TEST REPORT

Report Number. : R13441612R-E3

Applicant	:	Bose Corporation 100 The Mountain Road Framingham, MA 01701, USA
Model	:	109R
FCC ID	:	A94109R
IC	:	3232A-109R
EUT Description	:	Right Earbud
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C: 2020 ISED RSS-247 ISSUE 2: 2017 ISED RSS-GEN ISSUE 5 + Amendment 1: 2019

Date Of Issue:
October 29, 2020

Prepared by:
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NVLAP TESTING
NVLAP Lab code: 200246-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
v.1	10/29/2020	Initial Issue	Haley Ackun

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TABLE OF CONTENTS

REPORT REVISION HISTORY **2**

TABLE OF CONTENTS **3**

1. ATTESTATION OF TEST RESULTS **5**

2. TEST RESULTS SUMMARY **6**

3. TEST METHODOLOGY **7**

4. FACILITIES AND ACCREDITATION **7**

5. DECISION RULES AND MEASUREMENT UNCERTAINTY **8**

5.1. METROLOGICAL TRACEABILITY *8*

5.2. DECISION RULES *8*

5.3. MEASUREMENT UNCERTAINTY *8*

5.4. SAMPLE CALCULATION *9*

6. EQUIPMENT UNDER TEST **10**

6.1. EUT DESCRIPTION *10*

6.2. MAXIMUM OUTPUT POWER *10*

6.3. DESCRIPTION OF AVAILABLE ANTENNAS *10*

6.4. SOFTWARE AND FIRMWARE *10*

6.5. WORST-CASE CONFIGURATION AND MODE *10*

6.6. DESCRIPTION OF TEST SETUP *11*

7. MEASUREMENT METHOD **12**

8. TEST AND MEASUREMENT EQUIPMENT **13**

9. ANTENNA PORT TEST RESULTS **15**

9.1. ON TIME AND DUTY CYCLE *15*

9.2. 99% BANDWIDTH *17*

9.2.1. BLE (1Mbps) 18

9.3. 6 dB BANDWIDTH *19*

9.3.1. BLE (1Mbps) 20

9.4. OUTPUT POWER *21*

9.4.1. BLE (1Mbps) 21

9.5. AVERAGE POWER *22*

9.5.1. BLE (1Mbps) 22

9.6. POWER SPECTRAL DENSITY *23*

9.6.1. BLE (1Mbps) 24

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9.7. CONDUCTED SPURIOUS EMISSIONS 25
9.7.1. BLE (1Mbps) 26

10. RADIATED TEST RESULTS 27

10.1. LIMITS AND PROCEDURE 27

10.2. TRANSMITTER ABOVE 1 GHz 29
10.2.1. BLE (1Mbps) 29

10.3. WORST CASE BELOW 30MHZ 39

10.4. WORST CASE BELOW 1 GHZ 41

10.5. WORST CASE 18-26 GHz 43

11. AC POWER LINE CONDUCTED EMISSIONS 45

11.1.1. AC Power Line Norm 46

12. SETUP PHOTOS 48

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Bose Corporation
100 The Mountain Road
Framingham, MA 01701, USA

EUT DESCRIPTION: Right Earbud

MODEL: 109R

SERIAL NUMBER: 083103U02530013AE, 083103u02540009AE

DATE TESTED: 2020-10-07 to 2020-10-12

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C: 2020	Complies
ISED RSS-247 Issue 2: 2017	Complies
ISED RSS-GEN Issue 5+ Amendment 1: 2019	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.

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. government.

Approved & Released For
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2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.247 (a) (2)	RSS-247 5.2 (a)	6dB BW	Compliant	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Compliant	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Compliant	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Compliant	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Compliant	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Compliant	None.

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3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15: 2020, ANSI C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + Amendment 1: 2019, and RSS-247 Issue 2: 2017.

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Dr., Suite B Morrisville, NC, 27560 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.
ISED Site Code: 2180C	
☐ Chamber A RTP	☒ North Chamber
☐ Chamber C RTP	☐ South Chamber

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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	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.82%
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	4.88 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%
Conducted PSD	2.47 dB
Conducted RF Output Power (PK)	1.3 dB
Conducted RF Output Power (AV)	0.45 dB

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

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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 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

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a right wireless earbud of a wireless headset pair that has BT and BLE capability.

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	BLE	8.73	7.46

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an IFA monopole antenna, with a maximum gain of -0.6 dBi.

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was version 0.7.13

The EUT Driver version installed in the support equipment during testing was Qualcomm Technologies International, Ltd. 107.0.0.0

The test utility software used during testing was BlueSuite 3.3.4

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. In addition, both battery and charging modes were investigated and it was determined that battery mode is worst-case.

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 fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that Y orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in Y orientation at 1 Mbps.

For harmonics measurements, both the left and right earbuds were set to transmit simultaneously at different frequencies. This report only covers testing for the right earbud.

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charging base	Bose	435109	Non-serialized	NA
Laptop	Lenovo	ThinkPad T450	PC0A2UQT	PD97265NGU
Laptop charger	Lenovo	ADLX65NCC2A	11S45N0263Z1ZS9961BV0U	NA

I/O CABLES

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	1	1	USB 3.0	Single conductor	<1m	Used to charge EUT through the charging base and for test configuration purposes.

TEST SETUP

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

SETUP DIAGRAMS

Please refer to R13441612R-EP1 for setup diagrams

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7. MEASUREMENT METHOD

Duty Cycle: ANSI C63.10 Subclause- 11.6

6 dB BW: ANSI C63.10 Subclause -11.8.1 RBW ≥ DTS BW

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

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter

Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

PSD: ANSI C63.10 Subclause -11.10.2 Method PKPSD (peak PSD)

Emissions in non-restricted frequency bands: ANSI C63.10 Subclause -11.11 and 6.10.4

Emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.1 and 6.10.5

General Radiated Spurious Emissions: ANSI C63.10-2013 Sections 6.3-6.6

AC Power Line Conducted Emissions: ANSI C63.10-2013, Section 6.2

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8. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA0027 (PRE0126407	Spectrum Analyzer	Keysight Technologies	N9030A	2020-06-10	2021-06-10
HI0090 (PRE019127)	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
SOFTEMI	EMC Software	UL	Version 2020.9.1		
T177 (PRE007925)	Spectrum Analyzer	Agilent Technologies	E4446A	2020-04-30	2021-04-30
PWS001 (PRE013734)	Peak and Avg Power Sensor, 50MHz to 18GHz	Keysight Technologies	N1921A	2020-05-27	2021-05-27
PWM002 (PRE013734)	RF Power Meter	Keysight Technologies	N1911A	2020-07-31	2021-07-31

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
HI0091	Environmental Meter	Fisher Scientific	14-650-118	2020-06-26	2021-06-26
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2020-08-18	2021-08-18
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2020-08-18	2021-08-18
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2020-03-26	2021-03-26
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (2020-08-18)		

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

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Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz	**(Loop Ant.)**			
AT0079 (In @ 0800 09/02/2020)	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-07-27	2021-07-27
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-27	2021-04-27
	18-40 GHz				
AT0077	Horn Antenna, 26-40GHz	ARA	MWH-2640/B	2019-11-07	2020-11-07
	Gain-Loss Chains				
N-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-07-29	2021-07-29
N-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-07-29	2021-07-29
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-28	2021-07-28
N-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-07-31	2021-07-31
	Receiver & Software				
SA0026	Spectrum Analyzer	Agilent	N9030A	2020-07-16	2021-07-16
SOFTEMI	EMI Software	UL	Version 9.5 (2020-08-18)		
	Additional Equipment used				
S/N 200037610	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
BLE	0.390	0.625	0.624	62.40%	4.10	2.564

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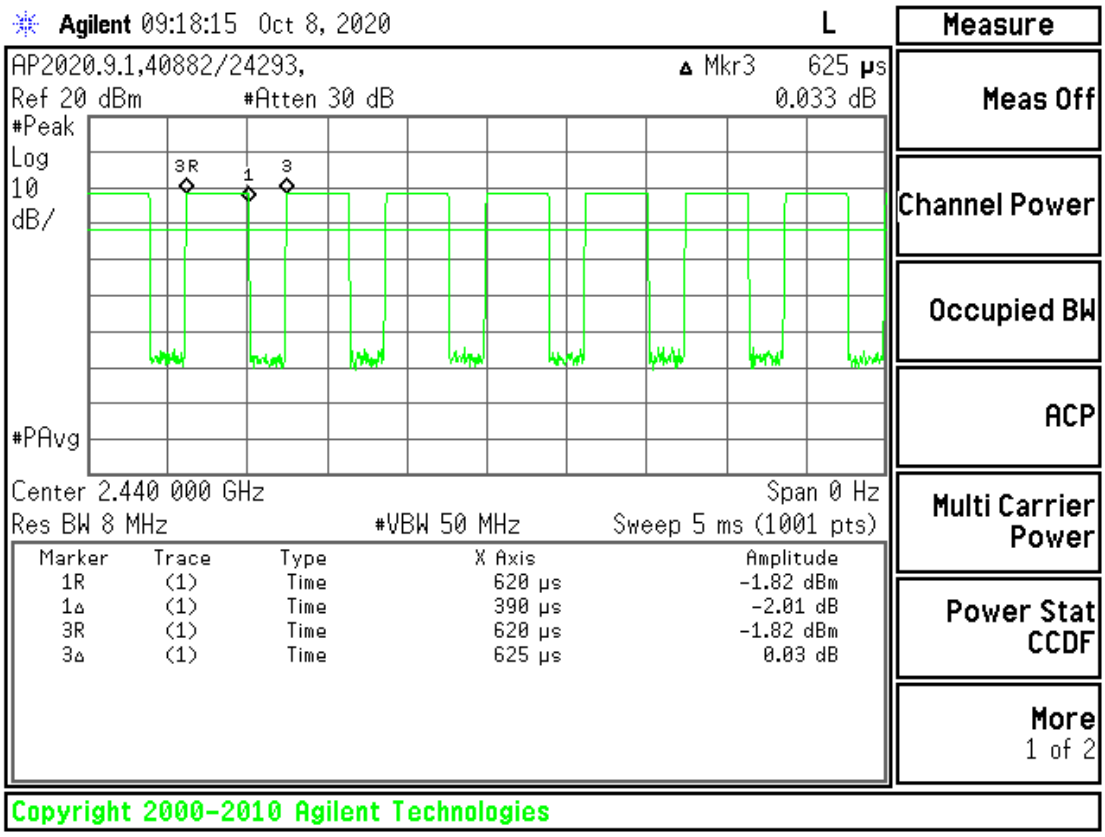
DUTY CYCLE PLOTS



DUTY CYCLE BLE

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9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

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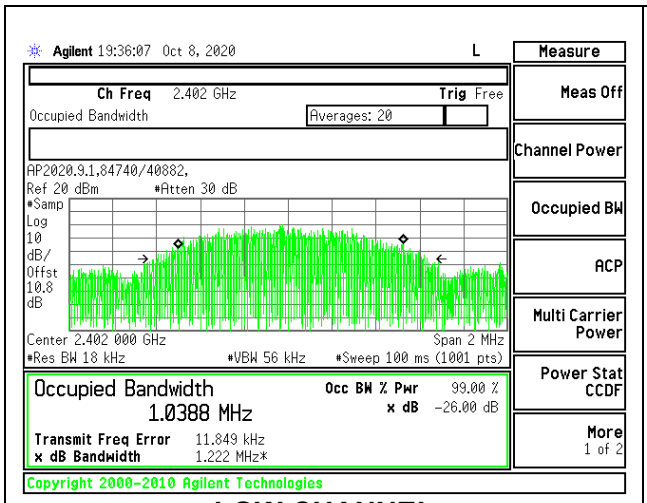
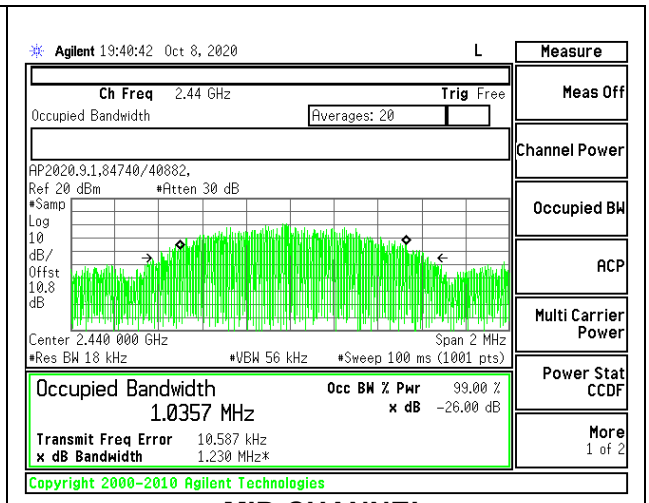
9.2.1. BLE (1Mbps)

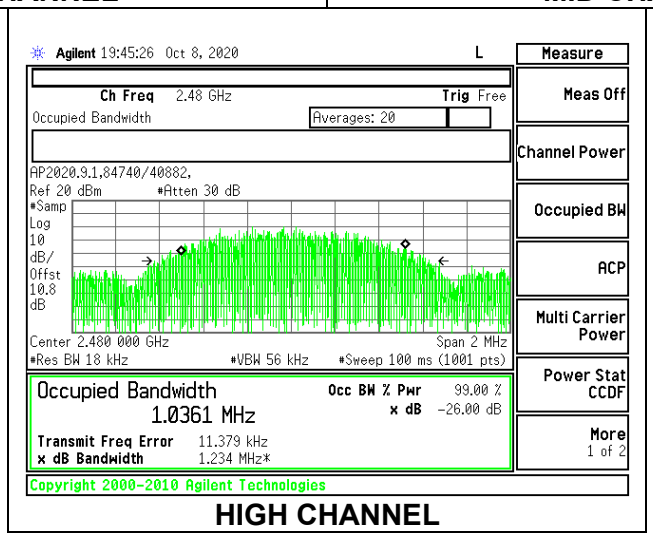
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0388
Middle	2440	1.0357
High	2480	1.0361



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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9.3. 6 dB BANDWIDTH

LIMITS

FCC §15.247 (a) (2)

RSS-247 5.2 (a)

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

RESULTS

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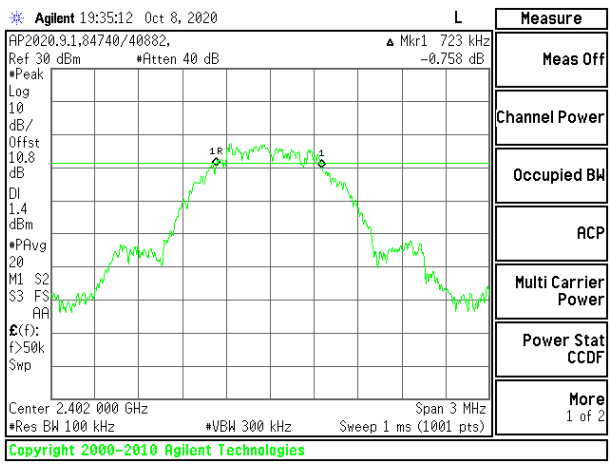
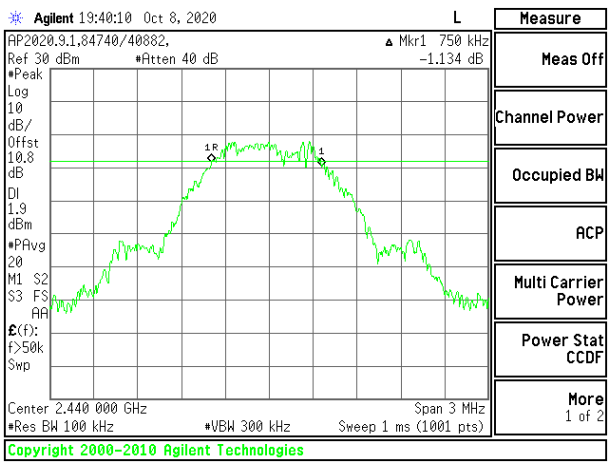
9.3.1. BLE (1Mbps)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.7230	0.5
Middle	2440	0.7500	0.5
High	2480	0.7200	0.5



LOW CHANNEL



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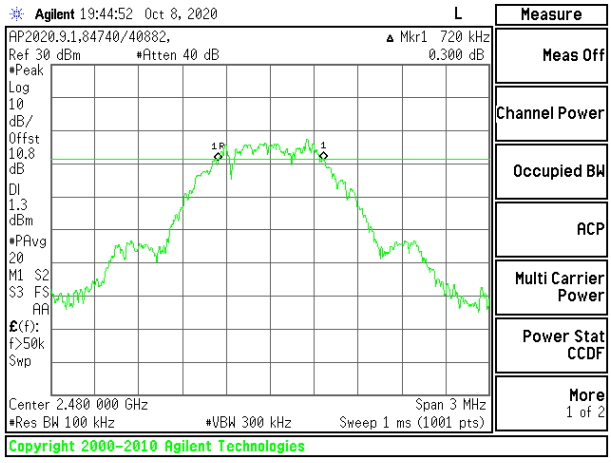

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9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.77 dB (including 10.13 dB pad and 0.64 dB cable) was entered as an offset in the power meter to allow for a peak reading of power.

RESULTS

9.4.1. BLE (1Mbps)

Tested By:	84740/40882
Date:	10/7/2020

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	8.33	30	-21.670
Middle	2440	8.73	30	-21.270
High	2480	7.90	30	-22.100

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9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.77 dB (including 10.13 dB pad and 0.64 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

RESULTS

9.5.1. BLE (1Mbps)

Tested By:	84740/40882
Date:	10/7/2020

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	8.14
Middle	2440	8.53
High	2480	7.68

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9.6. POWER SPECTRAL DENSITY

LIMITS

FCC §15.247 (e)

RSS-247 (5.2) (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

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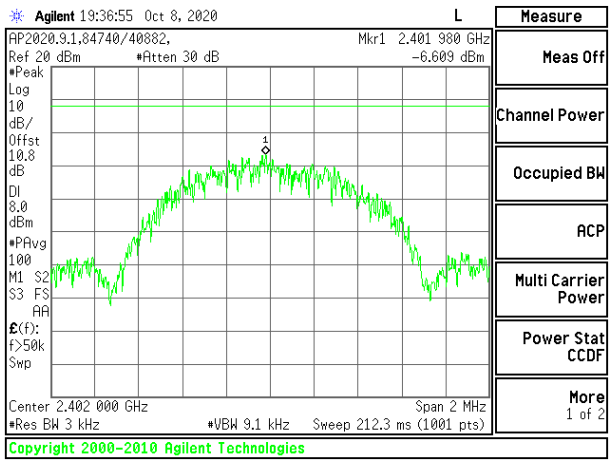
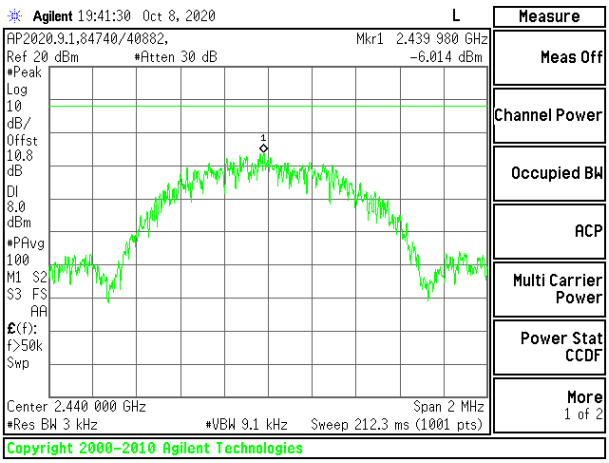
9.6.1. BLE (1Mbps)

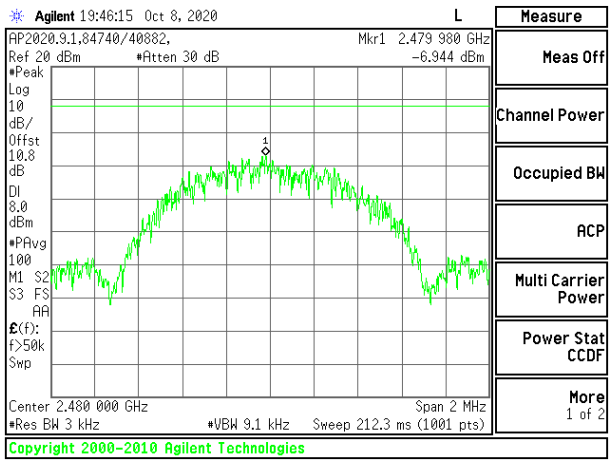
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-6.61	8	-14.61
Middle	2440	-6.01	8	-14.01
High	2480	-6.94	8	-14.94



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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9.7. CONDUCTED SPURIOUS EMISSIONS

LIMITS

FCC §15.247 (d)

RSS-247 5.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

RESULTS

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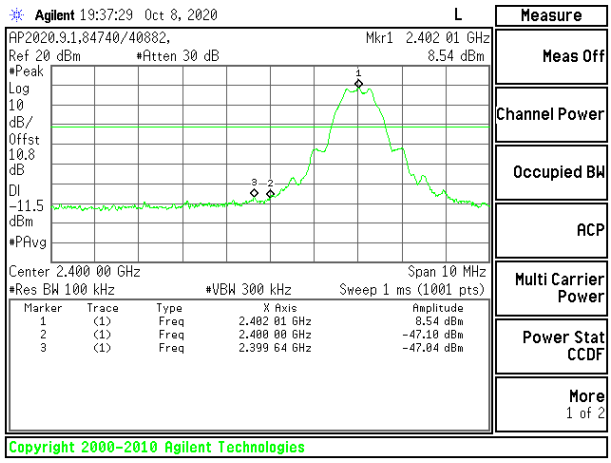
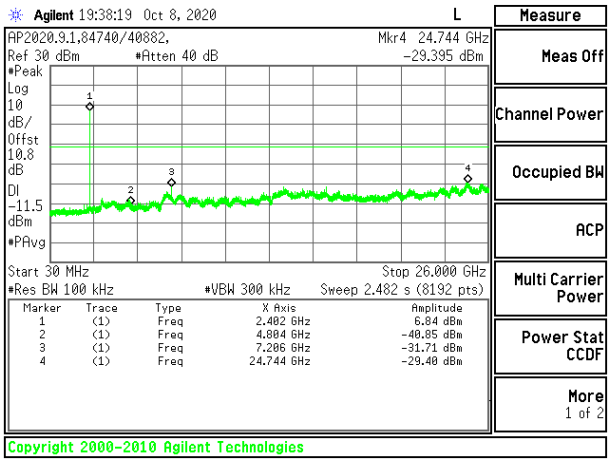
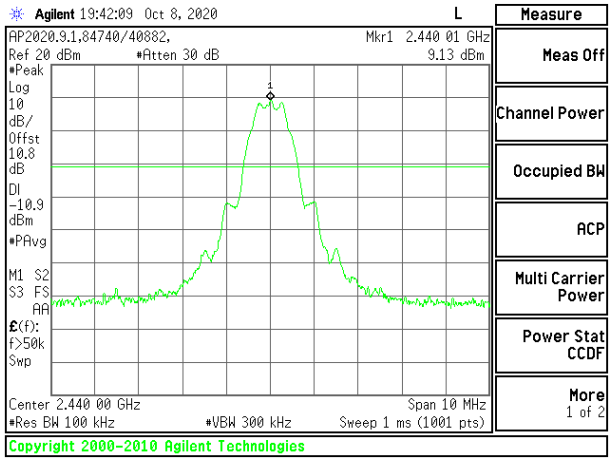
9.7.1. BLE (1Mbps)



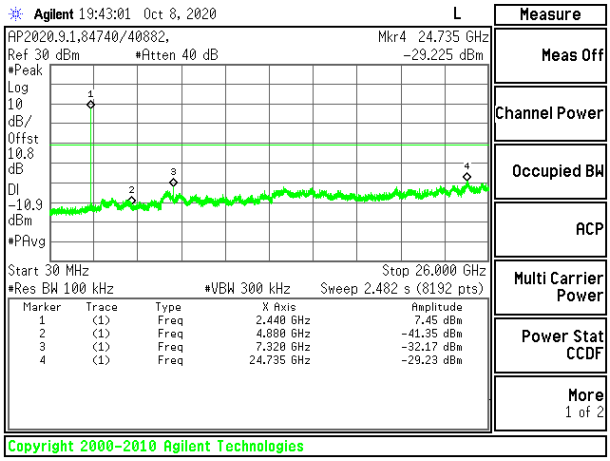
LOW CHANNEL BANDEDGE



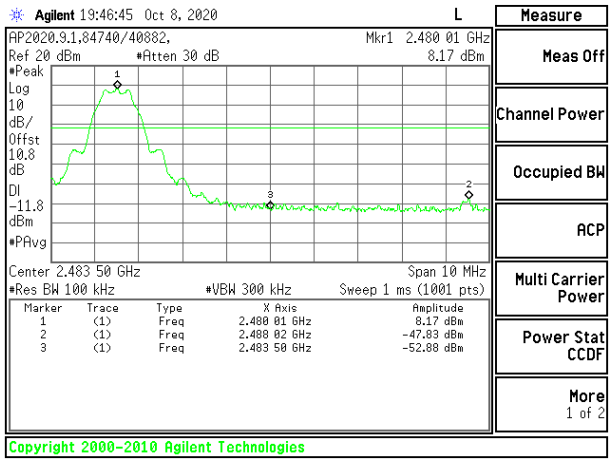
OUT-OF-BAND LOW CHANNEL



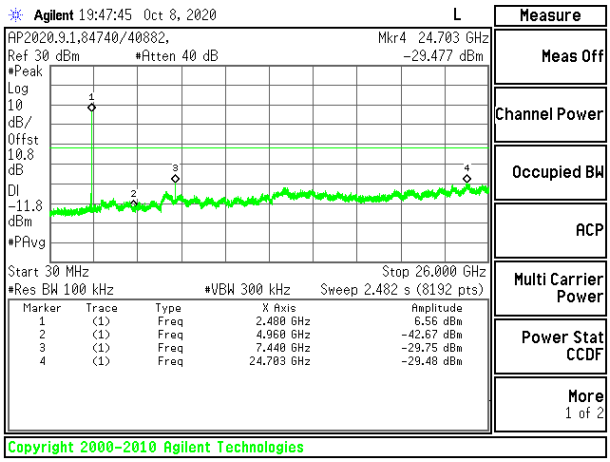
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

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 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 as applicable for voltage 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 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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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.

For harmonics measurements, both the left and right earbuds were set to transmit simultaneously at different frequencies. This report only covers testing for the right earbud.

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

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

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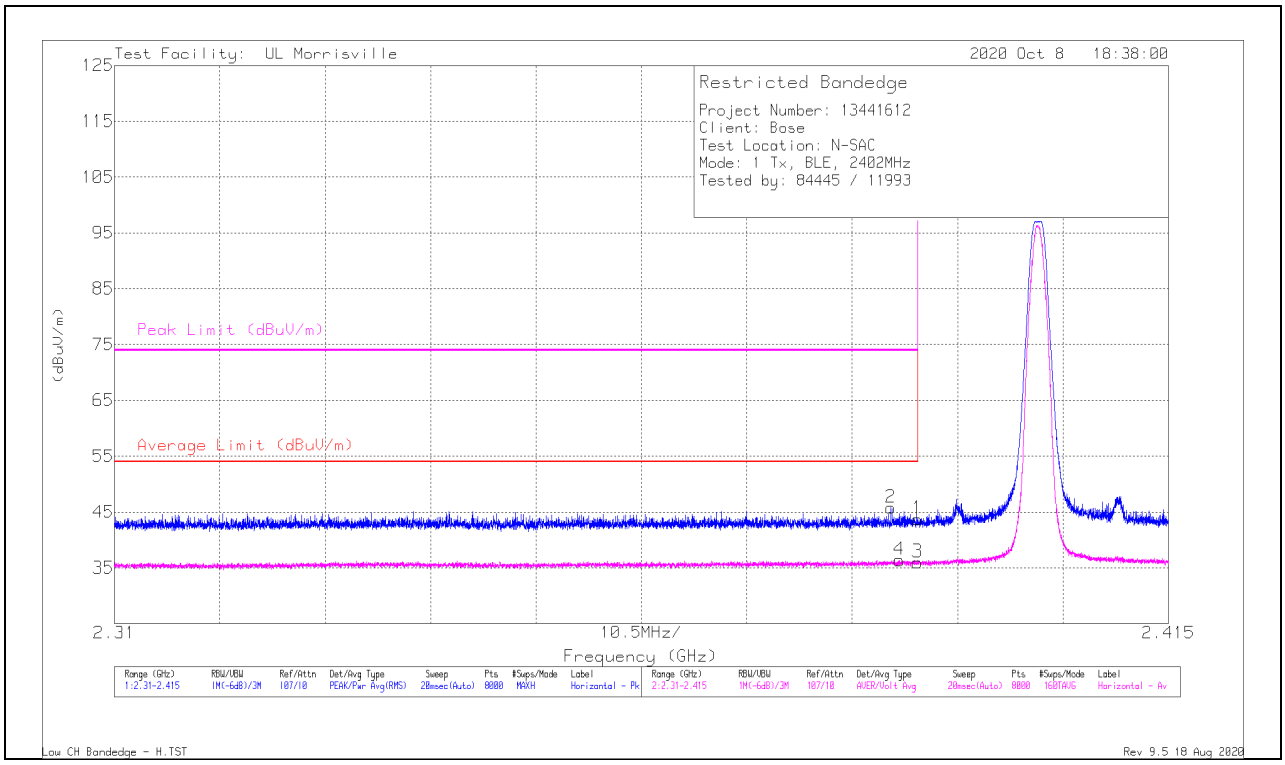
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	36.36	Pk	31.8	-24.4	0	43.76	-	-	74	-30.24	140	310	H
2	* ** 2.38736	38.37	Pk	31.8	-24.4	0	45.77	-	-	74	-28.23	140	310	H
3	* ** 2.39	24.51	ADV	31.8	-24.4	4.1	36.01	54	-17.99	-	-	140	309	H
4	* ** 2.38818	24.9	ADV	31.8	-24.4	4.1	36.4	54	-17.6	-	-	140	309	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector
ADV - Linear Voltage Average

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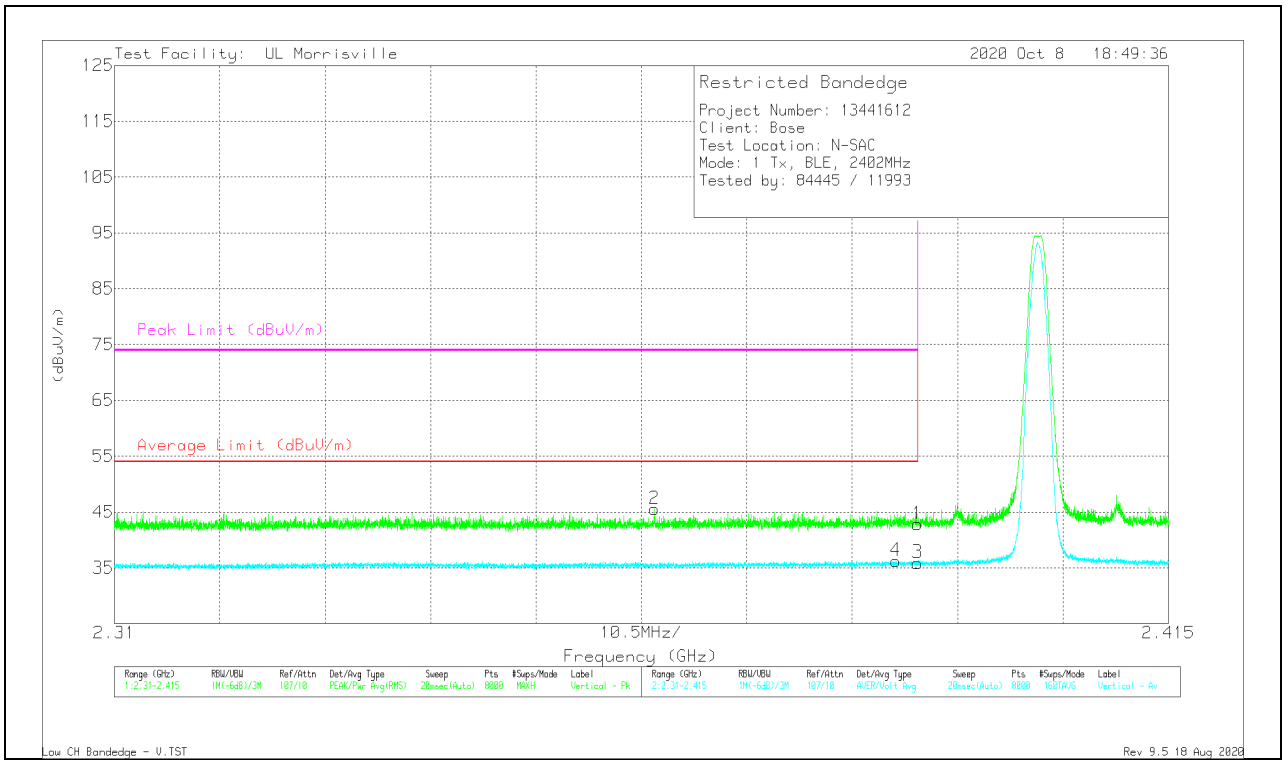
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	35.43	Pk	31.8	-24.4	0	42.83	-	-	74	-31.17	78	305	V
2	* ** 2.36378	38.21	Pk	31.7	-24.4	0	45.51	-	-	74	-28.49	78	305	V
3	* ** 2.39	24.39	ADV	31.8	-24.4	4.1	35.89	54	-18.11	-	-	78	305	V
4	* ** 2.38786	24.75	ADV	31.8	-24.4	4.1	36.25	54	-17.75	-	-	78	305	V

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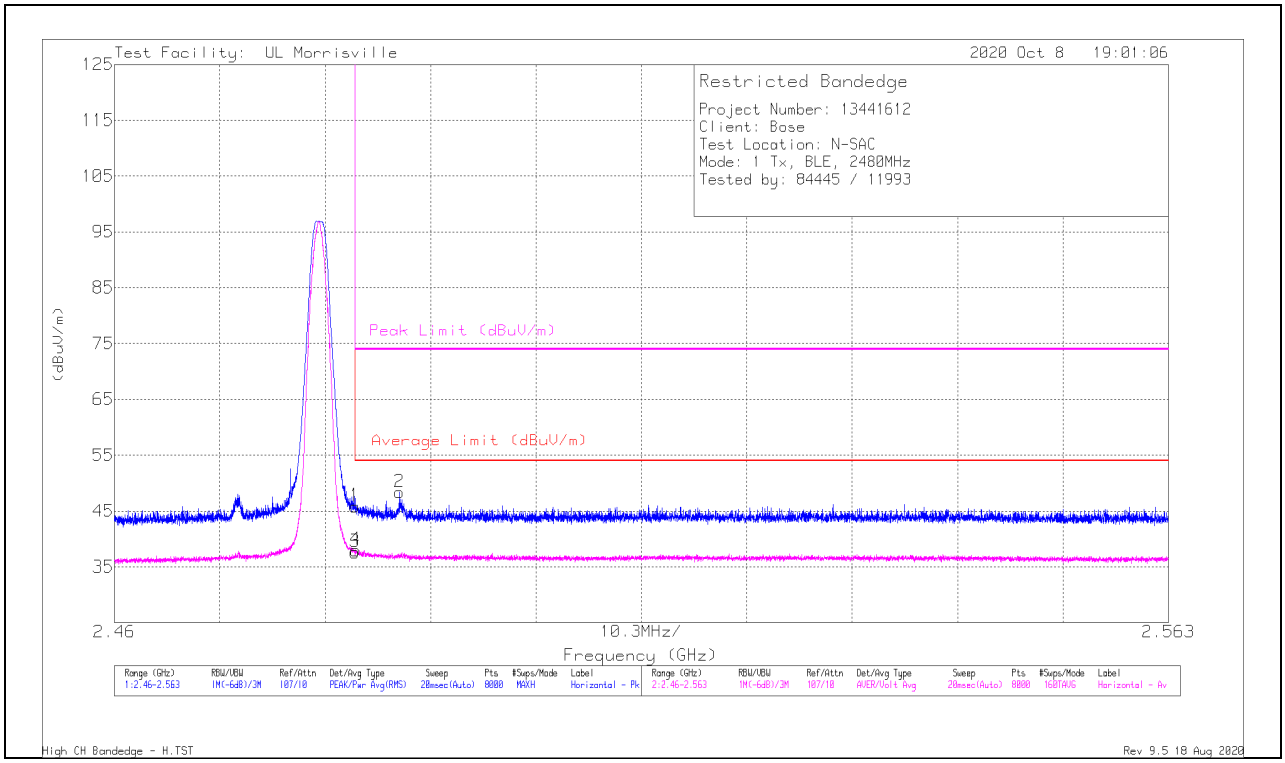
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	37.75	Pk	32.4	-24.3	0	45.85	-	-	74	-28.15	181	254	H
2	* ** 2.48785	40.14	Pk	32.5	-24.3	0	48.34	-	-	74	-25.66	181	254	H
3	* ** 2.4835	25.44	ADV	32.4	-24.3	4.1	37.64	54	-16.36	-	-	181	254	H
4	* ** 2.48359	25.8	ADV	32.4	-24.3	4.1	38	54	-16	-	-	181	254	H

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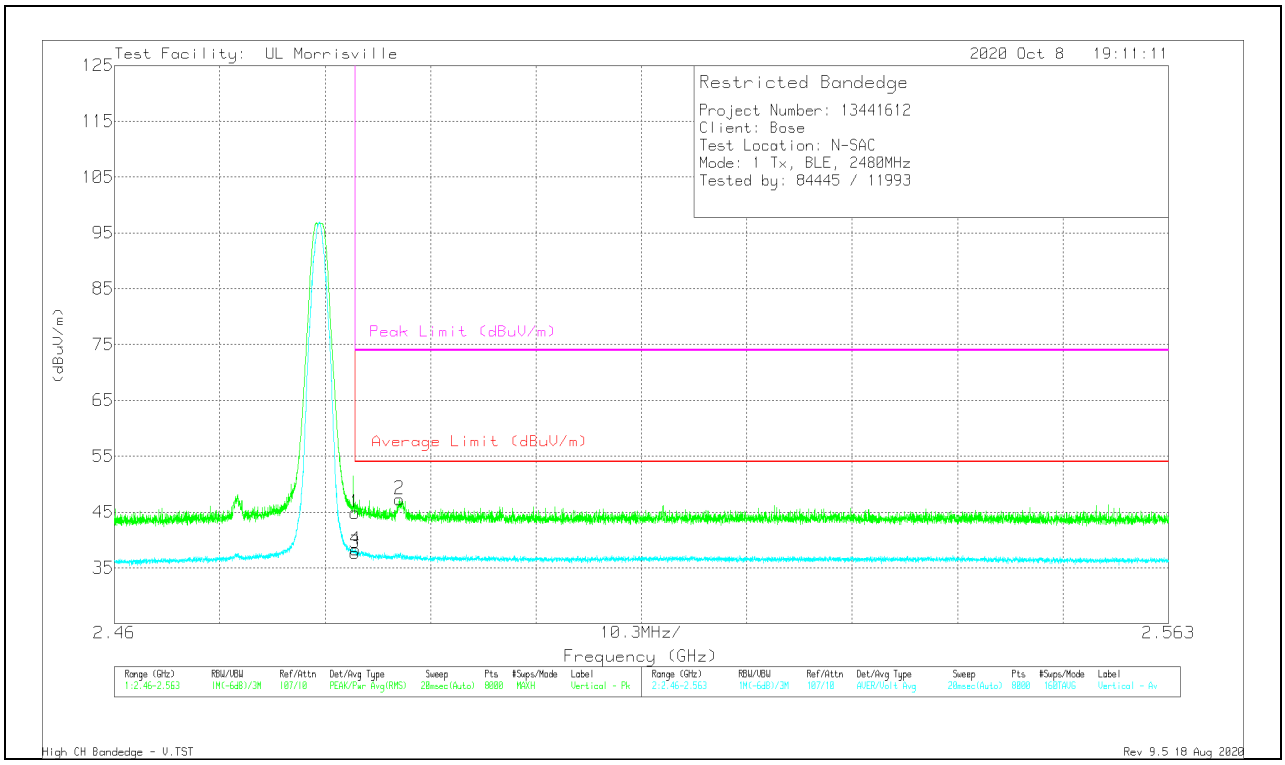
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	36.79	Pk	32.4	-24.3	0	44.89	-	-	74	-29.11	257	317	V
2	* ** 2.48785	39.11	Pk	32.5	-24.3	0	47.31	-	-	74	-26.69	257	317	V
3	* ** 2.4835	25.51	ADV	32.4	-24.3	4.1	37.71	54	-16.29	-	-	257	317	V
4	* ** 2.48355	26.08	ADV	32.4	-24.3	4.1	38.28	54	-15.72	-	-	257	317	V

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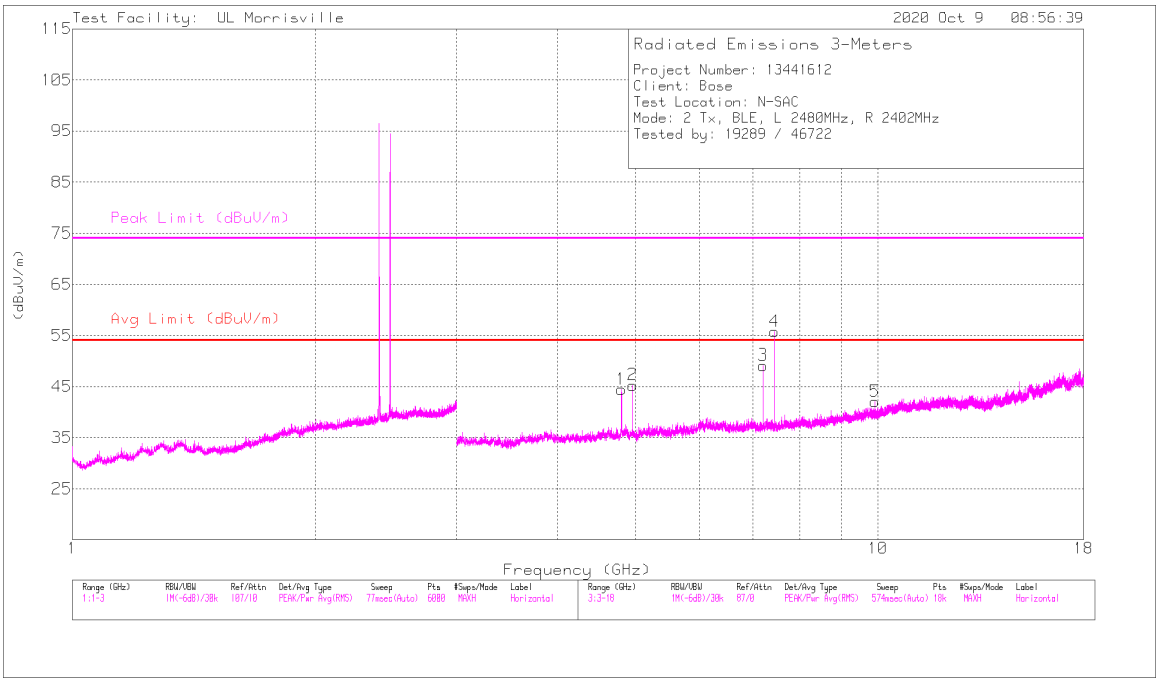
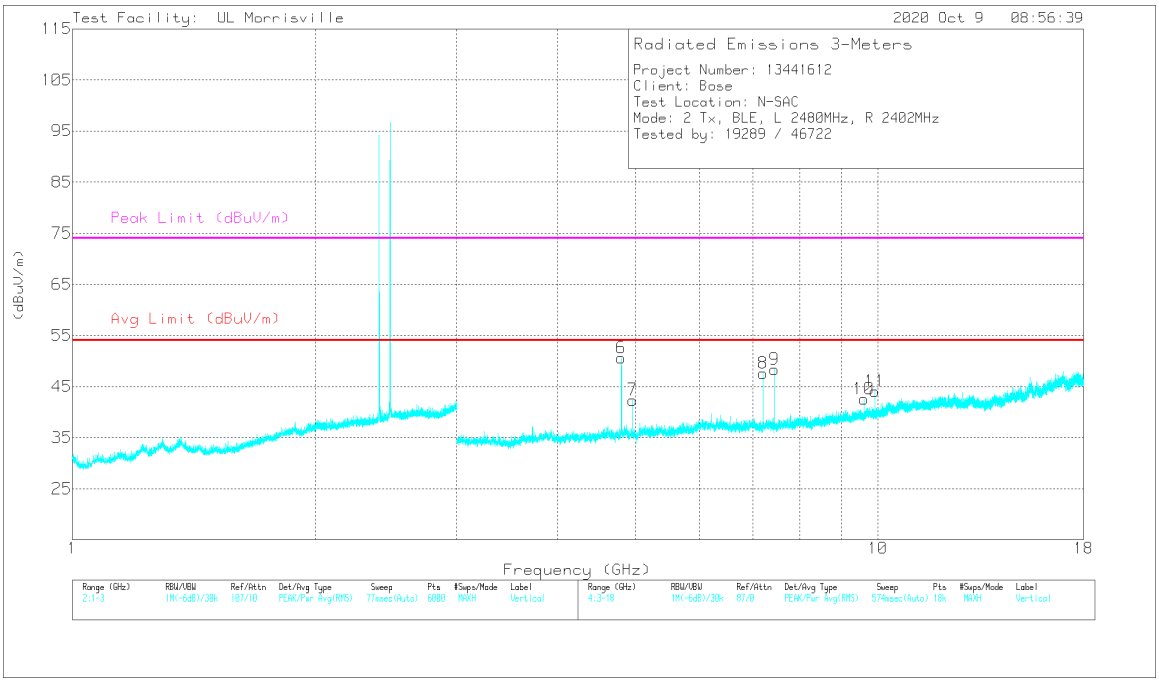
HARMONICS AND SPURIOUS EMISSIONS

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)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 4.80342	48.01	PK2	34.3	-31.5	0	50.81	-	-	74	-23.19	166	276	H
	* ** 4.80395	37.85	ADV	34.3	-31.5	4.1	44.75	54	-9.25	-	-	166	276	H
2	* ** 4.95957	46.55	PK2	34.1	-32.3	0	48.35	-	-	74	-25.65	154	214	H
	* ** 4.95972	35.28	ADV	34.1	-32.3	4.1	41.18	54	-12.82	-	-	154	214	H
4	* ** 7.44077	51	PK2	35.7	-29.3	0	57.4	-	-	74	-16.6	334	113	H
	* ** 7.43935	40.86	ADV	35.7	-29.3	4.1	51.36	54	-2.64	-	-	334	113	H
6	* ** 4.80347	51.15	PK2	34.3	-31.5	0	53.95	-	-	74	-20.05	9	103	V
	* ** 4.80392	41.89	ADV	34.3	-31.5	4.1	48.79	54	-5.21	-	-	9	103	V
7	* ** 4.95951	45.92	PK2	34.1	-32.3	0	47.72	-	-	74	-26.28	200	101	V
	* ** 4.95975	34.82	ADV	34.1	-32.4	4.1	40.62	54	-13.38	-	-	200	101	V
9	* ** 7.44077	45.12	PK2	35.7	-29.3	0	51.52	-	-	74	-22.48	17	101	V
	* ** 7.43941	34.21	ADV	35.7	-29.3	4.1	44.71	54	-9.29	-	-	17	101	V
3	7.20524	43.45	Pk	35.6	-29.9	0	49.15	-	-	-	-	0-360	101	H
8	7.20524	41.9	Pk	35.6	-29.9	0	47.6	-	-	-	-	0-360	200	V
10	9.6062	33.98	Pk	36.9	-28.3	0	42.58	-	-	-	-	0-360	101	V
5	9.92039	32.87	Pk	37	-27.8	0	42.07	-	-	-	-	0-360	101	H
11	9.92039	34.87	Pk	37	-27.8	0	44.07	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
ADV - Linear Voltage Average
Pk - Peak detector

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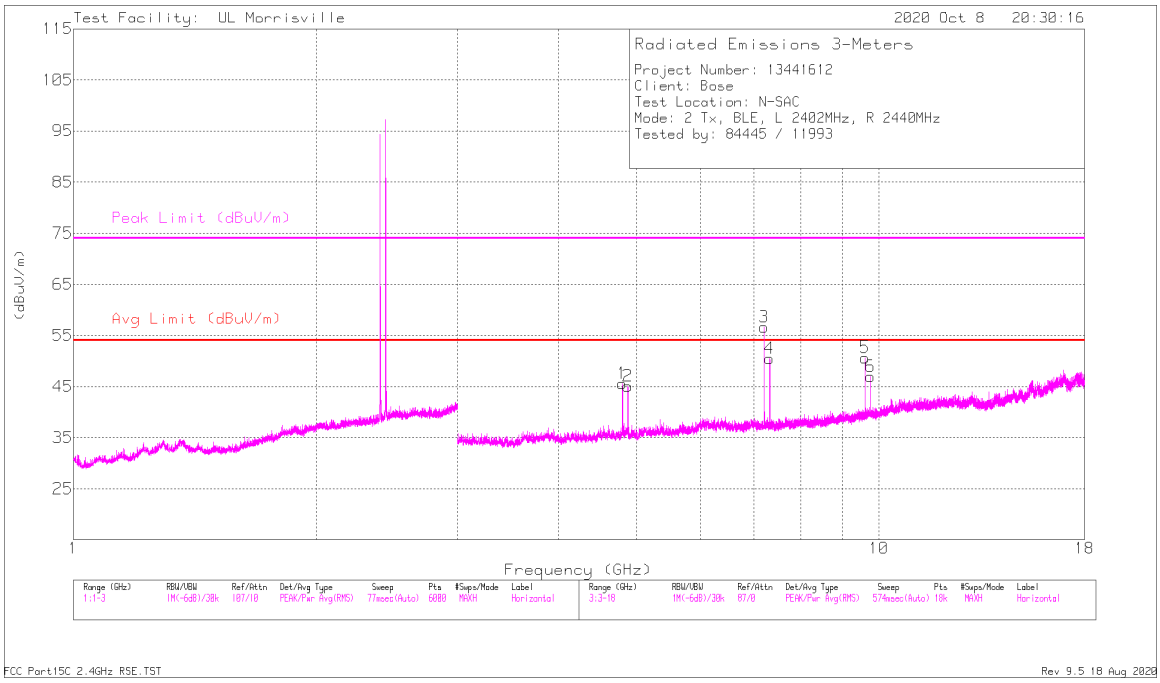
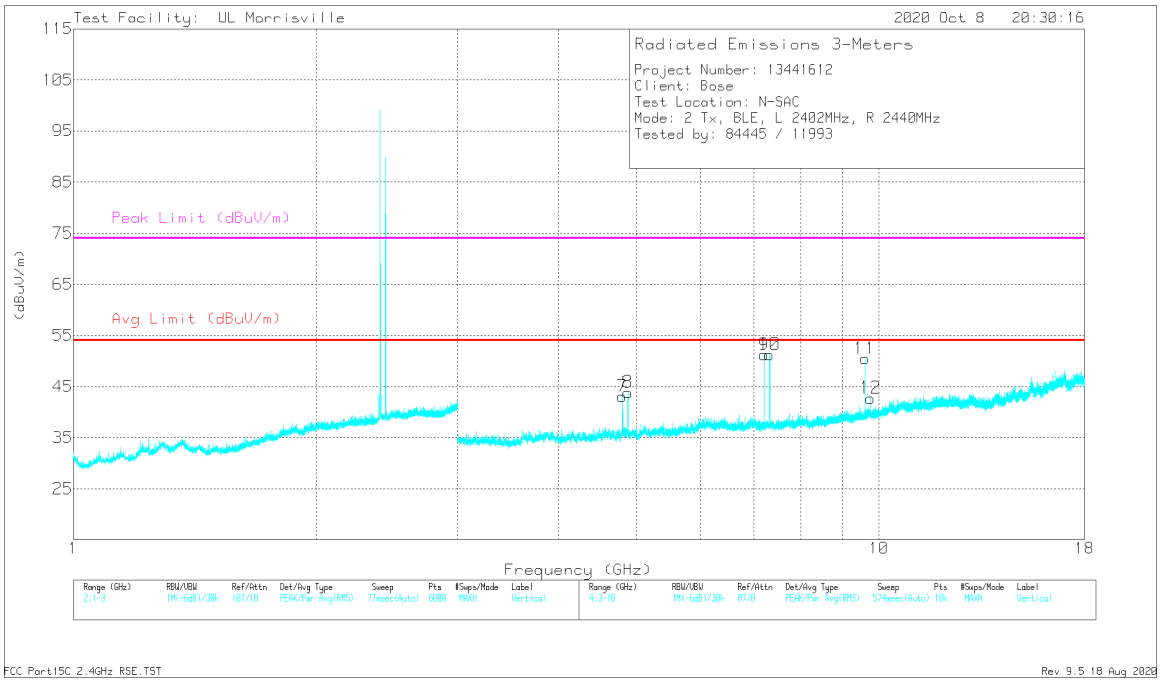
MID CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 4.80467	47.74	PK2	34.2	-31.5	0	50.44	-	-	74	-23.56	153	113	H
	* ** 4.80386	38.01	ADV	34.3	-31.5	4.1	44.91	54	-9.09	-	-	153	113	H
2	* ** 4.88049	48.59	PK2	34.1	-31.4	0	51.29	-	-	74	-22.71	43	380	H
	* ** 4.87986	38.79	ADV	34.1	-31.4	4.1	45.59	54	-8.41	-	-	43	380	H
4	* ** 7.31926	49.02	PK2	35.6	-29.3	0	55.32	-	-	74	-18.68	86	110	H
	* ** 7.31945	38.28	ADV	35.6	-29.3	4.1	48.68	54	-5.32	-	-	86	110	H
7	* ** 4.8041	45.34	PK2	34.3	-31.5	0	48.14	-	-	74	-25.86	223	113	V
	* ** 4.80387	34.12	ADV	34.3	-31.5	4.1	41.02	54	-12.98	-	-	223	113	V
8	* ** 4.88045	47.32	PK2	34.1	-31.4	0	50.02	-	-	74	-23.98	310	399	V
	* ** 4.87997	37.31	ADV	34.1	-31.4	4.1	44.11	54	-9.89	-	-	310	399	V
10	* ** 7.31993	48.01	PK2	35.6	-29.2	0	54.41	-	-	74	-19.59	329	104	V
	* ** 7.31934	37.61	ADV	35.6	-29.3	4.1	48.01	54	-5.99	-	-	329	104	V
3	7.20607	50.91	Pk	35.6	-29.9	0	56.61	-	-	-	-	0-360	101	H
9	7.2069	45.53	Pk	35.6	-29.9	0	51.23	-	-	-	-	0-360	101	V
11	9.6062	41.85	Pk	36.9	-28.3	0	50.45	-	-	-	-	0-360	101	V
5	9.6087	42.05	Pk	36.9	-28.3	0	50.65	-	-	-	-	0-360	101	H
6	9.75871	37.23	Pk	37	-27.3	0	46.93	-	-	-	-	0-360	101	H
12	9.76038	33.04	Pk	37	-27.3	0	42.74	-	-	-	-	0-360	101	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
ADV - Linear Voltage Average
Pk - Peak detector

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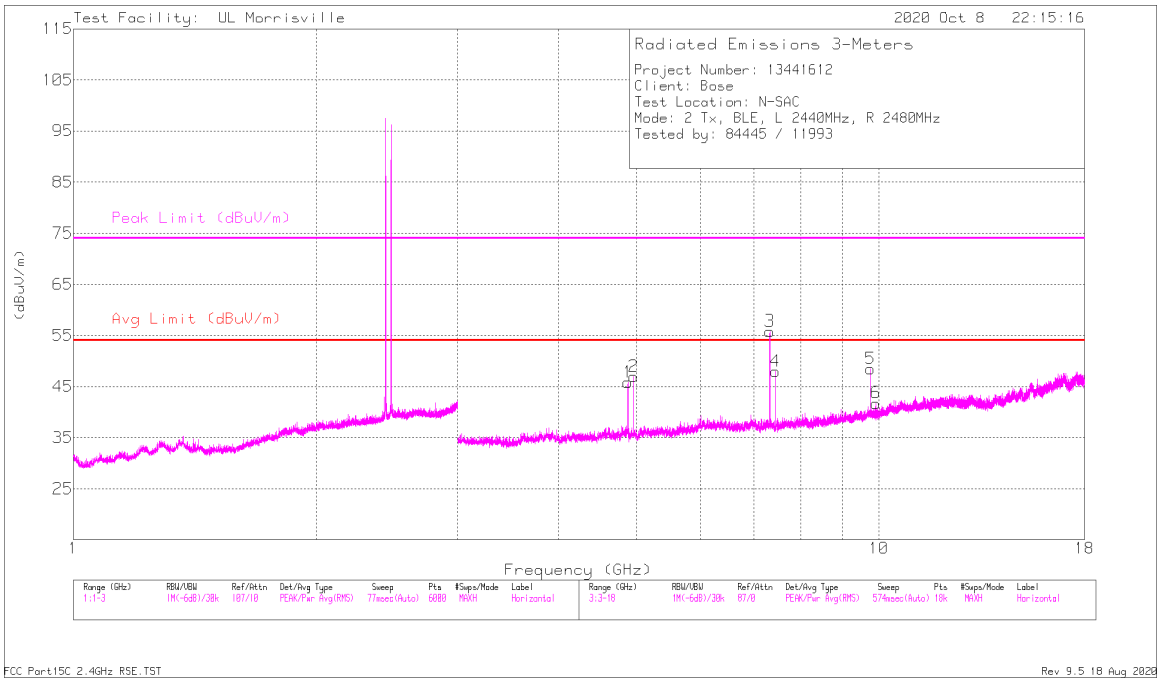
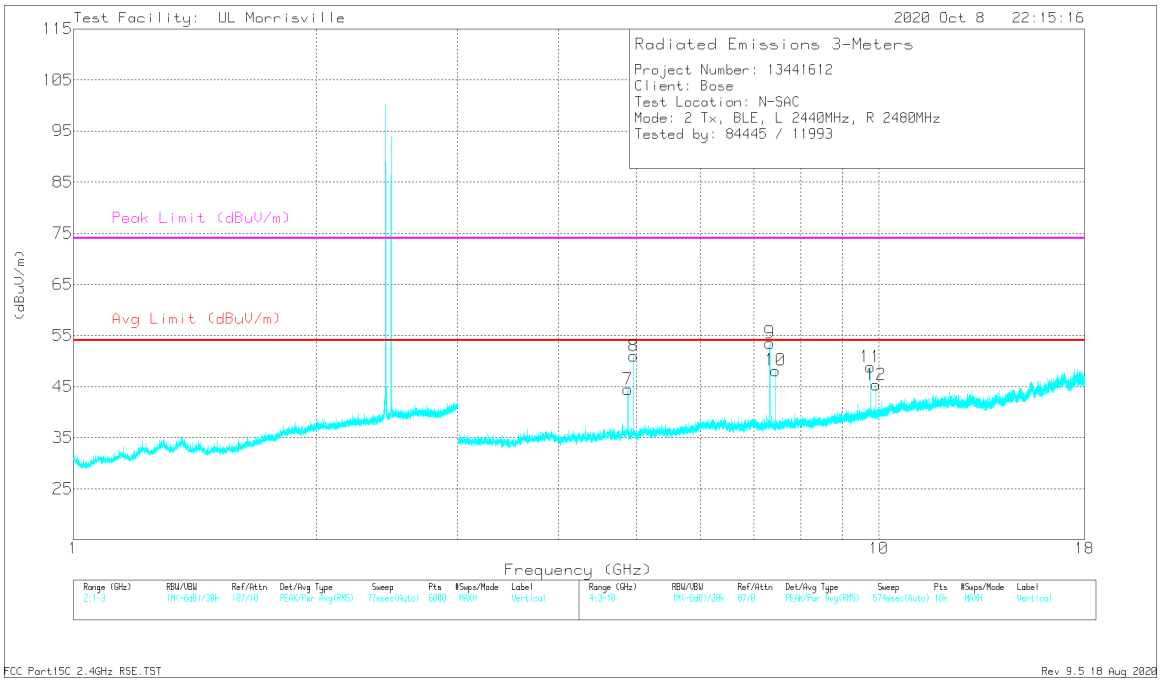
HIGH CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Markers	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 dB(/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 4.88057	47.91	PK2	34.1	-31.4	0	50.61	-	-	74	-23.39	267	101	H
	* ** 4.87996	38.12	ADV	34.1	-31.4	4.1	44.92	54	-9.08	-	-	267	101	H
2	* ** 4.96049	49.6	PK2	34.1	-32.4	0	51.3	-	-	74	-22.7	173	317	H
	* ** 4.95994	39.98	ADV	34.1	-32.4	4.1	45.78	54	-8.22	-	-	173	317	H
3	* ** 7.31924	51.42	PK2	35.6	-29.3	0	57.72	-	-	74	-16.28	320	101	H
	* ** 7.31945	41.9	ADV	35.6	-29.3	4.1	52.3	54	-1.7	-	-	320	101	H
4	* ** 7.44084	45.16	PK2	35.7	-29.3	0	51.56	-	-	74	-22.44	126	101	H
	* ** 7.4394	34.64	ADV	35.7	-29.3	4.1	45.14	54	-8.86	-	-	126	101	H
7	* ** 4.88046	46.95	PK2	34.1	-31.4	0	49.65	-	-	74	-24.35	237	103	V
	* ** 4.87996	36.66	ADV	34.1	-31.4	4.1	43.46	54	-10.54	-	-	237	103	V
8	* ** 4.96056	52.68	PK2	34.1	-32.4	0	54.38	-	-	74	-19.62	14	103	V
	* ** 4.95997	43.73	ADV	34.1	-32.4	4.1	49.53	54	-4.47	-	-	14	103	V
9	* ** 7.31933	50.19	PK2	35.6	-29.3	0	56.49	-	-	74	-17.51	85	216	V
	* ** 7.31939	40.57	ADV	35.6	-29.3	4.1	50.97	54	-3.03	-	-	85	216	V
10	* ** 7.43934	45.97	PK2	35.7	-29.3	0	52.37	-	-	74	-21.63	124	231	V
	* ** 7.4394	35.18	ADV	35.7	-29.3	4.1	45.68	54	-8.32	-	-	124	231	V
5	9.75955	38.77	Pk	37	-27.3	0	48.47	-	-	-	-	0-360	101	H
11	9.76038	39.17	Pk	37	-27.3	0	48.87	-	-	-	-	0-360	101	V
12	9.91872	36.26	Pk	37	-27.9	0	45.36	-	-	-	-	0-360	101	V
6	9.92039	32.55	Pk	37	-27.8	0	41.75	-	-	-	-	0-360	101	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
PK2 - Maximum Peak
ADV - Linear Voltage Average
Pk - Peak detector

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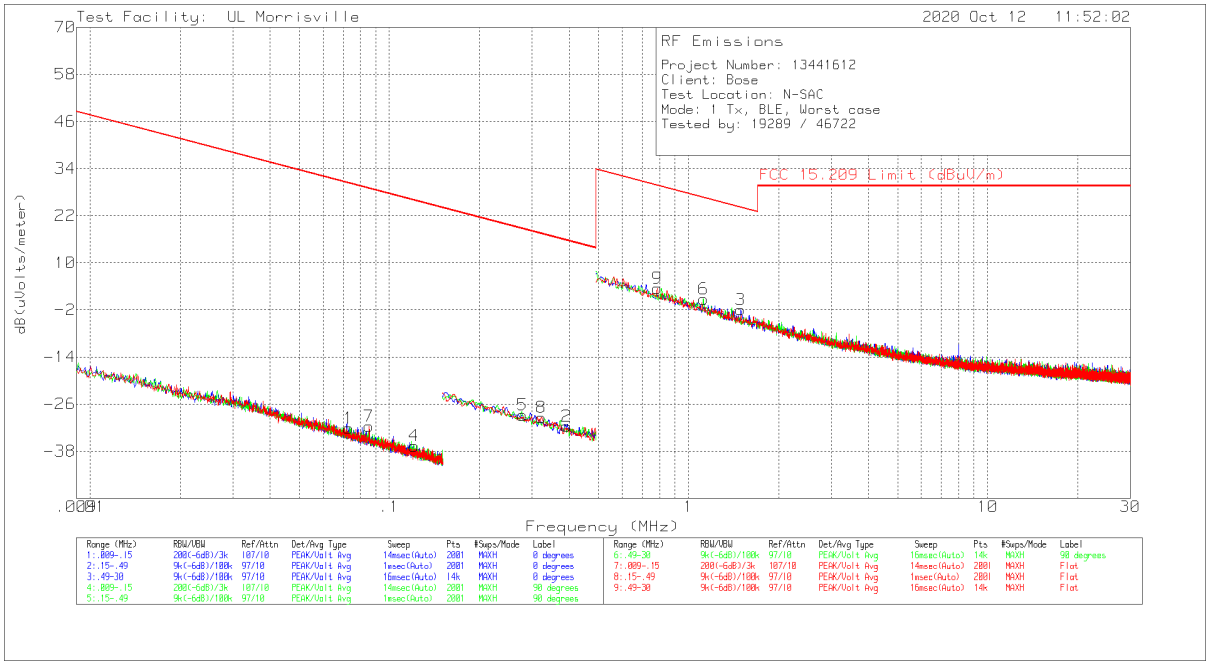
10.3. WORST CASE BELOW 30MHZ

Note for below 30 MHz scans: 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).

The below 30 MHz 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 377Ω. For example, the measurement frequency 73.11 kHz resulted in a level of -32.1 dBuV/m, which is equivalent to -32.1-51.5 = -83.60 dBuA/m, which has the same margin, -62.42 dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)



ANTENNA- THREE ORIENTATIONS

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Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)
1	.07311	36.6	Pk	11.2	.1	-80	-32.1	30.32	50.32	-62.42	0-360
7	.08568	37.06	Pk	11.2	.1	-80	-31.64	28.95	48.95	-60.59	0-360
4	.12083	32.34	Pk	10.9	.1	-80	-36.66	25.96	45.96	-62.62	0-360
5	.2792	40.36	Pk	10.7	.1	-80	-28.84	18.69	38.69	-47.53	0-360
8	.32264	39.78	Pk	10.7	.1	-80	-29.42	17.43	37.43	-46.85	0-360
2	.39157	37.68	Pk	10.6	.1	-80	-31.62	15.75	35.75	-47.37	0-360
9	.78512	32.47	Pk	10.8	.2	-40	3.47	29.71	-	-26.24	0-360
6	1.1224	29.52	Pk	11	.2	-40	.72	26.6	-	-25.88	0-360
3	1.49552	26.88	Pk	11	.2	-40	-1.92	24.11	-	-26.03	0-360

Pk - Peak detector

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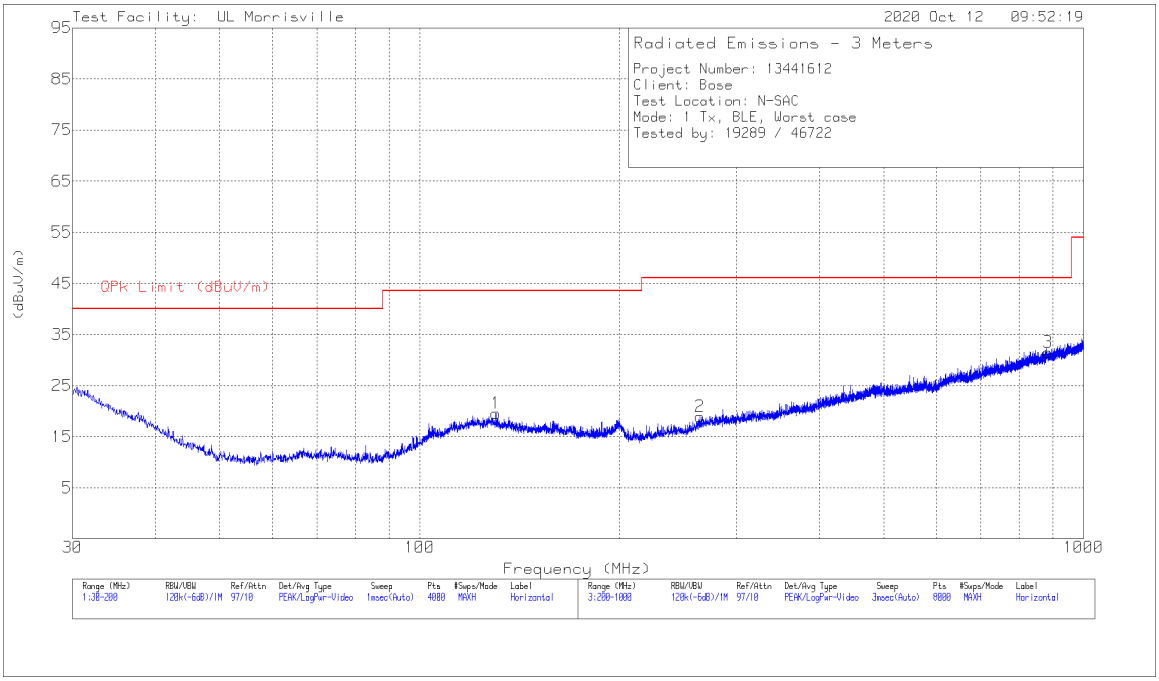
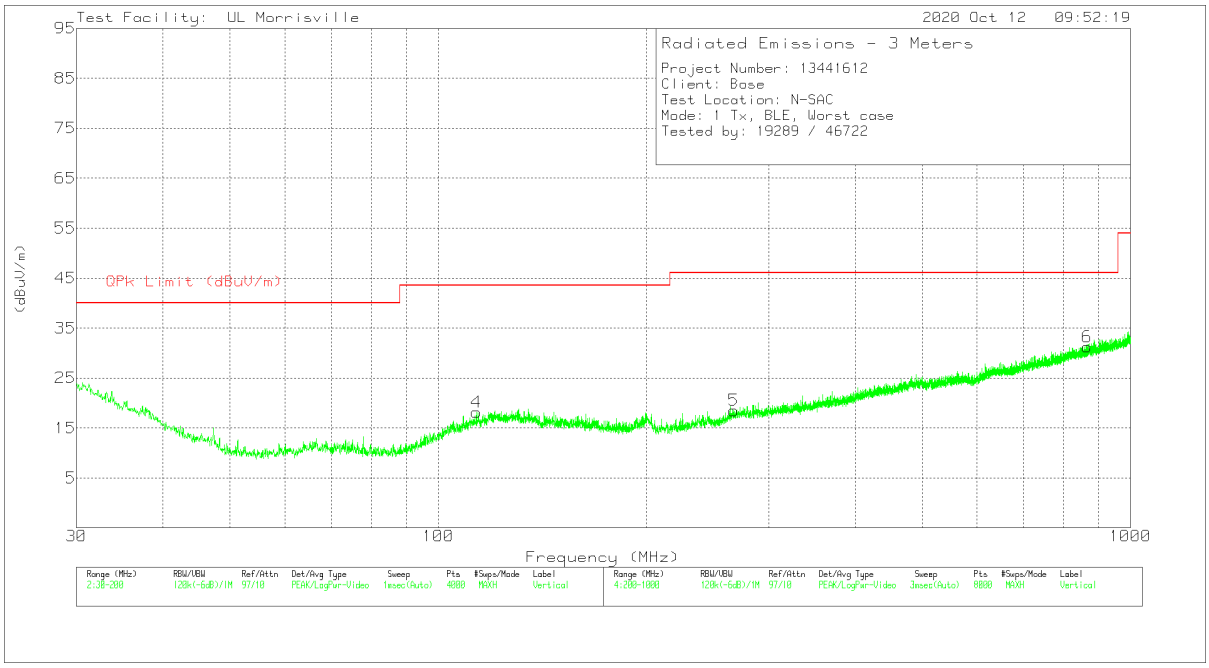
10.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 130.2834	29.76	Pk	19.9	-30.1	19.56	43.52	-23.96	0-360	400	H
4	* ** 113.5341	29.17	Pk	19.2	-30.2	18.17	43.52	-25.35	0-360	100	V
2	* ** 264.5084	28.82	Pk	18.9	-28.8	18.92	46.02	-27.1	0-360	299	H
3	** 884.1889	28.16	Pk	28.3	-25	31.46	46.02	-14.56	0-360	100	H
5	* ** 267.0087	28.3	Pk	19.1	-28.9	18.5	46.02	-27.52	0-360	99	V
6	** 865.8866	28.32	Pk	28.1	-25.2	31.22	46.02	-14.8	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector

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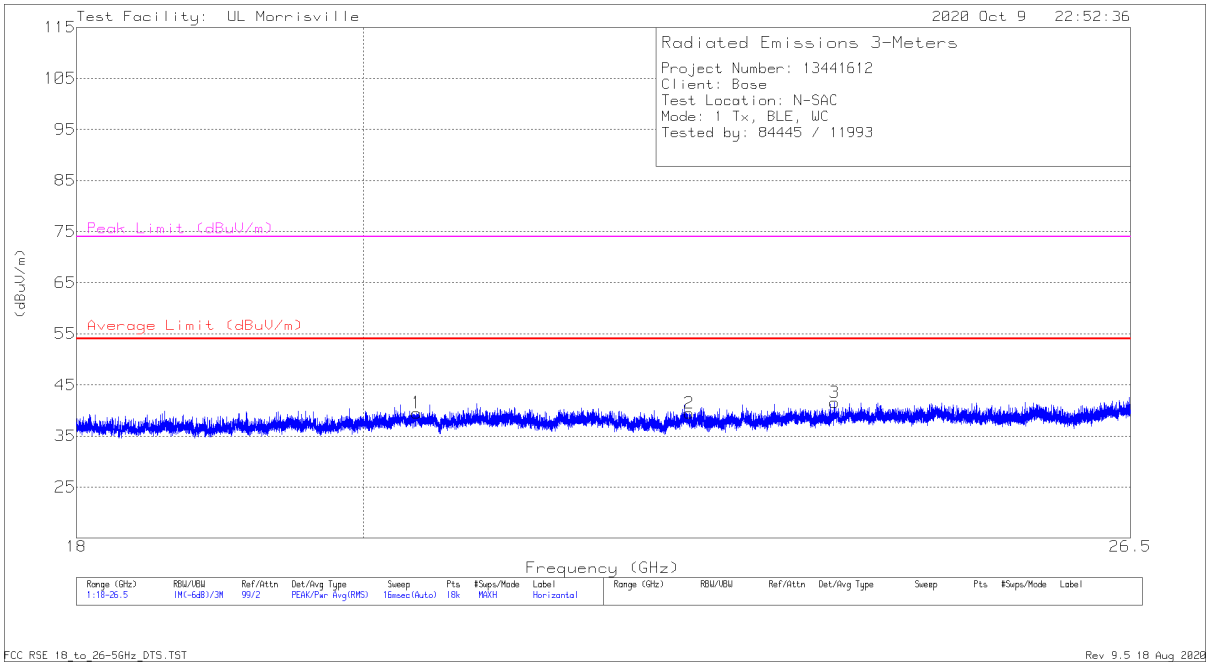
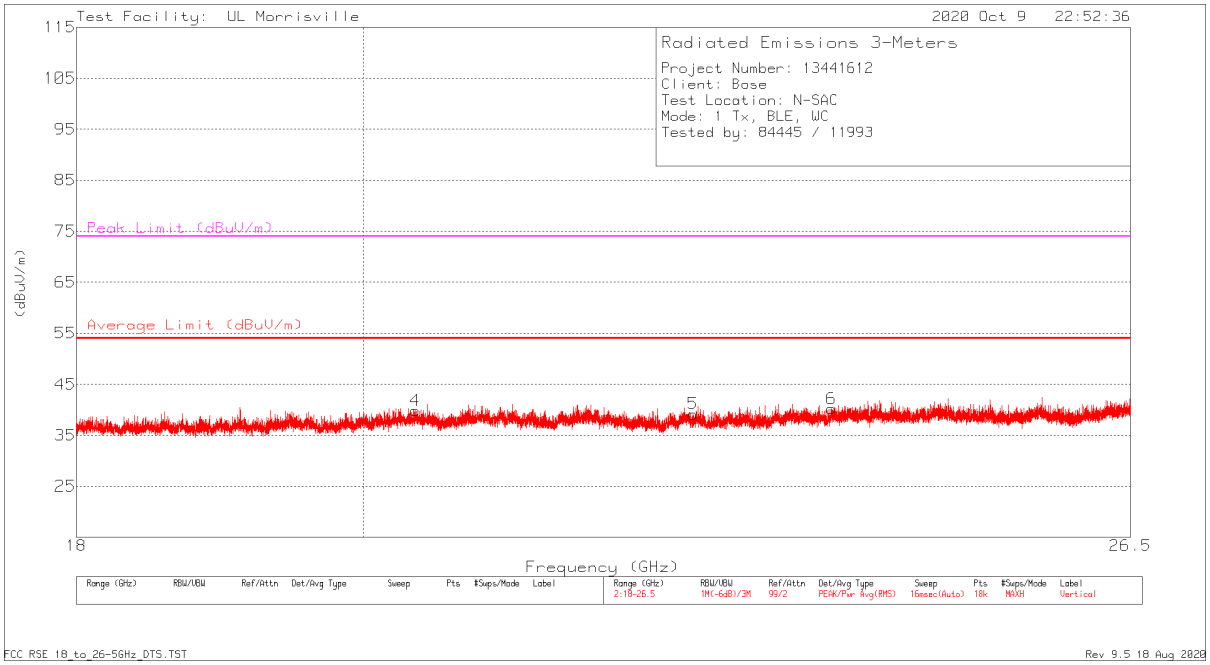
10.5. WORST CASE 18-26 GHz

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



HORIZONTAL



VERTICAL

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18-26 GHz DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 130.2834	29.76	Pk	19.9	-30.1	19.56	43.52	-23.96	0-360	400	H
4	* ** 113.5341	29.17	Pk	19.2	-30.2	18.17	43.52	-25.35	0-360	100	V
2	* ** 264.5084	28.82	Pk	18.9	-28.8	18.92	46.02	-27.1	0-360	299	H
3	** 884.1889	28.16	Pk	28.3	-25	31.46	46.02	-14.56	0-360	100	H
5	* ** 267.0087	28.3	Pk	19.1	-28.9	18.5	46.02	-27.52	0-360	99	V
6	** 865.8866	28.32	Pk	28.1	-25.2	31.22	46.02	-14.8	0-360	199	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
Pk - Peak detector

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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.

RESULTS

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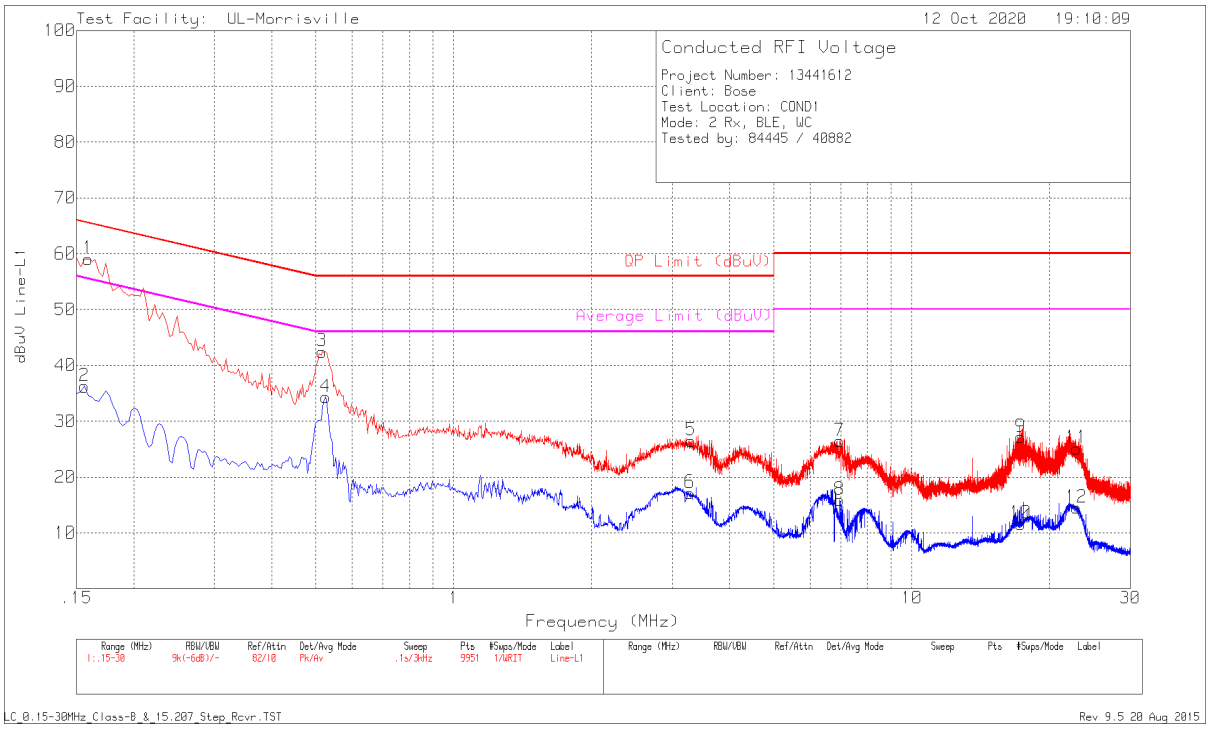
11.1.1. AC Power Line Norm

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	.159	49.18	Pk	.2	9.7	59.08	65.52	-6.44	-	-
2	.156	26.34	Av	.2	9.7	36.24	-	-	55.67	-19.43
3	.516	32.69	Pk	0	9.8	42.49	56	-13.51	-	-
4	.525	24.49	Av	0	9.8	34.29	-	-	46	-11.71
5	3.3	16.71	Pk	0	9.8	26.51	56	-29.49	-	-
6	3.276	7.36	Av	0	9.8	17.16	-	-	46	-28.84
7	6.954	16.42	Pk	.1	9.9	26.42	60	-33.58	-	-
8	6.954	5.91	Av	.1	9.9	15.91	-	-	50	-34.09
9	17.277	17.01	Pk	.1	10.1	27.21	60	-32.79	-	-
10	17.289	1.45	Av	.1	10.1	11.65	-	-	50	-38.35
11	22.863	14.84	Pk	.2	10.1	25.14	60	-34.86	-	-
12	22.872	4.21	Av	.2	10.1	14.51	-	-	50	-35.49

Pk - Peak detector
Av - Average detection

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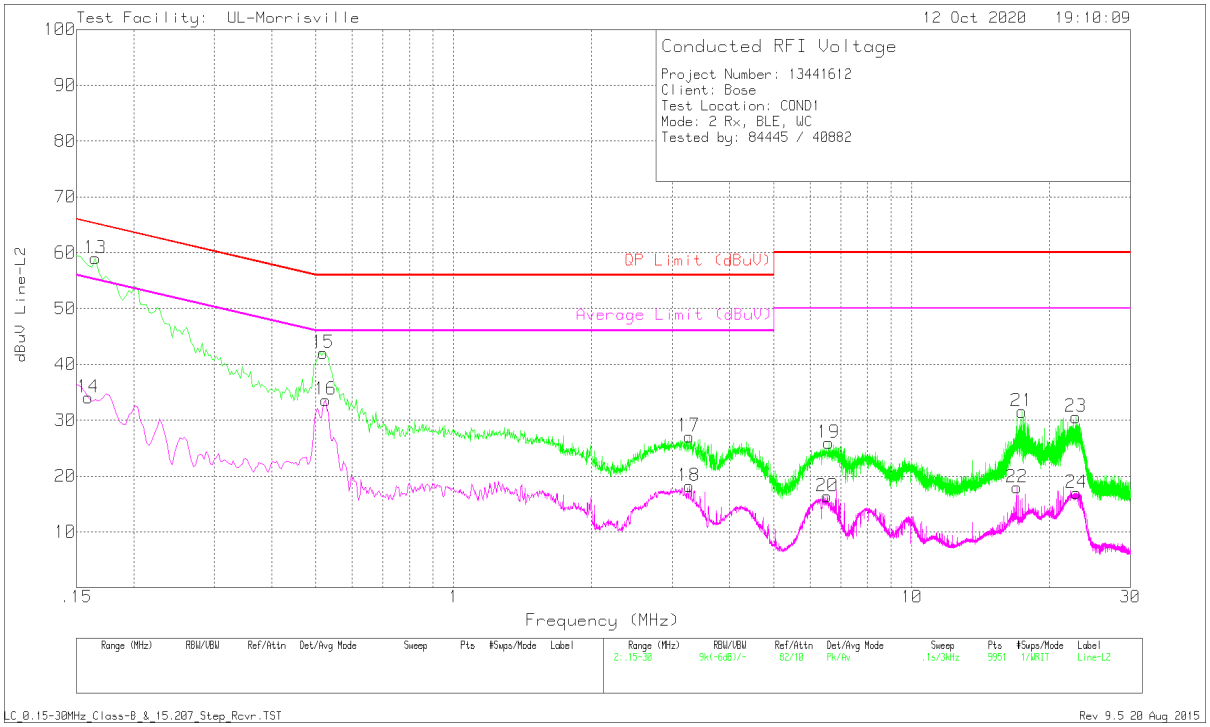
LINE 2 RESULTS



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	.165	49.12	Pk	.2	9.7	59.02	65.21	-6.19	-	-
14	.159	24.2	Av	.2	9.7	34.1	-	-	55.52	-21.42
15	.519	32.16	Pk	.1	9.8	42.06	56	-13.94	-	-
16	.525	23.74	Av	.1	9.8	33.64	-	-	46	-12.36
17	3.261	17.31	Pk	0	9.8	27.11	56	-28.89	-	-
18	3.261	8.43	Av	0	9.8	18.23	-	-	46	-27.77
19	6.582	15.95	Pk	.1	9.9	25.95	60	-34.05	-	-
20	6.537	6.37	Av	.1	9.9	16.37	-	-	50	-33.63
21	17.376	21.36	Pk	.1	10.1	31.56	60	-28.44	-	-
22	16.95	7.75	Av	.1	10.1	17.95	-	-	50	-32.05
23	22.797	20.28	Pk	.2	10.1	30.58	60	-29.42	-	-
24	22.875	6.65	Av	.2	10.1	16.95	-	-	50	-33.05

Pk - Peak detector
Av - Average detection

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12. SETUP PHOTOS

Please refer to R13441612R-EP1 for setup photos

END OF TEST REPORT

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