



TEST REPORT

Report Number. : 13129294-E2V3

Applicant : Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

Model : 1930

FCC ID : C3K1930

IC : 3048A-1930

EUT Description : Phablet Device

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C
ISED RSS-247 ISSUE 2
ISED RSS-GEN ISSUE 5

Date Of Issue:

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NVLAP Lab code: 200065-0

NVLAP Lab code: 200246-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	5/4/2020	Initial Issue	---
V2	6/5/2020	Section 3 Updated	Henry Lau
V3	6/9/2020	EUT updated	Grace Rincand

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Microsoft Corporation
One Microsoft Way
Redmond, WA 98052-6399
USA

EUT DESCRIPTION: Phablet Device

MODEL: 1930

SERIAL NUMBER: 900086500465, 900039701165 (Radiated)
901245700365(Conducted)

DATE TESTED: January 16, 2020 – April 8, 2020

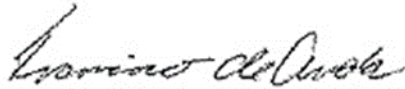
APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5	Complies

UL Verification Services Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. All samples tested were in good operating condition throughout the entire test program. Measurement Uncertainties are published for informational purposes only and were not taken into account unless noted otherwise.

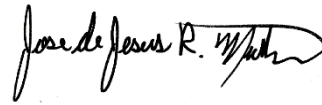
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2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle*	Reporting purposes only	Per ANSI C63.10, Section 11.6.
See Comment	RSS-GEN 6.7	20dB BW/99% OBW*	Reporting purposes only	ANSI C63.10 Sections 6.9.2 and 6.9.3
15.247 (a)(1)	RSS-247 (5.1) (b)	Hopping Frequency Separation*	Complies	None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Number of Hopping Channels*	Complies	None.
15.247 (a)(1)(iii)	RSS-247 (5.1) (d)	Average Time of Occupancy*	Complies	None.
15.247 (b)(1)	RSS-247 (5.4) (b)	Output Power***	Complies	None.
See Comment		Average Power***	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (d)	RSS-247 (5.5)	Conducted Spurious Emissions*	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions**	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions**	Complies	None.

*Testing performed at 47173 Benicia Street Fremont, California, 94538 USA facility.

**Testing performed at 12 Laboratory Dr., Research Triangle Park, NC 27709 U.S.A. facility.

***Testing performed at both above facilities.

3. 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, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, and RSS-247 Issue 2.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 & 47266 Benicia Street, 47658 Kato Road, Fremont, California, USA, 12 Laboratory Drive, Research Triangle Park and 2800 Perimeter Park Dr, Suite B, Morrisville, North Carolina, USA. 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.

12 Laboratory Dr.	2800 Suite Perimeter Park Dr.
☐ Chamber A RTP	☐ North Chamber
☐ Chamber C RTP	☒ South Chamber

UL Verification Services Inc. is accredited by NVLAP, Laboratory Code 200065-0

UL LLC (RTP) is accredited by NVLAP, Laboratory Code 200246-0

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

All test and measuring equipment utilized to perform the tests documented in this report are calibrated on a regular basis, with a maximum time between calibrations of one year or the manufacturers' recommendation, whichever is less, and where applicable is traceable to recognized national standards.

5.2. DECISION RULES

The Decision Rule is based on Simple Acceptance in accordance with ISO Guide 98-4:2012 Clause 8.2. (Measurement uncertainty is not taken into account when stating conformity with a specified requirement.)

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U _{Lab}
Worst Case Conducted Disturbance, 9KHz to 0.15 MHz	3.39 dB
Worst Case Conducted Disturbance, 0.15 to 30 MHz	3.07 dB
Worst Case Radiated Disturbance, 9KHz to 30 MHz	2.52 dB
Worst Case Radiated Disturbance, 30 to 1000 MHz	4.88 dB
Worst Case Radiated Disturbance, 1000 to 18000 MHz	4.24 dB
Worst Case Radiated Disturbance, 18000 to 26000 MHz	4.37 dB
Worst Case Radiated Disturbance, 26000 to 40000 MHz	5.17 dB

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:

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

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:

Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
 $36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Phablet Device with 802.11 a/b/g/n/ac 2x2 WLAN, Bluetooth, Bluetooth LE, GSM, WCDMA, and LTE radios.

6.2. 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	9.11	8.15
2402 - 2480	Enhanced DQPSK	7.51	5.64
2402 - 2480	Enhanced 8PSK	7.59	5.74

Note: GFSK, DQPSK, 8PSK Output Power are all investigated. The GFSK & 8PSK Power are the worst case. Testing is based on these modes to showing compliance. For average power data, refer to section 9.7.

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna, with a maximum gain of 1.1 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was Android version 10, Build Number b1 developer-generic 2020.311.4.

The test utility software used during testing was QRCT v4.0-00123.

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz, above 18GHz, and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

Band edge and radiated emissions between 1GHz and 18GHz were performed with the EUT set to transmit at the highest power on low, middle and high channels.

The EUT was investigated in three orthogonal orientations X/Y/Z. Additionally, the EUT was investigated in four configurations with both screens: folded and closed/open 90 degrees/flat 180 degrees/folded and open. It was determined that the EUT in flat 180 degrees with X (Flatbed) orientation was worst-case orientation therefore all final radiated testing was performed with the EUT in flat 180 degrees at X(Flatbed).

Worst-case data rates as provided by the client were:

GFSK mode: DH5
8PSK mode: 3-DH5

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC/DC Adapter	Lenovo	ADLX45NCC2A	8SSA10E75794C1SG8 5N14BE	DoC
Laptop	Lenovo	Yoga 11e	R9-0R7KPR	DoC

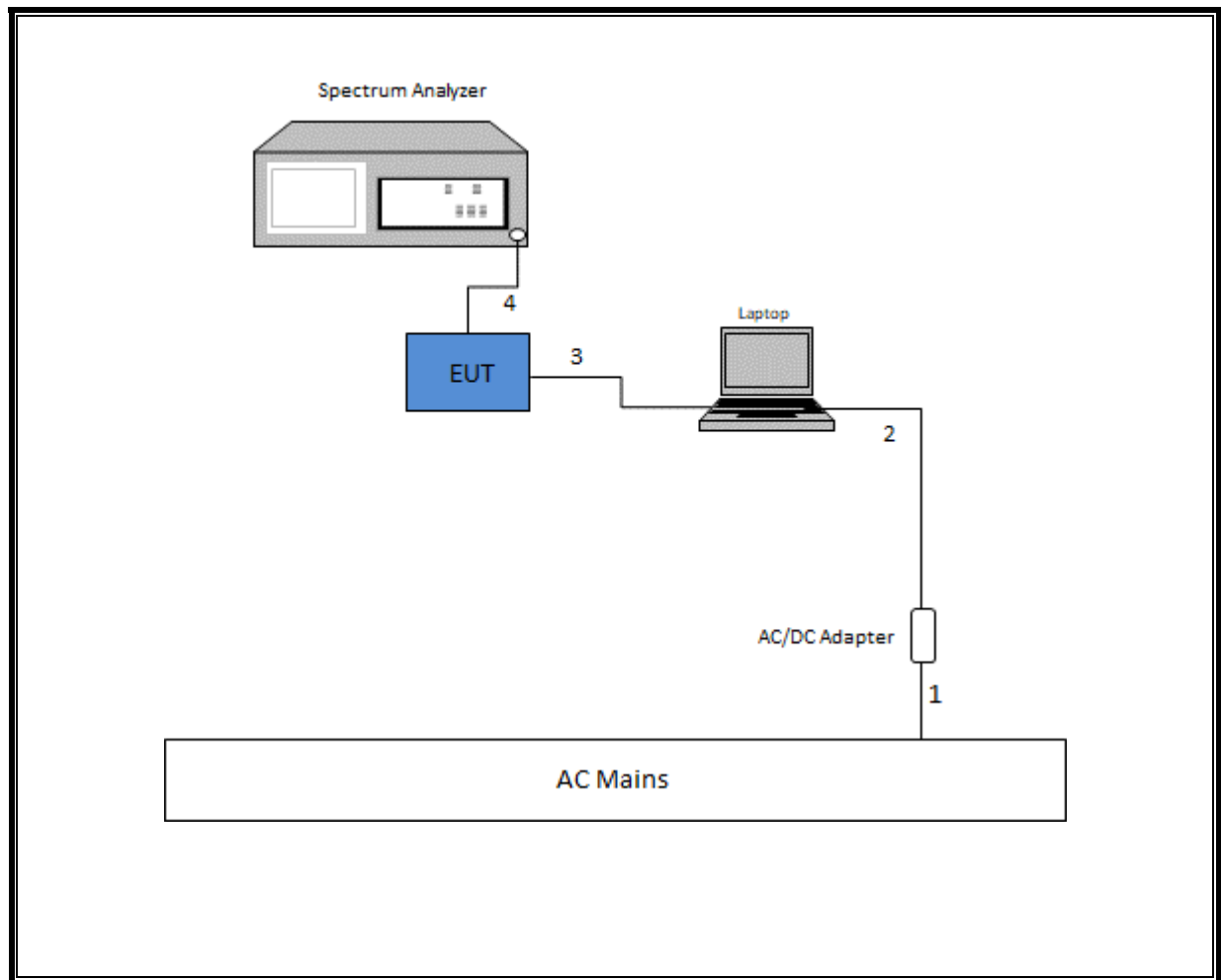
I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	AC	Un-Shielded	1	to AC/DC Adapter
2	DC	1	DC	Shielded	1	to Laptop
3	USB	1	Type C	Shielded	0.1	to EUT
4	Antenna	1	SMA	Un-Shielded	0.2	to Analyzer

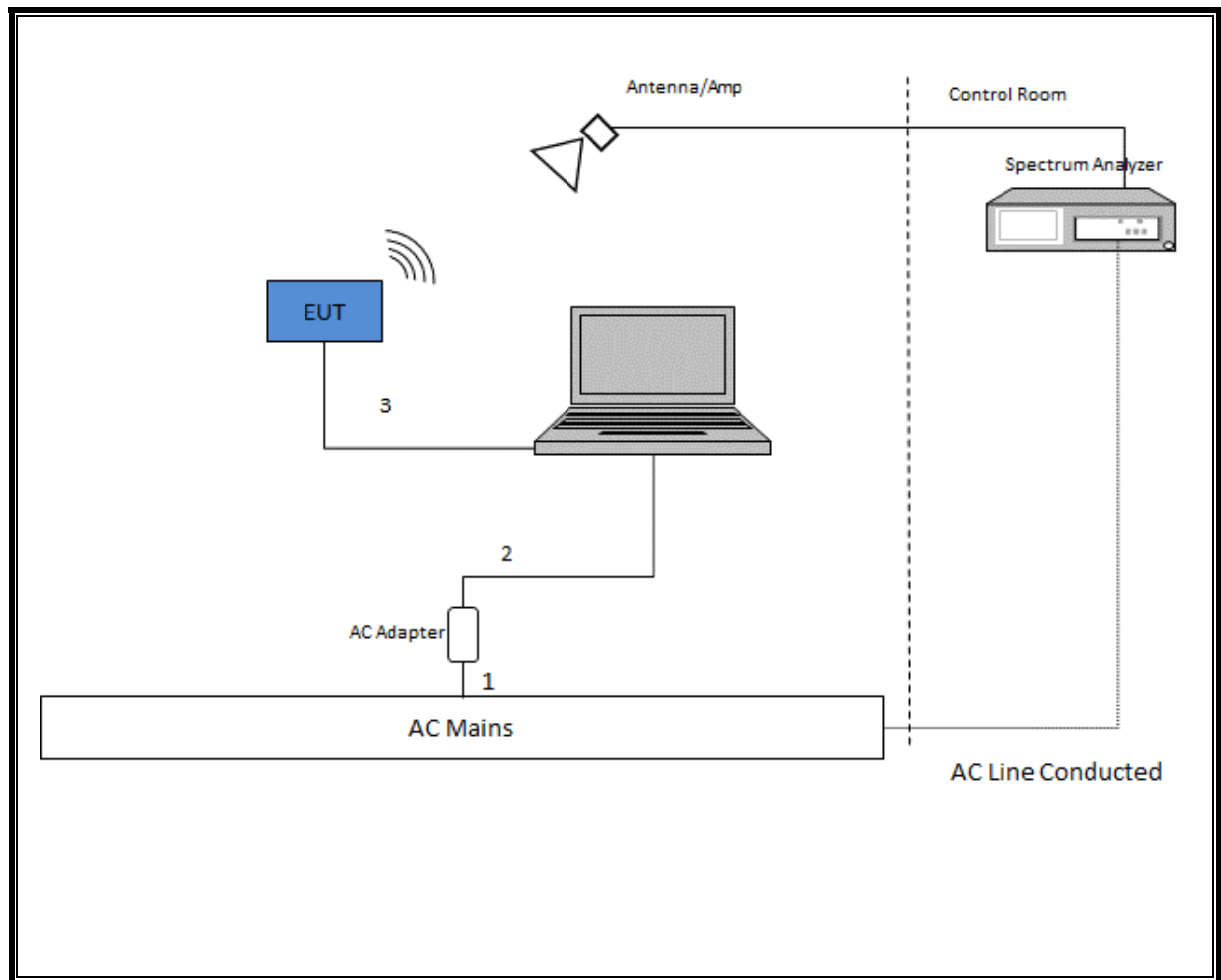
TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card.

CONDUCTED TEST SETUP DIAGRAM



RADIATED AND AC LINE CONDUCTED TEST SETUP DIAGRAM



7. 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
Spectrum Analyzer, PSA, 3Hz to 44GHz	Keysight Technologies Inc	E4446A	T146	01/29/2021
Power Meter, P-series single channel	Keysight Technologies Inc	N1911A	T1264	01/21/2021
Power Sensor, P - series, 50MHz to 18GHz, Wideband	Keysight Technologies Inc	N1921A	T1223	02/25/2020*
UL AUTOMATION SOFTWARE				
Antenna Port Software	UL	UL RF	Ver 2020.1.8	

*Equipment listed above that has a calibration due date during the testing period, the testing is completed before equipment expiration date.

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville - South Chamber)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	(Loop Ant.)			
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2019-08-08	2020-08-08
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-07-16	2020-07-16
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2019-04-22	2020-04-22
	18-26 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2019-11-07	2020-11-07
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2019-05-02	2020-05-02
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2019-05-02	2020-05-02
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-03-17	2021-03-17
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-03-23	2021-03-23
	Receiver & Software				
SA0027	Spectrum Analyzer	Agilent	N9030A	2019-05-15	2020-05-15
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

Test Equipment Used - Wireless Conducted Measurement Equipment (Morrisville – Conducted 2)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
T177 (PRE0079253)	Spectrum Analyzer	Agilent Technologies	E4446A	2019-04-22	2020-04-22
PWM002 (PRE0137344)	RF Power Meter	Keysight Technologies	N1911A	2019-08-23	2020-08-23
PWS003 (PRE0126443)	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2019-08-23	2020-08-23
76023 (EC0225)	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2019-06-14	2020-06-14
SN 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
76021	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	N/A	N/A
SOFTEMI	EMC Software	UL	Version 10.3 (2019-09-24)	NA	NA

Test Equipment Used - Line-Conducted Emissions – Voltage (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2020-03-26	2021-03-26
s/n 181562858	Environmental Meter	Fisher Scientific	14-650-118	2018-09-04	2020-09-04
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2019-08-19	2020-08-19
75141 (PRE0101521)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2019-08-20	2020-08-20
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2020-03-26	2021-03-26
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Miscellaneous (if needed)				
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2019-07-10	2020-07-10

8. MEASUREMENT METHODS

On Time and Duty Cycle: ANSI C63.10-2013 Section 11.6

Occupied BW (20dB): ANSI C63.10-2013 Section 6.9.2

Occupied BW (99%): ANSI C63.10-2013 Section 6.9.3

Carrier Frequency Separation: ANSI C63.10-2013 Section 7.8.2

Number of Hopping Frequencies: ANSI C63.10-2013 Section 7.8.3

Time of Occupancy (Dwell Time): ANSI C63.10-2013 Section 7.8.4

Peak Output Power: ANSI C63.10-2013 Section 7.8.5

Conducted Spurious Emissions: ANSI C63.10-2013 Section 7.8.8

Conducted Band-Edge: ANSI C63.10-2013 Section 6.10.4

Radiated Spurious Emissions Below 30MHz: ANSI C63.10-2013 Section 6.4

Radiated Spurious Emissions 30-1000MHz: ANSI C63.10-2013 Section 6.3 and 6.5

Radiated Spurious Emissions above 1GHz: ANSI C63.10-2013 Section 6.3 and 6.6

Radiated Band-edge: ANSI C63.10-2013 Section 6.10.5

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

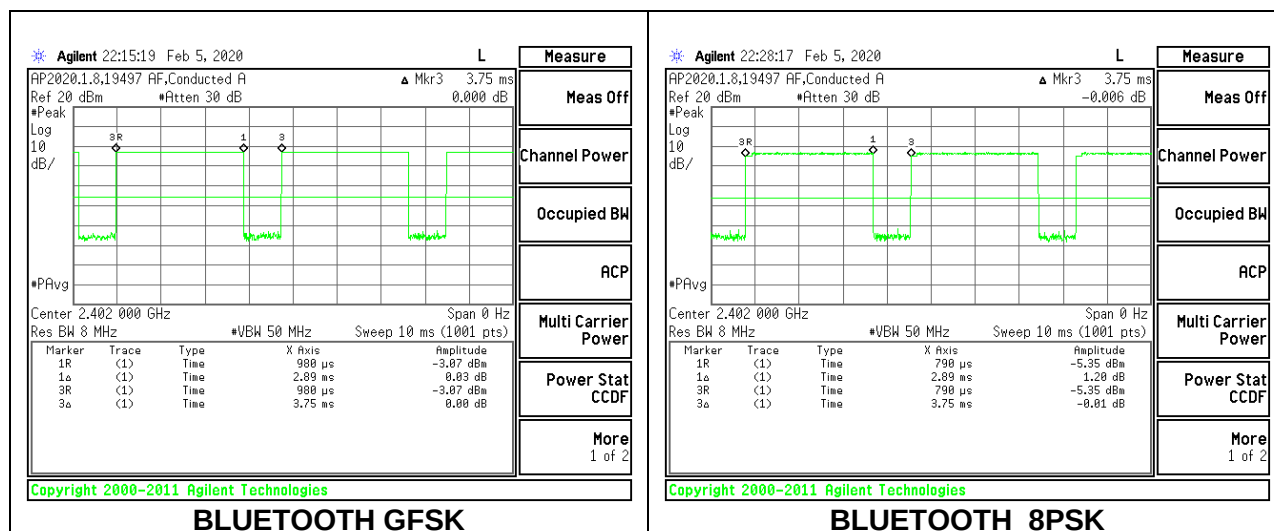
PROCEDURE

ANSI C63.10, Section 11.6 : 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/T Minimum VBW (kHz)
Bluetooth GFSK	2.89	3.75	0.771	77.1%	1.13	0.346
Bluetooth 8PSK	2.89	3.75	0.771	77.1%	1.13	0.346

DUTY CYCLE PLOTS



9.2. 20 dB AND 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

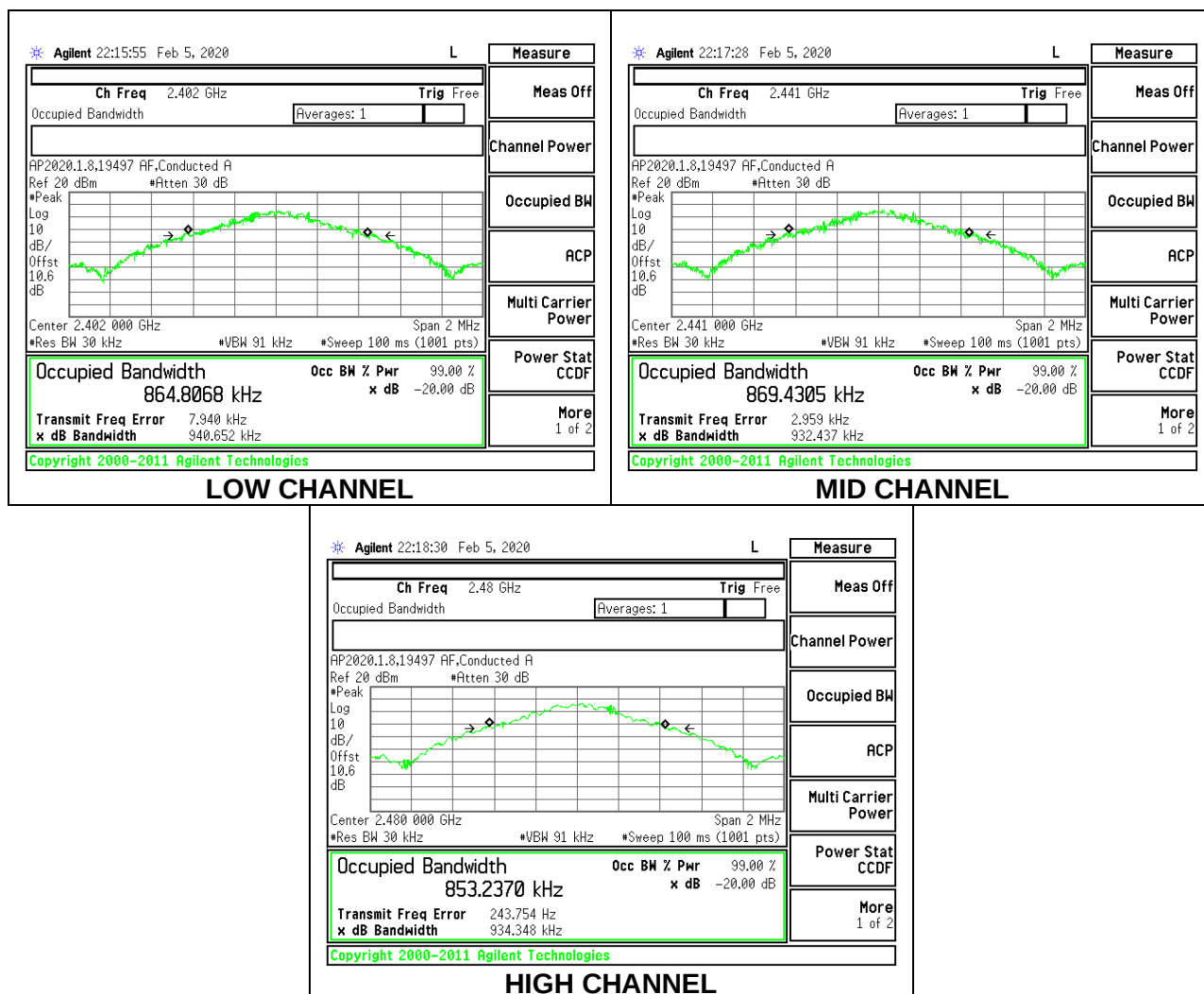
TEST PROCEDURE

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

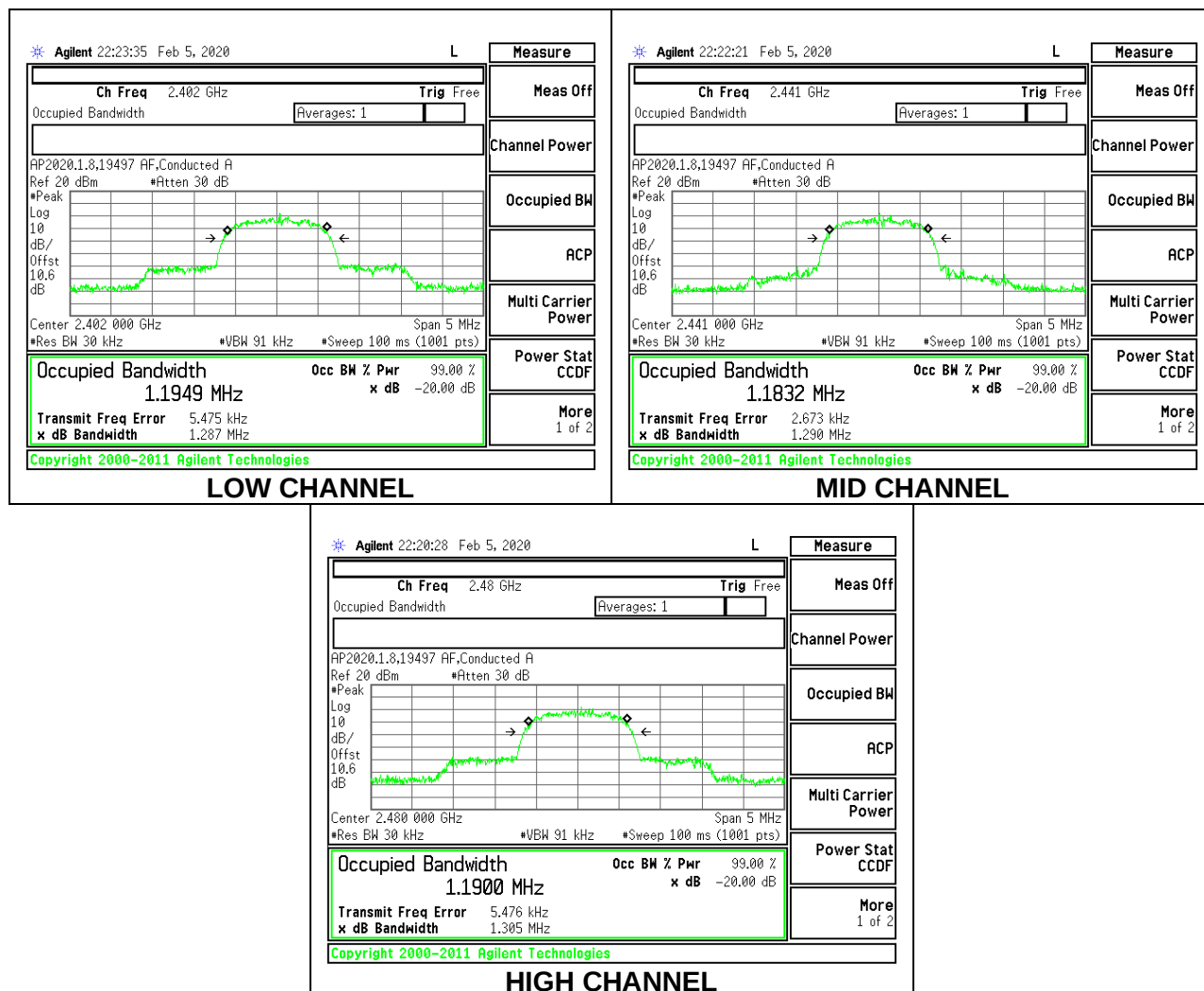
9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	0.941	0.865
Mid	2441	0.932	0.869
High	2480	0.934	0.853



9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	2402	1.287	1.1949
Mid	2441	1.29	1.1832
High	2480	1.305	1.19



9.3. HOPPING FREQUENCY SEPARATION

LIMITS

FCC §15.247 (a) (1)

RSS-247 (5.1) (b)

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

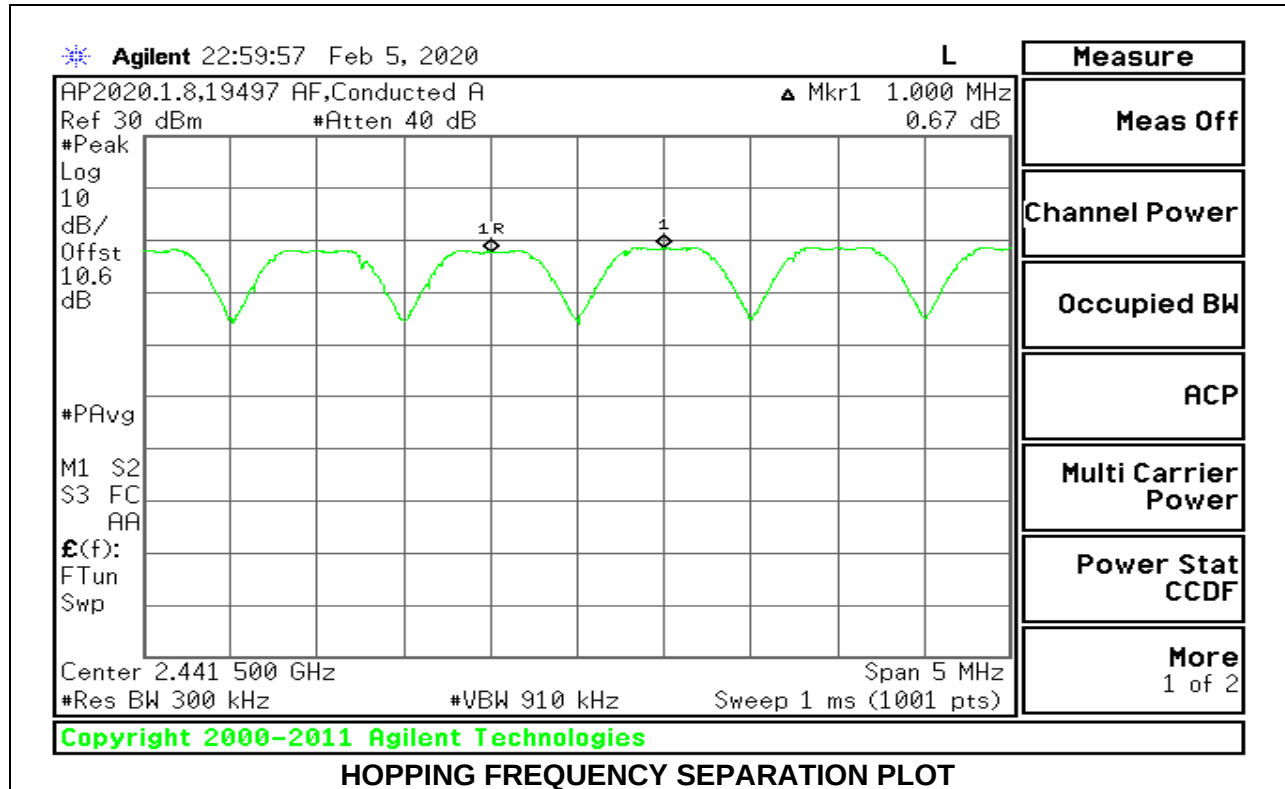
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than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

TEST PROCEDURE

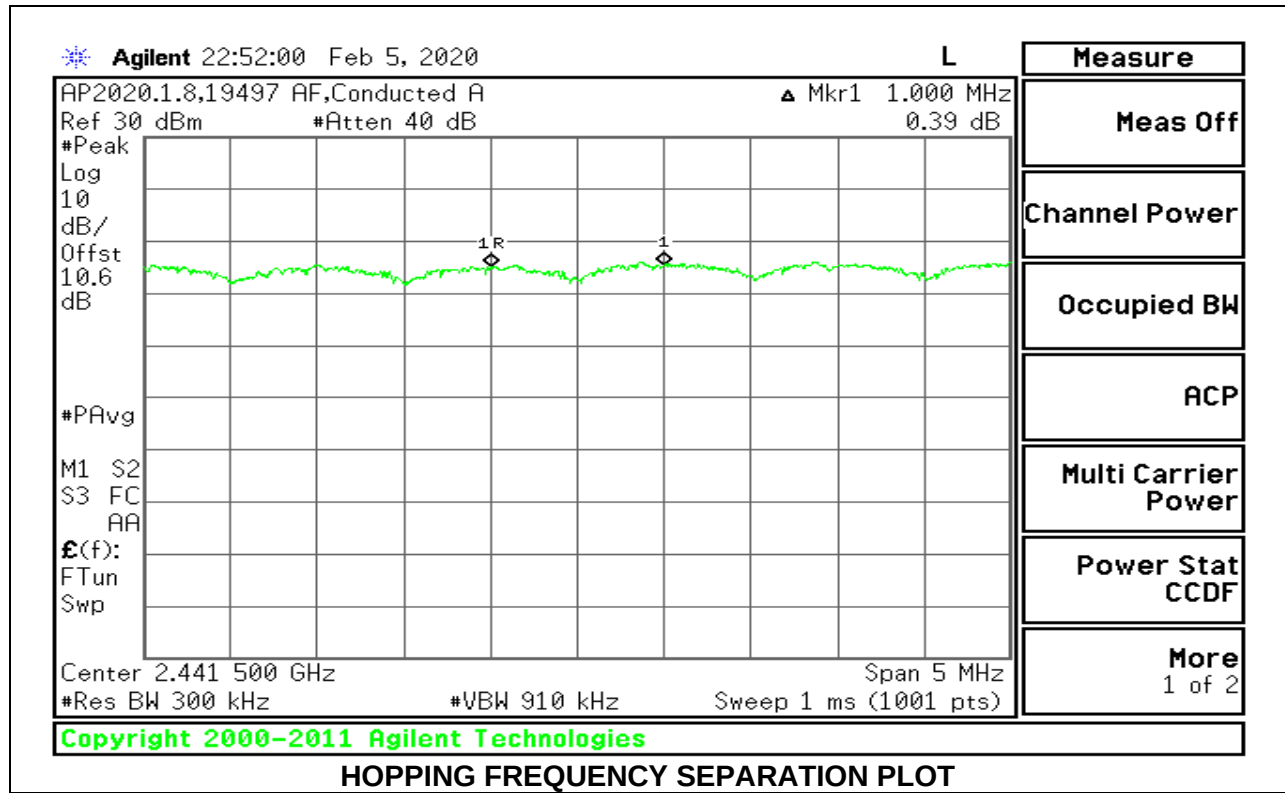
The transmitter output is connected to a spectrum analyzer. The RBW is set to 300 kHz and the VBW is set to $VBW \geq RBW$. The sweep time is coupled.

RESULTS

9.3.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION



9.3.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION



9.4. NUMBER OF HOPPING CHANNELS

LIMITS

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

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

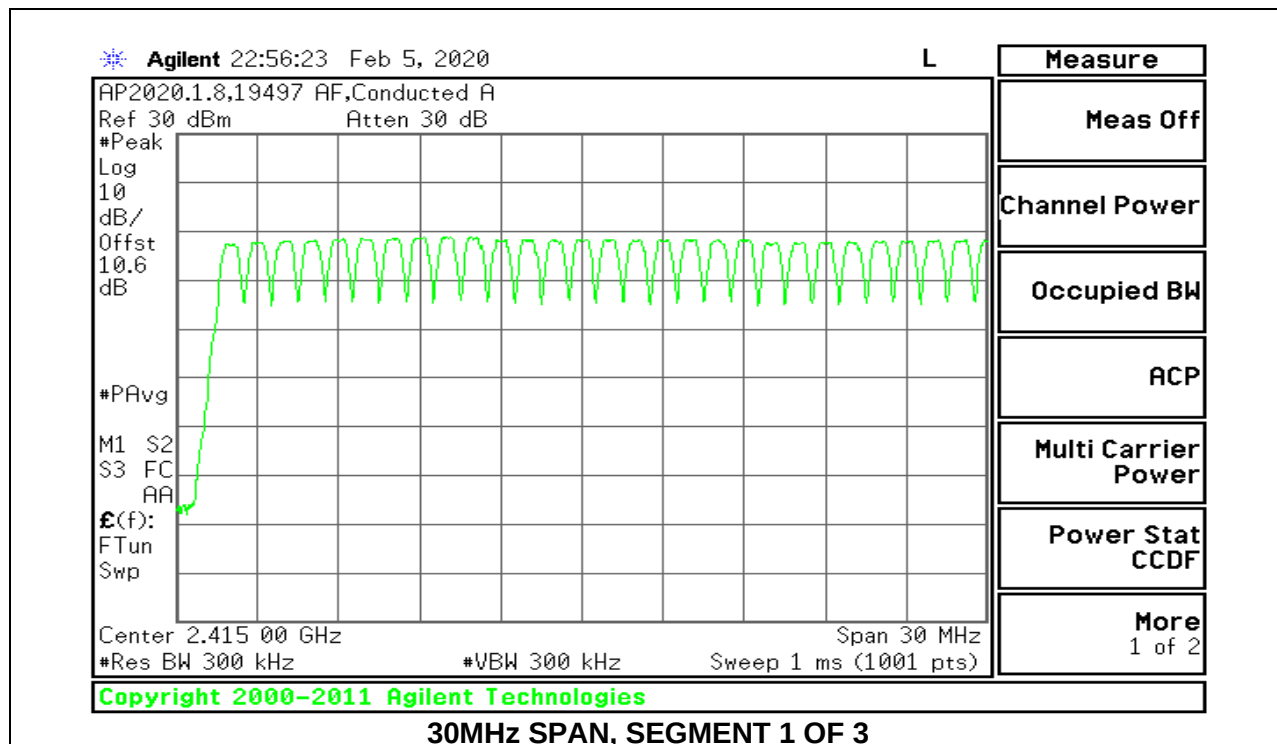
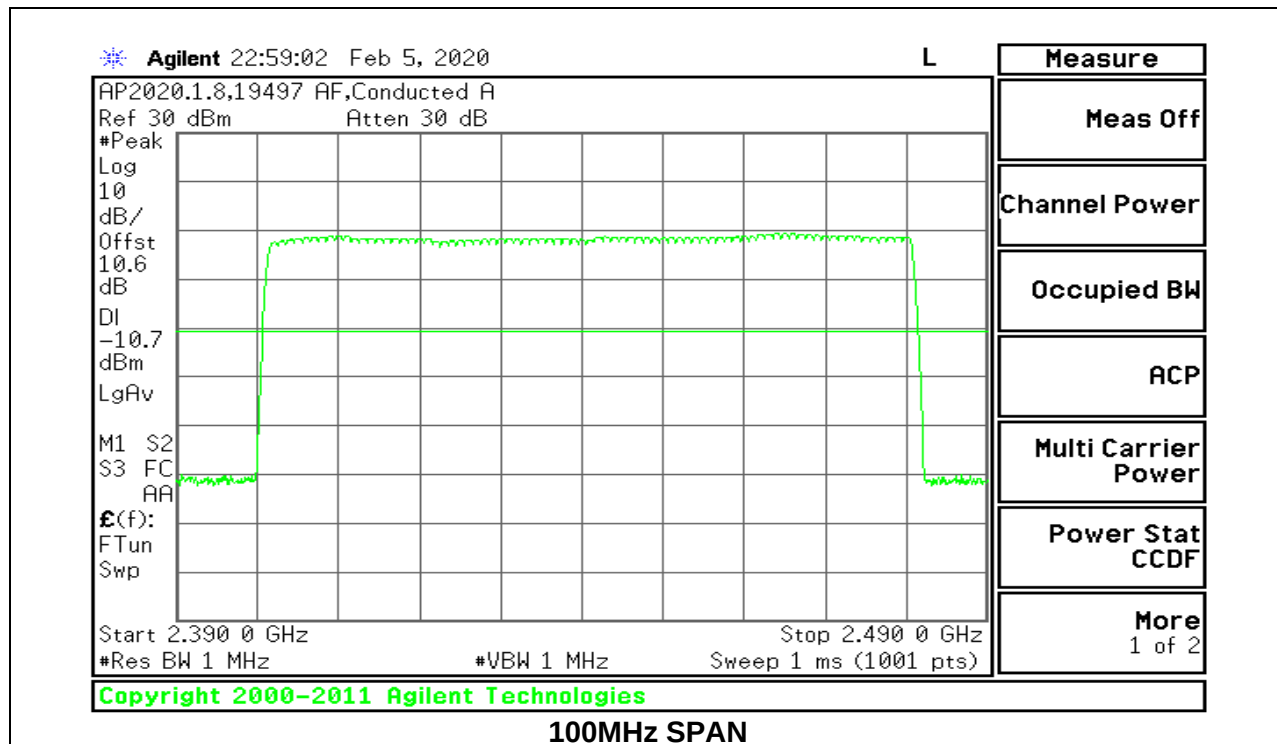
TEST PROCEDURE

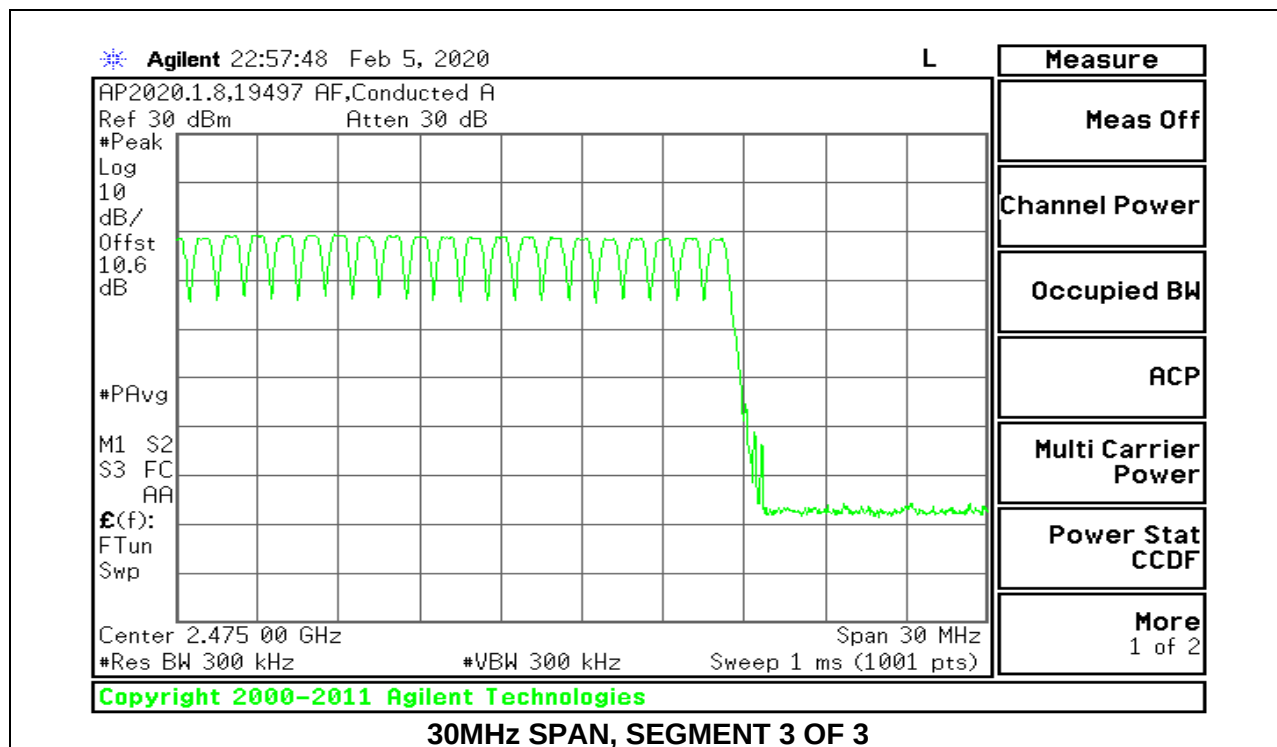
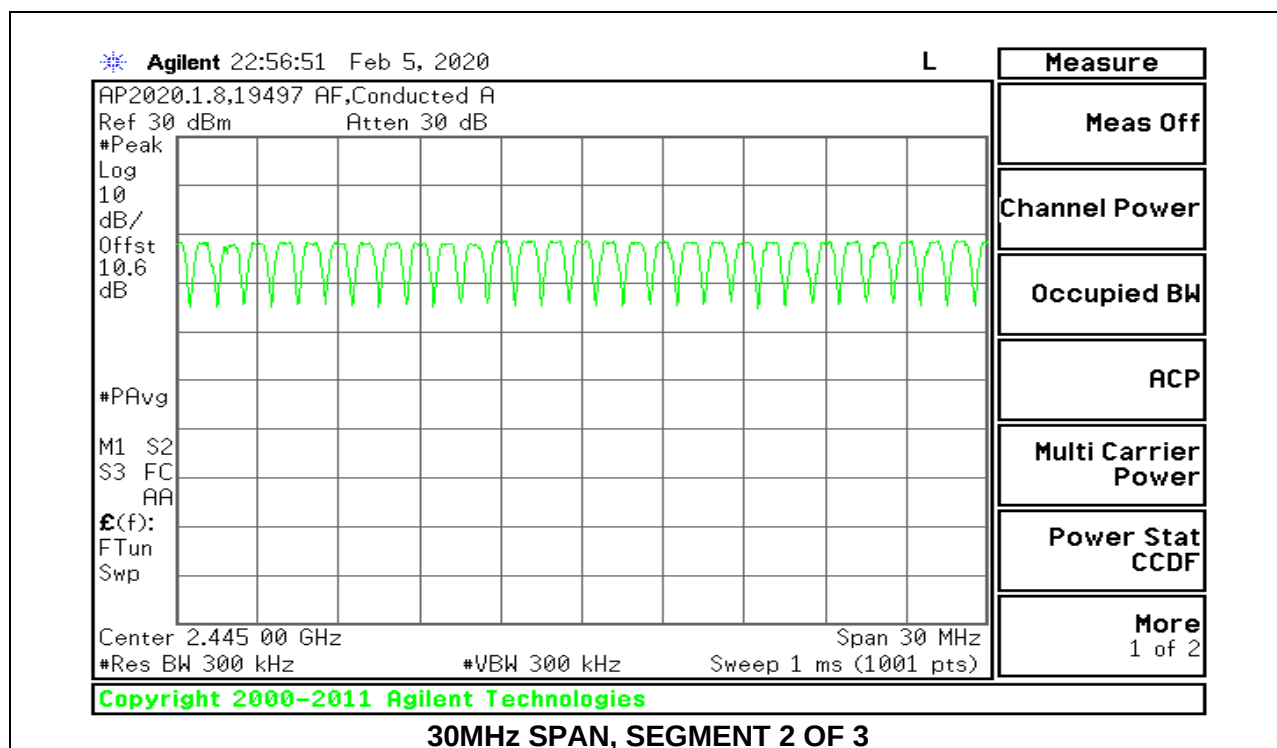
The transmitter output is connected to a spectrum analyzer. The span is set to cover the entire authorized band, in either a single sweep or in multiple contiguous sweeps. The RBW is set to a maximum of 1 % of the span. The analyzer is set to Max Hold.

RESULTS

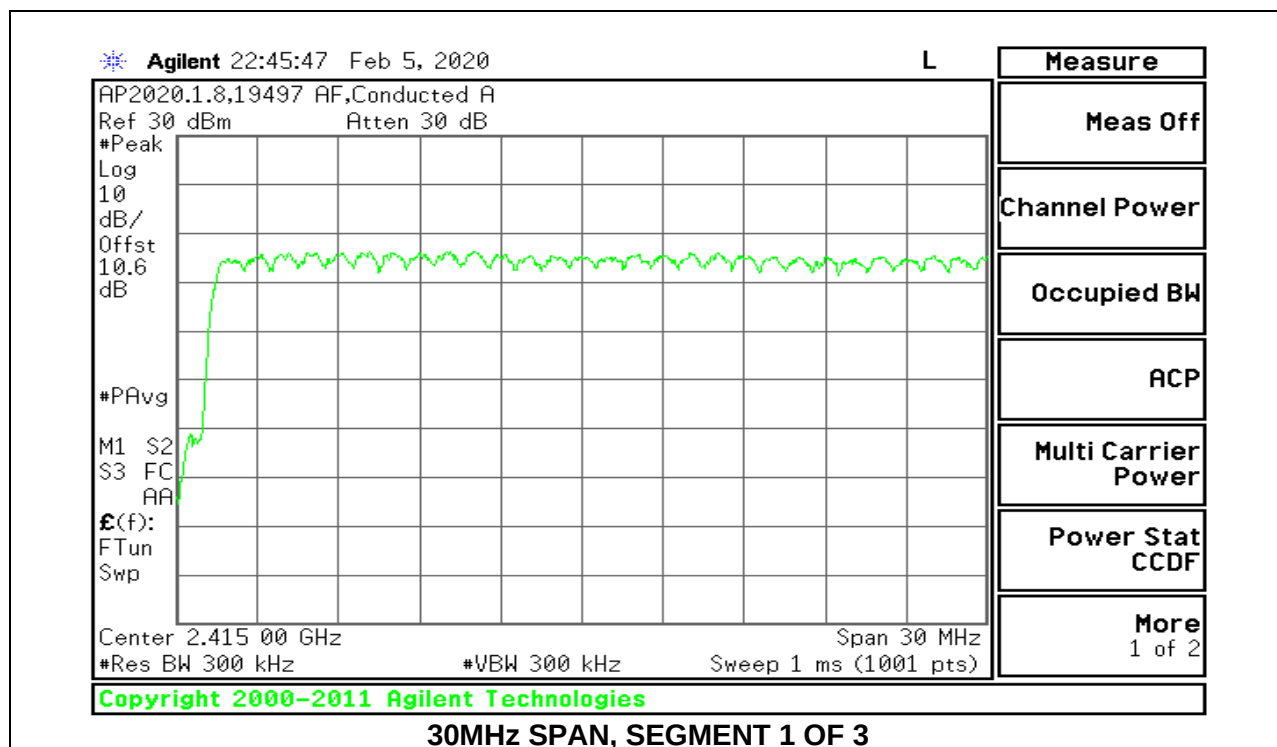
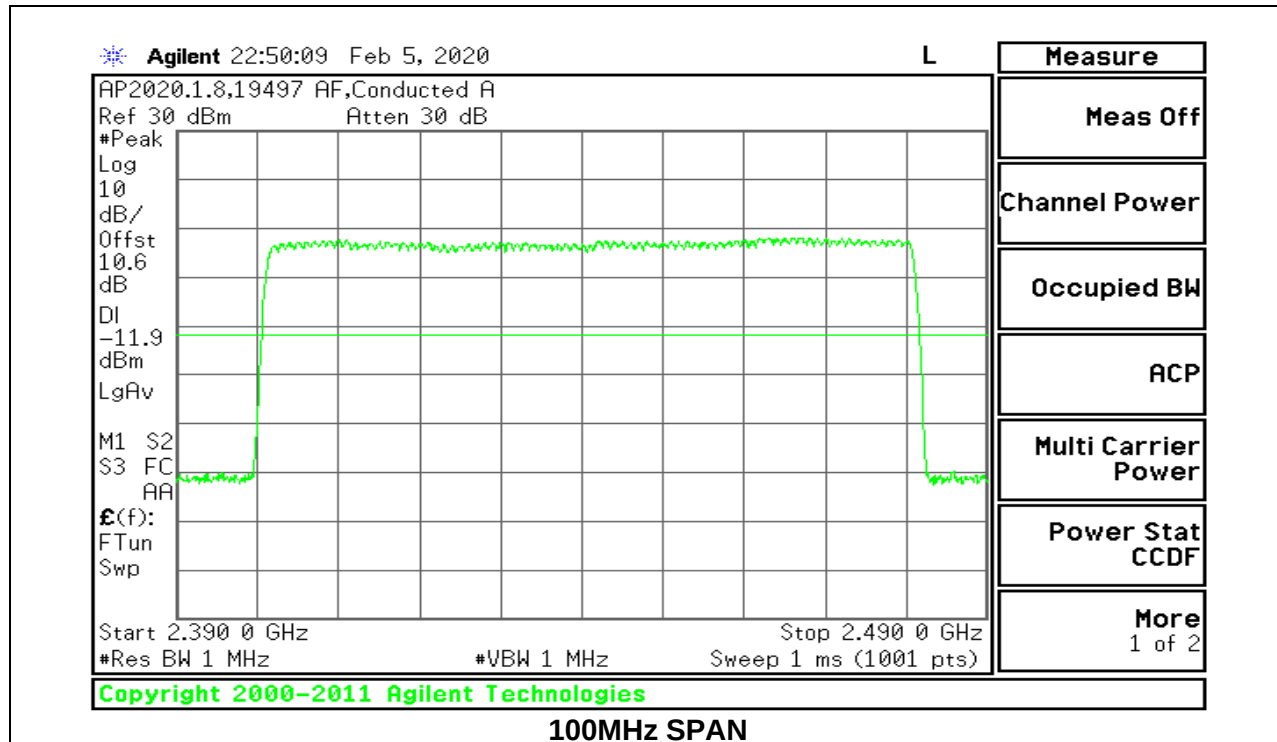
Normal Mode: 79 Channels Observed

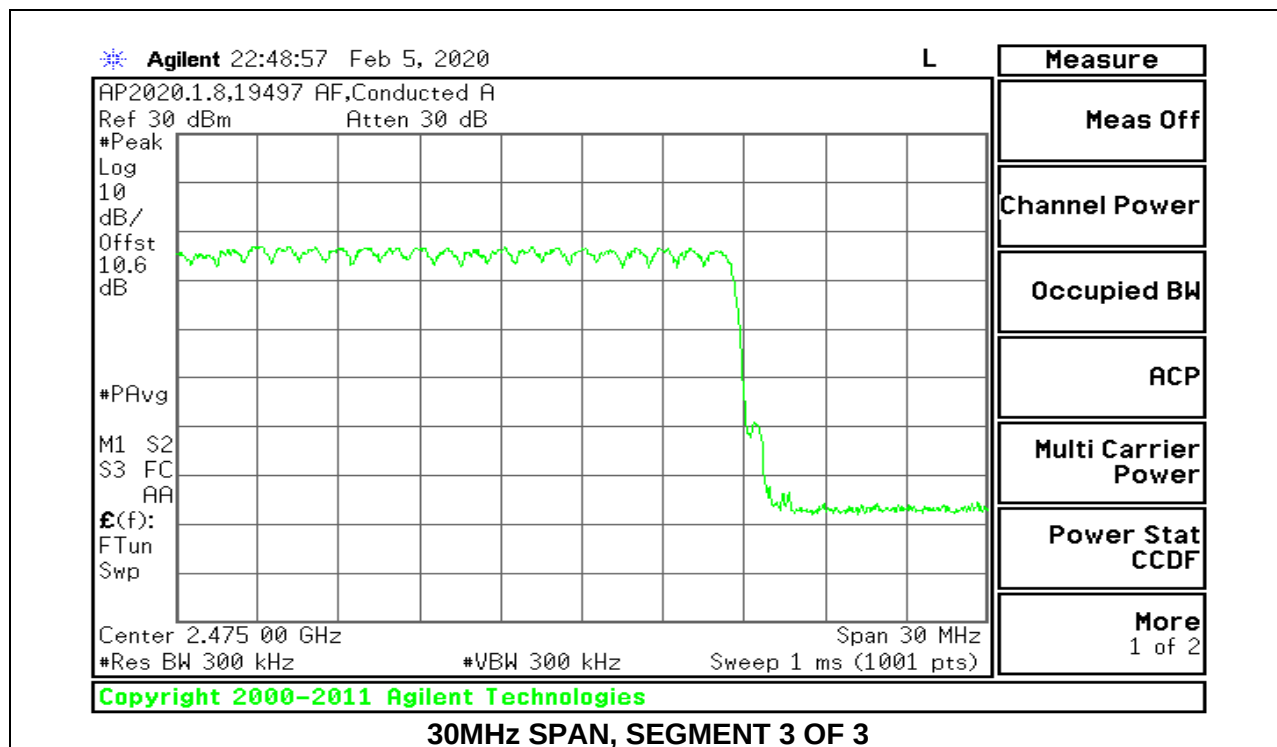
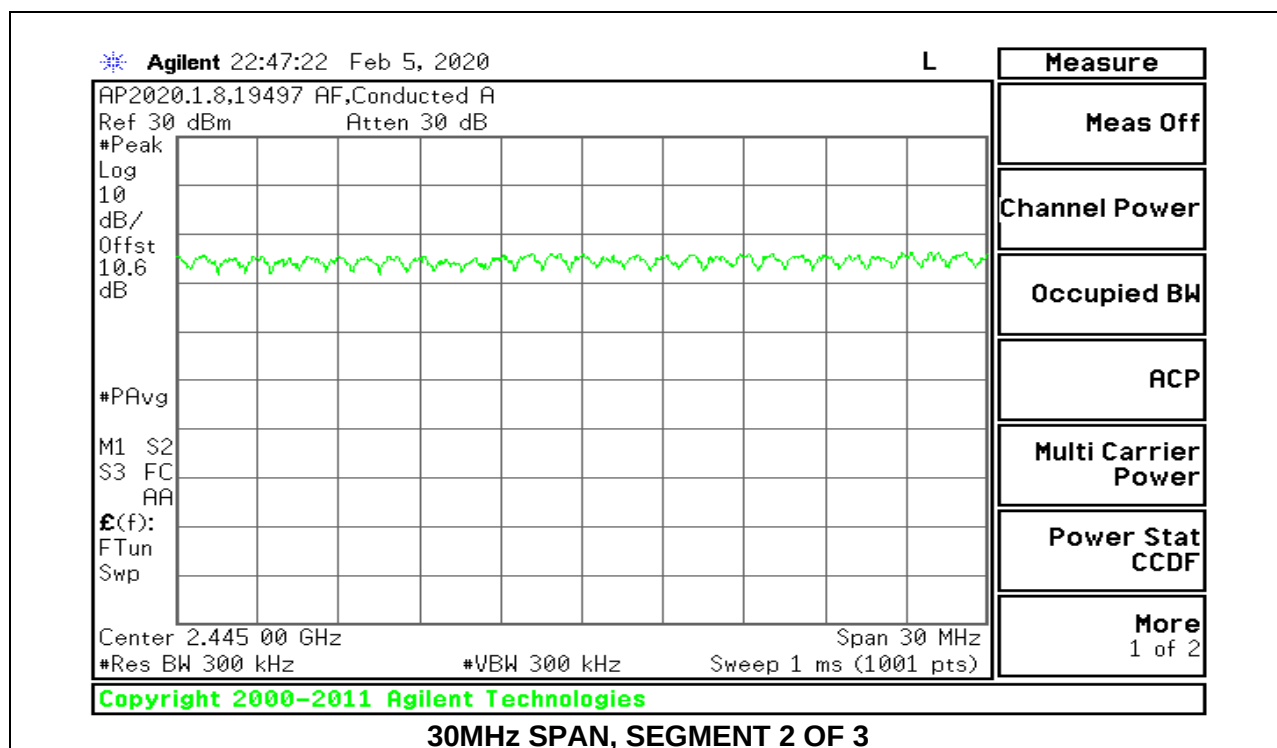
9.4.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION





9.4.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION





9.5. AVERAGE TIME OF OCCUPANCY

LIMITS

FCC §15.247 (a) (1) (iii)

RSS-247 (5.1) (d)

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

TEST PROCEDURE

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

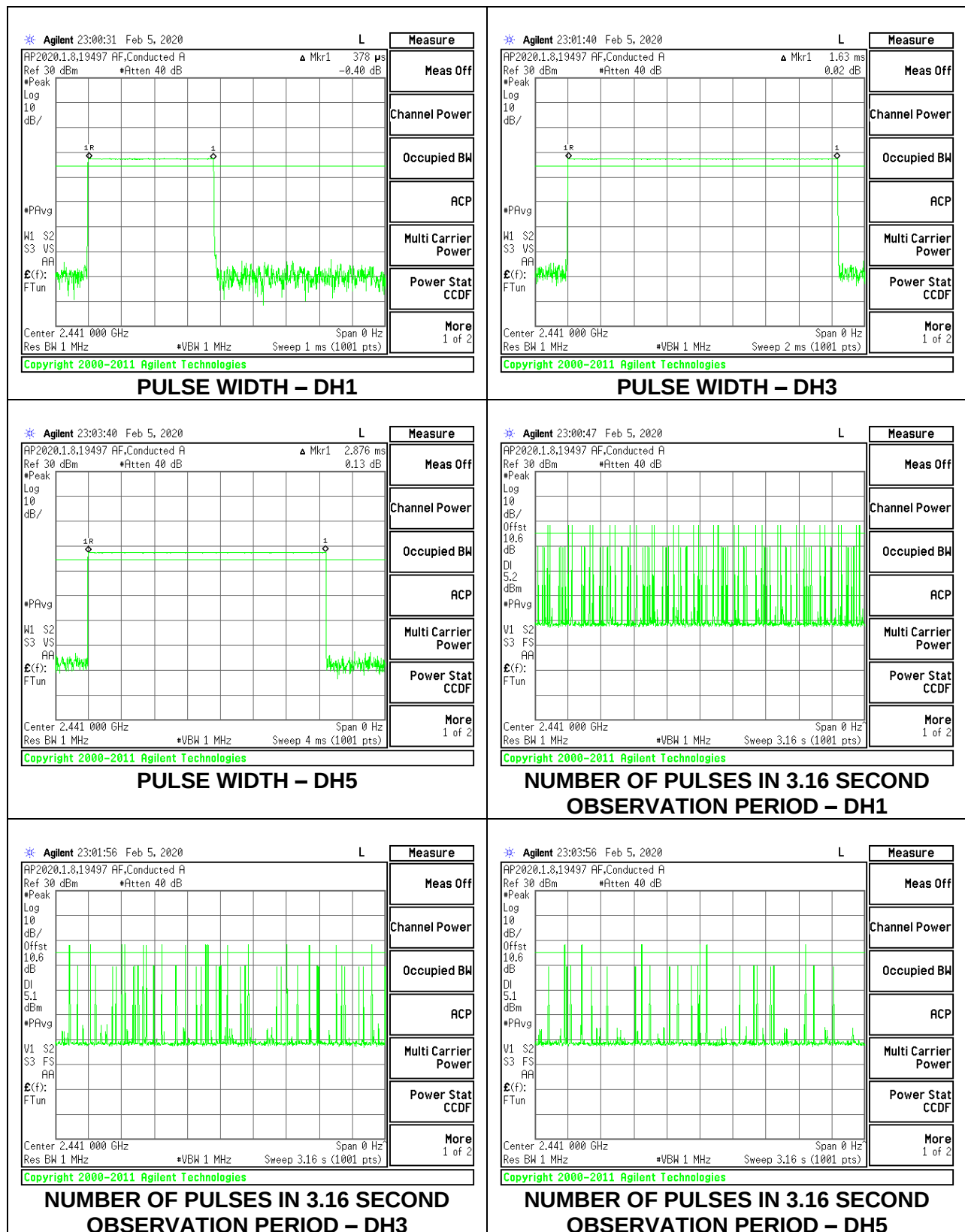
The average time of occupancy in the specified 3.16 second period (79 channels * 0.4 s) is equal to $10 * (\# \text{ of pulses in } 3.16 \text{ s}) * \text{pulse width}$.

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

9.5.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

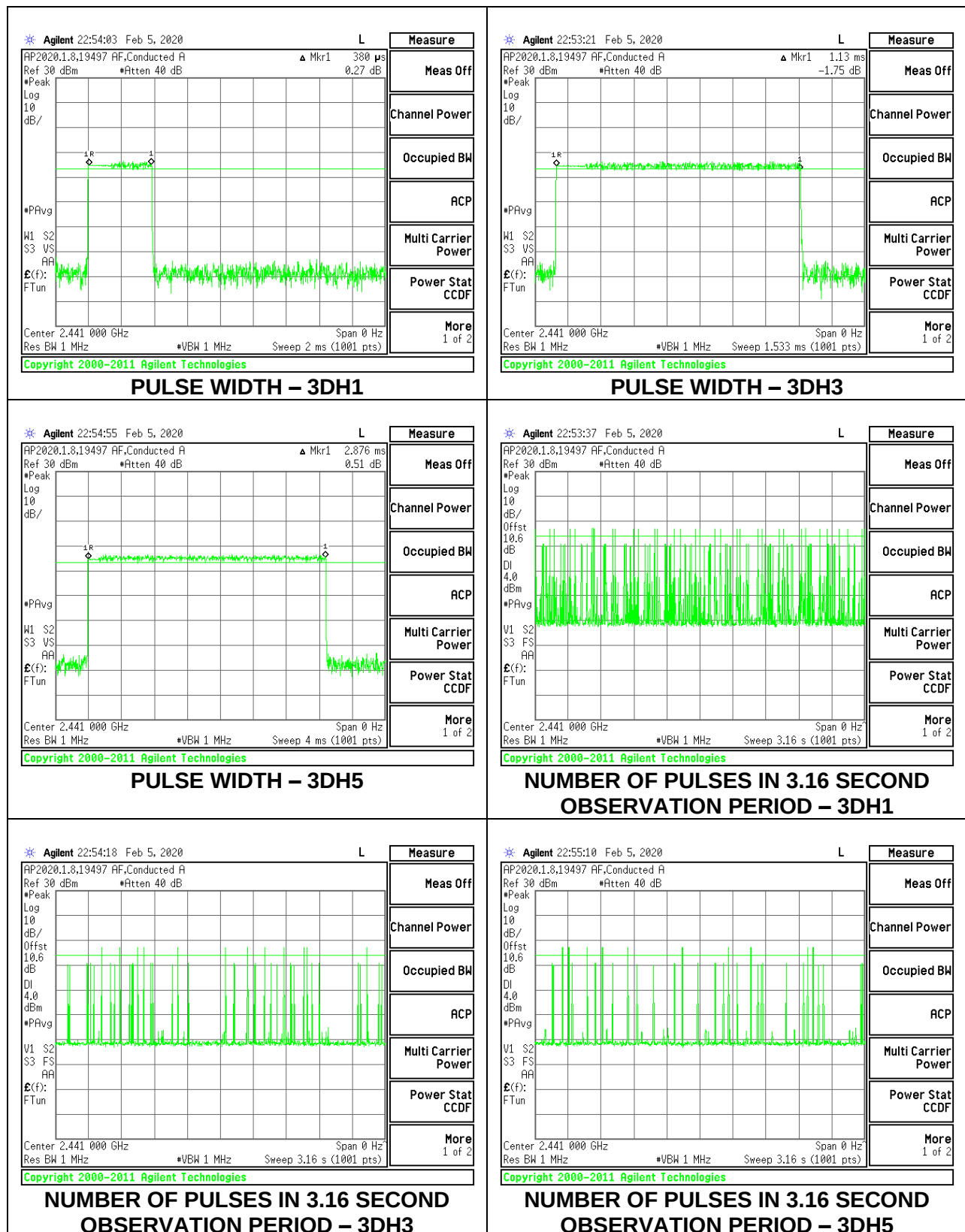
DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK Normal Mode					
DH1	0.378	32	0.1210	0.4	-0.2790
DH3	1.63	16	0.2608	0.4	-0.1392
DH5	2.876	6	0.1726	0.4	-0.2274
DH Packet	Pulse Width (msec)	Number of Pulses in 0.8 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
GFSK AFH Mode					
DH1	0.378	8	0.03024	0.4	-0.3698
DH3	1.63	4	0.06520	0.4	-0.3348
DH5	2.876	1.5	0.04314	0.4	-0.3569



9.5.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

DH Packet	Pulse Width (msec)	Number of Pulses in 3.16 seconds	Average Time of Occupancy (sec)	Limit (sec)	Margin (sec)
8PSK Normal Mode					
3DH1	0.38	33	0.1254	0.4	-0.2746
3DH3	1.13	12	0.1356	0.4	-0.2644
3DH5	2.876	10	0.2876	0.4	-0.1124

Note: for AFH(8PSK) mode, please refer to the results of AFH(GFSK) mode; the channel selection and hopping rate are the same for both EDR and Basic Rate operation, data for Basic Rate demonstrates compliance with channel occupancy when AFH is employed.



9.6. OUTPUT POWER

LIMITS

§15.247 (b) (1)

RSS-247 (5.4) (b)

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.

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion loss was entered as an offset in the power meter to allow for a peak reading of power.

RESULTS

9.6.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	16080 ZS
Date:	1/16/2020

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.07	21	-12.93
Middle	2441	8.53	21	-12.47
High	2480	9.11	21	-11.89

9.6.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	16080 ZS
Date:	1/16/2020

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.59	21	-13.41
Middle	2441	7.09	21	-13.91
High	2480	7.49	21	-13.51

9.6.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	16080 ZS
Date:	1/16/2020

Channel	Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Margin (dB)
Low	2402	7.51	21	-13.49
Middle	2441	7.03	21	-13.97
High	2480	7.32	21	-13.68

9.7. AVERAGE POWER

LIMITS

None; for reporting purposes only

TEST PROCEDURE

Measurements perform using a wideband gated RF power meter.

The cable assembly insertion loss was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

9.7.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Tested By:	16080 ZS
Date	1/16/2020

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	8.01
Middle	2441	8.47
High	2480	8.99

9.7.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Tested By:	16080 ZS
Date	1/16/2020

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	5.24
Middle	2441	4.44
High	2480	5.32

9.7.3. BLUETOOTH ENHANCED DATA RATE DQPSK MODULATION

Tested By:	16080 ZS
Date	1/16/2020

Channel	Frequency (MHz)	Average Power (dBm)
Low	2402	5.2
Middle	2441	4.4
High	2480	5.29

9.8. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

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.

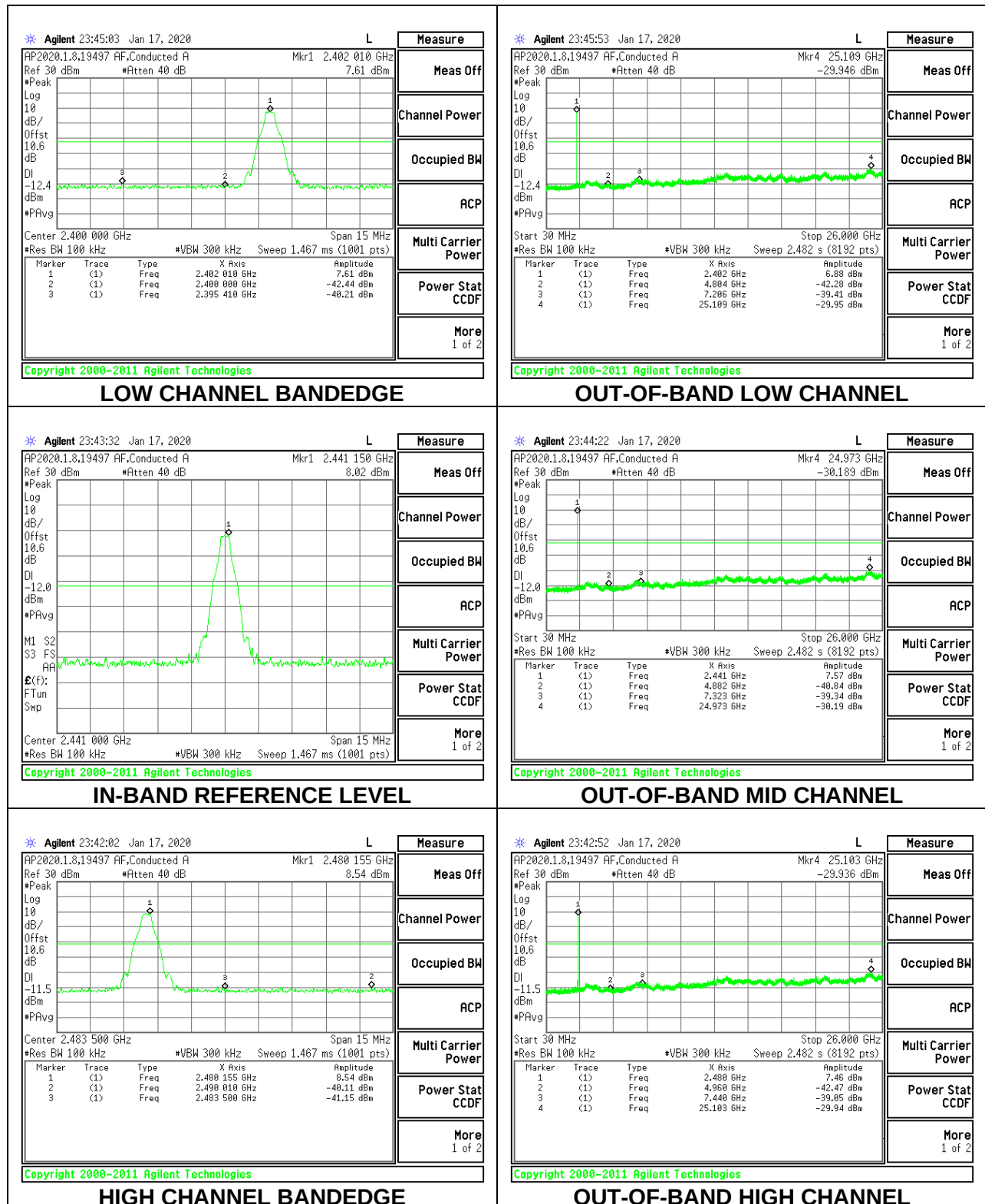
The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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

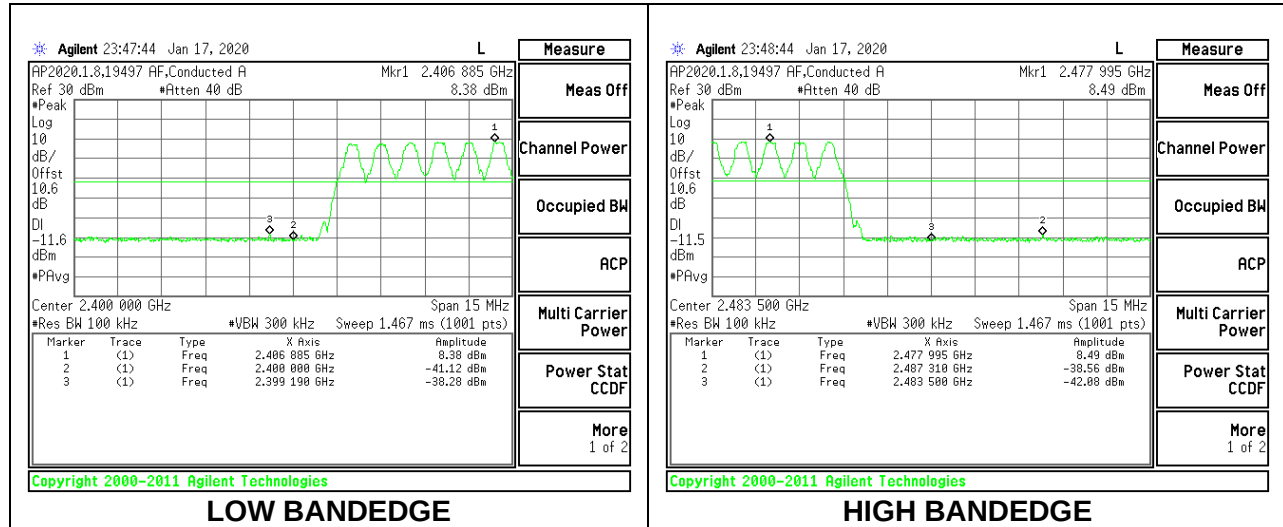
9.8.1. RESULTS

9.8.2. BLUETOOTH BASIC DATA RATE GFSK MODULATION

Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING

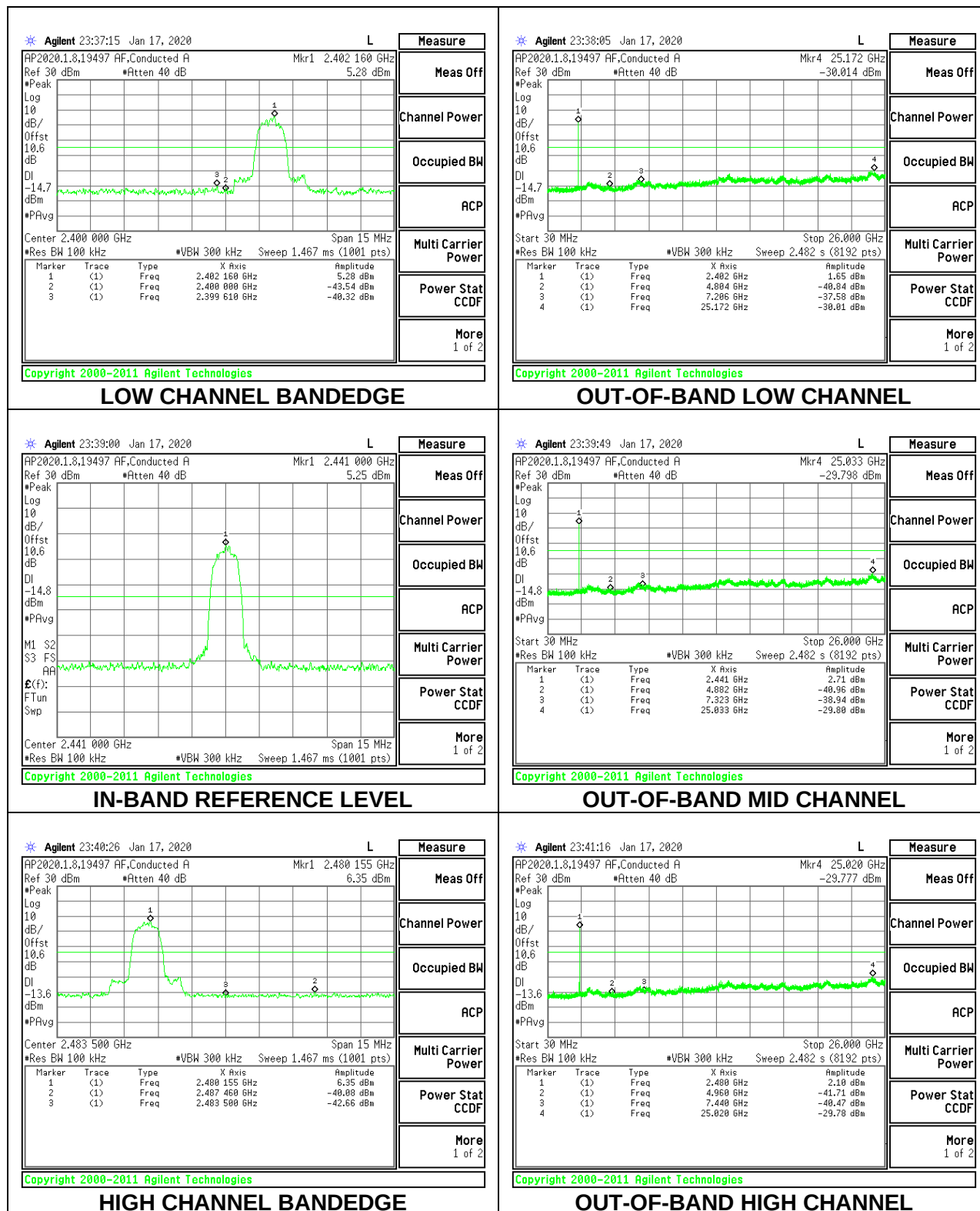


Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON

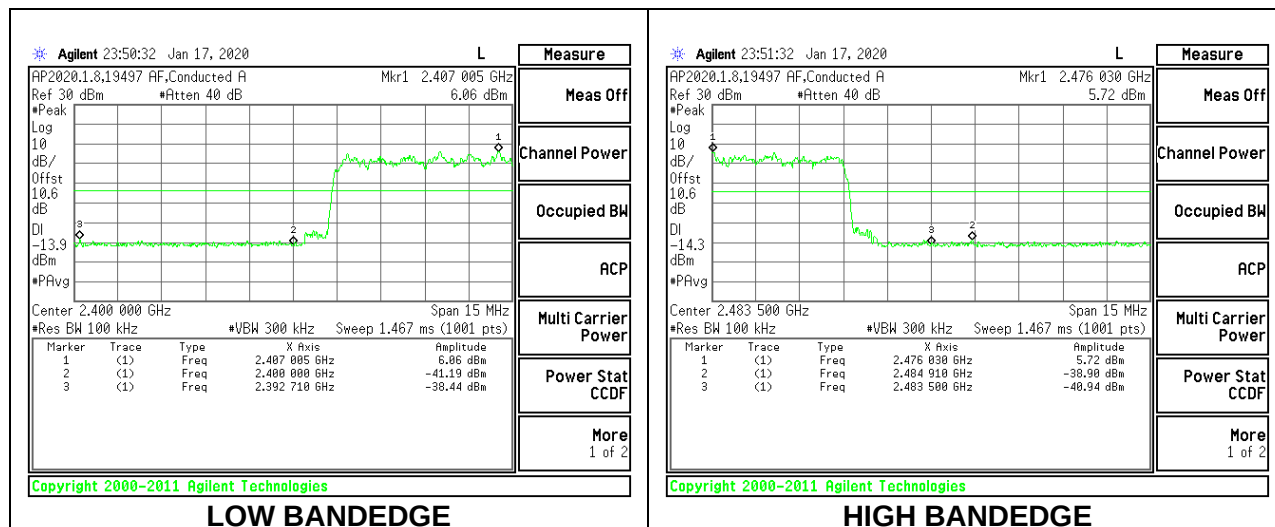


9.8.3. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

Antenna 1 SPURIOUS EMISSIONS, NON-HOPPING



Antenna 1 SPURIOUS BANDEDGE EMISSIONS WITH HOPPING ON



10. RADIATED TEST RESULTS

LIMITS

FCC §15.205 and §15.209

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
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
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 pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and 1 MHz resolution bandwidth with 1/T video bandwidth with peak detector for average measurements.

The spectrum from 1 GHz to 18 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band. Below 30MHz, below 1GHz and above 18GHz emissions, the channel with the highest output power was tested.

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.

2D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel), parallel and perpendicular are the worst orientations, therefore testing was performed on these two orientations only.

The limits in CFR 47, Part 15, Subpart C, paragraph 15.209(a), are identical to those in RSS-Gen section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table), using the free space impedance of 377 Ohms. For example the measurement at frequency X kHz resulted in a level of Y dBuV/m, which is equivalent to $Y - 51.5 = Z$ dBuA/m, which has the same margin, W dB, to the corresponding RSS-Gen Table 6 limit as it has to 15.209(a) limit.

KDB 414788 Open Field Site(OFS) and Chamber Correlation Justification

Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

OFS and chamber correlation testing had been performed and chamber measured test result is the worst case test result.

KDB 558074 D01 15.247 Meas Guidance v05r02

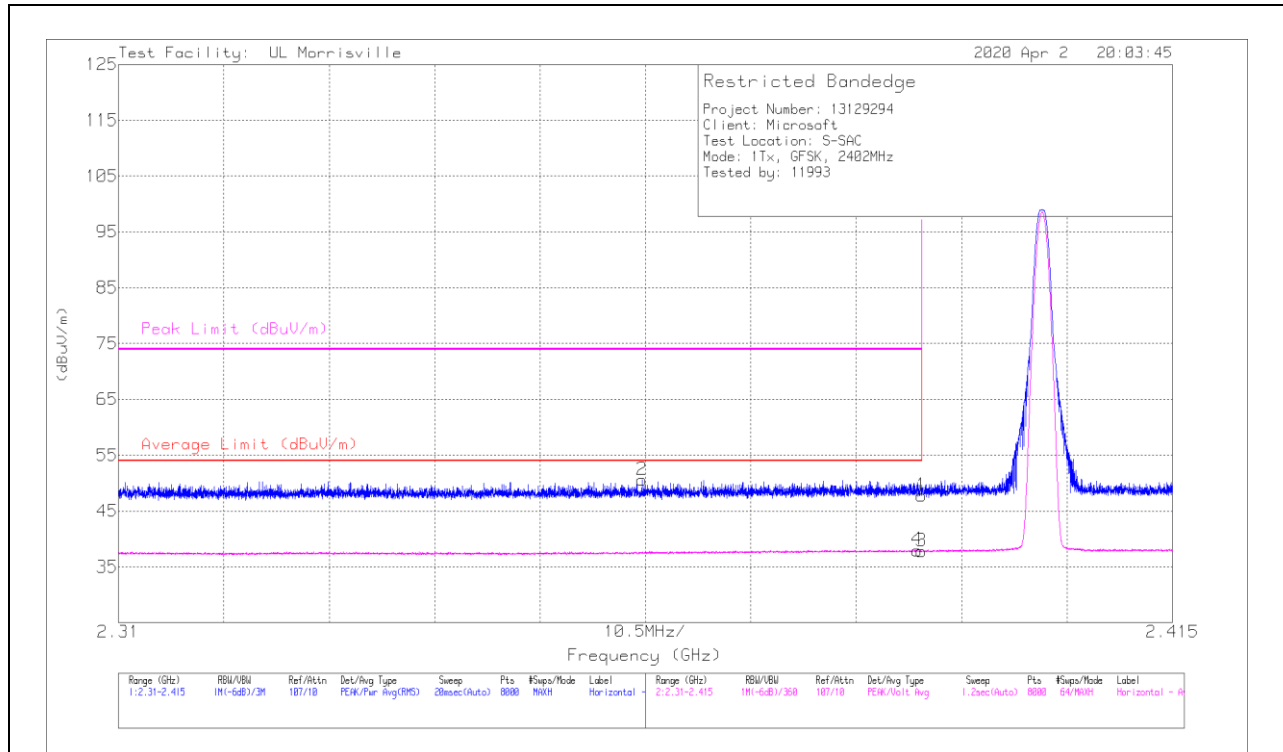
Use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.

10.1. TRANSMITTER ABOVE 1 GHz

10.1.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



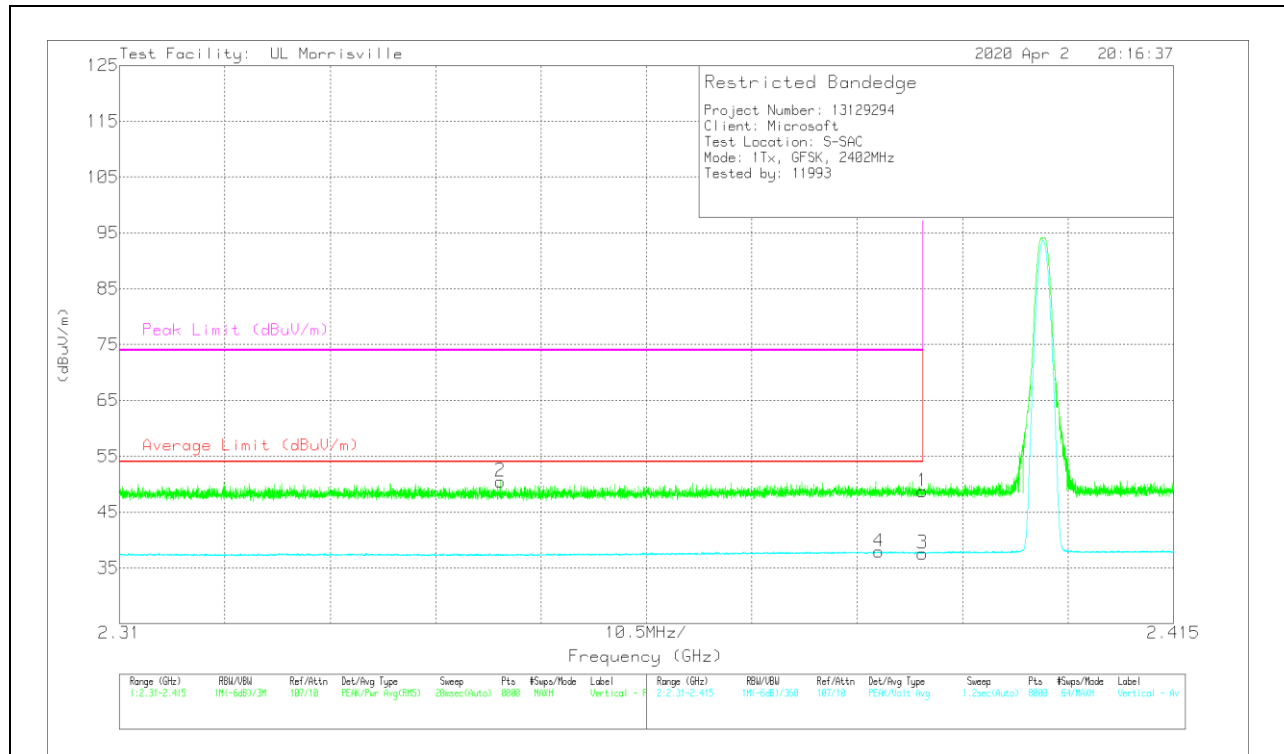
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dBm)	Amp/Cbl/Fit r/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	39.66	Pk	31.9	-23.8	47.76	-	-	74	-26.24	267	216	H
2	* 2.36215	42.8	Pk	31.7	-23.9	50.6	-	-	74	-23.4	267	216	H
3	* 2.39	29.7	V1TV	31.9	-23.8	37.8	54	-16.2	-	-	267	216	H
4	* 2.38956	29.89	V1TV	31.9	-23.8	37.99	54	-16.01	-	-	267	216	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dBm)	Amp/Cbl/Fit r/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	40.62	Pk	31.9	-23.8	48.72	-	-	74	-25.28	53	401	V
2	* 2.34796	42.81	Pk	31.6	-23.9	50.51	-	-	74	-23.49	53	401	V
3	* 2.39	29.51	V1TV	31.9	-23.8	37.61	54	-16.39	-	-	53	401	V
4	* 2.38564	29.83	V1TV	31.9	-23.8	37.93	54	-16.07	-	-	53	401	V

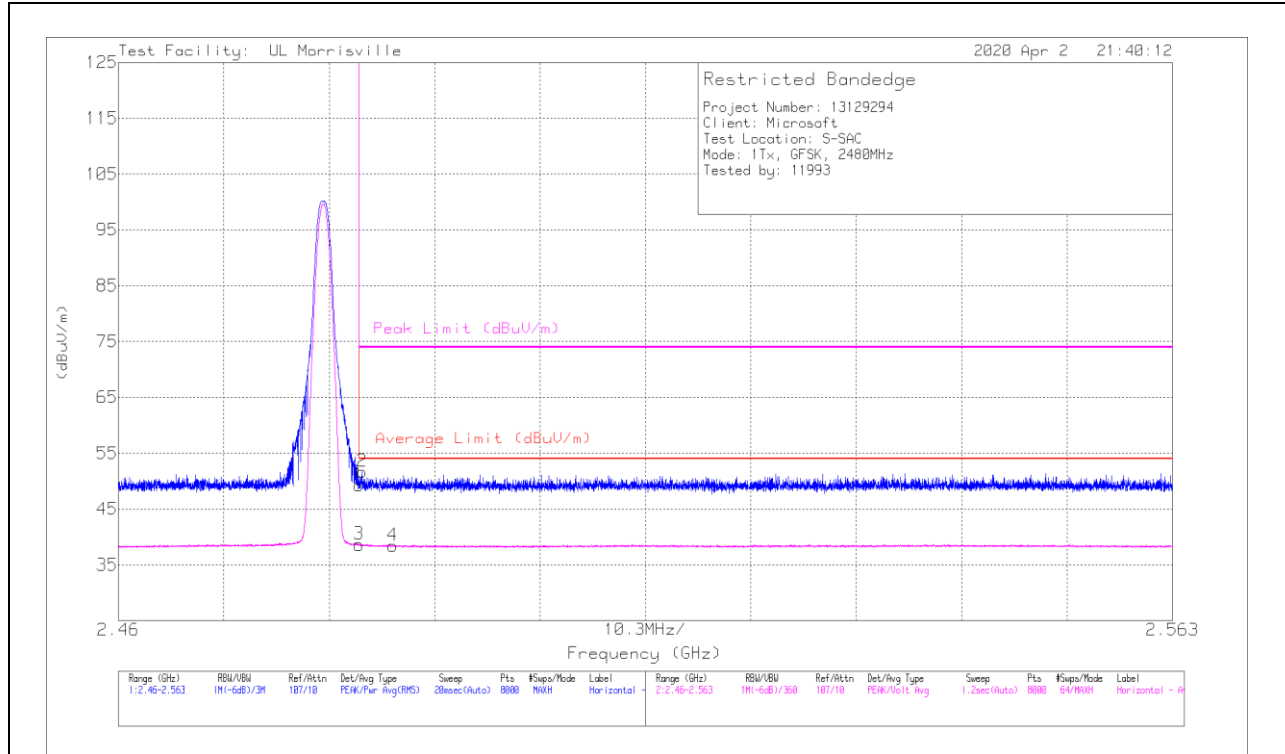
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



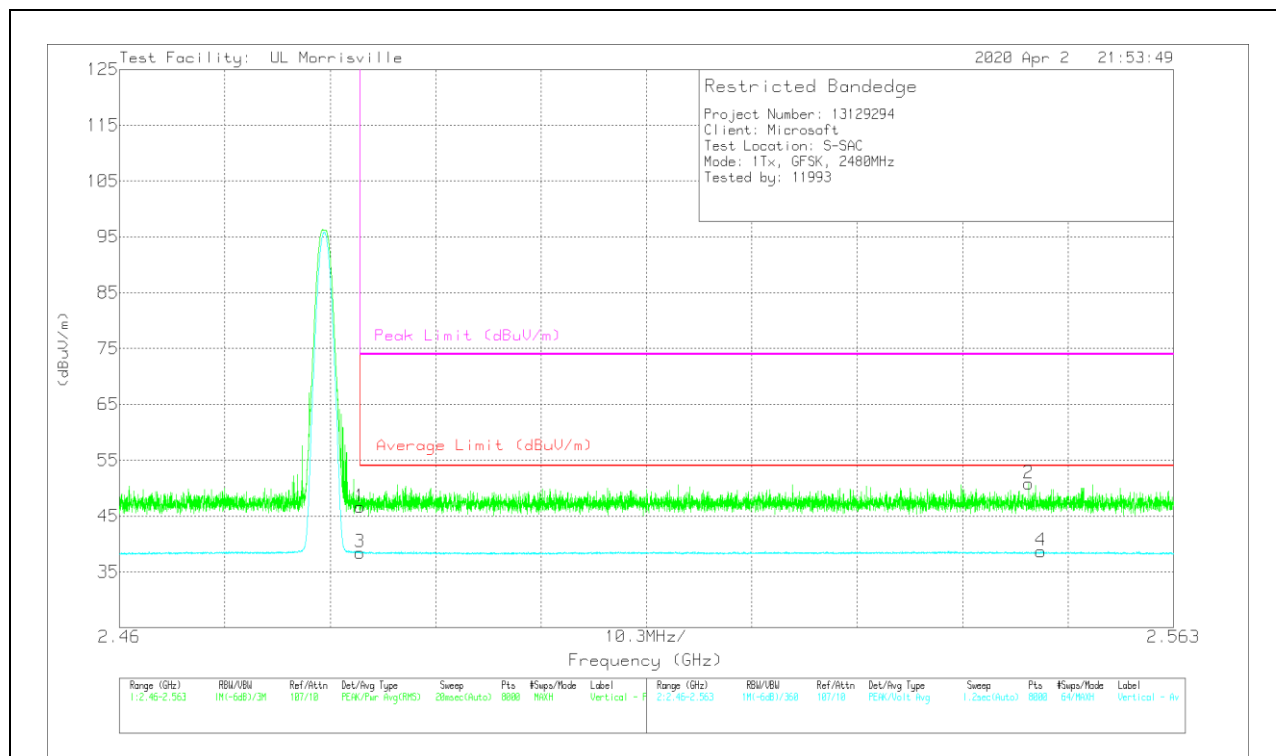
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fit r/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	40.6	Pk	32.3	-23.7	49.2	-	-	74	-24.8	51	202	H
2	* 2.48382	43.07	Pk	32.3	-23.7	51.67	-	-	74	-22.33	51	202	H
3	* 2.4835	30.02	V1TV	32.3	-23.7	38.62	54	-15.38	-	-	51	202	H
4	* 2.48681	29.83	V1TV	32.3	-23.7	38.43	54	-15.57	-	-	51	202	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dBm)	Amp/Cbl/Fit r/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	* 2.4835	38.02	Pk	32.3	-23.7	46.62	-	-	74	-27.38	81	323	V
2	2.54884	42.24	Pk	32.4	-23.8	50.84	-	-	74	-23.16	81	323	V
3	* 2.4835	29.88	V1TV	32.3	-23.7	38.48	54	-15.52	-	-	81	323	V
4	2.55005	30.13	V1TV	32.4	-23.8	38.73	54	-15.27	-	-	81	323	V

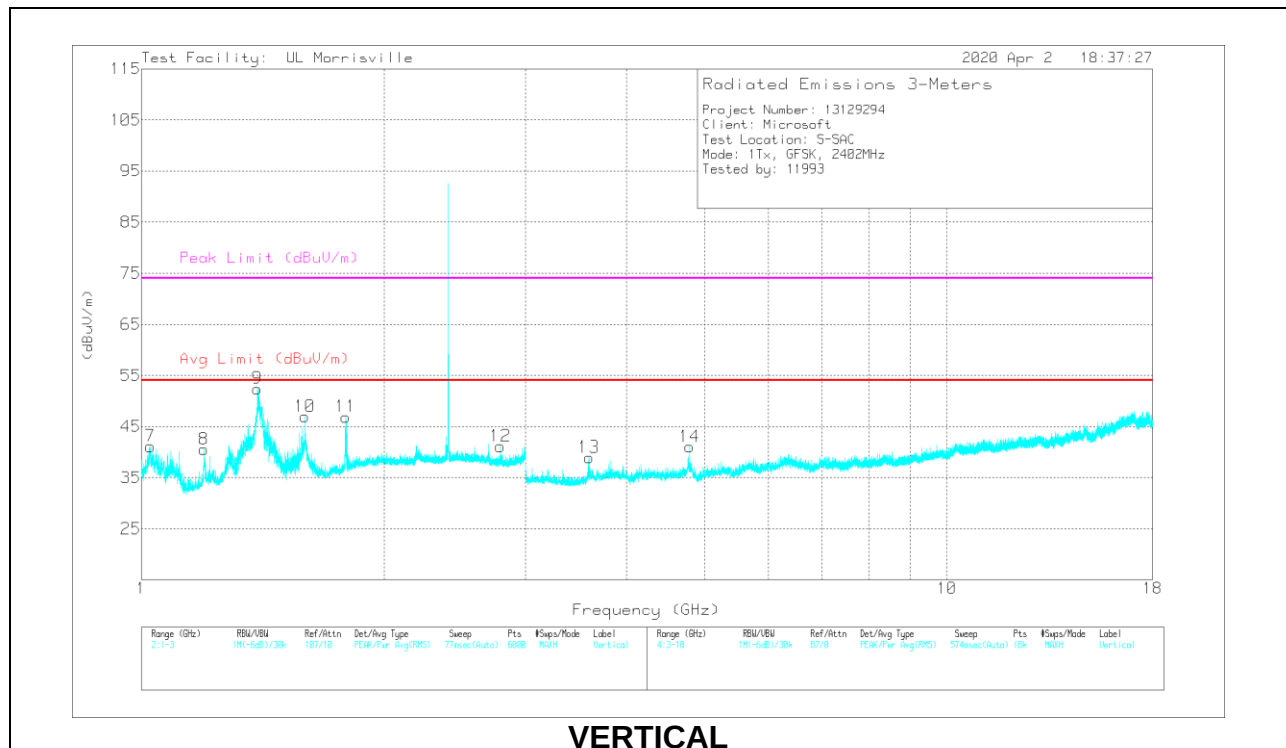
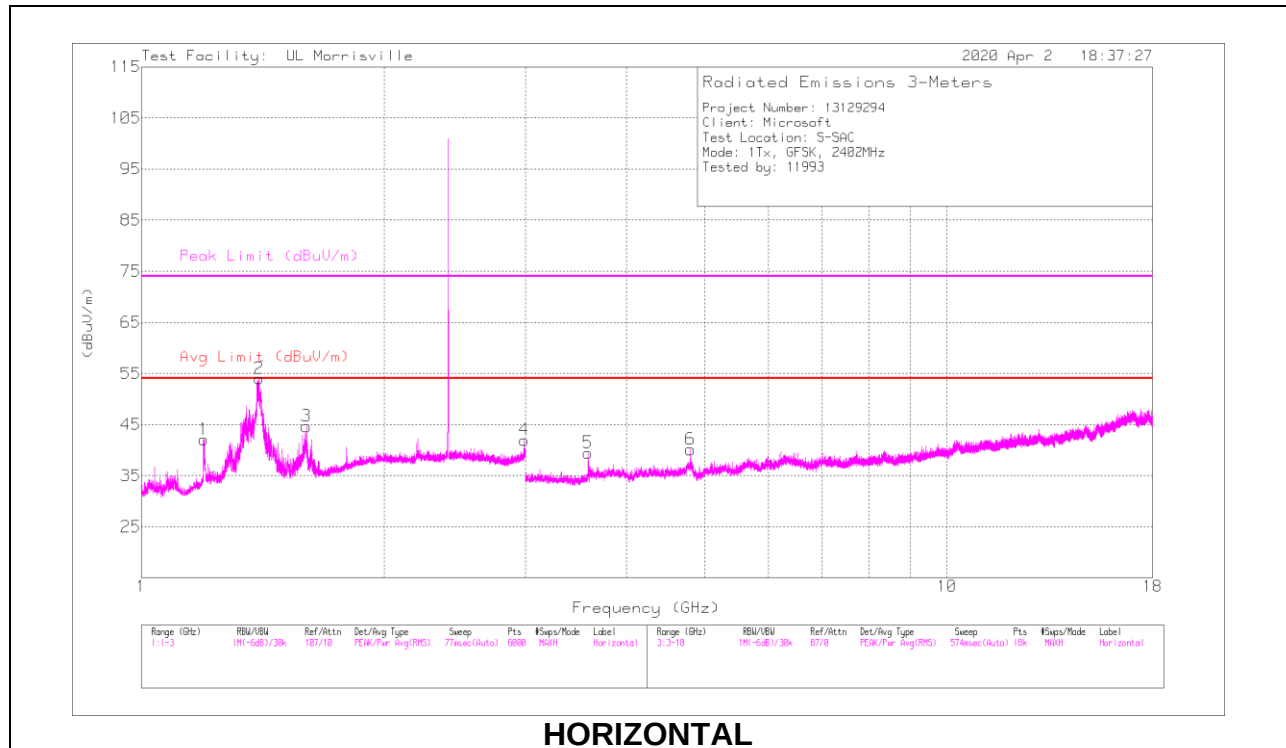
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fi tr/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	* 1.19462	44.24	PK2	28.5	-23.5	49.24	-	-	74	-24.76	287	258	H
	* 1.19483	30.4	V1TV	28.5	-23.5	35.4	54	-18.6	-	-	287	258	H
2	* 1.39758	58.79	PK2	28.7	-22.5	64.99	-	-	74	-9.01	215	235	H
	* 1.40053	41.72	V1TV	28.7	-22.4	48.02	54	-5.98	-	-	215	235	H
3	* 1.6023	45.82	PK2	27.8	-21.9	51.72	-	-	74	-22.28	152	361	H
	* 1.60237	30.61	V1TV	27.8	-21.9	36.51	54	-17.49	-	-	152	361	H
7	* 1.0278	53.55	PK2	27.2	-24.4	56.35	-	-	74	-17.65	7	244	V
	* 1.02846	29.69	V1TV	27.2	-24.4	32.49	54	-21.51	-	-	7	244	V
8	* 1.19557	44.94	PK2	28.5	-23.5	49.94	-	-	74	-24.06	225	199	V
	* 1.19521	27.3	V1TV	28.5	-23.5	32.3	54	-21.7	-	-	225	199	V
9	* 1.39521	54.24	PK2	28.8	-22.5	60.54	-	-	74	-13.46	206	170	V
	* 1.3934	37.26	V1TV	28.8	-22.5	43.56	54	-10.44	-	-	206	170	V
10	* 1.59583	49.6	PK2	27.8	-21.9	55.5	-	-	74	-18.5	28	339	V
	* 1.5955	33.18	V1TV	27.8	-21.9	39.08	54	-14.92	-	-	28	339	V
12	* 2.79091	42.65	PK2	32.2	-25.5	49.35	-	-	74	-24.65	153	187	V
	* 2.78863	26.63	V1TV	32.2	-25.5	33.33	54	-20.67	-	-	153	187	V
5	* 3.58762	46.5	PK2	32.9	-31.4	48	-	-	74	-26	106	248	H
	* 3.58724	29.58	V1TV	32.9	-31.4	31.08	54	-22.92	-	-	106	248	H
6	* 4.80378	42.78	PK2	34.2	-30.7	46.28	-	-	74	-27.72	7	122	H
	* 4.80403	33.69	V1TV	34.2	-30.7	37.19	54	-16.81	-	-	7	122	H
13	* 3.59384	48.67	PK2	32.9	-31.4	50.17	-	-	74	-23.83	168	131	V
	* 3.59403	30.44	V1TV	32.9	-31.4	31.94	54	-22.06	-	-	168	131	V
14	* 4.79374	45.88	PK2	34.2	-30.6	49.48	-	-	74	-24.52	227	187	V
	* 4.79422	29.4	V1TV	34.2	-30.7	32.9	54	-21.1	-	-	227	187	V
11	1.79313	38.9	Pk	30	-22	46.9	-	-	-	-	0-360	199	V
4	2.98633	34.5	Pk	33	-25.5	42	-	-	-	-	0-360	199	H

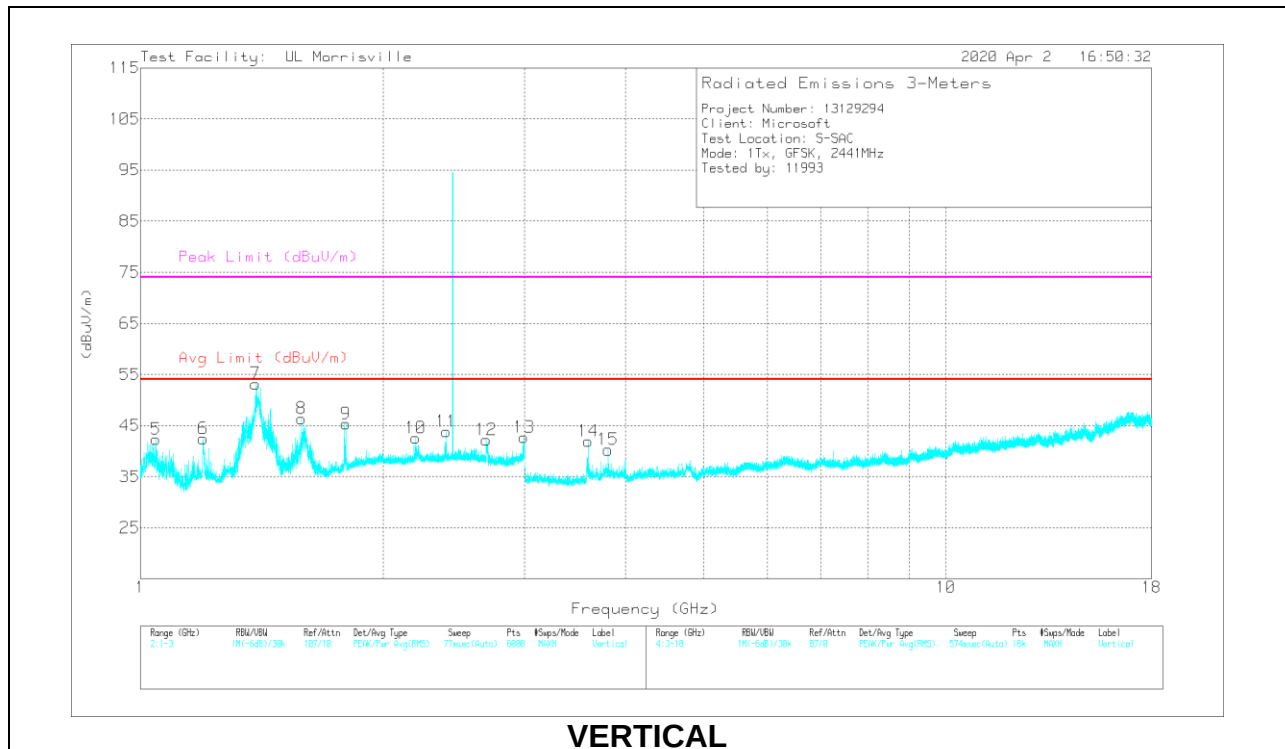
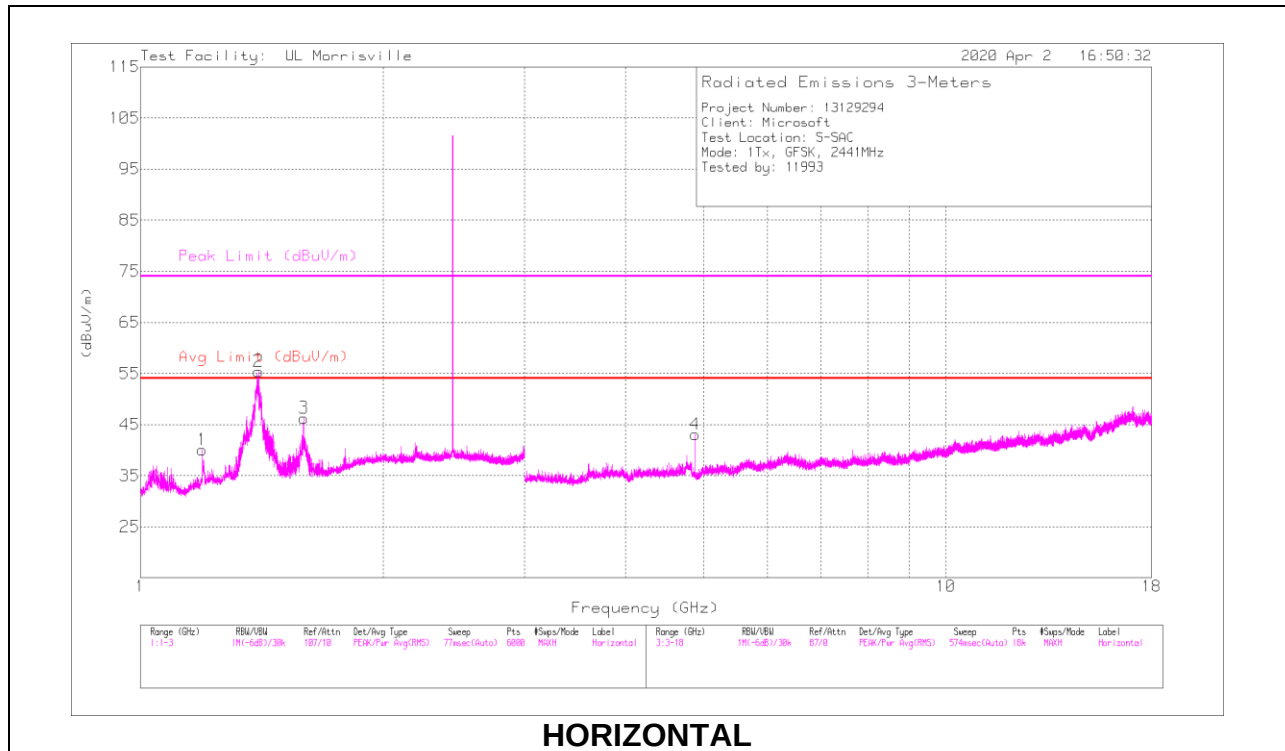
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

Pk - Peak detector

MID CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/FI tr/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	* 1.19543	46.98	PK2	28.5	-23.5	51.98	-	-	74	-22.02	293	271	H
	* 1.19502	28.82	V1TV	28.5	-23.5	33.82	54	-20.18	-	-	293	271	H
2	* 1.40197	55.33	PK2	28.7	-22.4	61.63	-	-	74	-12.37	5	269	H
	* 1.39865	41.59	V1TV	28.7	-22.4	47.89	54	-6.11	-	-	5	269	H
3	* 1.59517	49.52	PK2	27.8	-21.9	55.42	-	-	74	-18.58	161	255	H
	* 1.59603	32.7	V1TV	27.8	-21.9	38.6	54	-15.4	-	-	161	255	H
5	* 1.04566	45.92	PK2	27	-24.3	48.62	-	-	74	-25.38	204	142	V
	* 1.04551	29.85	V1TV	27	-24.3	32.55	54	-21.45	-	-	204	142	V
6	* 1.19827	42.67	PK2	28.6	-23.4	47.87	-	-	74	-26.13	345	165	V
	* 1.19867	25.67	V1TV	28.6	-23.4	30.87	54	-23.13	-	-	345	165	V
7	* 1.39198	55.23	PK2	28.9	-22.5	61.63	-	-	74	-12.37	212	174	V
	* 1.39306	40.38	V1TV	28.8	-22.5	46.68	54	-7.32	-	-	212	174	V
8	* 1.58414	48.17	PK2	27.9	-22	54.07	-	-	74	-19.93	38	212	V
	* 1.58395	31.51	V1TV	27.9	-22	37.41	54	-16.59	-	-	38	212	V
12	* 2.68956	41.48	PK2	32.3	-25.2	48.58	-	-	74	-25.42	237	148	V
	* 2.68937	26.26	V1TV	32.3	-25.2	33.36	54	-20.64	-	-	237	148	V
4	* 4.88166	43.45	PK2	34	-30.3	47.15	-	-	74	-26.85	353	101	H
	* 4.88197	36.54	V1TV	34	-30.3	40.24	54	-13.76	-	-	353	101	H
14	* 3.59853	50.76	PK2	32.9	-31.4	52.26	-	-	74	-21.74	235	212	V
	* 3.59862	29.7	V1TV	32.9	-31.4	31.2	54	-22.8	-	-	235	212	V
15	* 3.80659	42.68	PK2	33.5	-32	44.18	-	-	74	-29.82	173	156	V
	* 3.80584	29.66	V1TV	33.5	-32	31.16	54	-22.84	-	-	173	156	V
9	1.80013	37.23	Pk	30.1	-22	45.33	-	-	-	-	0-360	199	V
10	2.1972	33.99	Pk	31.4	-22.8	42.59	-	-	-	-	0-360	199	V
11	2.39757	35.51	Pk	31.9	-23.6	43.81	-	-	-	-	0-360	199	V
13	2.99467	35.18	Pk	33	-25.5	42.68	-	-	-	-	0-360	199	V

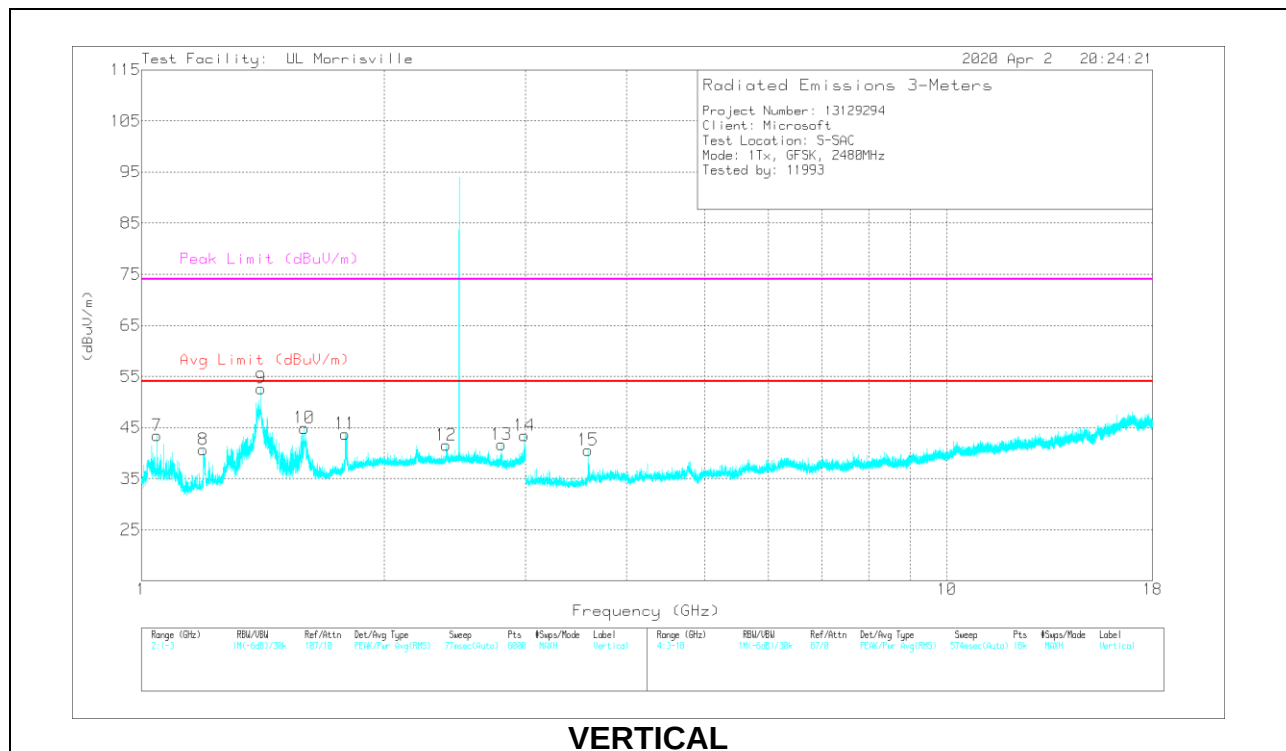
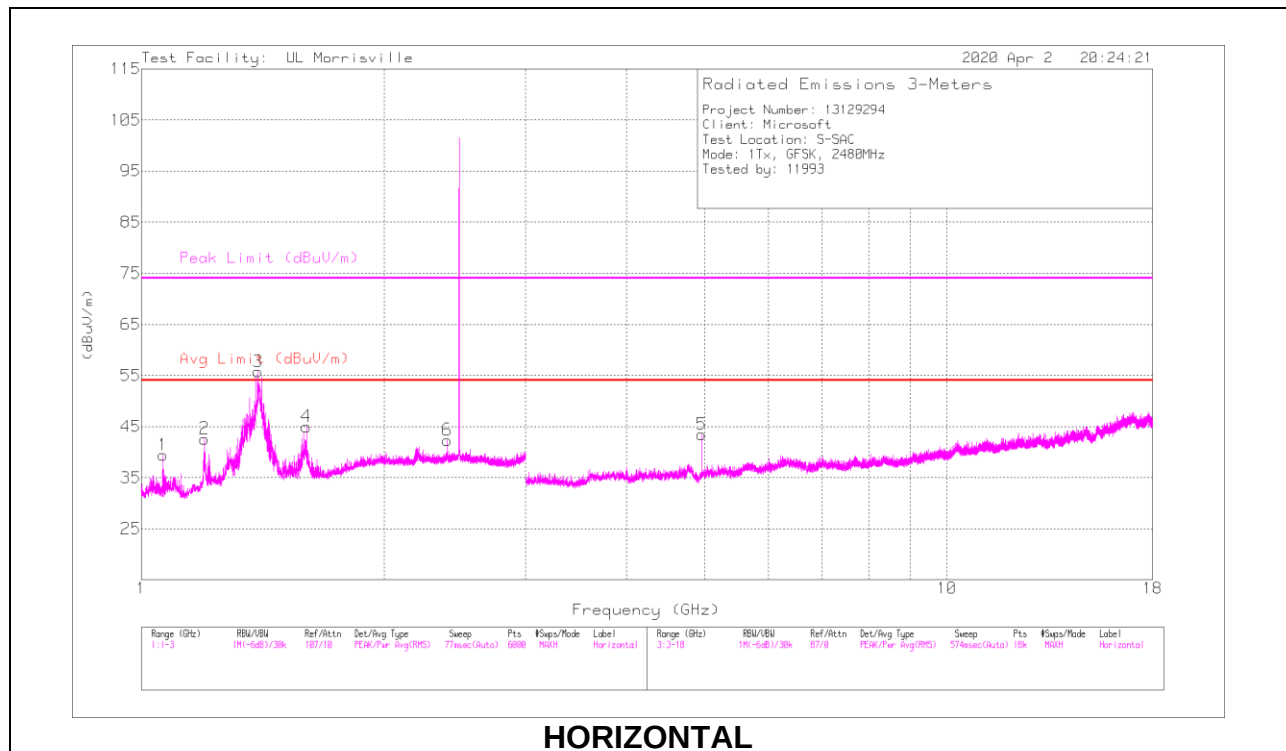
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

Pk - Peak detector

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/FI tr/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	* 1.06384	47.45	PK2	27.1	-24.2	50.35	-	-	74	-23.65	322	294	H
	* 1.06172	27.36	V1TV	27.1	-24.2	30.26	54	-23.74	-	-	322	294	H
2	* 1.19829	44.1	PK2	28.6	-23.4	49.3	-	-	74	-24.7	67	215	H
	* 1.19923	28.03	V1TV	28.6	-23.4	33.23	54	-20.77	-	-	67	215	H
3	* 1.39241	58.81	PK2	28.8	-22.5	65.11	-	-	74	-8.89	204	216	H
	* 1.39475	44.31	V1TV	28.8	-22.5	50.61	54	-3.39	-	-	204	216	H
4	* 1.60008	47.47	PK2	27.8	-21.9	53.37	-	-	74	-20.63	154	283	H
	* 1.60091	31.25	V1TV	27.8	-21.9	37.15	54	-16.85	-	-	154	283	H
7	* 1.04955	49.18	PK2	27	-24.3	51.88	-	-	74	-22.12	359	203	V
	* 1.04688	29.15	V1TV	27	-24.3	31.85	54	-22.15	-	-	359	203	V
8	* 1.19478	44.5	PK2	28.5	-23.5	49.5	-	-	74	-24.5	225	136	V
	* 1.19437	28.24	V1TV	28.5	-23.5	33.24	54	-20.76	-	-	225	136	V
9	* 1.40742	54.61	PK2	28.6	-22.4	60.81	-	-	74	-13.19	222	234	V
	* 1.40721	39.2	V1TV	28.6	-22.4	45.4	54	-8.6	-	-	222	234	V
10	* 1.59431	47.64	PK2	27.8	-21.9	53.54	-	-	74	-20.46	36	387	V
	* 1.5954	32.29	V1TV	27.8	-21.9	38.19	54	-15.81	-	-	36	387	V
13	* 2.79852	41.31	PK2	32.2	-25.5	48.01	-	-	74	-25.99	187	174	V
	* 2.79804	26.93	V1TV	32.2	-25.5	33.63	54	-20.37	-	-	187	174	V
5	* 4.96029	44.07	PK2	34.1	-30.6	47.57	-	-	74	-26.43	357	118	H
	* 4.96001	37.54	V1TV	34.1	-30.6	41.04	54	-12.96	-	-	357	118	H
15	* 3.5829	49.72	PK2	32.9	-31.4	51.22	-	-	74	-22.78	235	237	V
	* 3.58282	31.56	V1TV	32.9	-31.4	33.06	54	-20.94	-	-	235	237	V
11	1.79013	35.75	Pk	30	-22	43.75	-	-	-	-	0-360	101	V
12	2.39057	33.29	Pk	31.9	-23.6	41.59	-	-	-	-	0-360	199	V
6	2.39623	34.06	Pk	31.9	-23.6	42.36	-	-	-	-	0-360	199	H
14	2.98933	35.95	Pk	33	-25.5	43.45	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

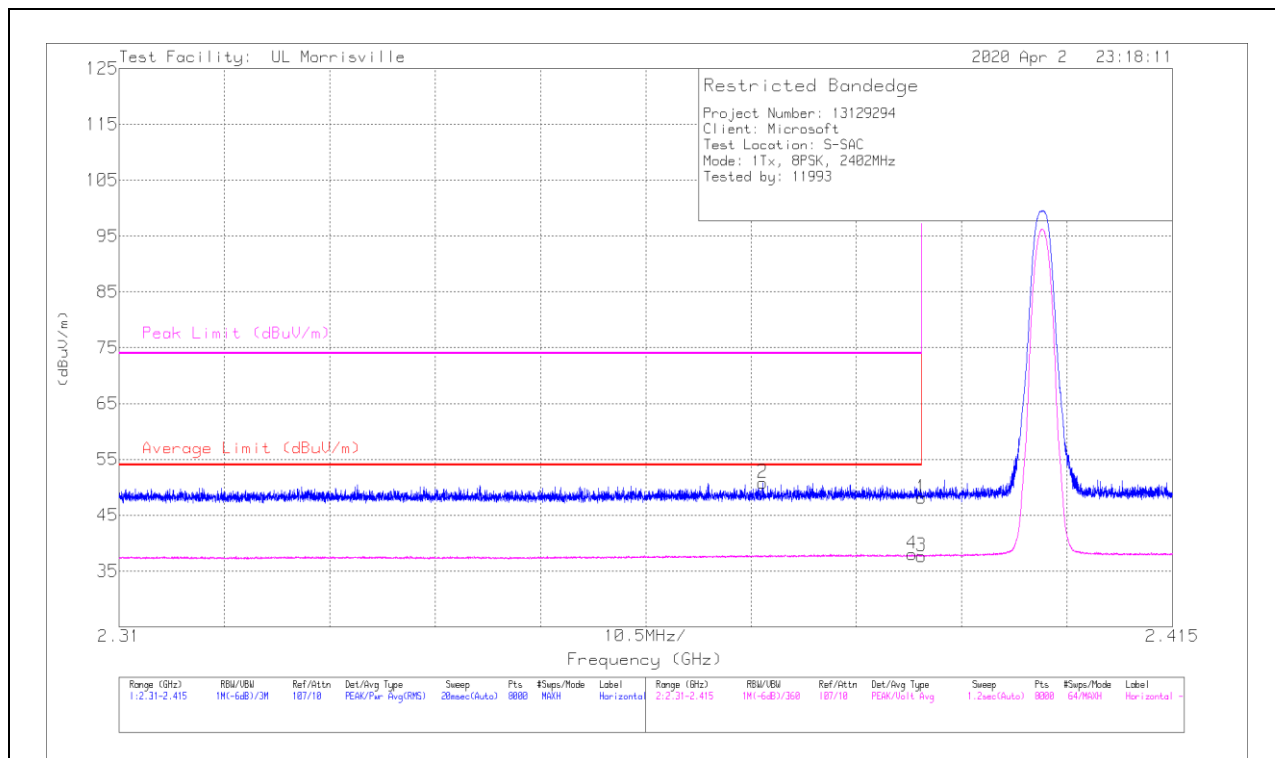
V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

Pk - Peak detector

10.1.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



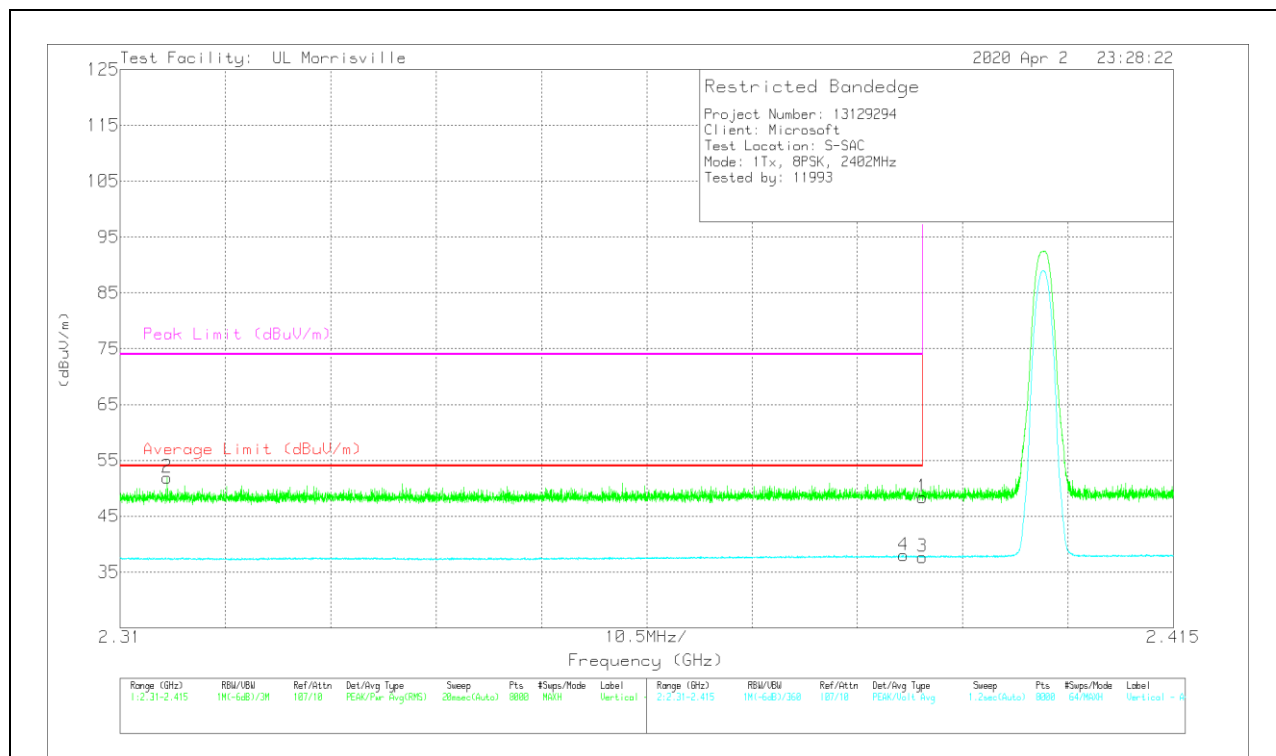
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dBm)	Amp/Cbl/Fit r/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.39	40.04	Pk	31.9	-23.8	48.14	-	-	74	-25.86	9	111	H
2	* 2.37418	42.93	Pk	31.8	-23.9	50.83	-	-	74	-23.17	9	111	H
3	* 2.39	29.6	V1TV	31.9	-23.8	37.7	54	-16.3	-	-	9	111	H
4	* 2.38905	29.98	V1TV	31.9	-23.8	38.08	54	-15.92	-	-	9	111	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dBm)	Amp/Cbl/Fit r/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	40.32	Pk	31.9	-23.8	48.42	-	-	74	-25.58	47	341	V
2	* 2.31469	44.24	Pk	31.7	-24	51.94	-	-	74	-22.06	47	341	V
3	* 2.39	29.61	V1TV	31.9	-23.8	37.71	54	-16.29	-	-	47	341	V
4	* 2.38808	29.92	V1TV	31.9	-23.8	38.02	54	-15.98	-	-	47	341	V

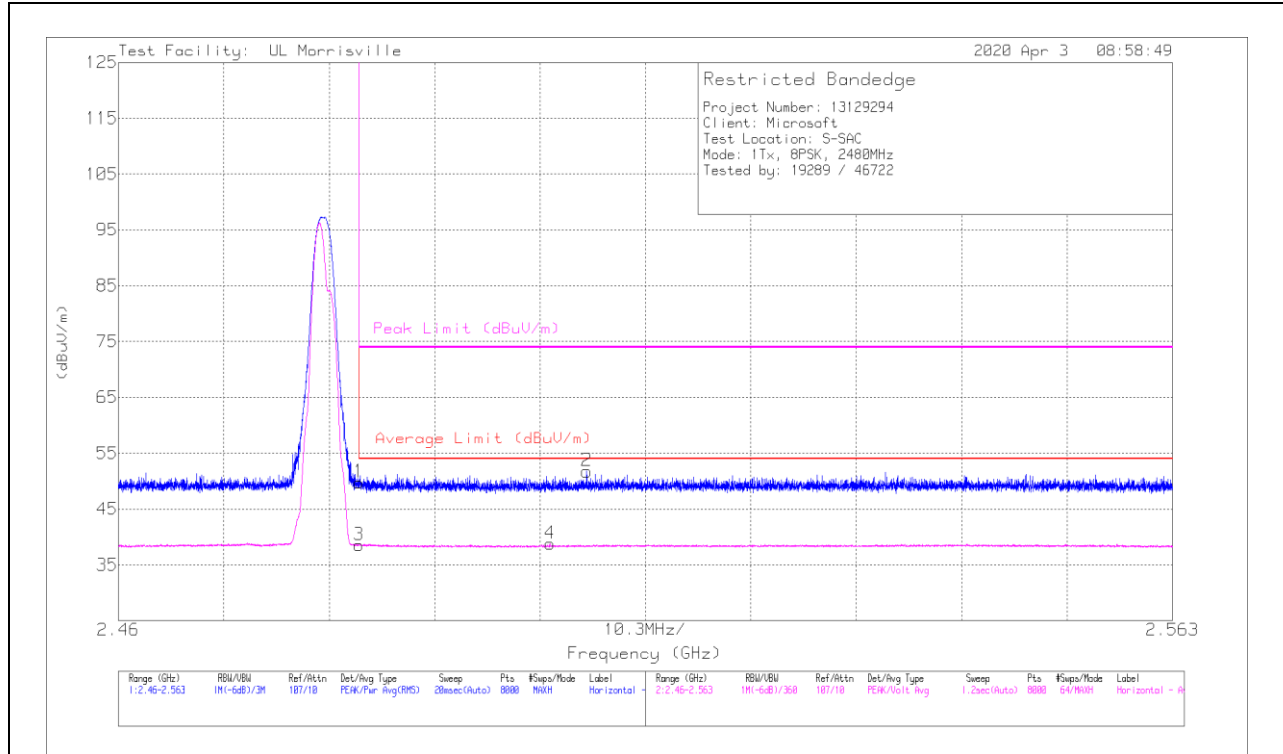
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



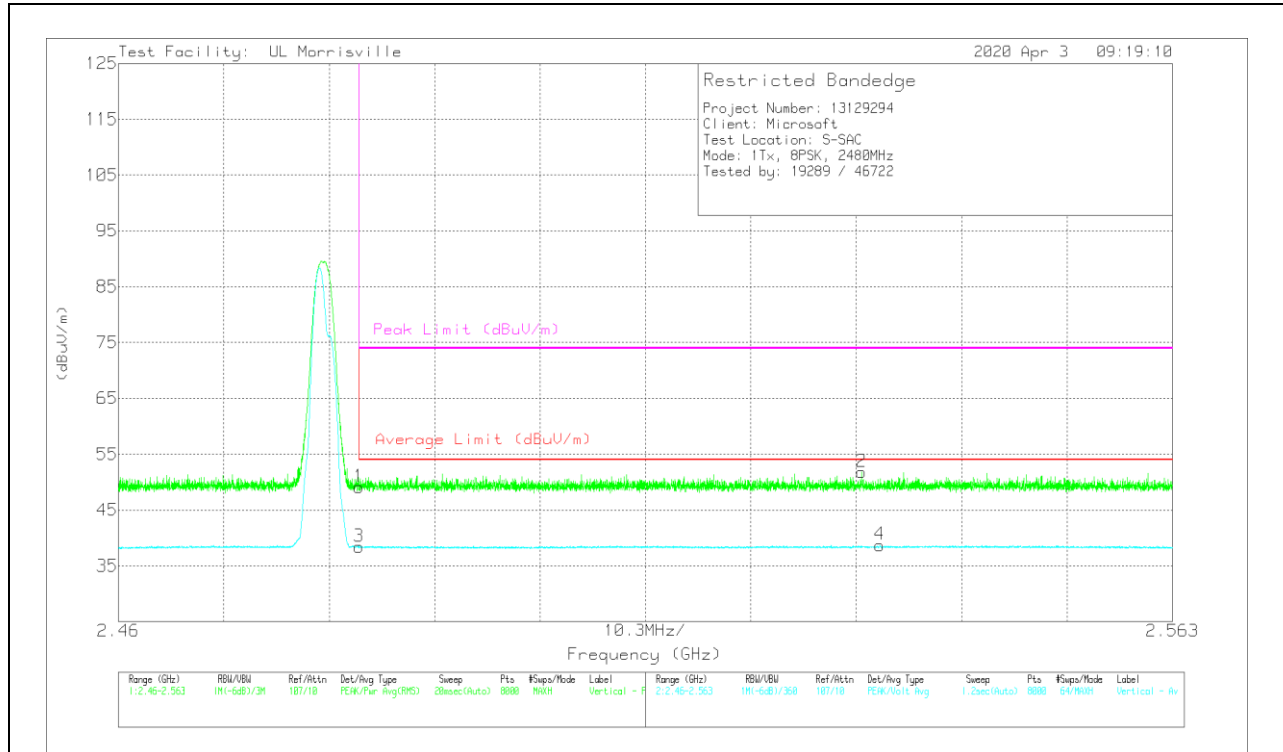
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dBm)	Ampl/Chirp/Tr/P ad (dB)	Fixture Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 2.4835	41.17	Pk	32.3	-23.7	0	49.77	-	-	74	-24.23	33	161	H
2	2.50577	43.17	Pk	32.4	-23.8	0	51.77	-	-	74	-22.23	33	161	H
3	* 2.4835	29.93	V1TV	32.3	-23.7	0	38.53	54	-15.47	-	-	33	161	H
4	2.50216	30.16	V1TV	32.4	-23.8	0	38.76	54	-15.24	-	-	33	161	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dBm)	Ampl/Cbl/Fit r/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	* 2.4835	40.52	Pk	32.3	-23.7	49.12	-	-	74	-24.88	242	362	V
2	2.53264	43.19	Pk	32.4	-23.8	51.79	-	-	74	-22.21	242	362	V
3	* 2.4835	29.79	V1TV	32.3	-23.7	38.39	54	-15.61	-	-	242	362	V
4	2.5344	30.13	V1TV	32.4	-23.8	38.73	54	-15.27	-	-	242	362	V

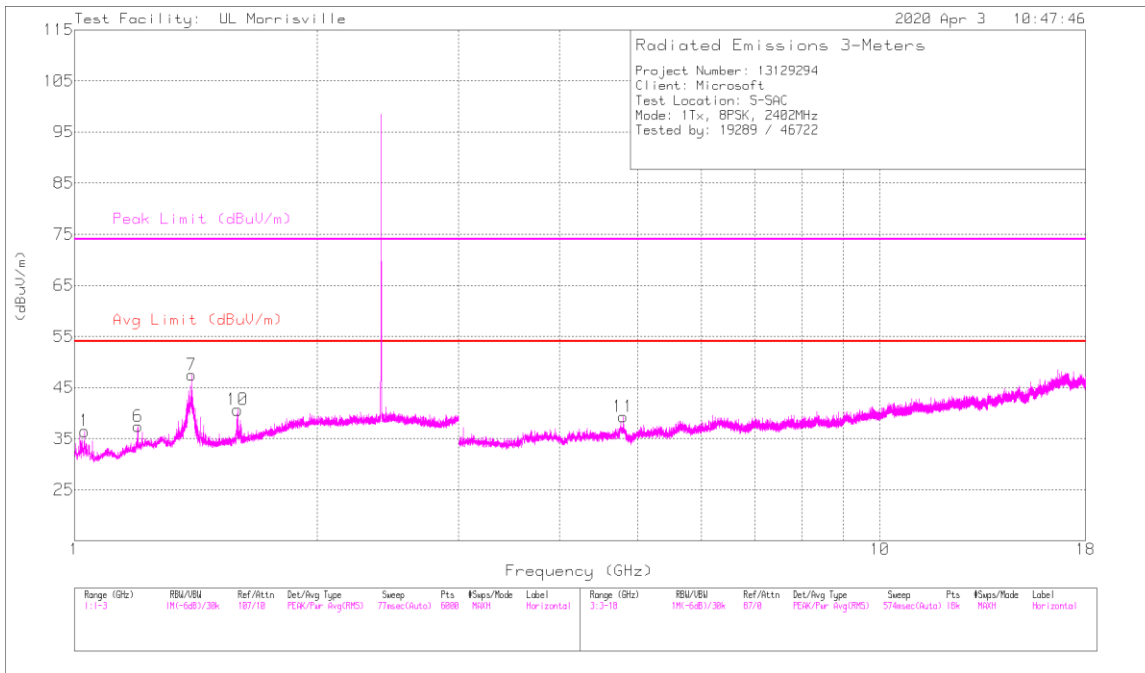
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

Pk - Peak detector

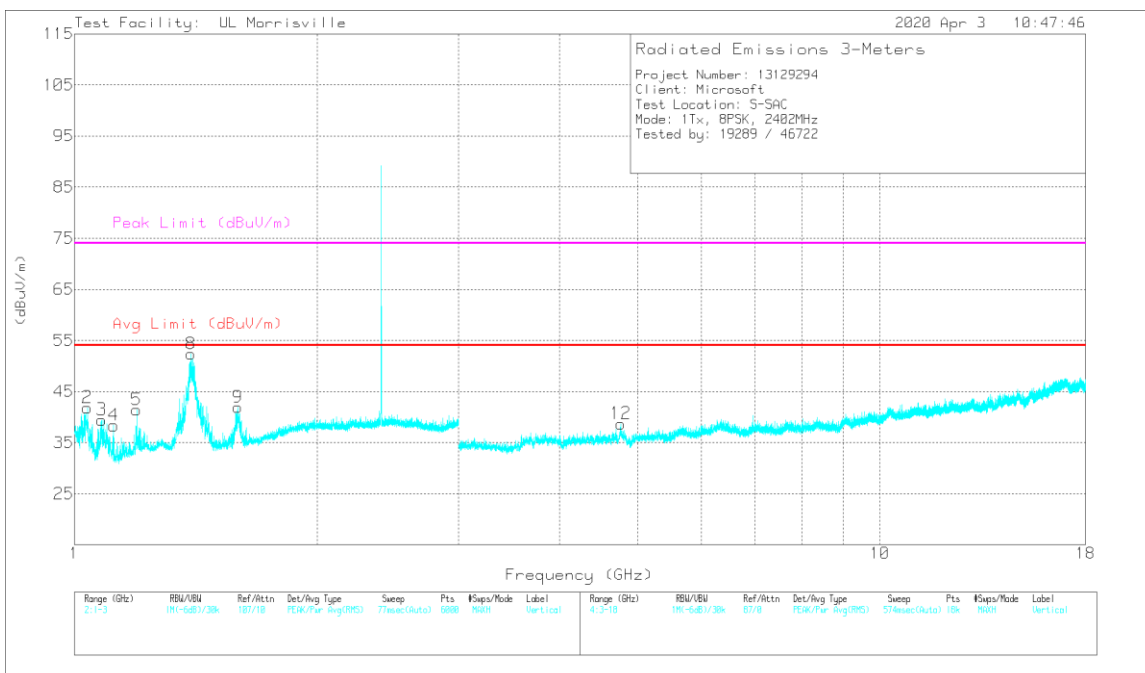
V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

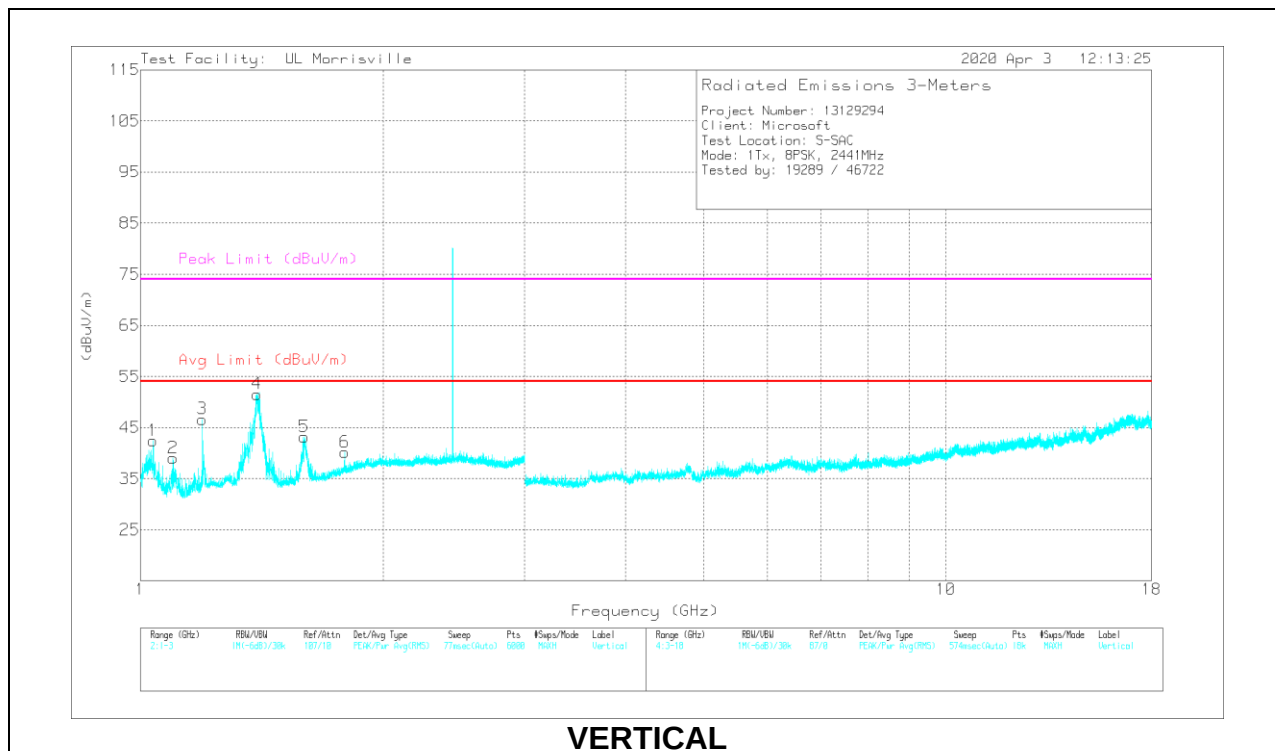
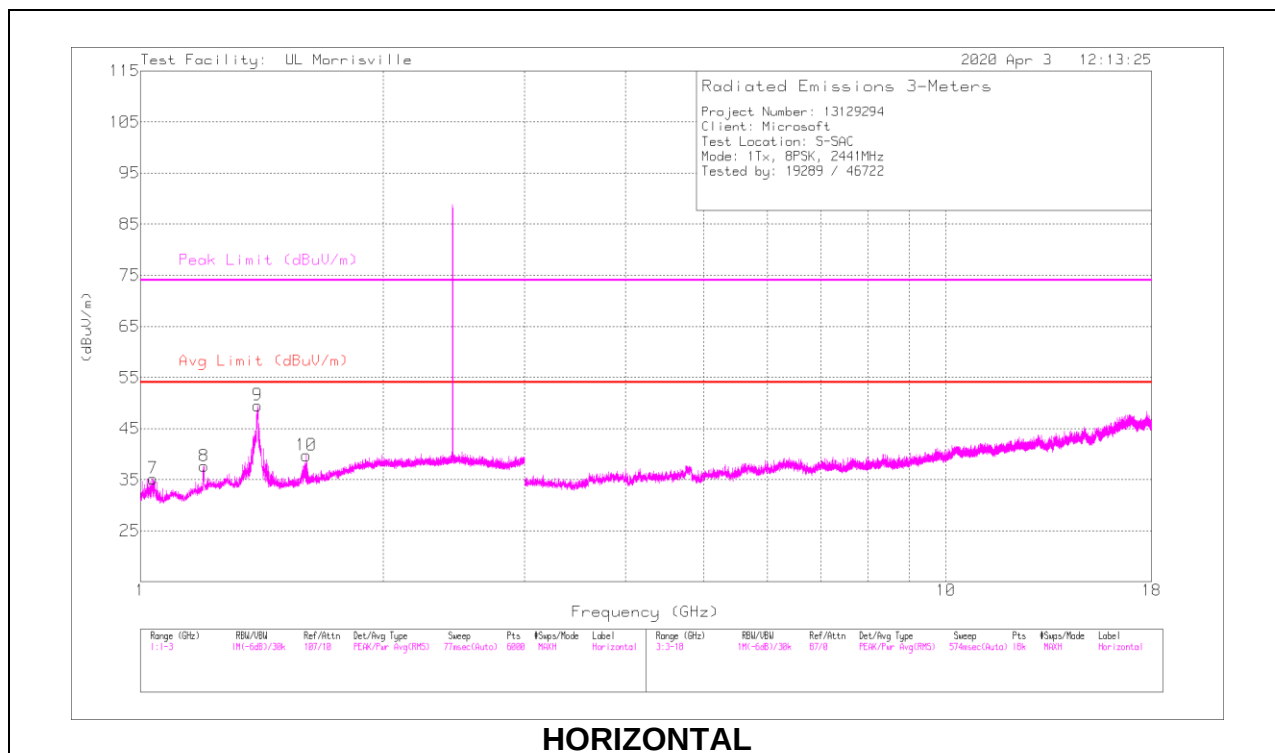
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 1.02926	40.51	PK2	27.2	-24.4	43.31	-	-	74	-30.69	254	164	H
	* 1.02891	25.89	V1TV	27.2	-24.4	28.69	54	-25.31	-	-	254	164	H
6	* 1.19978	41.8	PK2	28.6	-23.4	47	-	-	74	-27	237	242	H
	* 1.1985	25.4	V1TV	28.6	-23.4	30.6	54	-23.4	-	-	237	242	H
7	* 1.39684	50.6	PK2	28.8	-22.5	56.9	-	-	74	-17.1	141	259	H
	* 1.3981	33.97	V1TV	28.7	-22.5	40.17	54	-13.83	-	-	141	259	H
10	* 1.59576	39.32	PK2	27.8	-21.9	45.22	-	-	74	-28.78	128	207	H
	* 1.5953	25.53	V1TV	27.8	-21.9	31.43	54	-22.57	-	-	128	207	H
2	* 1.03484	47.45	PK2	27.1	-24.4	50.15	-	-	74	-23.85	203	210	V
	* 1.03394	31.13	V1TV	27.1	-24.4	33.83	54	-20.17	-	-	203	210	V
3	* 1.08303	44.56	PK2	27.4	-24.1	47.86	-	-	74	-26.14	223	183	V
	* 1.08057	30.41	V1TV	27.4	-24.1	33.71	54	-20.29	-	-	223	183	V
4	* 1.12045	40.47	PK2	27.6	-23.9	44.17	-	-	74	-29.83	201	256	V
	* 1.11911	27.92	V1TV	27.6	-23.9	31.62	54	-22.38	-	-	201	256	V
5	* 1.19388	42.41	PK2	28.5	-23.5	47.41	-	-	74	-26.59	212	242	V
	* 1.19492	27.77	V1TV	28.5	-23.5	32.77	54	-21.23	-	-	212	242	V
8	* 1.39397	58.17	PK2	28.8	-22.5	64.47	-	-	74	-9.53	212	191	V
	* 1.39571	38.73	V1TV	28.8	-22.5	45.03	54	-8.97	-	-	212	191	V
9	* 1.59429	49.66	PK2	27.8	-21.9	55.56	-	-	74	-18.44	205	183	V
	* 1.59515	33.34	V1TV	27.8	-21.9	39.24	54	-14.76	-	-	205	183	V
11	* 4.80406	42.1	PK2	34.2	-30.7	45.6	-	-	74	-28.4	246	203	H
	* 4.80331	31.48	V1TV	34.2	-30.7	34.98	54	-19.02	-	-	246	203	H
12	* 4.76793	41.57	PK2	34.1	-31	44.67	-	-	74	-29.33	120	396	V
	* 4.76807	29.06	V1TV	34.1	-31	32.16	54	-21.84	-	-	120	396	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

MID CHANNEL RESULTS



RADIATED EMISSIONS

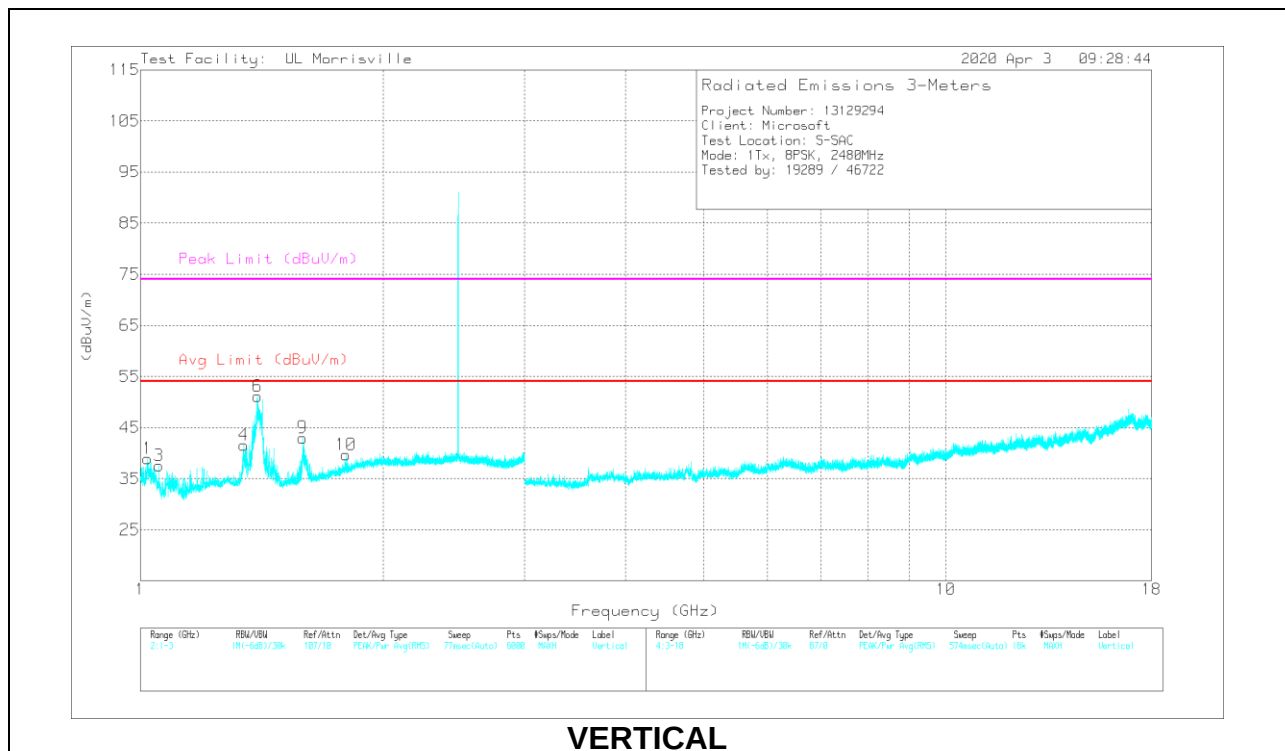
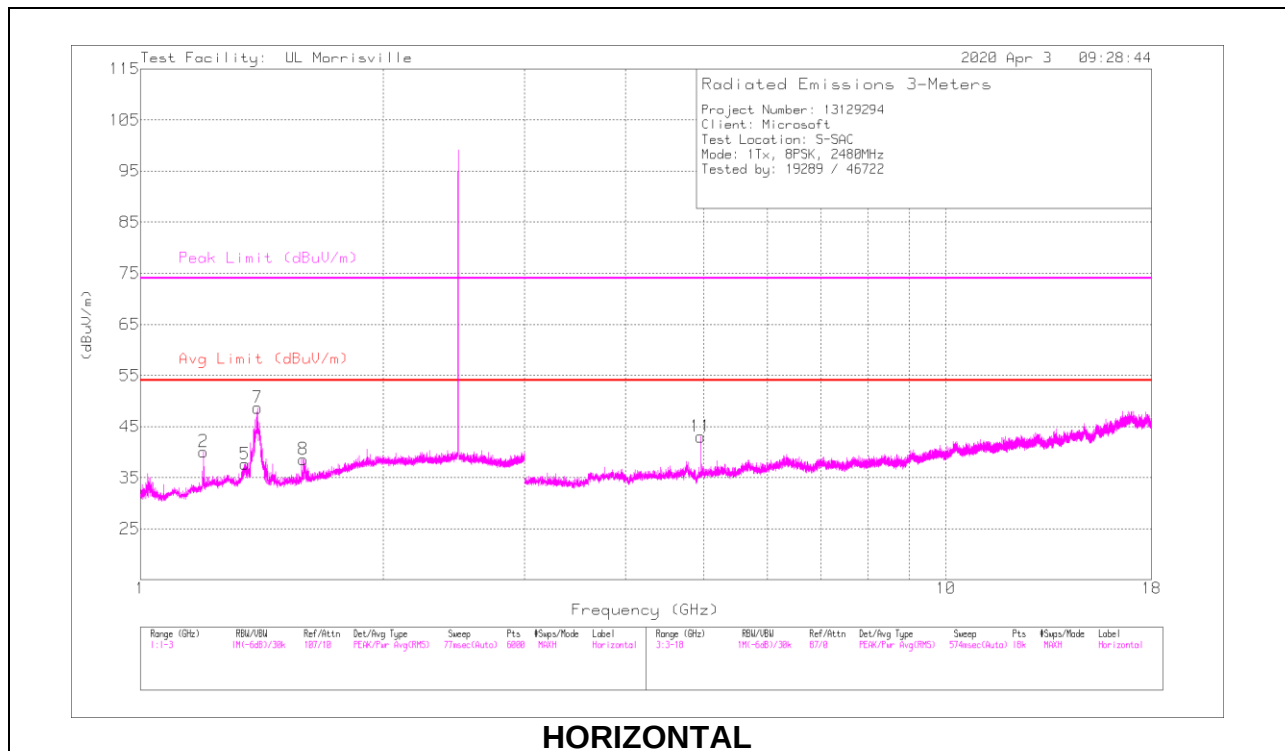
Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/FI tr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* 1.0364	41.2	PK2	27.1	-24.3	44	-	-	74	-30	130	234	H
	* 1.03721	26.76	V1TV	27.1	-24.3	29.56	54	-24.44	-	-	130	234	H
8	* 1.19868	43.8	PK2	28.6	-23.4	49	-	-	74	-25	235	257	H
	* 1.19828	26.31	V1TV	28.6	-23.4	31.51	54	-22.49	-	-	235	257	H
9	* 1.3948	52.64	PK2	28.8	-22.5	58.94	-	-	74	-15.06	94	251	H
	* 1.39488	37.35	V1TV	28.8	-22.5	43.65	54	-10.35	-	-	94	251	H
10	* 1.60792	44.11	PK2	27.8	-21.9	50.01	-	-	74	-23.99	318	189	H
	* 1.6071	28.38	V1TV	27.8	-22	34.18	54	-19.82	-	-	318	189	H
1	* 1.03675	45.21	PK2	27.1	-24.3	48.01	-	-	74	-25.99	4	177	V
	* 1.03664	29.96	V1TV	27.1	-24.3	32.76	54	-21.24	-	-	4	177	V
2	* 1.09706	44.61	PK2	27.6	-24	48.21	-	-	74	-25.79	203	230	V
	* 1.09788	28.74	V1TV	27.6	-24	32.34	54	-21.66	-	-	203	230	V
3	* 1.19348	46.59	PK2	28.5	-23.5	51.59	-	-	74	-22.41	195	341	V
	* 1.19486	28.76	V1TV	28.5	-23.5	33.76	54	-20.24	-	-	195	341	V
4	* 1.39426	57.12	PK2	28.8	-22.5	63.42	-	-	74	-10.58	215	191	V
	* 1.39294	39.2	V1TV	28.8	-22.5	45.5	54	-8.5	-	-	215	191	V
5	* 1.59728	50.75	PK2	27.8	-21.9	56.65	-	-	74	-17.35	204	168	V
	* 1.59486	33.18	V1TV	27.8	-21.9	39.08	54	-14.92	-	-	204	168	V
6	1.79247	32.15	Pk	30	-22	40.15	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

HIGH CHANNEL RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/FI tr/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	* 1.19552	40.7	PK2	28.5	-23.5	45.7	-	-	74	-28.3	234	254	H
	* 1.19832	24.3	V1TV	28.6	-23.4	29.5	54	-24.5	-	-	234	254	H
5	* 1.34916	39.82	PK2	29.2	-22.7	46.32	-	-	74	-27.68	166	124	H
	* 1.34623	25.13	V1TV	29.2	-22.7	31.63	54	-22.37	-	-	166	124	H
7	* 1.39712	52.54	PK2	28.8	-22.5	58.84	-	-	74	-15.16	96	126	H
	* 1.39725	33.37	V1TV	28.7	-22.5	39.57	54	-14.43	-	-	96	126	H
8	* 1.59264	43.72	PK2	27.8	-21.9	49.62	-	-	74	-24.38	277	207	H
	* 1.59338	27.59	V1TV	27.8	-21.9	33.49	54	-20.51	-	-	277	207	H
1	* 1.01965	45.55	PK2	27.4	-24.4	48.55	-	-	74	-25.45	356	195	V
	* 1.02134	32.72	V1TV	27.3	-24.4	35.62	54	-18.38	-	-	356	195	V
3	* 1.05275	43.37	PK2	27	-24.3	46.07	-	-	74	-27.93	350	148	V
	* 1.05183	27.49	V1TV	27	-24.3	30.19	54	-23.81	-	-	350	148	V
4	* 1.3444	45.18	PK2	29.1	-22.7	51.58	-	-	74	-22.42	216	240	V
	* 1.34372	30.67	V1TV	29.1	-22.7	37.07	54	-16.93	-	-	216	240	V
6	* 1.3972	56.27	PK2	28.7	-22.5	62.47	-	-	74	-11.53	215	205	V
	* 1.39457	40.14	V1TV	28.8	-22.5	46.44	54	-7.56	-	-	215	205	V
9	* 1.59226	46.27	PK2	27.8	-21.9	52.17	-	-	74	-21.83	49	264	V
	* 1.58931	30.19	V1TV	27.9	-21.9	36.19	54	-17.81	-	-	49	264	V
11	* 4.96031	44.01	PK2	34.1	-30.6	47.51	-	-	74	-26.49	8	117	H
	* 4.95928	37.41	V1TV	34.1	-30.6	40.91	54	-13.09	-	-	8	117	H
10	1.7988	31.57	PK	30.1	-22	39.67	-	-	-	-	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

PK2 - KDB558074 Method: Maximum Peak

V1TV - U-NII: VB=1/Ton, Linear Voltage Average where: Ton is packet duration

PK - Peak detector

10.2. SPURIOUS EMISSIONS FOR COLLOCATION

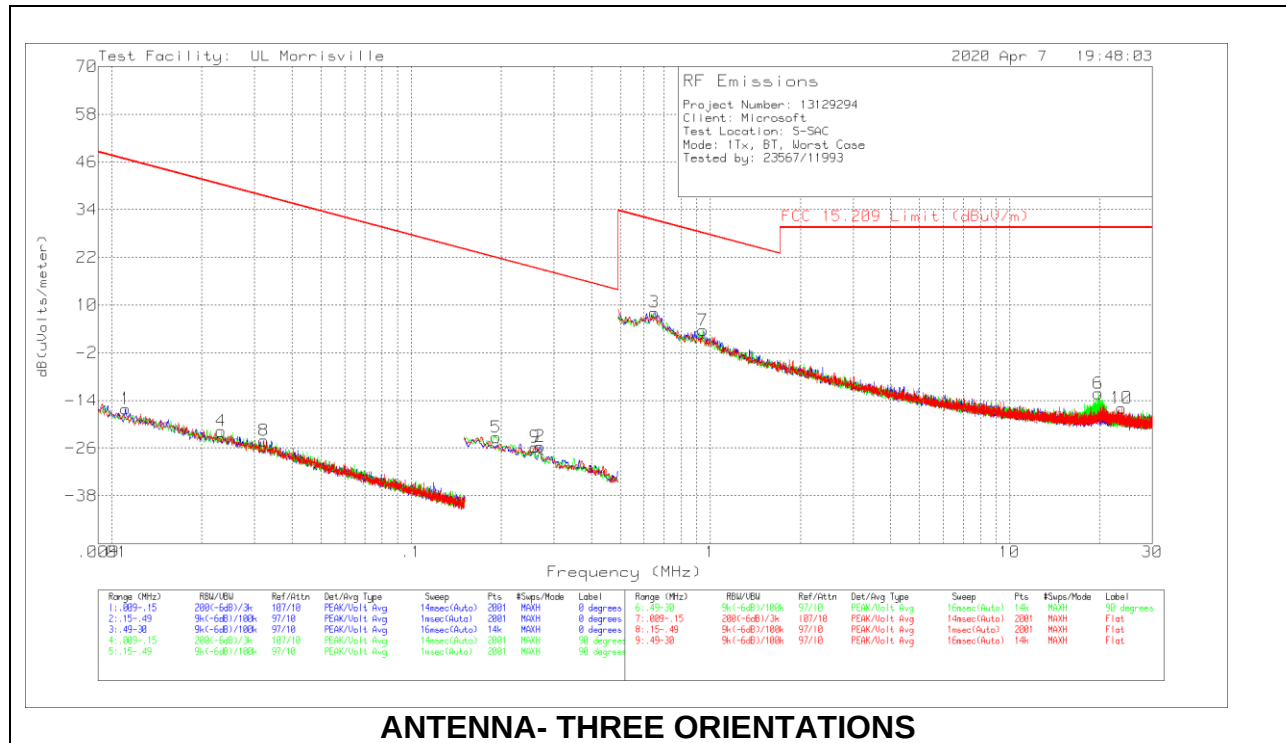
TEST-CASE CONDITIONS

Test Case #	Antenna	Mode	Frequency (MHz)
1a	1	BT GFSK	2480
	MAIN	LTE B7 (1RB, 20MHz , QPSK)	2510
	1	WLAN 5GHz, 11a	5260
1b	1	BT GFSK	2480
	MAIN	GSM (GPRS)	836.6MHz
	1	WLAN 5GHz, 11a	5260
4a	1	BT GFSK	2480
	MAIN	LTE B7 (1RB, 20MHz , QPSK)	2510
	2	WLAN 5GHz, 11a	5260
4b	1	BT GFSK	2480
	MAIN	GSM (GPRS)	836.6MHz
	2	WLAN 5GHz, 11a	5260
5a	1	BT GFSK	2480
	MAIN	LTE B7 (1RB, 20MHz , QPSK)	2510
	1 & 2	WLAN 5GHz, 11a	5260
5b	1	BT GFSK	2480
	MAIN	GSM (GPRS)	836.6MHz
	1 & 2	WLAN 5GHz, 11a	5260

Please refer to report # 13129294-E4 for Spurious Emissions for collocation results.

10.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



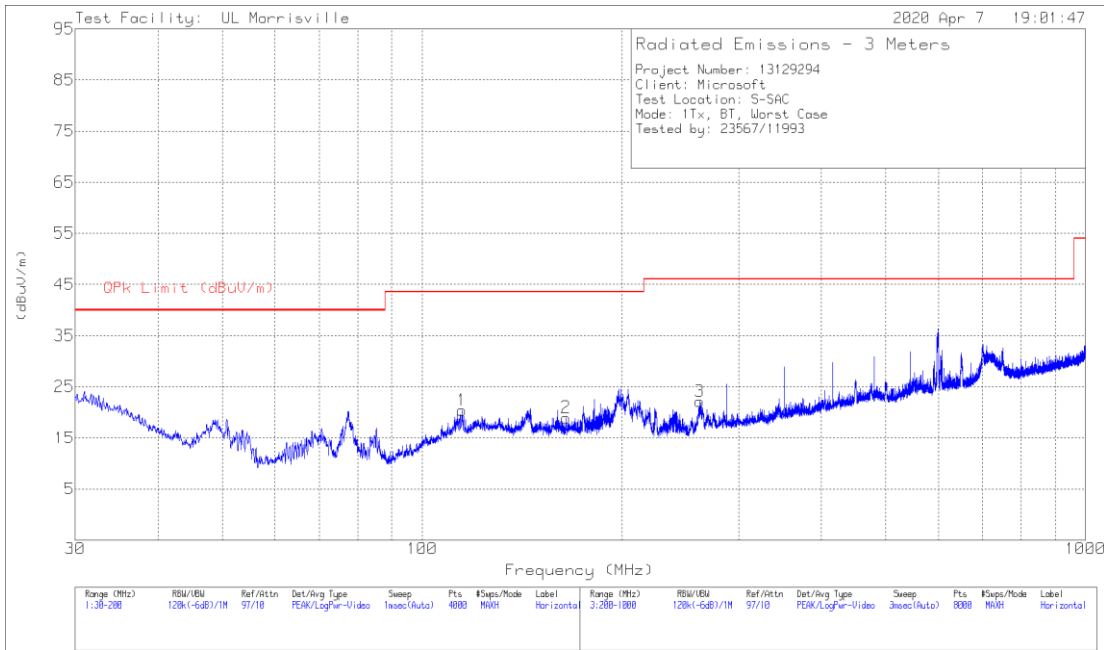
Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/ meter)	FCC 15.209 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.01113	46.09	Pk	17.7	.1	-80	-16.11	46.67	-62.78	0-360
4	.0232	44.47	Pk	13.7	.1	-80	-21.73	40.29	-62.02	0-360
8	.03222	42.81	Pk	13	.1	-80	-24.09	37.44	-61.53	0-360
5	.19242	45.61	Pk	11	.1	-80	-23.29	21.92	-45.21	0-360
9	.25991	43.17	Pk	11	.1	-80	-25.73	19.31	-45.04	0-360
2	.26994	43.31	Pk	11	.1	-80	-25.59	18.98	-44.57	0-360
3	.65021	37.07	Pk	11	.1	-40	8.17	31.34	-23.17	0-360
7	.94533	32.54	Pk	11	.1	-40	3.64	28.09	-24.45	0-360
6	19.8056	17.58	Pk	9.4	.8	-40	-12.22	29.54	-41.76	0-360
10	23.64638	14.26	Pk	9	.8	-40	-15.94	29.54	-45.48	0-360

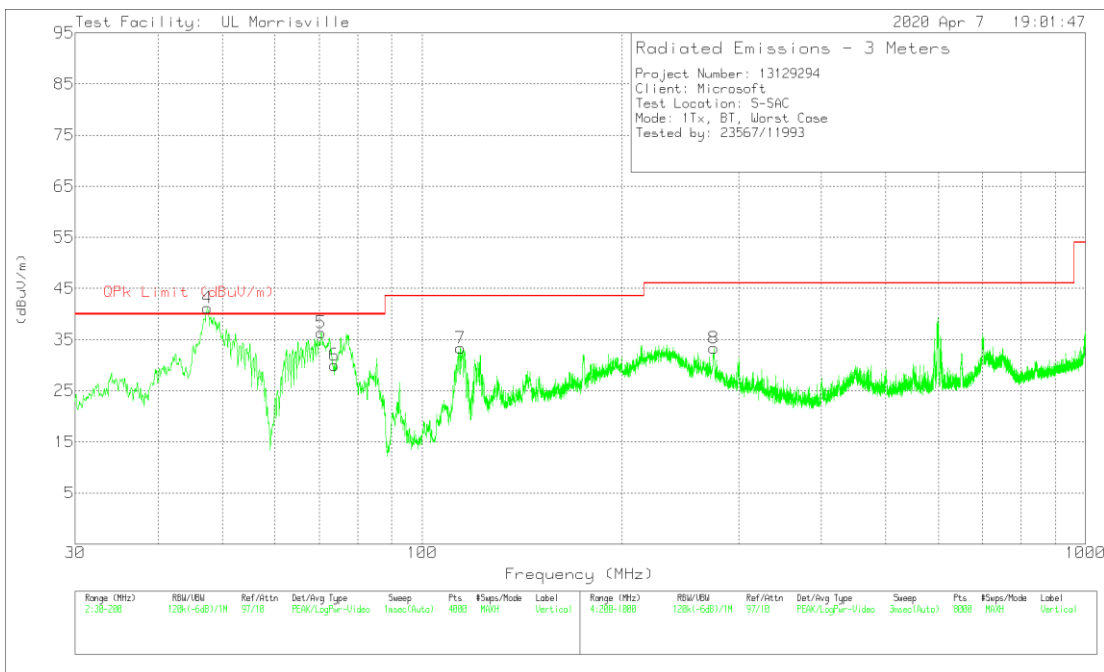
Pk - Peak detector

10.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

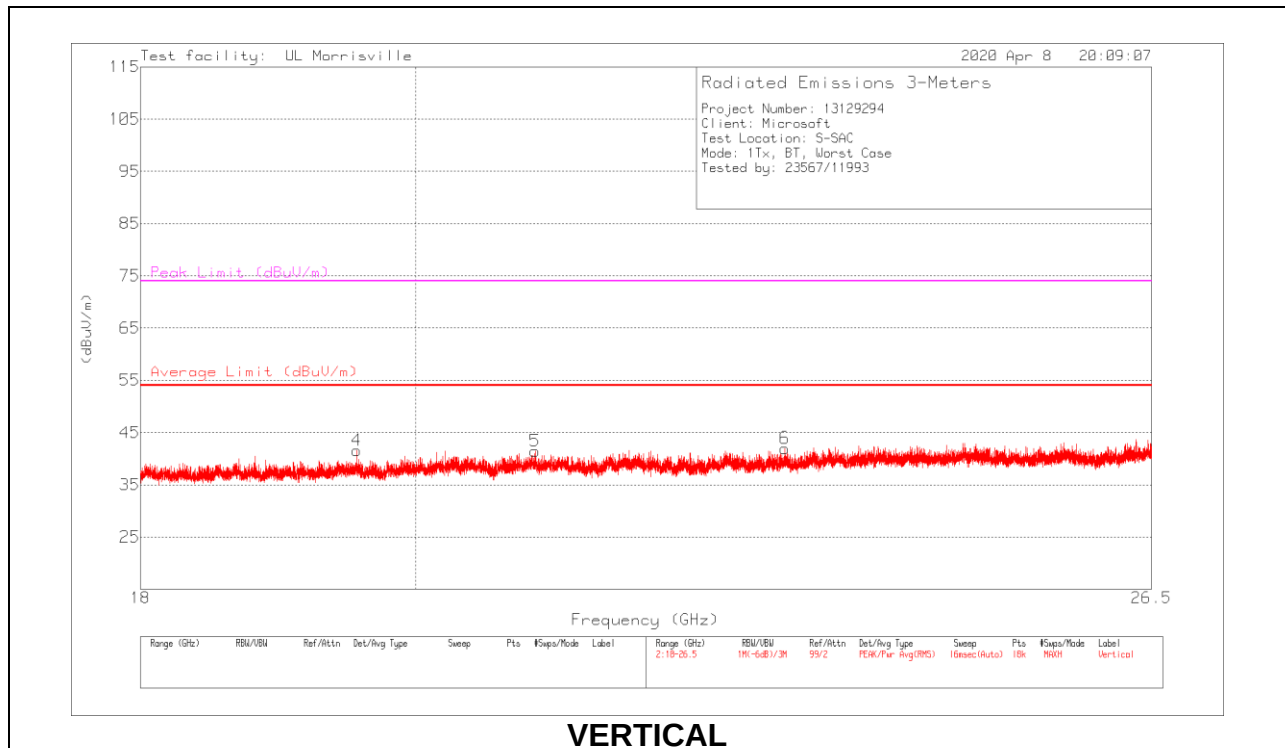
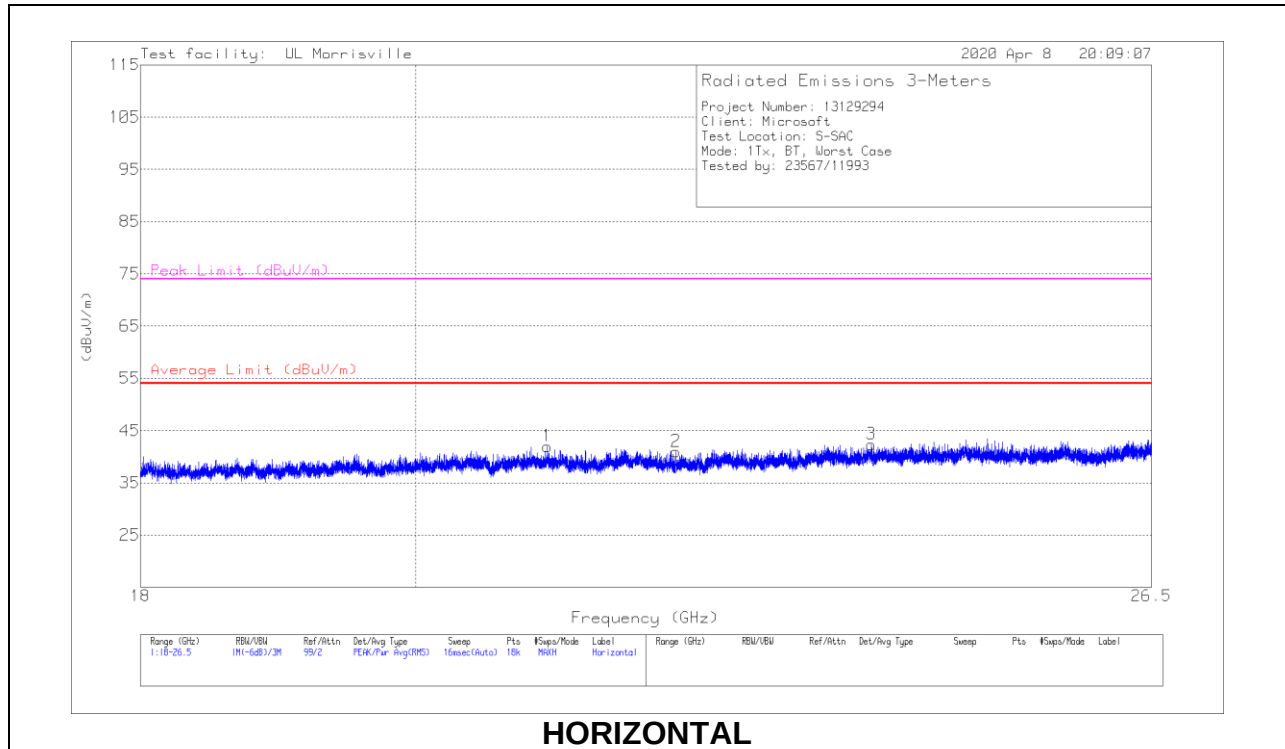
Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 114.852	31.68	Pk	19.5	-30.8	20.38	43.52	-23.14	0-360	198	H
2	* 164.9299	31.13	Pk	18.3	-30.5	18.93	43.52	-24.59	0-360	299	H
6	* 73.8288	47.1	Pk	14.1	-31.2	30	40	-10	0-360	102	V
7	* 114.2993	44.73	Pk	19.4	-30.8	33.33	43.52	-10.19	0-360	102	V
3	* 262.3081	33.43	Pk	18.5	-29.8	22.13	46.02	-23.89	0-360	102	H
8	* 275.3098	43.72	Pk	19.4	-29.8	33.32	46.02	-12.7	0-360	101	V
4	47.472	57.72	Pk	15	-31.5	41.22	-	-	0-360	102	V
5	70.513	53.55	Pk	14.1	-31.3	36.35	-	-	0-360	102	V

Pk - Peak detector

10.5. WORST CASE 18-26 GHZ

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION)



18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* 21.03325	46.4	Pk	33.2	-37.6	42	54	-12	74	-32	0-360	298	H
2	* 22.09061	44.8	Pk	33.3	-37.1	41	54	-13	74	-33	0-360	148	H
3	* 23.80723	44.77	Pk	34	-36.4	42.37	54	-11.63	74	-31.63	0-360	298	H
4	* 19.55228	46.65	Pk	32.7	-37.8	41.55	54	-12.45	74	-32.45	0-360	252	V
5	* 20.93266	45.77	Pk	33.1	-37.4	41.47	54	-12.53	74	-32.53	0-360	298	V
6	* 23.03322	44.88	Pk	33.7	-36.6	41.98	54	-12.02	74	-32.02	0-360	298	V

Pk - Peak detector

11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

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

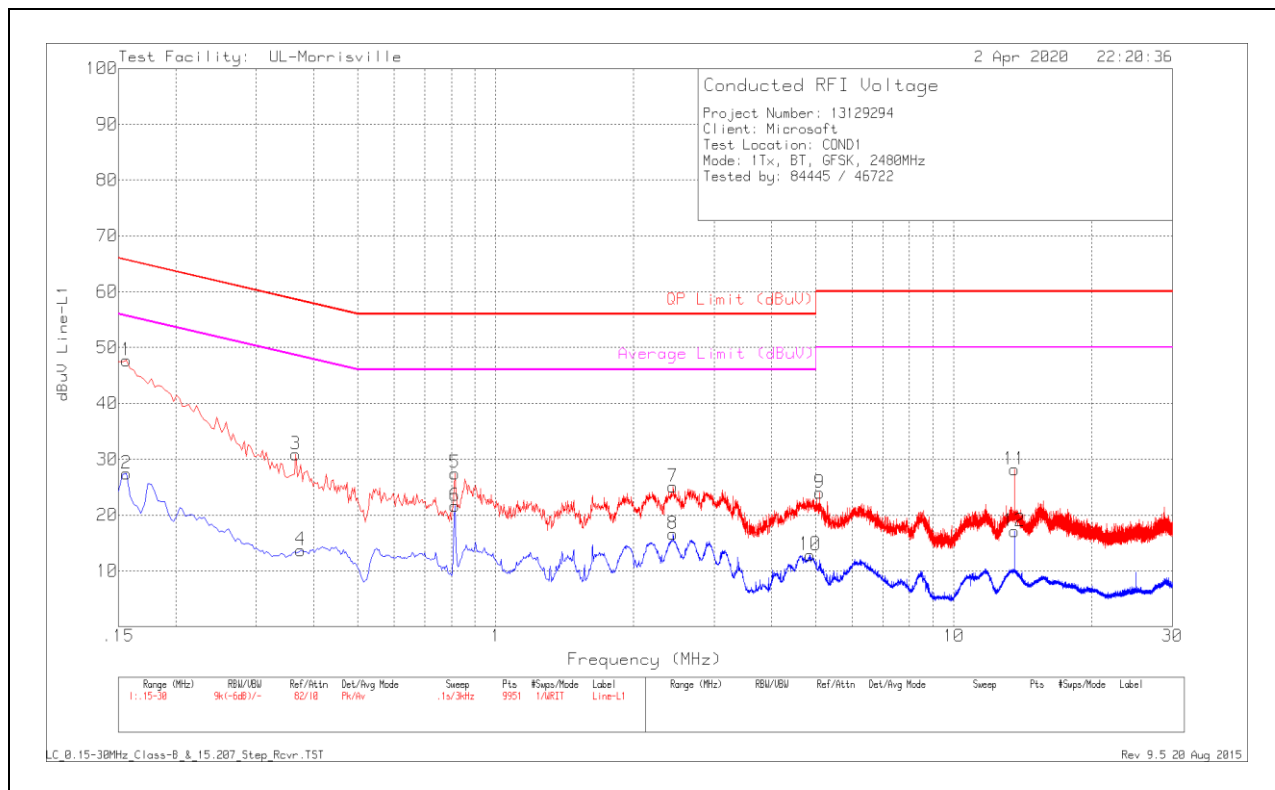
The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

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

RESULTS

11.1.1. AC Power Line Norm

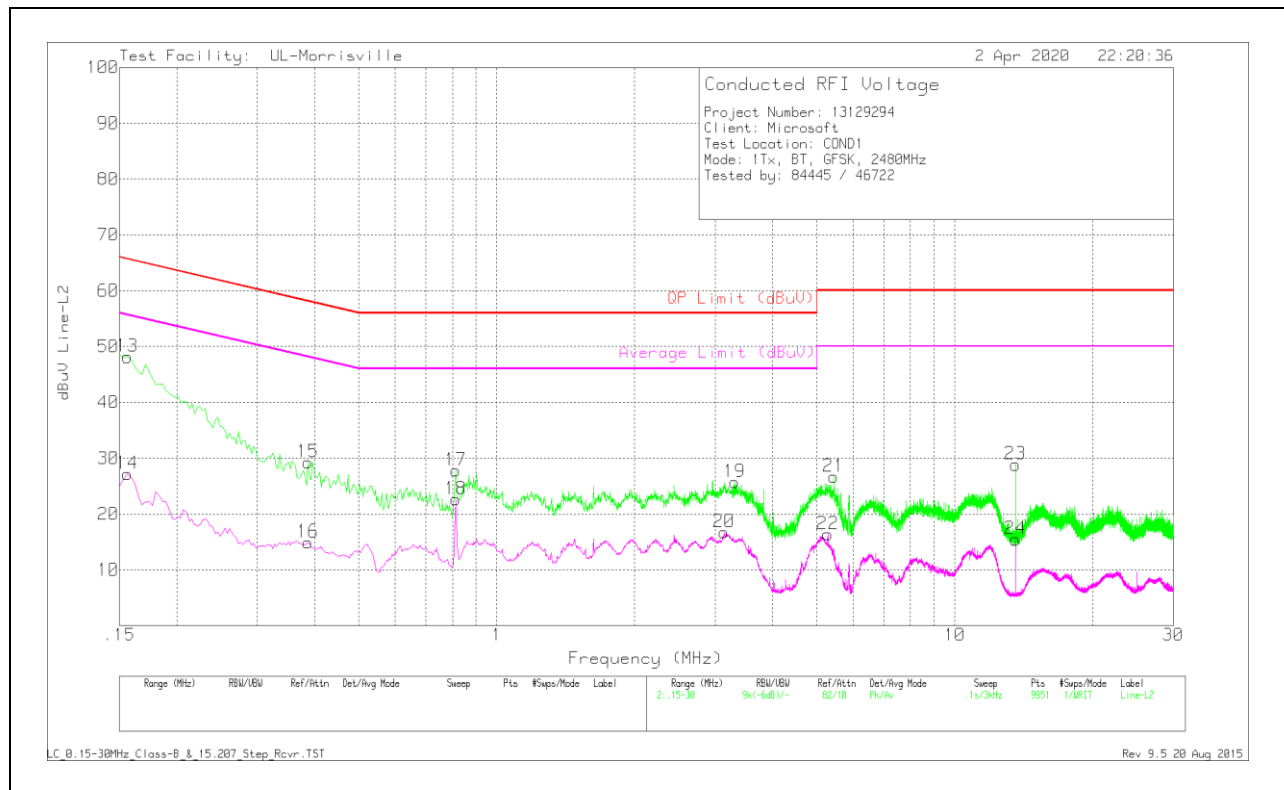
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.156	37.8	Pk	.2	9.7	47.7	65.67	-17.97	-	-
2	.156	17.53	Av	.2	9.7	27.43	-	-	55.67	-28.24
3	.366	21.08	Pk	.1	9.7	30.88	58.59	-27.71	-	-
4	.375	3.92	Av	.1	9.7	13.72	-	-	48.39	-34.67
5	.813	17.69	Pk	0	9.8	27.49	56	-28.51	-	-
6	.813	11.83	Av	0	9.8	21.63	-	-	46	-24.37
7	2.439	15.26	Pk	0	9.8	25.06	56	-30.94	-	-
8	2.439	6.82	Av	0	9.8	16.62	-	-	46	-29.38
9	5.091	13.97	Pk	.1	9.9	23.97	60	-36.03	-	-
10	4.857	2.85	Av	.1	9.9	12.85	-	-	46	-33.15
11	13.56	18.04	Pk	.1	10	28.14	60	-31.86	-	-
12	13.56	7.03	Av	.1	10	17.13	-	-	50	-32.87

Pk - Peak detector
Av - Average detector

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.156	38.26	Pk	.2	9.7	48.16	65.67	-17.51	-	-
14	.156	17.28	Av	.2	9.7	27.18	-	-	55.67	-28.49
15	.387	19.4	Pk	.1	9.8	29.3	58.13	-28.83	-	-
16	.387	5.03	Av	.1	9.8	14.93	-	-	48.13	-33.2
17	.813	18.02	Pk	0	9.8	27.82	56	-28.18	-	-
18	.813	12.85	Av	0	9.8	22.65	-	-	46	-23.35
19	3.309	15.88	Pk	0	9.8	25.68	56	-30.32	-	-
20	3.135	6.93	Av	0	9.8	16.73	-	-	46	-29.27
21	5.442	16.69	Pk	.1	9.9	26.69	60	-33.31	-	-
22	5.28	6.37	Av	.1	9.9	16.37	-	-	50	-33.63
23	13.56	18.76	Pk	.1	10	28.86	60	-31.14	-	-
24	13.56	5.36	Av	.1	10	15.46	-	-	50	-34.54

Pk - Peak detector
Av - Average detector