TEST REPORT

Report Number: R15607285-E6

Applicant	:	RF IDEAS 425 N. Martingale Road Suite 1680 Schaumburg, IL 60173, USA
Model	:	SP30L00
FCC ID	:	M9MSP30L00
IC	:	6571A-SP30L00
EUT Description	:	WAVE ID Mobile SP LEGIC USB Black Reader
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C: 2025 ISED RSS-247 ISSUE 3: 2023 ISED RSS-GEN ISSUE 5 + A1 + A2: 2021

Date Of Issue:
2025-04-03

Prepared by:
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CERT #0751.06

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2025-02-10	Initial Issue	Manish Baral
V2	2025-02-20	Updated Average Power	Manish Baral
V3	2025-03-25	Revised Power Spectral Density	Charles Moody
V2	2025-04-03	Revised Measurement Equipment	Charles Moody

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: RF IDEAS
425 N. Martingale Road, Suite 1680
Schaumburg, IL 60173, USA

EUT DESCRIPTION: WAVE ID Mobile SP LEGIC USB Black Reader

MODEL: SP30L00

SERIAL NUMBER: WLHA000127, WLHA000115, WLHA000139, WLHA000134

SAMPLE RECEIPT DATE: 2024-12-13

DATE TESTED: 2025-01-09 TO 2025-01-23

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	See Section 2
ISED RSS-247 Issue 3	See Section 2
ISED RSS-GEN Issue 5 + A1 + A2	See Section 2

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.

Approved & Released For
UL LLC. By:

Brian Kiewra
Project Engineer
Consumer, Medical and IT Segment.
UL LLC.

Prepared By:

Manish Baral
Engineer
Consumer, Medical and IT Segment.
UL LLC.

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2. TEST RESULTS SUMMARY

Below is a list of the data provided by the customer:
1) Antenna gain and type (see section 6.3)
2) Cable loss (see sections 9.4 and 9.5)

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	Complies	None.
15.247 (b) (3)	RSS-247 5.4 (d)	Output Power	Complies	None.
See Comment		Average power	Reporting purposes only	Per ANSI C63.10, Section 11.9.2.3.2.
15.247 (e)	RSS-247 5.2 (b)	PSD	Complies	None.
15.247 (d)	RSS-247 5.5	Conducted Spurious Emissions	Complies	None.
15.209, 15.205	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-Gen 8.8	AC Mains Conducted Emissions	Complies	None.

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 C63.10-2020, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A1 + A2, and RSS-247 Issue 3.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, Certificate Number #0751.06, for all testing performed within the scope of this report. Testing was performed at the locations noted below.

	Address	ISED CABID	ISED Company Number	FCC Registration
☐	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
☒	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A		27265	

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5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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

5.2. DECISION RULES

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

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	U_{Lab}
Radio Frequency (Spectrum Analyzer)	419.38 Hz
Occupied Channel Bandwidth	1.22%
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	6.01 dB
Conducted Emissions (0.150-30MHz) - LISN	3.40 dB
Temperature	0.57°C
Humidity	3.39%
DC Supply voltages	1.70%

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 RFID card reader capable of reading both 125 kHz and 13.56 MHz credentials and Legic Secure Segment credentials via Bluetooth communication. This report covers the full emissions testing of the BLE radio.

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	0.29	1.07

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

The antenna(s) gain and type, as provided by the manufacturer' are as follows:

The radio utilizes a chip antenna, with a maximum gain of 0.5 dBi.

6.4. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was:

EUT Firmware: WN5020600UPX7L0

6.5. WORST-CASE CONFIGURATION AND MODE

Radiated emissions below 1GHz and above 18GHz were performed with the EUT set to transmit at the channel with highest power spectral density as worst-case scenario.

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

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

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6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T14	0623PF4FKVWW	N/A
Laptop Charger	Lenovo	ADLX65YDC2D	8SSA10R16970D1SG	N/A
Laptop	HP	HP EliteBook Resolve 810 G2	8CG4340RMV	N/A
13.56MHz Tag	RF Ideas	N/A	996302030	N/A
125kHz Tag	RF Ideas	N/A	23993	N/A

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	Power	1	N/A	USB	<3m	N/A
2	Power	1	N/A	USB and RS232	<3m	Power to USB and RS232. RS232 to USB adapter For Rx Only

TEST SETUP

The EUT is connected to a test laptop during the tests. Test software exercised the radio card and the transmit power was set to 0dBm as instructed by the customer.

SETUP DIAGRAMS

Please refer to 15607285-EP3 for setup diagrams

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7. MEASUREMENT METHOD

On Time and Duty Cycle: ANSI C63.10, Section 11.6 : Zero-Span Spectrum Analyzer Method.

6 dB BW: ANSI C63.10 Subclause -11.8.1

Occupied BW (99%): ANSI C63.10-2020 Section 6.9.3

Output Power: ANSI C63.10 Subclause -11.9.1.2 Method PKPM1 Peak-reading power meter
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)

Conducted emissions non-restricted frequency bands: ANSI C63.10 Subclause -11.11 and 6.10.4

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

General radiated emissions: ANSI C63.10 Subclause – 6.3-6.6

AC Power Line Conducted Emissions: ANSI C63.10-2020, Section 6.2.

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8. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 1)

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
0.009-30MHz					
135144	Active Loop Antenna	ETS-Lindgren	6502	2024-10-02	2025-10-02
30-1000 MHz					
90629	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2024-01-30	2026-01-30
1-18 GHz					
135143	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2024-02-07	2026-02-07
18-40 GHz					
204704	Horn Antenna, 18-26.5GHz	Com-Power	AH-826	2023-07-20	2025-07-20
Gain-Loss Chains					
91974	Gain-loss string: 0.009-30MHz	Various	Various	2024-05-08	2025-05-08
91976	Gain-loss string: 25-1000MHz	Various	Various	2024-05-08	2025-05-08
91979	Gain-loss string: 1-18GHz	Various	Various	2024-05-08	2025-05-08
136042	Gain-loss string: 18-40GHz	Various	Various	2024-05-10	2025-05-10
Receiver & Software					
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2024-08-29	2025-08-29
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
Additional Equipment used					
241205	Environmental Meter	Fisher Scientific	15-077-963	2023-09-05	2025-09-05

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Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
Common Equipment					
Conducted Room 1					
90411	Spectrum Analyzer	Keysight Technologies	N9030A	2024-08-01	2025-08-01
90410	Spectrum Analyzer	Keysight Technologies	N9030A	2024-06-14	2025-06-14
179892	Environmental Meter	Fisher Scientific	15-077-963	2024-08-12	2025-08-12
SOFTEMI	Antenna Port Software	UL	Version 2022.8.16	NA	NA
211058	Real-Time Peak Power Sensor 50MHz to 8GHz	Boonton	RTP5000	2024-08-01	2025-08-01
Power Software	Boonton Power Analyzer	Boonton	Version 3.0.13.0	NA	NA
226563	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2024-02-29	2025-02-28

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
70374	EMI Test Receiver	ROHDE & SCHWARZ	ESCI7	2024-07-30	2025-07-30
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2024-04-04	2025-04-04
179892	Environmental Meter	Fisher Scientific	15-077-963	2024-08-12	2025-08-12
80391	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2024-08-01	2025-08-01
PS216	AC Power Source	Elgar	CW2501M	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		

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9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

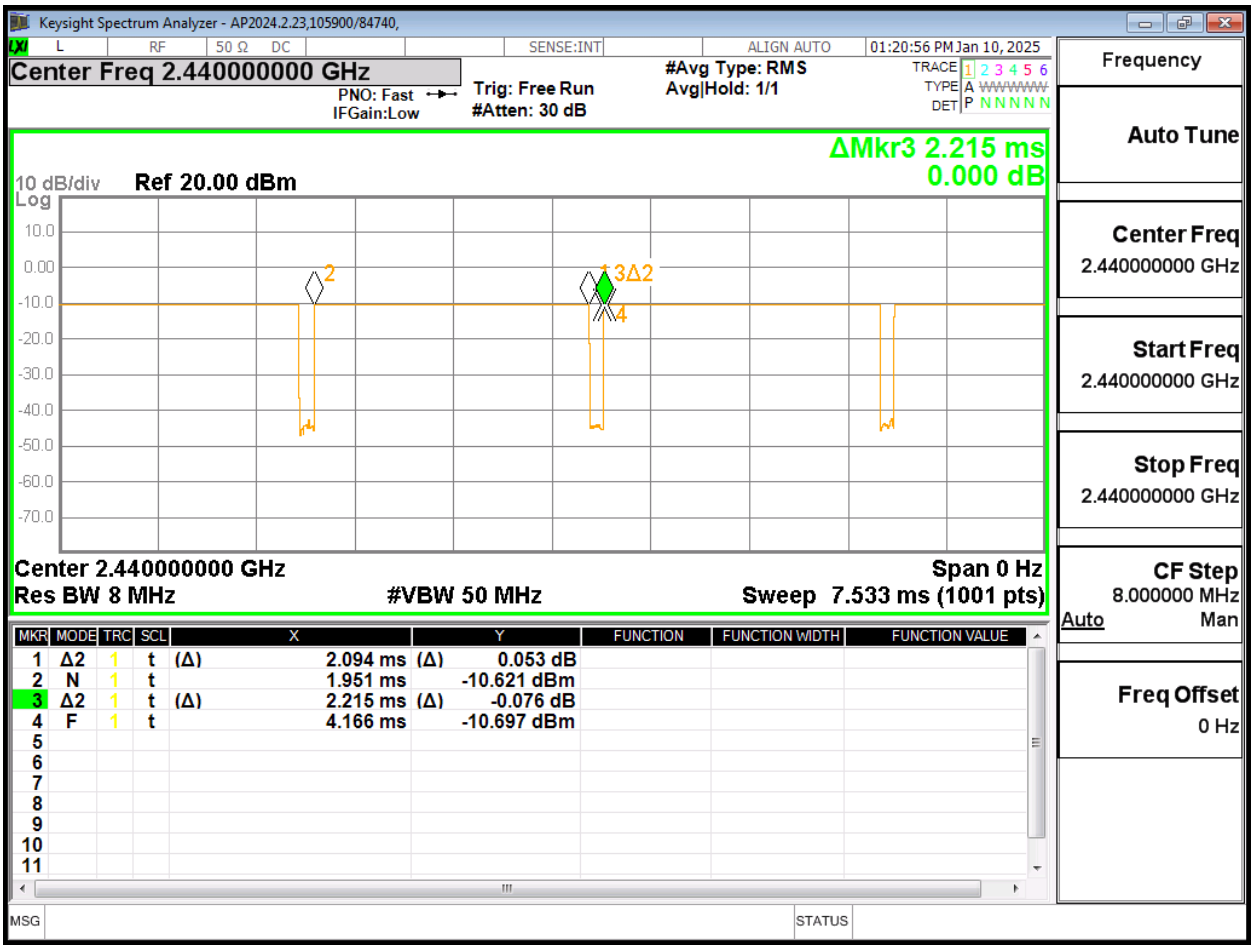
None; for reporting purposes only.

PROCEDURE

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

ON TIME AND DUTY CYCLE RESULTS

	B (msec)	(msec)	x (linear)	Cycle (%)	Correction Factor (dB)	Minimum VBW (kHz)
2.4GHz Band						
BLE	2.094	2.215	0.945	94.54	0.49	0.478



DUTY CYCLE: BLE – 1 Mbps

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9.2. 99% BANDWIDTH

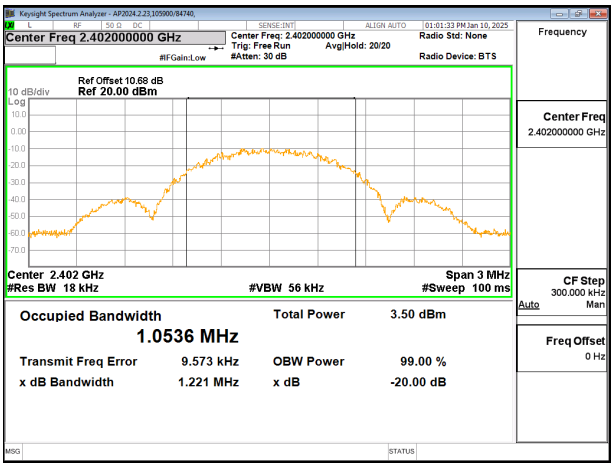
LIMITS

None; for reporting purposes only.

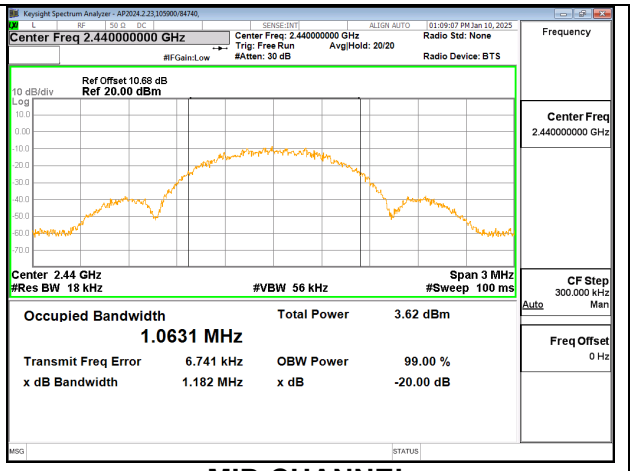
RESULTS

9.2.1. BLE (1Mbps)

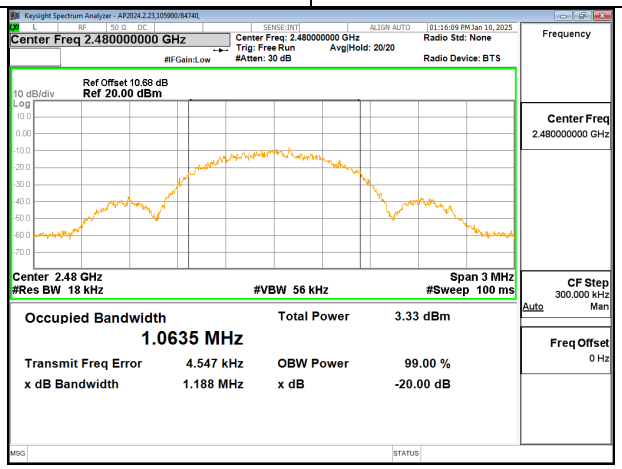
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2402	1.0536
Middle	2440	1.0631
High	2480	1.0635



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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9.3. 6 dB BANDWIDTH

LIMITS

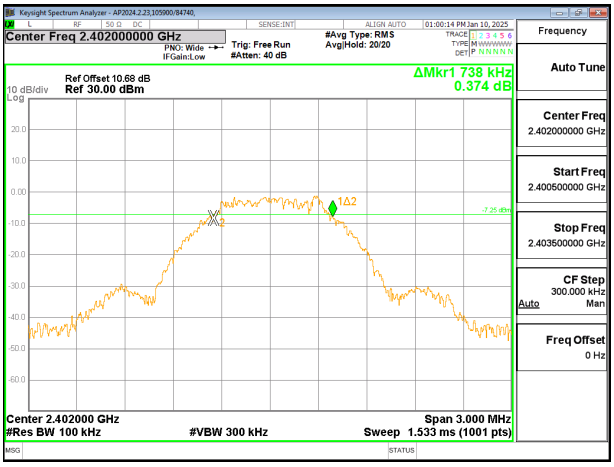
FCC §15.247 (a) (2)
RSS-247 5.2 (a)
The minimum 6 dB bandwidth shall be at least 500 kHz.

RESULTS

9.3.1. BLE (1Mbps)

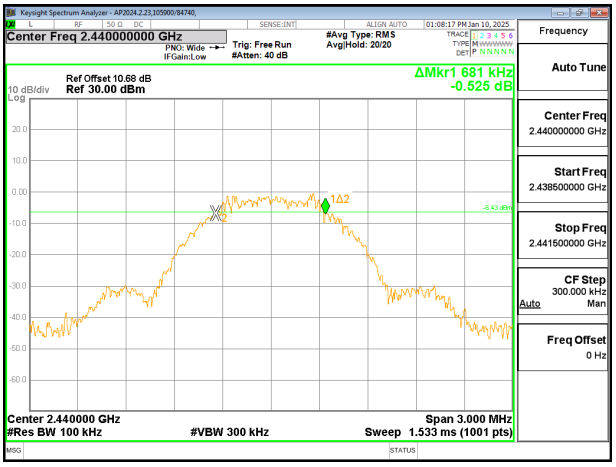
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2402	0.7380	0.5
Middle	2440	0.6810	0.5
High	2480	0.6540	0.5

Test Date: 2025-01-10



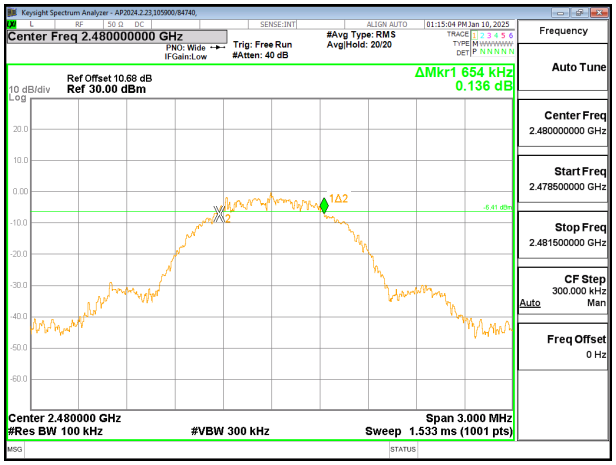
LOW CHANNEL

Test Date: 2025-01-10



MID CHANNEL

Test Date: 2025-01-10



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9.4. OUTPUT POWER

LIMITS

FCC §15.247 (b) (3)

RSS-247 5.4 (d)

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

TEST PROCEDURE
The transmitter output is connected to a power meter.

The cable assembly insertion loss of 10.86 dB (including 9.85 dB pad and 1.01 dB EUT cable) was entered as an offset in the power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband power sensor. Peak output power was read directly from power meter.

RESULTS

9.4.1. BLE (1Mbps)

Tested By:	105193/84740
Date:	2025-01-10

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2402	0.290	30	-29.710
Middle	2440	0.210	30	-29.790
High	2480	0.070	30	-29.930

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9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE
The transmitter output is connected to an average gated power meter.

The cable assembly insertion loss of 10.86 dB (including 9.85 dB pad and 1.01 dB EUT cable) was entered as an offset in the average gated power meter.

The power output was measured on the EUT antenna port using SMA cable with 10dB attenuator connected to a power meter via wideband average power sensor. Gated average output power was read directly from power meter.

RESULTS

9.5.1. BLE (1Mbps)

Tested By:	105193/84740
Date:	2025-01-10

Channel	Frequency (MHz)	AV power (dBm)
Low	2402	-0.109
Middle	2440	-0.169
High	2480	-0.302

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9.6. POWER SPECTRAL DENSITY

LIMITS

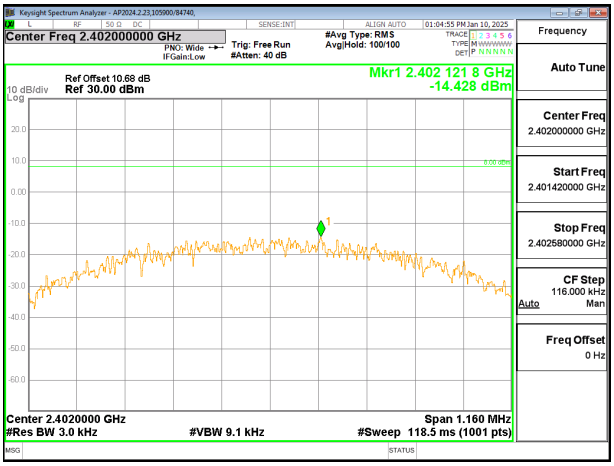
FCC §15.247 (e)
RSS-247 (5.2) (b)
The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS

9.6.1. BLE (1Mbps)

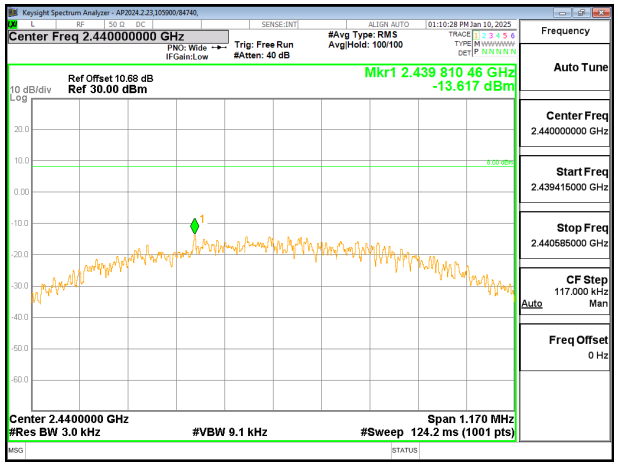
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2402	-14.43	8	-22.43
Middle	2440	-13.62	8	-21.62
High	2480	-13.48	8	-21.48

Test Date: 2025-01-10



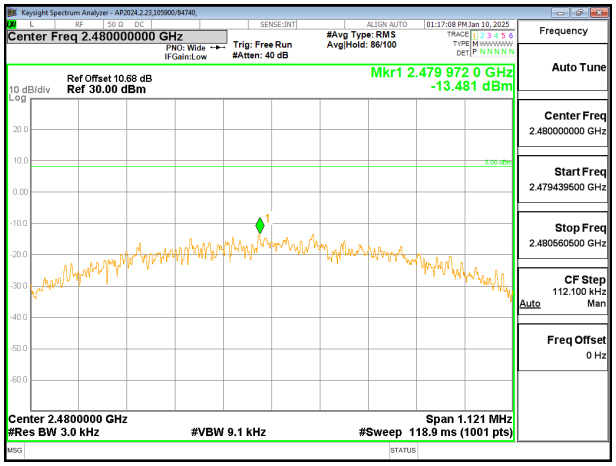
LOW CHANNEL

Test Date: 2025-01-10



MID CHANNEL

Test Date: 2025-01-10



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 dBc.

RESULTS

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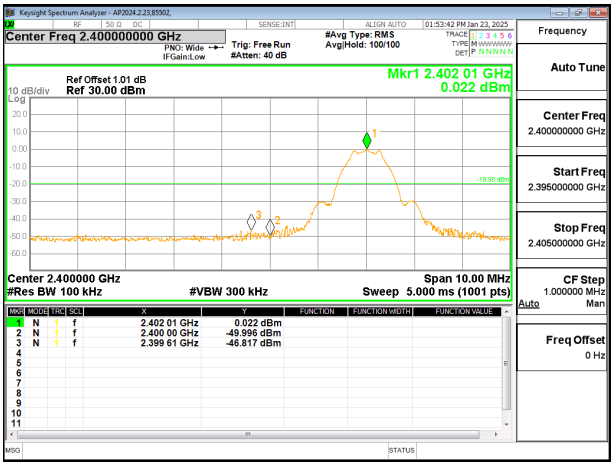
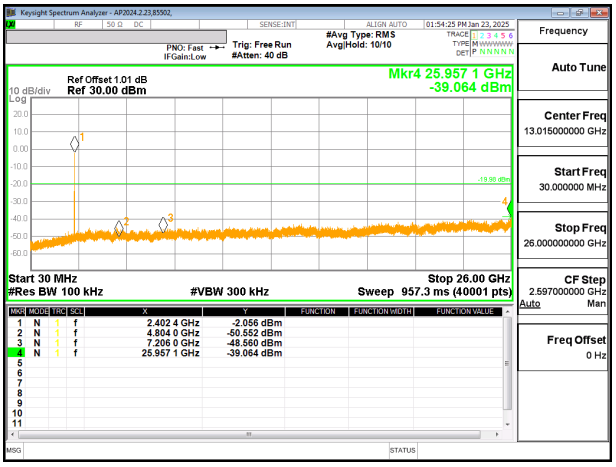
9.7.1. BLE (1Mbps)

Test Date: 2025-01-23



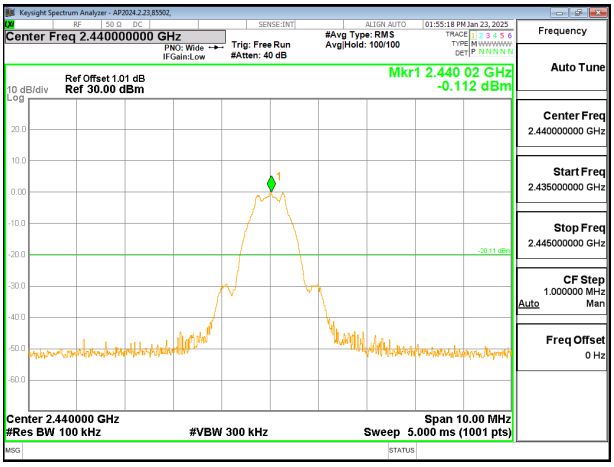
LOW CHANNEL BANDEDGE

Test Date: 2025-01-23



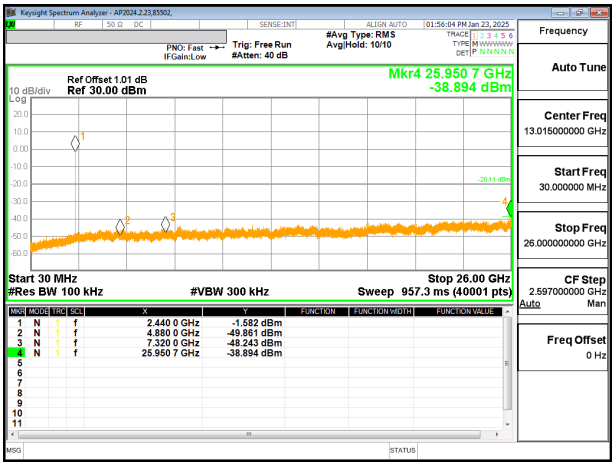
OUT-OF-BAND LOW CHANNEL

Test Date: 2025-01-23



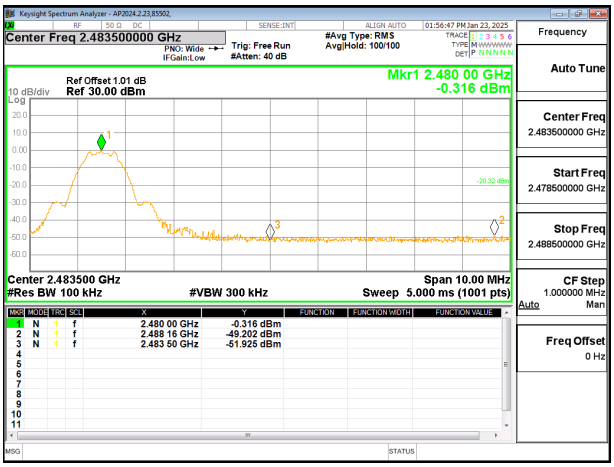
IN-BAND REFERENCE LEVEL

Test Date: 2025-01-23



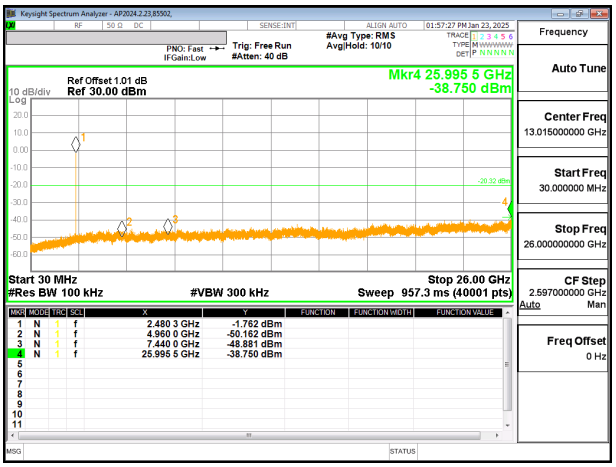
OUT-OF-BAND MID CHANNEL

Test Date: 2025-01-23



HIGH CHANNEL BANDEDGE

Test Date: 2025-01-23



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

RSS-GEN, Section 8.9 and 8.10.

Frequency Range (MHz)	Field Strength Limit (uA/m) at 3 m	Field Strength Limit (dBuA/m) at 3 m
0.009-0.490	6.37/F(kHz) @ 300 m	-
0.490-1.705	63.7/F(kHz) @ 30 m	-
1.705 - 30	0.08 @ 30m	-
Frequency Range (MHz)	**Field Strength Limit (uV/m) at 3 m**	**Field Strength Limit (dBuV/m) at 3 m**
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 or average (9-90kHz and 110-490kHz).

For pre-scans above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements.

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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. Voltage Averaging was 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 power spectral density 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.

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

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

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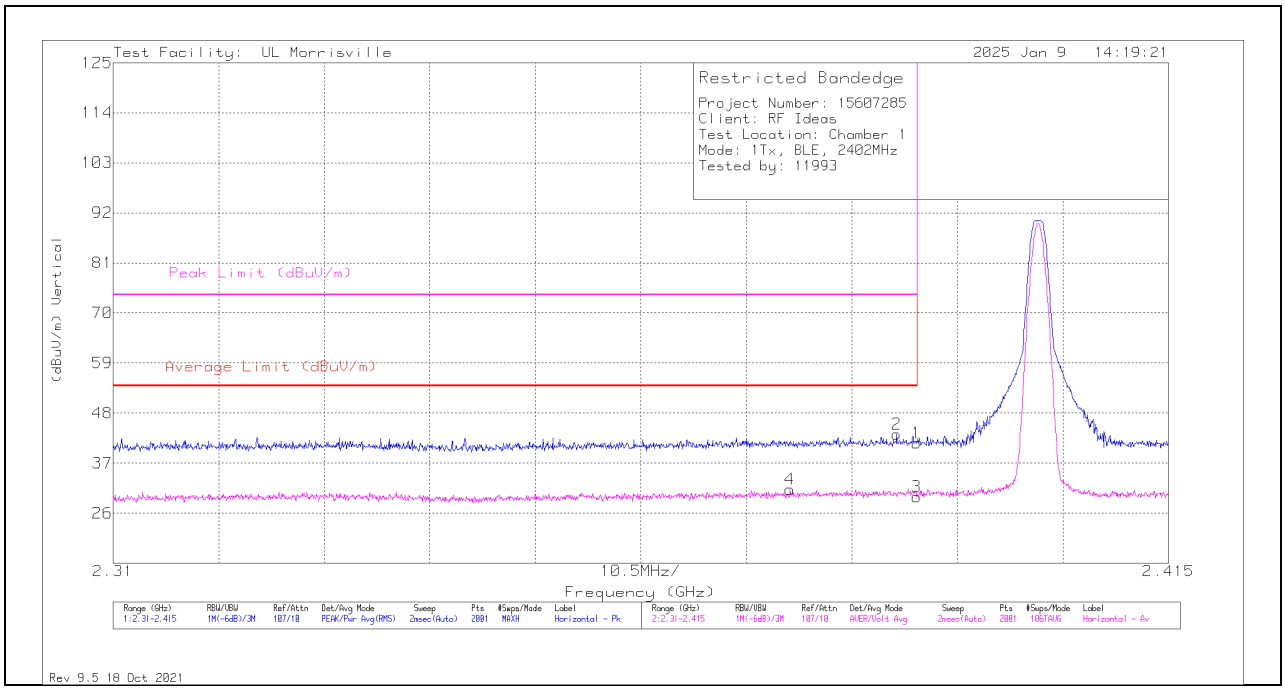
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. BLE (1Mbps)

BANDEDGE (LOW CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (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	* ** 2.38996	33.57	Pk	31.9	-24	0	41.50	-	-	74	-32.53	161	102	H
2	* ** 2.38796	35.31	Pk	31.9	-23.9	0	43.34	-	-	74	-30.69	161	102	H
3	* ** 2.38996	21.21	ADV	31.9	-24	.49	29.6	54	-24.4	-	-	161	102	H
4	* ** 2.37736	23	ADV	31.9	-24.2	.49	31.19	54	-22.81	-	-	161	102	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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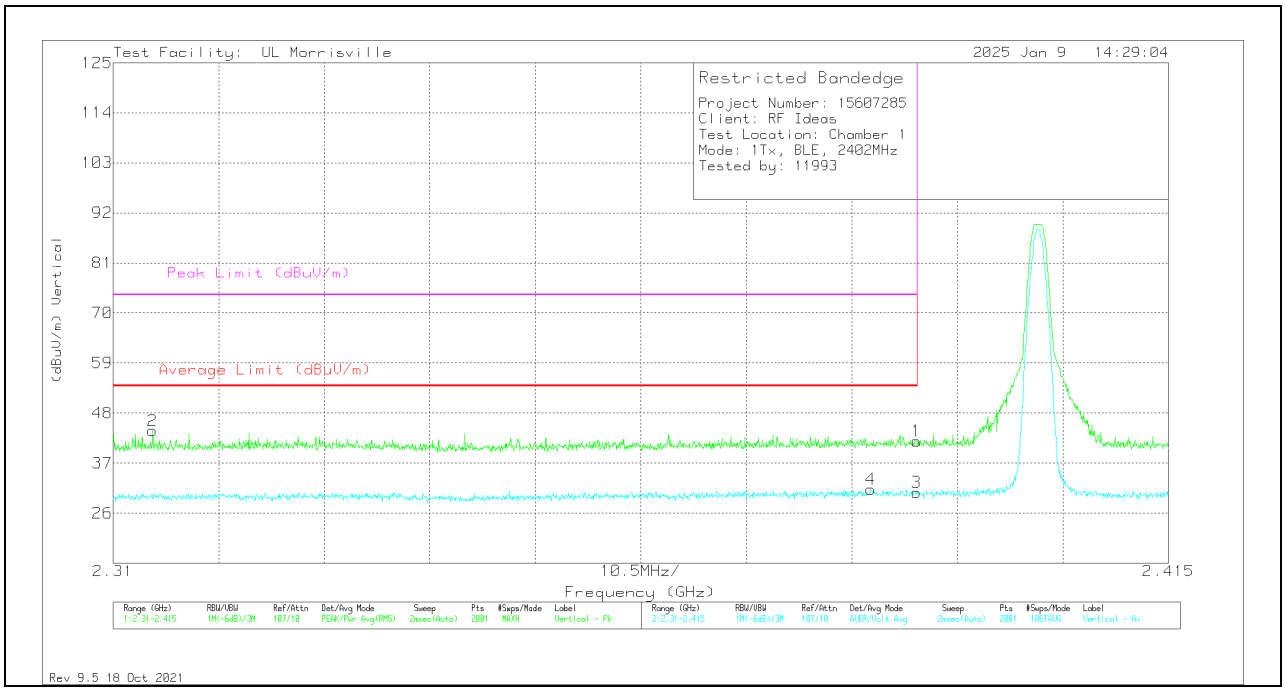
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (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	* ** 2.38996	33.94	Pk	31.9	-24	0	41.87	-	-	74	-32.16	134	118	V
2	* ** 2.31394	36.82	Pk	31.7	-24.4	0	44.15	-	-	74	-29.88	134	118	V
3	* ** 2.38996	22.09	ADV	31.9	-24	.49	30.48	54	-23.52	-	-	134	118	V
4	* ** 2.38539	22.78	ADV	31.9	-24	.49	31.17	54	-22.83	-	-	134	118	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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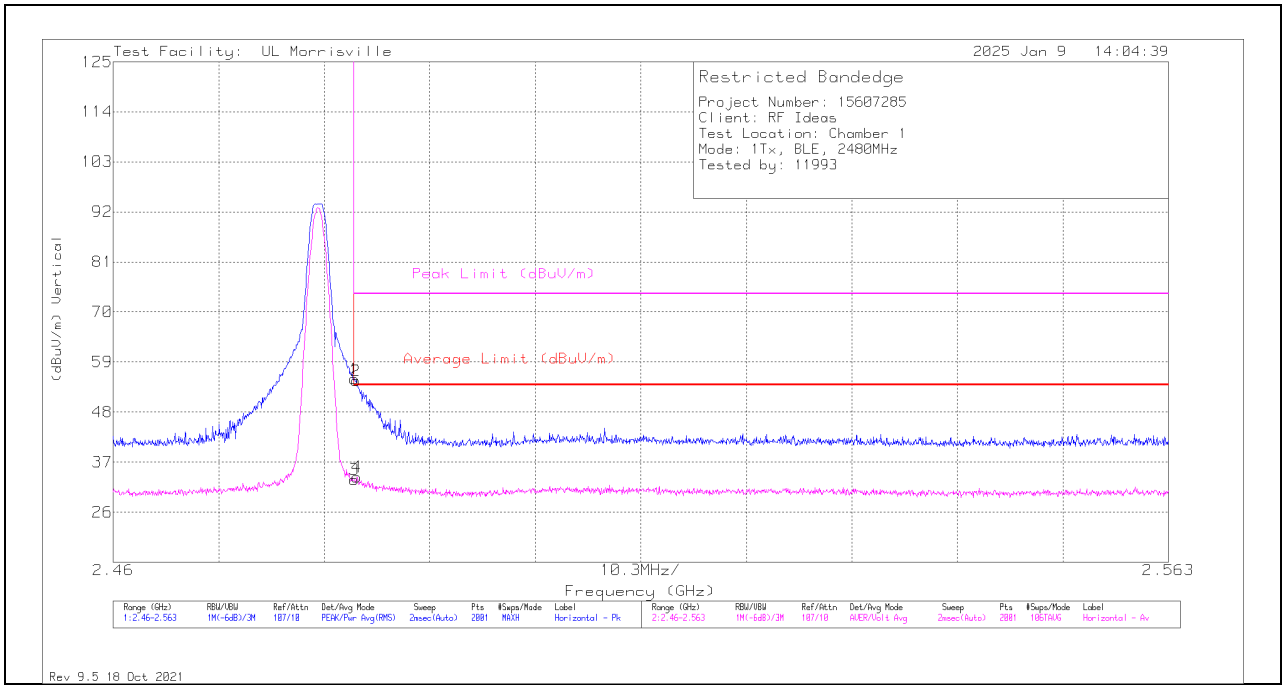
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (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	* ** 2.48354	46.77	Pk	32.2	-23.7	0	55.30	-	-	74	-18.73	325	110	H
2	* ** 2.48369	46.36	Pk	32.2	-23.7	0	54.89	-	-	74	-19.14	325	110	H
3	* ** 2.48354	24.14	ADV	32.2	-23.7	.49	33.13	54	-20.87	-	-	325	110	H
4	* ** 2.48379	24.74	ADV	32.2	-23.7	.49	33.73	54	-20.27	-	-	325	110	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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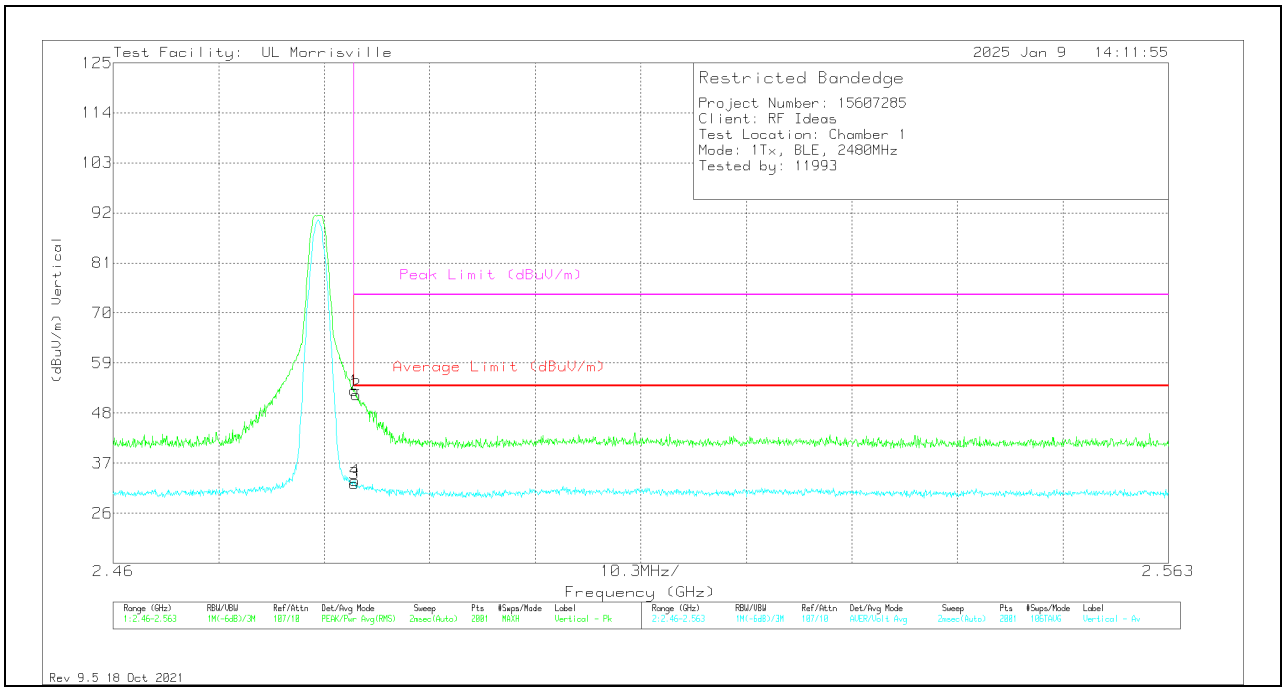
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (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	* ** 2.48354	44.43	Pk	32.2	-23.7	0	52.96	-	-	74	-21.07	137	103	V
2	* ** 2.48374	43.58	Pk	32.2	-23.7	0	52.11	-	-	74	-21.92	137	103	V
3	* ** 2.48354	23.49	ADV	32.2	-23.7	.49	32.48	54	-21.52	-	-	137	103	V
4	* ** 2.48359	24.19	ADV	32.2	-23.7	.49	33.18	54	-20.82	-	-	137	103	V

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

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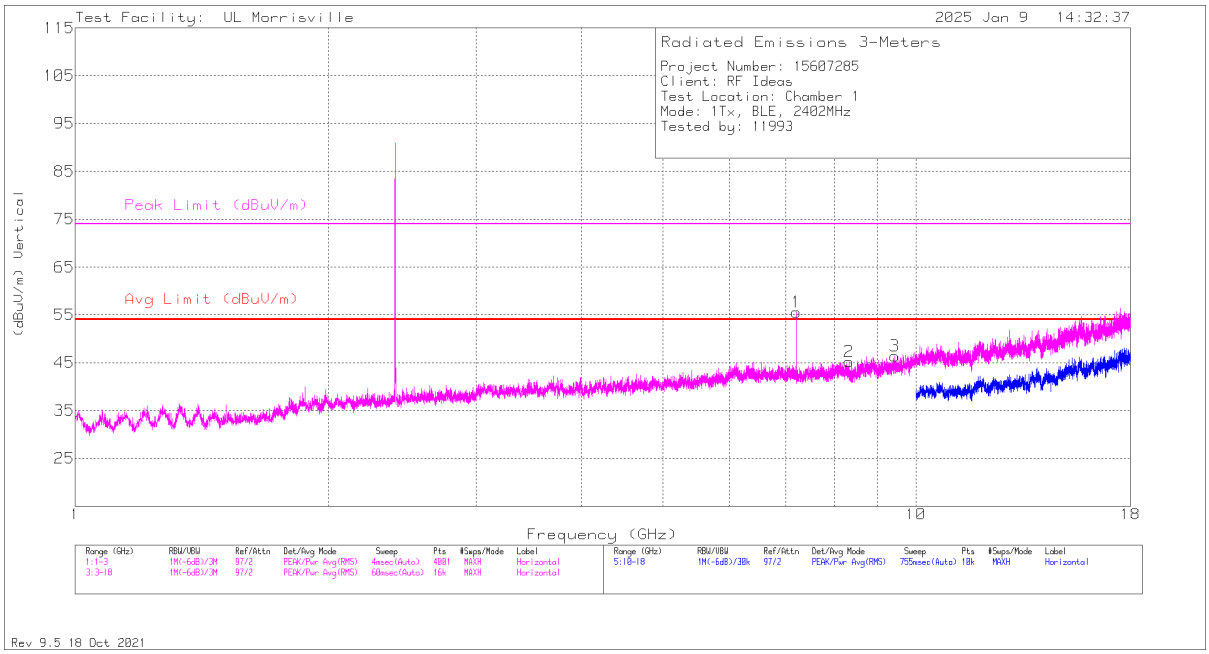
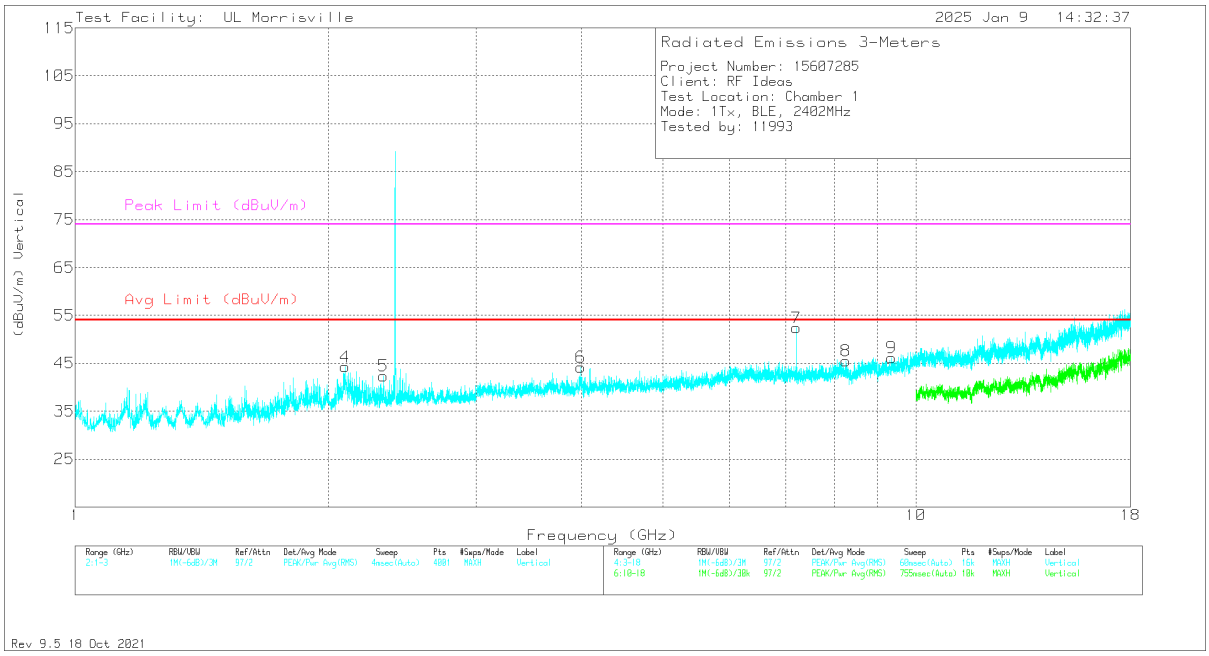
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (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
5	* ** 2.3275	34.81	Pk	31.7	-24.2	0	42.31	54	-11.69	74	-31.69	0-360	200	V
2	* ** 8.32688	50.8	Pk	35.8	-41.4	0	45.2	54	-8.8	74	-28.8	0-360	200	H
3	* ** 9.44531	50.76	Pk	36.3	-40.7	0	46.36	54	-7.64	74	-27.64	0-360	101	H
6	* ** 3.99469	55.04	Pk	33	-43.8	0	44.24	54	-9.76	74	-29.76	0-360	200	V
8	* ** 8.2575	50.37	Pk	35.9	-40.8	0	45.47	54	-8.53	74	-28.53	0-360	101	V
9	* ** 9.35813	50.55	Pk	36.2	-40.6	0	46.15	54	-7.85	74	-27.85	0-360	101	V
4	2.0945	36.85	Pk	31.7	-24.3	0	44.25	-	-	-	-	0-360	200	V
1	7.20656	62.42	Pk	35.4	-42.2	0	55.62	-	-	-	-	0-360	200	H
7	7.20656	59.17	Pk	35.4	-42.2	0	52.37	-	-	-	-	0-360	101	V

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

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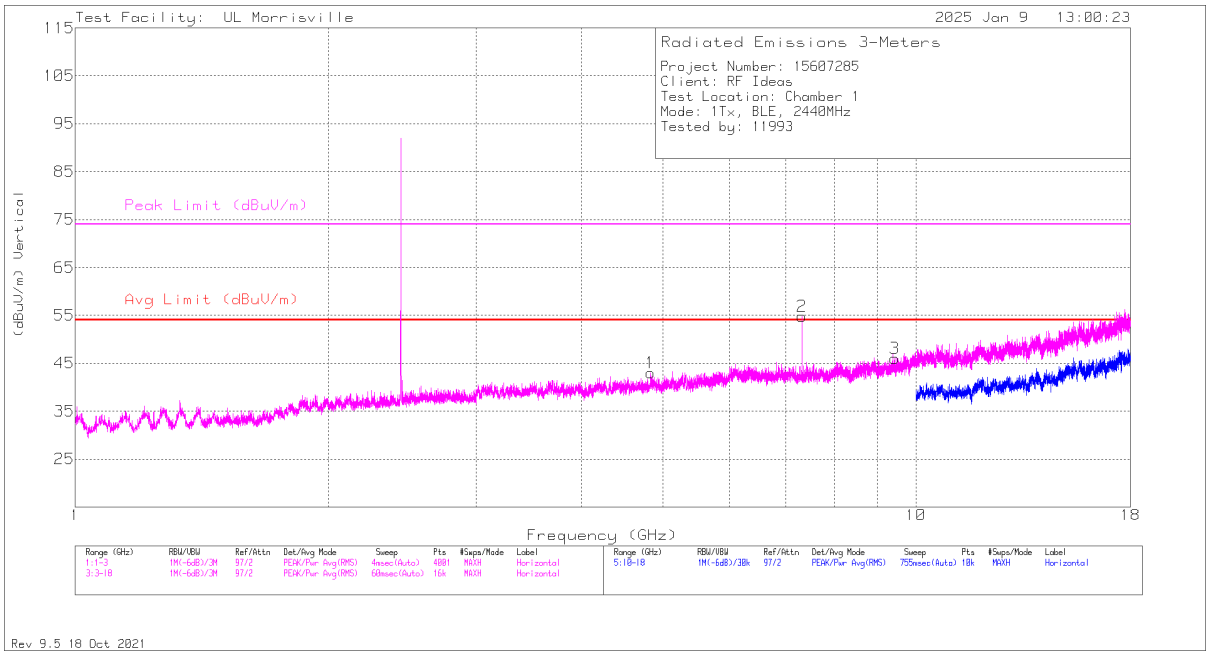
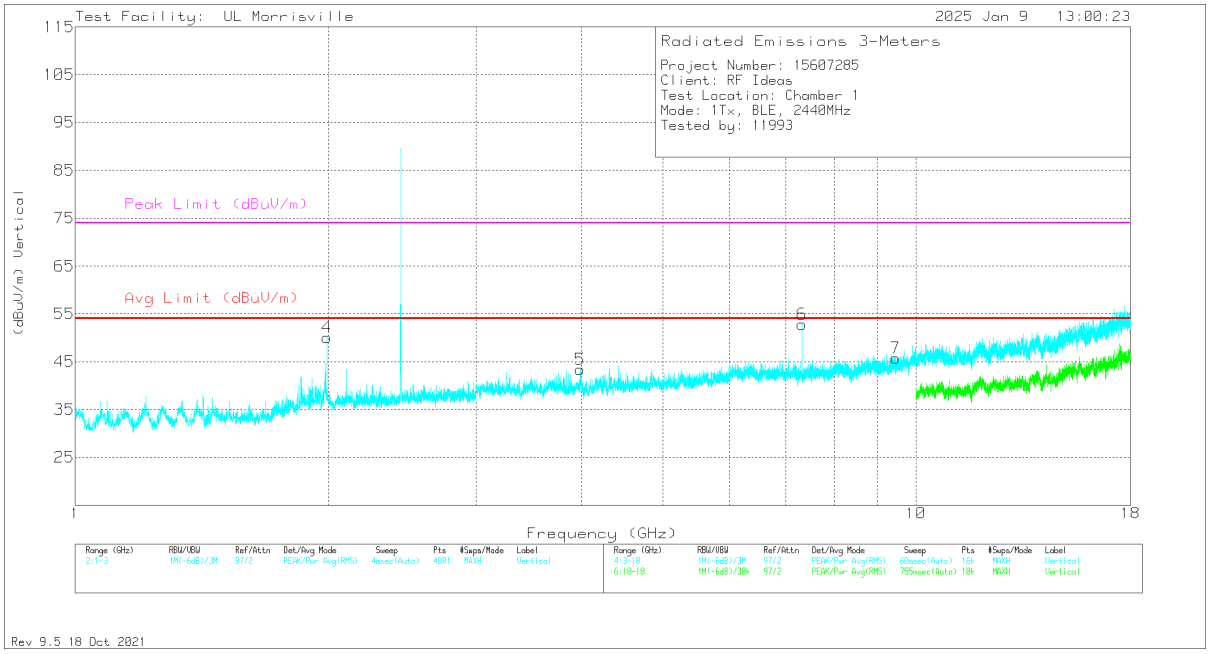
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (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	* ** 4.83656	54.25	Pk	33.9	-45.1	0	43.05	54	-10.95	74	-30.95	0-360	101	H
2	* ** 7.32088	63.64	PK2	35.4	-41.8	0	57.24	-	-	74	-16.76	160	347	H
	* ** 7.3206	57.37	ADV	35.4	-41.7	.49	51.56	54	-2.44	-	-	160	347	H
3	* ** 9.43313	50.01	Pk	36.3	-40.3	0	46.01	54	-7.99	74	-27.99	0-360	200	H
5	* ** 3.98719	54.54	Pk	33	-44.1	0	43.44	54	-10.56	74	-30.56	0-360	101	V
6	* ** 7.31922	63.98	PK2	35.4	-41.6	0	57.78	-	-	74	-16.22	145	323	V
	* ** 7.32063	57.51	ADV	35.4	-41.7	.49	51.70	54	-2.30	-	-	145	323	V
7	* ** 9.46313	50.16	Pk	36.4	-40.8	0	45.76	54	-8.24	74	-28.24	0-360	101	V
4	1.993	42.45	Pk	31.7	-24.1	0	50.05	-	-	-	-	0-360	101	V

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

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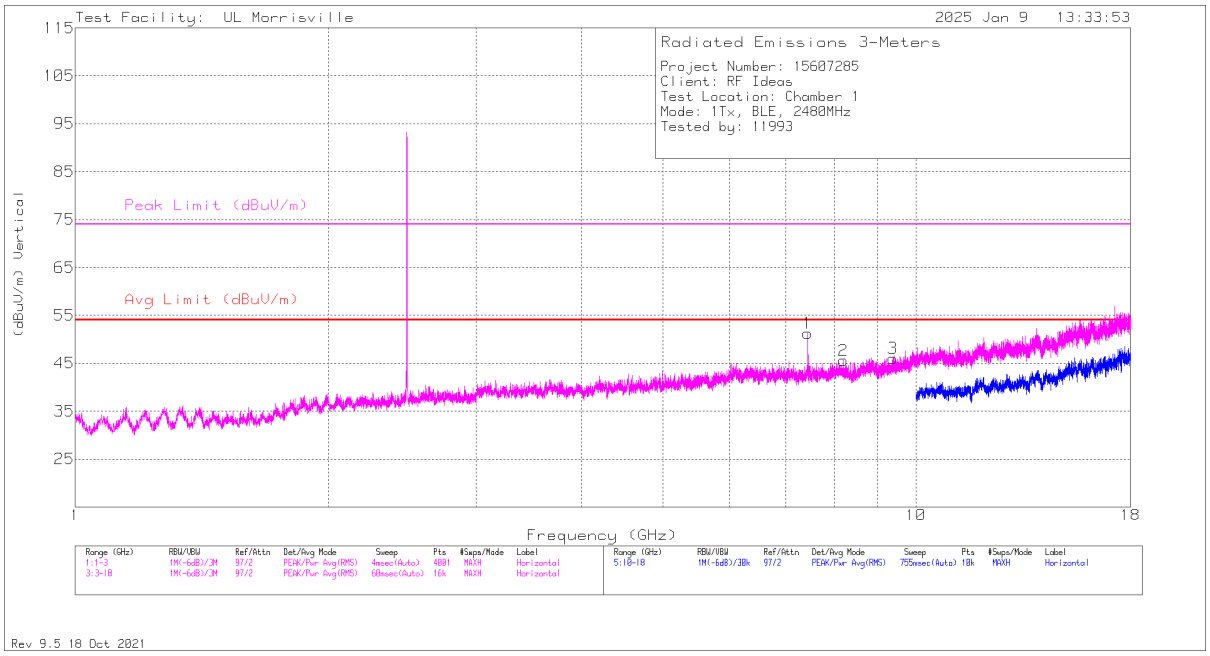
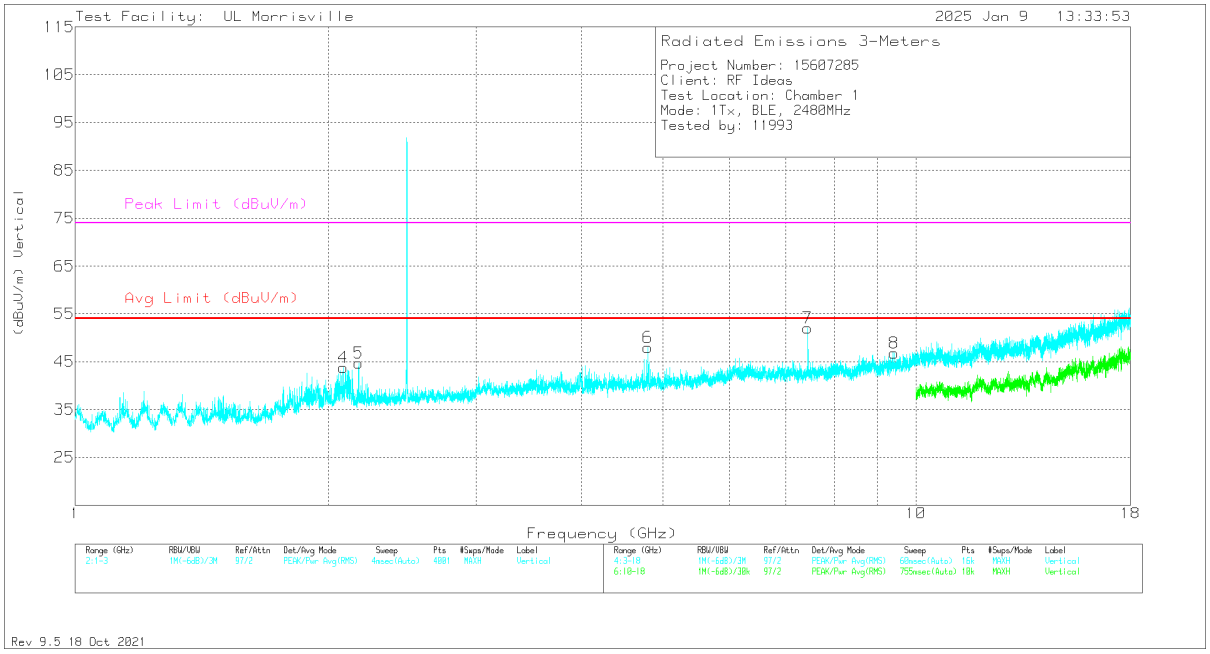
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (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	* ** 7.43926	60.37	PK2	35.4	-41	0	54.77	-	-	74	-19.23	155	211	H
	* ** 7.43937	52.36	ADV	35.4	-41	.49	47.25	54	-6.75	-	-	155	211	H
2	* ** 8.19563	50.47	Pk	35.9	-40.8	0	45.57	54	-8.43	74	-28.43	0-360	200	H
3	* ** 9.39094	50.04	Pk	36.2	-40.2	0	46.04	54	-7.96	74	-27.96	0-360	200	H
6	* ** 4.79719	59.47	Pk	33.9	-45.4	0	47.97	54	-6.03	74	-26.03	0-360	200	V
7	* ** 7.43928	61.63	PK2	35.4	-41	0	56.03	-	-	74	-17.97	86	315	V
	* ** 7.43921	54.22	ADV	35.4	-41	.49	49.11	54	-4.89	-	-	86	315	V
8	* ** 9.41719	50.17	Pk	36.3	-39.7	0	46.77	54	-7.23	74	-27.23	0-360	200	V
4	2.0825	36.51	Pk	31.7	-24.4	0	43.81	-	-	-	-	0-360	200	V
5	2.1735	37.45	Pk	31.5	-24.2	0	44.75	-	-	-	-	0-360	200	V

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

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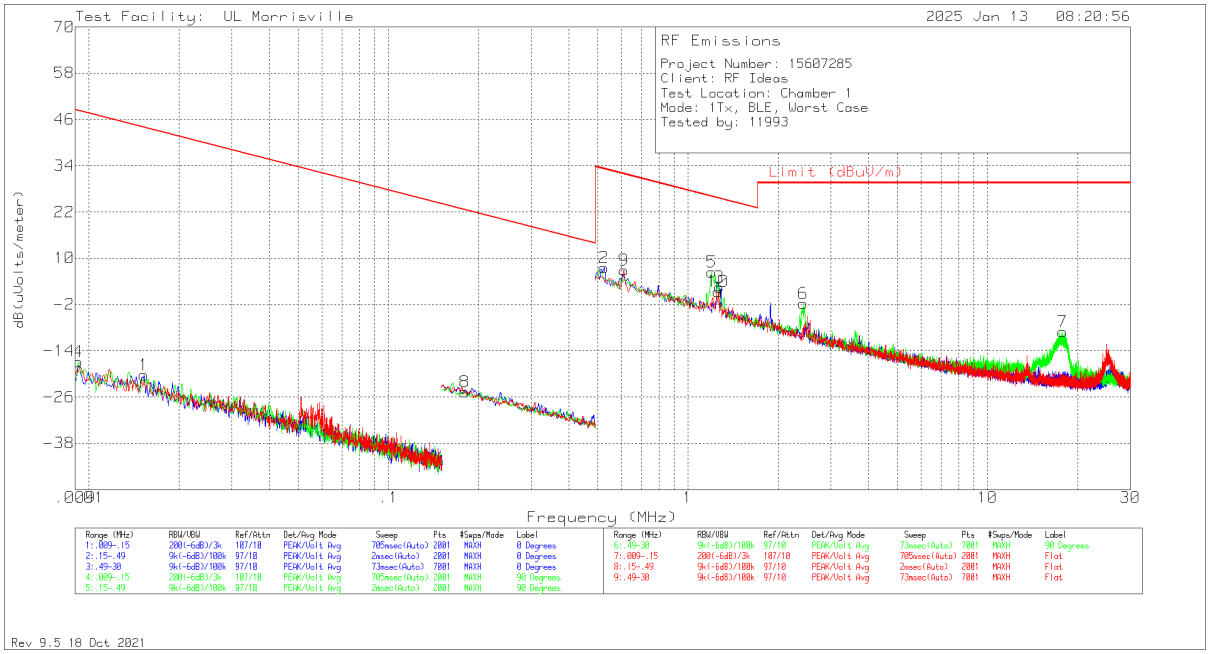
10.3. WORST CASE BELOW 30MHZ

SPURIOUS EMISSIONS BELOW 30 MHz (WORST-CASE CONFIGURATION)

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



ANTENNA- THREE ORIENTATIONS – E FIELD

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	QP/AV Limit (dBuV/m)	PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
4	.00921	44.16	Pk	18.9	.1	-80	-16.84	48.32	68.32	-65.16	0-360	90 degs
1	.01525	43.66	Pk	15.9	.1	-80	-20.34	43.94	63.94	-64.28	0-360	0 degs
8	.17992	44.29	Pk	11	.1	-80	-24.61	22.5	42.5	-47.11	0-360	Flat
2	.52373	36.5	Pk	11	.1	-40	7.6	33.22	-	-25.62	0-360	0 degs
9	.61226	35.86	Pk	11	.1	-40	6.96	31.87	-	-24.91	0-360	Flat
5	1.19829	35.17	Pk	11	.2	-40	6.37	26.03	-	-19.66	0-360	90 degs
10	1.26153	30.22	Pk	11	.2	-40	1.42	25.59	-	-24.17	0-360	Flat
3	1.26996	31.25	Pk	11	.2	-40	2.45	25.53	-	-23.08	0-360	0 degs
6	2.42093	27.02	Pk	11.1	.2	-40	-1.68	29.54	-	-31.22	0-360	90 degs
7	17.83884	20.96	Pk	9.3	.7	-40	-9.04	29.54	-	-38.58	0-360	90 degs

Pk - Peak detector

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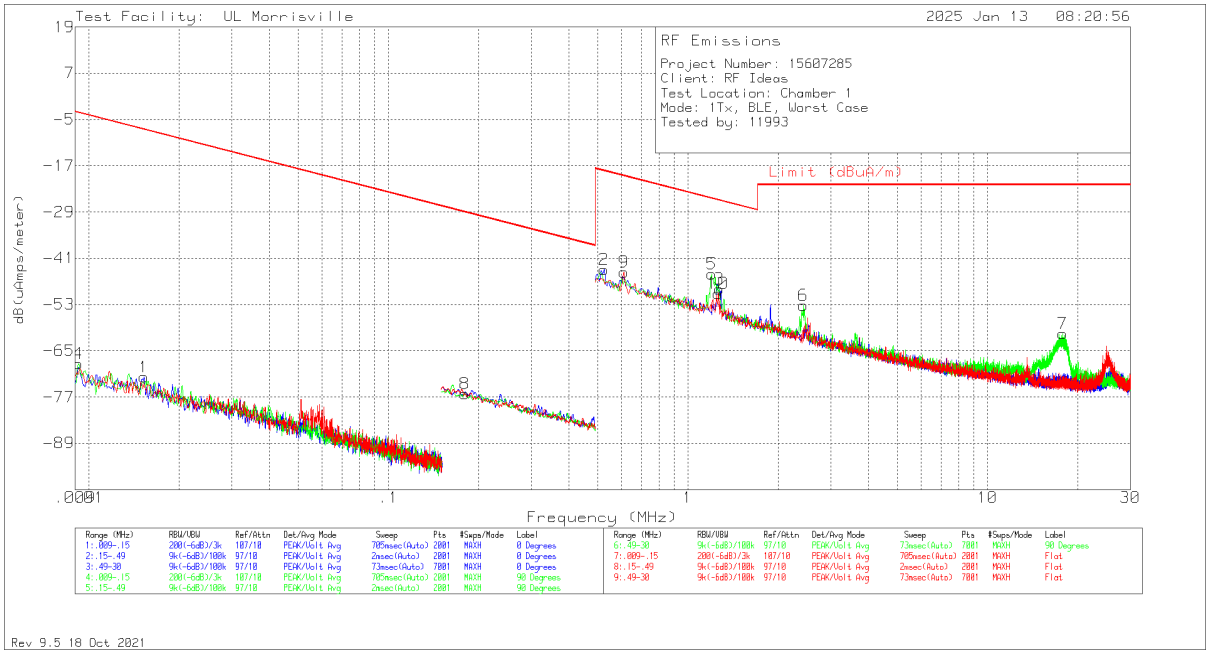

ANTENNA- THREE ORIENTATIONS – H FIELD

Below 30MHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	QP/AV Limit (dBuA/m)	Pk Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
4	.00921	44.16	Pk	-32.6	.1	-80	-68.34	-3.18	16.82	-65.16	0-360	90 degs
1	.01525	43.66	Pk	-35.6	.1	-80	-71.84	-7.56	12.41	-64.28	0-360	0 degs
8	.17992	44.29	Pk	-40.5	.1	-80	-76.11	-29	-9	-47.11	0-360	Flat
2	.52373	36.5	Pk	-40.5	.1	-40	-43.9	-18.28	-	-25.62	0-360	0 degs
9	.61226	35.86	Pk	-40.5	.1	-40	-44.54	-19.63	-	-24.91	0-360	Flat
5	1.19829	35.17	Pk	-40.5	.2	-40	-45.13	-25.47	-	-19.66	0-360	90 degs
10	1.26153	30.22	Pk	-40.5	.2	-40	-50.08	-25.91	-	-24.17	0-360	Flat
3	1.26996	31.25	Pk	-40.5	.2	-40	-49.05	-25.97	-	-23.08	0-360	0 degs
6	2.42093	27.02	Pk	-40.4	.2	-40	-53.18	-21.96	-	-31.22	0-360	90 degs
7	17.83884	20.96	Pk	-42.2	.7	-40	-60.54	-21.96	-	-38.58	0-360	90 degs

Pk - Peak detector

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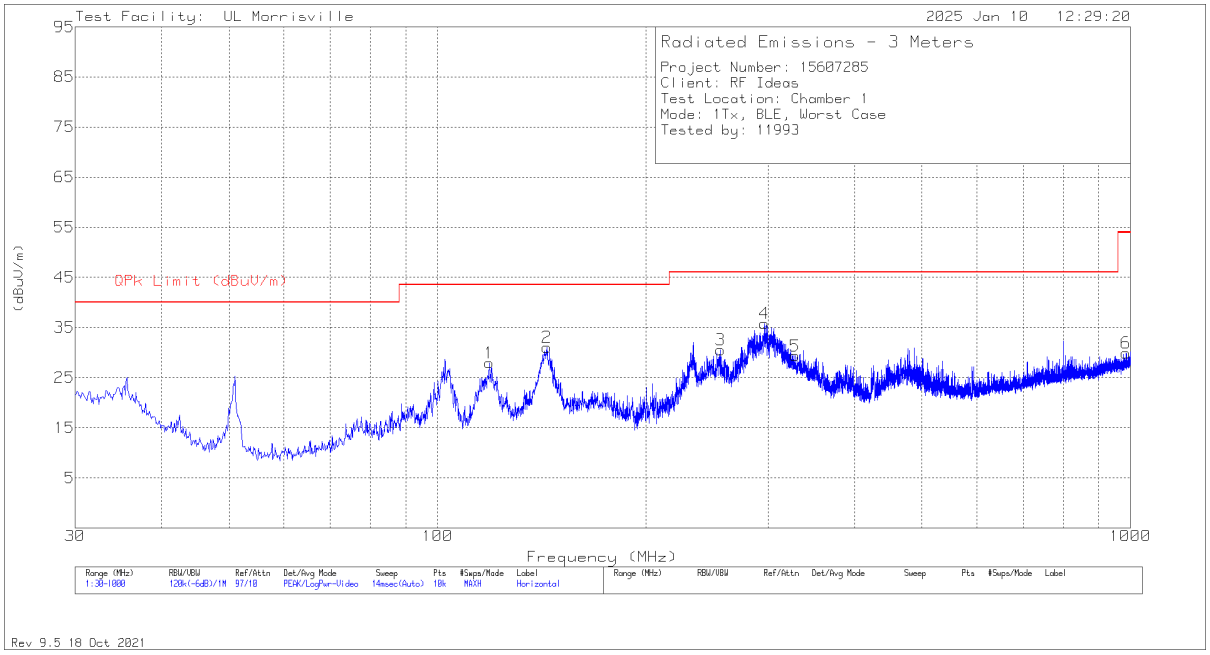
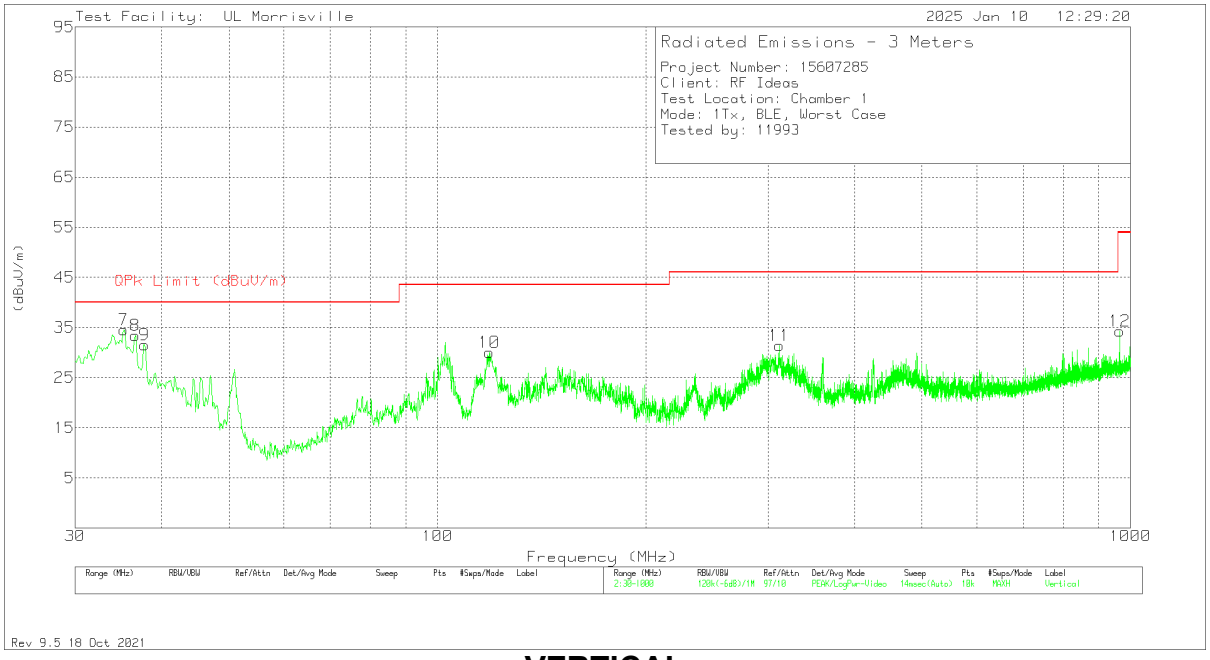
10.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



VERTICAL

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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	90629 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 118.755	38.37	Pk	19.9	-30.3	27.97	43.52	-15.55	0-360	299	H
3	* ** 256.107	42.32	Pk	17.7	-29.5	30.52	46.02	-15.5	0-360	100	H
5	* ** 328.178	39.35	Pk	20	-30	29.35	46.02	-16.67	0-360	100	H
6	* ** 984.965	26.24	Pk	29.3	-25.6	29.94	53.97	-24.03	0-360	299	H
9	* ** 37.76	41.96	Pk	21.4	-31.8	31.56	40	-8.44	0-360	100	V
10	* ** 118.852	40.49	Pk	19.9	-30.3	30.09	43.52	-13.43	0-360	100	V
12	* ** 965.274	31.05	Pk	29	-25.8	34.25	53.97	-19.72	0-360	100	V
7	35.238	42.91	Pk	23.2	-31.6	34.51	-	-	0-360	100	V
8	36.596	43.16	Pk	22.3	-32	33.46	-	-	0-360	100	V
2	143.975	42.79	Pk	19.1	-30.8	31.09	-	-	0-360	199	H
4	296.459	45.32	Pk	19.5	-29	35.82	-	-	0-360	100	H
11	311.688	40.77	Pk	19.8	-29.2	31.37	-	-	0-360	100	V

Pk - Peak detector

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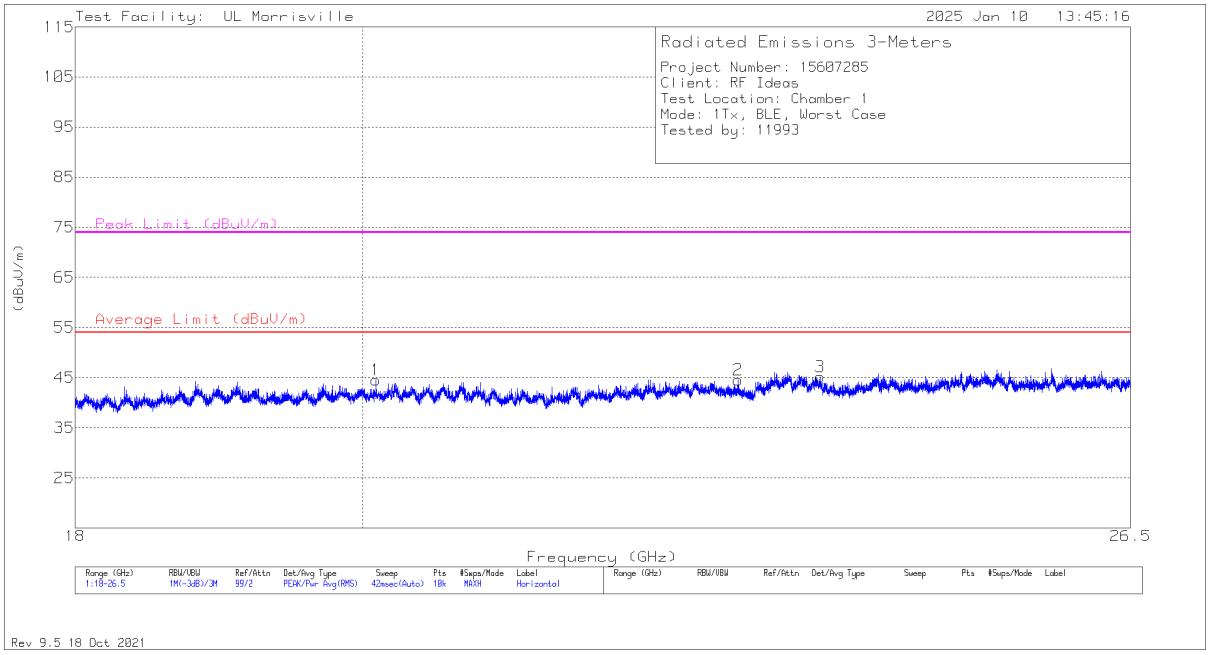
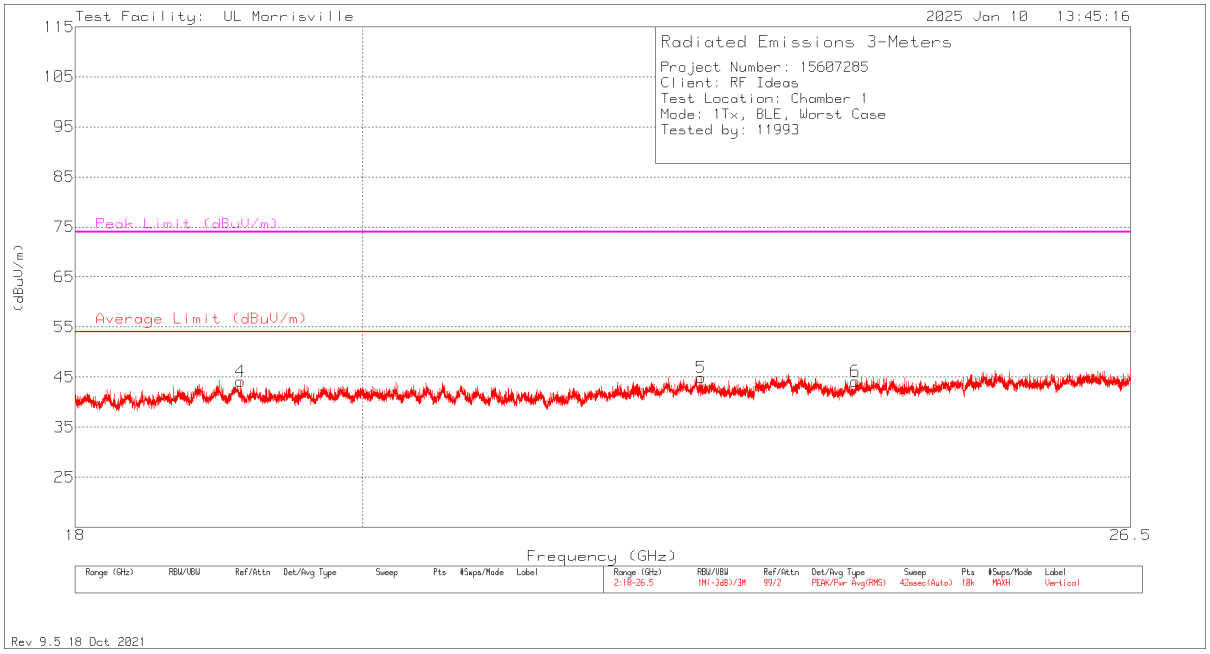
10.5. WORST CASE 18-26 GHZ

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



HORIZONTAL



VERTICAL

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18 – 26GHz Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	204704 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Average Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 20.09589	48.62	Pk	33.5	-37.6	44.52	54	-9.48	74	-29.48	0-360	250	H
2	* ** 22.95245	47.84	Pk	34	-37.3	44.54	54	-9.46	74	-29.46	0-360	250	H
3	* ** 23.65278	48	Pk	34.5	-37.3	45.2	54	-8.8	74	-28.8	0-360	149	H
4	* ** 19.12614	48.57	Pk	33.6	-38	44.17	54	-9.83	74	-29.83	0-360	150	V
5	* ** 22.63969	48.62	Pk	34.2	-37.9	44.92	54	-9.08	74	-29.08	0-360	299	V
6	* ** 23.9579	46.86	Pk	34.5	-37.2	44.16	54	-9.84	74	-29.84	0-360	101	V

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

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11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207
IC RSS-GEN, Section 8.8

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

Frequency range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50
Notes: 1. The lower limit shall apply at the transition frequencies 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

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

RESULTS

No non-compliance noted:

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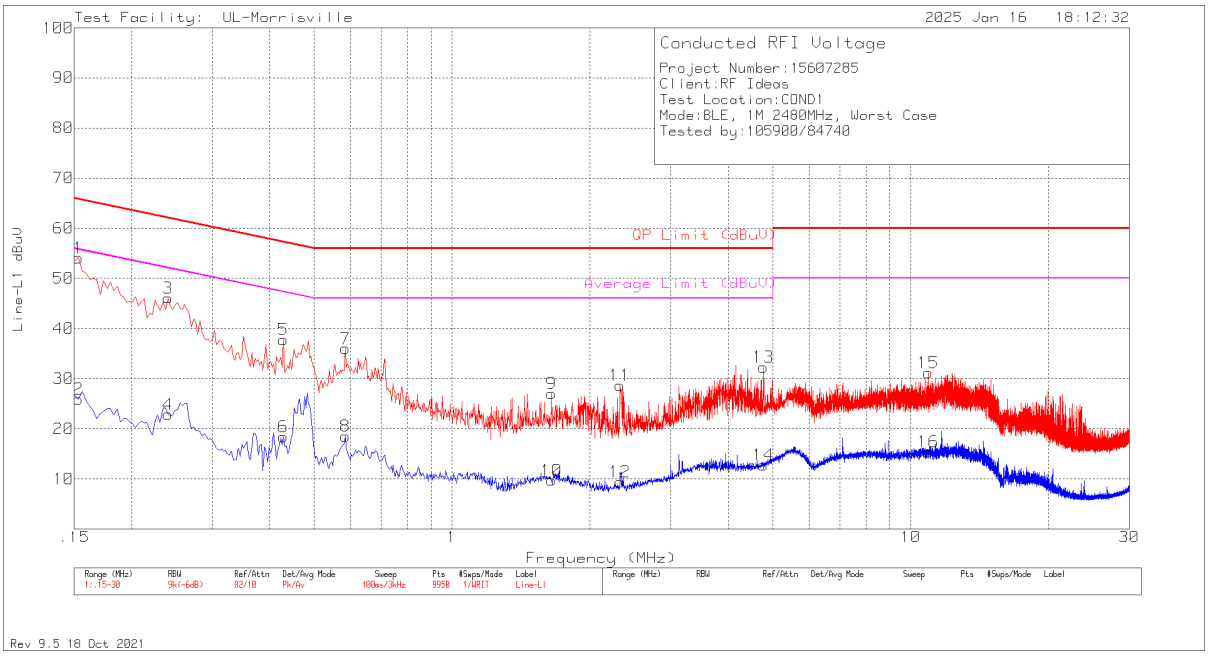
Conducted Emissions Graph

Line 1



Conducted Emissions Data Points

Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VDF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.153	44.05	Pk	.2	9.8	54.05	65.84	-11.79	-	-
2	.153	15.92	Av	.2	9.8	25.92	-	-	55.84	-29.92
3	.24	36.21	Pk	.1	9.8	46.11	62.1	-15.99	-	-
4	.24	12.94	Av	.1	9.8	22.84	-	-	52.1	-29.26
5	.429	27.92	Pk	.1	9.8	37.82	57.27	-19.45	-	-
6	.429	8.45	Av	.1	9.8	18.35	-	-	47.27	-28.92
7	.585	26.18	Pk	0	9.8	35.98	56	-20.02	-	-
8	.585	8.75	Av	0	9.8	18.55	-	-	46	-27.45
9	1.65	17.2	Pk	0	9.8	27	56	-29	-	-
10	1.65	-.1	Av	0	9.8	9.7	-	-	46	-36.3
11	2.322	18.81	Pk	0	9.8	28.61	56	-27.39	-	-
12	2.322	-.38	Av	0	9.8	9.42	-	-	46	-36.58
13	4.77	22.29	Pk	.1	9.9	32.29	56	-23.71	-	-
14	4.77	2.73	Av	.1	9.9	12.73	-	-	46	-33.27
15	10.929	21.06	Pk	.1	10	31.16	60	-28.84	-	-
16	10.929	5.26	Av	.1	10	15.36	-	-	50	-34.64

Pk - Peak detector
Av - Average detection

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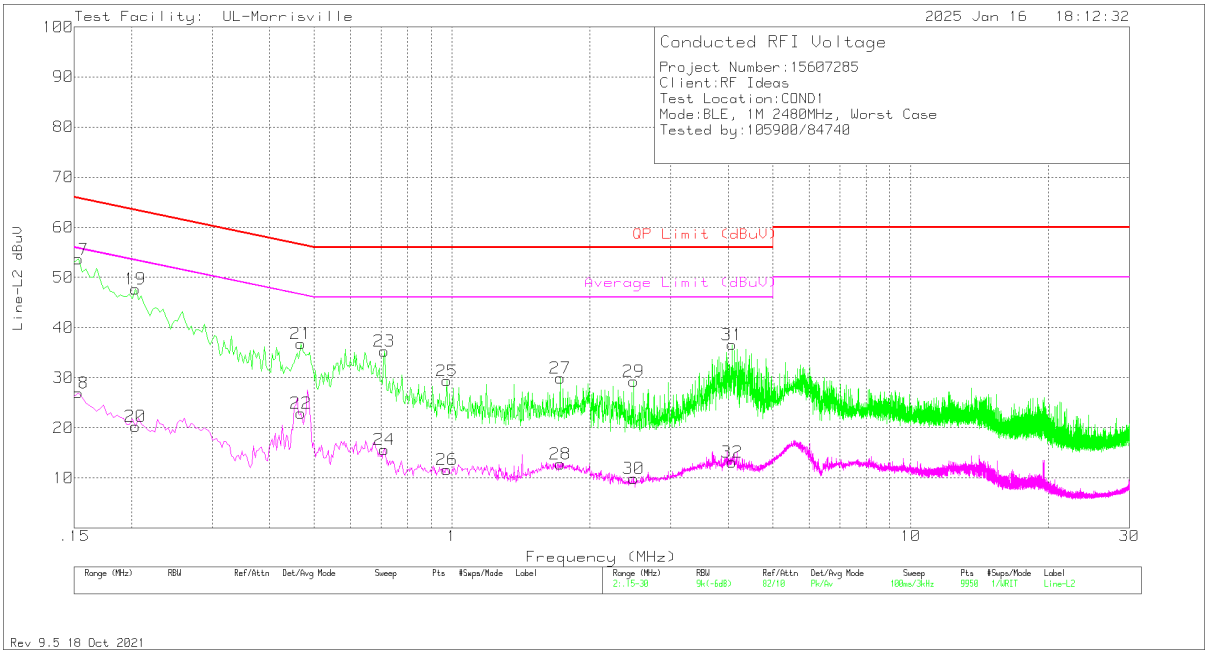
Conducted Emissions Graph

Line 2



Conducted Emissions Data Points

Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VDF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
17	.153	43.63	Pk	.2	9.8	53.63	65.84	-12.21	-	-
18	.153	16.96	Av	.2	9.8	26.96	-	-	55.84	-28.88
19	.204	37.76	Pk	.1	9.8	47.66	63.45	-15.79	-	-
20	.204	10.36	Av	.1	9.8	20.26	-	-	53.45	-33.19
21	.468	26.98	Pk	0	9.8	36.78	56.55	-19.77	-	-
22	.468	13.08	Av	0	9.8	22.88	-	-	46.55	-23.67
23	.711	25.48	Pk	0	9.8	35.28	56	-20.72	-	-
24	.711	5.83	Av	0	9.8	15.63	-	-	46	-30.37
25	.975	19.55	Pk	0	9.8	29.35	56	-26.65	-	-
26	.975	1.81	Av	0	9.8	11.61	-	-	46	-34.39
27	1.722	20.07	Pk	0	9.8	29.87	56	-26.13	-	-
28	1.722	2.97	Av	0	9.8	12.77	-	-	46	-33.23
29	2.49	19.52	Pk	0	9.8	29.32	56	-26.68	-	-
30	2.49	.05	Av	0	9.8	9.85	-	-	46	-36.15
31	4.083	26.7	Pk	0	9.9	36.6	56	-19.4	-	-
32	4.083	3.21	Av	0	9.9	13.11	-	-	46	-32.89

Pk - Peak detector
Av - Average detection
Qp - Quasi-Peak detector
Ca - CISPR average detection

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12. SETUP PHOTOS

Please refer to R15607285-EP3 for setup photos

END OF TEST REPORT

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