TEST REPORT

Report Number. : R13413705-E3

Applicant	:	Lutron Electronics Co Inc. 7200 Suter Rd. Coopersburg, PA, 18036-1249, USA
Model	:	HQP7-RF-2, HQREP-RF, RR-PROC3, RR-REP3
FCC ID	:	JPZ0129
IC	:	2851A-JPZ0129
EUT Description	:	Wireless Processor
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5 + Amendment 1

Date Of Issue:
2020-12-10

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

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
1	2020-11-13	Initial Issue	Mike Antola
2	2020-12-03	Misc. editorial updates	Mike Antola
3	2020-12-10	Updated power measurements; Misc. editorial updates	Mike Antola

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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 **6**

4. FACILITIES AND ACCREDITATION **6**

5. DECISION RULES AND MEASUREMENT UNCERTAINTY **7**

5.1. METROLOGICAL TRACEABILITY *7*

5.2. DECISION RULES *7*

5.3. MEASUREMENT UNCERTAINTY *7*

5.4. SAMPLE CALCULATION *7*

6. EQUIPMENT UNDER TEST **8**

6.1. EUT DESCRIPTION *8*

6.2. MAXIMUM OUTPUT POWER *8*

6.3. DESCRIPTION OF AVAILABLE ANTENNAS *8*

6.4. SOFTWARE AND FIRMWARE *8*

6.5. WORST-CASE CONFIGURATION AND MODE *8*

6.6. DESCRIPTION OF TEST SETUP *10*

7. MEASUREMENT METHOD **11**

8. TEST AND MEASUREMENT EQUIPMENT **12**

9. ANTENNA PORT TEST RESULTS **15**

9.1. ON TIME AND DUTY CYCLE *15*

9.2. 99% BANDWIDTH *16*

9.2.1. BLE (1Mbps) 17

9.2.2. BLE (2Mbps) 19

9.3. 6 dB BANDWIDTH *21*

9.3.1. BLE (1Mbps) 22

9.3.2. BLE (2Mbps) 24

9.4. OUTPUT POWER *26*

9.4.1. BLE (1Mbps) 27

9.4.2. BLE (2Mbps) 28

9.5. AVERAGE POWER *29*

9.5.1. BLE (1Mbps) 29

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9.5.2. BLE (2Mbps) 30

9.6. POWER SPECTRAL DENSITY 31
9.6.1. BLE (1Mbps) 32
9.6.2. BLE (2Mbps) 34

9.7. CONDUCTED SPURIOUS EMISSIONS 36
9.7.1. BLE (1Mbps) 37
9.7.2. BLE (2Mbps) 39

10. RADIATED TEST RESULTS 41

10.1. LIMITS AND PROCEDURE 41

10.2. TRANSMITTER ABOVE 1 GHz 43
10.2.1. BLE (1Mbps) 43
10.2.2. BLE (2Mbps) 63

10.3. WORST CASE BELOW 30MHZ 75

10.4. WORST CASE BELOW 1 GHZ 78

10.5. WORST CASE 18-26 GHZ 82

10.6. SIMULTANEOUS TRANSMISSION 86

11. AC POWER LINE CONDUCTED EMISSIONS 88

11.1. AC Power Line – Antenna 1 89

11.2. AC Power Line – Antenna 2 91

12. SETUP PHOTOS 93

END OF TEST REPORT 93

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Lutron Electronics Co Inc.
7200 Suter Rd.
Coopersburg, PA 18036-1249

EUT DESCRIPTION: Wireless Processor

MODEL: HQP7-RF-2, HQREP-RF, RR-PROC3, RR-REP3

SERIAL NUMBER: 02D5CD8E, 02D5CD87, BR2D8

SAMPLE RECEIVE DATE: 2020-09-03

DATE TESTED: 2020-09-28 to 2020-09-30

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Complies
ISED RSS-247 Issue 2	Complies
ISED RSS-GEN Issue 5 + Amendment 1	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
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UL LLC

Prepared By:

Mike Antola
Staff Engineer
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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.

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, KDB 414788 D01 Radiated Test Site v01r01, 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 12 Laboratory Drive, Research Triangle Park, North Carolina, 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.
☐ 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	U_{Lab}
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

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 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 wireless processor. Model HQP7-RF-2 tested to cover models HQREP-RF, RR-PROC3, and RR-REP3.

Model differences below:

HQREP-RF	Identical device marked differently for marketing purposes
RR-PROC3	Identical device with the same wireless functionality but processing power removed.
RR-REP3	Identical device with the same wireless functionality but processing power removed and marked differently for marketing purposes

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 - 1Mbps Ant1	19.15	82.22
2402 - 2480	BLE - 1Mbps Ant 2	22.15	164.06
2402 - 2480	BLE - 2Mbps Ant1	19.18	82.79
2402 - 2480	BLE - 2Mbps Ant 2	22.00	158.49

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes 2 antennas for diversity, with a maximum gain of:

- ANT1: 1.0dBd (integrated Printer F Antenna)
- ANT2: 0.75dBd (SMSD Chip Antenna)

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was Lutron Processor FCC Test FW

The test utility software used during testing was Lutron Wireless Command SW

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.

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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 on both antennas at 1Mbps since this data rate was highest PSD. At 2Mbps, only radiated bandedge performed.

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

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
PoE Power Supply	PHIHONG	POE16R-1AFG	P202200014A0	NA
Laptop	HP	Elitebook 840 G3	5CG7256KS3	NA

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	PoE	1	RJ45	UTP	0.9	PoE out of PoE power supply
2	AC	1	NEMA 1-15-P	NA	NA	Wall-wart connector on PoE power supply.

TEST SETUP

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

SETUP DIAGRAMS

Please refer to R13413705-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 PKPM1 Peak Power Meter Method
ANSI C63.10 Subclause – 11.9.2.3.2 AVGPM-G Method.

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

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

Radiated emissions restricted frequency bands: ANSI C63.10 Subclause -11.12.1 and 6.10.5

Conducted emissions in restricted frequency bands: ANSI C63.10 Subclause -11.12.2

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

Radiated Spurious Emissions: ANSI C63.10-2013 Section 6.3 to 6.6

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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 - 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
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (2016-08-15)		
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2020-08-08	2021-08-08

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
SA007	Spectrum Analyzer	Keysight Technologies	N9030A	2020-06-10	2021-06-10
T177	Spectrum Analyzer	Agilent Technologies	E4446A	2020-04-30	2021-04-30
PWM001	RF Power Meter	Keysight Technologies	N1912A	2020-07-17	2021-07-17
PWS001	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	N1921A	2020-05-27	2021-05-27
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2020-06-26	2021-06-26
76021	DC Regulated Power Supply	CircuitSpecialists.Com	CSI3005X5	NA	NA
SOFTEMI	EMC Software	UL	Version 2020.9.1	NA	NA
MM0167	True RMS Multimeter	Agilent	U1232A	2020-08-05	2021-08-05

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
0.009-30MHz (Loop Ant.)					
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
30-1000 MHz					
AT0081	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-11-20	2020-11-20
1-18 GHz					
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-28	2021-04-28
18-40 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	2020-07-10	2021-07-10
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-07-10	2021-07-10
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-06	2021-07-06
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2020-07-07	2021-07-07
Receiver & Software					
SA0025	Spectrum Analyzer	Agilent	N9030A	2020-03-17	2021-03-17
SA0027	Spectrum Analyzer	Agilent	N9030A	2020-06-10	2021-06-10
SOFTEMI	EMI Software	UL	Version 9.5 (2020-07-07)		
Additional Equipment used					
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22
ATA176 (in S-SAC)	10dB, DC-18GHz, 5W	Mini-Circuits	BW-N10W5	2020-08-29	2021-08-29

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

Equipment 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	2020-04-27	2021-04-27
Gain-Loss Chains					
N-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-28	2021-07-28
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
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA

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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.

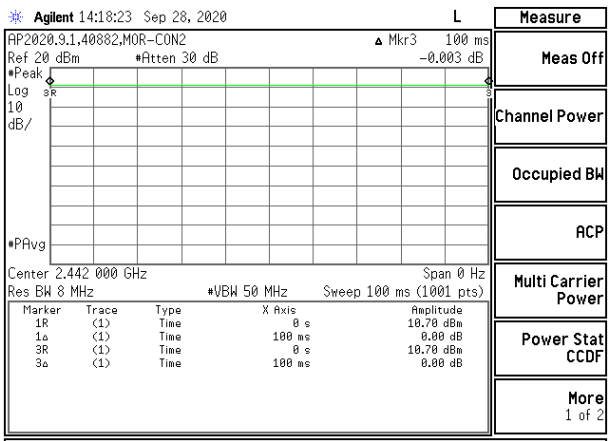
ON TIME AND DUTY CYCLE RESULTS

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 - All rates	100.000	100.000	1.000	100.00%	0.00	0.010

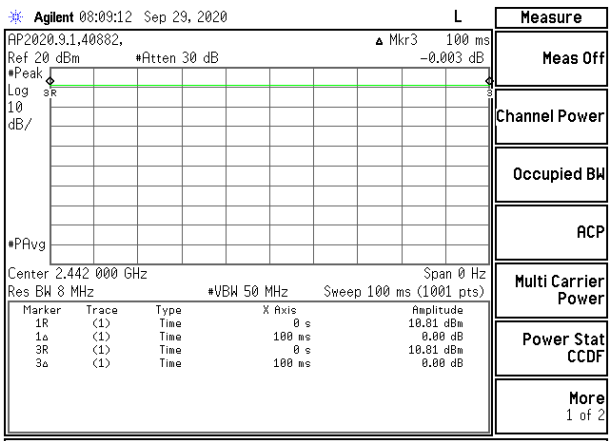
Note: Worse case "real-world" duty cycle of the EUT is 40% as declared by the manufacturer. Details as to how the manufacturer implemented the protocol limitations are documented in the operational description exhibit. It is this value that is used to derive the duty cycle correction factor that is referenced throughout the report. See calculation below:

Duty Cycle Correction Factor [Linear Voltage Averaging Mode] = 20*log(DC)
= 20*log(0.4) = -7.96dB

DUTY CYCLE PLOTS



1 Mbps



2 Mbps

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9.2. 99% BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

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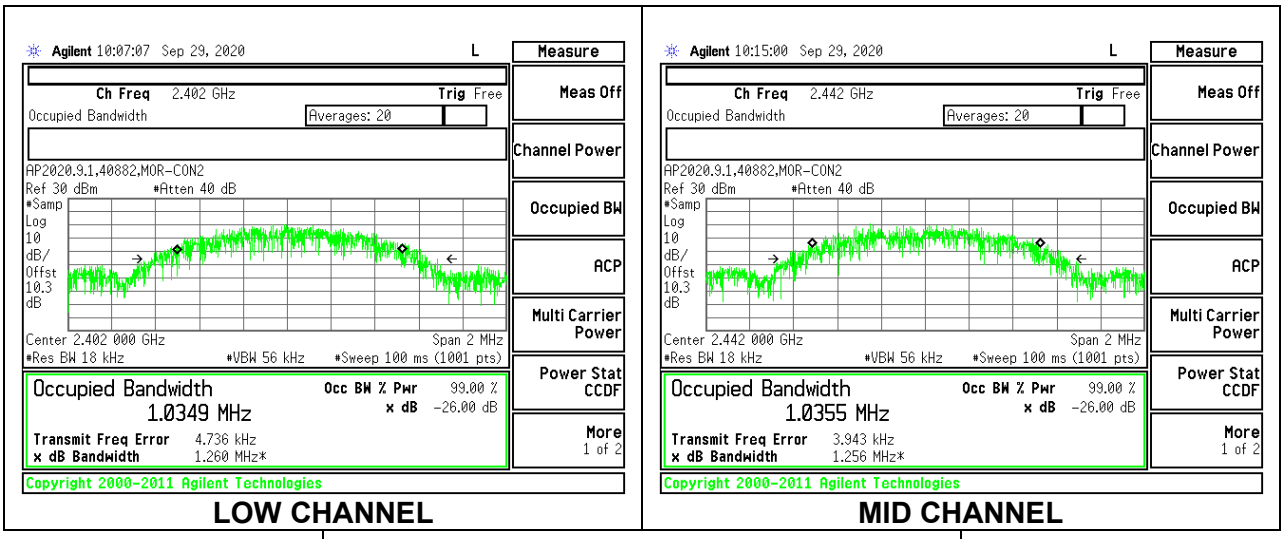
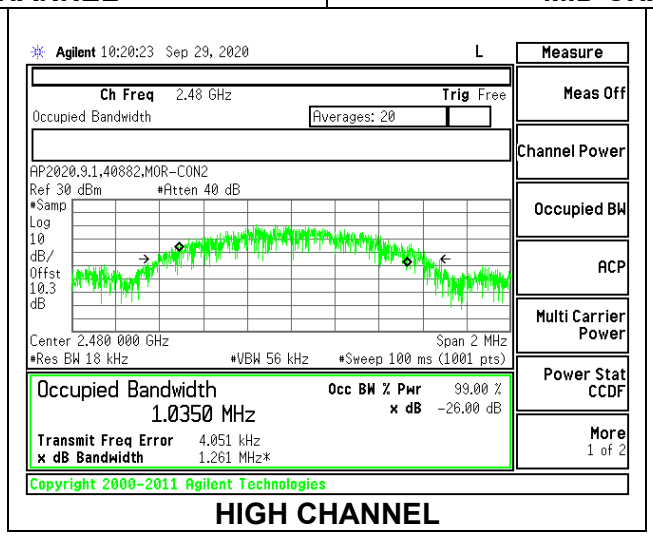
9.2.1. BLE (1Mbps)

Antenna 1

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0349
Middle	2440	1.0355
High	2480	1.0350



LOW CHANNEL **MID CHANNEL**



HIGH CHANNEL

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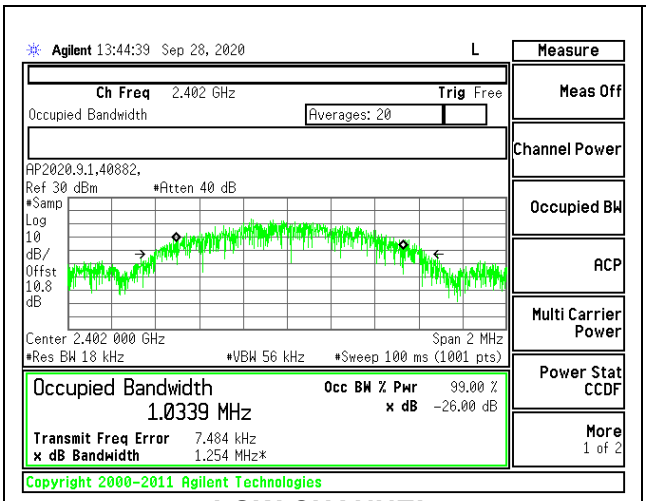
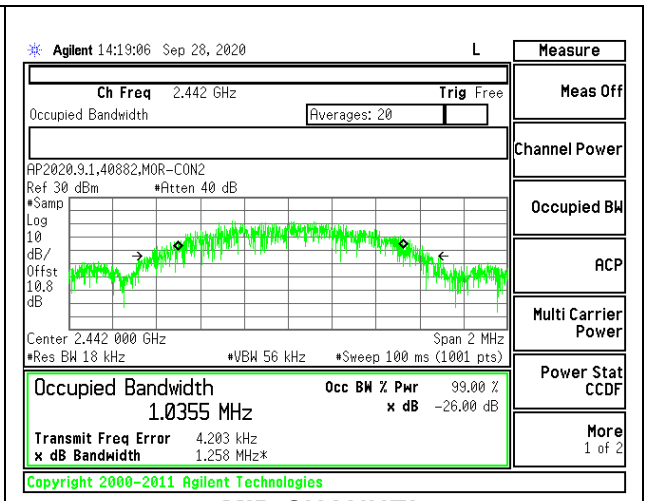
Antenna 2

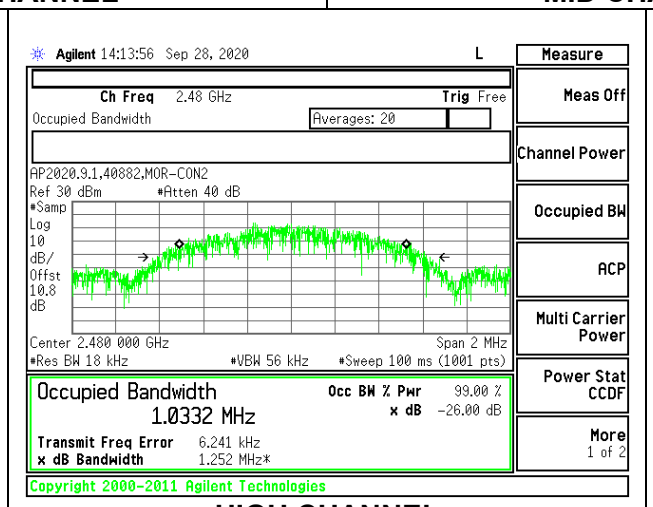
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0339
Middle	2440	1.0355
High	2480	1.0332



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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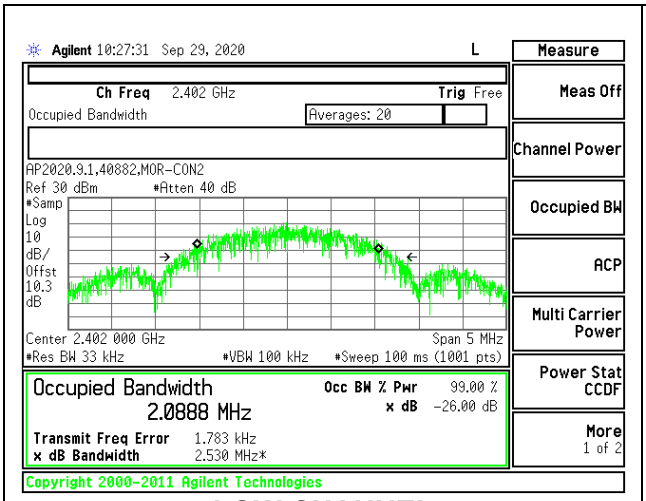
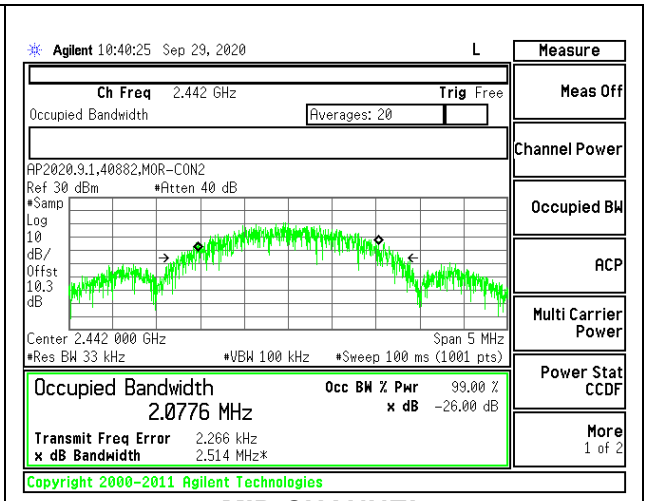
9.2.2. BLE (2Mbps)

Antenna 1

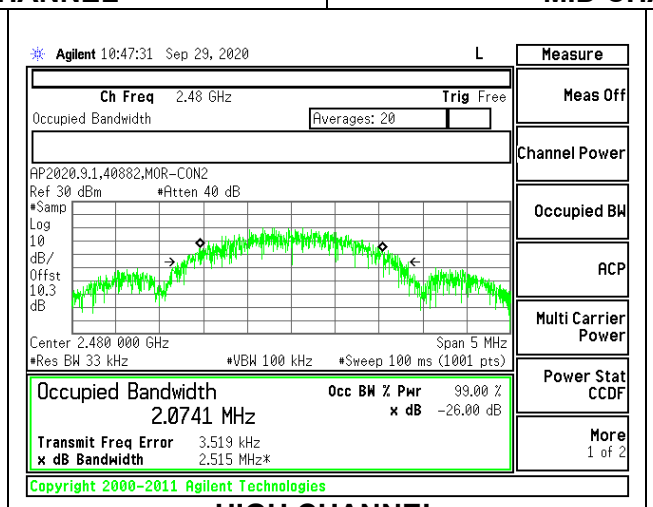
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	2.0888
Middle	2440	2.0776
High	2480	2.0741



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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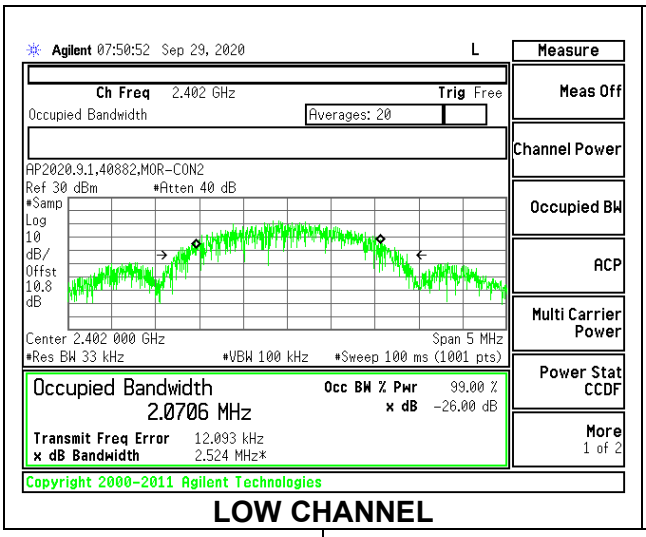
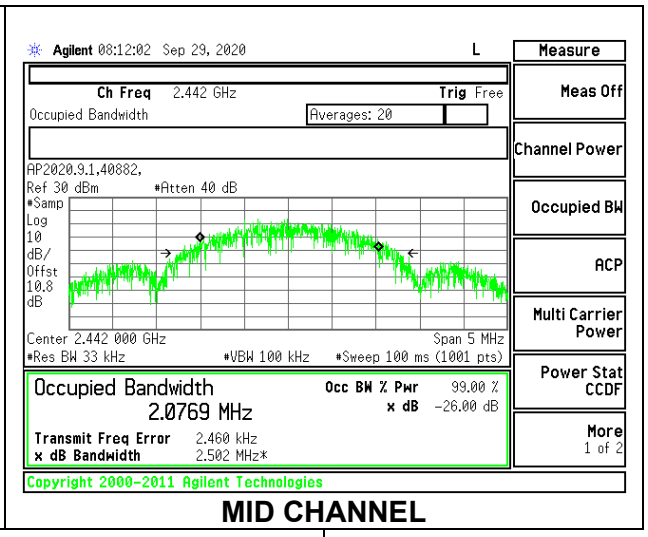
Antenna 2

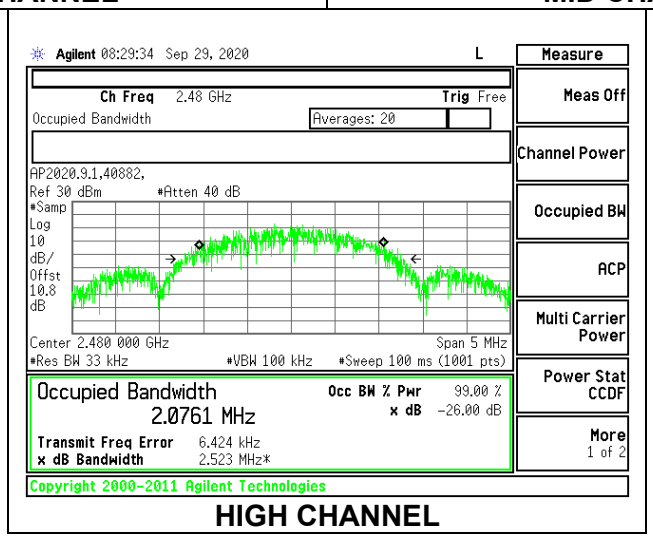
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	2.0706
Middle	2440	2.0769
High	2480	2.0761



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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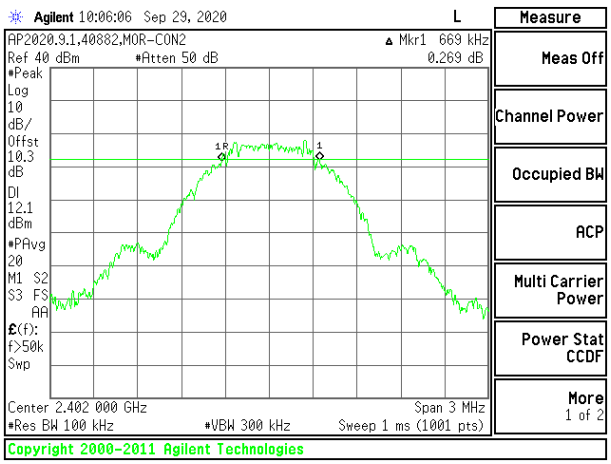
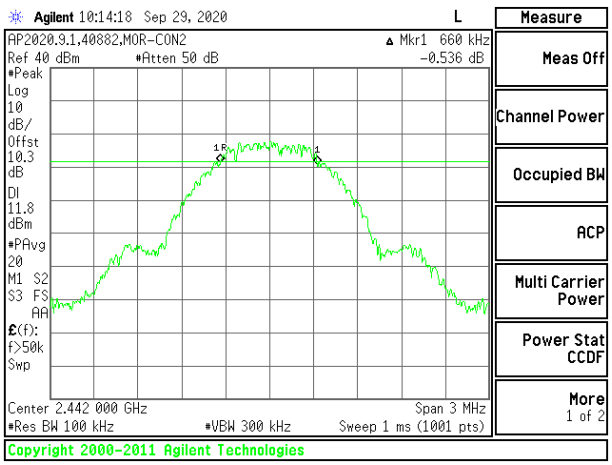
9.3.1. BLE (1Mbps)

Antenna 1

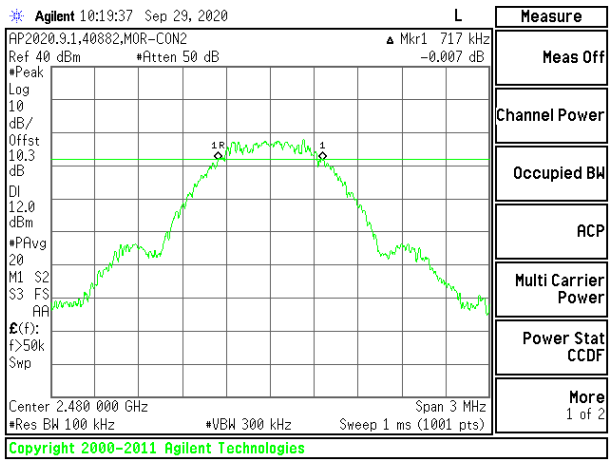
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6690	0.5
Middle	2440	0.6600	0.5
High	2480	0.7170	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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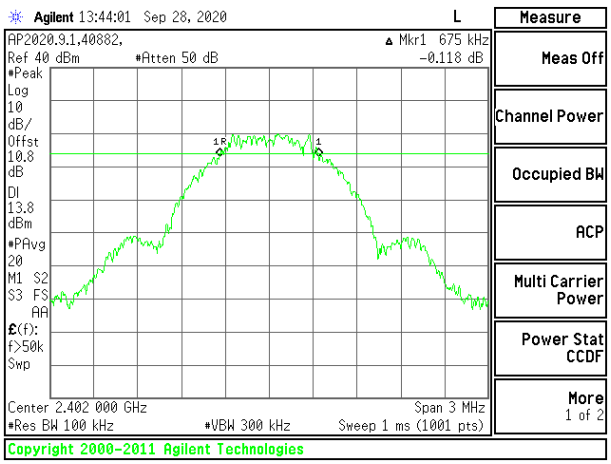
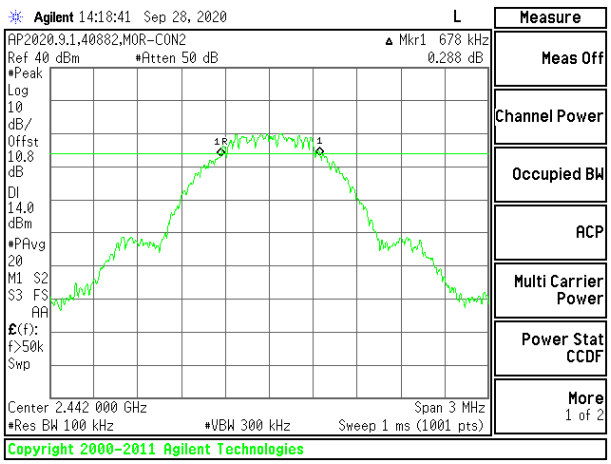
Antenna 2

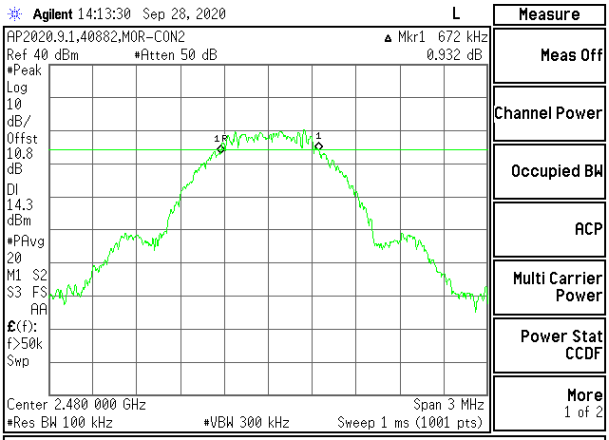
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6750	0.5
Middle	2440	0.6780	0.5
High	2480	0.6720	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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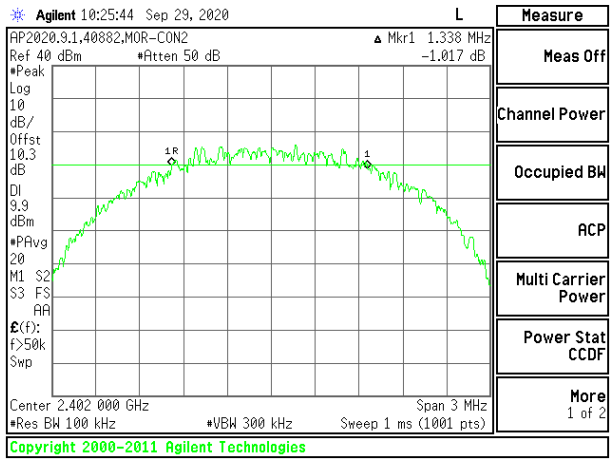
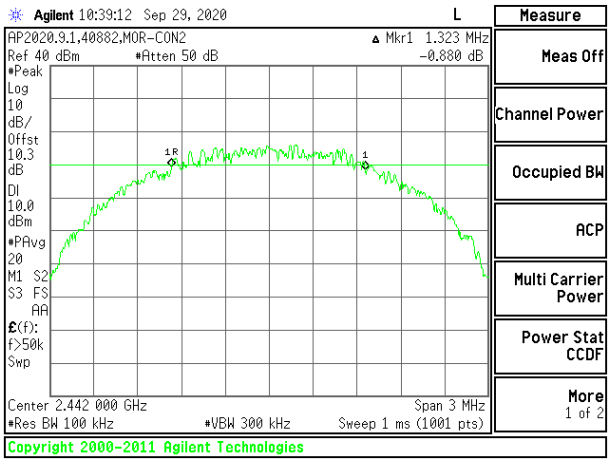
9.3.2. BLE (2Mbps)

Antenna 1

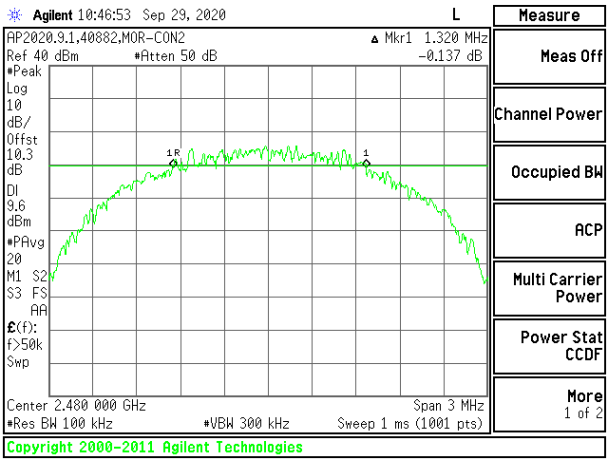
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.3380	0.5
Middle	2440	1.3230	0.5
High	2480	1.3200	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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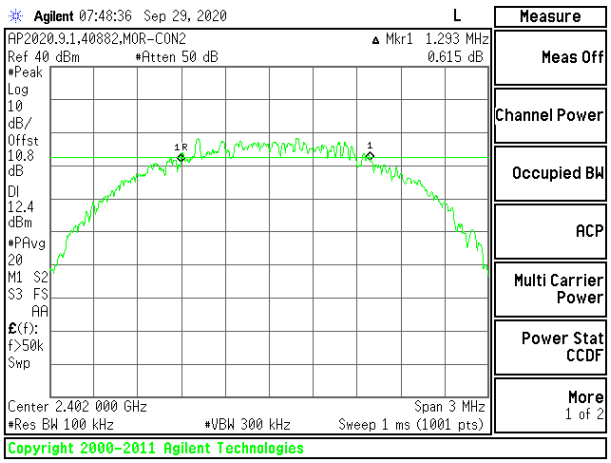
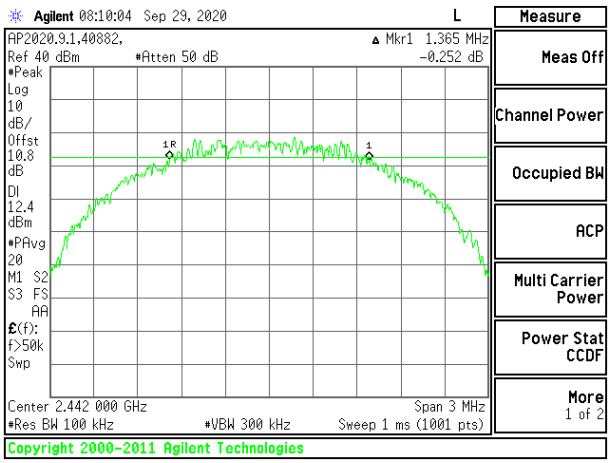
Antenna 2

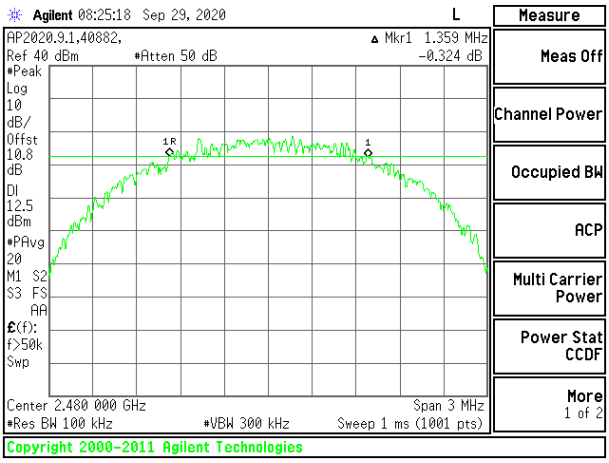
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.2930	0.5
Middle	2440	1.3650	0.5
High	2480	1.3590	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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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 10.3 dB (including 10 dB pad and 0.3 dB cable) was entered as an offset in the power meter to allow for a gated peak reading of power.

All testing was performed at EUT power setting “Pset -1” with the exception of Channel 39 (2480MHz), which utilized power setting “Pset -4”. Additional testing was performed at Channel 36 (2478MHz) at power setting “Pset -1” to verify High Channel compliance where appropriate throughout the report.

RESULTS

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9.4.1. BLE (1Mbps)

Antenna 1

Tested By:	40882
Date:	2020-12-01

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.080	30	-10.920
Middle	2442	19.150	30	-10.850
High (Ch 36)	2478	19.120	30	-10.880
High (Ch 39)	2480	14.920	30	-15.080

Antenna 2

Tested By:	40882
Date:	2020-12-01

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	21.800	30	-8.200
Middle	2442	21.830	30	-8.170
High (Ch 36)	2478	22.150	30	-7.850
High (Ch 39)	2480	17.870	30	-12.130

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9.4.2. BLE (2Mbps)

Antenna 1

Tested By:	40882
Date:	2020-12-01

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	19.180	30	-10.820
Middle	2442	19.120	30	-10.880
High	High (Ch 36)	19.010	30	-10.990
High	High (Ch 39)	14.260	30	-15.740

Antenna 2

Tested By:	40882
Date:	2020-12-01

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	21.780	30	-8.220
Middle	2442	21.870	30	-8.130
High (Ch 36)	2478	22.000	30	-8.000
High (Ch 39)	2480	17.060	30	-12.940

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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 10.3 dB was entered as an offset in the power meter to allow for a gated average reading of power

RESULTS

9.5.1. BLE (1Mbps)

Antenna 1

Tested By:	40882
Date:	2020-12-01

Channel	Frequency (MHz)	Average Power Reading (dBm)
Low	2402	18.97
Middle	2442	19.04
High (Ch 36)	2478	19.03
High (Ch 39)	2480	14.70

Antenna 2

Tested By:	40882
Date:	2020-12-01

Channel	Frequency (MHz)	Average Power Reading (dBm)
Low	2402	21.73
Middle	2442	21.74
High (Ch 36)	2478	22.08
High (Ch 39)	2480	17.76

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9.5.2. BLE (2Mbps)

Antenna 1

Tested By:	40882
Date:	2020-12-01

Channel	Frequency (MHz)	Average Power Reading (dBm)
Low	2402	19.07
Middle	2442	19.01
High (Ch 36)	2478	18.93
High (Ch 39)	2480	14.09

Antenna 2

Tested By:	40882
Date:	2020-12-01

Channel	Frequency (MHz)	Average Power Reading (dBm)
Low	2402	21.69
Middle	2442	21.79
High (Ch 36)	2478	21.94
High (Ch 39)	2480	16.94

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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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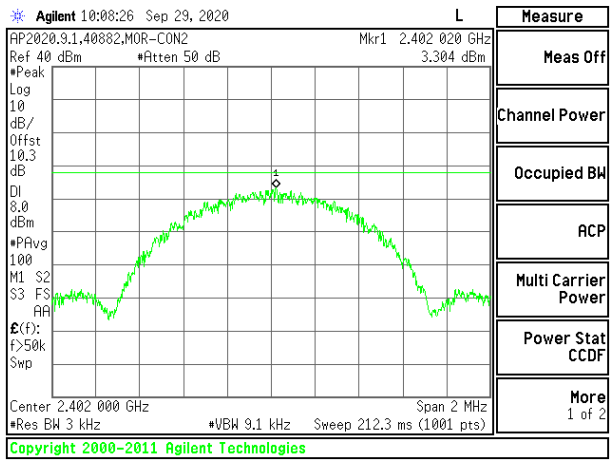
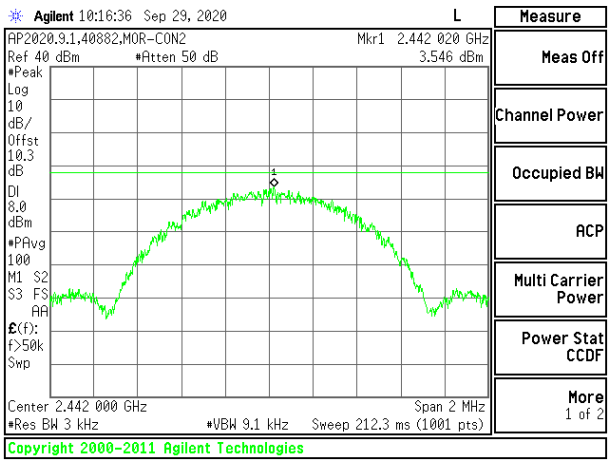
9.6.1. BLE (1Mbps)

Antenna 1

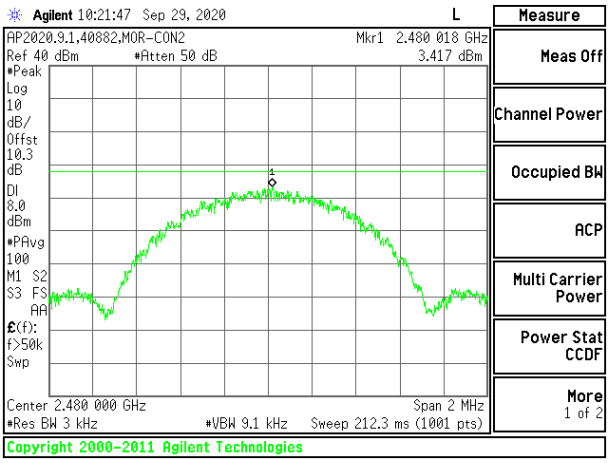
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	3.30	8	-4.70
Middle	2442	3.55	8	-4.45
High	2480	3.42	8	-4.58



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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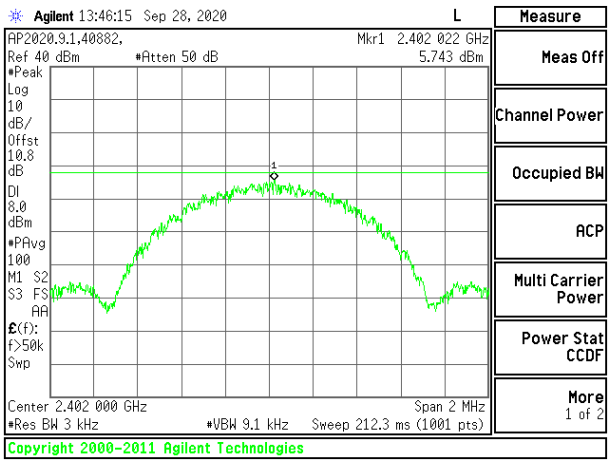
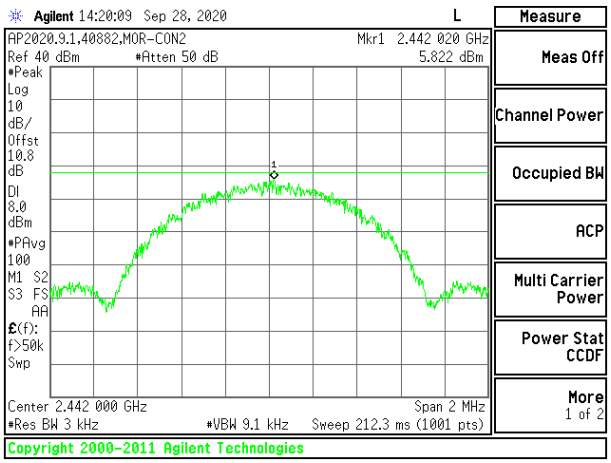
Antenna 2

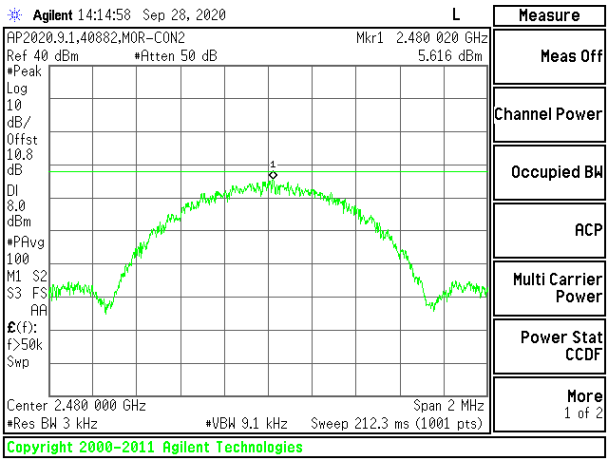
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	5.74	8	-2.26
Middle	2442	5.82	8	-2.18
High	2480	5.62	8	-2.38



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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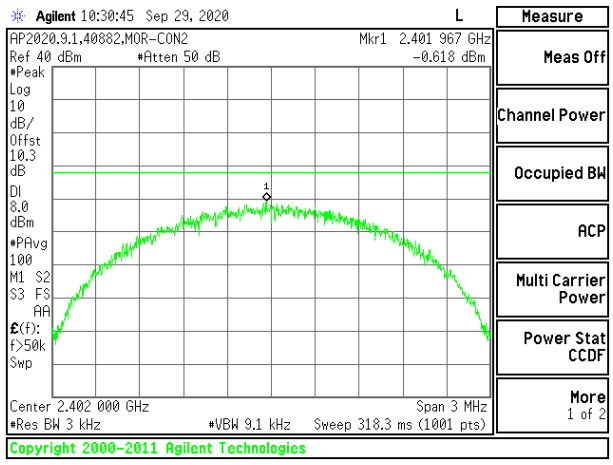
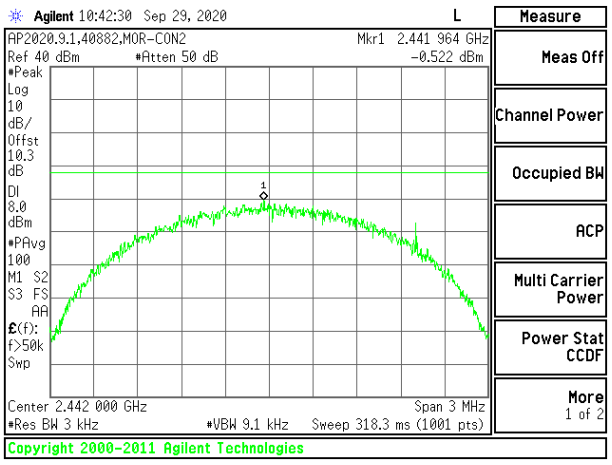
9.6.2. BLE (2Mbps)

Antenna 1

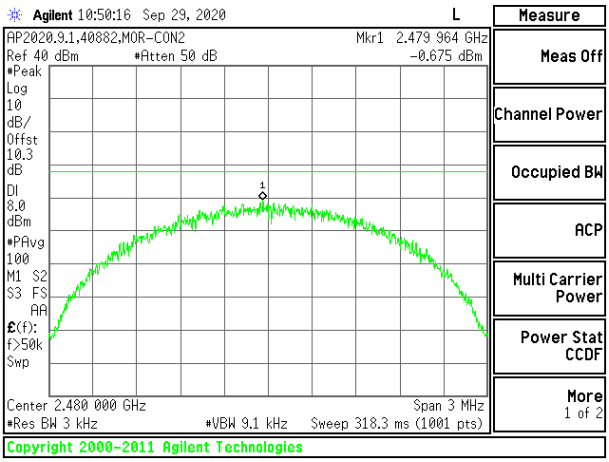
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-0.62	8	-8.62
Middle	2442	-0.52	8	-8.52
High	2480	-0.68	8	-8.68



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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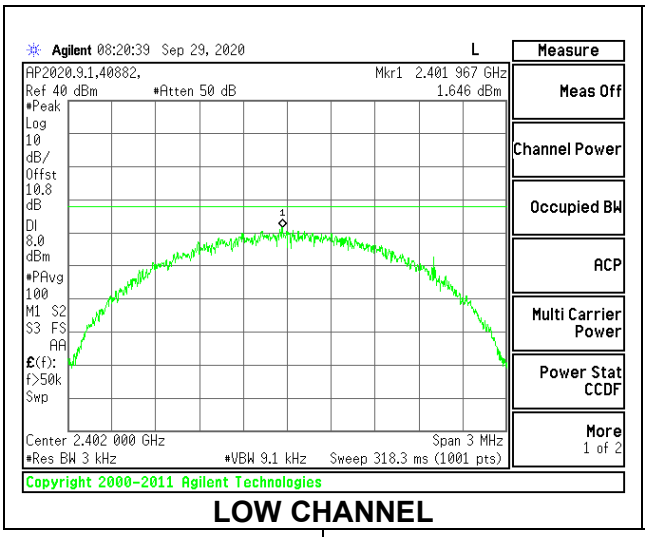
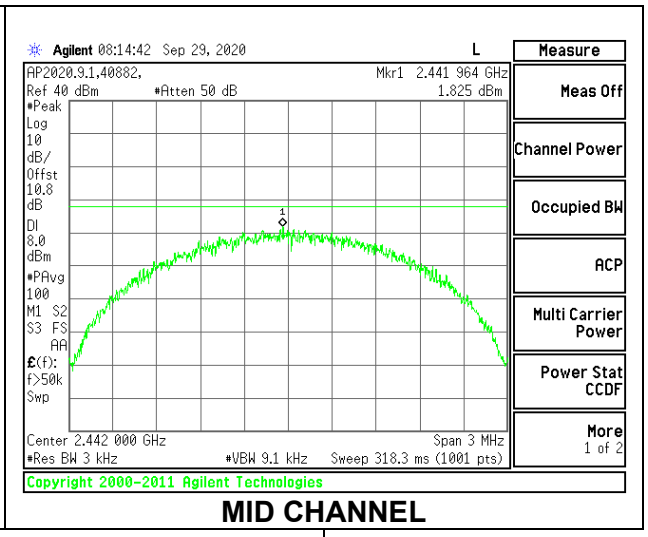
Antenna 2

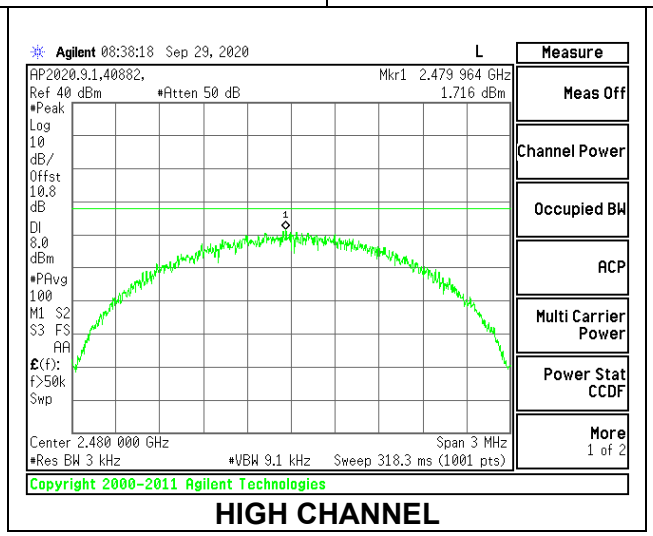
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	1.65	8	-6.35
Middle	2442	1.83	8	-6.18
High	2480	1.72	8	-6.28



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

Note: High channel Bandedge was performed on Channel 39 (2480MHz) at the highest available power setting (Pset -1) as this is representative of the worse-case condition.

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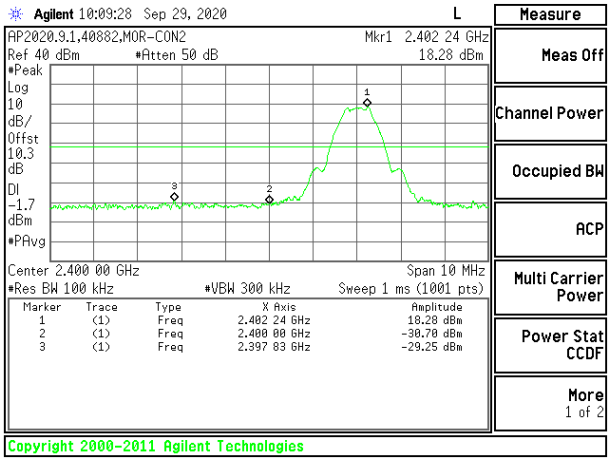
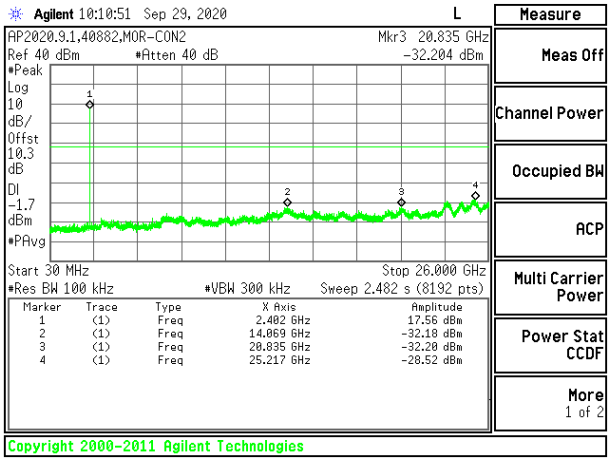
9.7.1. BLE (1Mbps)

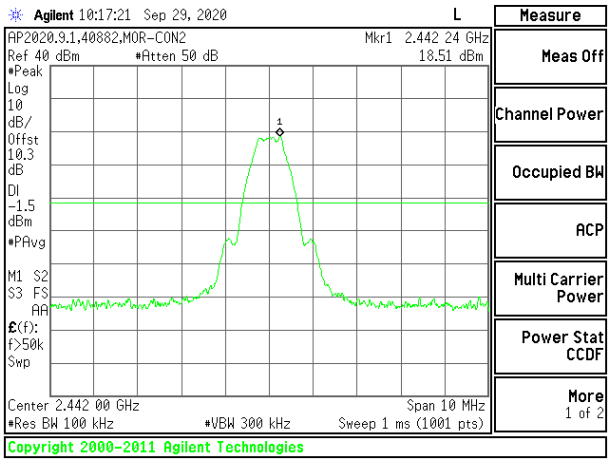
Antenna 1



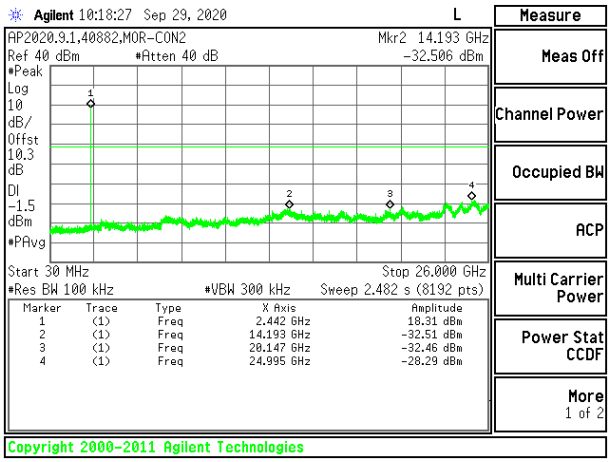
LOW CHANNEL BANDEDGE



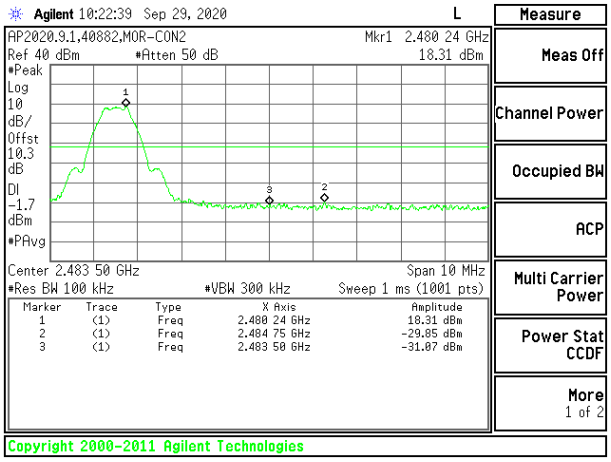
OUT-OF-BAND LOW CHANNEL



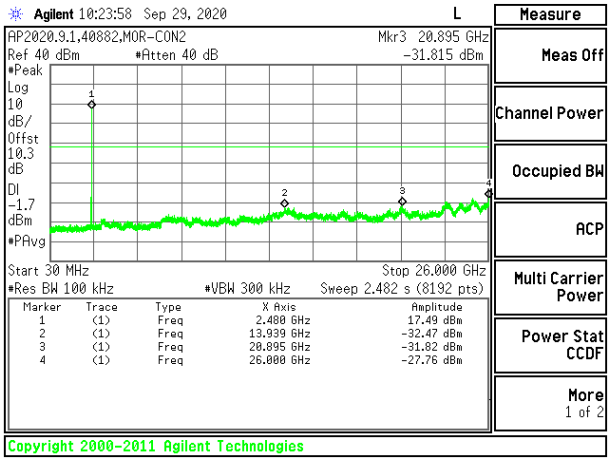
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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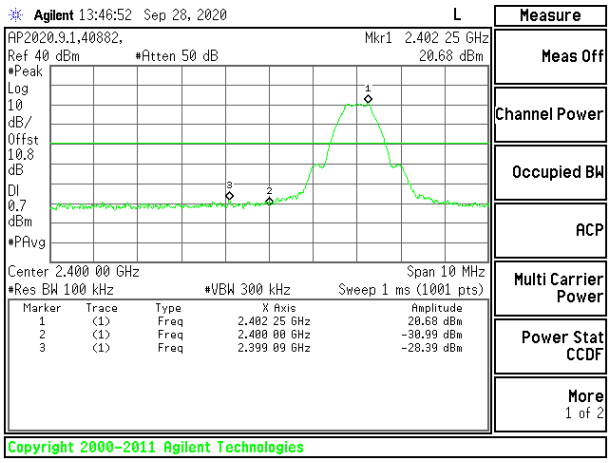
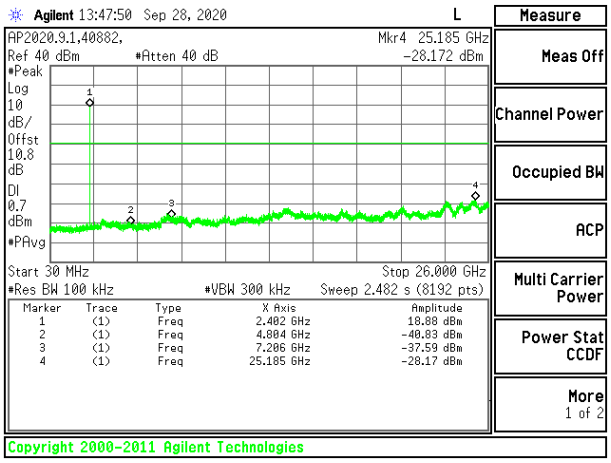
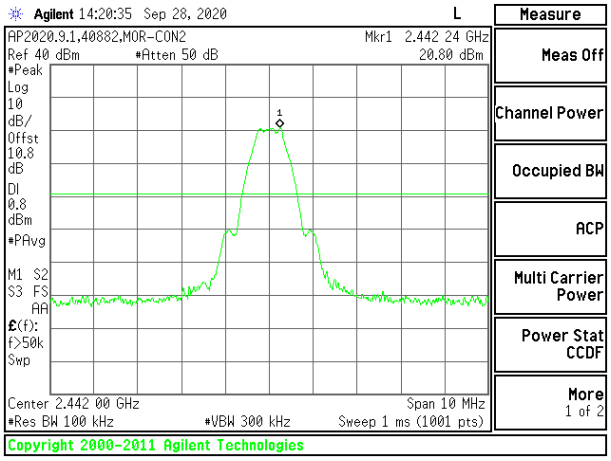
Antenna 2



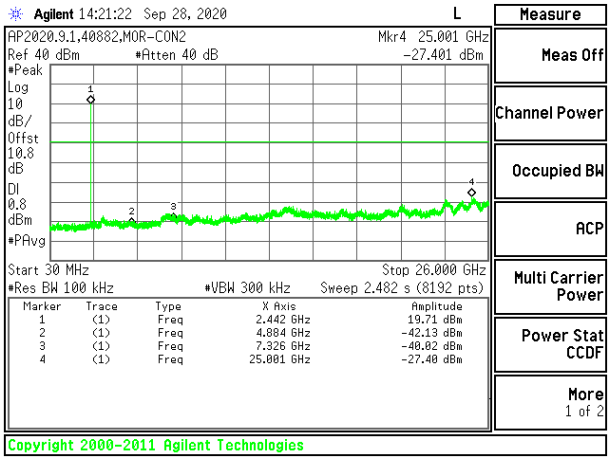
LOW CHANNEL BANDEDGE



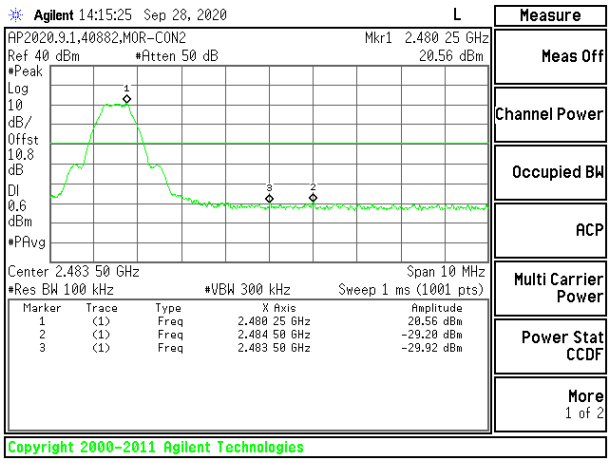
OUT-OF-BAND LOW CHANNEL



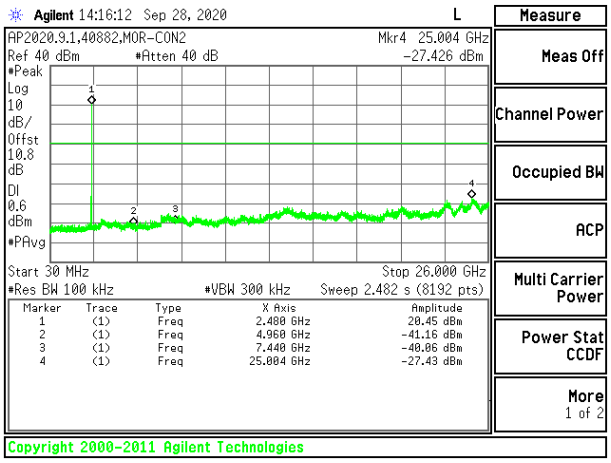
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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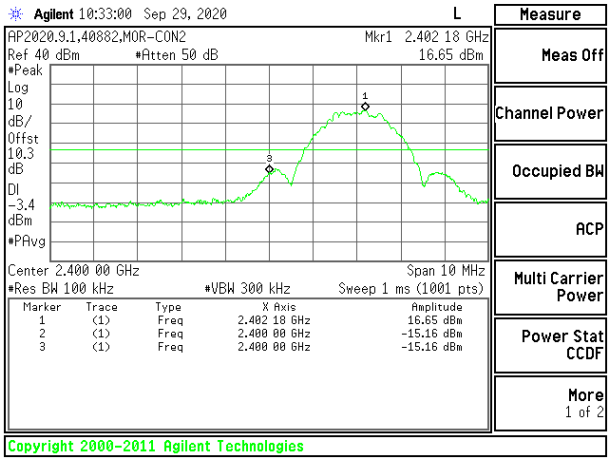
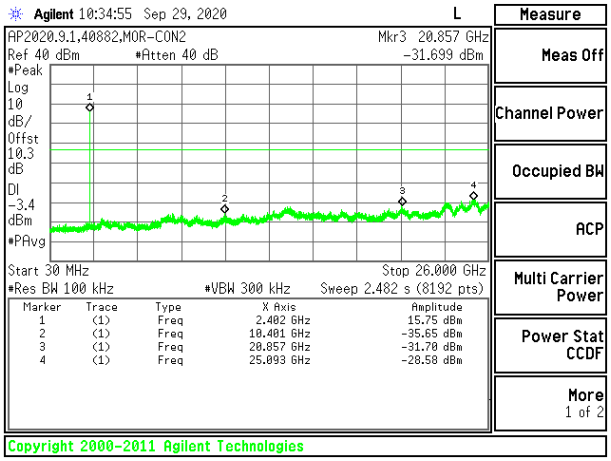
9.7.2. BLE (2Mbps)

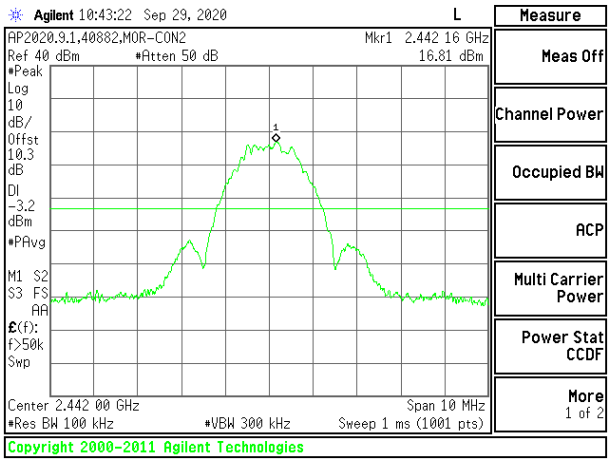
Antenna 1



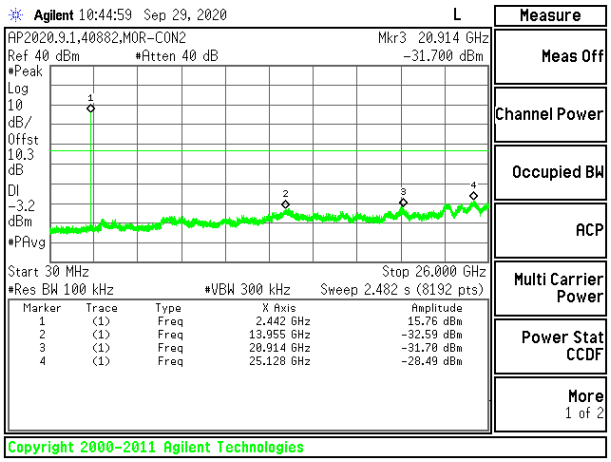
LOW CHANNEL BANDEDGE



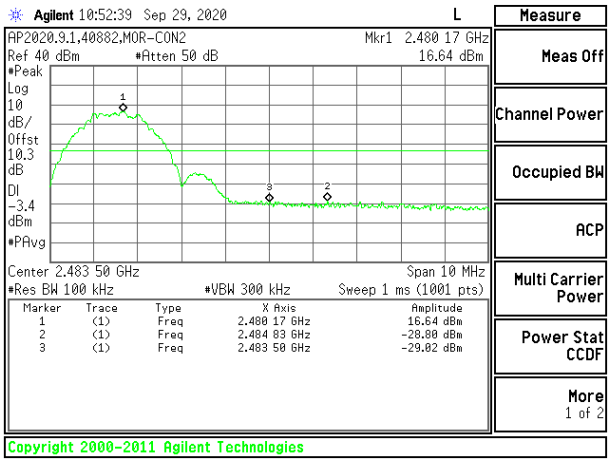
OUT-OF-BAND LOW CHANNEL



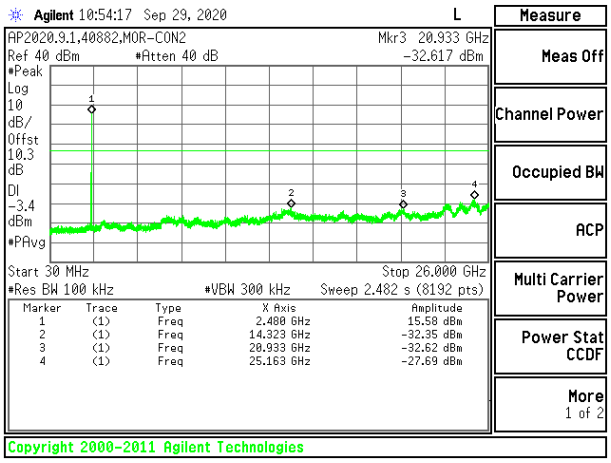
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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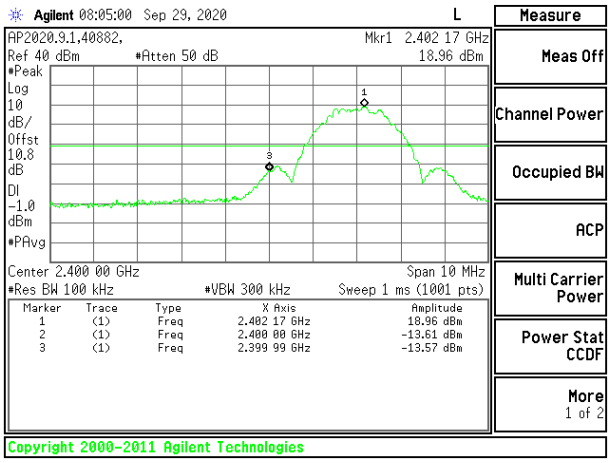
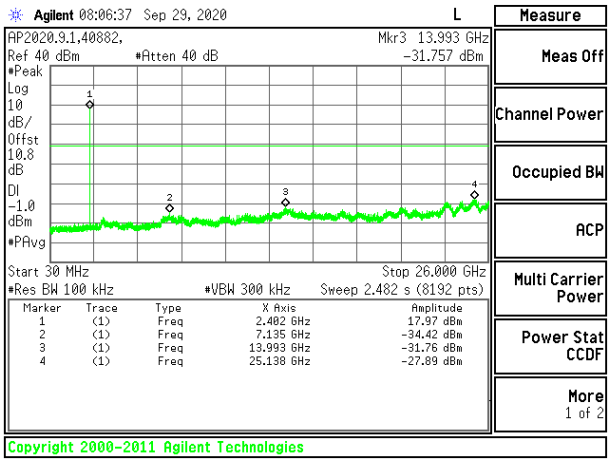
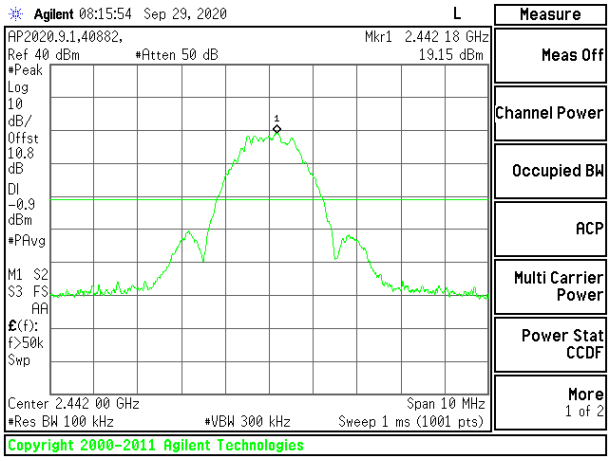
Antenna 2



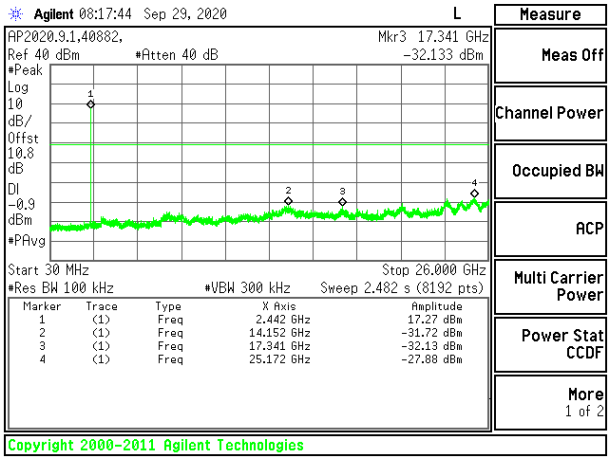
LOW CHANNEL BANDEDGE



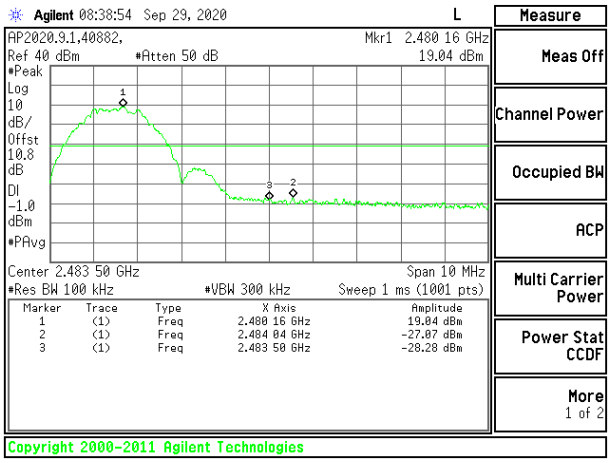
OUT-OF-BAND LOW CHANNEL



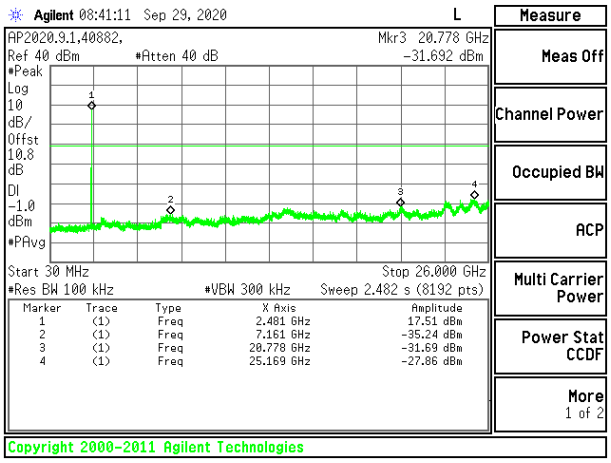
IN-BAND REFERENCE LEVEL



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.

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 9-150kHz 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 average measurements (linear voltage averaging).

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.

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

Based 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.

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.

Note: High channel Bandedge testing performed on Antenna 1 at 2 Mbps as follows:

- Ch 39 (2480MHz) at lower EUT power setting (Pset -4)
- Ch 36 (2478MHz) at typical EUT power setting (Pset -1)

High channel Bandedge at 1Mbps was performed on Channel 39 (2480MHz) at the highest available power setting (Pset -1) as this is representative of the worse-case condition.

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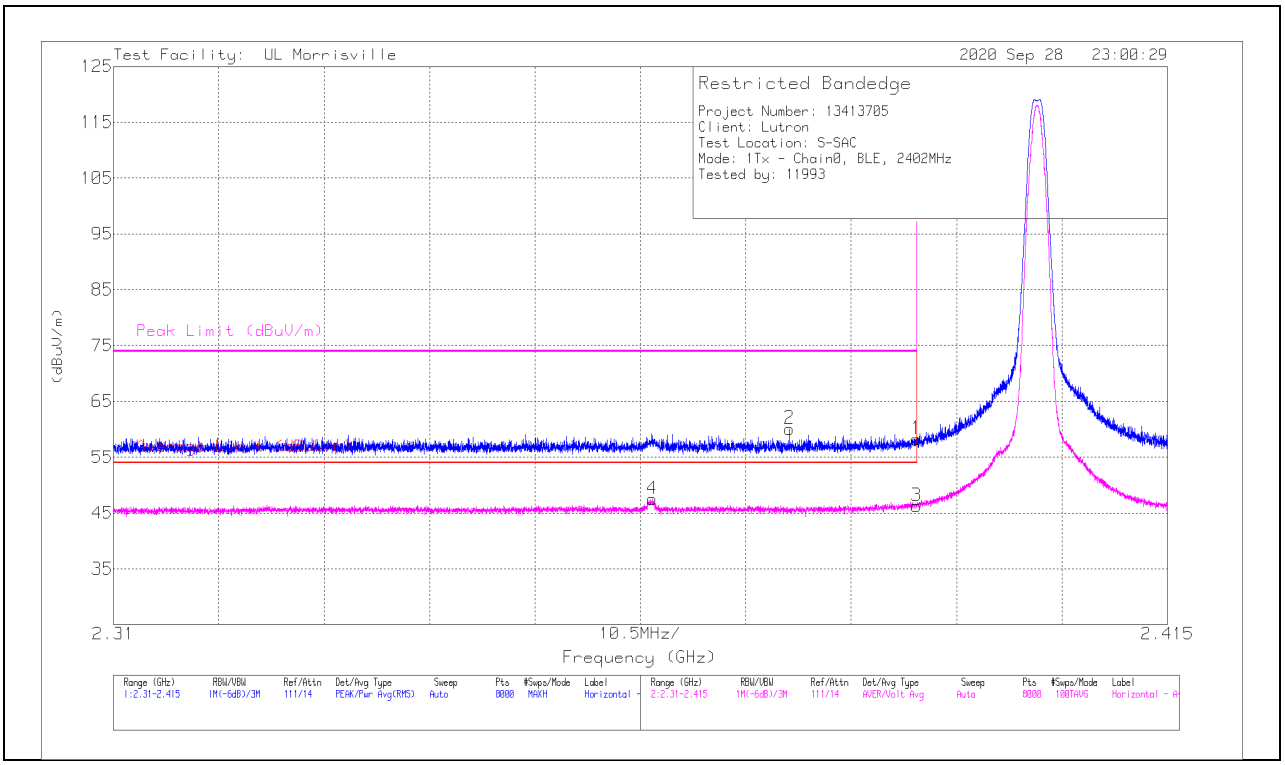
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	40.16	Pk	32.1	-24	10	0	58.26	-	-	74	-15.74	21	170	H
2	* ** 2.37734	41.8	Pk	32.2	-23.9	10	0	60.1	-	-	74	-13.9	21	170	H
3	* ** 2.39	28.2	ADV	32.1	-24	10	-7.96	38.34	54	-15.66	-	-	21	170	H
4	* ** 2.36368	29.18	ADV	32.2	-23.9	10	-7.96	39.52	54	-14.48	-	-	21	170	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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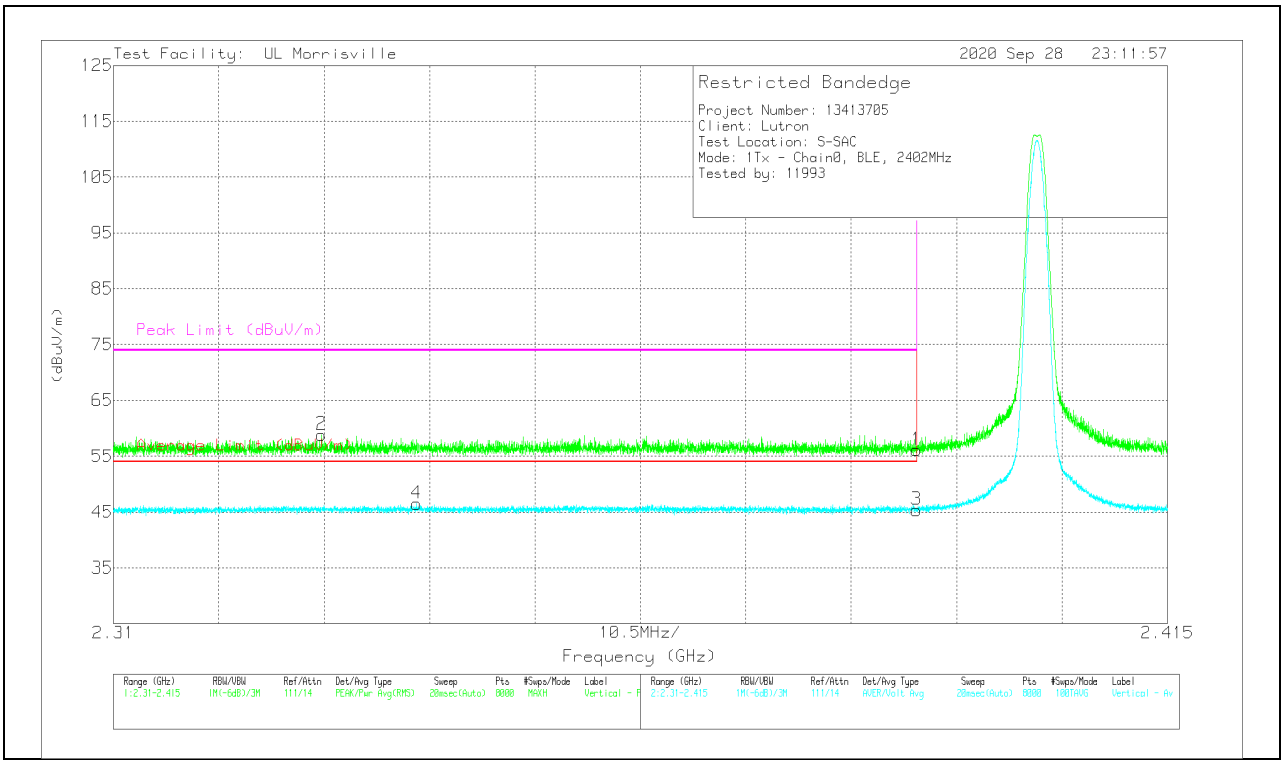
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	37.98	Pk	32.1	-24	10	0	56.08	-	-	74	-17.92	204	353	V
2	* ** 2.33073	40.48	Pk	32.1	-23.7	10	0	58.88	-	-	74	-15.12	204	353	V
3	* ** 2.39	27.27	ADV	32.1	-24	10	-7.96	37.41	54	-16.59	-	-	204	353	V
4	* ** 2.34018	28.08	ADV	32.2	-23.8	10	-7.96	38.52	54	-15.48	-	-	204	353	V

* - 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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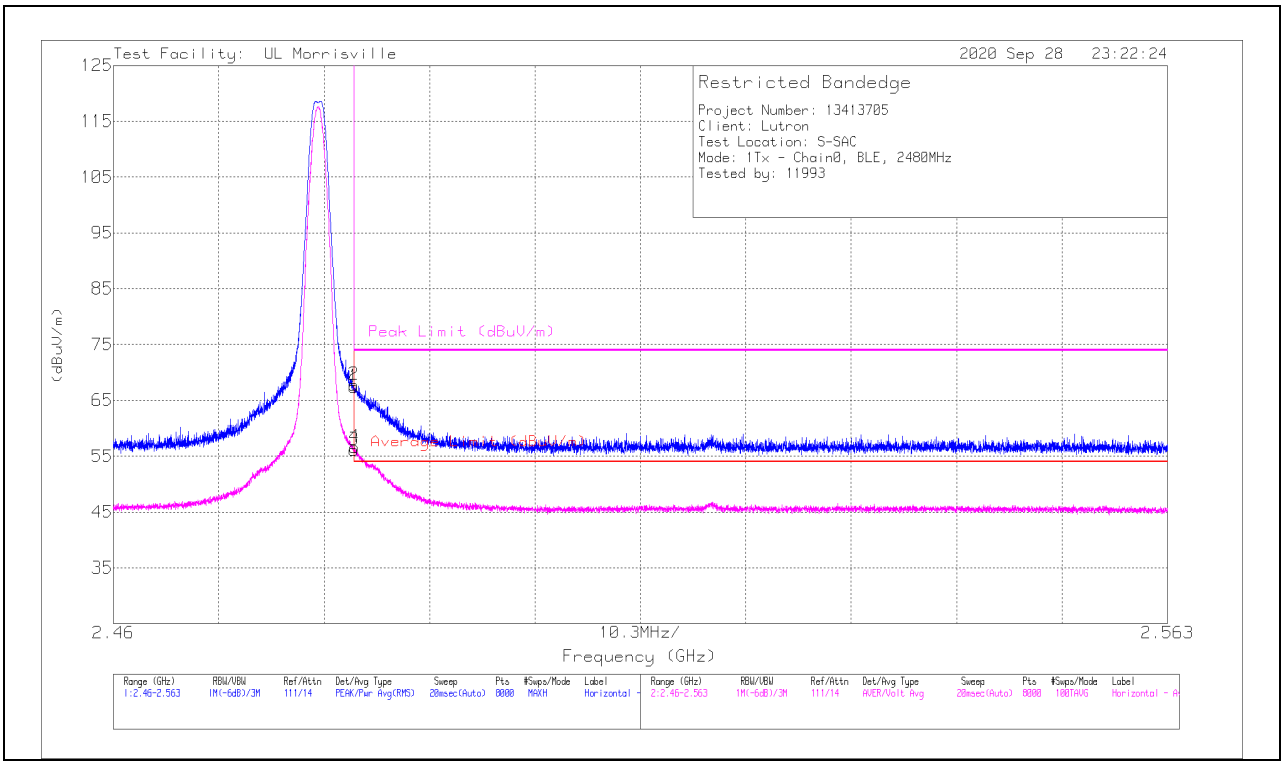
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	49.39	Pk	32.4	-24.4	10	0	67.39	-	-	74	-6.61	38	115	H
2	* ** 2.48353	49.79	Pk	32.4	-24.4	10	0	67.79	-	-	74	-6.21	38	115	H
3	* ** 2.4835	38.14	ADV	32.4	-24.4	10	-7.96	48.18	54	-5.82	-	-	38	115	H
4	* ** 2.48359	38.57	ADV	32.4	-24.4	10	-7.96	48.61	54	-5.39	-	-	38	115	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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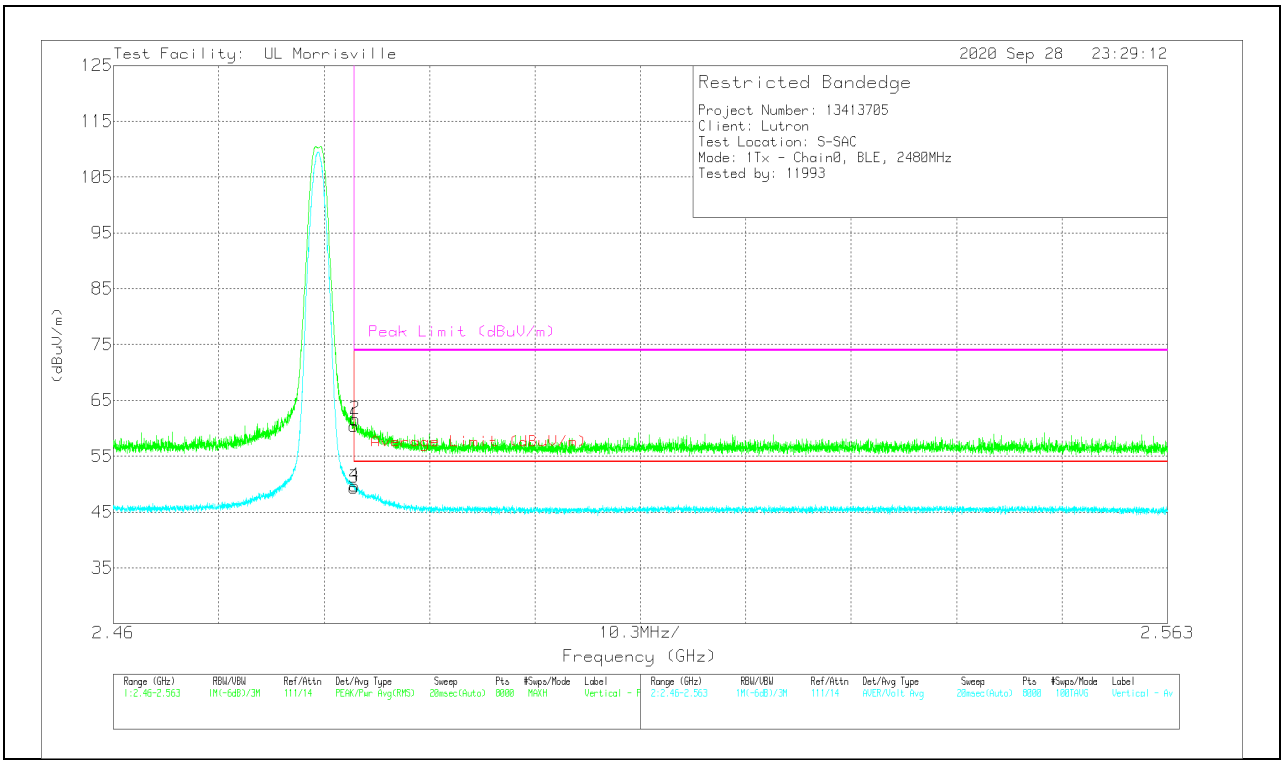
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	42.48	Pk	32.4	-24.4	10	0	60.48	-	-	74	-13.52	201	380	V
2	* ** 2.48362	43.6	Pk	32.4	-24.4	10	0	61.6	-	-	74	-12.4	201	380	V
3	* ** 2.4835	31.35	ADV	32.4	-24.4	10	-7.96	41.39	54	-12.61	-	-	201	380	V
4	* ** 2.48358	31.74	ADV	32.4	-24.4	10	-7.96	41.78	54	-12.22	-	-	201	380	V

* - 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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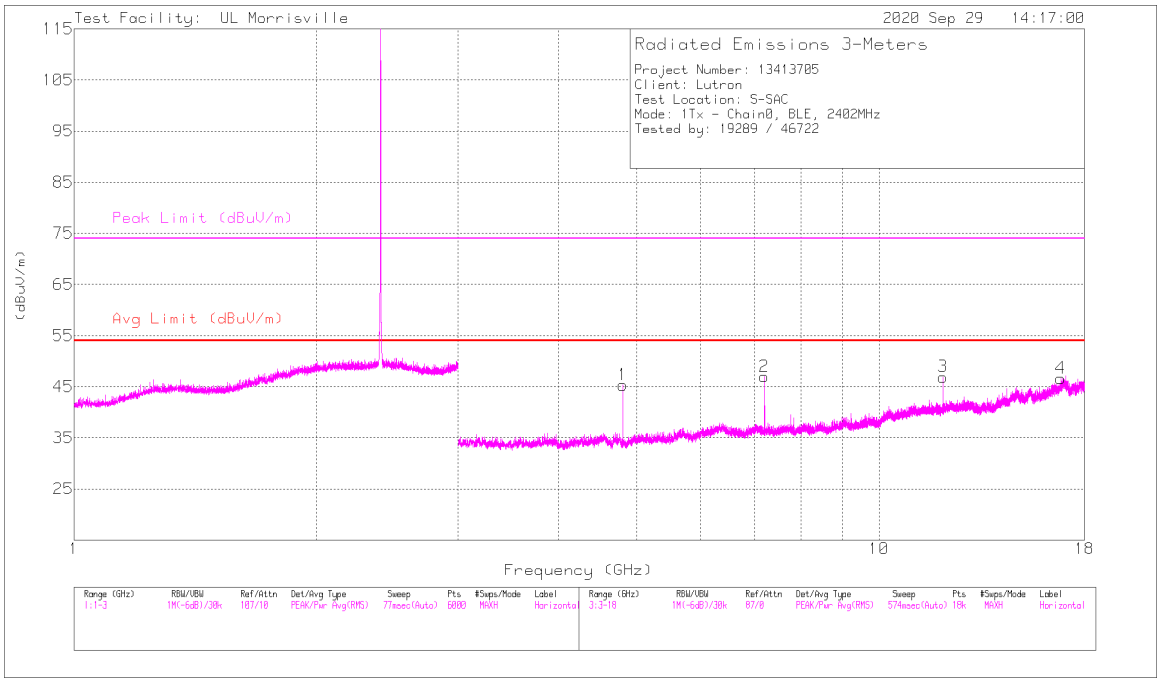
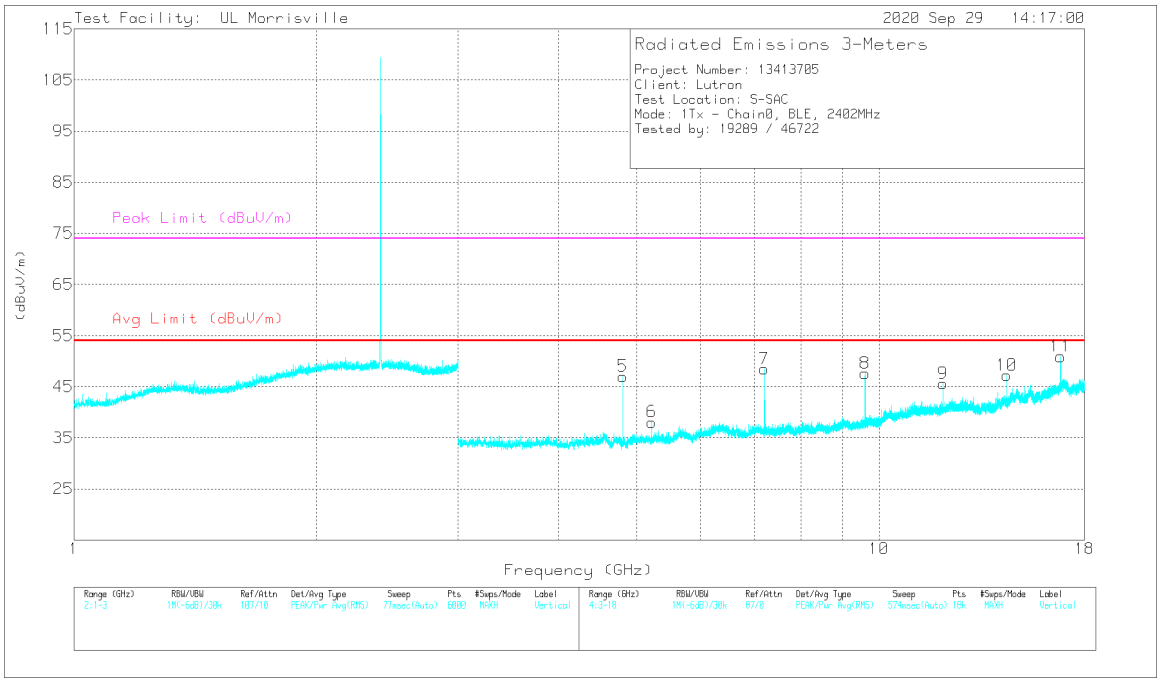
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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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	* ** 4.80466	46.64	PK2	34	-30.9	0	49.74	-	-	74	-24.26	43	322	H
	* ** 4.80404	39.36	ADV	34	-30.9	-7.96	34.5	54	-19.5	-	-	43	322	H
3	* ** 12.00892	38.12	PK2	38.7	-24.1	0	52.72	-	-	74	-21.28	335	100	H
	* ** 12.00888	28.07	ADV	38.7	-24.1	-7.96	34.71	54	-19.29	-	-	335	100	H
5	* ** 4.80352	49.19	PK2	34	-30.8	0	52.39	-	-	74	-21.61	115	364	V
	* ** 4.80402	44.15	ADV	34	-30.9	-7.96	39.29	54	-14.71	-	-	115	364	V
6	** 5.22117	39.12	PK2	34.3	-30.7	0	42.72	-	-	74	-31.28	281	110	V
	** 5.22115	28.5	ADV	34.3	-30.7	-7.96	24.14	54	-29.86	-	-	281	110	V
9	* ** 12.01124	36.84	PK2	38.7	-24.1	0	51.44	-	-	74	-22.56	61	120	V
	* ** 12.01113	26.45	ADV	38.7	-24.1	-7.96	33.09	54	-20.91	-	-	61	120	V
7	7.20524	40.77	Pk	35.6	-27.9	0	48.47	-	-	-	-	0-360	102	V
2	7.20607	39.28	Pk	35.6	-27.9	0	46.98	-	-	-	-	0-360	199	H
8	9.6087	37.31	Pk	36.6	-26.3	0	47.61	-	-	-	-	0-360	199	V
10	14.41064	32.72	Pk	39.4	-24.9	0	47.22	-	-	-	-	0-360	199	V
11	16.81244	32.62	Pk	41.9	-23.6	0	50.92	-	-	-	-	0-360	199	V
4	16.81494	28.33	Pk	41.9	-23.6	0	46.63	-	-	-	-	0-360	199	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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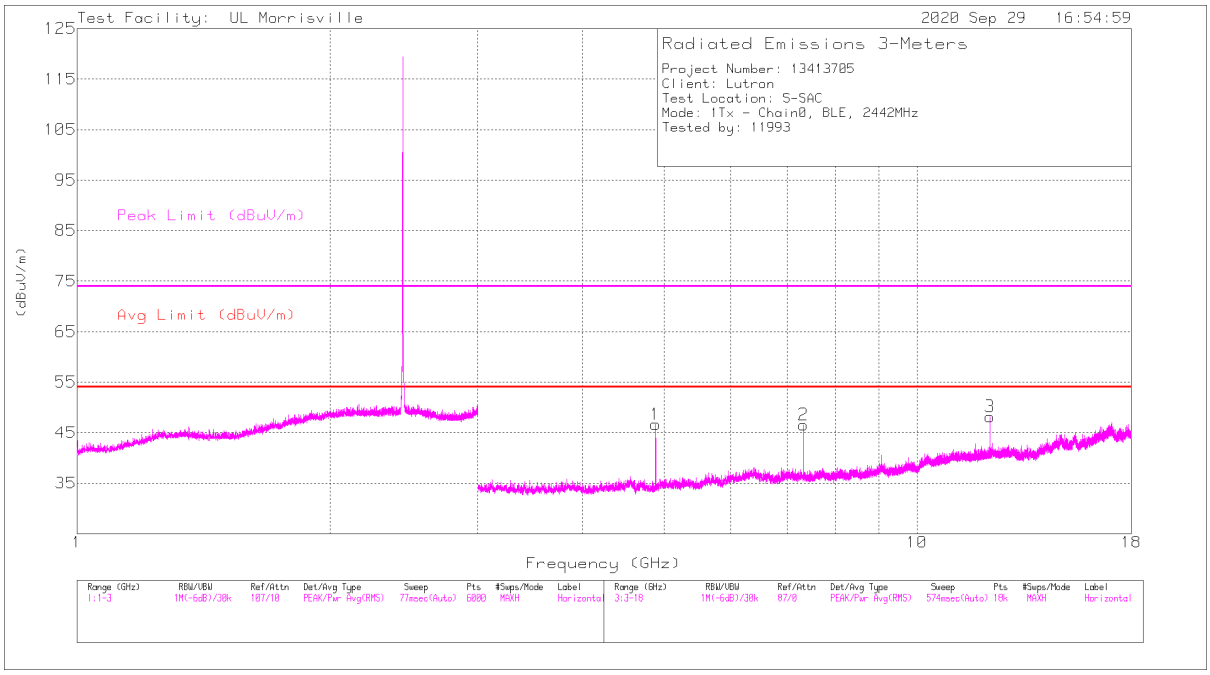
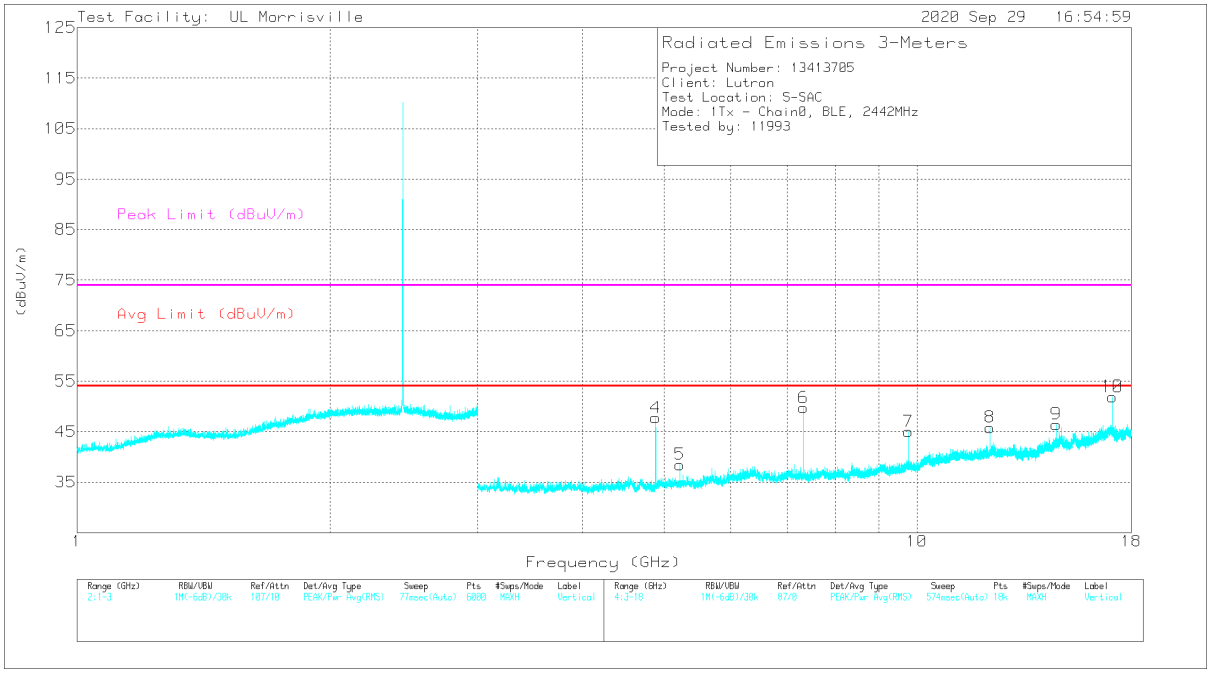
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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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	* ** 4.88447	46.85	PK2	34	-30.8	0	50.05	-	-	74	-23.95	176	299	H
	* ** 4.88403	40.23	ADV	34	-30.8	-7.96	35.47	54	-18.53	-	-	176	299	H
2	* ** 7.32673	44.03	PK2	35.6	-27.4	0	52.23	-	-	74	-21.77	70	326	H
	* ** 7.32543	36.16	ADV	35.6	-27.4	-7.96	36.4	54	-17.6	-	-	70	326	H
3	* ** 12.21113	40.21	PK2	38.8	-24.3	0	54.71	-	-	74	-19.29	339	112	H
	* ** 12.2111	30.04	ADV	38.8	-24.3	-7.96	36.58	54	-17.42	-	-	339	112	H
4	* ** 4.88354	49.12	PK2	34	-30.8	0	52.32	-	-	74	-21.68	92	306	V
	* ** 4.88398	43.16	ADV	34	-30.8	-7.96	38.4	54	-15.6	-	-	92	306	V
5	** 5.22126	40.66	PK2	34.3	-30.7	0	44.26	-	-	74	-29.74	0	116	V
	** 5.22117	31.45	ADV	34.3	-30.7	-7.96	27.09	54	-26.91	-	-	0	116	V
6	* ** 7.32524	46.06	PK2	35.6	-27.4	0	54.26	-	-	74	-19.74	131	284	V
	* ** 7.32534	38.22	ADV	35.6	-27.4	-7.96	38.46	54	-15.54	-	-	131	284	V
8	* ** 12.21145	38.85	PK2	38.8	-24.3	0	53.35	-	-	74	-20.65	42	120	V
	* ** 12.21116	28.06	ADV	38.8	-24.3	-7.96	34.6	54	-19.4	-	-	42	120	V
7	9.76871	34.12	Pk	36.8	-25.9	0	45.02	-	-	-	-	0-360	199	V
9	14.65065	29.86	Pk	39.8	-23.2	0	46.46	-	-	-	-	0-360	199	V
10	17.09579	33.32	Pk	41.8	-23.2	0	51.92	-	-	-	-	0-360	199	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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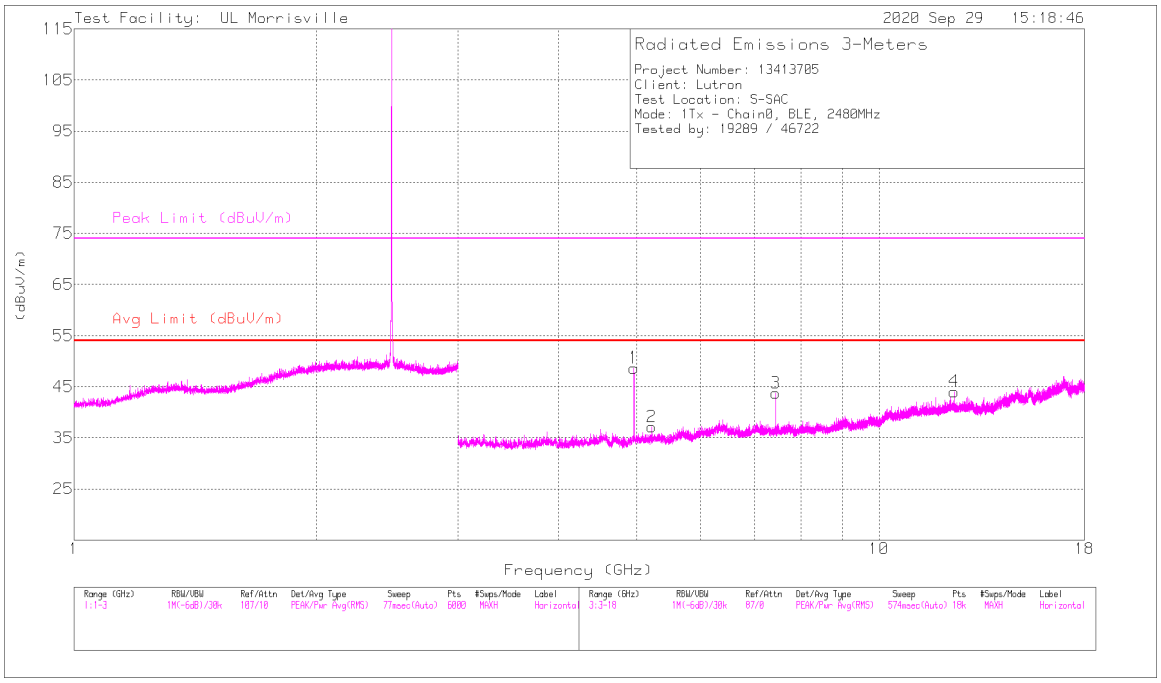
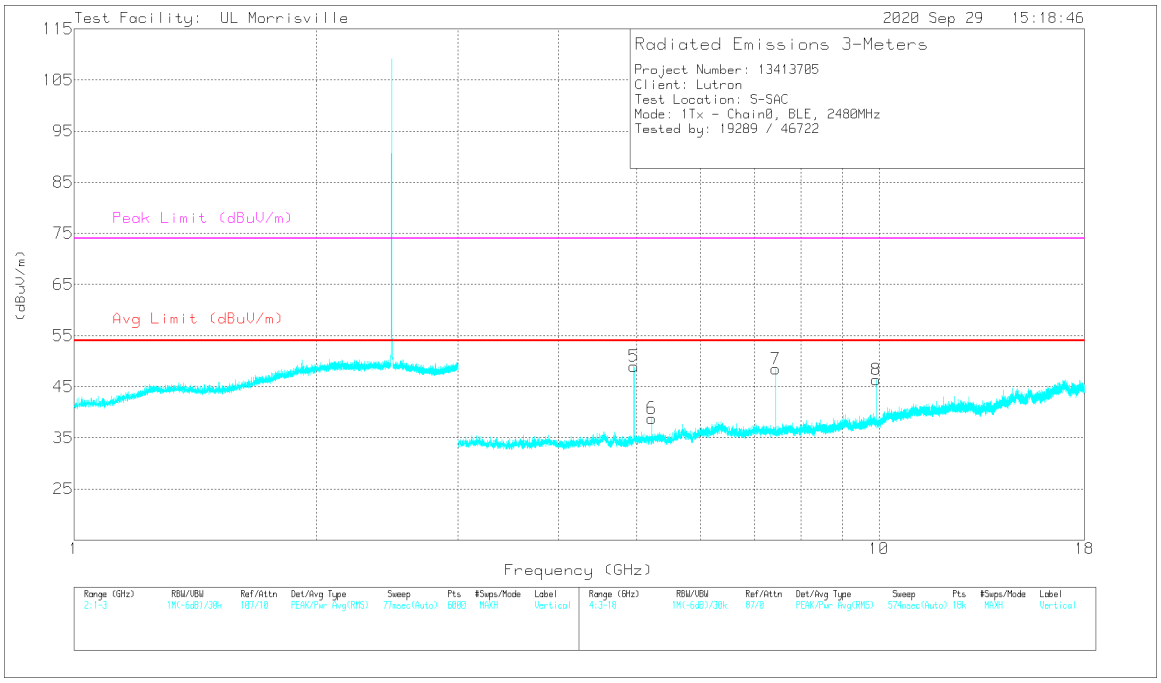
HIGH CHANNEL RESULTS



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	* ** 4.95958	48.64	PK2	33.9	-31	0	51.54	-	-	74	-22.46	55	339	H
	* ** 4.96011	42.55	ADV	33.9	-31	-7.96	37.49	54	-16.51	-	-	55	339	H
2	** 5.22133	38.82	PK2	34.3	-30.7	0	42.42	-	-	74	-31.58	276	300	H
	** 5.22111	28.14	ADV	34.3	-30.7	-7.96	23.78	54	-30.22	-	-	276	300	H
3	* ** 7.43926	41.28	PK2	35.6	-27.7	0	49.18	-	-	74	-24.82	64	311	H
	* ** 7.43941	31.76	ADV	35.6	-27.7	-7.96	31.7	54	-22.3	-	-	64	311	H
4	* ** 12.4011	36.37	PK2	38.9	-24.4	0	50.87	-	-	74	-23.13	316	380	H
	* ** 12.3989	24.46	ADV	38.9	-24.3	-7.96	31.1	54	-22.9	-	-	316	380	H
5	* ** 4.96053	50.41	PK2	33.9	-31	0	53.31	-	-	74	-20.69	105	333	V
	* ** 4.95997	44.63	ADV	33.9	-31	-7.96	39.57	54	-14.43	-	-	105	333	V
6	** 5.22113	40.87	PK2	34.3	-30.7	0	44.47	-	-	74	-29.53	1	102	V
	** 5.22115	32.02	ADV	34.3	-30.7	-7.96	27.66	54	-26.34	-	-	1	102	V
7	* ** 7.44068	44.39	PK2	35.6	-27.7	0	52.29	-	-	74	-21.71	74	117	V
	* ** 7.43943	36.04	ADV	35.6	-27.7	-7.96	35.98	54	-18.02	-	-	74	117	V
8	9.92039	35.17	Pk	37	-25.8	0	46.37	-	-	-	-	0-360	199	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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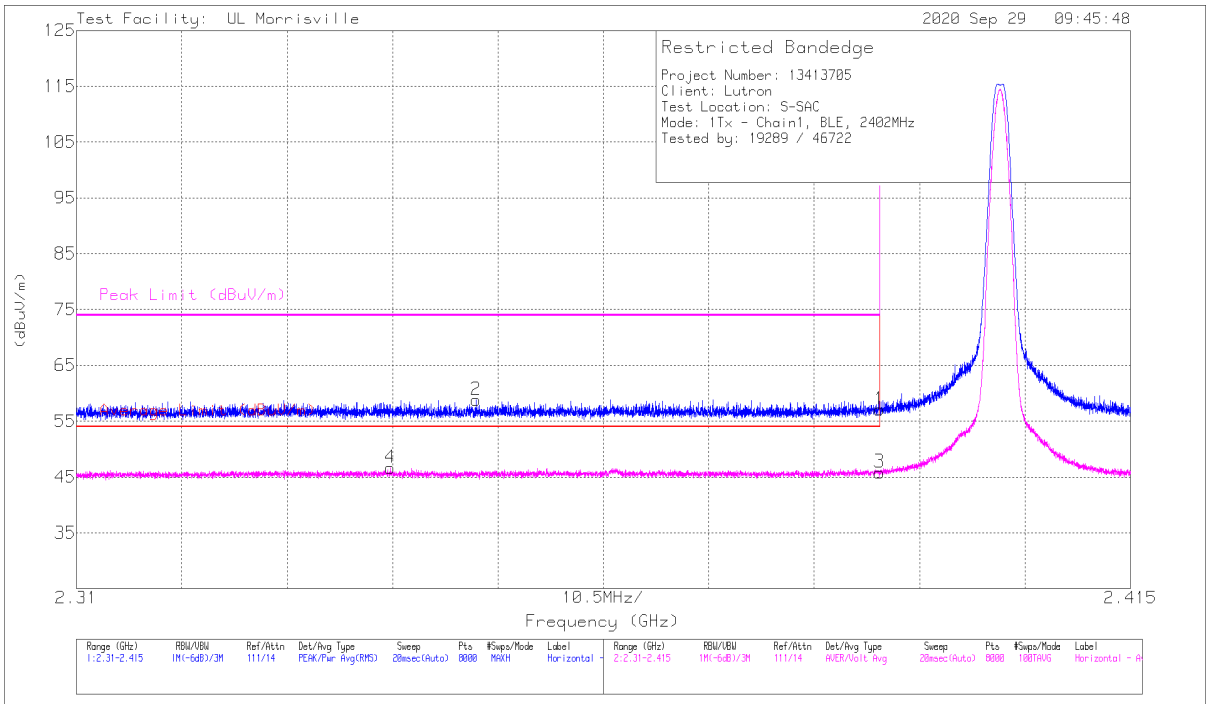
Antenna 2

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	39	Pk	32.1	-24	10	0	57.1	-	-	74	-16.9	36	187	H
2	* ** 2.34983	40.55	Pk	32.2	-23.9	10	0	58.85	-	-	74	-15.15	36	187	H
3	* ** 2.39	27.74	ADV	32.1	-24	10	-7.96	37.88	54	-16.12	-	-	36	187	H
4	* ** 2.34127	28.23	ADV	32.2	-23.8	10	-7.96	38.67	54	-15.33	-	-	36	187	H

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Pk - Peak detector
ADV - Linear Voltage Average

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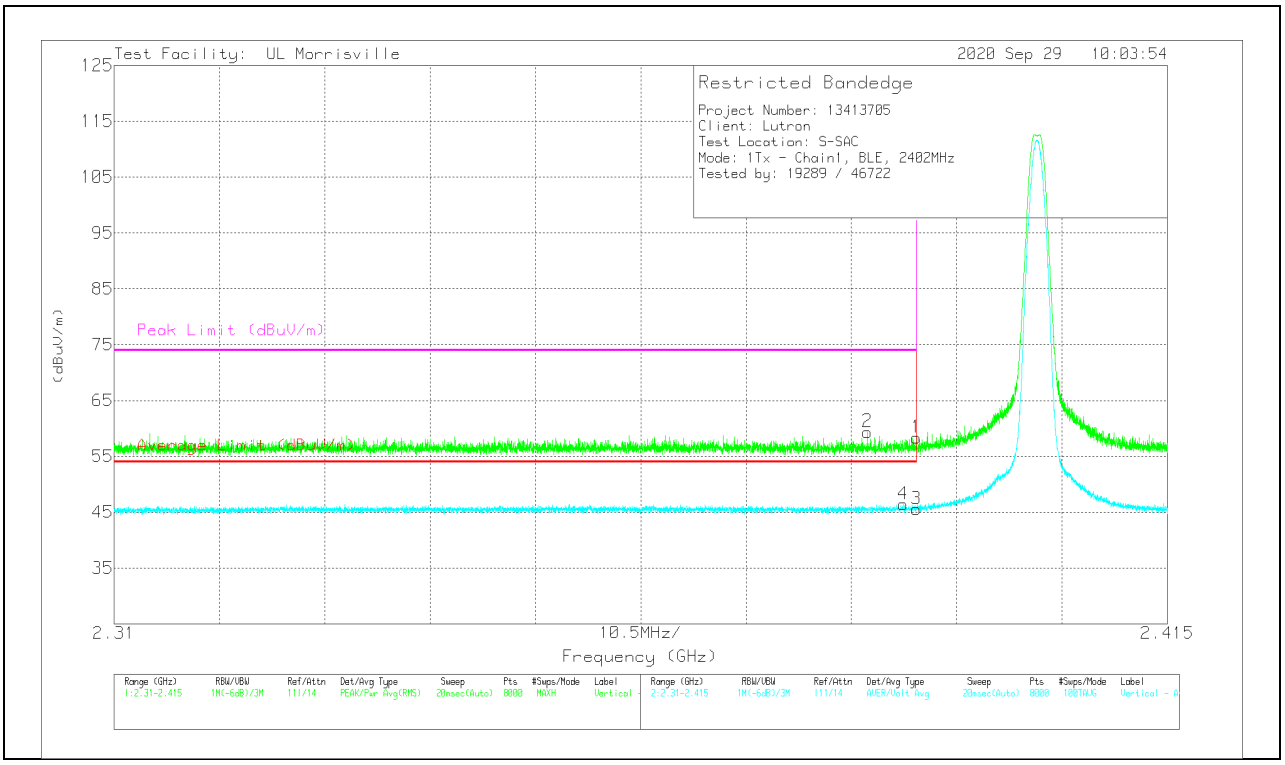
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	40.24	Pk	32.1	-24	10	0	58.34	-	-	74	-15.66	264	317	V
2	* ** 2.3851	41.06	Pk	32.2	-23.9	10	0	59.36	-	-	74	-14.64	264	317	V
3	* ** 2.39	27.46	ADV	32.1	-24	10	-7.96	37.6	54	-16.4	-	-	264	317	V
4	* ** 2.38866	28.29	ADV	32.1	-24	10	-7.96	38.43	54	-15.57	-	-	264	317	V

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

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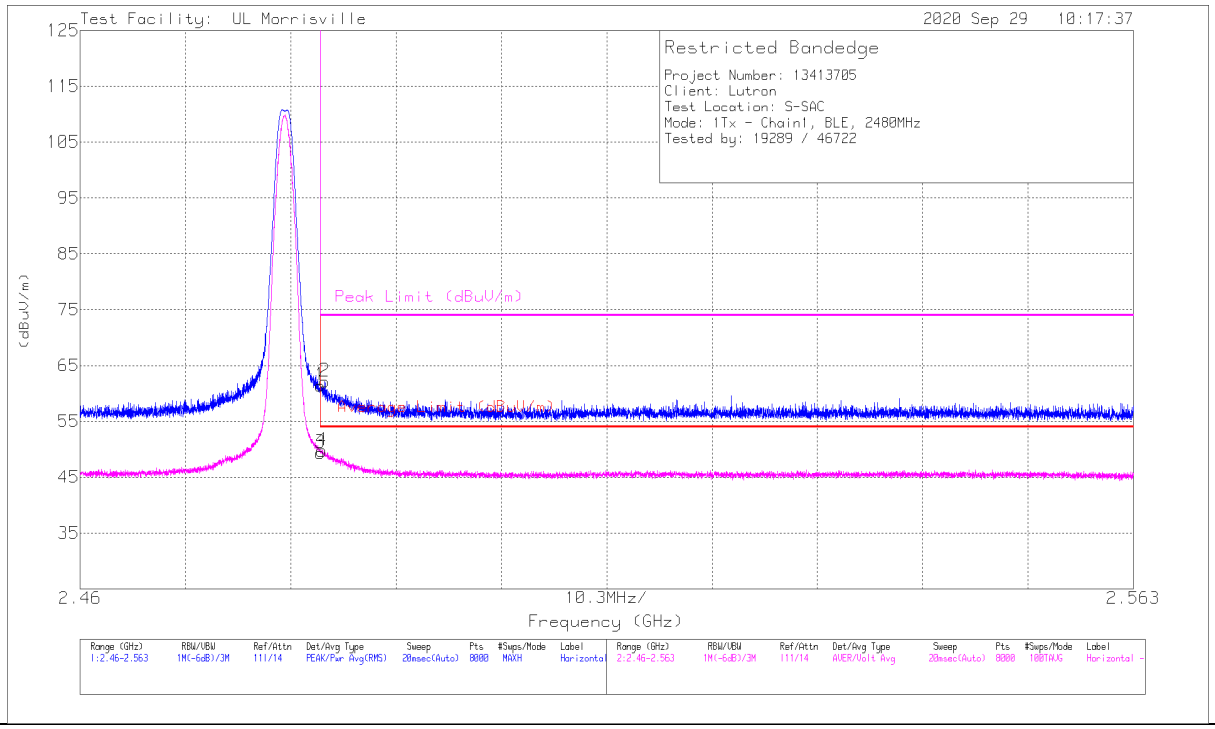
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	43.43	Pk	32.4	-24.4	10	0	61.43	-	-	74	-12.57	24	124	H
2	* ** 2.48394	44.15	Pk	32.4	-24.4	10	0	62.15	-	-	74	-11.85	24	124	H
3	* ** 2.4835	31.39	ADV	32.4	-24.4	10	-7.96	41.43	54	-12.57	-	-	24	124	H
4	* ** 2.48364	31.79	ADV	32.4	-24.4	10	-7.96	41.83	54	-12.17	-	-	24	124	H

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ADV - Linear Voltage Average

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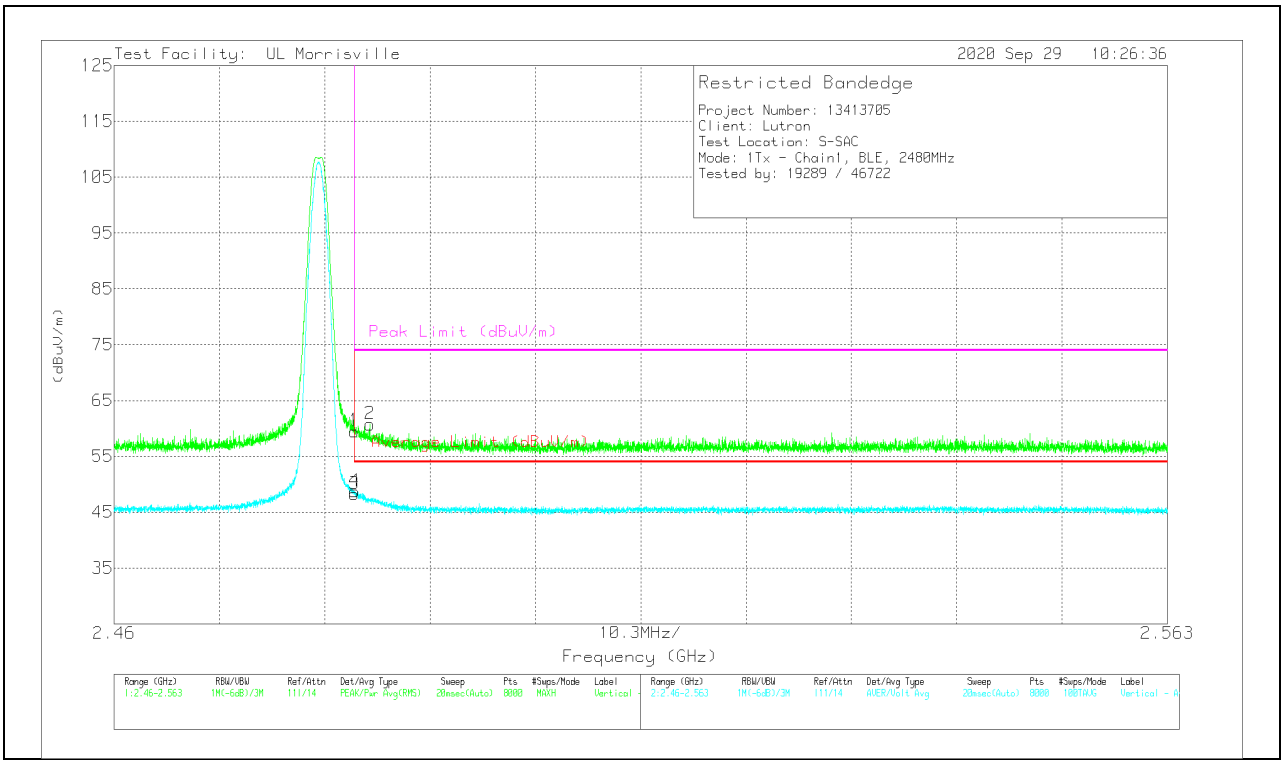
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	41.47	Pk	32.4	-24.4	10	0	59.47	-	-	74	-14.53	244	293	V
2	* ** 2.48502	42.75	Pk	32.4	-24.4	10	0	60.75	-	-	74	-13.25	244	293	V
3	* ** 2.4835	30.23	ADV	32.4	-24.4	10	-7.96	40.27	54	-13.73	-	-	244	293	V
4	* ** 2.48351	30.71	ADV	32.4	-24.4	10	-7.96	40.75	54	-13.25	-	-	244	293	V

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ADV - Linear Voltage Average

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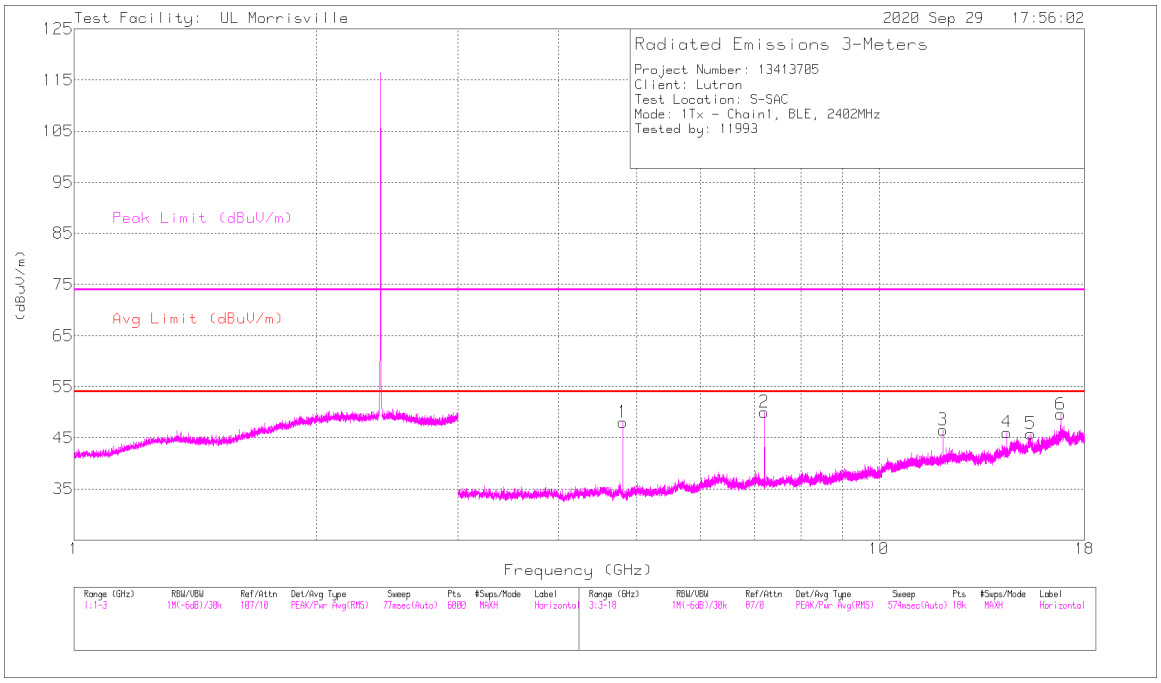
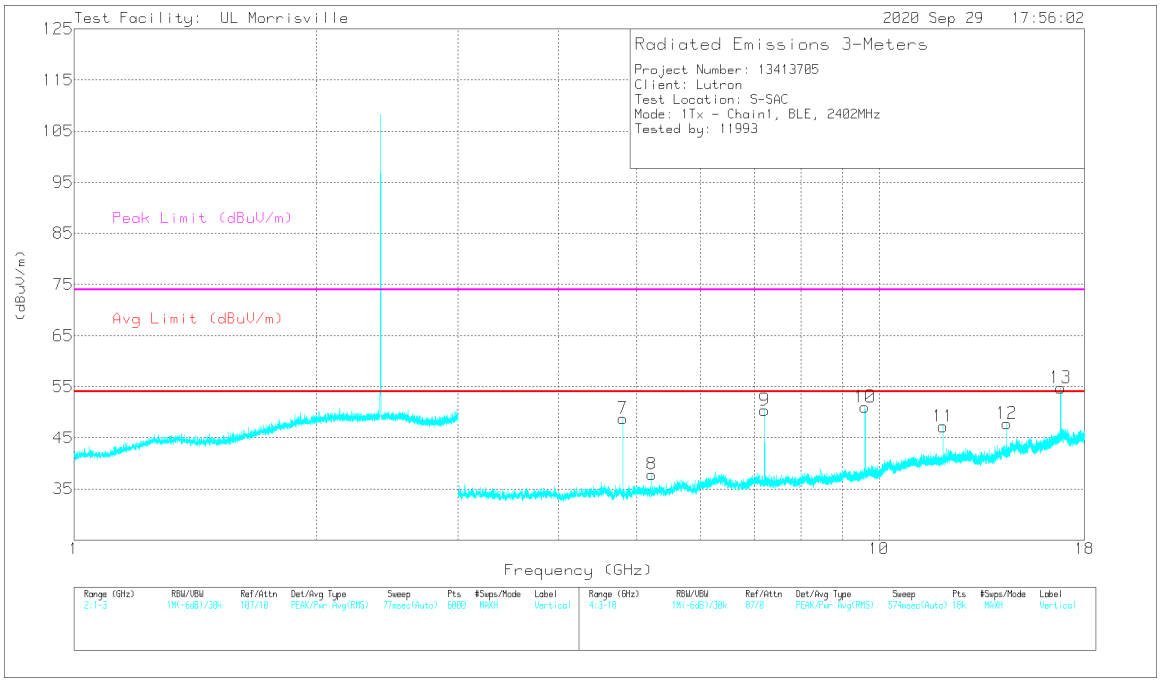
HARMONICS AND SPURIOUS EMISSIONS

LOW 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	* ** 4.80344	49.27	PK2	34	-30.8	0	52.47	-	-	74	-21.53	196	324	H
	* ** 4.80391	43.3	ADV	34	-30.9	-7.96	38.44	54	-15.56	-	-	196	324	H
3	* ** 12.01118	38.19	PK2	38.7	-24.1	0	52.79	-	-	74	-21.21	330	352	H
	* ** 12.01113	27.29	ADV	38.7	-24.1	-7.96	33.93	54	-20.07	-	-	330	352	H
5	* ** 15.42903	33.49	PK2	40.3	-21.9	0	51.89	-	-	74	-22.11	300	308	H
	* ** 15.42901	20.35	ADV	40.3	-21.9	-7.96	30.79	54	-23.21	-	-	300	308	H
7	* ** 4.80355	51.59	PK2	34	-30.8	0	54.79	-	-	74	-19.21	91	388	V
	* ** 4.804	46.32	ADV	34	-30.9	-7.96	41.46	54	-12.54	-	-	91	388	V
8	** 5.22109	40.11	PK2	34.3	-30.7	0	43.71	-	-	74	-30.29	347	110	V
	** 5.22119	31.97	ADV	34.3	-30.7	-7.96	27.61	54	-26.39	-	-	347	110	V
11	* ** 12.00876	39.34	PK2	38.7	-24.1	0	53.94	-	-	74	-20.06	242	365	V
	* ** 12.00879	29.81	ADV	38.7	-24.1	-7.96	36.45	54	-17.55	-	-	242	365	V
2	7.20524	42.34	Pk	35.6	-27.9	0	50.04	-	-	-	-	0-360	199	H
9	7.2069	42.72	Pk	35.6	-27.9	0	50.42	-	-	-	-	0-360	199	V
10	9.6062	40.72	Pk	36.6	-26.3	0	51.02	-	-	-	-	0-360	199	V
12	14.41064	33.32	Pk	39.4	-24.9	0	47.82	-	-	-	-	0-360	102	V
4	14.41314	31.49	Pk	39.4	-24.8	0	46.09	-	-	-	-	0-360	102	H
13	16.81244	36.5	Pk	41.9	-23.6	0	54.8	-	-	-	-	0-360	199	V
6	16.81577	31.33	Pk	41.9	-23.6	0	49.63	-	-	-	-	0-360	102	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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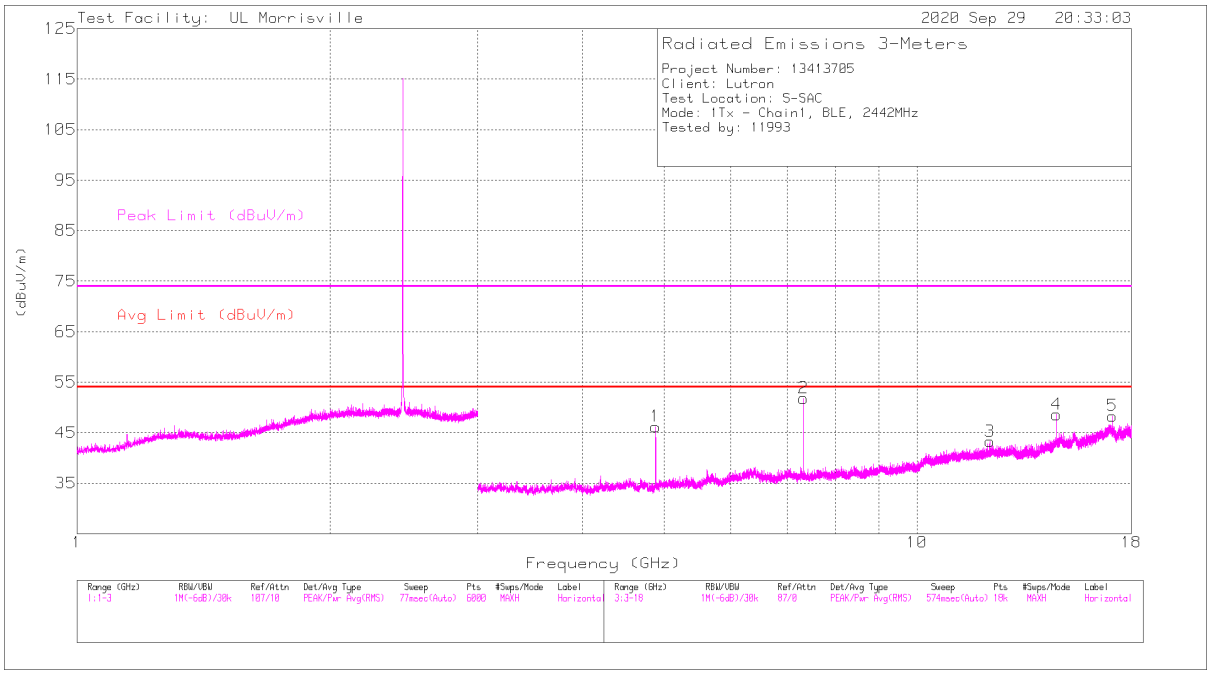
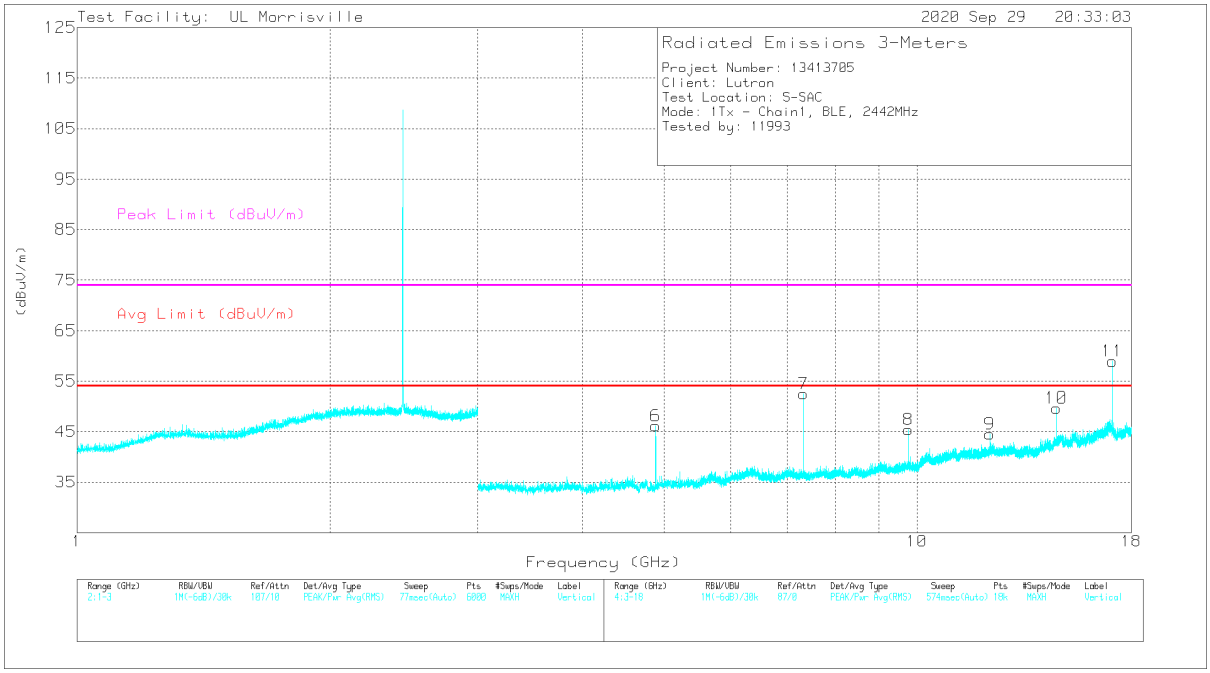
MID CHANNEL RESULTS



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	* ** 4.88348	46.59	PK2	34	-30.8	0	49.79	-	-	74	-24.21	179	359	H
	* ** 4.88399	39.85	ADV	34	-30.8	-7.96	35.09	54	-18.91	-	-	179	359	H
2	* ** 7.32524	46.12	PK2	35.6	-27.4	0	54.32	-	-	74	-19.68	117	107	H
	* ** 7.32542	38.61	ADV	35.6	-27.4	-7.96	38.85	54	-15.15	-	-	117	107	H
3	* ** 12.21142	36.63	PK2	38.8	-24.3	0	51.13	-	-	74	-22.87	331	116	H
	* ** 12.2111	24.49	ADV	38.8	-24.3	-7.96	31.03	54	-22.97	-	-	331	116	H
6	* ** 4.88345	48.15	PK2	34	-30.8	0	51.35	-	-	74	-22.65	129	386	V
	* ** 4.88393	41.79	ADV	34	-30.8	-7.96	37.03	54	-16.97	-	-	129	386	V
7	* ** 7.32528	47.05	PK2	35.6	-27.4	0	55.25	-	-	74	-18.75	6	234	V
	* ** 7.32541	39.57	ADV	35.6	-27.4	-7.96	39.81	54	-14.19	-	-	6	234	V
9	* ** 12.20859	35.74	PK2	38.8	-24.3	0	50.24	-	-	74	-23.76	214	236	V
	* ** 12.20887	24.54	ADV	38.8	-24.3	-7.96	31.08	54	-22.92	-	-	214	236	V
8	9.76871	34.5	Pk	36.8	-25.9	0	45.4	-	-	-	-	0-360	199	V
4	14.65399	32	Pk	39.8	-23.2	0	48.6	-	-	-	-	0-360	102	H
10	14.65399	33.05	Pk	39.8	-23.2	0	49.65	-	-	-	-	0-360	199	V
5	17.09246	29.63	Pk	41.8	-23.1	0	48.33	-	-	-	-	0-360	199	H
11	17.09579	40.35	Pk	41.8	-23.2	0	58.95	-	-	-	-	0-360	199	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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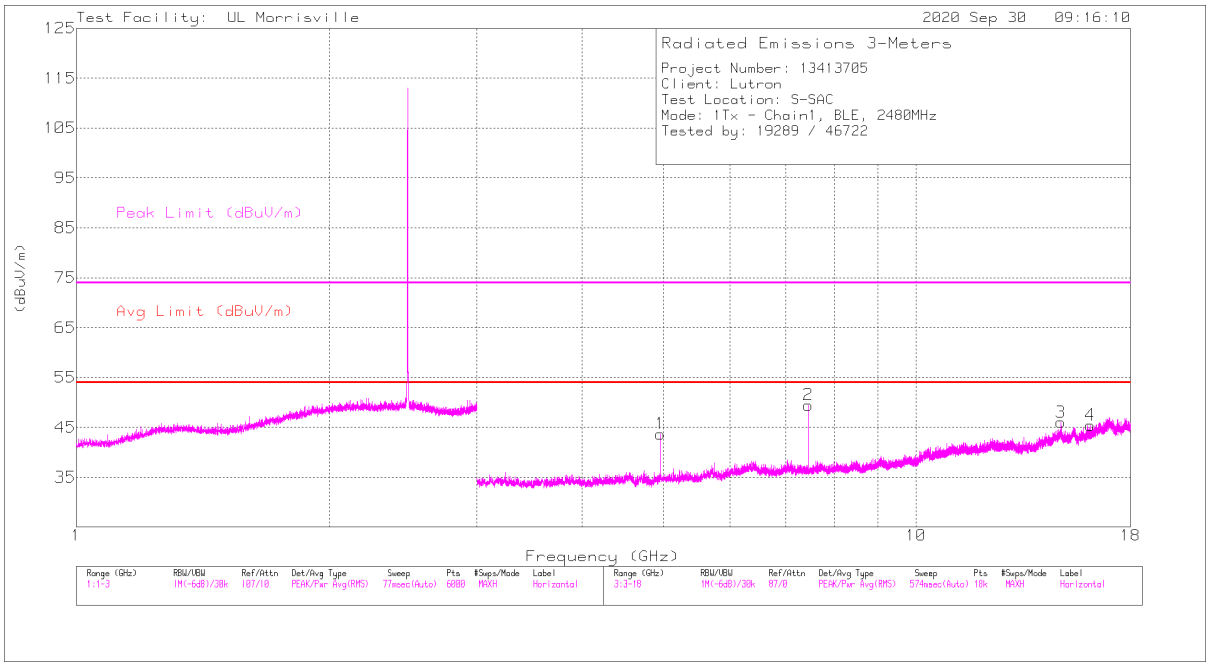
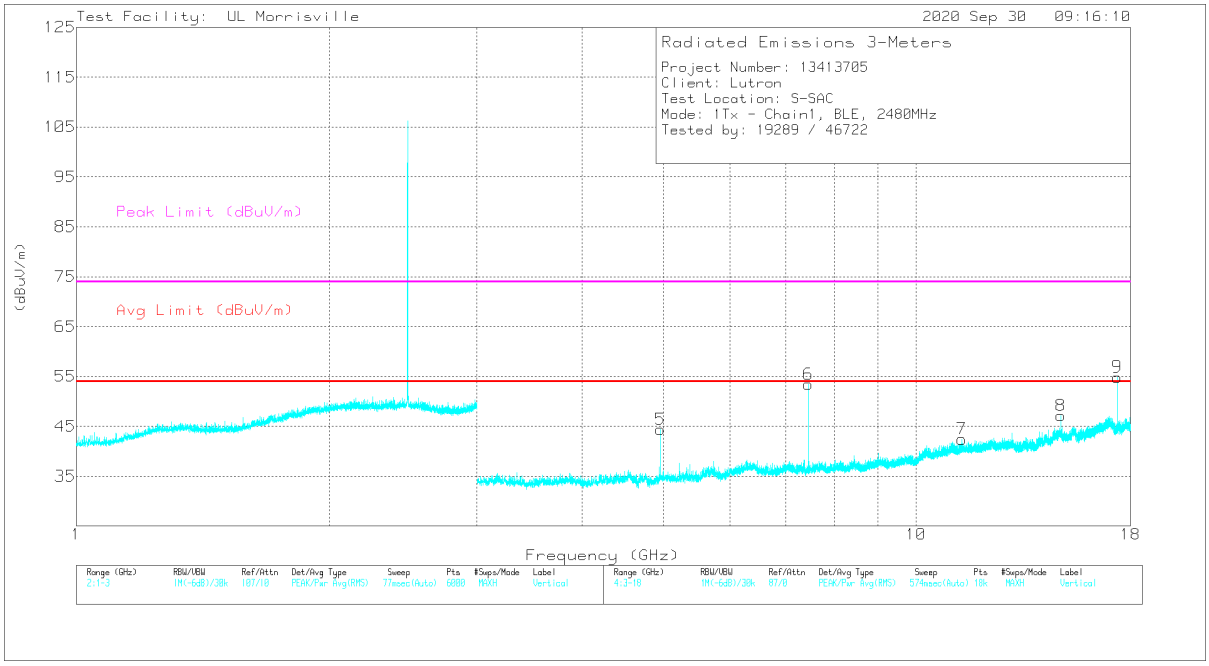
HIGH CHANNEL RESULTS



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	* ** 4.95949	46.18	PK2	33.9	-31	0	49.08	-	-	74	-24.92	45	101	H
	* ** 4.95987	27.3	ADV	33.9	-31	-7.96	22.24	54	-31.76	-	-	45	101	H
2	* ** 7.43922	45.48	PK2	35.6	-27.7	0	53.38	-	-	74	-20.62	74	266	H
	* ** 7.43939	37.29	ADV	35.6	-27.7	-7.96	37.23	54	-16.77	-	-	74	266	H
4	* ** 16.1299	35.2	PK2	40.6	-24.5	0	51.3	-	-	74	-22.7	31	225	H
	* ** 16.13057	21.85	ADV	40.6	-24.5	-7.96	29.99	54	-24.01	-	-	31	225	H
5	* ** 4.96039	47.27	PK2	33.9	-31	0	50.17	-	-	74	-23.83	101	332	V
	* ** 4.96002	40.24	ADV	33.9	-31	-7.96	35.18	54	-18.82	-	-	101	332	V
6	* ** 7.43933	48.71	PK2	35.6	-27.7	0	56.61	-	-	74	-17.39	121	326	V
	* ** 7.44056	41.39	ADV	35.6	-27.7	-7.96	41.33	54	-12.67	-	-	121	326	V
7	* ** 11.33557	34.19	PK2	38.1	-23.1	0	49.19	-	-	74	-24.81	327	342	V
	* ** 11.3366	19.98	ADV	38.1	-23.1	-7.96	27.02	54	-26.98	-	-	327	342	V
3	14.879	29.11	Pk	40.1	-23.2	0	46.01	-	-	-	-	0-360	101	H
8	14.8815	30.28	Pk	40.1	-23.2	0	47.18	-	-	-	-	0-360	200	V
9	17.36164	36.98	Pk	41.2	-23.3	0	54.88	-	-	-	-	0-360	200	V

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ADV - Linear Voltage Average
Pk - Peak detector

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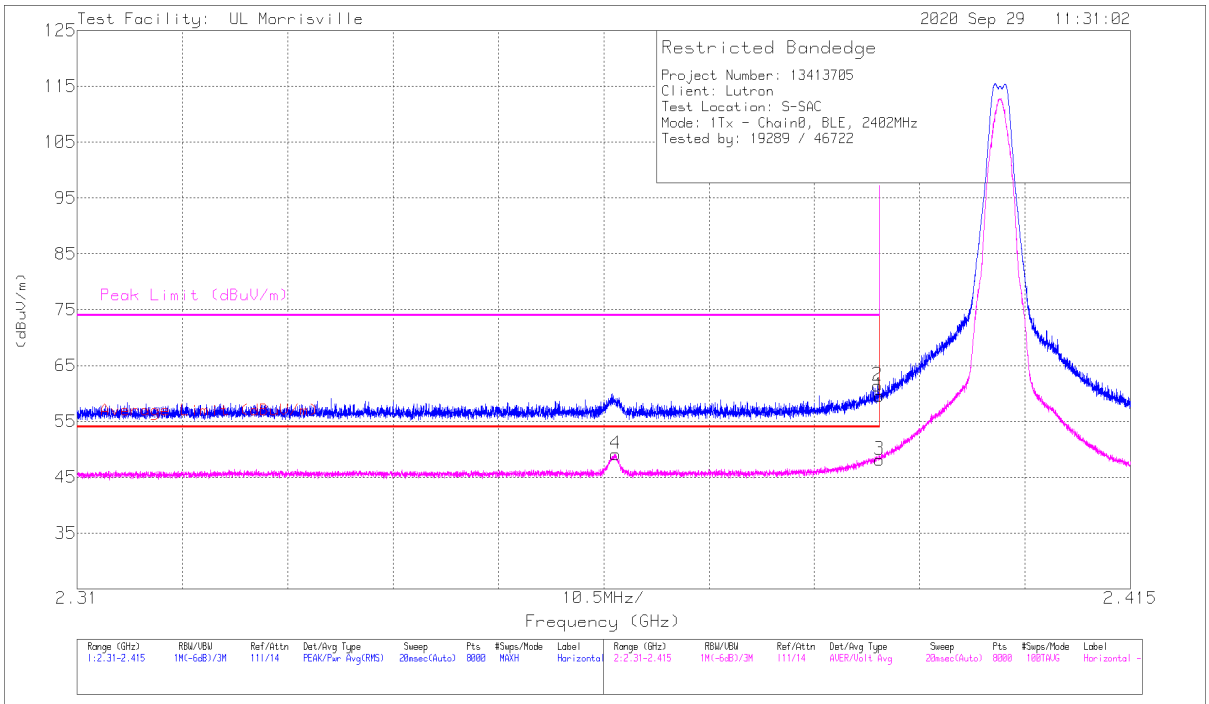
10.2.2. BLE (2Mbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	41.53	Pk	32.1	-24	10	0	59.63	-	-	74	-14.37	343	143	H
2	* ** 2.38977	43.33	Pk	32.1	-24	10	0	61.43	-	-	74	-12.57	343	143	H
3	* ** 2.39	30.07	ADV	32.1	-24	10	-7.96	40.21	54	-13.79	-	-	343	143	H
4	* ** 2.36368	30.86	ADV	32.2	-23.9	10	-7.96	41.2	54	-12.8	-	-	343	143	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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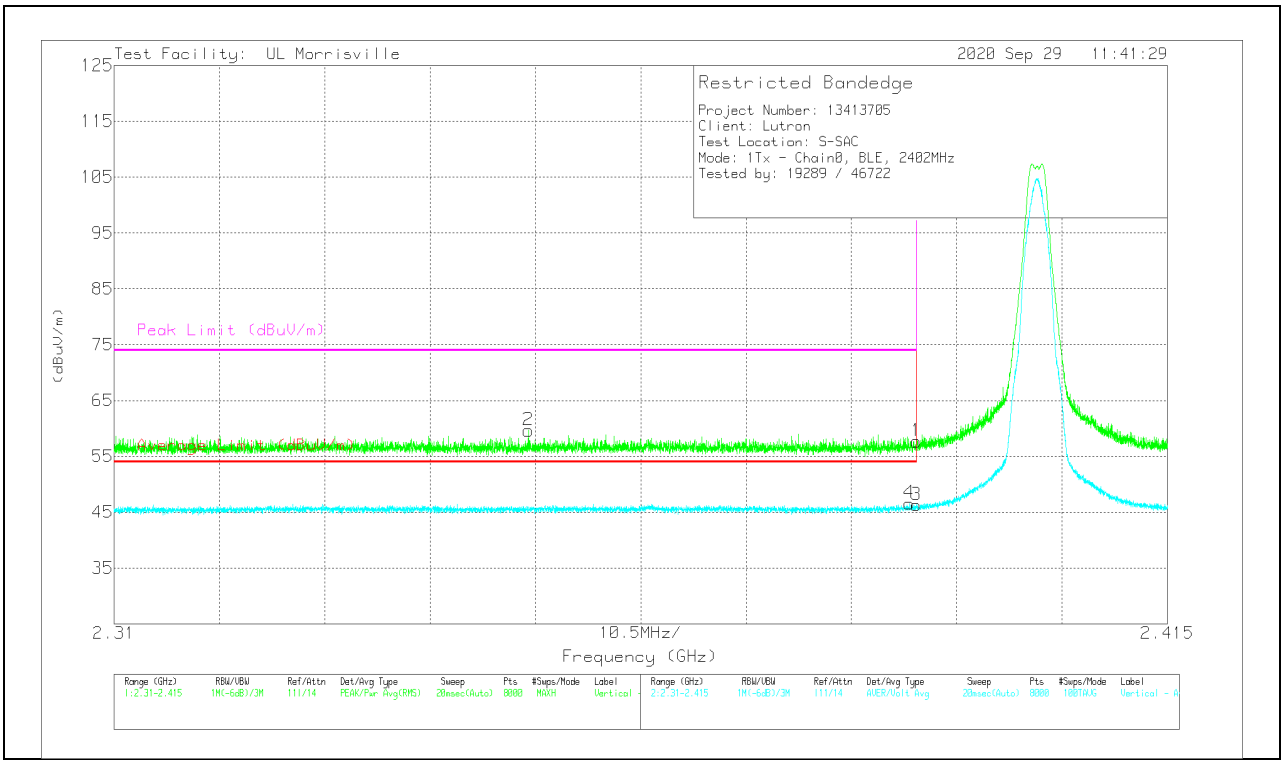
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	39.6	Pk	32.1	-24	10	0	57.7	-	-	74	-16.3	324	266	V
2	* ** 2.3513	41.35	Pk	32.2	-23.9	10	0	59.65	-	-	74	-14.35	324	266	V
3	* ** 2.39	28.18	ADV	32.1	-24	10	-7.96	38.32	54	-15.68	-	-	324	266	V
4	* ** 2.38926	28.5	ADV	32.1	-24	10	-7.96	38.64	54	-15.36	-	-	324	266	V

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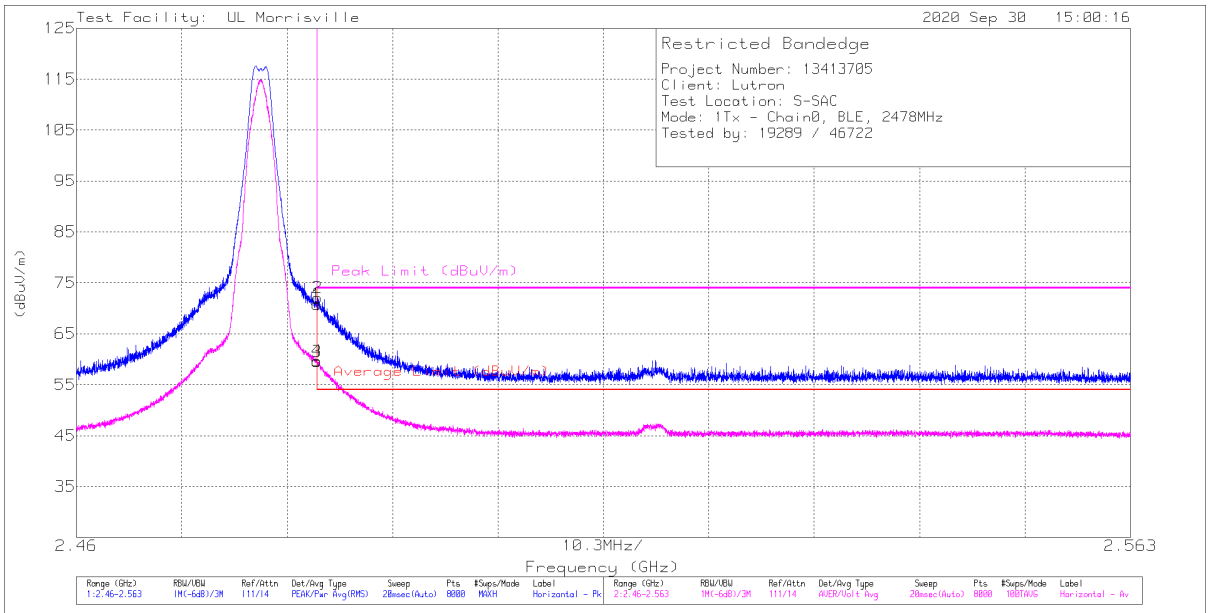
BANDEDGE (HIGH CHANNEL 36)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	52.71	Pk	32.4	-24.4	10	0	70.71	-	-	74	-3.29	24	159	H
2	* ** 2.48355	54.06	Pk	32.4	-24.4	10	0	72.06	-	-	74	-1.94	24	159	H
3	* ** 2.4835	41.52	ADV	32.4	-24.4	10	-7.96	51.56	54	-2.44	-	-	24	159	H
4	* ** 2.48351	41.66	ADV	32.4	-24.4	10	-7.96	51.7	54	-2.3	-	-	24	159	H

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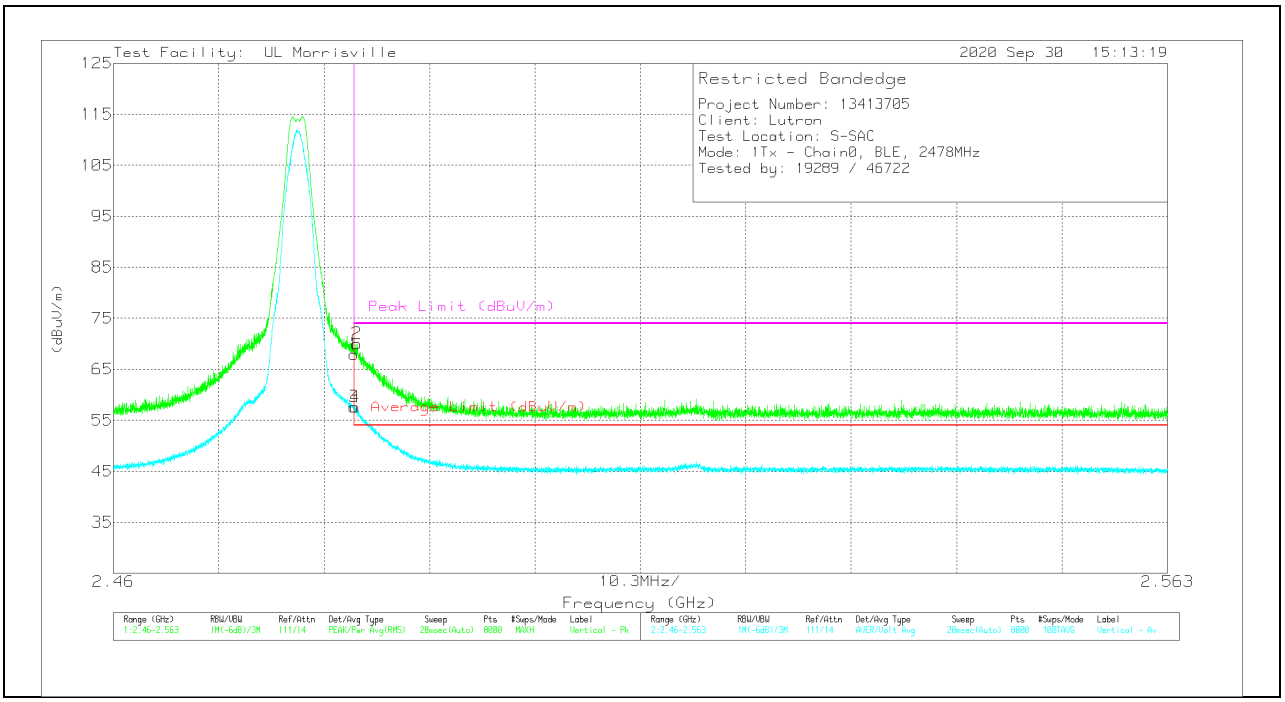
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	49.9	Pk	32.4	-24.4	10	0	67.9	-	-	74	-6.1	44	327	V
2	* ** 2.48378	52.06	Pk	32.4	-24.4	10	0	70.06	-	-	74	-3.94	44	327	V
3	* ** 2.4835	39.66	ADV	32.4	-24.4	10	-7.96	49.7	54	-4.3	-	-	44	327	V
4	* ** 2.48362	39.58	ADV	32.4	-24.4	10	-7.96	49.62	54	-4.38	-	-	44	327	V

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
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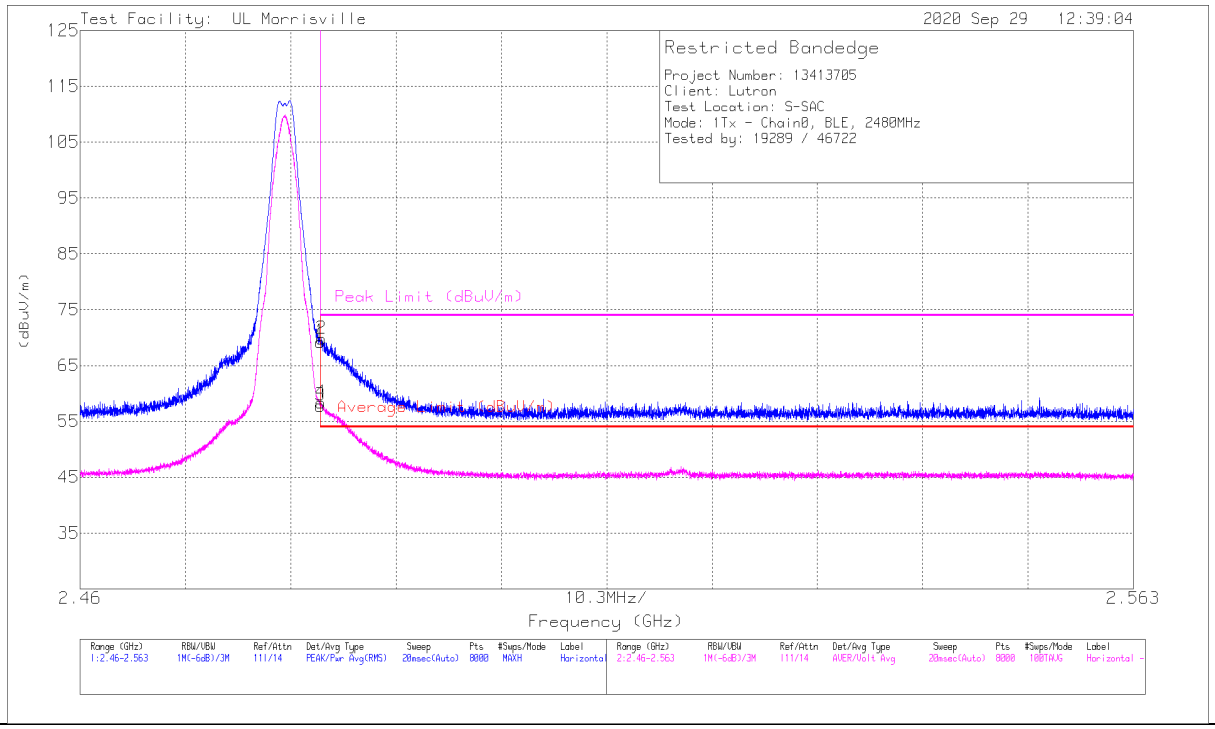
BANDEDGE (HIGH CHANNEL 39)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	51.23	Pk	32.4	-24.4	10	0	69.23	-	-	74	-4.77	29	105	H
2	* ** 2.48359	51.78	Pk	32.4	-24.4	10	0	69.78	-	-	74	-4.22	29	105	H
3	* ** 2.4835	39.83	ADV	32.4	-24.4	10	-7.96	49.87	54	-4.13	-	-	29	105	H
4	* ** 2.48355	40.36	ADV	32.4	-24.4	10	-7.96	50.4	54	-3.6	-	-	29	105	H

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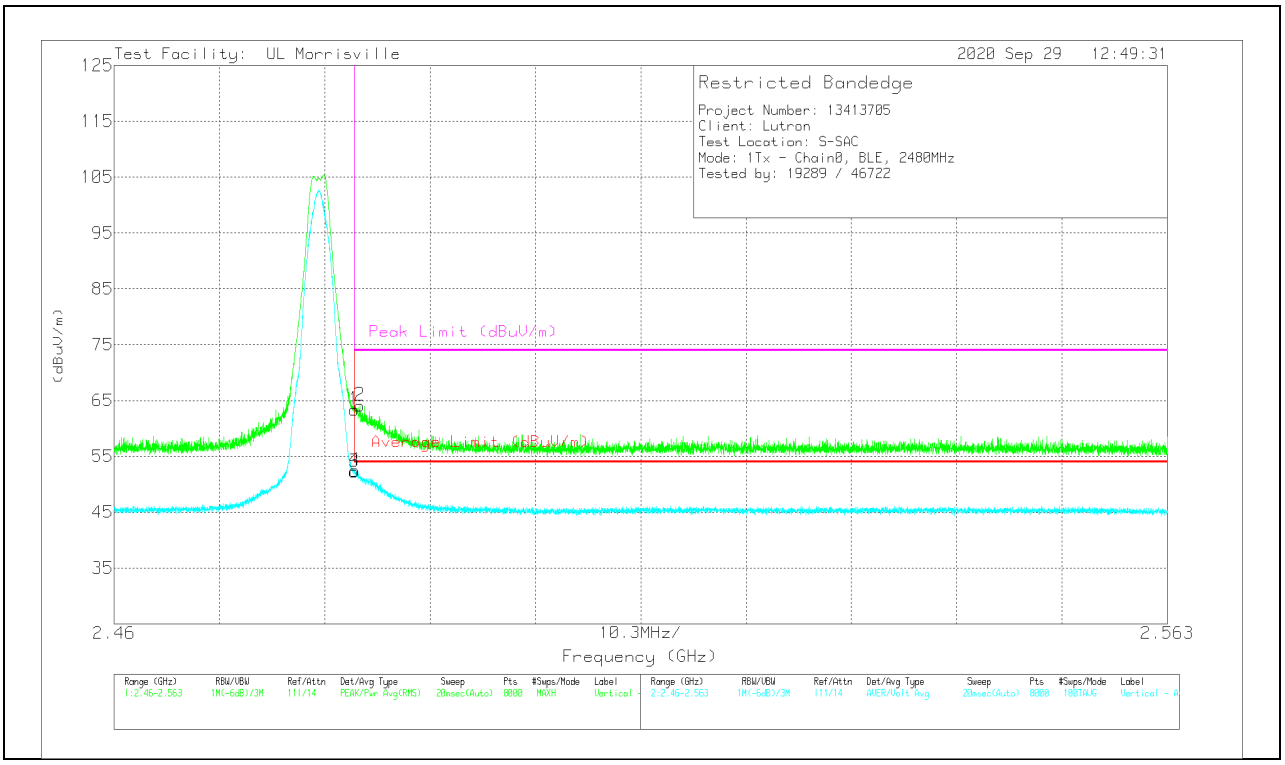
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	45.38	Pk	32.4	-24.4	10	0	63.38	-	-	74	-10.62	101	355	V
2	* ** 2.48404	46.1	Pk	32.4	-24.4	10	0	64.1	-	-	74	-9.9	101	355	V
3	* ** 2.4835	34.27	ADV	32.4	-24.4	10	-7.96	44.31	54	-9.69	-	-	101	355	V
4	* ** 2.48354	34.46	ADV	32.4	-24.4	10	-7.96	44.5	54	-9.5	-	-	101	355	V

* - 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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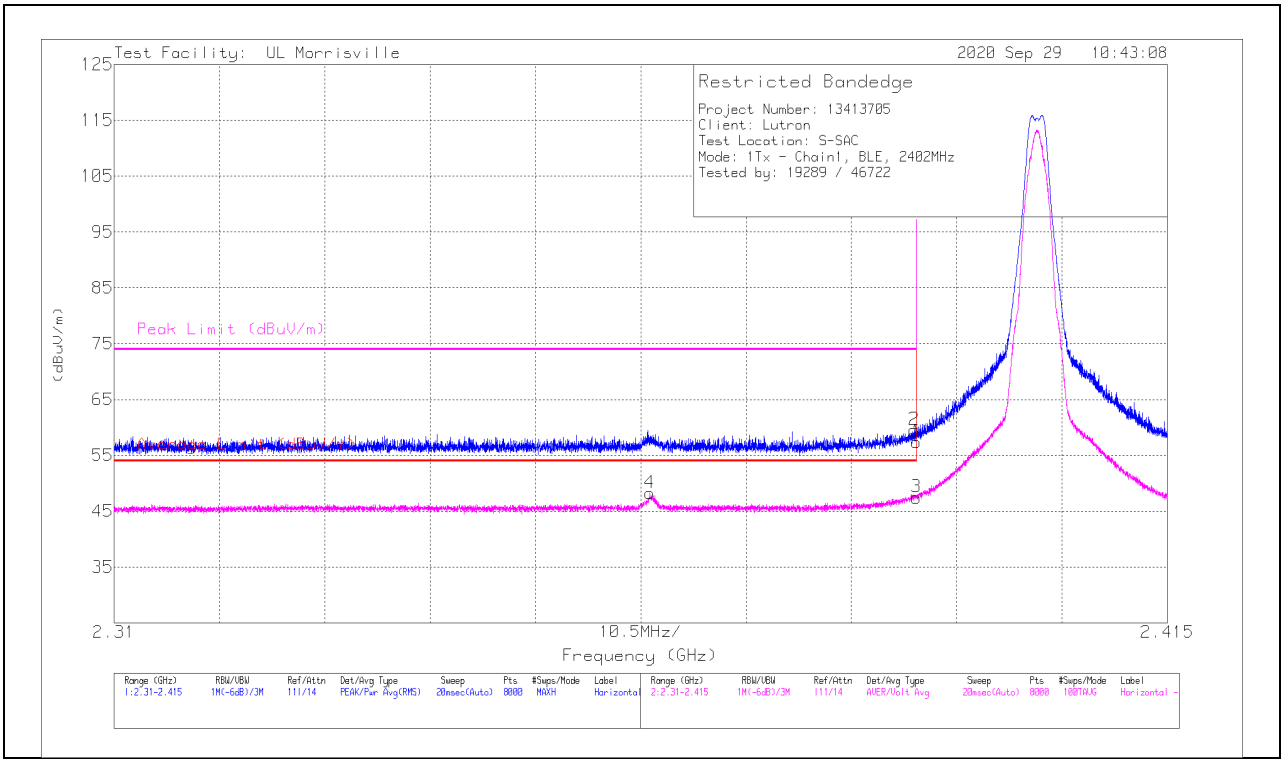
Antenna 2

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	39.26	Pk	32.1	-24	10	0	57.36	-	-	74	-16.64	226	165	H
2	* ** 2.38976	41.43	Pk	32.1	-24	10	0	59.53	-	-	74	-14.47	226	165	H
3	* ** 2.39	29.37	ADV	32.1	-24	10	-7.96	39.51	54	-14.49	-	-	226	165	H
4	* ** 2.36341	29.94	ADV	32.2	-23.9	10	-7.96	40.28	54	-13.72	-	-	226	165	H

* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band
** - indicates frequency in Taiwan NCC LP0002 Restricted Band
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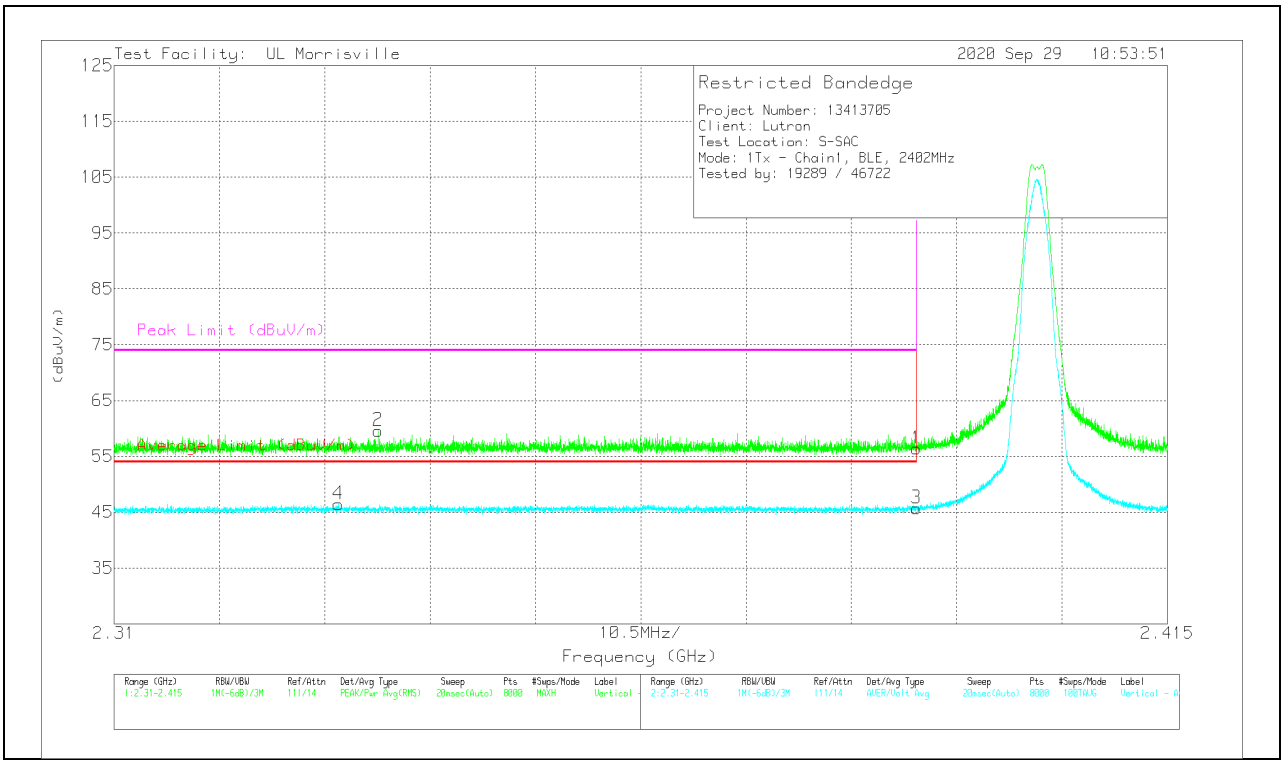
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	38.28	Pk	32.1	-24	10	0	56.38	-	-	74	-17.62	174	341	V
2	* ** 2.33631	41.22	Pk	32.2	-23.8	10	0	59.62	-	-	74	-14.38	174	341	V
3	* ** 2.39	27.61	ADV	32.1	-24	10	-7.96	37.75	54	-16.25	-	-	174	341	V
4	* ** 2.33236	28.05	ADV	32.1	-23.7	10	-7.96	38.49	54	-15.51	-	-	174	341	V

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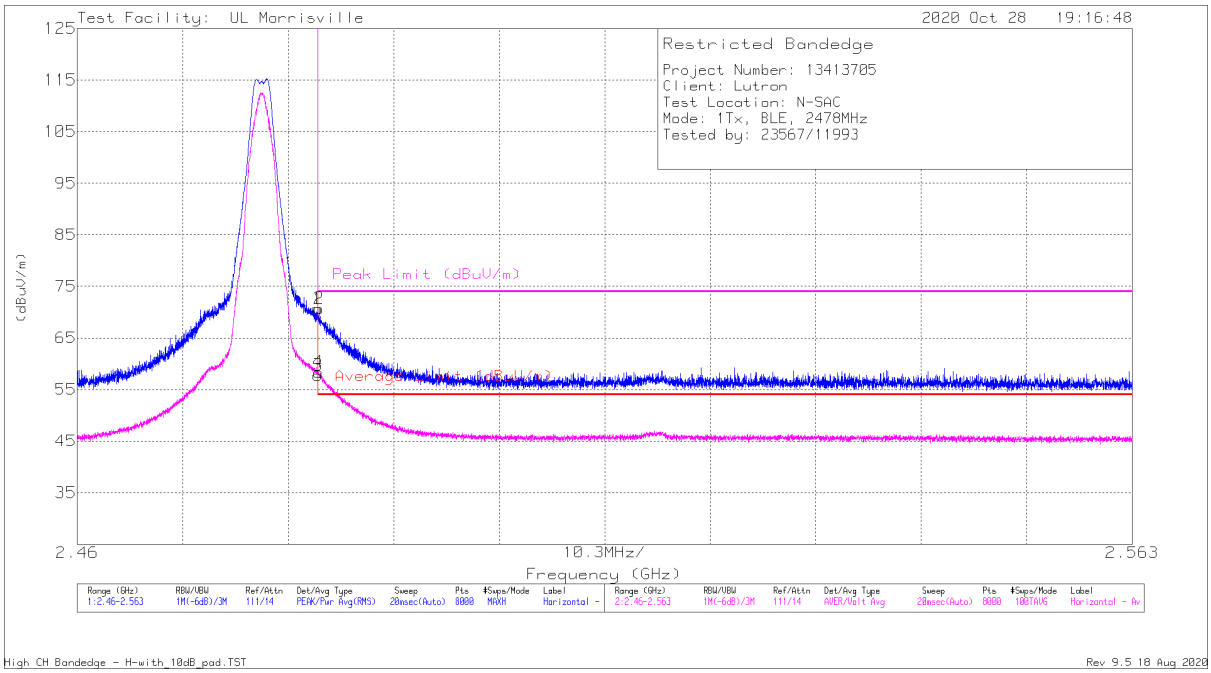
BANDEDGE (HIGH CHANNEL 36)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	52.54	Pk	32.4	-24.3	10		70.64	-	-	74	-3.36	155	183	H
2	* ** 2.48359	52.57	Pk	32.4	-24.3	10		70.67	-	-	74	-3.33	155	183	H
3	* ** 2.4835	39.67	ADV	32.4	-24.3	10	-7.96	49.81	54	-4.19	-	-	155	183	H
4	* ** 2.48355	40.29	ADV	32.4	-24.3	10	-7.96	50.43	54	-3.57	-	-	155	183	H

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ADV - Linear Voltage Average

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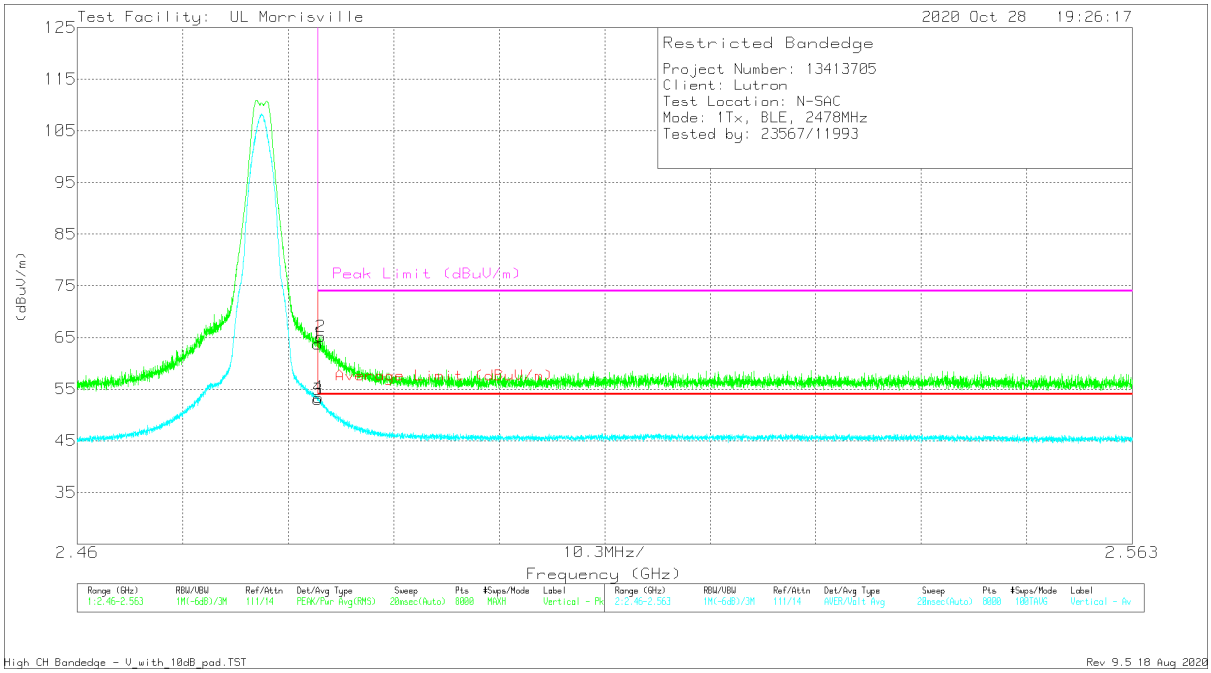
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	45.67	Pk	32.4	-24.3	10		63.77	-	-	74	-10.23	194	345	V
2	* ** 2.48377	47.05	Pk	32.4	-24.3	10		65.15	-	-	74	-8.85	194	345	V
3	* ** 2.4835	34.9	ADV	32.4	-24.3	10	-7.96	45.04	54	-8.96	-	-	194	345	V
4	* ** 2.48353	35.27	ADV	32.4	-24.3	10	-7.96	45.41	54	-8.59	-	-	194	345	V

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ADV - Linear Voltage Average

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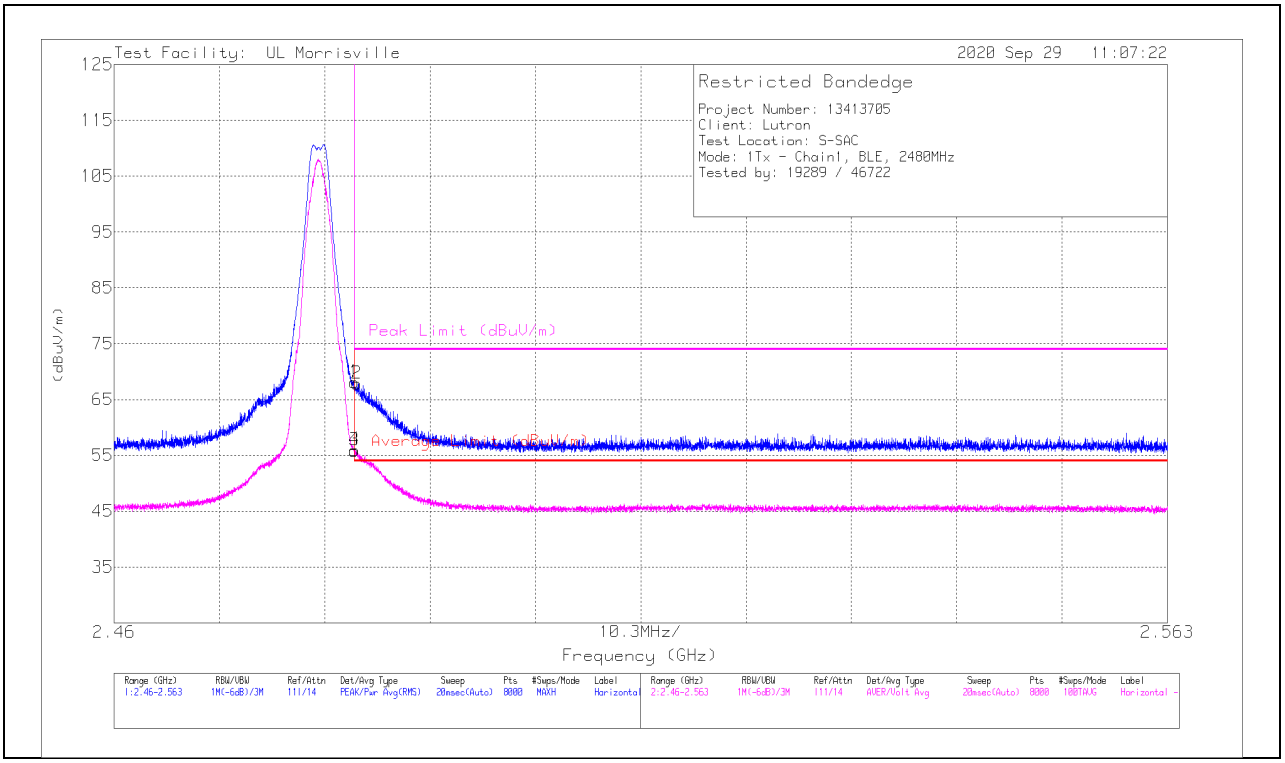
BANDEDGE (HIGH CHANNEL 39)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	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	50.09	Pk	32.4	-24.4	10	0	68.09	-	-	74	-5.91	198	208	H
2	* ** 2.48372	49.85	Pk	32.4	-24.4	10	0	67.85	-	-	74	-6.15	198	208	H
3	* ** 2.4835	37.85	ADV	32.4	-24.4	10	-7.96	47.89	54	-6.11	-	-	198	208	H
4	* ** 2.48351	37.95	ADV	32.4	-24.4	10	-7.96	47.99	54	-6.01	-	-	198	208	H

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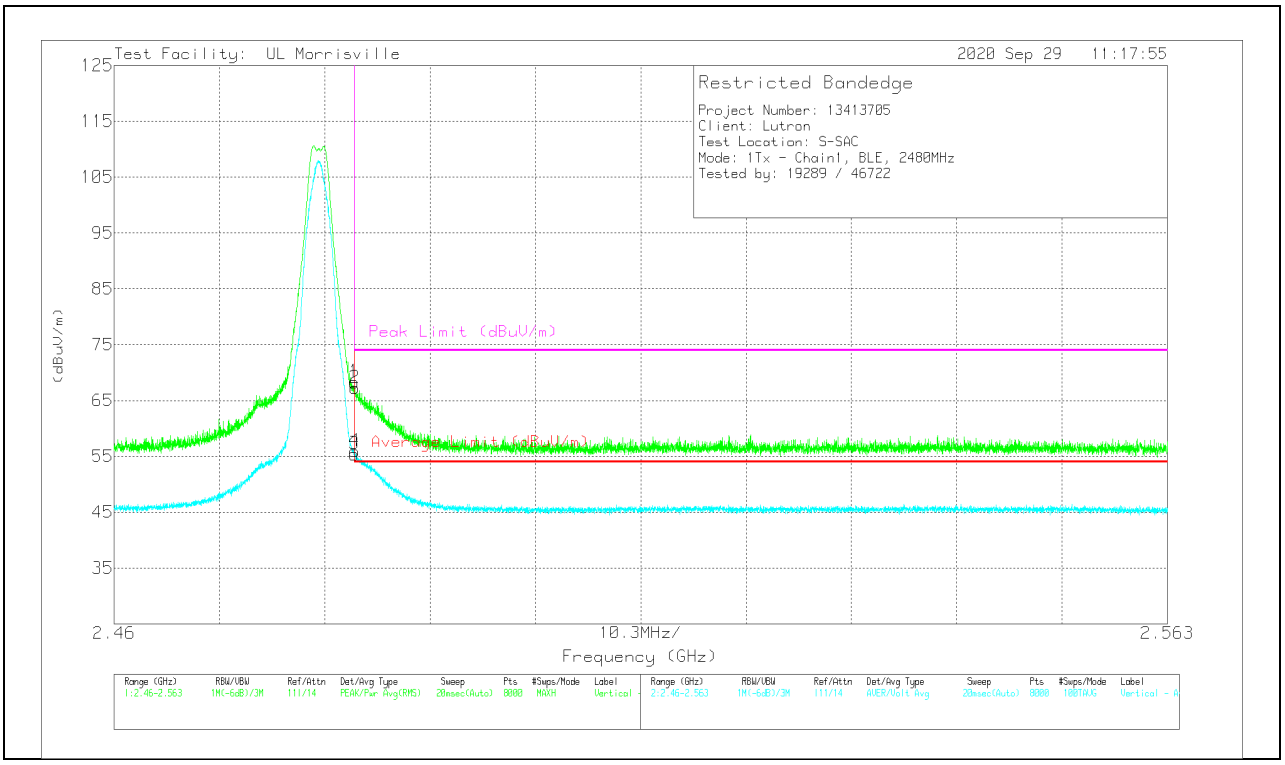

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	50.3	Pk	32.4	-24.4	10	0	68.3	-	-	74	-5.7	262	340	V
2	* ** 2.48353	49.22	Pk	32.4	-24.4	10	0	67.22	-	-	74	-6.78	262	340	V
3	* ** 2.4835	37.4	ADV	32.4	-24.4	10	-7.96	47.44	54	-6.56	-	-	262	340	V
4	* ** 2.48351	37.91	ADV	32.4	-24.4	10	-7.96	47.95	54	-6.05	-	-	262	340	V

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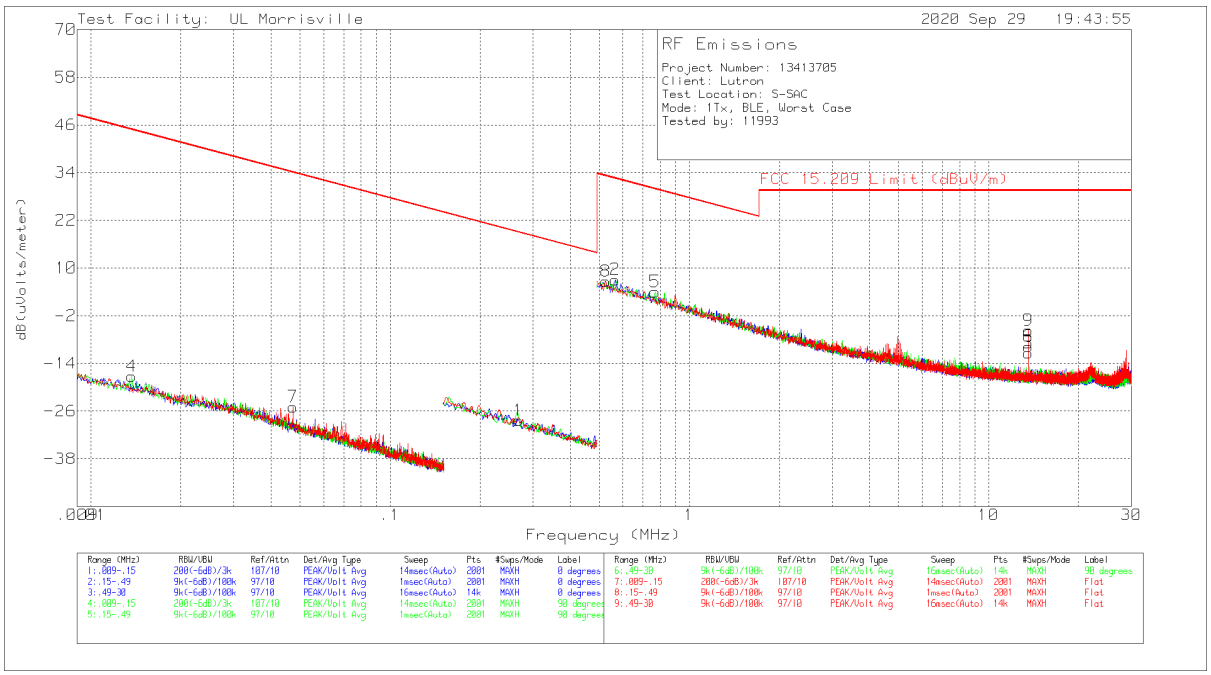
10.3. WORST CASE BELOW 30MHZ

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 269 KHz resulted in a level of -28.31 dBuV/m, which is equivalent to -28.31-51.5 = -79.81 dBuA/m, which has the same margin, -47.32 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 1



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)	Worst-case Margin (dB)	Azimuth (Degs)	Antenna Face
1	.269	40.89	Pk	10.7	.1	-80	-28.31	19.01	39.01	-47.32	0-360	On
2	.56589	36.16	Pk	10.8	.1	-40	7.06	32.55	-	-25.49	0-360	On
3	13.5596	17.55	Pk	10.4	.7	-40	-11.35	29.54	-	-40.89	0-360	On
4	.01369	46.24	Pk	16.4	.1	-80	-17.26	44.88	64.88	-62.14	0-360	Off
5	.76826	32.99	Pk	10.8	.2	-40	3.99	29.89	-	-25.9	0-360	Off
6	13.5596	19.19	Pk	10.4	.7	-40	-9.71	29.54	-	-39.25	0-360	Off
7	.04734	43.22	Pk	11.7	.1	-80	-24.98	34.1	54.1	-59.08	0-360	Flat
8	.52584	35.76	Pk	10.8	.1	-40	6.66	33.19	-	-26.53	0-360	Flat
9	13.5596	23.19	Pk	10.4	.7	-40	-5.71	29.54	-	-35.25	0-360	Flat

Pk - Peak detector

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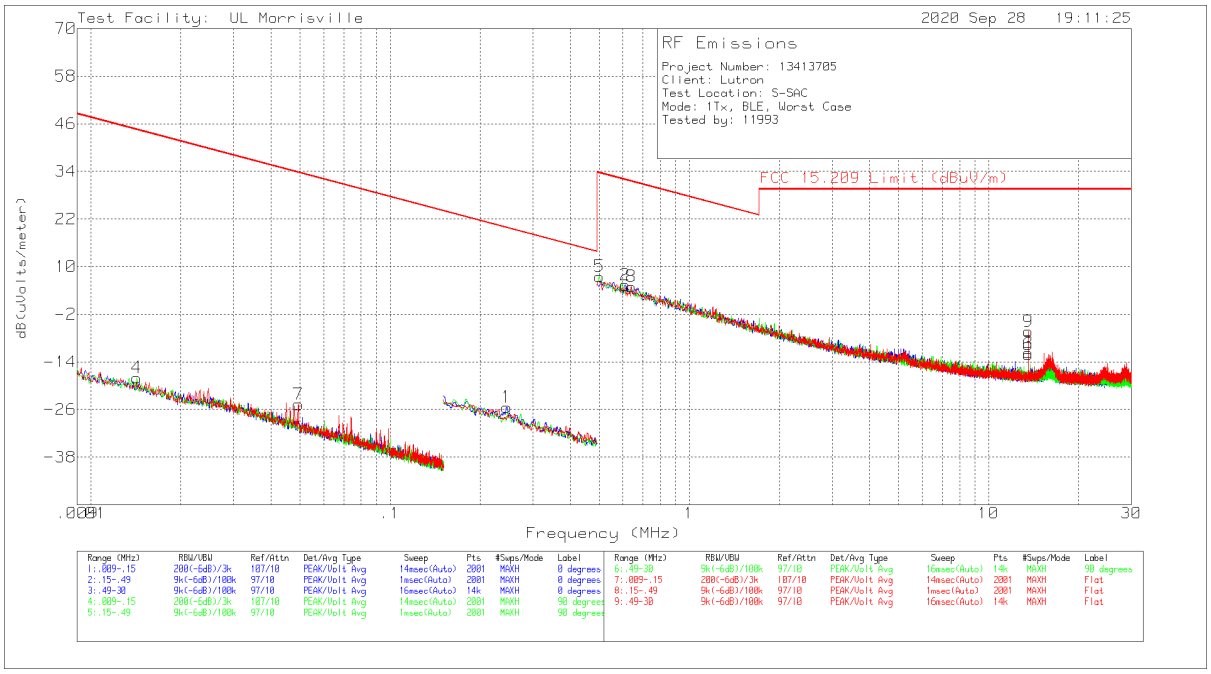
SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION) – ANTENNA 2



ANTENNA- THREE ORIENTATIONS

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)	Worst-Case Margin (dB)	Azimuth (Degs)	Antenna Face
1	.24546	43.67	Pk	10.8	.1	-80	-25.43	19.8	39.8	-45.23	0-360	On
2	.61016	34.35	Pk	10.8	.2	-40	5.35	31.9	-	-26.55	0-360	On
3	13.5596	17.23	Pk	10.4	.7	-40	-11.67	29.54	-	-41.21	0-360	On
4	.01425	45.79	Pk	16.1	.1	-80	-18.01	44.53	64.53	-62.54	0-360	Off
5	.50054	36.61	Pk	10.8	.1	-40	7.51	33.62	-	-26.11	0-360	Off
6	13.56065	16.78	Pk	10.4	.7	-40	-12.12	29.54	-	-41.66	0-360	Off
7	.0494	43.67	Pk	11.5	.1	-80	-24.73	33.73	53.73	-58.46	0-360	Flat
8	.63967	33.94	Pk	10.8	.2	-40	4.94	31.48	-	-26.54	0-360	Flat
9	13.5596	22.59	Pk	10.4	.7	-40	-6.31	29.54	-	-35.85	0-360	Flat

Pk - Peak detector

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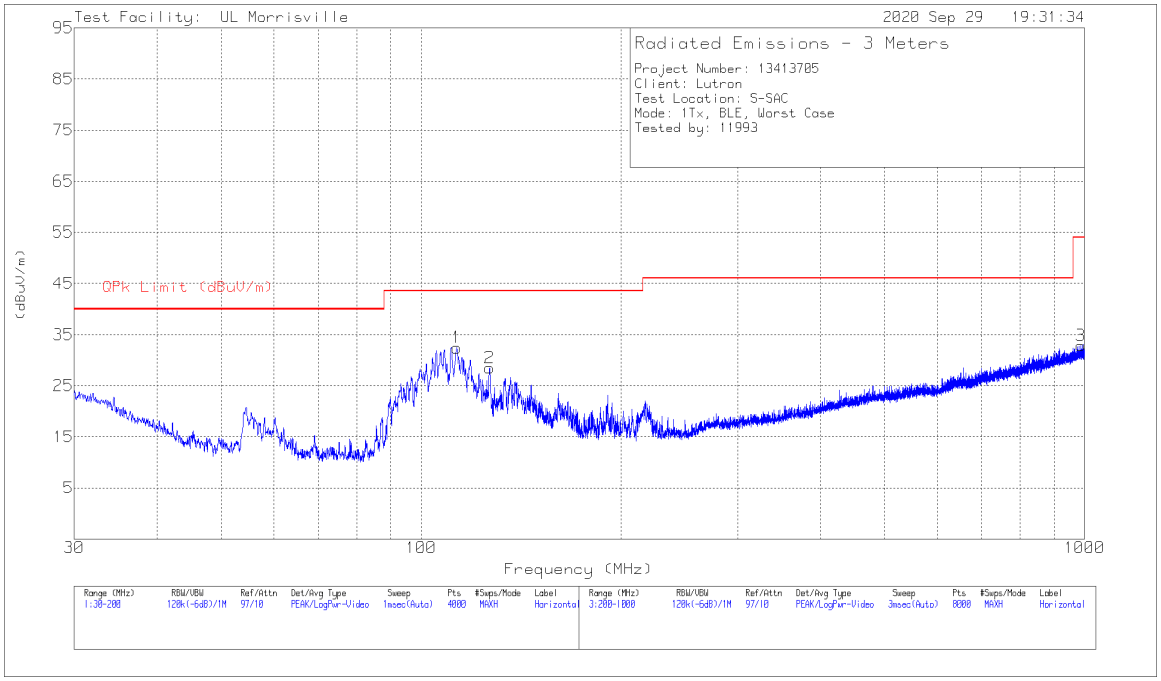
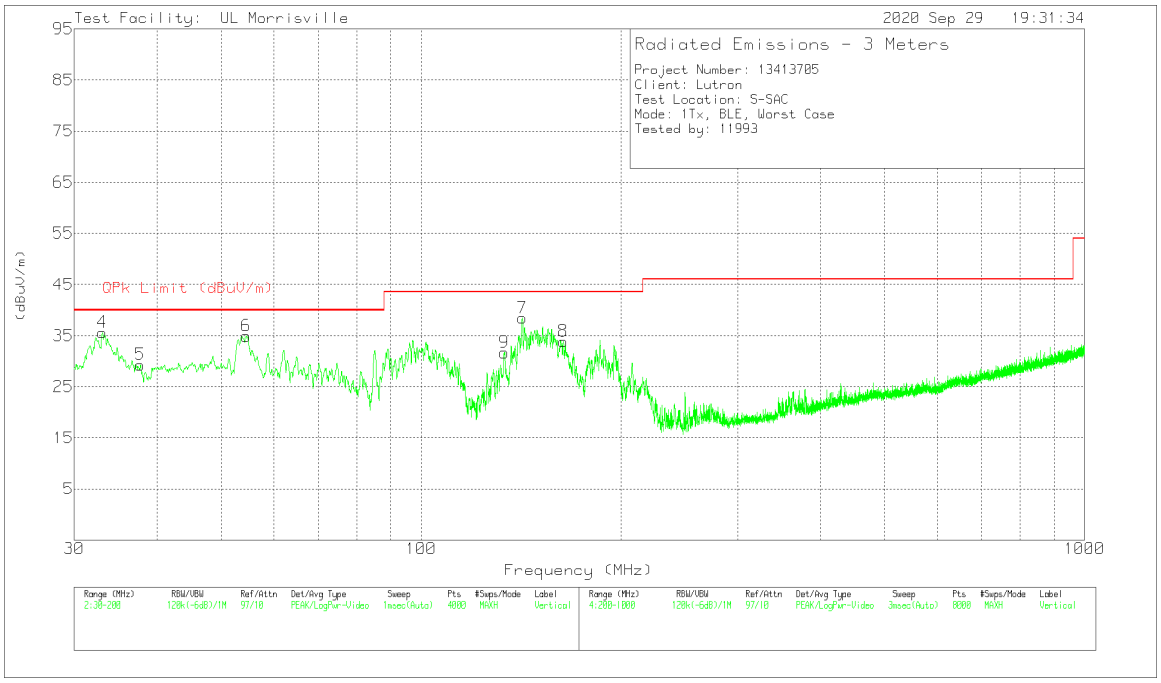
10.4. WORST CASE BELOW 1 GHZ

SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION) – ANTENNA 1



HORIZONTAL



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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0081 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 113.2153	43.52	Pk	19.3	-30.4	32.42	43.52	-11.1	0-360	299	H
2	* ** 126.8401	38.56	Pk	20.1	-30.2	28.46	43.52	-15.06	0-360	299	H
5	* ** 37.737	38.89	Pk	21.8	-31.4	29.29	40	-10.71	0-360	101	V
8	* ** 163.7396	45.57	Pk	18.2	-29.9	33.87	43.52	-9.65	0-360	101	V
9	* ** 133.5568	42.18	Pk	19.7	-30.2	31.68	43.52	-11.84	0-360	101	V
3	* ** 987.7024	27.82	Pk	29.3	-24.3	32.82	53.97	-21.15	0-360	299	H
4	33.1033	42.11	Pk	25	-31.5	35.61	-	-	0-360	101	V
6	54.5288	52.81	Pk	13.3	-31.2	34.91	-	-	0-360	101	V
7	142.1015	49.53	Pk	19	-30.1	38.43	-	-	0-360	101	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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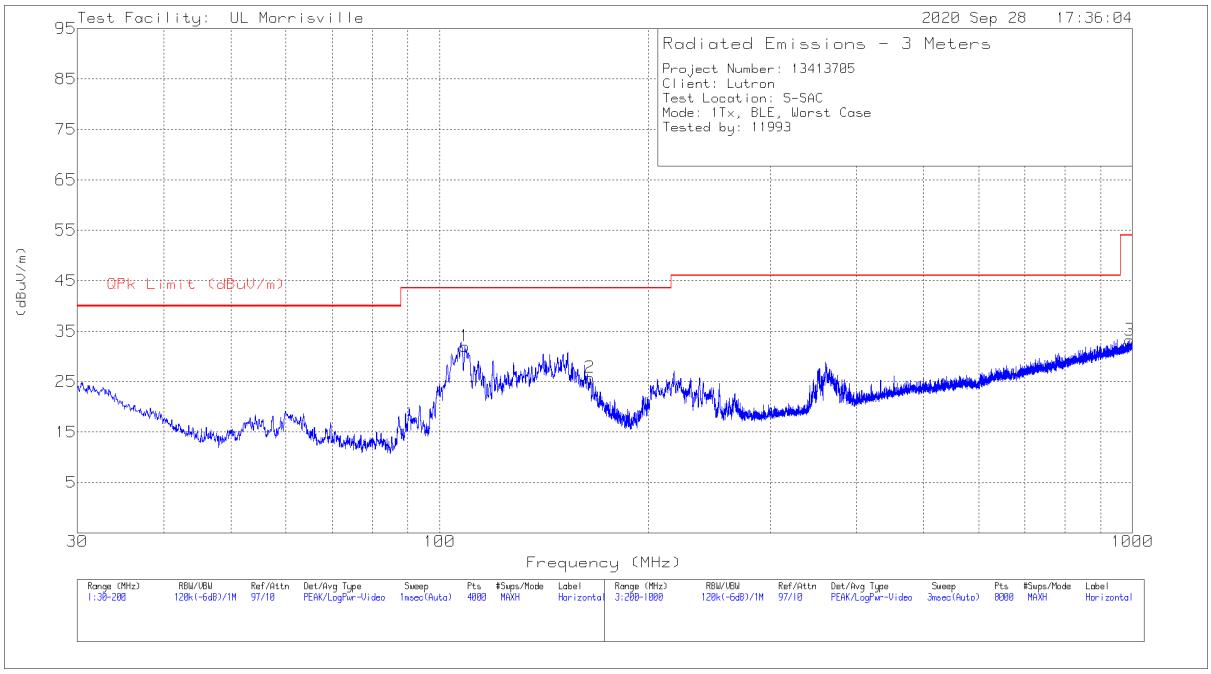
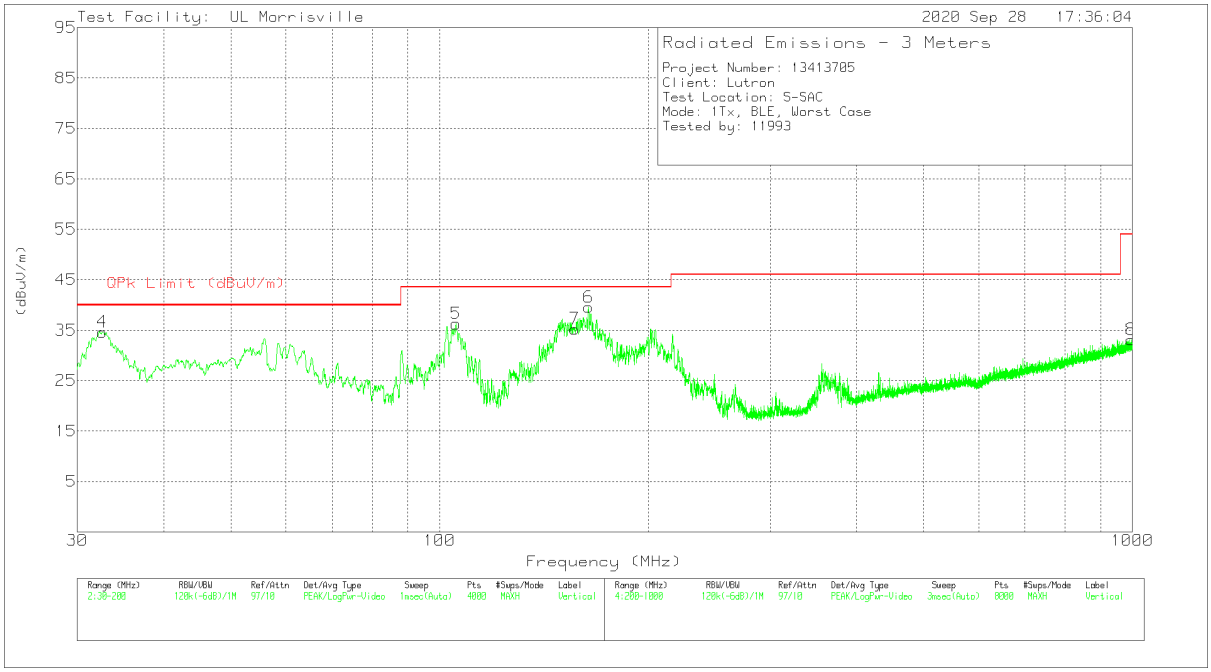
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION) – ANTENNA 2



HORIZONTAL



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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0081 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 108.7729	44.04	Pk	18.5	-30.5	32.04	43.52	-11.48	0-360	298	H
2	* ** 164.8449	37.51	Pk	18.2	-29.9	25.81	43.52	-17.71	0-360	199	H
6	* ** 164.0173	43.26	Qp	18.2	-29.9	31.56	43.52	-11.96	344	115	V
7	* ** 156.7253	46.66	Pk	18.6	-30	35.26	43.52	-8.26	0-360	101	V
3	* ** 990.8028	28.33	Pk	29.2	-24.3	33.23	53.97	-20.74	0-360	101	H
8	* ** 996.9036	28.04	Pk	29.3	-24.2	33.14	53.97	-20.83	0-360	299	V
4	32.5932	40.83	Pk	25.3	-31.5	34.63	-	-	0-360	101	V
5	105.6696	48.88	Pk	17.9	-30.5	36.28	-	-	0-360	101	V

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

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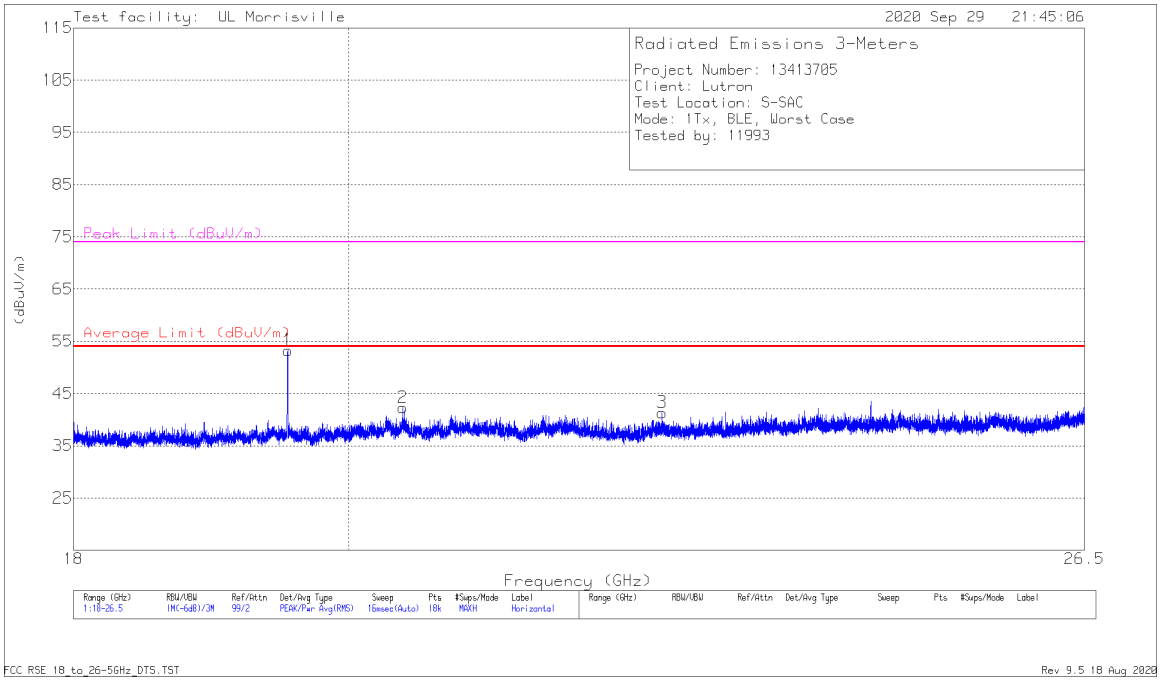
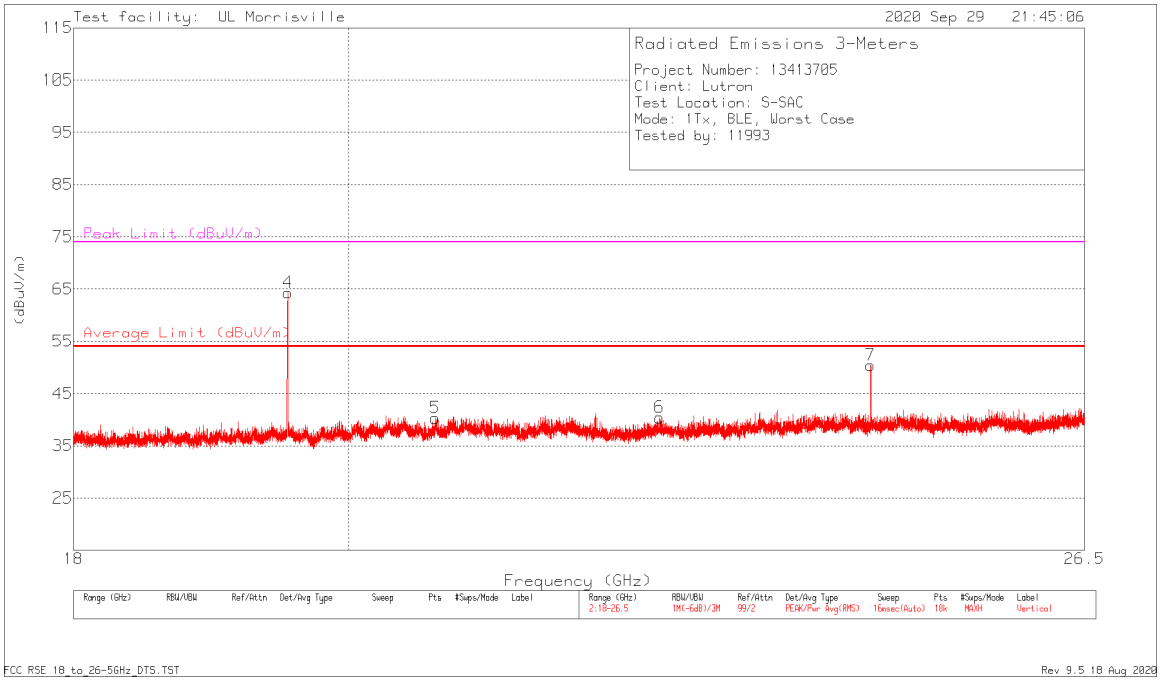
10.5. WORST CASE 18-26 GHZ

SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION) – ANTENNA 1



HORIZONTAL



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18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/Cbl (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 19.53796	59.72	PK2	32.8	-38.9	0	53.62	-	-	74	-20.38	222	254	H
	* ** 19.53795	51.23	ADV	32.8	-38.9	-7.96	37.17	54	-16.83	-	-	222	254	H
2	* ** 20.41602	47.89	Pk	33.1	-38.7	0	42.29	54	-11.71	74	-31.71	0-360	200	H
3	* ** 22.54633	47.07	Pk	33.5	-39.2	0	41.37	54	-12.63	74	-32.63	0-360	101	H
4	* ** 19.53797	71.21	PK2	32.8	-38.9	0	65.11	-	-	74	-8.89	179	231	V
	* ** 19.53795	67.72	ADV	32.8	-38.9	-7.96	53.66	54	-.34	-	-	179	231	V
5	* ** 20.67056	46.09	Pk	33	-38.8	0	40.29	54	-13.71	74	-33.71	0-360	101	V
6	* ** 22.52177	46.01	Pk	33.6	-39.2	0	40.41	54	-13.59	74	-33.59	0-360	250	V
7	24.41785	54.29	Pk	34.3	-38.2	0	50.39	54	-3.61	74	-23.61	0-360	300	V

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

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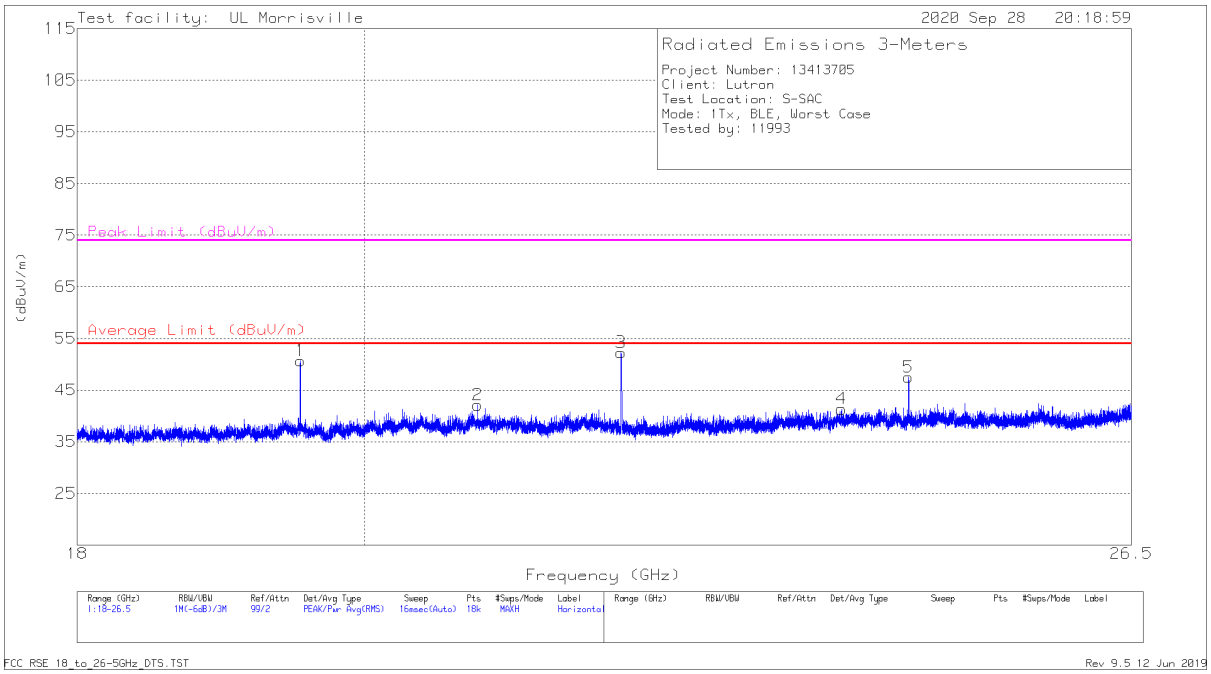
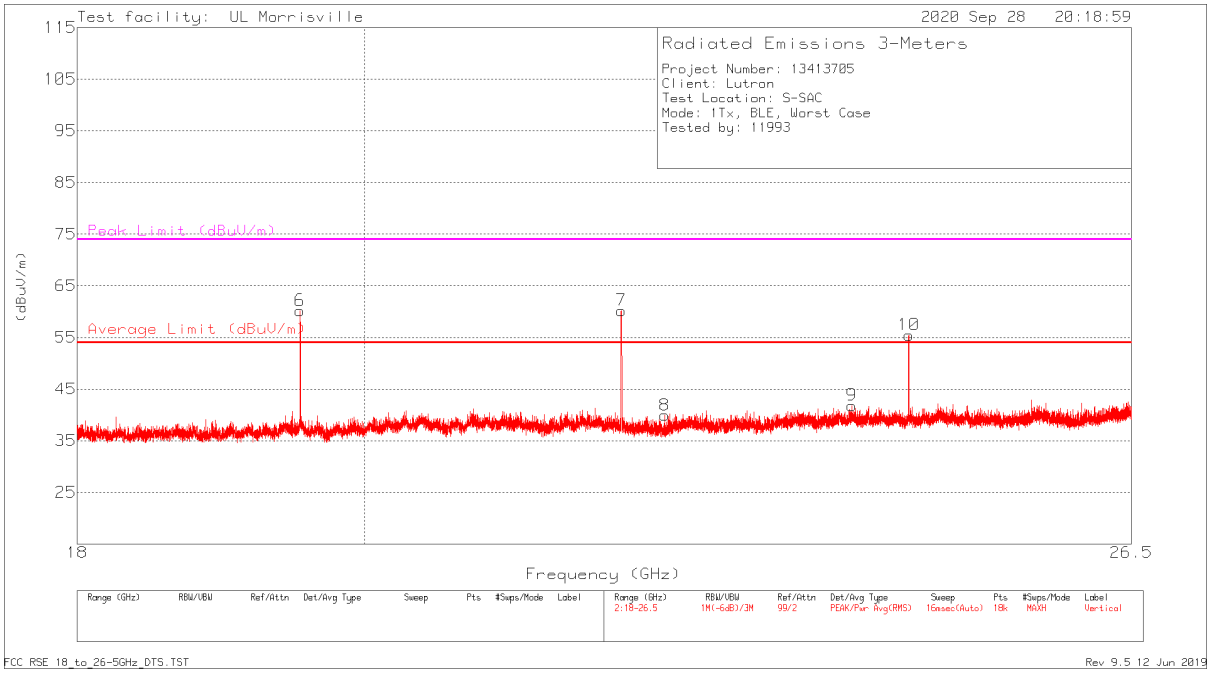
SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION) – ANTENNA 2



HORIZONTAL



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18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/Cbl (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 19.53792	55.4	PK2	32.8	-38.9	0	49.3	-	-	74	-24.7	209	134	H
	* ** 19.53793	52.01	ADV	32.8	-38.9	-7.96	37.95	54	-16.05	-	-	209	134	H
2	* ** 20.84813	48.21	Pk	33.2	-39.3	0	42.11	54	-11.89	74	-31.89	0-360	102	H
4	* ** 23.82707	45.96	Pk	34.1	-38.7	0	41.36	54	-12.64	74	-32.64	0-360	249	H
6	* ** 19.53398	66.79	PK2	32.8	-38.9	0	60.69	-	-	74	-13.31	180	234	V
	* ** 19.5341	65.84	ADV	32.8	-38.9	-7.96	51.78	54	-2.22	-	-	180	234	V
8	* ** 22.3291	45.75	Pk	33.6	-39.4	0	39.95	54	-14.05	74	-34.05	0-360	251	V
9	* ** 23.91821	46.14	Pk	34.1	-38.4	0	41.84	54	-12.16	74	-32.16	0-360	299	V
3	21.97538	57.86	Pk	33.6	-39.2	0	52.26	-	-	-	-	0-360	102	H
7	21.98011	65.63	Pk	33.6	-39	0	60.23	-	-	-	-	0-360	251	V
5	24.41785	51.4	Pk	34.3	-38.2	0	47.5	-	-	-	-	0-360	299	H
10	24.42257	59.38	Pk	34.3	-38.2	0	55.48	-	-	-	-	0-360	251	V

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

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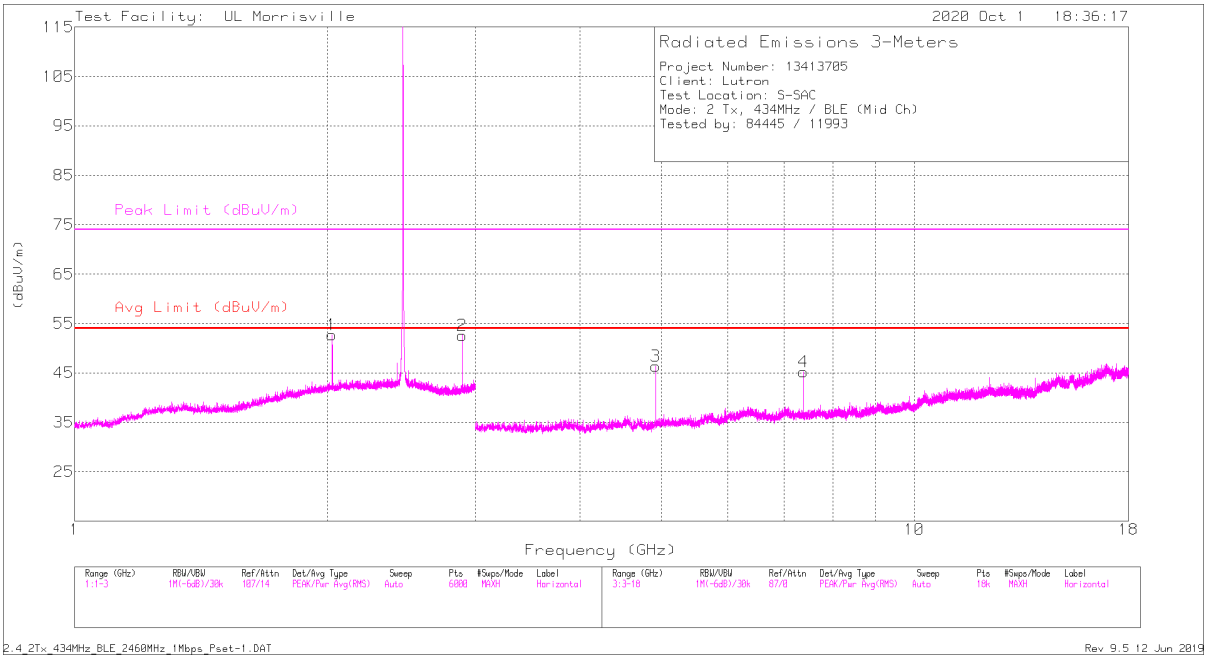
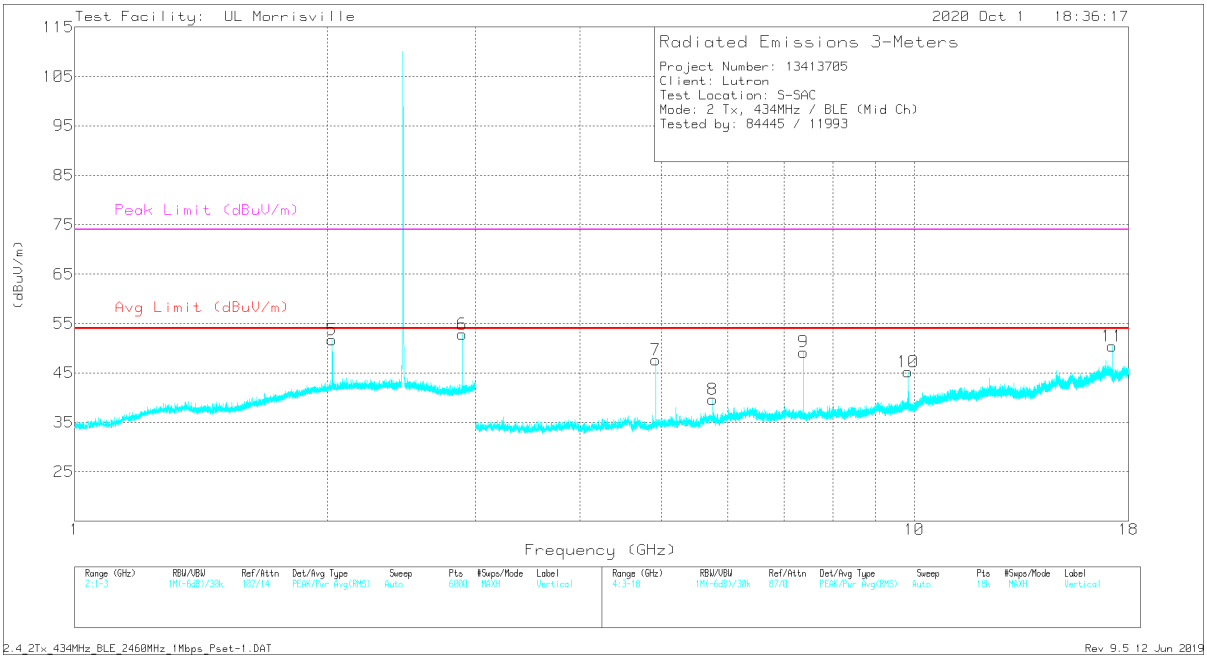
10.6. SIMULTANEOUS TRANSMISSION

SPURIOUS EMISSIONS 1 TO 18 GHz (434MHz & BLE TRANSMITTERS ON CONFIGURATION)



HORIZONTAL



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Above 1GHz Data

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
2	* ** 2.89327	48.12	PK2	32.7	-25.8	0	55.02	-	-	74	-18.98	341	297	H
	* ** 2.89359	43.53	ADV	32.7	-25.8	0	50.43	54	-3.57	-	-	341	297	H
6	* ** 2.89371	49.42	PK2	32.7	-25.8	0	56.32	-	-	74	-17.68	241	199	V
	* ** 2.89359	45.32	ADV	32.7	-25.8	0	52.22	54	-1.78	-	-	241	199	V
3	* ** 4.92051	47.16	PK2	33.9	-30.9	0	50.16	-	-	74	-23.84	184	288	H
	* ** 4.91999	40.96	ADV	33.9	-30.9	-7.96	36	54	-18	-	-	184	288	H
4	* ** 7.37925	41.5	PK2	35.6	-27.5	0	49.6	-	-	74	-24.4	130	209	H
	* ** 7.38059	32.57	ADV	35.6	-27.5	-7.96	32.71	54	-21.29	-	-	130	209	H
7	* ** 4.91935	48.5	PK2	33.9	-30.9	0	51.5	-	-	74	-22.5	90	258	V
	* ** 4.92	42.88	ADV	33.9	-30.9	-7.96	37.92	54	-16.08	-	-	90	258	V
9	* ** 7.37927	46.11	PK2	35.6	-27.5	0	54.21	-	-	74	-19.79	122	322	V
	* ** 7.38061	38.45	ADV	35.6	-27.5	-7.96	38.59	54	-15.41	-	-	122	322	V
1	2.0265	43.57	Pk	31.7	-22.6	0	52.67	-	-	-	-	0-360	101	H
5	2.0265	42.56	Pk	31.7	-22.6	0	51.66	-	-	-	-	0-360	199	V
8	5.75099	35.29	Pk	34.6	-30.3	0	39.59	-	-	-	-	0-360	101	V
10	9.84038	34.12	Pk	36.9	-25.8	0	45.22	-	-	-	-	0-360	200	V
11	17.2183	32.47	Pk	41.5	-23.5	0	50.47	-	-	-	-	0-360	200	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

Note: BLE and Zigbee radios cannot operate at the same time. Periodic operator and BLE radios were configured to transmit at their mid channel, BLE radio transmitted on ANT2 as these were the worse-case conditions.

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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.

TEST PROCEDURE

C63.10

RESULTS

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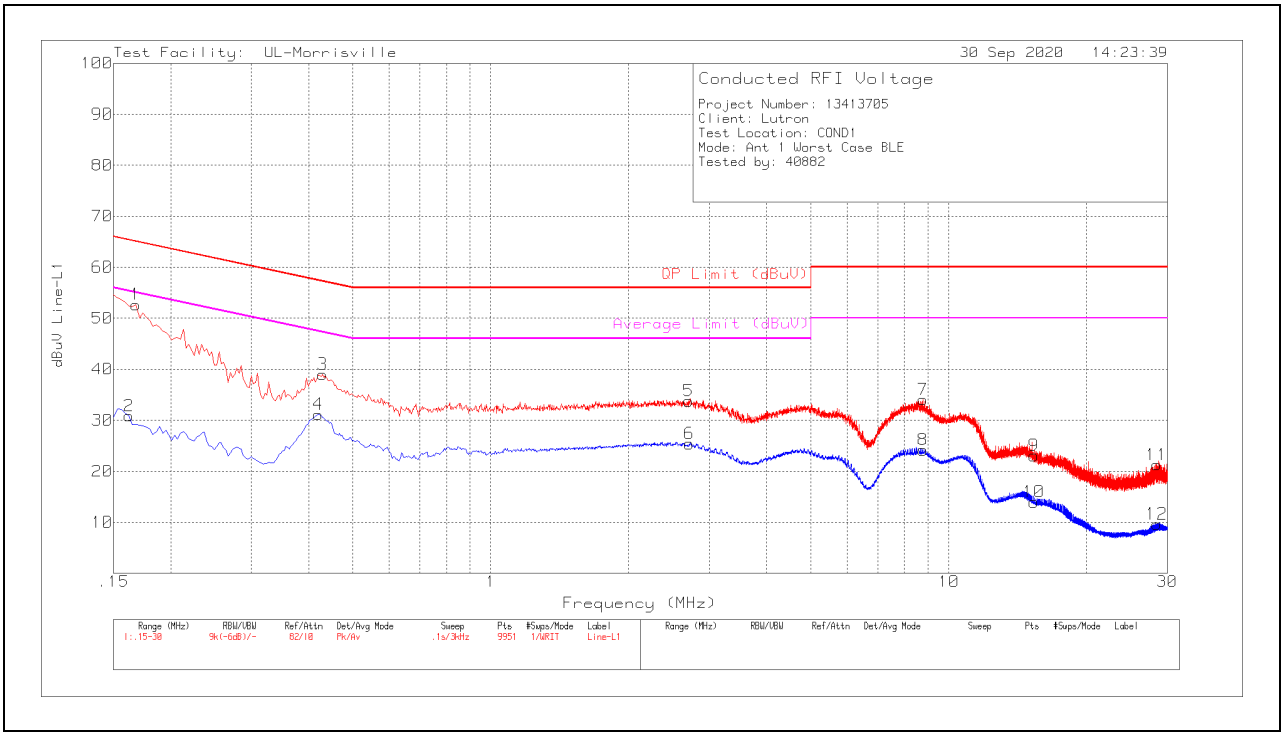
11.1. AC Power Line – Antenna 1

LINE 1 RESULTS



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	.168	42.79	Pk	.2	9.7	52.69	65.06	-12.37	-	-
2	.162	20.96	Av	.2	9.7	30.86	-	-	55.36	-24.5
3	.429	29.12	Pk	.1	9.8	39.02	57.27	-18.25	-	-
4	.42	21.37	Av	.1	9.7	31.17	-	-	47.45	-16.28
5	2.706	23.98	Pk	0	9.8	33.78	56	-22.22	-	-
6	2.715	15.61	Av	0	9.8	25.41	-	-	46	-20.59
7	8.772	23.94	Pk	.1	10	34.04	60	-25.96	-	-
8	8.772	14.09	Av	.1	10	24.19	-	-	50	-25.81
9	15.327	12.88	Pk	.1	10.1	23.08	60	-36.92	-	-
10	15.324	3.79	Av	.1	10.1	13.99	-	-	50	-36.01
11	28.461	10.76	Pk	.3	10.2	21.26	60	-38.74	-	-
12	28.428	-.85	Av	.3	10.2	9.65	-	-	50	-40.35

Pk - Peak detector
Av - Average detection

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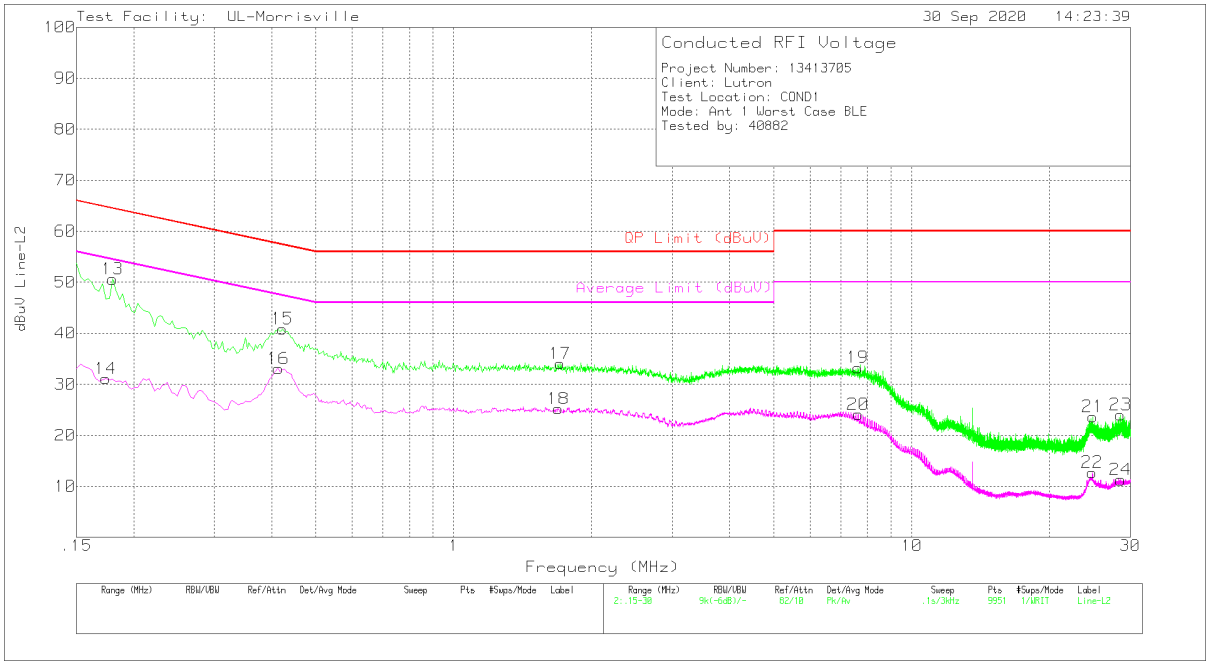
LINE 2 RESULTS



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	.18	40.71	Pk	.2	9.7	50.61	64.49	-13.88	-	-
14	.174	21.22	Av	.2	9.7	31.12	-	-	54.77	-23.65
15	.423	30.98	Pk	.1	9.8	40.88	57.39	-16.51	-	-
16	.414	23.3	Av	.1	9.7	33.1	-	-	47.57	-14.47
17	1.707	24.23	Pk	0	9.8	34.03	56	-21.97	-	-
18	1.692	15.43	Av	0	9.8	25.23	-	-	46	-20.77
19	7.623	23.27	Pk	.1	9.9	33.27	60	-26.73	-	-
20	7.635	14.01	Av	.1	10	24.11	-	-	50	-25.89
21	24.813	13.27	Pk	.2	10.2	23.67	60	-36.33	-	-
22	24.777	2.33	Av	.2	10.2	12.73	-	-	50	-37.27
23	28.557	13.54	Pk	.3	10.2	24.04	60	-35.96	-	-
24	28.566	.78	Av	.3	10.2	11.28	-	-	50	-38.72

Pk - Peak detector
Av - Average detection

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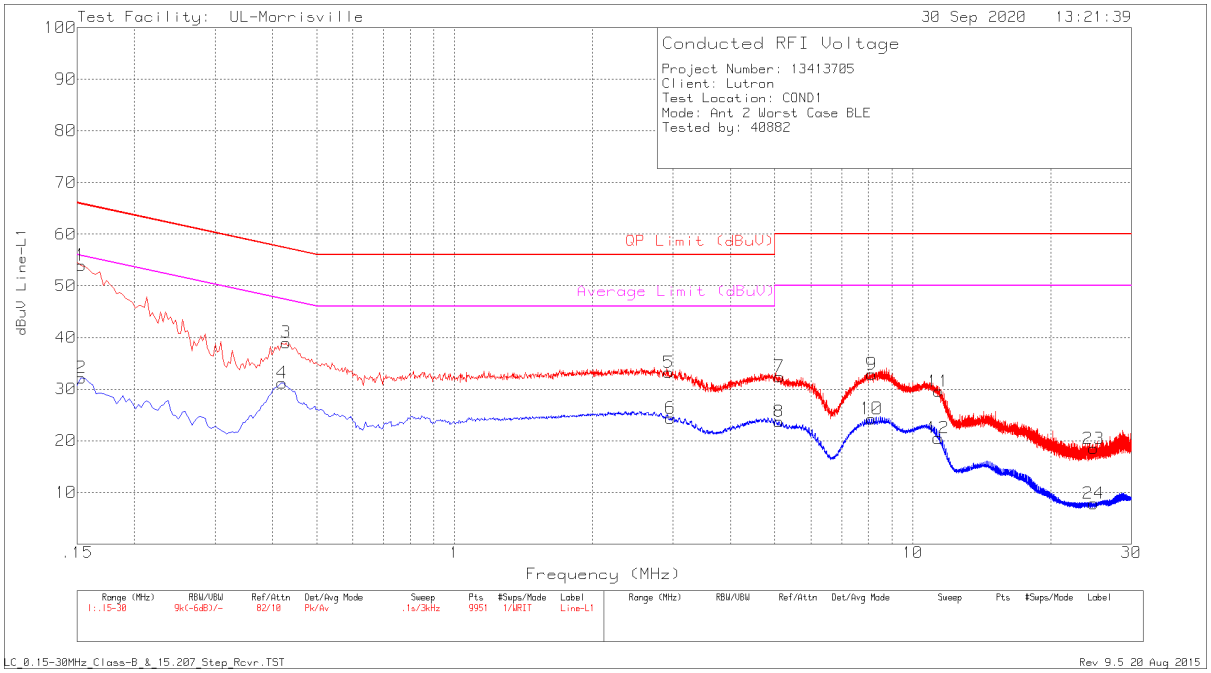
11.2. AC Power Line – Antenna 2

LINE 1 RESULTS



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	.153	44.06	Pk	.2	9.7	53.96	65.84	-11.88	-	-
2	.153	22.3	Av	.2	9.7	32.2	-	-	55.84	-23.64
3	.429	29.12	Pk	.1	9.8	39.02	57.27	-18.25	-	-
4	.42	21.37	Av	.1	9.7	31.17	-	-	47.45	-16.28
5	2.934	23.41	Pk	0	9.8	33.21	56	-22.79	-	-
6	2.955	14.59	Av	0	9.8	24.39	-	-	46	-21.61
7	5.115	22.41	Pk	.1	9.9	32.41	60	-27.59	-	-
8	5.109	13.72	Av	.1	9.9	23.72	-	-	50	-26.28
9	8.133	22.8	Pk	.1	10	32.9	60	-27.1	-	-
10	8.127	14.15	Av	.1	10	24.25	-	-	50	-25.75
11	11.3805	19.47	Pk	.1	10	29.57	60	-30.43	-	-
12	11.367	10.43	Av	.1	10	20.53	-	-	50	-29.47

Pk - Peak detector
Av - Average detection

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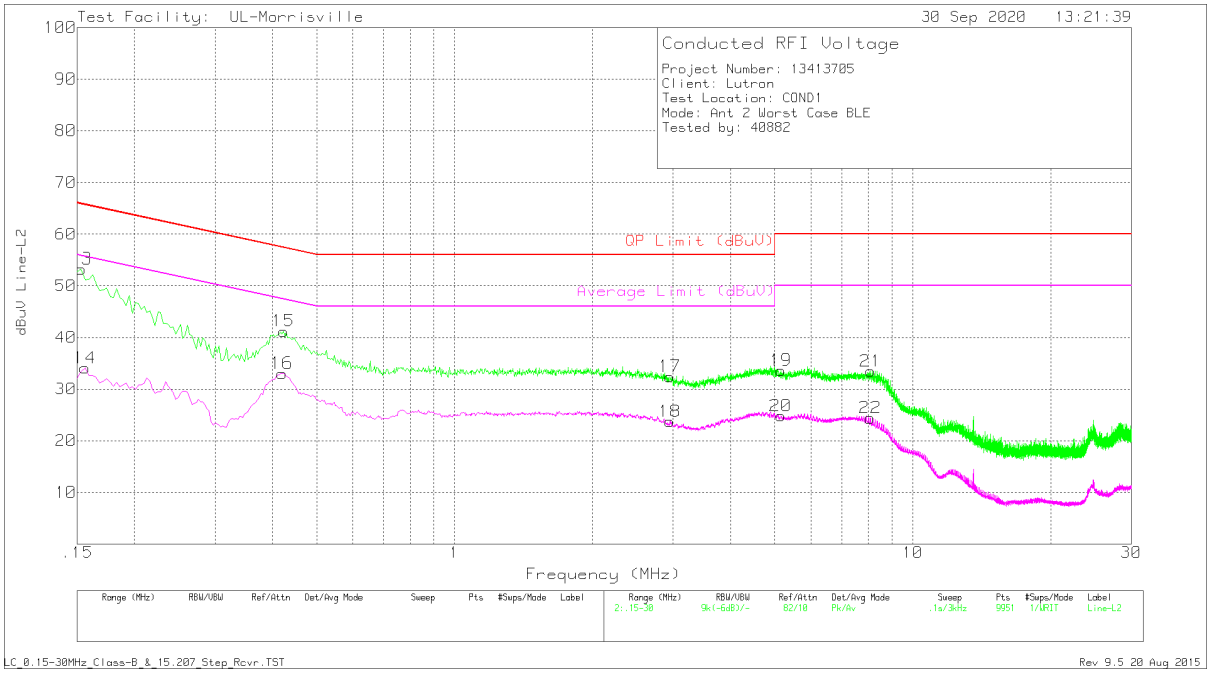
LINE 2 RESULTS



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	.153	43.36	Pk	.2	9.7	53.26	65.84	-12.58	-	-
14	.156	24.17	Av	.2	9.7	34.07	-	-	55.67	-21.6
15	.423	31.31	Pk	.1	9.8	41.21	57.39	-16.18	-	-
16	.42	23.24	Av	.1	9.7	33.04	-	-	47.45	-14.41
17	2.952	22.62	Pk	0	9.8	32.42	56	-23.58	-	-
18	2.952	13.91	Av	0	9.8	23.71	-	-	46	-22.29
19	5.151	23.61	Pk	.1	9.9	33.61	60	-26.39	-	-
20	5.151	14.8	Av	.1	9.9	24.8	-	-	50	-25.2
21	8.1	23.35	Pk	.1	10	33.45	60	-26.55	-	-
22	8.079	14.33	Av	.1	10	24.43	-	-	50	-25.57
23	24.816	8.08	Pk	.2	10.2	18.48	60	-41.52	-	-
24	24.816	-2.55	Av	.2	10.2	7.85	-	-	50	-42.15

Pk - Peak detector
Av - Average detection

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12. SETUP PHOTOS

Please refer to R13413705-EP1 for setup photos

END OF TEST REPORT

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