CERTIFICATION TEST REPORT

Report Number. : R12922855-E2

Applicant	:	Microsoft Corporation One Microsoft Way Redmond, WA 98052-6399 USA
Model	:	1867
FCC ID	:	C3K1867
IC	:	3048A-1867
EUT Description	:	Portable Computing Device
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
2019-08-29

Prepared by:
UL LLC
12 Laboratory Dr.
Research Triangle Park, NC 27709 U.S.A.
TEL: (919) 549-1400

NVLAP Lab code: 200246-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	--	Initial Issue	
2	2019-09-06	Added AC power adaptor to support equipment. Added model similarity explanation to Section 4.	Brian T. Kiewra

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TABLE OF CONTENTS

REPORT REVISION HISTORY **2**

TABLE OF CONTENTS **3**

1. ATTESTATION OF TEST RESULTS **4**

2. TEST METHODOLOGY **5**

3. FACILITIES AND ACCREDITATION **5**

4. SCOPE OF REPORT **5**

5. CALIBRATION AND UNCERTAINTY **6**

5.1. MEASURING INSTRUMENT CALIBRATION *6*

5.2. SAMPLE CALCULATION *6*

5.3. MEASUREMENT UNCERTAINTY *6*

6. EQUIPMENT UNDER TEST **7**

6.1. EUT DESCRIPTION *7*

6.2. MAXIMUM OUTPUT POWER *7*

6.3. DESCRIPTION OF AVAILABLE ANTENNAS *7*

6.4. SOFTWARE AND FIRMWARE *8*

6.5. WORST-CASE CONFIGURATION AND MODE *8*

6.6. DESCRIPTION OF TEST SETUP *9*

7. TEST AND MEASUREMENT EQUIPMENT **10**

8. MEASUREMENT METHODS **12**

9. RADIATED TEST RESULTS **13**

9.1. ON TIME AND DUTY CYCLE *15*

9.2. TRANSMITTER ABOVE 1 GHz *16*

9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION 16

9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION 26

9.3. WORST CASE BELOW 30MHZ *36*

9.4. WORST CASE BELOW 1 GHZ *37*

9.5. WORST CASE 18-26 GHZ *39*

10. AC POWER LINE CONDUCTED EMISSIONS **41**

10.1.1. AC Power Line Host 42

11. SETUP PHOTOS **44**

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1. ATTESTATION OF TEST RESULTS

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

EUT DESCRIPTION: Portable Computing Device

MODEL: 1867

SERIAL NUMBER: See section 6.4

DATE TESTED: 2019-07-18 to 2019-07-22

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 LLC 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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Approved & Released For
UL LLC By:

Prepared By:

Jeffrey Moser
Operations Leader
Consumer Technology Division
UL LLC

Niklas Haydon
Engineer
Consumer Technology Division
UL LLC

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, RSS-GEN Issue 5, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, North Carolina, USA 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 Perimeter Park Dr. Suite B
ISED Site Code: 2180C	
☐ Chamber A	☒ Chamber North
☐ Chamber C	☒ Chamber South

The above test sites and facilities are covered under FCC Test Firm Registration # 703469. Chambers above are covered under Industry Canada company address and respective code.

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

4. SCOPE OF REPORT

This test report covers the radiated emissions and AC power line conducted emissions data for model 1867. Antenna port conducted emissions data is leveraged from UL report number R12935938-E2, model 1868 (FCC ID: C3K1868, IC: 3048A-1868).

Models 1867 and 1868 are electrically and RF equivalent as they use the same motherboard, radio module and on-board RF components. Both models share a common WiFi and BT power table. The radio-related firmware and driver versions are the same for the two models. The peak antenna gains are in the antenna gain section of the report. Antenna port conducted emissions measurements are done on model 1868 (FCC ID: C3K1868, IC: 3048A-1868) and the data is leveraged for model 1867 (FCC ID: C3K1867, IC: 3048A-1867). Highest antenna gain across the two models in each band has been considered while doing the conducted emissions measurements. Separate radiated & SAR measurements are done on each model.

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5. CALIBRATION AND UNCERTAINTY

5.1. 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.

5.2. 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 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 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 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Unwanted Emissions, conducted	2.50 dB
All emissions, radiated	4.88 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%

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

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Portable Computing Device that contains 802.11 a/ac/ax/b/g/n 20/40/80/160MHz 2x2 dual band and BT/BLE 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	2.48	1.77
2402 - 2480	Enhanced DQPSK	5.14	3.27
2402 - 2480	Enhanced 8PSK	4.86	3.06

Note: GFSK, DQPSK, 8PSK average 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 please refer UL report number R12935938-E2, model 1868 (FCC ID: C3K1868, IC: 3048A-1868).

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

Frequency Range (GHz)	Antenna Type	Peak Gain (dBi) Chain 0 (Right)	Peak Gain (dBi) Chain 1 (Left)
Model 1867			
2.4 to 2.48	PIFA	0.7	2.6
5.15 to 5.25		4.9	4.4
5.25 to 5.35		6.1	5.0
5.47 to 5.72		7.2	5.5
5.725 to 5.85		9.4	5.6
Model 1868			
2.4 to 2.48	PIFA	0.4	1.0
5.15 to 5.25		3.6	2.2
5.25 to 5.35		5.2	3.5
5.47 to 5.72		6.4	4.7
5.725 to 5.85		7.8	4.5

The BT radio utilizes Chain 0.

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6.4. SOFTWARE AND FIRMWARE

EUT	Serial Number	Radio Test Tool Version	OS Version	BT Driver Version	WiFi Driver Version	EUT's Power Supply (s/n)
R-557-1867-FCC-RADIATED-08	006438792757	11.1916.0-09531	MTEOS 1.652.0	21.0.19157.20088	99.0.43.8	0D130P028D596
R-557-1867-FCC-RADIATED-09	006439692757	11.1916.0-09531	MTEOS 1.652.0	21.0.19157.20088	99.0.43.8	0D130P01H1596

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 has one intended orientations, X; therefore, all final radiated testing was performed with the EUT in X orientation.

Worst-case data rates/packet sizes were:

GFSK mode: DH5
DQPSK mode: 2-DH5
8PSK mode: 3-DH5

All radios that can transmit simultaneously have been evaluated for radiated for all possible combinations of transmission and found to be in compliance.

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
USB Hub	J5 Create	JCA374	AY2A1904000477 / AY6A1903004261	N/A
Earbuds	Sony	MDR-EX14AP	Non-serialized	N/A
USB Flash Drive	Kingston	DataTraveler G4	Non-serialized	N/A
AC Power Adaptor	Microsoft	1706	0D130P01H1596	N/A

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	Mains	1	12-pin	Mains	<3	None
2	USB-A	1	USB-A	USB	<3	None
3	USB-C	1	USB-C	USB	<3	None
4	Aux	1	Aux	Aux	<3	None

TEST SETUP

The test utility software was located on the EUT during the tests and was used to exercised the radios.

SETUP DIAGRAMS

Please refer to R12922855-EP1 for setup diagrams

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7. TEST AND MEASUREMENT EQUIPMENT

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

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2019-04-22	2020-04-22
	18-40 GHz				
AT0076	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2018-11-08	2019-11-08
	Gain-Loss Chains				
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2019-03-13	2020-03-13
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2018-09-30	2019-09-30
	Receiver & Software				
SA0025	Spectrum Analyzer	Agilent	N9030A	2019-02-28	2020-02-28
SA0027 (18-40GHz RSE)	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

NOTES:

1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0059	Active Loop Antenna	ETS-Lindgren	6502	2018-07-20	2019-07-31
	30-1000 MHz				
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2018-08-06	2019-08-31
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2019-05-02	2020-05-02
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2019-05-02	2020-05-02
	Receiver & Software				
SA0026	Spectrum Analyzer	Agilent	N9030A	2019-03-19	2020-03-19
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA
	Additional Equipment used				
s/n 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27

NOTES:
1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

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	2019-05-29	2020-05-29
s/n 161016511	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	2018-08-21	2019-08-21
75141 (PRE0101521)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2018-08-22	2019-08-22
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2019-05-29	2020-05-29
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5	NA	NA

NOTES:
1. For equipment listed above that was calibrated during the testing period, please note the equipment was used for testing after calibration.
2. For equipment listed above that has a calibration due date during the testing period, the testing was completed before the equipment expiration date.

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8. MEASUREMENT METHODS

Radiated Spurious Emissions: 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.

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9. 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 120 kHz for peak and/or quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. 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 where T = the on time.

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 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.

3D antenna use - For below 30MHz testing, investigation was done on three antenna orientations (parallel, perpendicular, and ground-parallel).

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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.

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9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

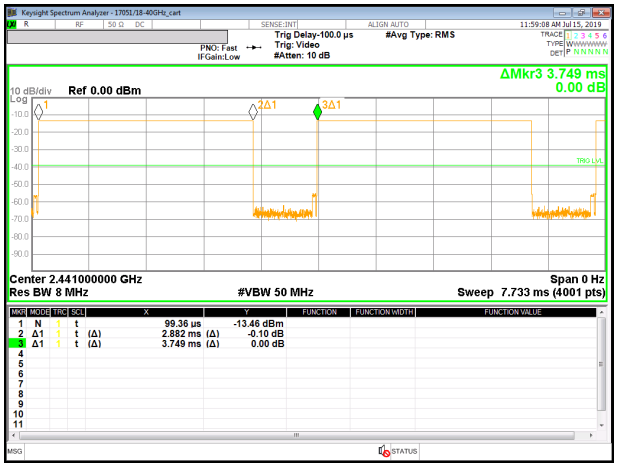
PROCEDURE

ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

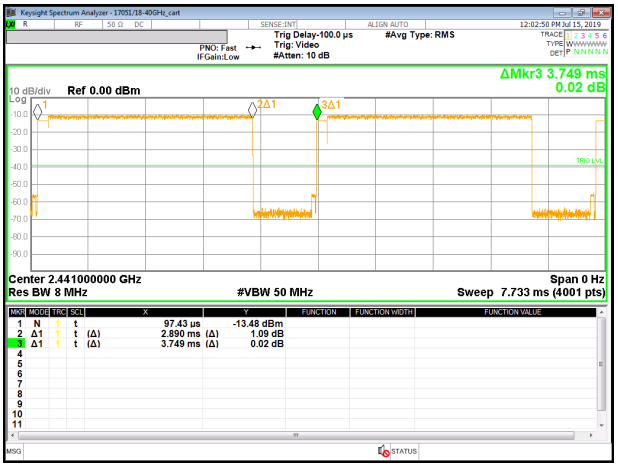
ON TIME AND DUTY CYCLE RESULTS

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	2.882	3.749	0.769	76.9%	1.14	0.347
Bluetooth 8PSK	2.890	3.749	0.771	77.1%	1.13	0.346

DUTY CYCLE PLOTS



BLUETOOTH GFSK



BLUETOOTH 8PSK

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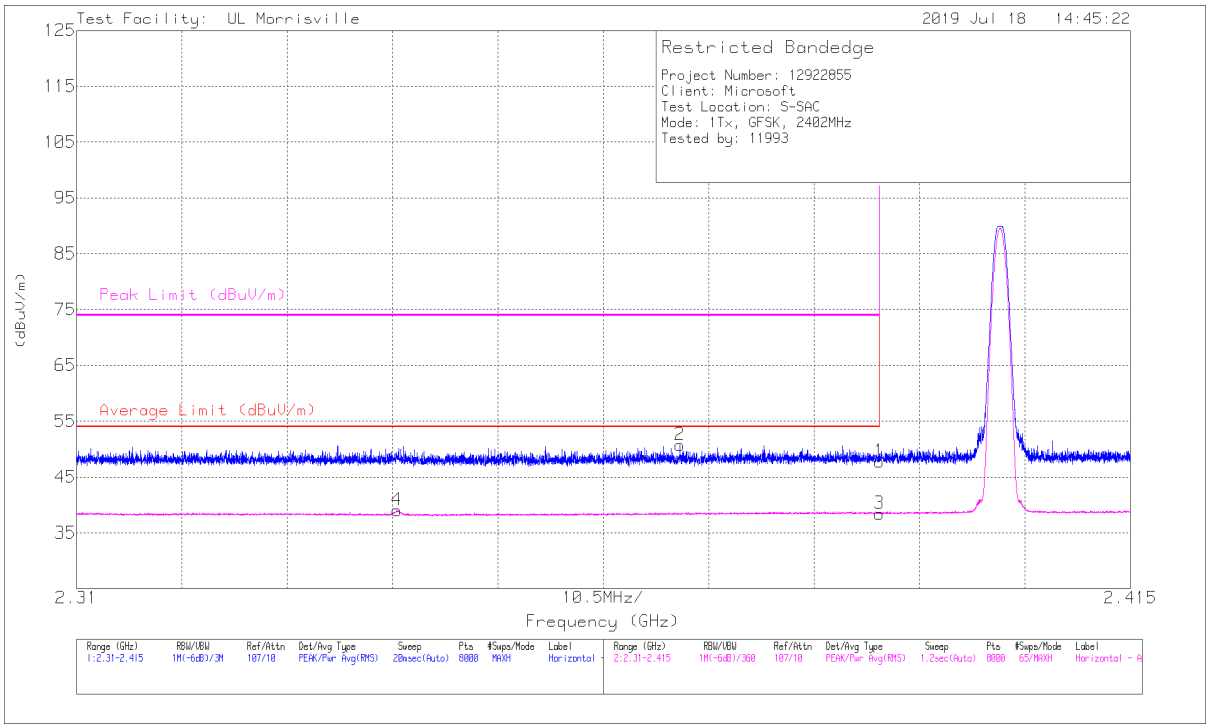
9.2. TRANSMITTER ABOVE 1 GHz

9.2.1. BLUETOOTH BASIC DATA RATE GFSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	39.99	Pk	31.9	-24.1	47.79	-	-	74	-26.21	74	118	H
2	* ** 2.37012	43.14	Pk	31.8	-24.2	50.74	-	-	74	-23.26	74	118	H
3	* ** 2.39	30.64	V1TR	31.9	-24.1	38.44	54	-15.56	-	-	74	118	H
4	* ** 2.34191	31.62	V1TR	31.6	-24.2	39.02	54	-14.98	-	-	74	118	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Average where: Ton is packet duration

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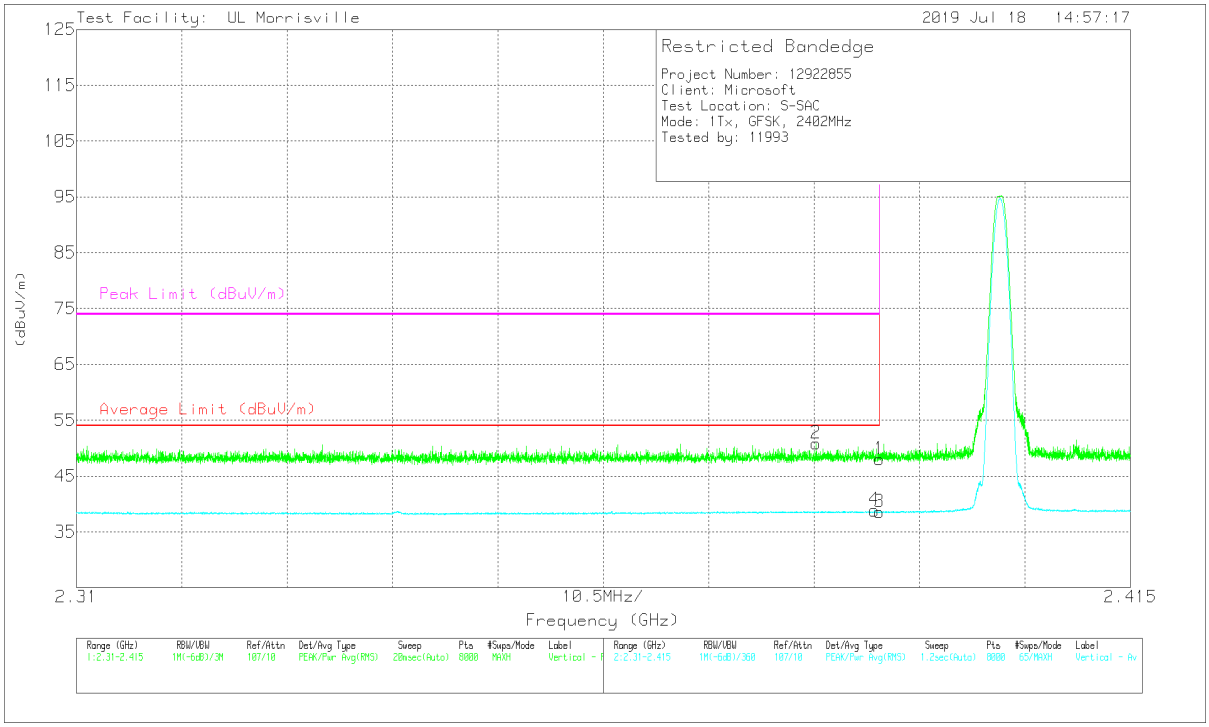
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	40.23	Pk	31.9	-24.1	48.03	-	-	74	-25.97	241	377	V
2	* ** 2.38368	43.05	Pk	31.9	-24.1	50.85	-	-	74	-23.15	241	377	V
3	* ** 2.39	30.75	V1TR	31.9	-24.1	38.55	54	-15.45	-	-	241	377	V
4	* ** 2.38951	31.06	V1TR	31.9	-24.1	38.86	54	-15.14	-	-	241	377	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Average where: Ton is packet duration

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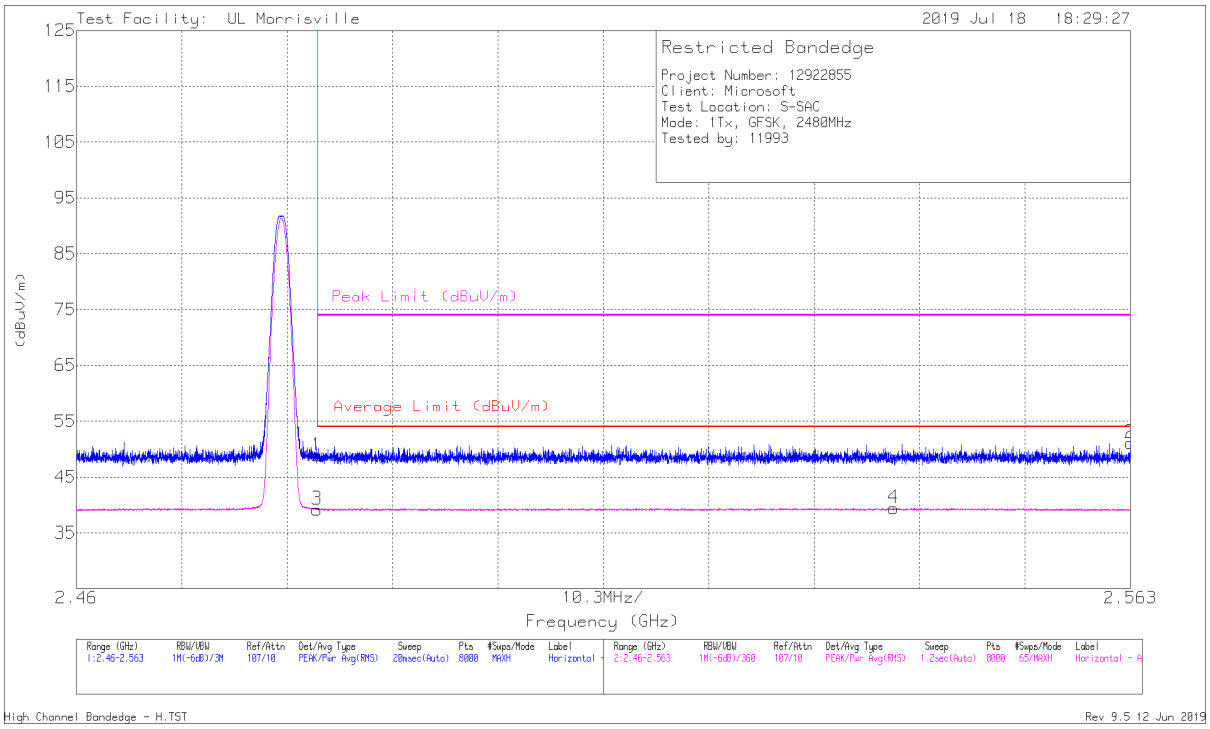
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	40.59	Pk	32.3	-24	48.89	-	-	74	-25.11	80	103	H
2	** 2.563	42.83	Pk	32.3	-24	51.13	-	-	74	-22.87	80	103	H
3	* ** 2.4835	30.91	V1TR	32.3	-24	39.21	54	-14.79	-	-	80	103	H
4	** 2.53985	31.06	V1TR	32.4	-24	39.46	54	-14.54	-	-	80	103	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Average where: Ton is packet duration

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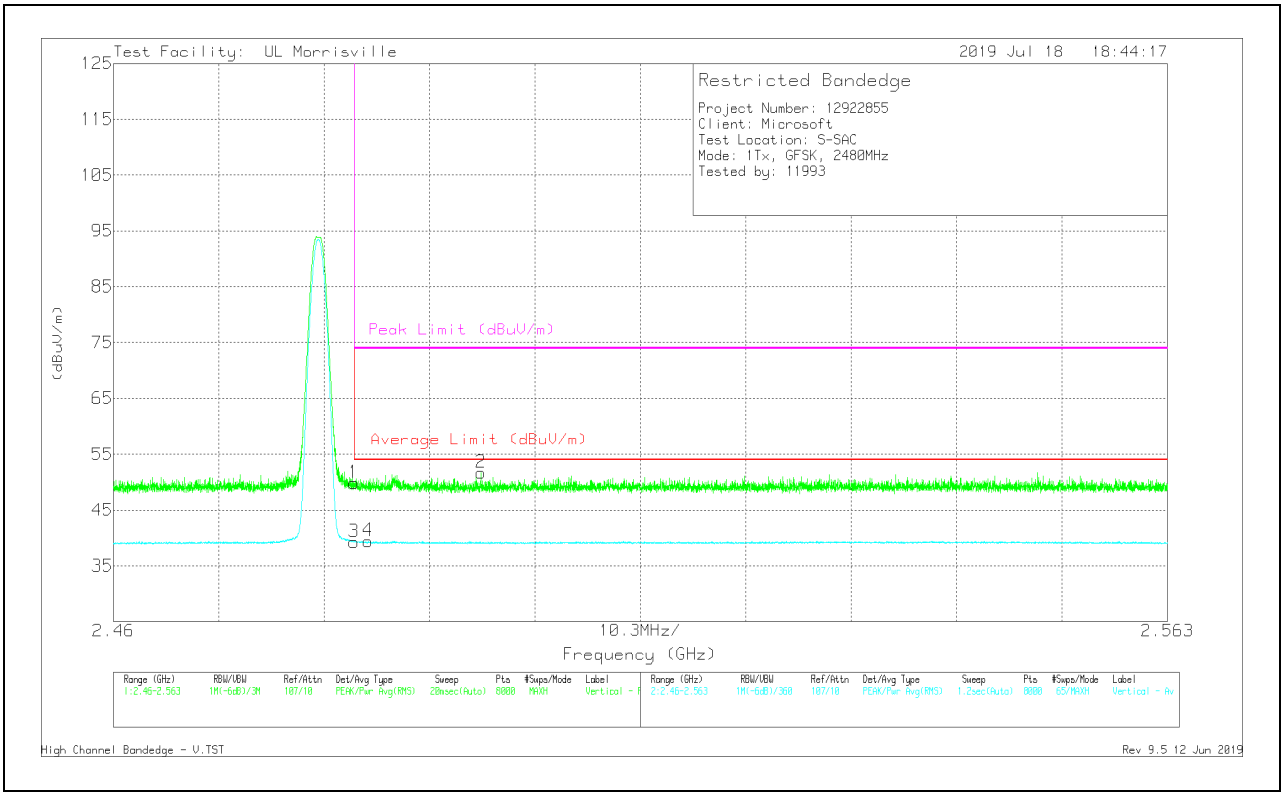
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	41.53	Pk	32.3	-24	49.83	-	-	74	-24.17	343	104	V
2	* ** 2.4959	43.41	Pk	32.3	-24	51.71	-	-	74	-22.29	343	104	V
3	* ** 2.4835	30.96	V1TR	32.3	-24	39.26	54	-14.74	-	-	343	104	V
4	* ** 2.48488	31.15	V1TR	32.3	-24	39.45	54	-14.55	-	-	343	104	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Average where: Ton is packet duration

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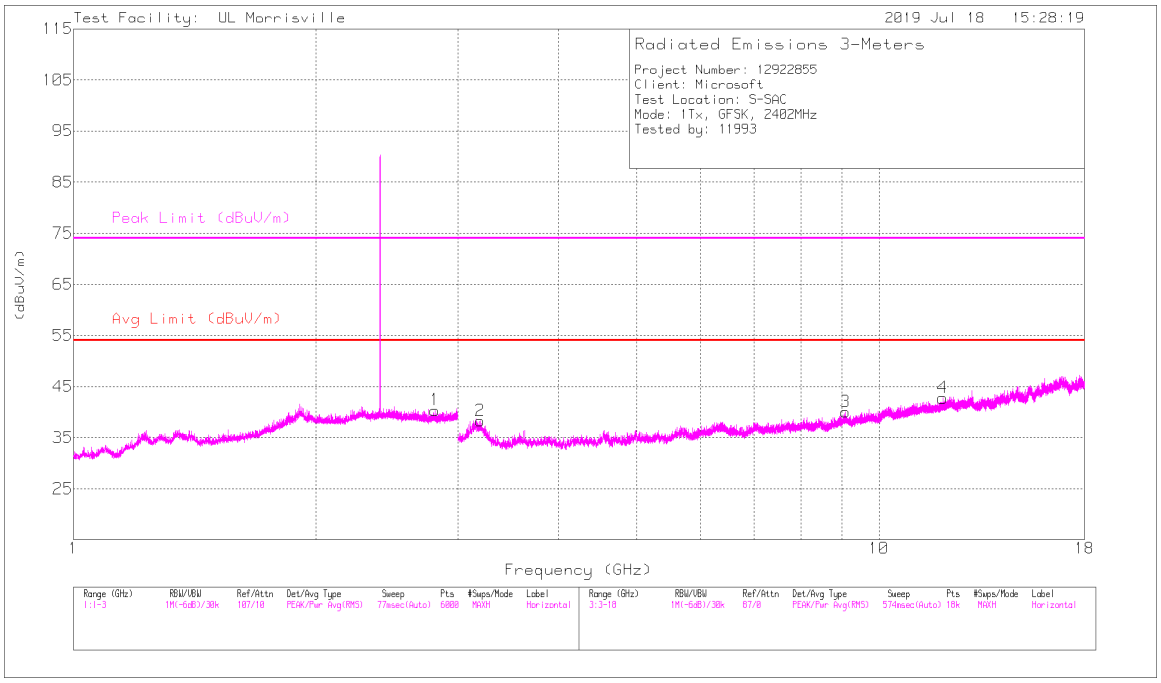
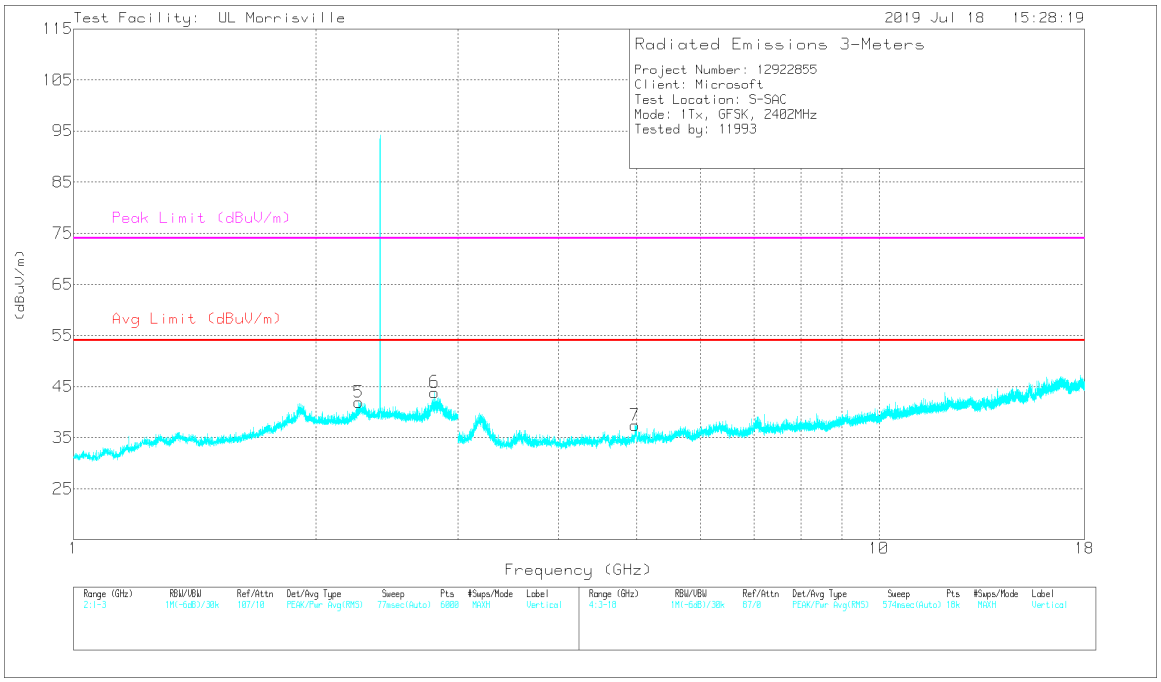
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.80795	39.78	PK-U	32.1	-25.9	45.98	-	-	74	-28.02	63	282	H
	* ** 2.80804	27.92	V1TR	32.1	-25.9	34.12	54	-19.88	-	-	63	282	H
5	* ** 2.25815	40.58	PK-U	31.7	-23.4	48.88	-	-	74	-25.12	103	207	V
	* ** 2.25839	28.91	V1TR	31.7	-23.4	37.21	54	-16.79	-	-	103	207	V
6	* ** 2.80897	45.04	PK-U	32.1	-25.9	51.24	-	-	74	-22.76	98	234	V
	* ** 2.80912	33.46	V1TR	32.1	-25.9	39.66	54	-14.34	-	-	98	234	V
3	* ** 9.08938	35.19	PK-U	36.6	-25.7	46.09	-	-	74	-27.91	236	328	H
	* ** 9.08935	23.61	V1TR	36.6	-25.7	34.51	54	-19.49	-	-	236	328	H
4	* ** 11.99996	33.7	PK-U	38.7	-23.7	48.7	-	-	74	-25.3	5	217	H
	* ** 12.00072	22	V1TR	38.7	-23.7	37	54	-17	-	-	5	217	H
7	* ** 4.97882	42.86	PK-U	34.1	-31.1	45.86	-	-	74	-28.14	305	105	V
	* ** 4.97905	29.3	V1TR	34.1	-31.1	32.3	54	-21.7	-	-	305	105	V
2	3.20001	37.81	Pk	33.1	-32.6	38.31	-	-	-	-	0-360	199	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK-U: Maximum Peak
V1TR: VB=1/Ton, Average where: Ton is packet duration
Pk - Peak detector

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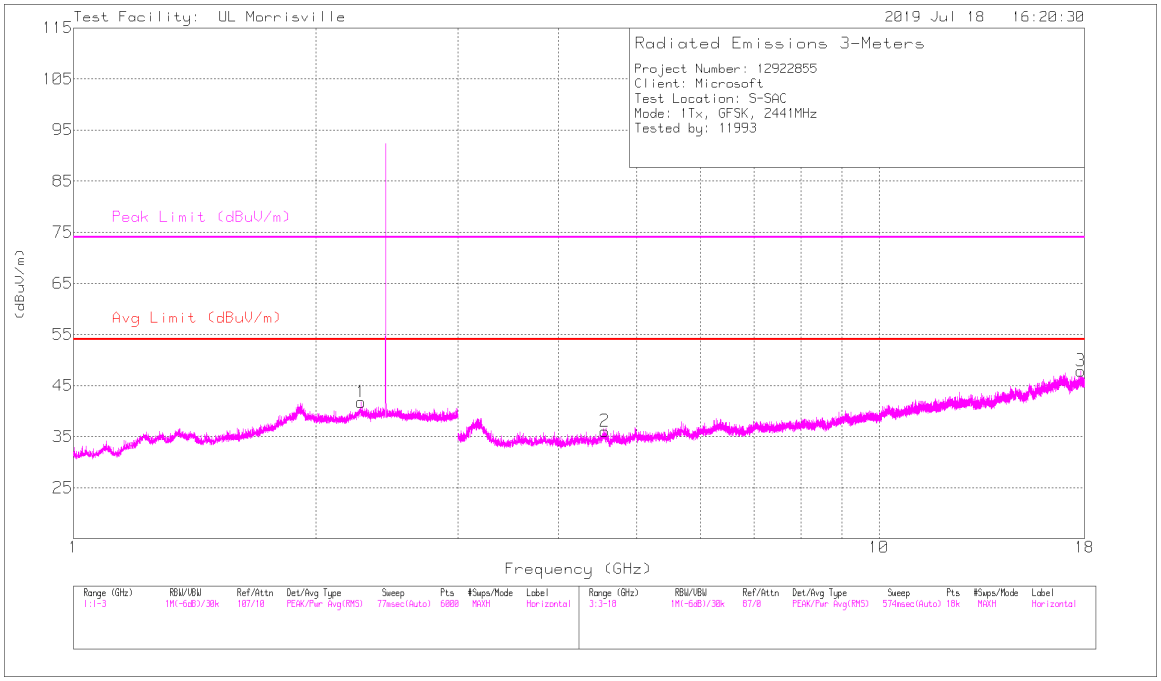
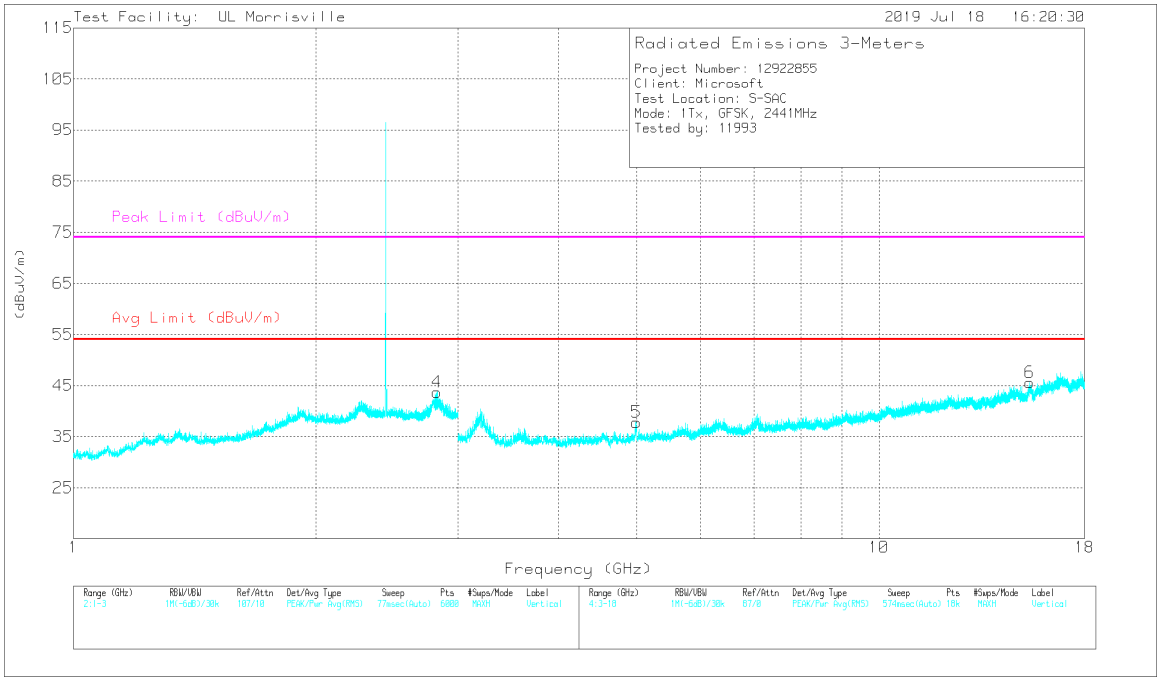
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.27449	38.92	PK-U	31.8	-23.5	47.22	-	-	74	-26.78	147	106	H
	* ** 2.27603	27.69	V1TR	31.8	-23.5	35.99	54	-18.01	-	-	147	106	H
4	* ** 2.82576	45.18	PK-U	32.1	-25.9	51.38	-	-	74	-22.62	99	216	V
	* ** 2.82409	33.2	V1TR	32.1	-25.9	39.4	54	-14.6	-	-	99	216	V
2	* ** 4.56845	40.5	PK-U	34.1	-31.4	43.2	-	-	74	-30.8	69	114	H
	* ** 4.56813	27.9	V1TR	34.1	-31.3	30.7	54	-23.3	-	-	69	114	H
3	* ** 17.80722	34.12	PK-U	41.2	-20.8	54.52	-	-	74	-19.48	235	247	H
	* ** 17.80732	22.19	V1TR	41.2	-20.8	42.59	54	-11.41	-	-	235	247	H
5	* ** 4.99909	42.81	PK-U	34.2	-31.1	45.91	-	-	74	-28.09	291	108	V
	* ** 4.99891	29.14	V1TR	34.2	-31.1	32.24	54	-21.76	-	-	291	108	V
6	* ** 15.38935	33.68	PK-U	39.9	-21.4	52.18	-	-	74	-21.82	277	259	V
	* ** 15.3893	21.78	V1TR	39.9	-21.4	40.28	54	-13.72	-	-	277	259	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK-U: Maximum Peak
V1TR: VB=1/Ton, Average where: Ton is packet duration

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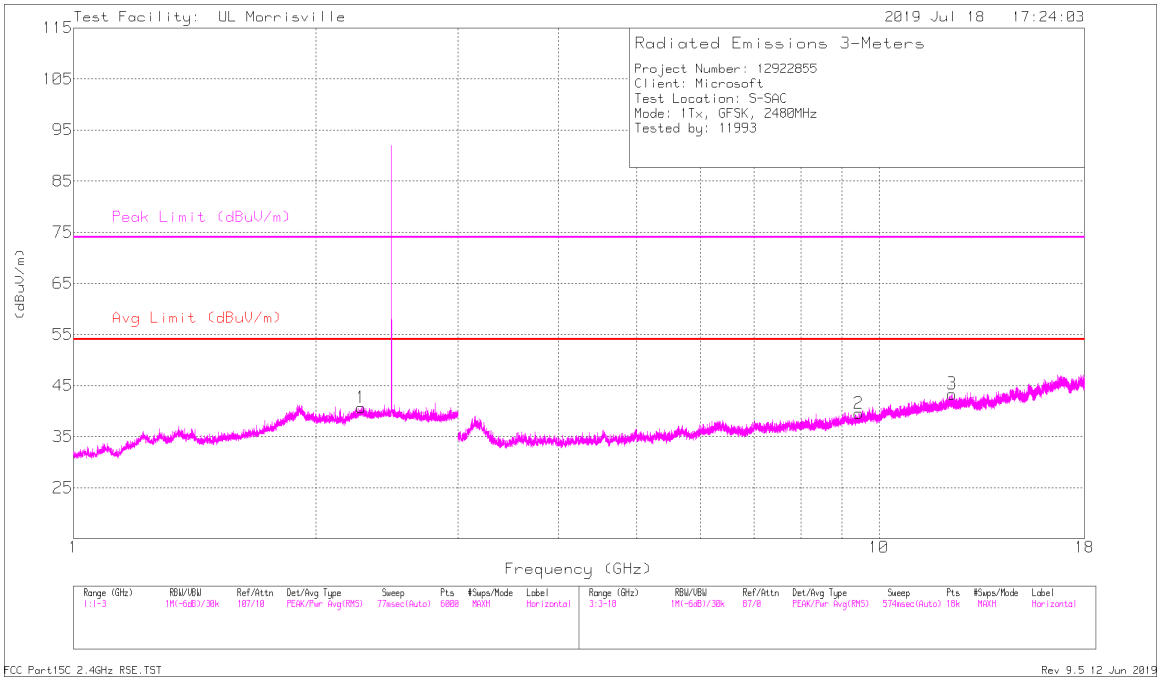
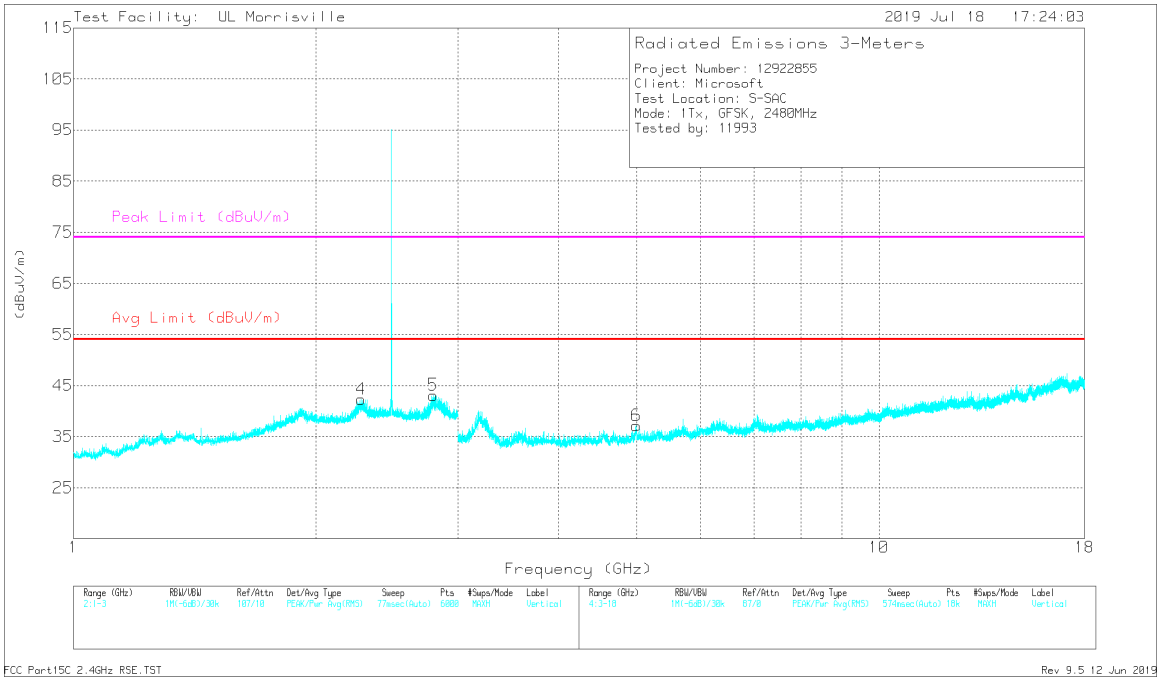
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.27778	39.55	PK-U	31.8	-23.5	47.85	-	-	74	-26.15	349	147	H
	* ** 2.27811	27.94	V1TR	31.8	-23.5	36.24	54	-17.76	-	-	349	147	H
4	* ** 2.27474	40.74	PK-U	31.8	-23.5	49.04	-	-	74	-24.96	92	236	V
	* ** 2.27367	29.34	V1TR	31.8	-23.5	37.64	54	-16.36	-	-	92	236	V
5	* ** 2.79382	44.45	PK-U	32.2	-25.8	50.85	-	-	74	-23.15	104	214	V
	* ** 2.79383	32.6	V1TR	32.2	-25.8	39	54	-15	-	-	104	214	V
2	* ** 9.43504	35.57	PK-U	37	-26.2	46.37	-	-	74	-27.63	337	400	H
	* ** 9.43447	23.52	V1TR	37	-26.2	34.32	54	-19.68	-	-	337	400	H
3	* ** 12.3244	34.28	PK-U	38.8	-23.8	49.28	-	-	74	-24.72	291	345	H
	* ** 12.32496	22.46	V1TR	38.8	-23.8	37.46	54	-16.54	-	-	291	345	H
6	* ** 4.99866	42.51	PK-U	34.2	-31.1	45.61	-	-	74	-28.39	291	101	V
	* ** 4.99879	28.99	V1TR	34.2	-31.1	32.09	54	-21.91	-	-	291	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK-U: Maximum Peak
V1TR: VB=1/Ton, Average where: Ton is packet duration

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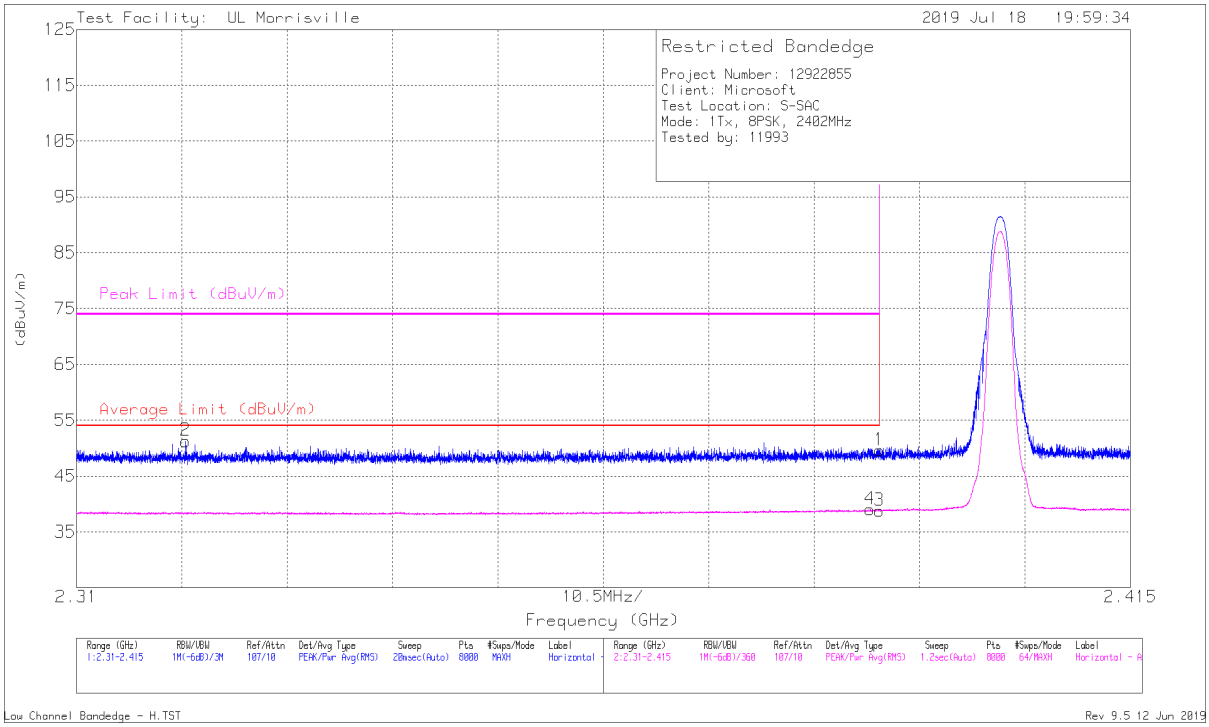
9.2.2. BLUETOOTH ENHANCED DATA RATE 8PSK MODULATION

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	41.82	Pk	31.9	-24.1	49.62	-	-	74	-24.38	78	112	H
2	* ** 2.32087	43.77	Pk	31.7	-24.2	51.27	-	-	74	-22.73	78	112	H
3	* ** 2.39	31.02	V1TR	31.9	-24.1	38.82	54	-15.18	-	-	78	112	H
4	* ** 2.38908	31.24	V1TR	31.9	-24.1	39.04	54	-14.96	-	-	78	112	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Average where: Ton is packet duration

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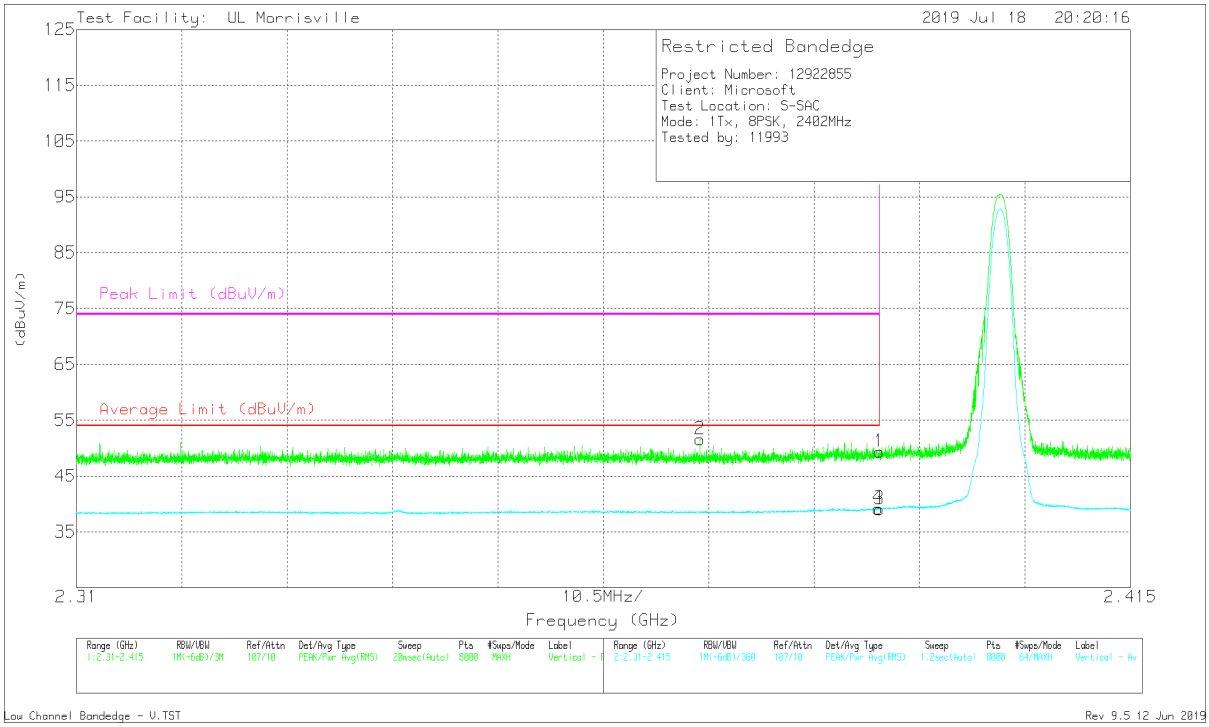
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	41.54	Pk	31.9	-24.1	49.34	-	-	74	-24.66	245	342	V
2	* ** 2.37213	43.94	Pk	31.8	-24.2	51.54	-	-	74	-22.46	245	342	V
3	* ** 2.39	31.28	V1TR	31.9	-24.1	39.08	54	-14.92	-	-	245	342	V
4	* ** 2.38985	31.41	V1TR	31.9	-24.1	39.21	54	-14.79	-	-	245	342	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Average where: Ton is packet duration

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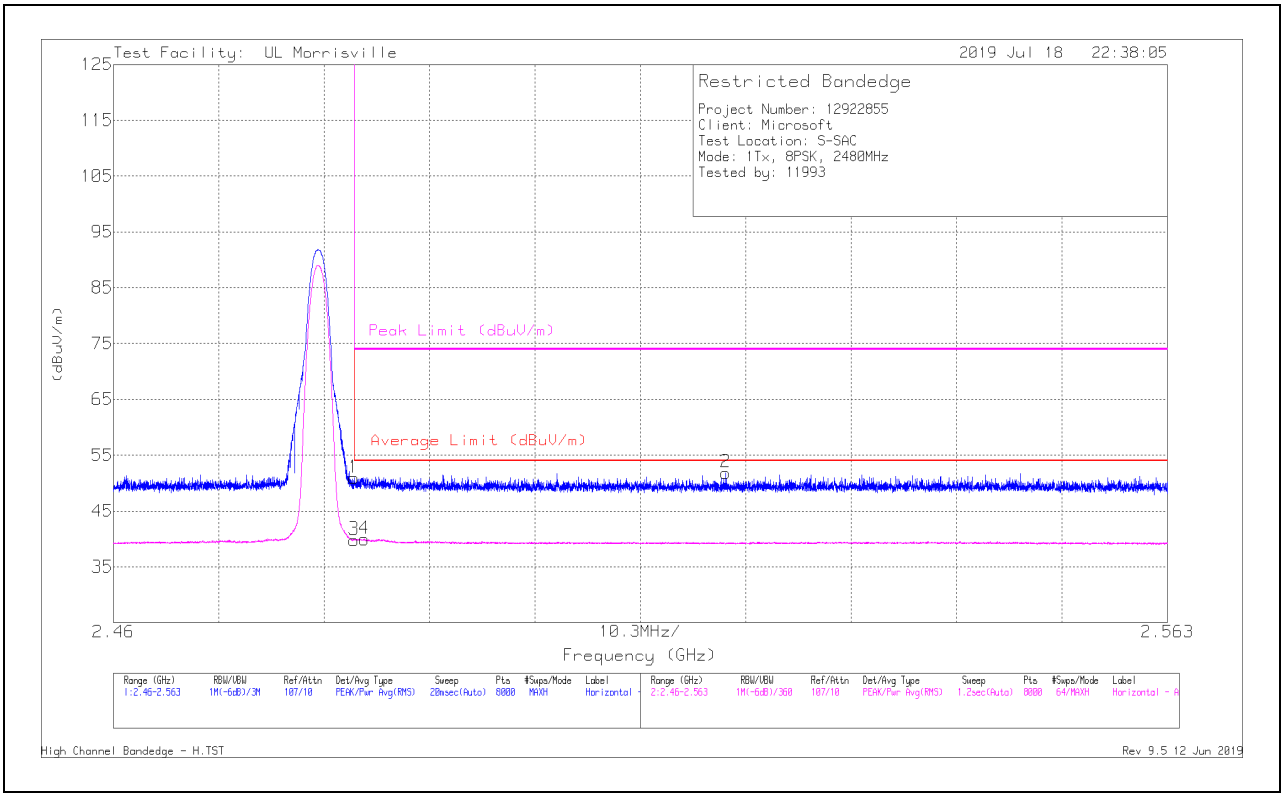
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	42.62	Pk	32.3	-24	50.92	-	-	74	-23.08	77	108	H
2	** 2.51983	43.48	Pk	32.4	-24	51.88	-	-	74	-22.12	77	108	H
3	* ** 2.4835	31.53	V1TR	32.3	-24	39.83	54	-14.17	-	-	77	108	H
4	* ** 2.48449	31.67	V1TR	32.3	-24	39.97	54	-14.03	-	-	77	108	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Average where: Ton is packet duration

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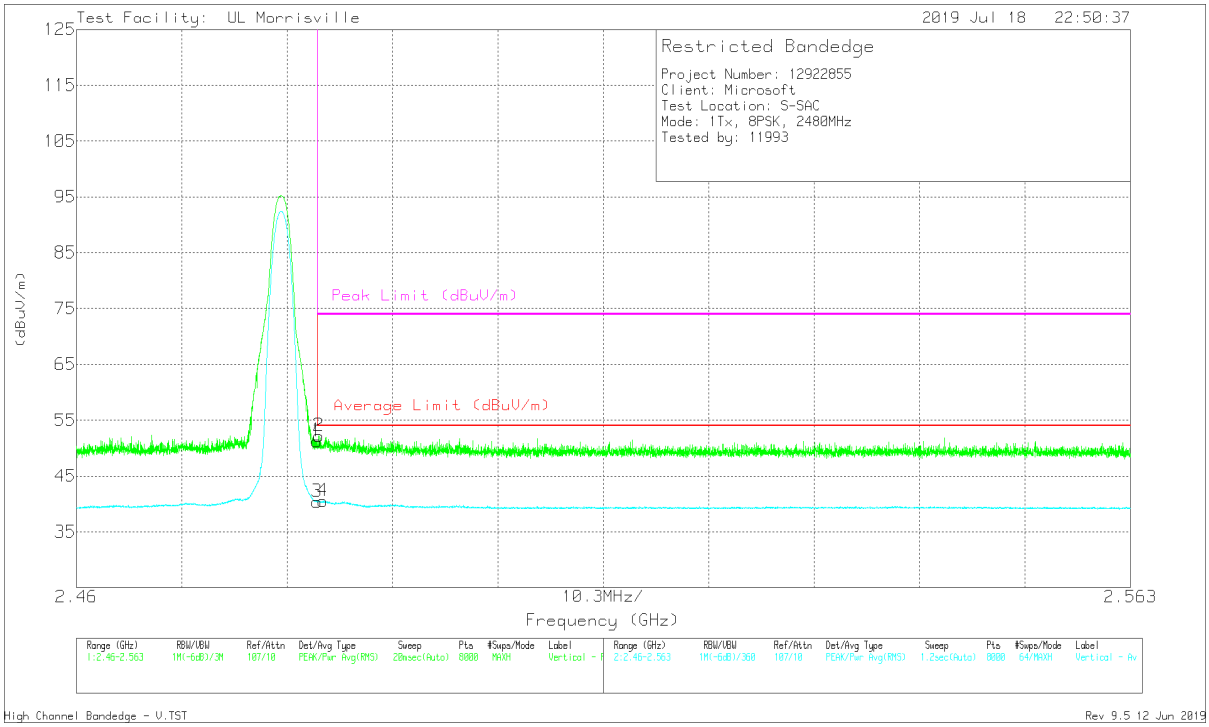
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	42.96	Pk	32.3	-24	51.26	-	-	74	-22.74	355	127	V
2	* ** 2.48368	43.9	Pk	32.3	-24	52.2	-	-	74	-21.8	355	127	V
3	* ** 2.4835	32.11	V1TR	32.3	-24	40.41	54	-13.59	-	-	355	127	V
4	* ** 2.48411	32.23	V1TR	32.3	-24	40.53	54	-13.47	-	-	355	127	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
V1TR: VB=1/Ton, Average where: Ton is packet duration

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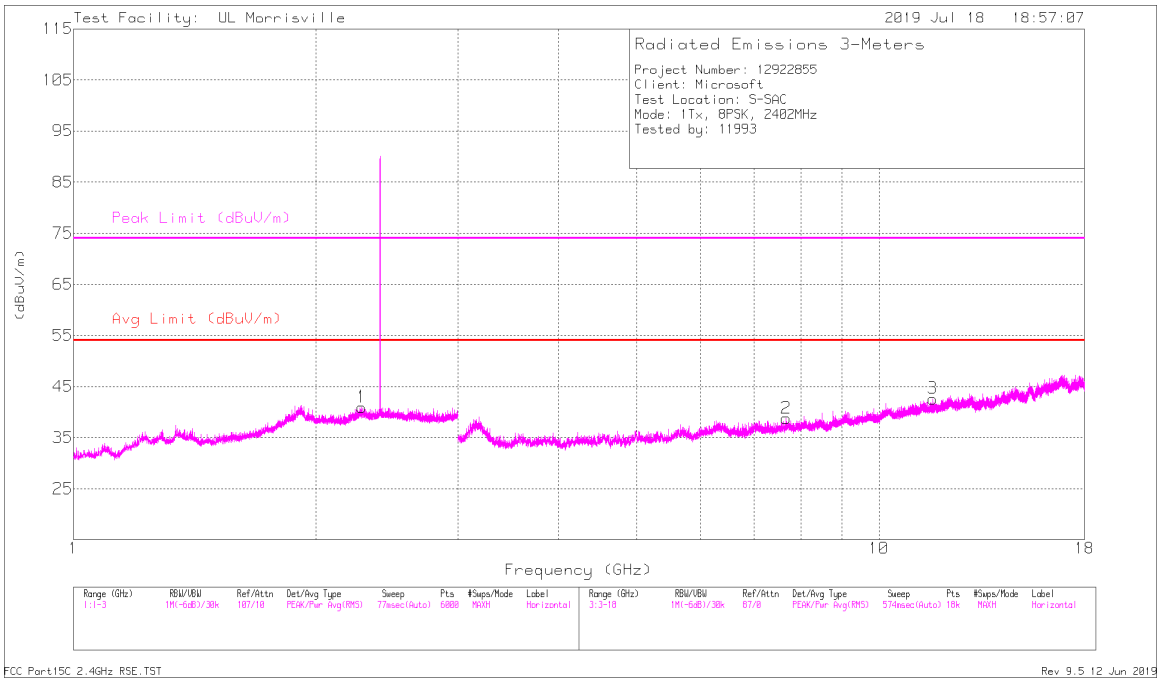
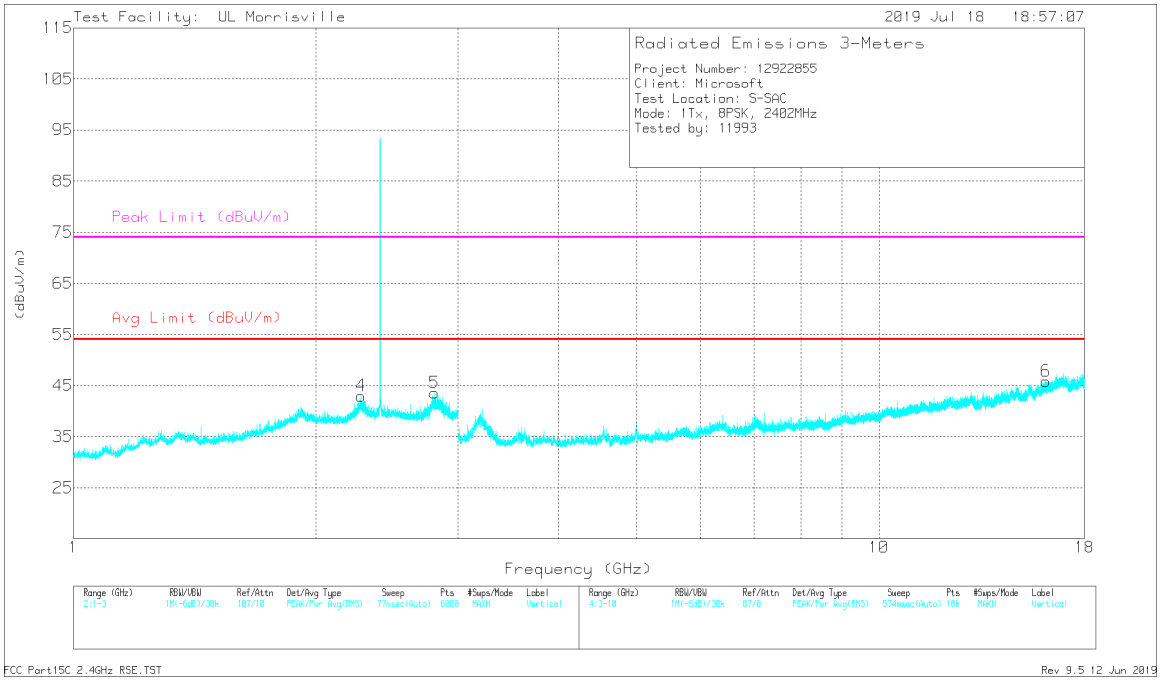
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.27687	40.09	PK-U	31.8	-23.5	48.39	-	-	74	-25.61	351	146	H
	* ** 2.27758	27.77	V1TR	31.8	-23.5	36.07	54	-17.93	-	-	351	146	H
4	* ** 2.27487	41.02	PK-U	31.8	-23.5	49.32	-	-	74	-24.68	91	261	V
	* ** 2.2737	29.29	V1TR	31.8	-23.5	37.59	54	-16.41	-	-	91	261	V
5	* ** 2.80717	45.34	PK-U	32.1	-25.9	51.54	-	-	74	-22.46	101	212	V
	* ** 2.80668	33.57	V1TR	32.2	-25.9	39.87	54	-14.13	-	-	101	212	V
2	* ** 7.6722	36.46	PK-U	35.9	-27.4	44.96	-	-	74	-29.04	37	136	H
	* ** 7.67248	24.52	V1TR	35.9	-27.4	33.02	54	-20.98	-	-	37	136	H
3	* ** 11.67174	34.66	PK-U	38.4	-24.1	48.96	-	-	74	-25.04	245	216	H
	* ** 11.67153	22.23	V1TR	38.4	-24.1	36.53	54	-17.47	-	-	245	216	H
6	* ** 16.12894	34.25	PK-U	40.9	-23.7	51.45	-	-	74	-22.55	183	162	V
	* ** 16.13089	23.32	V1TR	40.9	-23.7	40.52	54	-13.48	-	-	183	162	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK-U: Maximum Peak
V1TR: VB=1/Ton, Average where: Ton is packet duration

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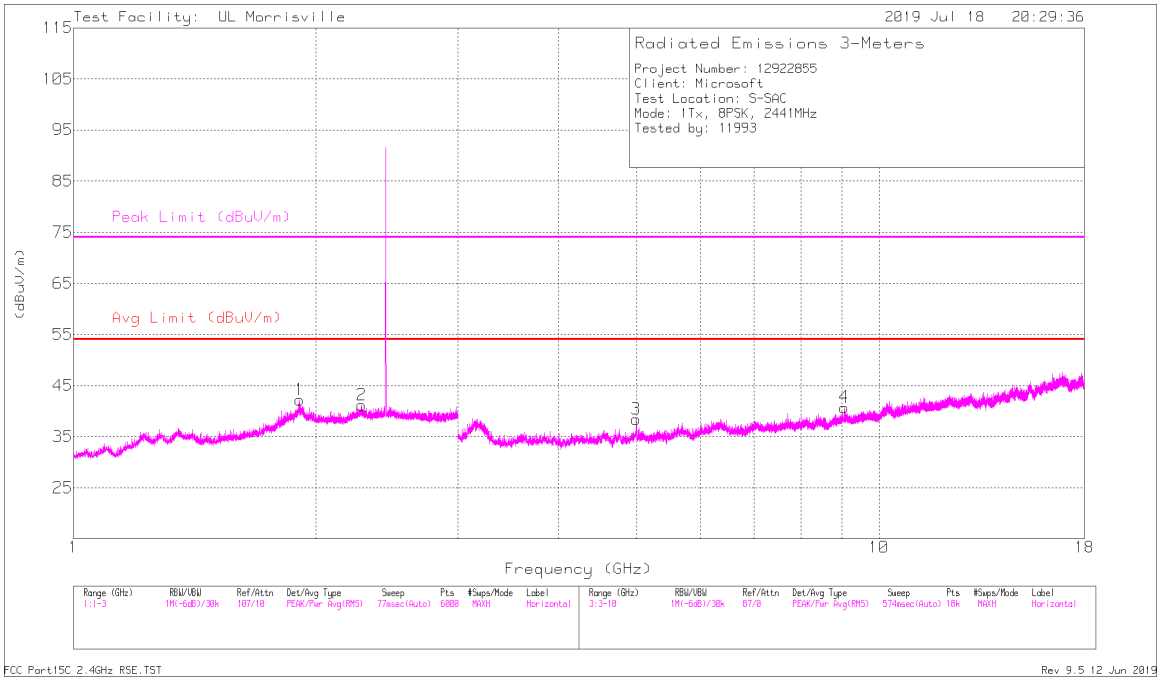
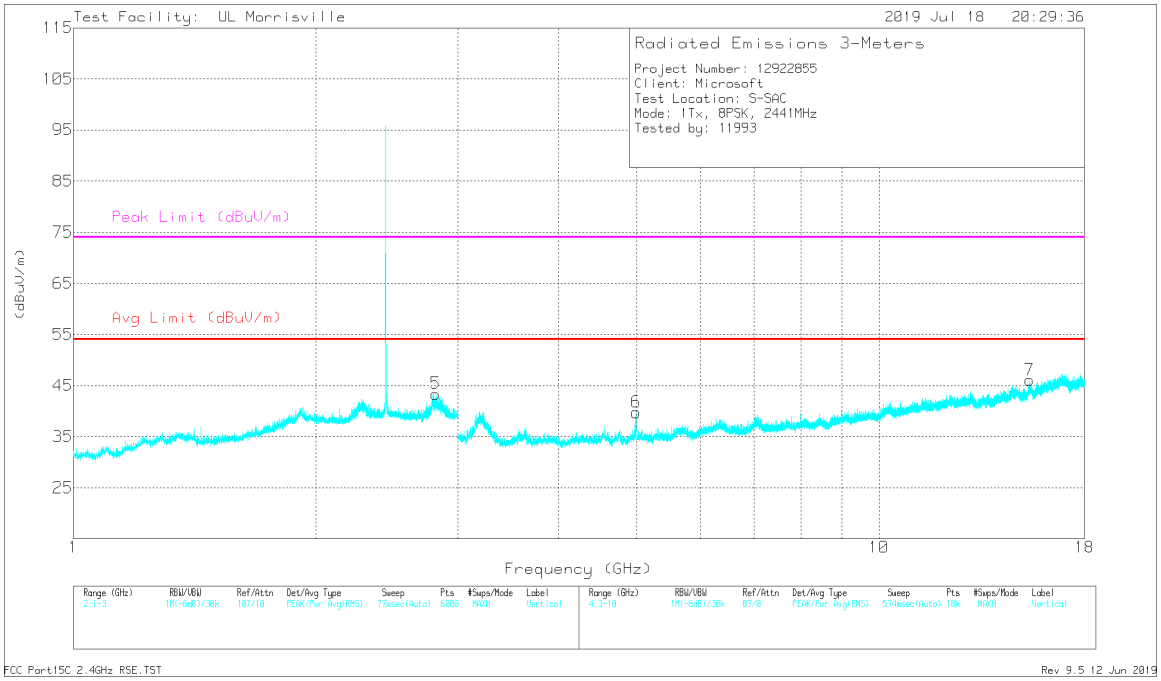
MID CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	** 1.90933	39.63	PK-U	31.1	-22.4	48.33	-	-	74	-25.67	360	206	H
	** 1.90966	27.9	V1TR	31.1	-22.4	36.6	54	-17.4	-	-	360	206	H
2	* ** 2.2776	39.77	PK-U	31.8	-23.5	48.07	-	-	74	-25.93	145	109	H
	* ** 2.27764	27.8	V1TR	31.8	-23.5	36.1	54	-17.9	-	-	145	109	H
5	* ** 2.81285	45.38	PK-U	32.1	-25.9	51.58	-	-	74	-22.42	100	239	V
	* ** 2.81263	33.63	V1TR	32.1	-25.9	39.83	54	-14.17	-	-	100	239	V
3	* ** 4.99844	42.54	PK-U	34.2	-31.1	45.64	-	-	74	-28.36	288	142	H
	* ** 4.99895	29.34	V1TR	34.2	-31.1	32.44	54	-21.56	-	-	288	142	H
4	* ** 9.06168	35.88	PK-U	36.6	-26.3	46.18	-	-	74	-27.82	311	148	H
	* ** 9.06209	24.08	V1TR	36.6	-26.3	34.38	54	-19.62	-	-	311	148	H
6	* ** 4.99917	43.5	PK-U	34.2	-31.1	46.6	-	-	74	-27.4	295	101	V
	* ** 4.99909	29.72	V1TR	34.2	-31.1	32.82	54	-21.18	-	-	295	101	V
7	* ** 15.38249	33.74	PK-U	39.9	-21.6	52.04	-	-	74	-21.96	303	231	V
	* ** 15.38299	22.14	V1TR	39.9	-21.5	40.54	54	-13.46	-	-	303	231	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK-U: Maximum Peak
V1TR: VB=1/Ton, Average where: Ton is packet duration

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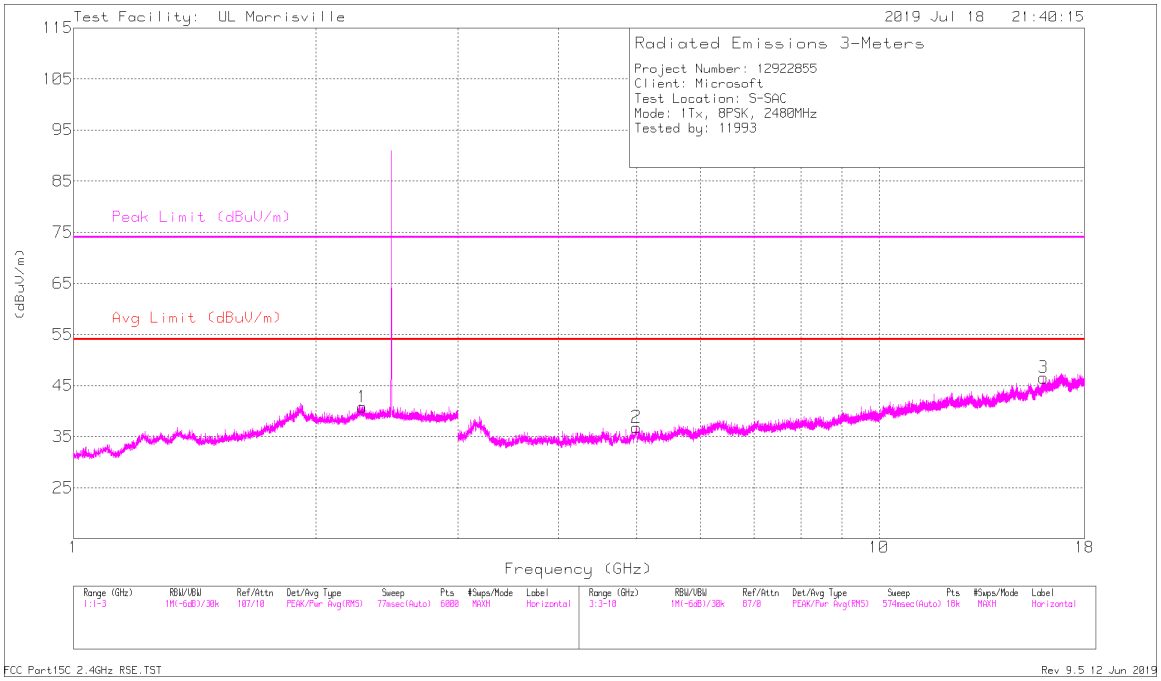
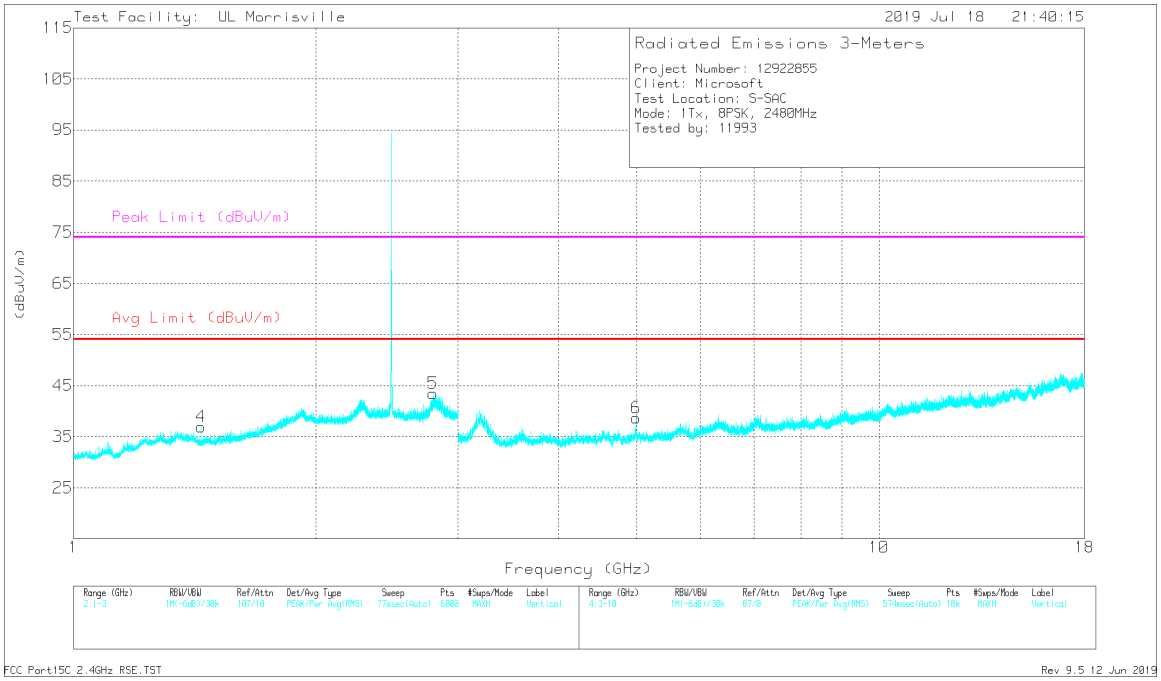
HIGH CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.28075	38.48	PK-U	31.8	-23.5	46.78	-	-	74	-27.22	231	261	H
	* ** 2.28054	27.13	V1TR	31.8	-23.5	35.43	54	-18.57	-	-	231	261	H
4	* ** 1.4401	37.52	PK-U	28.1	-22.7	42.92	-	-	74	-31.08	315	188	V
	* ** 1.44004	29.1	V1TR	28.1	-22.7	34.5	54	-19.5	-	-	315	188	V
5	* ** 2.79443	44.74	PK-U	32.2	-25.8	51.14	-	-	74	-22.86	97	234	V
	* ** 2.79414	33.44	V1TR	32.2	-25.8	39.84	54	-14.16	-	-	97	234	V
2	* ** 4.99895	42.66	PK-U	34.2	-31.1	45.76	-	-	74	-28.24	331	118	H
	* ** 4.99882	29.1	V1TR	34.2	-31.1	32.2	54	-21.8	-	-	331	118	H
3	* ** 16.0189	35.08	PK-U	40.7	-23.5	52.28	-	-	74	-21.72	6	123	H
	* ** 16.01933	23.69	V1TR	40.7	-23.5	40.89	54	-13.11	-	-	6	123	H
6	* ** 4.99268	42.88	PK-U	34.1	-31.1	45.88	-	-	74	-28.12	300	115	V
	* ** 4.99243	29.37	V1TR	34.1	-31.1	32.37	54	-21.63	-	-	300	115	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK-U: Maximum Peak
V1TR: VB=1/Ton, Average where: Ton is packet duration

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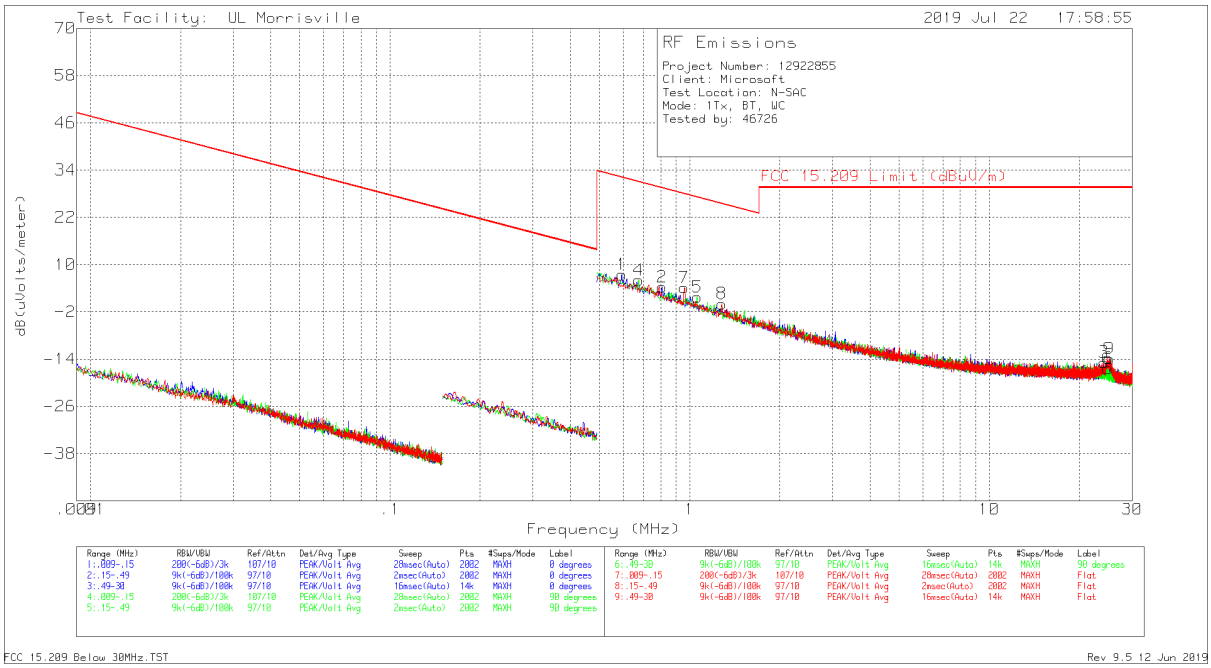
9.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

Note: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions and demonstrate compliance with the requirement that the level of any spurious emissions be below the level of the intentionally transmitted signal. The extrapolation factor for the limits were 40*Log (test distance / specification distance).



ANTENNA- THREE ORIENTATIONS

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0059 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/Avg Limit (dBuV/m)	FCC 15.209 Pk Limit (dBuV/m)	Worst-Case Margin (dB)	Azimuth (Degs)
1	.59329	36.92	Pk	10.4	.1	-40	7.42	32.14	-	-24.72	0-360
4	.6755	35.51	Pk	10.4	.1	-40	6.01	31.01	-	-25	0-360
2	.80831	33.84	Pk	10.3	.1	-40	4.24	29.45	-	-25.21	0-360
7	.96008	33.38	Pk	10.5	.2	-40	4.08	27.96	-	-23.88	0-360
5	1.05916	30.92	Pk	10.6	.2	-40	1.72	27.11	-	-25.39	0-360
8	1.2805	29.25	Pk	10.6	.2	-40	.05	25.46	-	-25.41	0-360
3	24.12068	14.78	Pk	9.6	.8	-40	-14.82	29.54	-	-44.36	0-360
6	24.90064	13.52	Pk	9.3	.8	-40	-16.38	29.54	-	-45.92	0-360
9	25.13463	15.89	Pk	9.3	.9	-40	-13.91	29.54	-	-43.45	0-360

Pk - Peak detector

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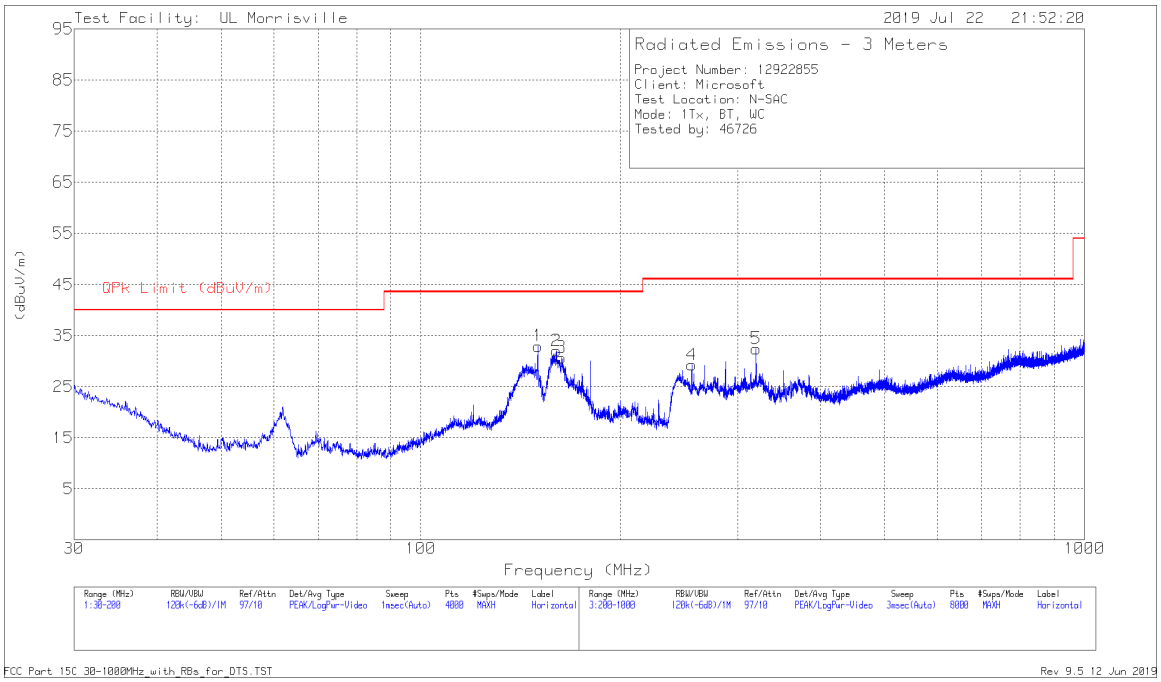
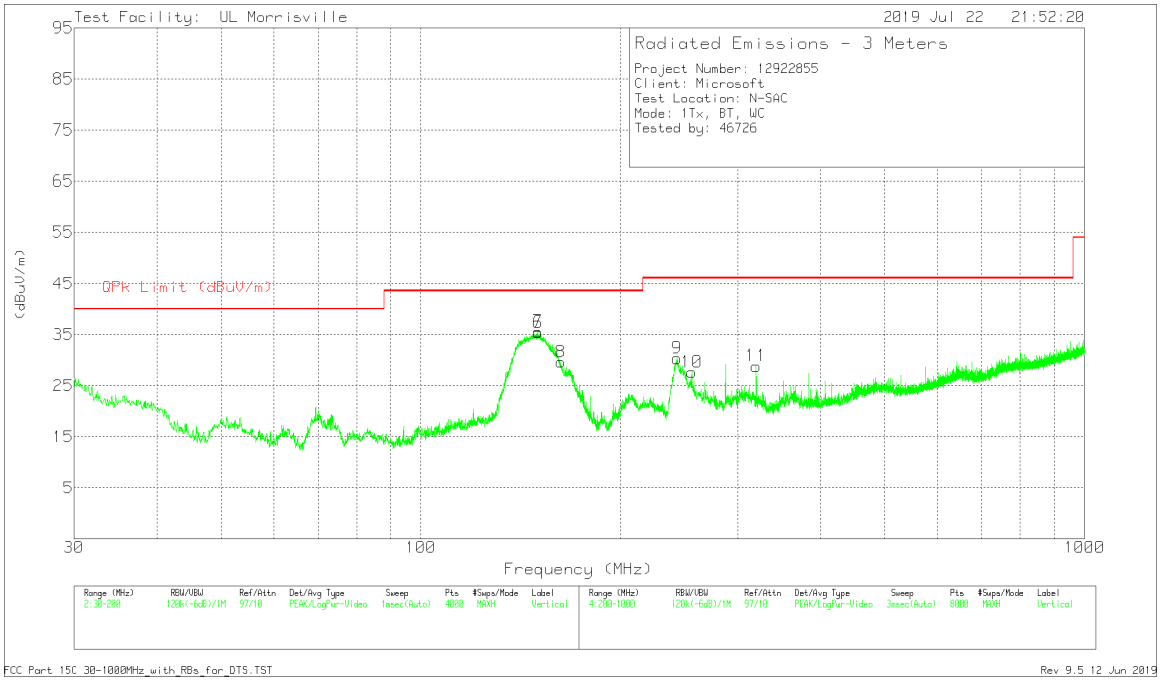
9.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0073 ACF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 150.0086	44.45	Pk	19	-30.5	32.95	43.52	-10.57	0-360	199	H
3	* ** 162.9319	42.38	Pk	18.7	-30.4	30.68	43.52	-12.84	0-360	199	H
6	* ** 150.0086	46.91	Pk	19	-30.5	35.41	43.52	-8.11	0-360	102	V
8	* ** 162.5068	41.36	Pk	18.7	-30.4	29.66	43.52	-13.86	0-360	102	V
4	* ** 256.0073	40.57	Pk	18.4	-29.7	29.27	46.02	-16.75	0-360	102	H
9	* ** 243.0056	41.95	Pk	18.2	-29.8	30.35	46.02	-15.67	0-360	102	V
10	* ** 256.0073	38.95	Pk	18.4	-29.7	27.65	46.02	-18.37	0-360	102	V
7	150.0511	47.04	Pk	19	-30.5	35.54	43.52	-7.98	0-360	102	V
2	159.9986	43.69	Pk	18.7	-30.4	31.99	43.52	-11.53	0-360	199	H
5	320.0156	41.22	Pk	20.6	-29.4	32.42	46.02	-13.6	0-360	102	H
11	320.0156	37.63	Pk	20.6	-29.4	28.83	46.02	-17.19	0-360	199	V

Pk - Peak detector

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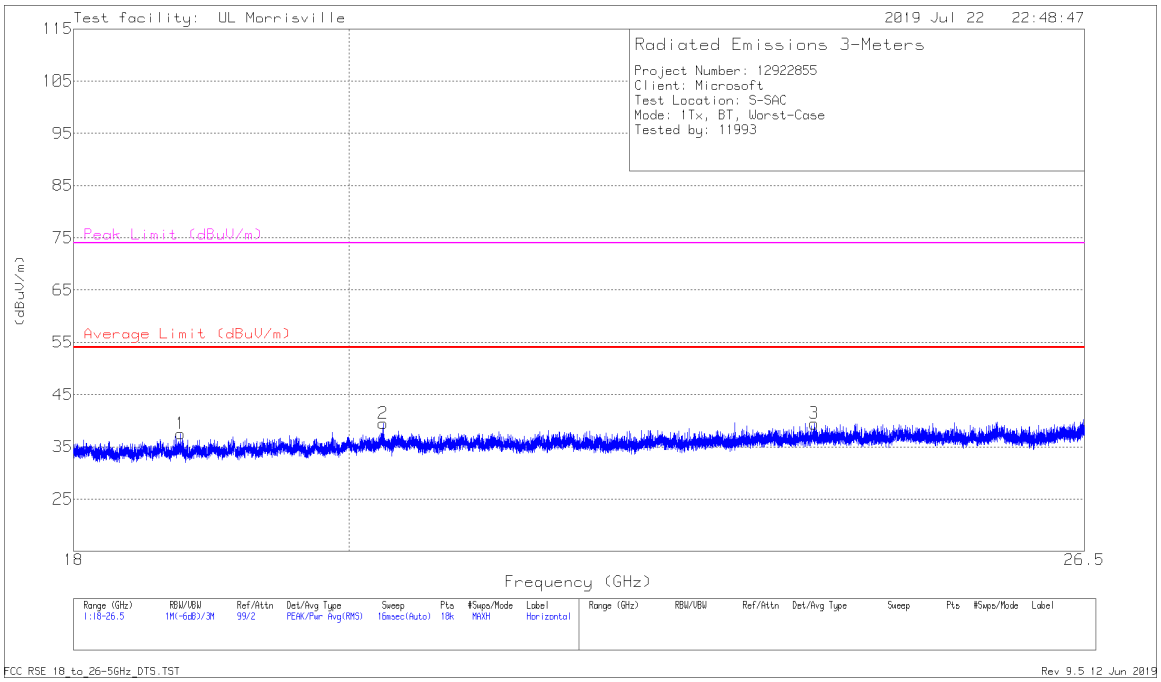
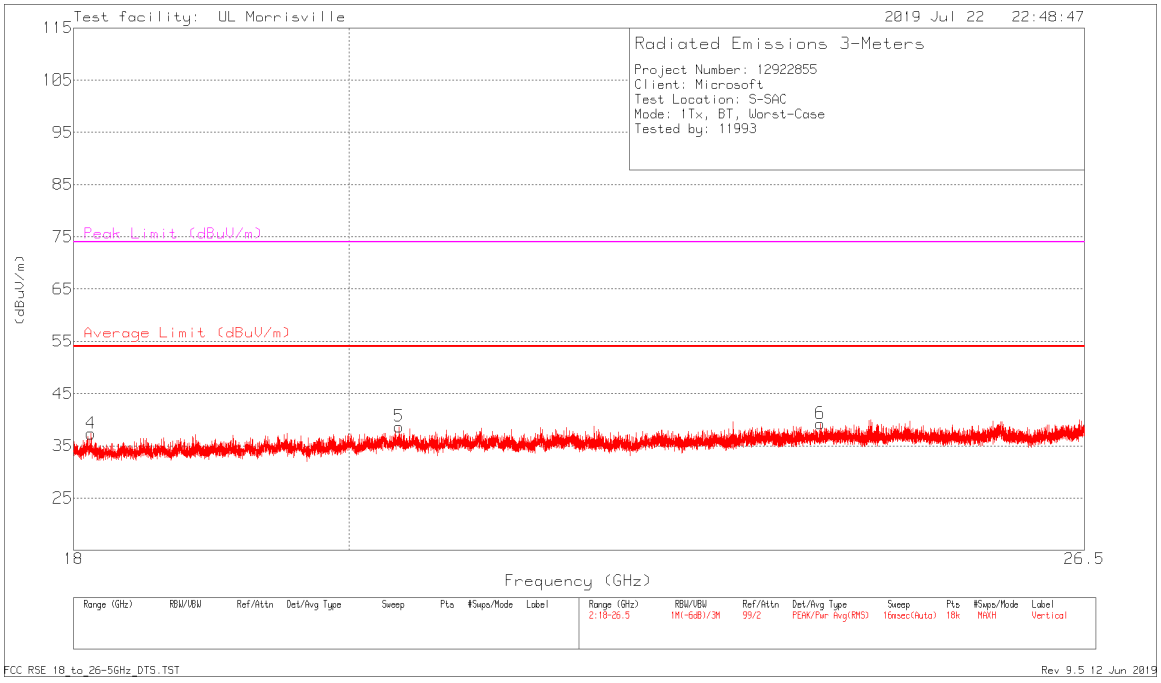
9.5. WORST CASE 18-26 GHZ

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



HORIZONTAL



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18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 18.75229	43.91	Pk	32.5	-38.9	37.51	54	-16.49	74	-36.49	0-360	199	H
2	* ** 20.26301	44.85	Pk	33	-38.4	39.45	54	-14.55	74	-34.55	0-360	299	H
3	* ** 23.89602	42.74	Pk	34	-37.3	39.44	54	-14.56	74	-34.56	0-360	299	H
4	* ** 18.12137	44.25	Pk	32.4	-39.3	37.35	54	-16.65	74	-36.65	0-360	299	V
5	* ** 20.38816	43.88	Pk	33	-38.2	38.68	54	-15.32	74	-35.32	0-360	201	V
6	* ** 23.95269	42.49	Pk	34	-37.2	39.29	54	-14.71	74	-34.71	0-360	299	V

Pk - Peak detector

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10. 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 C63.10.

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

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

RESULTS

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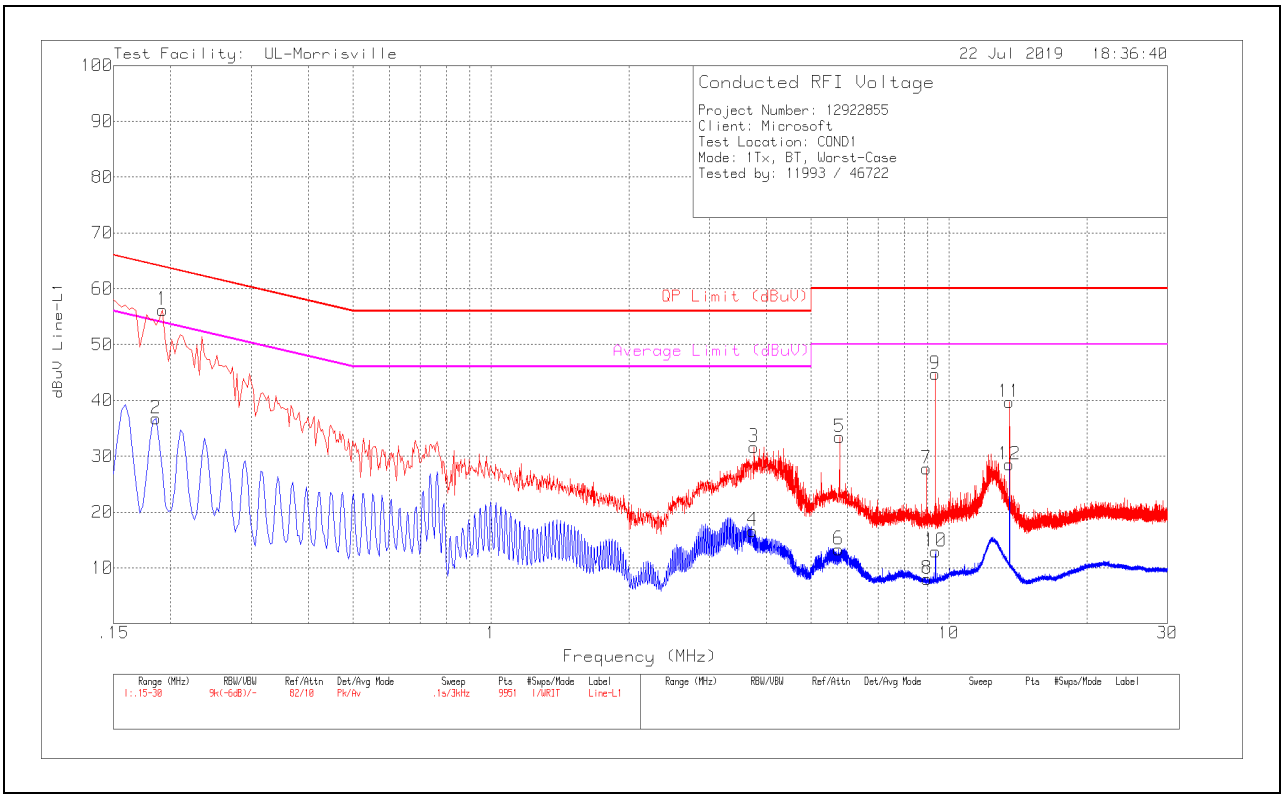
10.1.1. AC Power Line Host

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	.192	46.14	Pk	.1	10	56.24	63.95	-7.71	-	-
2	.186	26.57	Av	.2	10	36.77	-	-	54.21	-17.44
3	3.756	21.55	Pk	0	10.1	31.65	56	-24.35	-	-
4	3.729	6.57	Av	0	10.1	16.67	-	-	46	-29.33
5	5.772	23.26	Pk	0	10.2	33.46	60	-26.54	-	-
6	5.748	3.13	Av	0	10.2	13.33	-	-	50	-36.67
7	8.937	17.41	Pk	.1	10.3	27.81	60	-32.19	-	-
8	8.952	-2.34	Av	.1	10.3	8.06	-	-	50	-41.94
9	9.342	34.35	Pk	.1	10.3	44.75	60	-15.25	-	-
10	9.351	2.58	Av	.1	10.3	12.98	-	-	50	-37.02
11	13.56	29.23	Pk	.1	10.4	39.73	60	-20.27	-	-
12	13.56	18.01	Av	.1	10.4	28.51	-	-	50	-21.49

Pk - Peak detector
Av – Average Detector

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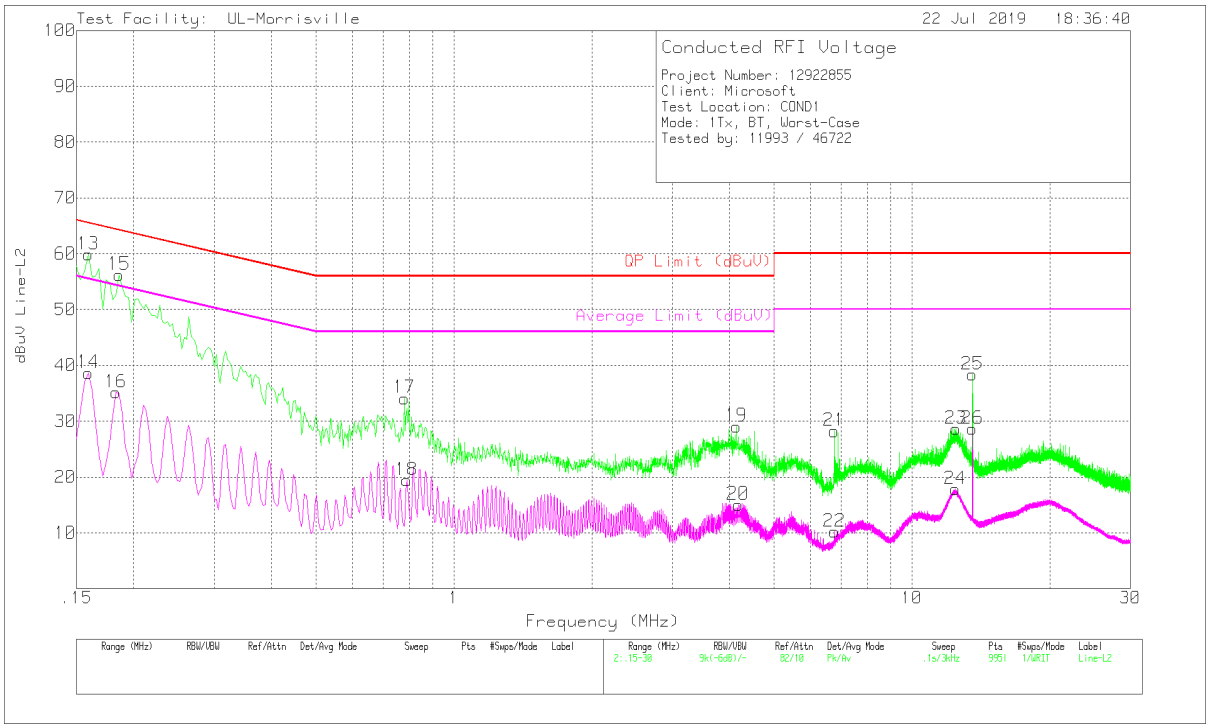
LINE 2 RESULTS



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	.15311	39.93	Qp	.2	10	50.13	65.83	-15.7	-	-
14	.15311	26.35	Av	.2	10	36.55	-	-	55.83	-19.28
15	.186	46.03	Pk	.2	10	56.23	64.21	-7.98	-	-
16	.183	24.94	Av	.2	10	35.14	-	-	54.35	-19.21
17	.78	24.13	Pk	0	10	34.13	56	-21.87	-	-
18	.789	9.45	Av	0	10	19.45	-	-	46	-26.55
19	4.14	18.88	Pk	0	10.2	29.08	56	-26.92	-	-
20	4.173	4.86	Av	0	10.2	15.06	-	-	46	-30.94
21	6.774	17.94	Pk	.1	10.2	28.24	60	-31.76	-	-
22	6.777	-.11	Av	.1	10.2	10.19	-	-	50	-39.81
23	12.474	18.14	Pk	.1	10.4	28.64	60	-31.36	-	-
24	12.444	7.37	Av	.1	10.4	17.87	-	-	50	-32.13
25	13.56	27.85	Pk	.1	10.4	38.35	60	-21.65	-	-
26	13.56	18.17	Av	.1	10.4	28.67	-	-	50	-21.33

Pk - Peak detector
Av – Average Detector

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11. SETUP PHOTOS

Please refer to R12922855-EP1 for setup photos

END OF TEST REPORT

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