

TEST REPORT

Report Number. : R14354333-E1

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

Model : IQ4HUB

Contains FCC ID : 2AAJXQS-IQ4H

Contains IC : 11205A-QSIQ4H

EUT Description : Home Management System

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:
2022-11-02

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



REPORT REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2022-11-02	Initial Issue	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 Radio Module

MODEL: IQ4HUB

SERIAL NUMBER: QPH058X022231G03834

SAMPLE RECEIPT DATE: 2022-09-13

DATE TESTED: 2022-08-09, 2022-10-18, 2022-10-19

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C: 2022	See Section 2
ISED RSS-210 Issue 10+A1: 2020	See Section 2
ISED RSS-GEN Issue 5 + A2: 2021	See Section 2

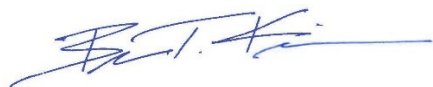
UL LLC tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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

This document may not be altered or revised in any way unless done so by UL LLC and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL LLC will constitute fraud and shall nullify the document. 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
UL LLC. By:

Prepared By:



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

Noah Bennett
Electrical Engineer
Consumer Technology Division
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	Not Performed	See Note 1.
15.249 (a)	RSS-210-B.10(a)	Fundamental Field Strength		
15.205, 15.209, 15.249(a)	RSS-GEN 8.9, 8.10	Radiated Emissions	See Comment	See Note 2.
15.207	RSS-GEN 8.8	AC Mains Conducted Emissions	Not Performed	See Note 1.

Note 1: This test report covers the assessment of the original radio module installed in a new host under FCC KDB 996369 D04 Module Integration Guide v02 via spot checks to verify continued compliance. It is the responsibility of the end product manufacturer to provide the original module reports to show full compliance to the FCC 15.249 and RSS-210 requirements.

Note 2: Radiated spot-checks were performed on worst-case data rates and channels as specified in section 6.5.

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
<input type="checkbox"/>	Building: 12 Laboratory Dr RTP, NC 27709, U.S.A	US0067	2180C	825374
<input checked="" type="checkbox"/>	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)

$$36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} = 28.9 \text{ dBuV/m}$$

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.

$$36.5 \text{ dBuV} + 0 \text{ dB} + 10.1 \text{ dB} + 0 \text{ dB} = 46.6 \text{ dBuV}$$

6. EQUIPMENT UNDER TEST

6.1. EUT DESCRIPTION

The EUT is a Z wave radio module to be installed in 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 were performed with the EUT set to transmit at its worst case channels. The Power setting used for radiated spurious emissions was Powerlevel 10.

Worst Case Channels are as follows:

BL1G Spurious: 908.40MHz.

A1G Spurious: 921.40MHz

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.

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
Laptop	Lenovo	L470	PF0ZV66P	N/A

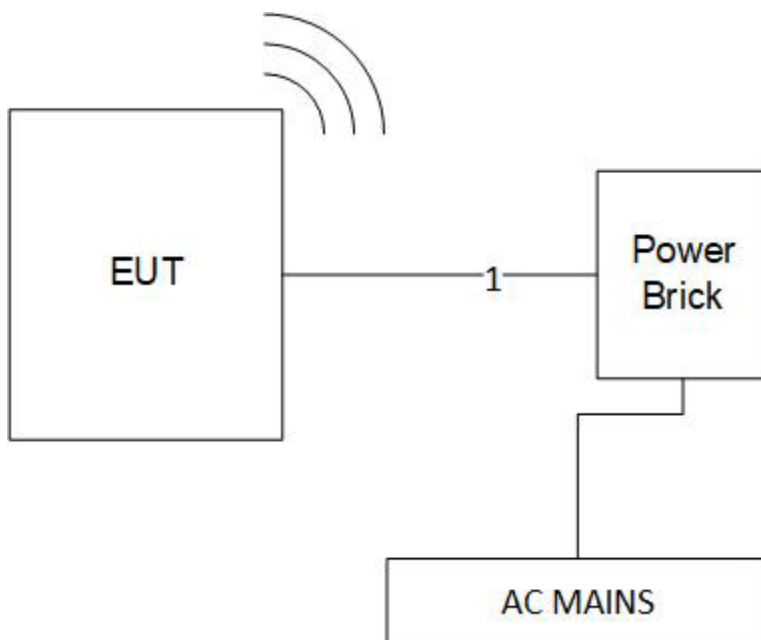
I/O CABLES

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



7. MEASUREMENT METHOD

Duty Cycle: ANSI C63.10-2013 Section 11.6

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

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.
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 2022.5.4		

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
	Gain-Loss Chains				
C4-SAC02	Gain-loss string: 25-1000MHz	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
BRF007	902-928MHz notch filter, 2W, F _{high} =1.5GHz	Micro-Tronics	BRC17691	2022-05-27	2023-05-27

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	1-18 GHz				
AT0072	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2022-05-11	2023-05-11
	Gain-Loss Chains				
C1-SAC03	Gain-loss string: 1-18GHz	Various	Various	2022-05-05	2023-05-05
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2022-04-14	2023-04-14
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
HI0096	Environmental Meter	Fisher Scientific	14-650-118 s/n 181562858	2022-09-26	2023-09-26
HPF012	1GHz high-pass filter, 2W, $F_{high} = 18\text{GHz}$	Micro-Tronics	HPM18129	2022-02-17	2023-02-17

9. ANTENNA PORT TEST RESULTS

9.1. ON TIME AND DUTY CYCLE

LIMITS

None; for reporting purposes only.

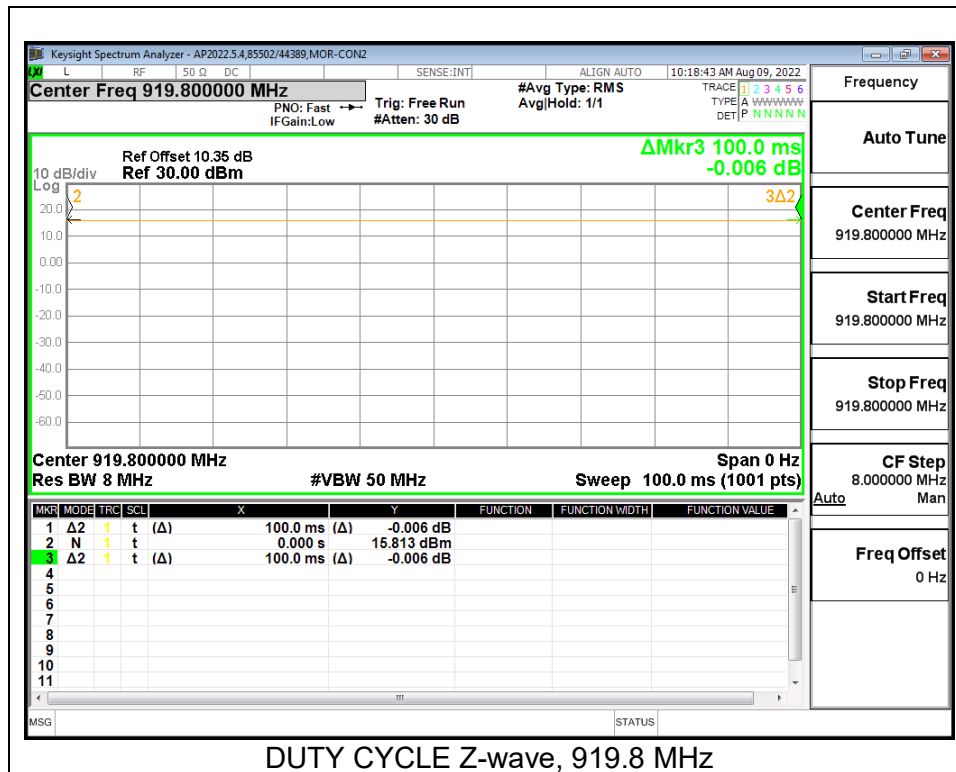
PROCEDURE

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



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

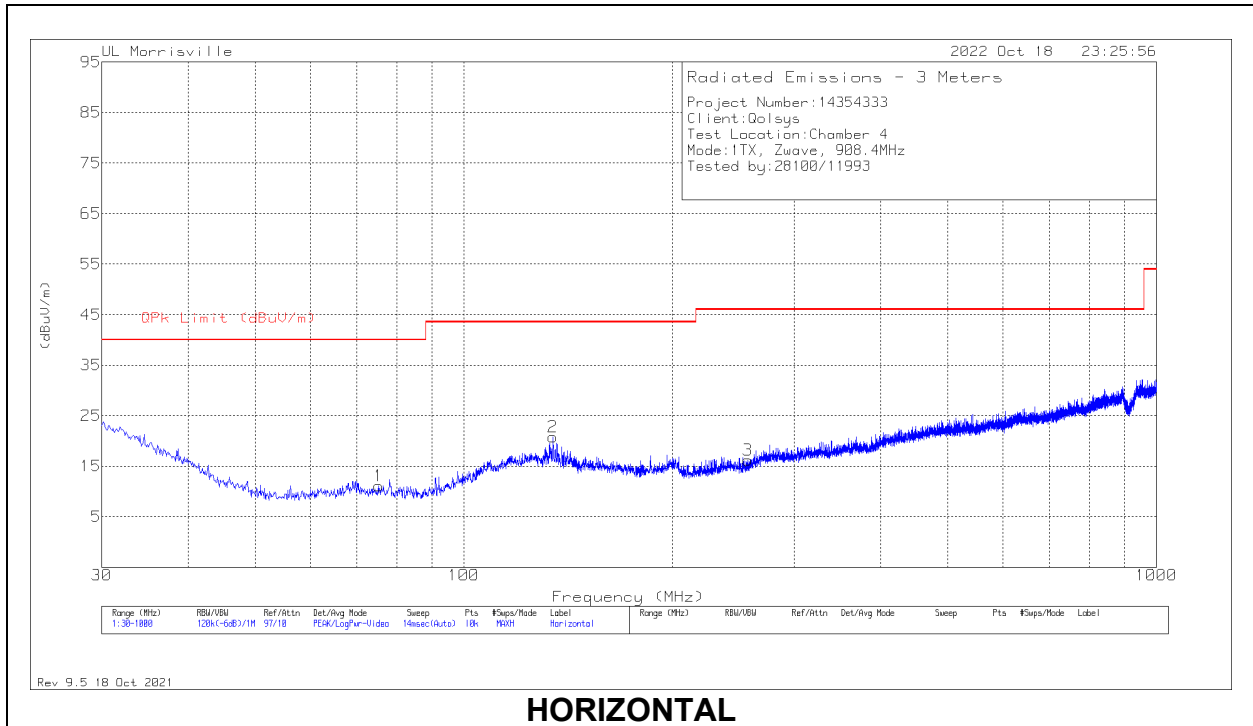
For final measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 3 MHz for peak measurements and as applicable for linear voltage averaging measurements.

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.

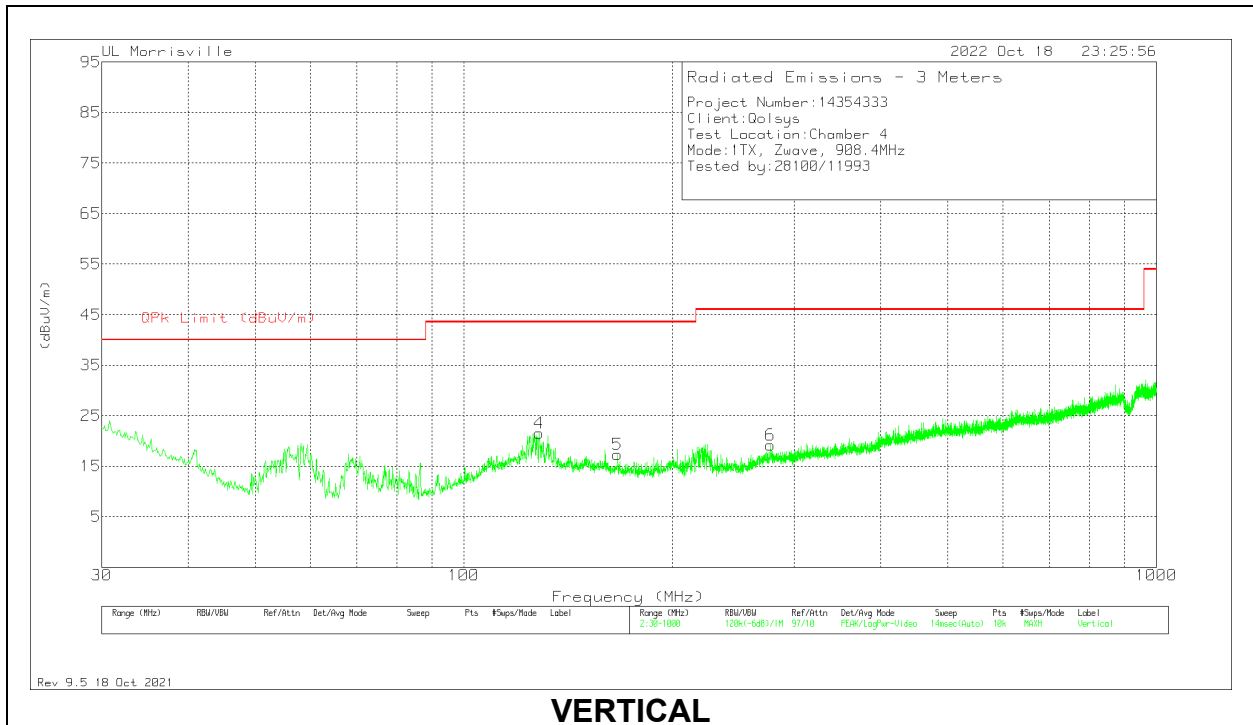
10.1. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.1.1. HARMONICS AND SPURIOUS EMISSIONS BELOW 1 GHz

LOW CHANNEL, 908.4 MHz RESULTS



HORIZONTAL



VERTICAL

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	** 75.396	27.65	Pk	14.2	-31.1	.3	11.05	40	-28.95	0-360	200	H
2	*** 134.566	31.1	Pk	19.7	-30.4	.4	20.8	43.52	-22.72	0-360	100	H
3	*** 257.174	26.94	Pk	18.1	-29.3	.4	16.14	46.02	-29.88	0-360	100	H
4	*** 128.358	31.66	Pk	20.1	-30.6	.4	21.56	43.52	-21.96	0-360	100	V
5	*** 166.576	28.86	Pk	18.2	-30.1	.3	17.26	43.52	-26.26	0-360	100	V
6	*** 276.962	28.31	Pk	19.8	-29.3	.4	19.21	46.02	-26.81	0-360	200	V

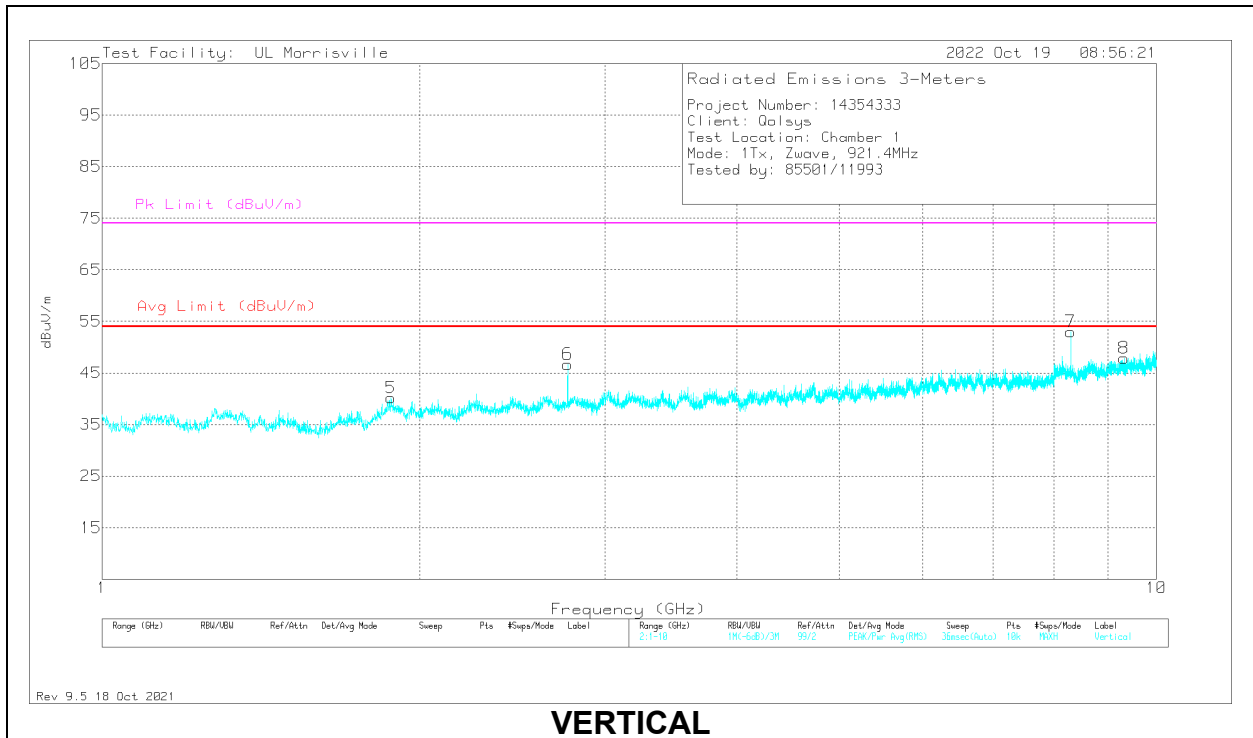
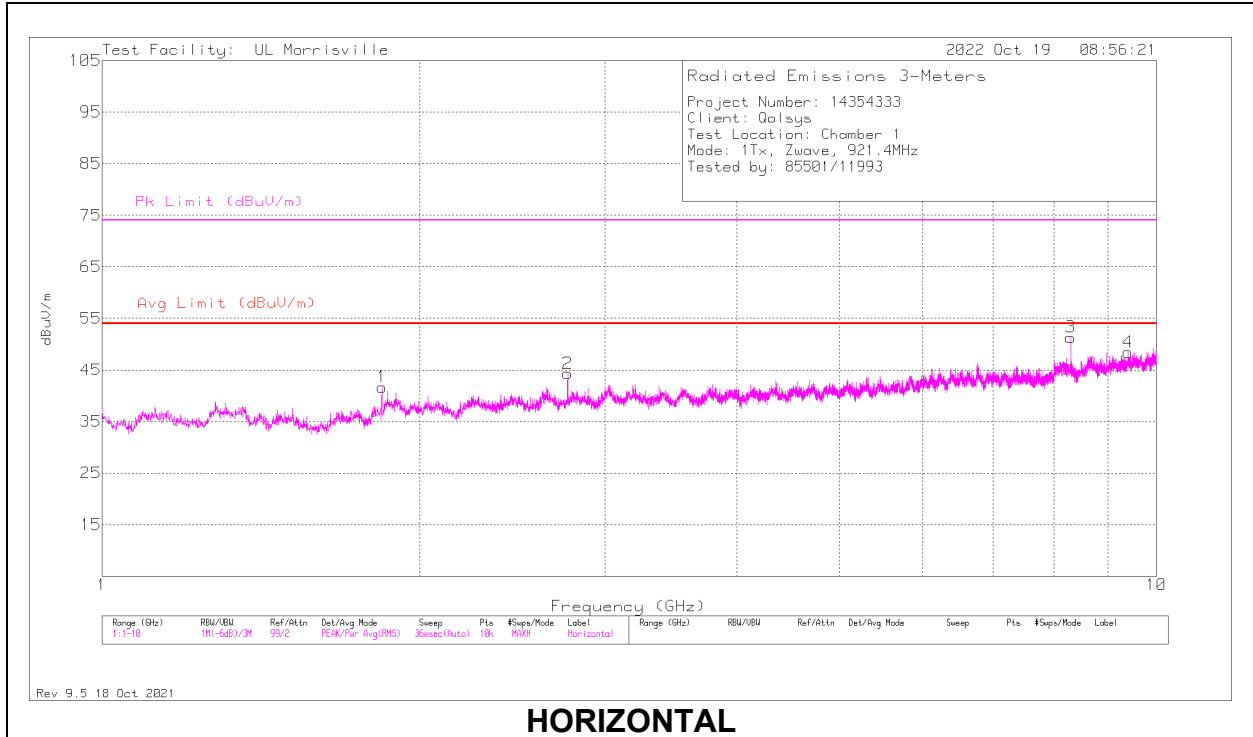
* - indicates frequency in CFR47 Pt 15 / IC RSS-Restricted Band

** - indicates frequency in Taiwan NCC LP0002 Restricted Band

Pk - Peak detector

10.2. FUNDAMENTAL AND SPURIOUS EMISSIONS

10.2.1. HARMONICS AND SPURIOUS EMISSIONS ABOVE 1 GHz MID CHANNEL, 921.4 MHz RESULTS



RADIATED EMISSIONS

Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	AT0072 (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	** 1.8424	45.11	Pk	30.9	-34.7	.4	41.71	-	-	-	-	0-360	200	H
2	*** 2.764	45.1	Pk	32.5	-33.7	.4	44.3	54	-9.7	74	-29.7	0-360	100	H
3	*** 8.29241	48.24	PK2	35.8	-29.9	.5	54.64	-	-	74	-19.36	303	101	H
	*** 8.29261	43.4	ADV	35.8	-29.9	.5	49.8	54	-4.2	-	-	303	101	H
4	*** 9.40024	41.48	PK2	36.6	-29.4	.6	49.28	-	-	74	-24.72	110	353	H
	*** 9.40071	29.37	ADV	36.6	-29.3	.6	37.27	54	-16.73	-	-	110	353	H
5	** 1.8793	43.07	Pk	31.4	-34.7	.4	40.17	-	-	-	-	0-360	399	V
6	*** 2.764	47.49	Pk	32.5	-33.7	.4	46.69	54	-7.31	74	-27.31	0-360	399	V
7	*** 8.29238	47.92	PK2	35.8	-29.9	.5	54.32	-	-	74	-19.68	149	389	V
	*** 8.29264	43.45	ADV	35.8	-29.9	.5	49.85	54	-4.15	-	-	149	389	V
8	*** 9.3178	39.57	Pk	36.5	-28.8	.6	47.87	54	-6.13	74	-26.13	0-360	399	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