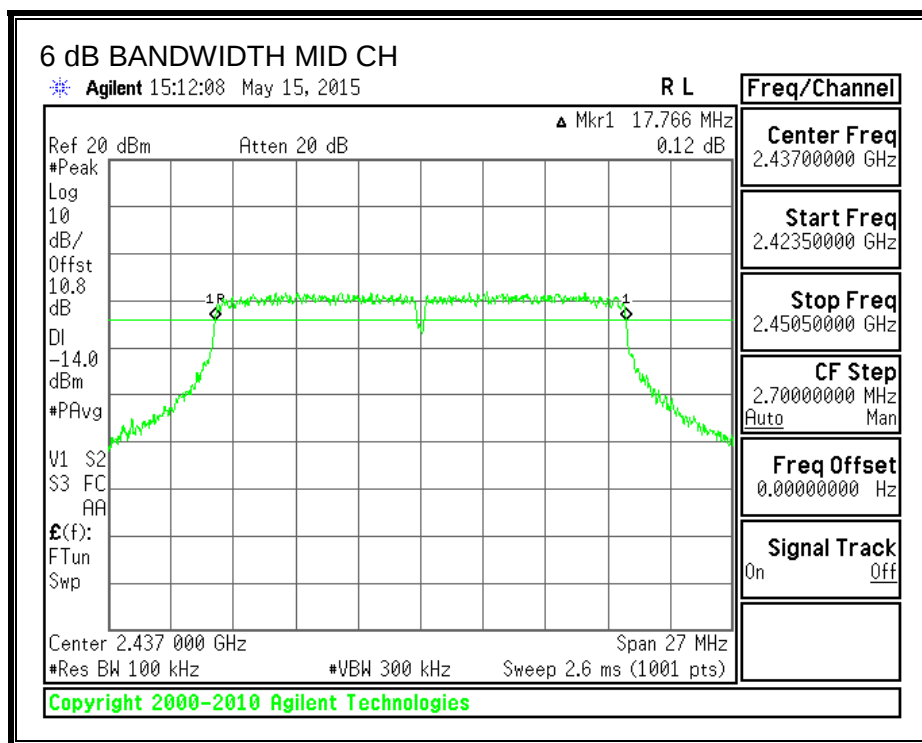
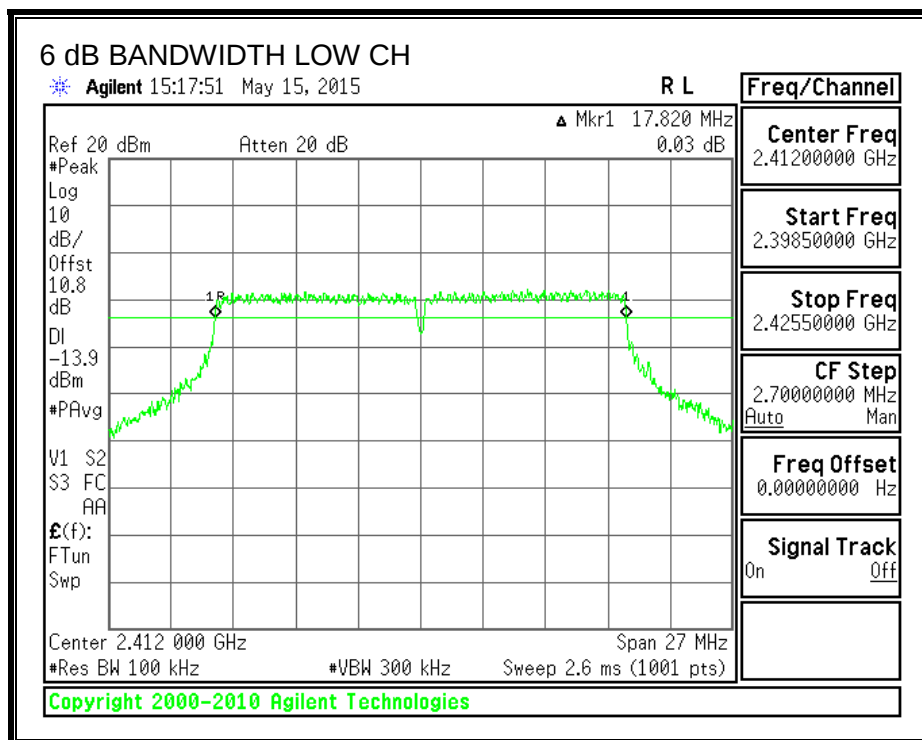
FCC §15.247 (a) (2)

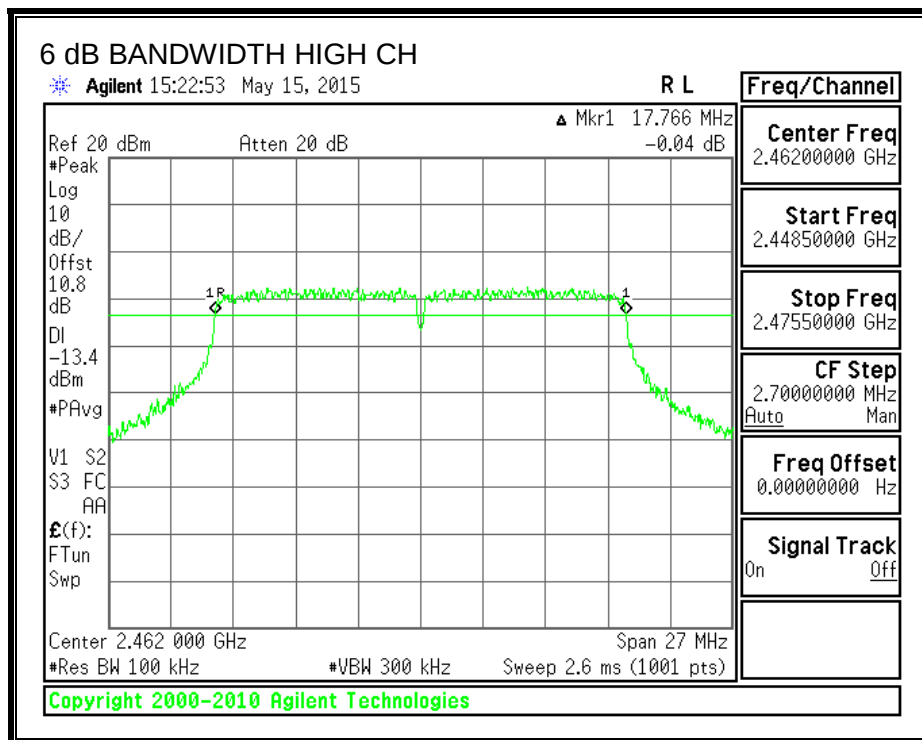
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2412	17.820	0.5
Mid	2437	17.766	0.5
High	2462	17.766	0.5

6 dB BANDWIDTH





8.3.2. 99% BANDWIDTH

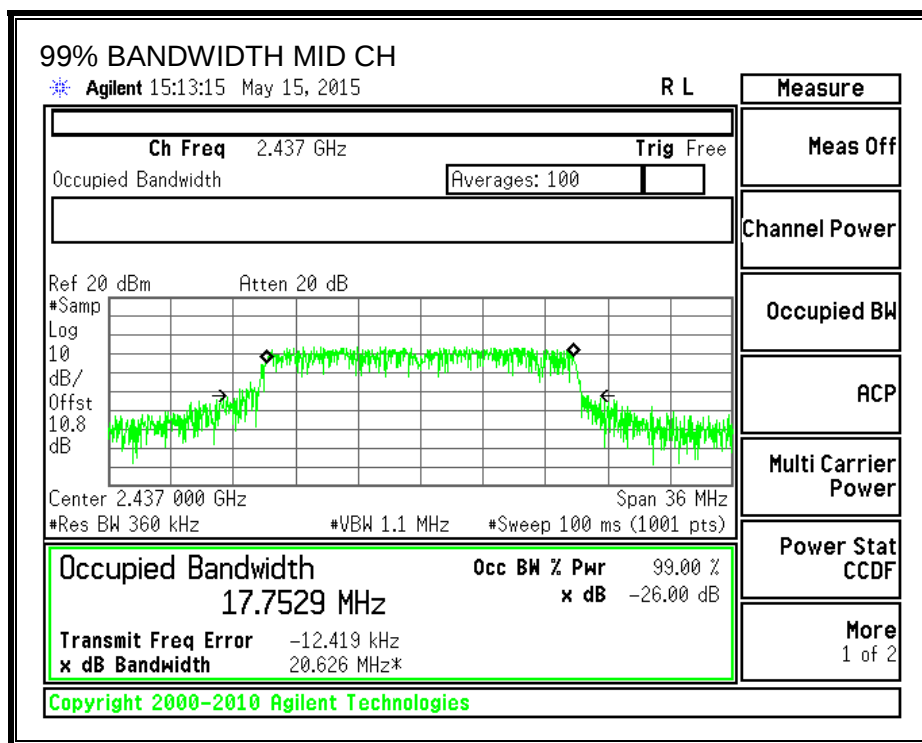
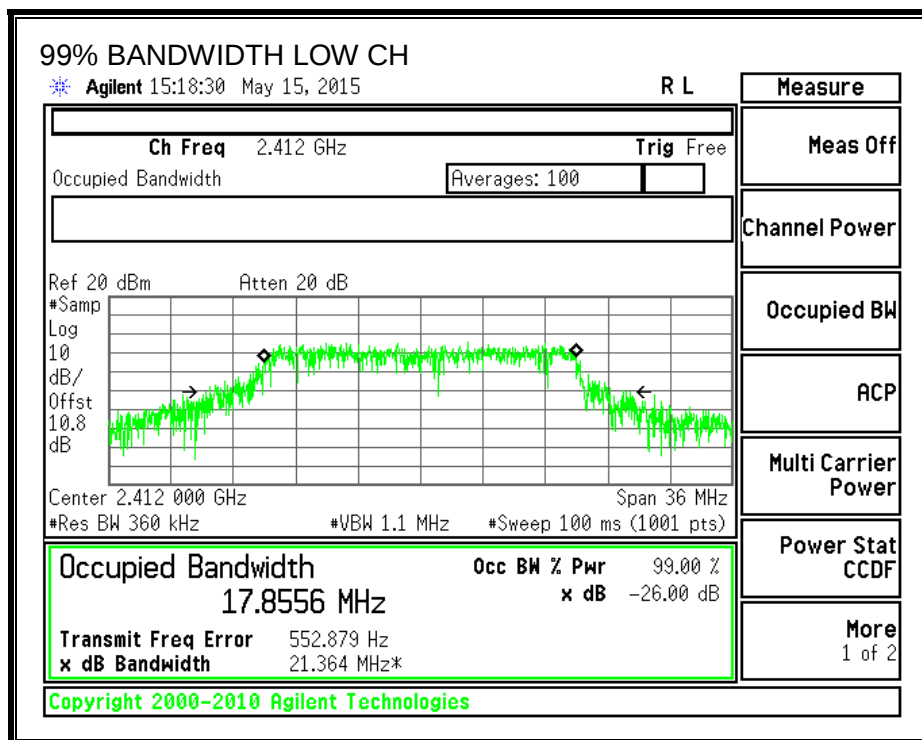
LIMITS

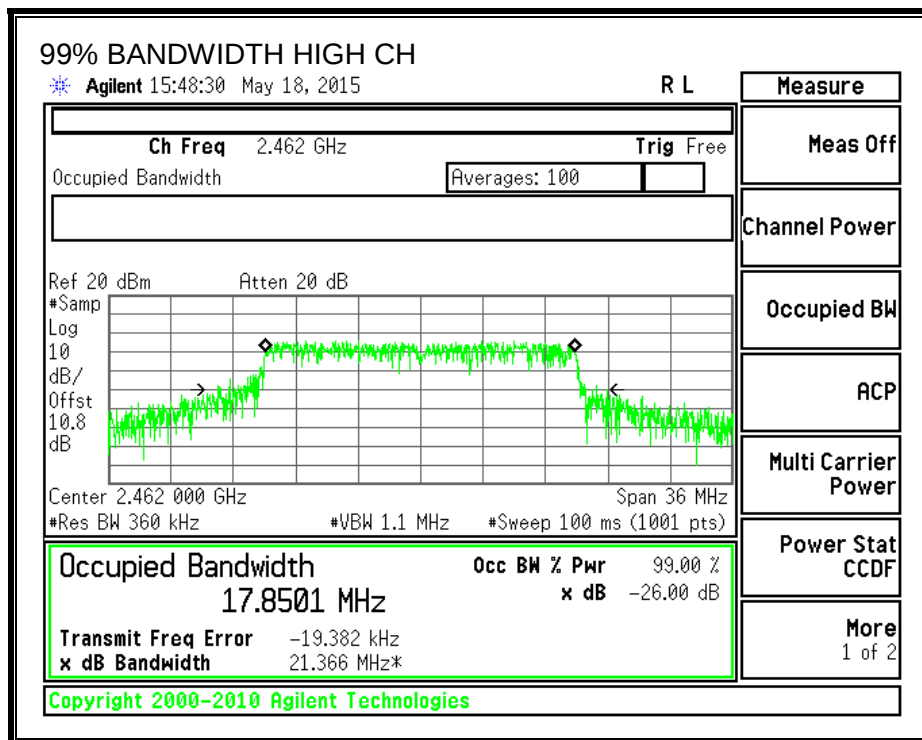
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2412	17.8556
Mid	2437	17.7529
High	2462	17.8501

99% BANDWIDTH





8.3.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	2412	7.95
Mid	2437	8.01
High	2462	8.48

8.3.4. OUTPUT POWER

LIMITS

FCC §15.247

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt, based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Limits

Channel	Frequency (MHz)	Directional Gain (dBi)	FCC Power Limit (dBm)	IC Power Limit (dBm)	IC EIRP Limit (dBm)	Max Power (dBm)
Low	2412	-0.30	30.00	30	36	30.00
Mid	2437	-0.30	30.00	30	36	30.00
High	2462	-0.30	30.00	30	36	30.00

Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd Power
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Results

Channel	Frequency (MHz)	Chain 0 Meas Power (dBm)	Total Corr'd Power (dBm)	Power Limit (dBm)	Margin (dB)
Low	2412	19.25	19.25	30.00	-10.75
Mid	2437	19.15	19.15	30.00	-10.85
High	2462	19.20	19.20	30.00	-10.80

8.3.5. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247

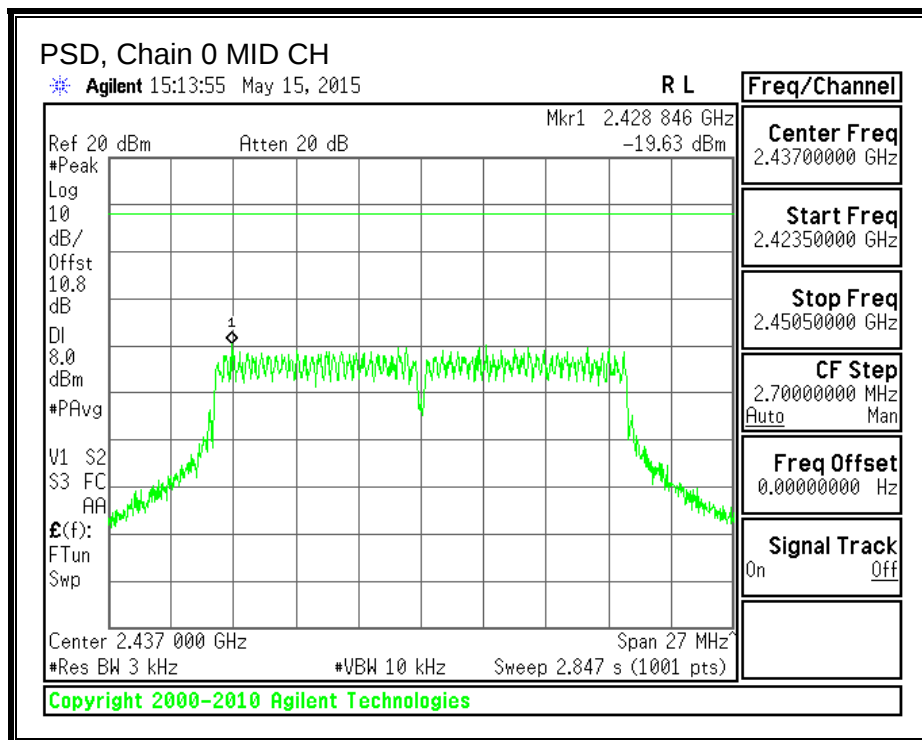
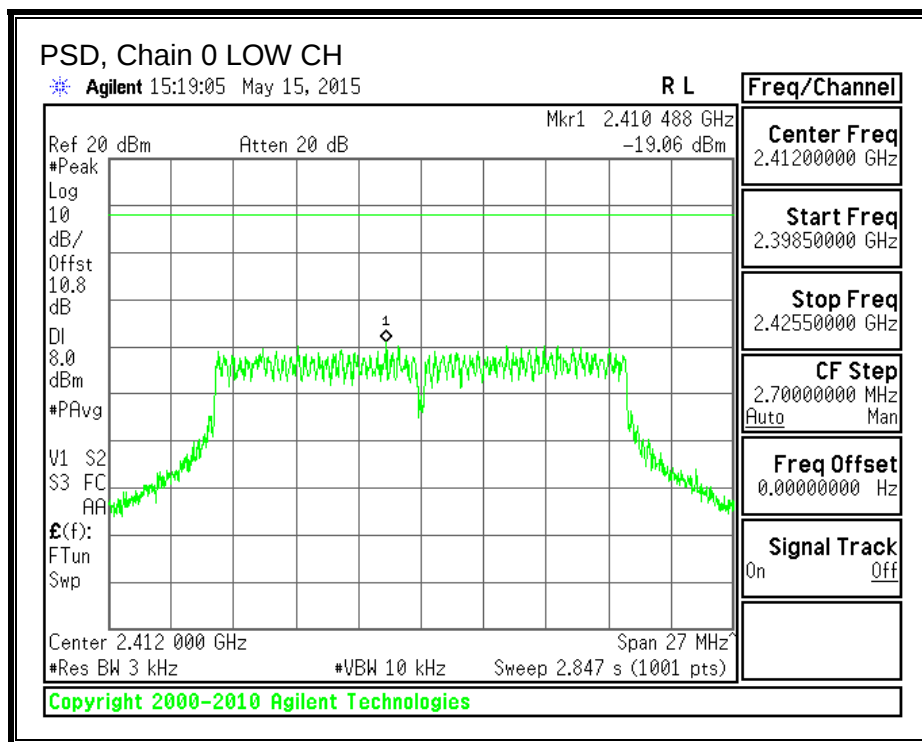
RESULTS

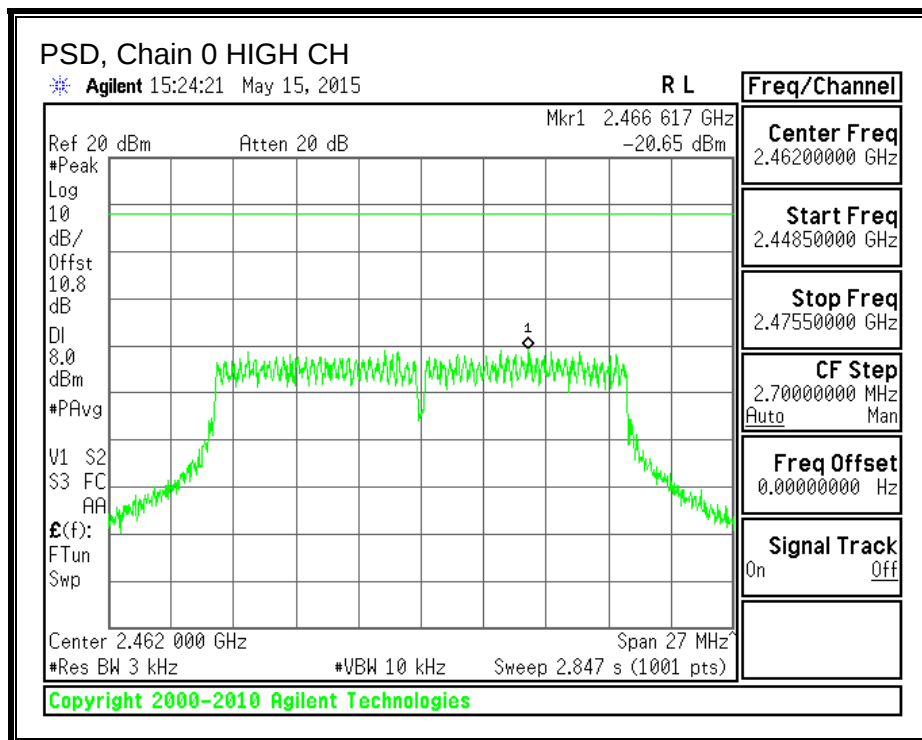
Duty Cycle CF (dB)	0.00	Included in Calculations of Corr'd PSD
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PSD Results

Channel	Frequency (MHz)	Chain 0 Meas (dBm)	Total Corr'd PSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-19.06	-19.06	8.0	-27.1
Mid	2437	-19.63	-19.63	8.0	-27.6
High	2462	-20.65	-20.65	8.0	-28.7

PSD, Chain 0





8.3.6. OUT-OF-BAND EMISSIONS

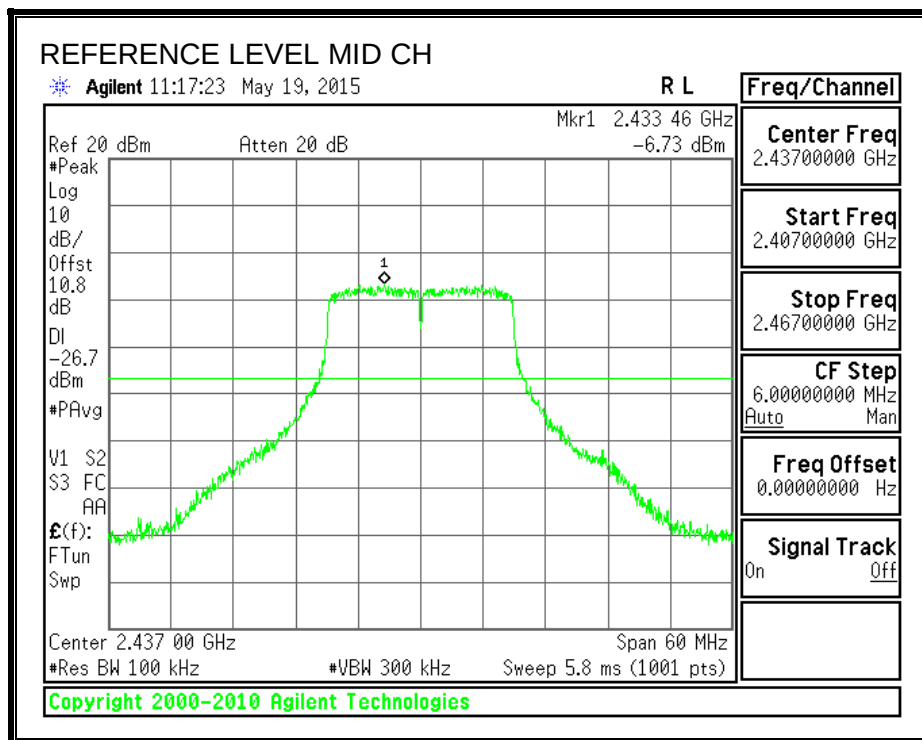
LIMITS

FCC §15.247 (d)

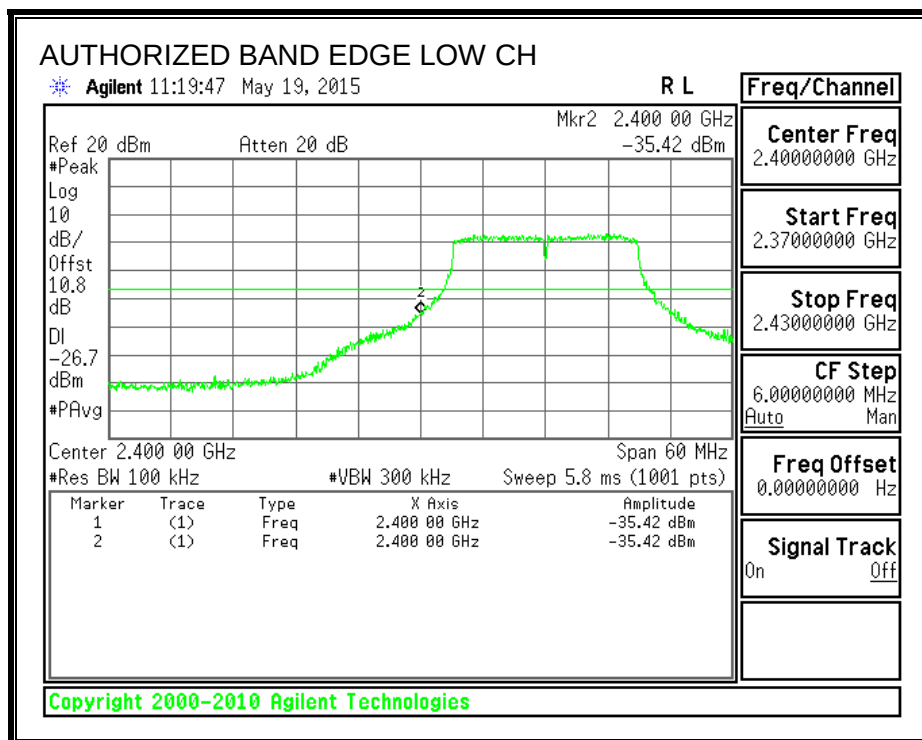
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required.

RESULTS

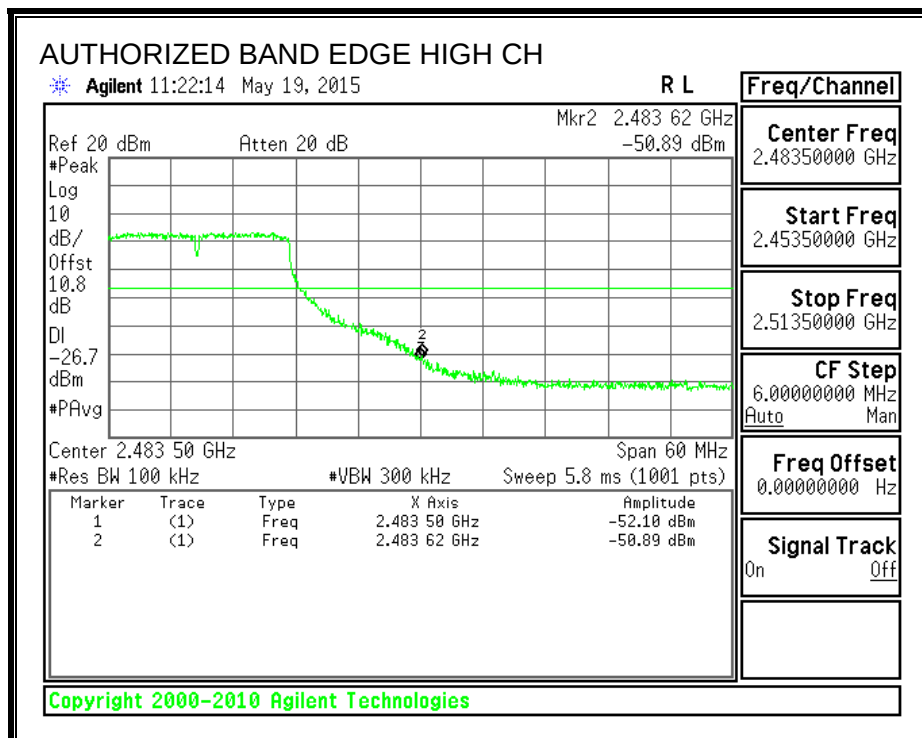
IN-BAND REFERENCE LEVEL



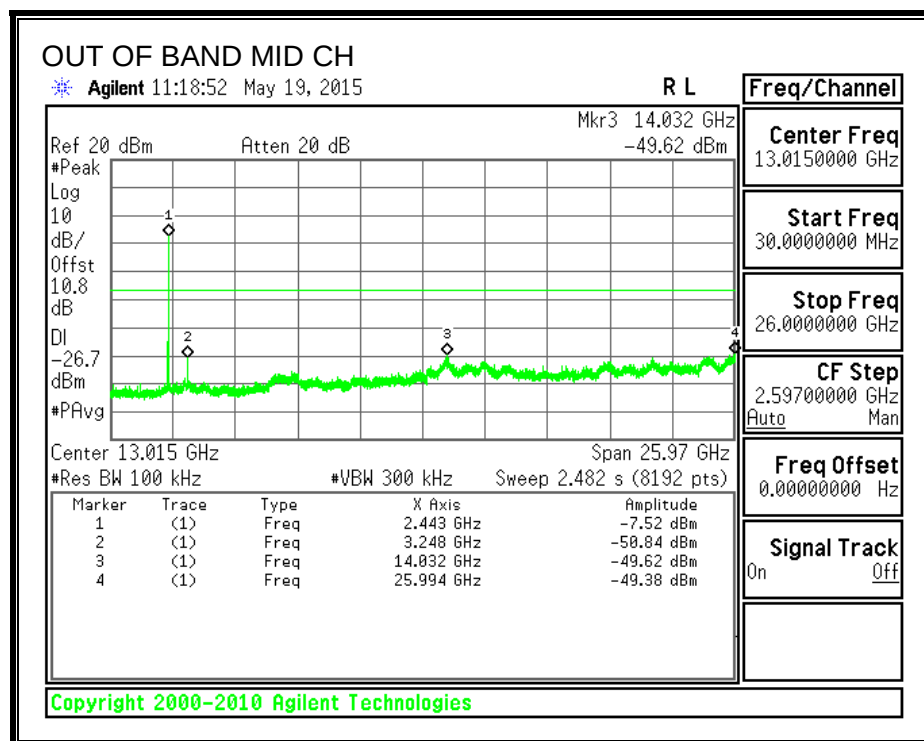
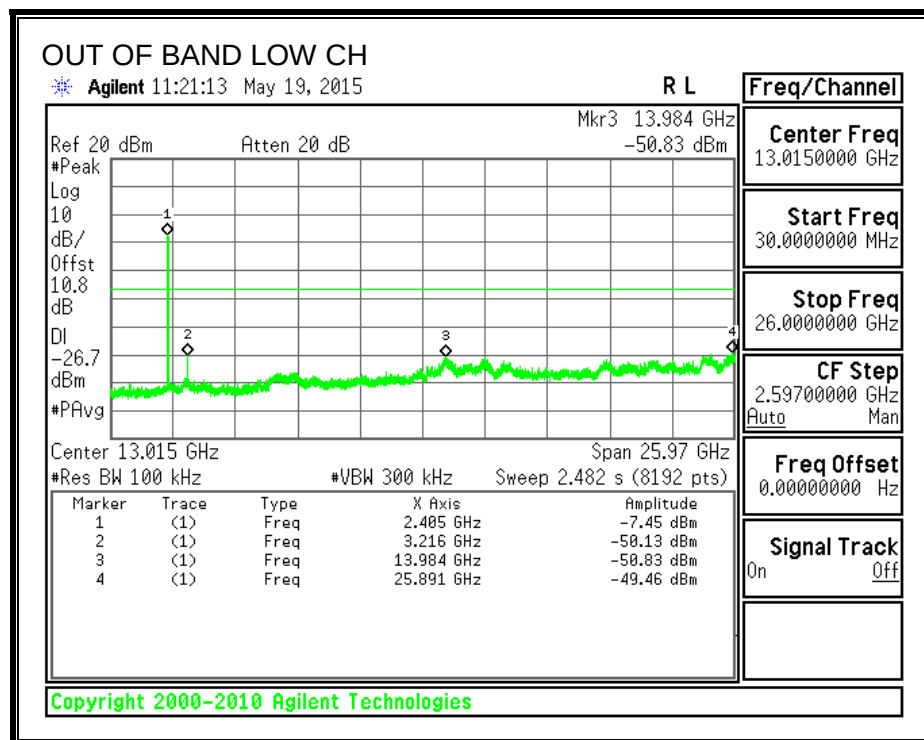
LOW CHANNEL BANDEDGE

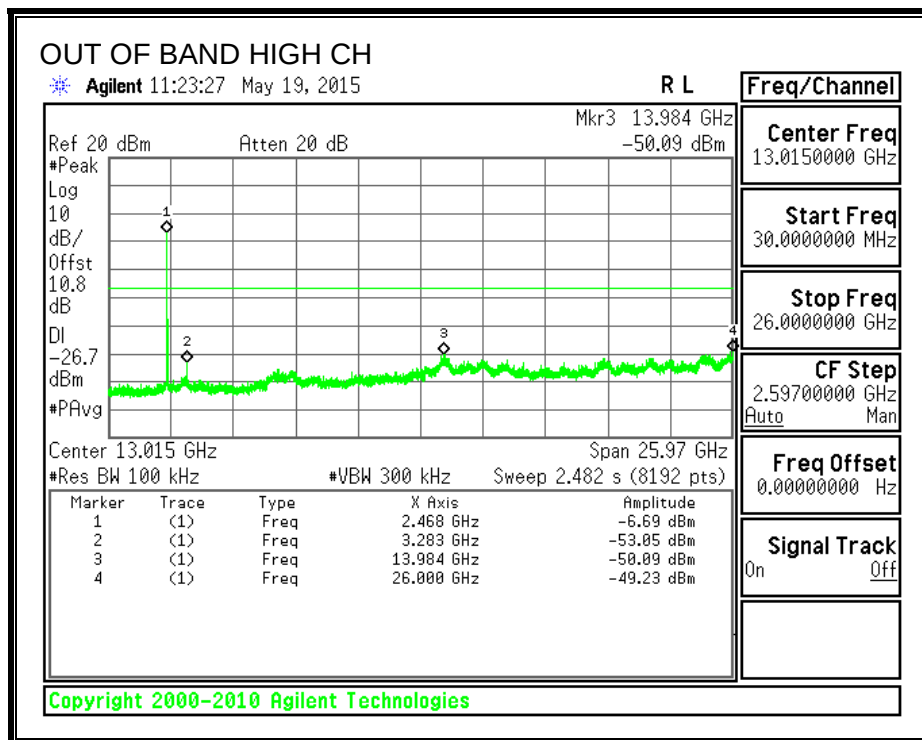


HIGH CHANNEL BANDEDGE



OUT-OF-BAND EMISSIONS





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 for below 1GHz measurements and 1.5 m above the ground plane for above 1GHz measurements. The antenna to EUT distance is 3 meters.

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

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

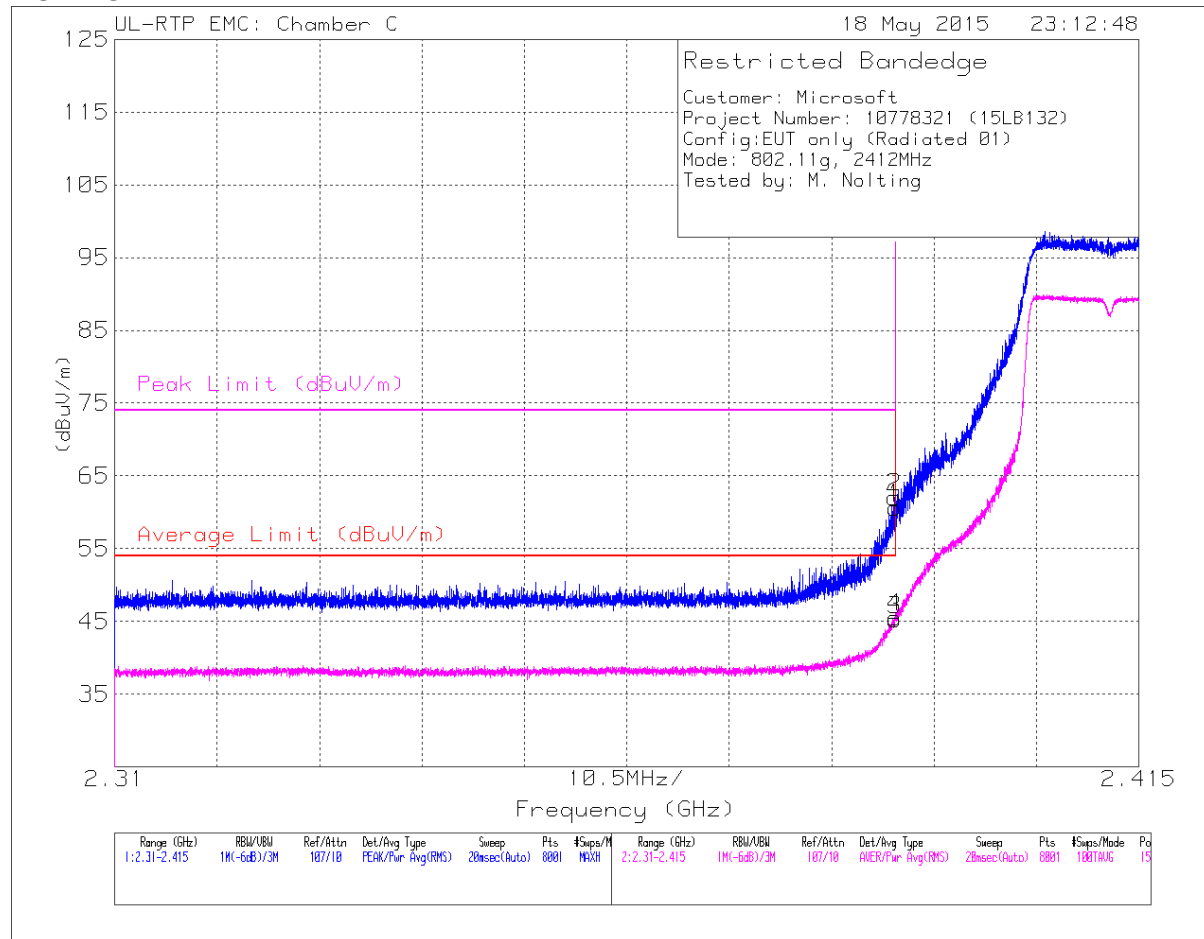
The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized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

9.2. TRANSMITTER ABOVE 1 GHz

9.3. TX ABOVE 1 GHz 802.11g MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL



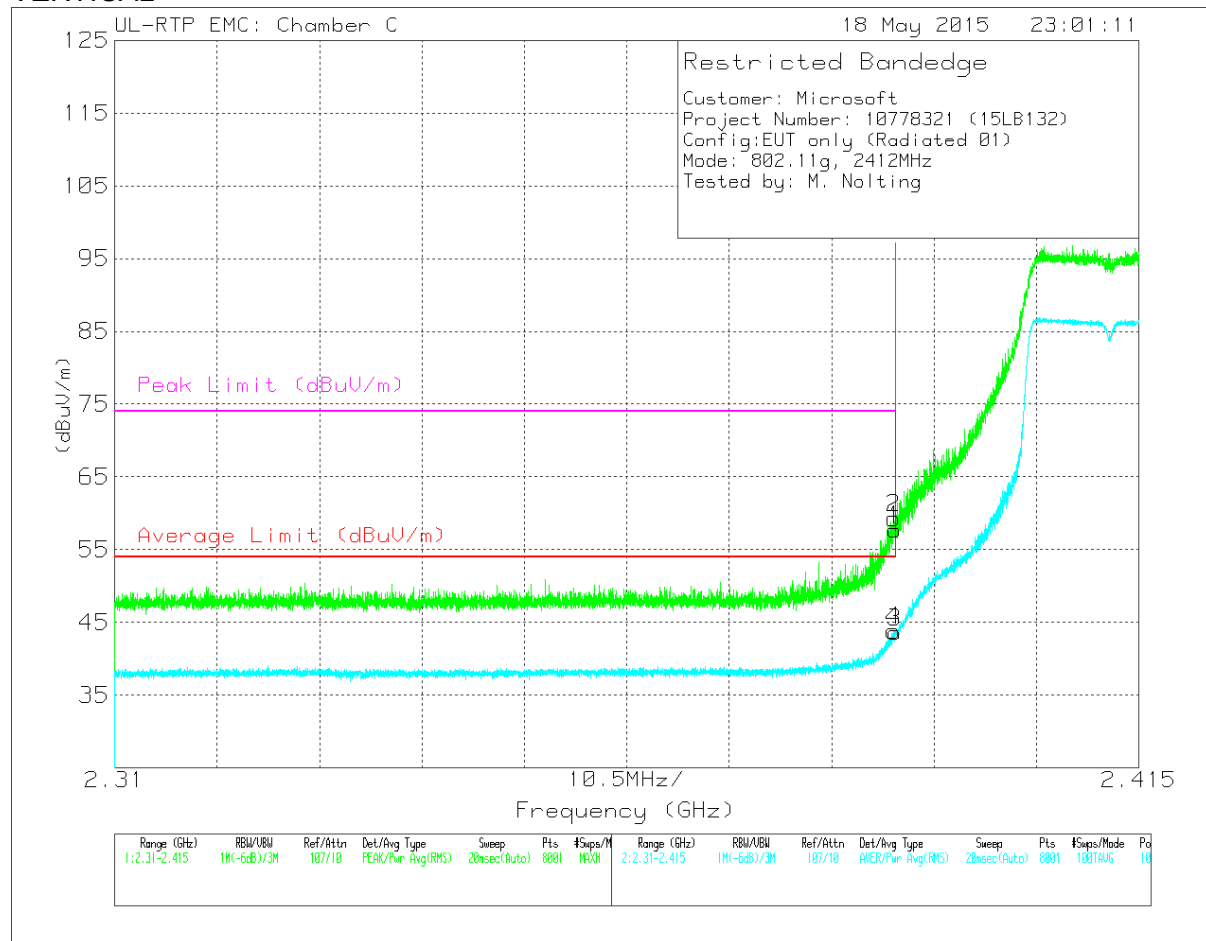
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	55.2	Pk	32.1	-26.7	60.6	-	-	74	-13.4	150	101	H
2	* 2.39	56.66	Pk	32.1	-26.7	62.06	-	-	74	-11.94	150	101	H
3	* 2.39	39.84	RMS	32.1	-26.7	45.24	54	-8.76	-	-	150	101	H
4	* 2.39	40.14	RMS	32.1	-26.7	45.54	54	-8.46	-	-	150	101	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	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	52.32	Pk	32.1	-26.7	57.72	-	-	74	-16.28	109	288	V
2	* 2.39	53.94	Pk	32.1	-26.7	59.34	-	-	74	-14.66	109	288	V
3	* 2.39	38.24	RMS	32.1	-26.7	43.64	54	-10.36	-	-	109	288	V
4	* 2.39	38.47	RMS	32.1	-26.7	43.87	54	-10.13	-	-	109	288	V

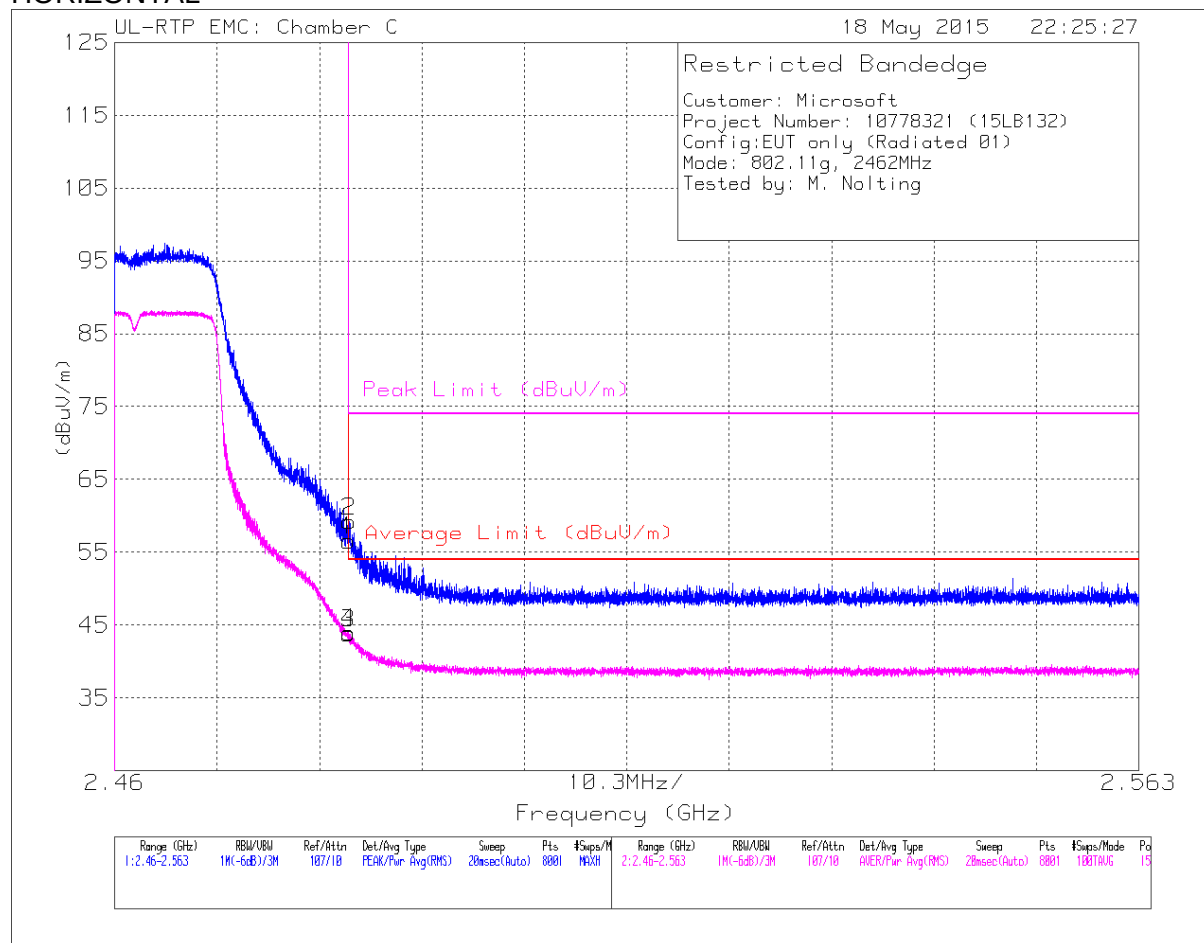
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL



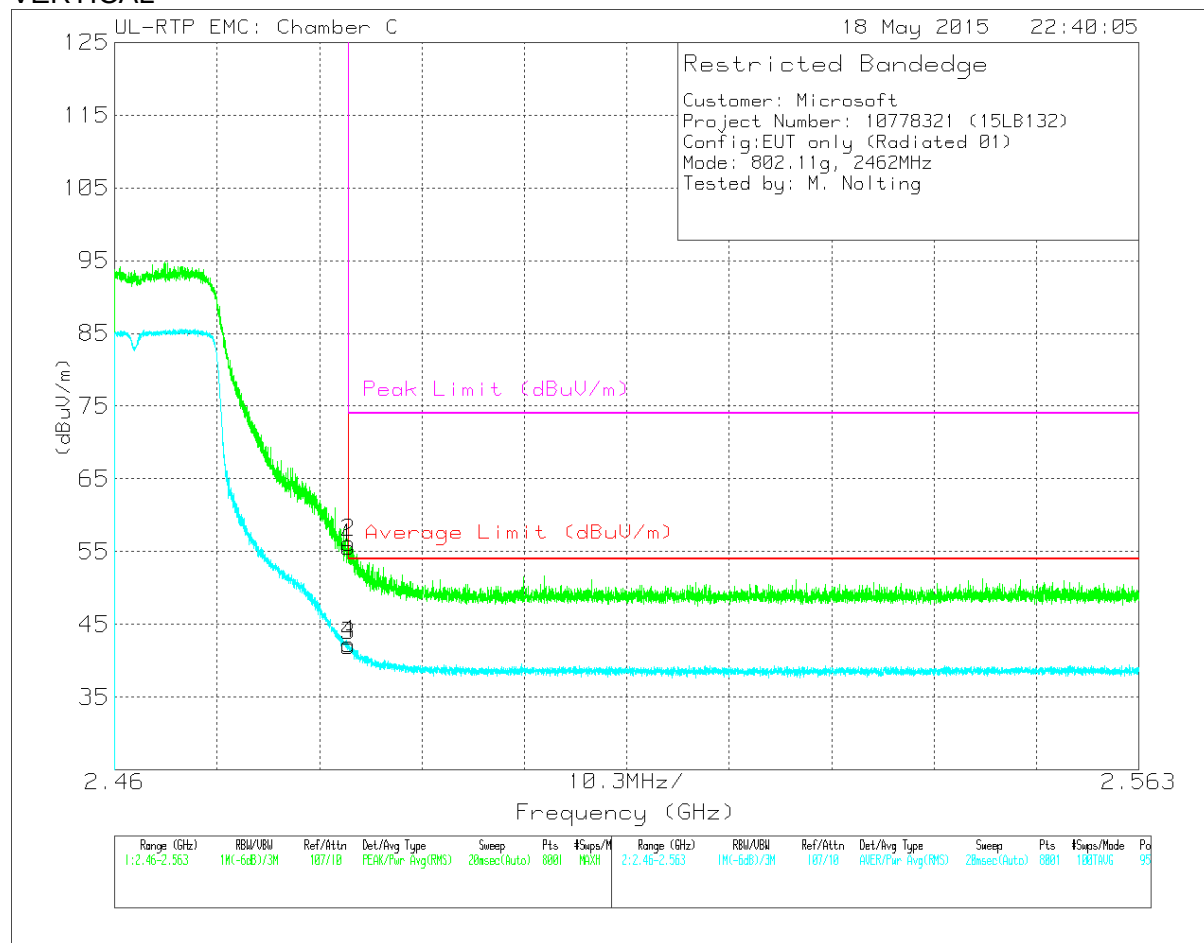
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	50.82	Pk	32.3	-26.5	56.62	-	-	74	-17.38	153	106	H
2	* 2.484	53.43	Pk	32.3	-26.5	59.23	-	-	74	-14.77	153	106	H
3	* 2.484	38.07	RMS	32.3	-26.5	43.87	54	-10.13	-	-	153	106	H
4	* 2.484	38.17	RMS	32.3	-26.5	43.97	54	-10.03	-	-	153	106	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL



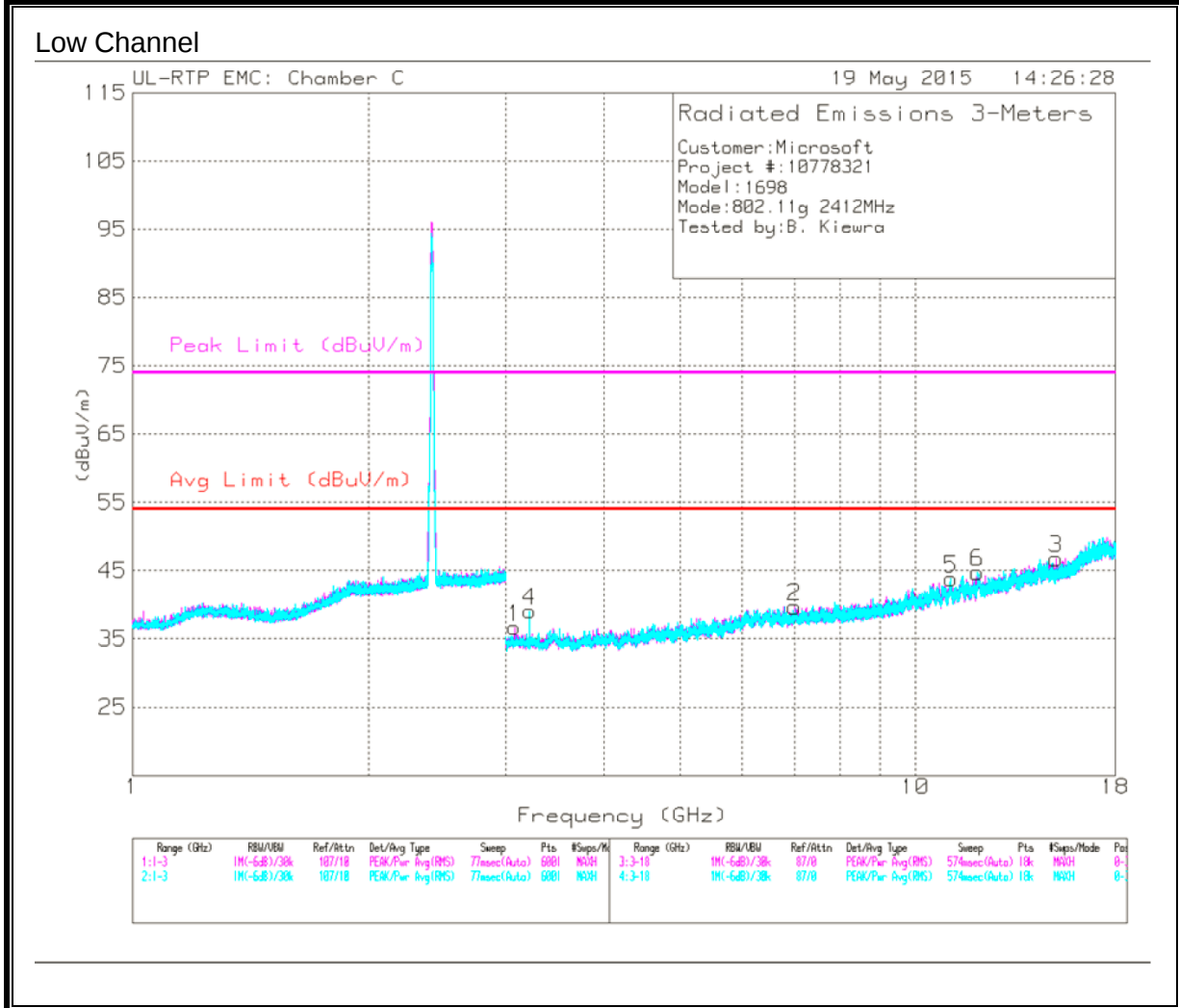
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	49.81	Pk	32.3	-26.5	55.61	-	-	74	-18.39	95	304	V
2	* 2.484	50.42	Pk	32.3	-26.5	56.22	-	-	74	-17.78	95	304	V
3	* 2.484	36.27	RMS	32.3	-26.5	42.07	54	-11.93	-	-	95	304	V
4	* 2.484	36.5	RMS	32.3	-26.5	42.3	54	-11.7	-	-	95	304	V

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

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS



Data

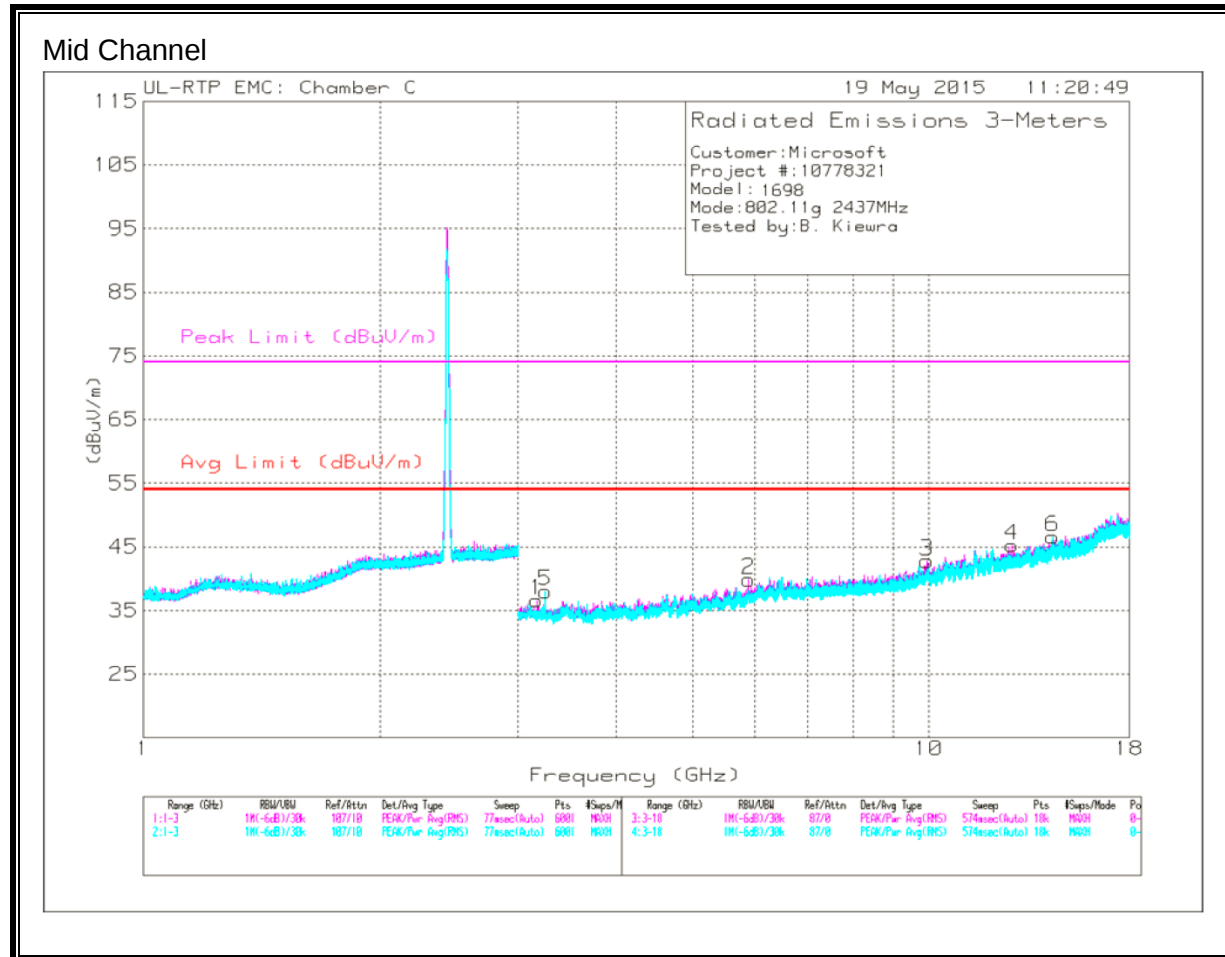
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.074	38.3	Pk	33.2	-34.8	36.7	-	-	74	-37.3	0-360	151	H
2	7.003	32.61	Pk	35.7	-28.6	39.71	-	-	74	-34.29	0-360	151	H
3	15.129	31.09	Pk	39.8	-24.1	46.79	-	-	74	-27.21	0-360	151	H
4	3.216	40.8	Pk	32.9	-34.6	39.1	-	-	74	-34.9	0-360	250	V
5	* 11.107	37.78	PK2	37.8	-24.3	51.28	-	-	74	-22.72	243	202	V
	* 11.107	25.74	MAV1	37.8	-24.3	39.24	54	-14.76	-	-	243	202	V
6	* 11.991	38.27	PK2	38.7	-25.3	51.67	-	-	74	-22.33	352	101	V
	* 11.991	26.79	MAV1	38.7	-25.3	40.19	54	-13.81	-	-	352	101	V

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

Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

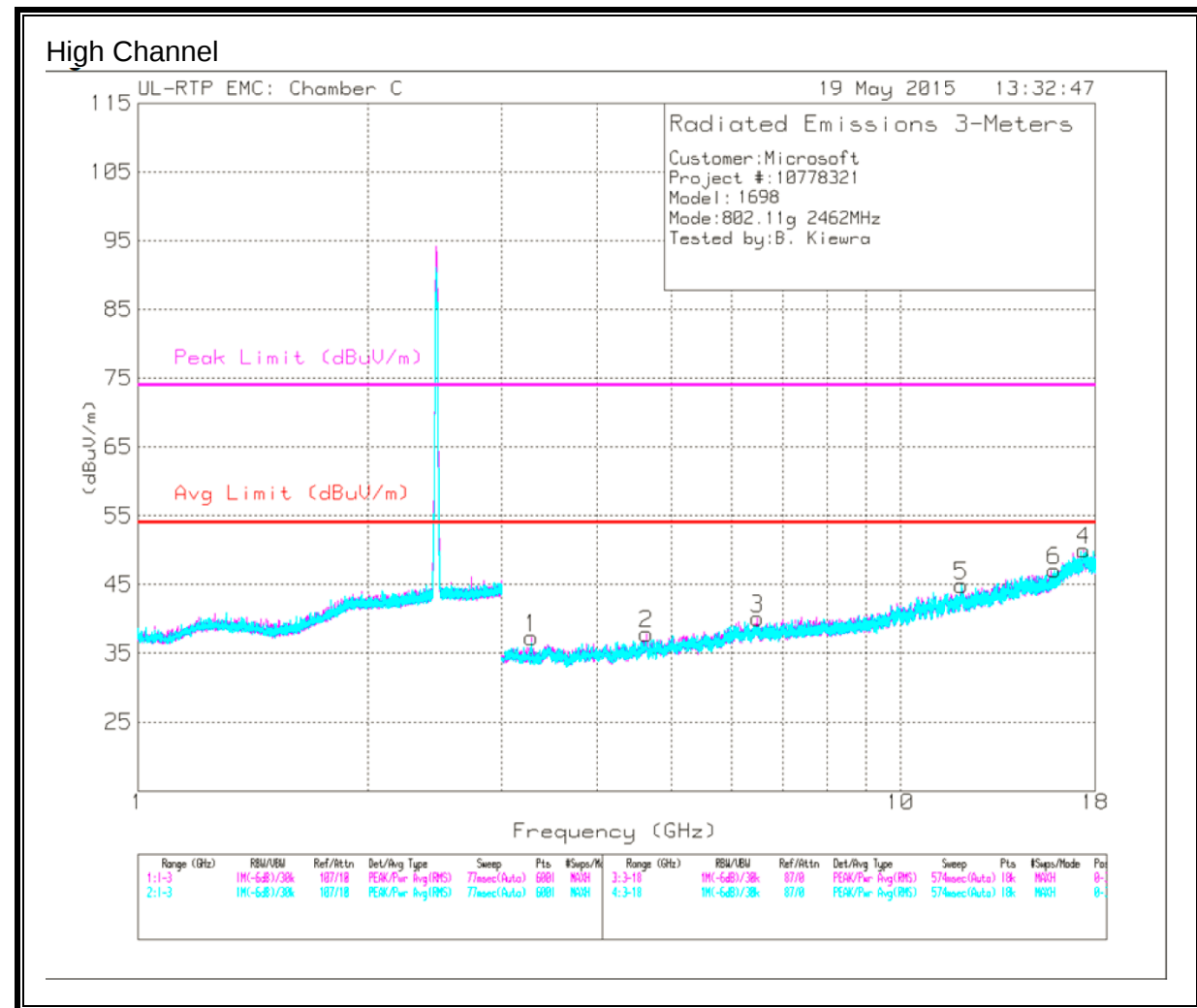
MAV1 - KDB558074 Option 1 Maximum RMS Average



Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.166	38.42	Pk	33	-34.8	36.62	-	-	74	-37.38	0-360	151	H
2	5.895	34.44	Pk	35	-29.6	39.84	-	-	74	-34.16	0-360	250	H
3	9.939	31.66	Pk	37.2	-26.1	42.76	-	-	74	-31.24	0-360	250	H
4	12.76	32.57	Pk	39.2	-26.5	45.27	-	-	74	-28.73	0-360	250	H
5	3.249	39.41	Pk	32.9	-34.3	38.01	-	-	74	-35.99	0-360	250	V
6	14.381	29.58	Pk	39.2	-22.2	46.58	-	-	74	-27.42	0-360	250	V

Pk - Peak detector



Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.282	38.79	Pk	32.8	-34.3	37.29	-	-	74	-36.71	0-360	151	H
2	* 4.645	43.5	PK2	34.1	-32.4	45.2	-	-	74	-28.8	123	350	H
	* 4.647	31.81	MAv1	34.1	-32.4	33.51	54	-20.49	-	-	123	350	H
3	6.491	33.09	Pk	35.7	-28.7	40.09	-	-	74	-33.91	0-360	250	H
4	17.383	24.02	MAv1	41.6	-19.7	45.92	54	-8.08	-	-	19	251	H
	17.385	35.76	PK2	41.6	-19.7	57.66	-	-	74	-16.34	19	251	H
5	* 12.022	38.6	PK2	38.7	-25	52.3	-	-	74	-21.7	170	383	V
	* 12.022	26.7	MAv1	38.7	-25	40.4	54	-13.6	-	-	170	383	V
6	* 15.91	37.87	PK2	40.6	-24	54.47	-	-	74	-19.53	202	368	V
	* 15.907	25.77	MAv1	40.6	-24	42.37	54	-11.63	-	-	202	368	V

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

Pk - Peak detector

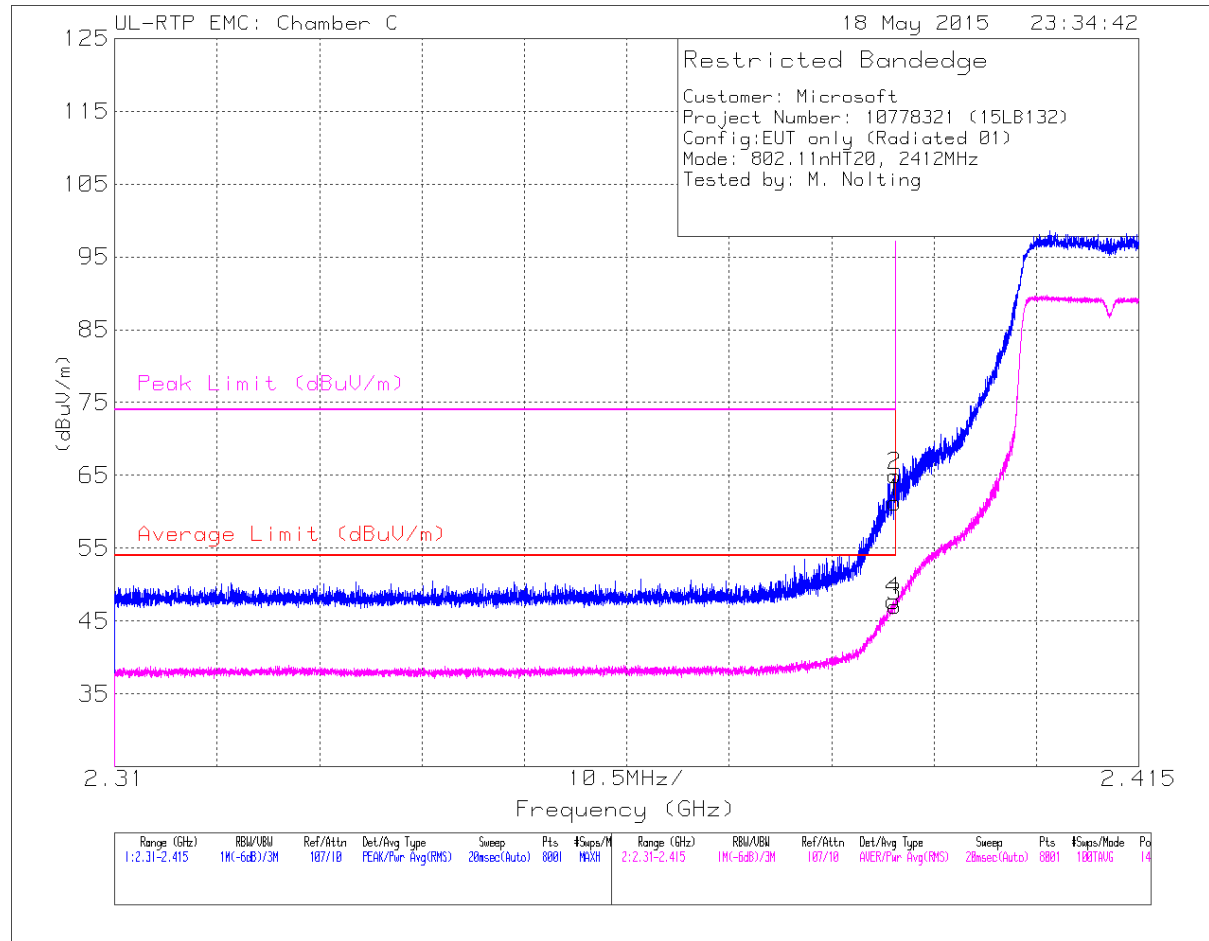
PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average

9.4. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 2.4 GHz BAND

RESTRICTED BANDEDGE (LOW CHANNEL)

HORIZONTAL



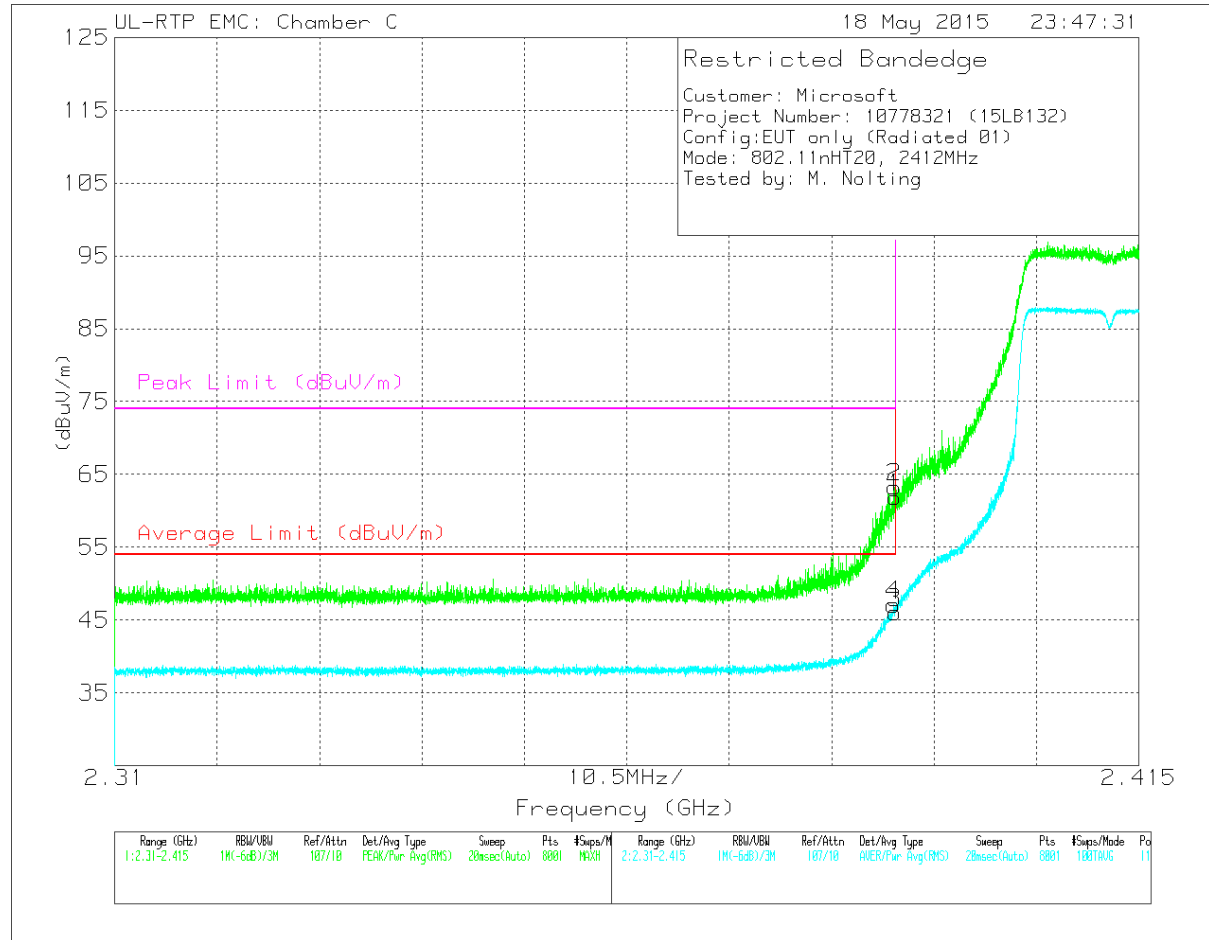
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	55.89	Pk	32.1	-26.7	61.29	-	-	74	-12.71	149	104	H
2	* 2.39	59.56	Pk	32.1	-26.7	64.96	-	-	74	-9.04	149	104	H
3	* 2.39	41.65	RMS	32.1	-26.7	47.05	54	-6.95	-	-	149	104	H
4	* 2.39	42.39	RMS	32.1	-26.7	47.79	54	-6.21	-	-	149	104	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	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	56.47	Pk	32.1	-26.7	61.87	-	-	74	-12.13	110	286	V
2	* 2.39	57.87	Pk	32.1	-26.7	63.27	-	-	74	-10.73	110	286	V
3	* 2.39	40.64	RMS	32.1	-26.7	46.04	54	-7.96	-	-	110	286	V
4	* 2.39	41.69	RMS	32.1	-26.7	47.09	54	-6.91	-	-	110	286	V

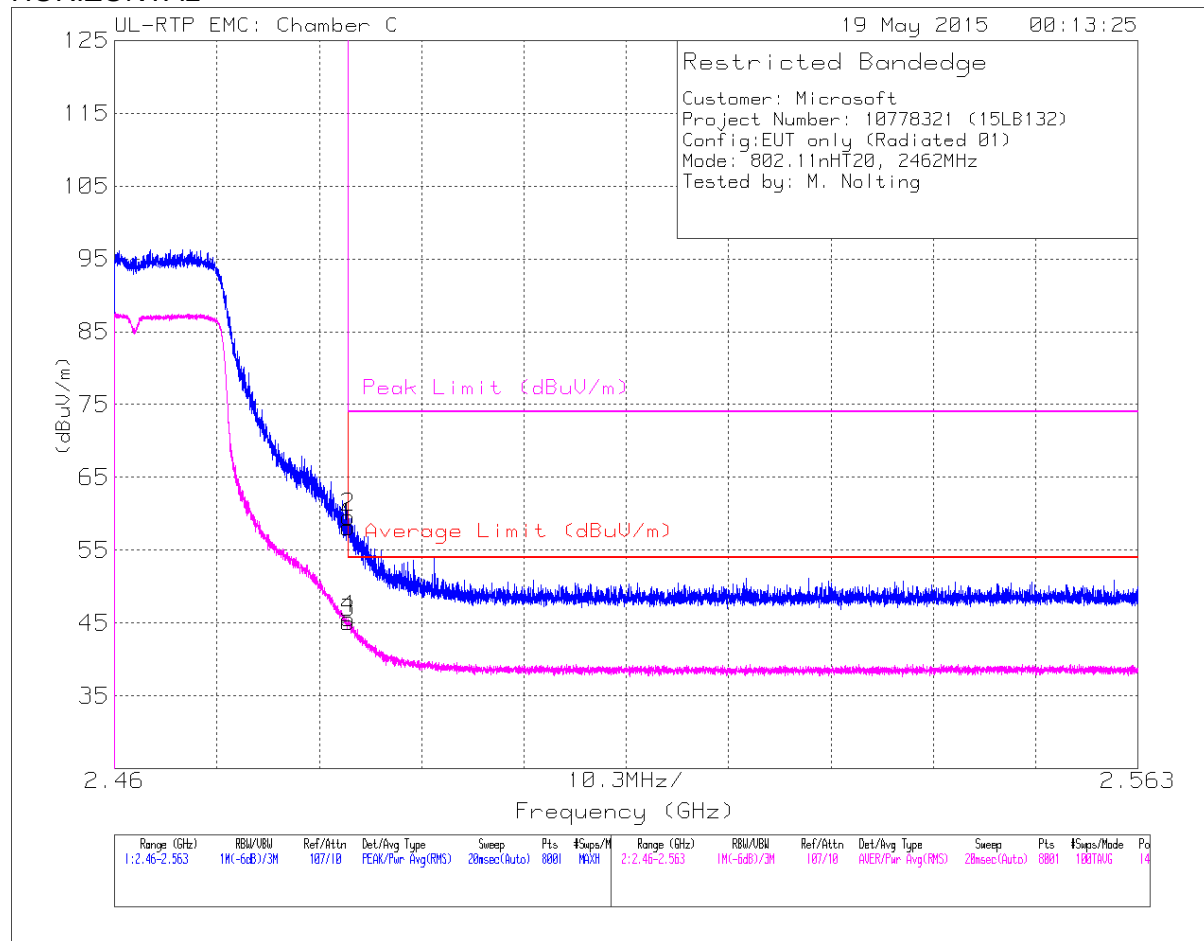
* - indicates frequency in CFR15.205/IC7.2.2 Restricted Band

Pk - Peak detector

RMS - RMS detection

AUTHORIZED BANDEDGE (HIGH CHANNEL)

HORIZONTAL



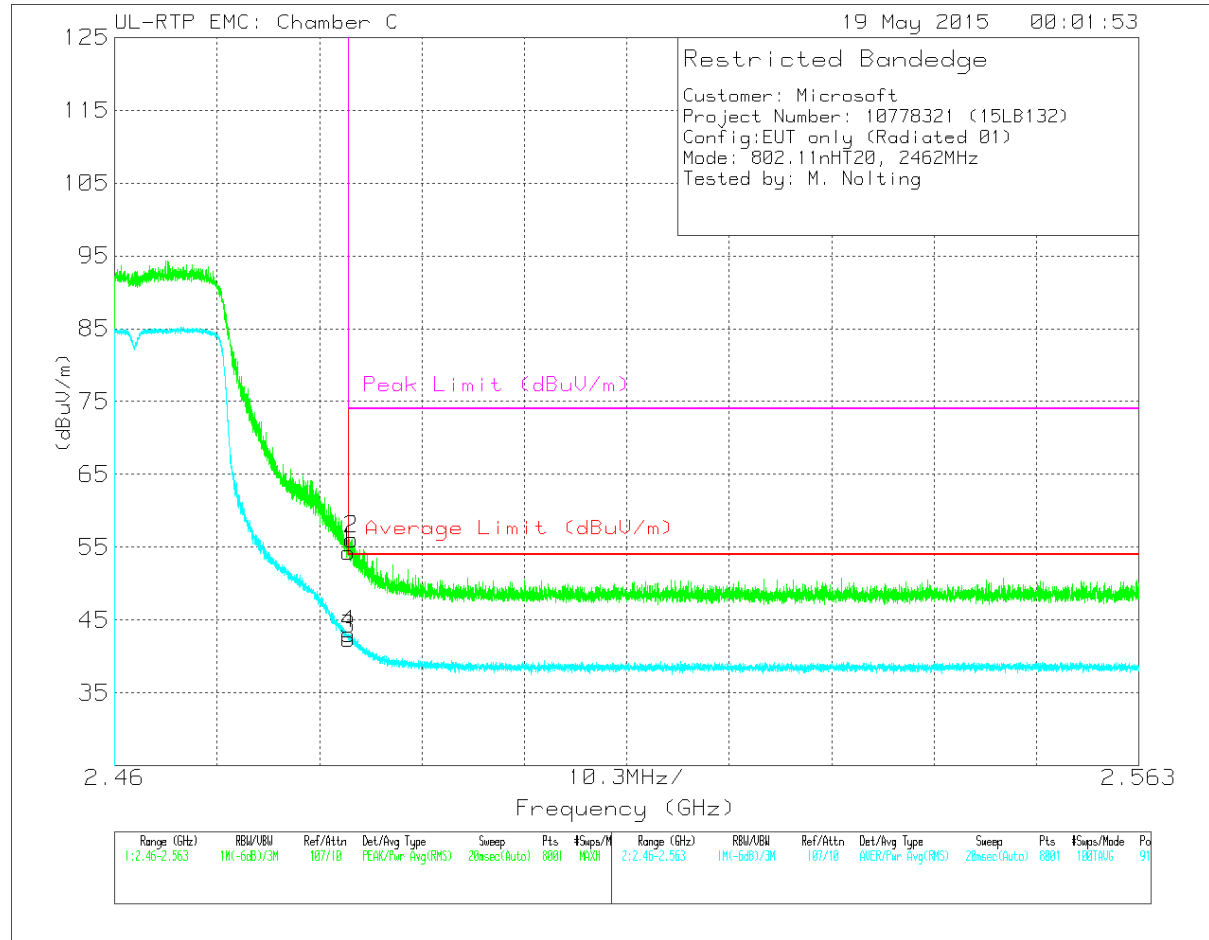
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	52.35	Pk	32.3	-26.5	58.15	-	-	74	-15.85	149	122	H
2	* 2.484	53.77	Pk	32.3	-26.5	59.57	-	-	74	-14.43	149	122	H
3	* 2.484	39.3	RMS	32.3	-26.5	45.1	54	-8.9	-	-	149	122	H
4	* 2.484	39.81	RMS	32.3	-26.5	45.61	54	-8.39	-	-	149	122	H

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

Pk - Peak detector

RMS - RMS detection

VERTICAL



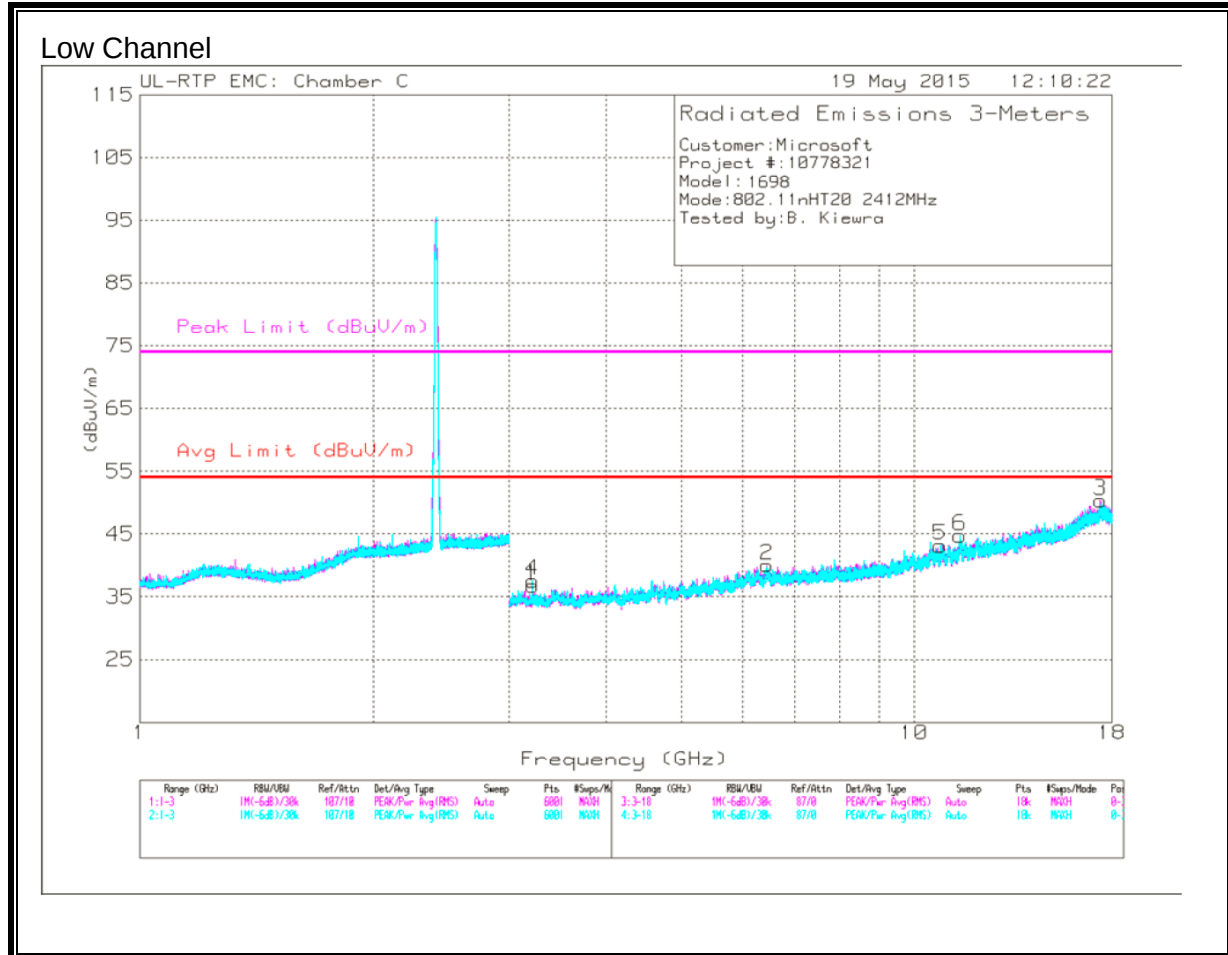
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.484	48.52	Pk	32.3	-26.5	54.32	-	-	74	-19.68	91	305	V
2	* 2.484	50.29	Pk	32.3	-26.5	56.09	-	-	74	-17.91	91	305	V
3	* 2.484	36.59	RMS	32.3	-26.5	42.39	54	-11.61	-	-	91	305	V
4	* 2.484	37.27	RMS	32.3	-26.5	43.07	54	-10.93	-	-	91	305	V

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

Pk - Peak detector

RMS - RMS detection

HARMONICS AND SPURIOUS EMISSIONS (1-18GHz)



Data

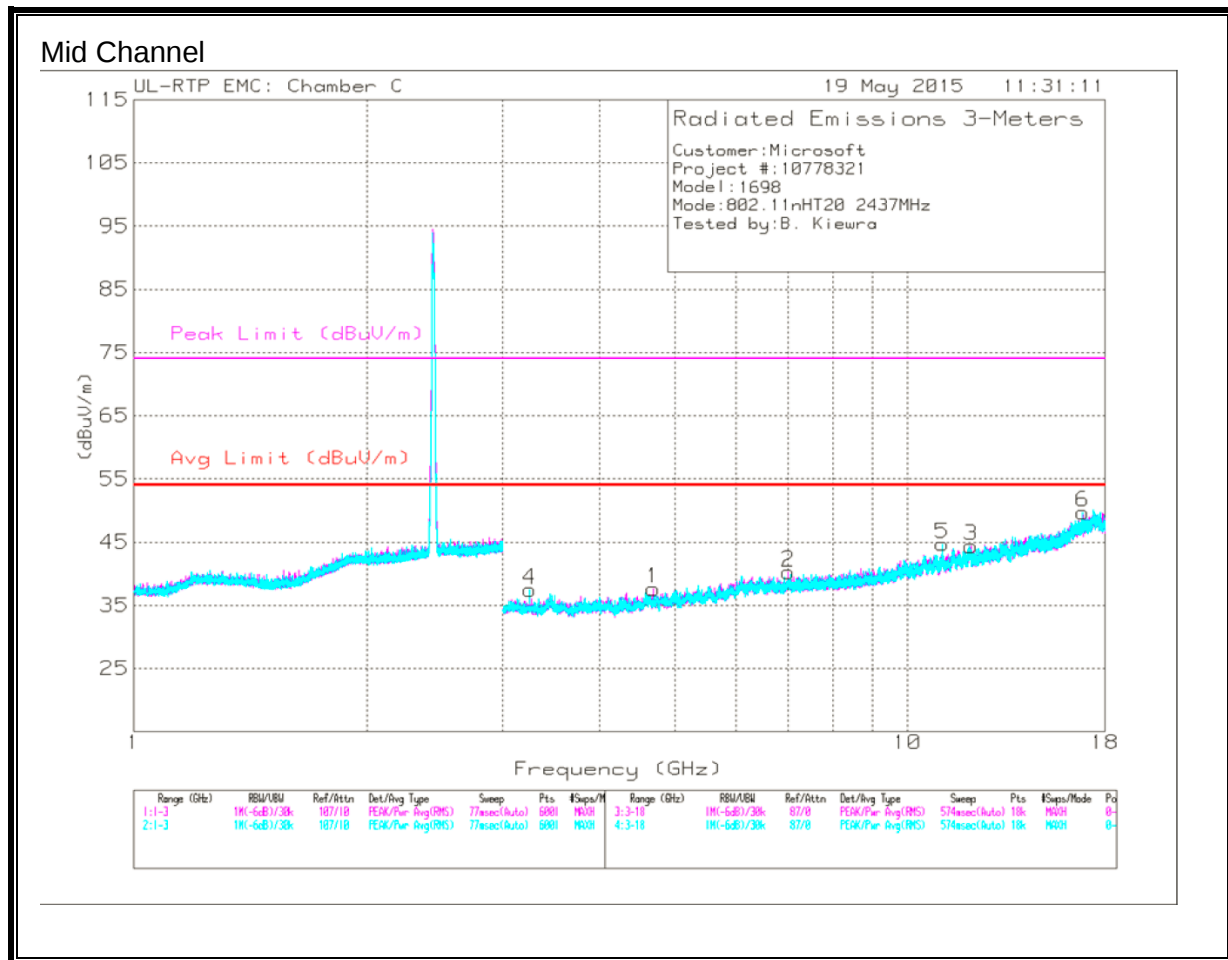
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	3.216	38.46	Pk	32.9	-34.6	36.76	-	-	74	-37.24	0-360	151	H
2	6.454	32.94	Pk	35.7	-28.6	40.04	-	-	74	-33.96	0-360	151	H
3	17.388	35.52	PK2	41.6	-19.6	57.52	-	-	74	-16.48	40	128	H
	17.39	23.96	MAv1	41.6	-19.6	45.96	54	-8.04	-	-	40	128	H
4	3.216	39.28	Pk	32.9	-34.6	37.58	-	-	74	-36.42	0-360	250	V
5	* 10.803	38.48	PK2	37.8	-26.2	50.08	-	-	74	-23.92	173	141	V
	* 10.804	26.64	MAv1	37.8	-26.2	38.24	54	-15.76	-	-	173	141	V
6	* 11.457	37.51	PK2	38.1	-23.9	51.71	-	-	74	-22.29	0	137	V
	* 11.458	25.89	MAv1	38.1	-24	39.99	54	-14.01	-	-	0	137	V

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

Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



Data

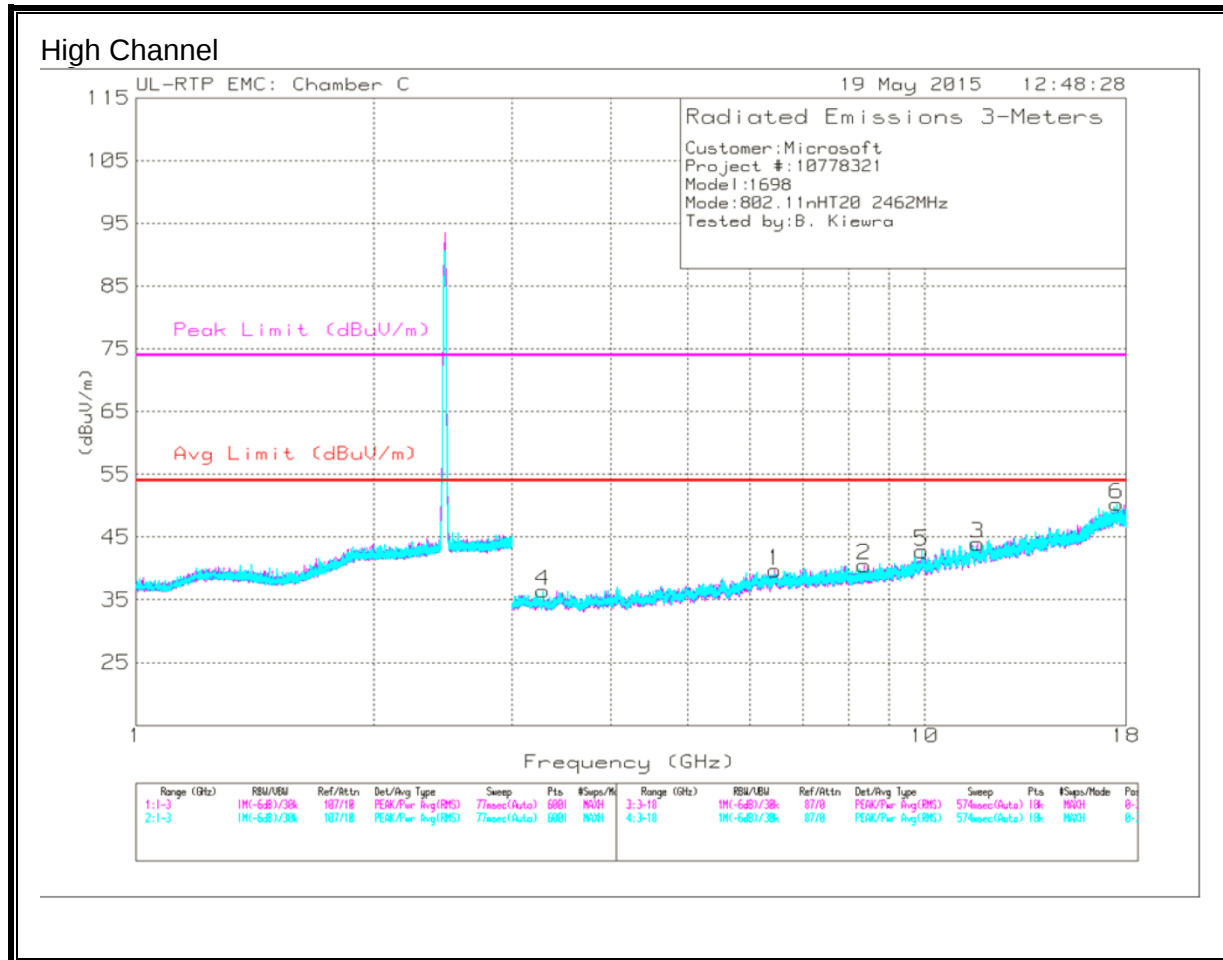
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 4.693	43.01	PK2	34.1	-33.1	44.01	-	-	74	-29.99	4	113	H
	* 4.693	31.31	MAv1	34.1	-33.1	32.31	54	-21.69	-	-	4	113	H
3	* 12.077	39.02	PK2	38.7	-25.4	52.32	-	-	74	-21.68	281	360	H
	* 12.077	26.75	MAv1	38.7	-25.4	40.05	54	-13.95	-	-	281	360	H
5	* 11.082	37.6	PK2	37.7	-23.9	51.4	-	-	74	-22.6	166	126	V
	* 11.082	25.6	MAv1	37.7	-23.9	39.4	54	-14.6	-	-	166	126	V
4	3.249	38.86	Pk	32.9	-34.3	37.46	-	-	74	-36.54	0-360	151	V
2	7.013	33.06	Pk	35.7	-28.5	40.26	-	-	74	-33.74	0-360	151	H
6	16.847	35.89	PK2	41.6	-20.8	56.69	-	-	74	-17.31	93	308	V
	16.847	24.37	MAv1	41.6	-20.8	45.17	54	-8.83	-	-	93	308	V

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

Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average



Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0062 (dB/m)	Amp/Cbl/F ltr/Pad	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	6.457	32.49	Pk	35.7	-28.5	39.69	-	-	74	-34.31	0-360	151	H
2	* 8.382	39.19	PK2	35.9	-27.6	47.49	-	-	74	-26.51	96	385	H
	* 8.382	27.67	MAV1	35.9	-27.6	35.97	54	-18.03	-	-	96	385	H
3	* 11.663	37.97	PK2	38.2	-24.9	51.27	-	-	74	-22.73	105	355	H
	* 11.664	26.06	MAV1	38.2	-24.9	39.36	54	-14.64	-	-	105	355	H
4	3.282	37.93	Pk	32.8	-34.3	36.43	-	-	74	-37.57	0-360	151	V
5	9.915	31.94	Pk	37.1	-26.3	42.74	-	-	74	-31.26	0-360	151	V
6	17.515	36.12	PK2	41.6	-20.6	57.12	-	-	74	-16.88	126	237	V
	17.516	24.34	MAV1	41.6	-20.6	45.34	54	-8.66	-	-	126	237	V

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

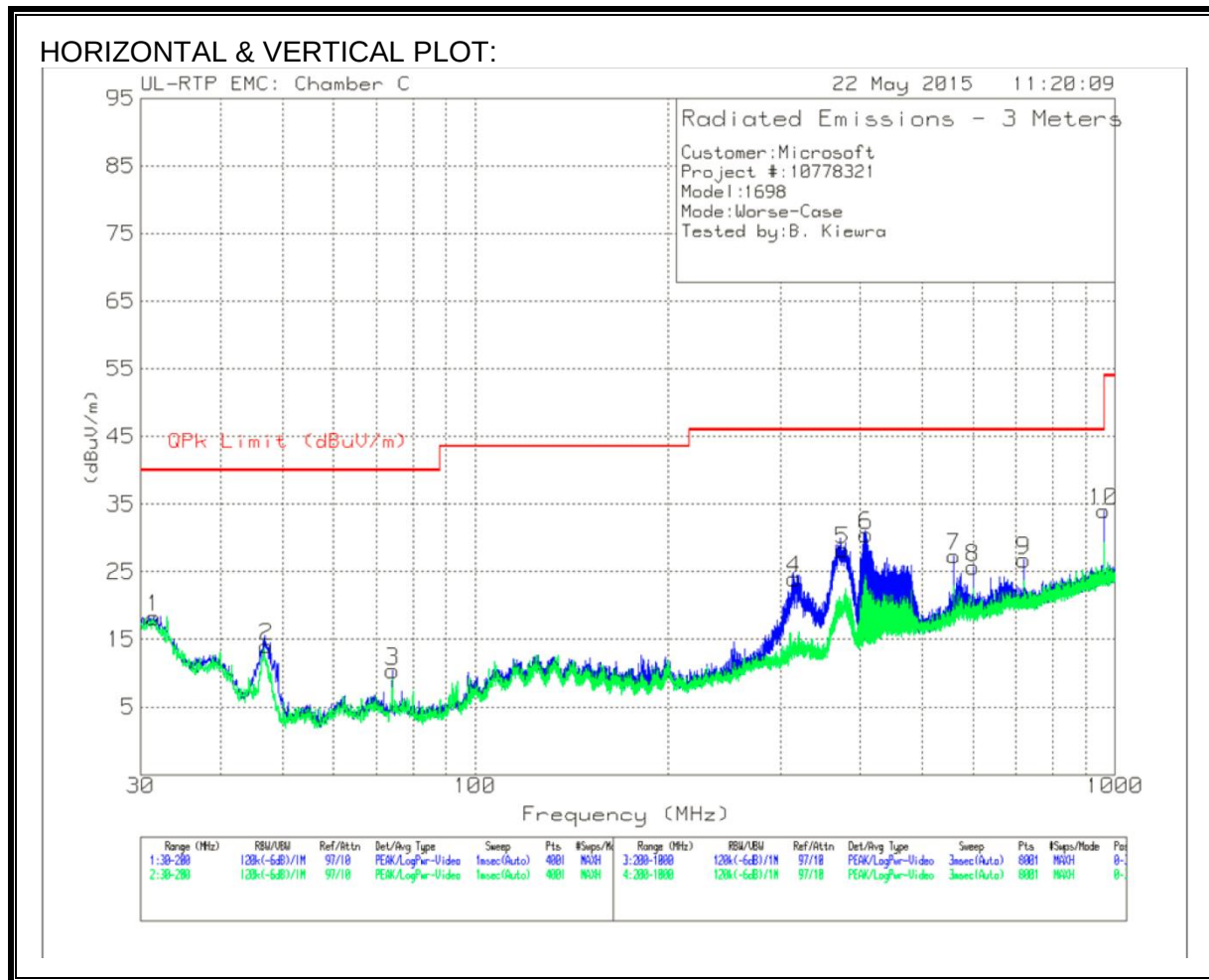
Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

MAV1 - KDB558074 Option 1 Maximum RMS Average

9.5. WORST-CASE BELOW 1 GHz

9.5.1. SPURIOUS EMISSIONS 30 TO 1000 MHz (2.4GHz BAND)



DATA

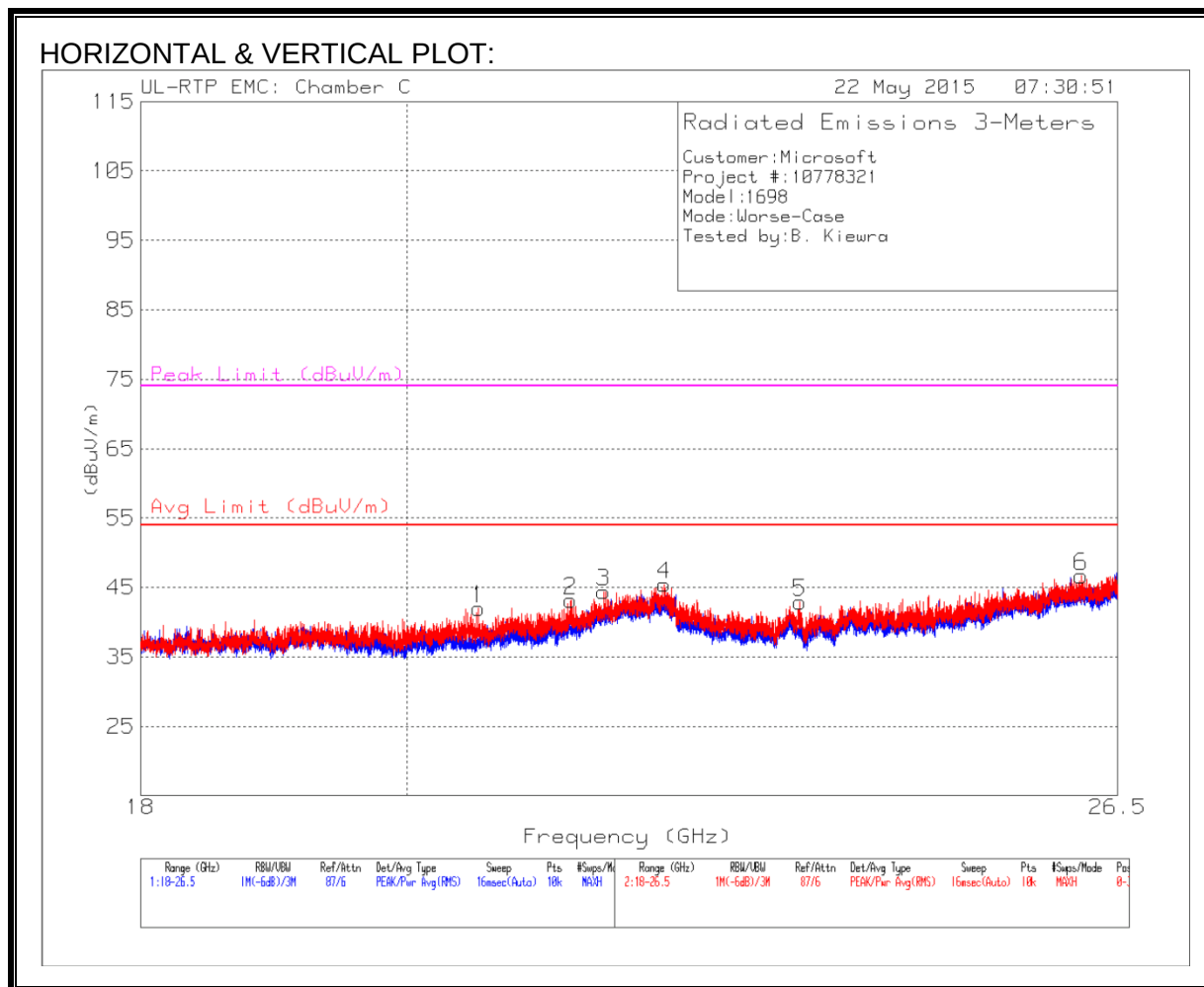
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0066 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
3	* 74.2425	33.35	Pk	8.1	-31.1	10.35	40	-29.65	0-360	100	H
6	* 408.7	43.88	Pk	16	-29.4	30.48	46.02	-15.54	0-360	100	H
10	* 960	37.83	Pk	23	-26.8	34.03	46.02	-11.99	0-360	100	H
1	31.4875	29.16	Pk	20.7	-31.6	18.26	40	-21.74	0-360	400	H
2	47.17	36.26	Pk	9.2	-31.4	14.06	40	-25.94	0-360	300	H
4	315	39.78	Pk	13.9	-29.7	23.98	46.02	-22.04	0-360	100	H
5	375.4	42.76	Pk	15	-29.5	28.26	46.02	-17.76	0-360	100	H
7	560	37.64	Pk	18.5	-28.8	27.34	46.02	-18.68	0-360	200	H
8	600	35.98	Pk	18.4	-28.7	25.68	46.02	-20.34	0-360	200	H
9	720	34.94	Pk	20.5	-28.7	26.74	46.02	-19.28	0-360	100	H

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

Pk - Peak detector

9.6. WORST-CASE 18-26GHz

9.6.1. SPURIOUS EMISSIONS 18 TO 26GHz (2.4GHz BAND)



Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	Horn AT0063 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 20.578	43.76	PK2	33	-32.6	44.16	-	-	74	-29.84	102	335	V
	* 20.576	32.52	MAv1	33	-32.6	32.92	54	-21.08	-	-	102	335	V
2	* 21.341	44.98	PK2	34.1	-32.1	46.98	-	-	74	-27.02	102	200	V
	* 21.342	33.62	MAv1	34.1	-32.1	35.62	54	-18.38	-	-	102	200	V
4	* 22.147	44.99	PK2	36.5	-31.9	49.59	-	-	74	-24.41	8	187	V
	* 22.148	32.94	MAv1	36.5	-31.9	37.54	54	-16.46	-	-	8	187	V
3	21.621	41.03	Pk	35.8	-32.4	44.43	-	-	74	-29.57	0-360	200	V
5	23.37	39.99	Pk	33.7	-30.8	42.89	-	-	74	-31.11	0-360	200	V
6	26.122	40.87	Pk	34.1	-28.3	46.67	-	-	74	-27.33	0-360	200	V

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

Pk - Peak detector

PK2 - KDB558074 Method: Maximum Peak

MAv1 - KDB558074 Option 1 Maximum RMS Average