CERTIFICATION TEST REPORT

Report Number: R13179001-E1

Applicant	:	iRobot Corporation 8 Crosby Drive Bedford, MA 01730, USA
Model	:	AXG-Y1
FCC ID	:	UFE-AXGY1
IC	:	6652A-AXGY1
EUT Description	:	Dual Band Radio Module This report covers the BLE testing.
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C ISED RSS-247 ISSUE 2 ISED RSS-GEN ISSUE 5

Date Of Issue:
2020-09-09

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

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
1	2020-05-20	Initial Issue	Brian T. Kiewra
2	2020-06-03	Updated all Average and Peak power values	Cristian Melara
3	2020-06-16	Revised cover page to include radio covered by report.	Brian T. Kiewra
4	2020-07-24	Revised PCB antenna gain.	Brian T. Kiewra
5	2020-09-09	Revised external antenna gain.	Cristian Melara

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: iRobot Corporation
8 Crosby Drive
Bedford, MA 01730, USA

EUT DESCRIPTION: Dual Band Radio Module

MODEL: AXGY1

SERIAL NUMBER: SS0040BWW, SS0040BHN, SS040B86 (PCB Unit), SS0040B59, SS0040BXP, SS0040BHN

DATE TESTED: 2020-05-05 to 2020-06-02

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

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

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

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

Approved & Released
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Operations Manager
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Prepared By:

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Project Engineer
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UL LLC

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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		
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		
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions		
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions		

3. TEST METHODOLOGY

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

4. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 12 Laboratory Drive, Research Triangle Park, NC 27709, USA and 2800 Perimeter Park Dr., Suite B, Morrisville, NC 27560, USA. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

12 Laboratory Dr.	2800 Perimeter Park Dr.
Site Code: 2180C	
☐ Chamber A RTP	☐ North Chamber
☐ Chamber C RTP	☒ South Chamber

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

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

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5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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

5.2. DECISION RULES

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

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	2.00%
RF output power, conducted	1.3 dB (PK) 0.45 dB (AV)
Power Spectral Density, conducted	2.47 dB
Unwanted Emissions, conducted	1.94 dB
All emissions, radiated	4.88 dB
Conducted Emissions (0.150-30MHz) - LISN	3.07 dB
Temperature	2.26°C
Humidity	6.79%
DC Supply voltages	1.70%
Time	3.39%

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

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 Dual band Radio module supporting 2.4WLAN and 5WLAN as well as BT and BLE. This report covers the BLE testing.

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 - EXT ANT	-0.48	0.90
2403 - 2480	BLE - PCB ANT	2.74	1.88

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PCB and a flexible external antennas for diversity, with a maximum gain of 2.91 dBi (PCB) and 3.5 dBi (external).

6.4. SOFTWARE AND FIRMWARE

The EUT firmware installed during testing was v sapphire+0.0.0+qcs405-som1+0000
The test utility software used during testing was QRCT version: 4.0.00127.0.

6.5. WORST-CASE CONFIGURATION AND MODE

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

Radiated and AC mains emissions testing were performed using both antennas. Radiated emissions test between 1-18 GHz was performed using 125Kbps and 2Mbps as worst-case data rates while AC mains emissions was performed using the worst-case data rate based on power.

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

Conducted testing was performed using PCB antenna port as worst-case at all data rates, with the exception of power and duty cycle which were done on both antenna ports, and at all data rates (125Kbps, 500Kbps, 1Mbps, and 2Mbps).

Worst-case data rates as measured were: 2Mbps

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T450	PC-OA2UQS	PD97265NGU
Laptop Charger	Lenovo	ADLX65NCC2A	11S36200284ZZ1005380J8	NA

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	Mains	1	Terminal	Single conductor	<3m	Provides DC power to PCB
2	Antenna port	1	u.fl	Coaxial	<1m	Cable to external antenna

SETUP DIAGRAMS

Please refer to R13179001-EP1 for setup diagrams

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7. TEST AND MEASUREMENT EQUIPMENT

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

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
0.009-30MHz (Loop Ant.)					
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2019-08-08	2020-08-08
30-1000 MHz					
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2019-07-16	2020-07-16
1-18 GHz					
AT0078	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2019-10-28	2020-10-28
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	2020-04-23	2021-04-23
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-04-23	2021-04-23
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-04-12	2021-04-12
S-SAC04	Gain-loss string: 18-40GHz	Various	Various	2019-03-23	2021-03-23
Receiver & Software					
SA0027	Spectrum Analyzer	Agilent	N9030A	2019-05-15	2020-05-15
SOFTEMI	EMI Software	UL	Version 9.5 (2019-06-12)		
Additional Equipment used					
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
76022	DC Regulated Power Supply	Circuit Specialists	CSI3005X5	N/A	N/A
76021	DC Regulated Power Supply	Circuit Specialists	CSI3005X5	N/A	N/A

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Test Equipment Used - Conducted Disturbance Emissions Test Equipment (Morrisville – Conducted 1)

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2019-05-29	2020-05-29
s/n 161024885	Environmental Meter	Fisher Scientific	15-0770-963	2018-09-04	2020-09-04
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2019-08-19	2020-08-19
75141 (PRE0101521)	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2019-08-20	2020-08-20
TL001	Transient Limiter, 0.009-30MHz	Com-Power	LIT-930A	2019-05-29	2020-05-29
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (2019-06-12)		
76021	DC Power Supply	Circuit Specialists	CSI3005X5	NA	NA

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
72822 (PRE0100902)	Spectrum Analyzer	Agilent Technologies	E4446A	2020-01-02	2021-01-02
PWM004 (PRE0137346)	RF Power Meter	Keysight Technologies	N1911A	2019-08-23	2020-08-23
PWS004 (PRE0126443)	Peak and Avg Power Sensor, 50MHz to 6GHz	Keysight Technologies	E9323A	2019-08-23	2020-08-23
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2019-06-17	2020-06-17
SN 181562858	Environmental Meter	Fisher Scientific	14-650-118	2018-09-04	2020-09-04
76022	DC Regulated Power Supply	Circuit Specialists	CSI3005X5	N/A	N/A
SOFTEMI	EMC Software	UL	Version 2020.3.11 and 2020.4.17	NA	NA
76023 (EC0225)	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2019-06-14	2020-06-14
SN 181474341	Environmental Meter	Fisher Scientific	15-077-963	2018-07-27	2020-07-27
30811	DC Regulated Power Supply	Tenma	72-6180A	N/A	N/A

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8. MEASUREMENT METHOD

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

6 dB BW: ANSI C63.10 Subclause -11.8.1

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

Output Power: ANSI C63.10 Subclause -11.9.1.3 Method PKPM1 Peak-reading power meter
Output Power: ANSI C63.10 Subclause -11.9.2.3.2 Method AVGPM-G (Measurement using a gated RF average-reading power meter)

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

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

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

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

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

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

PROCEDURE

ANSI C63.10 Zero-Span Spectrum Analyzer Method.

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 - EXT ANT 1Mbps	0.3914	0.6257	0.626	62.55%	4.07	2.555
BLE - EXT ANT 2Mbps	0.2052	0.6245	0.329	32.86%	9.67	4.873
BLE - EXT ANT 125Kbps	3.1000	3.7500	0.827	82.67%	1.65	0.323
BLE - EXT ANT 500Kbps	1.0700	1.8750	0.571	57.07%	4.87	0.935
BLE - PCB ANT 1Mbps	0.3914	0.6257	0.626	62.55%	4.07	2.555
BLE - PCB ANT 2Mbps	0.2052	0.6245	0.329	32.86%	9.67	4.873
BLE - PCB ANT 125Kbps	3.1100	3.7500	0.829	82.93%	1.63	0.322
BLE - PCB ANT 500Kbps	1.0700	1.8750	0.571	57.07%	4.87	0.935

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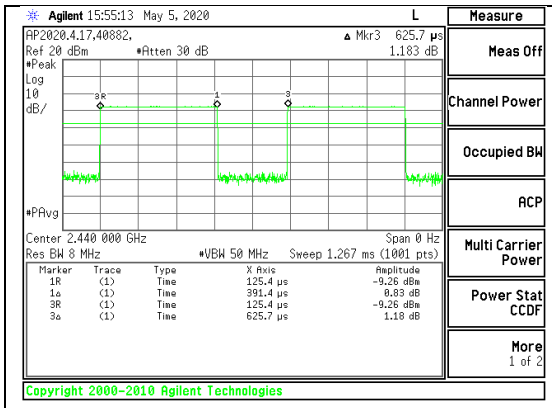
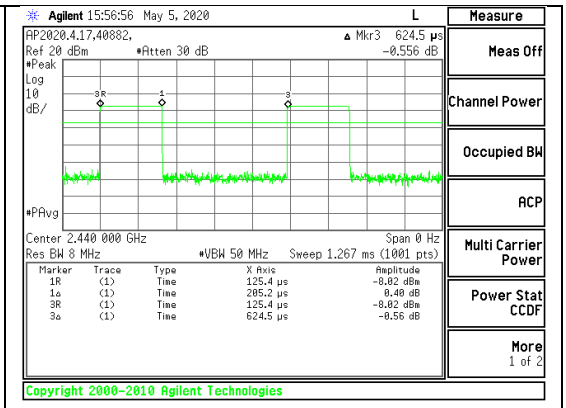
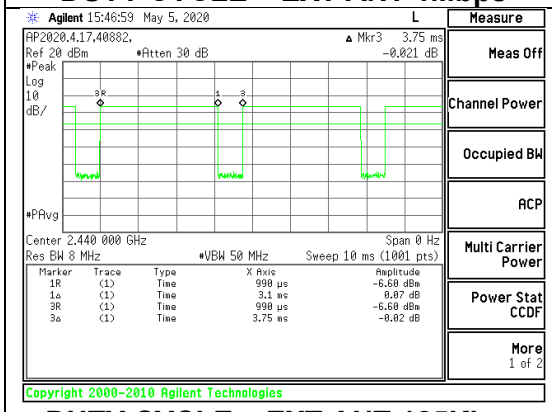
DUTY CYCLE EXT ANT PLOTS



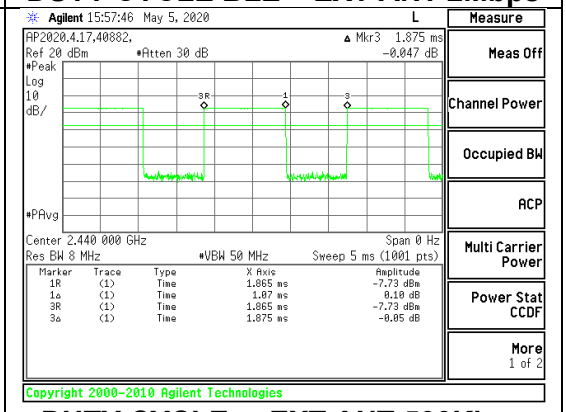
DUTY CYCLE – EXT ANT 1Mbps



DUTY CYCLE BLE – EXT ANT 2Mbps



DUTY CYCLE – EXT ANT 125Kbps



DUTY CYCLE – EXT ANT 500Kbps

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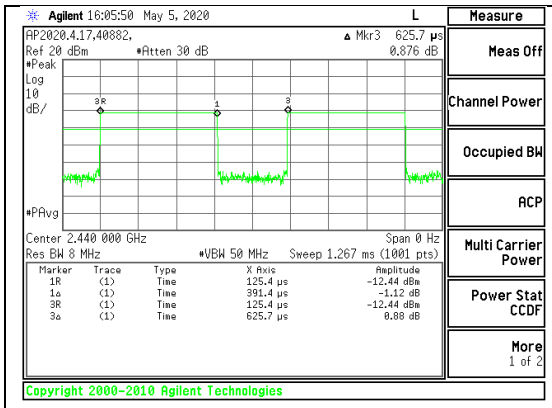
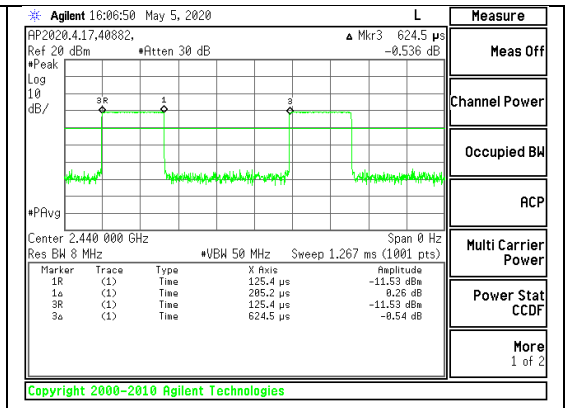
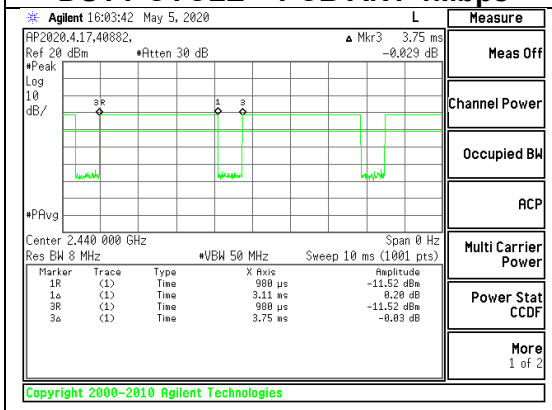
DUTY CYCLE PCB ANT PLOTS



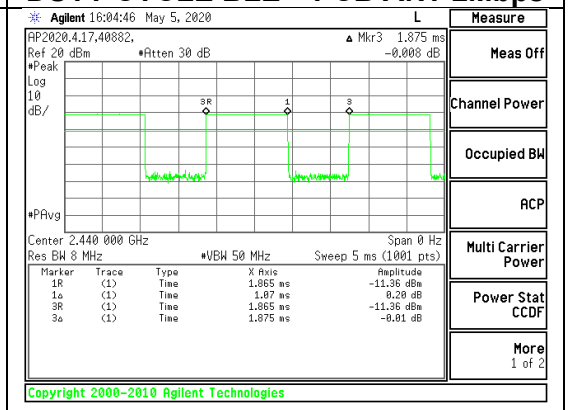
DUTY CYCLE – PCB ANT 1Mbps



DUTY CYCLE BLE – PCB ANT 2Mbps



DUTY CYCLE – PCB ANT 125Kbps



DUTY CYCLE – PCB ANT 500Kbps

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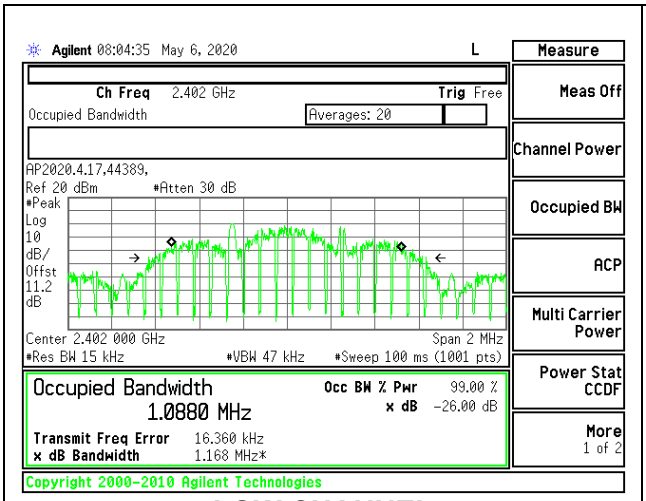
9.2. 99% BANDWIDTH

LIMITS

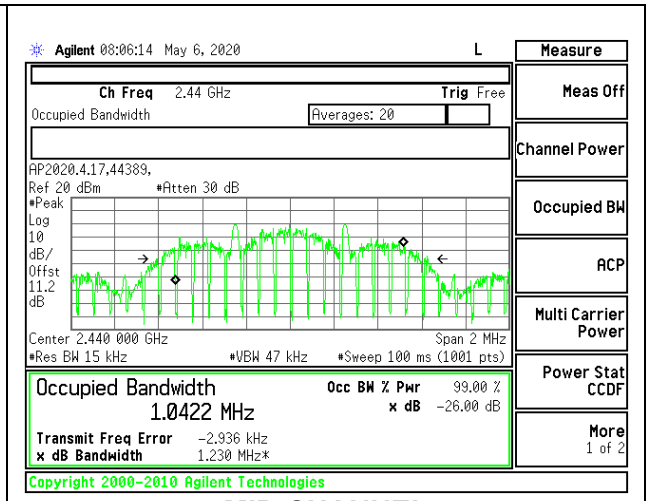
None; for reporting purposes only.

9.2.1. BLE (125Kbps)

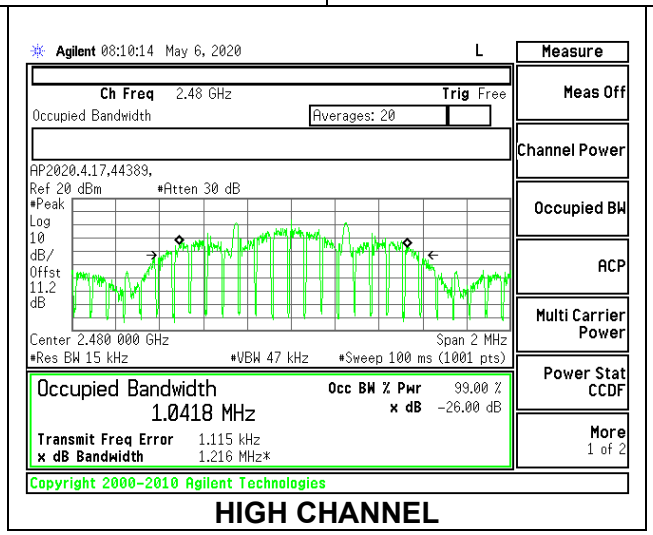
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0880
Middle	2440	1.0422
High	2480	1.0418



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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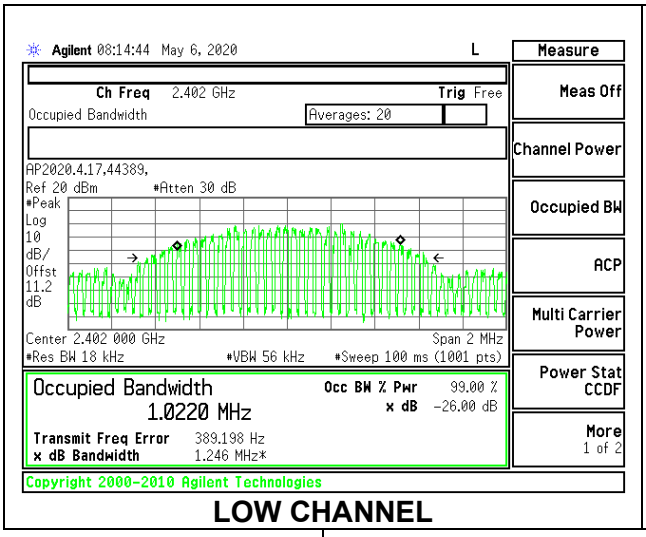
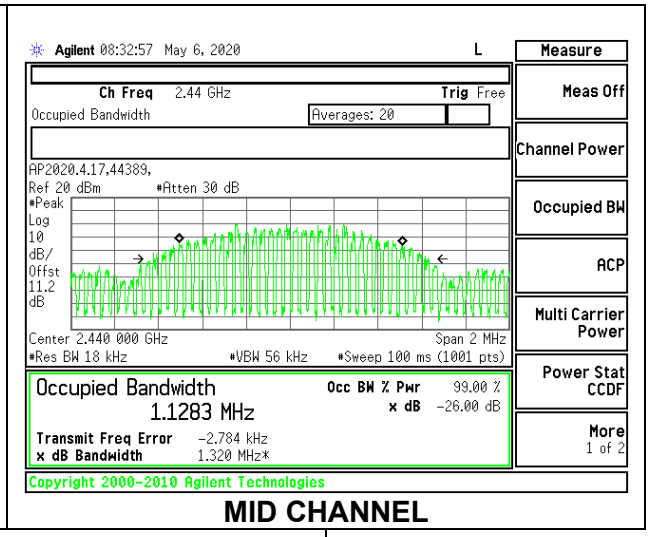
9.2.2. BLE (500Kbps)

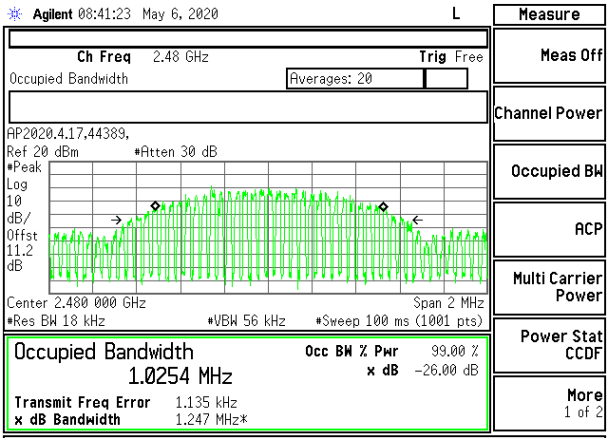
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0220
Middle	2440	1.1283
High	2480	1.0254



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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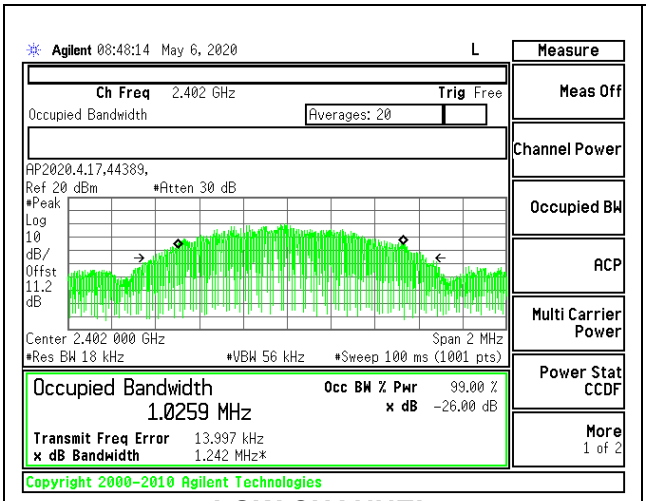
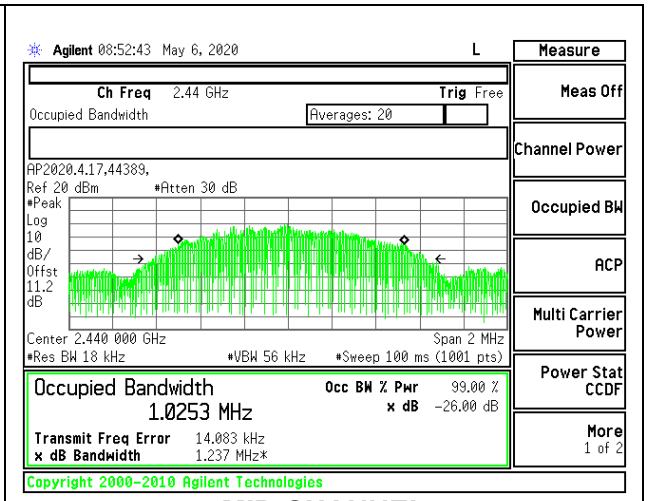
9.2.3. BLE (1Mbps)

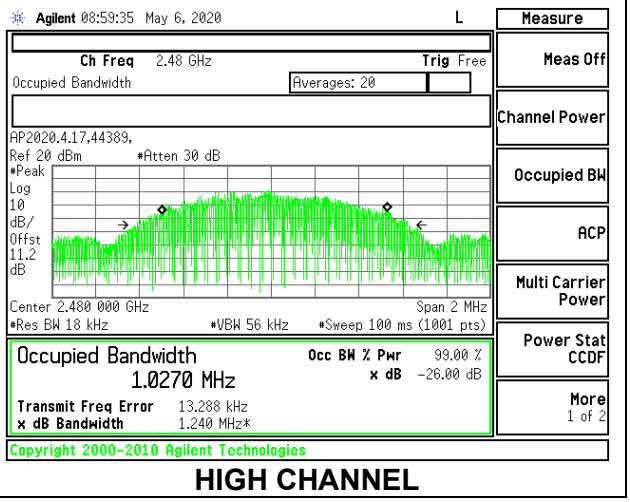
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0259
Middle	2440	1.0253
High	2480	1.0270



LOW CHANNEL



MID CHANNEL



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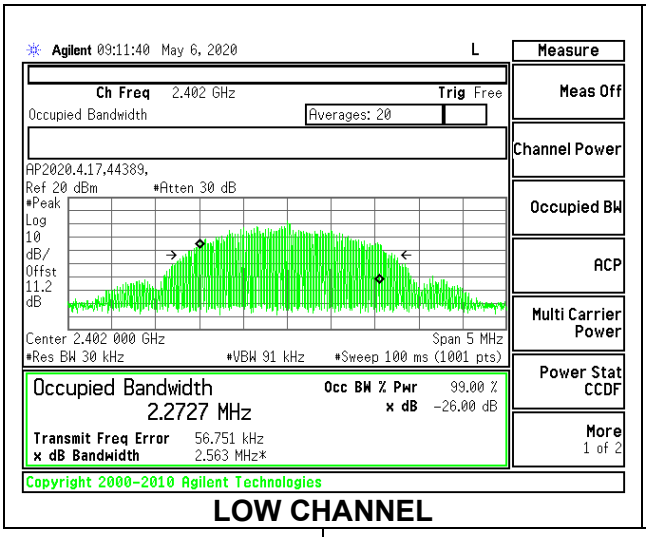
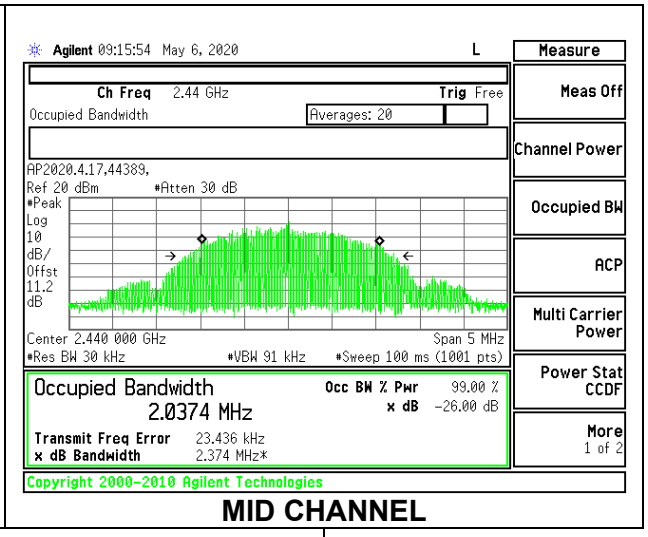
9.2.4. BLE (2Mbps)

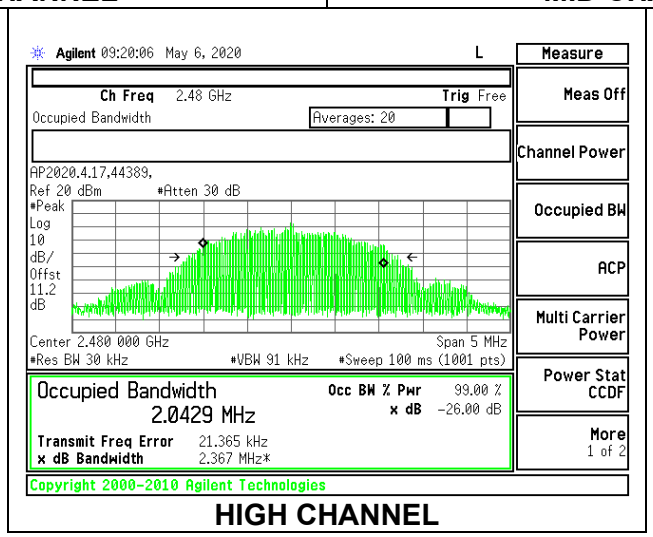
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	2.2727
Middle	2440	2.0374
High	2480	2.0429



LOW CHANNEL



MID CHANNEL



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9.3.6 dB BANDWIDTH

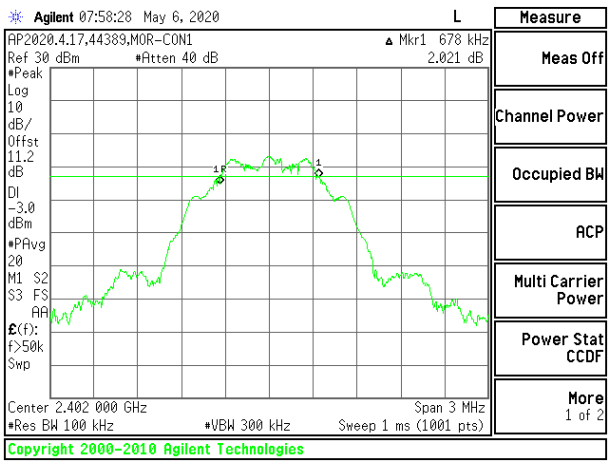
LIMITS

FCC §15.247 (a) (2)
RSS-247 5.2 (a)

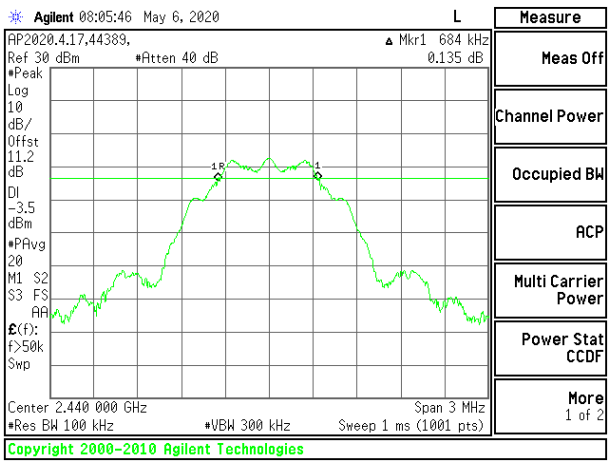
The minimum 6 dB bandwidth shall be at least 500 kHz.

9.3.1. BLE (125Kbps)

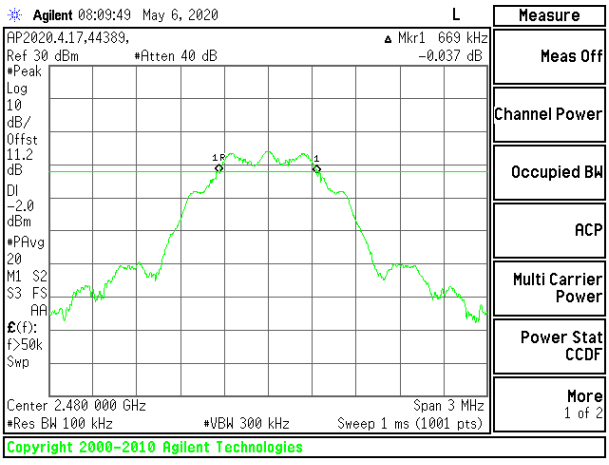
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6780	0.5
Middle	2440	0.6840	0.5
High	2480	0.6690	0.5



LOW CHANNEL



MID CHANNEL



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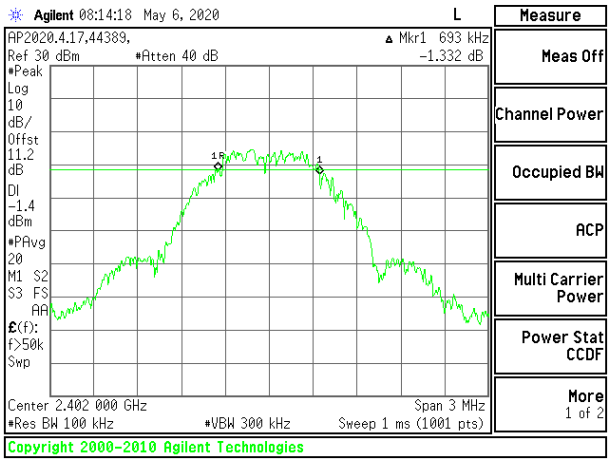
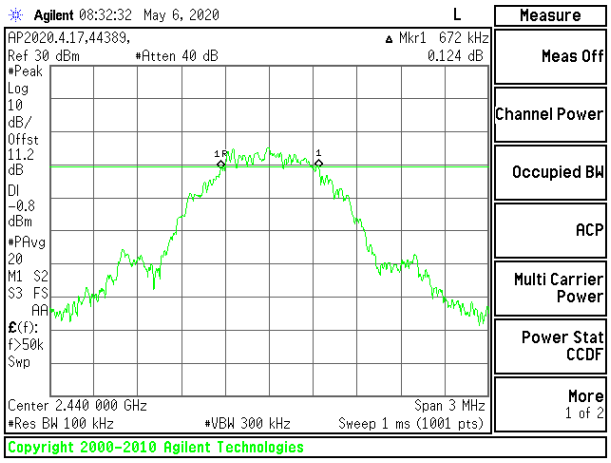
9.3.2. BLE (500Kbps)

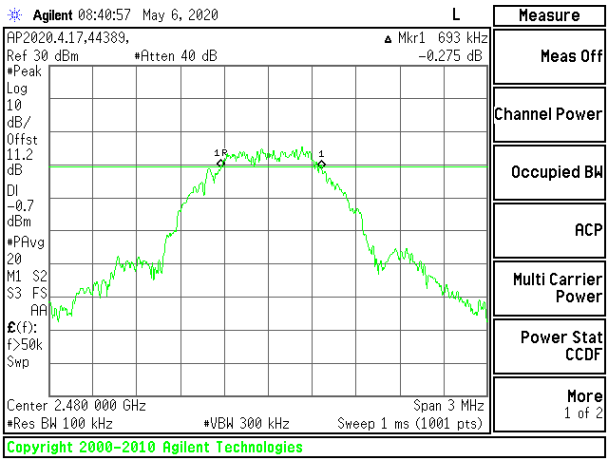
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6930	0.5
Middle	2440	0.6720	0.5
High	2480	0.6930	0.5



LOW CHANNEL



MID CHANNEL



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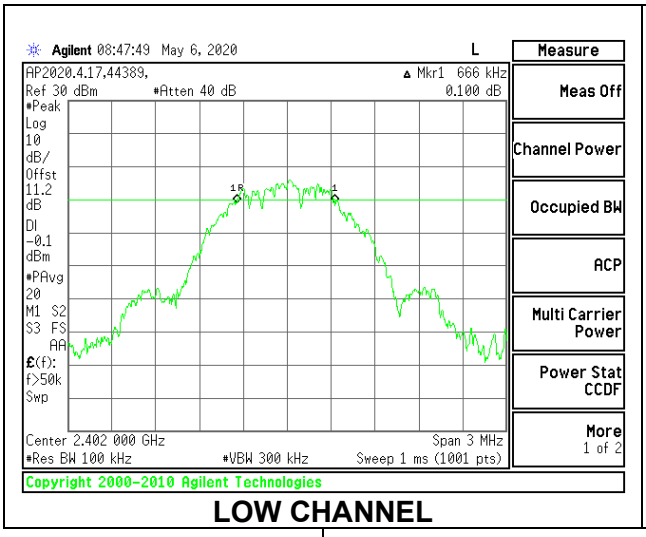
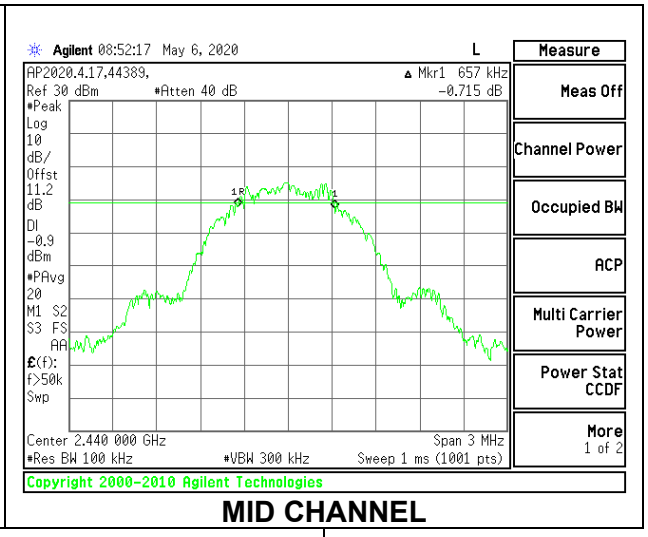
9.3.3. BLE (1Mbps)

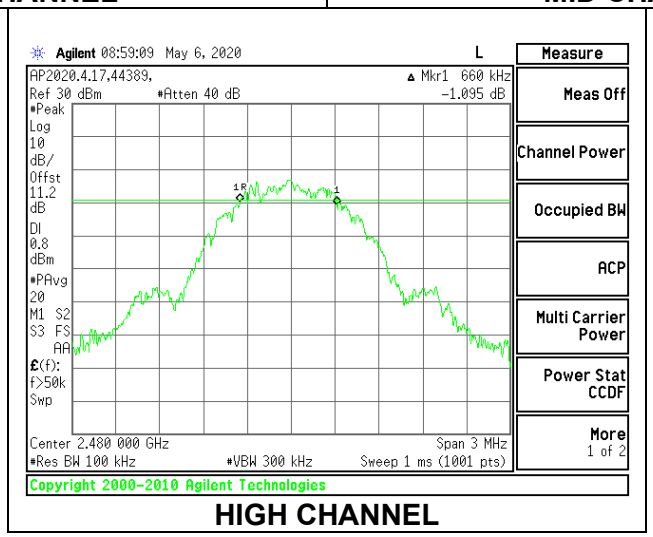
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.6660	0.5
Middle	2440	0.6570	0.5
High	2480	0.6600	0.5



LOW CHANNEL



MID CHANNEL



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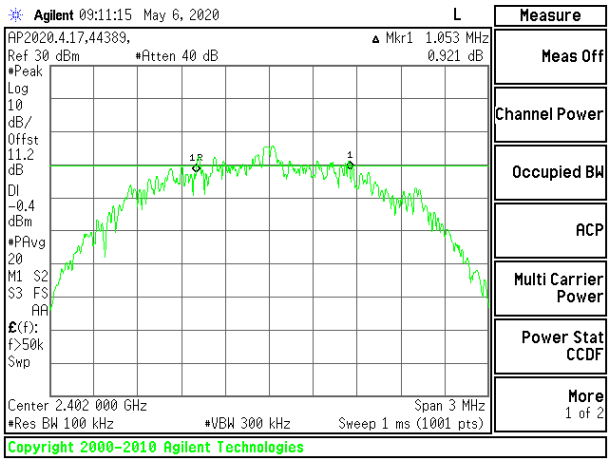
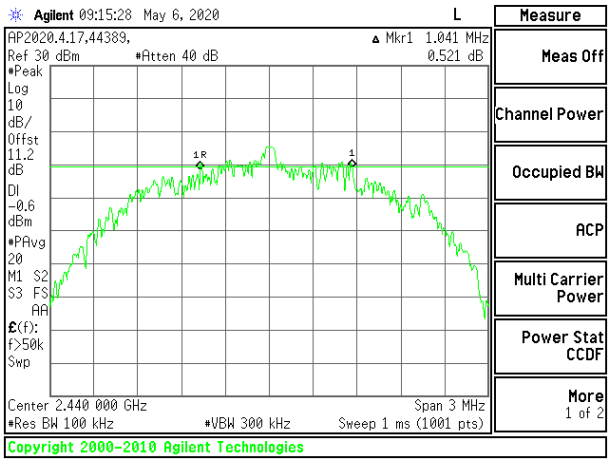
9.3.4. BLE (2Mbps)

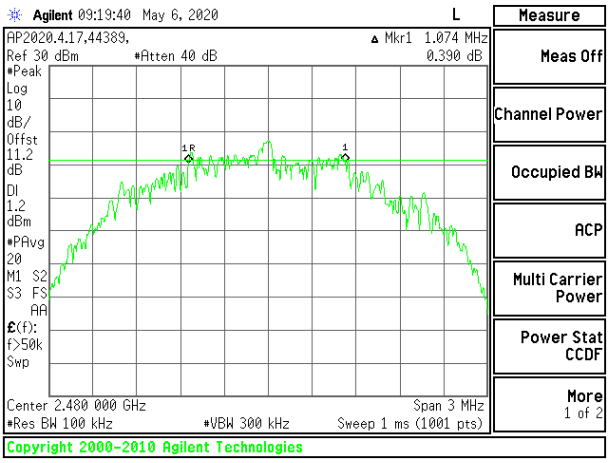
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	1.0530	0.5
Middle	2440	1.0410	0.5
High	2480	1.0740	0.5



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 11.39 dB (including 10.49 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for a peak reading of power.

9.4.1. BLE (125Kbps)

EXTERNAL ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-1.08	30	-31.080
Middle	2440	-2.19	30	-32.190
High	2480	-0.64	30	-30.640

PCB ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.12	30	-27.880
Middle	2440	1.65	30	-28.350
High	2480	2.62	30	-27.380

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9.4.2. BLE (500Kbps)

EXTERNAL ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-1.10	30	-31.100
Middle	2440	-2.16	30	-32.160
High	2480	-0.61	30	-30.610

PCB ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.10	30	-27.900
Middle	2440	1.57	30	-28.430
High	2480	2.61	30	-27.390

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9.4.3. BLE (1Mbps)

EXTERNAL ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-1.10	30	-31.100
Middle	2440	-2.20	30	-32.200
High	2480	-0.60	30	-30.600

PCB ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.13	30	-27.870
Middle	2440	1.53	30	-28.470
High	2480	2.58	30	-27.420

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9.4.4. BLE (2Mbps)

EXTERNAL ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	-0.93	30	-30.930
Middle	2440	-1.98	30	-31.980
High	2480	-0.48	30	-30.480

PCB ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	2.32	30	-27.680
Middle	2440	1.81	30	-28.190
High	2480	2.74	30	-27.260

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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 11.39 dB (including 10.49 dB pad and 0.9 dB cable) was entered as an offset in the power meter to allow for a gated average reading of power.

9.5.1. BLE (125Kbps)

EXTERNAL ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-1.492
Middle	2440	-2.56
High	2480	-0.997

PCB ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	1.842
Middle	2440	1.221
High	2480	2.294

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9.5.2. BLE (500Kbps)

EXTERNAL ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-1.494
Middle	2440	-2.547
High	2480	-0.97

PCB ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	1.804
Middle	2440	1.256
High	2480	2.316

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9.5.3. BLE (1Mbps)

EXTERNAL ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-1.484
Middle	2440	-2.561
High	2480	-0.982

PCB ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	1.793
Middle	2440	1.232
High	2480	2.3

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9.5.4. BLE (2Mbps)

EXTERNAL ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-1.531
Middle	2440	-2.593
High	2480	-1

PCB ANTENNA

Tested By:	44389
Date:	2020-06-02

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	1.723
Middle	2440	1.209
High	2480	2.293

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9.6. POWER SPECTRAL DENSITY

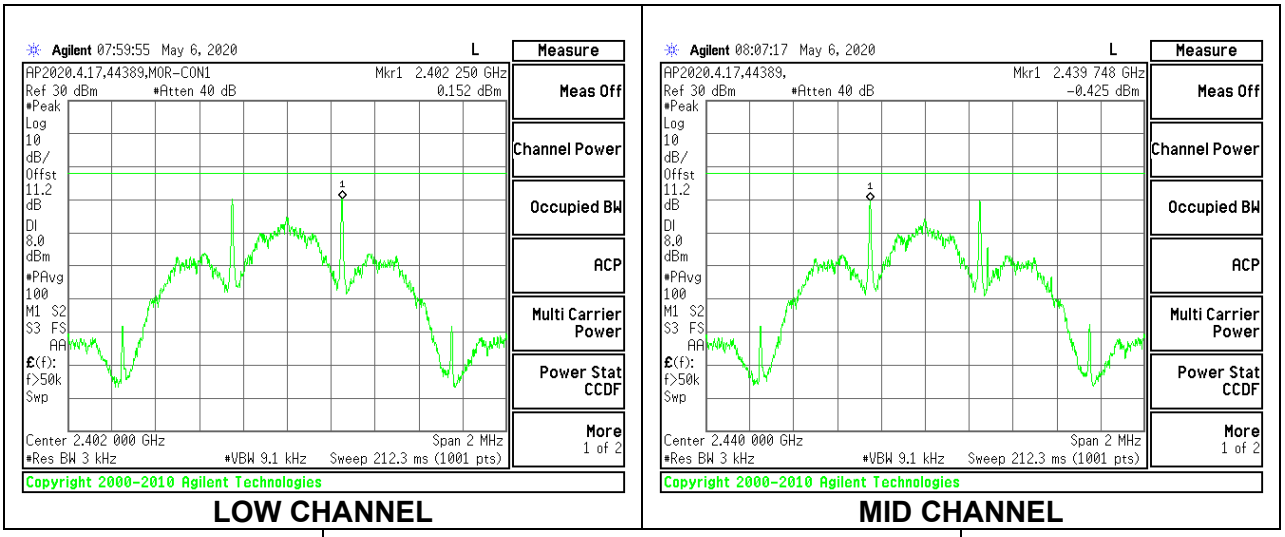
LIMITS

FCC §15.247 (e)
RSS-247 (5.2) (b)

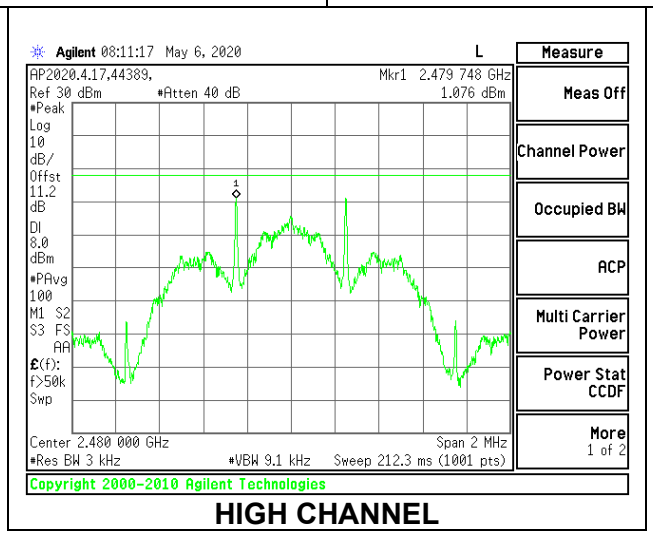
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

9.6.1. BLE (125Kbps)

Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	0.152	8	-7.85
Middle	2440	-0.425	8	-8.43
High	2480	1.076	8	-6.92



LOW CHANNEL MID CHANNEL



HIGH CHANNEL

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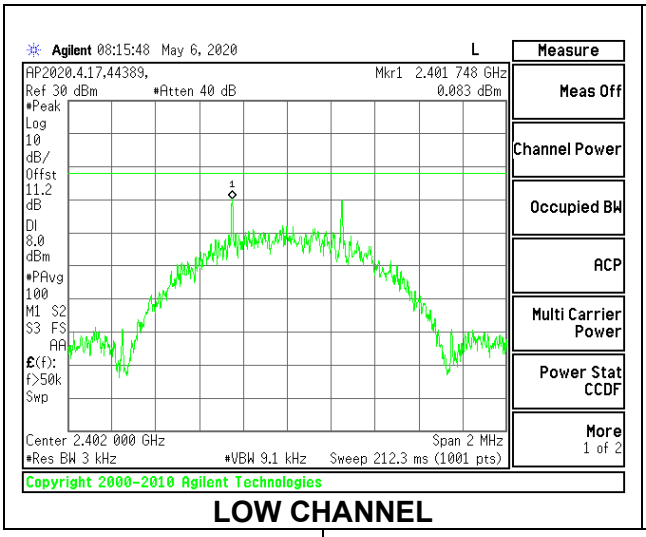
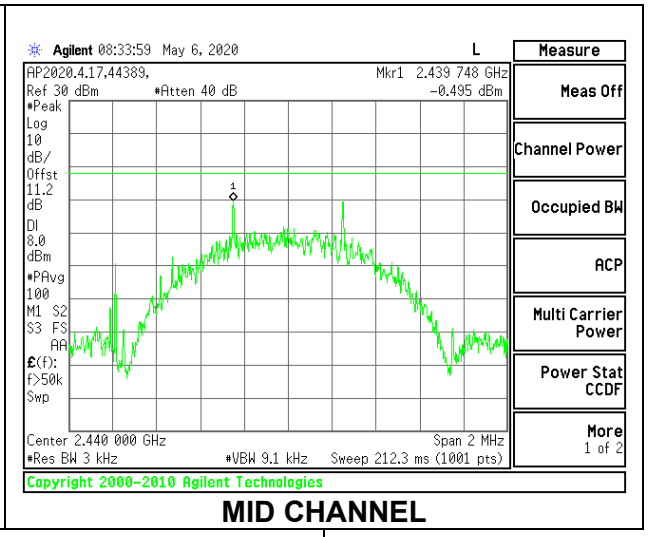
9.6.2. BLE (500Kbps)

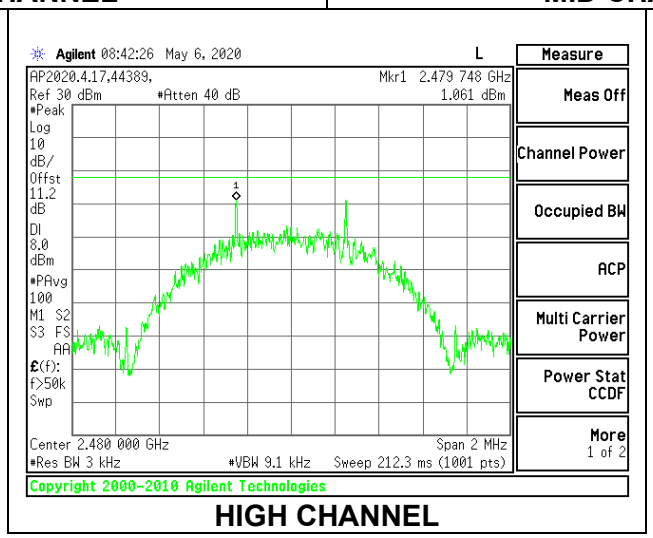
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	0.083	8	-7.92
Middle	2440	-0.495	8	-8.50
High	2480	1.061	8	-6.94



LOW CHANNEL



MID CHANNEL



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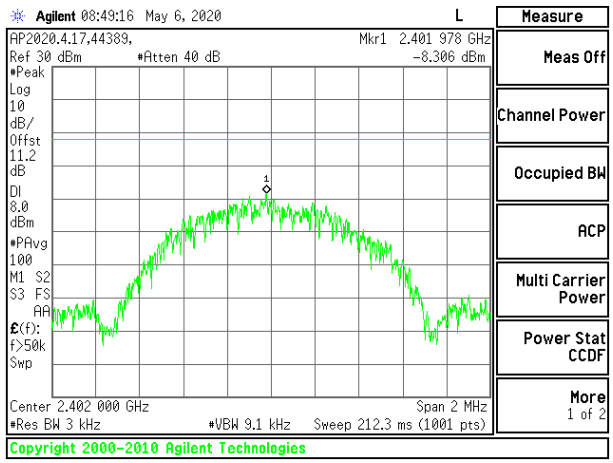
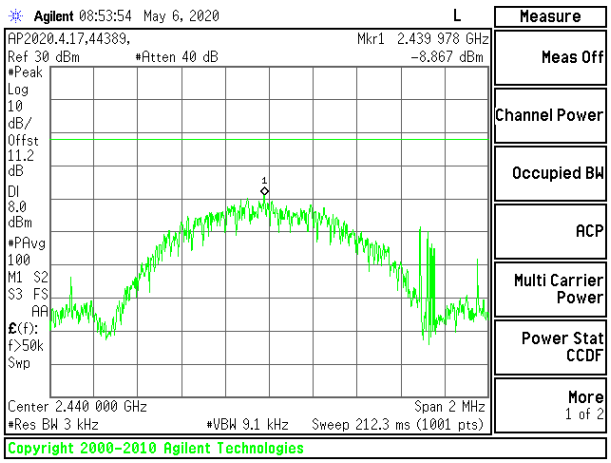
9.6.3. BLE (1Mbps)

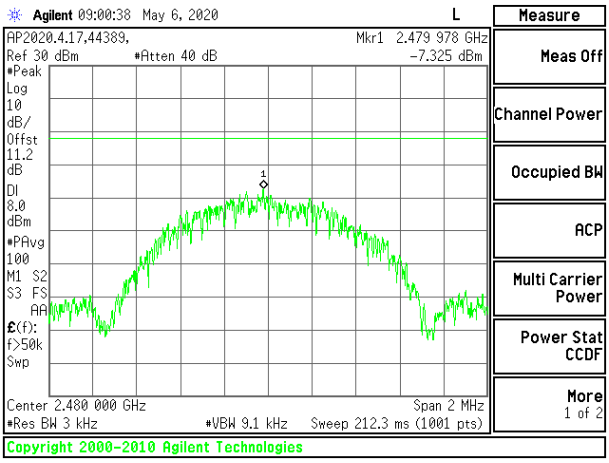
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-8.306	8	-16.31
Middle	2440	-8.867	8	-16.87
High	2480	-7.325	8	-15.33



LOW CHANNEL



MID CHANNEL



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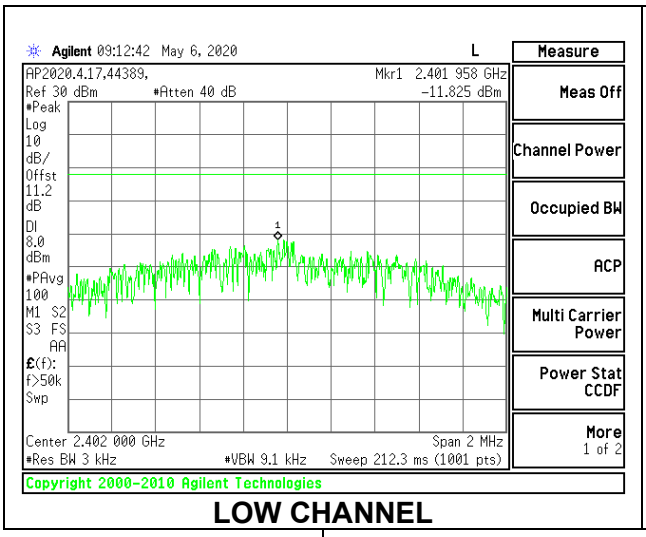
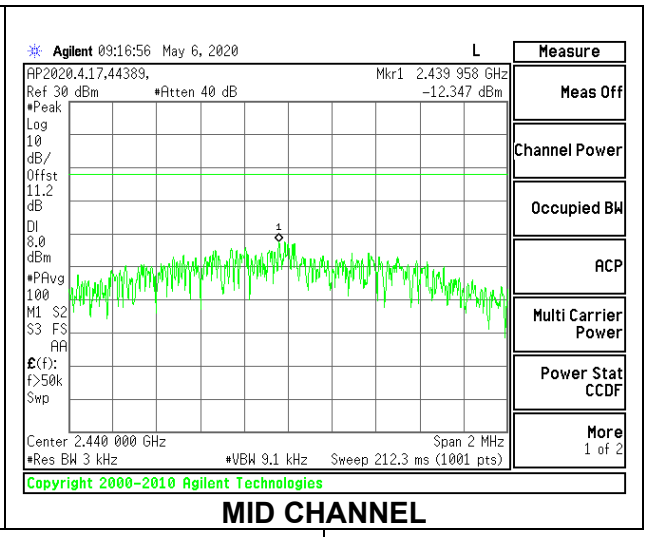
9.6.4. BLE (2Mbps)

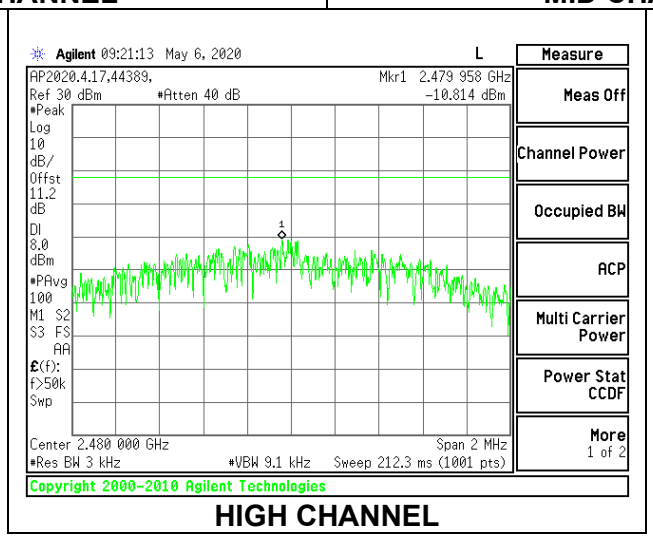
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-11.825	8	-19.83
Middle	2440	-12.347	8	-20.35
High	2480	-10.814	8	-18.81



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.

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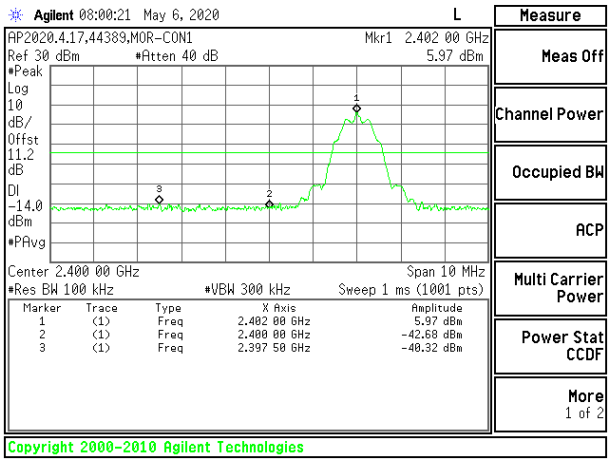
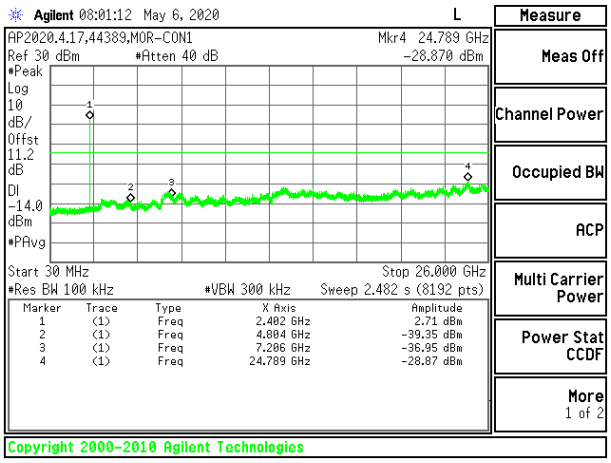
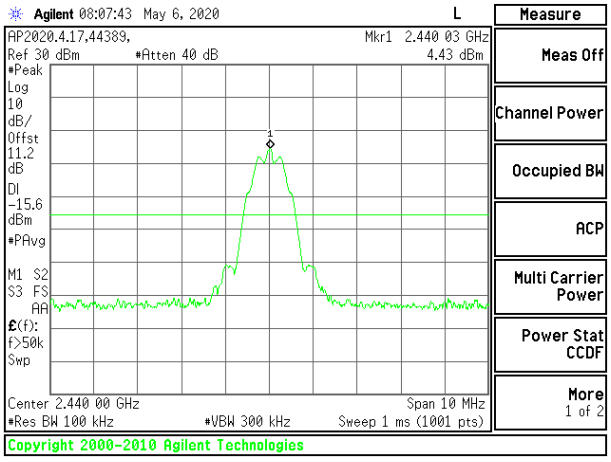
9.7.1. BLE (125Kbps)



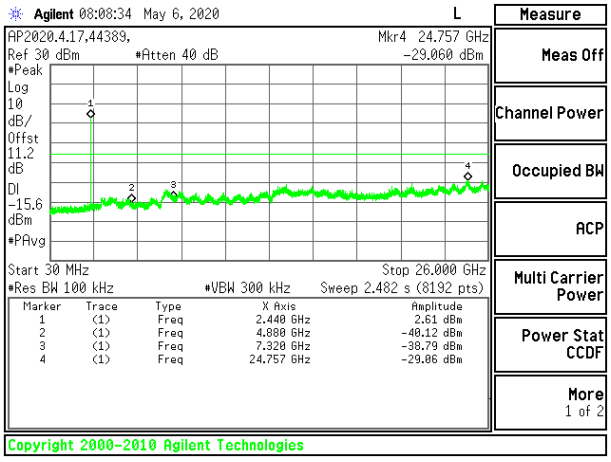
LOW CHANNEL BANDEDGE



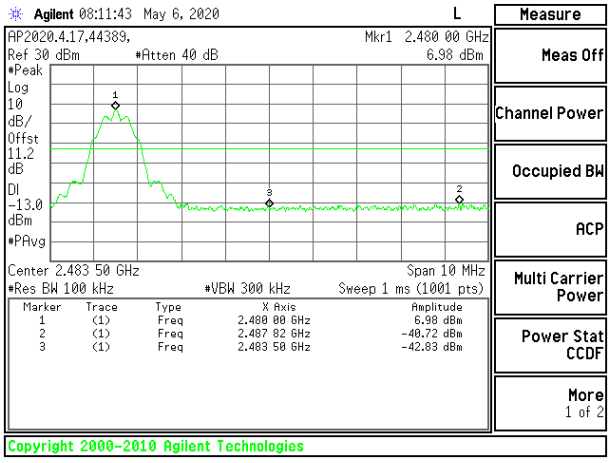
OUT-OF-BAND LOW CHANNEL



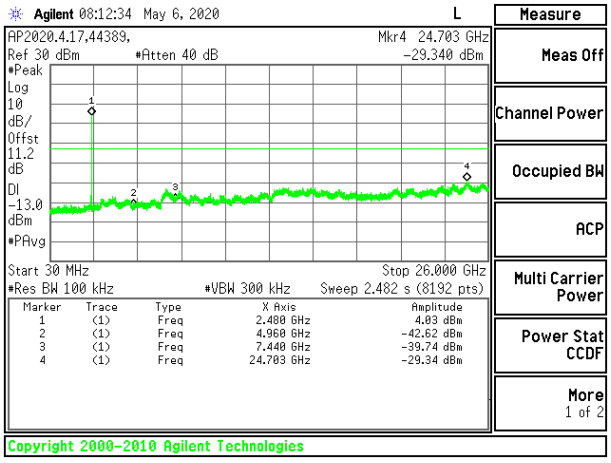
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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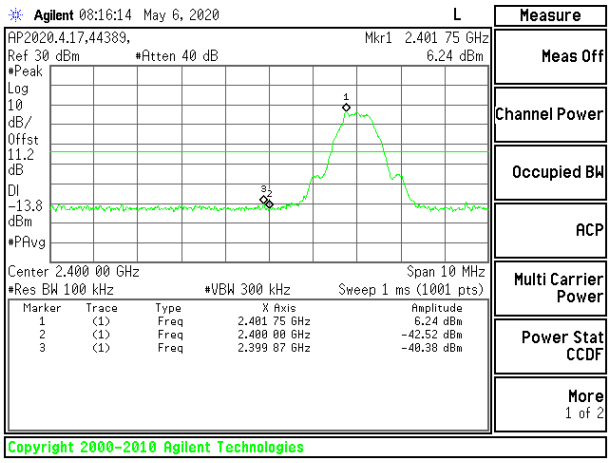
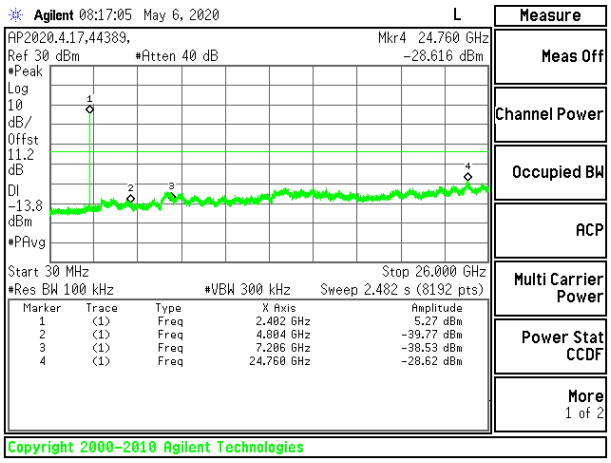
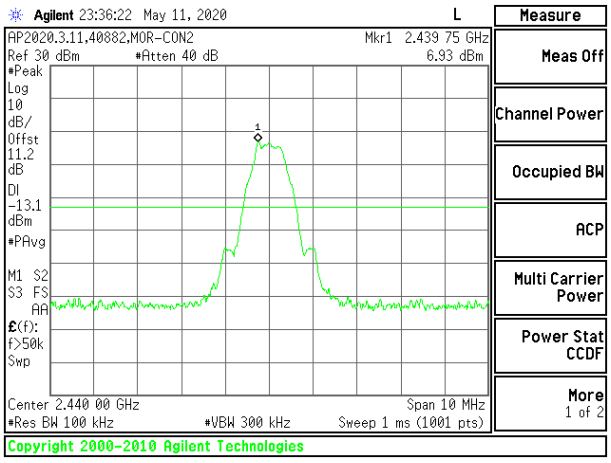
9.7.2. BLE (500Kbps)



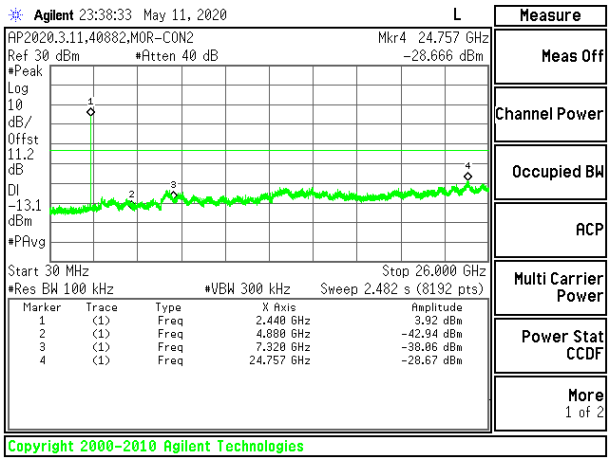
LOW CHANNEL BANDEDGE



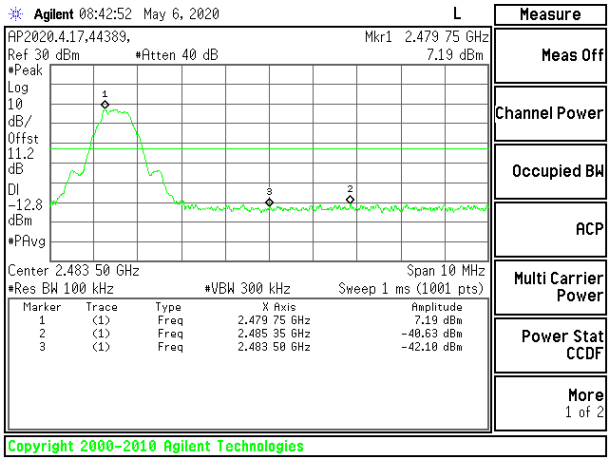
OUT-OF-BAND LOW CHANNEL



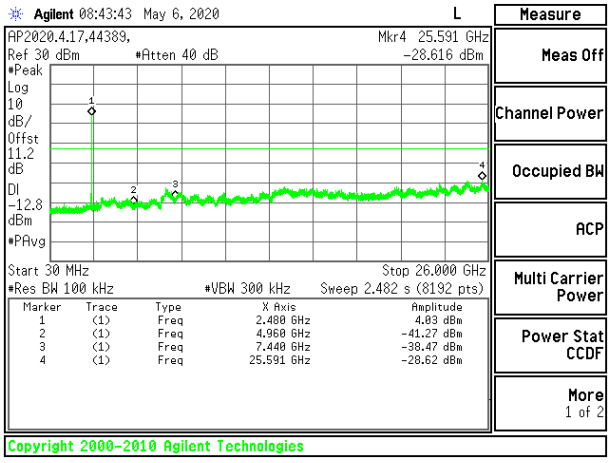
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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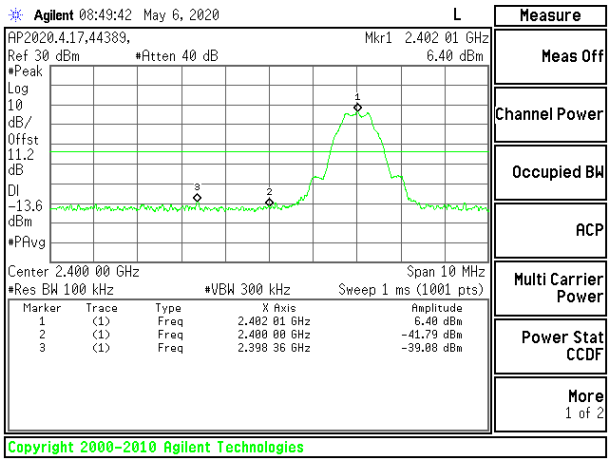
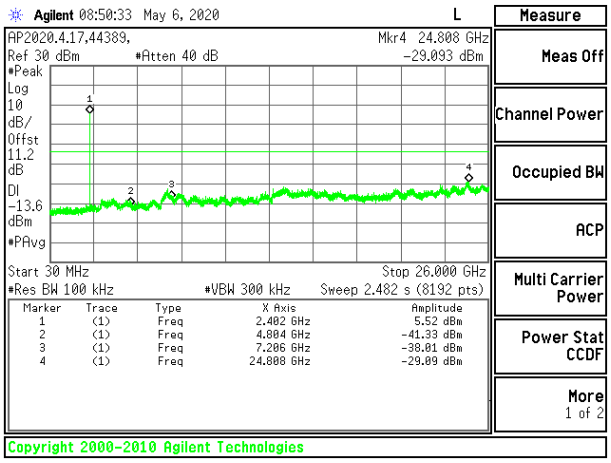
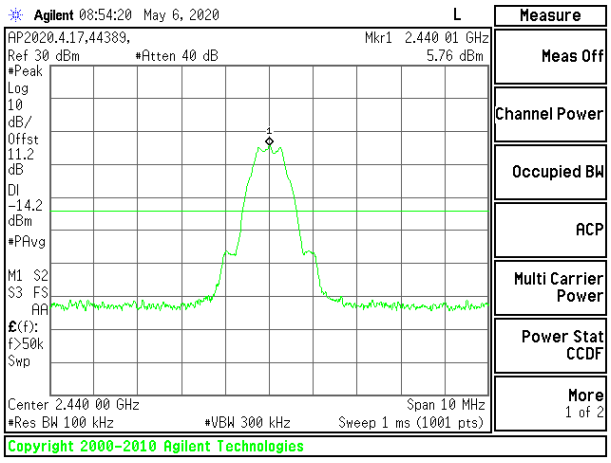
9.7.3. BLE (1Mbps)



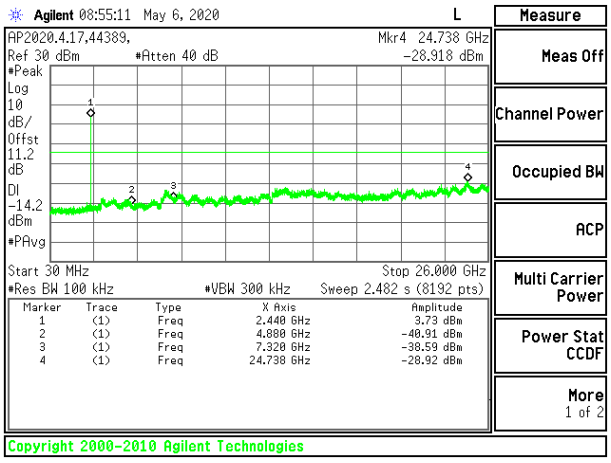
LOW CHANNEL BANDEDGE



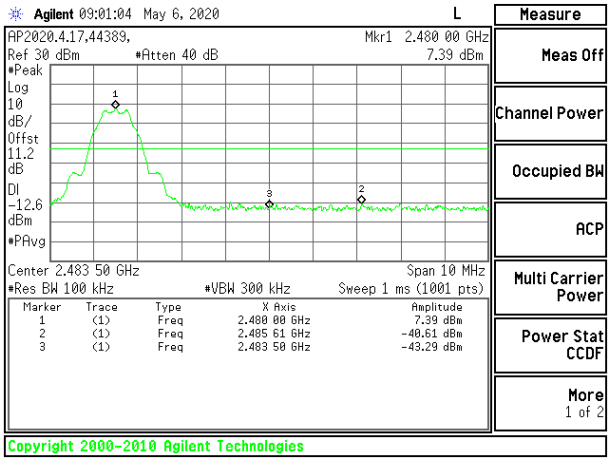
OUT-OF-BAND LOW CHANNEL



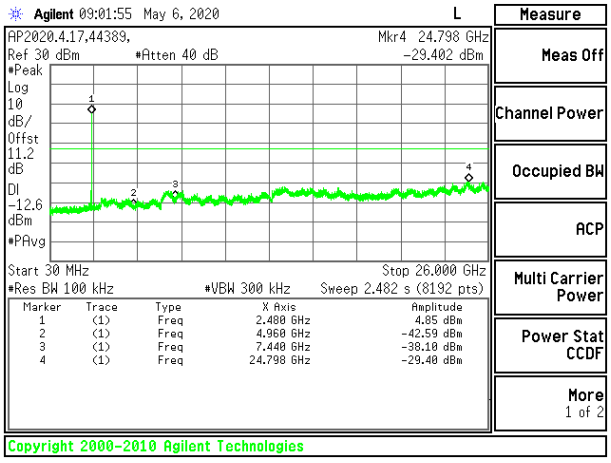
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



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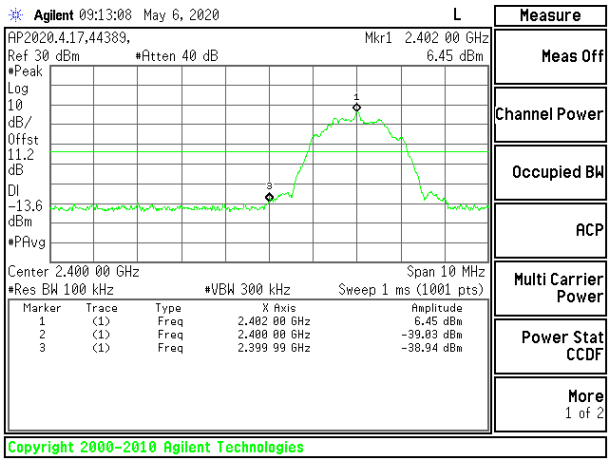
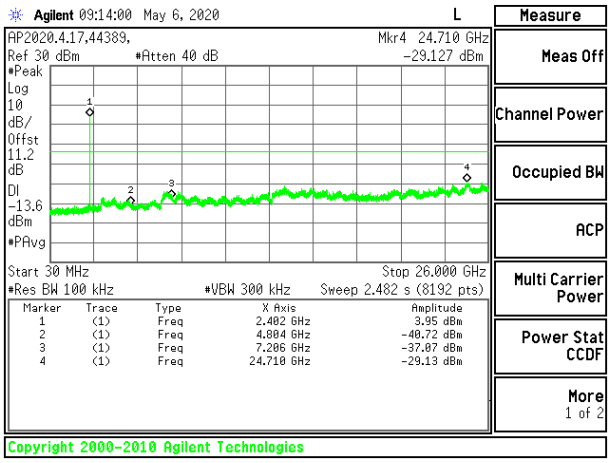
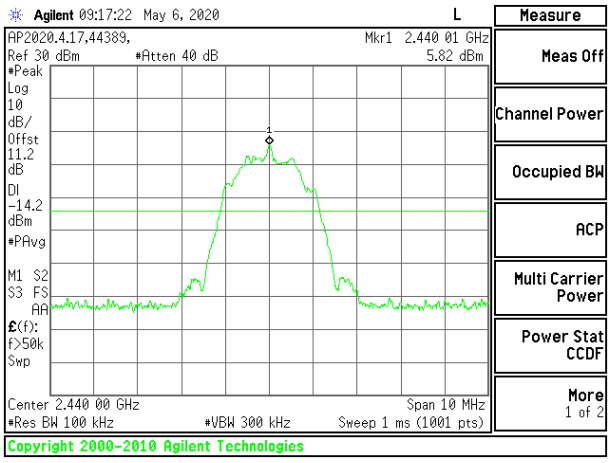
9.7.4. BLE (2Mbps)



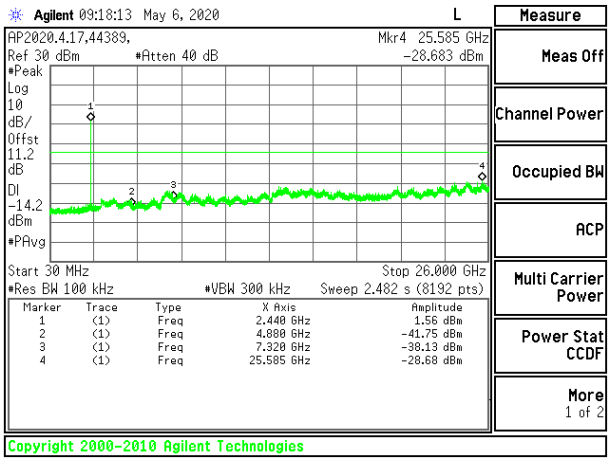
LOW CHANNEL BANDEDGE



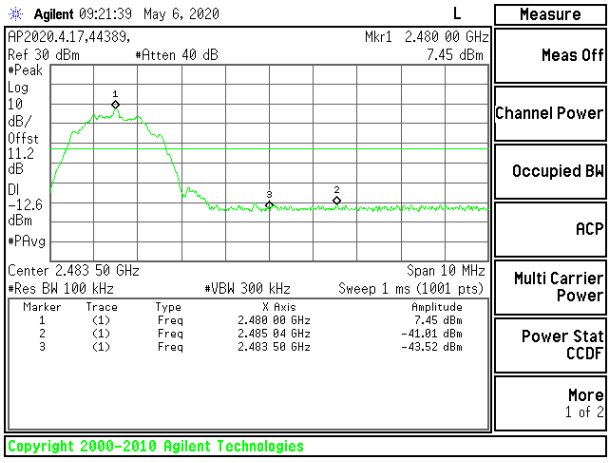
OUT-OF-BAND LOW CHANNEL



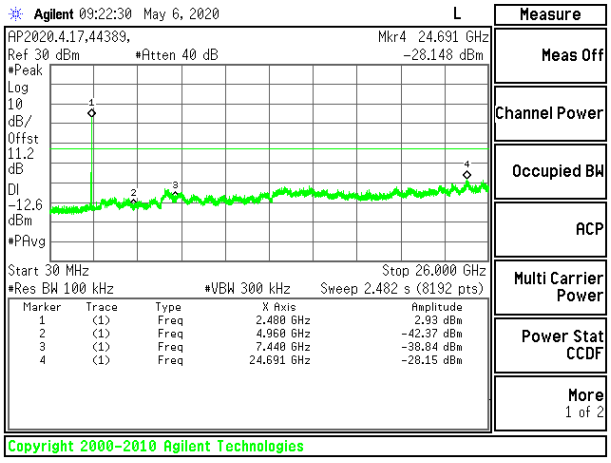
IN-BAND REFERENCE LEVEL



OUT-OF-BAND MID CHANNEL



HIGH CHANNEL BANDEDGE



OUT-OF-BAND HIGH CHANNEL

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10. RADIATED TEST RESULTS

10.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209
RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
0.009-0.490	2400/F(kHz) @ 300 m	-
0.490-1.705	24000/F(kHz) @ 30 m	-
1.705 - 30	30 @ 30m	-
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 1GHz; 1.5 m above the ground plane for measurement above 1GHz. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.10. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30-1000MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15-30MHz range and 200Hz for peak and/or quasi-peak detection measurements in the 9 to 150kHz range. Peak detection is used unless otherwise noted as quasi-peak.

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 30 KHz for peak measurements.

For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for average measurements, in this case voltage averaging used.

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

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

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

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

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

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

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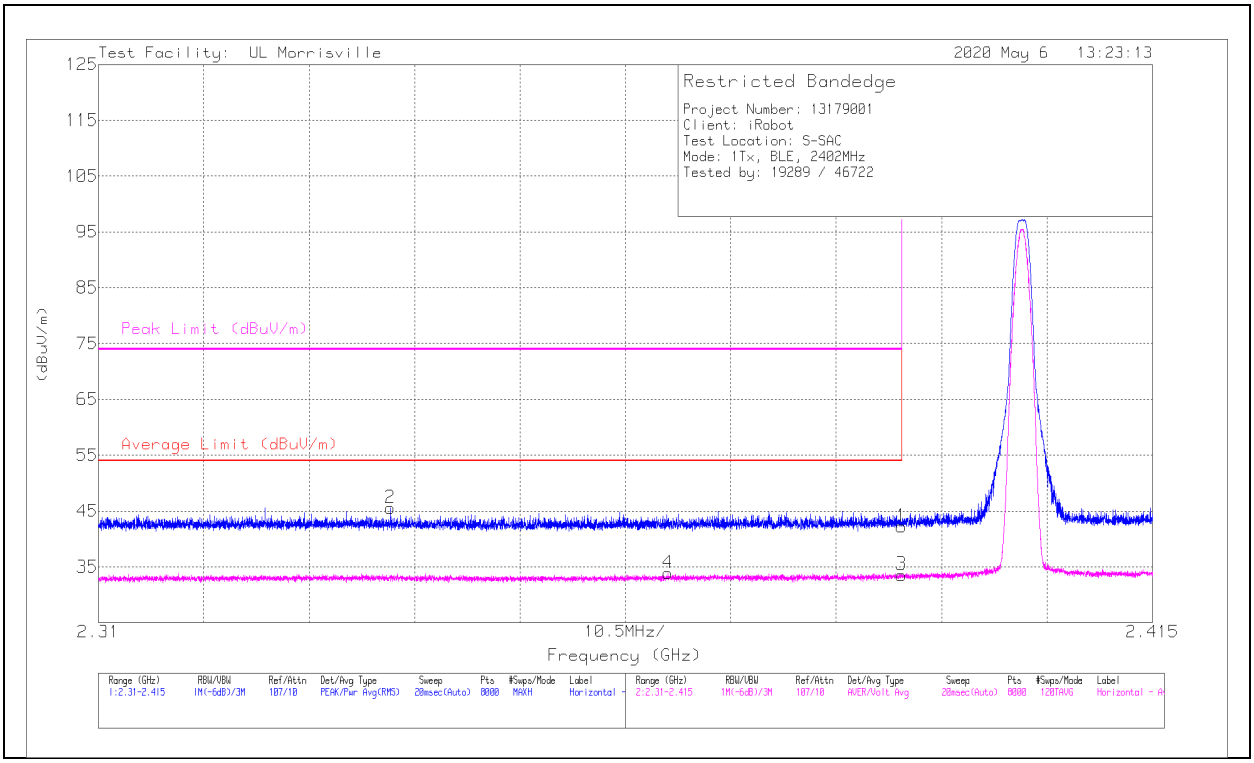
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (125Kbps)

EXTERNAL ANTENNA

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	34.24	Pk	32	-24	0	42.24	-	-	74	-31.76	30	167	H
2	* ** 2.33909	37.57	Pk	31.8	-23.8	0	45.57	-	-	74	-28.43	30	167	H
3	* ** 2.39	23.91	ADV	32	-24	1.65	33.56	54	-20.44	-	-	30	167	H
4	* ** 2.36675	24.21	ADV	31.9	-23.9	1.65	33.86	54	-20.14	-	-	30	167	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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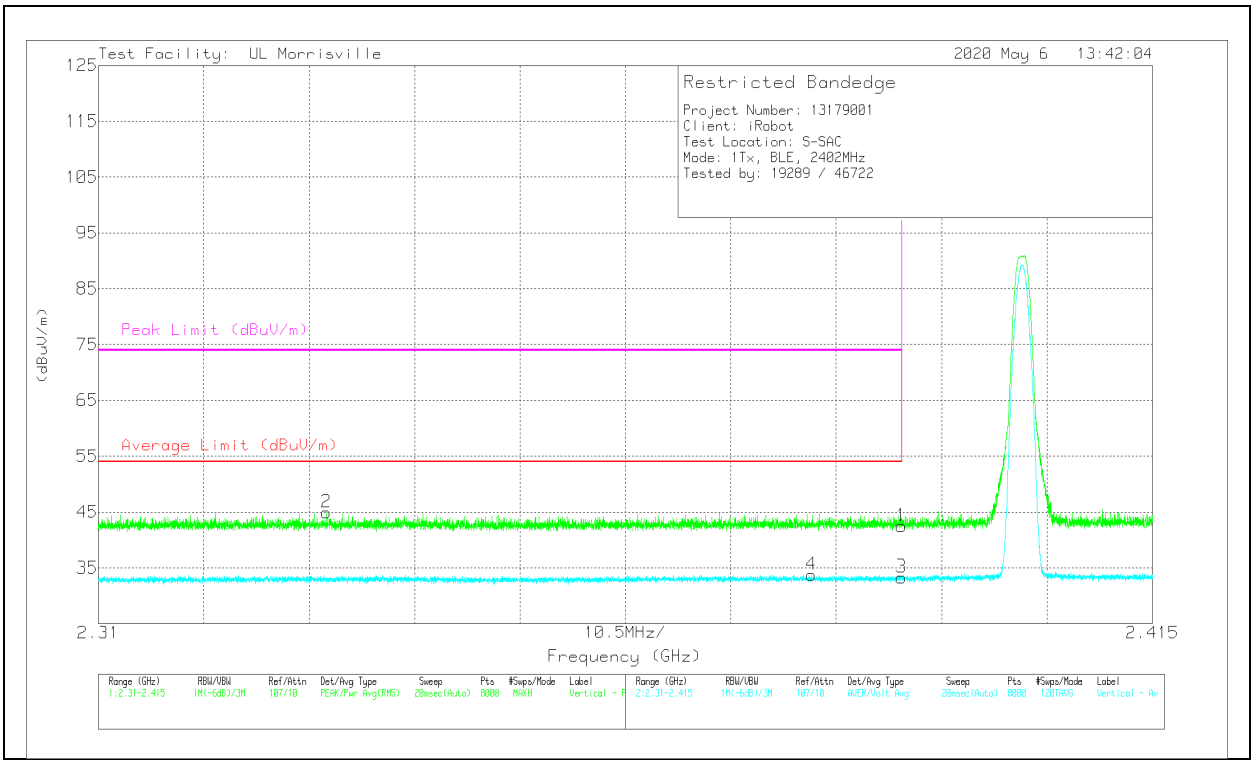
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	34.46	Pk	32	-24	0	42.46	-	-	74	-31.54	135	391	V
2	* ** 2.33271	36.84	Pk	31.8	-23.7	0	44.94	-	-	74	-29.06	135	391	V
3	* ** 2.39	23.64	ADV	32	-24	1.65	33.29	54	-20.71	-	-	135	391	V
4	* ** 2.38103	24.12	ADV	32	-24	1.65	33.77	54	-20.23	-	-	135	391	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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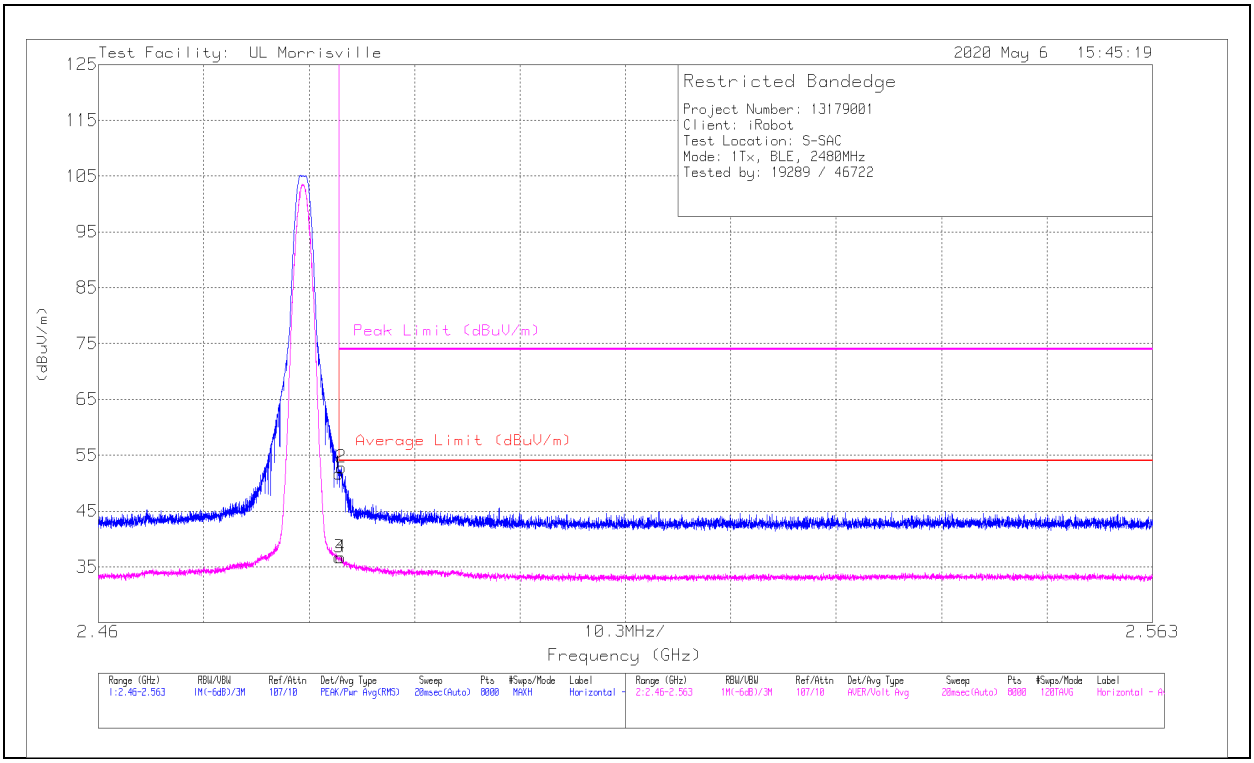
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	44.01	Pk	32.1	-24.4	0	51.71	-	-	74	-22.29	18	107	H
2	* ** 2.48376	45.07	Pk	32.1	-24.4	0	52.77	-	-	74	-21.23	18	107	H
3	* ** 2.4835	27.34	ADV	32.1	-24.4	1.65	36.69	54	-17.31	-	-	18	107	H
4	* ** 2.48367	27.36	ADV	32.1	-24.4	1.65	36.71	54	-17.29	-	-	18	107	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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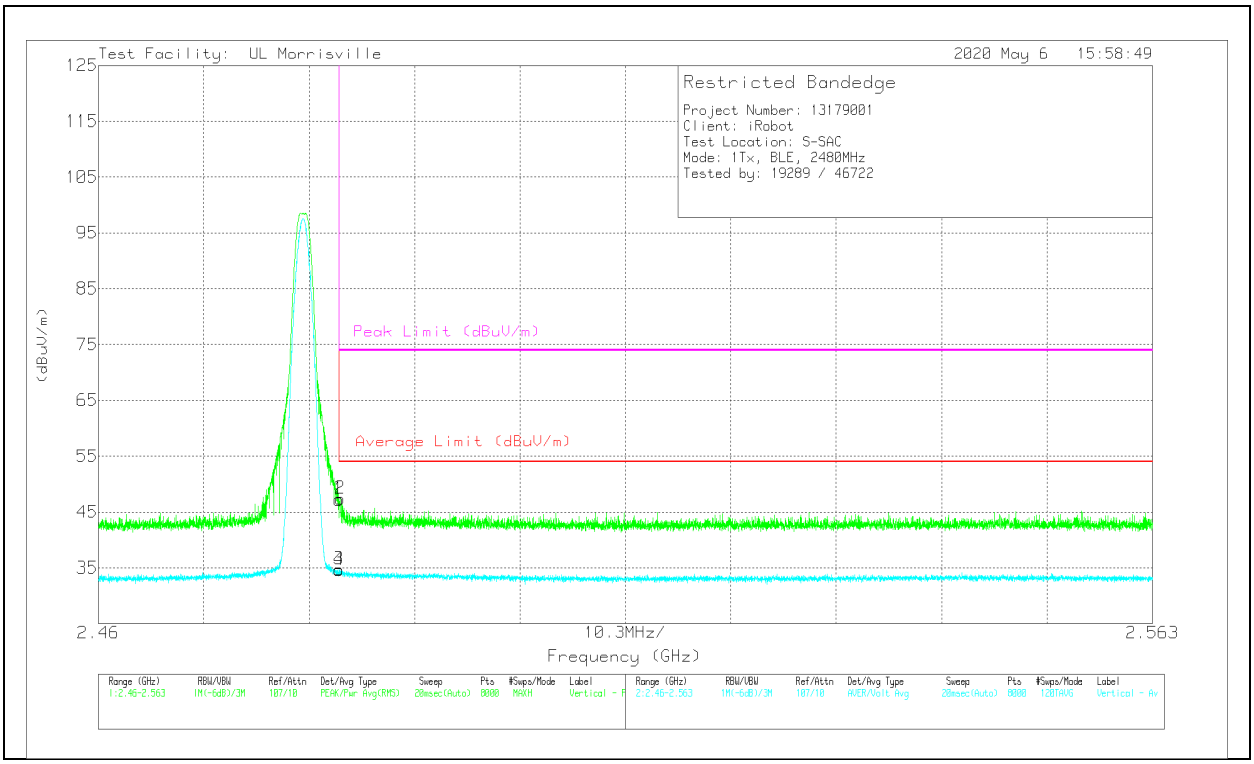
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	39.52	Pk	32.1	-24.4	0	47.22	-	-	74	-26.78	115	256	V
2	* ** 2.48363	39.71	Pk	32.1	-24.4	0	47.41	-	-	74	-26.59	115	256	V
3	* ** 2.4835	25.36	ADV	32.1	-24.4	1.65	34.71	54	-19.29	-	-	115	256	V
4	* ** 2.48353	25.29	ADV	32.1	-24.4	1.65	34.64	54	-19.36	-	-	115	256	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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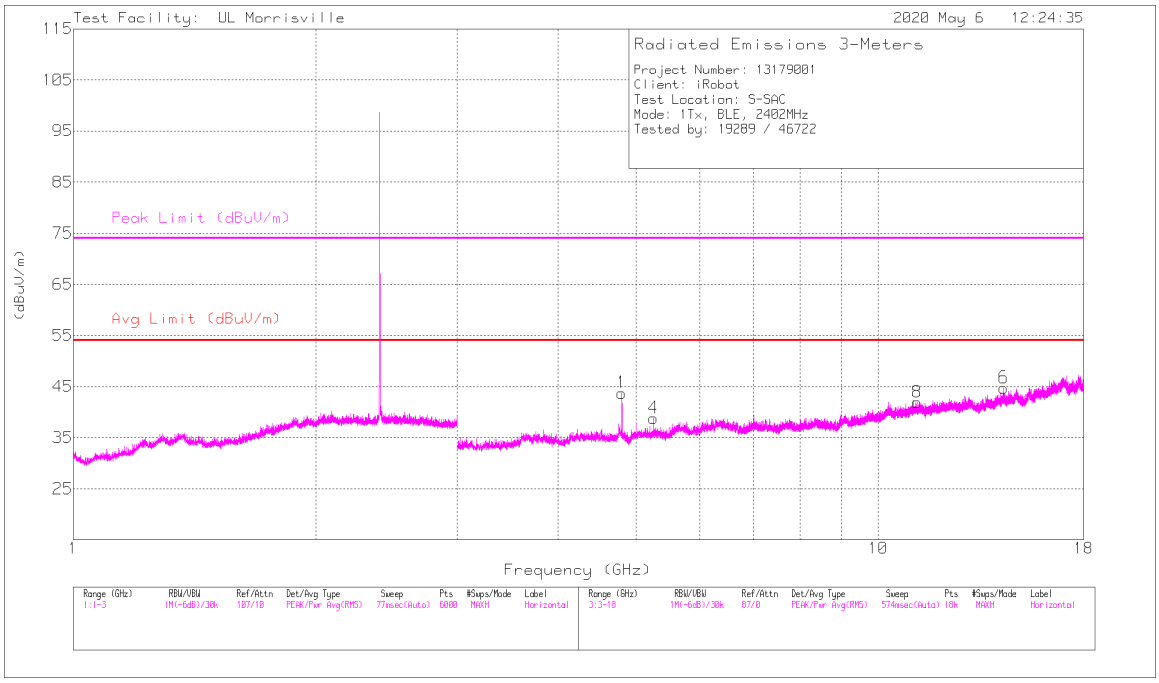
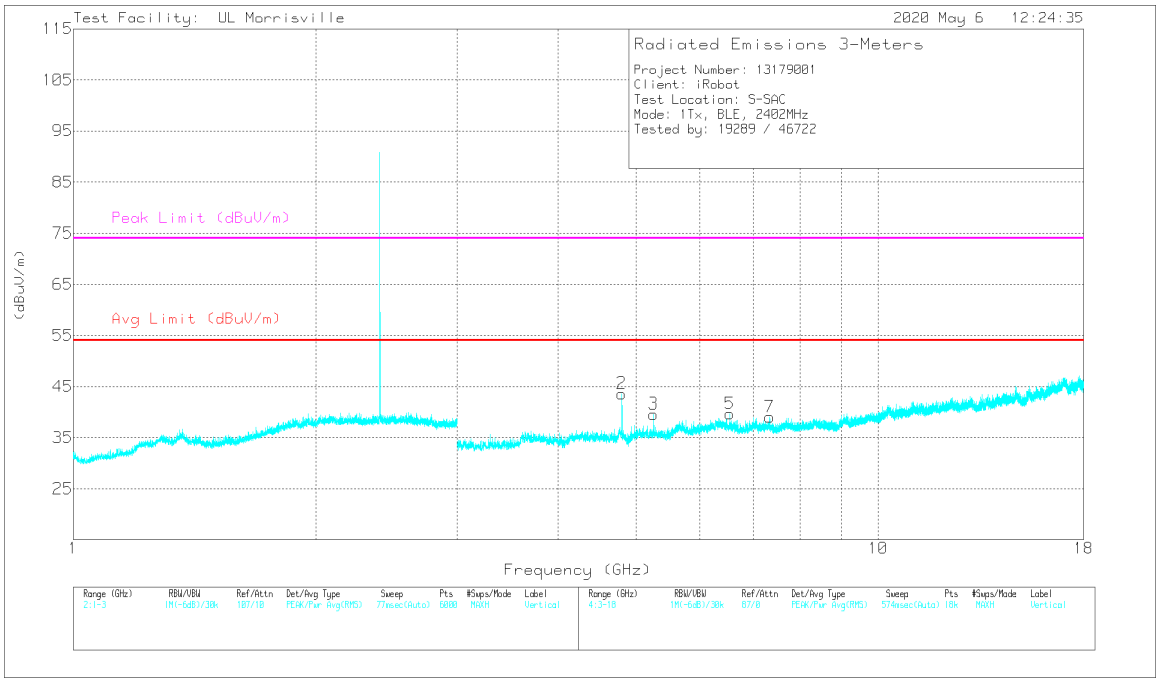
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	* ** 4.80455	47.57	PK2	33.9	-30.9	0	50.57	-	-	74	-23.43	84	111	H
	* ** 4.80424	39.25	ADV	33.9	-30.9	1.65	43.9	54	-10.1	-	-	84	111	H
8	* ** 11.18126	34.83	PK2	37.9	-24.4	0	48.33	-	-	74	-25.67	115	372	H
	* ** 11.18113	21.39	ADV	37.9	-24.4	1.65	36.54	54	-17.46	-	-	115	372	H
2	* ** 4.80447	47.2	PK2	33.9	-30.9	0	50.2	-	-	74	-23.8	121	228	V
	* ** 4.80394	37.67	ADV	33.9	-31	1.65	42.22	54	-11.78	-	-	121	228	V
7	* ** 7.33324	38.32	PK2	35.6	-27.6	0	46.32	-	-	74	-27.68	218	101	V
	* ** 7.33328	27.64	ADV	35.6	-27.6	1.65	37.29	54	-16.71	-	-	218	101	V
4	5.26096	34.54	Pk	34.3	-30	0	38.84	-	-	-	-	0-360	199	H
3	5.26179	35.31	Pk	34.3	-30	0	39.61	-	-	-	-	0-360	199	V
5	6.54437	33.4	Pk	35.5	-29.2	0	39.7	-	-	-	-	0-360	199	V
6	14.32147	29.16	Pk	39.1	-23.5	0	44.76	-	-	-	-	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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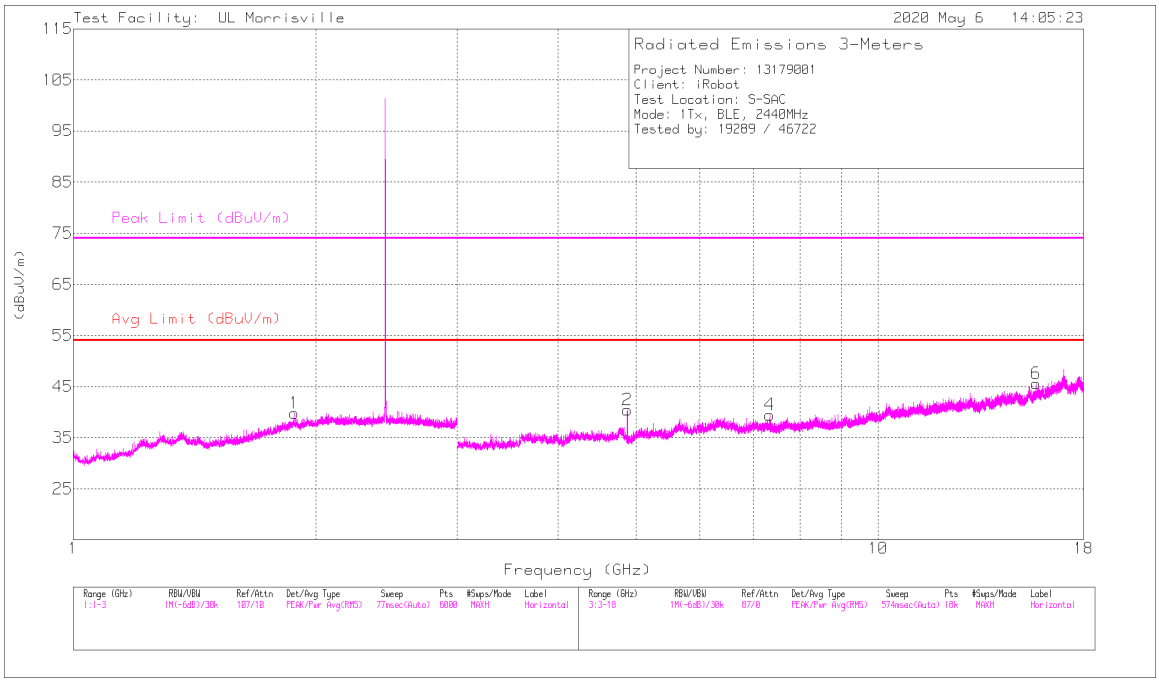
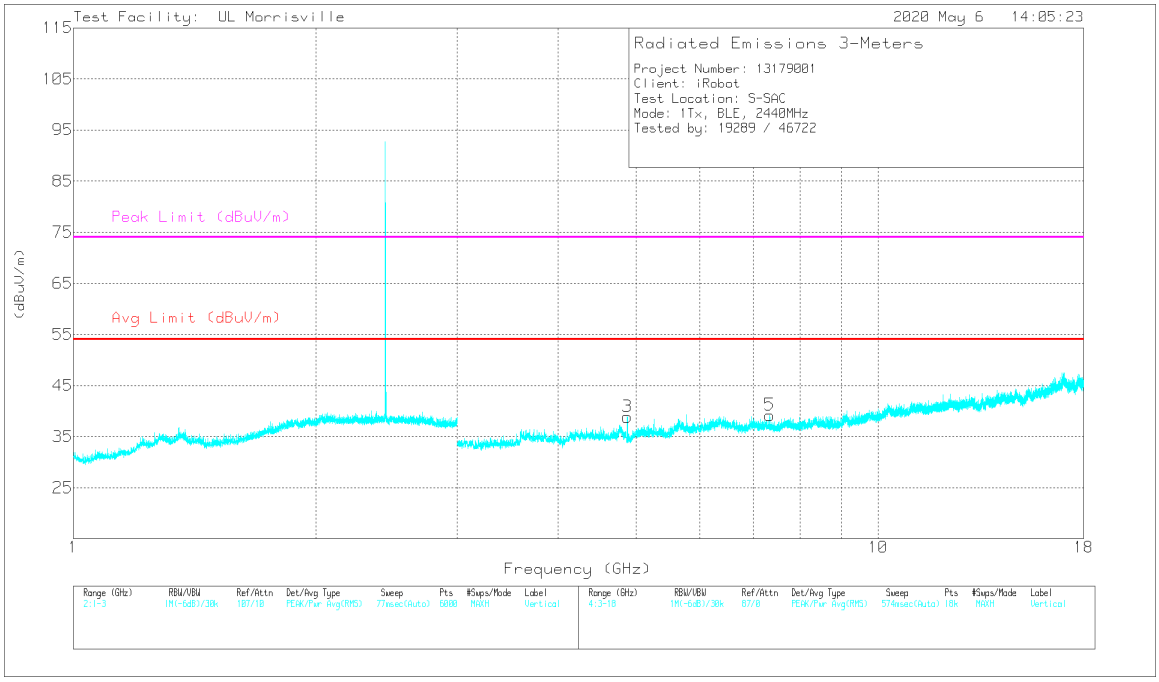
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	* ** 4.87955	44.48	PK2	33.8	-31	0	47.28	-	-	74	-26.72	88	104	H
	* ** 4.88016	34.49	ADV	33.8	-31	1.65	38.94	54	-15.06	-	-	88	104	H
4	* ** 7.33331	38.03	PK2	35.6	-27.6	0	46.03	-	-	74	-27.97	7	114	H
	* ** 7.33327	27.2	ADV	35.6	-27.6	1.65	36.85	54	-17.15	-	-	7	114	H
6	* ** 15.72165	35.33	PK2	40.1	-23.6	0	51.83	-	-	74	-22.17	148	156	H
	* ** 15.72132	21.39	ADV	40.1	-23.6	1.65	39.54	54	-14.46	-	-	148	156	H
3	* ** 4.88067	43.74	PK2	33.8	-31	0	46.54	-	-	74	-27.46	113	221	V
	* ** 4.88027	32.75	ADV	33.8	-31	1.65	37.2	54	-16.8	-	-	113	221	V
5	* ** 7.33303	38.52	PK2	35.6	-27.6	0	46.52	-	-	74	-27.48	216	115	V
	* ** 7.33332	27.36	ADV	35.6	-27.6	1.65	37.01	54	-16.99	-	-	216	115	V
1	1.88131	30.93	Pk	31.3	-22.4	0	39.83	-	-	-	-	0-360	101	H

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

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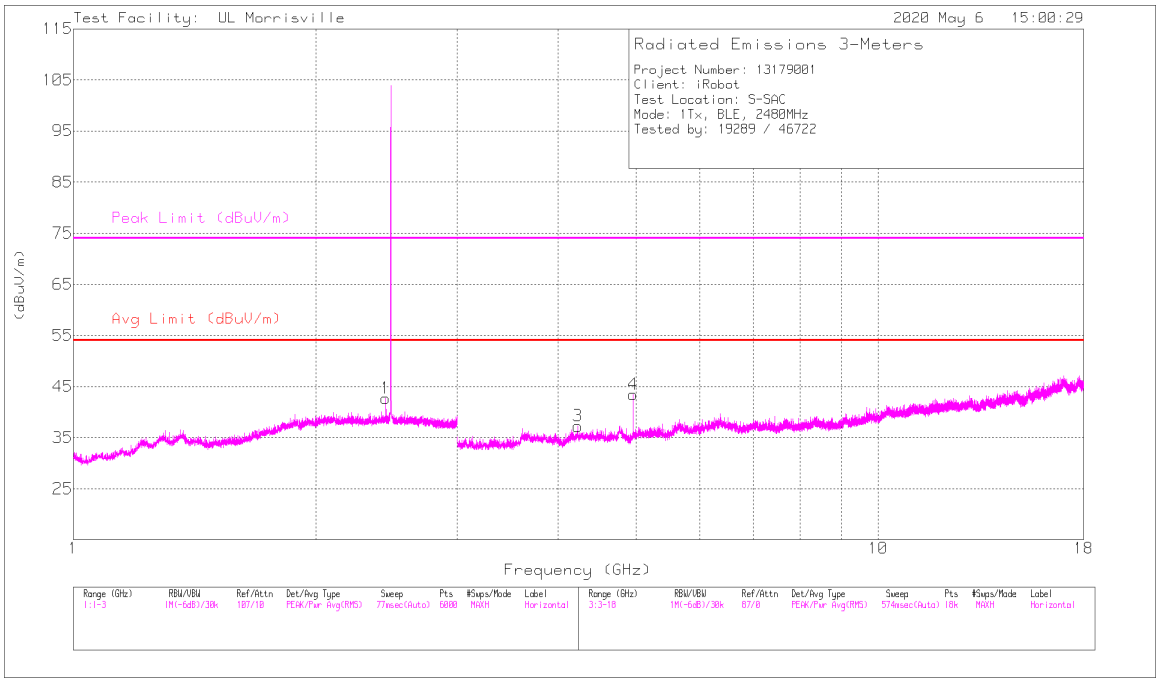
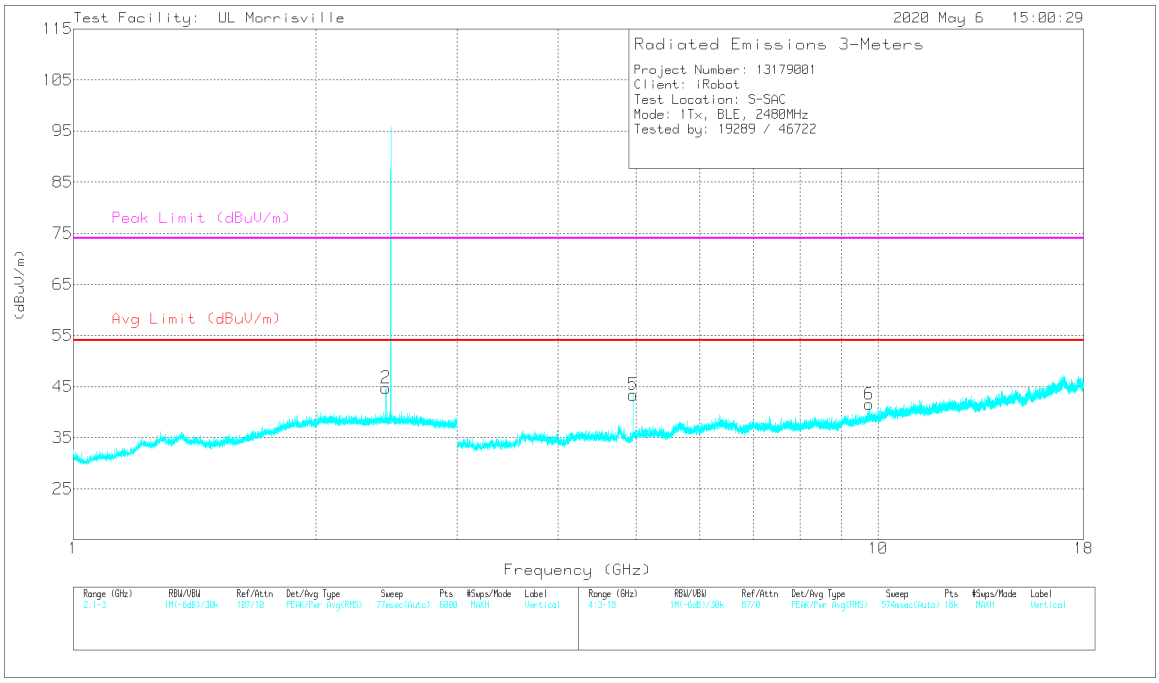
HIGH CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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
3	* ** 4.23506	40.32	PK2	33.5	-31	0	42.82	-	-	74	-31.18	235	308	H
	* ** 4.23621	27.28	ADV	33.5	-31	1.65	31.43	54	-22.57	-	-	235	308	H
4	* ** 4.95956	46.28	PK2	34	-31.1	0	49.18	-	-	74	-24.82	213	126	H
	* ** 4.95986	36.44	ADV	34	-31.1	1.65	40.99	54	-13.01	-	-	213	126	H
5	* ** 4.96044	46.22	PK2	34	-31.1	0	49.12	-	-	74	-24.88	115	227	V
	* ** 4.95998	36.87	ADV	34	-31.1	1.65	41.42	54	-12.58	-	-	115	227	V
1	2.44491	34.79	Pk	32.1	-24.2	0	42.69	-	-	-	-	0-360	199	H
2	2.44558	36.85	Pk	32.1	-24.2	0	44.75	-	-	-	-	0-360	101	V
6	9.74538	30.53	Pk	36.7	-25.7	0	41.53	-	-	-	-	0-360	101	V

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

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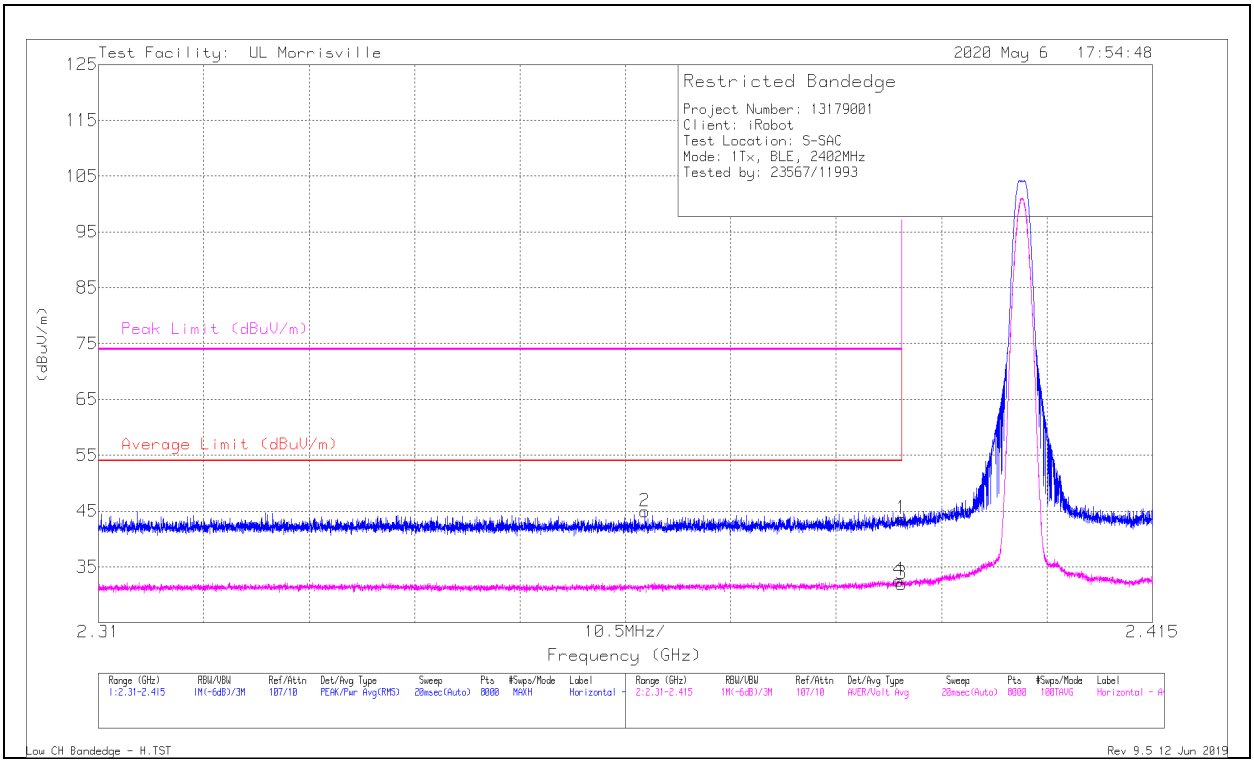
PCB ANTENNA

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	35.62	Pk	32	-24	0	43.62	-	-	74	-30.38	76	115	H
2	* ** 2.36441	36.96	Pk	31.9	-23.9	0	44.96	-	-	74	-29.04	76	115	H
3	* ** 2.39	22.34	ADV	32	-24	1.63	31.97	54	-22.03	-	-	76	115	H
4	* ** 2.38975	22.95	ADV	32	-24	1.63	32.58	54	-21.42	-	-	76	115	H

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ADV - Linear Voltage Average

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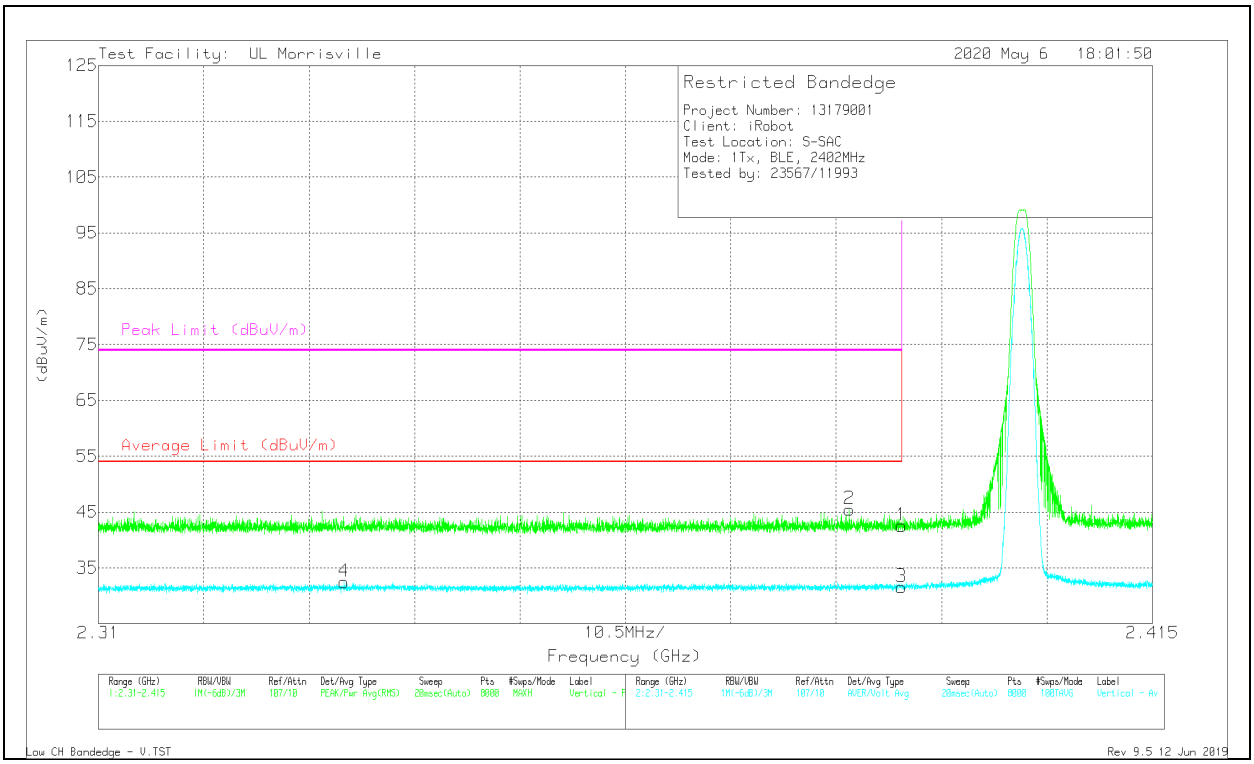
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	34.55	Pk	32	-24	0	42.55	-	-	74	-31.45	352	387	V
2	* ** 2.38481	37.49	Pk	32	-24	0	45.49	-	-	74	-28.51	352	387	V
3	* ** 2.39	21.95	ADV	32	-24	1.63	31.58	54	-22.42	-	-	352	387	V
4	* ** 2.33446	22.75	ADV	31.8	-23.7	1.63	32.48	54	-21.52	-	-	352	387	V

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Pk - Peak detector
ADV - Linear Voltage Average

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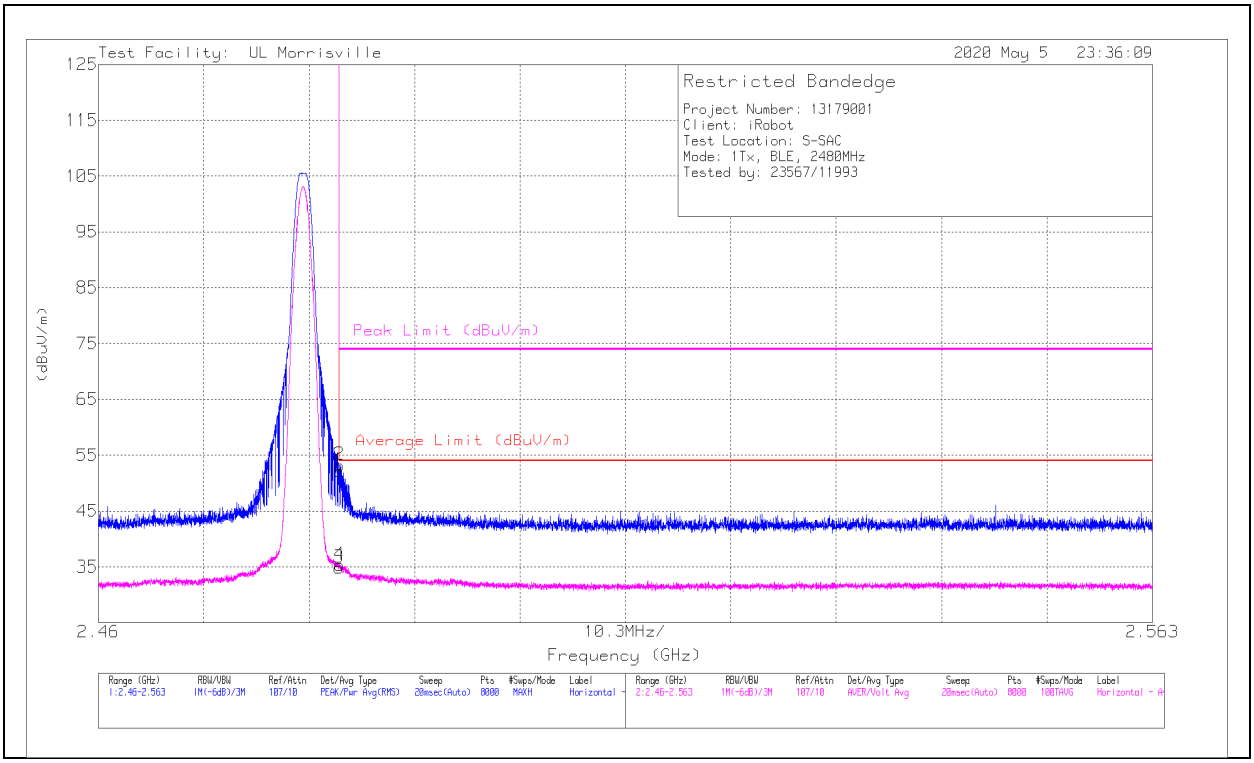
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	44.52	Pk	32.1	-24.4	0	52.22	-	-	74	-21.78	78	116	H
2	* ** 2.48354	45.53	Pk	32.1	-24.4	0	53.23	-	-	74	-20.77	78	116	H
3	* ** 2.4835	25.51	ADV	32.1	-24.4	1.63	34.84	54	-19.16	-	-	78	116	H
4	* ** 2.48358	26.02	ADV	32.1	-24.4	1.63	35.35	54	-18.65	-	-	78	116	H

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ADV - Linear Voltage Average

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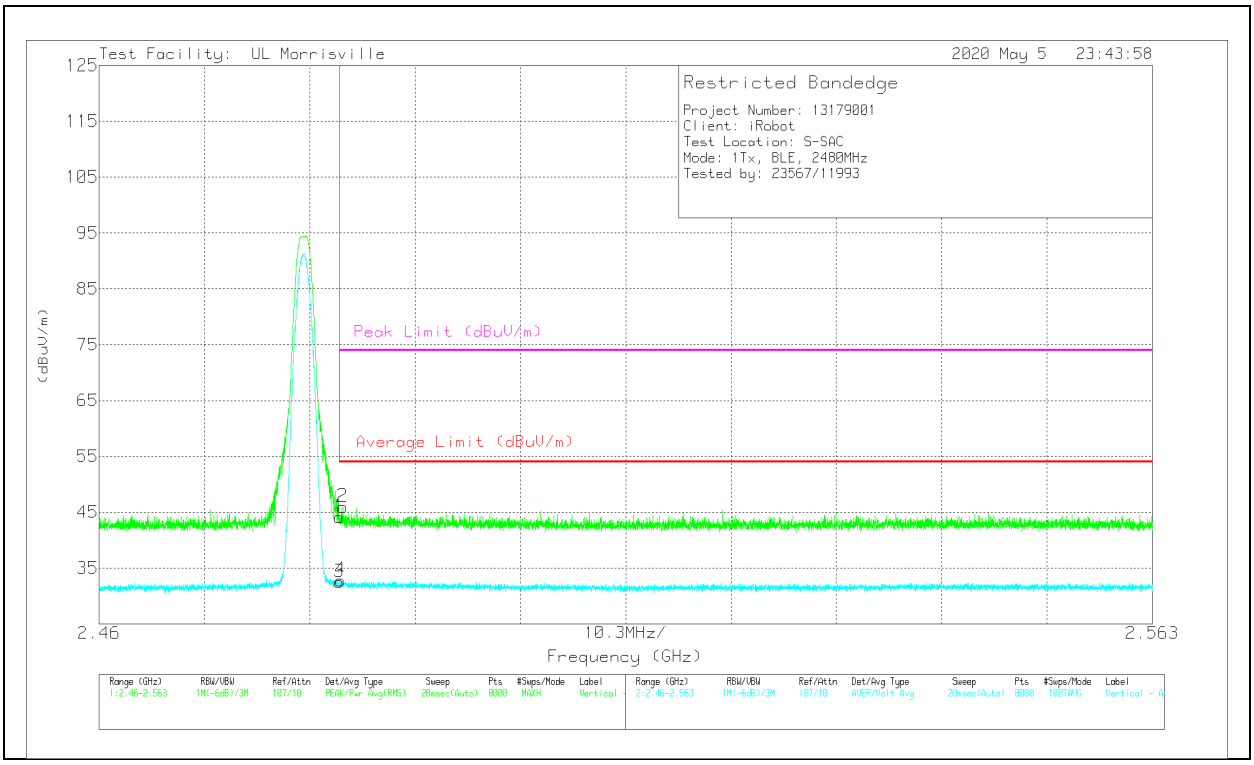
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	36.45	Pk	32.1	-24.4	0	44.15	-	-	74	-29.85	306	355	V
2	* ** 2.48382	38.27	Pk	32.1	-24.4	0	45.97	-	-	74	-28.03	306	355	V
3	* ** 2.4835	23.2	ADV	32.1	-24.4	1.63	32.53	54	-21.47	-	-	306	355	V
4	* ** 2.48362	23.48	ADV	32.1	-24.4	1.63	32.81	54	-21.19	-	-	306	355	V

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Pk - Peak detector
ADV - Linear Voltage Average

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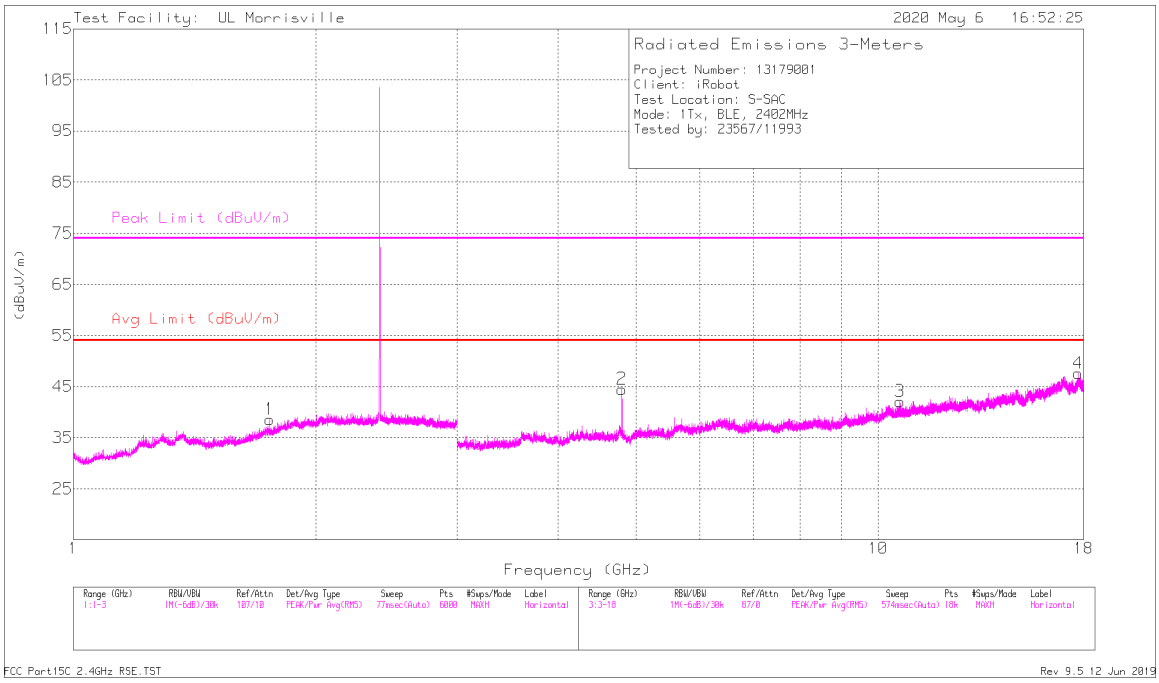
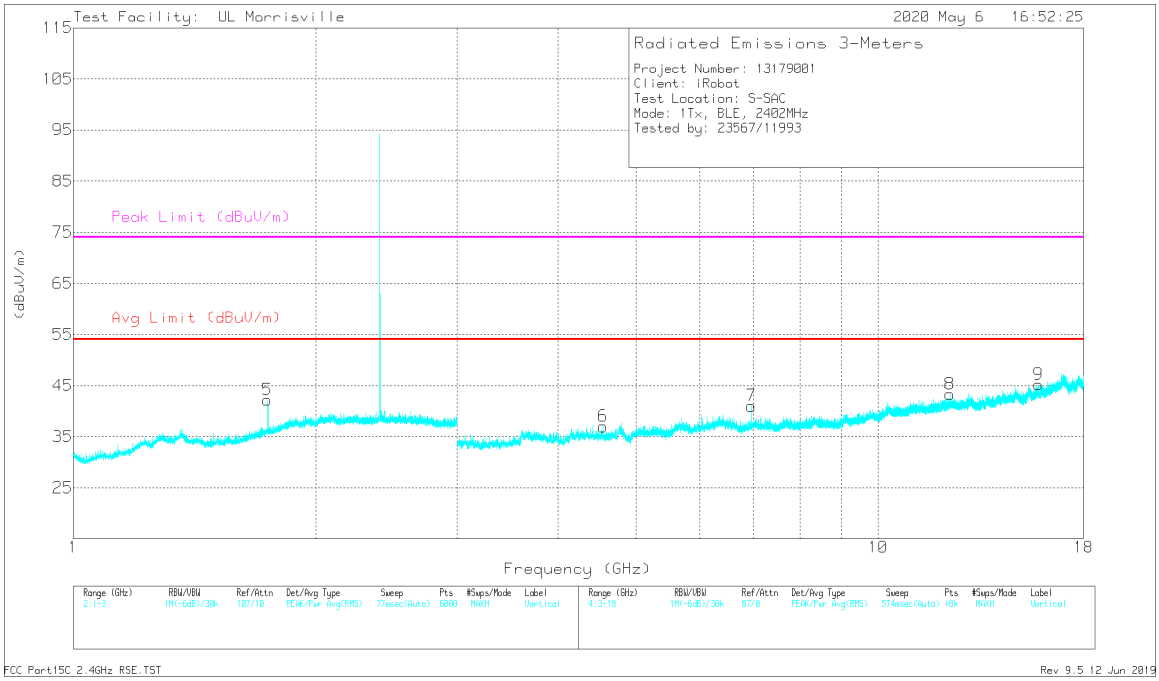
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	** 1.75529	35.25	PK2	29.8	-22.3	0	42.75	-	-	74	-31.25	204	389	H
	** 1.75301	22.52	ADV	29.8	-22.3	1.63	31.65	54	-22.35	-	-	204	389	H
5	** 1.74208	35.58	PK2	29.8	-22.2	0	43.18	-	-	74	-30.82	128	315	V
	** 1.7413	22.58	ADV	29.8	-22.2	1.63	31.81	54	-22.19	-	-	128	315	V
2	* ** 4.80438	47.05	PK2	33.9	-30.9	0	50.05	-	-	74	-23.95	356	101	H
	* ** 4.80385	37.48	ADV	33.9	-31	1.63	42.01	54	-11.99	-	-	356	101	H
3	* ** 10.6459	34.28	PK2	37.7	-24.7	0	47.28	-	-	74	-26.72	275	178	H
	* ** 10.64668	21.42	ADV	37.7	-24.7	1.63	36.05	54	-17.95	-	-	275	178	H
4	* ** 17.72955	35.1	PK2	41	-22.4	0	53.7	-	-	74	-20.3	336	306	H
	* ** 17.72879	21.88	ADV	41	-22.4	1.63	42.11	54	-11.89	-	-	336	306	H
6	* ** 4.55338	40.99	PK2	33.8	-31.4	0	43.39	-	-	74	-30.61	241	371	V
	* ** 4.55362	27.2	ADV	33.8	-31.4	1.63	31.23	54	-22.77	-	-	241	371	V
8	* ** 12.27996	34.1	PK2	38.8	-24.2	0	48.7	-	-	74	-25.3	277	102	V
	* ** 12.27988	21.19	ADV	38.8	-24.2	1.63	37.42	54	-16.58	-	-	277	102	V
9	* ** 15.81735	34.41	PK2	40.2	-23.7	0	50.91	-	-	74	-23.09	322	290	V
	* ** 15.8176	21.39	ADV	40.2	-23.7	1.63	39.52	54	-14.48	-	-	322	290	V
7	6.95939	33.41	Pk	35.5	-27.9	0	41.01	-	-	-	-	0-360	101	V

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

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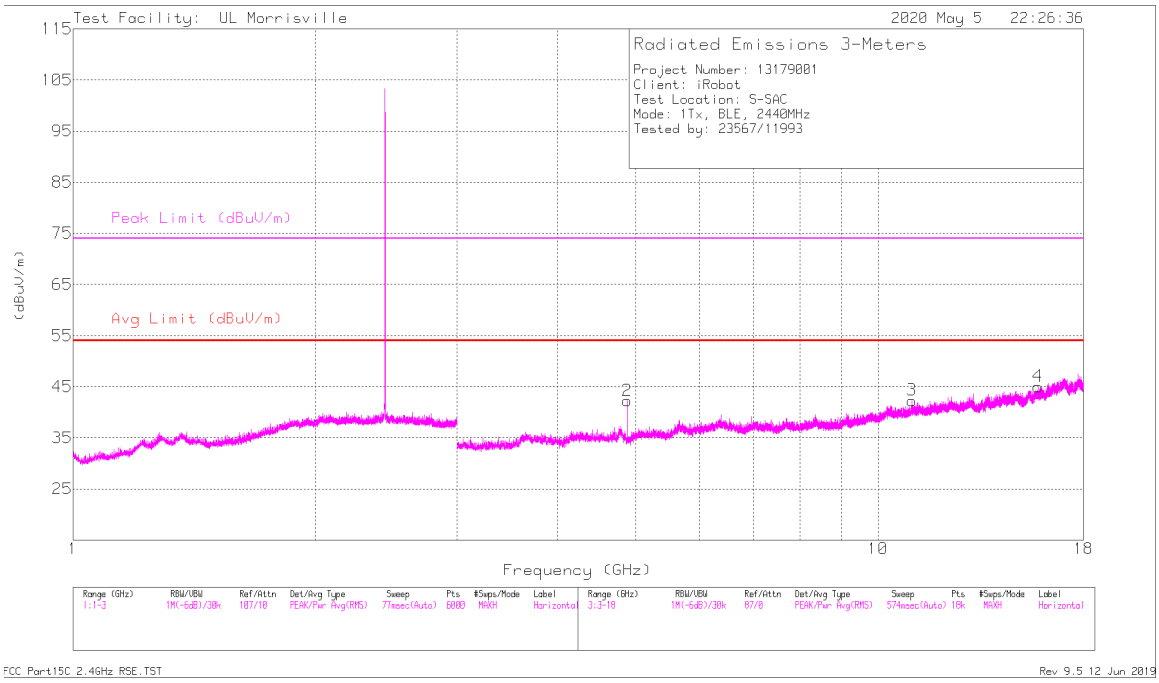
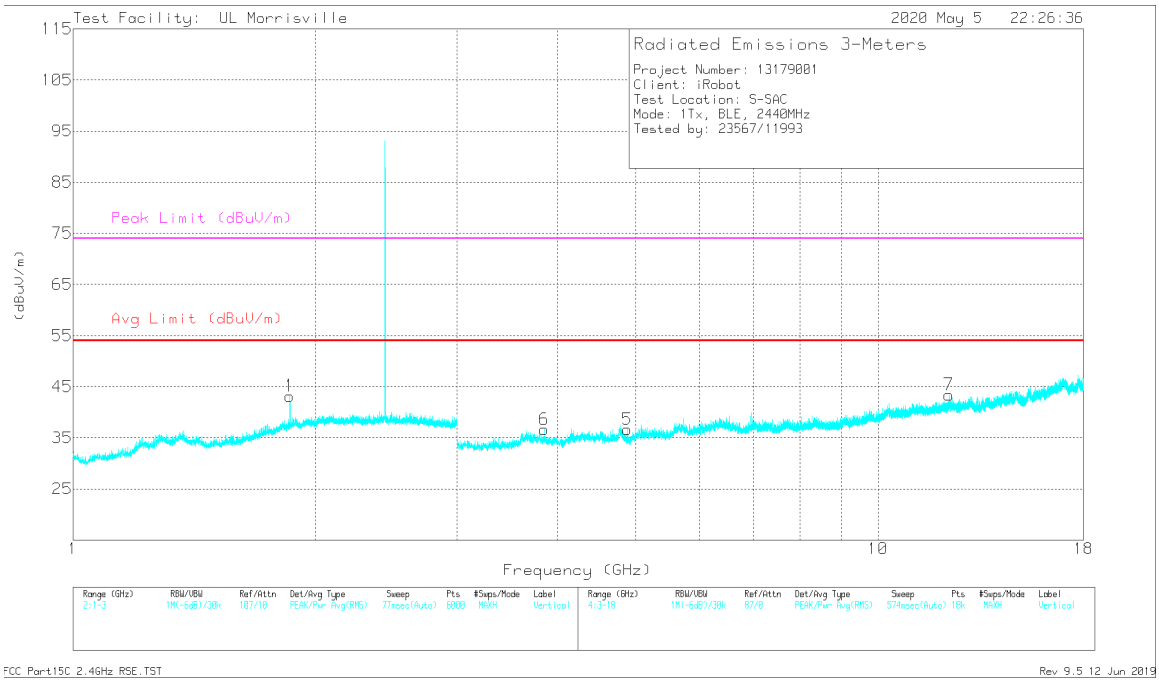
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	** 1.85885	35.42	PK2	31.2	-22.2	0	44.42	-	-	74	-29.58	200	212	V
	** 1.85902	22.41	ADV	31.2	-22.2	1.63	33.04	54	-20.96	-	-	200	212	V
2	* ** 4.87959	44.64	PK2	33.8	-31	0	47.44	-	-	74	-26.56	354	109	H
	* ** 4.88005	35.29	ADV	33.8	-31	1.63	39.72	54	-14.28	-	-	354	109	H
3	* ** 11.01627	34.61	PK2	37.8	-24.3	0	48.11	-	-	74	-25.89	82	167	H
	* ** 11.01546	21.32	ADV	37.8	-24.3	1.63	36.45	54	-17.55	-	-	82	167	H
4	* ** 15.80553	34.46	PK2	40.2	-23.5	0	51.16	-	-	74	-22.84	312	215	H
	* ** 15.80423	21.42	ADV	40.2	-23.4	1.63	39.85	54	-14.15	-	-	312	215	H
5	* ** 4.88037	44.07	PK2	33.8	-31	0	46.87	-	-	74	-27.13	165	338	V
	* ** 4.88004	34.1	ADV	33.8	-31	1.63	38.53	54	-15.47	-	-	165	338	V
6	* ** 3.84988	41.18	PK2	33.1	-32	0	42.28	-	-	74	-31.72	30	176	V
	* ** 3.84955	28.08	ADV	33.1	-32	1.63	30.81	54	-23.19	-	-	30	176	V
7	* ** 12.24733	34.03	PK2	38.8	-24.3	0	48.53	-	-	74	-25.47	327	109	V
	* ** 12.24771	21.11	ADV	38.8	-24.2	1.63	37.34	54	-16.66	-	-	327	109	V

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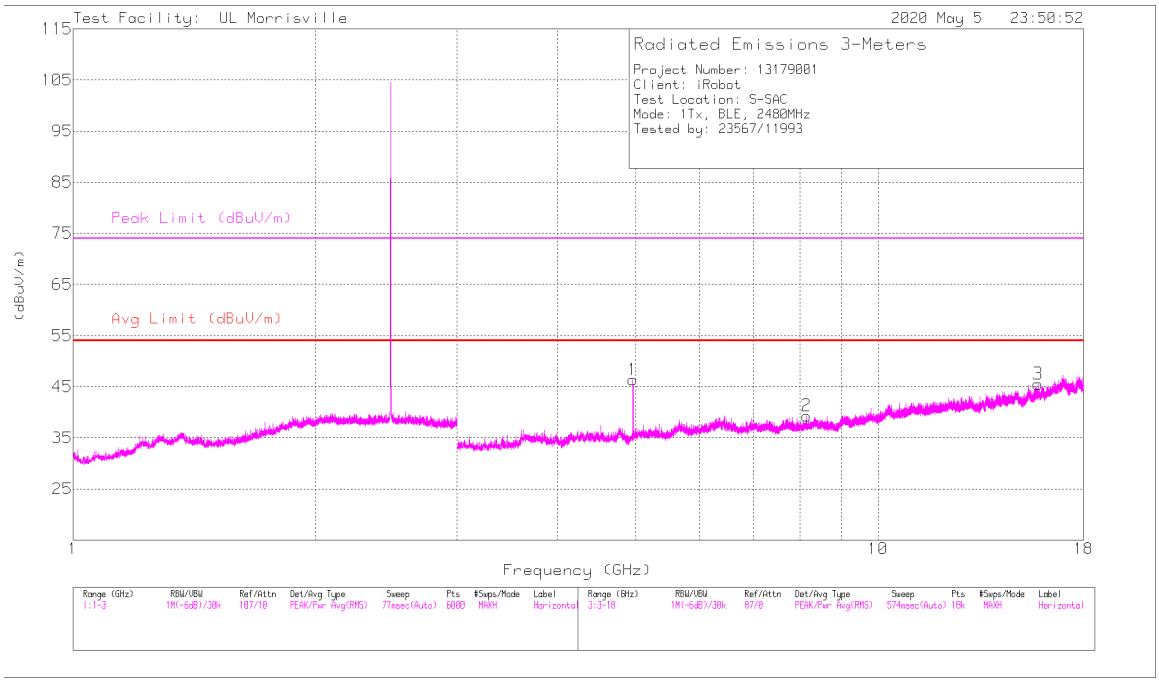
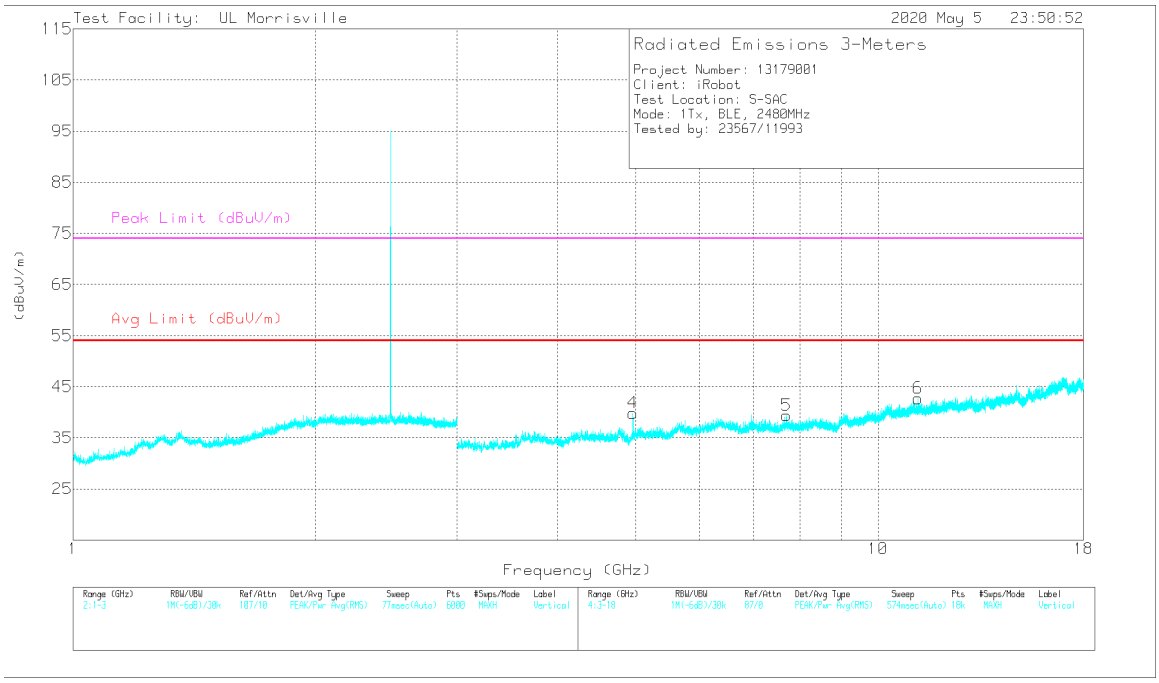
HIGH CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	* ** 4.96037	47.02	PK2	34	-31.1	0	49.92	-	-	74	-24.08	353	106	H
	* ** 4.95995	38.27	ADV	34	-31.1	1.63	42.8	54	-11.2	-	-	353	106	H
2	* ** 8.1531	36.91	PK2	35.7	-27.3	0	45.31	-	-	74	-28.69	208	271	H
	* ** 8.15173	23.25	ADV	35.7	-27.3	1.63	33.28	54	-20.72	-	-	208	271	H
3	* ** 15.80322	34.61	PK2	40.2	-23.4	0	51.41	-	-	74	-22.59	94	382	H
	* ** 15.8045	21.36	ADV	40.2	-23.4	1.63	39.79	54	-14.21	-	-	94	382	H
4	* ** 4.95943	46.15	PK2	34	-31.1	0	49.05	-	-	74	-24.95	170	347	V
	* ** 4.9599	36.72	ADV	34	-31.1	1.63	41.25	54	-12.75	-	-	170	347	V
5	* ** 7.69394	37.47	PK2	35.7	-27.7	0	45.47	-	-	74	-28.53	303	168	V
	* ** 7.6951	23.9	ADV	35.7	-27.7	1.63	33.53	54	-20.47	-	-	303	168	V
6	* ** 11.20304	34.19	PK2	37.9	-24.4	0	47.69	-	-	74	-26.31	96	346	V
	* ** 11.20308	21.15	ADV	37.9	-24.4	1.63	36.28	54	-17.72	-	-	96	346	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

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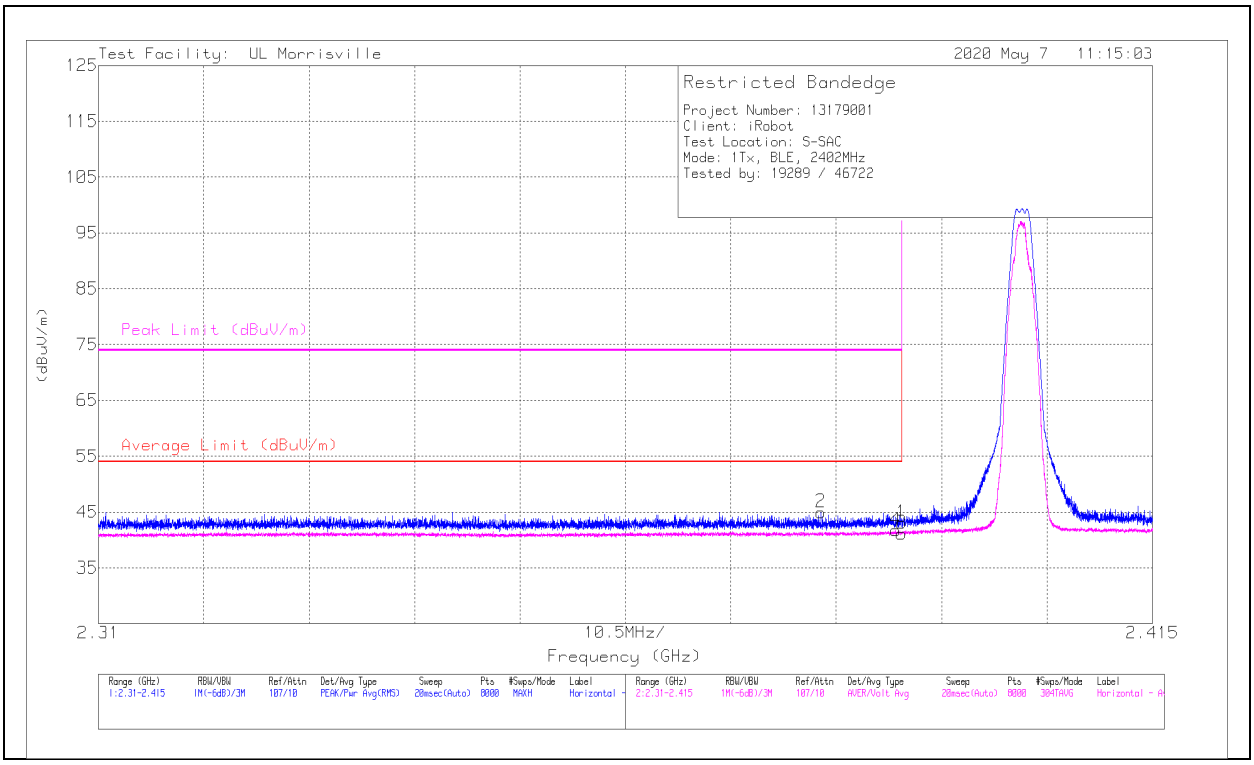
10.2.2. BLE (2Mbps)

EXTERNAL ANTENNA

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	35.08	Pk	32	-24	0	43.08	-	-	74	-30.92	21	126	H
2	* ** 2.38198	36.98	Pk	32	-24	0	44.98	-	-	74	-29.02	21	126	H
3	* ** 2.39	23.49	ADV	32	-24	9.67	41.16	54	-12.84	-	-	21	126	H
4	* ** 2.38943	24.08	ADV	32	-24	9.67	41.75	54	-12.25	-	-	21	126	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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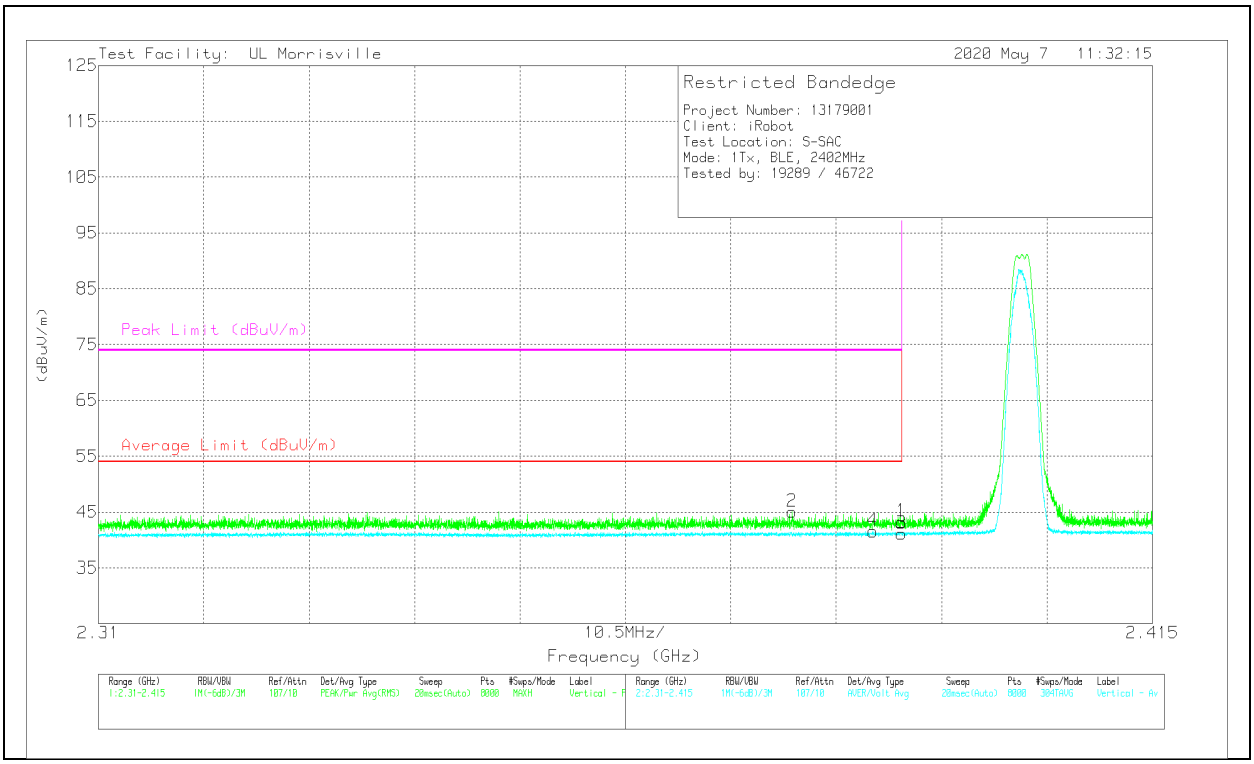
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	35.27	Pk	32	-24	0	43.27	-	-	74	-30.73	59	280	V
2	* ** 2.37913	37.03	Pk	32	-24	0	45.03	-	-	74	-28.97	59	280	V
3	* ** 2.39	23.43	ADV	32	-24	9.67	41.1	54	-12.9	-	-	59	280	V
4	* ** 2.38717	23.9	ADV	32	-24	9.67	41.57	54	-12.43	-	-	59	280	V

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

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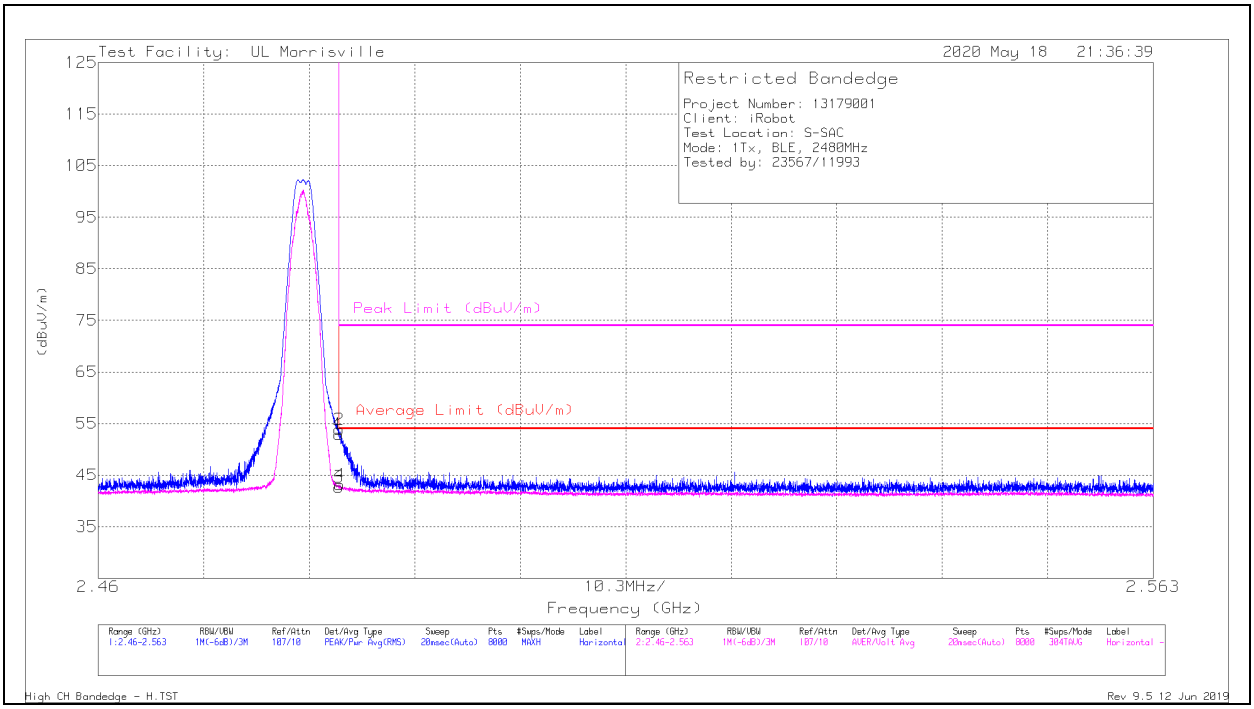
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	45.02	Pk	32.1	-24.2	0	52.92	-	-	74	-21.08	12	126	H
2	* ** 2.48351	45.93	Pk	32.1	-24.2	0	53.83	-	-	74	-20.17	12	126	H
3	* ** 2.4835	25.11	ADV	32.1	-24.2	9.67	42.68	54	-11.32	-	-	12	126	H
4	* ** 2.48358	25.57	ADV	32.1	-24.2	9.67	43.14	54	-10.86	-	-	12	126	H

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

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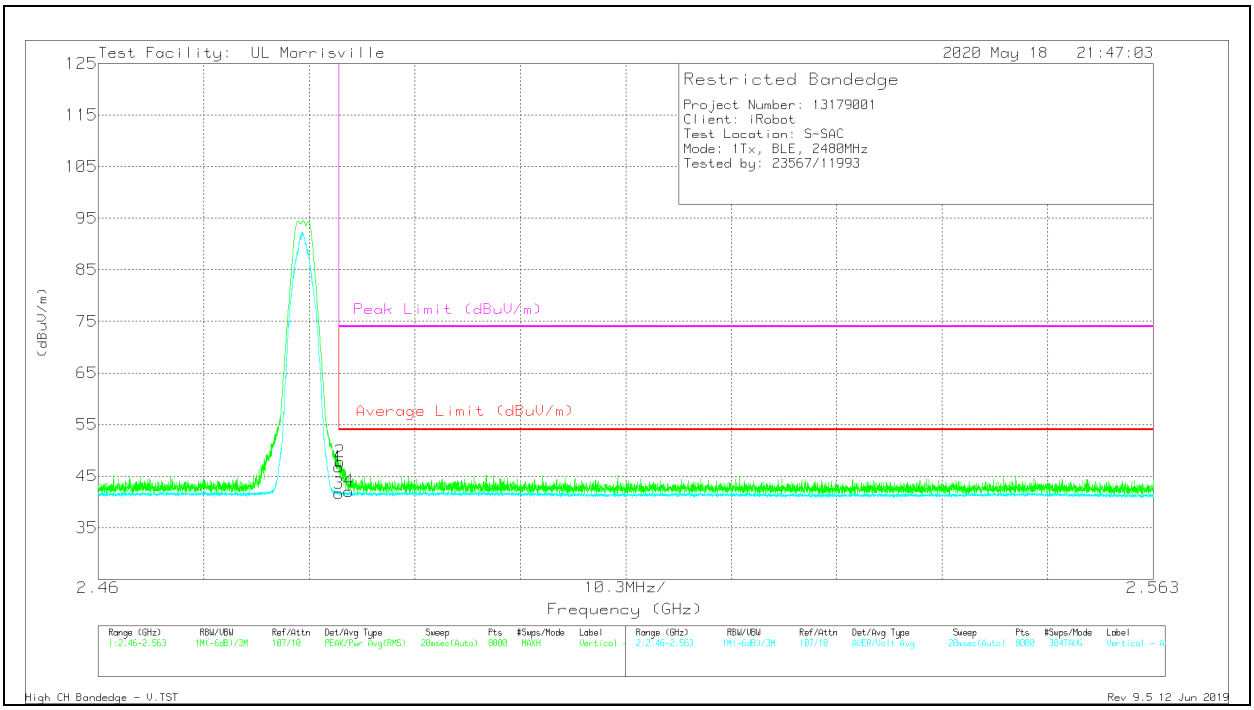
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	38.86	Pk	32.1	-24.2	0	46.76	-	-	74	-27.24	116	254	V
2	* ** 2.48363	39.87	Pk	32.1	-24.2	0	47.77	-	-	74	-26.23	116	254	V
3	* ** 2.4835	24.09	ADV	32.1	-24.2	9.67	41.66	54	-12.34	-	-	116	254	V
4	* ** 2.48445	24.52	ADV	32.1	-24.2	9.67	42.09	54	-11.91	-	-	116	254	V

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Pk - Peak detector
ADV - Linear Voltage Average

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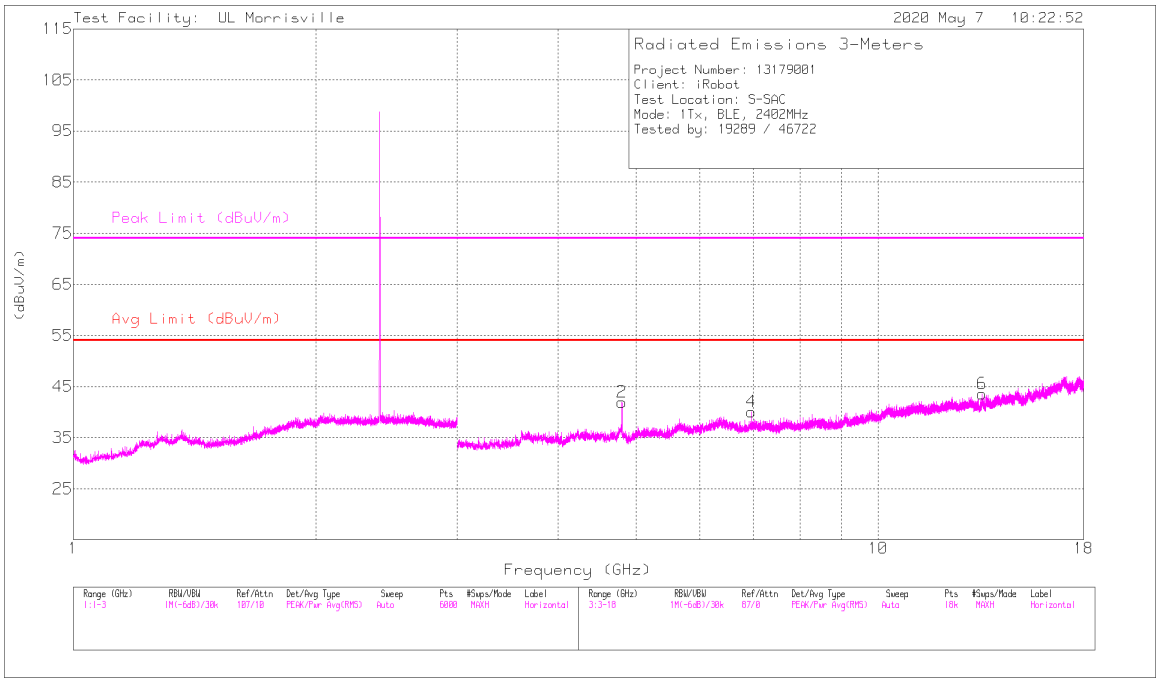
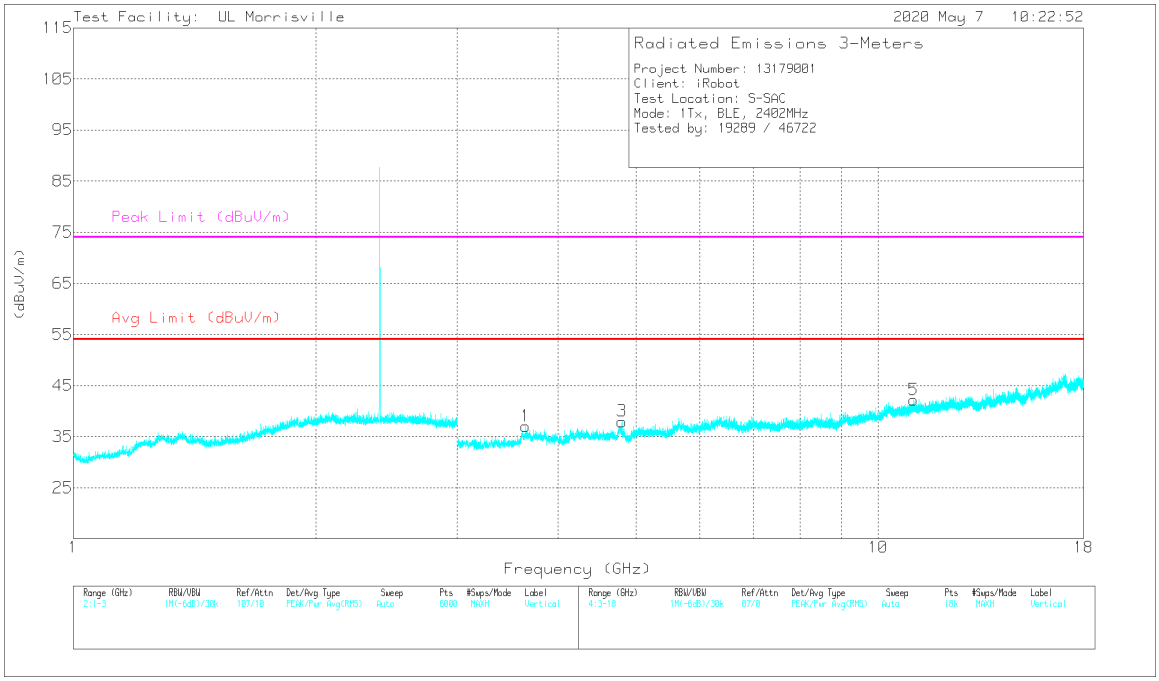
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	* ** 4.80405	47.64	PK2	33.9	-30.9	0	50.64	-	-	74	-23.36	48	121	H
	* ** 4.80373	32	ADV	33.9	-31	9.67	44.57	54	-9.43	-	-	48	121	H
1	* ** 3.64615	40.88	PK2	33.1	-31.8	0	42.18	-	-	74	-31.82	345	106	V
	* ** 3.64646	28	ADV	33.1	-31.8	9.67	38.97	54	-15.03	-	-	345	106	V
3	* ** 4.80394	45.59	PK2	33.9	-31	0	48.49	-	-	74	-25.51	139	297	V
	* ** 4.80308	31.41	ADV	33.9	-31	9.67	43.98	54	-10.02	-	-	139	297	V
5	* ** 11.06991	34.64	PK2	37.8	-24.2	0	48.24	-	-	74	-25.76	258	200	V
	* ** 11.06877	21.53	ADV	37.8	-24.2	9.67	44.8	54	-9.2	-	-	258	200	V
4	6.96022	32.45	Pk	35.5	-27.9	0	40.05	-	-	-	-	0-360	101	H
6	13.45559	28.78	Pk	38.7	-23.9	0	43.58	-	-	-	-	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

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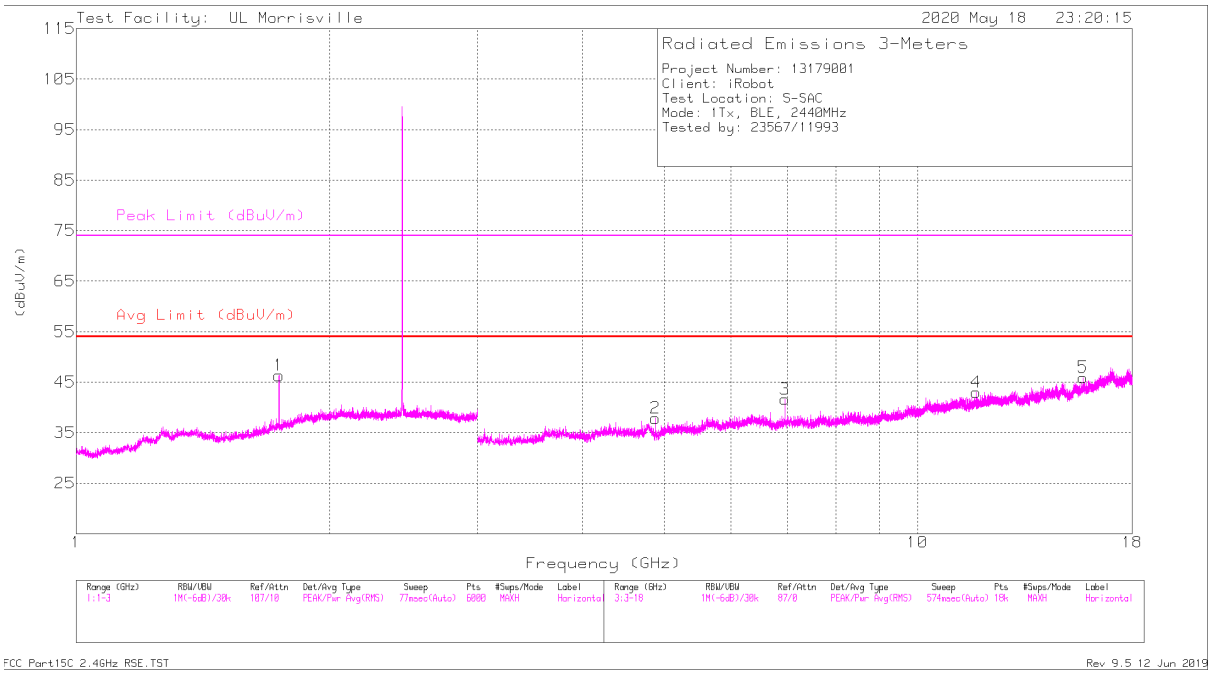
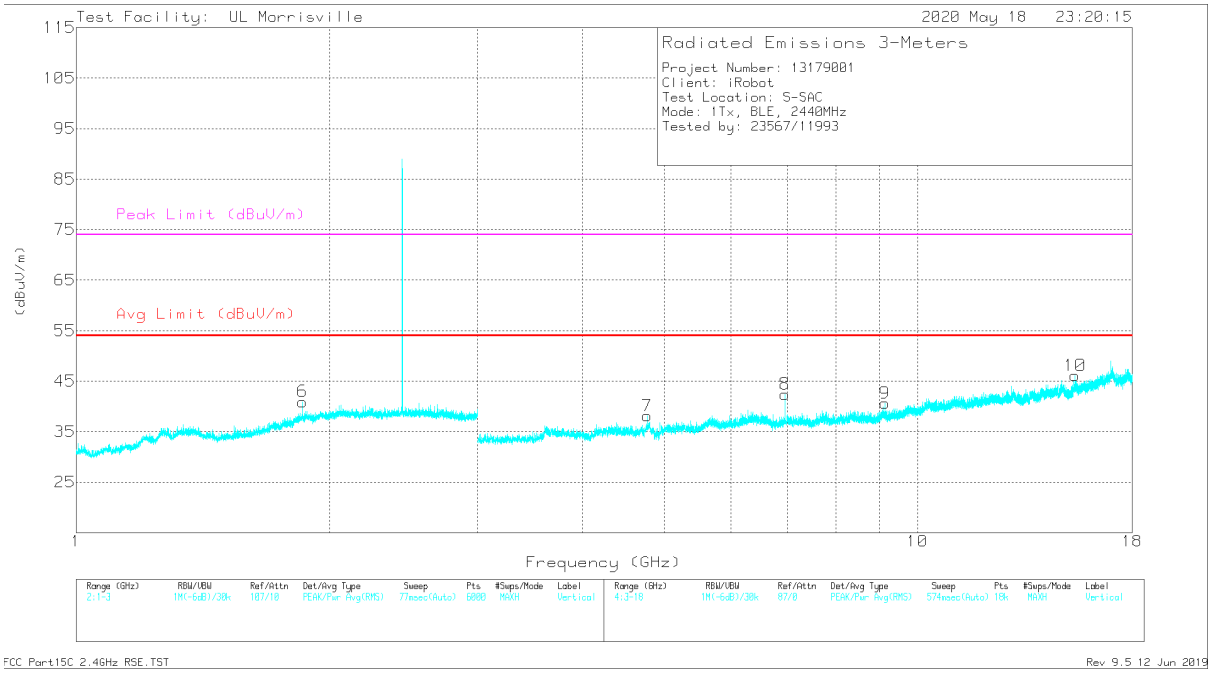
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	** 1.74386	35.39	PK2	29.8	-22.2	0	42.99	-	-	74	-31.01	288	362	H
	** 1.74262	22.19	ADV	29.8	-22.2	9.67	39.46	54	-14.54	-	-	288	362	H
6	** 1.85923	43.84	PK2	31.2	-22.3	0	52.74	-	-	74	-21.26	97	193	V
	** 1.86088	22.22	ADV	31.3	-22.3	9.67	40.89	54	-13.11	-	-	97	193	V
2	* ** 4.87897	41.92	PK2	33.8	-30.8	0	44.92	-	-	74	-29.08	42	111	H
	* ** 4.87904	27.64	ADV	33.8	-30.8	9.67	40.31	54	-13.69	-	-	42	111	H
4	* ** 11.73764	34.06	PK2	38.3	-24	0	48.36	-	-	74	-25.64	177	315	H
	* ** 11.73567	20.84	ADV	38.3	-24.1	9.67	44.71	54	-9.29	-	-	177	315	H
5	* ** 15.74563	34.42	PK2	40.1	-23	0	51.52	-	-	74	-22.48	205	281	H
	* ** 15.74486	21.15	ADV	40.1	-23	9.67	47.92	54	-6.08	-	-	205	281	H
7	* ** 4.76928	41.18	PK2	33.8	-31.2	0	43.78	-	-	74	-30.22	264	252	V
	* ** 4.7688	27.95	ADV	33.8	-31.2	9.67	40.22	54	-13.78	-	-	264	252	V
9	* ** 9.14645	34.93	PK2	36.3	-25.7	0	45.53	-	-	74	-28.47	231	287	V
	* ** 9.14458	22.12	ADV	36.3	-25.7	9.67	42.39	54	-11.61	-	-	231	287	V
10	* ** 15.39284	33.28	PK2	39.8	-21.7	0	51.38	-	-	74	-22.62	1	330	V
	* ** 15.39234	20.15	ADV	39.8	-21.7	9.67	47.92	54	-6.08	-	-	1	330	V
3	6.95939	34.01	Pk	35.5	-27.9	0	41.61	-	-	-	-	0-360	101	H
8	6.95939	34.81	Pk	35.5	-27.9	0	42.41	-	-	-	-	0-360	101	V

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

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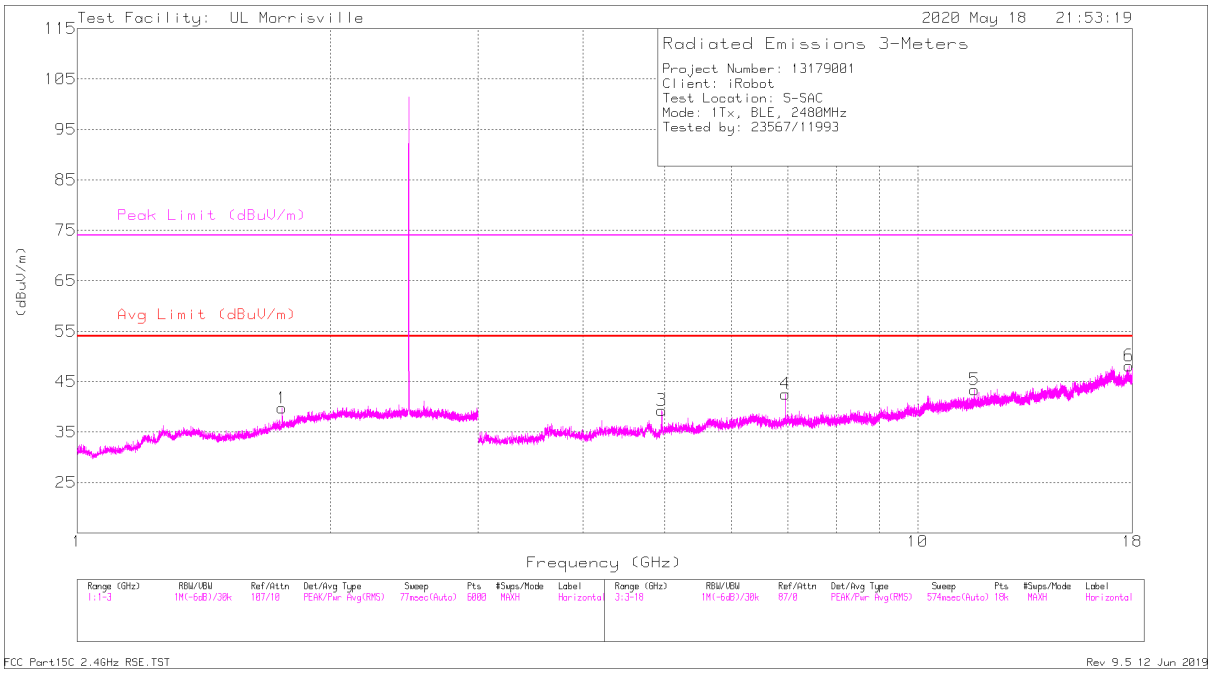
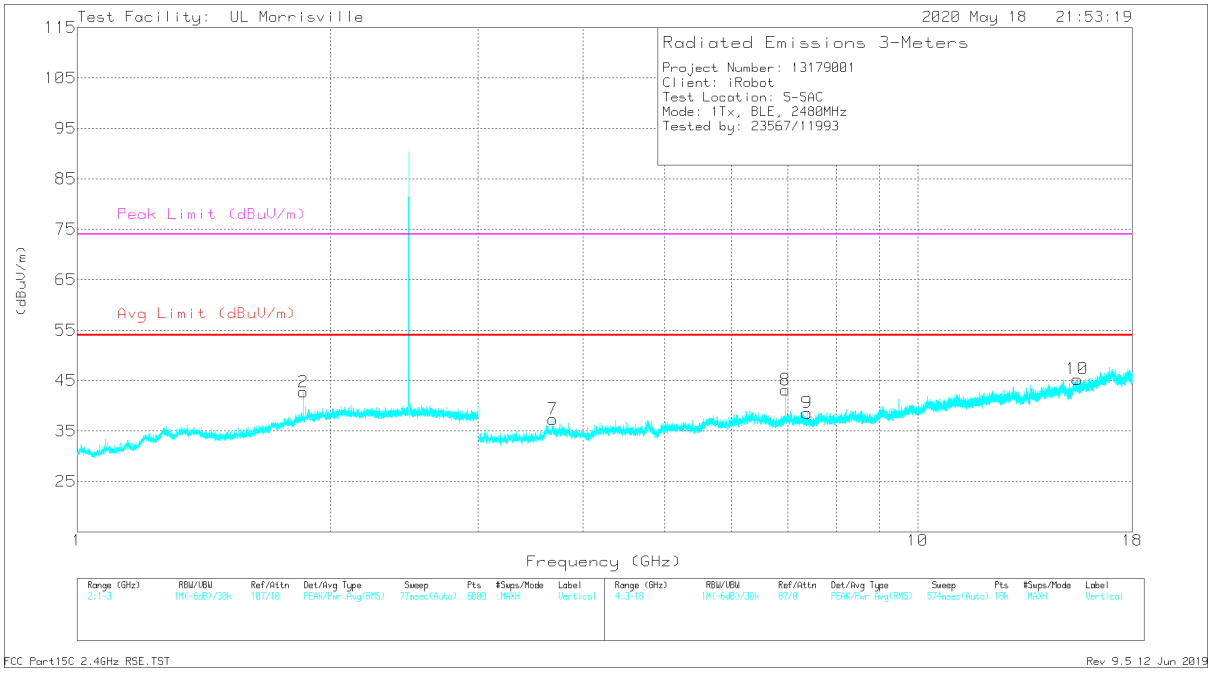
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	** 1.75331	35.61	PK2	29.8	-22.2	0	43.21	-	-	74	-30.79	303	149	H
	** 1.75085	22.29	ADV	29.8	-22.2	9.67	39.56	54	-14.44	-	-	303	149	H
2	** 1.8568	37.31	PK2	31.2	-22.2	0	46.31	-	-	74	-27.69	201	224	V
	** 1.85607	22.88	ADV	31.2	-22.2	9.67	41.55	54	-12.45	-	-	201	224	V
3	* ** 4.95902	41.51	PK2	34	-31	0	44.51	-	-	74	-29.49	208	200	H
	* ** 4.95901	27.44	ADV	34	-31	9.67	40.11	54	-13.89	-	-	208	200	H
5	* ** 11.68979	34.7	PK2	38.3	-24.3	0	48.7	-	-	74	-25.3	344	321	H
	* ** 11.68927	21.06	ADV	38.3	-24.3	9.67	44.73	54	-9.27	-	-	344	321	H
6	* ** 17.83853	33.64	PK2	41.3	-21.4	0	53.54	-	-	74	-20.46	173	213	H
	* ** 17.83791	20.64	ADV	41.3	-21.4	9.67	50.21	54	-3.79	-	-	173	213	H
7	* ** 3.67844	41.4	PK2	33.1	-32.2	0	42.3	-	-	74	-31.7	36	384	V
	* ** 3.67832	28.23	ADV	33.1	-32.2	9.67	38.8	54	-15.2	-	-	36	384	V
9	* ** 7.38549	36.44	PK2	35.6	-27.3	0	44.74	-	-	74	-29.26	66	351	V
	* ** 7.38489	23.1	ADV	35.6	-27.4	9.67	40.97	54	-13.03	-	-	66	351	V
10	* ** 15.48075	33.11	PK2	39.9	-22.3	0	50.71	-	-	74	-23.29	61	284	V
	* ** 15.48049	20.21	ADV	39.9	-22.3	9.67	47.48	54	-6.52	-	-	61	284	V
4	6.96022	34.97	Pk	35.5	-27.9	0	42.57	-	-	-	-	0-360	101	H
8	6.96022	35.54	Pk	35.5	-27.9	0	43.14	-	-	-	-	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

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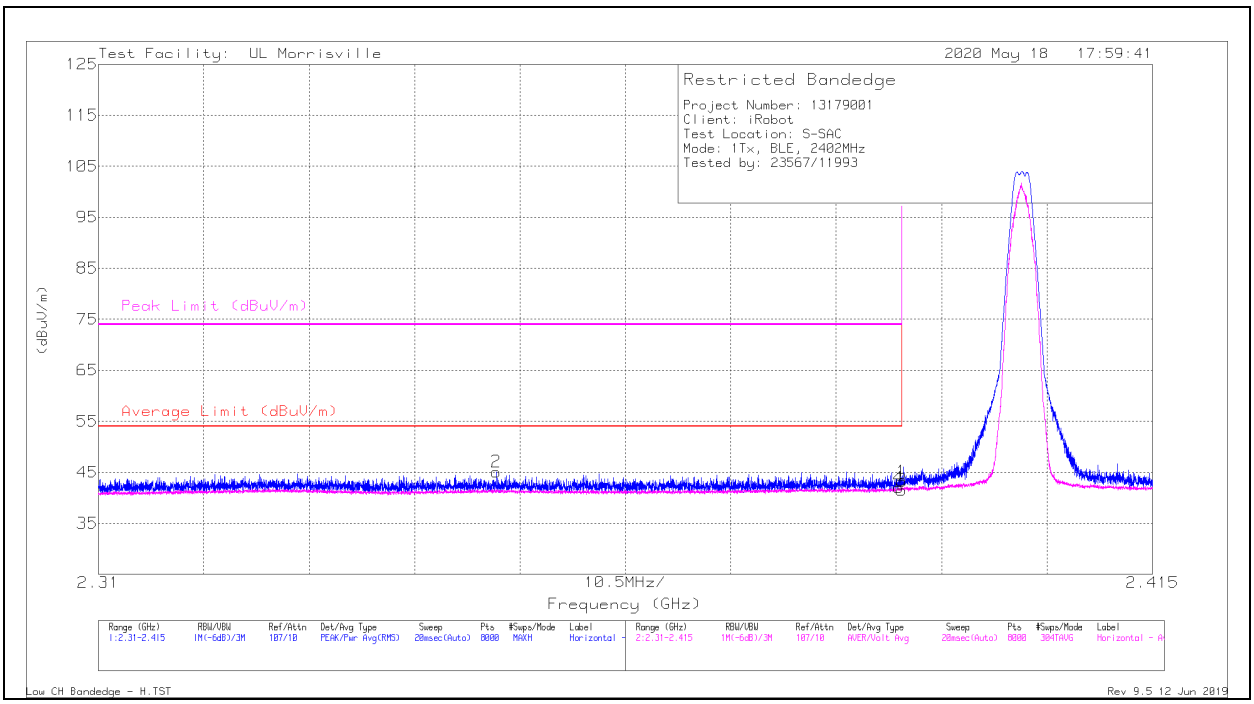
PCB ANTENNA

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	35.1	Pk	32	-23.9	0	43.2	-	-	74	-30.8	78	112	H
2	* ** 2.34963	36.81	Pk	31.8	-23.5	0	45.11	-	-	74	-28.89	78	112	H
3	* ** 2.39	23.79	ADV	32	-23.9	9.67	41.56	54	-12.44	-	-	78	112	H
4	* ** 2.38971	24.23	ADV	32	-23.9	9.67	42	54	-12	-	-	78	112	H

* - 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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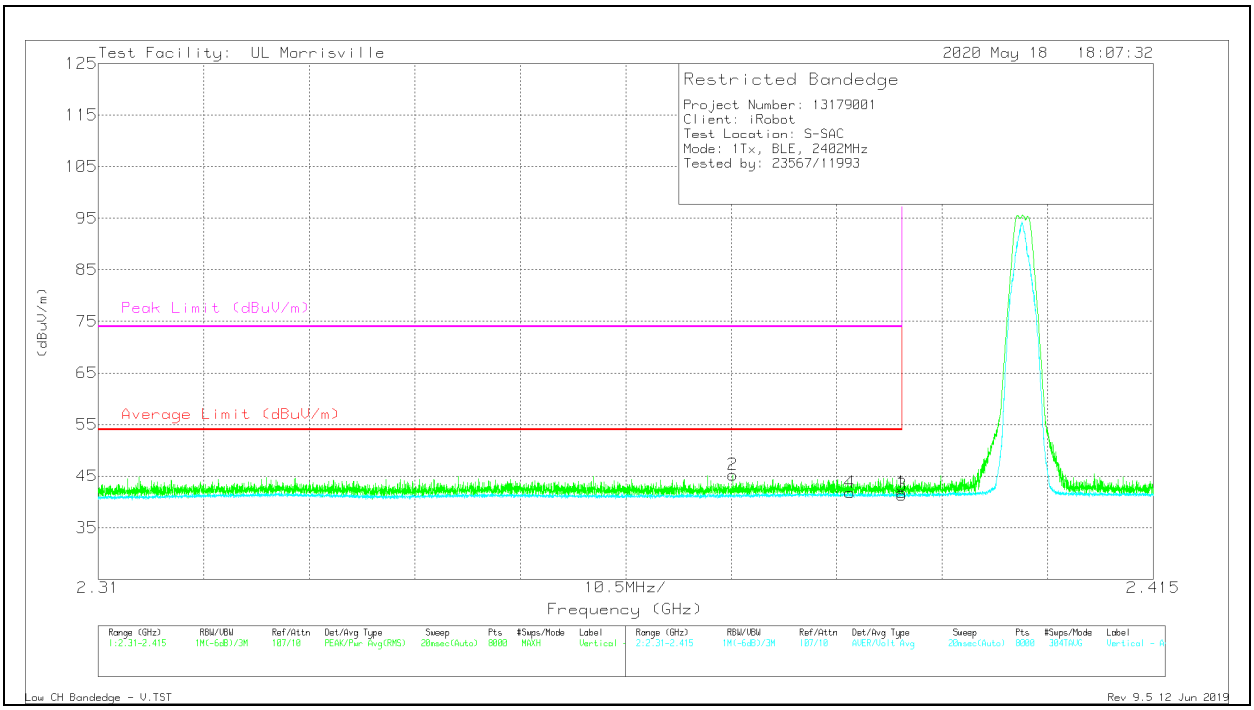
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.39	33.73	Pk	32	-23.9	0	41.83	-	-	74	-32.17	106	304	V
2	* ** 2.37314	37.16	Pk	32	-23.9	0	45.26	-	-	74	-28.74	106	304	V
3	* ** 2.39	23.57	ADV	32	-23.9	9.67	41.34	54	-12.66	-	-	106	304	V
4	* ** 2.38482	23.95	ADV	32	-23.8	9.67	41.82	54	-12.18	-	-	106	304	V

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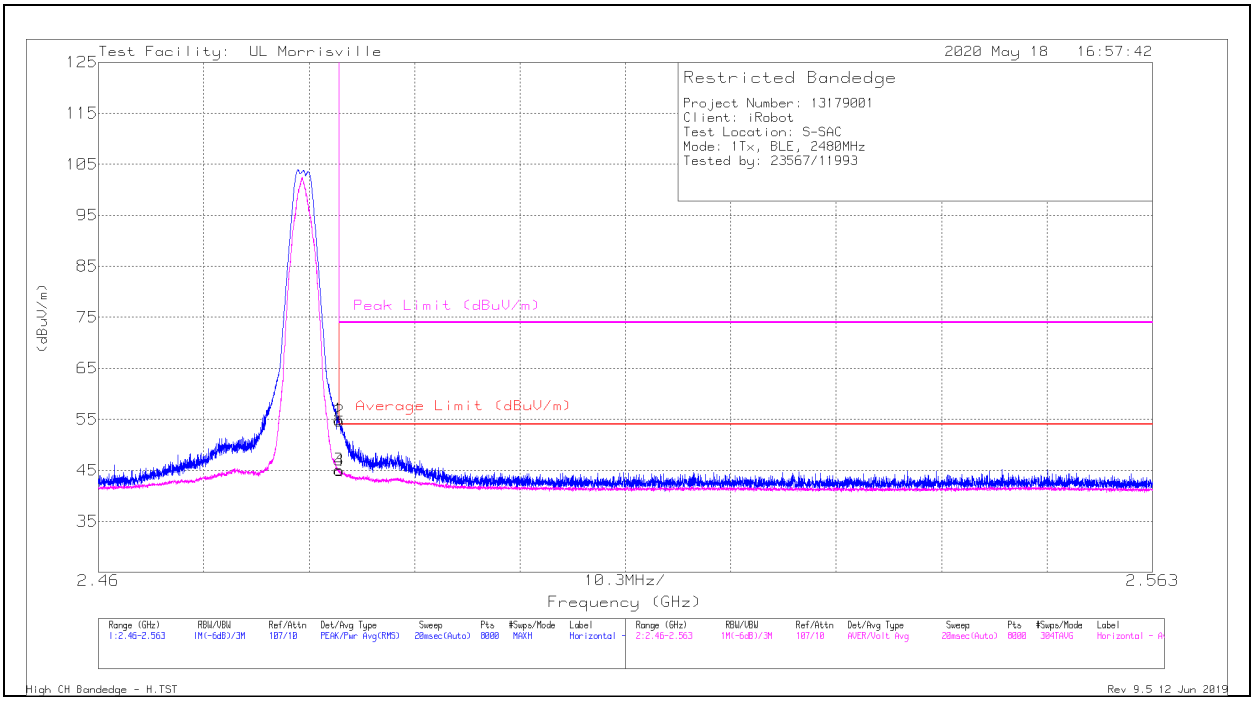
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	47.13	Pk	32.1	-24.2	0	55.03	-	-	74	-18.97	287	167	H
2	* ** 2.48359	46.73	Pk	32.1	-24.2	0	54.63	-	-	74	-19.37	287	167	H
3	* ** 2.4835	27.53	ADV	32.1	-24.2	9.67	45.1	54	-8.9	-	-	287	167	H
4	* ** 2.48359	27.41	ADV	32.1	-24.2	9.67	44.98	54	-9.02	-	-	287	167	H

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ADV - Linear Voltage Average

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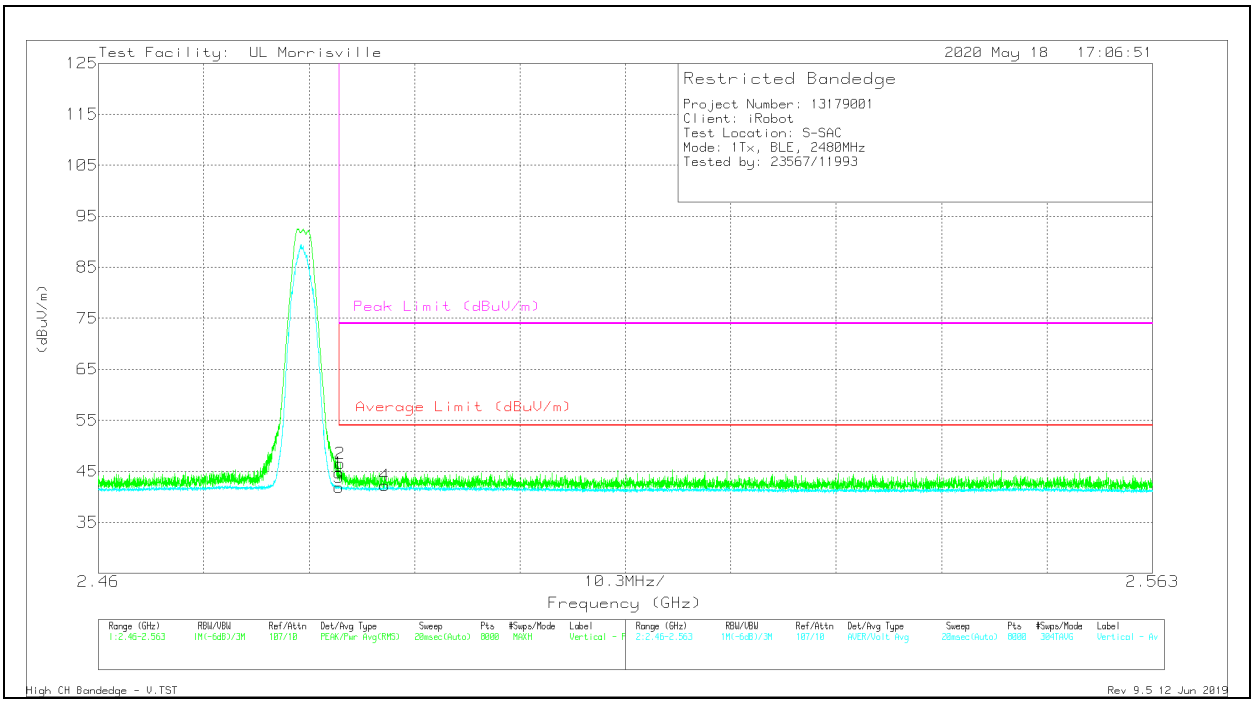
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (dB/m)	Amp/Cbl/Fltr/Pad (dB)	DC Corr (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.4835	36.75	Pk	32.1	-24.2	0	44.65	-	-	74	-29.35	241	371	V
2	* ** 2.48364	38.64	Pk	32.1	-24.2	0	46.54	-	-	74	-27.46	241	371	V
3	* ** 2.4835	24.29	ADV	32.1	-24.2	9.67	41.86	54	-12.14	-	-	241	371	V
4	* ** 2.48796	24.54	ADV	32.2	-24.2	9.67	42.21	54	-11.79	-	-	241	371	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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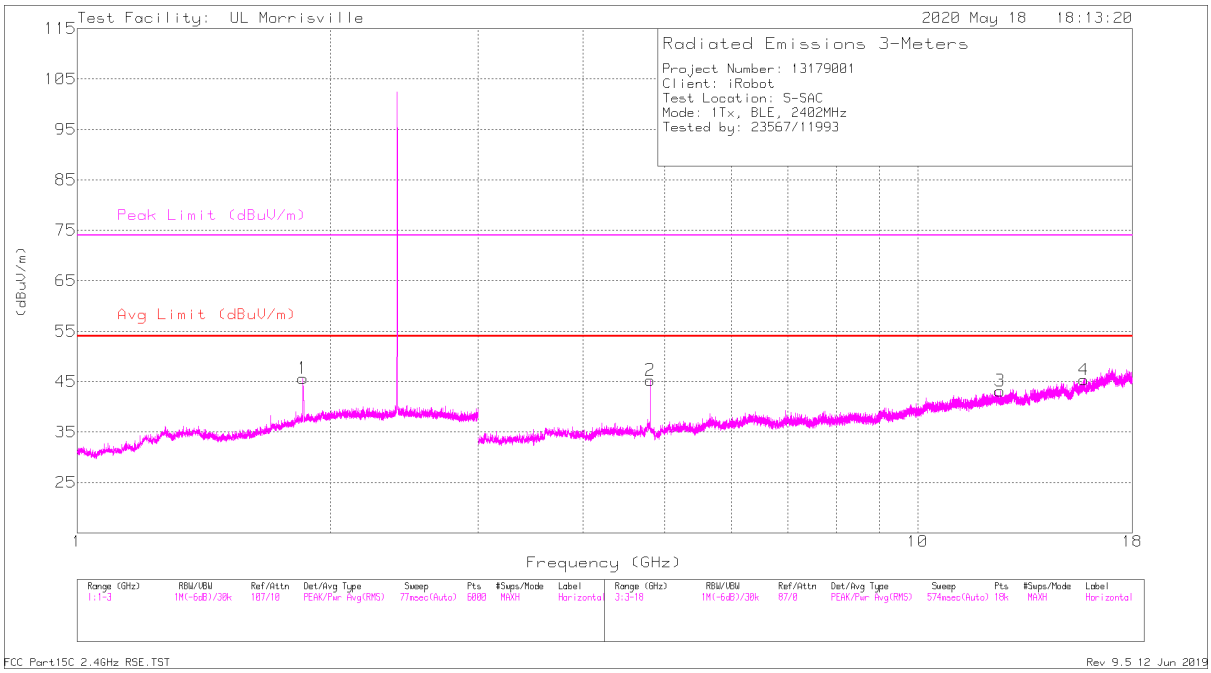
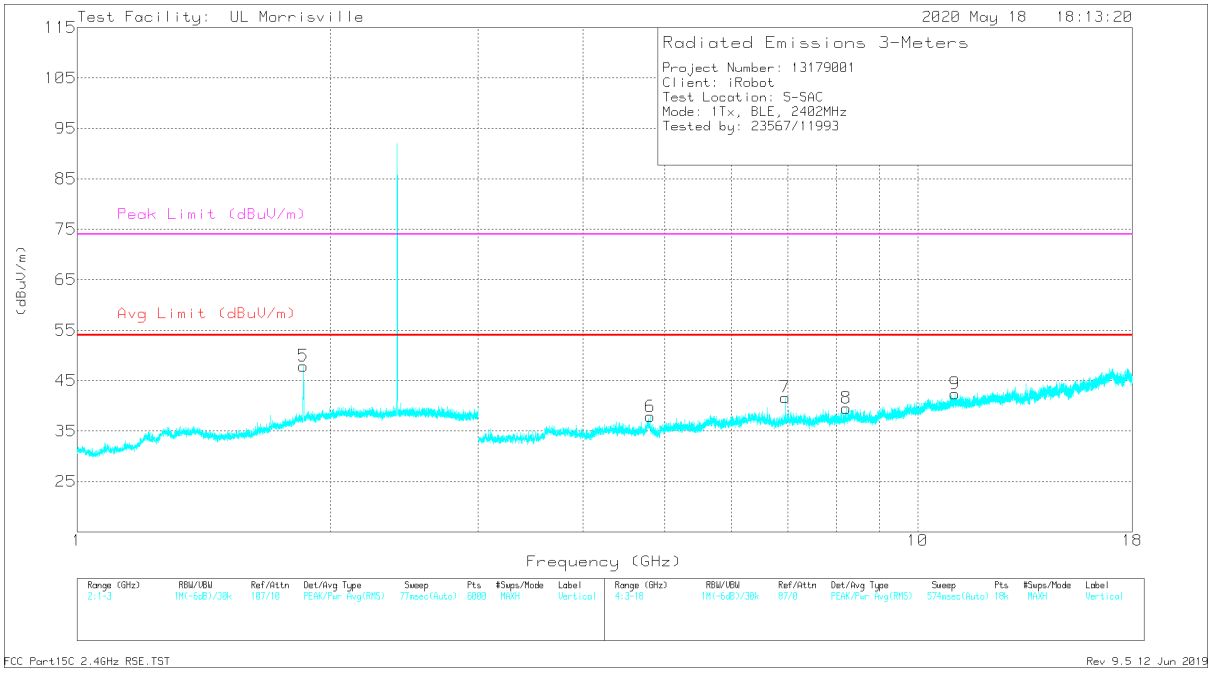
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	** 1.85782	46.76	PK2	31.2	-22.2	0	55.76	-	-	74	-18.24	128	374	H
	** 1.85594	22.42	ADV	31.2	-22.2	9.67	41.09	54	-12.91	-	-	128	374	H
5	** 1.85935	35.26	PK2	31.2	-22.3	0	44.16	-	-	74	-29.84	9	327	V
	** 1.85976	22.24	ADV	31.2	-22.3	9.67	40.81	54	-13.19	-	-	9	327	V
2	* ** 4.80397	47.19	PK2	33.9	-31.1	0	49.99	-	-	74	-24.01	1	101	H
	* ** 4.80306	32.48	ADV	33.9	-31.1	9.67	44.95	54	-9.05	-	-	1	101	H
3	* ** 12.5295	34.24	PK2	38.8	-24.3	0	48.74	-	-	74	-25.26	200	115	H
	* ** 12.52859	21.09	ADV	38.8	-24.3	9.67	45.26	54	-8.74	-	-	200	115	H
4	* ** 15.76514	34.28	PK2	40.2	-22.9	0	51.58	-	-	74	-22.42	31	297	H
	* ** 15.76404	21.18	ADV	40.2	-22.9	9.67	48.15	54	-5.85	-	-	31	297	H
6	* ** 4.80289	46.11	PK2	33.9	-31.1	0	48.91	-	-	74	-25.09	168	370	V
	* ** 4.80305	32.07	ADV	33.9	-31.1	9.67	44.54	54	-9.46	-	-	168	370	V
8	* ** 8.2211	36.64	PK2	35.8	-27.2	0	45.24	-	-	74	-28.76	280	253	V
	* ** 8.22176	23.29	ADV	35.8	-27.2	9.67	41.56	54	-12.44	-	-	280	253	V
9	* ** 11.0802	34.67	PK2	37.8	-24.3	0	48.17	-	-	74	-25.83	95	296	V
	* ** 11.08041	21.24	ADV	37.8	-24.3	9.67	44.41	54	-9.59	-	-	95	296	V
7	6.95939	34.1	Pk	35.5	-27.9	0	41.7	-	-	-	-	0-360	101	V

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

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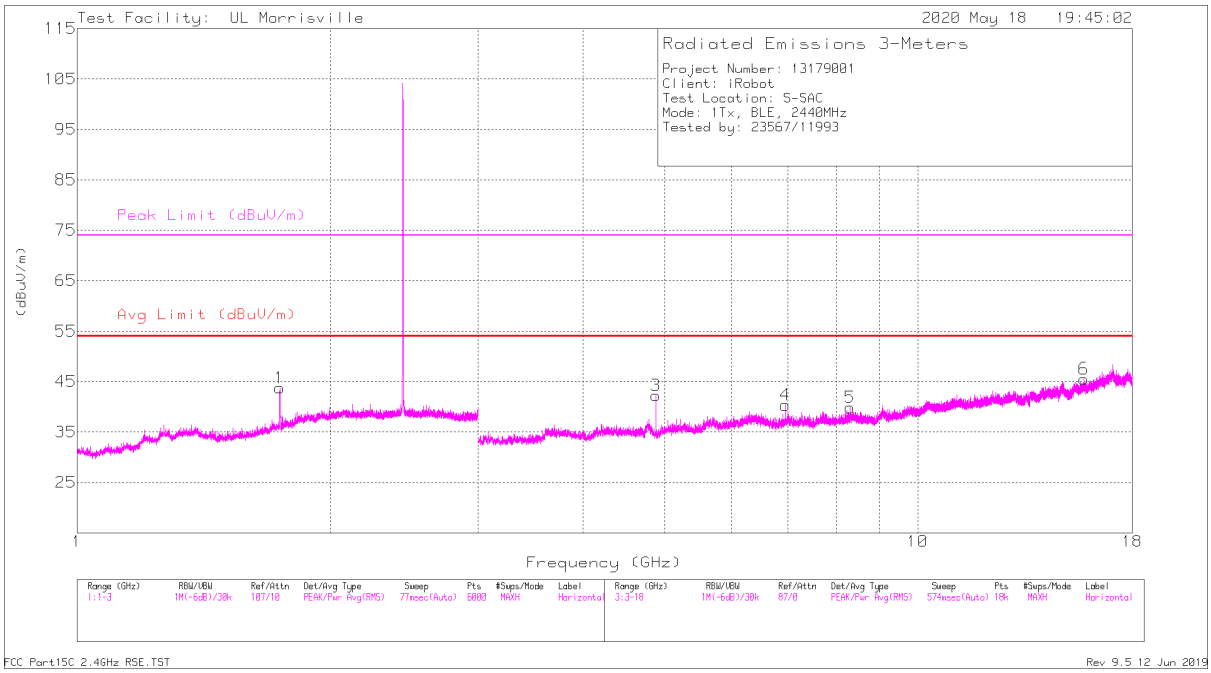
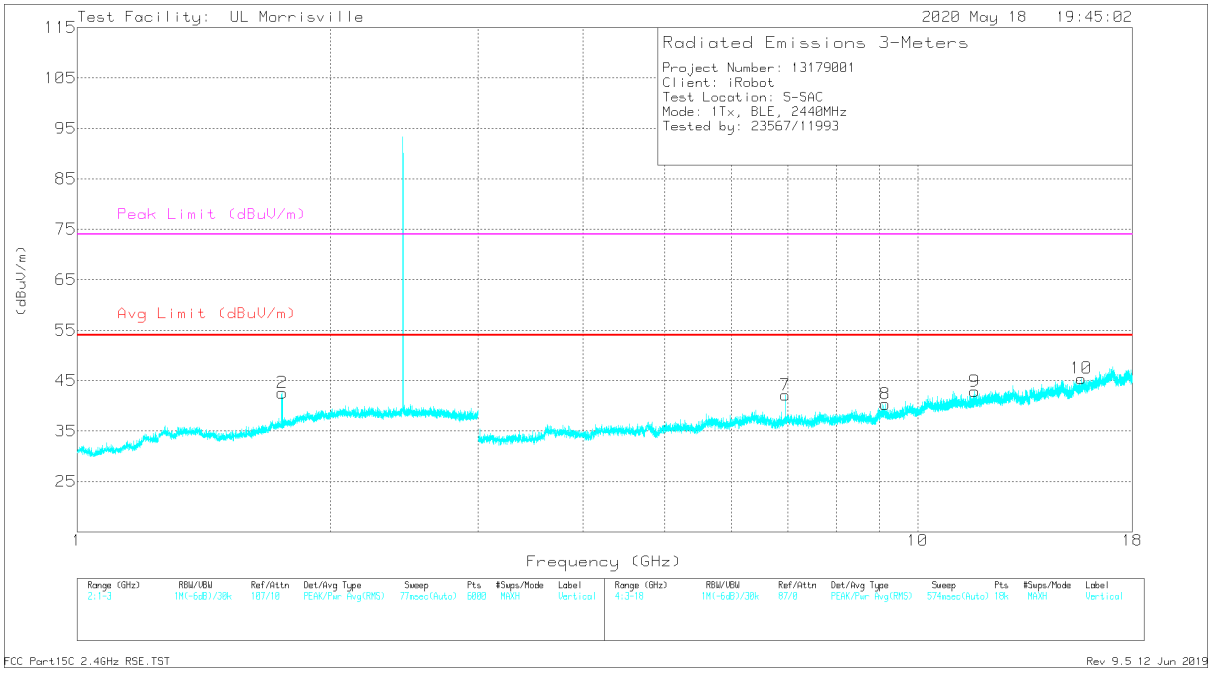
MID CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	** 1.74134	40.28	PK2	29.8	-22.2	0	47.88	-	-	74	-26.12	222	204	H
	** 1.7413	22.31	ADV	29.8	-22.2	9.67	39.58	54	-14.42	-	-	222	204	H
2	** 1.75391	35.92	PK2	29.8	-22.2	0	43.52	-	-	74	-30.48	157	172	V
	** 1.75307	22.32	ADV	29.8	-22.2	9.67	39.59	54	-14.41	-	-	157	172	V
3	* ** 4.88075	44.46	PK2	33.8	-30.8	0	47.46	-	-	74	-26.54	2	111	H
	* ** 4.87907	29.65	ADV	33.8	-30.8	9.67	42.32	54	-11.68	-	-	2	111	H
5	* ** 8.30868	36.81	PK2	35.8	-27.3	0	45.31	-	-	74	-28.69	240	382	H
	* ** 8.30816	23.39	ADV	35.8	-27.3	9.67	41.56	54	-12.44	-	-	240	382	H
6	* ** 15.7645	34.54	PK2	40.2	-22.9	0	51.84	-	-	74	-22.16	216	192	H
	* ** 15.76427	21.12	ADV	40.2	-22.9	9.67	48.09	54	-5.91	-	-	216	192	H
8	* ** 9.14198	35.69	PK2	36.3	-25.8	0	46.19	-	-	74	-27.81	274	209	V
	* ** 9.14212	22.09	ADV	36.3	-25.8	9.67	42.26	54	-11.74	-	-	274	209	V
9	* ** 11.69091	34.12	PK2	38.3	-24.3	0	48.12	-	-	74	-25.88	0	368	V
	* ** 11.68902	21.02	ADV	38.3	-24.3	9.67	44.69	54	-9.31	-	-	0	368	V
10	* ** 15.65283	34.68	PK2	40.1	-23.4	0	51.38	-	-	74	-22.62	223	317	V
	* ** 15.65298	21.37	ADV	40.1	-23.4	9.67	47.74	54	-6.26	-	-	223	317	V
4	6.95939	32.75	Pk	35.5	-27.9	0	40.35	-	-	-	-	0-360	101	H
7	6.95939	34.52	Pk	35.5	-27.9	0	42.12	-	-	-	-	0-360	101	V

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

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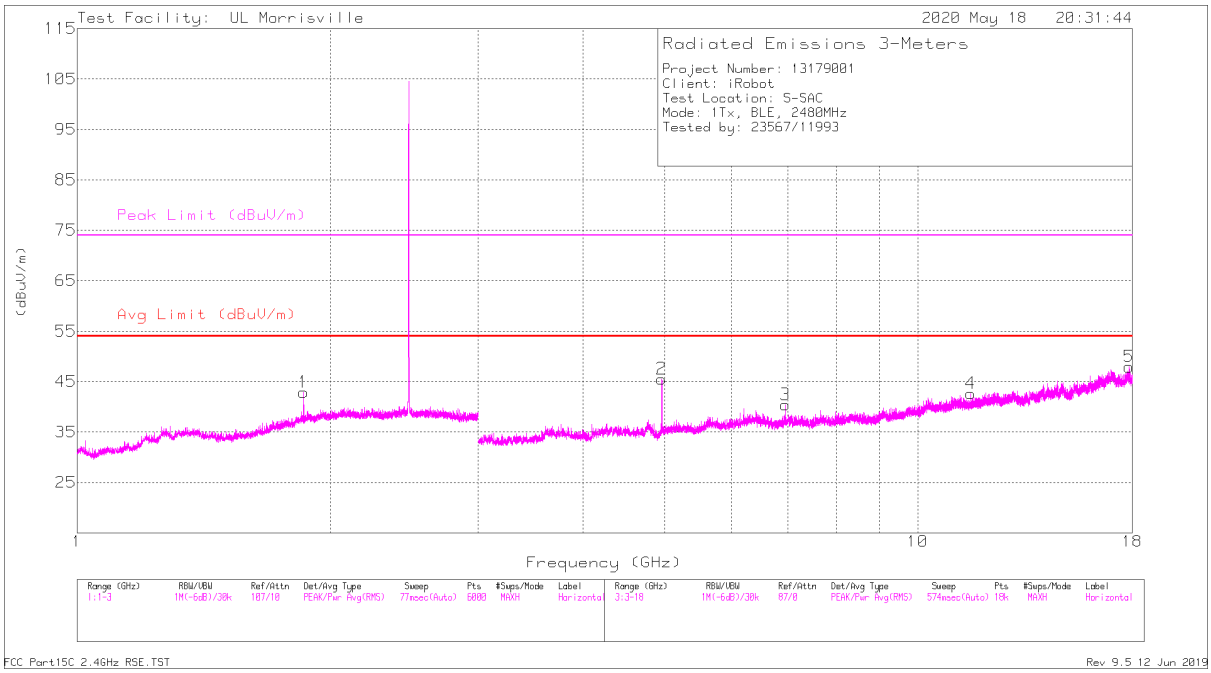
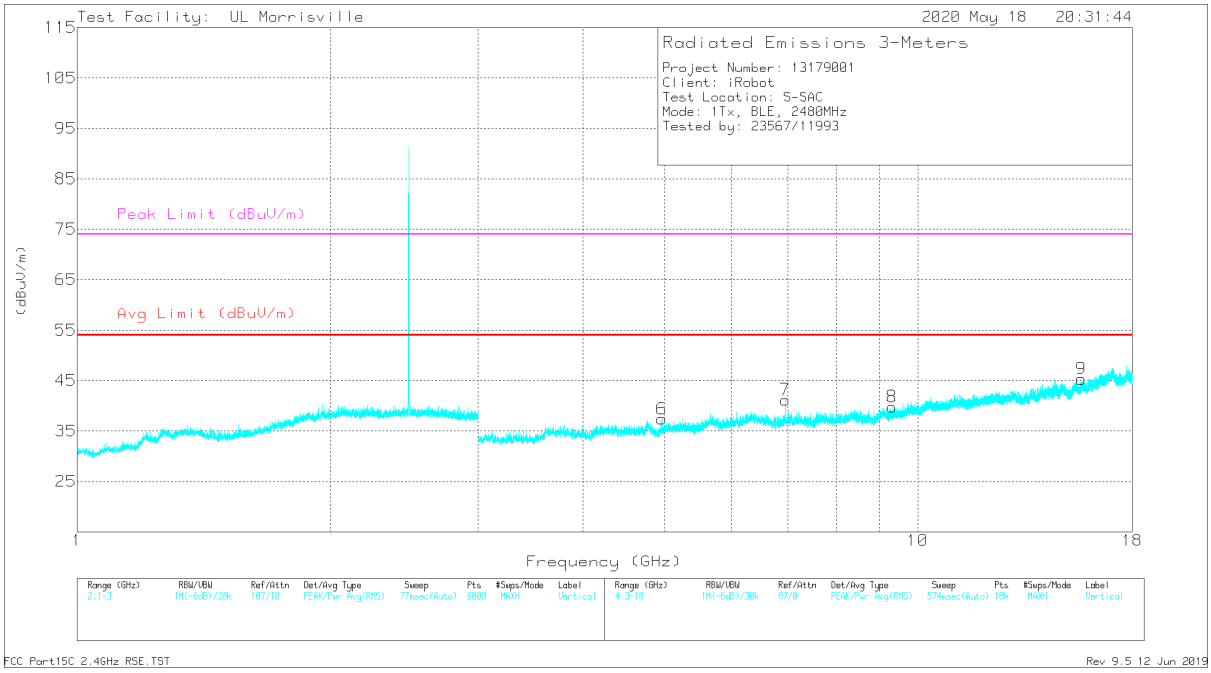
HIGH CHANNEL RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0078 (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	** 1.85983	35.26	PK2	31.2	-22.3	0	44.16	-	-	74	-29.84	352	138	H
	** 1.85875	22.3	ADV	31.2	-22.2	9.67	40.97	54	-13.03	-	-	352	138	H
2	* ** 4.96095	46.69	PK2	34	-31	0	49.69	-	-	74	-24.31	360	118	H
	* ** 4.95908	32.64	ADV	34	-31	9.67	45.31	54	-8.69	-	-	360	118	H
4	* ** 11.55841	34.19	PK2	38.2	-24.4	0	47.99	-	-	74	-26.01	22	310	H
	* ** 11.55659	20.95	ADV	38.2	-24.4	9.67	44.42	54	-9.58	-	-	22	310	H
5	* ** 17.83419	33.55	PK2	41.3	-21.4	0	53.45	-	-	74	-20.55	69	302	H
	* ** 17.83523	20.45	ADV	41.3	-21.4	9.67	50.02	54	-3.98	-	-	69	302	H
6	* ** 4.95913	43.92	PK2	34	-31	0	46.92	-	-	74	-27.08	108	259	V
	* ** 4.95906	29.29	ADV	34	-31	9.67	41.96	54	-12.04	-	-	108	259	V
8	* ** 9.32241	36.38	PK2	36.4	-26.3	0	46.48	-	-	74	-27.52	172	166	V
	* ** 9.32252	22.42	ADV	36.4	-26.3	9.67	42.19	54	-11.81	-	-	172	166	V
9	* ** 15.64414	34.81	PK2	40.1	-23.6	0	51.31	-	-	74	-22.69	11	278	V
	* ** 15.64365	21.43	ADV	40.1	-23.6	9.67	47.6	54	-6.4	-	-	11	278	V
7	6.95939	33.59	Pk	35.5	-27.9	0	41.19	-	-	-	-	0-360	199	V
3	6.96022	32.81	Pk	35.5	-27.9	0	40.41	-	-	-	-	0-360	101	H

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

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10.3. WORST CASE BELOW 30MHZ

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

The below 30 MHz limits in CFR 47, Part 15, Subpart C, paragraph 15.209 (a), are identical to those in RSS-GEN Section 8.9, Table 6, since the measurements are performed in terms of magnetic field strength and converted to electric field strength levels (as reported in the table) using the free space impedance of 377Ω. For example, the measurement frequency 10.92 KHz resulted in a level of -15.15 dBuV/m, which is equivalent to -15.15-51.5 = -66.65 dBuA/m, which has the same margin, -61.99 dB, to the corresponding RSS-GEN Table 6 limit as it has to be 15.209(a) limit.

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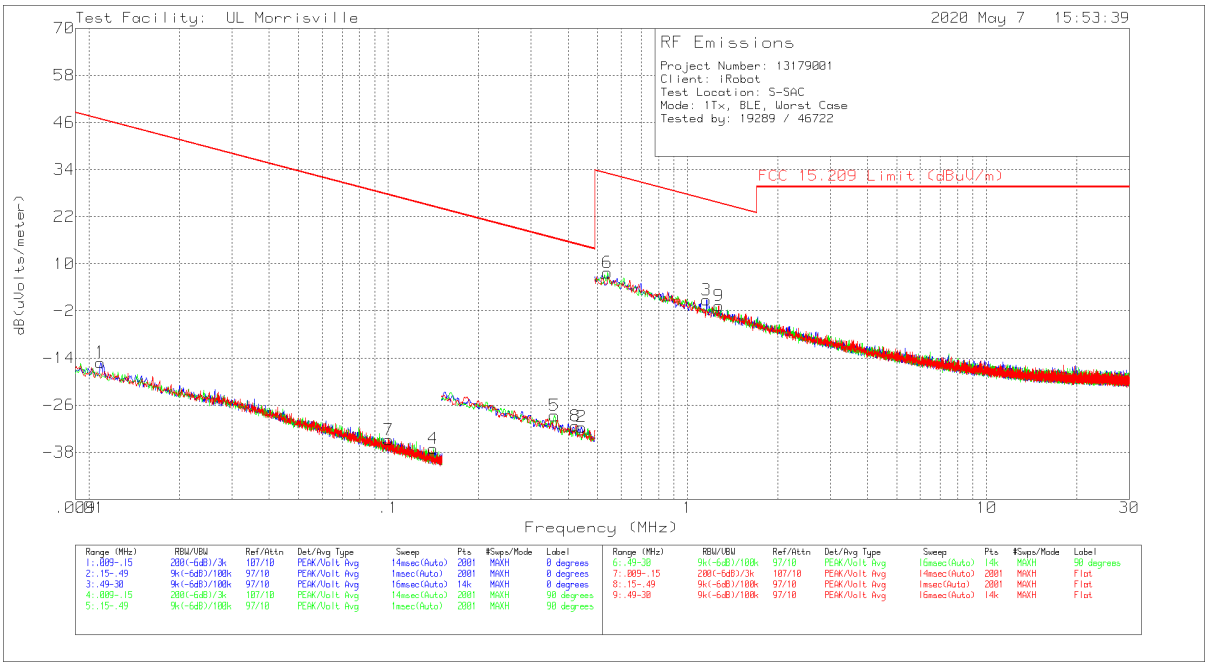
SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION – EXT ANTENNA)



ANTENNA- THREE ORIENTATIONS

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 PK Limit (dBuV/m)	Worst-Case Margin (dB)	Azimuth (Degs)
1	.01092	46.95	Pk	17.8	.1	-80	-15.15	46.84	66.84	-61.99	0-360
7	.10024	33.91	Pk	11.1	.1	-80	-34.89	27.58	-	-62.47	0-360
4	.14149	31.78	Pk	11	.1	-80	-37.12	24.59	44.59	-61.71	0-360
5	.35919	40.22	Pk	11	.1	-80	-28.68	16.5	36.5	-45.18	0-360
8	.42285	37.54	Pk	11	.1	-80	-31.36	15.08	35.08	-46.44	0-360
2	.44215	37.33	Pk	11	.1	-80	-31.57	14.69	34.69	-46.26	0-360
6	.54059	36.64	Pk	11	.1	-40	7.74	32.95	-	-25.21	0-360
3	1.15824	29.49	Pk	11.1	.2	-40	.79	26.33	-	-25.54	0-360
9	1.27207	28	Pk	11.1	.2	-40	-.7	25.51	-	-26.21	0-360

Pk - Peak detector

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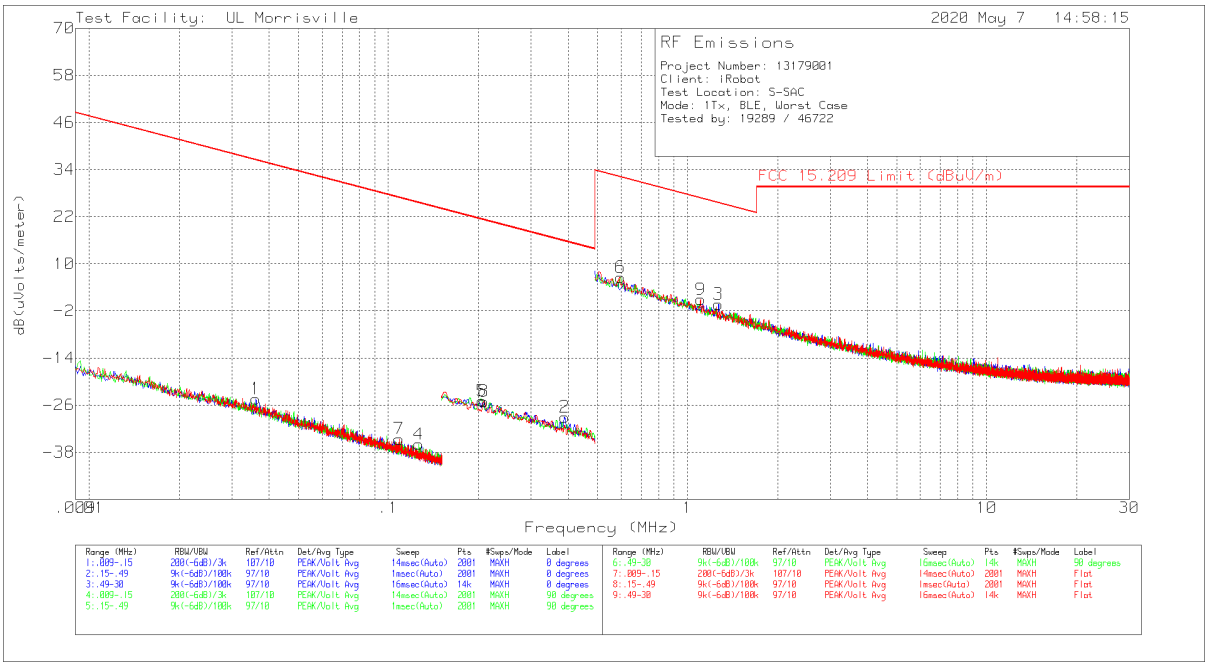
SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION – PCB ANTENNA)



ANTENNA- THREE ORIENTATIONS

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 AF (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 QP/AV Limit (dBuV/m)	FCC 15.209 QP/AV Limit (dBuV/m)	Worst-Case Margin (dB)	Azimuth (Degs)
1	.03612	42.79	Pk	12.7	.1	-80	-24.41	36.45	56.45	-60.86	0-360
7	.10861	34.2	Pk	11.1	.1	-80	-34.6	26.89	46.89	-61.49	0-360
4	.12636	32.94	Pk	11	.1	-80	-35.96	25.57	45.57	-61.53	0-360
5	.20576	43.94	Pk	11	.1	-80	-24.96	21.34	41.34	-46.3	0-360
8	.20874	43.87	Pk	11	.1	-80	-25.03	21.21	41.21	-46.24	0-360
2	.38809	39.86	Pk	11	.1	-80	-29.04	15.83	35.83	-44.87	0-360
6	.59751	35.49	Pk	11	.1	-40	6.59	32.08	-	-25.49	0-360
9	1.10659	29.62	Pk	11.1	.2	-40	.92	26.72	-	-25.8	0-360
3	1.26996	28.42	Pk	11.1	.2	-40	-.28	25.53	-	-25.81	0-360

Pk - Peak detector

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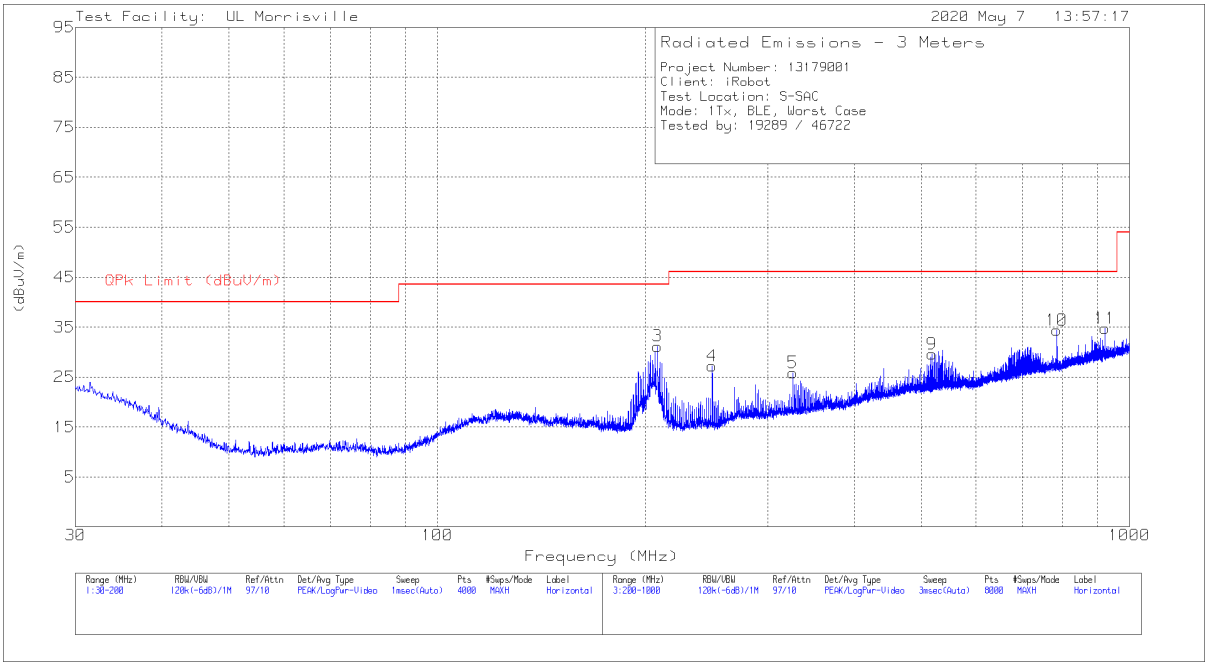
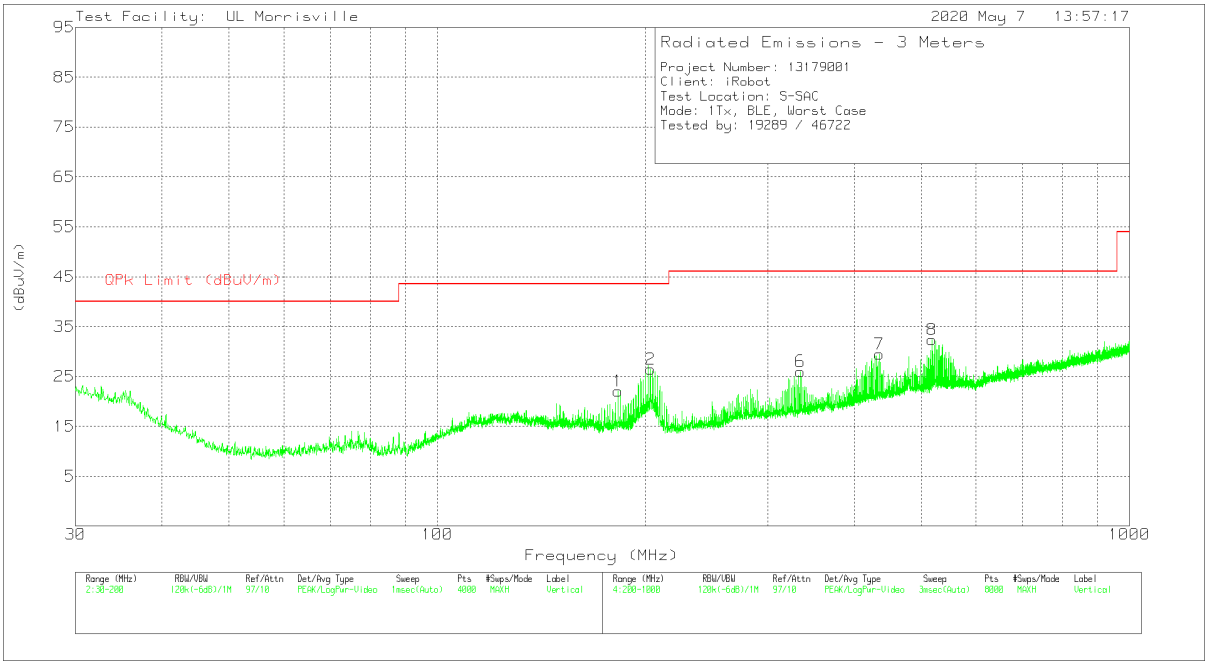
10.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* ** 249.6064	39.6	Pk	17.5	-29.9	27.2	46.02	-18.82	0-360	101	H
5	* ** 326.4164	35.27	Pk	20	-29.4	25.87	46.02	-20.15	0-360	101	H
10	** 784.676	35.27	Pk	27.1	-28	34.37	46.02	-11.65	0-360	298	H
6	* ** 334.4175	35.4	Pk	20	-29.4	26	46.02	-20.02	0-360	101	V
1	182.4019	35.06	Pk	17.3	-30.3	22.06	43.52	-21.46	0-360	101	V
2	203.2004	39.04	Pk	17.6	-30.2	26.44	43.52	-17.08	0-360	101	V
3	208.001	44.88	Pk	16.4	-30.1	31.18	43.52	-12.34	0-360	199	H
7	435.2306	35.77	Pk	22.7	-29	29.47	46.02	-16.55	0-360	101	V
9	518.4414	34.79	Pk	23.7	-28.9	29.59	46.02	-16.43	0-360	199	H
8	518.4414	37.6	Pk	23.7	-28.9	32.4	46.02	-13.62	0-360	101	V
11	921.5938	32.95	Pk	28.6	-26.8	34.75	46.02	-11.27	0-360	101	H

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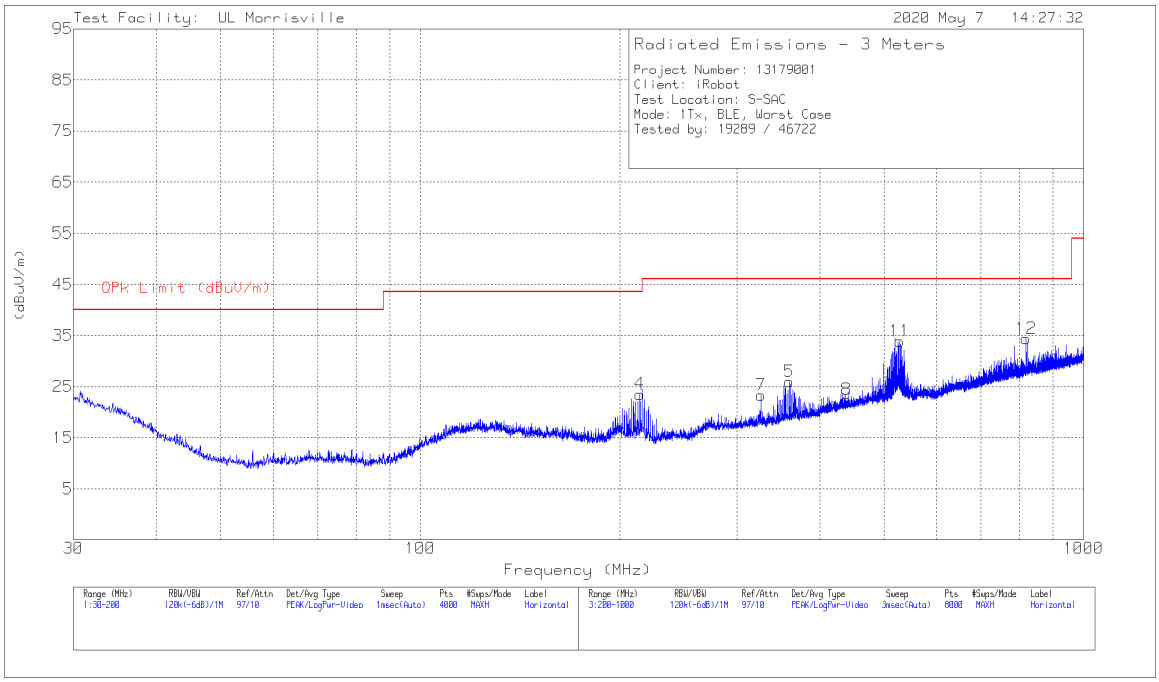
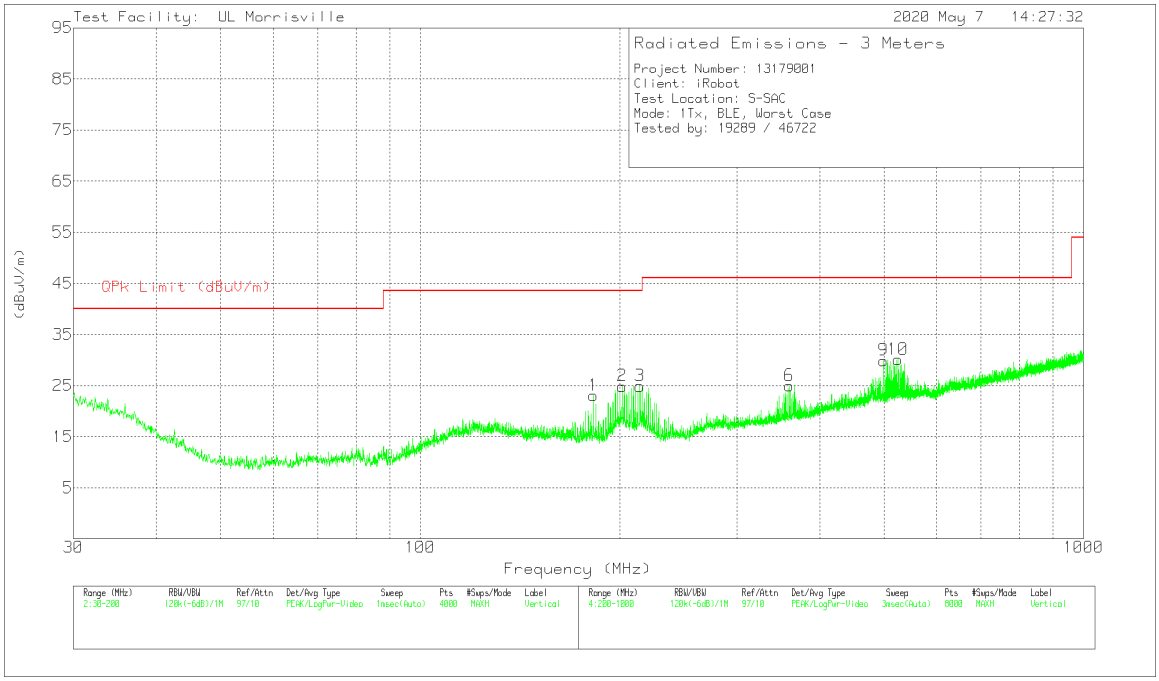
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION – PCB ANTENNA)



HORIZONTAL



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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 AF (dB/m)	Cbl/Amp (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
7	* ** 326.4164	32.68	Pk	20	-29.4	23.28	46.02	-22.74	0-360	102	H
9	** 499.2389	35.02	Pk	23.7	-28.8	29.92	46.02	-16.1	0-360	101	V
1	182.4019	36.1	Pk	17.3	-30.3	23.1	43.52	-20.42	0-360	102	V
2	201.6002	36.69	Pk	18.4	-30.2	24.89	43.52	-18.63	0-360	101	V
4	214.4019	37	Pk	16.6	-30.1	23.5	43.52	-20.02	0-360	102	H
3	214.4019	38.4	Pk	16.6	-30.1	24.9	43.52	-18.62	0-360	199	V
5	360.0208	34.56	Pk	20.8	-29.4	25.96	46.02	-20.06	0-360	102	H
6	360.0208	33.59	Pk	20.8	-29.4	24.99	46.02	-21.03	0-360	101	V
8	439.3311	28.79	Pk	22.7	-29.1	22.39	46.02	-23.63	0-360	102	H
10	524.8422	34.79	Pk	23.9	-28.6	30.09	46.02	-15.93	0-360	101	V
11	528.0426	38.65	Pk	23.9	-28.7	33.85	46.02	-12.17	0-360	198	H
12	819.1805	34.51	Pk	27.7	-27.8	34.41	46.02	-11.61	0-360	198	H

Pk - Peak detector

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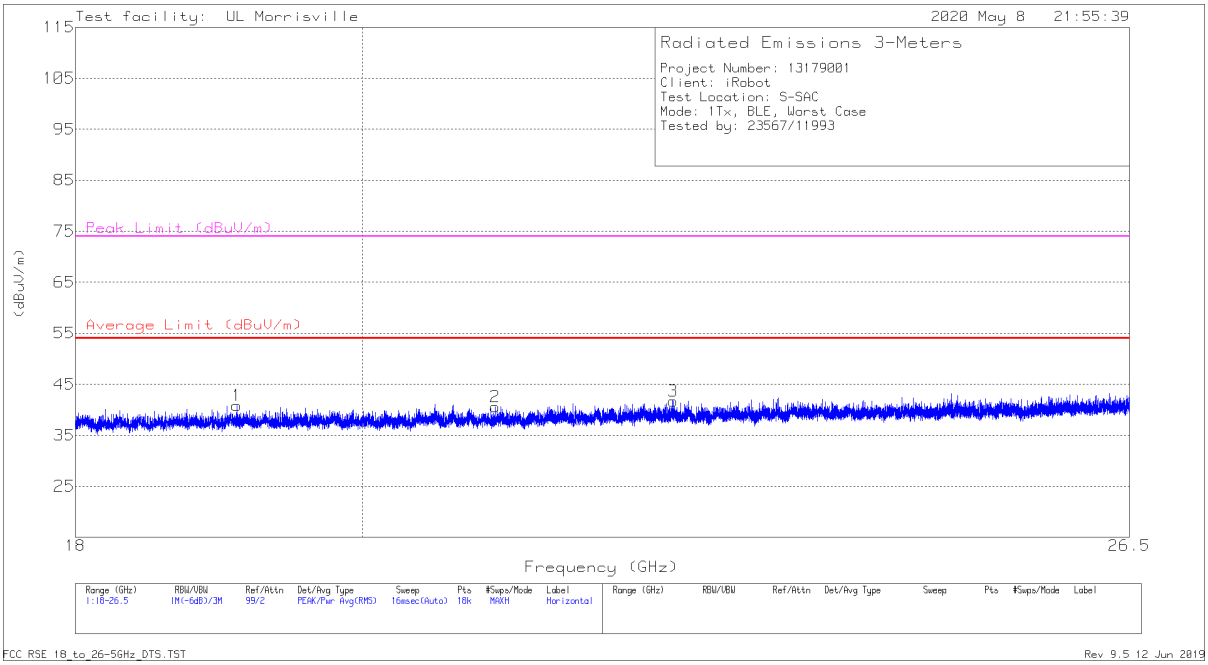
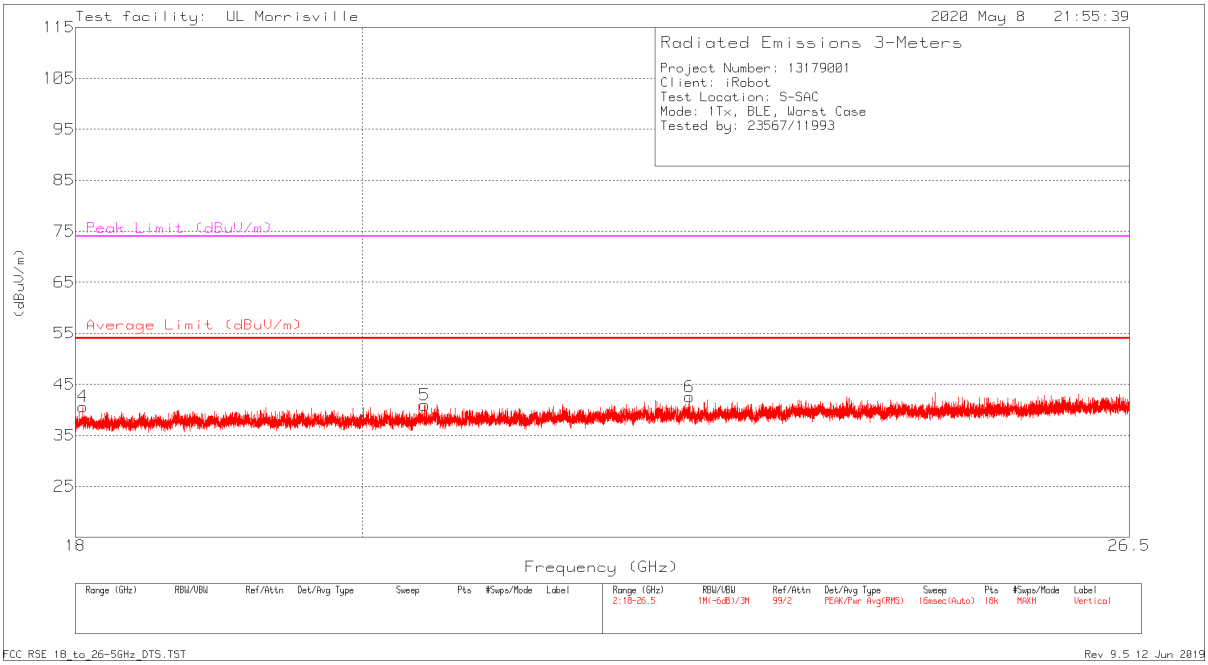
10.5. WORST CASE 18-26 GHZ

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



HORIZONTAL



VERTICAL

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18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 19.0975	46.14	Pk	32.8	-38.1	40.84	54	-13.16	74	-33.16	0-360	198	H
2	* ** 20.99878	44.9	Pk	33.2	-37.5	40.6	54	-13.4	74	-33.4	0-360	102	H
3	* ** 22.41552	45.2	Pk	33.5	-37	41.7	54	-12.3	74	-32.3	0-360	148	H
4	* ** 18.04864	46.54	Pk	32.5	-38.4	40.64	54	-13.36	74	-33.36	0-360	298	V
5	* ** 20.46136	45.21	Pk	33.2	-37.5	40.91	54	-13.09	74	-33.09	0-360	202	V
6	* ** 22.54869	45.96	Pk	33.5	-36.9	42.56	54	-11.44	74	-31.44	0-360	152	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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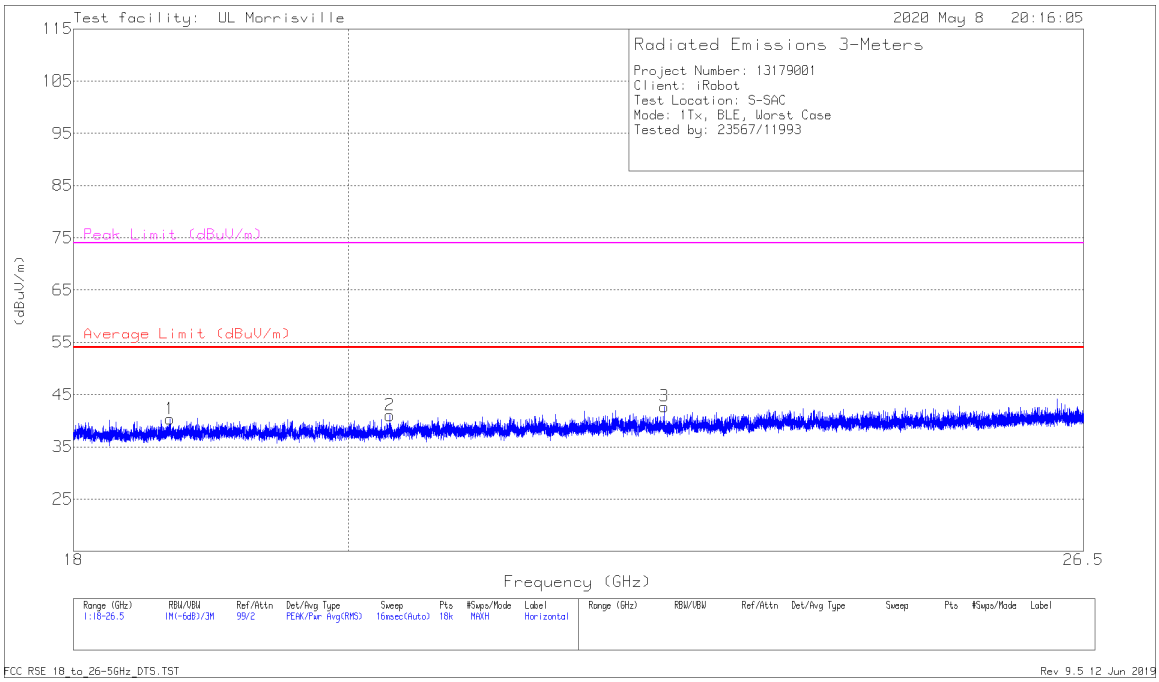
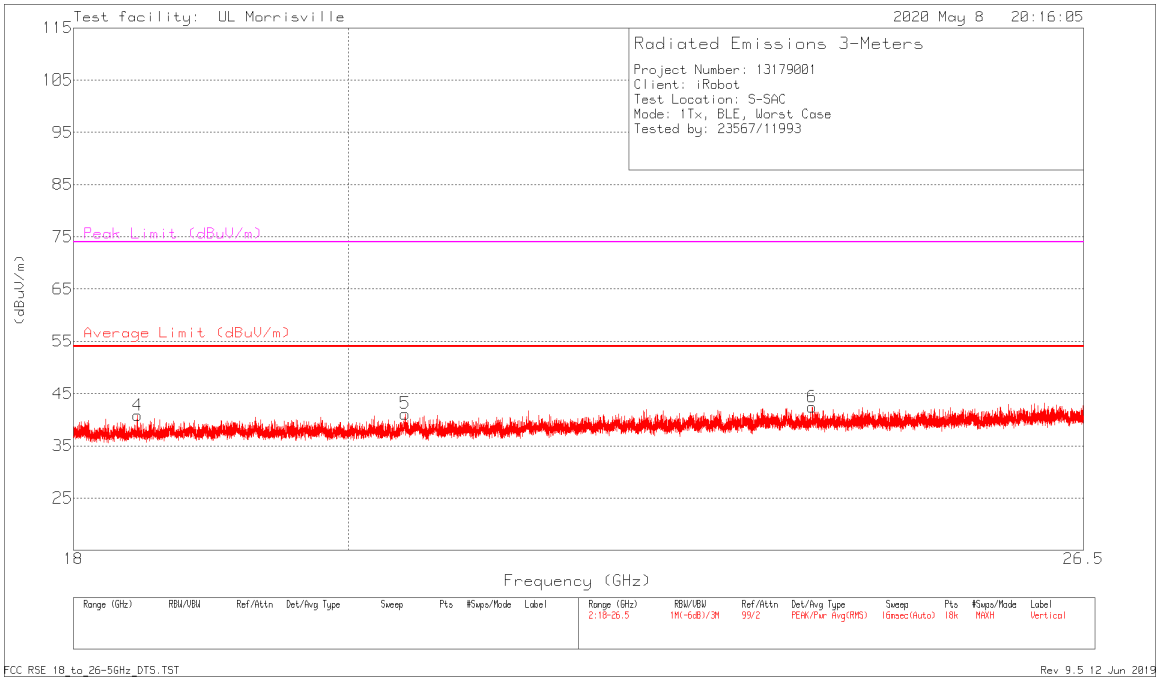
SPURIOUS EMISSIONS 18-26 GHz (WORST-CASE CONFIGURATION – PCB ANTENNA)



HORIZONTAL



VERTICAL

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18 – 26GHz DATA

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0076 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 18.67909	45.94	Pk	32.5	-38.1	40.34	54	-13.66	74	-33.66	0-360	102	H
2	* ** 20.31921	45.73	Pk	33	-37.7	41.03	54	-12.97	74	-32.97	0-360	102	H
3	* ** 22.57089	46.44	Pk	33.4	-37.1	42.74	54	-11.26	74	-31.26	0-360	298	H
4	* ** 18.4458	46.73	Pk	32.4	-38.3	40.83	54	-13.17	74	-33.17	0-360	102	V
5	* ** 20.43774	45.54	Pk	33.1	-37.5	41.14	54	-12.86	74	-32.86	0-360	102	V
6	* ** 23.88516	44.8	Pk	34	-36.4	42.4	54	-11.6	74	-31.6	0-360	298	V

Pk - Peak detector

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11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

* Decreases with the logarithm of the frequency.

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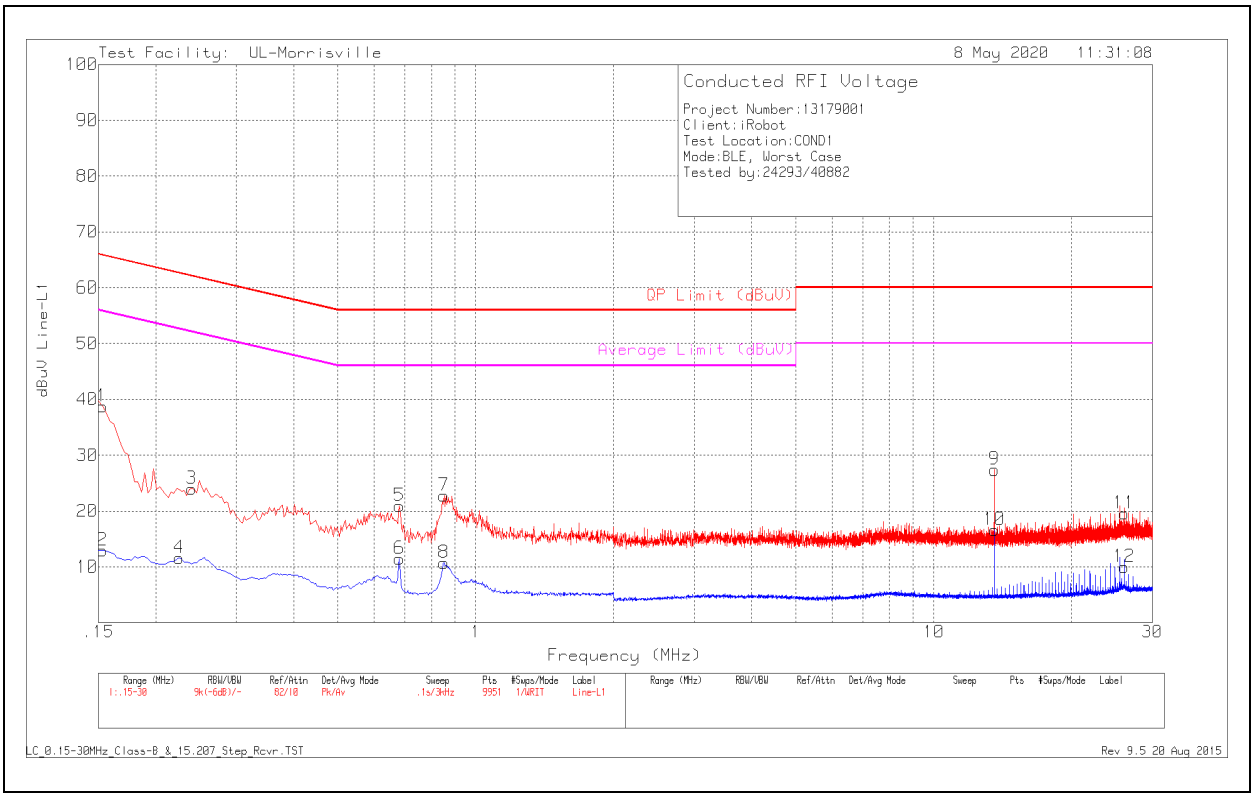
11.1.1. AC Power Line Norm

LINE 1 RESULTS – EXTERNAL ANTENNA



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.153	28.85	Pk	.2	9.7	38.75	65.84	-27.09	-	-
2	.153	3	Av	.2	9.7	12.9	-	-	55.84	-42.94
3	.24	14.21	Pk	.1	9.7	24.01	62.1	-38.09	-	-
4	.225	1.78	Av	.1	9.7	11.58	-	-	52.63	-41.05
5	.681	11.02	Pk	.1	9.8	20.92	56	-35.08	-	-
6	.681	1.52	Av	.1	9.8	11.42	-	-	46	-34.58
7	.852	12.98	Pk	0	9.8	22.78	56	-33.22	-	-
8	.852	.89	Av	0	9.8	10.69	-	-	46	-35.31
9	13.56	17.29	Pk	.1	10	27.39	60	-32.61	-	-
10	13.56	6.53	Av	.1	10	16.63	-	-	50	-33.37
11	26.031	9.09	Pk	.3	10.2	19.59	60	-40.41	-	-
12	26.031	-.53	Av	.3	10.2	9.97	-	-	50	-40.03

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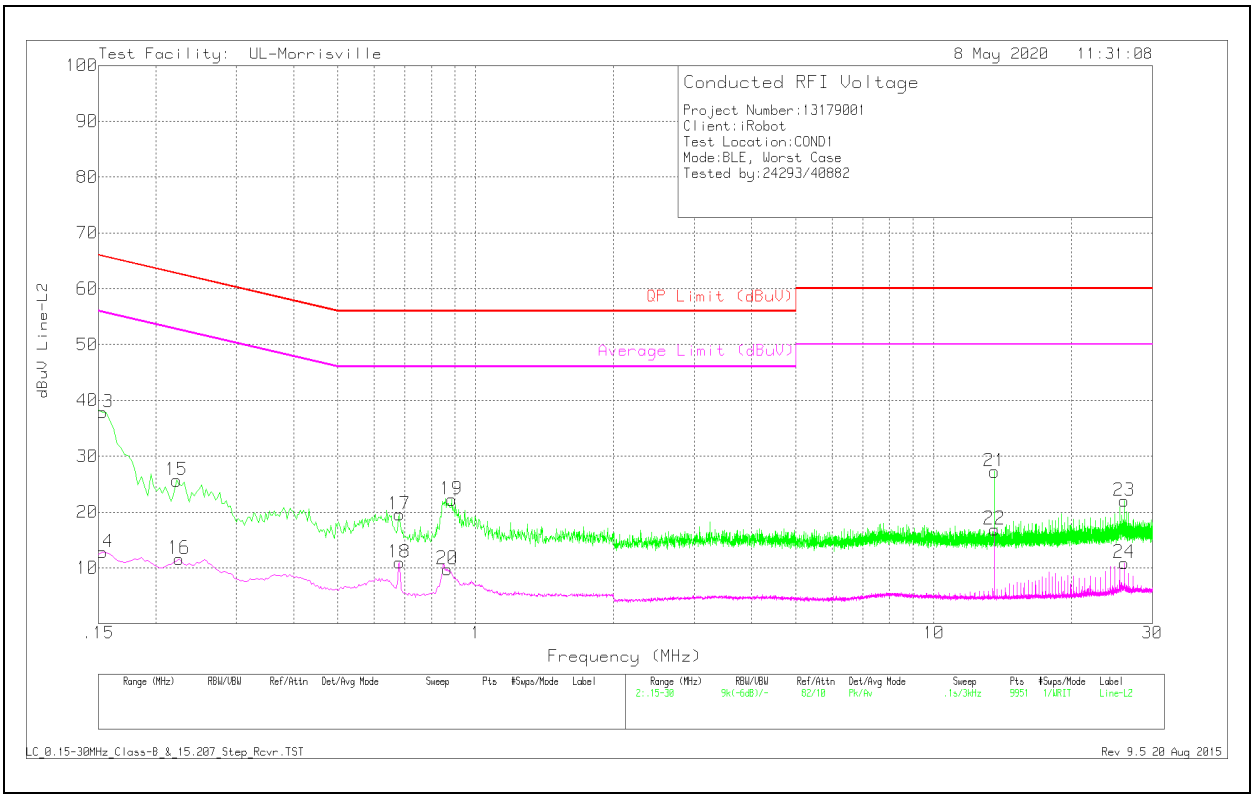
LINE 2 RESULTS – EXTERNAL ANTENNA



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.153	27.98	Pk	.2	9.7	37.88	65.84	-27.96	-	-
14	.153	2.91	Av	.2	9.7	12.81	-	-	55.84	-43.03
15	.222	15.86	Pk	.1	9.7	25.66	62.74	-37.08	-	-
16	.225	1.83	Av	.1	9.7	11.63	-	-	52.63	-41
17	.681	9.77	Pk	0	9.8	19.57	56	-36.43	-	-
18	.681	1.13	Av	0	9.8	10.93	-	-	46	-35.07
19	.885	12.42	Pk	0	9.8	22.22	56	-33.78	-	-
20	.867	-.03	Av	0	9.8	9.77	-	-	46	-36.23
21	13.56	17.16	Pk	.1	10	27.26	60	-32.74	-	-
22	13.56	6.81	Av	.1	10	16.91	-	-	50	-33.09
23	26.028	11.62	Pk	.2	10.2	22.02	60	-37.98	-	-
24	26.019	.49	Av	.2	10.2	10.89	-	-	50	-39.11

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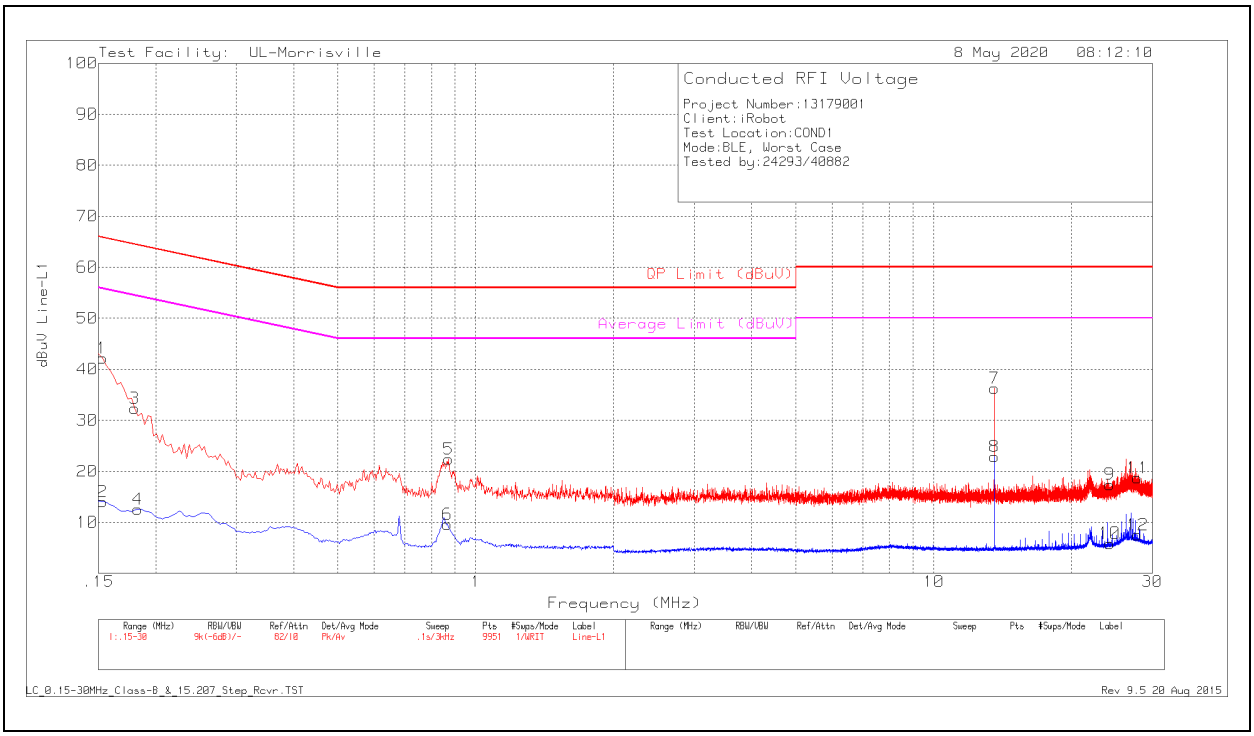
LINE 1 RESULTS – PCB ANTENNA



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.153	32.25	Pk	.2	9.7	42.15	65.84	-23.69	-	-
2	.153	4.11	Av	.2	9.7	14.01	-	-	55.84	-41.83
3	.18	22.44	Pk	.2	9.7	32.34	64.49	-32.15	-	-
4	.183	2.69	Av	.2	9.7	12.59	-	-	54.35	-41.76
5	.873	12.58	Pk	0	9.8	22.38	56	-33.62	-	-
6	.867	-.22	Av	0	9.8	9.58	-	-	46	-36.42
7	13.56	26.19	Pk	.1	10	36.29	60	-23.71	-	-
8	13.56	12.79	Av	.1	10	22.89	-	-	50	-27.11
9	24.207	7.02	Pk	.2	10.2	17.42	60	-42.58	-	-
10	24.213	-4.55	Av	.2	10.2	5.85	-	-	50	-44.15
11	27.852	8.19	Pk	.3	10.2	18.69	60	-41.31	-	-
12	27.849	-2.99	Av	.3	10.2	7.51	-	-	50	-42.49

Pk - Peak detector
Av - Average detection

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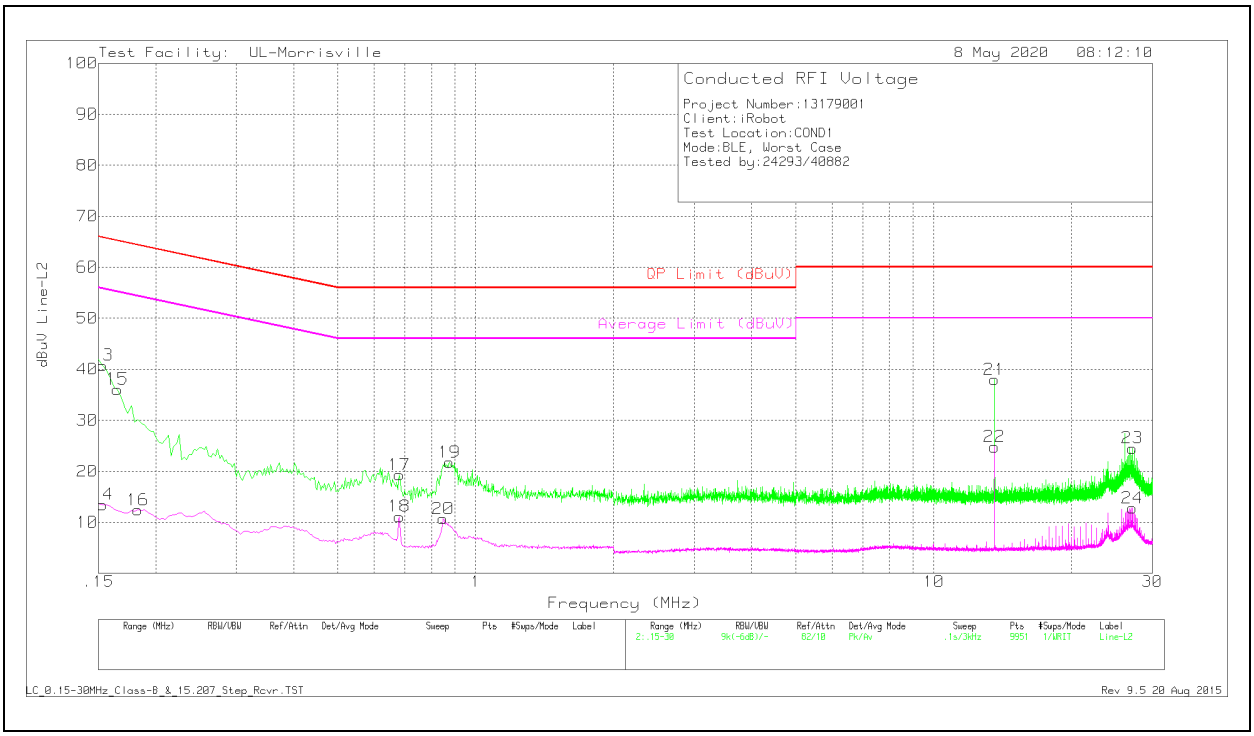
LINE 2 RESULTS – PCB ANTENNA



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
13	.153	30.87	Pk	.2	9.7	40.77	65.84	-25.07	-	-
14	.153	3.58	Av	.2	9.7	13.48	-	-	55.84	-42.36
15	.165	26.19	Pk	.2	9.7	36.09	65.21	-29.12	-	-
16	.183	2.52	Av	.2	9.7	12.42	-	-	54.35	-41.93
17	.681	9.54	Pk	0	9.8	19.34	56	-36.66	-	-
18	.681	1.35	Av	0	9.8	11.15	-	-	46	-34.85
19	.876	11.99	Pk	0	9.8	21.79	56	-34.21	-	-
20	.849	.91	Av	0	9.8	10.71	-	-	46	-35.29
21	13.56	27.9	Pk	.1	10	38	60	-22	-	-
22	13.56	14.7	Av	.1	10	24.8	-	-	50	-25.2
23	27.138	14.14	Pk	.2	10.2	24.54	60	-35.46	-	-
24	27.129	2.41	Av	.2	10.2	12.81	-	-	50	-37.19

Pk - Peak detector
Av - Average detection

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12. SETUP PHOTOS

Please refer to R13179001-EP1 for setup photos

END OF TEST REPORT

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