HEADQUARTERS: 914 WEST PATAPSCO AVENUE • BALTIMORE, MARYLAND 21230 • PHONE (410) 354-3300 • FAX (410) 354-3313

3/25/2024

HID Global Corporation (US)
6533 Flying Cloud Drive, Ste. 1000
Eden Prairie, MN 55344
USA

Dear Richard Georgerian,

Enclosed is the EMC test report for compliance testing of HID Global Corporation (US), OMNIKEY SE Reader Core, tested to the requirements of:

- Title 47 of the CFR, Part 15 Subpart C for Certification as an Intentional Radiator.
- RSS-210: Issue 10, License-Exempt Radio Apparatus: Category 1 Equipment

Thank you for using the services of Eurofins E&E North America. If you have any questions regarding these results or if we can be of further service to you, please feel free to contact me.

Sincerely,

Nancy LaBrecque
Documentation Department
Eurofins Electrical and Electronic Testing NA, Inc.

Reference: WIRA125908– FCC-IC-RFID-LF_R1

125kHz RFID
Test Report

for the

HID Global Corporation (US)
OMNIKEY SE Reader Core (Model: RCL5510)

Tested under
the FCC Certification Rules
contained in
15 Subpart C and
RSS-210: Issue 10
for Intentional Radiators

Bryan Taylor, Wireless Team Lead
Electromagnetic Compatibility Lab

Nancy LaBrecque
Documentation Department

Engineering Statement: The measurements shown in this report were made in accordance with the procedures indicated, and the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them.

Matthew Hinojosa
EMC Manager, Austin Electromagnetic Compatibility Lab

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	2/26/2024	Initial Issue.
1	3/25/2024	Addressed comments from HID and from TCB reviewer

Table of Contents

List of Tables

List of Figures

Executive Summary

A. Purpose of Test

An EMC evaluation was performed to determine compliance of the HID Global Corporation (US) OMNIKEY SE Reader Core, with the requirements of Part 15, §15C and RSS-210 Issue10. All references are to the most current version of Title 47 of the Code of Federal Regulations and RSS-210 in effect. The following data is presented in support of the Certification of the OMNIKEY SE Reader Core. HID Global Corporation (US) should retain a copy of this document which should be kept on file for at least two years after the manufacturing of the OMNIKEY SE Reader Core, has been **permanently** discontinued.

B. Executive Summary

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15C and RSS-210, in accordance with HID Global Corporation (US), under purchase order number 1110985118. All tests were conducted using measurement procedures ANSI C63.4-2014 and C63.10-2013.

FCC Reference	ISED Reference	Description	Compliance
Part 15 §15.203	---	Antenna Requirement	Compliant
Part 15 §15.207(a)	RSS-Gen (8.8)	Conducted Emission Limits	Compliant
Part 15 §15.215	---	20dB Occupied Bandwidth	Compliant
---	RSS-Gen (6.7)	99% Occupied Bandwidth	Compliant
Part 15 §15.209	RSS-210 (7.2) RSS-Gen (8.9)	General Field Strength Limitations	Compliant

Table 1. Executive Summary

Equipment Configuration

A. Overview

Eurofins E&E North America was contracted by HID Global Corporation (US) to perform testing on the OMNIKEY SE Reader Core.

This document describes the test setups, test methods, required test equipment, and the test limit criteria used to perform compliance testing of the HID Global Corporation (US) OMNIKEY SE Reader Core.

The results obtained relate only to the item(s) tested.

Product Name:	OMNIKEY SE Reader Core	
Model(s) Tested:	RCL5510	
Model(s) Included by Similarity	RCS5510	
FCC Identifiers	JQ6-RCL5510 (for model RCL5510), JQ6-RCS5510 (for model RCS5510)	
ISED Identifiers	2236B-RCL5510 (for model RCL5510), JQ6-RCS5510 (for model RCS5510)	
EUT Specifications:	Primary Power: 3.6 – 6VDC	
	Type of Modulation(s):	ASK
	Equipment Code:	DXX
	Maximum field Strength:	81.61dBuV/m
	Antenna Type:	loop
	EUT Frequency Ranges:	125kHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35º C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Bryan Taylor and Sergio Gutierrez	
Test Date(s):	1/8/2024 to 1/16/2024	

Table 2. EUT Summary Table

B. References

CFR 47, Part 15, Subpart C	Federal Communication Commission, Code of Federal Regulations, Title 47, Part 15: General Rules and Regulations, Allocation, Assignment, and Use of Radio Frequencies
RSS-210 Issue 10: December 2019	Licence-Exempt Radio Apparatus: Category I Equipment
RSS-Gen Issue 5: April 2018	General Requirements for Compliance of Radio Apparatus
ANSI C63.4:2014	Methods and Measurements of Radio-Noise Emissions from Low-Voltage Electrical And Electronic Equipment in the Range of 9 kHz to 40 GHz
ISO/IEC 17025:2017	General Requirements for the Competence of Testing and Calibration Laboratories
ANSI C63.10-2013	American National Standard for Testing Unlicensed Wireless Devices

Table 3. References

C. Test Site

Eurofins MET Laboratories Inc. (Eurofins E&E North America) is part of the Eurofins Electrical & Electronics (E&E) global compliance network.

All testing was performed at Eurofins E&E North America, 13501 McCallen Pass, Austin, TX 78753. All equipment used in making physical determinations is accurate and bears recent traceability to the National Institute of Standards and Technology.

Radiated Emissions measurements were performed in a 10 meter semi-anechoic chamber (equivalent to an Open Area Test Site). In accordance with §2.948(a)(3), a complete site description is contained at MET Laboratories.

Correlation between semi-anechoic chamber and OATS:

Two calibrated Loop antennas were used on an OATS. One antenna was driven by a signal generator with a known power. The receive antenna was initially placed 1m away from the transmit antenna. The two antennas were placed parallel to each other. The receive antenna was in turn connected to a calibrated spectrum analyzer. The emissions were swept from 9 kHz to 30 MHz. The receive antenna was then rotated 90 degrees and measurements re-taken. Additional measurements were taken when the receive antenna was placed at 3meters.
This same setup was taken to inside the semi-anechoic chamber and the measurements repeated.

The data was used to correlate the semi-anechoic chamber and OATS.

D. Measurement Uncertainty

Test Method	Typical Expanded Uncertainty	K	Confidence Level
RF Frequencies	±4.52 Hz	2	95%
RF Power Conducted Emissions	±2.97 dB	2	95%
RF Power Radiated Emissions	±2.95 dB	2	95%
Radiated Emissions, (30 MHz – 1 GHz)	±2.95	2	95%
Radiated Emissions, (1 GHz – 18 GHz)	±3.54	2	95%
Conducted Emission Voltage	±2.97	2	95%

Table 4. Uncertainty Calculations Summary

E. Description of Test Sample

OMNIKEY SE Reader Core/OMNIKEY SE Reader Core Standard (RCL55100000, SRD Model: RCL5510) OMNIKEY SE Reader Core/OMNIKEY SE Reader Core MINI (RCS55100000, SRD Model: RCS5510) The OMNIKEY SE Reader Core's triple frequency capability allows the use of the high, low, and BLE frequency credentials with the same reader, providing a solution for mixed credential and credential migration applications. It includes more memory, faster performance, expanded connectivity, and Bluetooth Smart (BLE), while still offering a secure and standards-based independent technology and flexible identity data structure.

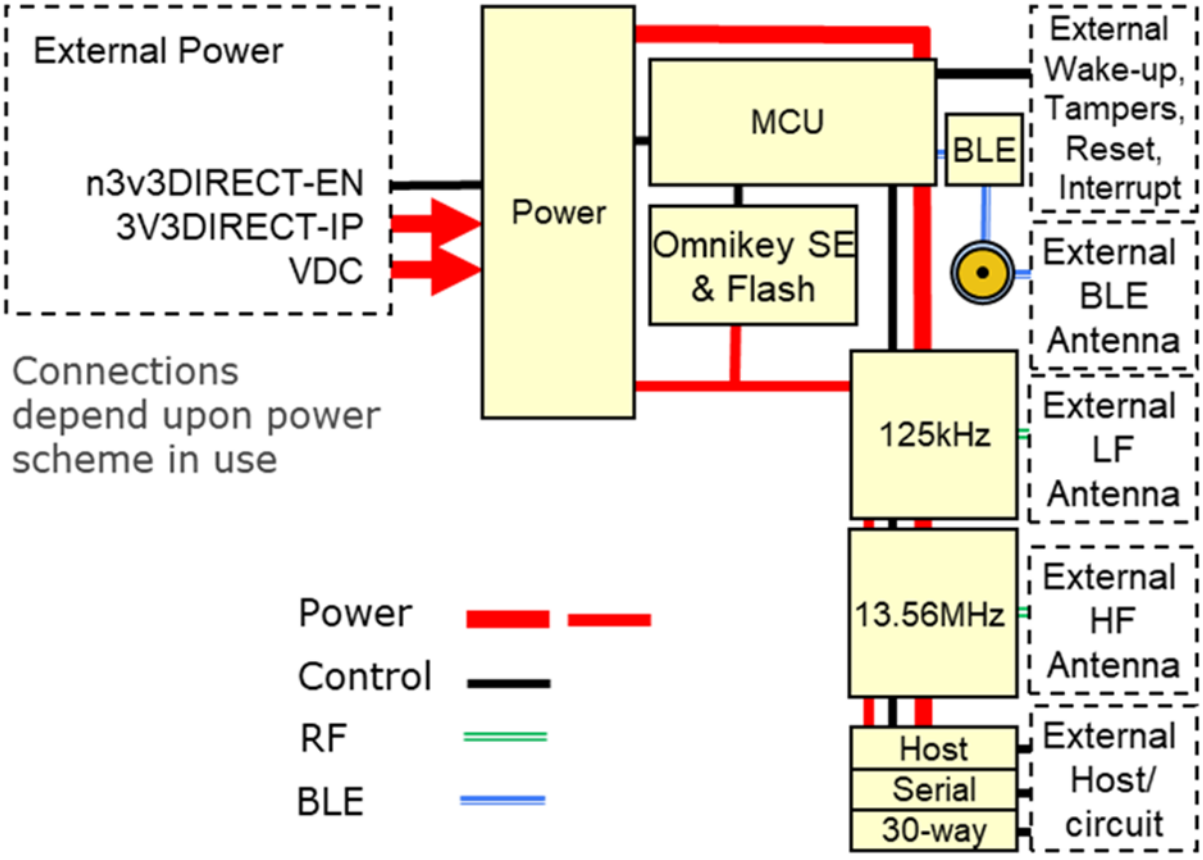


Figure 1. Block Diagram of Test Configuration

F. Equipment Configuration

A 125kHz Credential was placed in front of the OMNIKEY SE Reader Core to force a continuous reading operation.

G. Support Equipment

Support equipment necessary for the operation and testing of the EUT is included in the following list.

Ref. ID	Name/Description	Manufacturer	Model Number	Customer Supplied Calibration Data
	USB port, host	USB cable	Generic	Not applicable.
	USB to Fibre optic	Fibre optic cable	Generic	Not applicable.
	DELL Laptop	DELL	Latitude 7480	Not applicable.
	USB-UART Convertor	Waveshare	FT232 USB UART Board (Micro)	Not applicable.
	UART-Fibre Optic convertor	AVAGO	AFBR-1629, AFBR-2529	Not applicable.
	Motorola /Android phone	Motorola	YDMW1942401P	Not applicable.
	Battery pack, 4x1.2Vdc, NiMH	Generic	Not applicable.	Not applicable.
	LF credential/Prox	HID Global	Indala FlexISO	Not applicable.
	HF credential/14443A	HID Global	MIFARE Classic 4K SE	Not applicable.
	LF Antenna	HID Global	6500-101-03	Not applicable.
	Combined LF/HF antenna	HID Global	4090A16	Not applicable.

Table 5. Support Equipment

H. Ports and Cabling Information

Ref. Id	Port Name on EUT	Cable Description or reason for no cable	Qty	Length as tested (m)	Max Length (m)	Shielded? (Y/N)	Termination Box ID & Port Name
	Rx-Tx	3-wire twisted		0.2	0.2	No	Not applicable.

Table 6. Ports and Cabling Information

I. Mode of Operation

The RF Credential was placed in front of the OMNIKEY SE Reader Core in order to force continuous reading operations.

Transmit Band	Modulation	Channel Frequencies Tested	Exercising Method
125kHz	ASK	125kHz	125kHz RFID Credential

Table 7. Test Channels Utilized

J. Modifications

a) Modifications to EUT

No modifications were made to the EUT.

b) Modifications to Test Standard

No modifications were made to the test standard.

K. Disposition of EUT

The test sample including all support equipment submitted to the Electro-Magnetic Compatibility Lab for testing was returned to HID Global Corporation (US) upon completion of testing.

Antenna Requirements

§ 15.203 Antenna Requirement

Test Requirement: **§ 15.203:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

a.) Antenna must be permanently attached to the unit.

b.) Antenna must use a unique type of connector to attach to the EUT.

c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Results: The OMNIKEY SE Reader Core as evaluated, was compliant as the antenna was permanently attached.

Test Engineer(s): Bryan Taylor

Test Date(s): 1/10/2024

Conducted Emissions

§ 15.207(a) Conducted Emissions Limits

Test Requirement(s): **§ 15.207 (a):** For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency range (MHz)	§ 15.207(a), Conducted Limit (dBμV)	
	Quasi-Peak	Average
* 0.15 - 0.5	66 - 56	56 - 46
0.5 - 5	56	46
5 - 30	60	50

Table 8. Conducted Limits for Intentional Radiators from FCC Part 15 § 15.207(a)

Note: *Decreases with the logarithm of the frequency.

RSS-GEN (8.8) AC Power-Line Conducted Emissions Limits

Test Requirement(s): **RSS-GEN (8.8):** Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in the below figure, as measured using a 50 µH / 50 Ω line impedance stabilization network (LISN). This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in the below figure shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

Frequency (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
* 0.15-0.5	66 to 56	56 to 46[1]
0.5-5	56	46
5-30	60	50

Table 9. AC Power Line Conducted Emissions Limits

Note: *Decreases with the logarithm of the frequency.

Test Procedure: The EUT was placed on a 0.8 m-high non-conducting table above a ground plane. The EUT was situated such that the back of the EUT was 0.4 m from one wall of the vertical ground plane, and the remaining sides of the EUT were no closer than 0.8 m from any other conductive surface. The EUT was powered from a 50 Ω/50 µH Line Impedance Stabilization Network (LISN). The EMC receiver scanned the frequency range from 150 kHz to 30 MHz. Conducted Emissions measurements were made in accordance with *ANSI C63.10-2013 "Procedures for Compliance Testing of Unlicensed Wireless Devices"*. The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 µH LISN as the input transducer to an EMI receiver.

Test Results: The OMNIKEY SE Reader Core was compliant with this requirement. Both the LF and HF antennas were replaced with 50 ohm load resistors. The resistors were located at the antenna solder locations on the main printed circuit board.

Test Engineer(s): An Dang

Test Date(s): 1/9/2024

Conducted Emissions Voltage Test Setup

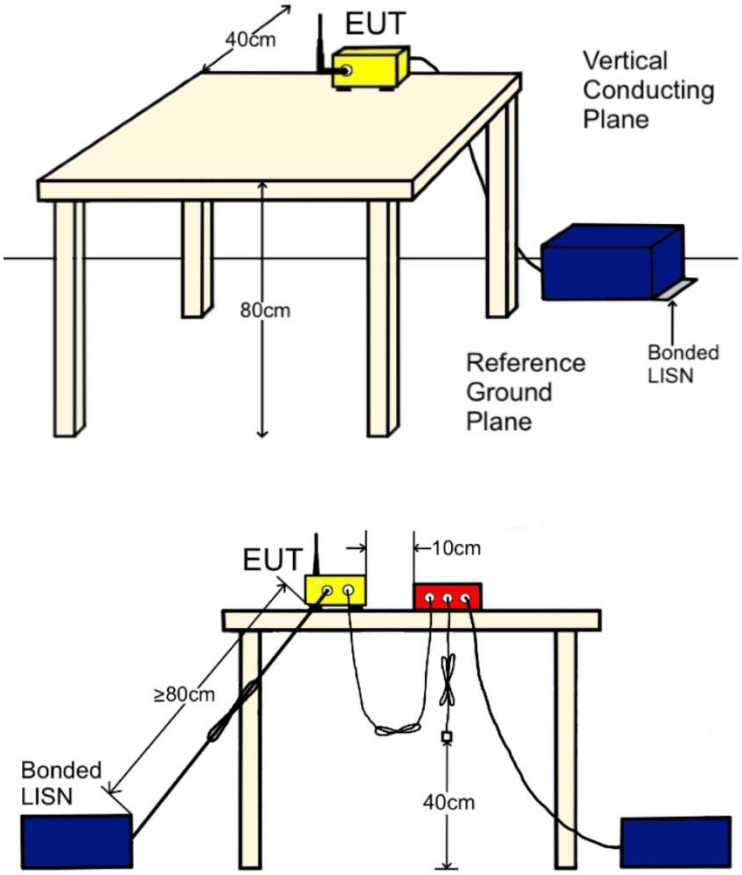
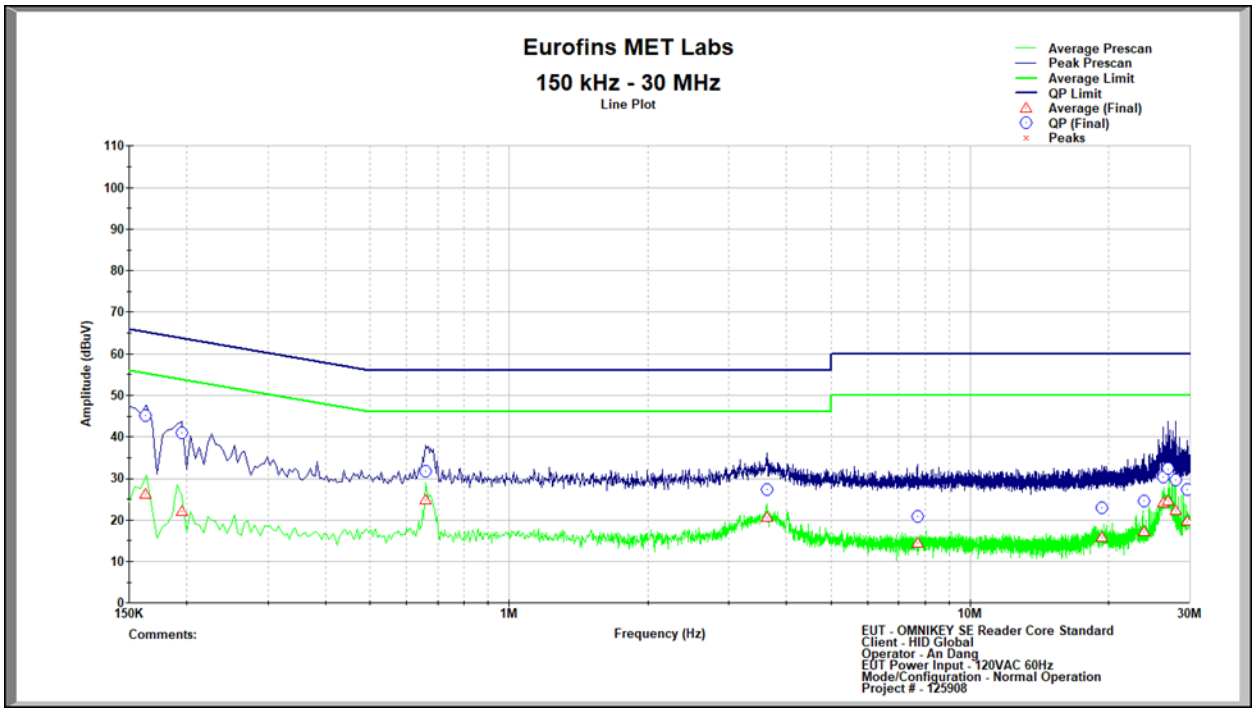


Figure 2. CEV Test Setup

15.207(a) Conducted Emissions Test Results

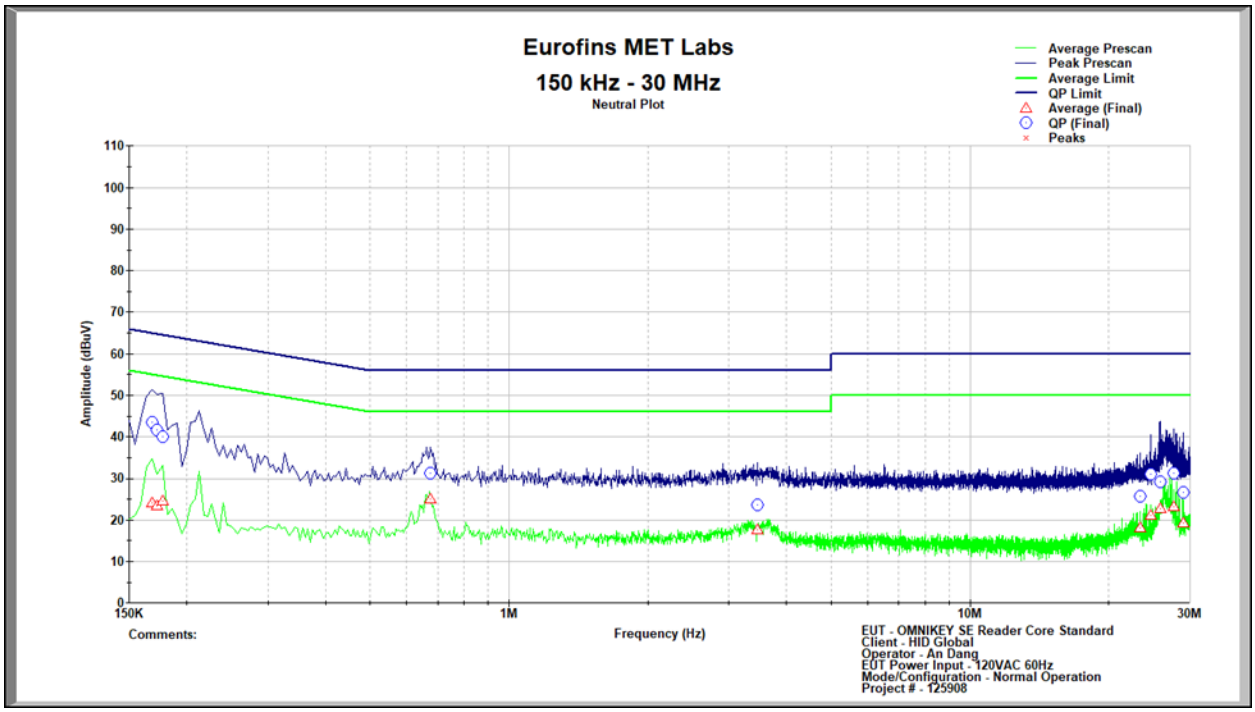


Conducted Emissions, 15.207(a), Phase

Frequency (MHz)	Quasi-Peak (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Quasi-Peak Margin (dB)	Average (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
0.163	45.158	65.629	20.471	26.151	55.629	29.478
0.195	40.944	64.714	23.770	21.949	54.714	32.765
0.658	31.720	56.000	24.280	24.796	46.000	21.204
3.621	27.253	56.000	28.747	20.667	46.000	25.333
7.686	20.888	60.000	39.112	14.462	50.000	35.538
19.297	22.913	60.000	37.087	15.845	50.000	34.155
23.826	24.610	60.000	35.390	17.184	50.000	32.816
26.271	30.304	60.000	29.696	24.116	50.000	25.884
26.838	32.296	60.000	27.704	24.637	50.000	25.363
27.897	29.623	60.000	30.377	22.290	50.000	27.710
29.611	27.365	60.000	32.635	19.645	50.000	30.355

Table 10. Conducted Emissions, 15.207(a), Phase, Test Results

15.207(a) Conducted Emissions Test Results



Conducted Emissions, 15.207(a), Neutral

Frequency (MHz)	Quasi-Peak (dBµV/m)	Quasi-Peak Limit (dBµV/m)	Quasi-Peak Margin (dB)	Average (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
0.168	43.415	65.486	22.070	24.109	55.486	31.376
0.172	41.643	65.357	23.714	23.334	55.357	32.024
0.177	40.104	65.229	25.124	24.524	55.229	30.705
0.676	31.213	56.000	24.787	24.986	46.000	21.014
3.463	23.685	56.000	32.315	17.534	46.000	28.466
23.363	25.678	60.000	34.322	17.970	50.000	32.030
24.674	31.047	60.000	28.953	21.155	50.000	28.845
25.852	29.224	60.000	30.776	22.716	50.000	27.284
27.645	31.164	60.000	28.836	23.195	50.000	26.805
29.076	26.585	60.000	33.415	19.213	50.000	30.787

Table 11. Conducted Emissions, 15.207(a), Neutral, Test Results

Occupied Bandwidth Measurements

§ 15.215(c) 20 dB Occupied Bandwidth

Test Requirement(s): **§ 15.215 (c)** Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

Test Procedure: The transmitter was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer. Per ANSI C63.10: 2020 the RBW should be between 1% and 5% of the occupied bandwidth.

Test Results: The OMNIKEY SE Reader Core was compliant with this requirement.

RSS-GEN (6.7) 99% Occupied Bandwidth

Test Requirements: The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

Test Procedure: The EUT was on and transmitting at the highest output power. The bandwidth of the fundamental frequency was measured with the spectrum analyzer. Per ANSI C63.10: 2020 the RBW should be between 1% and 5% of the occupied bandwidth.

Test Engineer(s): Bryan Taylor

Test Date(s): 1/8/2024

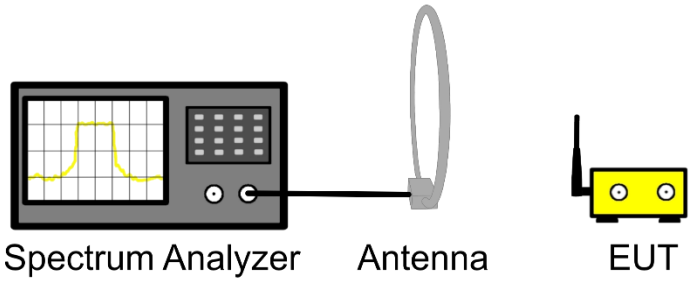
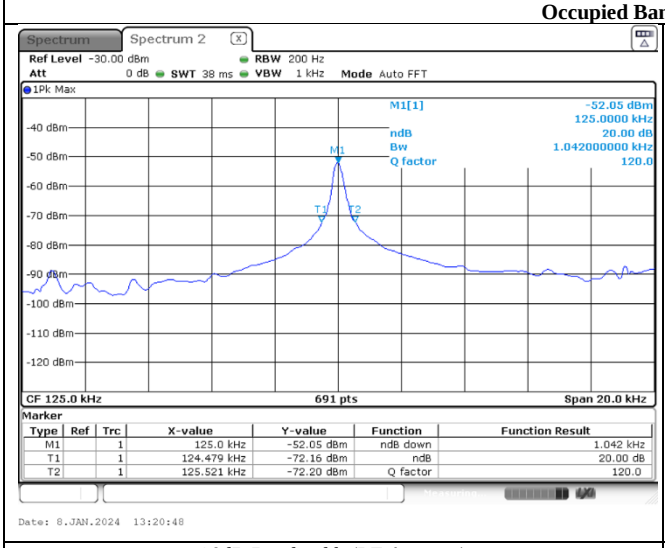


Figure 3. 20 dB Bandwidth and 99% Bandwidth Test Setup

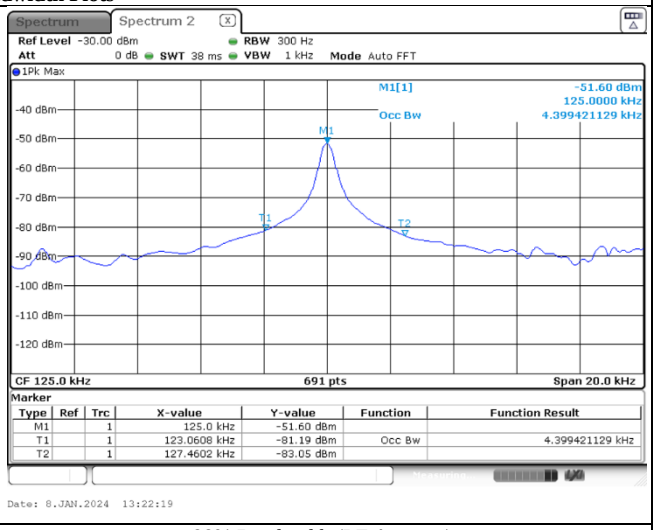
Antenna Tested	Center Frequency (kHz)	20 dB Bandwidth	99% Bandwidth
LF Antenna	125kHz	1.04kHz	4.39kHz
Combined LF Antenna	125kHz	1.47kHz	4.22kHz

Table 12. Occupied Bandwidth Test Results

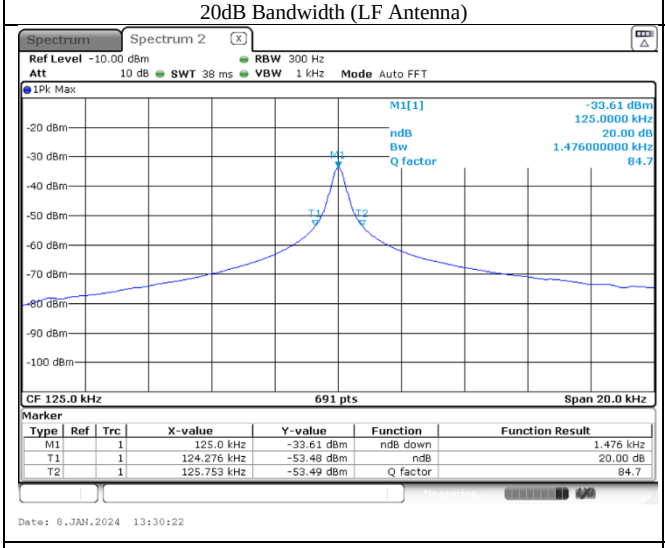
Occupied Bandwidth Plots



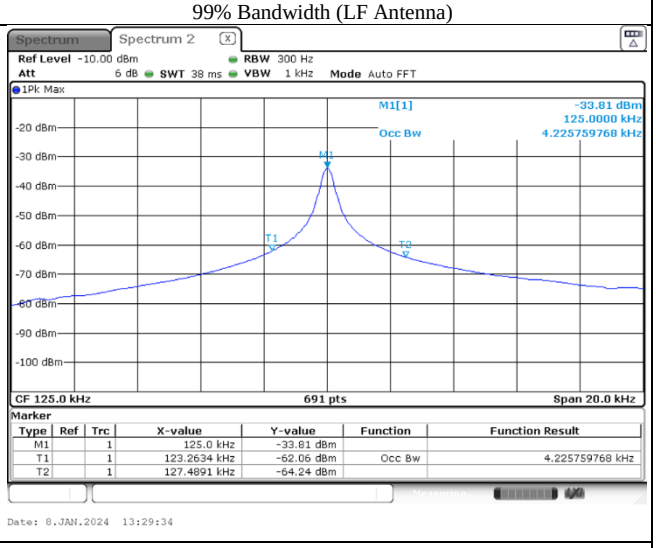
20dB Bandwidth (LF Antenna)



99% Bandwidth (LF Antenna)



20dB Bandwidth (Combined LF Antenna)



99% Bandwidth (Combined LF Antenna)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.209 Radiated Emissions Limits; General Requirements

Test Requirement(s):

§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 (40dBuV/m) **	3
88-216	150 (43.5dBuV/m)**	3
216-960	200 (46.0dBuV/m)**	3
Above 960	500 (54.0dBuV/m)	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., §§ 15.231 and 15.241.		

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

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

(f) In accordance with § 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in § 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in § 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in § 15.109 that are applicable to the incorporated digital device.

(g) Perimeter protection systems may operate in the 54–72 MHz and 76–88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

RSS-210 (7.2) General Field Strength Limits

Test Requirement(s): RSS-Gen includes the general field strength limits of unwanted emissions, where applicable, for transmitters and receivers operating in accordance with the provisions specified in this standard.

Unless otherwise indicated, unwanted emissions of transmitters and receivers are permitted to fall within the restricted frequency bands listed in RSS-Gen and the TV bands 54-72 MHz, 76-88 MHz, 174-216 MHz and 470-602 MHz; however, fundamental emissions are prohibited in these bands, except where equipment operation is permitted in the applicable RSS.

RSS-Gen (8.9) Transmitter Emission Limits

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 – General field strength limits at frequencies above 30 MHz

Frequency (MHz)	Field strength (µV/m at 3 m)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Table 6 – General field strength limits at frequencies below 30 MHz

Frequency	Magnetic field strength (H-Field) (µA/m)	Measurement distance (m)
9 - 490 kHz[Note 1]	6.37/F (F in kHz)	300
490 - 1705 kHz	63.7/F (F in kHz)	30
1.705 - 30 MHz	0.08	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

Test Procedure:

The EUT was set to transmit and placed on a 0.8 m-high wooden stand inside a semi-anechoic chamber. The method of testing and test conditions of ANSI C63.10: 2013 were used. For measurements below 30 MHz a loop antenna placed 3m away from the unit was used. For measurements above 30 MHz a biconalog antenna placed 10 m away from the unit was used. Measurements below 30 MHz were conducted with the loop antenna at coaxial (parallel) and planar (perpendicular) orientations. Measurements above 30 MHz were conducted with the biconalog antenna in the vertical and horizontal polarizations. A peak detector was used to perform a pre-scan from 9 kHz to 10 times the fundamental frequency. Spurious emissions within 20 dB of the applicable limit were measured using a quasi-peak detector and recorded in the subsequent section. Peak emissions that were observed over the appliable limit were determined to be digital emissions subject to the requirements of FCC Part 15 Subpart B and ICES-003 subsection 6.2 for Class A devices.

The measurements made at 3 m with the loop antenna (below 30MHz) were then extrapolated to 30m or 300 m using the following correction factors which were applied to the limit.

40log (30/3) = 40 dB
40log (300/3) = 80 dB

The measurements made at 10 m with the biconilog antenna (above 30MHz) were then extrapolated to the 3m using the following correction factor which were applied to the limit.

20log (10/3) = 10.46 dB

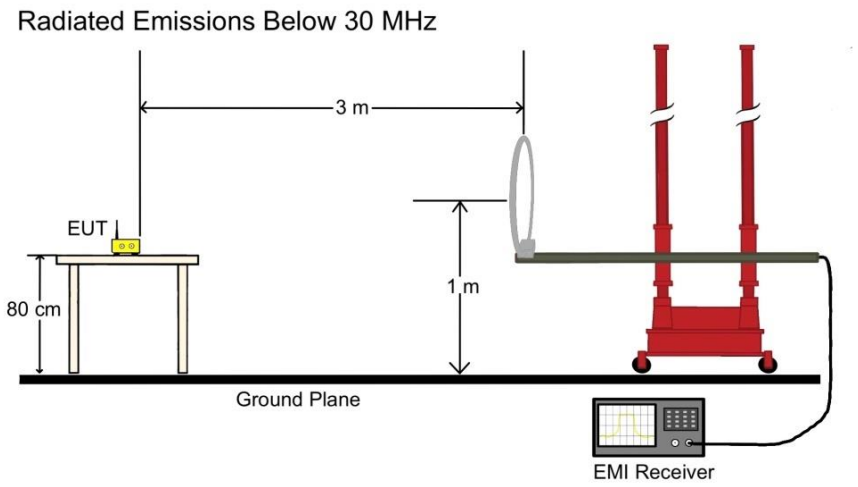


Figure 4: Radiated Emissions (Below 30MHz), Test Setup

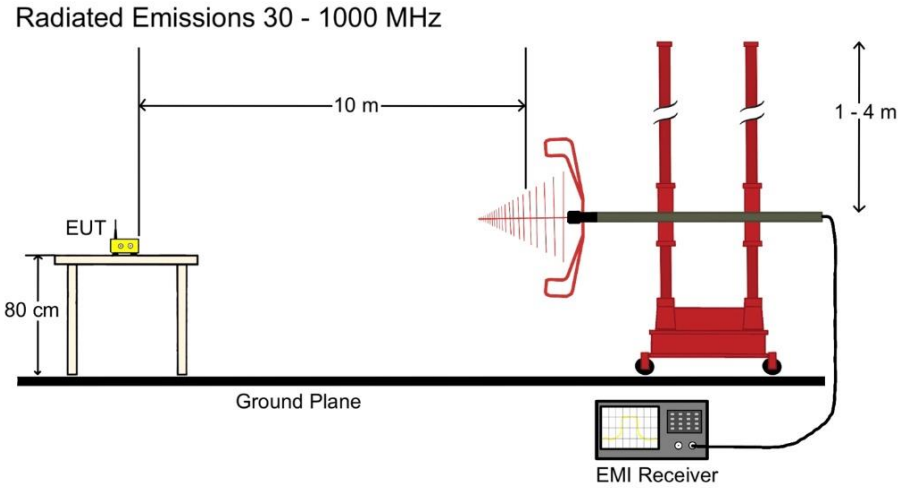


Figure 5. Radiated Emissions (Above 30MHz), Test Setup

Test Results: The OMNIKEY SE Reader Core was compliant with the general radiated emission limits.

Test Engineer(s): Sergio Gutierrez, Michael Ermer

Test Date(s): 1/9/2024 – 1/10/2024

Frequency [MHz]	Peak Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.110	39.30	106.79	67.49	11.57	H	91.1	1	0.200	Pass
0.125	81.42	105.66	24.24	11.51	V	179.4	1	0.200	Pass
0.125	81.61	105.66	24.05	11.51	H	175.5	1	0.200	Pass
0.140	39.33	104.66	65.33	11.64	H	222.5	1	0.200	Pass
0.326	49.80	97.35	47.55	11.43	V	270	1	9.000	Pass
0.375	50.05	96.12	46.07	11.33	H	111.4	1	9.000	Pass

Table 13. Radiated Spurious Emissions 9kHz – 30MHz (LF Antenna)

Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Comment
45.900	13.81	29.55	15.74	-11.05	V	245.7	1.28	120.000	Pass
56.670	8.80	29.55	20.75	-14.15	V	185.7	1.17	120.000	Pass
57.000	5.51	29.55	24.04	-14.14	H	135.9	2.78	120.000	Pass
290.580	21.90	35.57	13.67	-6.00	H	13.8	3.47	120.000	Pass
320.160	15.19	35.57	20.38	-4.70	V	167.5	1.23	120.000	Pass

Table 14. Radiated Spurious Emissions Above 30MHz (LF Antenna)

Frequency [MHz]	Peak Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.110	47.09	106.79	59.7	11.57	V	237	1	0.200	Pass
0.112	48.38	106.60	58.22	11.55	H	271.9	1	0.200	Pass
0.125	76.16	105.66	29.5	11.51	V	259.5	1	0.200	Pass
0.125	76.18	105.66	29.48	11.51	H	258.6	1	0.200	Pass
0.138	45.66	104.81	59.15	11.61	H	266.2	1	0.200	Pass
0.139	43.97	104.73	60.76	11.63	V	249.5	1	0.200	Pass
0.654	44.65	71.29	26.64	11.54	H	112.1	1	9.000	Pass

Table 15. Radiated Spurious Emissions 9kHz – 30MHz (Combined LF Antenna)

Frequency [MHz]	QPK Level [dBµV/m]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Comment
46.680	11.97	29.55	17.58	-11.43	H	180	2.03	120.000	Pass
47.010	18.28	29.55	11.27	-11.58	V	360	1.5	120.000	Pass
89.520	14.67	33.07	18.40	-11.43	V	330.6	1.5	120.000	Pass
235.560	19.10	35.57	16.47	-8.03	H	9.2	3.53	120.000	Pass
284.820	20.49	35.57	15.08	-6.13	H	30.9	2.67	120.000	Pass
512.310	22.70	35.57	12.87	-0.42	V	6.5	3.62	120.000	Pass

Table 16. Radiated Spurious Emissions Above 30MHz (Combined LF Antenna)

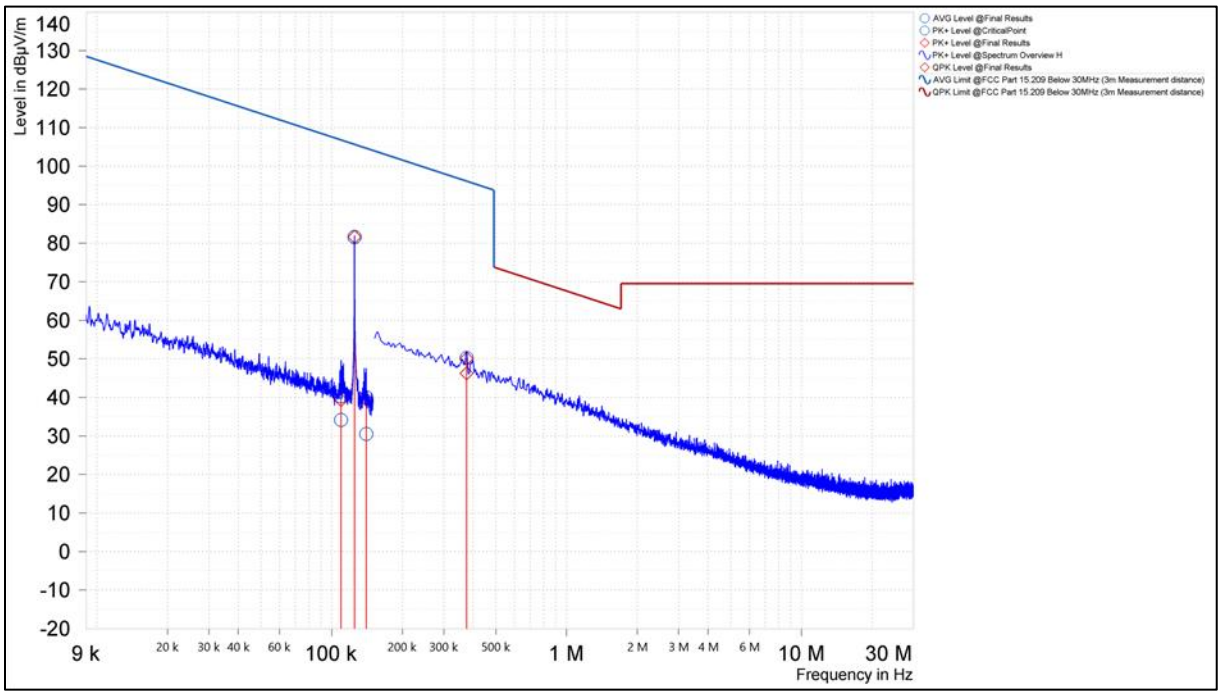


Figure 6. Spurious Emissions Below 30MHz, (LF Antenna, Coplanar Loop)

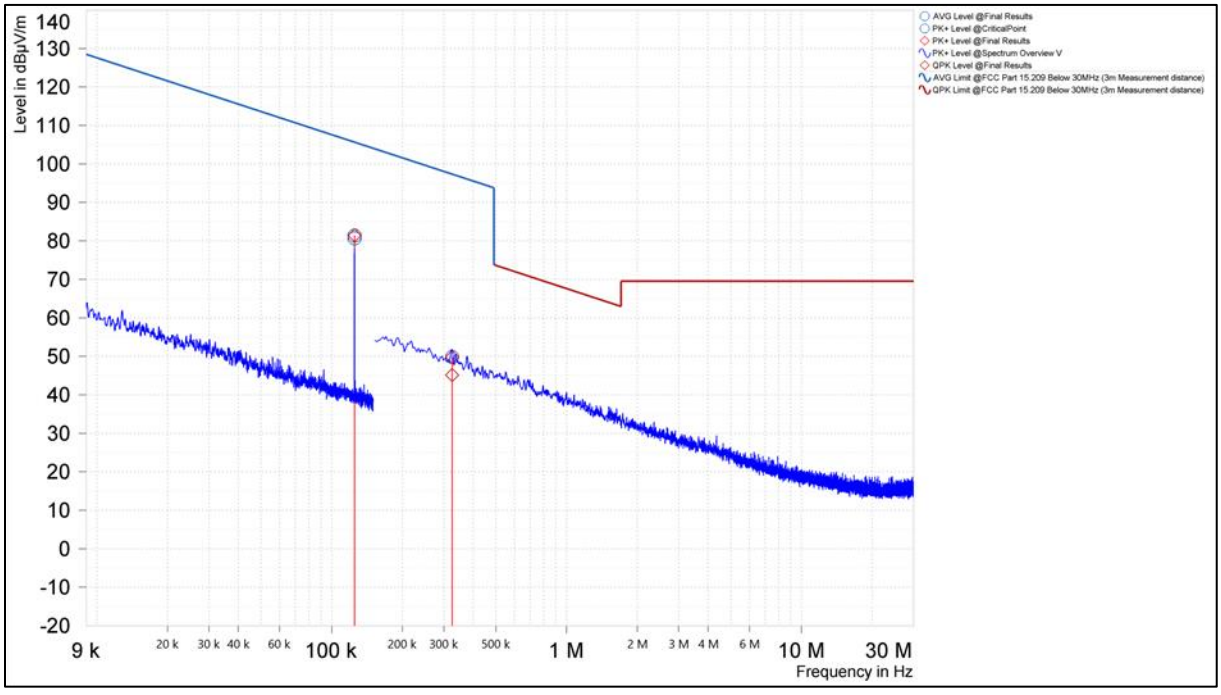


Figure 7. Spurious Emissions Below 30MHz, (LF Antenna, Coaxial Loop)

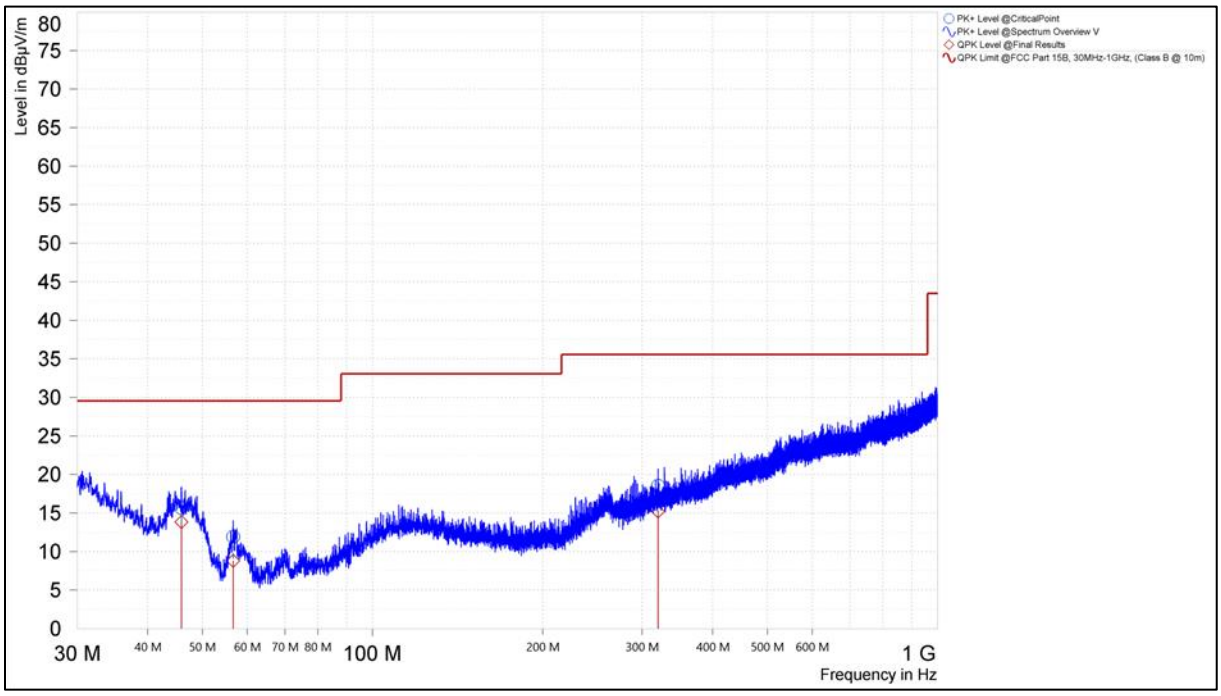


Figure 8. Spurious Emissions 30MHz – 1GHz, (LF Antenna, Vertical Polarity)

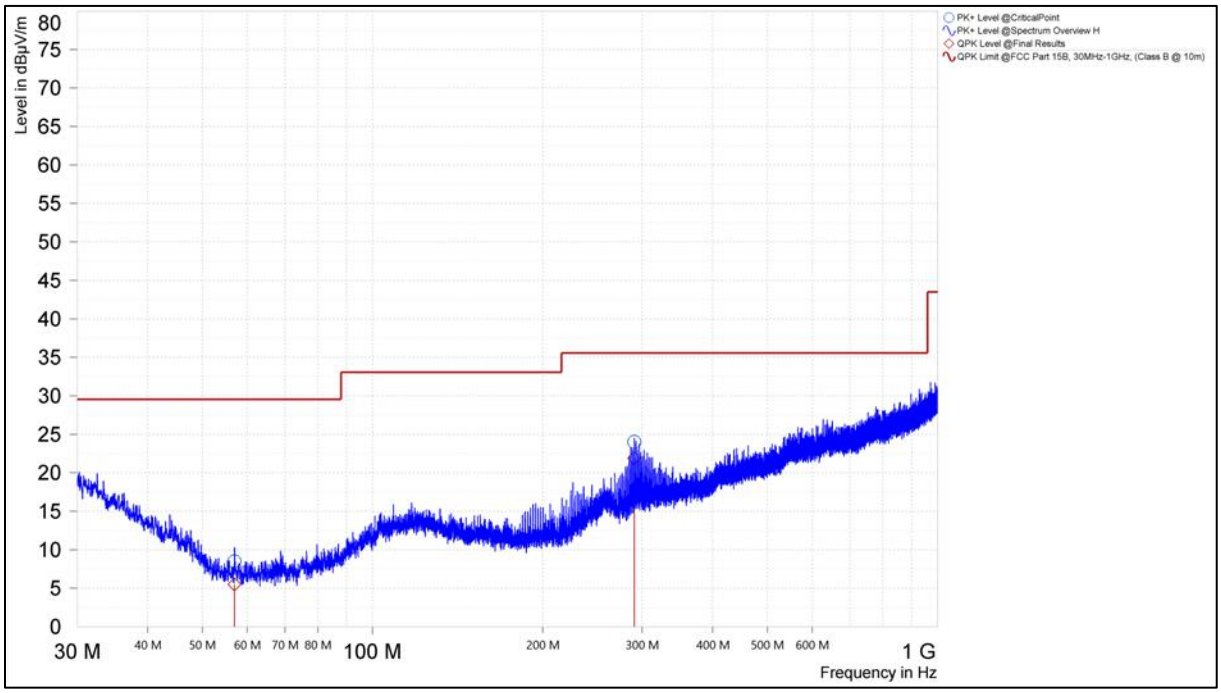


Figure 9. Spurious Emissions 30MHz – 1GHz, (LF Antenna, Horizontal Polarity)

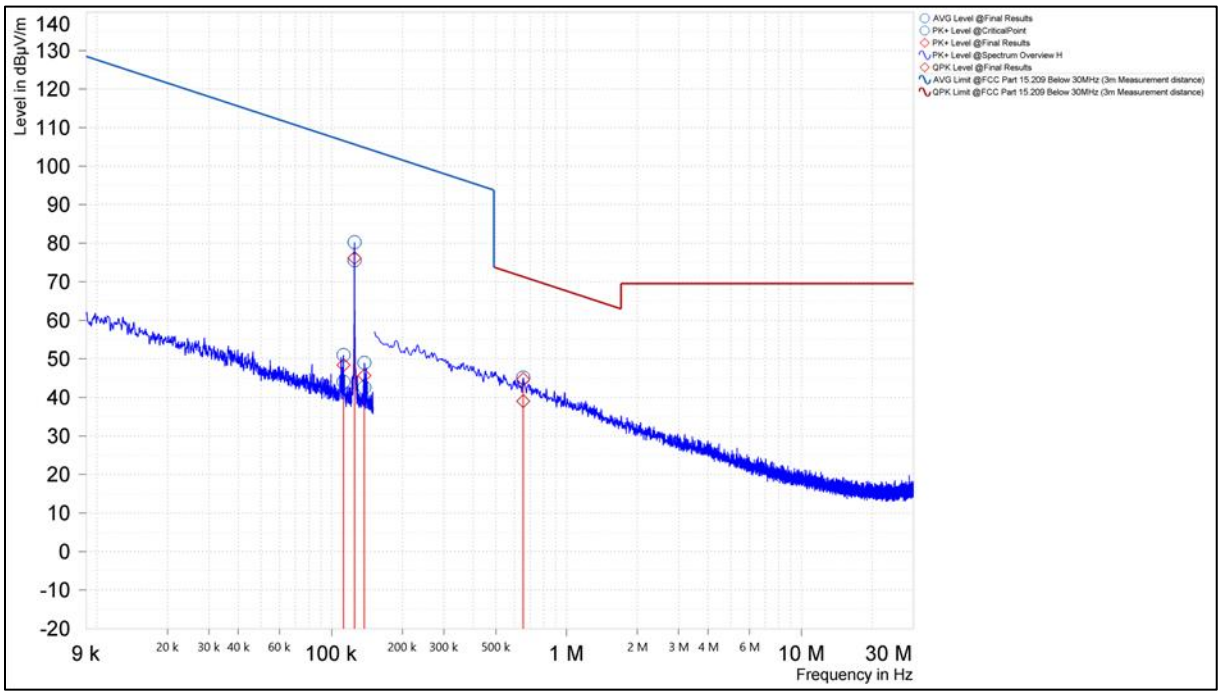


Figure 10. Spurious Emissions Below 30MHz, (Combined LF Antenna, Coplanar Loop)

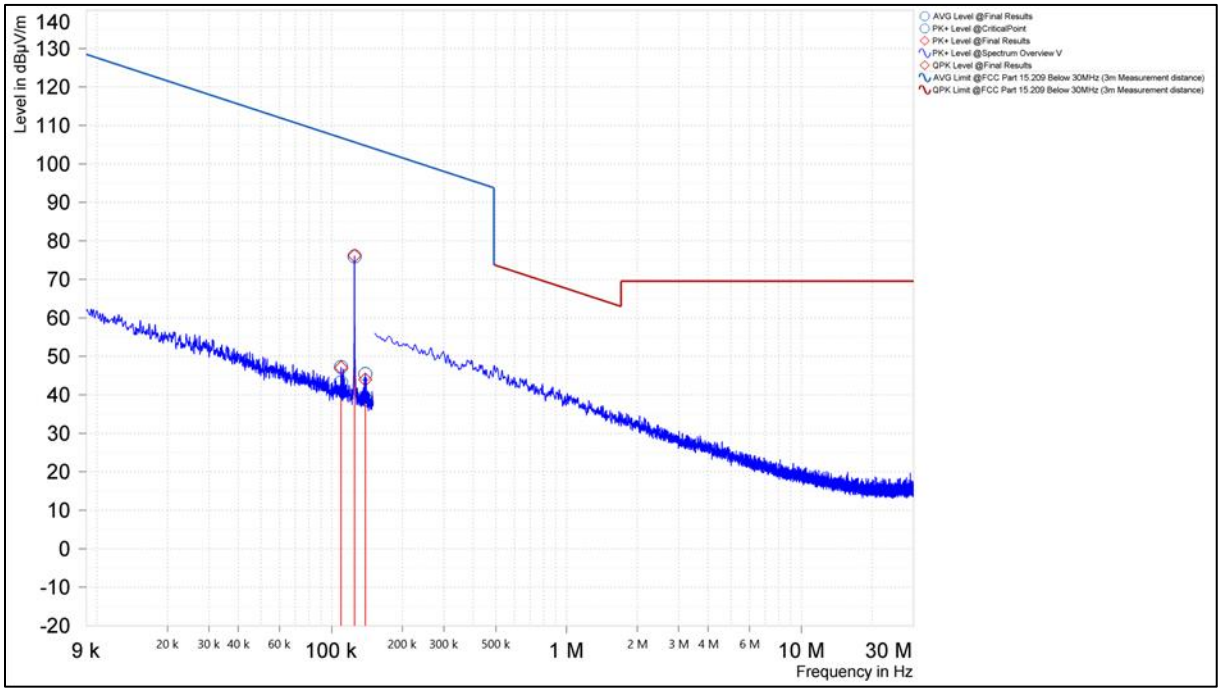


Figure 11. Spurious Emissions Below 30MHz, (Combined LF Antenna, Coaxial Loop)

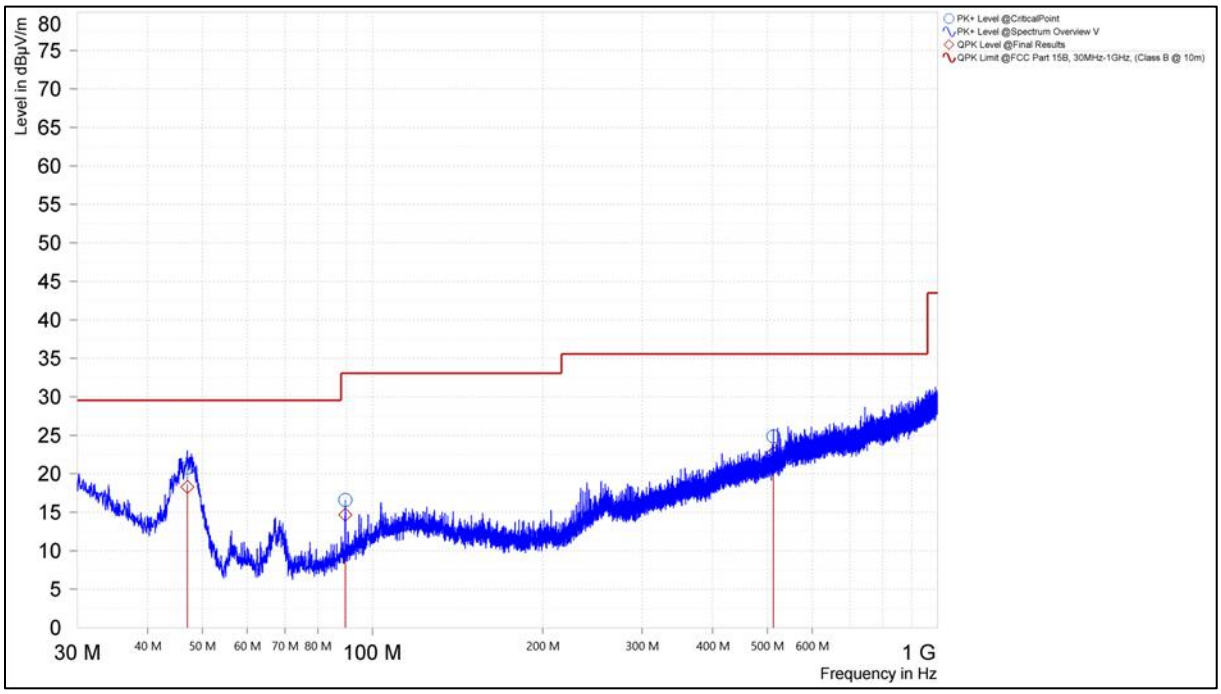


Figure 12. Spurious Emissions 30MHz – 1GHz, (Combined LF Antenna, Vertical Polarity)

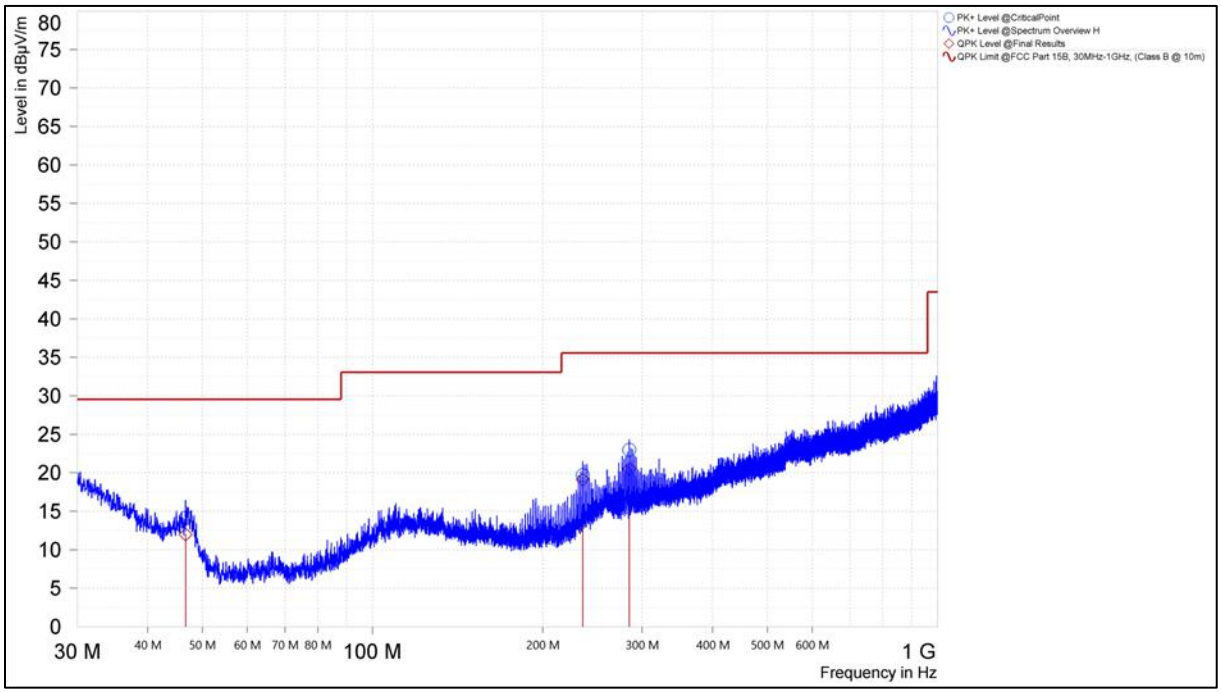


Figure 13. Spurious Emissions 30MHz – 1GHz, (Combined LF Antenna, Horizontal Polarity)

Test Equipment

Calibrated test equipment utilized during testing was maintained in a current state of calibration per the requirements of ISO/IEC 17025:2017.

MET Asset #	Description	Manufacturer	Model	Last Cal Date	Cal Due Date
1A1234	FSV Signal Analyzer	Rohde & Schwarz	FSV 40	1/23/2023	1/23/2024
1A1083	Receiver	Rohde & Schwarz	ESU40	11/20/2023	11/20/2024
1A1176	Active Loop Antenna (9KHz-30MHz)	ETS-Lindgren	6502	7/13/2023	7/13/2024
1A1050	Bilog Antenna (30MHz – 1GHz)	Schaffner	CBL 6112D	1/24/2023	1/24/2024
1A1065	EMI Receiver	Rohde & Schwarz	ESCI	8/4/2023	8/4/2024
1A1087	Pulse Limiter	Rohde & Schwarz	ESH3Z2	12/21/2022	12/21/2023
1A1122	LISN	Teseq	NNB 51	9/19/2023	9/19/2024
1A1123	LISN	Teseq	NNB 51	12/20/2023	12/20/2024
1A1149	DC Milliohm Meter	GW Instek	GOM-802	9/20/2023	9/20/2024
1A1117	Digital Multimeter	Fluke	87 III	11/6/2023	11/6/2024
1A1099	Generator	Com-Power	CGO-51000	See Note	
1A1088	Preamplifier	Rohde & Schwarz	TS-PR1	See Note	
1A1044	Generator	Com-Power	CG-520	See Note	
1A1073	Multi Device Controller	ETS	2090	See Note	
1A1074	System Controller	Panasonic	WV-CU101	See Note	
1A1080	Multi-Device	ETS	2090	See Note	
1A1180	Preamplifier	Miteq	AMF-7D-01001800-22-10P	See Note	

Table 17. Test Equipment List

Note: Functionally tested equipment is verified using calibrated instrumentation at the time of testing.

End of Report