TEST REPORT

Report Number: 14014404-E3

Applicant	:	Schneider Electric Industries SAS 31 rue Pierre Mendes France 38050 - Grenoble Cedex 9, France
Model	:	33102
Brand	:	Schneider Electric Industries SAS
FCC ID	:	2AH7L-BCMW-V1
IC	:	21522-BCMW-V1
EUT Description	:	Wireless Circuit Breaker Communication Module
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C: 2022 ISED RSS-247 ISSUE 2: 2017 ISED RSS-GEN ISSUE 5 + A2:2021

Date Of Issue:
2023-01-31

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

ACCREDITED
CERT #0751.06

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2022-07-25	Initial Issue	Charles Moody
V2	2022-08-17	Revised EUT description	Brian Kiewra
V3	2022-08-23	Correcting units in section 10.3 and limits in 11.1.1	Charles Moody
V4	2022-10-04	Revised power	Brian Kiewra
V5	2022-11-22	Revised section 6.2 and corrected formatting issue	Brian Kiewra
V6	2022-12-09	Added 10dB attenuator to Section 8	Brian Kiewra
V7	2023-01-31	Revised Antenna Gain	Charles Moody

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Schneider Electric Industries SAS
31 rue Pierre Mendes France
38050 - Grenoble Cedex 9, France

EUT DESCRIPTION: Wireless Circuit Breaker Communication Module

MODEL: 33102

BRAND: Schneider Electric Industries SAS

SERIAL NUMBER: Non-Serialized

SAMPLE RECEIPT DATE: 2022-07-05

DATE TESTED: 2022-07-06 – 2022-07-11

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Refer to Section 2
ISED RSS-247 Issue 2	Refer to Section 2
ISED RSS-GEN Issue 5 + A2	Refer to 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. This report must not be used by the client to claim product certification, approval, or endorsement by A2LA, NIST, or any agency of the U.S. government.

Approved & Released For
UL LLC By:

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

Prepared By:

Charles Moody
Electrical Engineer
Consumer, Medical, and IT Segment
UL LLC

2. TEST RESULTS SUMMARY

This report contains data provided by the applicant which can impact the validity of results. UL LLC is only responsible for the validity of results after the integration of the data provided by the customer.

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 (a)	RSS-Gen 8.8	AC Power Lines Conducted Measurements	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 C63.10-2013, KDB 558074 D01 15.247 Meas Guidance v05r02, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A2, and RSS-247 Issue 2.

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 2800 Suite Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A	US0067	27265	825374

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)	141.2 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%.

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5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

Where relevant, the following sample calculation is provided:
Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)
36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

MAINS CONDUCTED EMISSIONS

Where relevant, the following sample calculation is provided:
Final Voltage (dBuV) = Measured Voltage (dBuV) + Cable Loss (dB) + Limiter Factor (dB) + LISN Insertion Loss.
36.5 dBuV + 0 dB +10.1 dB+ 0 dB = 46.6 dBuV

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Breaker monitoring, alarming, and ERMS accessory

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)
2405-2480	Zigbee	1.09	1.29

6.3. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes a PCB antenna, with a maximum gain of 0.61 dBi.

6.4. SOFTWARE AND FIRMWARE

The test utility software used during testing was v0.0.3.

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 output power as worst-case scenario.

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

The fundamental of the EUT was investigated in its only orthogonal orientation. As provided by the manufacturer, the EUT only operates in one orientation. Therefore, all final radiated testing was performed with the EUT in that defined orientation.

All testing performed at higher power setting than what power was measured.
Manufacturer will set the device to operate at the lower power setting at which power was measured.

6.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	Lenovo	T14S	PC26TDYM	-
AC to DC Power Supply	Schneider Electric	ABLM1A24025	IB215103243	-

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	6-Pin Plug	Power	<3m	Used to connect EUT to power supply

TEST SETUP

The EUT is controlled using an over-the-air communication between the support laptop and the device. This allows for a wireless control of the UCE

SETUP DIAGRAMS

Please refer to 14014404-EP1 for setup diagrams

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7. MEASUREMENT METHOD

On time and Duty Cycle: ANSI C63.10 subclause 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)

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

AC Power-line conducted emissions: ANSI C63.10-2013, Section 6.2.

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8. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 2				
HI0096	Environmental Meter	Fisherbrand	14-650-118	2021-09-21	2022-09-22
PWM003	RF Power Meter	Keysight	N1911A	2021-08-30	2022-08-30
PWS005	Peak and Avg Power Sensor, 50MHz – 18GHz	Keysight	N1921A	2022-06-15	2023-06-15
SA0027	Spectrum Analyzer	Keysight	N9030A	2022-05-24	2023-05-24
-	10dB Attenuator	CentricRF	C18S2-10	2022-05-03	2023-05-03
SOFTEMI	Antenna Port Software	UL	Version 2022.5.4		

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2022-04-05	2023-04-05
s/n 210701941	Environmental Meter	Fisher Scientific	15-077-963	2021-08-16	2023-08-16
LISN003	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2021-08-16	2022-08-16
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2021-08-17	2022-08-17
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2022-04-05	2023-04-05
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		

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Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 4)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	30-1000 MHz				
AT0081	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2021-12-08	2022-12-08
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2022-05-24	2023-05-24
	Gain-Loss Chains				
C4-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2022-05-20	2023-05-20
C4-SAC03	Gain-loss string: 1-18GHz	Various	Various	2022-05-20	2023-05-20
	Receiver & Software				
206496	Spectrum Analyzer	Rohde & Schwarz	ESW44	2022-02-15	2023-02-15
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
s/n 210701942	Environmental Meter	Fisher Scientific	15-077-963	2021-8-16	2023-08-16

Test Equipment Used - Radiated Disturbance Emissions Test Equipment (Morrisville – Chamber 2)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2021-08-19	2022-08-19
	30-1000 MHz				
AT0073	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2021-08-30	2022-08-30
	1-18 GHz				
206211	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2022-03-21	2023-03-21
	18-40 GHz				
AT0063	Horn Antenna, 18-26.5GHz	ARA	MWH-1826/B	2021-11-04	2022-11-04
	Gain-Loss Chains				
C2-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2022-05-10	2023-05-10
C2-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2022-05-10	2023-05-10
C2-SAC03	Gain-loss string: 1-18GHz	Various	Various	2022-05-10	2023-05-10
C2-SAC04	Gain-loss string: 18-40GHz	Various	Various	2022-05-10	2023-05-10
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2022-03-08	2023-03-08
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
s/n 181474409	Environmental Meter	Fisher Scientific	15-077-963	2021-09-27	2022-09-27

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

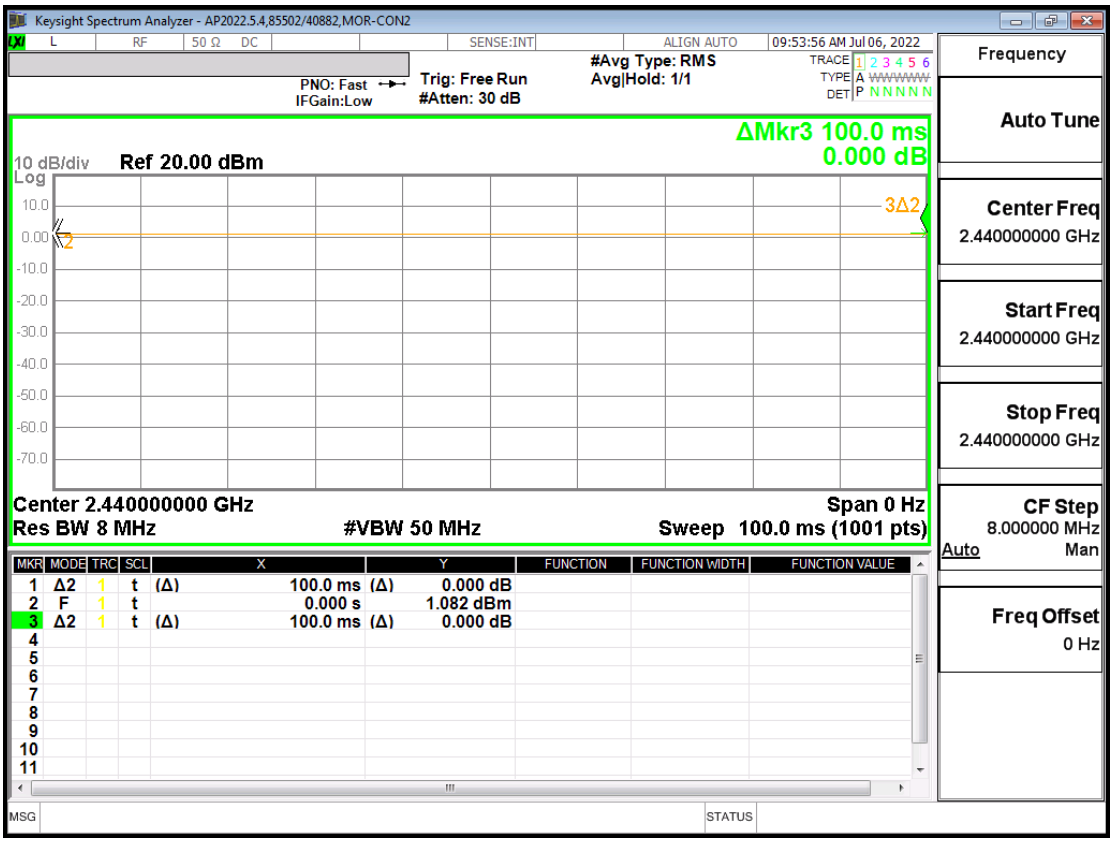
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
2.4GHz Band						
BLE	100.000	100.000	1.000	100.00	0.00	0.010

DUTY CYCLE PLOTS



DUTY CYCLE Zigbee

9.2. 99% BANDWIDTH

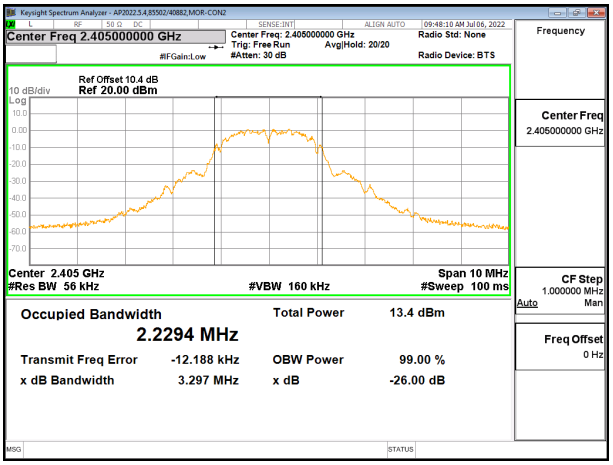
LIMITS

None; for reporting purposes only.

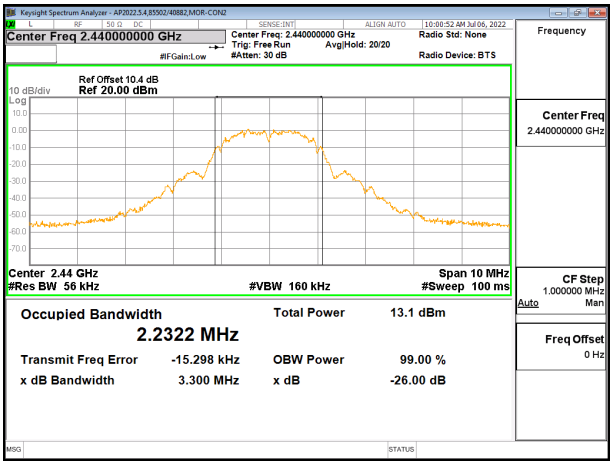
RESULTS

9.2.1. Zigbee (250kbps)

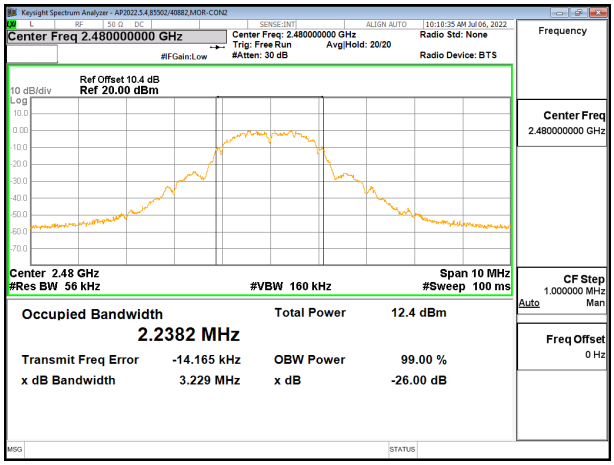
Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	2405	2.2294
Middle	2440	2.2322
High	2480	2.2382



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

9.3. 6 dB BANDWIDTH

LIMITS

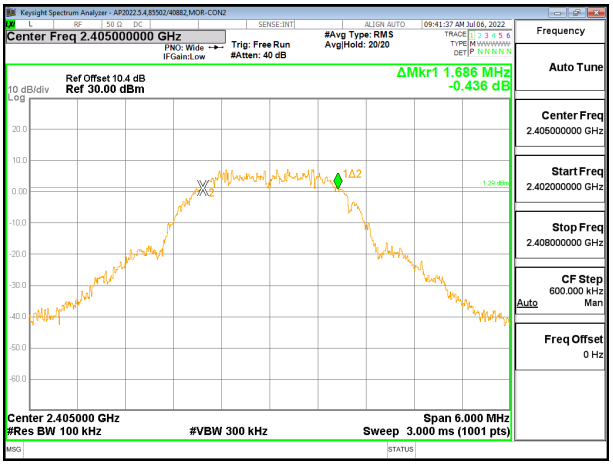
FCC §15.247 (a) (2)
RSS-247 5.2 (a)

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

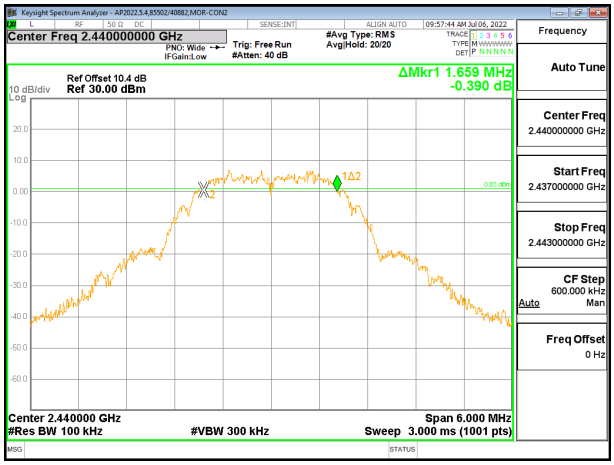
RESULTS

9.3.1. Zigbee (250kbps)

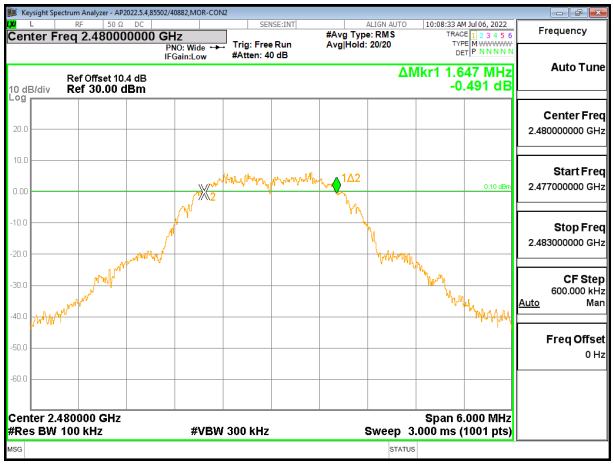
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
Low	2405	1.6860	0.5
Middle	2440	1.6590	0.5
High	2480	1.6470	0.5



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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 10.4 dB (including 9.65 dB pad and 0.75 dB cable) was entered as an offset in the power meter.

The power output was measured on the EUT antenna port using SMA cable with 9.65 dB attenuator connected to a power meter via wideband average power sensor. Peak output power was read directly from power meter.

RESULTS

9.4.1. Zigbee (250kbps)

Tested By:	85502/40882
Date:	2022-07-06

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	2405	1.09	30	-28.910
Middle	2440	0.54	30	-29.460
High	2480	-0.24	30	-30.240

9.5. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a gated average power meter.

The cable assembly insertion loss of 10.4 dB (including 9.65 dB pad and 0.75 dB cable) was entered as an offset in the power meter.

The power output was measured on the EUT antenna port using SMA cable with 9.65 dB attenuator connected to a power meter via wideband average power sensor. Average output power was read directly from power meter.

RESULTS

9.5.1. Zigbee (250kbps)

Tested By:	85502/40882
Date:	2022-07-06

Channel	Frequency (MHz)	AV power (dBm)
Low	2405	0.85
Middle	2440	0.26
High	2480	-0.55

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9.6. POWER SPECTRAL DENSITY

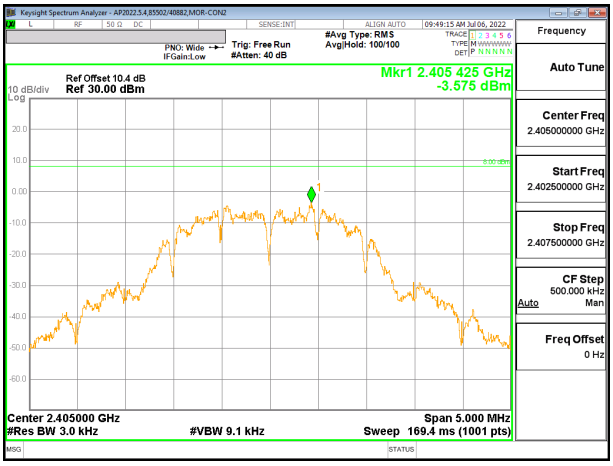
LIMITS

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.

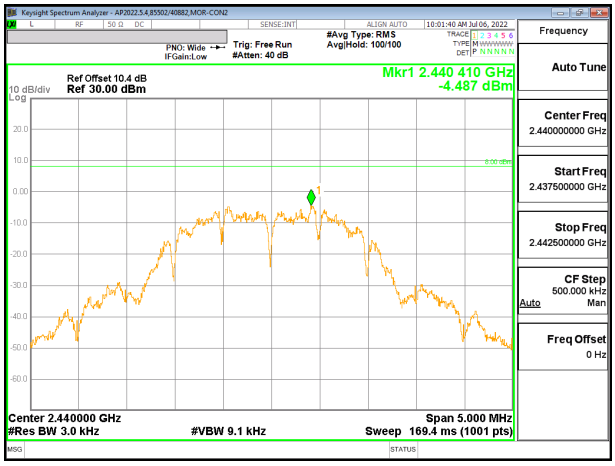
RESULTS

9.6.1. Zigbee (250kbps)

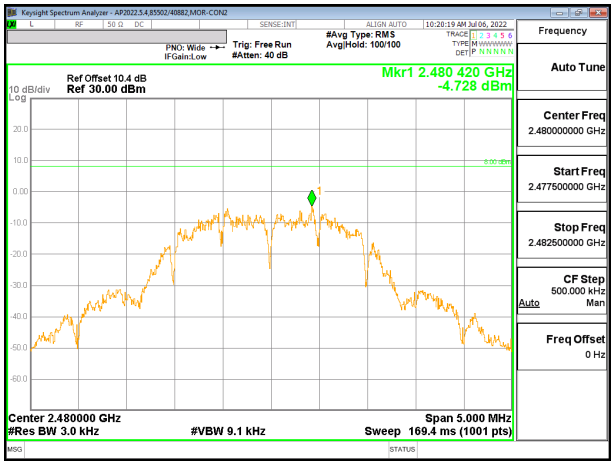
Channel	Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)
Low	2405	-3.575	8	-11.58
Middle	2440	-4.487	8	-12.49
High	2480	-4.728	8	-12.73



LOW CHANNEL



MID CHANNEL



HIGH CHANNEL

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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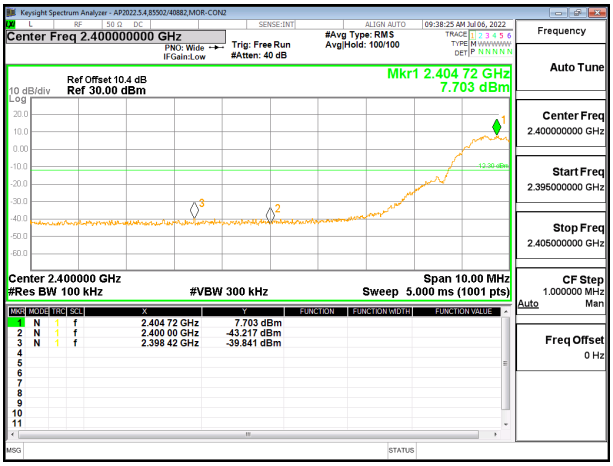
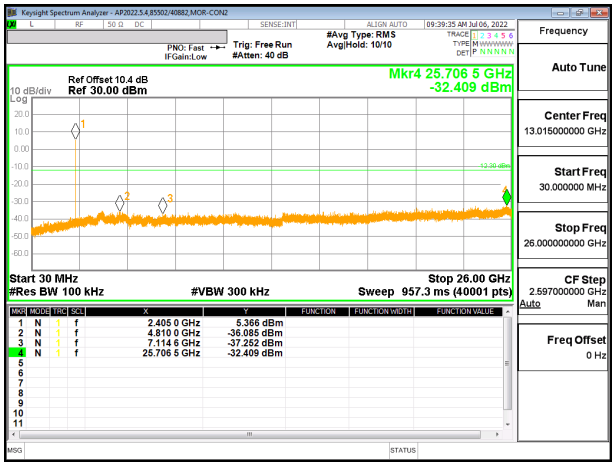
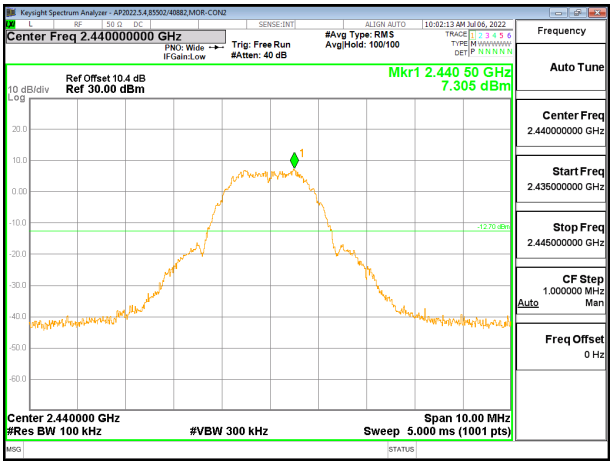
9.7.1. Zigbee (250kbps)



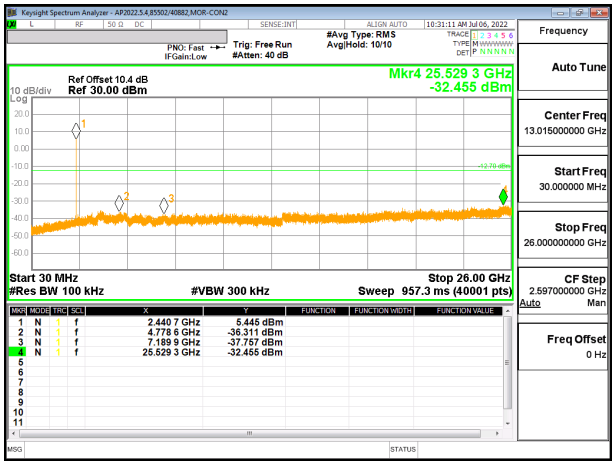
LOW CHANNEL BANDEDGE



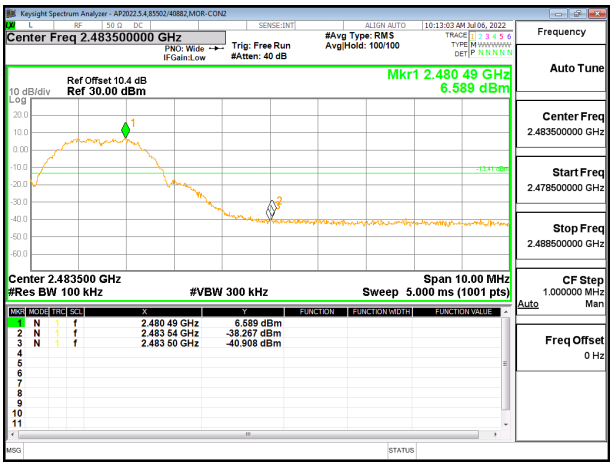
OUT-OF-BAND LOW CHANNEL



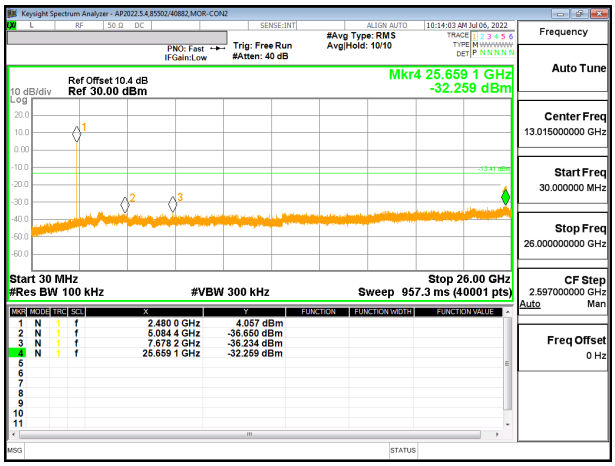
IN-BAND REFERENCE LEVEL



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

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	6.37/F(kHz) @ 30 m	-
1.705 - 30	.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. Linear 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 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.

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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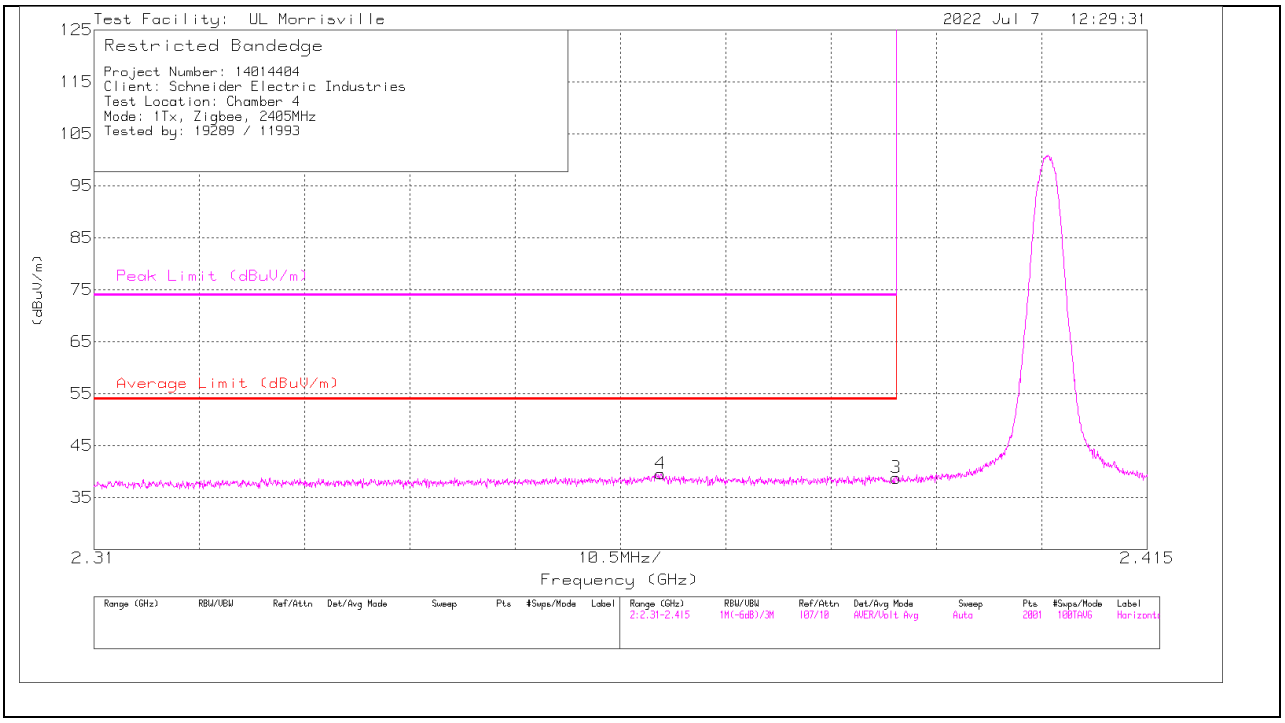
10.2. TRANSMITTER ABOVE 1 GHz

10.2.1. Zigbee (250kbps)

Antenna 1

BANDEDGE (LOW CHANNEL)

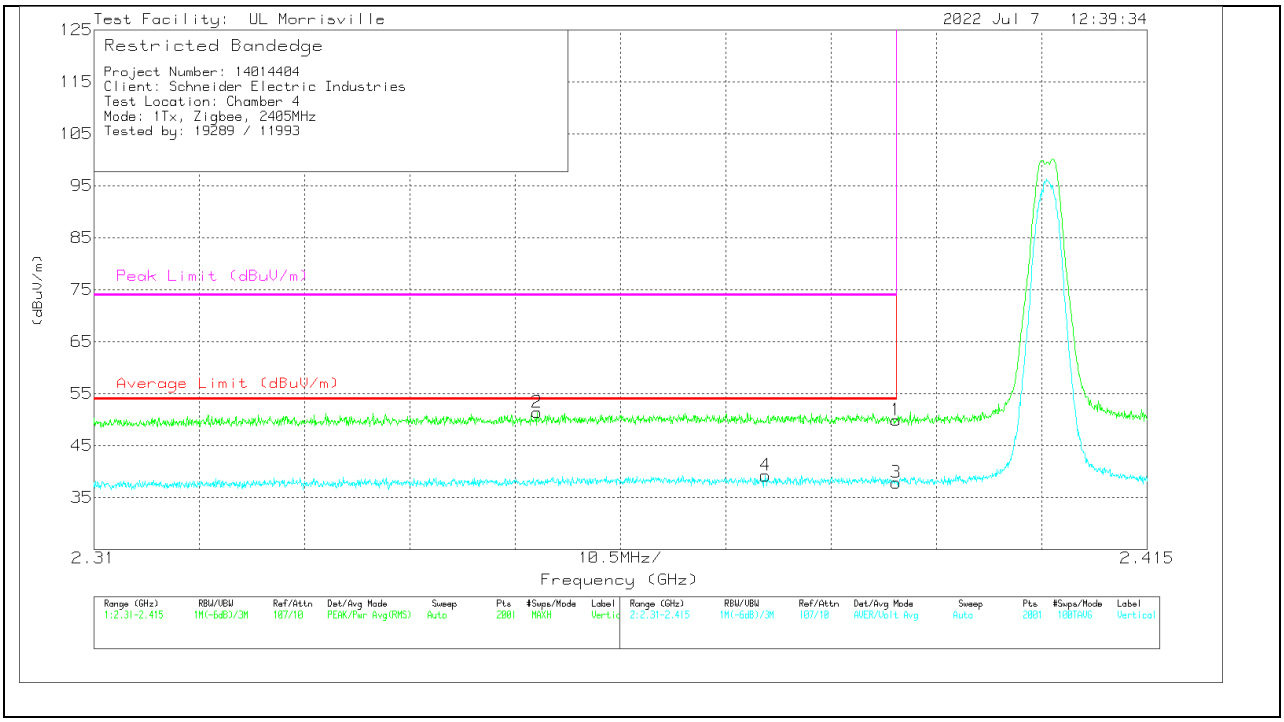
HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Gain/Loss (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	31.41	Pk	32.2	-13.6	50.01	-	-	74	-23.99	40	356	H
2	* ** 2.33672	33.73	Pk	32.1	-13.8	52.03	-	-	74	-21.97	40	356	H
3	* ** 2.38996	20.19	ADV	32.2	-13.6	38.79	54	-15.21	-	-	40	356	H
4	* ** 2.36649	20.96	ADV	32.2	-13.6	39.56	54	-14.44	-	-	40	356	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

VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Gain/Loss (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	31.3	Pk	32.2	-13.6	49.9	-	-	74	-24.1	277	152	V
2	* ** 2.35421	33.08	Pk	32.1	-13.8	51.38	-	-	74	-22.62	277	152	V
3	* ** 2.38996	19.26	ADV	32.2	-13.6	37.86	54	-16.14	-	-	277	152	V
4	* ** 2.37694	20.75	ADV	32.2	-13.7	39.25	54	-14.75	-	-	277	152	V

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

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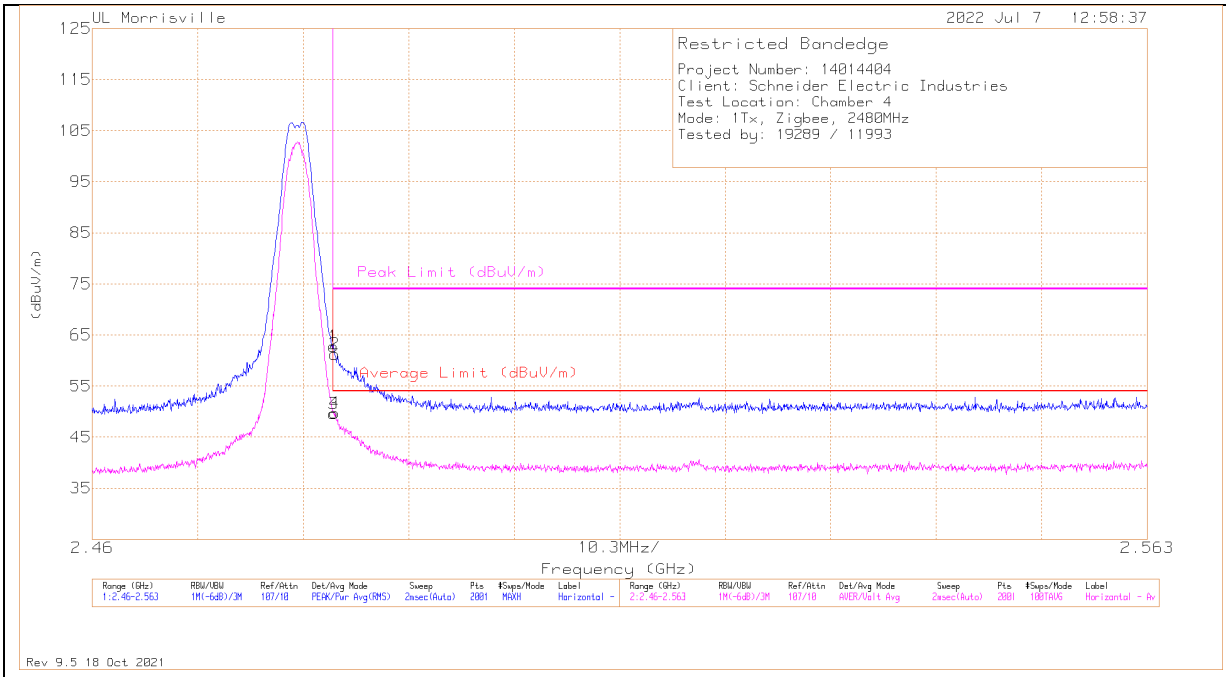
BANDEDGE (HIGH CHANNEL)

HORIZONTAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Gain/Loss (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	43.88	Pk	32.6	-13.7	62.78	-	-	74	-11.22	28	121	H
2	* ** 2.48369	42.35	Pk	32.6	-13.7	61.25	-	-	74	-12.75	28	121	H
3	* ** 2.48354	30.7	ADV	32.6	-13.7	49.6	54	-4.4	-	-	28	121	H
4	* ** 2.48369	30.81	ADV	32.6	-13.7	49.71	54	-4.29	-	-	28	121	H

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

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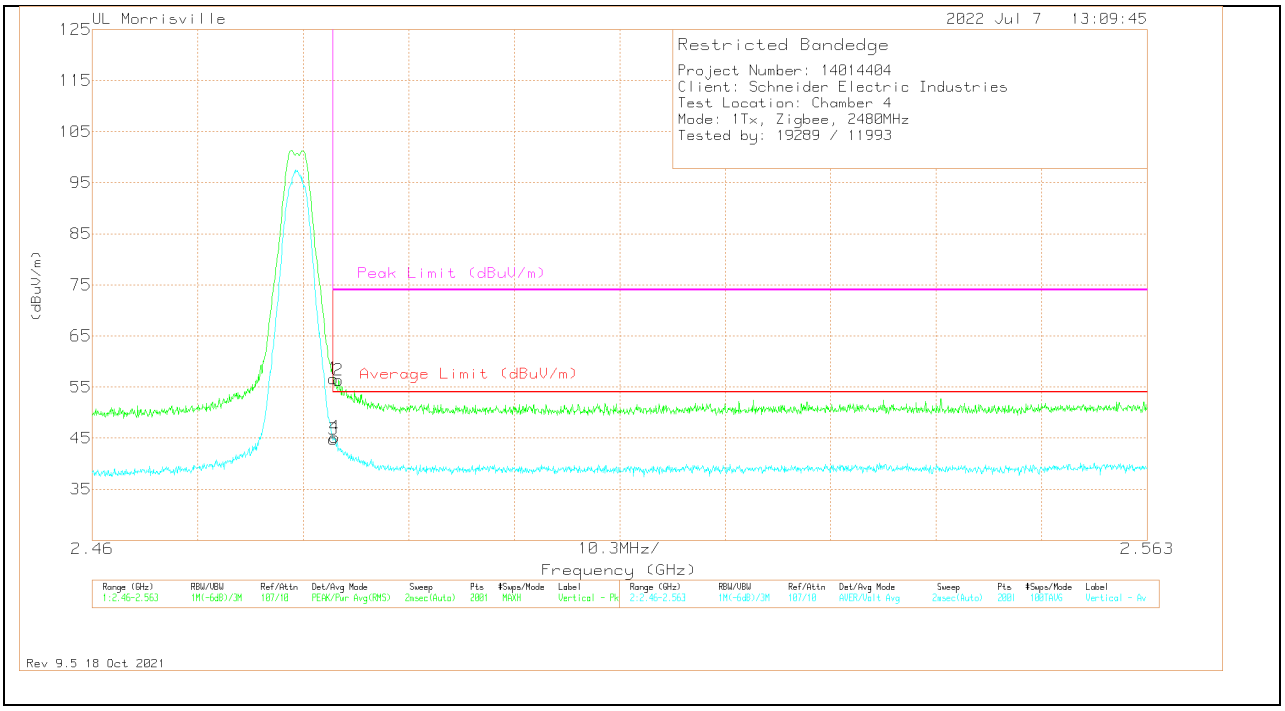
VERTICAL RESULT



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Gain/Loss (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	37.75	Pk	32.6	-13.7	56.65	-	-	74	-17.35	104	100	V
2	* ** 2.48405	37.44	Pk	32.6	-13.7	56.34	-	-	74	-17.66	104	100	V
3	* ** 2.48354	25.89	ADV	32.6	-13.7	44.79	54	-9.21	-	-	104	100	V
4	* ** 2.48369	26.32	ADV	32.6	-13.7	45.22	54	-8.78	-	-	104	100	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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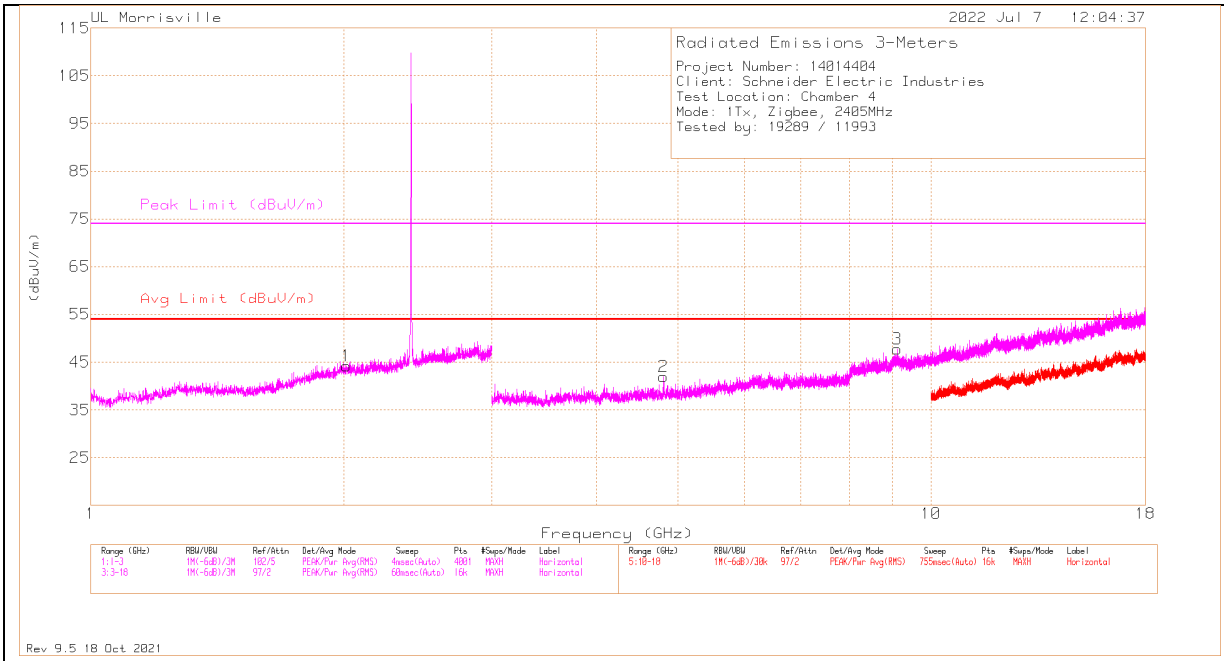
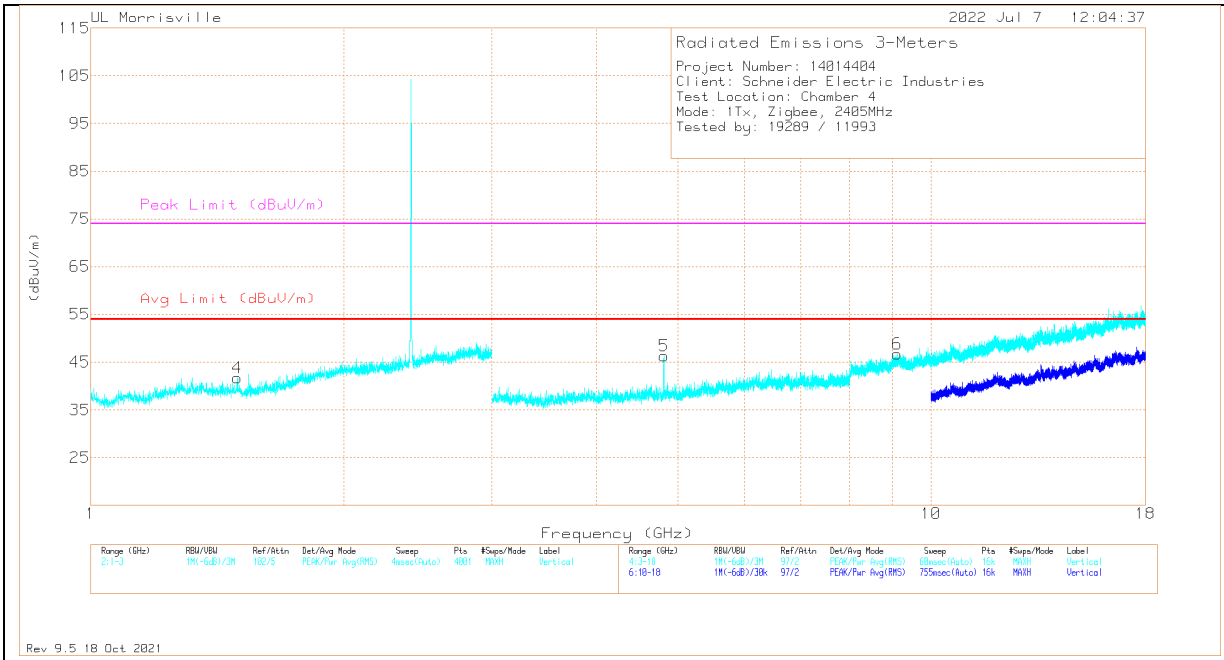
HARMONICS AND SPURIOUS EMISSIONS

LOW CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	** 2.015	26.5	Pk	31.9	-14.2	44.2	54	-9.8	74	-29.8	0-360	100	H
4	* ** 1.4955	28.27	Pk	28.4	-15	41.67	54	-12.33	74	-32.33	0-360	200	V
2	* ** 4.80844	39.63	Pk	34.1	-31.8	41.93	54	-12.07	74	-32.07	0-360	100	H
3	* ** 9.11531	37.14	Pk	36.2	-25.6	47.74	54	-6.26	74	-26.26	0-360	100	H
5	* ** 4.81125	43.98	Pk	34.1	-31.8	46.28	54	-7.72	74	-27.72	0-360	200	V
6	* ** 9.11625	36.1	Pk	36.2	-25.6	46.7	54	-7.3	74	-27.3	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

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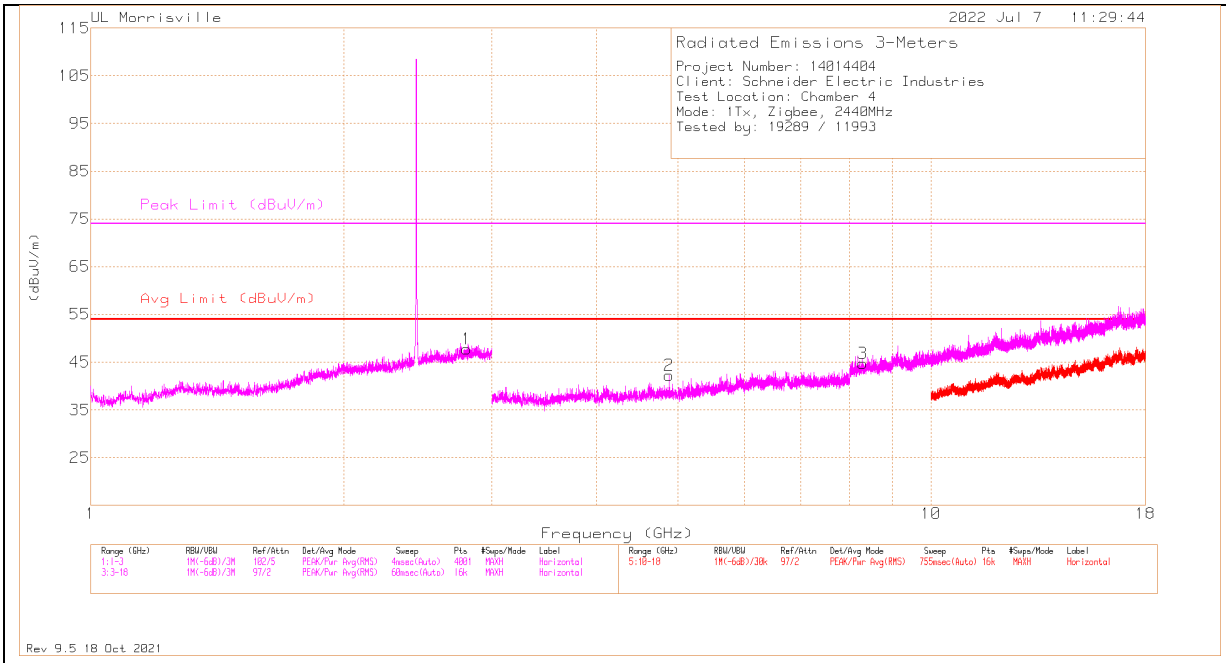
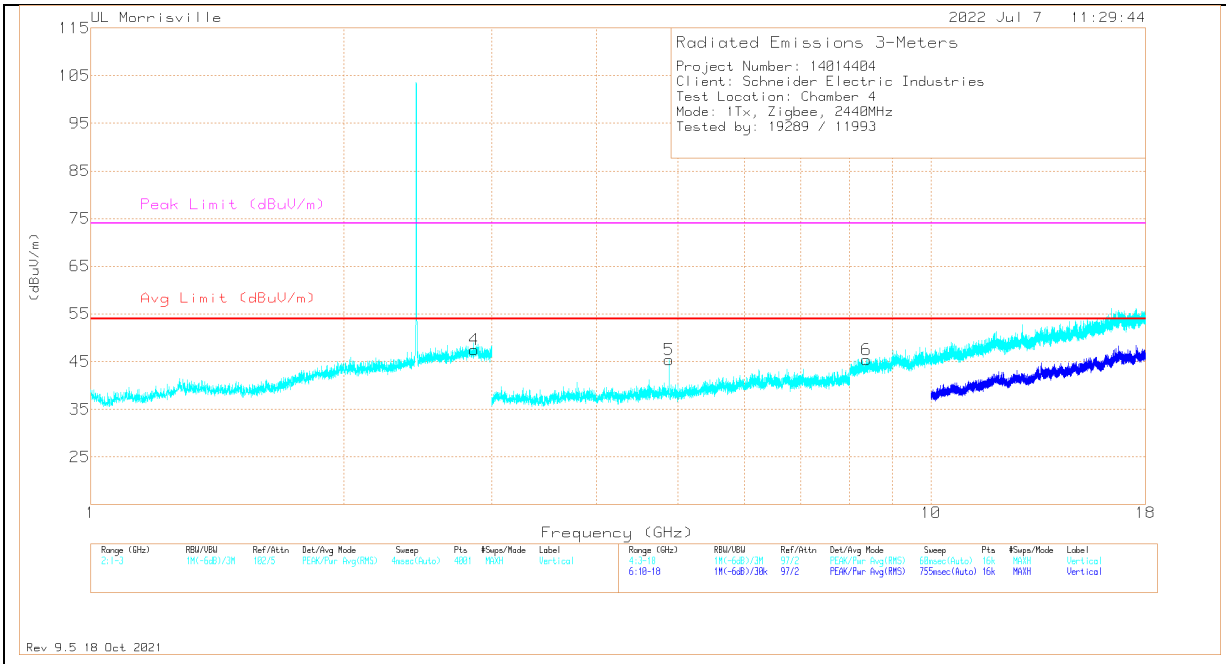
MID CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.801	28.17	Pk	32.6	-13	47.77	54	-6.23	74	-26.23	0-360	100	H
4	* ** 2.858	27.66	Pk	32.6	-12.8	47.46	54	-6.54	74	-26.54	0-360	200	V
2	* ** 4.88063	40.19	Pk	34	-31.9	42.29	54	-11.71	74	-31.71	0-360	100	H
3	* ** 8.3025	35.99	Pk	35.7	-27	44.69	54	-9.31	74	-29.31	0-360	100	H
5	* ** 4.87875	43.34	Pk	34	-31.9	45.44	54	-8.56	74	-28.56	0-360	200	V
6	* ** 8.3775	36.74	Pk	35.7	-27.1	45.34	54	-8.66	74	-28.66	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

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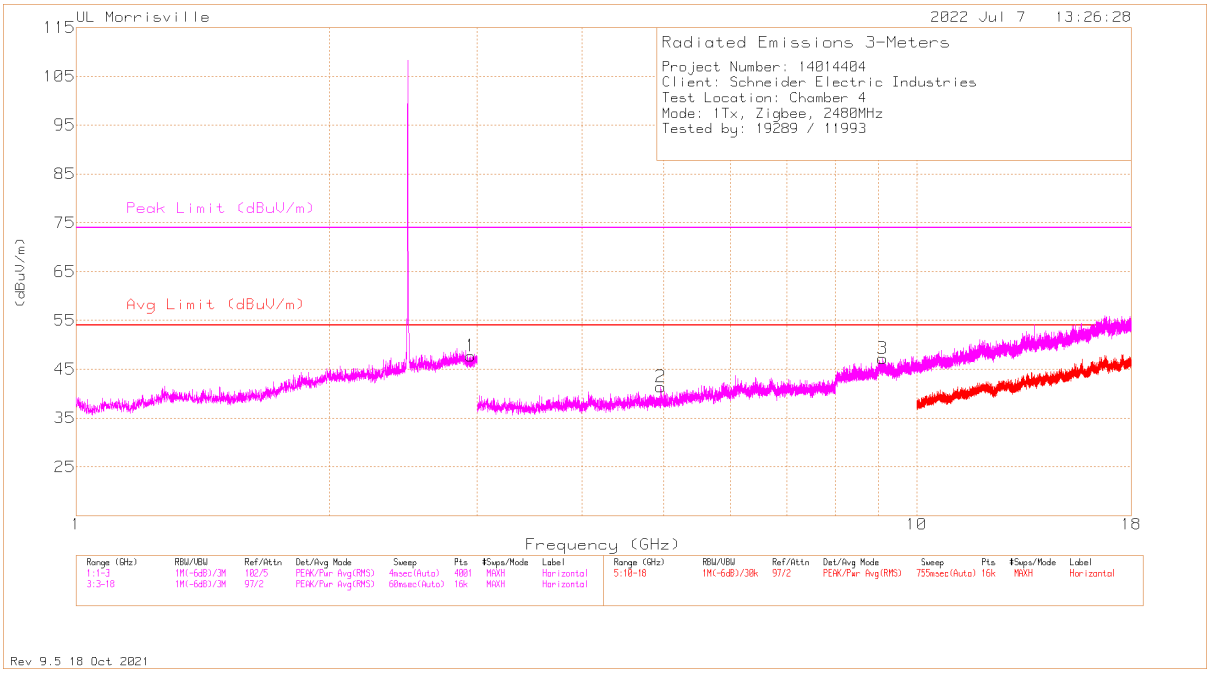
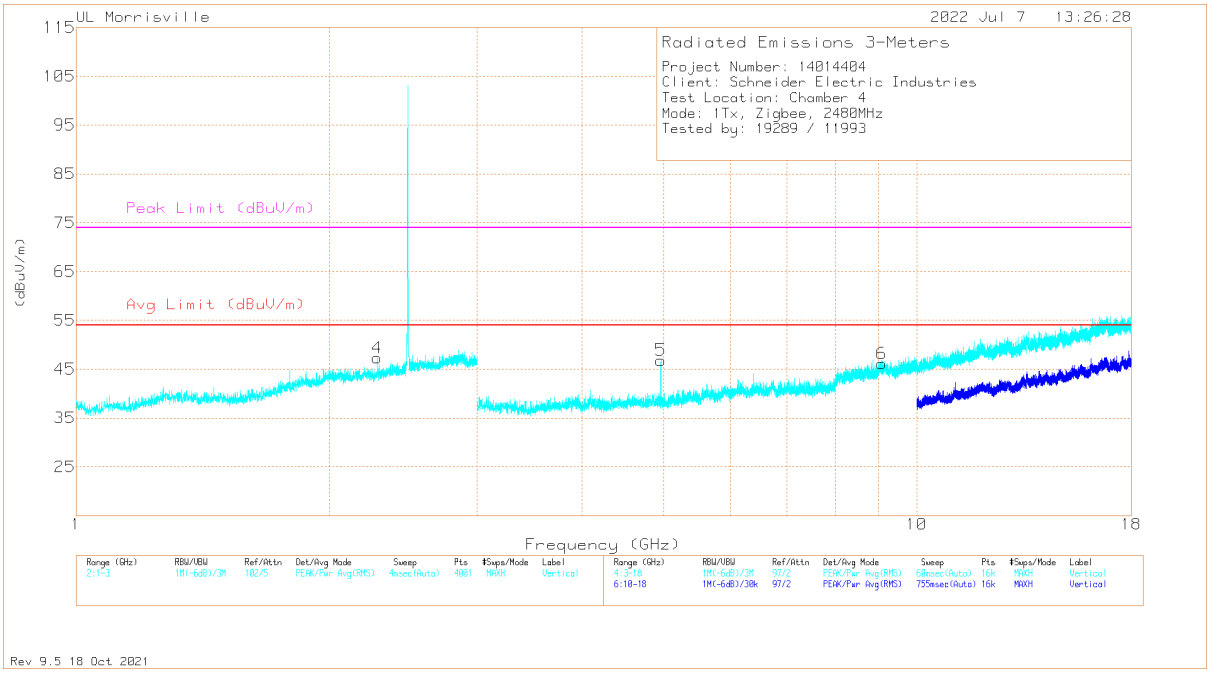
HIGH CHANNEL RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Avg Limit (dBuV/m)	Margin (dB)	Peak Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	* ** 2.281	29.21	Pk	32	-13.9	47.31	54	-6.69	74	-26.69	0-360	200	V
2	* ** 4.96031	39.01	Pk	34	-31.6	41.41	54	-12.59	74	-32.59	0-360	100	H
3	* ** 9.10781	36.62	Pk	36.2	-25.6	47.22	54	-6.78	74	-26.78	0-360	100	H
5	* ** 4.96125	44.44	Pk	34	-31.6	46.84	54	-7.16	74	-27.16	0-360	200	V
6	* ** 9.08625	35.34	Pk	36.2	-25.4	46.14	54	-7.86	74	-27.86	0-360	200	V
1	2.9465	27.65	Pk	32.7	-12.6	47.75	-	-	-	-	0-360	100	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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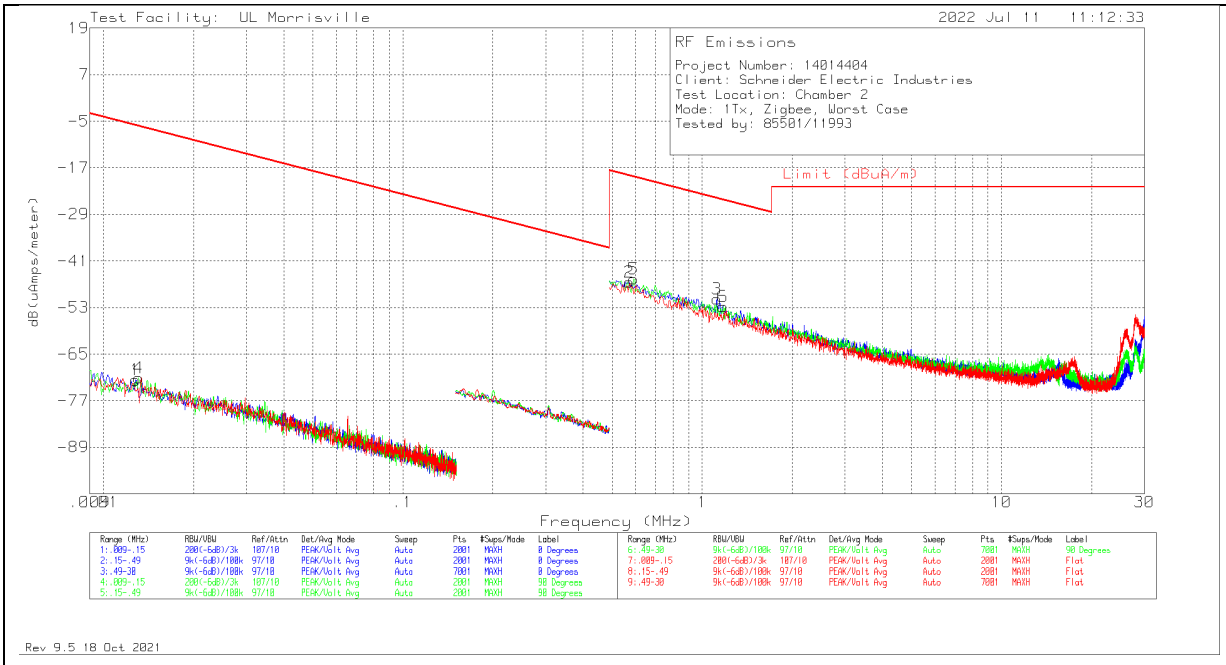
10.3. WORST CASE BELOW 30MHZ

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).

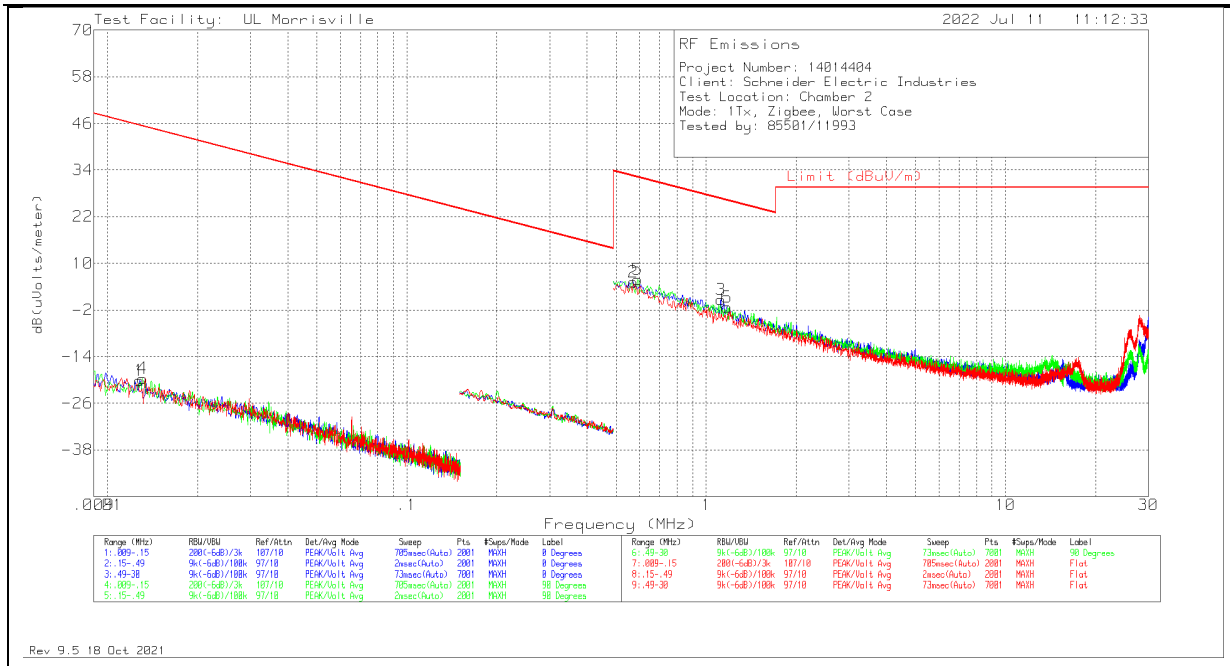


ANTENNA- THREE ORIENTATIONS H FIELD

Below 30MHz Data H FIELD

Marker	Frequency (MHz)	Meter Reading (dBuA)	Det	AT0079 (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)	Height (cm)	Loop Angle
1	.01276	42.49	Pk	-34.3	.1	-80	-71.71	-6.01	13.99	-65.7	0-360	102	0 degs
4	.01312	43.21	Pk	-34.4	.1	-80	-71.09	-6.25	13.75	-64.84	0-360	102	90 degs
2	.5701	33.81	Pk	-40.3	.1	-40	-46.39	-19.02	-	-27.37	0-360	102	0 degs
5	.59118	34.39	Pk	-40.3	.2	-40	-45.71	-19.33	-	-26.38	0-360	102	90 degs
3	1.11818	29.2	Pk	-40.2	.2	-40	-50.8	-24.87	-	-25.93	0-360	102	0 degs
6	1.17299	27.3	Pk	-40.2	.2	-40	-52.7	-25.28	-	-27.42	0-360	102	90 degs

Pk - Peak detector



ANTENNA- THREE ORIENTATIONS E FIELD

Below 30MHz Data E FIELD

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (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)	Height (cm)	Loop Angle
1	.01276	42.49	Pk	17.2	.1	-80	-20.21	45.49	65.49	-65.7	0-360	102	0 degs
4	.01312	43.21	Pk	17.1	.1	-80	-19.59	45.25	65.25	-64.84	0-360	102	90 degs
2	.5701	33.81	Pk	11.2	.1	-40	5.11	32.48	-	-27.37	0-360	102	0 degs
5	.59118	34.39	Pk	11.2	.2	-40	5.79	32.17	-	-26.38	0-360	102	90 degs
3	1.11818	29.2	Pk	11.3	.2	-40	.7	26.63	-	-25.93	0-360	102	0 degs
6	1.17299	27.3	Pk	11.3	.2	-40	-1.2	26.22	-	-27.42	0-360	102	90 degs

Pk - Peak detector

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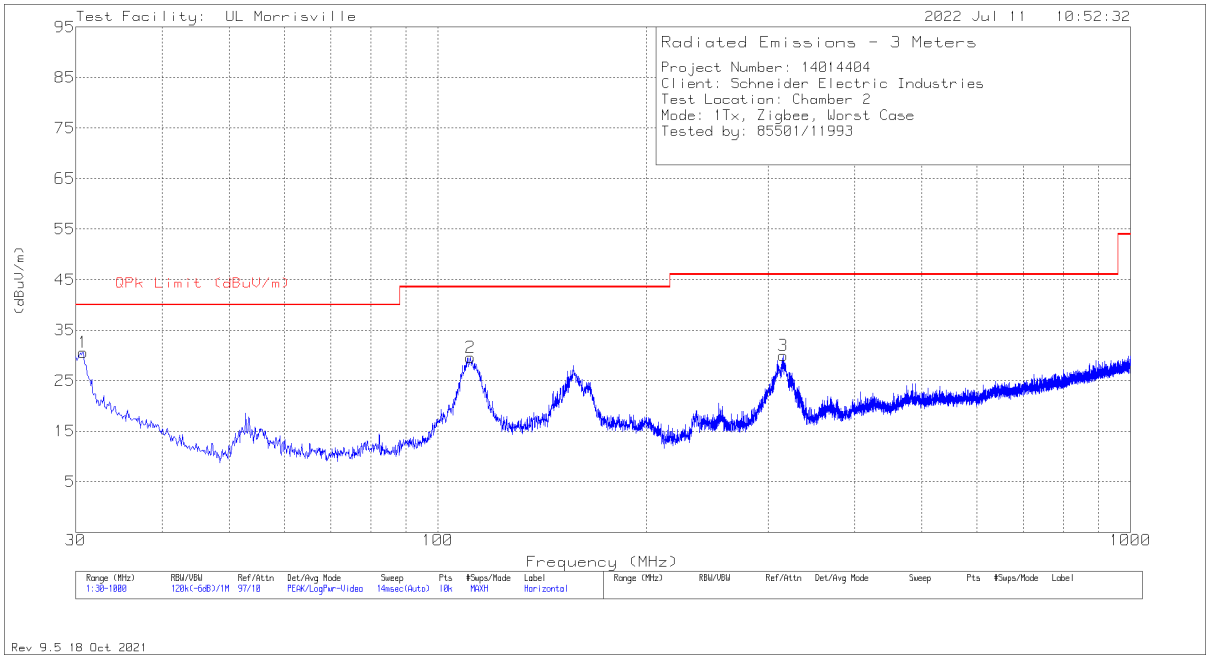
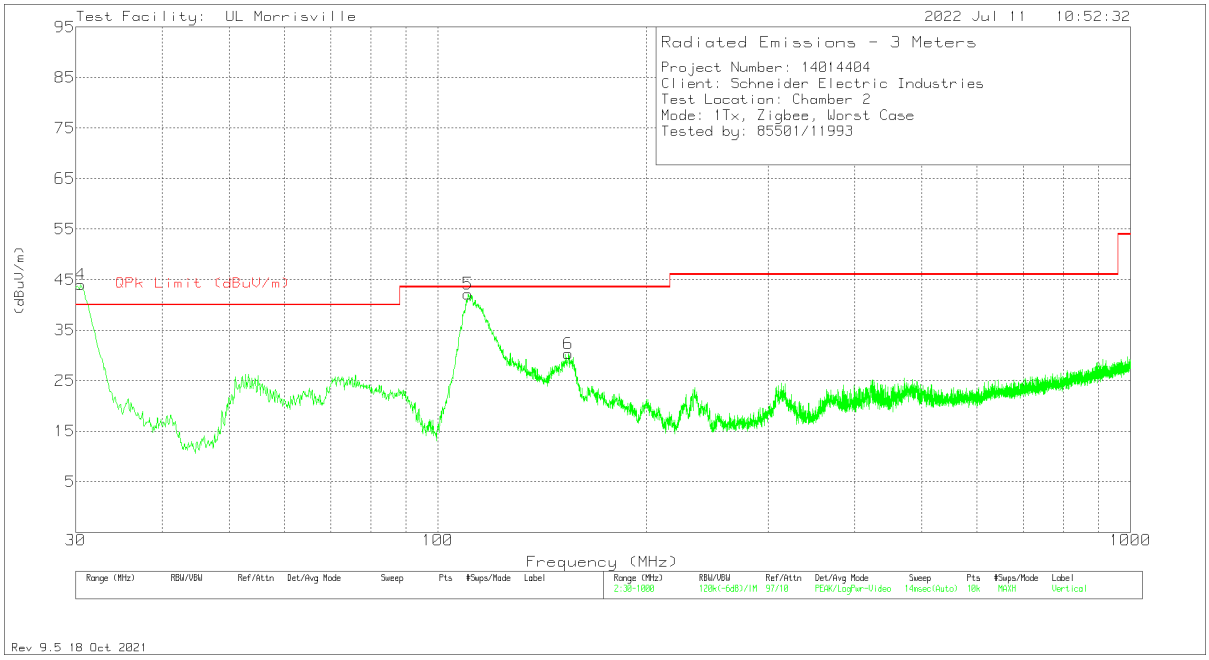
10.4. WORST CASE BELOW 1 GHZ

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



HORIZONTAL



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Below 1GHz Data

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0073 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
4	30.7123	44.21	Qp	26.4	-31.5	39.11	40	-.89	204	100	V
1	30.776	35.74	Pk	26.3	-31.4	30.64	40	-9.36	0-360	299	H
5	110.7878	51.18	Qp	19	-30.6	39.58	43.52	-3.94	168	103	V
2	111.383	40.98	Pk	19	-30.4	29.58	43.52	-13.94	0-360	299	H
6	154.354	41.95	Pk	18.5	-30.1	30.35	43.52	-13.17	0-360	101	V
3	315.18	38.8	Pk	19.9	-28.7	30	46.02	-16.02	0-360	101	H

Pk - Peak detector
Qp - Quasi-Peak detector

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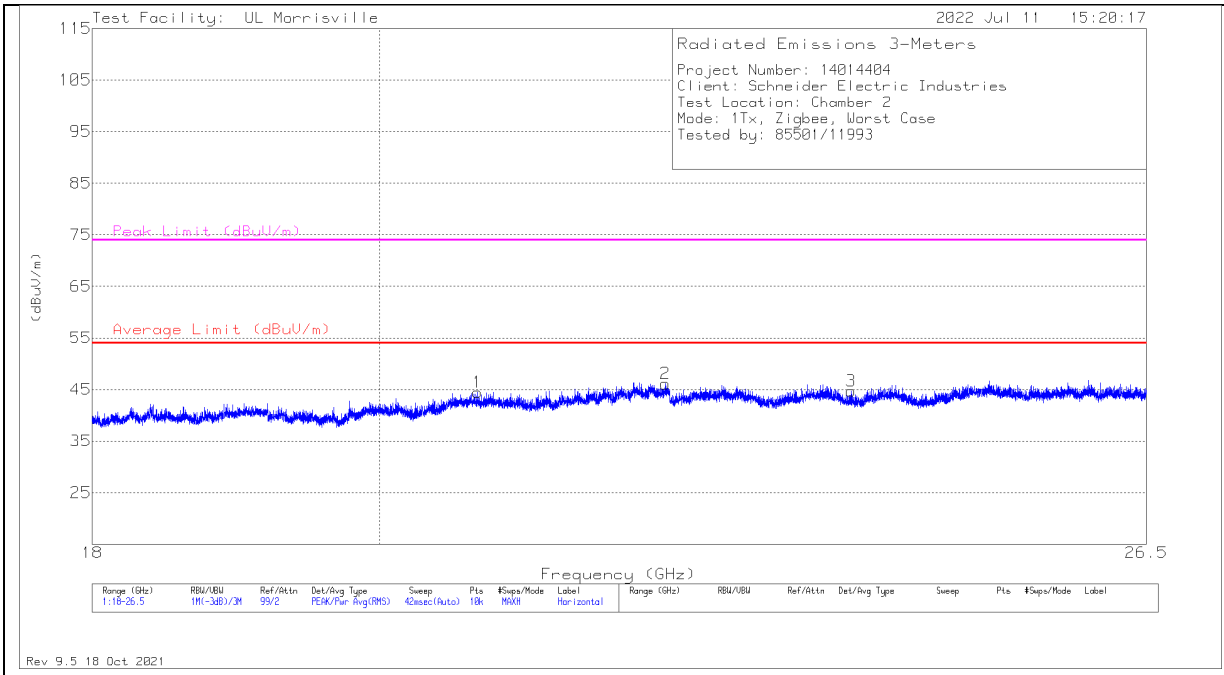
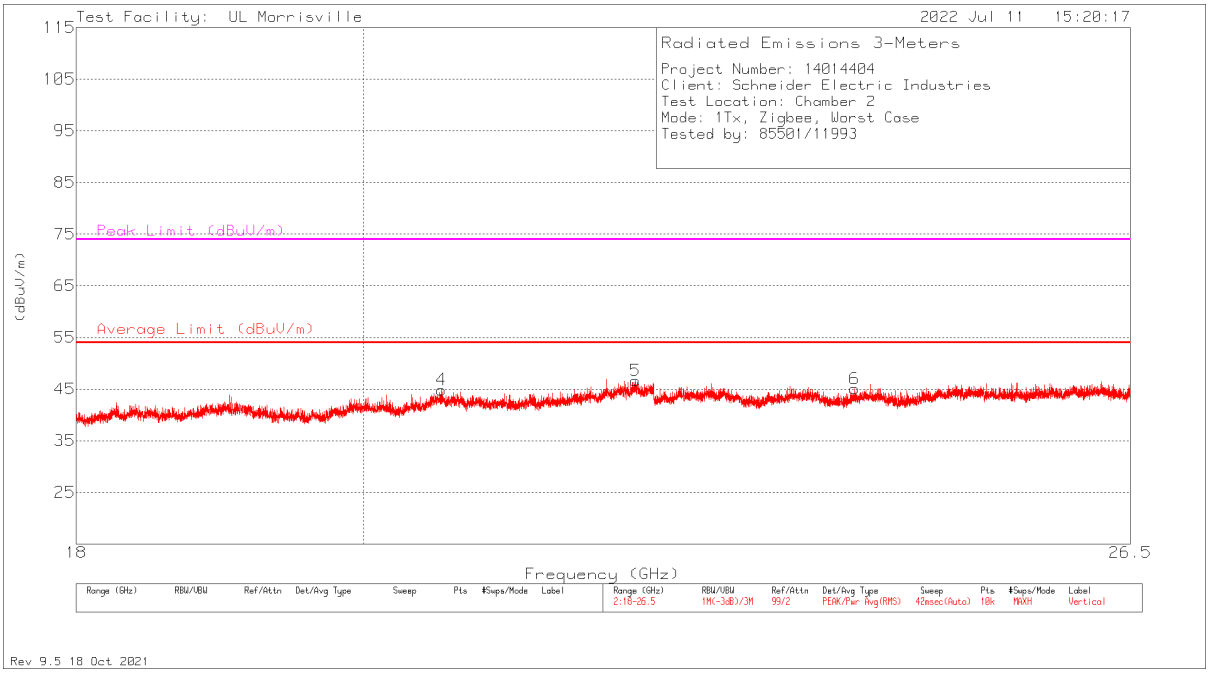
10.5. WORST CASE 18-26 GHZ

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



HORIZONTAL



VERTICAL

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18 – 26GHz Data

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0063 (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	* ** 20.73248	49.14	Pk	33.9	-38.6	44.44	54	-9.56	74	-29.56	0-360	101	H
2	* ** 22.21218	47.63	Pk	36.8	-38.3	46.13	54	-7.87	74	-27.87	0-360	250	H
3	* ** 23.78112	47.38	Pk	34.9	-37.6	44.68	54	-9.32	74	-29.32	0-360	300	H
4	* ** 20.58204	49.33	Pk	33.9	-38.4	44.83	54	-9.17	74	-29.17	0-360	150	V
5	* ** 22.10169	47.75	Pk	37.1	-38.2	46.65	54	-7.35	74	-27.35	0-360	200	V
6	* ** 23.9511	47.66	Pk	34.9	-37.5	45.06	54	-8.94	74	-28.94	0-360	150	V

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

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11. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 8.8

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

* Decreases with the logarithm of the frequency.

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 C63.4.

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 lines.

RESULTS

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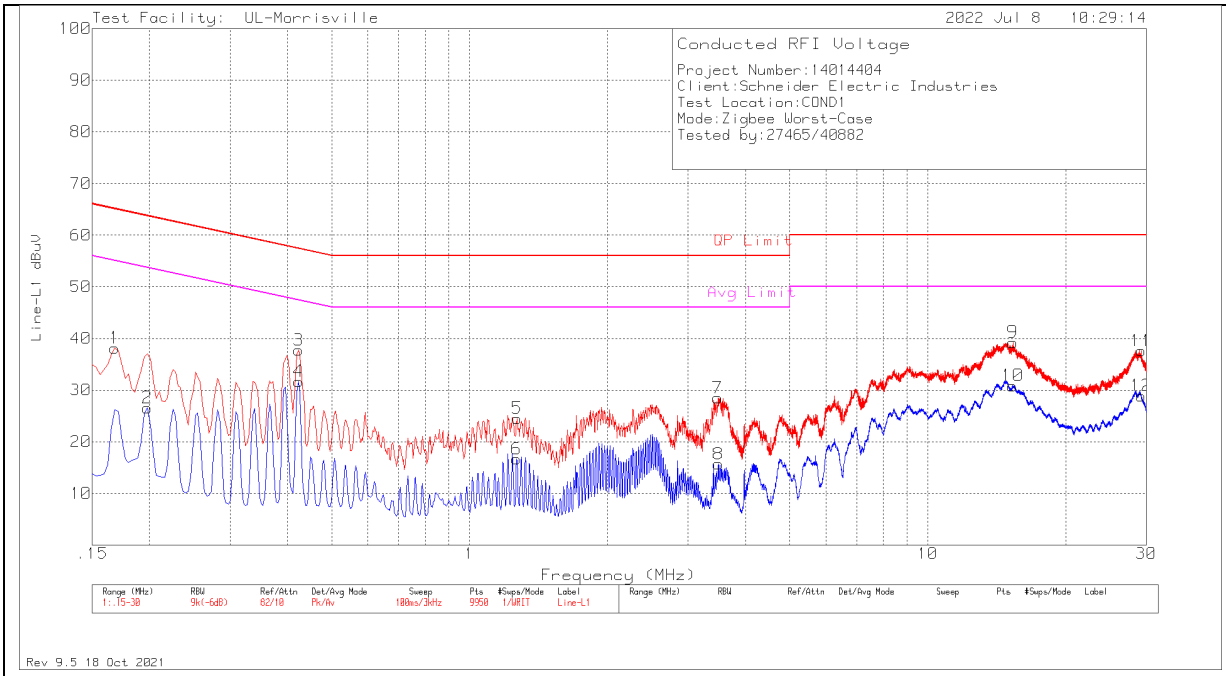
11.1.1. AC Power Line Norm

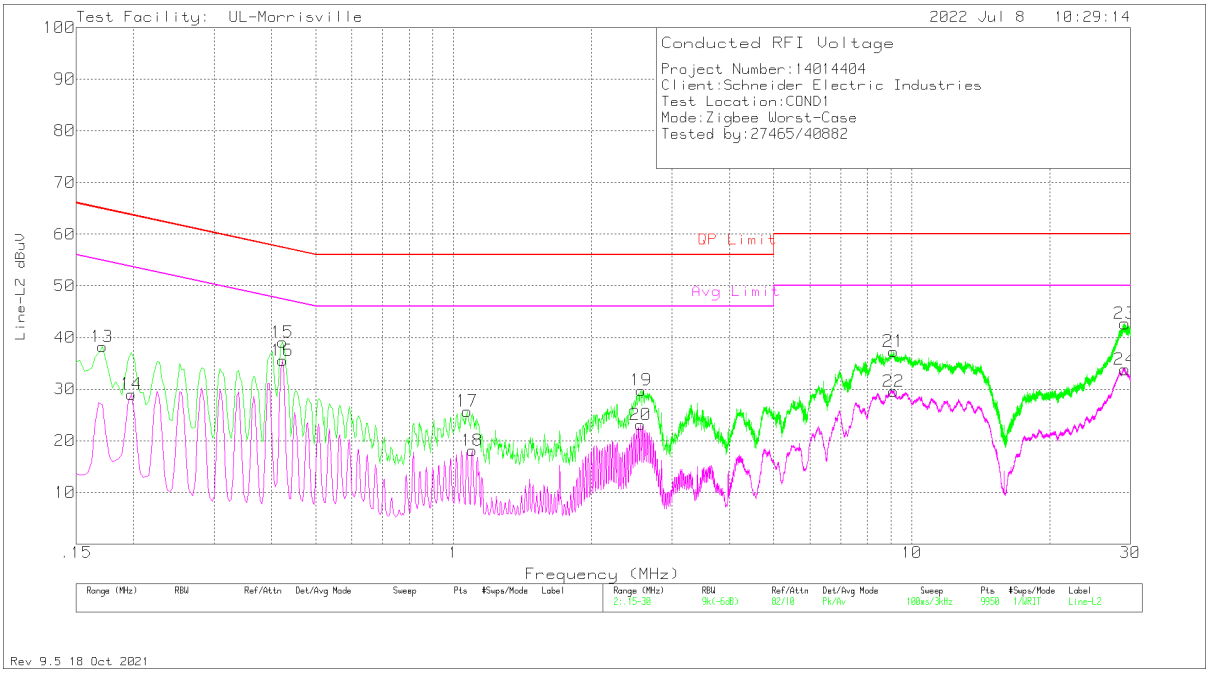
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit	Margin (dB)	Avg Limit	Margin (dB)
1	.168	28.13	Pk	.2	9.8	38.13	65.06	-26.93	55.06	-16.93
2	.198	16.57	Av	.2	9.8	26.57	63.69	-37.12	53.69	-27.12
3	.423	27.84	Pk	.1	9.8	37.74	57.39	-19.65	47.39	-9.65
4	.423	21.78	Av	.1	9.8	31.68	57.39	-25.71	47.39	-15.71
6	1.266	6.87	Av	0	9.8	16.67	56	-39.33	46	-29.33
5	1.269	14.71	Pk	0	9.8	24.51	56	-31.49	46	-21.49
7	3.48	18.58	Pk	0	9.9	28.48	56	-27.52	46	-17.52
8	3.492	5.77	Av	0	9.9	15.67	56	-40.33	46	-30.33
10	15.33	20.66	Av	.1	10.1	30.86	60	-29.14	50	-19.14
9	15.336	29.05	Pk	.1	10.1	39.25	60	-20.75	50	-10.75
12	29.229	18.41	Av	.3	10.2	28.91	60	-31.09	50	-21.09
11	29.241	27.12	Pk	.3	10.2	37.62	60	-22.38	50	-12.38

Pk - Peak detector
Av - Average detection

LINE 2 RESULTS



Range 2: Line-L2 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit	Margin (dB)	Avg Limit	Margin (dB)
13	.171	28.22	Pk	.2	9.8	38.22	64.91	-26.69	54.91	-16.69
14	.198	19	Av	.2	9.8	29	63.69	-34.69	53.69	-24.69
15	.423	29.16	Pk	.1	9.8	39.06	57.39	-18.33	47.39	-8.33
16	.423	25.64	Av	.1	9.8	35.54	57.39	-21.85	47.39	-11.85
17	1.071	15.9	Pk	0	9.8	25.7	56	-30.3	46	-20.3
18	1.098	8.32	Av	0	9.8	18.12	56	-37.88	46	-27.88
20	2.559	13.3	Av	0	9.8	23.1	56	-32.9	46	-22.9
19	2.565	19.96	Pk	0	9.8	29.76	56	-26.24	46	-16.24
21	9.123	27.18	Pk	.1	10	37.28	60	-22.72	50	-12.72
22	9.123	19.48	Av	.1	10	29.58	60	-30.42	50	-20.42
23	29.19	32.19	Pk	.3	10.2	42.69	60	-17.31	50	-7.31
24	29.202	23.31	Av	.3	10.2	33.81	60	-26.19	50	-16.19

Pk - Peak detector
Av - Average detection

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12. SETUP PHOTOS

Please refer to 14014404-EP1 for setup photos

END OF TEST REPORT

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