FCC 47 CFR PART 15 SUBPART F
ISED RSS-220 ISSUE 1 + A1

TEST REPORT

FOR

ULTRA WIDEBAND SENSOR

MODEL NUMBER: RTS200G

FCC ID: 2AK3W-RTS200G
IC: 22510-RTS200G

REPORT NUMBER: R14672943-E1

ISSUE DATE: 2024-02-28

Prepared for
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4125 LAFAYETTE CENTER DRIVE, SUITE 200
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CERT #0751.06

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2023-04-03	Initial Issue	M. Antola
V2	2024-02-28	Misc. editorial update	M. Antola

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: PANERATECH, INC.
4125 Lafayette Drive, Suite 200
Chantilly, VA, 20151, USA

EUT DESCRIPTION: Ultra-wideband Sensor

MODEL: RTS200G

SERIAL NUMBER: Non-serilaized production unit

DATE TESTED: 2023-03-13 to 2023-03-29

SAMPLE RECEIPT DATE: 2023-03-13

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart F	Complies
ISED RSS-220 Issue 1 + A1	Complies
ISED RSS-GEN Issue 5 + A1 + A2	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.

Approved & Released For
UL LLC By:

Bob DeLisi
Principal Engineer
UL LLC

Prepared By:

Mike Antola
Staff Engineer
UL LLC

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC KDB 393764, ANSI C63.10-2013, RSS-GEN Issue 5 + A1 + A2, and RSS-220 Issue 1 + A1.

This report contains data provided by the customer 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.

Below is a list of the data provided by the customer:

1. Antenna gain and type (see Section 5.4)

3. 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

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. 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

4.3. MEASUREMENT UNCERTAINTY

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

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.4 dB
Radiated Disturbance, All ranges	6.0 dB

All measurements with the exception of AC power line conducted emissions performed over the air, radiated.

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

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is an Ultra Wide Band transceiver, utilized as a wall imaging system. The EUT is used in the glass manufacturing industry to monitor structural health of the walls of high temperature melters made out of specialty refractory bricks.

5.2. OPERATING FREQUENCY RANGE

The UWB radio operates over a nominal frequency range of 2000 to 8000 MHz. The measured UWB bandwidths of all channels lie within this range.

5.3. MAXIMUM OUTPUT POWER

The UWB transmitter has a maximum radiated output power as follows:

Max Pk Field Strength (dBuV/m)	Peak Output Power (dBm/MHz EIRP)	Peak Output Power (uW/MHz EIRP)
63.29	-31.91	0.644

The peak power was derived from a maximum field strength of:

63.29 dBuV/m – 95.2 (3M) = -31.91 dBm/MHz

5.4. DESCRIPTION OF AVAILABLE ANTENNAS

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

The radio utilizes two custom TEM horn antennas, with a maximum gain of 2.2 dBi.

5.5. SOFTWARE AND FIRMWARE

The firmware installed in the EUT during testing was Ver. 6070.
The test utility software used during testing was ProbeAdmin, Ver. 7.5.29.159.

5.6. WORST-CASE CONFIGURATION

The EUT was orientated downward into a sand bed as outlined in C63.10: 2013, Section 10.2.2.

5.7. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST			
Description	**Manufacturer**	**Model**	**Serial Number**
Controller/Cable	Panera Tech	Controller	SM-A0003-01
Handheld Computer	Panasonic	FZ-E1	6JKSA08399
Computer Power Supply	Panasonic	CF-AA6373A	6373AJ316401581C

I/O CABLES

I/O Cable List						
Cable No.	**Port**	**# of Identical Ports**	**Connector Type**	**Cable Type**	**Cable Length**	**Remarks**
1	USB	1	LEMO M, F	Armored USB	< 3M	Integrated into Controller/Cable
2	Power	1	LS18, 3 Pin US Plug	AC Power	< 3M	Used to power handheld computer

SETUP DIAGRAM FOR TESTS

Refer to Setup Photo Exhibit R14672943-EP1 for details.

6. 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 1)

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				
159203	Hybrid Broadband Antenna	Sunol Sciences Corp.	JB3	2023-01-23	2024-01-31
	1-18 GHz				
89509	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2022-05-11	2023-05-11
135143	Double-Ridged Waveguide Horn Antenna, 1 to 18 GHz	ETS Lindgren	3117	2023-01-19	2024-01-19
	18-40 GHz				
204704	Horn Antenna, 18-26.5GHz	Com-Power	AH-626	2022-07-11	2023-07-11
204705	Horn Antenna, 26-40GHz	Com-Power	AH-640	2022-07-11	2023-07-11
	Gain-Loss Chains				
91974	Gain-loss string: 0.009-30MHz	Various	Various	2022-05-05	2023-05-05
91976	Gain-loss string: 25-1000MHz	Various	Various	2022-05-05	2023-05-05
91979	Gain-loss string: 1-18GHz	Various	Various	2022-12-02	2023-12-02
135999	Gain-loss string: 18-40GHz	Various	Various	2022-05-05	2023-05-05
	Receiver & Software				
197955	Spectrum Analyzer	Rohde & Schwarz	ESW44	2022-03-08	2023-03-31
90411	Spectrum Analyzer	Keysight	N9030A	2022-08-02	2023-08-02
214284	Spectrum Analyzer	Rohde & Schwarz	FSW50	2023-01-24	2024-01-24
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		
	Additional Equipment used				
200539	Environmental Meter	Fisher Scientific	15-077-963	2022-10-05	2023-10-05

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

Equip. 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
SOFTEMI	EMI Software	UL	Version 9.5 (18 Oct 2021)		

7. UWB TEST PROCEDURES

TEST PROCEDURES

All RF characteristics of the EUT are made using radiated measurements.

For Occupied Bandwidth, in order to capture the waveform, the EUT was placed on a non-reflective surface and pointed directly toward the Receive antenna. Due to the low amplitude of the transmit signal, the Receive antenna was moved as close as necessary to obtain a measureable signal.

For Radiated Emissions testing, the EUT was configured so that the transmit antenna was facing down in a bed of dry sand as described in ANSI C63.10: 2013 Section 10.2.2. The dry sand had a depth of 50 cm and the surface of the sand that the EUT was placed on was 80 cm above the ground reference plane. The EUT is set to transmit in a continuous mode.

For measurements below 960 MHz the antenna is located 3 meters from the EUT. The resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements in the 30 to 960 MHz range, 9kHz for peak and/or quasi-peak detection measurements in the 0.15 MHzto 30 MHz range and 200 Hz for peak and/or quasi-peak detection measurements in the 9 kHz to 150 kHz range. Peak detection is used unless otherwise noted as quasi-peak or average (9kHz to 90 kHz and 110 kHz to 490 kHz).

For 1 MHz RBW final measurements above 960 MHz the antenna is located no more than 3 meter from the EUT. The RBW and VBW are both set to 1 MHz. A R&S FSW signal analyzer with a true RMS detector is utilized. The number of points is equal to (Frequency Span in MHz) and the sweep time is set to no more than (Frequency Span in MHz) milliseconds so as not to exceed the maximum 1 ms averaging time.

A R&S FSW signal analyzer with a true RMS detector is utilized for measurements in the frequency ranges of 1164 to 1240 MHz and 1559 to 16160 MHz with the antenna located 3 meters from the EUT. The RBW is set to 3 kHz and the VBW is set to 10 kHz.

The resulting 3 meter field strength is converted to EIRP using the equation P (dBm EIRP) = E (dBuV/m) – 95.2 per C63.10: 2013, Section 10.3.9.

Measurements used for calculating bandwidth, peak power, and the peak level of digital device emissions are made using peak detection.

8. LIMITS AND RESULTS

8.1. 99% BANDWIDTH

LIMITS

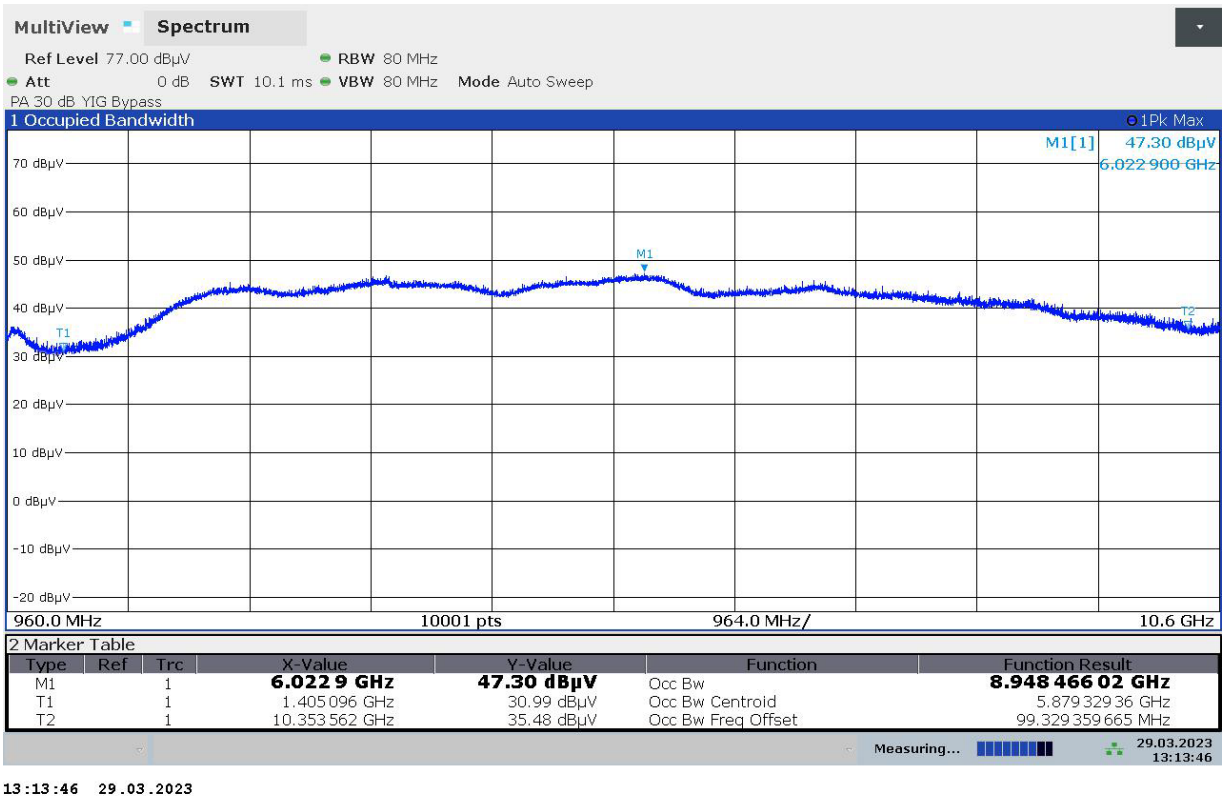
None; for reporting purposes only.

TESTED BY

Employee IDs: 23854
Test Dates: 2023-03-29
Test Location: Chamber 1

RESULTS

99% Bandwidth (MHz)
8948.5



8.2. UWB BANDWIDTH, CENTER FREQUENCY, AND FRACTIONAL BW

DEFINITIONS AND LIMITS

§15.503 Definitions.
(a) UWB Bandwidth. For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated fH and the lower boundary is designated f_L. The frequency at which the highest radiated emission occurs is designated f_M.
(b) Center frequency. The center frequency, f_C, equals $(f_H + f_L)/2$.
(c) Fractional bandwidth. The fractional bandwidth equals $2(f_H - f_L)/ (f_H + f_L)$.
(d) Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

§15.509 (a) The UWB bandwidth of an imaging system operating under the provisions of this section must be below 10.6 GHz.

RSS-220 6.2.1 (a) - The -10 dB UWB bandwidth for GPR or an in-wall radar imaging device shall be entirely below 10.6 GHz.

TEST PROCEDURE

Radiated measurements are made using the procedures described above. The detection mode is set to peak detection, RBW/VBW = 1 MHz/3 MHz, the sweep time is AUTO, and the Max Hold trace function is utilized. The frequency range from 960 MHz to 10.6 GHz is measured.

The frequency at which the maximum EIRP is measured is designated as f_M. A major graticule line of the plot is adjusted to exactly equal the peak EIRP at f_M. The spectral envelope at the major graticule line that is 10 dB below the reference graticule is examined to determine the frequency band bounded by the points that are 10 dB below the highest radiated emission. The upper boundary is designated f_H and the lower boundary is designated f_L.

The center frequency, f_C, is calculated as $(f_H + f_L)/2$.

The RX antenna polarization that yields the highest EIRP at f_M is used to calculate the above parameters. In this case, the vertical polarity yielded the highest EIRP.

TESTED BY

Employee IDs: 23854
Test Dates: 2023-03-14
Test Location: Chamber 1

RESULTS

f Max (GHz)	Reference Amplitude at f Max (dBuV)	10 dB down from Reference Amplitude (dBuV)
5.985	34.6	24.6

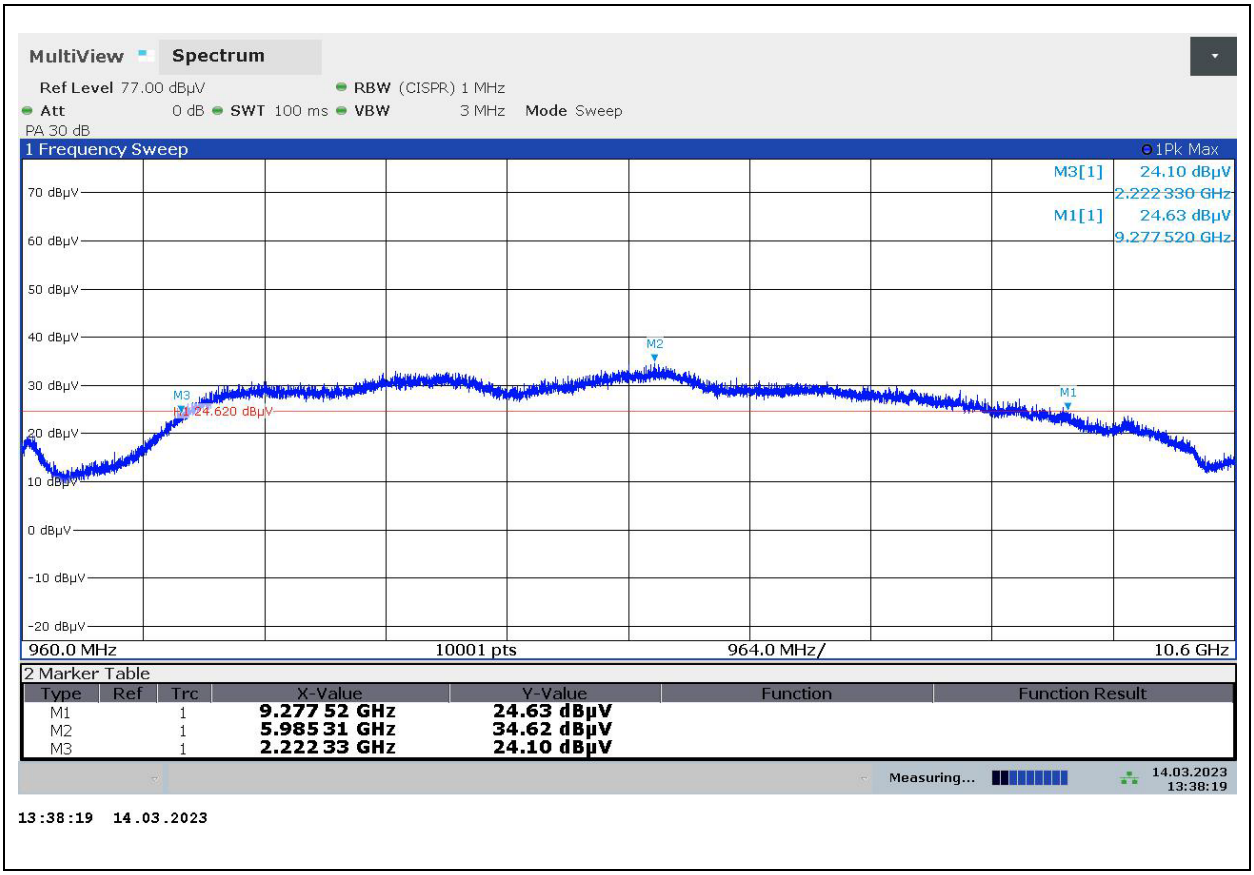
f Low (GHz)	Minimum f Low (GHz)
2.222	None

f High (GHz)	Maximum f High (GHz)
9.278	10.6

f Center (GHz)
5.750

UWB BW (MHz)	Minimum UWB BW (MHz)
7055	500

PLOT



8.3. TRANSMISSION TIME

LIMITS

FCC §15.509 (c)

A GPR that is designed to be operated while being hand held and a wall imaging system shall contain a manually operated switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. In lieu of a switch located on the imaging system, it is permissible to operate an imaging system by remote control provided the imaging system ceases transmission within 10 seconds of the remote switch being released by the operator.

ISED RSS-220 6.2.1 (b)

A device operating under the provisions of this section shall contain a mechanism that deactivates the equipment when normal use is interrupted. For manually operated hand-held devices, this mechanism shall contain a manual switch that causes the transmitter to cease operation within 10 seconds of being released by the operator. In lieu of remotely/computer controlled equipment with a switch located on the radar imaging device, it is permissible to operate the device by a remote control unit provided that deactivation takes place within 10 seconds of the remote switch being released by the operator.

TEST PROCEDURE

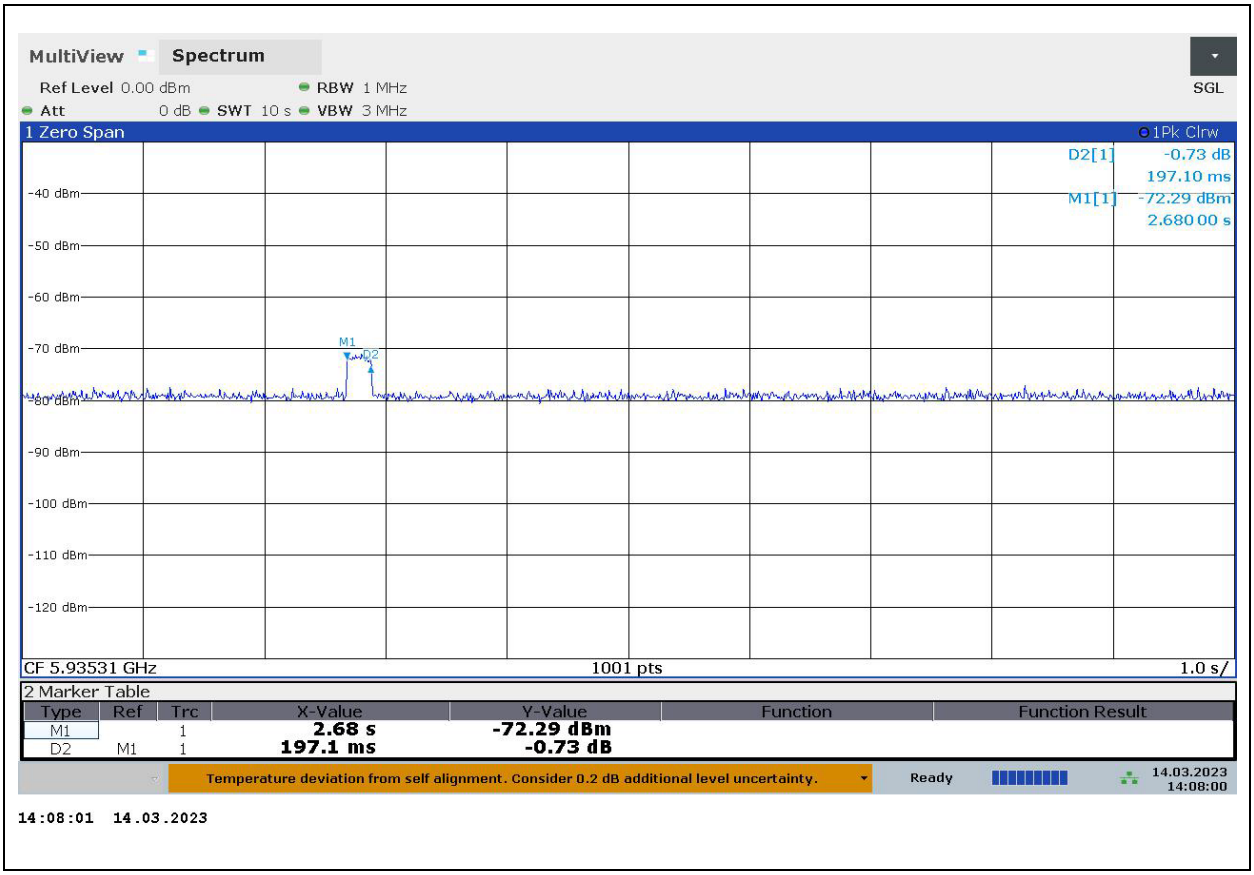
The measurements are performed radiated, over the air. The RBW is set to 1MHz and the VBW is set to 3MHz. The sweep time is set to 10 seconds and the span is set to 0 Hz.

RESULTS

The time indicated is time period for the radar turn on and off.

TESTED BY

Employee IDs: 23854
Test Dates: 2023-03-14
Test Location: Chamber 1



Time denotes total time from the remote button press commanding radar on to button release and radar off. The measured time was 197.1 ms.

8.4. PEAK POWER

LIMIT

§15.509 (f) For UWB devices where the frequency at which the highest radiated emission occurs, f_M, is above 960 MHz, there is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on f_M. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in § 15.521.

§15.521 (e) The frequency at which the highest radiated emission occurs, f_M, must be contained within the UWB bandwidth.

§15.521 (g) When a peak measurement is required, it is acceptable to use a resolution bandwidth other than the 50 MHz specified in this subpart. This resolution bandwidth shall not be lower than 1 MHz or greater than 50 MHz, and the measurement shall be centered on the frequency at which the highest radiated emission occurs, fM. If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed. This may be converted to a peak field strength level at 3 meters using E(dBuV/m) = P(dBm EIRP) + 95.2. If RBW is greater than 3 MHz, the application for certification filed with the Commission must contain a detailed description of the test procedure, calibration of the test setup, and the instrumentation employed in the testing.

RSS-220 6.2.1 (g) The peak level of the transmissions shall not exceed the peak equivalent of the average limit contained within any 50 MHz bandwidth, as defined in section 4 of the Annex.

TEST PROCEDURE

Radiated measurements are made using the procedures described above.

The spectrum analyzer center frequency is set to f_M. The RBW and VBW are both set to 50 MHz. The detector function is set to peak.

The instrumentation used is a R&S signal analyzer, model FSW50, which includes a standard RBW of 50 MHz. Thus, no correction to the limit is required and the E-field equivalent limit is defined as follows:

Peak E-field (3m) E(dBuV/m) = P(dBm EIRP) + 95.2 = 0 dBm + 95.2 = 95.2 dBuV/m

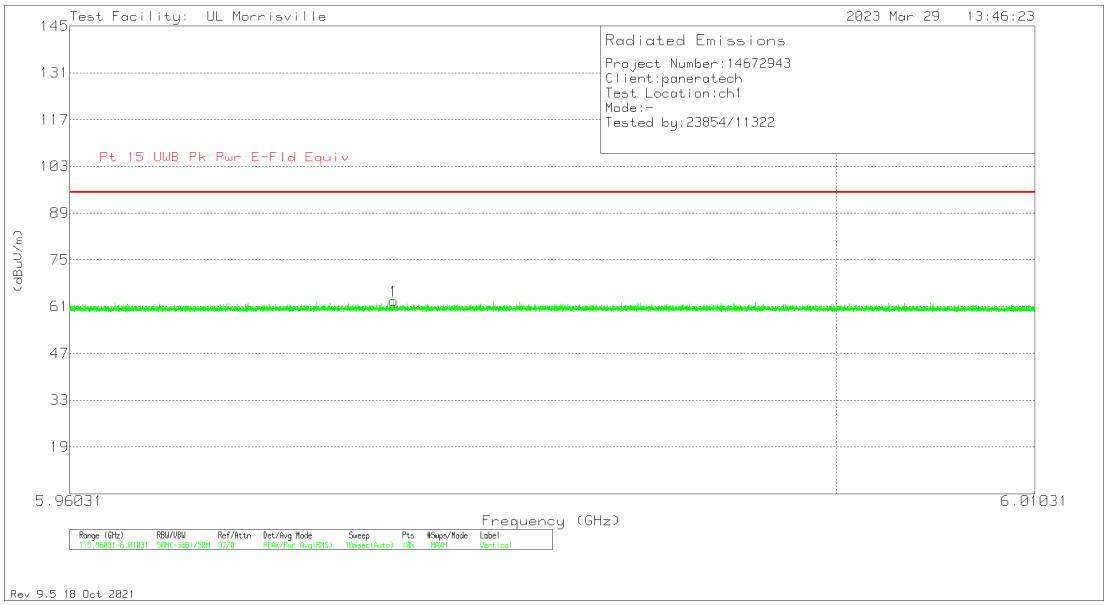
TESTED BY

Employee IDs: 23854
Test Dates: 2023-03-29
Test Location: Chamber 1

RESULTS

Horizontal

Vertical



Frequency (MHz)	Meter Reading (dBuV)	Det	89509 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	Pt 15 UWB Pk Pwr E-Fld Equiv (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
6.27485	61.5	Pk	35.4	-33.9	63	95.2	-32.2	115	174	H
5.97704	62.17	Pk	35	-34.5	62.67	95.2	-32.53	38	137	V

Pk - Peak detector

8.5. RADIATED EMISSIONS ABOVE 960 MHz

LIMITS

§15.509 (d) The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz.

RSS-220 6.2.1 (d) - Radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz.

Frequency in MHz	EIRP in dBm
960-1610	-65.3
1610-1990	-53.3
1990-3100	-51.3
3100-10600	-41.3
Above 10600	-51.3

15.509 (e) In addition to the radiated emission limits specified in the table in paragraph (d) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz.

RSS-220 6.2.1 (e) - In addition to the limits specified in paragraph (d) of this section, radiated emissions shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz. The measurements shall demonstrate compliance with the stated limits at whatever resolution bandwidth is used.

Frequency in MHz	EIRP in dBm
1164-1240	-75.3
1559-1610	-75.3

§15.521 (d) Within the tables in §§15.509, 15.511, 15.513, 15.515, 15.517, and 15.519, the tighter emission limit applies at the band edges. Radiated emission levels above 960 MHz are based on RMS average measurements over a 1 MHz resolution bandwidth. The RMS average measurement is based on the use of a spectrum analyzer with a resolution bandwidth of 1 MHz, an RMS detector, and a 1 millisecond or less averaging time.

§15.521 (e) The frequency at which the highest radiated emission occurs, f_M, must be contained within the UWB bandwidth.

TEST PROCEDURE

Radiated measurements are made using the procedures described in ANSI C63.10: 2013 Section 10.3. RBW/VBW = 1MHz/3MHz, the sweep time is set to 1ms/MHz, and the detector function is set to RMS average.

For the requirements of §15.509 (e), an RBW of 3 kHz is utilized in the 1164-1240 MHz and 1559-1610 MHz frequency ranges.

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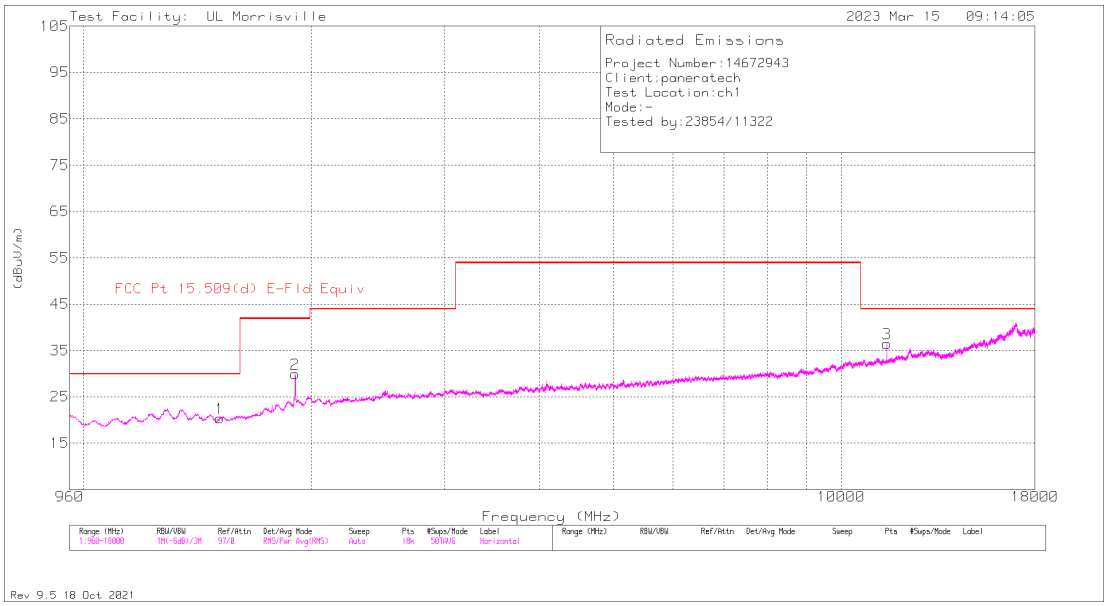
RESULTS - 960 MHz TO 18 GHz, 1 MHz BW

Horizontal



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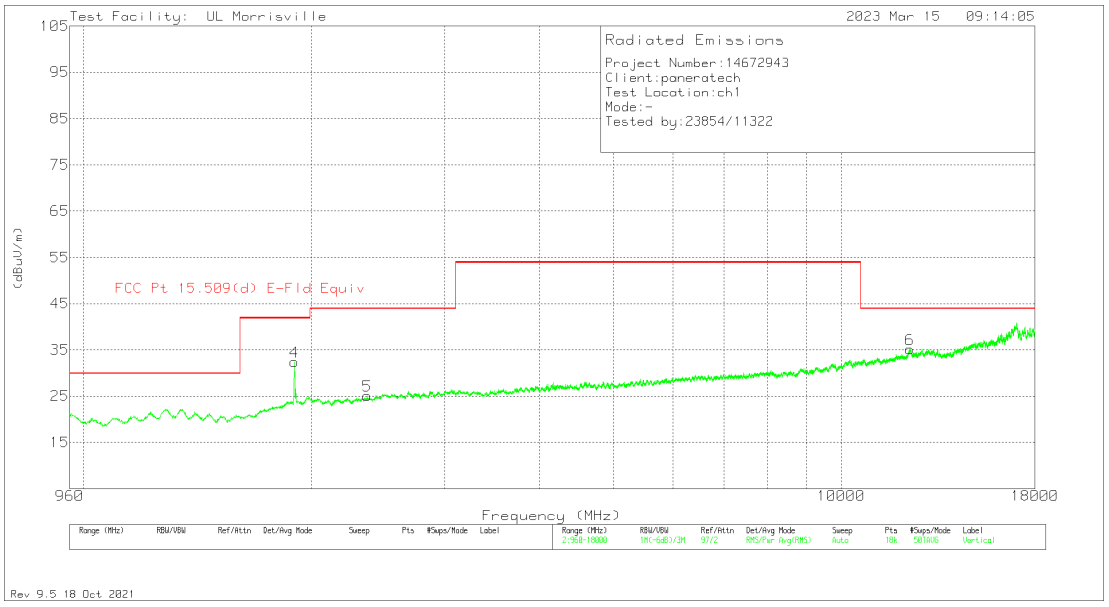
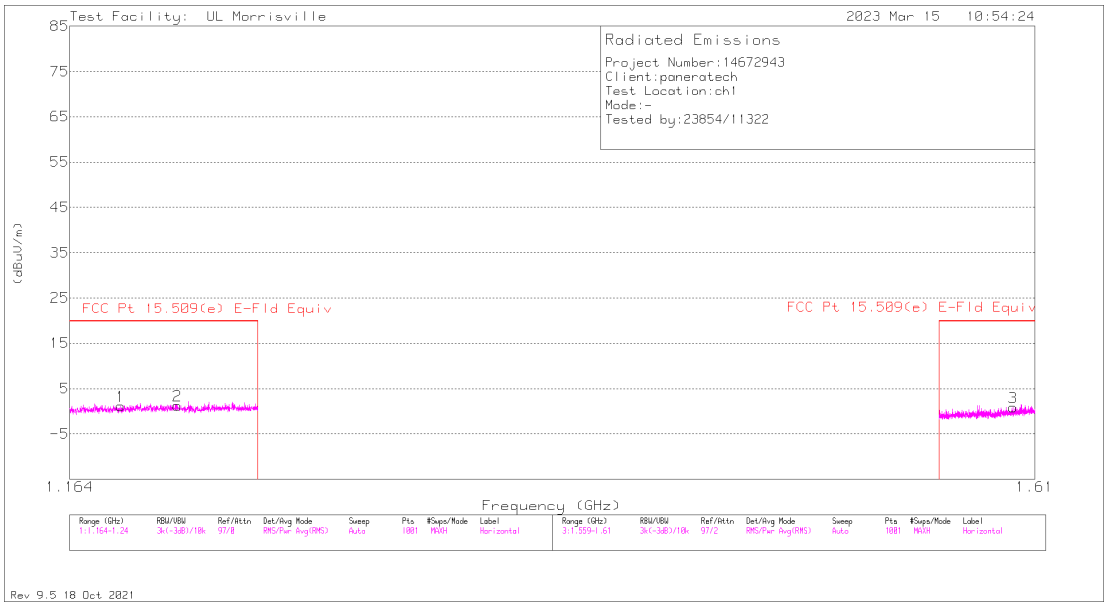


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135143 (dB/m)	Gain/Loss (dB)	DCF (dB)	Corrected Reading (dBuV/m)	FCC Pt 15.509(d) E-Fld Equiv (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1515.6935	33.12	RMS	28.1	-37.4	-3.5	20.32	29.9	-9.58	118	200	H
4	1899.0937	41.75	RMS	31.3	-37.1	-3.5	32.45	41.9	-9.45	198	101	V
2	1903.827	39.1	RMS	31.3	-37	-3.5	29.9	41.9	-12	339	200	H
5	2370.5338	32.82	RMS	32	-36.3	-3.5	25.02	43.9	-18.88	185	200	V
3	11479.3637	30.64	RMS	38.1	-28.8	-3.5	36.44	43.9	-7.46	250	200	H
6	12320.004	27.37	RMS	38.9	-27.6	-3.5	35.17	43.9	-8.73	29	101	V

RMS - RMS detection

RESULTS - 1.164 TO 1.240 GHz & 1.559 TO 1.610 GHz, 3 kHz BW

Horizontal



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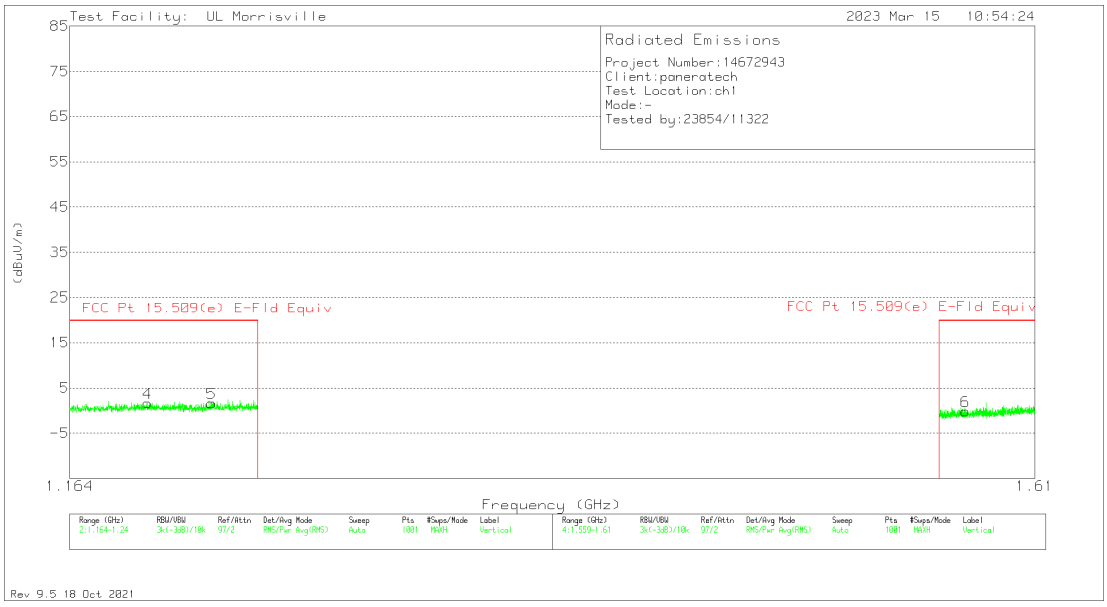
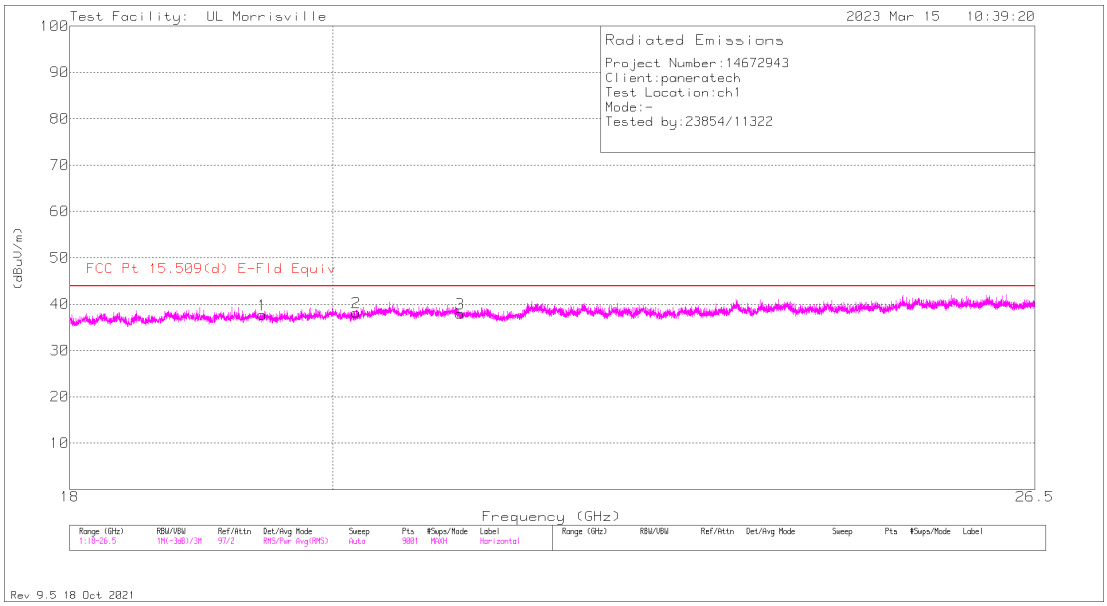


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	89509 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC Pt 15.509(e) E-Fld Equiv (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	1.18422	10.88	RMS	28.6	-38.3	1.18	19.9	-18.72	0-360	200	H
4	1.19493	11.08	RMS	28.7	-38.1	1.68	19.9	-18.22	0-360	200	V
2	1.20694	10.61	RMS	28.7	-38.1	1.21	19.9	-18.69	0-360	200	H
5	1.22085	10.94	RMS	28.9	-38.2	1.64	19.9	-18.26	0-360	101	V
6	1.57292	9.15	RMS	28.2	-37.5	-.15	19.9	-20.05	0-360	101	V
3	1.59827	9.86	RMS	28.4	-37.4	.86	19.9	-19.04	0-360	200	H

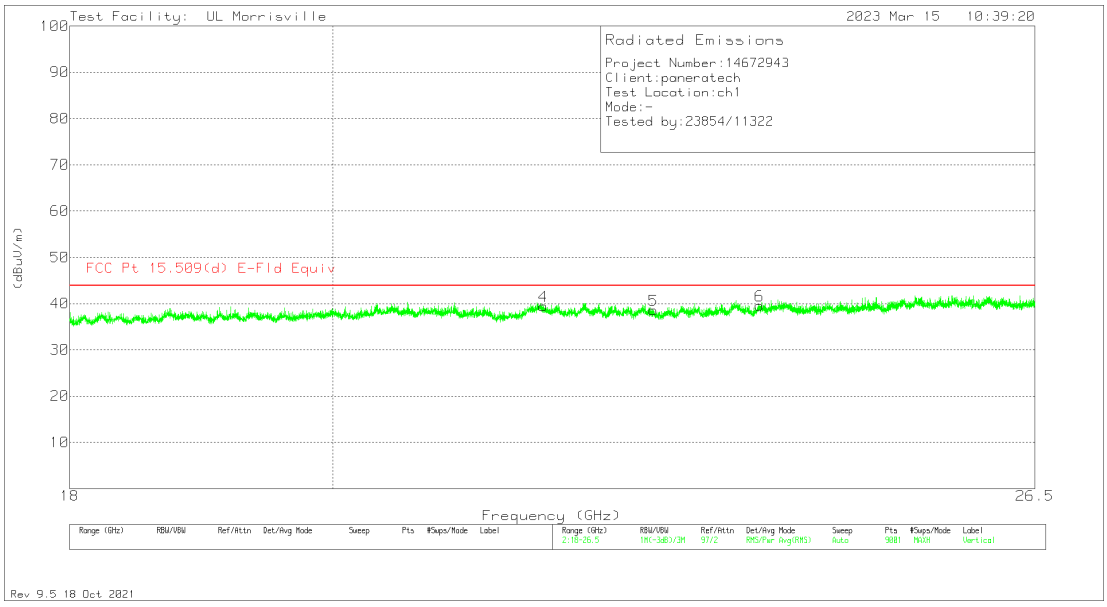
RMS - RMS detection

RESULTS - 18 TO 26.5 GHz, 1 MHz BW

Horizontal



Vertical

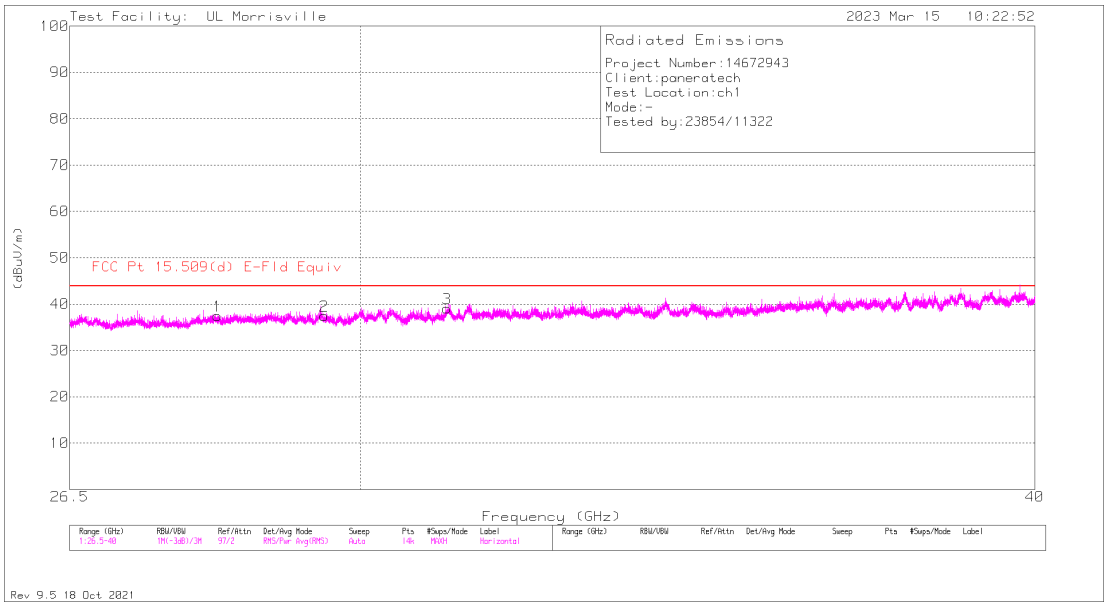


Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	204704 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC Pt 15.509(d) E-Fld Equiv (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	19.445	43.07	RMS	33.5	-38.9	37.67	43.9	-6.23	0-360	199	H
2	20.19017	43.84	RMS	33.7	-39.3	38.24	43.9	-5.66	0-360	199	H
3	21.04772	43.23	RMS	34	-39.3	37.93	43.9	-5.97	0-360	300	H
4	21.76455	44.11	RMS	34.5	-39.2	39.41	43.9	-4.49	0-360	300	V
5	22.743	43.67	RMS	34.3	-39.4	38.57	43.9	-5.33	0-360	300	V
6	23.73278	43.55	RMS	35.1	-39.1	39.55	43.9	-4.35	0-360	300	V

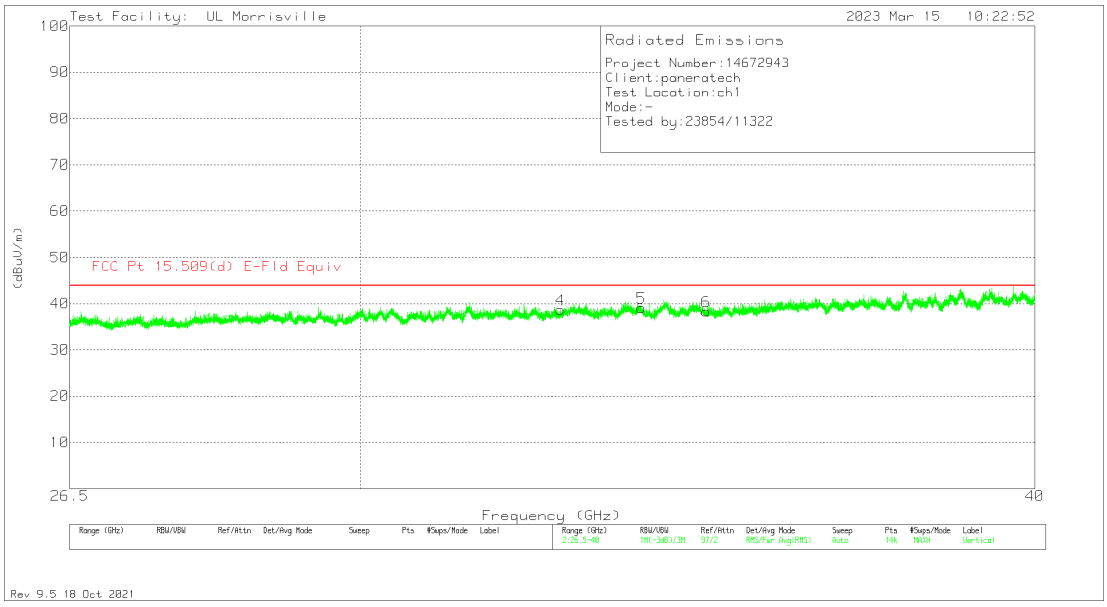
RMS - RMS detection

RESULTS - 26.5 TO 40 GHz, 1 MHz BW

Horizontal



Vertical



Marker	Frequency (GHz)	Meter Reading (dBuV)	Det	204705 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	FCC Pt 15.509(d) E-Fld Equiv (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	28.22607	41.02	RMS	36.6	-40.2	37.42	43.9	-6.48	0-360	300	H
2	29.53847	41.01	RMS	36.5	-40	37.51	43.9	-6.39	0-360	300	H
3	31.12568	41.3	RMS	37	-39.2	39.1	43.9	-4.8	0-360	101	H
4	32.67143	41.31	RMS	37.4	-40	38.71	43.9	-5.19	0-360	101	V
5	33.81893	41.23	RMS	37.4	-39.5	39.13	43.9	-4.77	0-360	300	V
6	34.7649	41.07	RMS	37.9	-40.6	38.37	43.9	-5.53	0-360	200	V

RMS - RMS detection

8.6. RADIATED EMISSIONS AT OR BELOW 960 MHz

LIMITS

§15.509 (d) The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in Section 15.209 of this chapter.

RSS-220 6.2.1 (c) - Radiated emissions at or below 960 MHz from a device shall not exceed the limits in section 3.4.
§15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
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
88-216	150**	3
216-960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

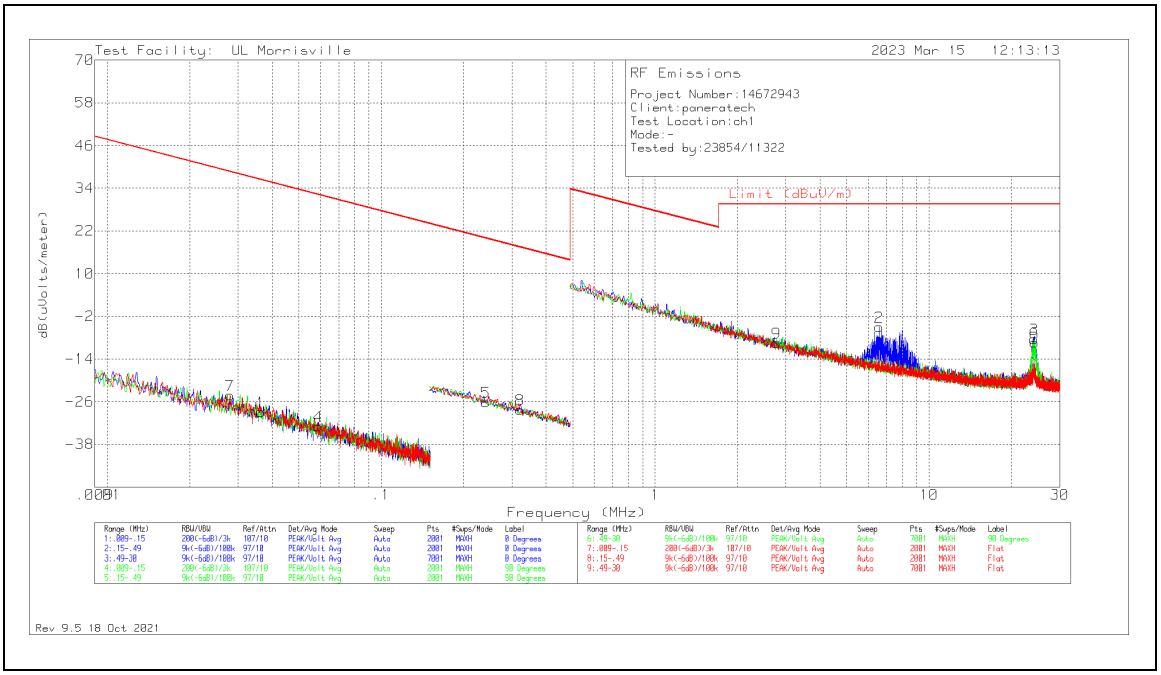
§15.209 (b) In the emission table above, the tighter limit applies at the band edges.

RESULTS

SPURIOUS EMISSIONS 0.009 TO 30 MHz

Note: All measurements were made at a test distance of 3 m. The limits in the plots and tabular data are the FCC/IC limits extrapolated from the specification distance (300 m from 9-490 kHz and 30 m from 490 kHz – 30 MHz) to the measurement distance 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 (specification distance / test distance).

Although these tests were performed at a test site other than an open area test site, adequate comparison measurements were confirmed against an open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 937606

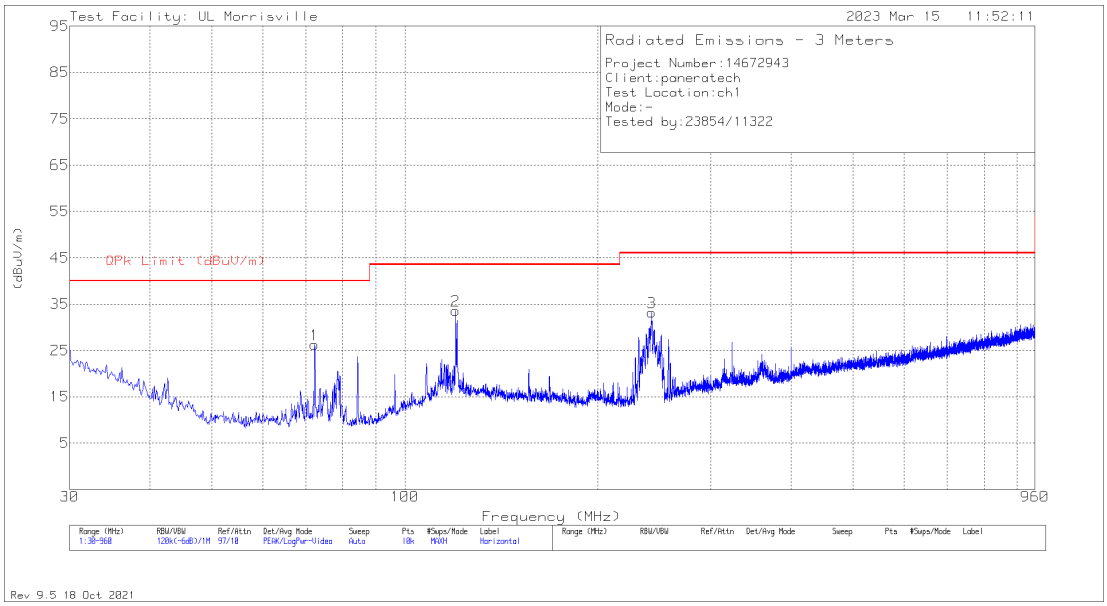


Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	135144 (dB/m)	Gain/Loss (dB)	Dist. Corr. Factor (dB)	Corrected Reading dB(uVolts/meter)	QP/AV Limit (dBuV/m)	PK Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Loop Angle
7	.0281	41.42	Pk	14.3	.1	-80	-24.18	38.63	58.63	-62.81	0-360	Flat
1	.03634	37.44	Pk	13.6	.1	-80	-28.86	36.4	56.4	-65.26	0-360	0 degs
4	.05898	34.43	Pk	12.5	.1	-80	-32.97	32.19	52.19	-65.16	0-360	90 degs
5	.24044	41.59	Pk	12.2	.1	-80	-26.11	19.98	39.98	-46.09	0-360	90 degs
8	.32221	39.47	Pk	12.2	.1	-80	-28.23	17.44	37.44	-45.67	0-360	Flat
9	2.77086	17.97	Pk	12.2	.3	-40	-9.53	29.54	-	-39.07	0-360	Flat
2	6.57369	23.07	Pk	11.5	.5	-40	-4.93	29.54	-	-34.47	0-360	0 degs
3	24.15862	21.56	Pk	9.1	1	-40	-8.34	29.54	-	-37.88	0-360	0 degs
6	24.24716	20.67	Pk	9	1	-40	-9.33	29.54	-	-38.87	0-360	90 degs

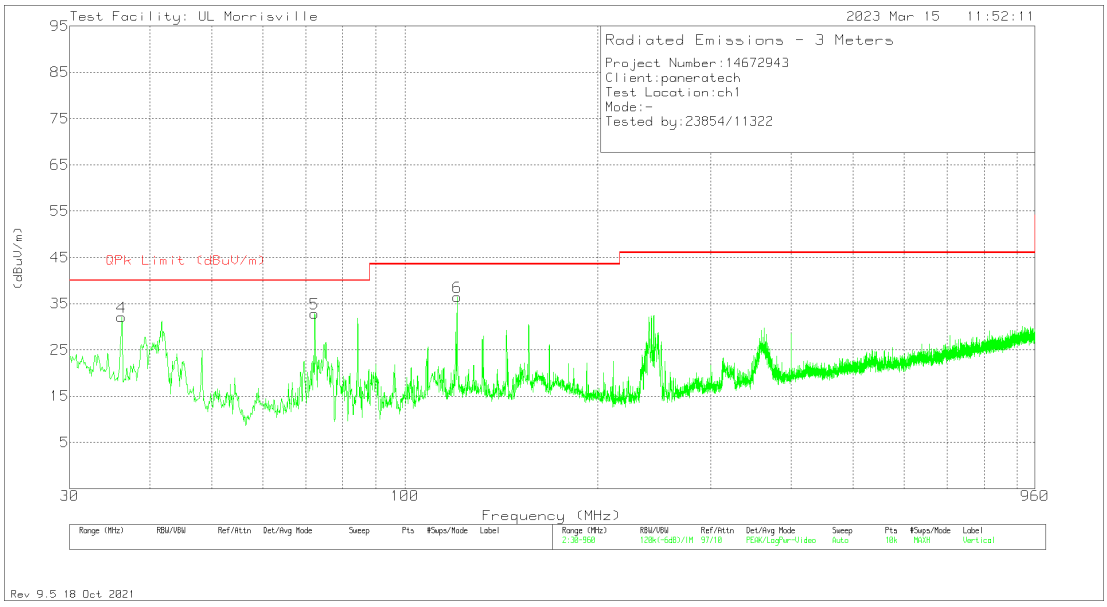
Pk - Peak detector

SPURIOUS EMISSIONS 30 TO 960 MHz

Horizontal



Vertical



Marker	Frequency (MHz)	Meter Reading (dBuV)	Det	159203 (dB/m)	Gain/Loss (dB)	Corrected Reading (dBuV/m)	QPk Limit (dBuV/m)	Margin (dB)	Azimuth (Degs)	Height (cm)	Polarity
1	72.315	42.93	Pk	14.1	-30.8	26.23	40	-13.77	0-360	101	H
2	120.024	43.84	Pk	19.8	-30.1	33.54	43.52	-9.98	0-360	299	H
3	242.412	44.72	Pk	17.6	-29.1	33.22	46.02	-12.8	0-360	101	H
4	36.138	40.83	Pk	22.7	-31.5	32.03	40	-7.97	0-360	101	V
5	72.315	49.55	Pk	14.1	-30.8	32.85	40	-7.15	0-360	101	V
6	120.582	46.56	Pk	19.9	-30	36.46	43.52	-7.06	0-360	101	V

Pk - Peak detector

9. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

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

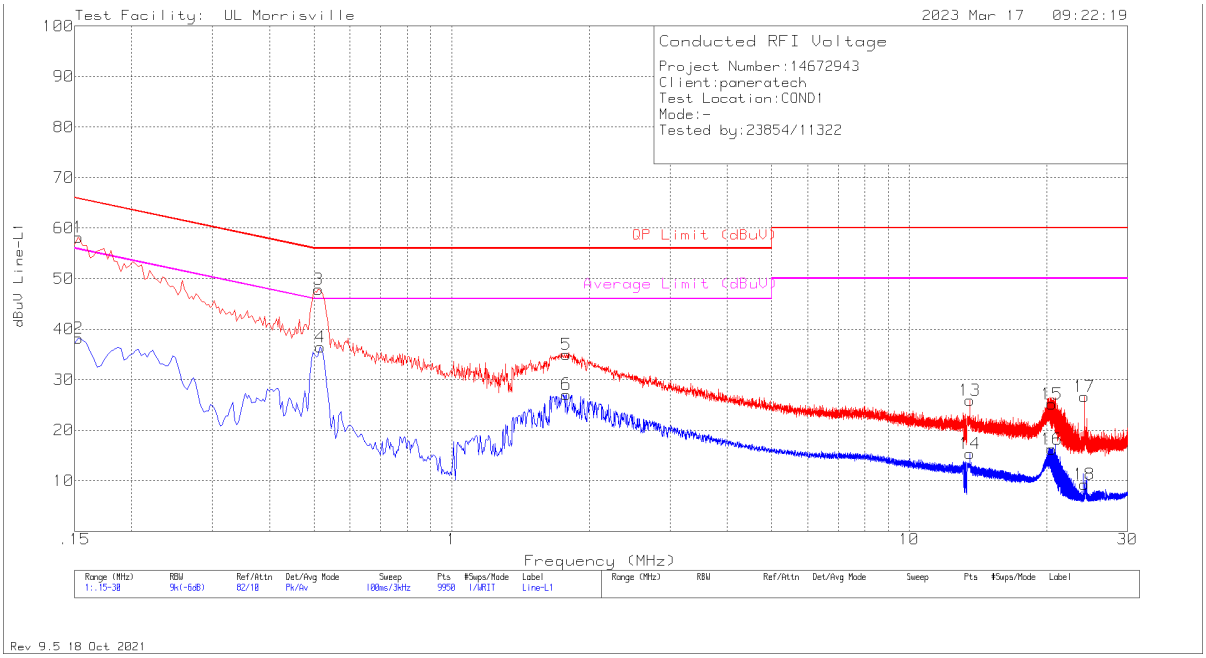
The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.10.

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

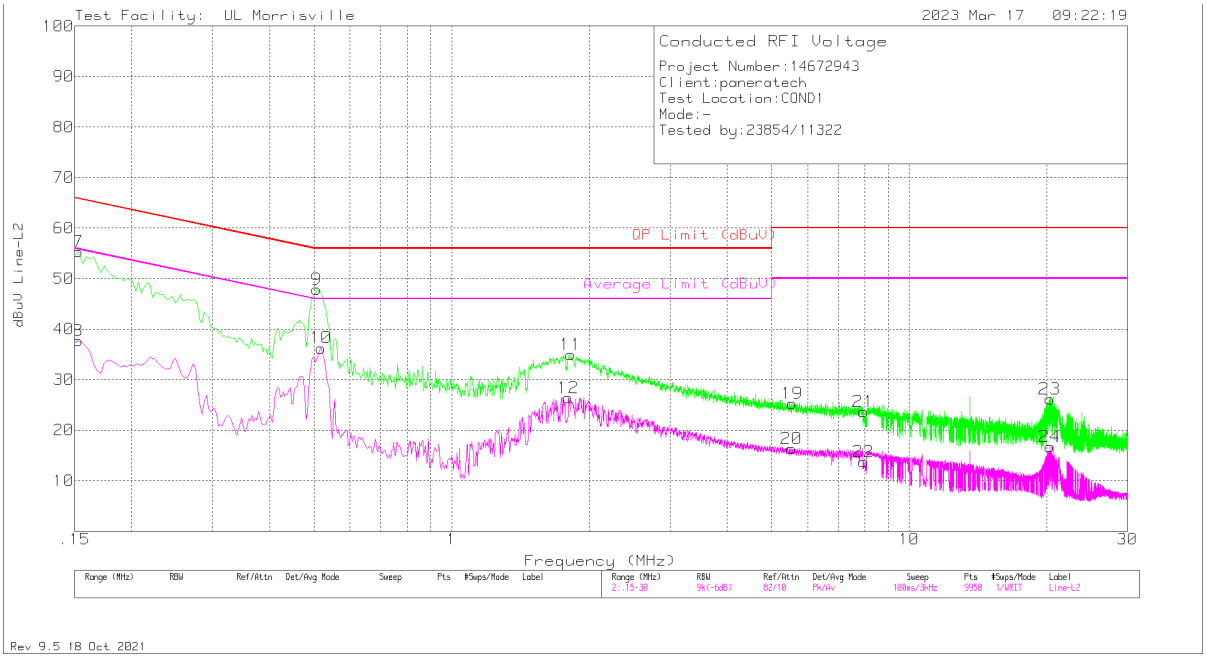
LINE 1 RESULTS



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	.153	48.21	Pk	.2	9.8	58.21	65.84	-7.63	-	-
2	.153	28.21	Av	.2	9.8	38.21	-	-	55.84	-17.63
3	.5115	38.11	Pk	0	9.8	47.91	56	-8.09	-	-
4	.516	26.64	Av	0	9.8	36.44	-	-	46	-9.56
5	1.782	25.21	Pk	0	9.8	35.01	56	-20.99	-	-
6	1.779	17.29	Av	0	9.8	27.09	-	-	46	-18.91
13	13.563	15.81	Pk	.1	10	25.91	60	-34.09	-	-
14	13.563	5.23	Av	.1	10	15.33	-	-	50	-34.67
15	20.52	14.88	Pk	.2	10.1	25.18	60	-34.82	-	-
16	20.496	5.88	Av	.2	10.1	16.18	-	-	50	-33.82
17	24.135	16.22	Pk	.2	10.2	26.62	60	-33.38	-	-
18	24.135	-1.11	Av	.2	10.2	9.29	-	-	50	-40.71

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)**
7	.153	45.29	Pk	.2	9.8	55.29	65.84	-10.55	-	-
8	.153	27.76	Av	.2	9.8	37.76	-	-	55.84	-18.08
9	.507	38.12	Pk	0	9.8	47.92	56	-8.08	-	-
10	.519	26.48	Av	0	9.8	36.28	-	-	46	-9.72
11	1.821	25.17	Pk	0	9.8	34.97	56	-21.03	-	-
12	1.8	16.61	Av	0	9.8	26.41	-	-	46	-19.59
19	5.553	15.44	Pk	0	9.9	25.34	60	-34.66	-	-
20	5.538	6.42	Av	0	9.9	16.32	-	-	50	-33.68
21	7.956	13.56	Pk	.1	10	23.66	60	-36.34	-	-
22	7.944	3.67	Av	.1	10	13.77	-	-	50	-36.23
23	20.271	15.86	Pk	.2	10.1	26.16	60	-33.84	-	-
24	20.271	6.38	Av	.2	10.1	16.68	-	-	50	-33.32

Pk - Peak detector
Av - Average detection

10. SETUP PHOTOS

Refer to Setup Photo Exhibit R14672943-EP1 for details.

END OF TEST REPORT