TEST REPORT

Report Number. : R14476982-E1

Applicant	:	Qolsys Inc. 1919 S. Bascom Ave. Suite 600 Campbell, CA 95008
Model	:	IQ PANEL4
FCC ID	:	2AAJXQS-IQP4
IC ID	:	11205A-QSIQP4
EUT Description	:	Zwave 800 Radio
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C: 2022 ISED RSS-210 ISSUE 10+A1: 2020 ISED RSS-GEN ISSUE 5 + A2: 2021

Date Of Issue:
2023-02-21

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	2022-11-02	Initial Issue	Noah Bennett
V2	2023-02-21	Addressed TCB Feedback: -Fixed ToC Error -Added Attenuator to Equipment List.	Noah Bennett

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Qolsys Inc.
1919 S. Bascom Ave. Suite 600
Campbell, CA 95008

EUT DESCRIPTION: Zwave 800 Radio

MODEL: IQ PANEL4

SERIAL NUMBER: QP4004X162224G04858, QP4004X162224G04876

SAMPLE RECEIPT DATE: 2022-09-13

DATE TESTED: 2022-09-20 to 2022-09-29

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C: 2022	Complies
ISED RSS-210 Issue 10+A1: 2020	Complies
ISED RSS-GEN Issue 5 + A2: 2021	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 A2LA, or any agency of the U.S. government.

Approved & Released For
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2. TEST RESULTS SUMMARY

FCC Clause	ISED Clause	Requirement	Result	Comment
See Comment		Duty Cycle	Reporting purposes only	ANSI C63.10 Section 11.6.
-	RSS-GEN 6.7	99% OBW	Reporting purposes only	ANSI C63.10 Section 6.9.3.
15.249 (a)	RSS-210-B.10(a)	Fundamental Field Strength	Complies	None
15.205, 15.209, 15.249(a)	RSS-GEN 8.9, 8.10	Radiated Emissions	Complies	None.
15.207	RSS-GEN 8.8	AC Mains Conducted Emissions	Complies	None.

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.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15: 2022, ANSI C63.10-2013, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A2: 2021, and RSS-210 Issue 10 + A1: 2020.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by A2LA, Laboratory Code 200246-0, 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	703469
☒	Building: 2800 Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A	US0067	27265	703469

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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

5.2. DECISION RULES

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

5.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Radio Frequency (Spectrum Analyzer)	141.2 Hz
Occupied Channel Bandwidth	1.22%
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	0.57%
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 Z wave radio module build into the PCB of a Home Maintenance hub.

6.2. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an ISM band loop antenna, with a maximum gain of 1.5 dBi.

6.3. SOFTWARE AND FIRMWARE

The EUT software installed during testing was msm8953_64-userdebug 9 PKQ1.190723.001

The test utility software used during testing was Android Debug Bridge v29.

6.4. WORST-CASE CONFIGURATION AND MODE

Radiated Emissions below 30 MHz and power line conducted emissions were performed with the EUT set to transmit at the channel with highest output fundamental field strength as worst-case scenario.

Radiated emissions and Equivalent Radiated Power below and above 1GHz were performed with the EUT set to transmit at 908.4 MHz, 908.42 MHz, 916 MHz, 919.8 MHz, and 921.4 MHz. The Power setting used for radiated spurious emissions was power setting 10 and ERP was set as below:

Channel (MHz)	Power Level
908.4 MHz	10
908.42 MHz	10
916 MHz	10
919.8 MHz	10
921.4 MHz	9

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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6.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Laptop	HP	15-p100dx	5CD43938XL	N/A

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	AC Power	1	Barrell	Shielded	<3m	Used to connect Host Device to AC Mains

TEST SETUP

The EUT was connected to a test laptop and configured to transmit continuously before the tests.

SETUP DIAGRAM

See R14476982-EP1 for Setup Diagrams

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7. MEASUREMENT METHOD

Duty Cycle: ANSI C63.10-2013 Section 11.6

20dB Bandwidth: ANSI C63.10-2013 Section 6.9.2

Occupied Bandwidth: ANSI C63.10-2013 Subclause 6.9.3

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

General Radiated Spurious Emissions: ANSI C63.10-2013, Section 6.3, 6.5, 6.6

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

Fundamental emission output power: ANSI C63.10-2013, Section 11.9

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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 4)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
AT0059	Active Loop Antenna	ETS-Lindgren	6502	2022-09-12	2023-09-12
	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-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2022-05-20	2023-05-20
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				
21642	Environmental Meter	Fisher Scientific	15-077-963 (s/n 210701692)	2021-08-16	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.
	30-1000 MHz				
AT0074	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2022-09-07	2023-09-07
	1-18 GHz				
206211	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2022-03-21	2023-03-21
	Gain-Loss Chains				
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
	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				
200540	Environmental Meter	Fisher Scientific	15-077-963 (s/n 181474409)	2021-09-27	2022-09-27
BRF007	902-928MHz notch filter, 2W, F_{high} =1.5GHz	Micro-Tronics	BRC17691	2022-05-27	2023-05-27
HPF009	1GHz high-pass filter, 2W, F_{high} =10GHz	Micro-Tronics	HPM17672	2022-02-17	2023-02-17

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
HI0091	Environmental Meter	Fisher Scientific	15-077-963	2022-07-20	2023-07-20
LISN003	LISN, 50-ohm/50-uH, 250uH 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50/250-25-2-01	2022-08-01	2023-08-01
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2022-08-03	2023-08-03
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2022-04-05	2023-04-05
PS215	AC Power Source	Elgar	CW2501M (s/n 1523A02397)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Miscellaneous (if needed)				
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2022-09-12	2023-09-12

Test Equipment Used - Wireless Conducted 2 Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2022-07-20	2023-07-20
SA0027	Spectrum Analyzer	Keysight Technologies	N9030A	2022-05-24	2023-05-24
SOFTEMI	Antenna Port Software	UL	Version 2022.8.16		

Test Equipment Used - Wireless Conducted Attenuators, Cables, and Couplers

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Common Equipment				
	Attenuators				
226561	SMA Coaxial 10dB Attenuator 25MHz-18GHz	CentricRF	C18S2-10	2022-05-03	2023-05-03

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

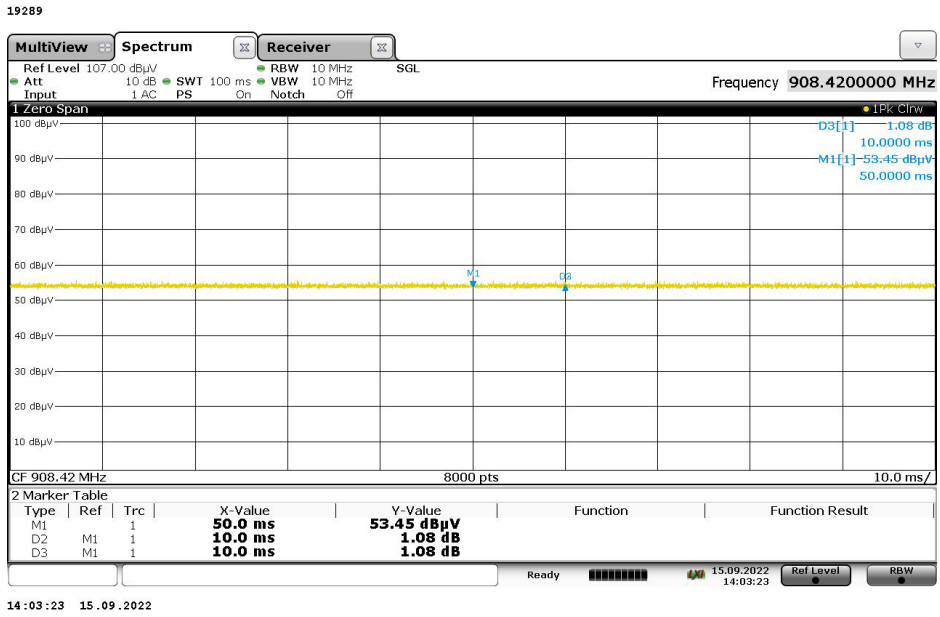
PROCEDURE

ANSI C63.10 Section 11.6
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)
Z-wave- 919.8 MHz	100.000	100.000	1.000	100.00%	0.00	0.010

DUTY CYCLE PLOT



DUTY CYCLE Z-wave, 919.8 MHz

9.2. 99% AND 20dB BANDWIDTH

LIMITS

None; for reporting purposes only.

RESULTS

9.2.1. Z-WAVE

1TX Antenna 1 MODE

Channel	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
Low 1	908.4	85.28	87.077
Low 2	908.42	66.77	65.004
Mid	916	121.60	114.560
High 1	919.8	121.20	112.910
High 2	921.4	84.01	84.614

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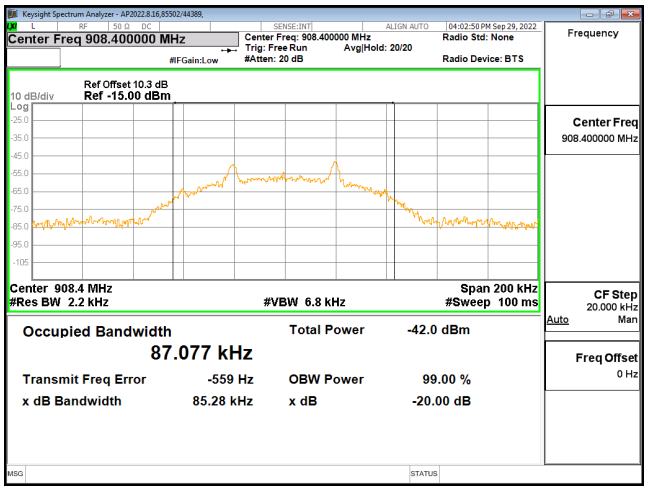
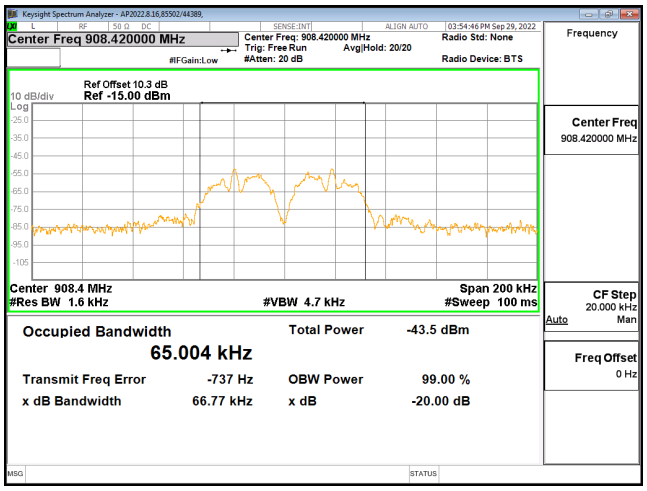
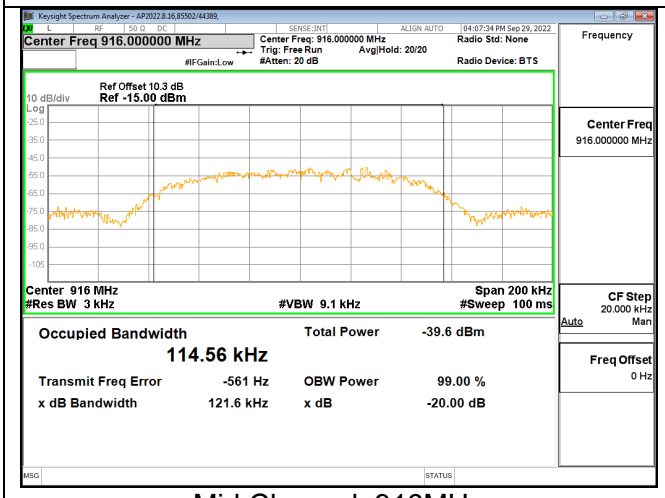


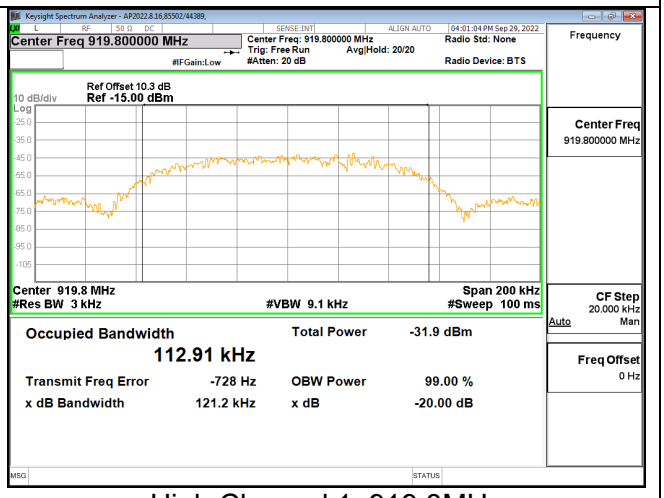
Low Channel 1: 908.4MHz



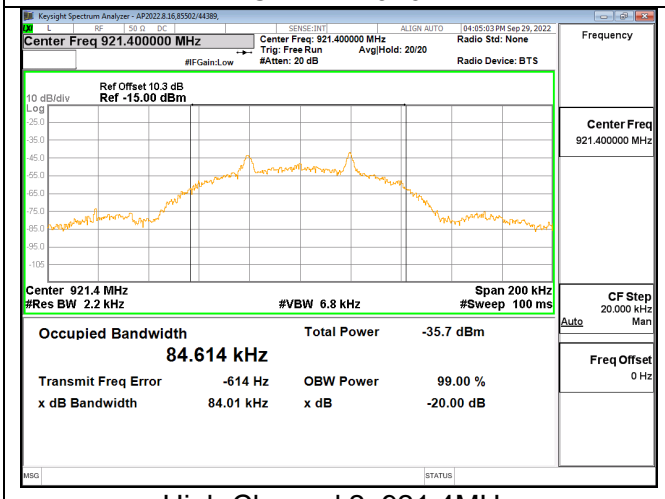
Low Channel 2: 908.42MHz



Mid Channel: 916MHz



High Channel 1: 919.8MHz



High Channel 2: 921.4MHz

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10. RADIATED TEST RESULTS

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

FCC 15.249(a), RSS-210 B.10(a)

Frequency Range (MHz)	Field Strength Limit of Fundamental (mV/m) at 3 m	Field Strength Limit of Harmonics (mV/m) at 3 m
902-928	50	.5

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 3 MHz 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 linear voltage averaging measurements.

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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10.1. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.1.1. FUNDAMENTAL (908.4 MHz)

Frequency (MHz)	Meter Reading (dBuV)	Det	AT0081 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
908.378	89.92	Qp	29	-25.4	93.52	94	-.48	263	102	H
908.379	78.66	Qp	29	-25.4	82.26	94	-11.74	221	283	V

Qp - Quasi-Peak detector

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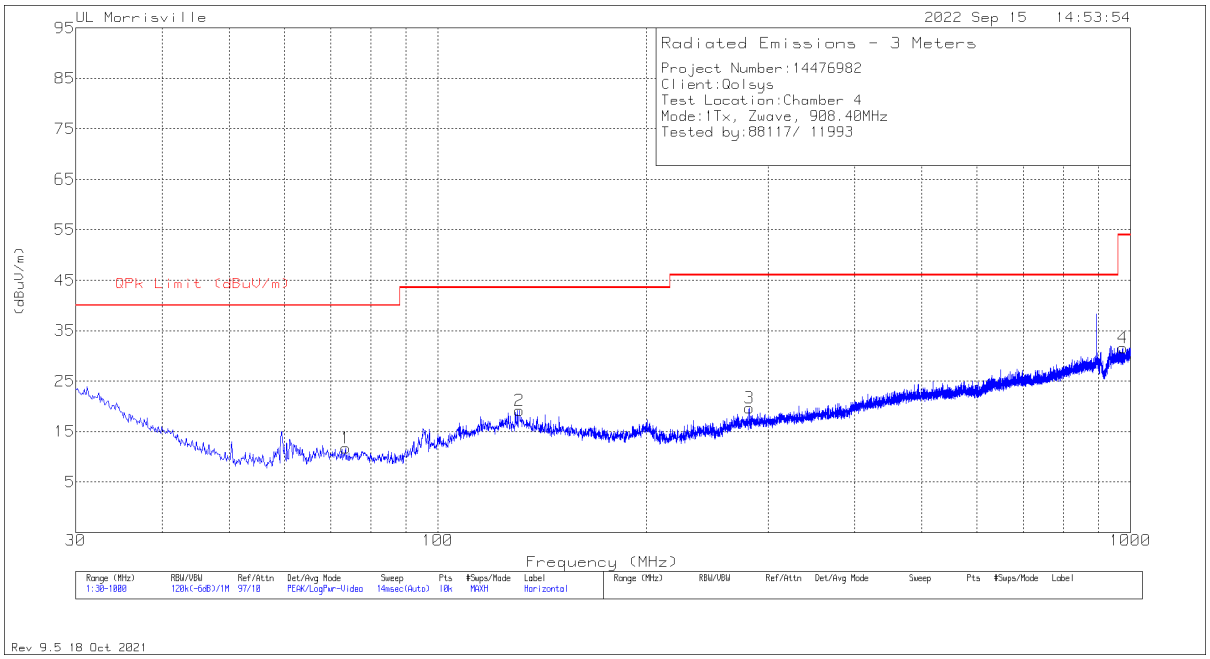
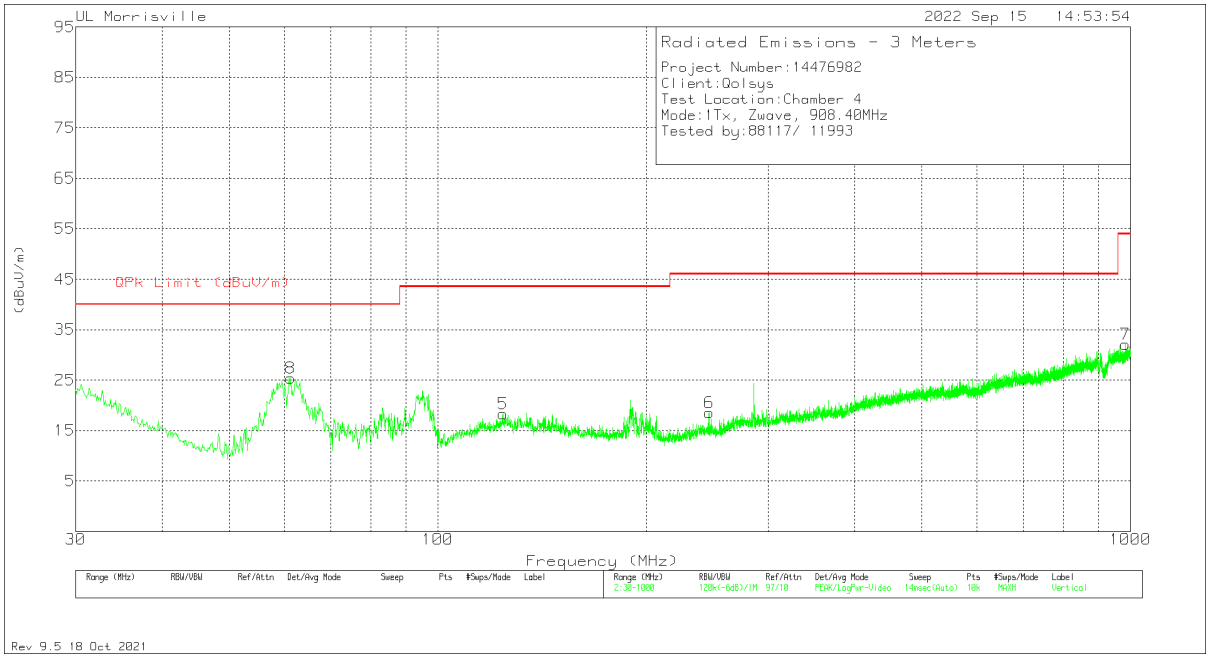
10.1.2. HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

LOW CHANNEL, 908.4 MHz RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0081 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 73.553	28.37	Pk	14.3	-31.1	.2	11.77	40	-28.23	0-360	100	H
2	* ** 131.171	29.21	Pk	20	-30.4	.4	19.21	43.52	-24.31	0-360	100	H
3	* ** 281.424	28.7	Pk	19.8	-29.2	.4	19.7	46.02	-26.32	0-360	100	H
4	* ** 974.877	25.47	Pk	29.6	-24.4	.9	31.57	53.97	-22.4	0-360	300	H
5	* ** 124.09	28.21	Pk	20.2	-30.5	.4	18.31	43.52	-25.21	0-360	100	V
6	* ** 246.31	29.25	Pk	18.1	-29.3	.5	18.55	46.02	-27.47	0-360	100	V
7	* ** 983.316	25.73	Pk	29.7	-24.2	.9	32.13	53.97	-21.84	0-360	100	V
8	61.331	42.83	Pk	13.7	-31.3	.2	25.43	-	-	0-360	100	V

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

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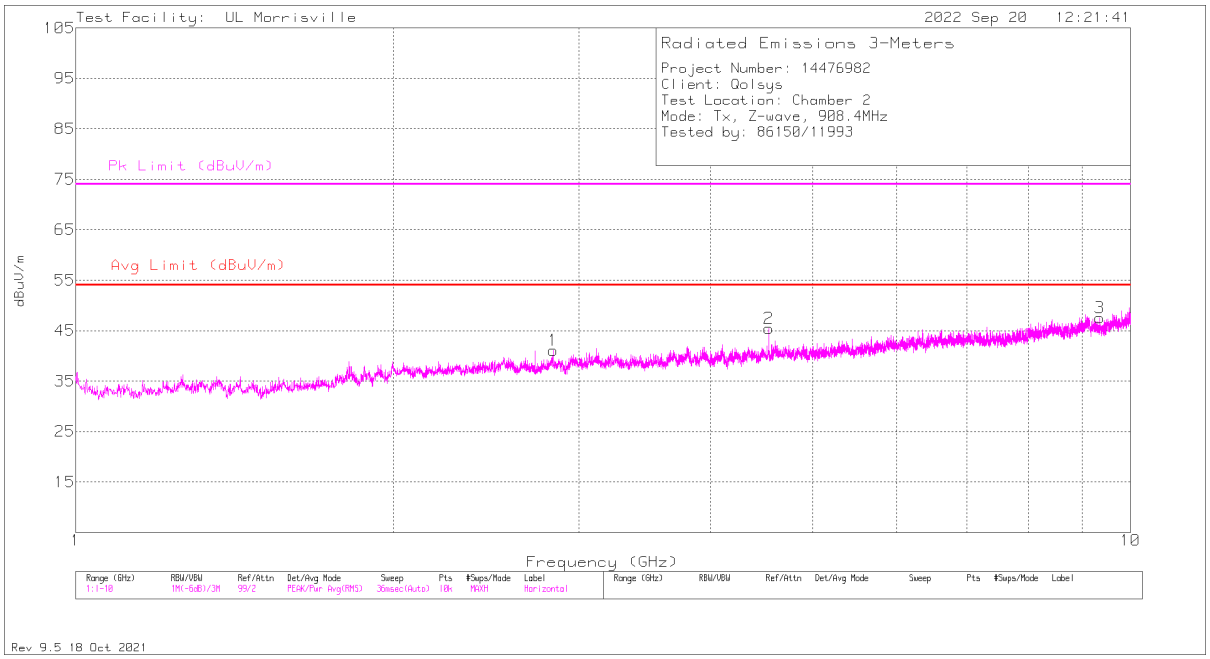
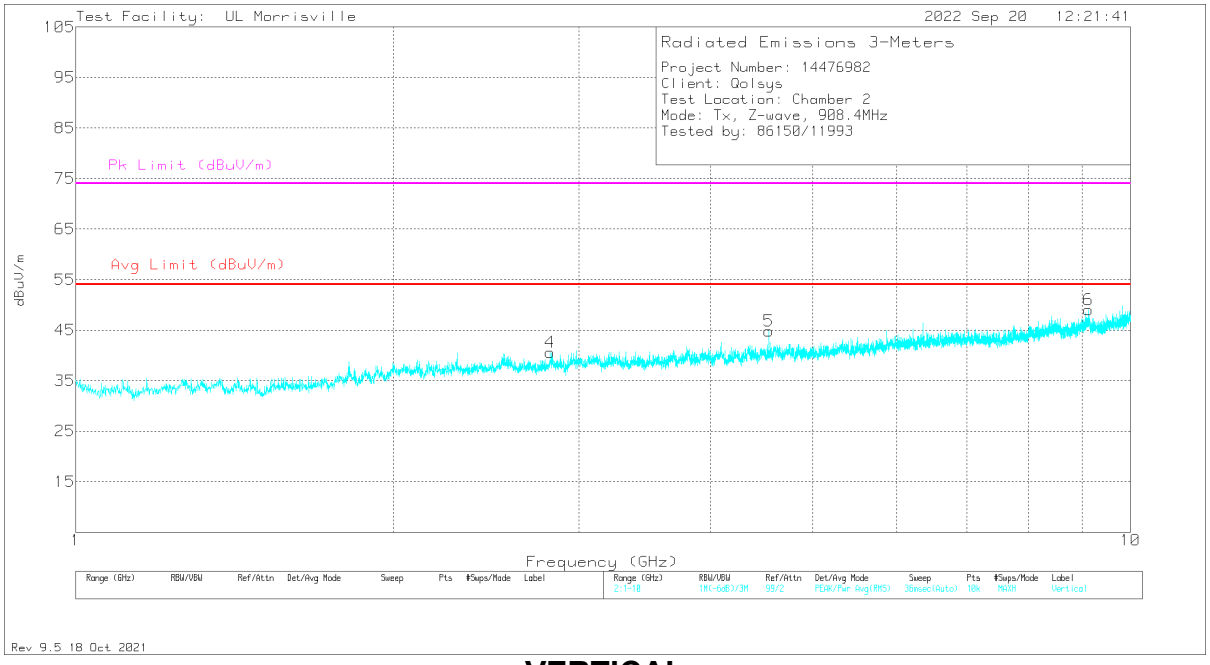
10.1.3. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz

LOW CHANNEL, 908.4 MHz RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	206211 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading dBuV/m	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.8369	41.84	Pk	32.3	-33.4	.4	41.14	54	-12.86	74	-32.86	0-360	200	H
2	* ** 4.5424	42.71	Pk	34.1	-31.6	.2	45.41	54	-8.59	74	-28.59	0-360	101	H
3	* ** 9.3466	36.79	Pk	36.5	-26.2	.5	47.59	54	-6.41	74	-26.41	0-360	399	H
4	* ** 2.8162	41.32	Pk	32.3	-33.4	.4	40.62	54	-13.38	74	-33.38	0-360	101	V
5	* ** 4.5415	42.02	Pk	34.1	-31.5	.2	44.82	54	-9.18	74	-29.18	0-360	101	V
6	* ** 9.12381	39.19	PK2	36.2	-26.2	.5	49.69	-	-	74	-24.31	64	243	V
	* ** 9.12297	26.23	ADV	36.2	-26.2	.5	36.73	54	-17.27	-	-	64	243	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

UL LLC
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10.2. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.2.1. FUNDAMENTAL (908.42 MHz)

Frequency (MHz)	Meter Reading (dBuV)	Det	AT0081 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
908.399	79.51	Qp	29	-25.4	83.11	94	-10.89	123	169	V
908.4	88.96	Qp	29	-25.4	92.56	94	-1.44	60	168	H

Qp - Quasi-Peak detector

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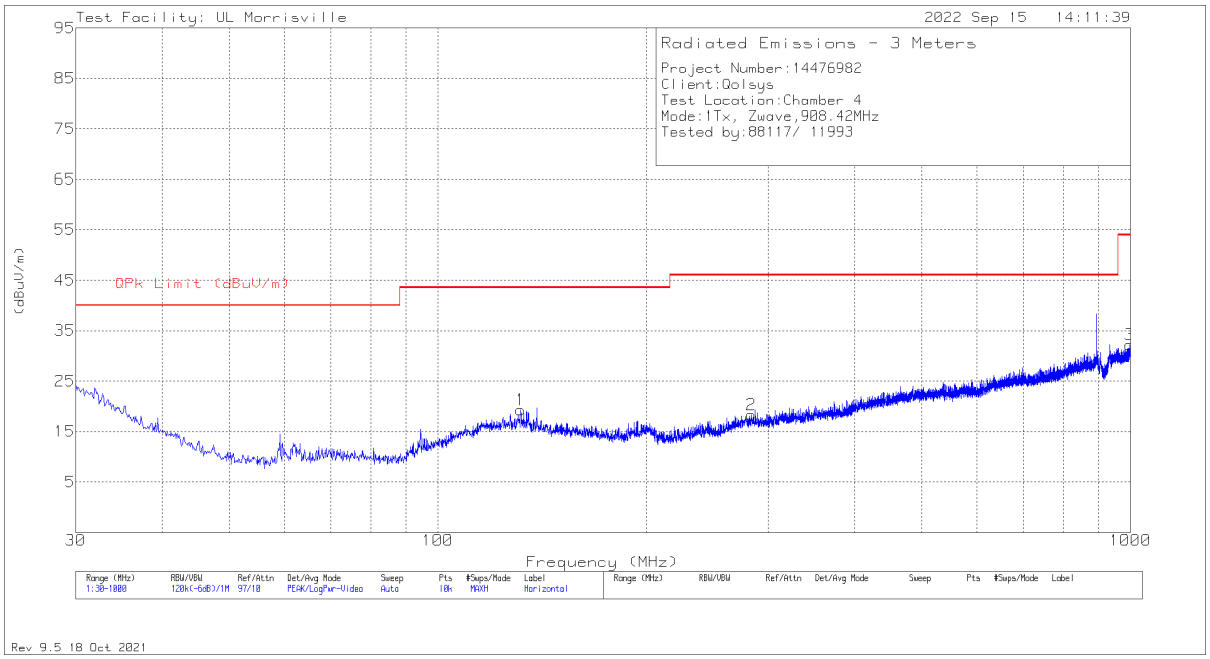
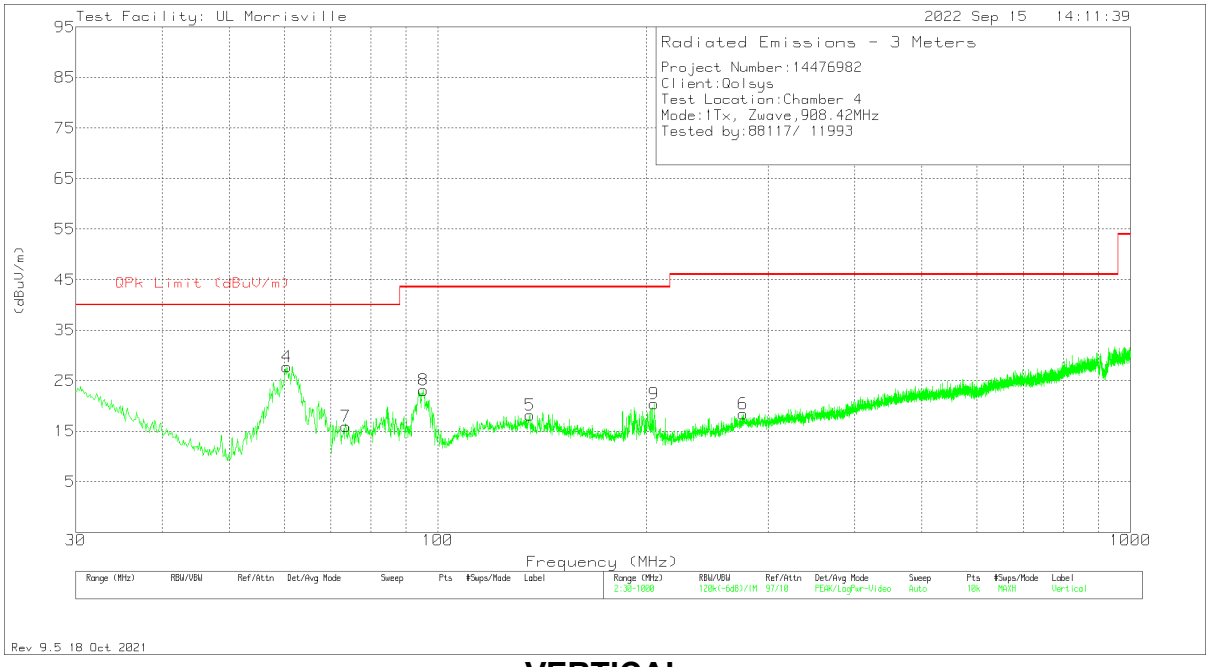
10.2.2. HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

LOW CHANNEL, 908.42 MHz RESULTS



HORIZONTAL



VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0081 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 131.559	29.32	Pk	19.9	-30.3	.4	19.32	43.52	-24.2	0-360	100	H
2	* ** 283.364	27.33	Pk	19.8	-29.2	.4	18.33	46.02	-27.69	0-360	200	H
3	* ** 996.993	25.14	Pk	30	-24	1.1	32.24	53.97	-21.73	0-360	100	H
5	* ** 135.73	28.49	Pk	19.6	-30.3	.4	18.19	43.52	-25.33	0-360	100	V
6	* ** 276.089	27.39	Pk	19.8	-29.2	.4	18.39	46.02	-27.63	0-360	100	V
7	* ** 73.65	32.52	Pk	14.3	-31.1	.2	15.92	40	-24.08	0-360	100	V
4	60.555	45.03	Pk	13.6	-31.1	.2	27.73	40	-12.27	0-360	100	V
8	95.378	38.49	Pk	15.2	-30.8	.2	23.09	43.52	-20.43	0-360	100	V
9	205.182	32.06	Pk	17.5	-29.6	.4	20.36	43.52	-23.16	0-360	100	V

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

UL LLC
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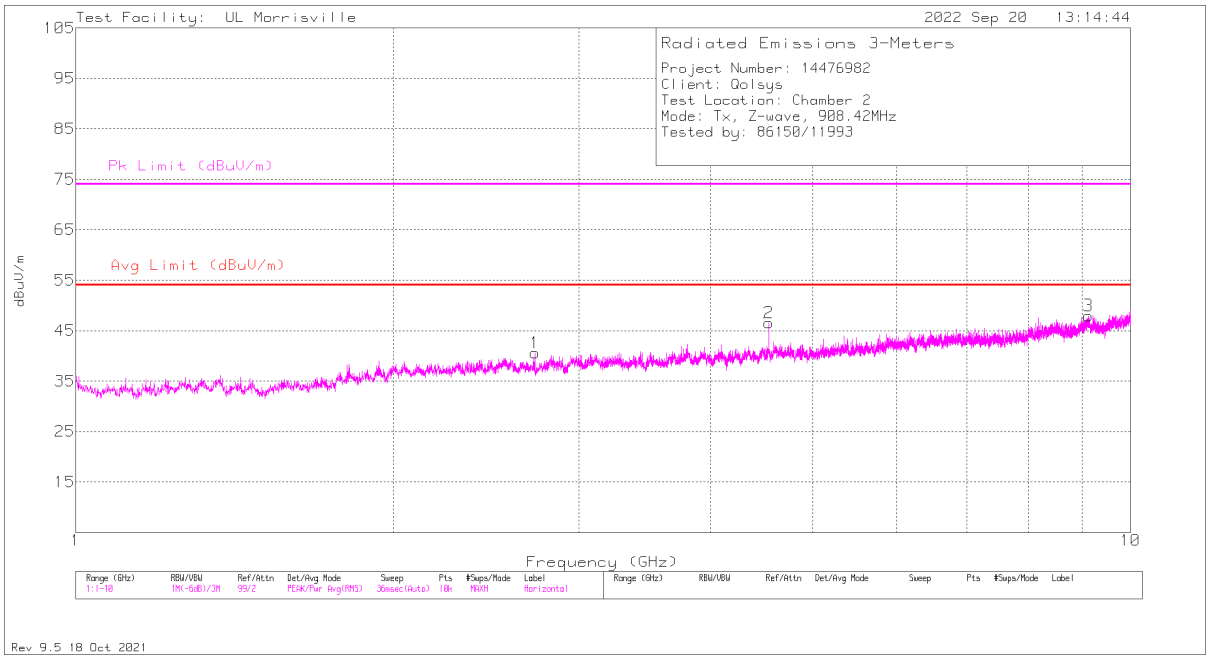
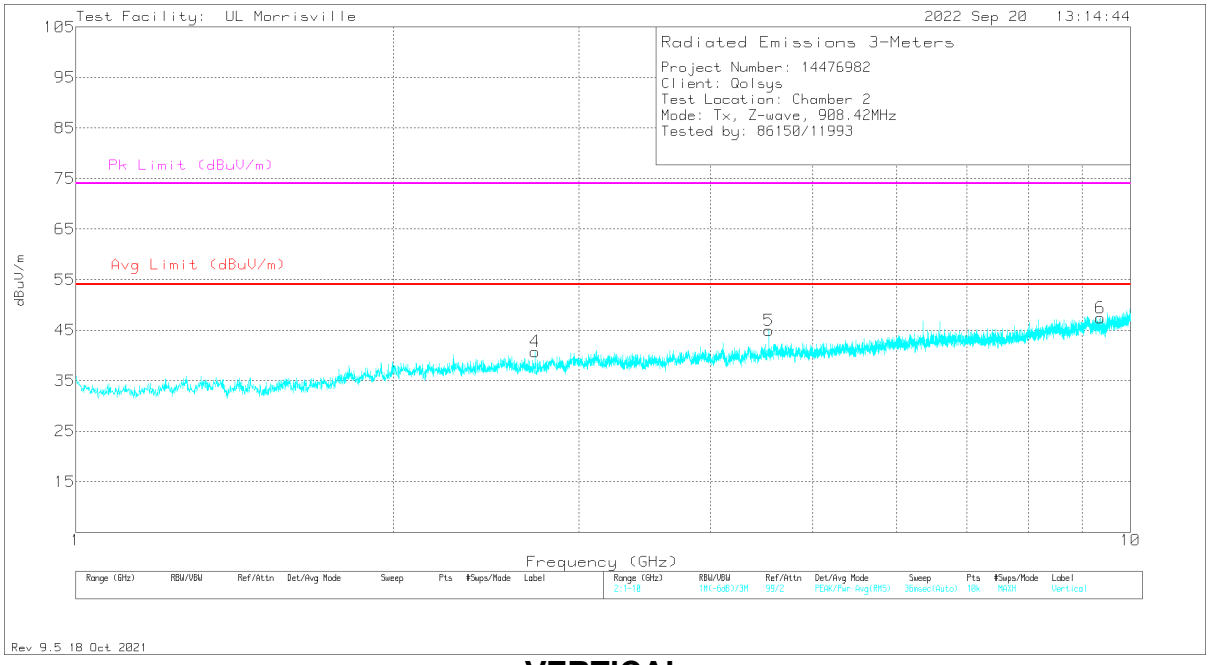
10.2.3. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz

LOW CHANNEL, 908.42 MHz RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	206211 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading dBuV/m	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.7253	42.41	Pk	31.8	-34	.4	40.61	54	-13.39	74	-33.39	0-360	300	H
2	* ** 4.5424	43.9	Pk	34.1	-31.6	.2	46.6	54	-7.4	74	-27.4	0-360	101	H
3	* ** 9.1279	37.48	Pk	36.2	-26.2	.5	47.98	54	-6.02	74	-26.02	0-360	200	H
4	* ** 2.7253	42.58	Pk	31.8	-34	.4	40.78	54	-13.22	74	-33.22	0-360	400	V
5	* ** 4.5424	42.27	Pk	34.1	-31.6	.2	44.97	54	-9.03	74	-29.03	0-360	101	V
6	* ** 9.3655	36.26	Pk	36.5	-25.8	.5	47.46	54	-6.54	74	-26.54	0-360	400	V

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

10.3. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.3.1. FUNDAMENTAL (916 MHz)

Frequency (MHz)	Meter Reading (dBuV)	Det	AT0081 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
916.026	78.72	Qp	29	-25.4	82.32	94	-11.68	229	170	V
916.028	88.61	Qp	29	-25.4	92.21	94	-1.79	273	102	H

Qp - Quasi-Peak detector

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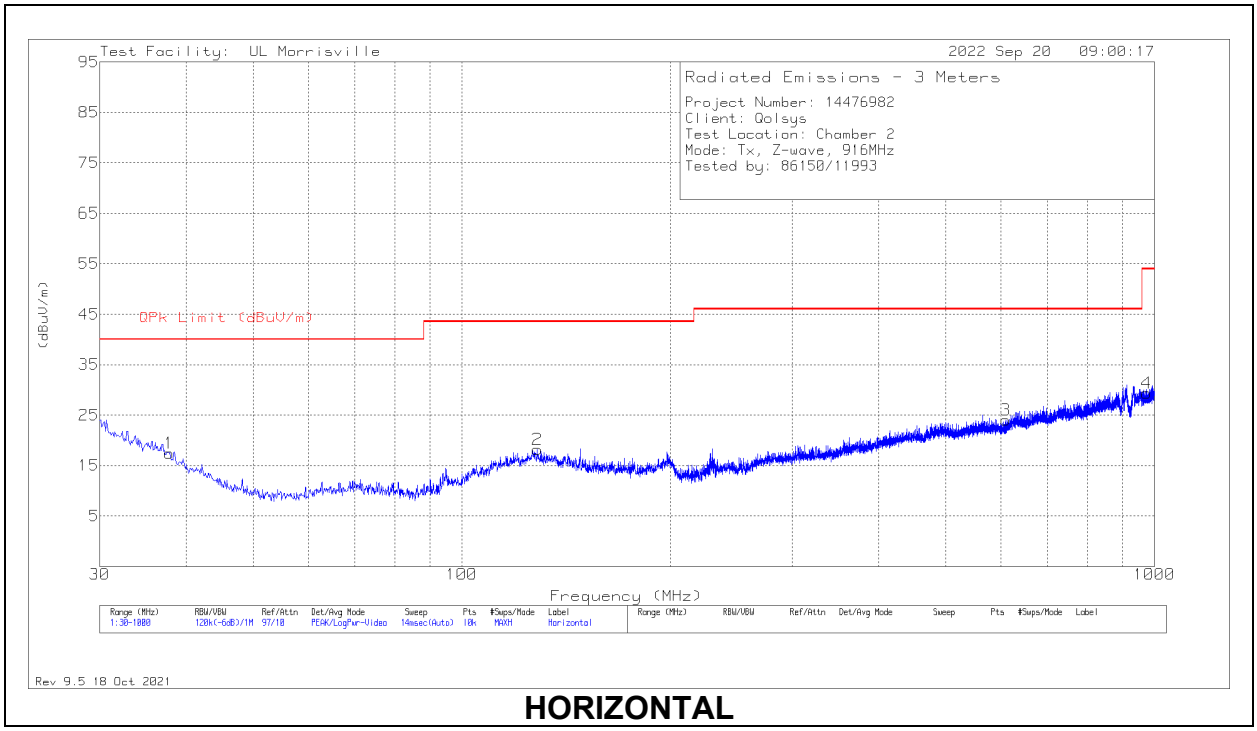
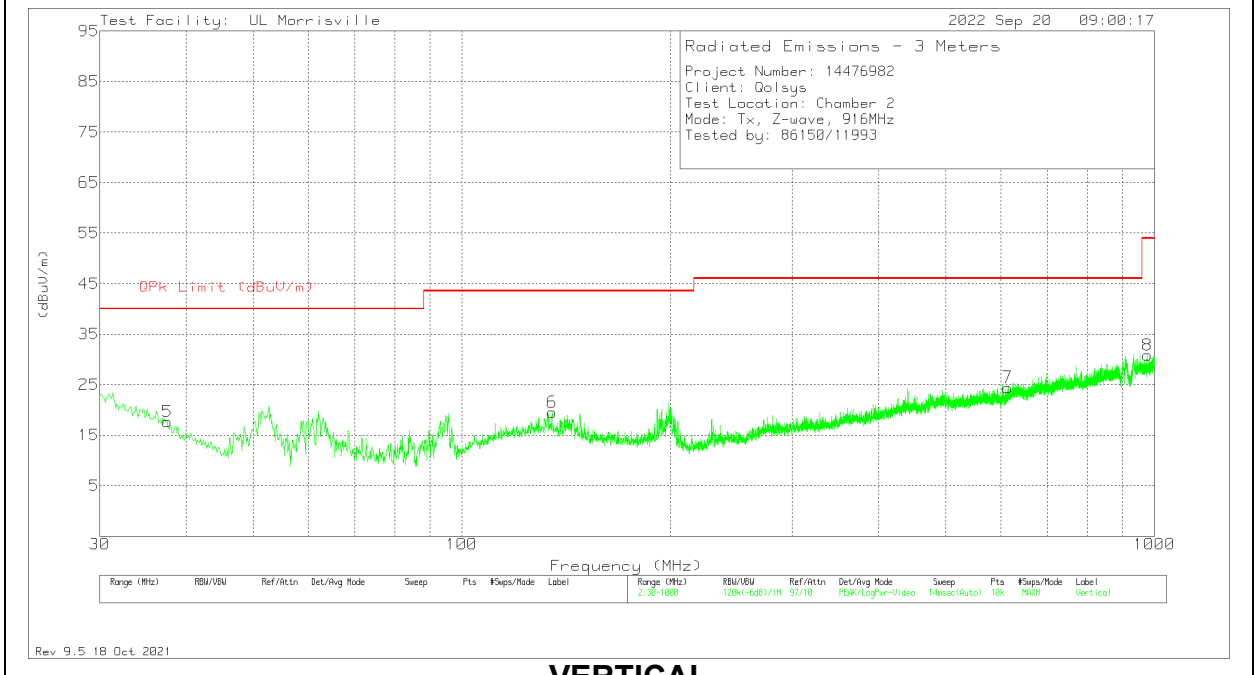
10.3.2. HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

MID CHANNEL, 916 MHz RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

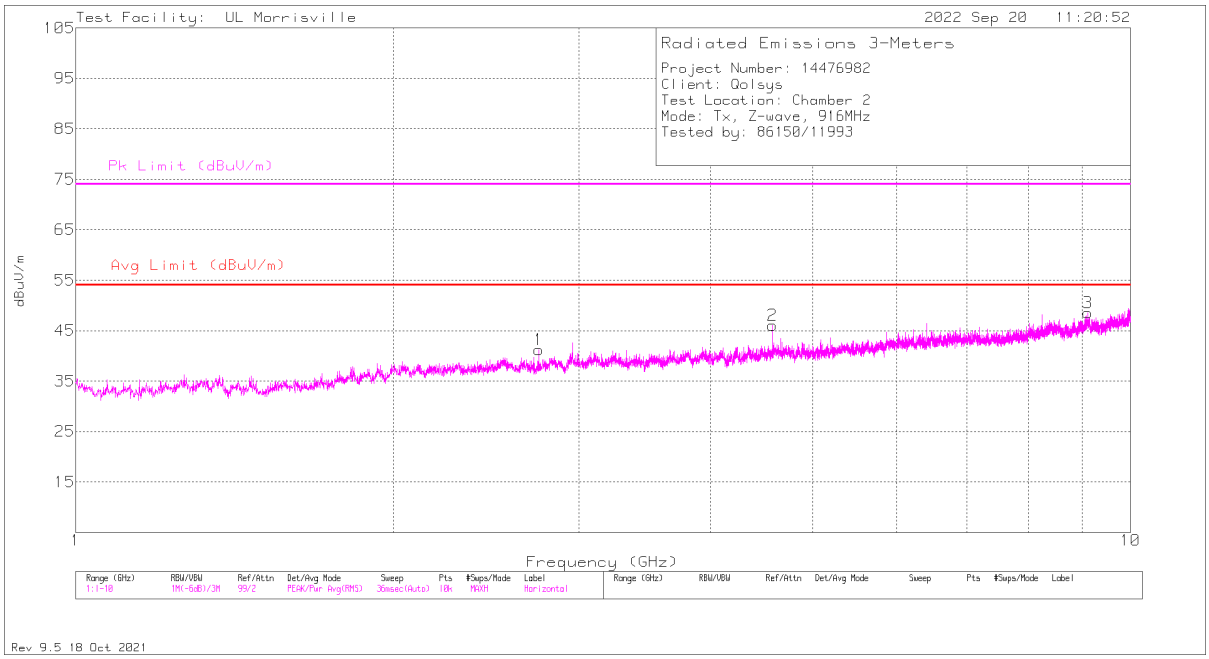
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 37.76	27.17	Pk	21.6	-31.4	.1	17.47	40	-22.53	0-360	101	H
2	* ** 128.552	27.75	Pk	20	-30	.4	18.15	43.52	-25.37	0-360	299	H
3	* ** 610.254	25.68	Pk	24.6	-27	.7	23.98	46.02	-22.04	0-360	399	H
4	* ** 974.198	24.02	Pk	28.6	-24.3	1	29.32	53.97	-24.65	0-360	101	H
5	* ** 37.566	27.22	Pk	21.8	-31.4	.1	17.72	40	-22.28	0-360	299	V
6	* ** 135.051	29.68	Pk	19.6	-30.1	.4	19.58	43.52	-23.94	0-360	101	V
7	* ** 613.746	26.05	Pk	24.7	-27	.7	24.45	46.02	-21.57	0-360	101	V
8	* ** 977.593	25.48	Pk	28.6	-24.1	.9	30.88	53.97	-23.09	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

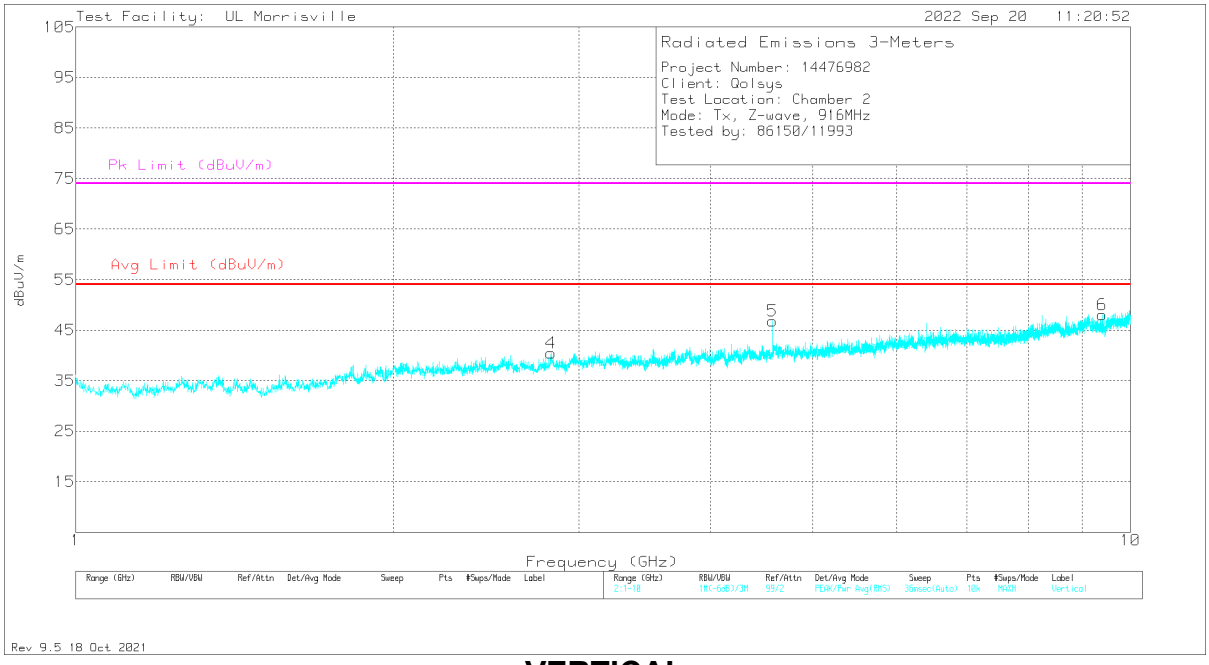
UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919) 549-1400

10.3.3. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz

MID CHANNEL, 916 MHz RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	206211 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading dBuV/m	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.7478	42.12	Pk	32.1	-33.5	.5	41.22	54	-12.78	74	-32.78	0-360	100	H
2	* ** 4.5802	43.73	Pk	34.2	-32.1	.2	46.03	54	-7.97	74	-27.97	0-360	100	H
3	* ** 9.11467	39.3	PK2	36.2	-26.2	.5	49.8	-	-	74	-24.2	314	117	H
	* ** 9.11652	26.22	ADV	36.2	-26.2	.5	36.72	54	-17.28	-	-	314	117	H
4	* ** 2.8225	40.96	Pk	32.4	-33.3	.4	40.46	54	-13.54	74	-33.54	0-360	200	V
5	* ** 4.5802	44.53	Pk	34.2	-32.1	.2	46.83	54	-7.17	74	-27.17	0-360	101	V
6	* ** 9.40536	38.61	PK2	36.5	-26.1	.5	49.51	-	-	74	-24.49	36	311	V
	* ** 9.40662	24.94	ADV	36.5	-26.1	.5	35.84	54	-18.16	-	-	36	311	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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10.4. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.4.1. FUNDAMENTAL (919.8 MHz)

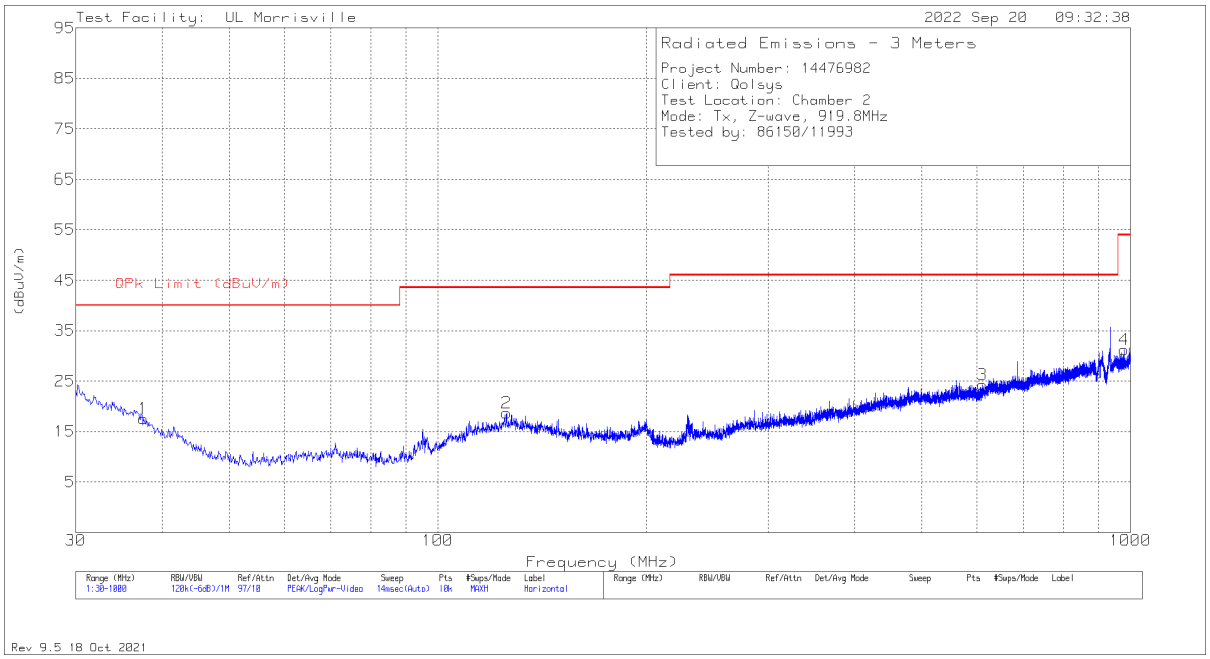
Frequency (MHz)	Meter Reading (dBuV)	Det	AT0066 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
919.8282	88.77	Qp	28.2	-24.6	92.37	94	-1.63	129	153	H
919.8288	82.8	Qp	28.2	-24.6	86.4	94	-7.6	291	159	V

Qp - Quasi-Peak detector

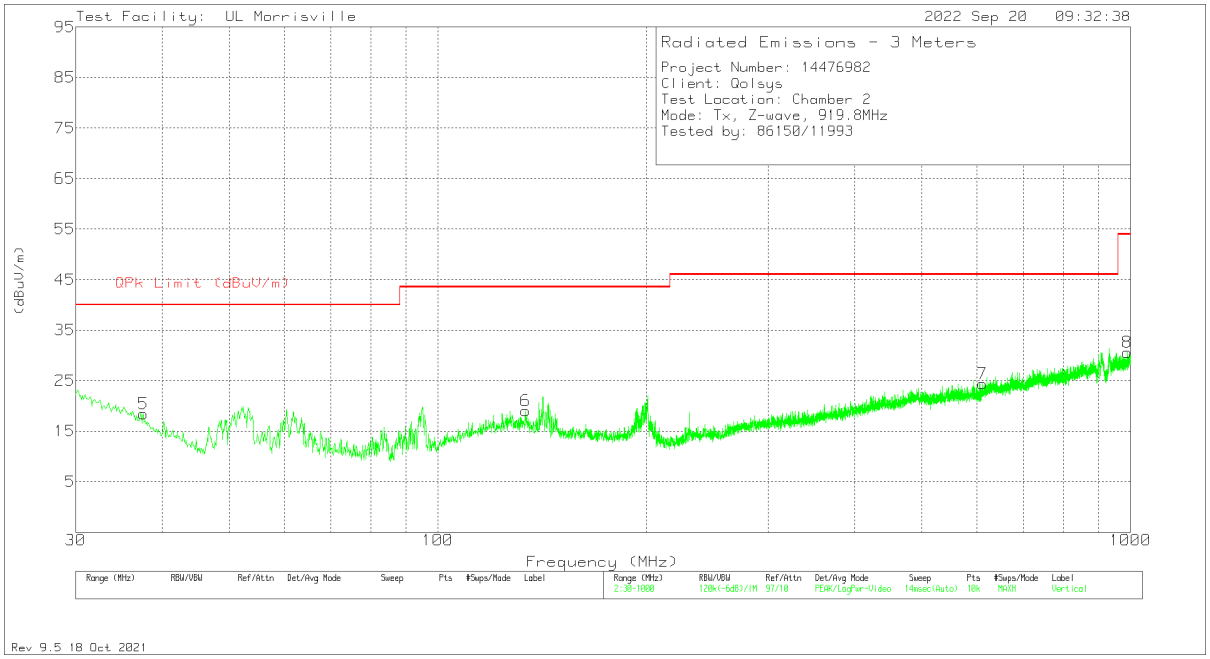
UL LLC
12 Laboratory Dr., RTP, NC 27709; USA TEL: (919) 549-1400

10.4.2. HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

MID CHANNEL, 919.8 MHz RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 37.566	27.03	Pk	21.8	-31.4	.1	17.53	40	-22.47	0-360	399	H
2	* ** 125.642	28.41	Pk	20	-30.1	.4	18.71	43.52	-24.81	0-360	299	H
3	* ** 612	25.87	Pk	24.7	-27	.7	24.27	46.02	-21.75	0-360	101	H
4	* ** 979.339	25.57	Pk	28.7	-23.9	.9	31.27	53.97	-22.7	0-360	199	H
5	* ** 37.566	27.94	Pk	21.8	-31.4	.1	18.44	40	-21.56	0-360	101	V
6	* ** 133.887	28.87	Pk	19.7	-29.9	.4	19.07	43.52	-24.45	0-360	101	V
7	* ** 611.224	26.1	Pk	24.6	-27	.7	24.4	46.02	-21.62	0-360	101	V
8	* ** 988.651	24.9	Pk	28.8	-24	.9	30.6	53.97	-23.37	0-360	299	V

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

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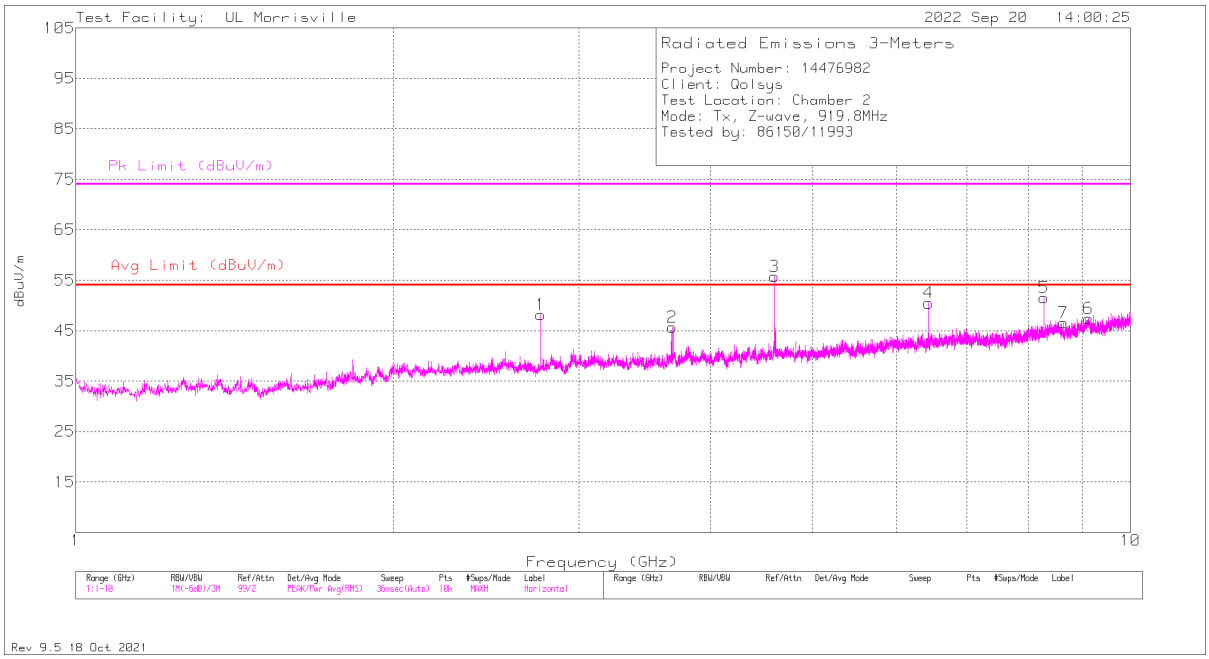
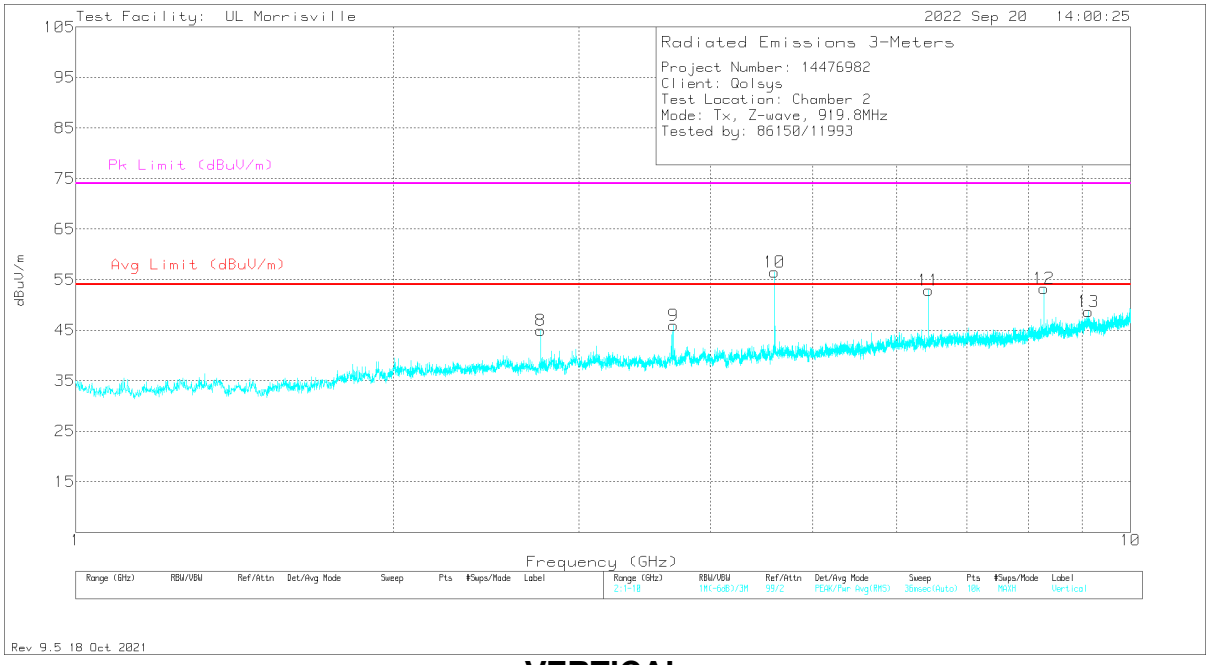
10.4.3. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz

MID CHANNEL, 919.8 MHz RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	206211 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading dBuV/m	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 2.76288	41.73	PK2	32.2	-33.7	.5	40.73	-	-	74	-33.27	67	110	H
	* ** 2.76212	29.18	ADV	32.2	-33.7	.5	28.18	54	-25.82	-	-	67	110	H
2	* ** 3.6793	44.67	Pk	33.1	-32.8	.7	45.67	54	-8.33	74	-28.33	0-360	101	H
3	* ** 4.59847	40.93	PK2	34.2	-31.7	.4	43.83	-	-	74	-30.17	240	237	H
	* ** 4.5988	28.74	ADV	34.2	-31.6	.4	31.74	54	-22.26	-	-	240	237	H
5	* ** 8.27952	38.6	PK2	35.8	-27.3	.4	47.5	-	-	74	-26.5	245	346	H
	* ** 8.28104	26.3	ADV	35.8	-27.2	.4	35.3	54	-18.7	-	-	245	346	H
6	* ** 9.1288	36.94	Pk	36.2	-26.2	.5	47.44	54	-6.56	74	-26.56	0-360	200	H
8	* ** 2.7595	46.07	Pk	32.1	-33.7	.5	44.97	54	-9.03	74	-29.03	0-360	400	V
9	* ** 3.6874	44.38	Pk	33.1	-32.2	.7	45.98	54	-8.02	74	-28.02	0-360	400	V
10	* ** 4.5977	41.28	PK2	34.2	-31.7	.4	44.18	-	-	74	-29.82	330	243	V
	* ** 4.59773	28.54	ADV	34.2	-31.7	.4	31.44	54	-22.56	-	-	330	243	V
12	* ** 8.28018	39.04	PK2	35.8	-27.3	.4	47.94	-	-	74	-26.06	284	301	V
	* ** 8.27966	26.15	ADV	35.8	-27.3	.4	35.05	54	-18.95	-	-	284	301	V
13	* ** 9.12115	38.35	PK2	36.2	-26.2	.5	48.85	-	-	74	-25.15	103	184	V
	* ** 9.12186	26.14	ADV	36.2	-26.2	.5	36.64	54	-17.36	-	-	103	184	V
4	6.4387	43.67	Pk	35.6	-29.1	.3	50.47	-	-	-	-	0-360	101	H
11	6.4387	46.09	Pk	35.6	-29.1	.3	52.89	-	-	-	-	0-360	101	V
7	8.6329	37.05	Pk	35.9	-26.7	.3	46.55	-	-	-	-	0-360	400	H

* - 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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10.5. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.5.1. FUNDAMENTAL (921.4 MHz)

Frequency (MHz)	Meter Reading (dBuV)	Det	AT0066 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
921.3784	80.47	Qp	28.2	-24.5	84.17	94	-9.83	275	165	V
921.379	89.61	Qp	28.2	-24.5	93.31	94	-.69	329	100	H

Qp - Quasi-Peak detector

UL LLC
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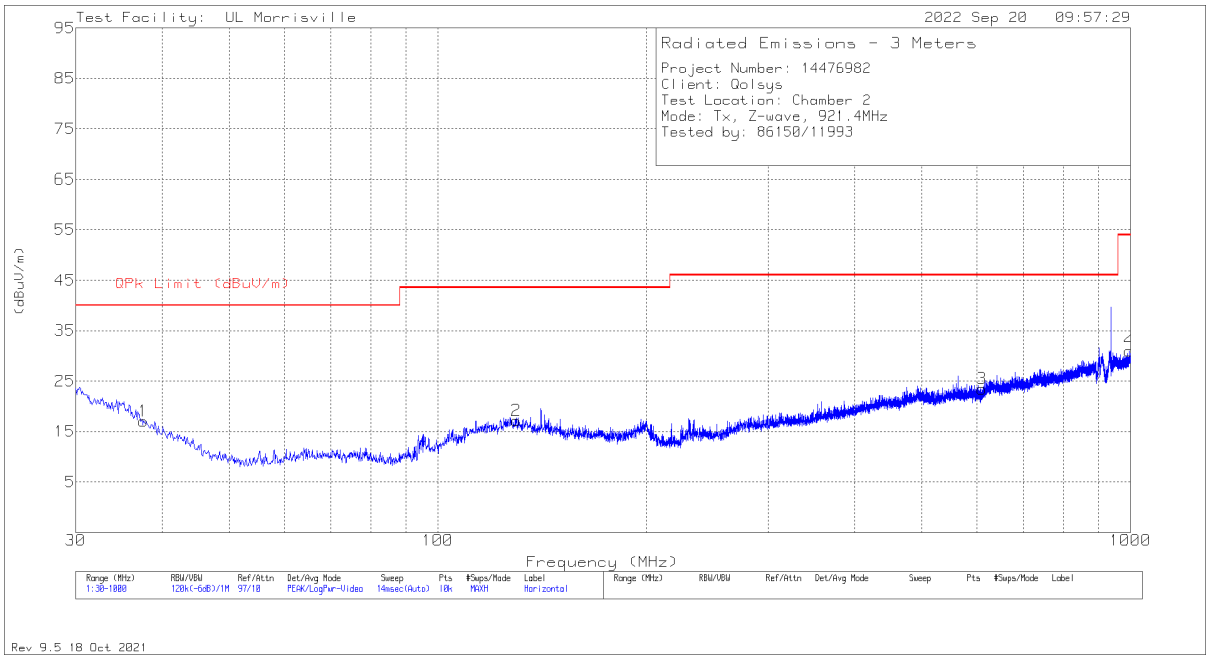
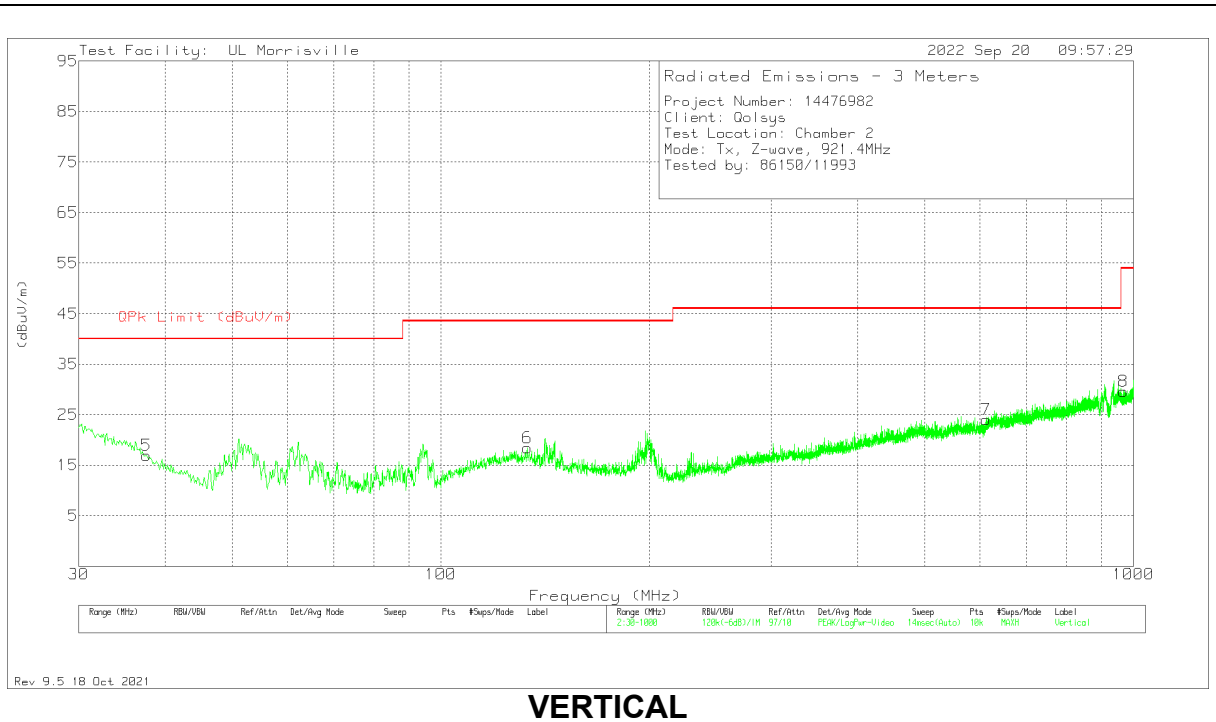
10.5.2. HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

MID CHANNEL, 921.4 MHz RESULTS



HORIZONTAL



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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0074 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 37.566	26.52	Pk	21.8	-31.4	.1	17.02	40	-22.98	0-360	199	H
2	* ** 129.716	26.9	Pk	19.9	-30	.4	17.2	43.52	-26.32	0-360	199	H
3	* ** 610.642	25.26	Pk	24.6	-27.1	.7	23.46	46.02	-22.56	0-360	399	H
4	* ** 996.314	24.93	Pk	28.9	-23.8	1	31.03	53.97	-22.94	0-360	299	H
5	* ** 37.566	26.39	Pk	21.8	-31.4	.1	16.89	40	-23.11	0-360	199	V
6	* ** 133.208	28.28	Pk	19.8	-30.1	.4	18.38	43.52	-25.14	0-360	99	V
7	* ** 613.164	25.47	Pk	24.7	-26.9	.7	23.97	46.02	-22.05	0-360	299	V
8	* ** 966.923	24.54	Pk	28.4	-24.3	1	29.64	53.97	-24.33	0-360	299	V

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

UL LLC
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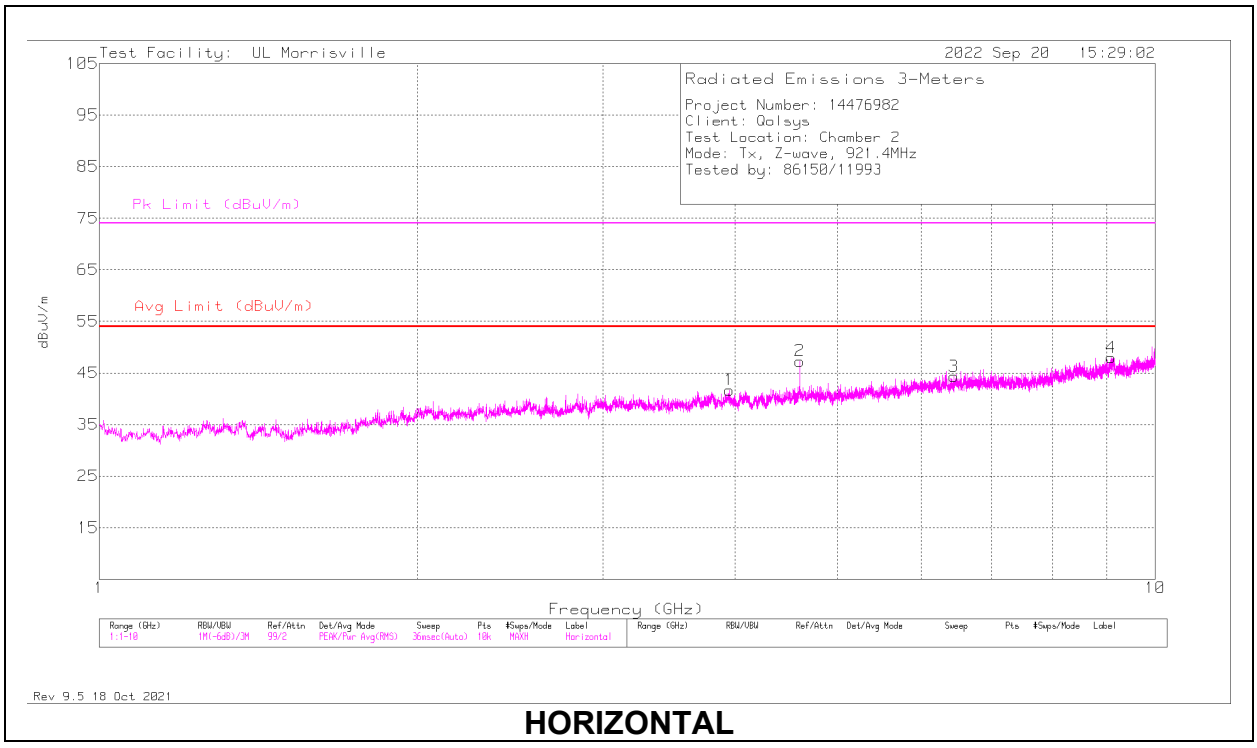
10.5.3. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz

MID CHANNEL, 921.4 MHz RESULTS



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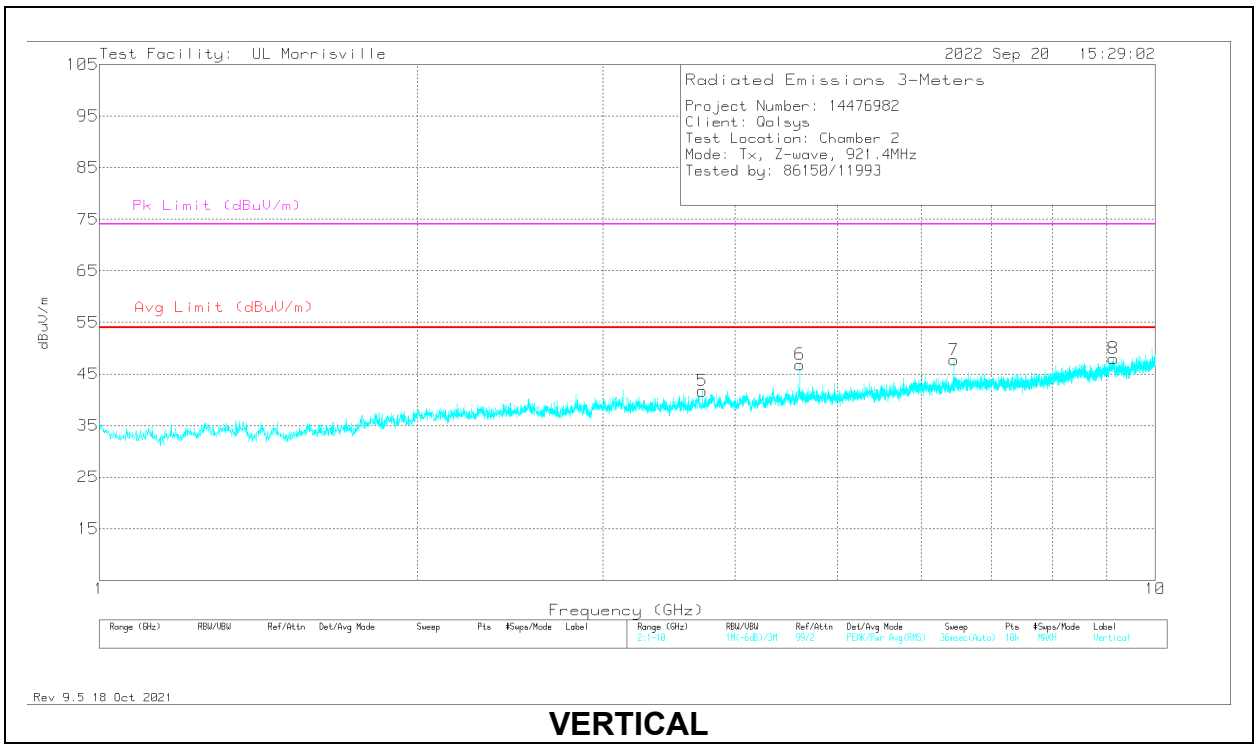

VERTICAL

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	206211 (dB/m)	Gain/Loss (dB)	Filter (dB)	Corrected Reading dBuV/m	Avg Limit (dBuV/m)	Margin (dB)	Pk Limit (dBuV/m)	PK Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 3.9511	39.51	Pk	33.4	-31.9	.7	41.71	54	-12.29	74	-32.29	0-360	200	H
2	* ** 4.6072	44.4	Pk	34.2	-31.7	.4	47.3	54	-6.7	74	-26.7	0-360	101	H
4	* ** 9.0847	37.45	Pk	36.1	-26.1	.5	47.95	54	-6.05	74	-26.05	0-360	200	H
5	* ** 3.7243	40.52	Pk	33.3	-32.4	.3	41.72	54	-12.28	74	-32.28	0-360	200	V
6	* ** 4.6072	43.92	Pk	34.2	-31.7	.4	46.82	54	-7.18	74	-27.18	0-360	101	V
8	* ** 9.127	37.49	Pk	36.2	-26.2	.5	47.99	54	-6.01	74	-26.01	0-360	101	V
3	6.4495	37.6	Pk	35.5	-29.1	.3	44.3	-	-	-	-	0-360	101	H
7	6.4495	41.02	Pk	35.5	-29.1	.3	47.72	-	-	-	-	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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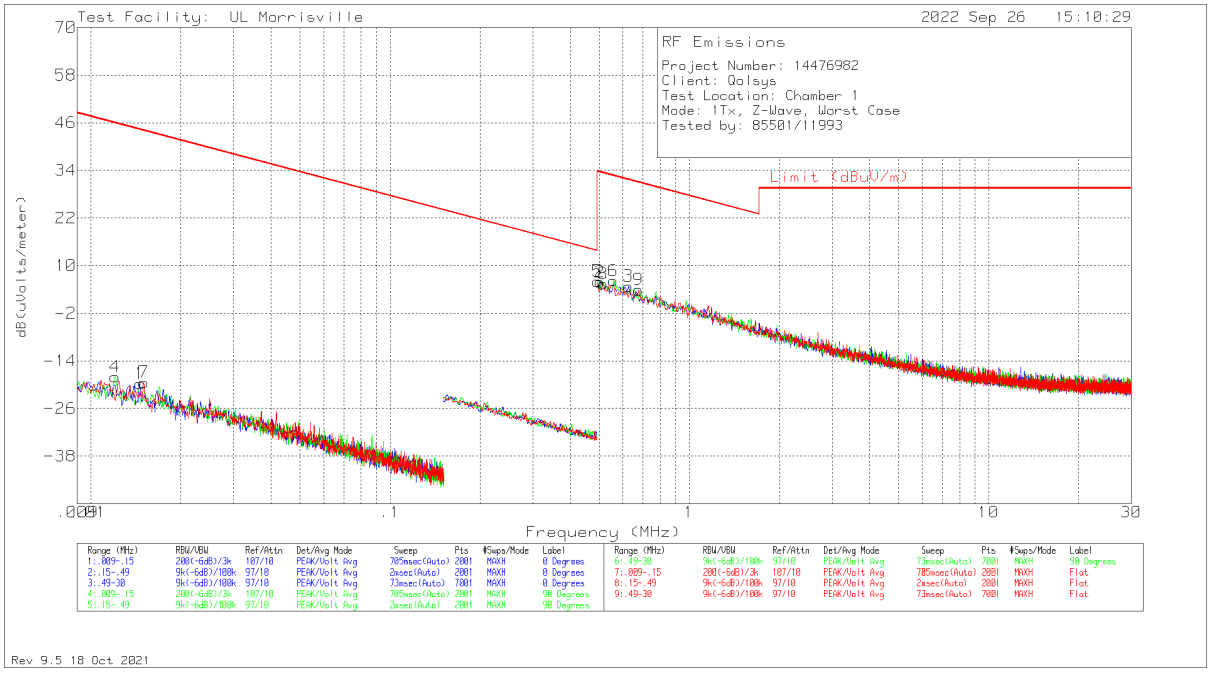
10.6. SPURIOUS EMISSIONS BELOW 30 MHz

WORST-CASE CONFIGURATION

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). Emissions were applied to the QP/AV limits as worst case.



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
4	.01205	44.38	Pk	17.5	.1	-80	-18.02	45.98	65.98	-64	0-360	101	90 degs
1	.01461	43.86	Pk	16.3	.1	-80	-19.74	44.31	64.31	-64.05	0-360	101	0 degs
7	.01504	44.36	Pk	16.1	.1	-80	-19.44	44.06	64.06	-63.5	0-360	101	Flat
5	.49422	34.86	Pk	11	.2	-40	6.06	33.73	-	-27.67	0-360	101	90 degs
2	.50265	34.55	Pk	11.1	.2	-40	5.85	33.58	-	-27.73	0-360	101	0 degs
8	.5153	34.11	Pk	11.1	.2	-40	5.41	33.36	-	-27.95	0-360	101	Flat
6	.55746	34.88	Pk	11.1	.2	-40	6.18	32.68	-	-26.5	0-360	101	90 degs
3	.62491	33.53	Pk	11.1	.2	-40	4.83	31.69	-	-26.86	0-360	101	0 degs
9	.6755	32.61	Pk	11.1	.2	-40	3.91	31.01	-	-27.1	0-360	101	Flat

Pk - Peak detector

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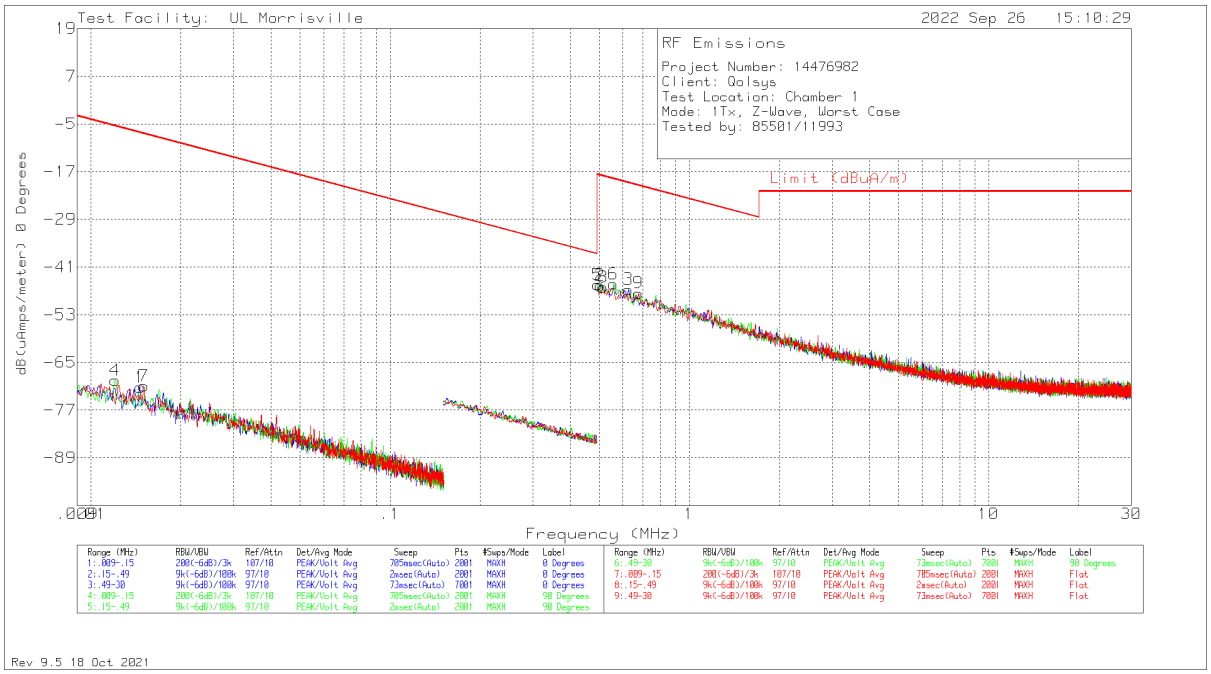

H-Field

Marker	Frequency (MHz)	Meter Reading (dBuV)	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
4	.01205	44.38	Pk	-34	.1	-80	-69.52	-5.52	15.48	-64	0-360	101	90 degs
1	.01461	43.86	Pk	-35.2	.1	-80	-71.24	-7.19	12.81	-64.05	0-360	101	0 degs
7	.01504	44.36	Pk	-35.4	.1	-80	-70.94	-7.44	12.56	-63.5	0-360	101	Flat
5	.49422	34.86	Pk	-40.5	.2	-40	-45.44	-17.77	-	-27.67	0-360	101	90 degs
2	.50265	34.55	Pk	-40.4	.2	-40	-45.65	-17.92	-	-27.73	0-360	101	0 degs
8	.5153	34.11	Pk	-40.4	.2	-40	-46.09	-18.14	-	-27.95	0-360	101	Flat
6	.55746	34.88	Pk	-40.4	.2	-40	-45.32	-18.82	-	-26.5	0-360	101	90 degs
3	.62491	33.53	Pk	-40.4	.2	-40	-46.67	-19.81	-	-26.86	0-360	101	0 degs
9	.6755	32.61	Pk	-40.4	.2	-40	-47.59	-20.49	-	-27.1	0-360	101	Flat

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 C63.10.

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

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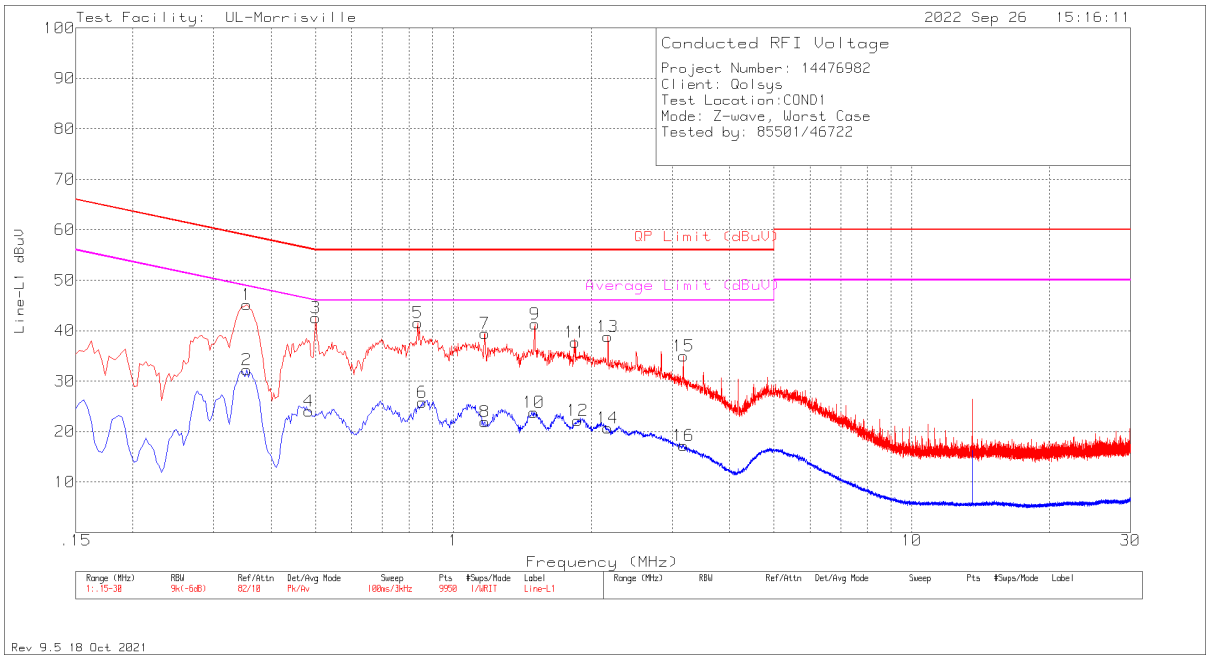
11.1.1. AC Power Line

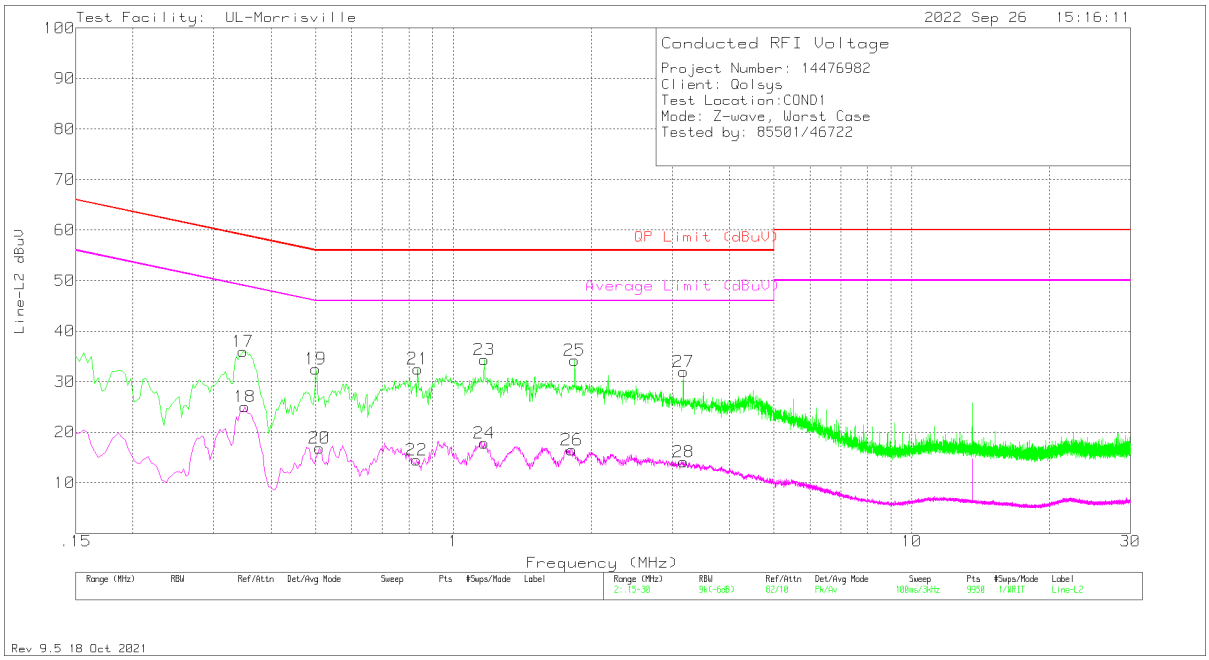
LINE 1 RESULTS



Range 1: Line-L1 .15 - 30MHz										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
1	.354	35.23	Pk	.1	9.8	45.13	58.87	-13.74	-	-
2	.354	22.4	Av	.1	9.8	32.3	-	-	48.87	-16.57
4	.483	14.27	Av	0	9.8	24.07	-	-	46.29	-22.22
3	.501	32.73	Pk	0	9.8	42.53	56	-13.47	-	-
5	.837	31.74	Pk	0	9.8	41.54	56	-14.46	-	-
6	.855	15.99	Av	0	9.8	25.79	-	-	46	-20.21
7	1.17	29.7	Pk	0	9.8	39.5	56	-16.5	-	-
8	1.17	12.18	Av	0	9.8	21.98	-	-	46	-24.02
10	1.497	13.96	Av	0	9.8	23.76	-	-	46	-22.24
9	1.506	31.54	Pk	0	9.8	41.34	56	-14.66	-	-
11	1.845	27.88	Pk	0	9.8	37.68	56	-18.32	-	-
12	1.866	12.4	Av	0	9.8	22.2	-	-	46	-23.8
13	2.172	29.06	Pk	0	9.8	38.86	56	-17.14	-	-
14	2.172	10.86	Av	0	9.8	20.66	-	-	46	-25.34
16	3.177	7.35	Av	0	9.9	17.25	-	-	46	-28.75
15	3.18	25.08	Pk	0	9.9	34.98	56	-21.02	-	-

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 (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
17	.348	26.05	Pk	.1	9.8	35.95	59.01	-23.06	-	-
18	.351	15.09	Av	.1	9.8	24.99	-	-	48.94	-23.95
19	.501	22.75	Pk	0	9.8	32.55	56	-23.45	-	-
20	.51	7.03	Av	0	9.8	16.83	-	-	46	-29.17
22	.831	4.64	Av	0	9.8	14.44	-	-	46	-31.56
21	.837	22.75	Pk	0	9.8	32.55	56	-23.45	-	-
23	1.167	24.5	Pk	0	9.8	34.3	56	-21.7	-	-
24	1.167	8.02	Av	0	9.8	17.82	-	-	46	-28.18
26	1.812	6.71	Av	0	9.8	16.51	-	-	46	-29.49
25	1.839	24.38	Pk	0	9.8	34.18	56	-21.82	-	-
27	3.174	22.05	Pk	0	9.9	31.95	56	-24.05	-	-
28	3.174	4.23	Av	0	9.9	14.13	-	-	46	-31.87

Pk - Peak detector
Av - Average detection

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12. SETUP PHOTOS

See R14476982-EP1 for Setup Photos.

END OF TEST REPORT

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