TEST REPORT

Report Number. : R13622615-E6

Applicant	:	Qolsys Inc. 1900 The Alameda, Suite 420 San Jose, CA 95126, U.S.A
Model	:	IQPanel 4
FCC ID	:	2AAJXQS-IQP4
IC ID	:	11205A-QSIQP4
EUT Description	:	Home Management System
Test Standard(s)	:	FCC 47 CFR PART 15 SUBPART C: 2021 ISED RSS-210 ISSUE 10: 2019 ISED RSS-GEN ISSUE 5 + A1: 2019

Date Of Issue:
2021-06-23

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

NVLAP TESTING

NVLAP Lab code: 200246-0

REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2021-05-04	Initial Issue	Haley Ackun
V2	2021-05-05	Updated Power Supply Info.	Haley Ackun
V3	2021-05-17	Added statement for sim tx. of all radios for compliance	Haley Ackun
V4	2021-06-02	Added Below 30 MHz data	Haley Ackun
V5	2021-06-23	Updated Antenna Gain	Haley Ackun

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Qolsys Inc.
1900 The Alameda, Suite 420
San Jose, CA 95126, U.S.A

EUT DESCRIPTION: Home Management System

MODEL: IQPanel 4

SERIAL NUMBER: QP4004X052105G03457

SAMPLE RECEIPT DATE: 2021-03-19

DATE TESTED: 2021-03-19 to 2021-05-28

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C: 2021	Complies
ISED RSS-210 Issue 10: 2019	Complies
ISED RSS-GEN Issue 5 + A1: 2019	Complies

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

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

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

Approved & Released For
UL LLC. By:

Brian T. Kiewra
Project Engineer
Consumer Technology Division
UL LLC.

Prepared By:

Haley Ackun
Laboratory Engineer
Consumer Technology Division
UL LLC.

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: 2021, ANSI C63.10-2013, KDB 414788 D01 Radiated Test Site v01r01, RSS-GEN Issue 5 + A1: 2019, and RSS-210 Issue 10: 2019.

4. FACILITIES AND ACCREDITATION

UL LLC is accredited by NVLAP, 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	1.70%
Time	3.39%

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

5.4. SAMPLE CALCULATION

RADIATED EMISSIONS

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

MAINS CONDUCTED EMISSIONS

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

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6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a home management system that supports WWAN, BT, BLE, 319MHz, Power-G, Zigbee, Z-wave, and 2.4GHz/5GHz WLAN. This report covers testing for the Z-Wave radio only.

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 below and above 1GHz were performed with the EUT set to transmit at the highest power at 908.4 MHz, 916 MHz, 919.8 MHz, and 921.4 MHz.

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

All radios that can transmit simultaneously have been evaluated for radiated for all possible combinations of transmission and found to be in compliance.

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6.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Power Supply	Sure-power	SW-070100AB	-	NA
Speaker	Qolsys	ABY1-TS68-2PR	STG2204900232	NA

I/O CABLES

Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	1	1	I/O	AC Mains	<3m	None
2	2	1	I/O	UART	<1m	None

TEST SETUP

Test software exercised the radio card.

SETUP DIAGRAM

Please refer to R13622615-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.

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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 - South Chamber)

Equip. ID	Description	Manufacturer/Brand	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
AT0079	Active Loop Antenna	ETS-Lindgren	6502	2020-08-20	2021-08-20
	30-1000 MHz				
AT0075	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2020-10-27	2021-10-27
	1-18 GHz				
AT0067	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2020-04-28	2021-04-28
	Gain-Loss Chains				
S-SAC01	Gain-loss string: 0.009-30MHz	Various	Various	2020-07-10	2021-07-10
S-SAC02	Gain-loss string: 25-1000MHz	Various	Various	2020-07-10	2021-07-10
S-SAC03	Gain-loss string: 1-18GHz	Various	Various	2020-07-06	2021-07-06
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2021-03-10	2022-03-10
SOFTEMI	EMI Software	UL	Version 9.5 (2021-03-04)		
	Additional Equipment used				
s/n 200037635	Environmental Meter	Fisher Scientific	06-662-4	2020-01-22	2022-01-22
HPF012	1GHz high-pass filter, 2W, F_{high} =18GHz	Micro-Tronics	HPM18129	2021-02-15	2022-02-15
BRF007	902-928MHz notch filter, 2W, F_{high} =1.5GHz	Micro-Tronics	BRC17691	2020-07-15	2021-07-15

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

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
CBL087	Coax cable, RG223, N-male to BNC-male, 20-ft.	Pasternack	PE3W06143-240	2020-03-26	2021-03-31
HI0091	Environmental Meter	Fisher Scientific	14-650-118	2020-06-26	2021-06-26
LISN003	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2020-08-18	2021-08-18
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2020-08-18	2021-08-18
75141	EMI Test Receiver 9kHz-7GHz	Rohde & Schwarz	ESCI 7	2020-08-18	2021-08-18
ATA222	Transient Limiter, 0.009-100MHz	Electro-Metrics	EM-7600	2020-03-26	2021-03-26
PS214	AC Power Source	Elgar	CW2501M (s/n 1523A02396)	NA	NA
SOFTEMI	EMI Software	UL	Version 9.5(2015-08-20)		
	Miscellaneous (if needed)				
CDECABLE001	ANSI C63.4 1m extension cable.	UL	Per Annex B of ANSI C63.4	2020-08-08	2021-08-08

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

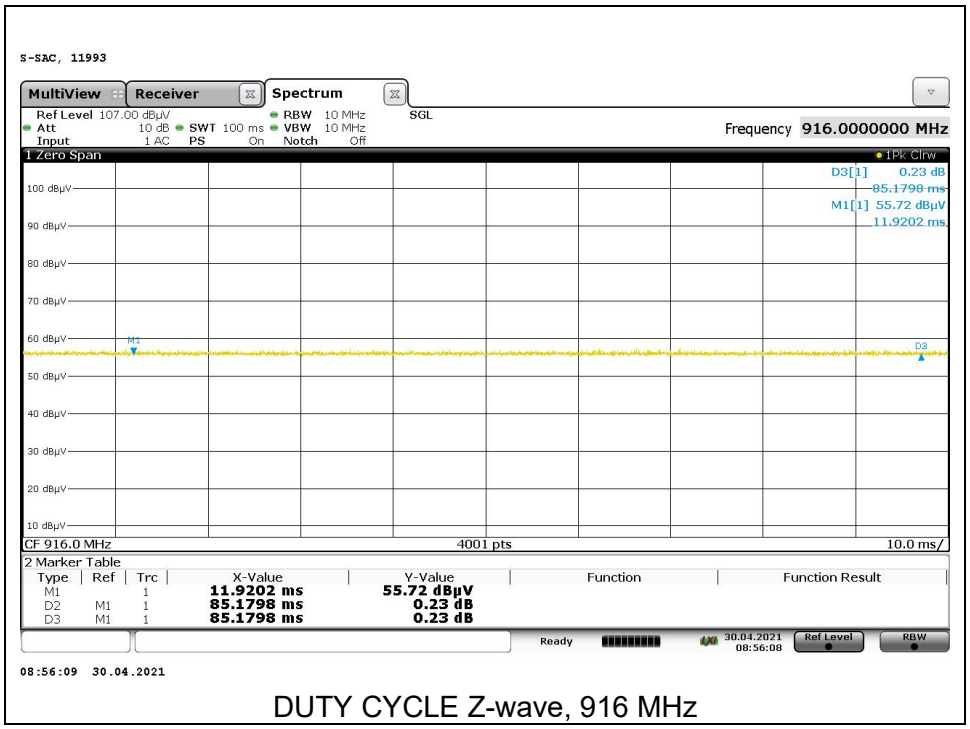
PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method.

Is 100ON 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- 916 MHz	85.180	85.180	1.000	100.00%	0.00	0.010

DUTY CYCLE PLOT



DUTY CYCLE Z-wave, 916 MHz

9.2. 99% AND 20dB BANDWIDTH

LIMITS

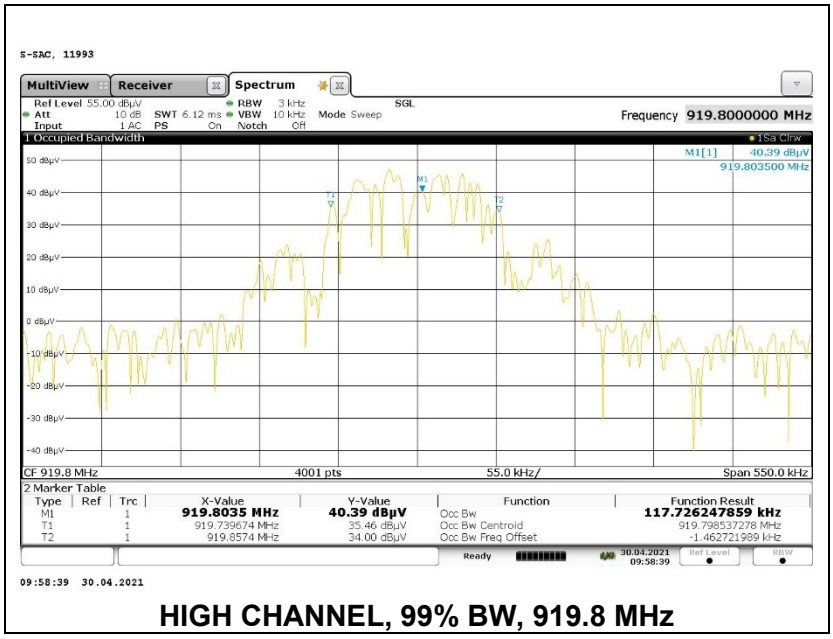
None; for reporting purposes only.

RESULTS

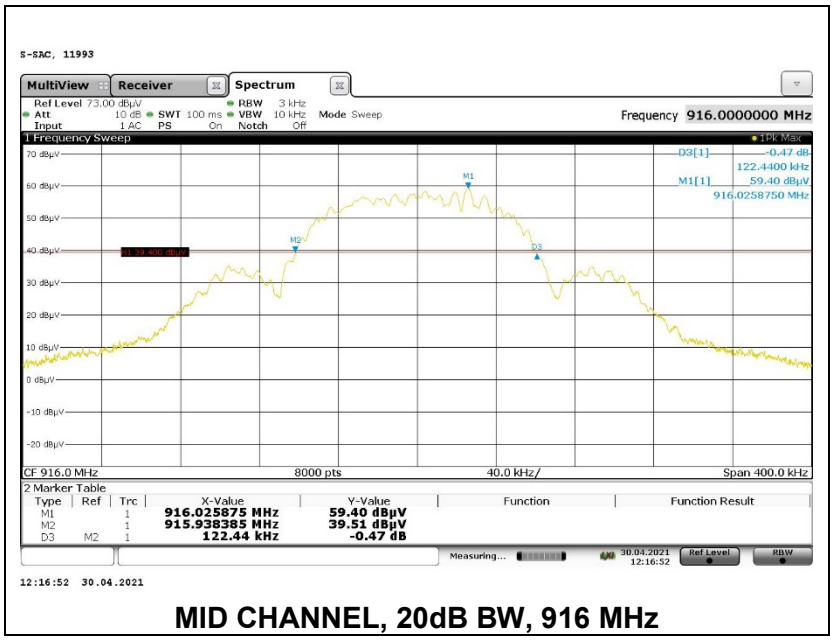
9.2.1. Z-WAVE

1TX Antenna 1 MODE

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
Low	908.4	0.093	0.0899
Mid	916	0.12244	0.112
High 1	919.8	0.122415	0.118
High 2	921.4	0.092	0.0898



HIGH CHANNEL, 99% BW, 919.8 MHz



MID CHANNEL, 20dB BW, 916 MHz

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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)

Frequency Range (MHz)	Field Strength Limit of Fundamental (mV/m) at 3 m	Field Strength Limit of Harmonics (uV/m) at 3 m
902-928	50	500

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 spectrum from 1 GHz to 18 GHz and below 1 GHz is investigated with the transmitter set to 908.4 MHz, 916 MHz, 919.8 MHz, and 921.4 MHz.

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)

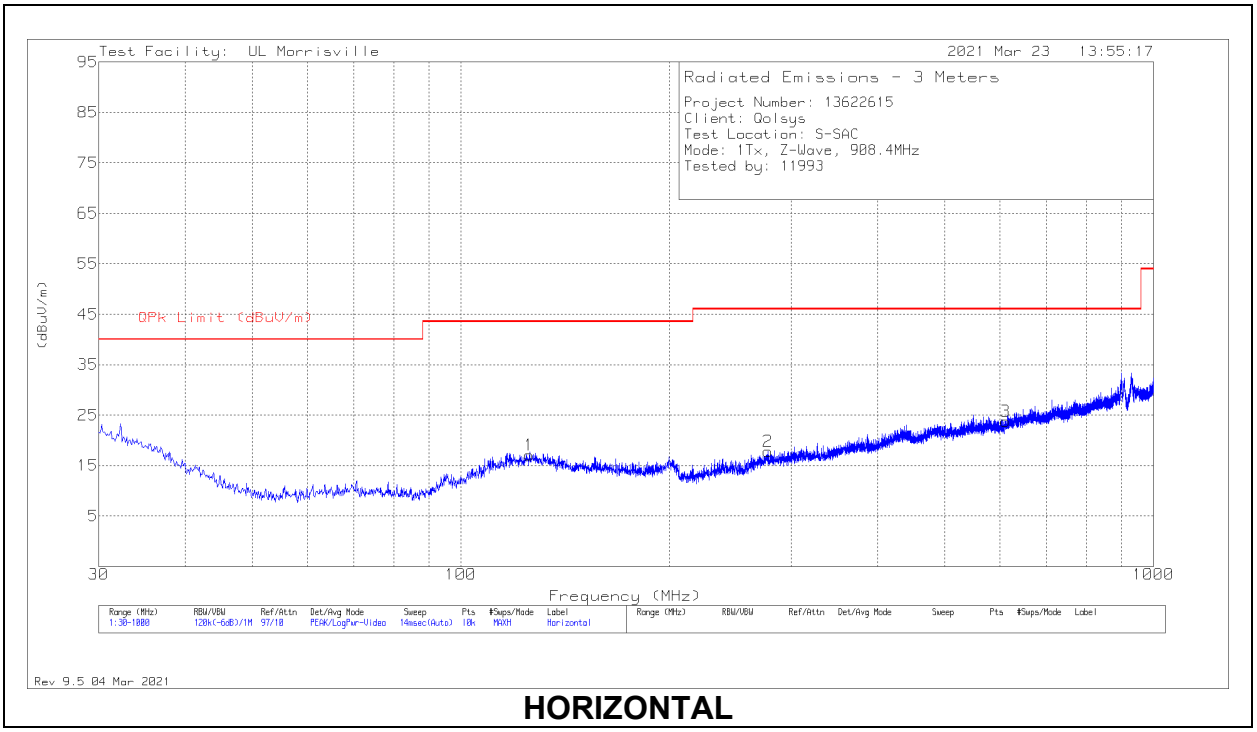
Project Number:	13622615
Client:	Qolsys
Test Location:	S-SAC
Mode:	Z-Wave, 908.4MHz
Tested by:	23854
Date:	2021-04-02

Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk/Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
908.397	67.56	Qp	28.5	-25.4	70.66	94	-23.34	230	148	H
908.397	90.8	Qp	28.5	-25.4	93.9	94	-0.1	230	148	V

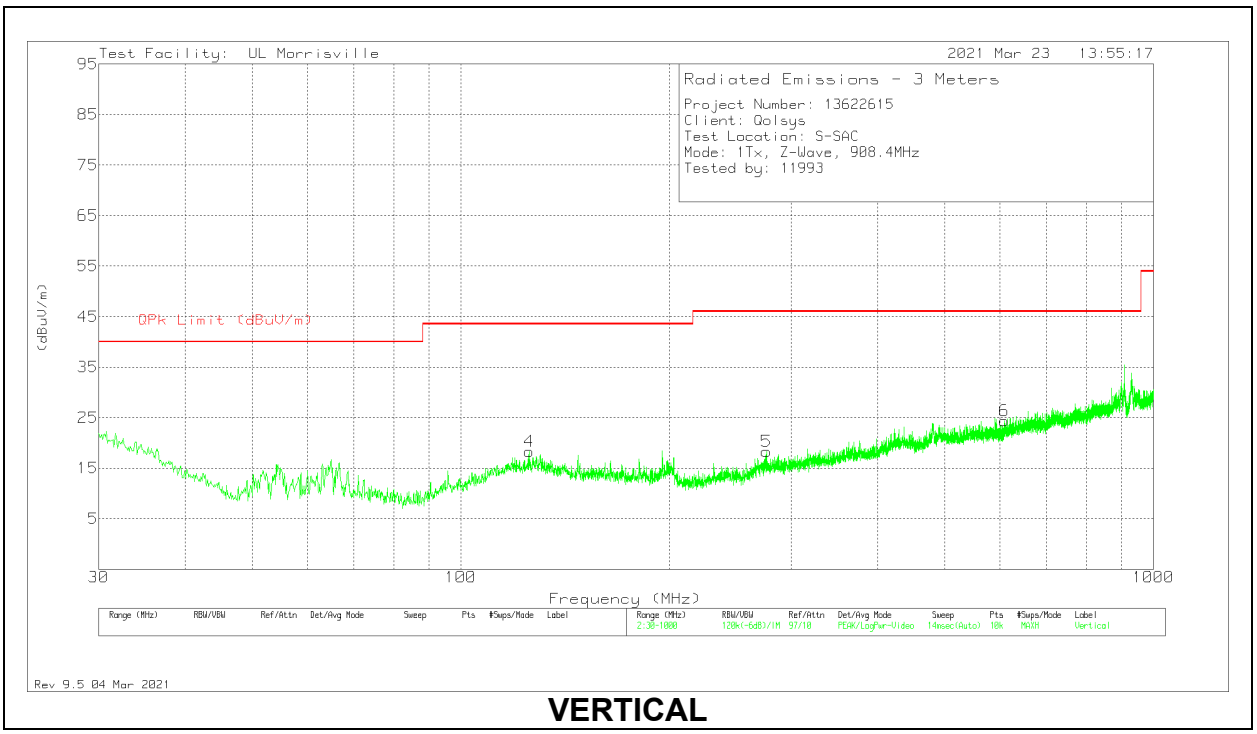
Pk - Peak detector
Qp - Quasi-Peak detector

HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

LOW CHANNEL, 908.4 MHz RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Filter (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 125.448	26.91	Pk	20.1	-30.1	.2	17.11	43.52	-26.41	0-360	299	H
2	* ** 277.447	26.9	Pk	19.4	-28.8	.3	17.8	46.02	-28.22	0-360	101	H
3	* ** 611.903	25.32	Pk	24.9	-27	.6	23.82	46.02	-22.2	0-360	199	H
4	* ** 125.448	28.12	Pk	20.1	-30.1	.2	18.32	43.52	-25.2	0-360	101	V
5	* ** 276.186	27.32	Pk	19.4	-28.7	.3	18.32	46.02	-27.7	0-360	101	V
6	* ** 609.187	26.06	Pk	24.7	-27	.6	24.36	46.02	-21.66	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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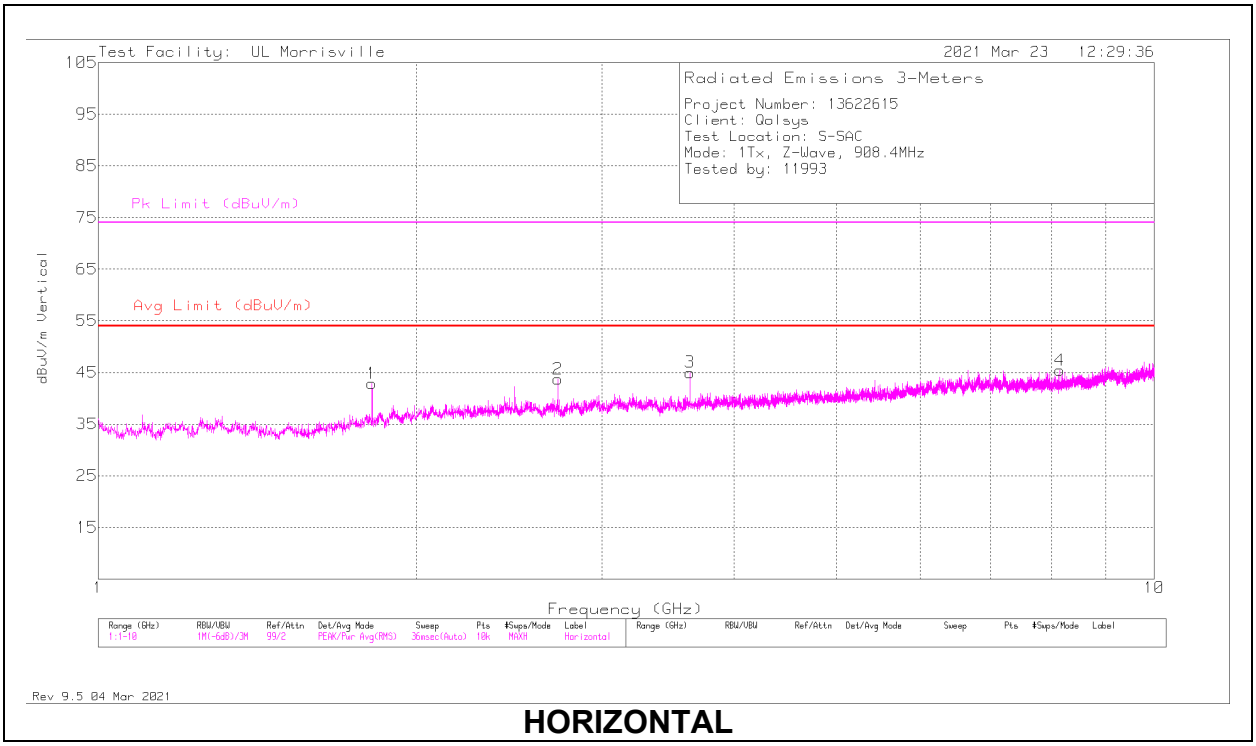
HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz

LOW CHANNEL, 908.4 MHz RESULTS



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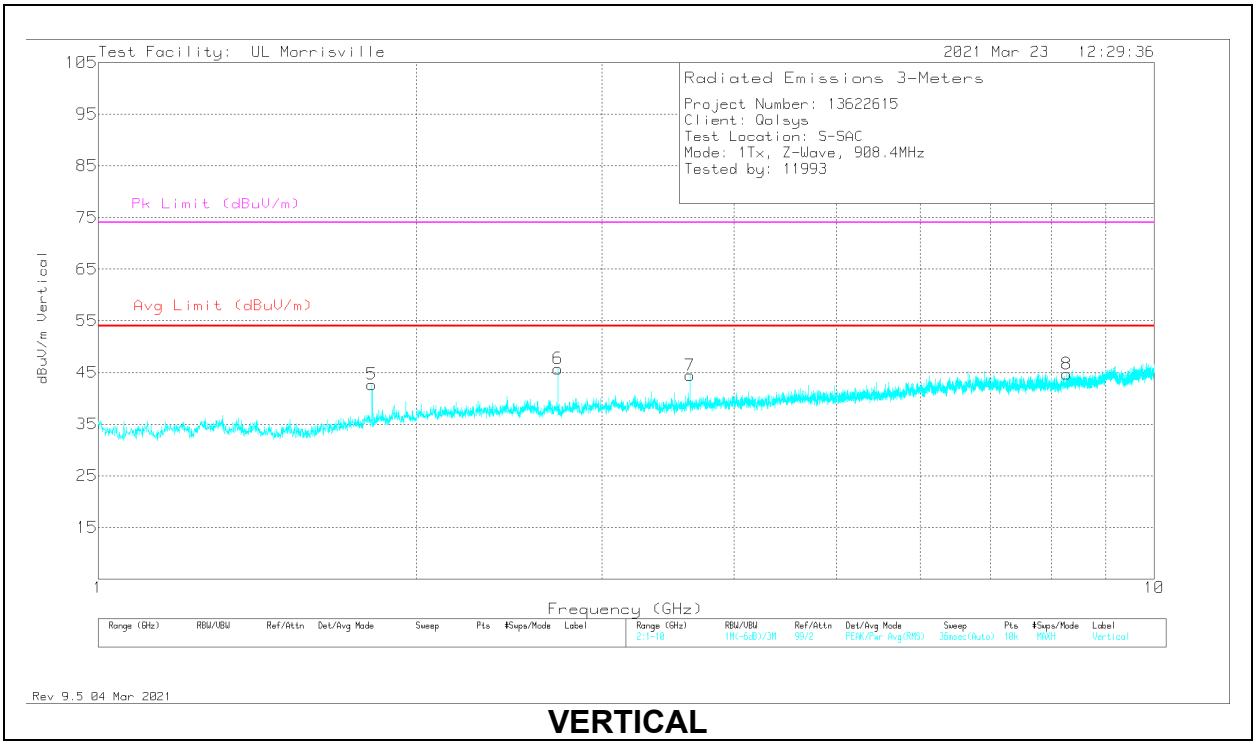

VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (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	** 1.8163	46.45	Pk	30.7	-34.7	.4	42.85	54	-11.15	74	-31.15	0-360	199	H
2	* ** 2.7253	44.91	Pk	32.3	-34	.5	43.71	54	-10.29	74	-30.29	0-360	300	H
3	* ** 3.6334	44.59	Pk	33	-33.1	.5	44.99	54	-9.01	74	-29.01	0-360	199	H
4	* ** 8.1406	37	Pk	35.8	-27.8	.4	45.4	54	-8.6	74	-28.6	0-360	399	H
5	** 1.8163	46.28	Pk	30.7	-34.7	.4	42.68	54	-11.32	74	-31.32	0-360	200	V
6	* ** 2.7253	46.92	Pk	32.3	-34	.5	45.72	54	-8.28	74	-28.28	0-360	300	V
7	* ** 3.6334	44.02	Pk	33	-33.1	.5	44.42	54	-9.58	74	-29.58	0-360	200	V
8	* ** 8.2594	36.2	Pk	35.8	-27.8	.5	44.7	54	-9.3	74	-29.3	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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10.2. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.2.1. FUNDAMENTAL (916 MHz)

Project Number:	13622615
Client:	Qolsys
Test Location:	S-SAC
Mode:	Z-Wave, 916MHz
Tested by:	23854
Date:	2021-04-01

Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk/Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
916	90.68	Qp	28.7	-25.4	93.98	94	-0.02	179	133	H
916	88.99	Qp	28.7	-25.4	92.29	94	-1.71	226	145	V

Pk - Peak detector
Qp - Quasi-Peak detector

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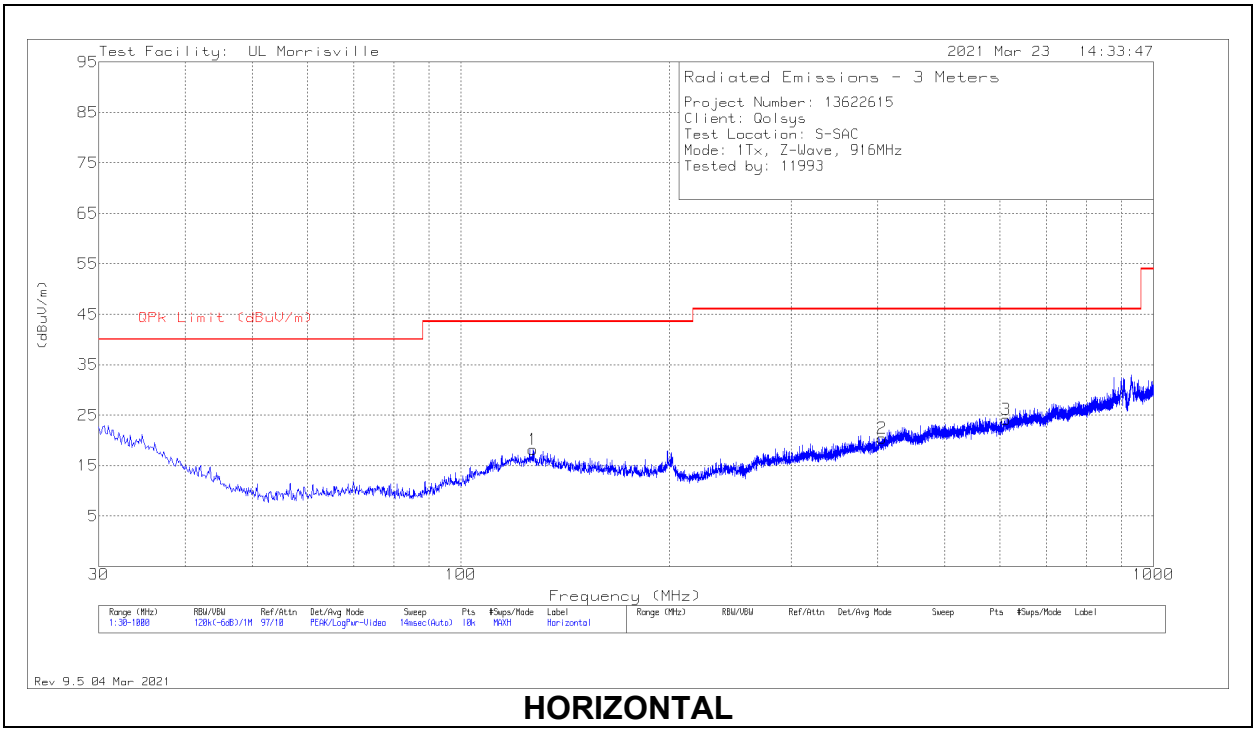
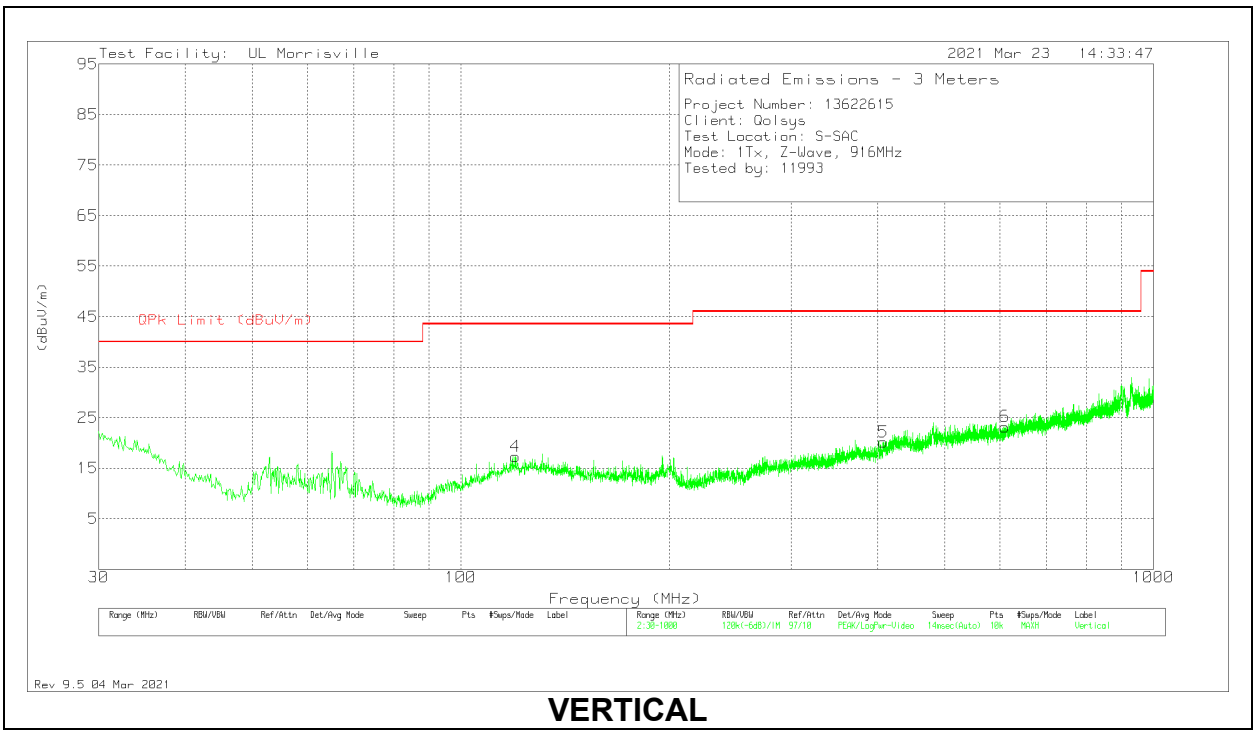
HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

MID CHANNEL, 916 MHz RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Filter (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 127.194	27.88	Pk	20.1	-30	.2	18.18	43.52	-25.34	0-360	199	H
2	* ** 405.681	25.87	Pk	22	-27.9	.5	20.47	46.02	-25.55	0-360	299	H
3	* ** 612.776	25.63	Pk	25	-27.1	.6	24.13	46.02	-21.89	0-360	299	H
4	* ** 119.822	27.17	Pk	20	-30.1	.2	17.27	43.52	-26.25	0-360	101	V
5	* ** 407.039	25.59	Pk	22	-27.9	.5	20.19	46.02	-25.83	0-360	101	V
6	* ** 610.06	24.81	Pk	24.8	-27	.6	23.21	46.02	-22.81	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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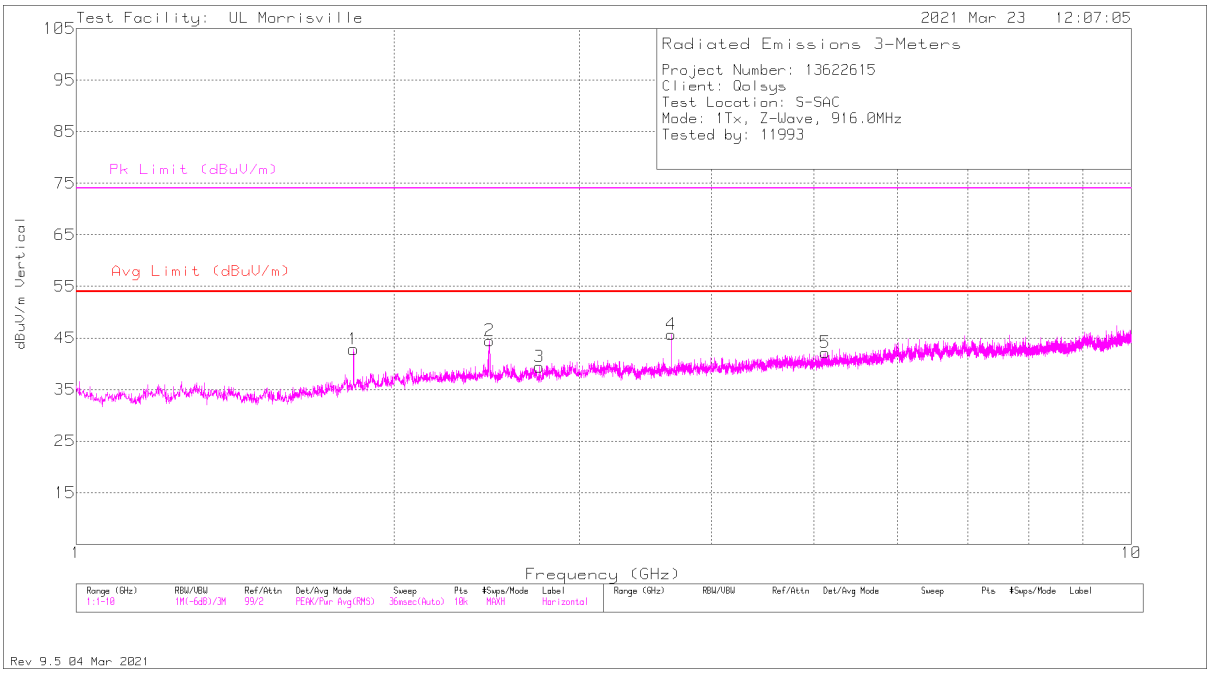
HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz

MID CHANNEL, 916 MHz RESULTS



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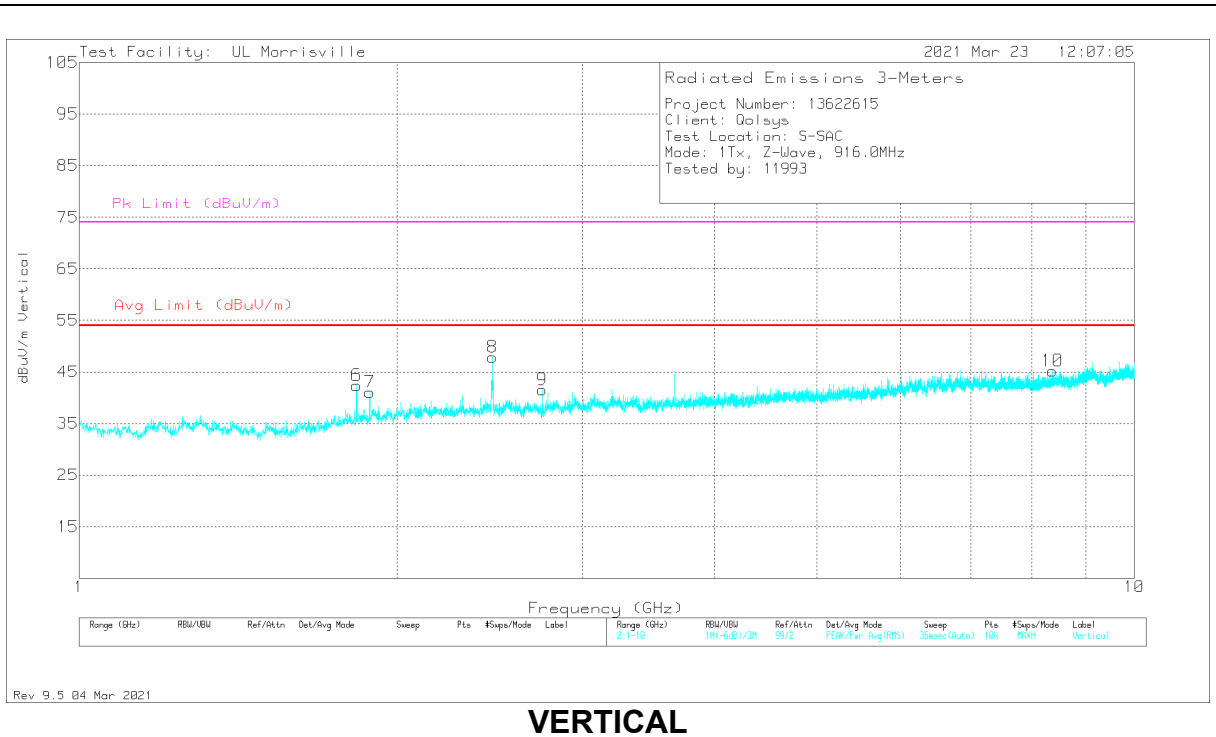

VERTICAL

UL LLC
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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (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	** 1.8316	46.42	Pk	30.7	-34.7	.4	42.82	54	-11.18	74	31.18	0-360	199	H
3	* ** 2.7478	40.42	Pk	32.4	-33.9	.5	39.42	54	-14.58	74	-34.58	0-360	101	H
4	* ** 3.664	44.9	Pk	33.1	-32.8	.5	45.7	54	-8.3	74	-28.3	0-360	199	H
5	* ** 5.1283	38.75	Pk	34.1	-31.1	.4	42.15	54	-11.85	74	-31.85	0-360	399	H
6	** 1.8316	46.02	Pk	30.7	-34.7	.4	42.42	54	-11.58	74	-31.58	0-360	300	V
7	** 1.8856	44.2	Pk	31.1	-34.6	.4	41.1	54	-12.9	74	-32.9	0-360	200	V
9	* ** 2.7478	42.53	Pk	32.4	-33.9	.5	41.53	54	-12.47	74	-32.47	0-360	300	V
10	* ** 8.3674	36.42	Pk	35.8	-27.5	.5	45.22	54	-8.78	74	-28.78	0-360	300	V
2	2.4643	45.88	Pk	32.5	-34.3	.4	44.48	-	-	-	-	0-360	199	H
8	2.4652	49.17	Pk	32.5	-34.2	.4	47.87	-	-	-	-	0-360	300	V

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

10.3. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.3.1. FUNDAMENTAL (919.8 MHz)

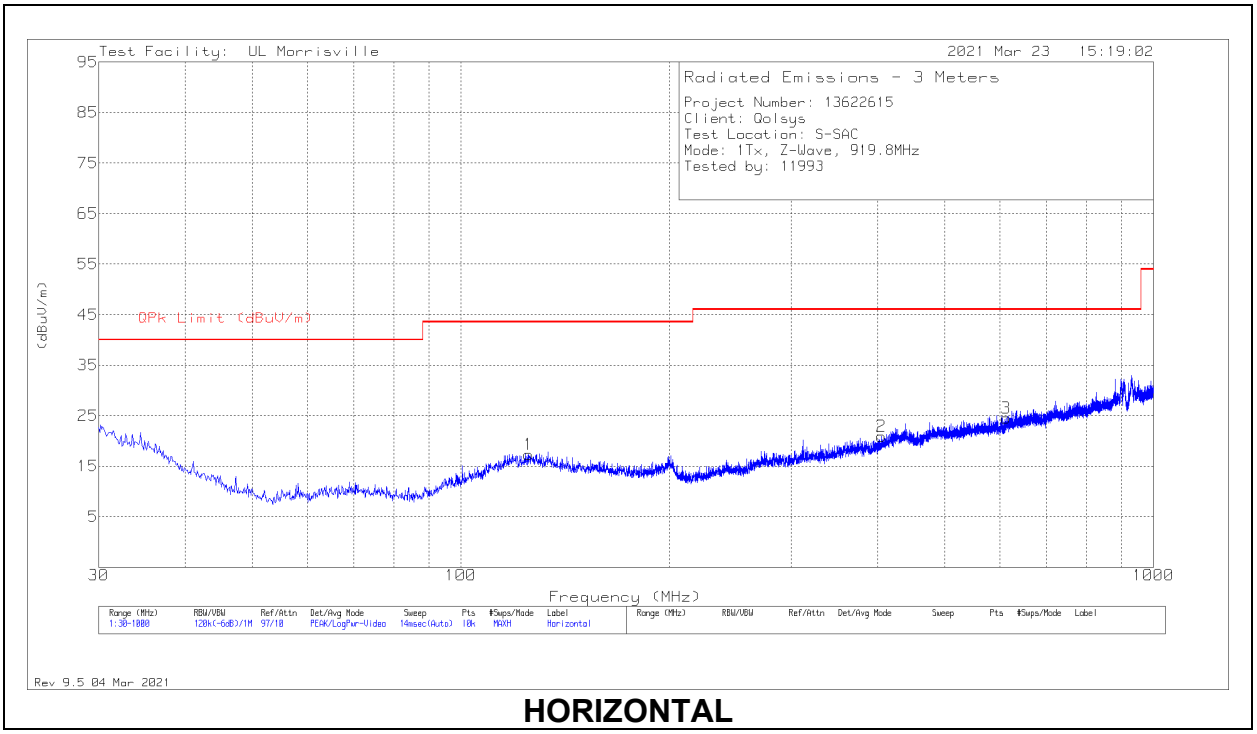
Project Number:	13622615
Client:	Qolsys
Test Location:	S-SAC
Mode:	Z-Wave, 919.8 MHz
Tested by:	23854
Date:	2021-04-02

Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk/Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
919.7952	88.39	Qp	28.7	-25.3	91.79	94	-2.21	230	144	V
919.805	89.74	Qp	28.7	-25.3	93.14	94	-0.86	181	133	H

Pk - Peak detector
Qp - Quasi-Peak detector

HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

MID CHANNEL, 919.8 MHz RESULTS



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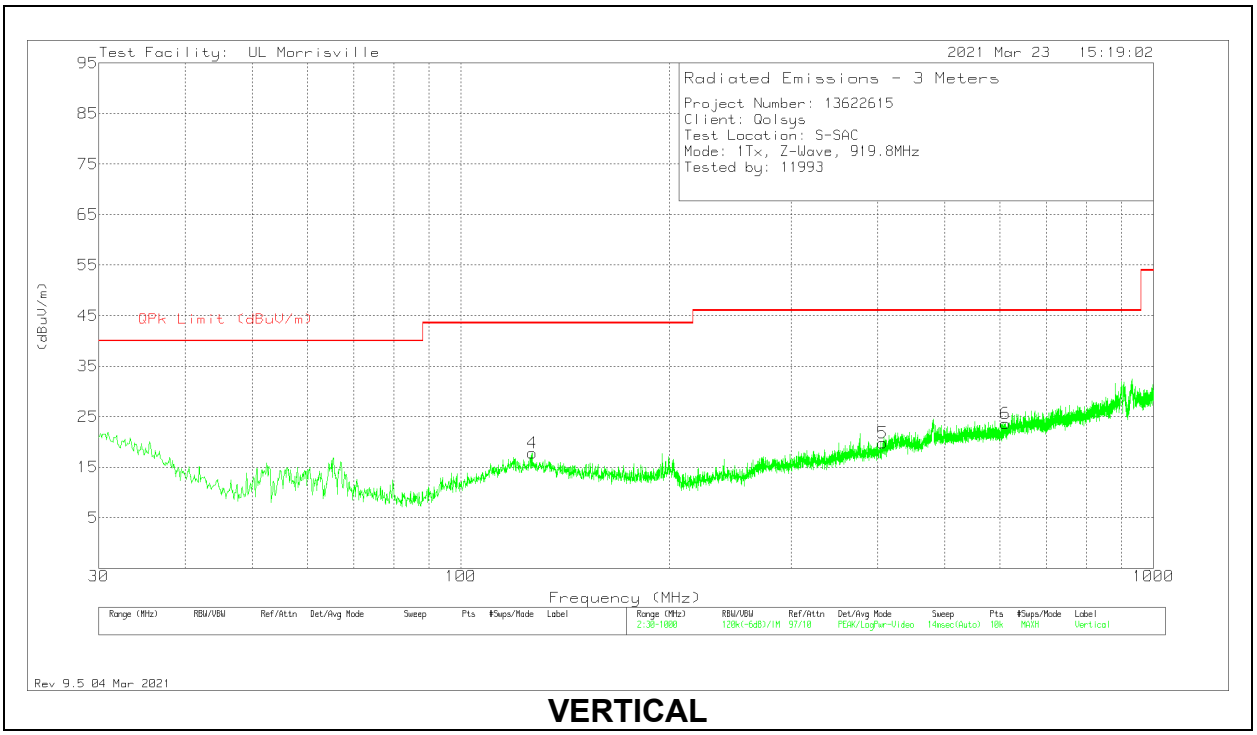

VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Filter (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 125.351	27.15	Pk	20.1	-30.1	.2	17.35	43.52	-26.17	0-360	199	H
2	* ** 404.711	26.46	Pk	22	-28	.5	20.96	46.02	-25.06	0-360	399	H
3	* ** 612.776	26.05	Pk	25	-27.1	.6	24.55	46.02	-21.47	0-360	399	H
4	* ** 126.709	27.52	Pk	20.1	-30.1	.3	17.82	43.52	-25.7	0-360	101	V
5	* ** 406.263	25.16	Pk	22	-27.9	.5	19.76	46.02	-26.26	0-360	101	V
6	* ** 611.127	25.16	Pk	24.9	-27	.6	23.66	46.02	-22.36	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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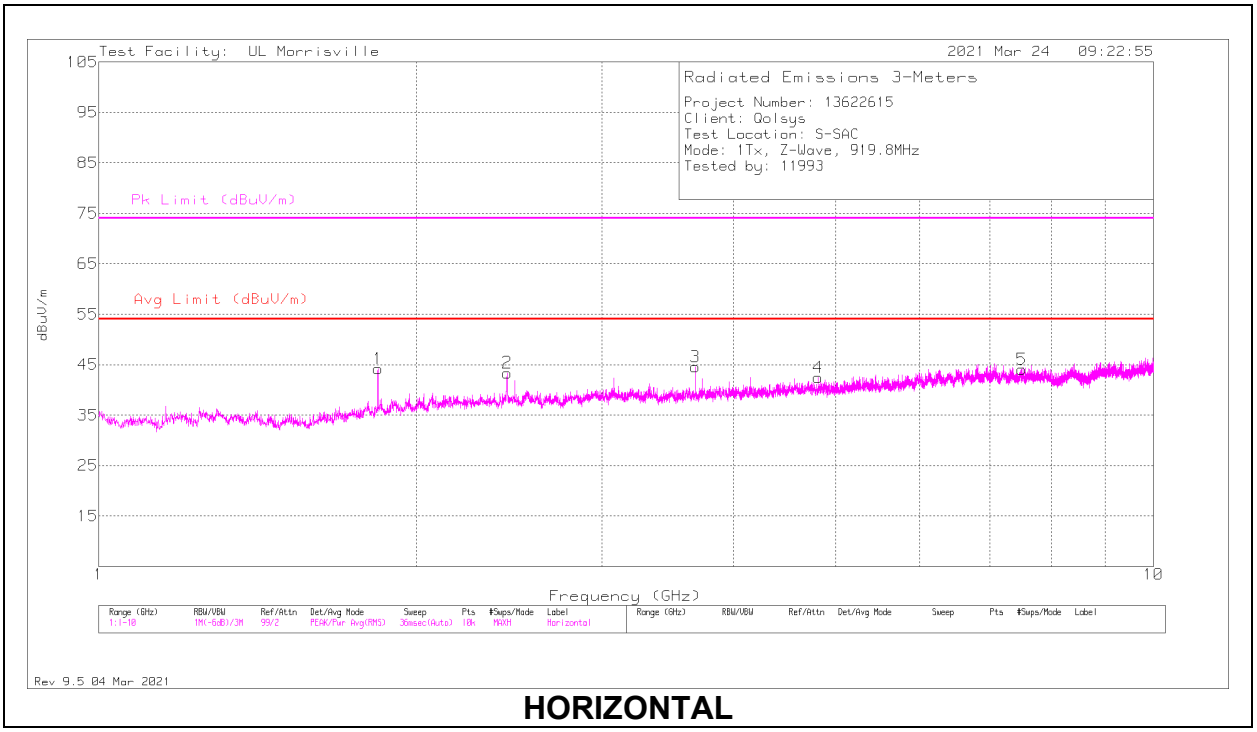
HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz

MID CHANNEL, 919.8 MHz RESULTS



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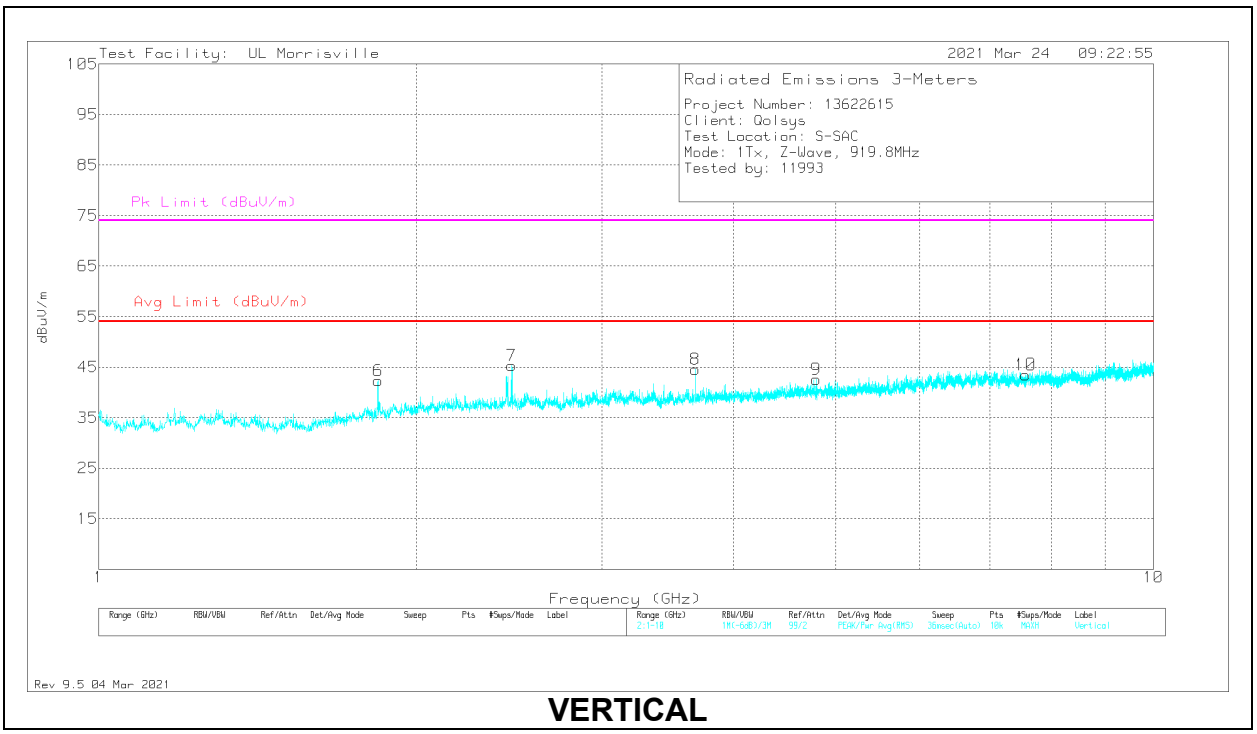

VERTICAL

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

RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (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	** 1.8397	47.71	Pk	30.7	-34.6	.4	44.21	54	-9.79	74	-29.79	0-360	200	H
3	* ** 3.6793	43.85	Pk	33.1	-32.9	.5	44.55	54	-9.45	74	-29.45	0-360	300	H
4	* ** 4.807	39.87	Pk	34	-31.7	.3	42.47	54	-11.53	74	-31.53	0-360	399	H
5	* ** 7.5025	35.91	Pk	35.6	-28	.6	44.11	54	-9.89	74	-29.89	0-360	200	H
6	** 1.8397	45.84	Pk	30.7	-34.6	.4	42.34	54	-11.66	74	-31.66	0-360	200	V
8	* ** 3.6793	43.88	Pk	33.1	-32.9	.5	44.58	54	-9.42	74	-29.42	0-360	200	V
9	* ** 4.789	40.22	Pk	34	-31.9	.3	42.62	54	-11.38	74	-31.38	0-360	101	V
10	* ** 7.5655	35.11	Pk	35.7	-27.9	.6	43.51	54	-10.49	74	-30.49	0-360	200	V
2	2.4382	44.79	Pk	32.4	-34.3	.5	43.39	-	-	-	-	0-360	300	H
7	2.4643	46.66	Pk	32.5	-34.3	.4	45.26	-	-	-	-	0-360	300	V

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

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

10.4. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.4.1. FUNDAMENTAL (921.4 MHz)

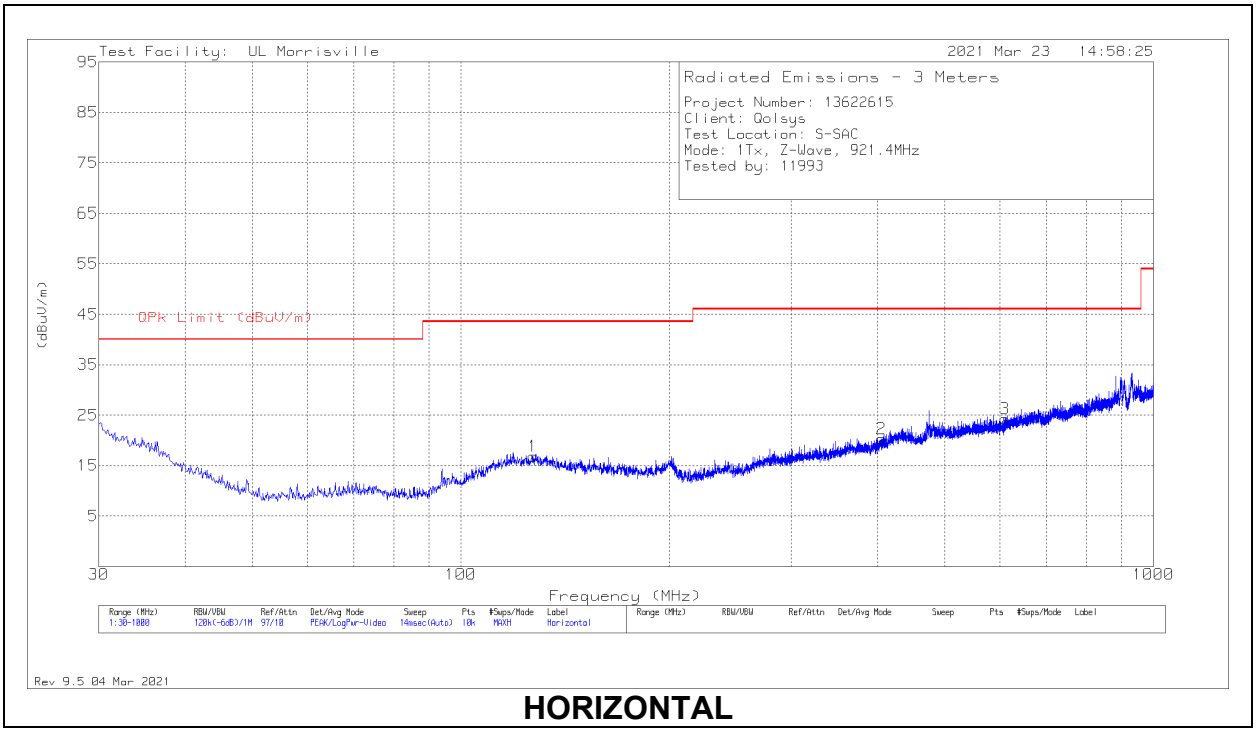
Project Number:	13622615
Client:	Qolsys
Test Location:	S-SAC
Mode:	Z-Wave, 921.4MHz
Tested by:	23854
Date:	2021-04-02

Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Corrected Reading (dBuV/m)	QPk/Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
921.4	89	Qp	28.9	-25.2	92.7	94	-1.3	181	132	H
921.4	87.64	Qp	28.9	-25.2	91.34	94	-2.66	229	146	V

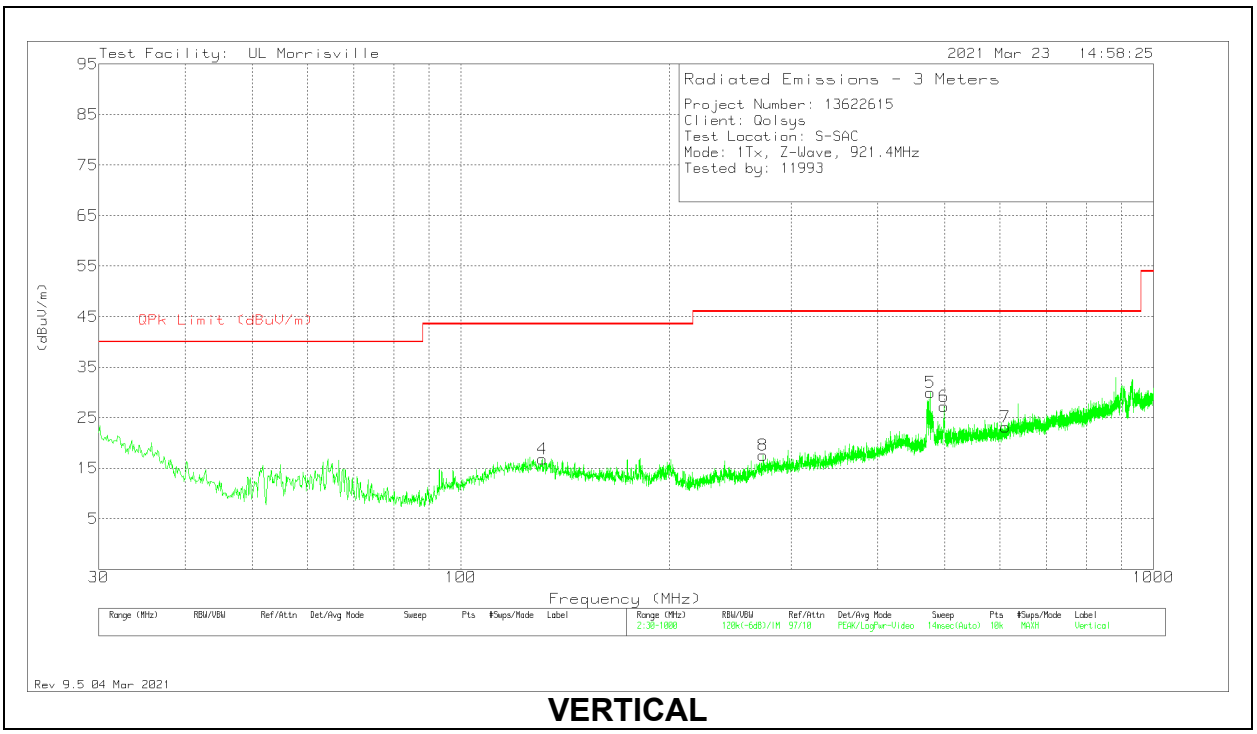
Pk - Peak detector
Qp - Quasi-Peak detector

HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

MID CHANNEL, 921.4 MHz RESULTS



HORIZONTAL



VERTICAL

RADIATED EMISSIONS

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0075 AF (dB/m)	Amp/Cbl (dB)	Filter (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	* ** 127	26.38	Pk	20.1	-30	.3	16.78	43.52	-26.74	0-360	101	H
2	* ** 405.002	25.81	Pk	22	-28	.5	20.31	46.02	-25.71	0-360	199	H
3	* ** 610.545	25.74	Pk	24.9	-27	.6	24.24	46.02	-21.78	0-360	399	H
4	* ** 131.074	26.71	Pk	19.9	-30	.2	16.81	43.52	-26.71	0-360	101	V
6	** 498.898	30.24	Pk	23.8	-27.3	.5	27.24	46.02	-18.78	0-360	101	V
7	* ** 611.612	24.7	Pk	24.9	-27	.6	23.2	46.02	-22.82	0-360	101	V
8	* ** 273.276	26.77	Pk	19.3	-28.8	.3	17.57	46.02	-28.45	0-360	101	V
5	476.297	33.22	Pk	23.8	-27.5	.5	30.02	-	-	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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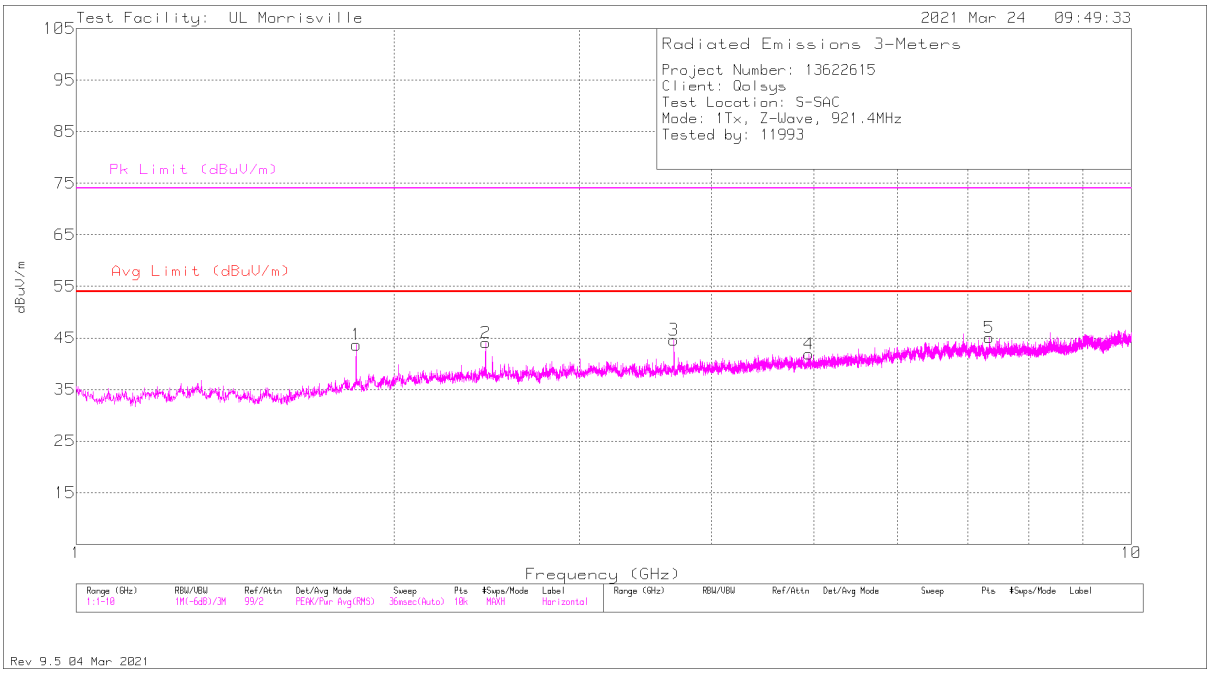
HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz

MID CHANNEL, 921.4 MHz RESULTS



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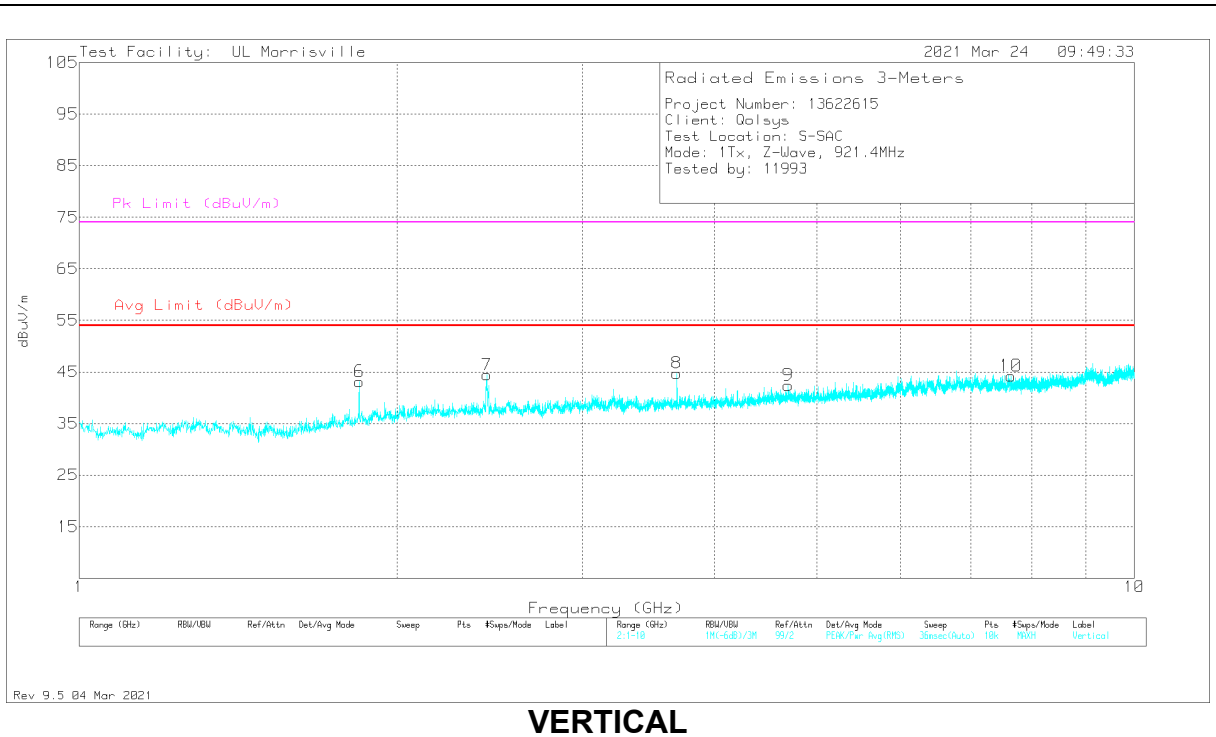

VERTICAL

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RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0067 (dB/m)	Amp/Cbl/Fltr/Pad (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	** 1.8424	47.17	Pk	30.7	-34.6	.4	43.67	54	-10.33	74	-30.33	0-360	200	H
3	* ** 3.6856	43.88	Pk	33.1	-32.9	.5	44.58	54	-9.42	74	-29.42	0-360	299	H
4	* ** 4.9465	38.98	Pk	33.9	-31.3	.3	41.88	54	-12.12	74	-32.12	0-360	400	H
5	* ** 7.3315	37.06	Pk	35.6	-28.2	.6	45.06	54	-8.94	74	-28.94	0-360	299	H
6	** 1.8424	46.62	Pk	30.7	-34.6	.4	43.12	54	-10.88	74	-30.88	0-360	200	V
8	* ** 3.6856	44.05	Pk	33.1	-32.9	.5	44.75	54	-9.25	74	-29.25	0-360	200	V
9	* ** 4.699	39.52	Pk	34.1	-31.6	.4	42.42	54	-11.58	74	-31.58	0-360	200	V
10	* ** 7.6384	35.94	Pk	35.7	-27.9	.5	44.24	54	-9.76	74	-29.76	0-360	101	V
7	2.4337	45.85	Pk	32.4	-34.3	.5	44.45	-	-	-	-	0-360	101	V
2	2.4436	45.36	Pk	32.5	-34.3	.5	44.06	-	-	-	-	0-360	299	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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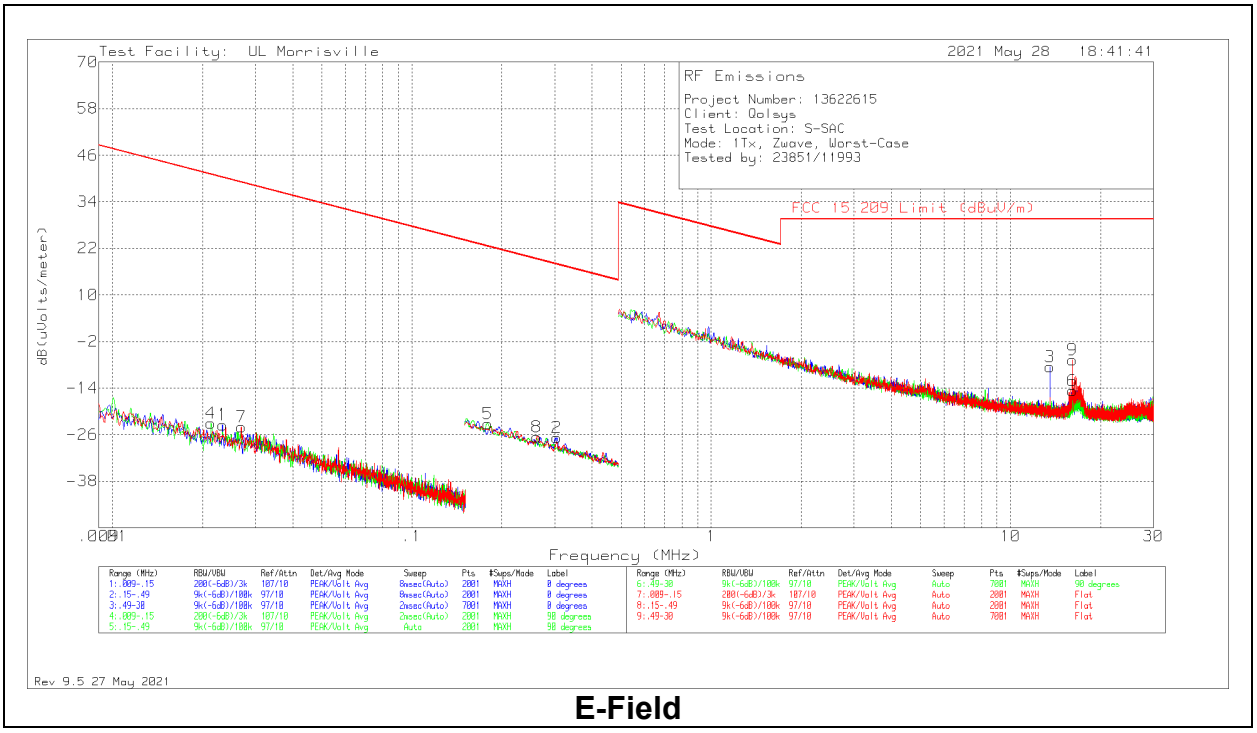
10.5. SPURIOUS EMISSIONS BELOW 30 MHz

WORST-CASE CONFIGURATION

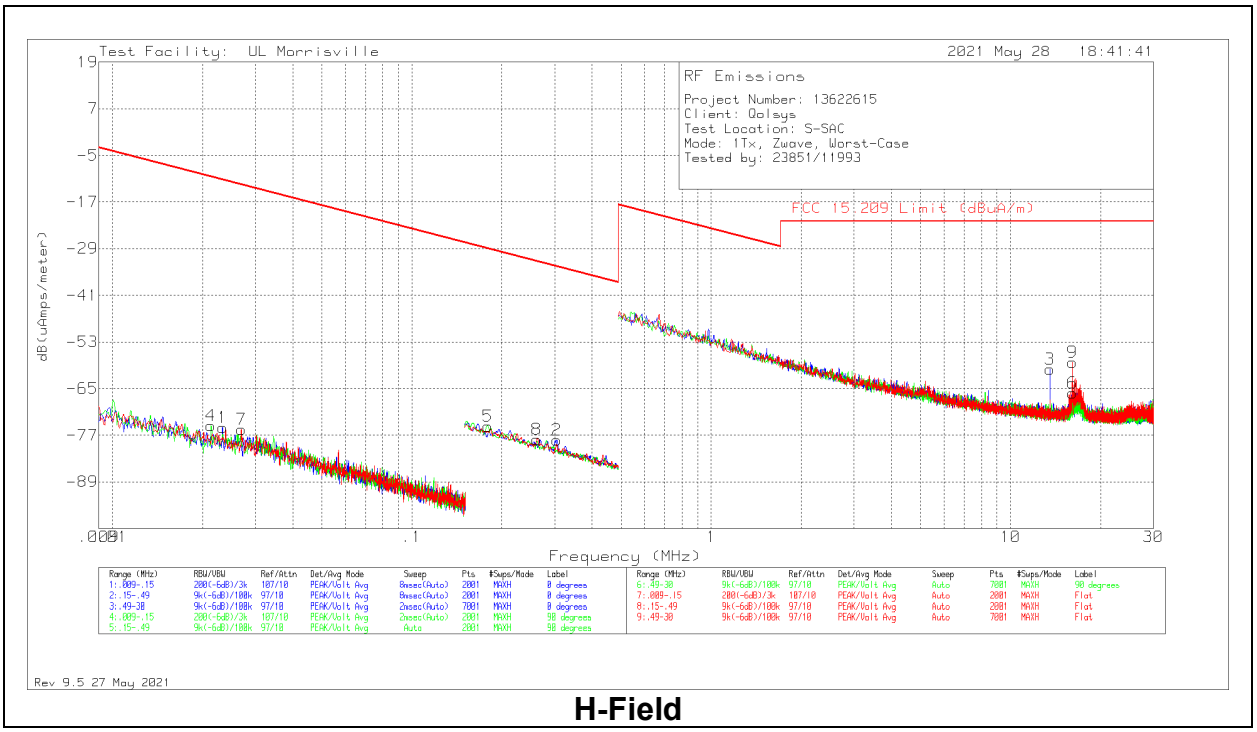
Note for below 30 MHz scans: All measurements were made at a test distance of 3 m. The measured data was extrapolated from the test distance (3m) to the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to clearly show the relative levels of fundamental and spurious emissions 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).



E-Field

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.209 Qp/Av Limit (dBuV/m)	FCC 15.209 Pk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Antenna Face
1	.02334	42.84	Pk	13.6	.1	-80	-23.46	40.24	60.24	-63.7	0-360	On
2	.30513	42.4	Pk	10.7	.1	-80	-26.8	17.91	37.91	-44.71	0-360	On
3	13.5596	20.42	Pk	10.4	.7	-40	-8.48	29.54	-	-38.02	0-360	On
4	.02135	43.23	Pk	13.6	.1	-80	-23.07	41.02	61.02	-64.09	0-360	Off
5	.17975	45.85	Pk	10.8	.1	-80	-23.25	22.51	42.51	-45.76	0-360	Off
6	16.07655	14.25	Pk	10.3	.8	-40	-14.65	29.54	-	-44.19	0-360	Off
7	.02696	42.51	Pk	13.4	.1	-80	-23.99	38.99	58.99	-62.98	0-360	Flat
8	.26152	42.66	Pk	10.7	.1	-80	-26.54	19.25	39.25	-45.79	0-360	Flat
9	16.09342	22.2	Pk	10.3	.8	-40	-6.7	29.54	-	-36.24	0-360	Flat

Pk - Peak detector



H-Field

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	AT0079 (dB/m)	Cbl (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uAmps/meter)	RSS-GEN Qp/Av Limit (dBuA/m)	RSS-GEN Pk Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Antenna Face
1	.02334	42.84	Pk	-37.9	.1	-80	-74.96	-11.26	8.74	-63.7	0-360	On
2	.30513	42.4	Pk	-40.8	.1	-80	-78.3	-33.59	-13.59	-44.71	0-360	On
3	13.5596	20.42	Pk	-41.1	.7	-40	-59.98	-21.96	-	-38.02	0-360	On
4	.02135	43.23	Pk	-37.9	.1	-80	-74.57	-10.48	9.52	-64.09	0-360	Off
5	.17975	45.85	Pk	-40.7	.1	-80	-74.75	-28.99	-8.99	-45.76	0-360	Off
6	16.07655	14.25	Pk	-41.2	.8	-40	-66.15	-21.96	-	-44.19	0-360	Off
7	.02696	42.51	Pk	-38.1	.1	-80	-75.49	-12.51	7.49	-62.98	0-360	Flat
8	.26152	42.66	Pk	-40.8	.1	-80	-78.04	-32.25	-12.25	-45.79	0-360	Flat
9	16.09342	22.2	Pk	-41.2	.8	-40	-58.2	-21.96	-	-36.24	0-360	Flat

Pk - Peak detector

UL LLC
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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

UL LLC
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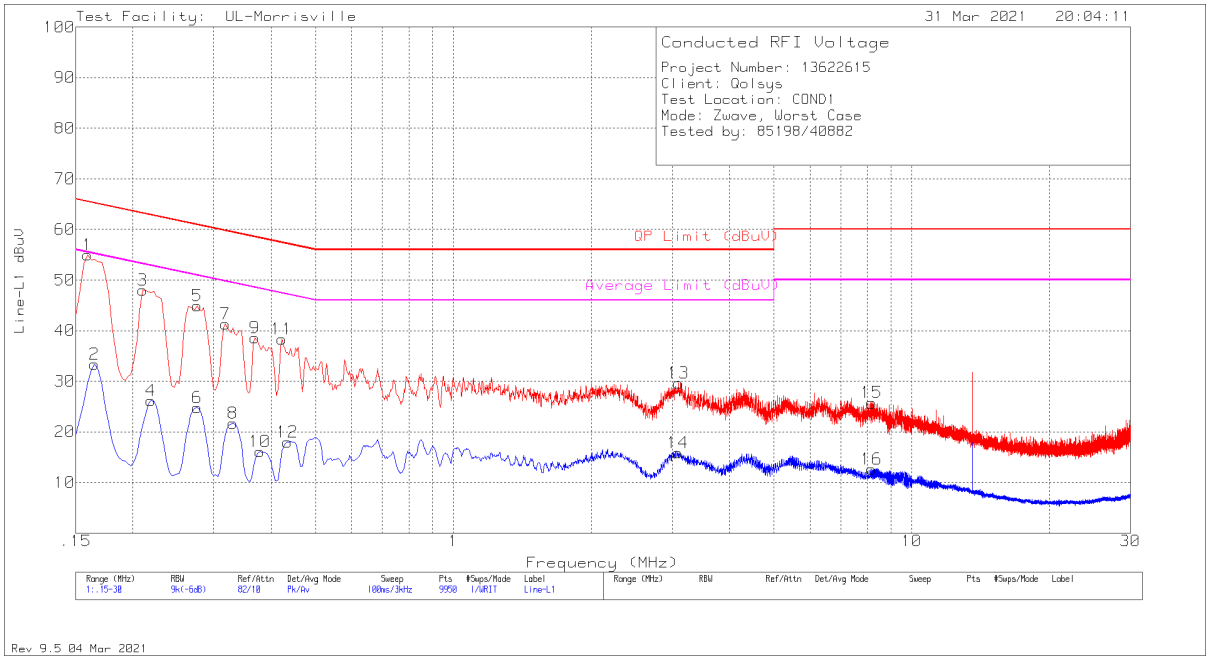
11.1.1. AC Power Line

LINE 1 RESULTS

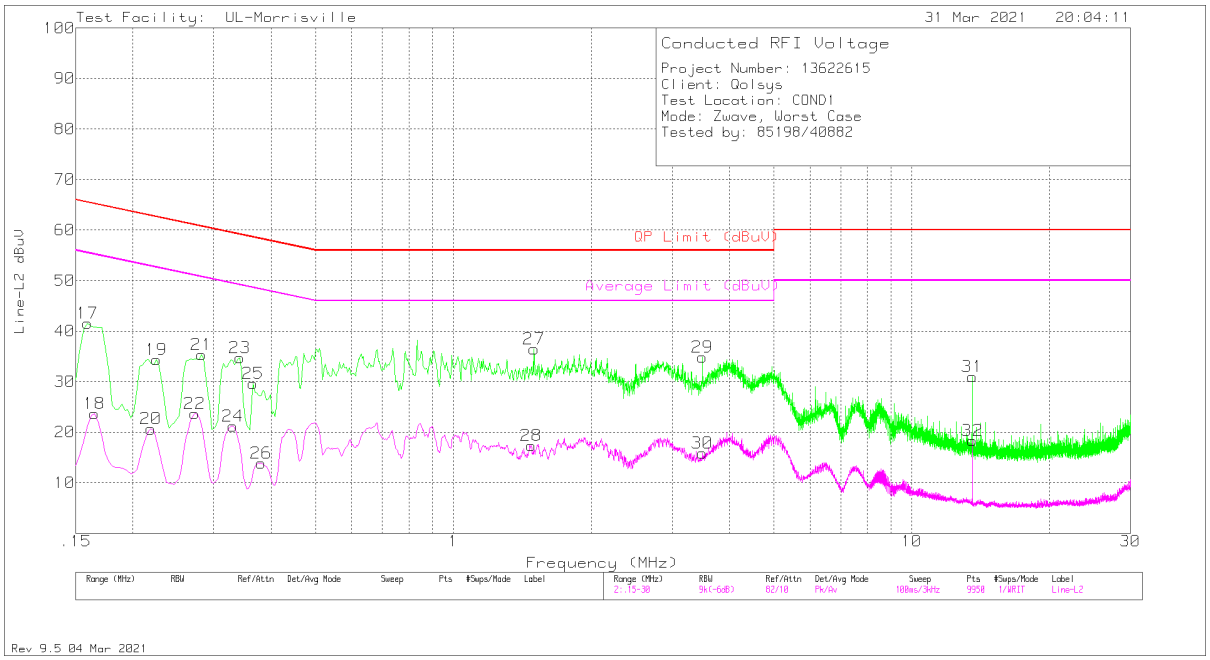


Range 1: Line-L1 .15 - 30MHz

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	.159	45.07	Pk	.2	9.7	54.97	65.52	-10.55	-	-
2	.165	23.42	Av	.2	9.7	33.32	-	-	55.21	-21.89
3	.21	38.19	Pk	.1	9.7	47.99	63.21	-15.22	-	-
4	.219	16.37	Av	.1	9.7	26.17	-	-	52.86	-26.69
5	.276	35.09	Pk	.1	9.7	44.89	60.94	-16.05	-	-
6	.276	14.99	Av	.1	9.7	24.79	-	-	50.94	-26.15
7	.318	31.38	Pk	.1	9.8	41.28	59.76	-18.48	-	-
8	.33	11.94	Av	.1	9.7	21.74	-	-	49.45	-27.71
9	.369	28.73	Pk	.1	9.7	38.53	58.52	-19.99	-	-
10	.378	6.25	Av	.1	9.8	16.15	-	-	48.32	-32.17
11	.423	28.47	Pk	.1	9.8	38.37	57.39	-19.02	-	-
12	.435	8.02	Av	.1	9.8	17.92	-	-	47.16	-29.24
13	3.102	19.89	Pk	0	9.8	29.69	56	-26.31	-	-
14	3.093	6.09	Av	0	9.8	15.89	-	-	46	-30.11
15	8.181	15.63	Pk	.1	10	25.73	60	-34.27	-	-
16	8.184	2.54	Av	.1	10	12.64	-	-	50	-37.36

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	.159	31.66	Pk	.2	9.7	41.56	65.52	-23.96	-	-
18	.165	13.73	Av	.2	9.7	23.63	-	-	55.21	-31.58
19	.225	24.6	Pk	.1	9.7	34.4	62.63	-28.23	-	-
20	.219	10.84	Av	.1	9.7	20.64	-	-	52.86	-32.22
21	.282	25.51	Pk	.1	9.7	35.31	60.76	-25.45	-	-
22	.273	13.87	Av	.1	9.7	23.67	-	-	51.03	-27.36
23	.342	24.9	Pk	.1	9.7	34.7	59.15	-24.45	-	-
24	.33	11.38	Av	.1	9.7	21.18	-	-	49.45	-28.27
25	.366	19.82	Pk	.1	9.7	29.62	58.59	-28.97	-	-
26	.381	3.99	Av	.1	9.8	13.89	-	-	48.26	-34.37
27	1.5	26.66	Pk	0	9.8	36.46	56	-19.54	-	-
28	1.479	7.6	Av	0	9.8	17.4	-	-	46	-28.6
29	3.495	25.08	Pk	0	9.8	34.88	56	-21.12	-	-
30	3.495	6.01	Av	0	9.8	15.81	-	-	46	-30.19
31	13.563	20.91	Pk	.1	10	31.01	60	-28.99	-	-
32	13.56	8.27	Av	.1	10	18.37	-	-	50	-31.63

Pk - Peak detector
Av - Average detection

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12. SETUP PHOTOS

Please refer to R13622615-EP1 for setup photos

END OF TEST REPORT