

TEST REPORT

Report Number. : R14664772-E1

Applicant : Whoop, Inc
1325 Boylston St, Suite 401
Boston, MA 02215, USA

Model : WP40

FCC ID : 2AJ2X-WP40

IC : 22056-WP40

EUT Description : A mobile Wireless Power Transfer device that charges the battery of a wearable strap.

Test Standard(s) : FCC 47 CFR PART 15 SUBPART C: 2023
ISED RSS-216 ISSUE 2+A1: 2020

Date Of Issue:

2023-05-17

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REVISION HISTORY

Rev.	Issue Date	Revisions	Revised By
V1	2023-03-31	Initial Issue	Noah Bennett
V2	2023-05-17	Revised EUT description and other editorial revisions	Brian Kiewra

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: Whoop, Inc.
1325 Boylston St, Suite 401
Boston, MA 02215, USA

EUT DESCRIPTION: A mobile Wireless Power Transfer device that charges the battery of a wearable strap.

MODEL: WP40

SERIAL NUMBER: **Strap:** 4A0897596, 4A0896174, 4A0891876
Battery: P4CE002193, P4CE002355--(Used for standby), P4CE002551, P4CE002440--(Dummy Load)

SAMPLE RECEIVE DATE: 2023-03-20

DATE TESTED: 2023-03-20 to 2023-03-23

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
FCC 47 CFR Part 15 Subpart C: 2023	Refer to Section 2
RSS-216 Issue 2+A1: 2020	Refer to Section 2

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

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

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

Approved & Released For
UL LLC. By:

Prepared By:



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2. SUMMARY OF TEST RESULTS

FCC Clause	ISED Clause	Requirement	Result	Comment
15.209, 15.205, 15.225	RSS-216 6.2.2.2	Radiated Emissions	Compliant	None
15.215	RSS-GEN 6.7	Emissions Bandwidth	For Reporting Purposes only.	None.
15.207	RSS-216 6.2.2.1	AC Mains Conducted Emissions	Compliant	Note 1.
15.225(e)	N/A	Frequency Tolerance	Compliant.	None

Note 1: AC Mains scans were performed while the EUT was charging via WPT, as well as operating as intended while terminated into a dummy load.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2013, FCC CFR 47 Part 2, and FCC CFR 47 Part 15, FCC KDB 174176 D01 v01r01, RSS-GEN Issue 5 + A1 and RSS-216 Issue 2 + A1: 2020.

4. FACILITIES AND ACCREDITATION

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

	Address	ISED CABID	ISED Company Number	FCC Registration
☒	Building 2800 Suite Perimeter Park Dr. Suite B Morrisville, NC 27560, U.S.A	US0067	27265	825374

5. DECISION RULES AND MEASUREMENT UNCERTAINTY

5.1. METROLOGICAL TRACEABILITY

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

5.2. DECISION RULES

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

5.3. MEASUREMENT UNCERTAINTY

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

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

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

6. EQUIPMENT UNDER TEST

6.1. DESCRIPTION OF EUT

The EUT is a mobile Wireless Power Transfer device that charges the battery of a wearable strap.

6.2. MAXIMUM OUTPUT POWER

The transmitter has maximum peak radiated electric and magnetic field strength as follows:

Fundamental Frequency (KHz)	Mode	E field (300m distance) FCC (dBuV/m)	H field (3m distance) IC (dBuA/m)
13.56	Config 1 – Charge Mode	13.43	0.92

6.3. SOFTWARE AND FIRMWARE

The firmware version installed in the EUT during testing was 171-25-02-00 for the battery packs, and 172-11-02-01 for the straps.

6.4. WORST-CASE CONFIGURATION AND MODE

The EUT is a single frequency wearable strap that receives power via WPT battery pack. For the entire radiated emissions test, the EUT was examining on the following configuration. AC power line conducted emissions were also investigated on the following configurations:

Config	Mode	Descriptions
1	Charging Mode	The EUT was attached to the strap set to charge while the battery was <20%.
2	Dummy Load	AC Lines Only – WPT radio was terminated into a dummy load battery.

For all radiated emissions tests, the EUT was discharged to at least $\leq 20\%$ battery level prior to testing, and set to continuously charge during the entirety of the test. The intended included USB cable and a representative AC Adaptor were connected to the strap used for all testing to represent worst case. The AC Adaptor will not be included with the end product.

The fundamental of the EUT was investigated in three orthogonal orientations, X, Y and Z to determine the worst case orientation. It was found that Y orientation was worst case. Therefore, all testing was performed in this orientation.

6.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	Manufacturer	Model	Serial Number	FCC ID
AC Adapter	DeWalt	DXMA1310851	NA	NA
Wearable Strap	Whoop	WS40	4A0897596, 4A0896174,4A0891876	NA

I/O CABLES

I/O Cable List						
Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	USB C	1	USB C	Shielded	<3m	Port on the battery not the strap

SETUP DIAGRAM

Please refer to R14664772-EP1 for setup diagrams

7. TEST AND MEASUREMENT EQUIPMENT

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

Test Equipment Used - Wireless Conducted Measurement Equipment

Equipment ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	Conducted Room 2				
SA0025	Spectrum Analyzer	Keysight Technologies	N9030A	2022-05-02	2023-05-02
76023 (EC0225)	Temp/Humid Chamber	Cincinnati Sub-Zero	ZPH-8-3.5-SCT/AC	2023-01-20	2024-01-20
HI0090	Environmental Meter	Fisher Scientific	15-077-963	2022-07-20	2023-07-20
MM0167 (PRE0126458)	True RMS Multimeter	Agilent	U1232A	2021-08-17	2023-08-17
-	DC Power Supply	Keysight Technologies	E3633A	-	-
	Additional Equipment Used				
-	Near Field Probe Kit	EMC Test Systems	7405	-	-

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

Equip. ID	Description	Manufacturer	Model Number	Last Cal.	Next Cal.
	0.009-30MHz				
135144	Active Loop Antenna	ETS-Lindgren	6502	2023-01-17	2024-01-17
	30-1000 MHz				
90629 (AT0075)	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2023-01-06	2024-01-06
	Gain-Loss Chains				
207638	Gain-loss string: 0.009-30MHz	Various	Various	2022-05-20	2023-05-20
207639	Gain-loss string: 25-1000MHz	Various	Various	2022-05-20	2023-05-20
	Receiver & Software				
197954	Spectrum Analyzer	Rohde & Schwarz	ESW44	2023-02-02	2024-02-02
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 - 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
LISN001	LISN, 50-ohm/50-uH, 2-conductor, 25A	Fischer Custom Com.	FCC-LISN-50-25-2-01-550V	2022-08-01	2023-08-01
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
PS214	AC Power Source	Elgar	CW2501M	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

8. ANTENNA PORT TEST RESULTS

8.1. OCCUPIED BANDWIDTH

TEST PROCEDURE

The transmitter output is measured via a near field probe connected to the spectrum analyzer. The RBW is set to 1-5% of the OBW. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

EUT SETUP

Configuration 1: Charger in charging mode with CW signal and duty cycle varied to control charge level via load modulation from watch.

Results for when the EUT was in standable battery mode, and while connected to AC Mains was investigated.

RESULTS

Configuration	Frequency measured	99% OBW Result	-20dB BW Result
Config 1 - Battery	13.56 MHz	2.1392 MHz	1.742 MHz
Config 1 - USB		1.7686 MHz	1.288 MHz

8.2. FREQUENCY STABILITY

LIMIT

§15.225 (e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency, over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from the minimum to the maximum of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

TEST PROCEDURE

ANSI C63.10-2013 Clause 6.8

RESULTS

No non-compliance noted.

8.2.1. USB

Reference Frequency: EUT Channel 13.56 MHz @ 20°C Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir. Temp	Frequency Deviation Measured with Time Elapse								
(Vdc)	(°C)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
5.00	50	13.5601145	0.627	13.5601168	0.457	13.5601195	0.258	13.5601213	0.125	± 100
5.00	40	13.5601117	0.833	13.5601111	0.878	13.5601120	0.811	13.5601125	0.774	± 100
5.00	30	13.5601304	-0.546	13.5601225	0.037	13.5601178	0.383	13.5601148	0.605	± 100
5.00	20	13.5601230	0.000	13.5601161	0.509	13.5601165	0.479	13.5601130	0.737	± 100
5.00	10	13.5601794	-4.159	13.5601761	-3.916	13.5601721	-3.621	13.5601643	-3.046	± 100
5.00	0	13.5601808	-4.263	13.5601816	-4.322	13.5601833	-4.447	13.5601828	-4.410	± 100
5.00	-10	13.5601487	-1.895	13.5601627	-2.928	13.5601736	-3.732	13.5601764	-3.938	± 100
5.00	-20	13.5601254	-0.177	13.5601364	-0.988	13.5601403	-1.276	13.5601439	-1.541	± 100

Tested by: 85502/44389

Test date: 2023-03-20

8.2.2. Battery

Reference Frequency: EUT Channel 13.56 MHz @ 20°C Limit: ± 100 ppm = 1.356 kHz										
Power Supply	Envir. Temp	Frequency Deviation Measured with Time Elapse								
(Vdc)	(°C)	Startup (MHz)	Delta (ppm)	@ 2 mins (MHz)	Delta (ppm)	@ 5 mins (MHz)	Delta (ppm)	@ 10 mins (MHz)	Delta (ppm)	Limit (ppm)
3.85	50	13.5601425	0.155	13.5601431	0.111	13.5601433	0.096	13.5601449	-0.022	± 100
3.85	40	13.5601295	1.114	13.5601338	0.796	13.5601353	0.686	13.5601365	0.597	± 100
3.85	30	13.5601357	0.656	13.5601299	1.084	13.5601316	0.959	13.5601327	0.878	± 100
3.85	20	13.5601446	0.000	13.5601345	0.745	13.5601295	1.114	13.5601328	0.870	± 100
3.85	10	13.5601716	-1.991	13.5601708	-1.932	13.5601707	-1.925	13.5601691	-1.807	± 100
3.85	0	13.5601670	-1.652	13.5601734	-2.124	13.5601739	-2.161	13.5601743	-2.190	± 100
3.85	-10	13.5601546	-0.737	13.5601555	-0.804	13.5601579	-0.981	13.5601602	-1.150	± 100
3.85	-20	13.5601054	2.891	13.5601133	2.308	13.5601159	2.117	13.5601174	2.006	± 100
3.30	20	13.5601541	-0.701	13.5601433	0.096	13.5601364	0.605	13.5601338	0.796	± 100
	20		1000010.664		1000010.664		1000010.664		1000010.664	± 100

Tested by: 85502/44389

Test date: 2023-03-22

9. RADIATED EMISSION TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMIT

FCC §15.209 (a), 15.225(a)-(d)

Frequency (MHz)	FCC 15.209 Field Strength (microvolts/meter)	FCC Measurement Distance (m)
0.009–0.490	2400/F(kHz)	300
0.490–1.705	24000/F(kHz)	30
1.705–30.0	30	30
30–88	100	3
88 to 216	150	3
216 to 960	200	3
Above 960 MHz	500	3
Frequency (MHz)	FCC 15.225 Field Strength (microvolts/meter)	FCC Measurement Distance (m)
13.110-13.410	106	30
13.410-13.553	334	30
13.553-13.567	15848	30
13.567-13.710	334	30
13.710-14.010	106	30
Note:15.225 Limits outside of the 13.110 to 14.010 are shared with 15.209		

ICES-001 Section 6.2, IC RSS-216 6.2.2, and IC RSS-GEN Sections 8.9 and 8.10.

Table 2: Magnetic field strength radiated emission limits for induction cooking appliances

Frequency range (MHz)	Quasi-peak, at 3 m distance (dBμA/m)
0.009 – 0.07	69
0.07 – 0.15	69 to 39 *
0.15 – 30	39 to 7 *
* The limit level in dBμA/m decreases linearly with the logarithm of frequency.	

Table 4: Electric field strength radiated emission limits for induction cooking appliances

Frequency range (MHz)	OATS or SAC * 10 m measurement distance Quasi-peak (dBμV/m)	OATS or SAC * 3 m measurement distance Quasi-peak (dBμV/m)	FAR * 3 m measurement distance Quasi-peak (dBμV/m)
30 – 230	30	40	42 to 35**
230 – 1000	37	47	42
Note: The more stringent limit applies at the transition frequency. * OATS = open-area test site, SAC = semi-anechoic chamber, FAR = fully-anechoic room (see CSA CISPR 11:19). ** The limit level in dBμV/m decreases linearly with the logarithm of frequency.			

TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane for measurement below 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.

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 9-150kHz range. Peak detection is used unless otherwise noted as quasi-peak.

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).

Based 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.

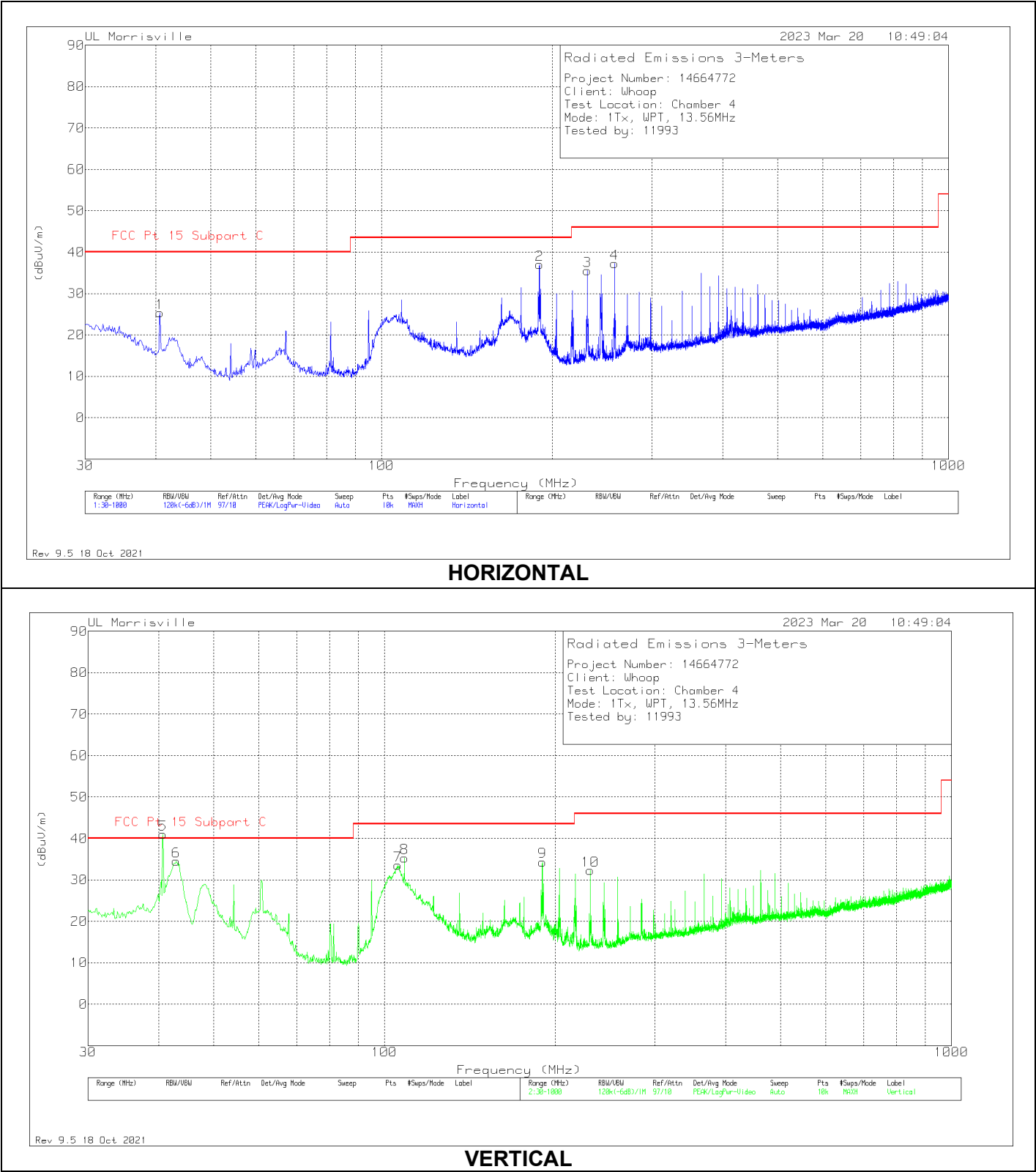
KDB 414788 Open Field Site (OFS) and Chamber Correlation Justification

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

RESULTS

9.2. FCC TX SPURIOUS EMISSION 30 TO 1000 MHz

9.2.1. CONFIG 1



RADIATED EMISSIONS

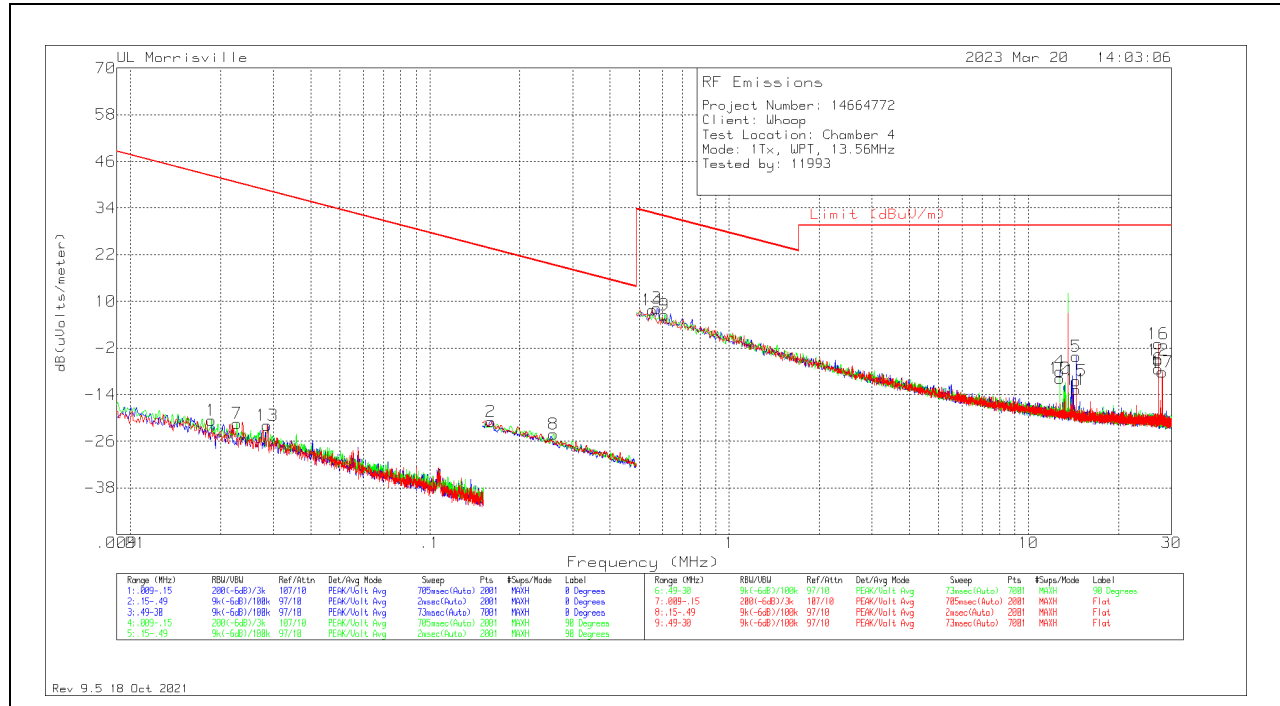
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	90629 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC Pt 15 Subpart C	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	40.67	37.77	Pk	19.2	-31.6	25.37	40	-14.63	0	300	H
5	40.6666	52.21	Qp	19.2	-31.6	39.81	40	-.19	50	102	V
6	43.088	44.91	Qp	17.5	-31.4	31.01	40	-8.99	0	109	V
7	105.66	46.31	Pk	17.8	-30.6	33.51	43.5	-9.99	0	100	V
8	108.473	47.34	Pk	18.4	-30.4	35.34	43.5	-8.16	0	100	V
2	189.856	49.47	Pk	17.5	-29.9	37.07	43.5	-6.43	1	100	H
9	189.856	46.75	Pk	17.5	-29.9	34.35	43.5	-9.15	0	100	V
3	230.499	47.89	Pk	17.2	-29.6	35.49	46	-10.51	1	100	H
10	230.499	44.75	Pk	17.2	-29.6	32.35	46	-13.65	0	100	V
4	257.659	48.96	Pk	17.8	-29.5	37.26	46	-8.74	1	100	H

Pk - Peak detector

Qp - Quasi-Peak detector

9.3. FCC TX FUNDAMENTAL & SPURIOUS EMISSIONS FROM 9 kHz TO 30 MHz

9.3.1. CONFIG 1 – E FIELD

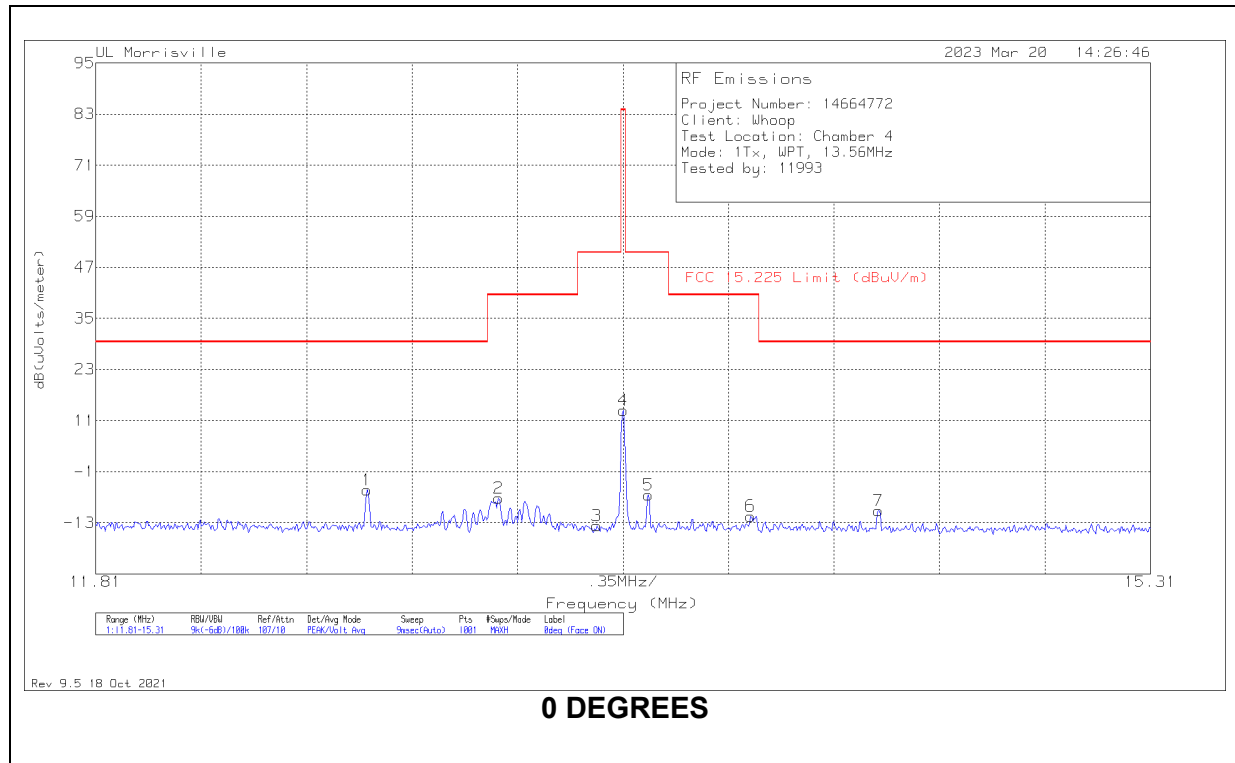


DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
1	.01866	43.92	Pk	15.5	0	-80	-20.58	42.19	-62.77	0	0 degs
7	.0227	43.82	Pk	14.7	0	-80	-21.48	40.48	-61.96	0	90 degs
13	.02867	43.83	Pk	14.2	0	-80	-21.97	38.46	-60.43	0	Flat
2	.15969	46.8	Pk	12.2	.1	-80	-20.9	23.54	-44.44	0	0 degs
8	.2594	43.54	Pk	12.2	.1	-80	-24.16	19.32	-43.48	0	90 degs
14	.55324	35.43	Pk	12.2	.1	-40	7.73	32.75	-25.02	0	Flat
3	.57432	35.87	Pk	12.2	.1	-40	8.17	32.42	-24.25	0	0 degs
9	.60805	34.24	Pk	12.2	.1	-40	6.54	31.93	-25.39	0	90 degs
4	12.71218	20.53	Pk	10.7	.7	-40	-8.07	29.54	-37.61	0	0 degs
10	12.71218	18.85	Pk	10.7	.7	-40	-9.75	29.54	-39.29	0	90 degs
5	14.40702	24.65	Pk	10.5	.7	-40	-4.15	29.54	-33.69	0	0 degs
11	14.40702	16.08	Pk	10.5	.7	-40	-12.72	29.54	-42.26	0	90 degs
15	14.40702	18.26	Pk	10.5	.7	-40	-10.54	29.54	-40.08	0	Flat
6	27.12247	23.35	Pk	8.3	1	-40	-7.35	29.54	-36.89	0	0 degs
12	27.12247	25.54	Pk	8.3	1	-40	-5.16	29.54	-34.7	0	90 degs
16	27.12247	29.74	Pk	8.3	1	-40	-.96	29.54	-30.5	0	Flat
17	27.96989	22.72	Pk	8.1	1	-40	-8.18	29.54	-37.72	0	Flat

Pk - Peak detector

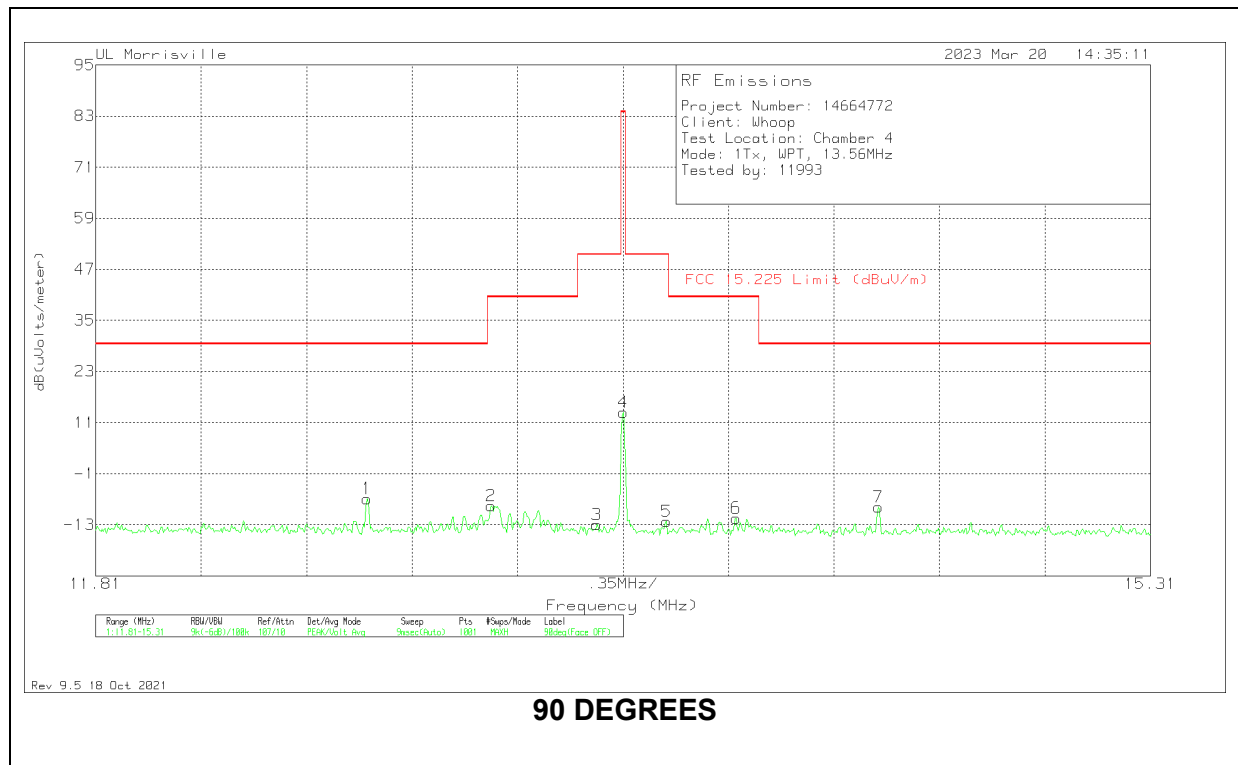
9.3.2. CONFIG 1 – Tx Mask



DATA – 0 Degrees

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	12.7095	23.28	Pk	10.7	.7	-40	-5.32	29.5	-34.82	188	100	0 degs
2	13.147	21.4	Pk	10.6	.7	-40	-7.3	40.5	-47.8	188	100	0 degs
3	13.4725	14.99	Pk	10.6	.7	-40	-13.71	50.5	-64.21	188	100	0 degs
4	13.56	42.06	Pk	10.6	.7	-40	13.36	84	-70.64	188	100	0 degs
5	13.644	22.14	Pk	10.6	.7	-40	-6.56	50.5	-57.06	188	100	0 degs
6	13.9835	17.36	Pk	10.5	.7	-40	-11.44	40.5	-51.94	188	100	0 degs
7	14.407	18.66	Pk	10.5	.7	-40	-10.14	29.5	-39.64	188	100	0 degs

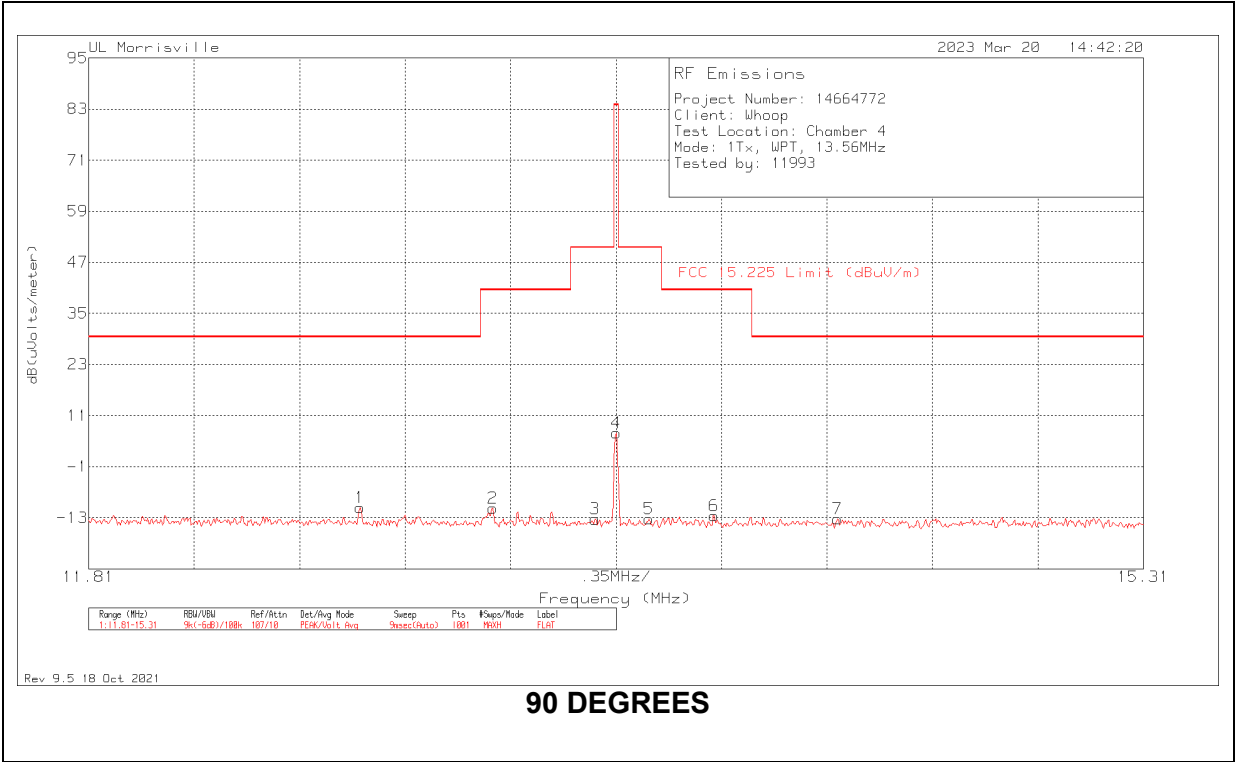
Pk - Peak detector



DATA – 90 Degrees

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	12.7095	21.73	Pk	10.7	.7	-40	-6.87	29.5	-36.37	254	100	90 degs
2	13.1225	20.07	Pk	10.6	.7	-40	-8.63	40.5	-49.13	254	100	90 degs
3	13.4725	15.74	Pk	10.6	.7	-40	-12.96	50.5	-63.46	254	100	90 degs
4	13.56	42.13	Pk	10.6	.7	-40	13.43	84	-70.57	254	100	90 degs
5	13.7035	16.46	Pk	10.6	.7	-40	-12.24	50.5	-62.74	254	100	90 degs
6	13.9345	17.36	Pk	10.5	.7	-40	-11.44	40.5	-51.94	254	100	90 degs
7	14.407	19.96	Pk	10.5	.7	-40	-8.84	29.5	-38.34	254	100	90 degs

Pk - Peak detector



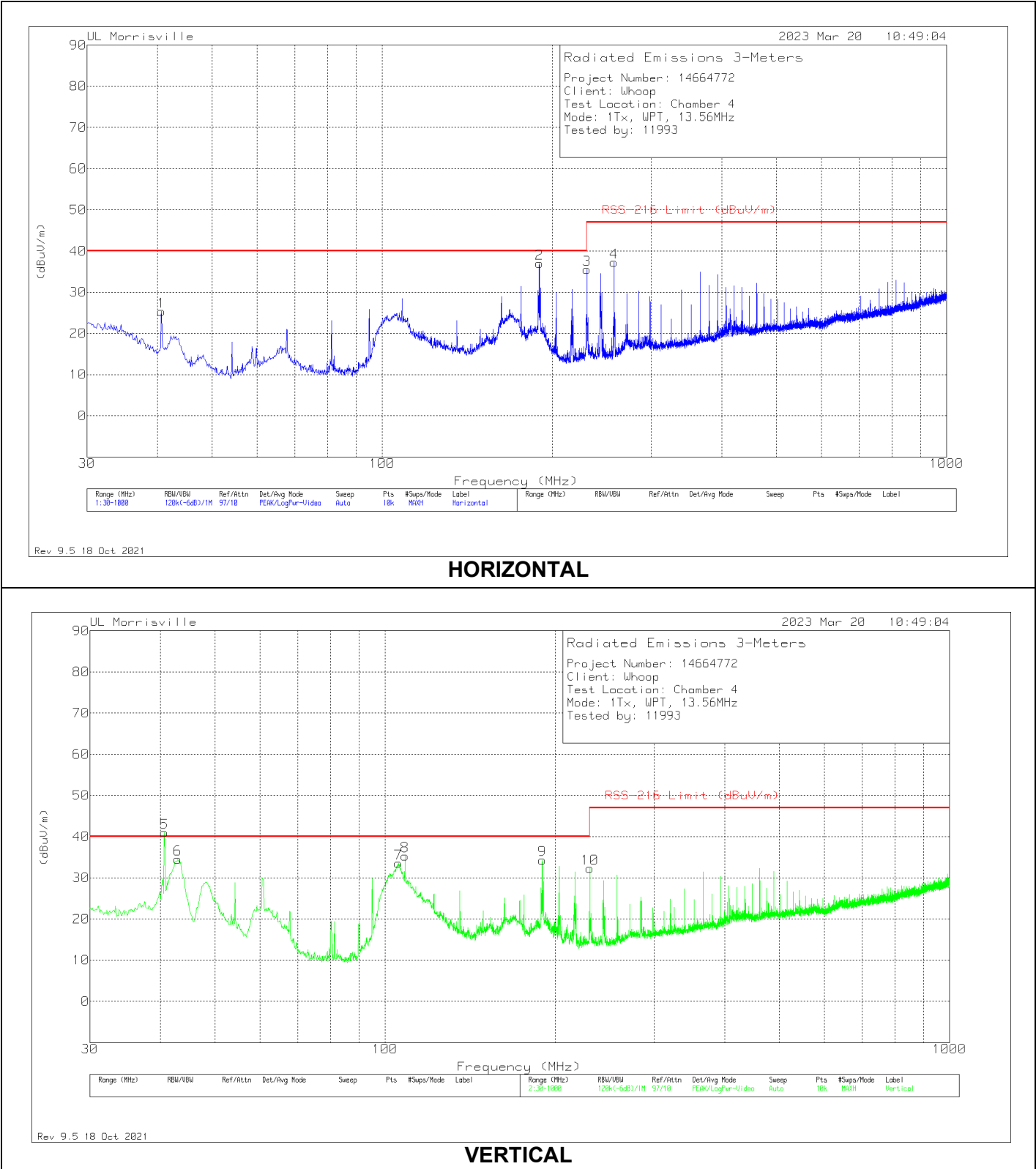
DATA – Flat

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	FCC 15.225 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Loop Angle
1	12.7095	18.01	Pk	10.7	.7	-40	-10.59	29.5	-40.09	183	100	Flat
2	13.1505	17.94	Pk	10.6	.7	-40	-10.76	40.5	-51.26	183	100	Flat
3	13.49	15.35	Pk	10.6	.7	-40	-13.35	50.5	-63.85	183	100	Flat
4	13.56	35.66	Pk	10.6	.7	-40	6.96	84	-77.04	183	100	Flat
5	13.6685	15.44	Pk	10.6	.7	-40	-13.26	50.5	-63.76	183	100	Flat
6	13.8855	16.27	Pk	10.5	.7	-40	-12.53	40.5	-53.03	183	100	Flat
7	14.295	15.56	Pk	10.5	.7	-40	-13.24	29.5	-42.74	183	100	Flat

Pk - Peak detector

9.4. IC / RSS-216 TX SPURIOUS EMISSION 30 TO 1000 MHz

9.4.1. CONFIG 1



RADIATED EMISSIONS

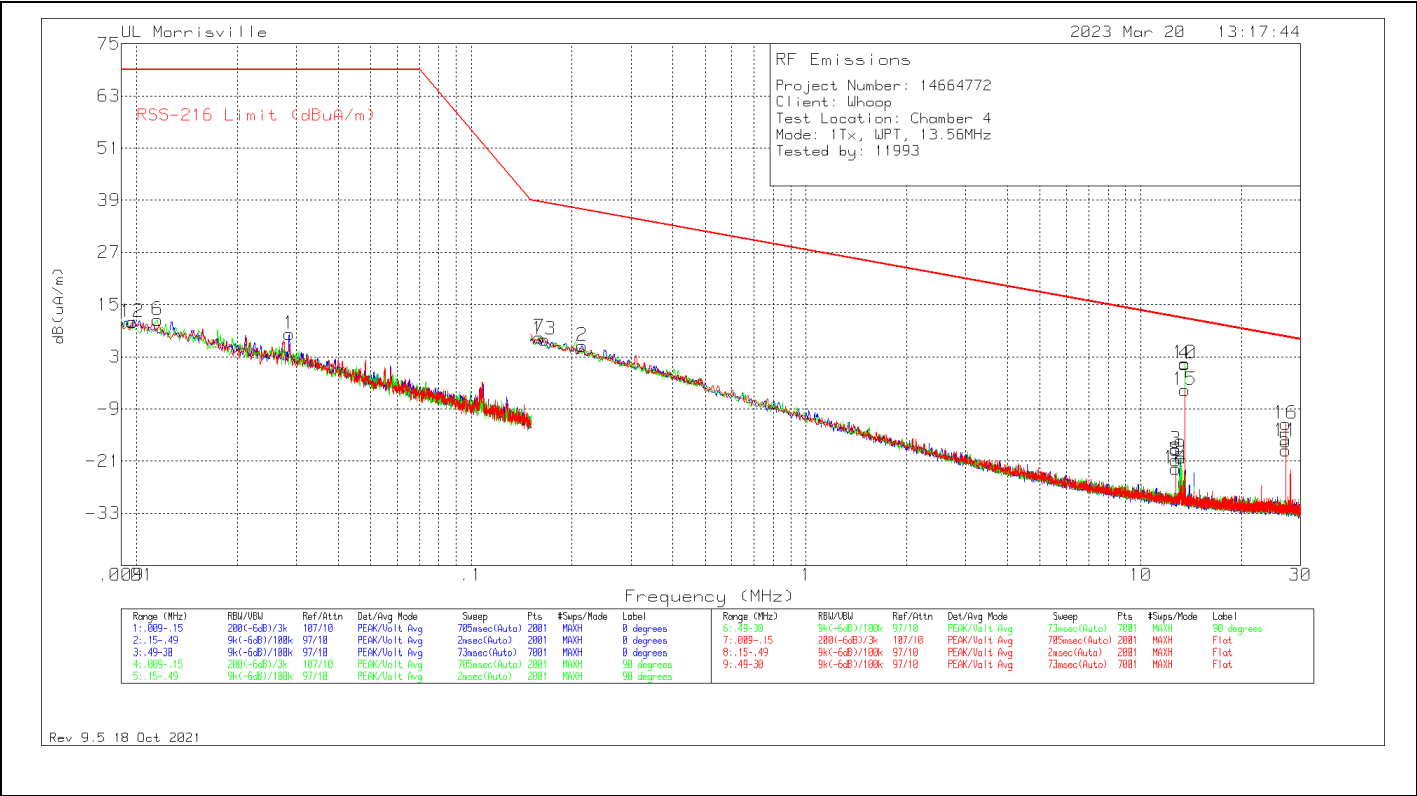
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	90629 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	RSS-216 Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	40.67	37.77	Pk	19.2	-31.6	25.37	40	-14.63	0	300	H
5	40.6666	52.21	Qp	19.2	-31.6	39.81	40	-.19	50	102	V
6	43.088	44.91	Qp	17.5	-31.4	31.01	40	-8.99	0	109	V
7	105.66	46.31	Pk	17.8	-30.6	33.51	40	-6.49	0	100	V
8	108.4581	44.81	Qp	18.4	-30.4	32.81	40	-7.19	182	102	V
2	189.844	49.11	Qp	17.5	-29.9	36.71	40	-3.29	145	182	H
9	189.8483	44.01	Qp	17.5	-29.9	31.61	40	-8.39	152	102	V
3	230.499	47.89	Pk	17.2	-29.6	35.49	47	-11.51	1	100	H
10	230.499	44.75	Pk	17.2	-29.6	32.35	47	-14.65	0	100	V
4	257.659	48.96	Pk	17.8	-29.5	37.26	47	-9.74	1	100	H

Pk - Peak detector

Qp - Quasi-Peak detector

9.5. RSS-216 FUNDAMENTAL & SPURIOUS EMISSIONS FROM 9 kHz TO 30 MHz

9.5.1. CONFIG 1



DATA

Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dBS/m)	Gain/Loss (dB)	Corrected Reading dB(uA/m)	RSS-216 Limit (dBuA/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
12	.00971	43.02	Pk	-32	0	11.02	69	-57.98	0	Flat
6	.01156	44.36	Pk	-32.9	0	11.46	69	-57.54	0	90 degs
1	.0286	45.54	Pk	-37.3	0	8.24	69	-60.76	0	0 degs
7	.16012	46.7	Pk	-39.3	.1	7.5	38.61	-31.11	0	90 degs
13	.16496	46.21	Pk	-39.3	.1	7.01	38.43	-31.42	0	Flat
2	.21409	44.67	Pk	-39.3	.1	5.47	36.85	-31.38	0	0 degs
3	12.71218	21.65	Pk	-40.8	.7	-18.45	12.19	-30.64	0	0 degs
8	12.71218	19.28	Pk	-40.8	.7	-20.82	12.19	-33.01	15	90 degs
14	12.71218	17.36	Pk	-40.8	.7	-22.74	12.19	-34.93	0	Flat
9	13.15065	20	Pk	-40.9	.7	-20.2	11.98	-32.18	15	90 degs
4	13.5603	41.12	Qp	-40.9	.7	.92	11.8	-10.88	179	0 degs
10	13.5605	39.21	Qp	-40.9	.7	-.99	11.8	-12.79	223	90 degs
15	13.56	35.1	Qp	-40.9	.7	-5.1	11.8	-16.9	355	Flat
5	27.12247	23.7	Pk	-43.2	1	-18.5	7.61	-26.11	0	0 degs
11	27.12247	25.69	Pk	-43.2	1	-16.51	7.61	-24.12	15	90 degs
16	27.12247	29.86	Pk	-43.2	1	-12.34	7.61	-19.95	0	Flat

Pk - Peak detector
Qp - Quasi-Peak detector

10. AC MAINS LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

Frequency of Emission (MHz)	Conducted Limit (dB μ V)	
	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.

RSS-Gen 8.8; RSS-216 6.2.2.1

Frequency of Emission (MHz)	Conducted Limit (dB μ A)	
	Quasi-peak	Average
0.009-0.05	110	-
0.05-0.15	90 to 80 *	-
0.15-0.5	66 to 56 *	56 to 46 *
0.5-5	56	46
5-30	60	50

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 for above 150kHz and 200Hz for below 150kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

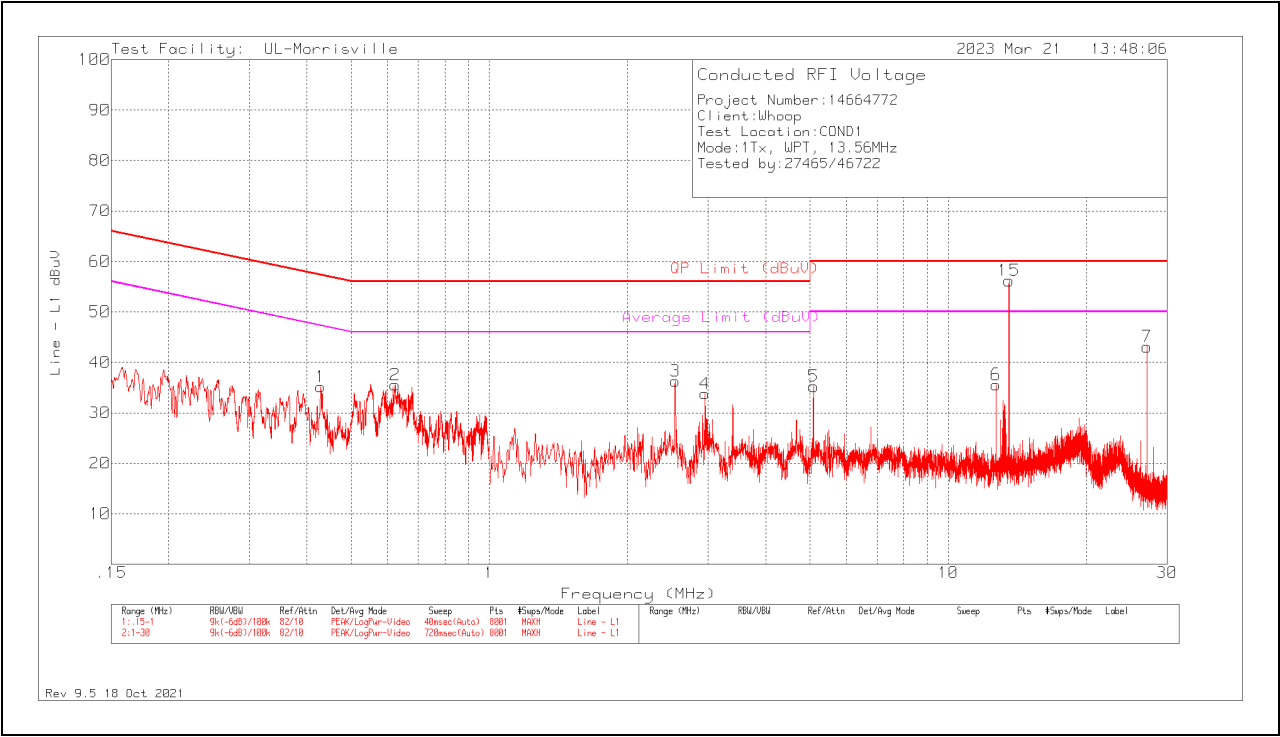
Line conducted data is recorded for both NEUTRAL and HOT lines.

RESULTS

11.1. FCC 15.207 AC MAINS LINE CONDUCTED

11.1.1. CONFIG 1

LINE 1 RESULTS

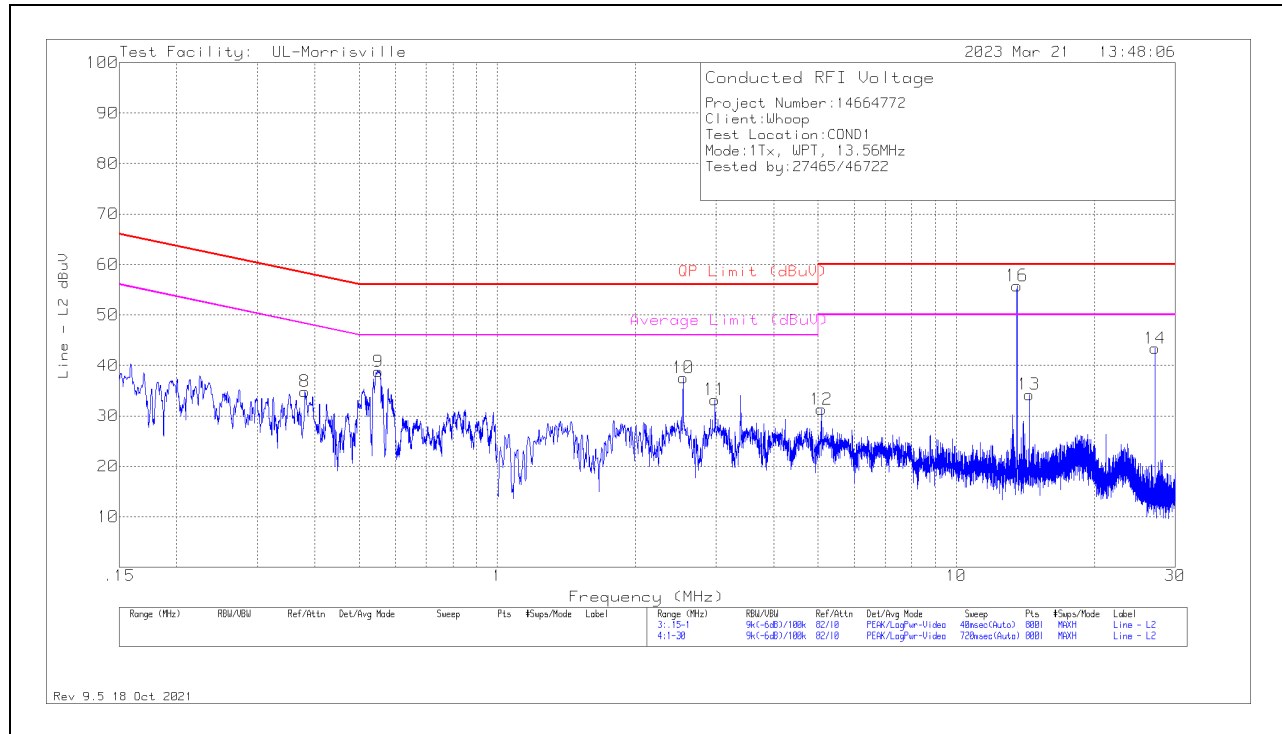


WORST EMISSIONS

Range 1: Line - L1										
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	.4291	25.35	Pk	0	9.8	35.15	57.27	-22.12	-	-
2	.62318	25.73	Pk	0	9.8	35.53	56	-20.47	-	-
3	2.54063	26.48	Pk	0	9.8	36.28	56	-19.72	-	-
4	2.95025	23.99	Pk	0	9.8	33.79	56	-22.21	-	-
5	5.08538	25.35	Pk	0	9.9	35.25	60	-24.75	-	-
6	12.716	25.45	Pk	.1	10	35.55	60	-24.45	-	-
7	27.12175	32.6	Pk	.3	10.2	43.1	60	-16.9	-	-
15*	13.5594	45.29	Qp	.1	10	55.39	60	-4.61	-	-
*	13.5599	45.33	Av	.1	10	55.43	-	-	50	5.43

Pk - Peak detector
Qp - Quasi-Peak detector
Av - Average detection
*Note: Fundamental Frequency

LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line - L2										
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)
8	.38066	24.91	Pk	.1	9.8	34.81	58.27	-23.46	-	-
9	.54989	28.96	Pk	0	9.8	38.76	56	-17.24	-	-
10	2.54063	27.74	Pk	0	9.8	37.54	56	-18.46	-	-
11	2.97925	23.4	Pk	0	9.8	33.2	56	-22.8	-	-
12	5.08175	21.39	Pk	0	9.9	31.29	60	-28.71	-	-
13	14.40525	24.03	Pk	.1	10.1	34.23	60	-25.77	-	-
14	27.12175	32.88	Pk	.3	10.2	43.38	60	-16.62	-	-
16*	13.5601	45.21	Qp	.1	10	55.31	60	-4.69	-	-
*	13.5607	45.24	Av	.1	10	55.34	-	-	50	5.34

Pk - Peak detector

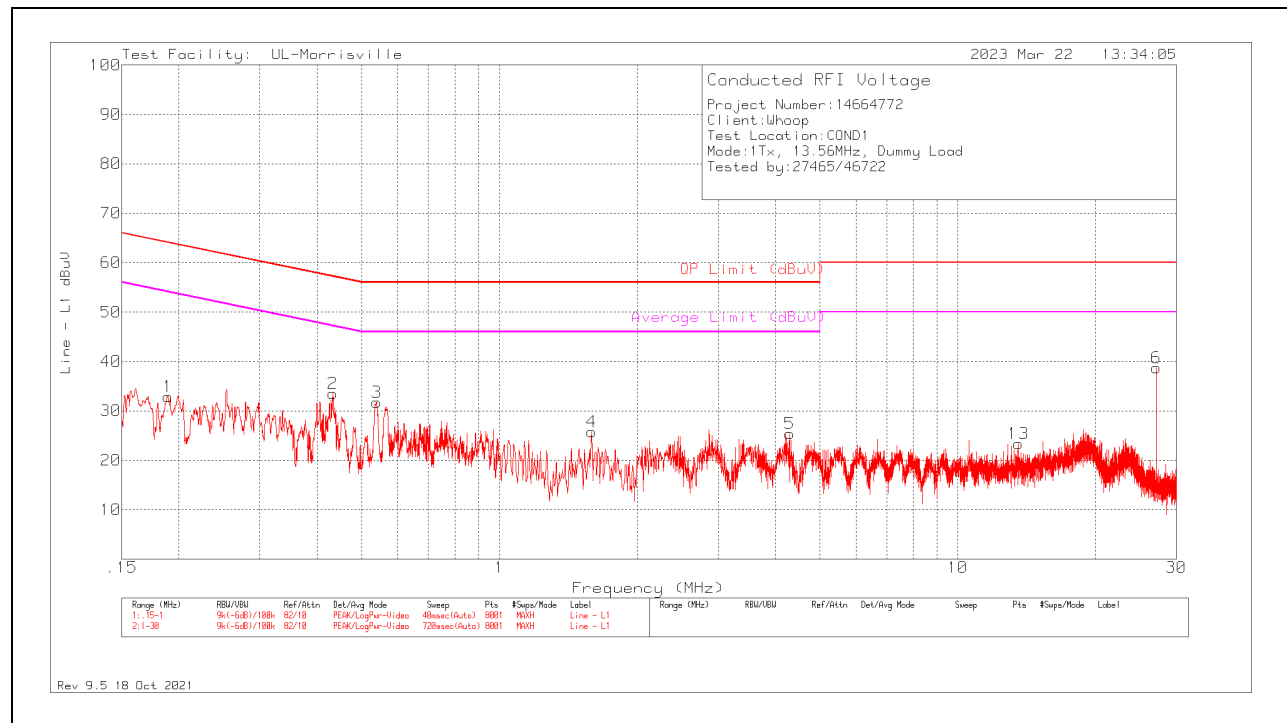
Qp - Quasi-Peak detector

Av - Average detection

*Note: Fundamental Frequency

11.1.2. CONFIG 2

LINE 1 RESULTS

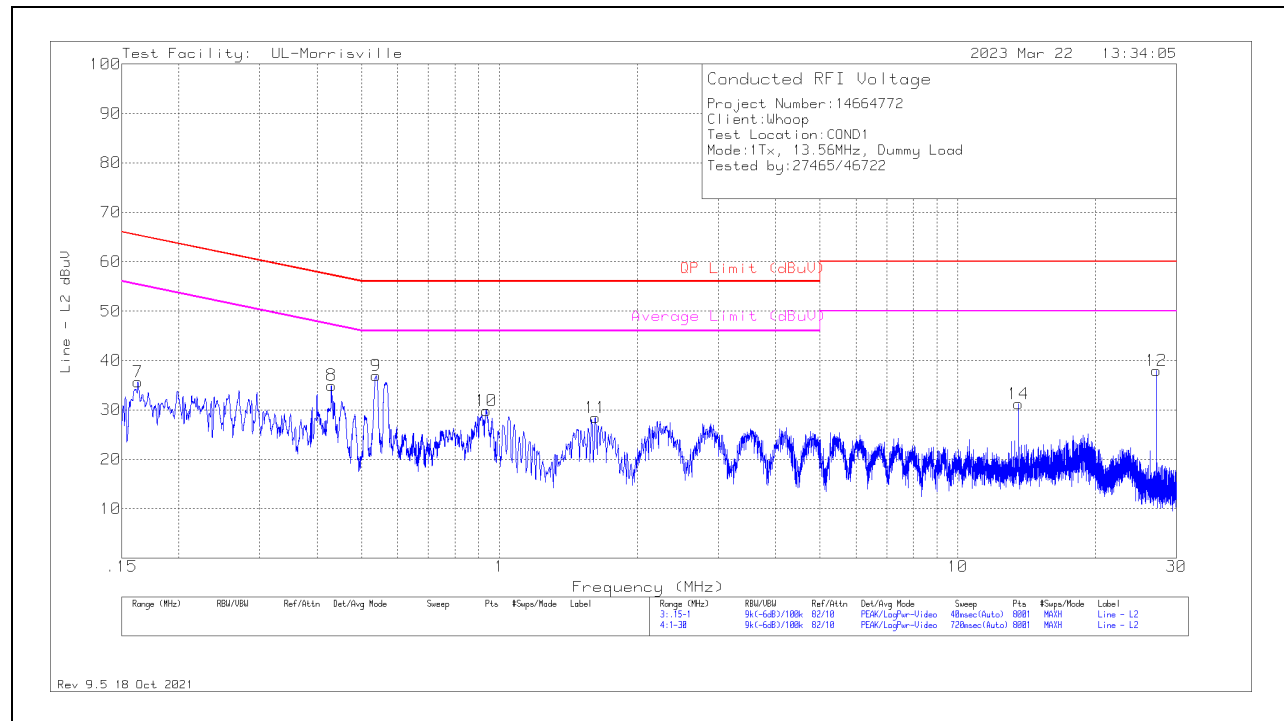


WORST EMISSIONS

Range 1: Line - L1										
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	.18906	22.92	Pk	.2	9.8	32.92	64.08	-31.16	54.08	-21.16
2	.43307	23.75	Pk	0	9.8	33.55	57.19	-23.64	47.19	-13.64
3	.5396	21.93	Pk	0	9.8	31.73	56	-24.27	46	-14.27
4	1.59088	15.94	Pk	0	9.8	25.74	56	-30.26	46	-20.26
5	4.29513	15.5	Pk	0	9.9	25.4	56	-30.6	46	-20.60
6	27.12175	28.22	Pk	.3	10.2	38.72	60	-21.28	50	-11.28
13	13.56063	13.27	Pk	.1	10	23.37	60	-36.63	50	-26.63

Pk - Peak detector

LINE 2 RESULTS



WORST EMISSIONS

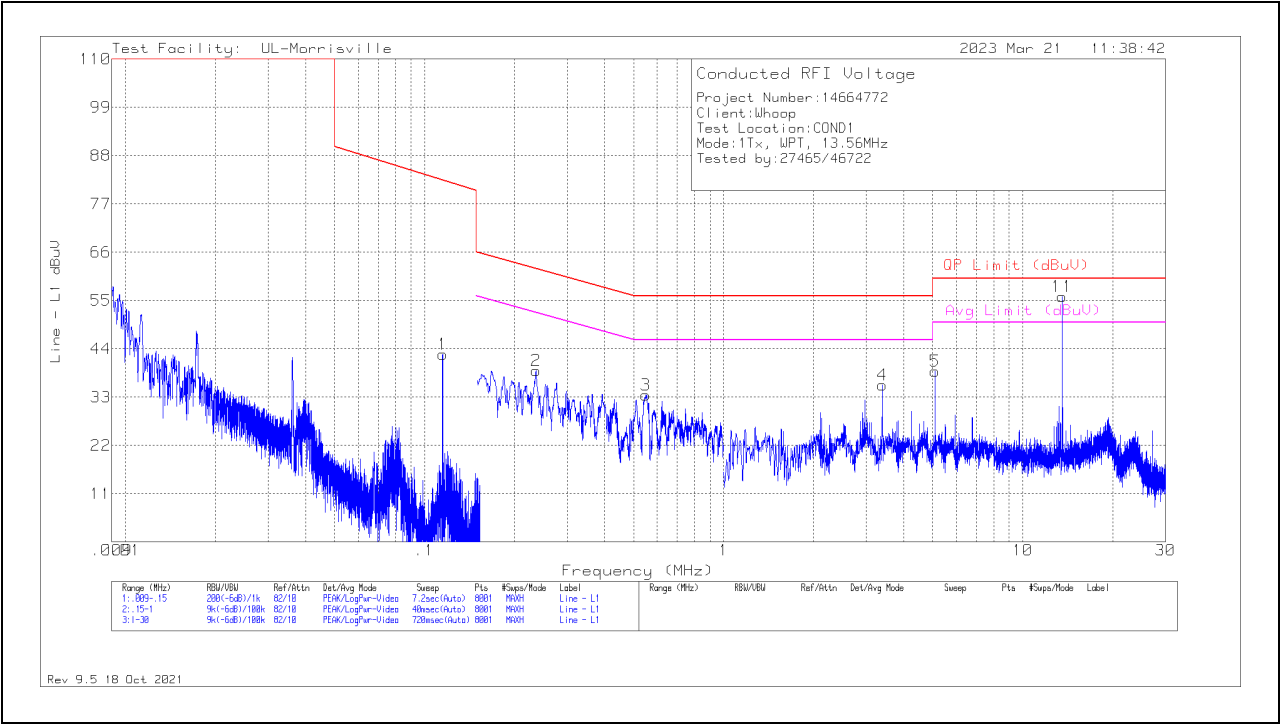
Range 2: Line - L2										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN VCF (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Average Limit (dBuV)	Margin (dB)
7	.16272	25.73	Pk	.2	9.8	35.73	65.32	-29.59	55.32	-19.59
8	.42995	25.18	Pk	0	9.8	34.98	57.25	-22.27	47.25	-12.27
9	.53828	27.13	Pk	0	9.8	36.93	56	-19.07	46	-9.07
10	.93785	20.07	Pk	0	9.8	29.87	56	-26.13	46	-16.13
11	1.61988	18.69	Pk	0	9.8	28.49	56	-27.51	46	-17.51
12	27.12175	27.52	Pk	.3	10.2	38.02	60	-21.98	50	-11.98
14	13.56063	21.14	Pk	.1	10	31.24	60	-28.76	50	-28.76

Pk - Peak detector

11.2. RSS-216 AC MAINS LINE CONDUCTED

11.2.1. CONFIG 1

LINE 1 RESULTS

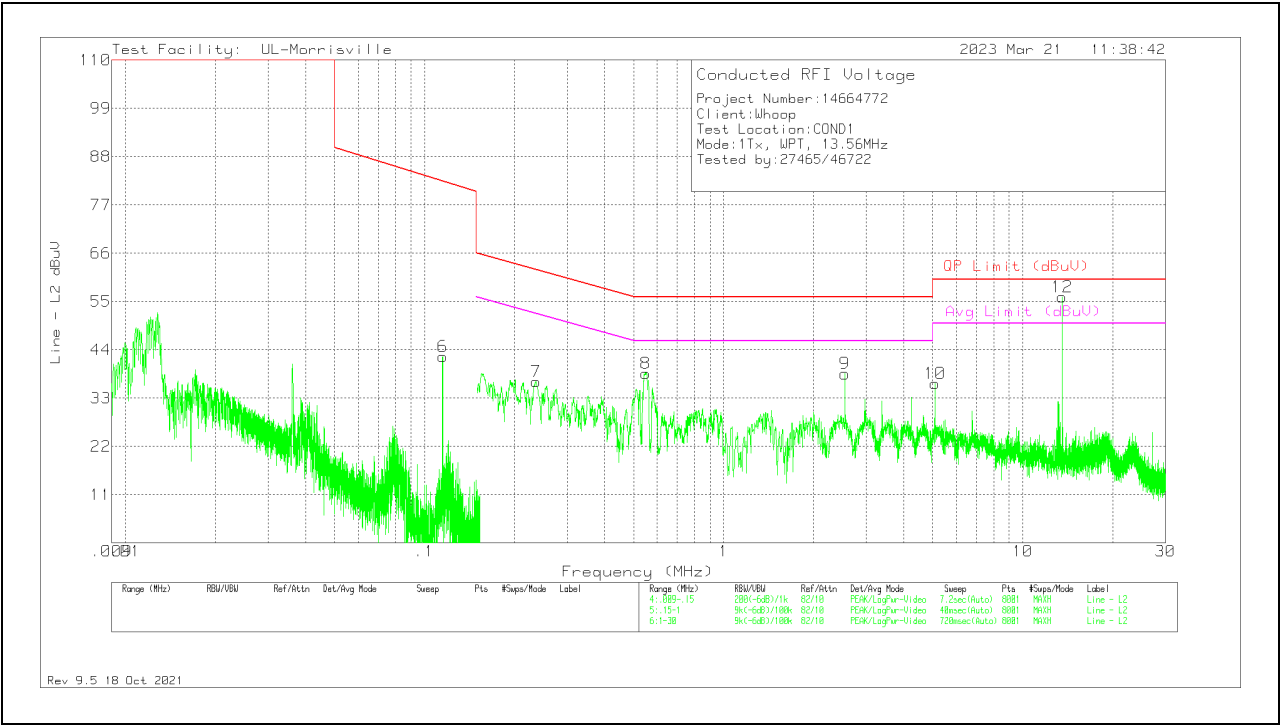


WORST EMISSIONS

Range 1: Line - L1										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN001 (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Avg Limit (dBuV)	Margin (dB)
1	.11493	32.92	Pk	.1	9.8	42.82	82.35	-39.53	-	-
2	.23597	29.24	Pk	0	9.8	39.04	62.19	-23.15	52.19	-13.15
3	.54925	23.75	Pk	0	9.8	33.55	56	-22.45	46	-12.45
4	3.3925	25.89	Pk	0	9.9	35.79	56	-20.21	46	-10.21
5	5.08175	29.03	Pk	0	9.9	38.93	60	-21.07	50	-11.07
11*	13.5598	45.53	Qp	.1	10	55.63	60	-4.14	-	-
*	13.5607	45.27	Av	.1	10	55.37	-	-	50	5.37

Pk - Peak detector
Qp - Quasi-Peak detector
Av - Average detection
*Note: Fundamental Frequency

LINE 2 RESULTS



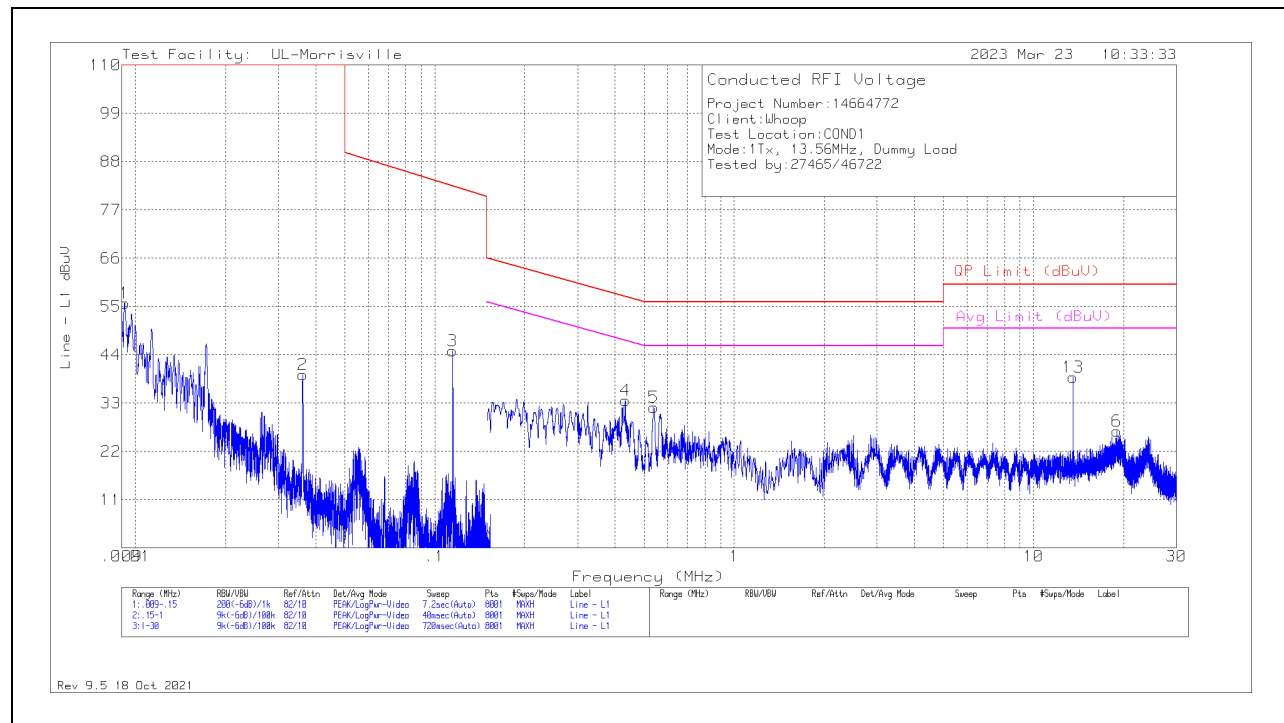
WORST EMISSIONS

Range 2: Line - L2										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN001 (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Avg Limit (dBuV)	Margin (dB)
6	.11491	32.54	Pk	.1	9.8	42.44	82.36	-39.92	-	-
7	.23565	26.93	Pk	0	9.8	36.73	62.2	-25.47	52.2	-15.47
8	.54845	28.86	Pk	0	9.8	38.66	56	-17.34	46	-7.34
9	2.54063	28.76	Pk	0	9.8	38.56	56	-17.44	46	-7.44
10	5.08538	26.45	Pk	0	9.9	36.35	60	-23.65	50	-13.65
12*	13.5594	45.32	Qp	.1	10	55.42	60	-4.58	-	-
*	13.5599	45.43	Av	.1	10	55.53	-	-	50	5.53

Pk - Peak detector
Qp - Quasi-Peak detector
Av - Average detection
*Note: Fundamental Frequency

11.2.2. CONFIG 2

LINE 1 RESULTS

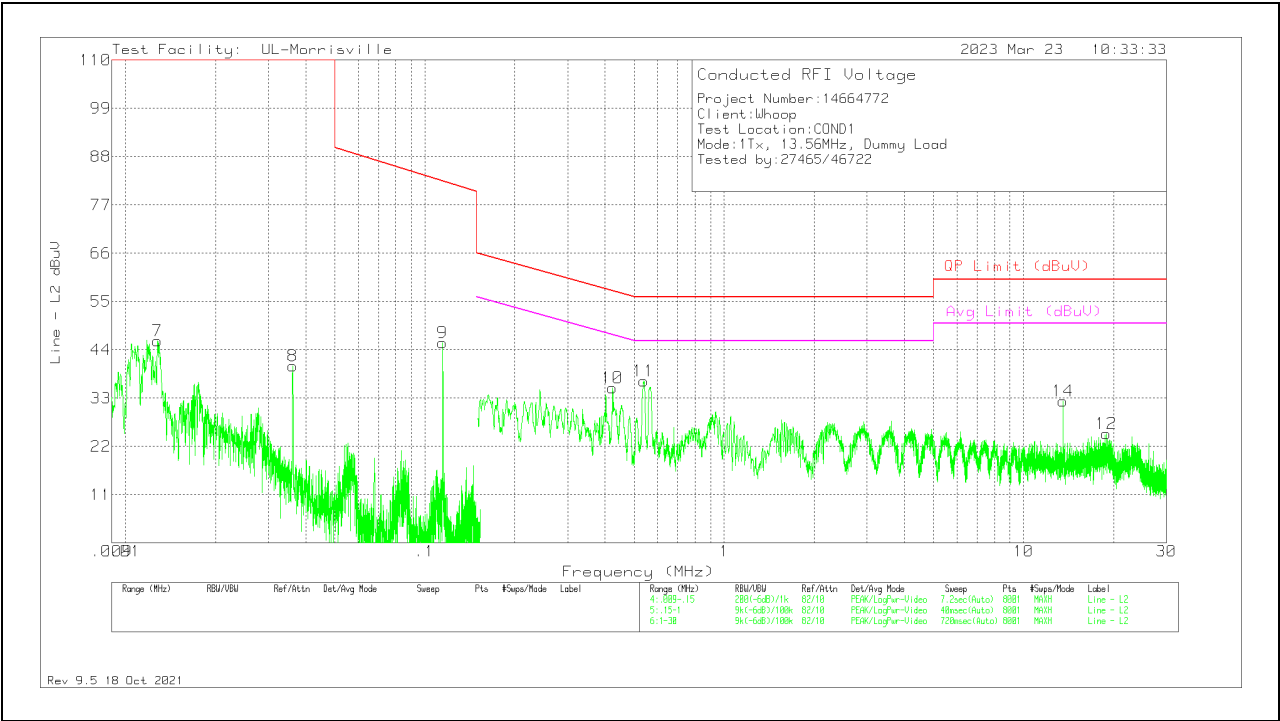


WORST EMISSIONS

Range 1: Line - L1										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN001 (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Avg Limit (dBuV)	Margin (dB)
1	.0092	40.27	Pk	5	10.5	55.77	110	-54.23	-	-
2	.0362	28.88	Pk	.6	10	39.48	110	-70.52	-	-
3	.11475	35.07	Pk	.1	9.8	44.97	82.37	-37.4	-	-
4	.43281	23.88	Pk	0	9.8	33.68	57.19	-23.51	47.19	-13.51
5	.53833	22.31	Pk	0	9.8	32.11	56	-23.89	46	-13.89
6	18.99088	16.43	Pk	.1	10.1	26.63	60	-33.37	50	-23.37
13	13.56063	28.84	Pk	.1	10	38.94	60	-21.06	50	-11.06

Pk - Peak detector

LINE 2 RESULTS



WORST EMISSIONS

Range 2: Line - L2										
Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	LISN001 (dB)	Cbl/Limiter (dB)	Corrected Reading dBuV	QP Limit (dBuV)	Margin (dB)	Avg Limit (dBuV)	Margin (dB)
7	.0128	32.34	Pk	3.3	10.4	46.04	110	-63.96	-	-
8	.0362	29.8	Pk	.6	10	40.4	110	-69.6	-	-
9	.11476	35.71	Pk	.1	9.8	45.61	82.37	-36.76	-	-
10	.42369	25.56	Pk	0	9.8	35.36	57.36	-22	47.36	-12
11	.53934	27.15	Pk	0	9.8	36.95	56	-19.05	46	-9.05
12	18.87669	14.65	Pk	.1	10.1	24.85	60	-35.15	50	-25.15
14	13.56063	22.2	Pk	.1	10	32.3	60	-27.7	50	-17.7

Pk - Peak detector

12. SETUP PHOTOS

Please refer to R14664772-EP1 for setup photos

END OF TEST REPORT