



RADIO TEST REPORT

For

MODEL NO.: 2082

IC ID: 3048A-2082

Test Report No. R-TR1125-ISED-WPT-1

Issue Date: March 19, 2024

Innovation, Science and Economic Development
Canada RSS-216 Issue 2

Prepared by

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TESTING CERT #3472.01

1 Record of Revisions

Revision	Date	Section	Page(s)	Summary of Changes	Author/Revised By:
1.0	03/19/2024	All	All	Version 1.0	Vishwas Narayan

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Test Report Attestation

Microsoft Corporation
Model: 2082
IC ID: 3048A-2082

Applicable Standards

Specification	Test Result
Innovation, Science and Economic Development Canada RSS-216 Issue 2, RSS-GEN Issue 5, ICES-001	Pass

Microsoft EMC Laboratory attests that the product model identified in this report has been tested to and meets the requirements identified in the above standards. The test results in this report solely pertain to the specific sample tested, under the conditions and operating modes as provided by the customer.

This report shall not be used to claim product certification, approval, or endorsement by A2LA or any agency of any Government. Reproduction, duplication, or publication of extracts from this test report is prohibited and requires prior written approval of Microsoft EMC Laboratory.



Reviewed By: Vishwas Narayan

RF Test engineer

Written/ Issued By: Jems Pradhan

RF Compliance Test Lead

2 Deviations from Standards

None.

3 Facilities and Accreditations

3.1 Test Facility

All test facilities used to collect the test data are located at Microsoft EMC Laboratory,
17760 NE 67th Ct,
Redmond WA, 98052, USA

3.2 Accreditations

The lab is established and follows procedures as outlined in IEC/ISO 17025 and A2LA accreditation requirements.

A2LA Accredited Testing Certificate Number: 3472.01

FCC Registration Number: US1141

IC Site Registration Numbers: 26315

ISED CAB ID: US0212

3.3 Test Equipment

The site and related equipment are constructed in conformance with the requirements of ANSI C63.4:2017, CISPR 16-1-4, and other equivalent applicable standards. The test site for measurements below 30MHz has been demonstrated to correlate with an open field site per KDB 414788. Test site requirements for measurements above 1GHz are in accordance with ANSI C63.4:2014.

ANSI C63.10:2013 and ICES-001 test methods were followed.

4 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the product, as specified in ETSI TR 100 028. This represents an expanded uncertainty expressed at 95% confidence level using a coverage factor $k=2$. These levels are for reference only and not included to determine product compliance.

Expanded uncertainty calculations are available upon request.

Test item	Uncertainty	Unit
Radiated disturbance (9 kHz to 30 MHz)	5.32	dB
Radiated disturbance (30 MHz to 1 GHz)	5.99	dB
Conducted Disturbance at Mains Port	3.89	dB
Uncertainty for test site temperature	0.5	°C
Uncertainty for test site Humidity	3	%

5 Product Description

Company Name:	Microsoft Corporation
Address:	One Microsoft Way
City, State, Zip:	Redmond, WA 98052-6399
Customer Contact:	Mike Boucher
Functional Description of the EUT:	Portable Computing, I/O Accessory Device with NFC/WPT Charging Capability
Model:	2082
IC ID:	3048A-2082
Radio under test:	NFC/WPT (13.110-14.010 MHz)
Modulation(s):	ASK/CW
Antenna Information:	Integral coil
Equipment Design State:	Prototype/Production Equivalent (DV)
Equipment Condition:	Good
Test Sample Details:	AC Line Conducted Emissions Test Sample 0E348KG24013KM RF Radiated Test Samples 0E348BM24013KM

5.1 Test Configurations

Test firmware provided by the customer was used to program the EUT to transmit continuously. With this firmware, the device can operate in CW and ASK modulation modes.

Measurements with a companion device acting as a load in charging mode were also performed.

Radiated measurements were performed in X orientation as this is the device's intended orientation.

5.2 Environmental Conditions

Ambient air temperature of the test site was within the range of 10 °C to 40 °C (50 °F to 104 °F) unless the EUT specified testing over a different temperature range. Humidity levels were in the range of 10% to 90% relative humidity. Testing conditions were within tolerance, and any deviations required from the EUT are reported.

5.3 Antenna Requirements

The antenna/coil is permanently attached and there are no provisions for connection to an external antenna.

5.4 Equipment Modifications

No modifications were made during testing.

5.5 Support Equipment

Manufacturer	Model Number	Description	Serial Number(s)
Microsoft	2038	Surface Tablet Pro	0F00XXD22463BF
Microsoft	1962	NFC Tag/Load Device	0F030GS223400D

5.6 Dates of Testing

Testing was performed from Jan 31st to Mar 7th,2024.

5.7 Test Samples Details

Serial number	Internal Lab ID	Test Cases
0E348BM24013KM	R-1125-DV-03	Radiated
0E348KG24013KM	R-1125-DV-01	AC Line conducted emissions

5.8 Test Engineers

Name	Test Cases
Vishwas	Radiated
Tucker Livingston	AC Line conducted emissions

6 Test Results Summary

Test Description	Test requirement	Limit	Test Result
Radiated Emissions	RSS-216 ICES-001	RSS-216 ICES-001	Pass
AC Line Conducted Emissions	RSS-216 ICES-001	RSS-216 ICES-001	Pass

7 Test Equipment List

Equipment used for Radiated and Conducted Measurements				
Manufacturer	Description	Model #	Asset #	Calibration Due
Rohde & Schwarz	EMI Test Receiver	ESW44	RF-1331	4/3/2024
Rohde & Schwarz	EMI Test Receiver	ESU40	RF-012	4/10/2024
Sunol Sciences	Antenna - Broadband	JB6	RF-039	5/16/2024
ETS-Lindgren	Antenna - Passive Loop	6512	RF-202	3/8/2024
Pasternack	6dB attenuator	PE7004-6	EMC-949	5/16/2024
Rohde & Schwarz	Open Switch and Control Unit	OSP130	RF-1337	12/22/2024
Rohde & Schwarz	Open Switch and Control Unit	OSP150	RF-1336	12/22/2024
Teledyne	RF Cable	57500	RF-1036	12/22/2024
Micro-Coax	RF Cable	A SERIES 505552-K 00000071	RF-1399	12/22/2024
Micro-Coax	RF Cable	142A SERIES 505508-C 00000856	RF-1398	12/22/2024
Madge Tech	Environmental (THP) meter	PRHTemp2000	SAR-091	07/18/2024

Equipment used for AC Line Conducted Emissions Measurement				
Manufacturer	Description	Model #	Asset #	Calibration Due
Rohde & Schwarz	EMI Test Receiver	ESR3	EMC-1396	06/12/2024
Teseq	LISN	NNB 51	EMC-642	1/11/2025
Fluke	Multimeter	87V	EMC-052	11/28/2024
PCE	Environmental (THP) meter	PCE-THB 40	EMC-1205	1/4/2025
Micro-Coax	RF Cable	UFA210A-1-1800-50U50U	EMC-367	11/8/2024
Chroma	AC Power Source	61602	EMC-055	N/A
ETS-Lindgren	TILE- Software License/USB	--	EMC-367	N/A

Note: Items with Calibration Due date marked as N/A are characterized before use, where applicable.

Note*: All equipment used was within calibration during applicable measurements

8 Test Site Description

8.1 Radiated Emissions Test Site

Radiated measurements are performed in a 3m semi-anechoic chamber, which meets NSA requirements for the frequency range of 30MHz to 1000MHz in accordance with ANSI C63.4:2017, and CISPR 16-1-4. Measurements below 30 MHz were performed on a site demonstrating equivalence to an open field site per KDB 414788 D01.

8.1.1 Radiated Measurements in 9kHz- 30 MHz

The EUT is positioned on a turntable at a height of 80cm using a non-conducting table. A loop antenna is positioned at 3m from the EUT periphery at 1m height from the ground. The turntable is rotated 360 degrees to determine the highest emissions. This is repeated for three orientations of the measurement antenna- parallel, perpendicular, and ground-parallel. All possible orientations of the EUT were investigated for emissions and the flat, or 'X', orientation was identified as the only applicable configuration.

8.1.2 Radiated Measurements in 30 MHz - 1000 MHz

The EUT is positioned on a turntable at a height of 80cm using a non-conducting table. A linearly polarized broadband antenna is positioned at 3m from the EUT periphery. The turntable is rotated 360 degrees, and the antenna height varied from 1m to 4m to determine the highest emissions. This is repeated for both horizontal and vertical polarizations of the measurement antenna. All possible orientations of the EUT were investigated for emissions and the flat, or 'X', orientation was identified as the only applicable configuration.

8.1.3 AC Line Conducted Emissions

The EUT is positioned on a non-conducting table at a height of 80cm over a metallic ground (reference) plane extending more than 50cm horizontally around the EUT. The EUT is setup at the back of the table with interconnecting cables draping off the back of table. The back of the EUT is positioned so that it is 40 cm away from a vertical ground plane. The EUT power port or power port that is indirectly connected to the EUT is terminated in 50 Ω /50 μ H Artificial Mains Network (AMN). All other ports are terminated with equipment representing a normal use case.

8.2 Test Setup Diagrams

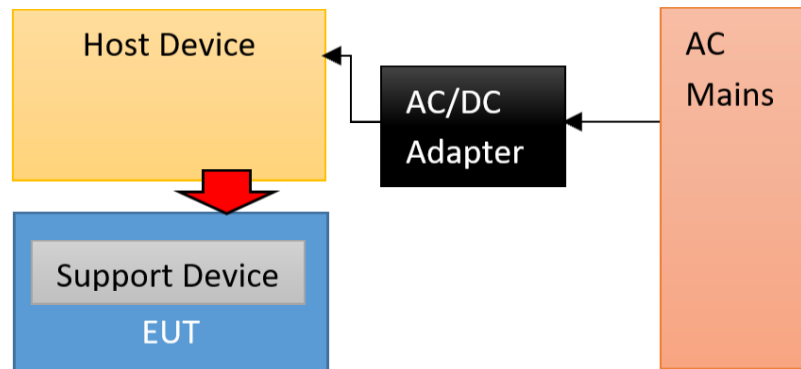


Figure 8-1 EUT Setup Block Diagram

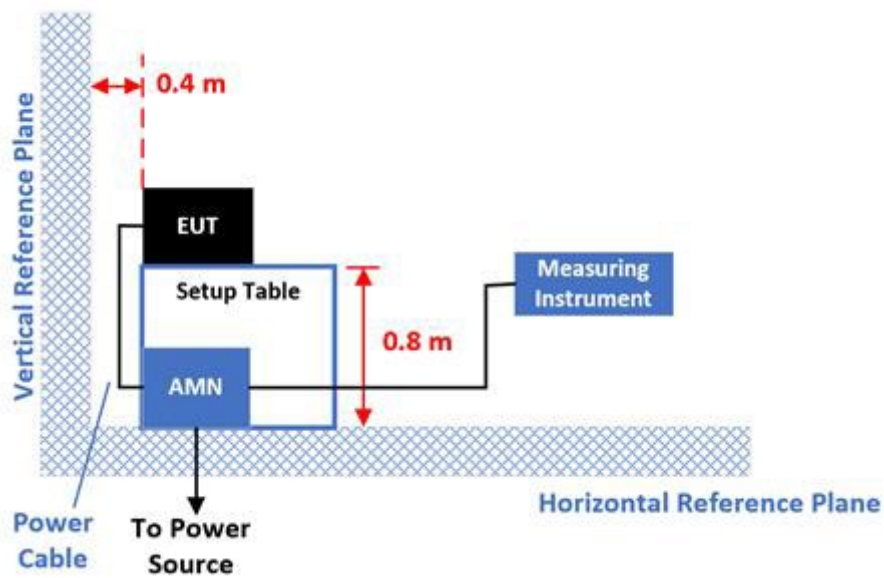


Figure 8-2 AC Line Conducted Emissions

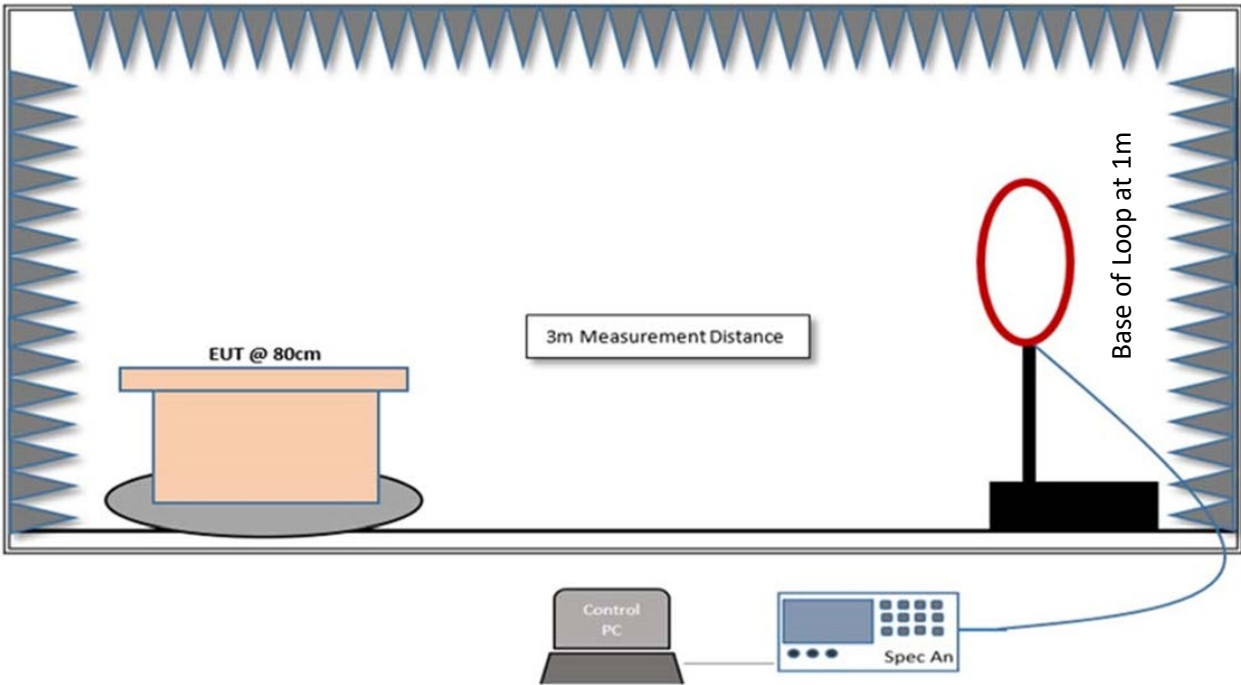


Figure 8-3 Test Setup for Radiated measurements in 9kHz - 30MHz range

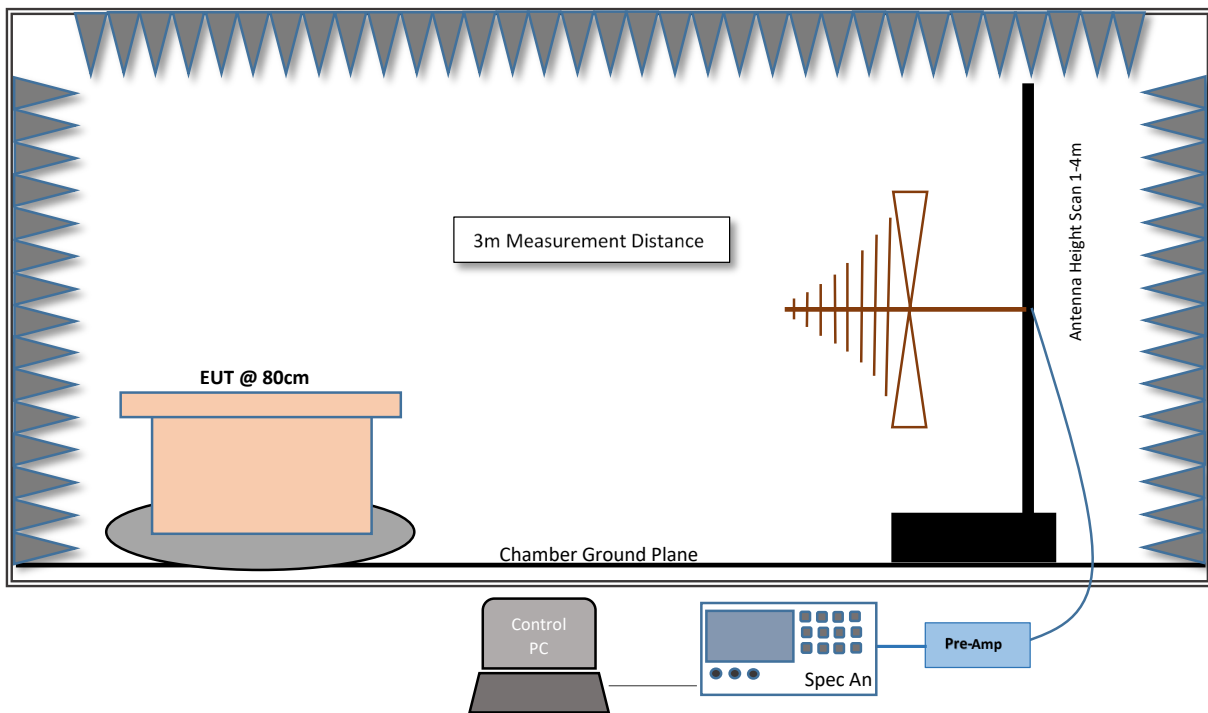


Figure 8-4 Test Setup for Radiated measurements in 30MHz- 1GHz range

9 Test Results

9.1 Radiated Spurious Emissions

9.1.1 Test Requirement:

ISED RSS-216, ICES-001

9.1.2 Test Method:

Radiated spurious measurements were made from 9kHz to 1 GHz following procedures in ANSI C63.10:2013. The limit for radiated emissions is per ICES-001.

Guidelines in ANSI C63.10:2013 were followed with respect to maximizing the emissions. Measurements were performed with and without a load as specified in RSS-216.

A pre-amp was required to provide the measuring system with sufficient sensitivity. The peak field strength of the emission is corrected by the antenna factor, cable loss, pre-amp etc.

Parallel, ground parallel and perpendicular loop orientations were investigated. Worst-case maximized data for all loop orientations is shown in this test report.

Radiated Spurious Emissions

Spectrum Analyzer Settings:

9 kHz – 150 kHz

RBW= 300 Hz

VBW= 1 kHz

Trace Mode: Peak Detector (Max Hold)

Span= 1 - 150 kHz

Sweep time= Auto

Sweep points $\geq 2 \times \text{Span}/\text{RBW}$

150 kHz – 30 MHz

RBW= 10 kHz

VBW= 30 kHz

Trace Mode: Peak Detector (Max Hold)

Span= 150 kHz – 30 MHz

Sweep time= Auto

Sweep points $\geq 2 \times \text{Span}/\text{RBW}$

30 MHz - 1 GHz:

RBW = 120 kHz

VBW $\geq 3 \times \text{RBW}$

Trace Mode: Peak Detector (Max Hold). Final measurements performed using QP Detector.

Span= 30 MHz - 1 GHz

Sweep time= Auto

Sweep points $\geq 2 \times \text{Span}/\text{RBW}$

Final Quasi-Peak Measurements

RBW = 200 Hz; 9 kHz; 120 kHz (9 kHz – 150 kHz; 150 kHz – 30 MHz; 30 MHz – 1 GHz)

IF filter = 6dB

Detector = Quasi-Peak

Measurement Time = 15s

Final Average Measurements (Magnetron driven equipment only)

RBW = 120 kHz (30 MHz – 1 GHz)

Detector = Average

IF filter = 6dB

Measurement time = 15s

Trace mode = max hold.

Sample Calculations:

Distance Correction Factor = $20 \times \log(3/10) = -10.46$ dB

Field Strength Level: Analyzer Level + AFCL (Antenna Factor and Cable losses) – Amplifier Gain + Distance Correction Factor = 50 dB μ V + 33 dB – 25 dB – 10.46 = 47.54 dB μ V/m

9.1.3 Limits:

Frequency (MHz)	Measurement Distance (meters)	Field Strength Limit (dB μ A/m)
0.009 - 0.070	3	69
0.070 - 0.15	3	69 to 39*
0.15 – 30	3	39 to 7*

Frequency (MHz)	Measurement Distance (meters)	Field Strength Limit – Quasi-peak (dB μ V/m)
30.0 – 230	3	40
230.0 – 1000.0	3	47

9.1.4 Test Result:

Pass.

9.1.5 Test Data:

9.1.5.1 Emissions in 9 kHz – 30 MHz

All modes, with and without passive tag load were tested and worst-case results are reported. The worst-case mode was observed to be with the EUT in flat 'X' orientation without the passive tag support device in CW mode. The worst-case measurement antenna orientation was parallel loop orientation.

RSE 9 kHz – 30 MHz						
Carrier Frequency (MHz)	Emission Frequency (MHz)	Raw Quasi-Peak Amplitude (dB μ V/m)	Correction Factor (dB)	Corrected Quasi-Peak Field Strength (dB μ V/m)	Quasi-Peak Limit (dB μ V/m)	Quasi-Peak Margin (dB)
13.56	0.031	-16.91	-3.68	-20.59	69.00	-89.59
13.56	0.513	-4.19	12.06	7.87	31.58	-23.71
13.56	0.696	-5.44	9.62	4.18	29.73	-25.55
13.56	13.558*	3.07	-5.13	-2.06	11.80	-13.86
13.56	21.663	-6.26	-5.13	-11.39	8.97	-20.36
13.56	23.129	-1.48	-5.41	-6.89	8.57	-15.46

*Fundamental emission

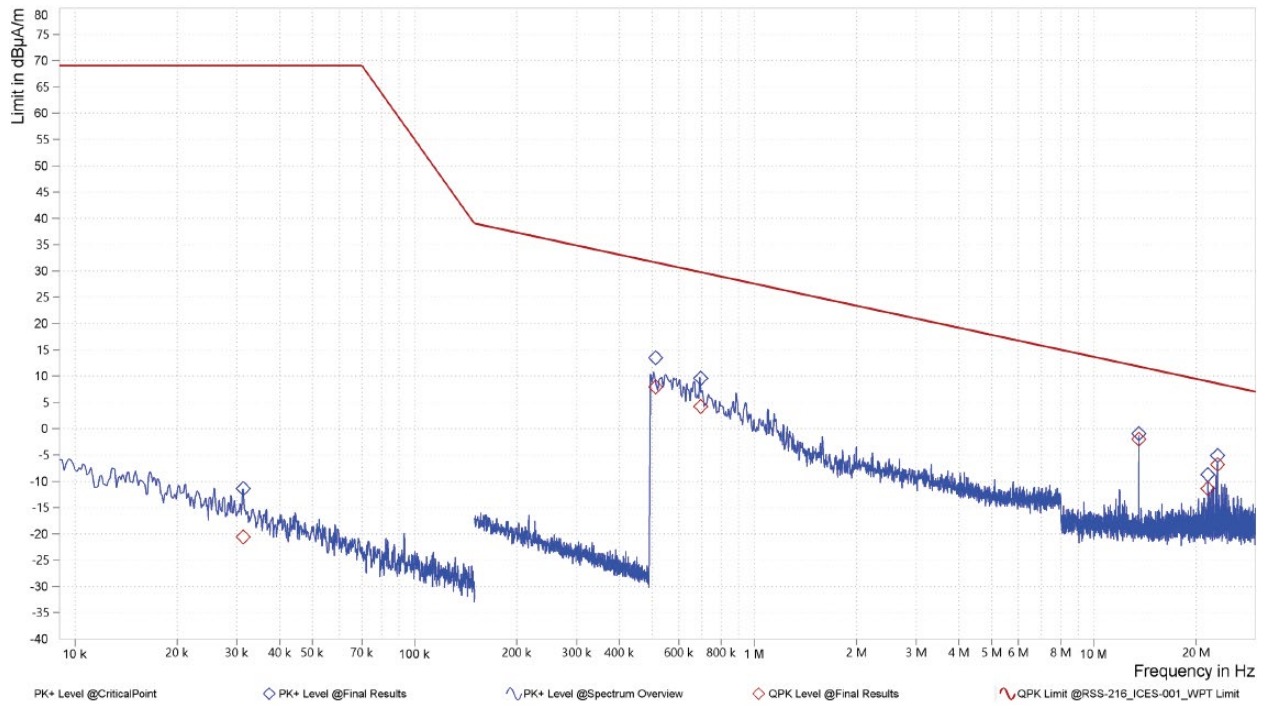


Figure 9-1 Radiated Spurious Emissions 9 kHz – 30 MHz

9.1.5.2 Emissions in 30 MHz- 1 GHz range

All modes were tested, and worst-case results are reported. EUT was setup in 'X' or flat orientation with the passive tag/charging device in ASK mode.

RSE 30-1000 MHz						
Carrier Frequency (MHz)	Emission Frequency (MHz)	Raw Quasi-Peak Amplitude (dBµV/m)	Correction Factor (dB)	Corrected Quasi-Peak Field Strength (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Quasi-Peak Margin (dB)
13.56	189.87	10.92	19.52	30.44	40.00	-9.56
13.56	203.39	13.47	20.03	33.50	40.00	-6.50
13.56	216.97	8.92	18.82	27.74	40.00	-12.26
13.56	230.49	9.22	19.32	28.54	47.00	-18.46
13.56	379.69	4.96	23.67	28.63	47.00	-18.37
13.56	732.29	0.72	30.65	31.37	47.00	-15.63

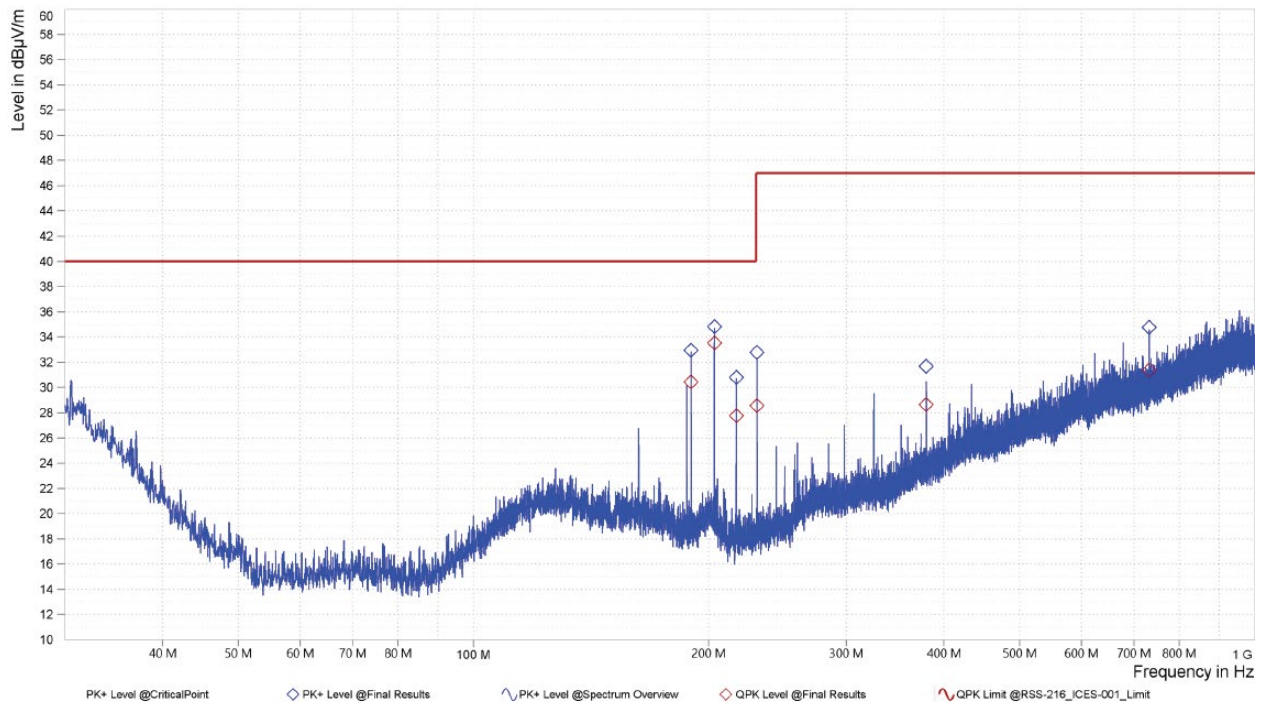


Figure 9-2 Radiated Spurious Emissions 30 MHz – 1 GHz

9.2 AC Line Conducted Emissions

9.2.1 Test Requirements

ISED RSS-216, RSS GEN [8.8], ICES-001

9.2.2 Test Method

Conducted power line measurements are made, unless otherwise specified, over the frequency range from 9 kHz to 30 MHz to determine the Unsymmetric radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Equipment is tested with the power cords that are used under normal operating conditions. These measurements are made using an AMN/LISN (Line Impedance Stabilization Network). AC powered peripherals are attached to a second LISN with the 50-ohm measuring port terminated by a 50-ohm resistive load.

Measurements were performed with and without a load per RSS-216. Worst case results were recorded when the EUT was transmitting continuously with a passive tag load in charging mode for this test.

EMI Receiver Settings:

9 kHz – 30 MHz:

RBW= 200 Hz; 9 kHz (9 kHz - 150 kHz, 150 kHz – 30 MHz)

VBW \geq 3 X RBW

Trace Mode: Peak Detector (Max Hold).

Final measurements were performed using Quasi-Peak and Average Detectors.

Span= 9 kHz – 30 MHz

Sweep time= Auto

9.2.3 Limit

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.009 – 0.050	122	--
0.050 – 0.1485	102 to 92*	--
0.1485 – 0.50	72 to 62*	62 to 52*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

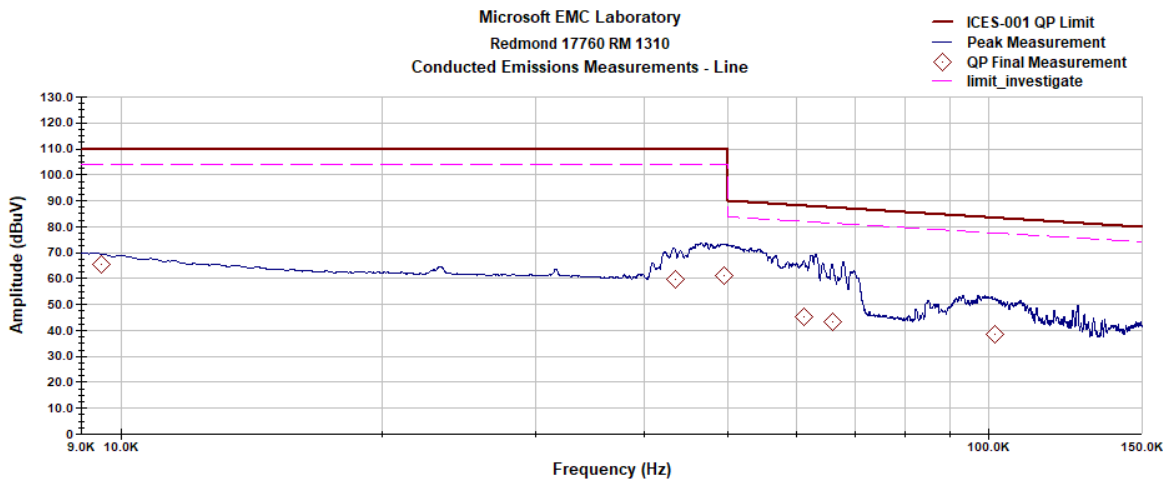
Note*: Decreasing linearly with logarithm of frequency

9.2.4 Test Result:

Pass

9.2.5 Test Data:

9KHz – 150KHz AC Conducted Line Emissions Data – ASK with Load				
Frequency (MHz)	QP Amplitude (dBμV)	Quasi-Peak Limit (dBμV)	Line Tested (L or N)	Quasi-Peak Margin (dB)
0.010	65.624	110.00	L	-44.376
0.043	59.457	110.00	L	-50.543
0.049	61.140	110.00	L	-48.860
0.061	45.196	88.163	L	-42.967
0.066	43.126	87.459	L	-44.334
0.102	38.595	83.547	L	-44.952
0.009	66.209	110.00	N	-43.791
0.044	54.458	110.00	N	-55.542
0.049	65.117	110.00	N	-44.883
0.063	46.119	87.870	N	-41.750
0.099	42.413	83.765	N	-41.352
0.134	29.073	81.036	N	-51.963

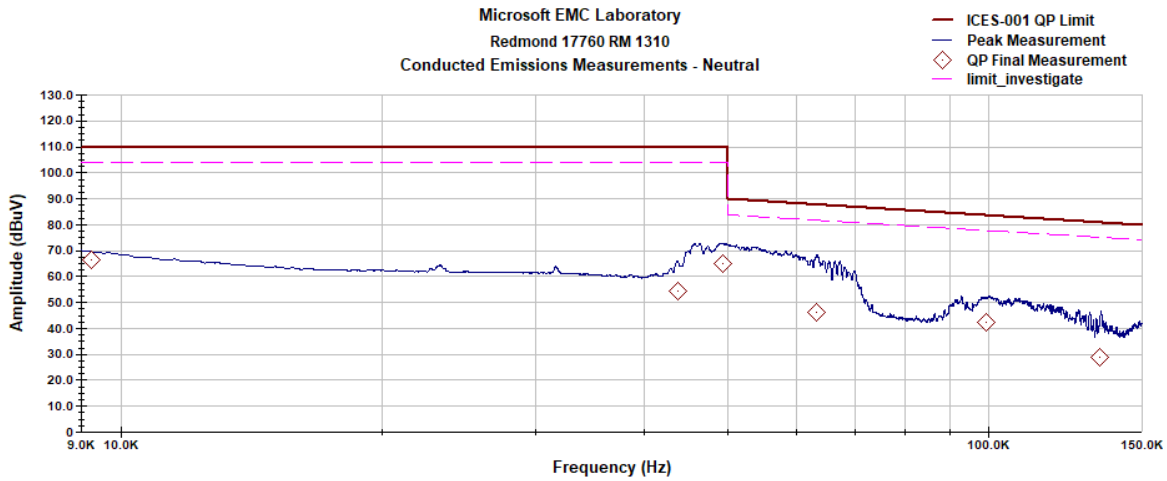


Operator: Tucker

Last Data Update 06:09:48 PM, Wednesday, March 06, 2024

CE Profile V2.3

Figure 9-2 AC Line Conducted Emissions - Line (9 kHz - 150 kHz)



Operator: Tucker

Last Data Update 08:05:16 PM, Wednesday, March 06, 2024

CE Profile V2.3

Figure 9-3 AC Line Conducted Emissions - Neutral (9 kHz - 150 kHz)

150KHz – 30MHz AC Conducted Line Emissions Data – ASK with Load							
Frequency (MHz)	QP Amplitude (dBµV)	AVG Amplitude (dBµV)	Quasi-Peak Limit (dBµV)	Average Limit (dBµV)	Line Tested (L or N)	Quasi-Peak Margin (dB)	Average Margin (dB)
0.164	50.138	27.771	65.267	55.267	L	-15.129	-27.496
1.052	25.594	13.747	56.000	46.000	L	-30.406	-32.253
1.651	22.436	12.272	56.000	46.000	L	-33.564	-33.728
2.042	17.449	10.416	56.000	46.000	L	-38.551	-35.584
10.163	28.130	19.589	60.000	50.000	L	-31.870	-30.411
13.559	23.696	14.438	60.000	50.000	L	-36.304	-35.562
0.152	53.387	31.971	65.890	55.890	N	-12.503	-23.919
0.160	52.425	30.217	65.464	55.464	N	-13.039	-25.247
1.102	31.564	14.958	56.000	46.000	N	-29.578	-31.042
2.042	30.002	11.238	56.000	46.000	N	-36.445	-34.762
13.558	30.560	24.306	60.000	50.000	N	-32.451	-25.694
26.988	25.062	11.350	60.000	50.000	N	-42.971	-38.650

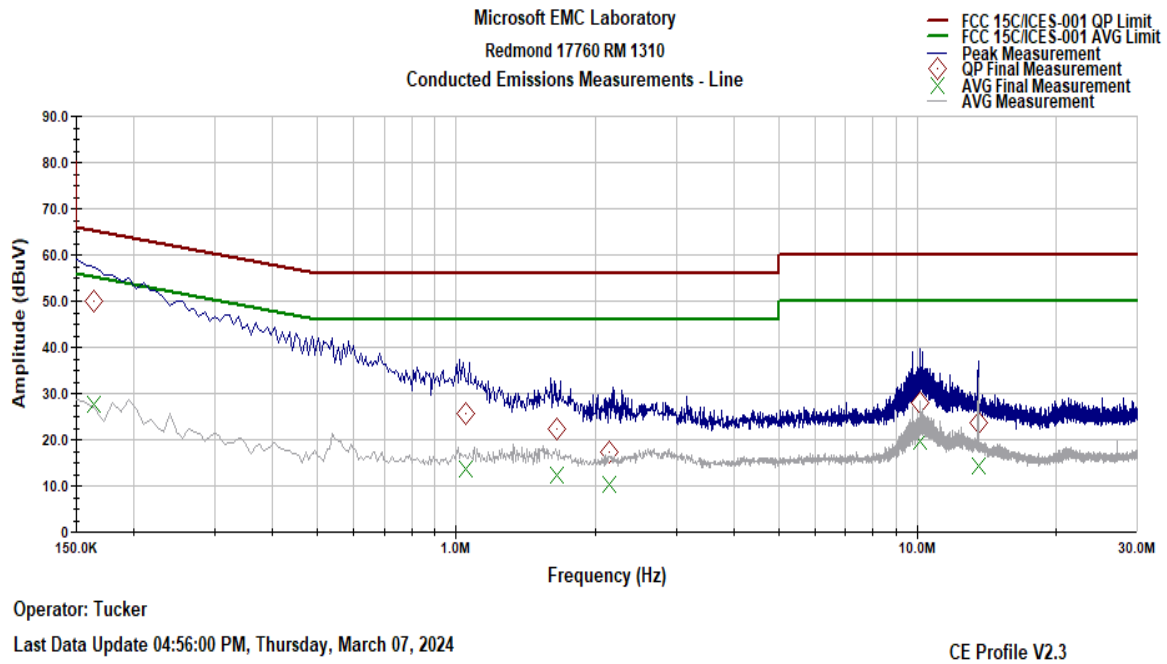


Figure 9-5 AC Line Conducted Emissions - Line (150 kHz - 30 MHz)

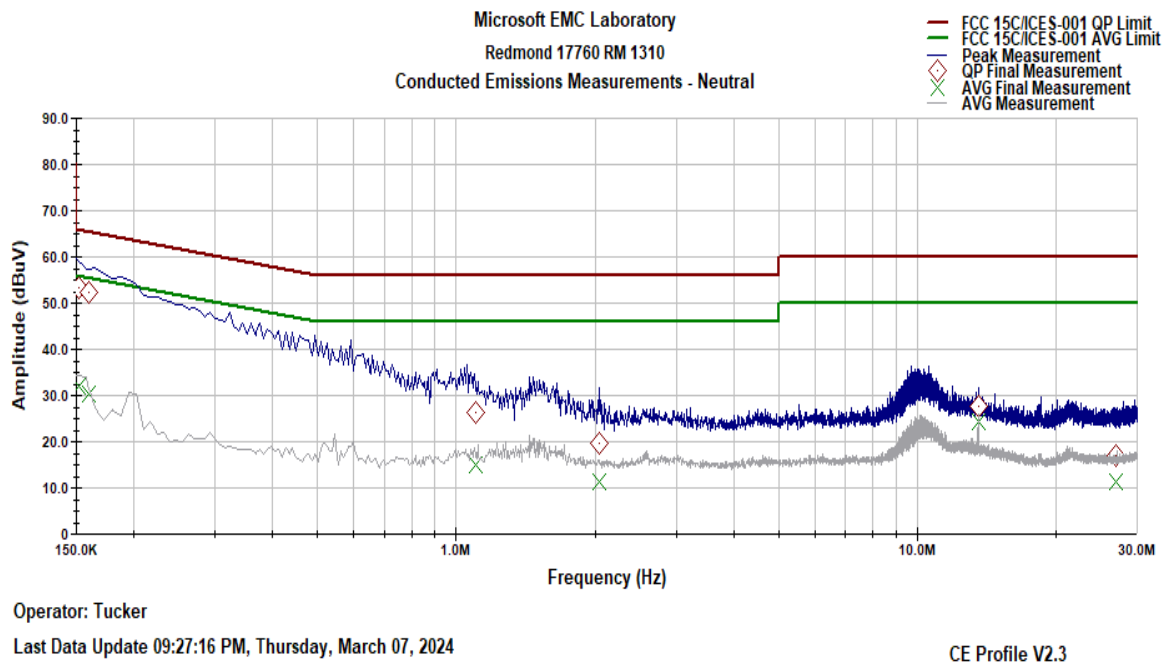


Figure 9-6 AC Line Conducted Emissions - Neutral (150 kHz - 30 MHz)

End of Report