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

7/23/2024

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

Dear Erik Ray,

Enclosed is the EMC test report for compliance testing of HID Global Corporation (US), HDP5000e, tested to the requirements of:

- Title 47 of the CFR, Part 15.225, 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: WIRA130667 – FCC-IC-HF_R3

13.56MHz RFID
Test Report

for the

HID Global Corporation (US)
HDP5000e (Model: X002700)

Tested under
the FCC Certification Rules
contained in
15.225 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
∅	4/24/2024	Initial Issue.
1	4/29/2024	Changes requested by client
2	7/15/2024	Reviewer Comments.
3	7/23/2024	Reviewer Comments

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) HDP5000e, with the requirements of Part 15, §15.225 and RSS-210 Issue10, Annex B, B.6. 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 HDP5000e. 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 HDP5000e, 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 15, §15.225 and RSS-210, in accordance with HID Global Corporation (US), under purchase order number 9HID0510R1. 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 §15.225(a)	RSS-210 (B.6.a.i)	Field Strength emissions within the band 13.553 – 13.567 MHz	**Compliant**
Part 15 §15.225(b)	RSS-210 (B.6.a.ii)	Field Strength emissions within the band 13.410 – 13.553 MHz and 13.567 – 13.710 MHz	**Compliant**
Part 15 §15.225(c)	RSS-210 (B.6.a.iii)	Field Strength emissions within the band 13.110 – 13.410 MHz and 13.710 – 14.010 MHz	**Compliant**
Part 15 §15.225(d)	RSS-210 (B.6.a.iv)	Outside-Band Field Strength emissions per 15.209 - 13.110 – 14.010 MHz	**Compliant**
Part 15 §15.225(e)	RSS-210 (B.6.b)	Frequency Tolerance of the Carrier	**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 HDP5000e.

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) HDP5000e.

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

Product Name:	HDP5000e	
Model(s) Tested:	X002700	
Model(s) Covered:	X002700	
EUT Specifications:	Primary Power: 100 – 240VAC	
	Type of Modulation(s):	ASK
	Equipment Code:	DXX
	Maximum field Strength:	69.60dBuV/m
	Antenna Type:	loop
	EUT Frequency Ranges:	13.56MHz
Analysis:	The results obtained relate only to the item(s) tested.	
Environmental Test Conditions:	Temperature: 15-35° C	
	Relative Humidity: 30-60%	
	Barometric Pressure: 860-1060 mbar	
Evaluated by:	Bryan Taylor and Sergio Gutierrez	
Test Date(s):	3/4/2024 to 3/8/2024	

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	Licence-Exempt Radio Apparatus: Category I Equipment
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.

ISED Lab Info:
CAB Identifier: US0004
Company Number: 2043D

FCC Lab Info:
Designation Number: US1127

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

The HDP5000e, Model X002700 is a modular, high definition printer system designed to print and encode ID cards. The system can only use the following modules, there are no other configuration.

Configuration 2 (DVT3#4) = Single Input Hopper, Dual-Sided Printer, Flipper, Single Output Stacker. Encoders: Mag, OMNIKEY 5122, OMNIKEY 5127SI.

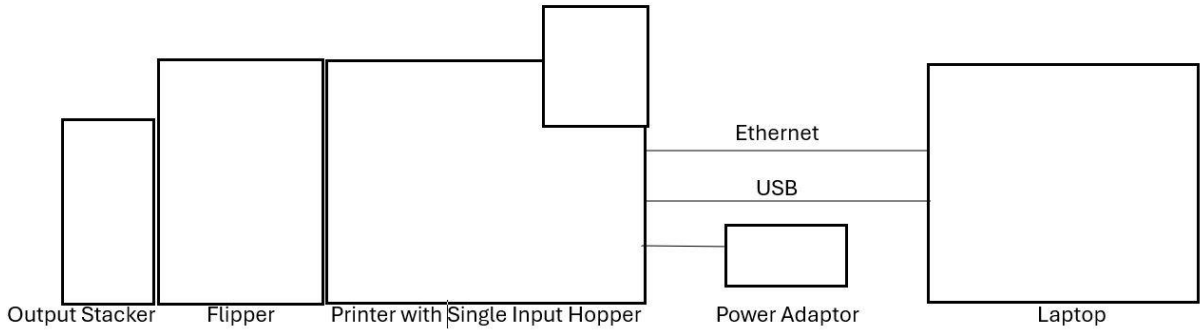


Figure 1. Block Diagram of Test Configuration

F. Equipment Configuration

The EUT was set up as outlined in Figure 1 above. A laptop was used to control the transmitters onboard and force them to transmit one at a time in order to measure their individual radio parameters. In normal operation the transmitters do not operate simultaneously.

G. Support Equipment

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

Name/Description	Manufacturer	Model Number	Serial Number	*Customer Supplied Calibration Data
Support Laptop	Dell	Lattitude	ErayRegsLaptop1	N.A.
Support Laptop	Dell	Lattitude	Compliance Lab PC	N.A.

Table 5. Support Equipment

H. Ports and Cabling Information

Port Name on EUT	Cable Desc. or reason for none	3 Meters or Longer	Length as tested (m)	Max Length (m)	Shielded?	Termination Box ID & Port Name
USB		No	2	2	Yes	Laptop
Ethernet		Yes	3	>3m	No	Laptop
Power		No	2	2	No	AC outlet

Table 6. Ports and Cabling Information

I. Mode of Operation

A laptop computer with a specific utility that allowed for controlling of each transmitter on board the HDP5000e was used during the testing. The following transmitters were tested:

Transmitter	Channel Frequencies Tested	Exercising Method
Film RFID	13.56MHz	Test commands via laptop computer
OMNIKEY 5122	13.56MHz	Test commands via laptop computer
OMNIKEY 5127SI	13.56MHz	Test commands via laptop computer
OMNIKEY 5127SI	125kHz	Test commands via laptop computer
Ribbon Rfid	13.56MHz	Test commands via laptop computer

Table 7. Transmitters Onboard

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 HDP5000e as evaluated, was compliant as the antennas were permanently attached.

Test Engineer(s): Bryan Taylor

Test Date(s): 3/7/2024

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 HDP5000e was compliant with this requirement. Testing was performed on the AC input to an AC to DC power supply that was feeding the 12VDC to the HDP5000e.

Test Engineer(s): Sergio Gutierrez

Test Date(s): 03/07/2024 – 03/08/2024

Conducted Emissions Voltage Test Setup

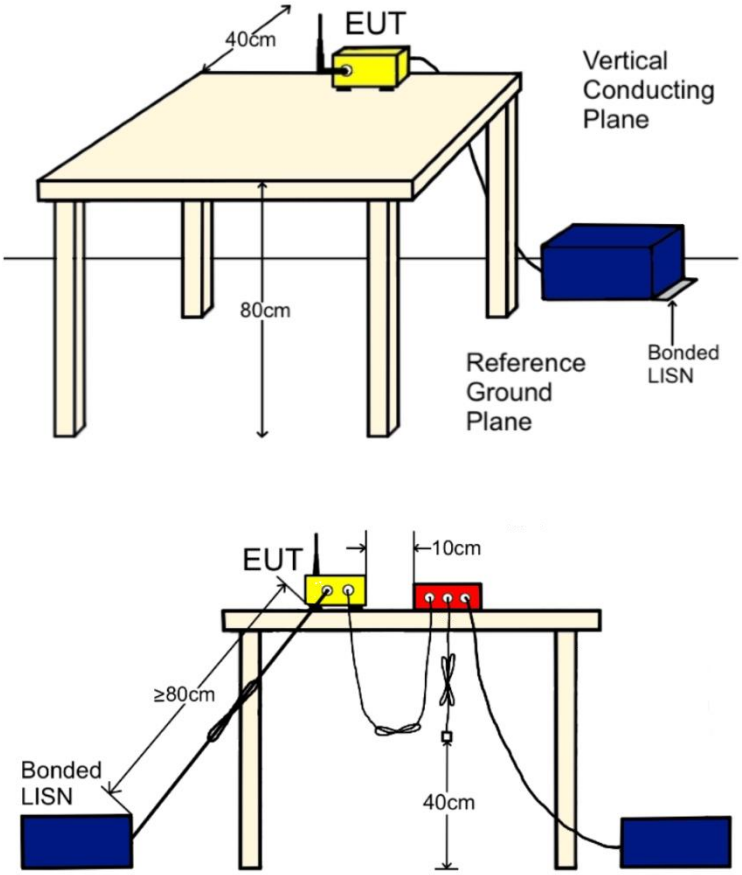
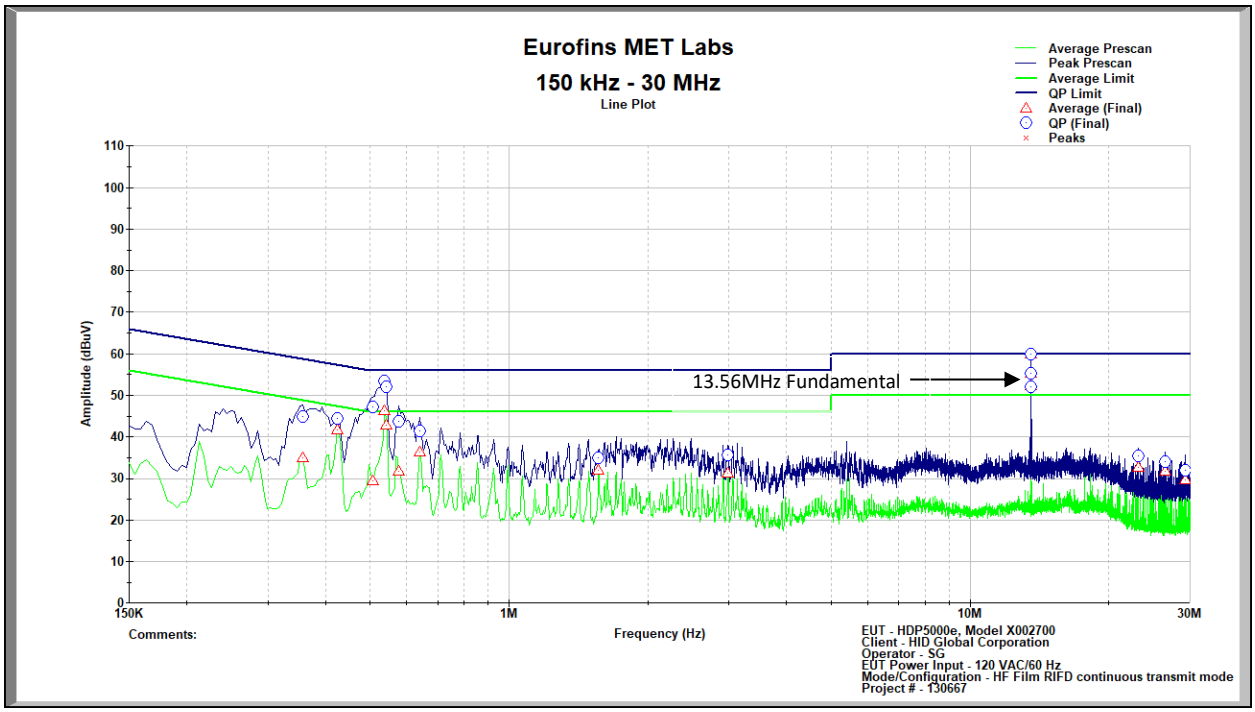


Figure 2. CEV Test Setup

15.207(a) Conducted Emissions Test Results

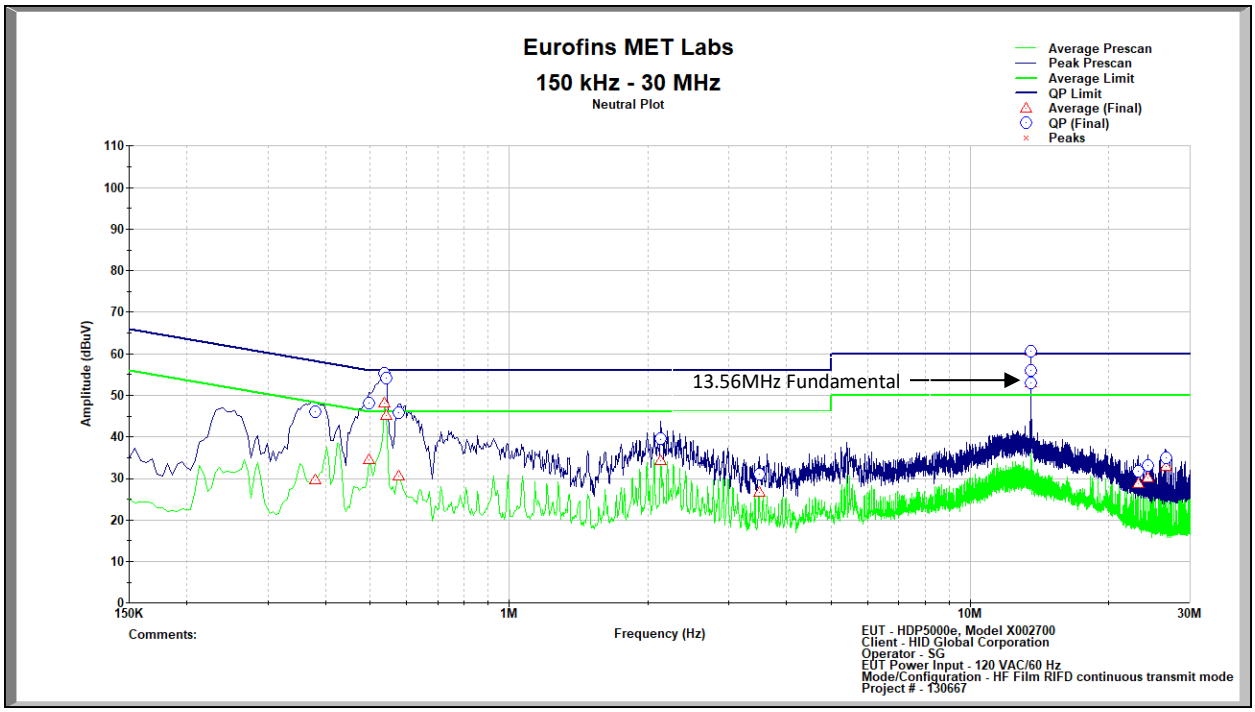


Conducted Emissions, 15.207(a), Phase (Film RFID)

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)
0.357	44.962	60.086	15.123	34.952	50.086	15.134
0.424	44.400	58.157	13.757	41.712	48.157	6.445
0.505	47.153	56.000	8.847	29.366	46.000	16.634
0.537	53.409	56.000	2.591	46.292	46.000	-0.292[1]
0.541	52.099	56.000	3.901	42.825	46.000	3.175
0.578	43.664	56.000	12.336	31.776	46.000	14.224
0.640	41.350	56.000	14.650	36.358	46.000	9.642
1.563	34.904	56.000	21.096	32.009	46.000	13.991
2.985	35.715	56.000	20.285	31.249	46.000	14.751
23.128	35.323	60.000	24.677	32.658	50.000	17.342
26.550	34.124	60.000	25.876	31.789	50.000	18.211
29.238	32.009	60.000	27.991	29.665	50.000	20.335

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

[1] This frequency was found to originate from other digital functions onboard the HDP5000e which is subject to class A emission limits.

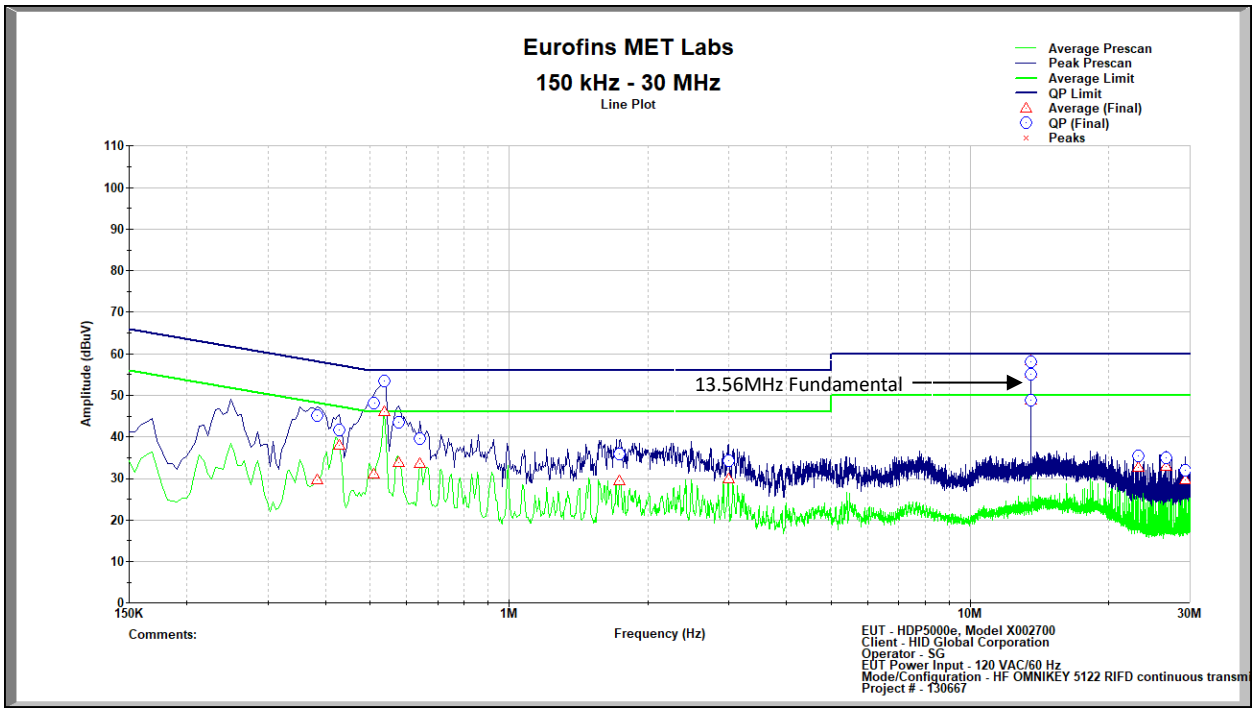


Conducted Emissions, 15.207(a), Neutral (Film RFID)

Frequency (MHz)	Quasi-Peak (dBµV)	Quasi-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.380	46.035	59.443	13.408	29.530	49.443	19.913
0.496	48.073	56.100	8.027	34.391	46.100	11.709
0.537	55.222	56.000	0.778	48.037	46.000	-2.037[2]
0.541	54.046	56.000	1.954	45.205	46.000	0.795
0.578	45.735	56.000	10.265	30.476	46.000	15.524
2.135	39.454	56.000	16.546	34.314	46.000	11.686
3.486	30.960	56.000	25.040	26.609	46.000	19.391
23.133	31.632	60.000	28.368	28.671	50.000	21.329
24.349	33.051	60.000	26.949	30.124	50.000	19.876
26.608	34.960	60.000	25.040	32.819	50.000	17.181
0.380	46.035	59.443	13.408	29.530	49.443	19.913

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

[2] This frequency was found to originate from other digital functions onboard the HDP5000e which is subject to class A emission limits.

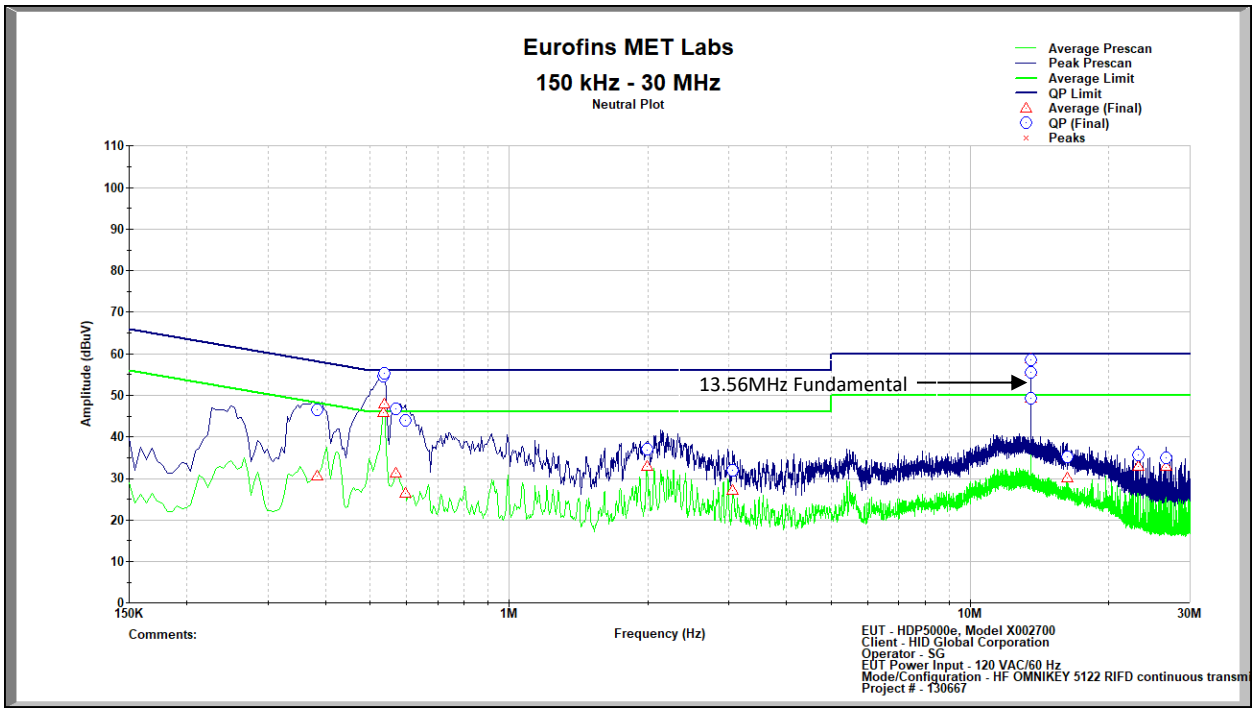


Conducted Emissions, 15.207(a), Phase (OMNIKEY 5122)

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)
0.384	45.203	59.314	14.111	29.578	49.314	19.736
0.429	41.726	58.029	16.302	38.033	48.029	9.995
0.510	48.214	56.000	7.786	31.049	46.000	14.951
0.537	53.557	56.000	2.443	46.079	46.000	-0.079[3]
0.578	43.413	56.000	12.587	33.792	46.000	12.208
0.640	39.520	56.000	16.480	33.519	46.000	12.481
1.738	35.887	56.000	20.113	29.426	46.000	16.574
2.990	34.165	56.000	21.835	29.875	46.000	16.125
23.128	35.339	60.000	24.661	32.675	50.000	17.325
26.608	34.968	60.000	25.032	32.859	50.000	17.141
29.238	31.891	60.000	28.109	29.714	50.000	20.286

Table 12. Conducted Emissions, 15.207(a), Phase, Test Results (OMNIKEY 5122)

[3] This frequency was found to originate from other digital functions onboard the HDP5000e which is subject to class A emission limits.

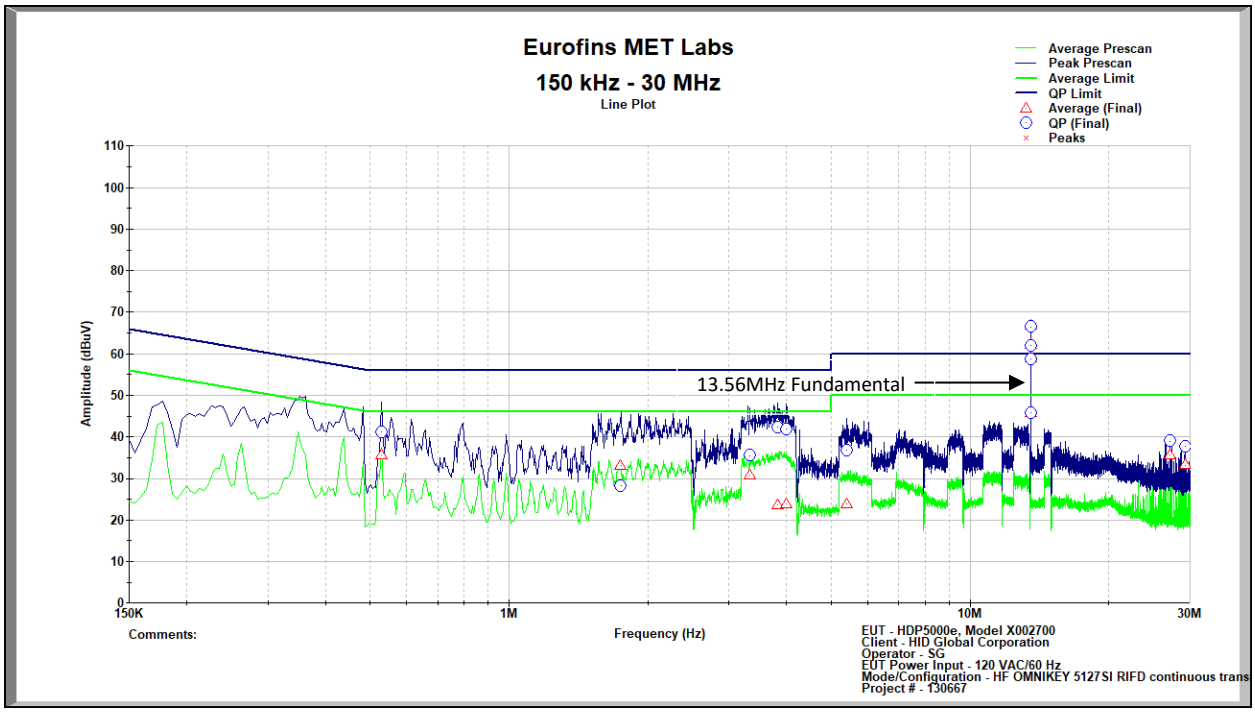


Conducted Emissions, 15. 207(a), Neutral (OMNIKEY 5122)

Frequency (MHz)	Quasi-Peak (dBµV)	Quasi-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.384	46.606	59.314	12.709	30.619	49.314	18.695
0.532	54.506	56.000	1.494	45.921	46.000	0.079
0.537	55.403	56.000	0.597	47.852	46.000	-1.852[4]
0.569	46.658	56.000	9.342	31.260	46.000	14.740
0.596	43.957	56.000	12.043	26.503	46.000	19.497
1.990	36.914	56.000	19.086	32.843	46.000	13.157
3.057	31.912	56.000	24.088	27.189	46.000	18.811
16.227	35.214	60.000	24.786	30.045	50.000	19.955
23.128	35.629	60.000	24.371	32.928	50.000	17.072
26.608	34.985	60.000	25.015	32.761	50.000	17.239

Table 13. Conducted Emissions, 15.207(a), Neutral, Test Results (OMNIKEY 5122)

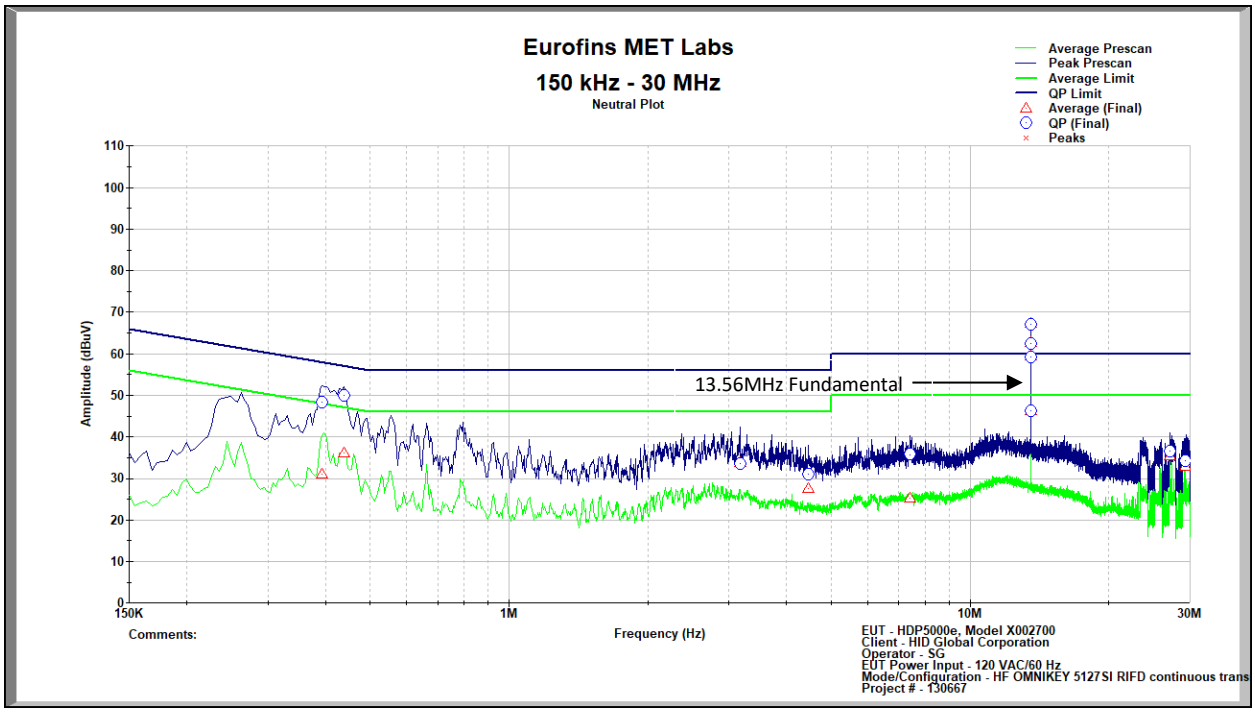
[4] This frequency was found to originate from other digital functions onboard the HDP5000e which is subject to class A emission limits.



Conducted Emissions, 15.207(a), Phase (OMNIKEY 5127SI)

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)
0.528	41.294	56.000	14.706	35.627	46.000	10.373
1.748	28.361	56.000	27.639	33.071	46.000	12.929
3.324	35.535	56.000	20.465	30.752	46.000	15.248
3.824	42.245	56.000	13.755	23.586	46.000	22.414
3.994	41.844	56.000	14.156	23.955	46.000	22.045
5.389	36.706	60.000	23.294	23.776	50.000	26.224
13.553	45.755	60.000	14.245	45.779	50.000	4.221
27.159	39.011	60.000	20.989	35.611	50.000	14.389
29.238	37.667	60.000	22.333	33.207	50.000	16.793

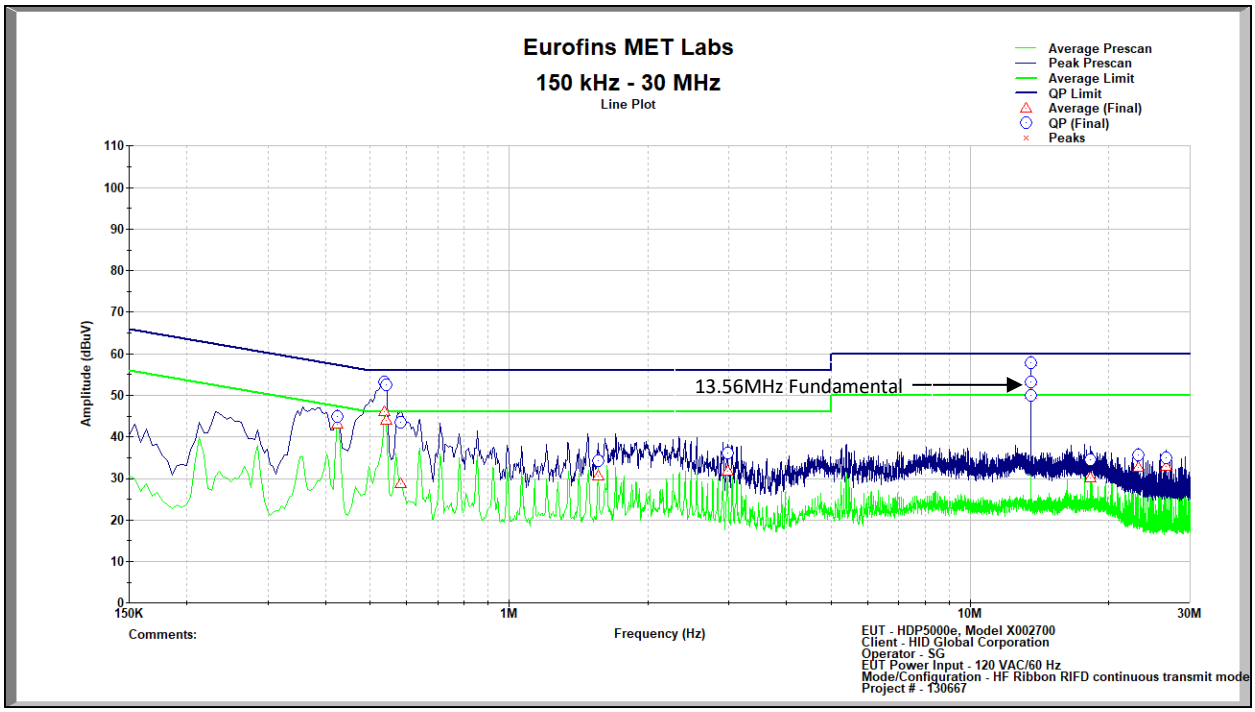
Table 14. Conducted Emissions, 15.207(a), Phase, Test Results (OMNIKEY 5127SI)



Conducted Emissions, 15.207(a), Neutral (OMNIKEY 5127SI)

Frequency (MHz)	Quasi-Peak (dBµV)	Quasi-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.393	48.473	59.057	10.584	31.061	49.057	17.996
0.438	49.921	57.771	7.851	36.059	47.771	11.712
3.167	33.471	56.000	22.529	33.675	46.000	12.325
4.454	31.001	56.000	24.999	27.451	46.000	18.549
7.425	35.752	60.000	24.248	25.230	50.000	24.770
13.553	46.324	60.000	13.676	46.250	50.000	3.750
27.159	36.562	60.000	23.438	35.290	50.000	14.710
29.238	34.238	60.000	25.762	32.828	50.000	17.172

Table 15. Conducted Emissions, 15.207(a), Neutral, Test Results (OMNIKEY 5127SI)

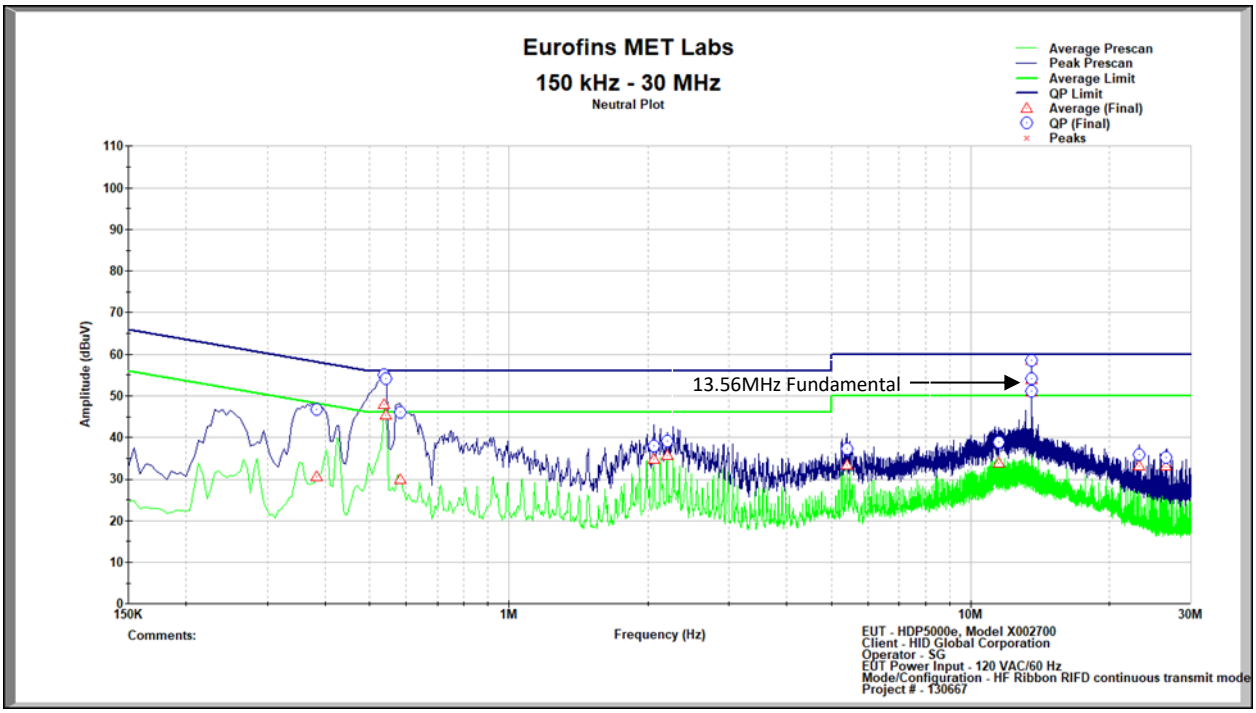


Conducted Emissions, 15.207(a), Phase (Ribbon RFID)

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)
0.424	44.876	58.157	13.281	43.018	48.157	5.139
0.537	53.138	56.000	2.862	46.063	46.000	-0.063[5]
0.541	52.523	56.000	3.477	44.006	46.000	1.994
0.582	43.526	56.000	12.474	28.756	46.000	17.244
1.558	34.251	56.000	21.749	30.553	46.000	15.447
2.981	36.046	56.000	19.954	31.654	46.000	14.346
18.244	34.506	60.000	25.494	30.034	50.000	19.966
23.128	35.579	60.000	24.421	32.731	50.000	17.269
26.608	35.034	60.000	24.966	32.835	50.000	17.165

Table 16. Conducted Emissions, 15.207(a), Phase, Test Results (Ribbon RFID)

[5] This frequency was found to originate from other digital functions onboard the HDP5000e which is subject to class A emission limits.



Conducted Emissions, 15.207(a), Neutral (Ribbon RFID)

Frequency (MHz)	Quasi-Peak (dBµV)	Quasi-Peak Limit (dBµV)	Quasi-Peak Margin (dB)	Average (dBµV)	Average Limit (dBµV)	Average Margin (dB)
0.384	46.644	59.314	12.670	30.515	49.314	18.799
0.537	55.104	56.000	0.896	47.932	46.000	-1.932[6]
0.541	54.249	56.000	1.751	45.350	46.000	0.650
0.582	45.953	56.000	10.047	29.856	46.000	16.144
2.063	38.059	56.000	17.941	34.649	46.000	11.351
2.202	39.051	56.000	16.949	35.628	46.000	10.372
5.399	37.287	60.000	22.713	33.416	50.000	16.584
11.508	38.855	60.000	21.145	33.699	50.000	16.301
23.128	35.922	60.000	24.078	33.038	50.000	16.962
26.487	35.186	60.000	24.814	32.982	50.000	17.018

Table 17. Conducted Emissions, 15.207(a), Neutral, Test Results (Ribbon RFID)

[6] This frequency was found to originate from other digital functions onboard the HDP5000e which is subject to class A emission limits.

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 HDP5000e was compliant with this requirement. The 20dB Bandwidth is shown on the plots on the following pages.

Test Engineer(s): Bryan Taylor

Test Date(s): 3/4/2024 - 3/8/2024

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 Results The HDP5000e was compliant with this requirement. The 99% Bandwidth is shown on the plots on the following pages.

Test Engineer(s): Bryan Taylor

Test Date(s): 3/4/2024 - 3/8/2024

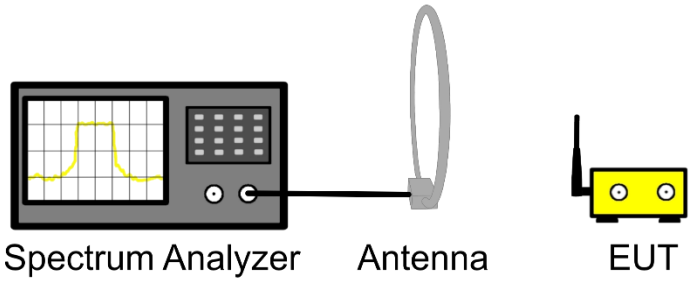
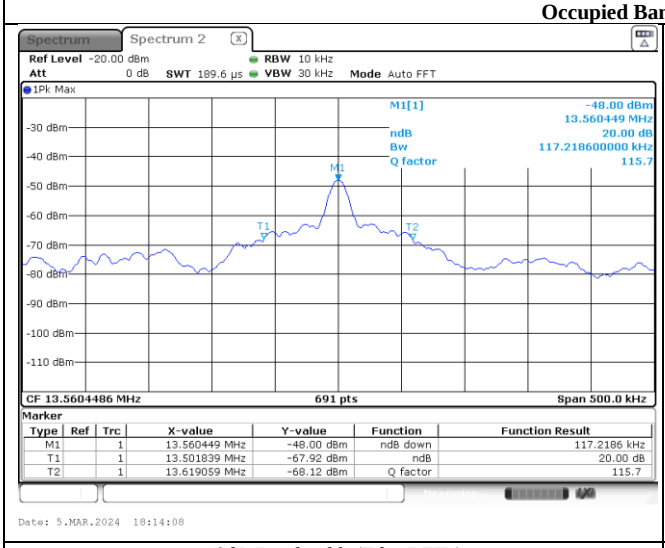


Figure 3. 20 dB Bandwidth and 99% Bandwidth Test Setup

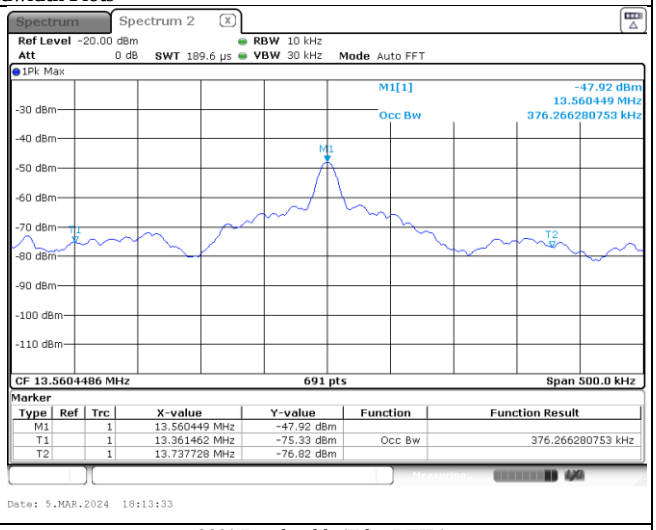
Transmitter Under Test	Center Frequency (MHz)	20 dB Bandwidth	99% Bandwidth
Film RFID	13.56MHz	117.21kHz	376.26kHz
OMNIKEY 5122	13.56MHz	40.54kHz	503.61kHz
OMNIKEY 5127SI	13.56MHz	81.04kHz	657.02kHz
Ribbon Rfid	13.56MHz	135.31kHz	439.21kHz

Table 18. Occupied Bandwidth Test Results

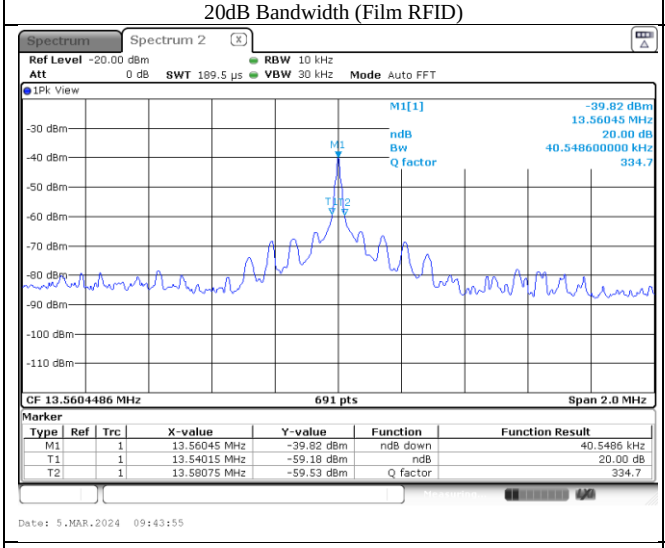
Occupied Bandwidth Plots



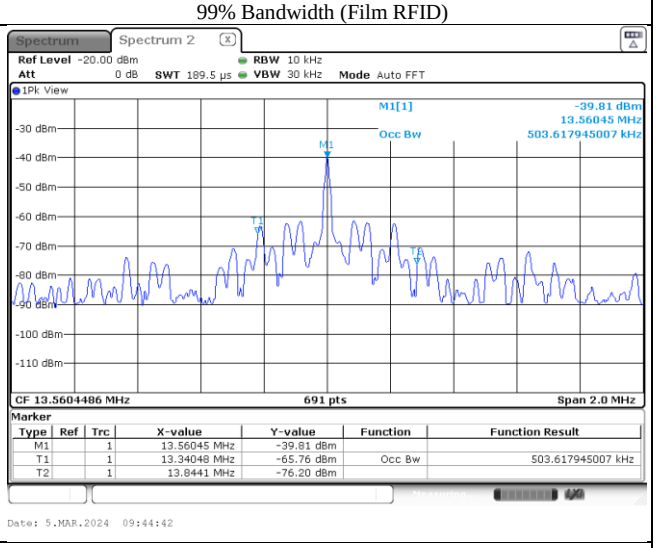
20dB Bandwidth (Film RFID)



99% Bandwidth (Film RFID)

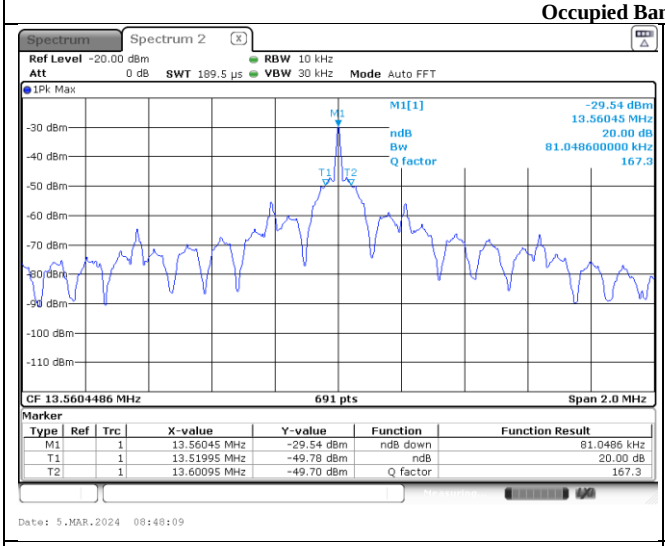


20dB Bandwidth (OMNIKEY 5122)

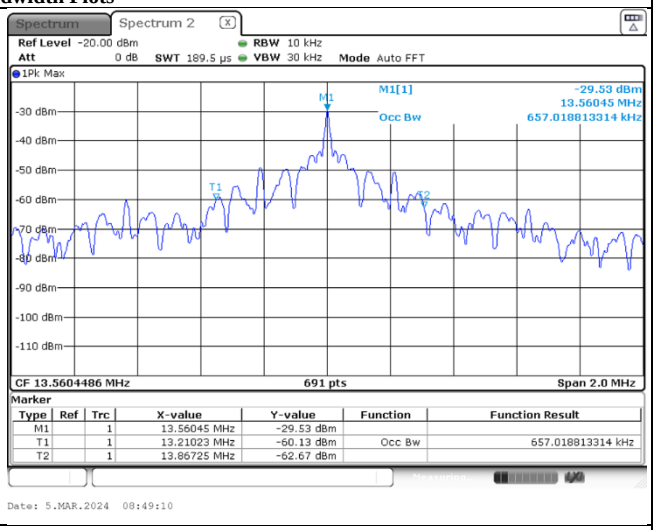


99% Bandwidth (OMNIKEY 5122)

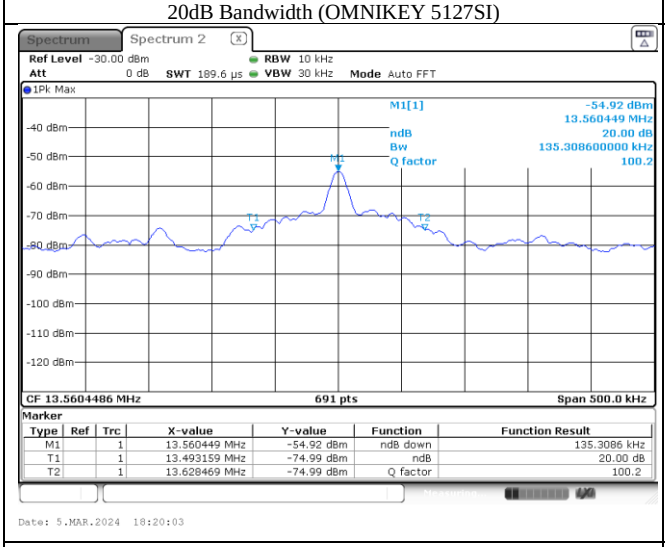
Occupied Bandwidth Plots



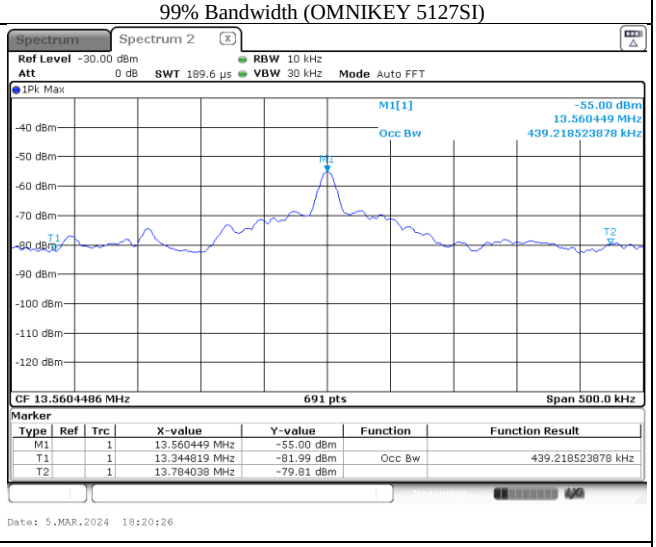
20dB Bandwidth (OMNIKEY 5127SI)



99% Bandwidth (OMNIKEY 5127SI)



20dB Bandwidth (Ribbon RFID)



99% Bandwidth (Ribbon RFID)

Electromagnetic Compatibility Criteria for Intentional Radiators

§ 15.225(a-d) Field Strength of Radiated Emissions

Test Requirement(s):

15.225 (a) The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

15.225 (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

15.225 (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

15.225 (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

RSS-210 (B.6.a(ii - iv)) Field Strength of Radiated Emissions

Test Requirement(s):

RSS-210 (B.6.a(i)) The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15.848 mV/m (84 dBµV/m) at 30 meters.

RSS-210 (B.6.a(ii)) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 µV/m (50.5 dBµV/m) at 30 meters.

RSS-210 (B.6.a(iii)) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 µV/m (40.5 dBµV/m) at 30 meters.

RSS-210 (B.6.a(iv)) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in RSS-GEN Section 8.9.

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 were made at 3 m with the loop antenna (below 30MHz). They 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.

20log (10/3) = +10.46 dB

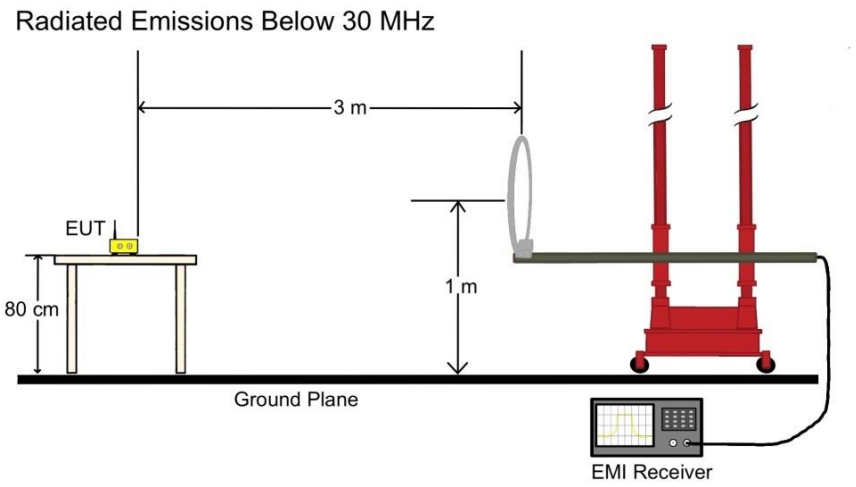


Figure 4: Radiated Emissions (Below 30MHz), Test Setup

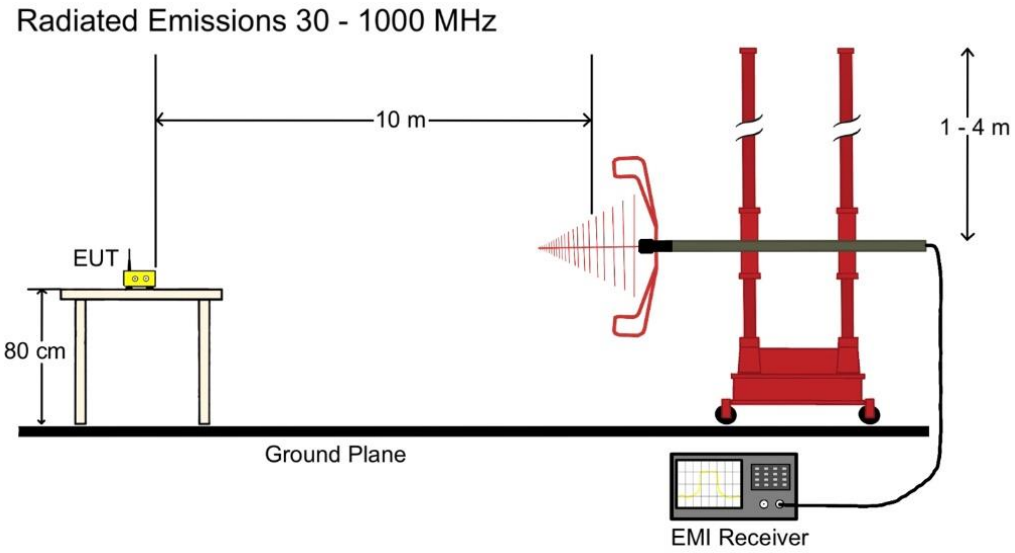


Figure 5. Radiated Emissions (Above 30MHz), Test Setup

Test Results: The HDP5000e was compliant with the requirements of **§15.225(a - d)** and **RSS-210 RSS-210 (B.6.a(i, ii, iii, and iv))**.

Test Engineer(s): Sergio Gutierrez and Michael Ermer

Test Date(s): 3/4/2024 - 3/8/2024

Radiated Field Strength Test Results

Frequency [MHz]	QPK Level [dBµV/m] [7]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB] [8]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
13.200	13.58	80.50	66.92	10.62	H	47.8	1	9.000	Pass
13.200	16.31	80.50	64.19	10.62	V	66.1	1	9.000	Pass
13.466	12.59	90.50	77.91	10.61	H	34.3	1	9.000	Pass
13.522	15.05	90.50	75.45	10.61	V	54.3	1	9.000	Pass
13.560	54.52	124.00	69.48	10.61	H	66.9	1	9.000	Pass
13.560	62.44	124.00	61.56	10.61	V	14.8	1	9.000	Pass
13.668	15.12	90.50	75.38	10.60	V	79.2	1	9.000	Pass
13.700	14.25	90.50	76.25	10.60	H	32.1	1	9.000	Pass
13.803	14.40	80.50	66.10	10.60	H	105.2	1	9.000	Pass
13.907	14.01	80.50	66.49	10.59	V	114.5	1	9.000	Pass

Figure 6. Worst Case In-Band Field Strength (Film RFID)

Frequency [MHz]	Peak Level [dBµV/m] [7]	Limit [dBµV/m]	Margin [dB]	Correction [dB] [8]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.100	62.79	107.57	44.77	11.26	V	3	1	0.200	Pass
0.100	40.98	107.56	66.58	11.27	H	348.3	1	0.200	Pass
0.641	49.32	71.47	22.15	11.36	H	285	1	9.000	Pass
0.650	45.87	71.35	25.48	11.37	V	54.7	1	9.000	Pass
13.560	58.37	69.50	11.13	10.61	H	71.1	1	9.000	Pass
13.560	63.43	69.50	6.07	10.61	V	350.1	1	9.000	Pass
22.211	19.40	69.50	50.10	9.82	H	132.7	1	9.000	Pass

Figure 7. Worst Case Field Strength Below 30MHz (Film RFID)

Frequency [MHz]	QPK Level [dBµV/m] [7]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB] [8]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
88.860	27.42	33.07	5.65	-11.52	H	211.5	3.99	120.000	Pass
106.680	30.66	33.07	2.41	-8.19	V	81	1.36	120.000	Pass
264.450	25.91	35.57	9.66	-5.75	V	174.2	1.02	120.000	Pass
285.510	31.09	35.57	4.48	-6.12	V	180.1	1.09	120.000	Pass
294.570	31.42	35.57	4.15	-5.83	V	189	0.99	120.000	Pass
350.010	34.07	35.57	1.50	-3.82	H	267.9	2.09	120.000	Pass

Figure 8. Worst Case Field Strength Above 30MHz (Film RFID)

[7] This corrected level includes the factor shown in the "correction" column. The corrected level = Raw Reading + Correction Factor. The raw reading is not shown in the table above.
[8] This correction factor includes cable loss in dB, preamplifier gain in dB, and an electric field antenna factor in (dB/m).

Frequency [MHz]	QPK Level [dBµV/m] [9]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB] [10]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
13.232	20.86	80.50	59.64	10.62	H	68	1	9.000	Pass
13.234	15.89	80.50	64.61	10.62	V	60.2	1	9.000	Pass
13.463	19.19	90.50	71.31	10.61	H	56.7	1	9.000	Pass
13.502	14.74	90.50	75.76	10.61	V	293.5	1	9.000	Pass
13.560	55.24	124.00	68.76	10.61	H	315.3	1	9.000	Pass
13.560	62.39	124.00	61.61	10.61	V	275.5	1	9.000	Pass
13.610	18.82	90.50	71.68	10.61	H	315.3	1	9.000	Pass
13.666	15.66	90.50	74.84	10.60	V	90.5	1	9.000	Pass
13.945	19.64	80.50	60.86	10.59	H	64.1	1	9.000	Pass
13.961	14.08	80.50	66.42	10.59	V	309.5	1	9.000	Pass

Figure 9. Worst Case In-Band Field Strength (OMNIKEY 5122)

Frequency [MHz]	Peak Level [dBµV/m][9]	Limit [dBµV/m]	Margin [dB]	Correction [dB][10]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.100	39.92	107.61	67.69	11.27	H	341.6	1	0.200	Pass
0.100	41.81	107.61	65.80	11.27	V	51	1	0.200	Pass
0.992	41.87	67.67	25.80	11.76	H	345.7	1	9.000	Pass
1.295	36.27	65.35	29.08	11.71	V	131.3	1	9.000	Pass

Figure 10. Worst Case Field Strength Below 30MHz (OMNIKEY 5122)

Frequency [MHz]	QPK Level [dBµV/m] [9]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB] [10]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
86.130	25.95	29.55	3.60	-12.16	V	24.7	2.57	120.000	Pass
87.480	27.82	29.55	1.73	-11.86	V	360	1.62	120.000	Pass
108.810	30.79	33.07	2.28	-7.98	V	48.5	1.42	120.000	Pass
261.090	27.40	35.57	8.17	-5.36	V	339	0.99	120.000	Pass
297.150	28.13	35.57	7.44	-5.77	H	240.4	3.34	120.000	Pass
298.230	30.96	35.57	4.61	-5.67	V	36.2	2.22	120.000	Pass
350.010	35.35	35.57	0.22	-3.82	H	186.9	2.17	120.000	Pass

Figure 11. Worst Case Field Strength Above 30MHz (OMNIKEY 5122)

[9] This corrected level includes the factor shown in the "correction" column. The corrected level = Raw Reading + Correction Factor. The raw reading is not shown in the table above.
[10] This correction factor includes cable loss in dB, preamplifier gain in dB, and an electric field antenna factor in (dB/m).

Frequency [MHz]	QPK Level [dBµV/m] [11]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB] [12]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
13.283	13.66	80.50	66.84	10.62	H	124.1	1	9.000	Pass
13.376	16.53	80.50	63.97	10.61	V	166.7	1	9.000	Pass
13.418	14.21	90.50	76.29	10.61	H	26.6	1	9.000	Pass
13.445	17.22	90.50	73.28	10.61	V	217.4	1	9.000	Pass
13.558	59.45	124.00	64.55	10.61	V	333.5	1	9.000	Pass
13.560	69.60	124.00	54.40	10.61	H	55.6	1	9.000	Pass
13.592	13.56	90.50	76.94	10.61	H	287.8	1	9.000	Pass
13.646	17.28	90.50	73.22	10.60	V	276.9	1	9.000	Pass
13.855	14.06	80.50	66.44	10.60	H	59.2	1	9.000	Pass
13.866	16.75	80.50	63.75	10.60	V	225.3	1	9.000	Pass

Figure 12. Worst Case In-Band Field Strength (OMNIKEY 5127SI)

Frequency [MHz]	Peak Level [dBµV/m] [9]	Limit [dBµV/m]	Margin [dB]	Correction [dB] [10]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.087	57.26	108.83	51.57	11.69	V	344.5	1	0.200	Pass
0.088	41.92	108.76	66.83	11.70	H	54.1	1	0.200	Pass

Figure 13. Worst Case Field Strength Below 30MHz (OMNIKEY 5127SI)

Frequency [MHz]	QPK Level [dBµV/m] [9]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB] [10]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
75.150	26.13	29.55	3.42	-13.62	V	146	2.04	120.000	Pass
297.300	29.54	35.57	6.03	-5.76	H	233.6	3.45	120.000	Pass
302.250	32.45	35.57	3.12	-5.44	V	181.9	1.13	120.000	Pass
307.350	32.03	35.57	3.54	-5.10	V	174.1	1.19	120.000	Pass
308.430	29.48	35.57	6.09	-5.01	H	227.2	2.88	120.000	Pass
315.810	31.42	35.57	4.15	-4.75	V	356.1	1.06	120.000	Pass

Figure 14. Worst Case Field Strength Above 30MHz (OMNIKEY 5127SI)

[11] This corrected level includes the factor shown in the "correction" column. The corrected level = Raw Reading + Correction Factor. The raw reading is not shown in the table above.
[12] This correction factor includes cable loss in dB, preamplifier gain in dB, and an electric field antenna factor in (dB/m).

Frequency [MHz]	QPK Level [dBµV/m] [13]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB] [14]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
13.241	14.26	80.50	66.24	10.62	V	177.5	1	9.000	Pass
13.360	14.95	80.50	65.55	10.62	H	106	1	9.000	Pass
13.439	15.87	90.50	74.63	10.61	V	88.4	1	9.000	Pass
13.450	14.42	90.50	76.08	10.61	H	215	1	9.000	Pass
13.560	55.61	124.00	68.39	10.61	H	5.6	1	9.000	Pass
13.560	55.57	124.00	68.43	10.61	V	1.4	1	9.000	Pass
13.596	14.61	90.50	75.89	10.61	V	54.7	1	9.000	Pass
13.630	14.33	90.50	76.17	10.60	H	86.8	1	9.000	Pass
13.724	15.70	80.50	64.80	10.60	V	86.1	1	9.000	Pass
13.758	15.36	80.50	65.14	10.60	H	89.7	1	9.000	Pass

Figure 15. Worst Case In-Band Field Strength (Ribbon RFID)

Frequency [MHz]	Peak Level [dBµV/m] [9]	Limit [dBµV/m]	Margin [dB]	Correction [dB] [10]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
0.099	38.85	107.69	68.85	11.32	H	87.3	1	0.200	Pass
0.101	40.02	107.55	67.53	11.27	V	24.9	1	0.200	Pass
0.641	47.27	71.47	24.20	11.36	H	62.9	1	9.000	Pass
22.076	18.69	69.50	50.81	9.80	H	218.2	1	9.000	Pass
27.121	22.02	69.50	47.48	9.22	V	333.9	1	9.000	Pass

Figure 16. Worst Case Field Strength Below 30MHz (Ribbon RFID)

Frequency [MHz]	QPK Level [dBµV/m] [9]	QPK Limit [dBµV/m]	QPK Margin [dB]	Correction [dB] [10]	Polarization	Azimuth [deg]	Antenna Height [m]	Meas. BW [kHz]	Result
54.240	24.78	29.55	4.77	-13.89	V	251.7	2.85	120.000	Pass
87.480	24.68	29.55	4.87	-11.86	H	9.4	3.28	120.000	Pass
106.680	30.54	33.07	2.53	-8.19	V	53.7	1.53	120.000	Pass
289.080	31.20	35.57	4.37	-6.01	V	201.6	1.3	120.000	Pass
350.010	30.93	35.57	4.64	-3.82	V	1.5	1.49	120.000	Pass
350.010	35.48	35.57	0.09	-3.82	H	203.4	2.21	120.000	Pass

Figure 17. Worst Case Field Strength Above 30MHz (Ribbon RFID)

[13] This corrected level includes the factor shown in the "correction" column. The corrected level = Raw Reading + Correction Factor. The raw reading is not shown in the table above.
[14] This correction factor includes cable loss in dB, preamplifier gain in dB, and an electric field antenna factor in (dB/m).

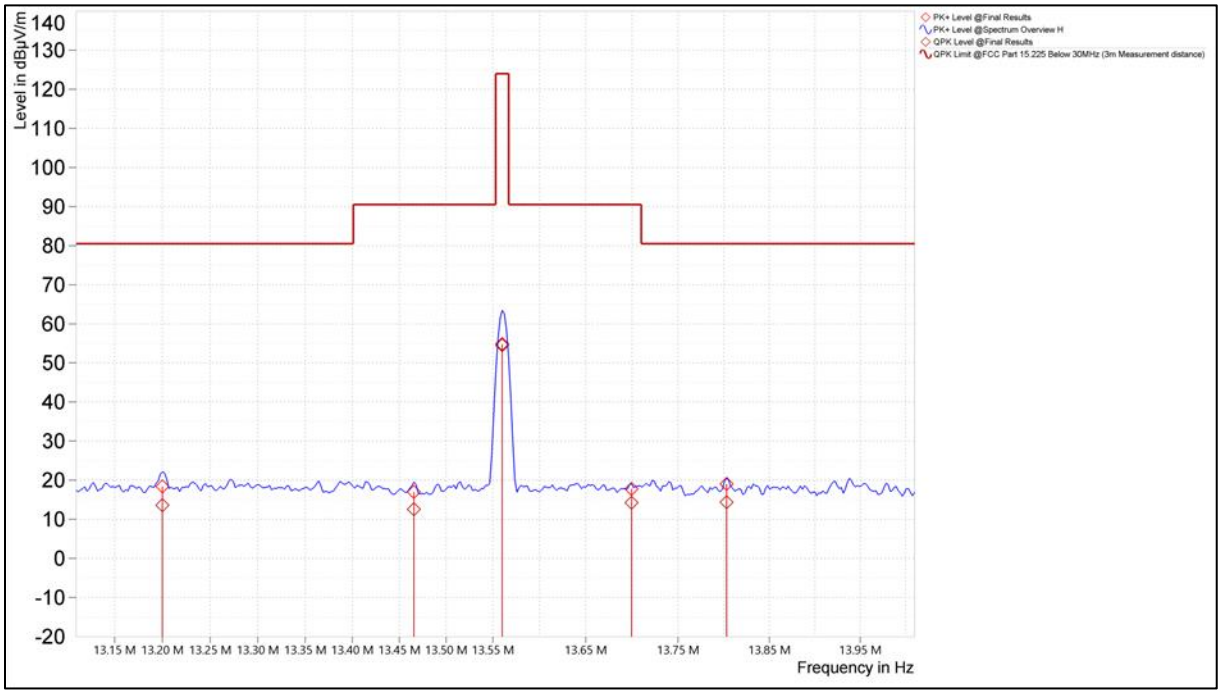


Figure 18. In-Band Emission Mask (Coplanar Loop, Film RFID)

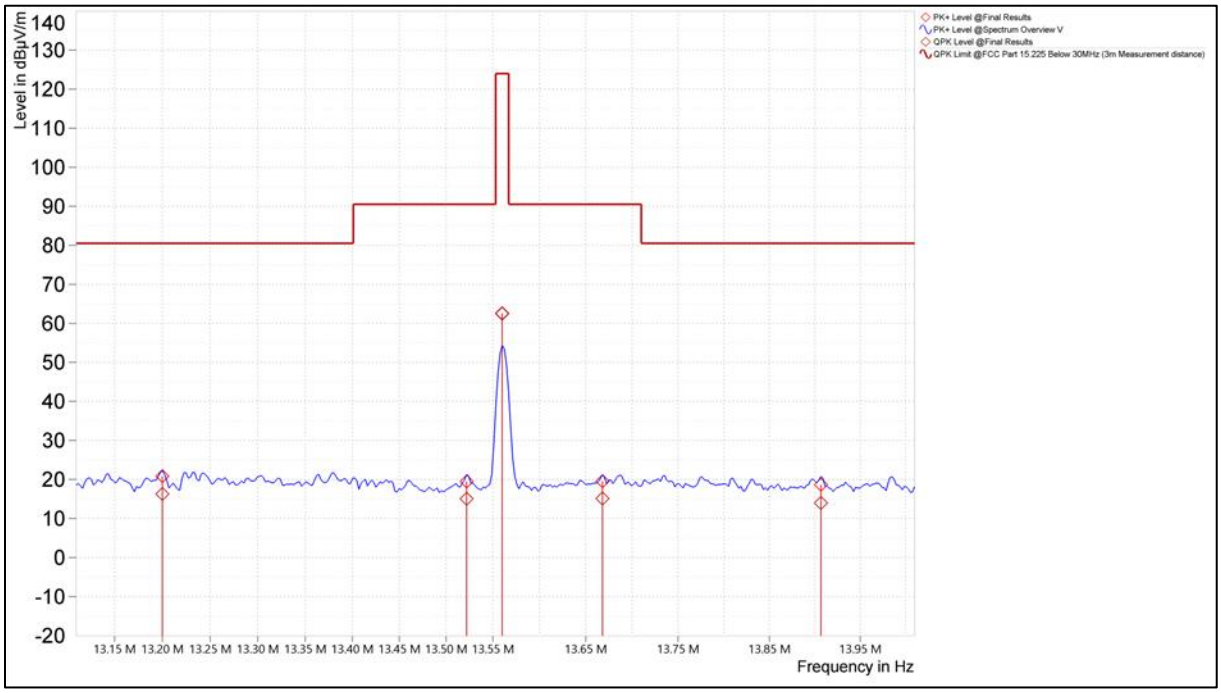


Figure 19. In-Band Emission Mask (Coaxial Loop, Film RFID)

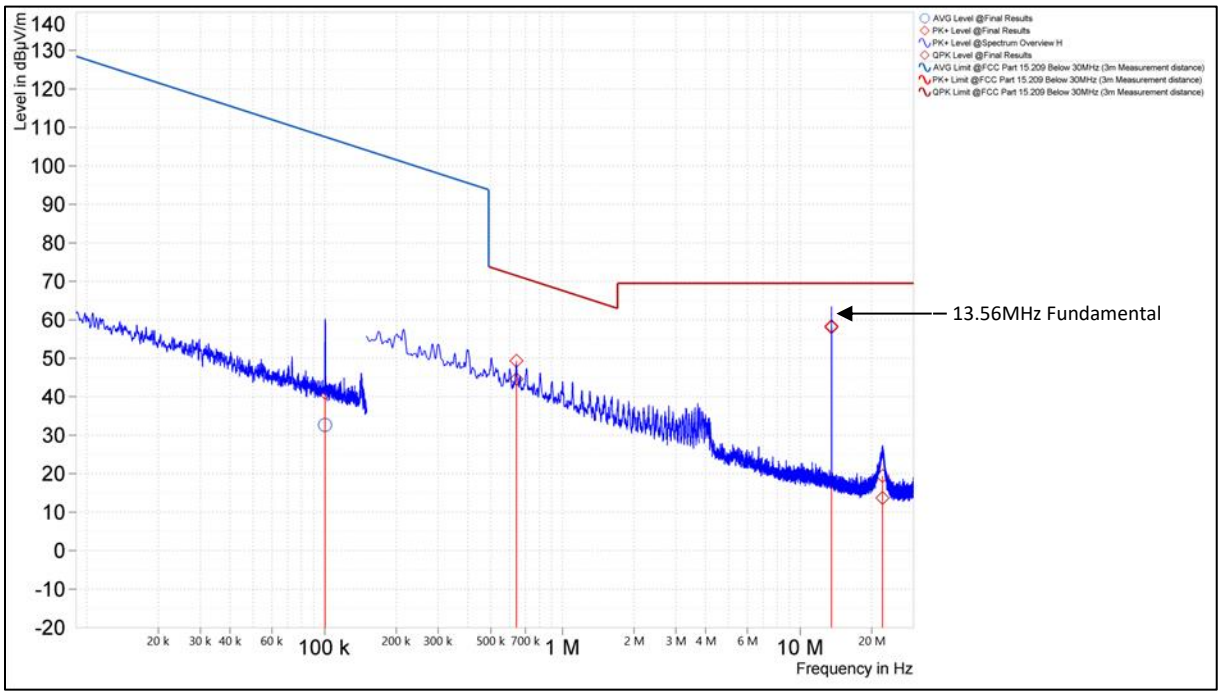


Figure 20. Out of Band Emissions Below 30MHz (Coplanar Loop, Film RFID)

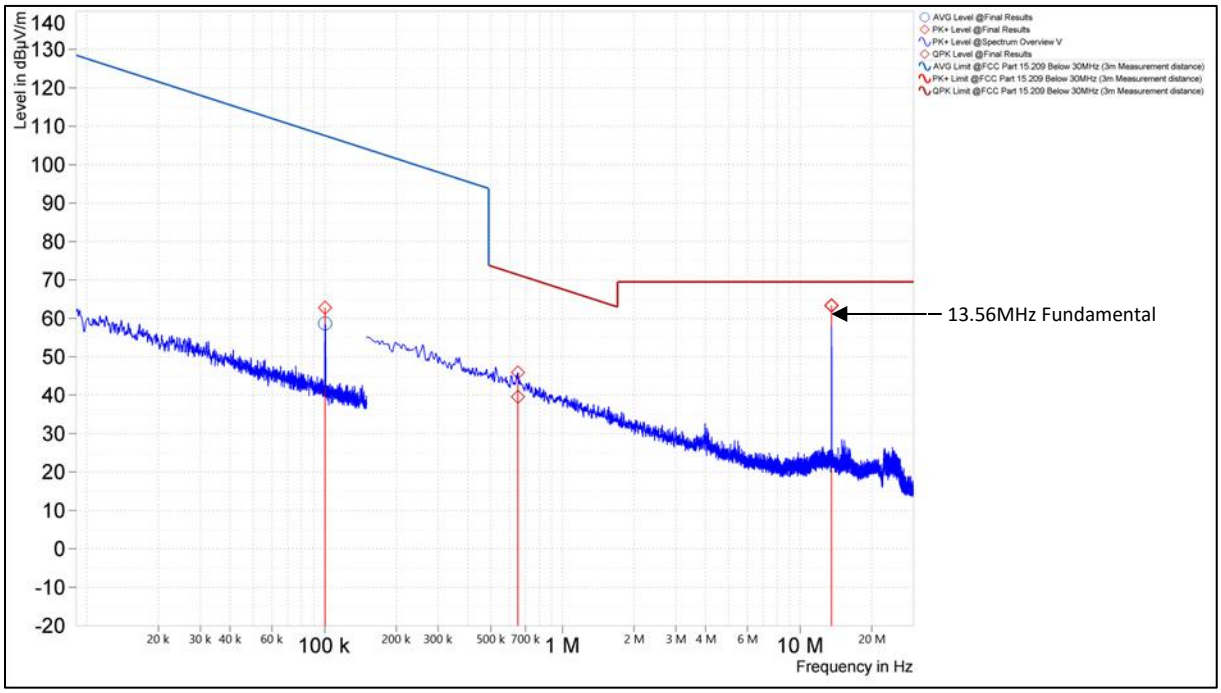


Figure 21. Out of Band Emissions Below 30MHz (Coaxial Loop, Film RFID)

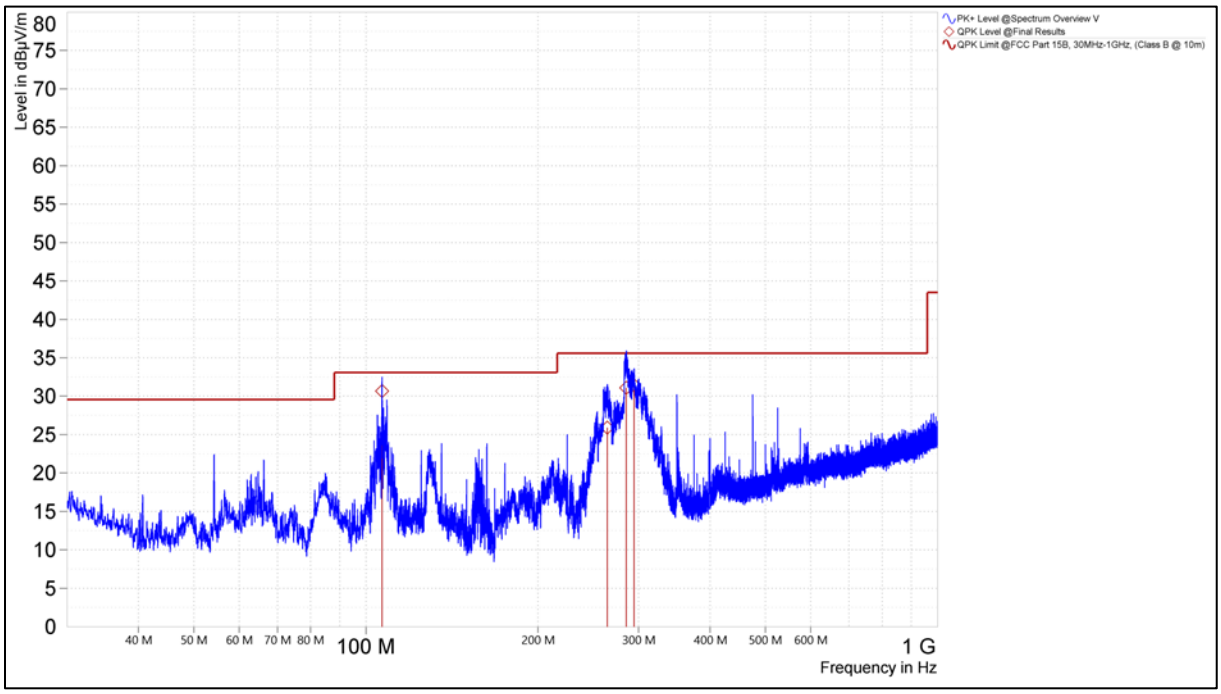


Figure 22. Out of Band Emissions Above 30MHz (Vertical Polarity, Film RFID)

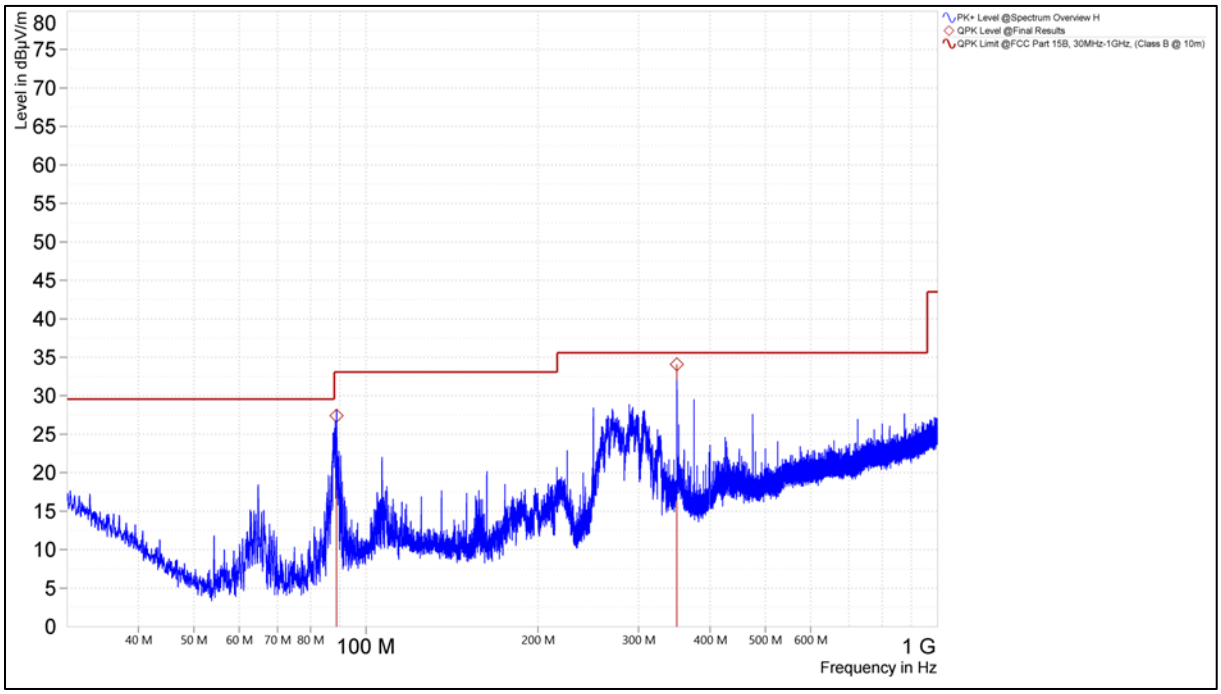


Figure 23. Out of Band Emissions Above 30MHz (Horizontal Polarity, Film RFID)

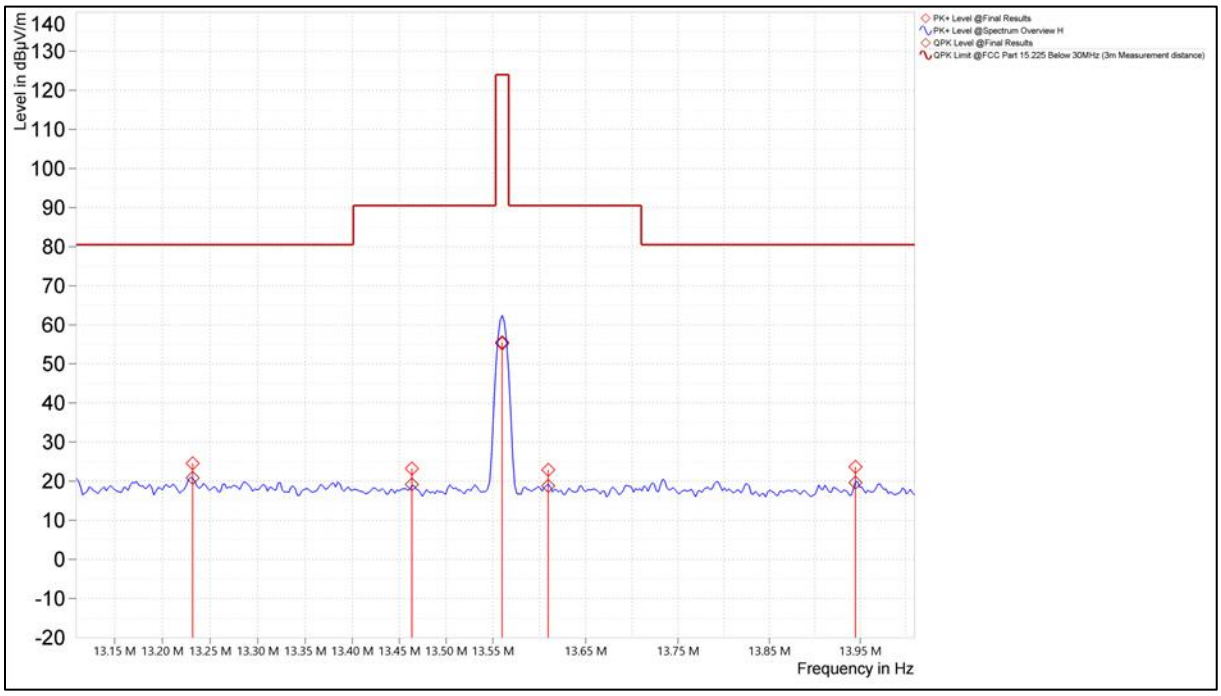


Figure 24. In-Band Emission Mask (Coplanar Loop, OMNIKEY 5122)

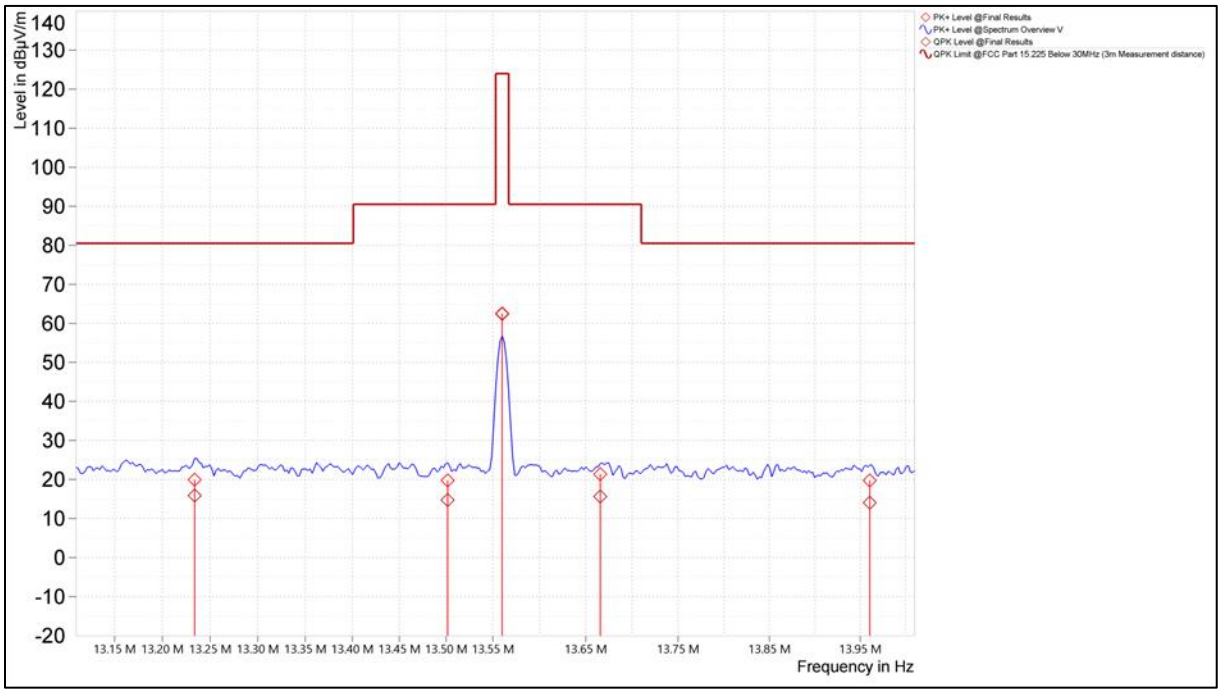


Figure 25. In-Band Emission Mask (Coaxial Loop, OMNIKEY 5122)

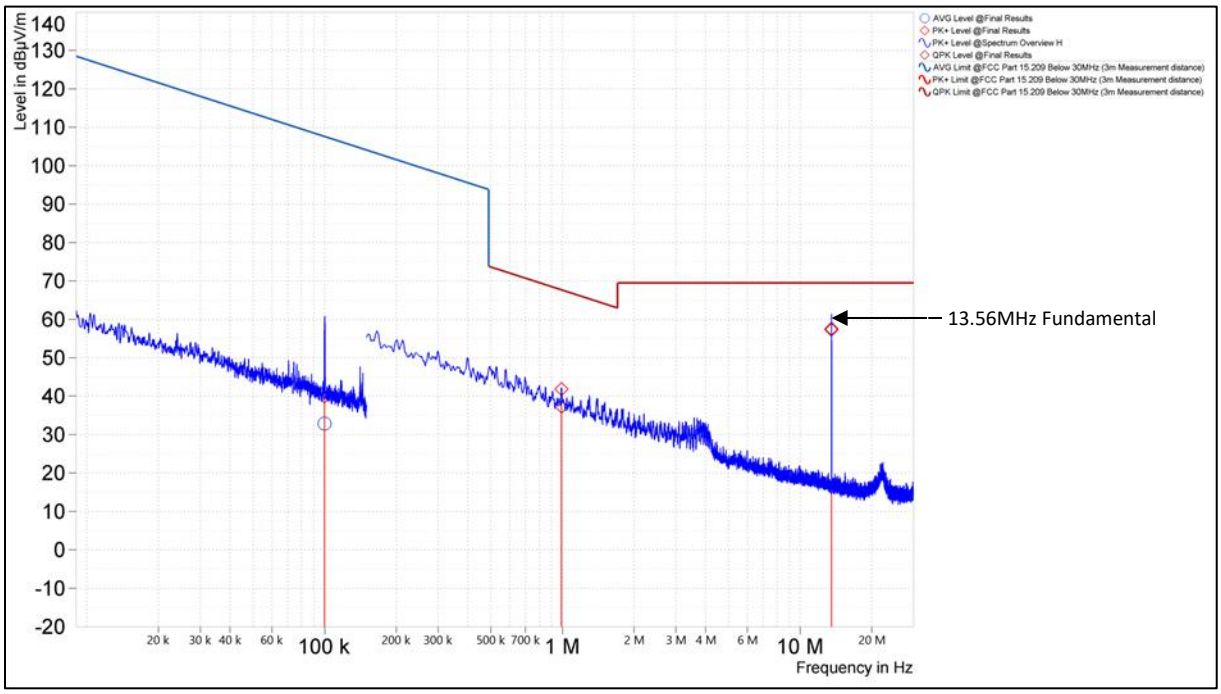


Figure 26. Out of Band Emissions Below 30MHz (Coplanar Loop, OMNIKEY 5122)

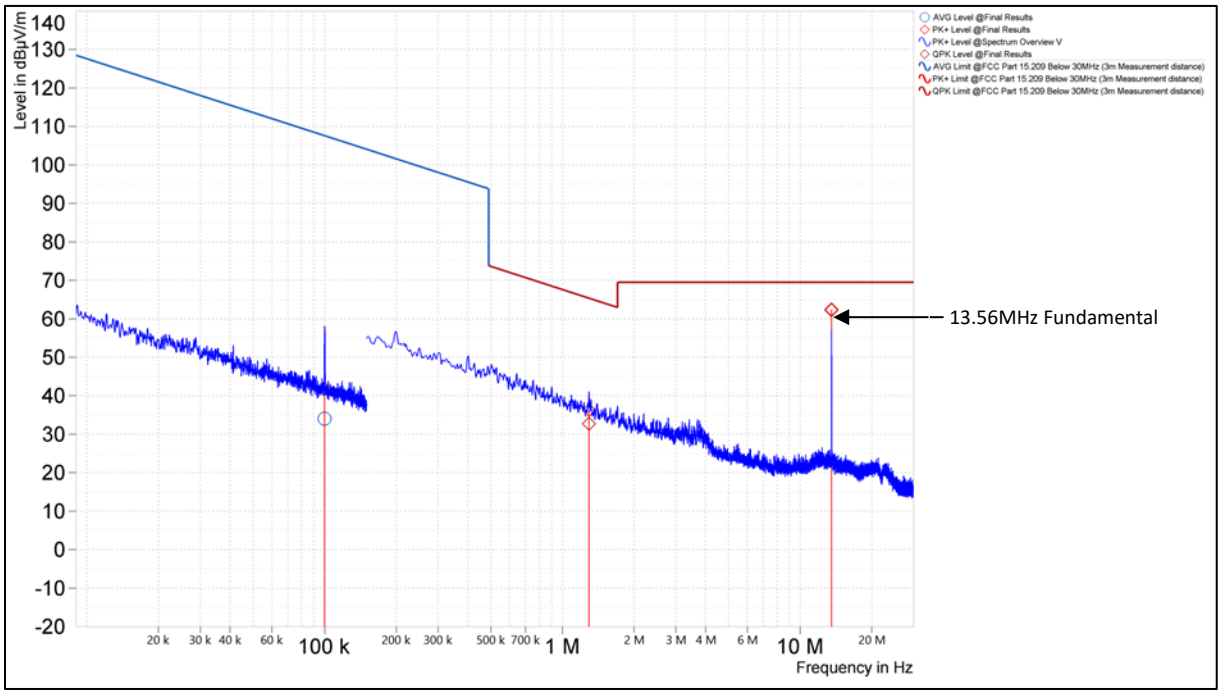


Figure 27. Out of Band Emissions Below 30MHz (Coaxial Loop, OMNIKEY 5122)

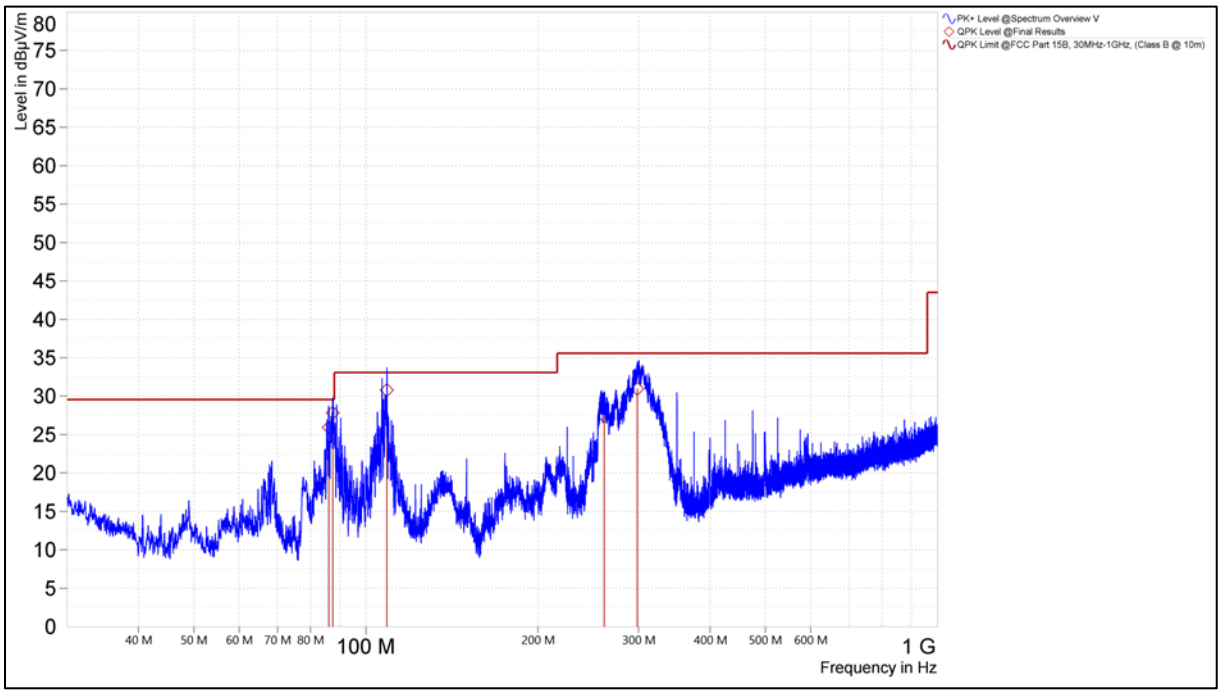


Figure 28. Out of Band Emissions Above 30MHz (Vertical Polarity, OMNIKEY 5122)

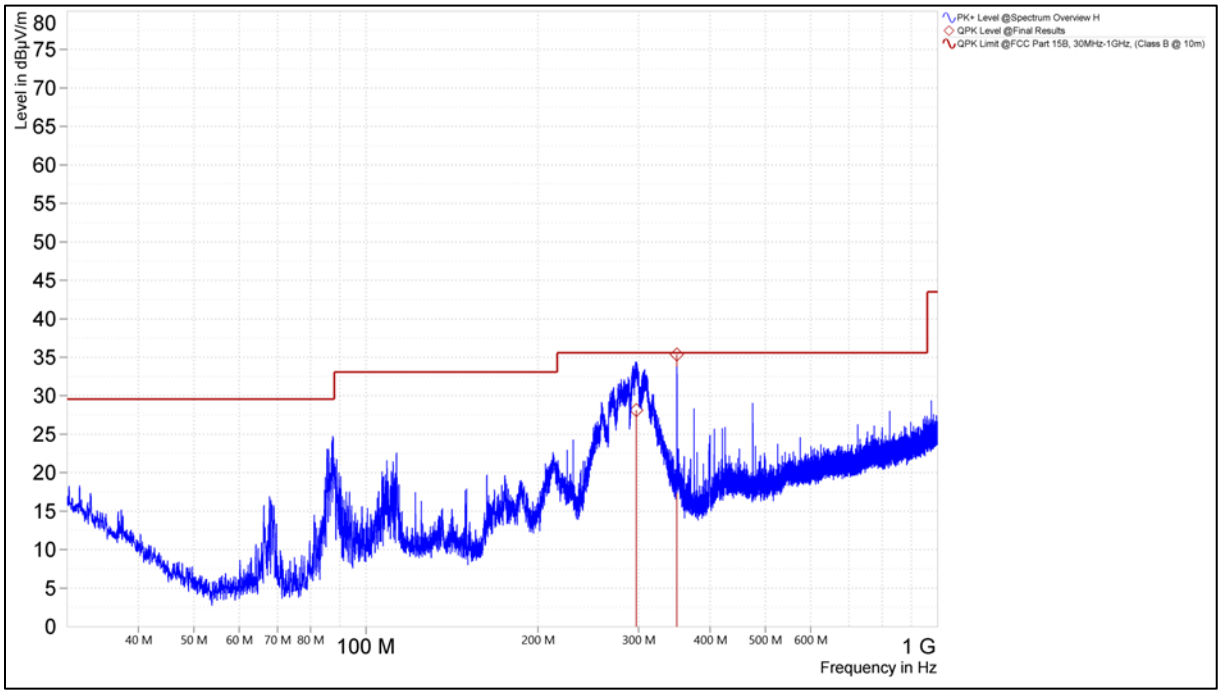


Figure 29. Out of Band Emissions Above 30MHz (Horizontal Polarity, OMNIKEY 5122)

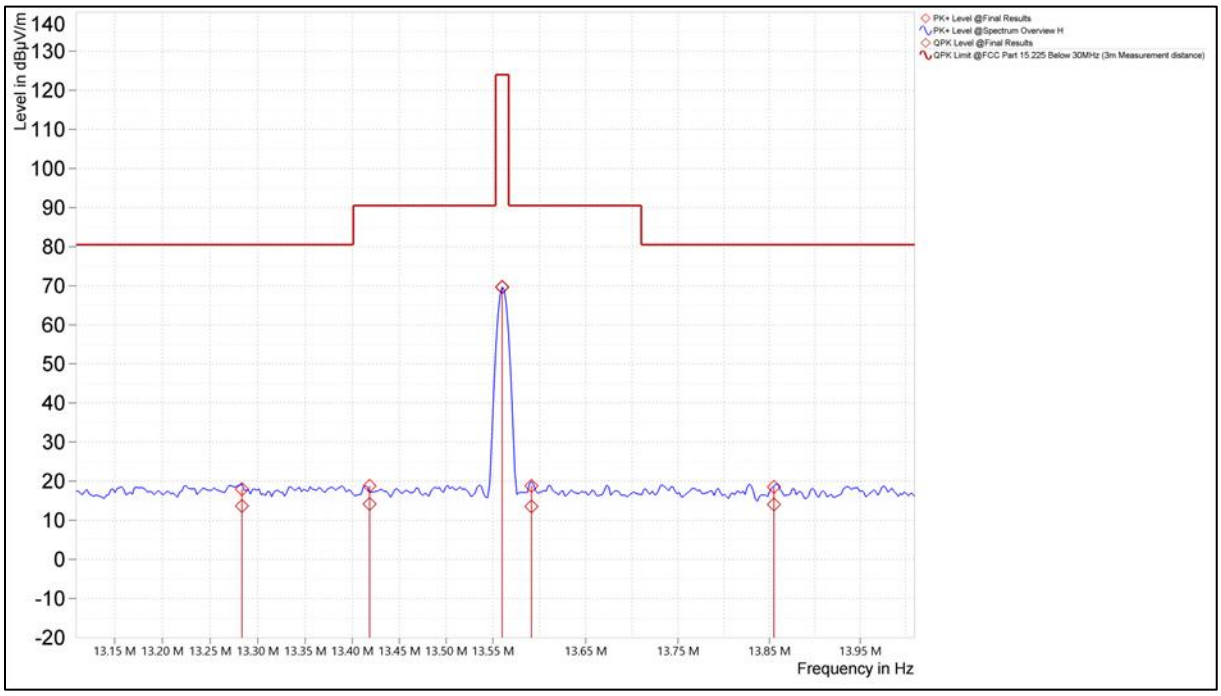


Figure 30. In-Band Emission Mask (Coplanar Loop, OMNIKEY 5127SI)

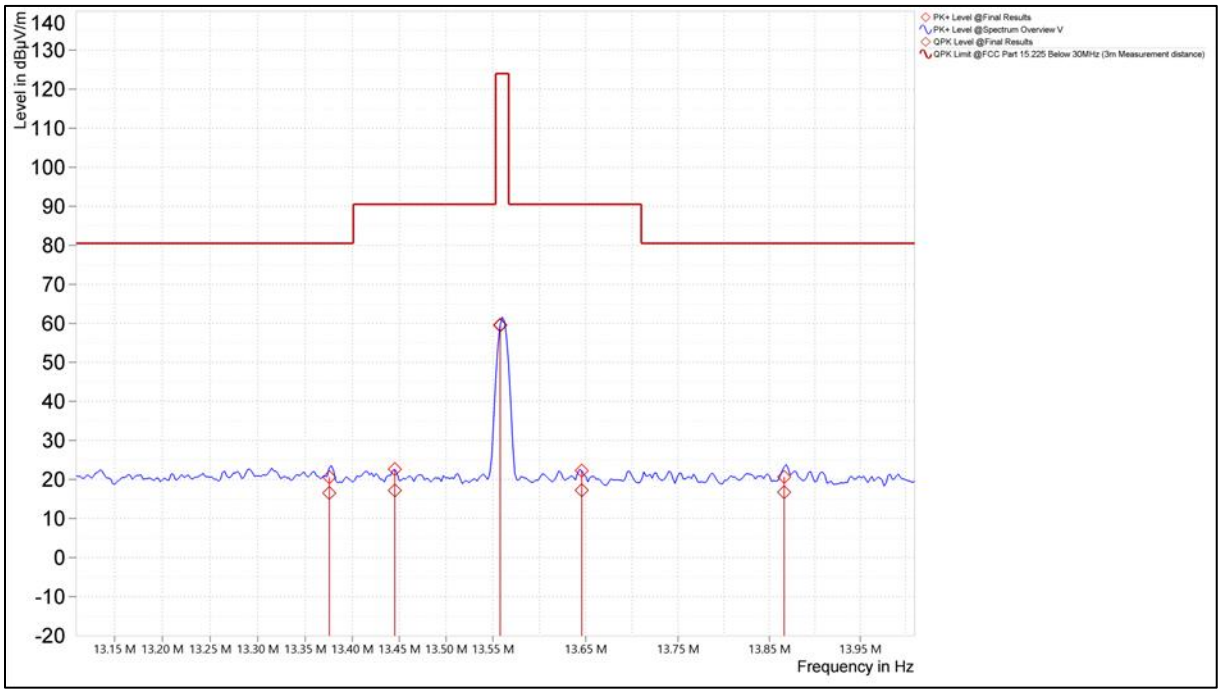


Figure 31. In-Band Emission Mask (Coaxial Loop, OMNIKEY 5127SI)

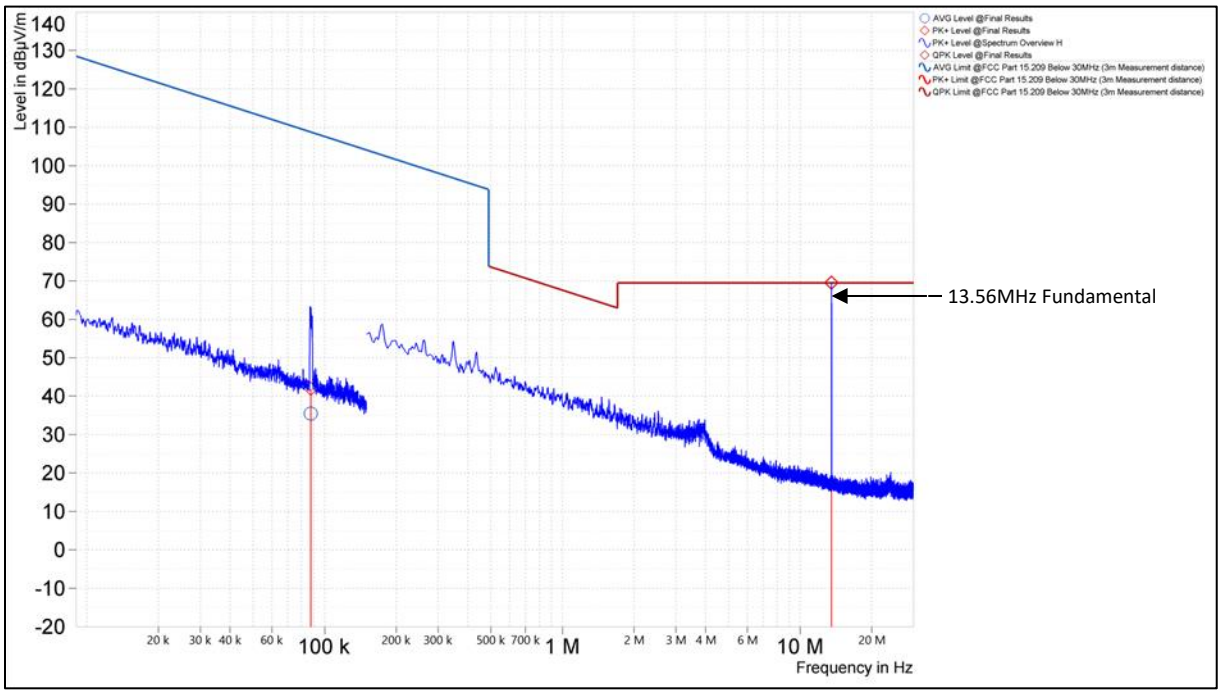


Figure 32. Out of Band Emissions Below 30MHz (Coplanar Loop, OMNIKEY 5127SI)

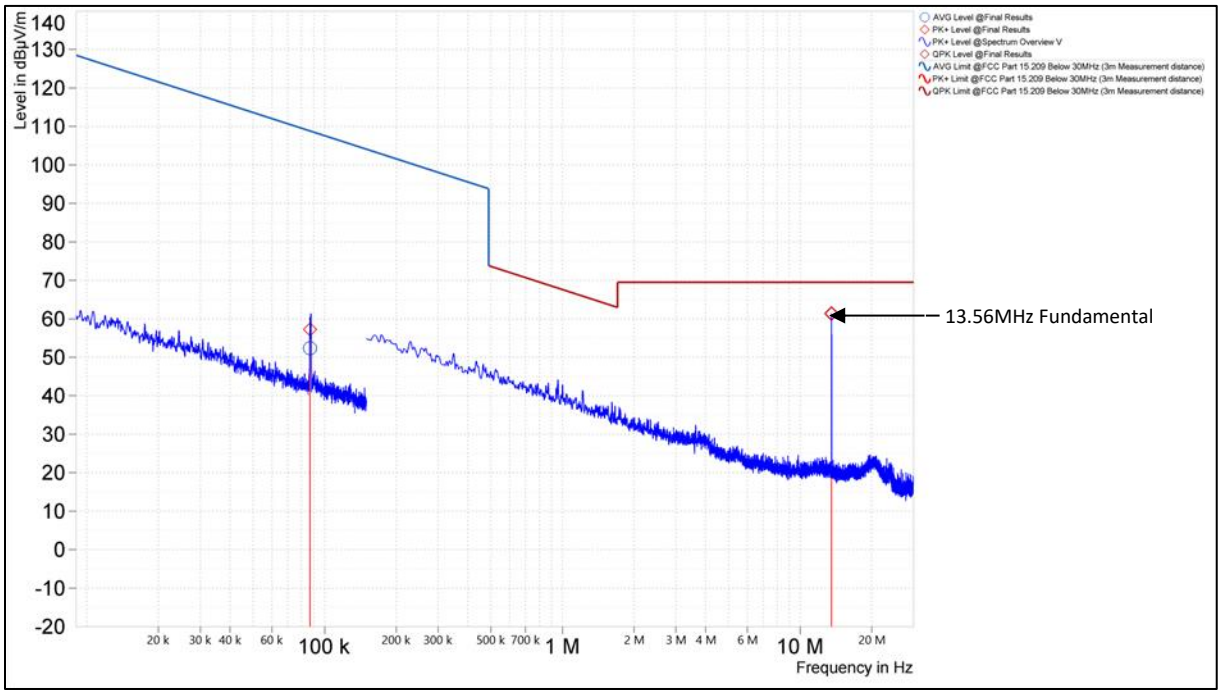


Figure 33. Out of Band Emissions Below 30MHz (Coaxial Loop, OMNIKEY 5127SI)

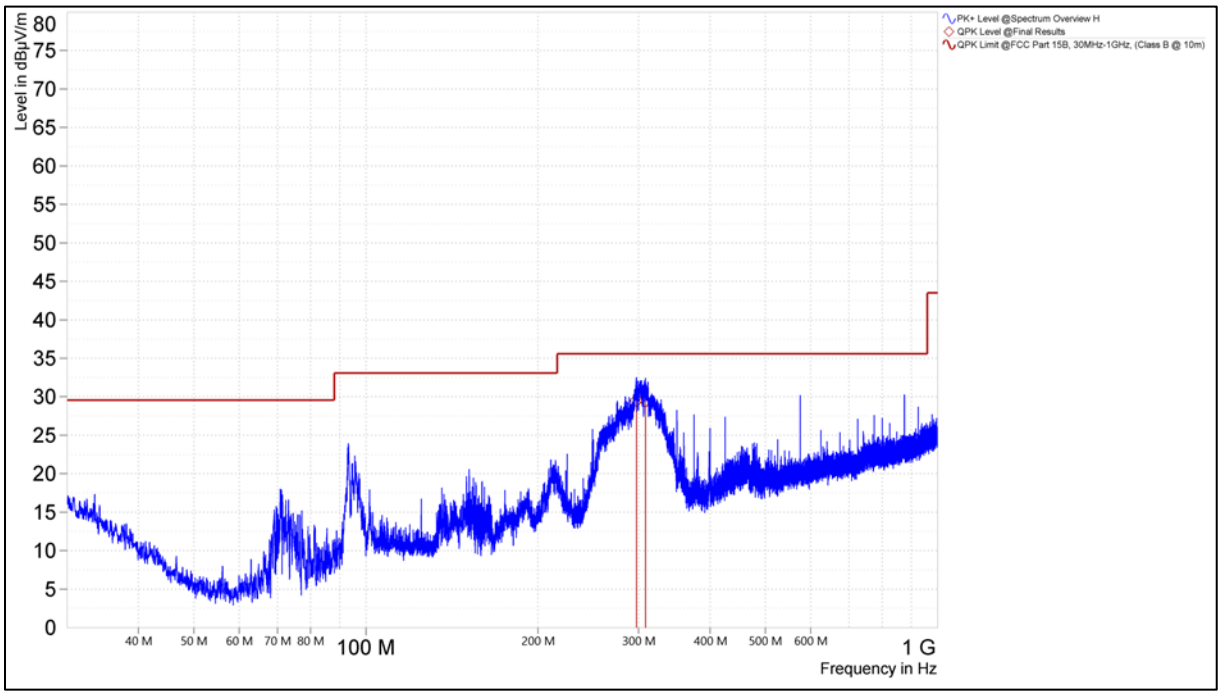


Figure 34. Out of Band Emissions Above 30MHz (Vertical Polarity, OMNIKEY 5127SI)

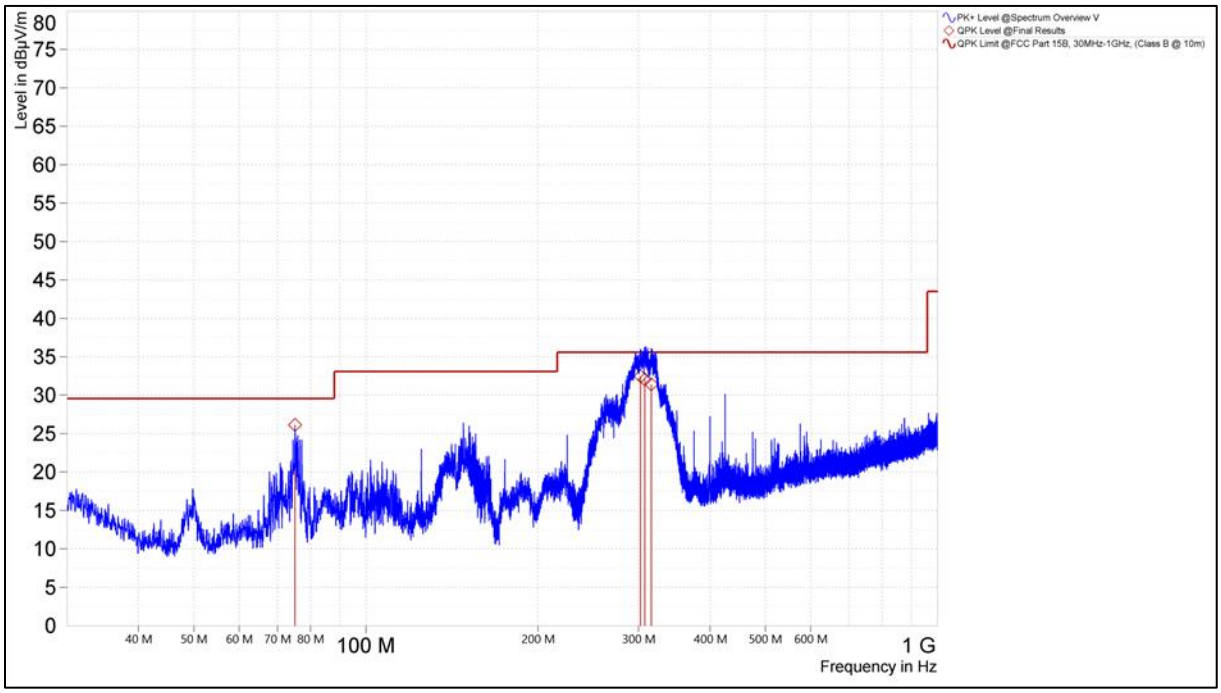


Figure 35. Out of Band Emissions Above 30MHz (Horizontal Polarity, OMNIKEY 5127SI)

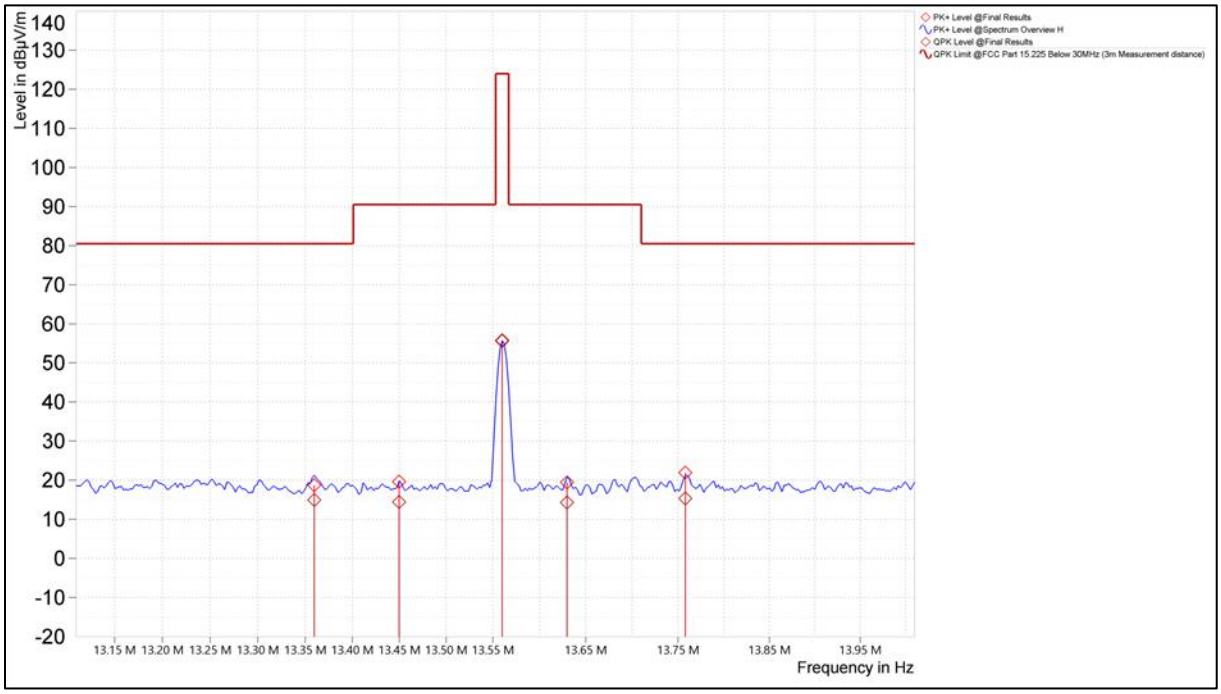


Figure 36. In-Band Emission Mask (Coplanar Loop, Ribbon RFID)

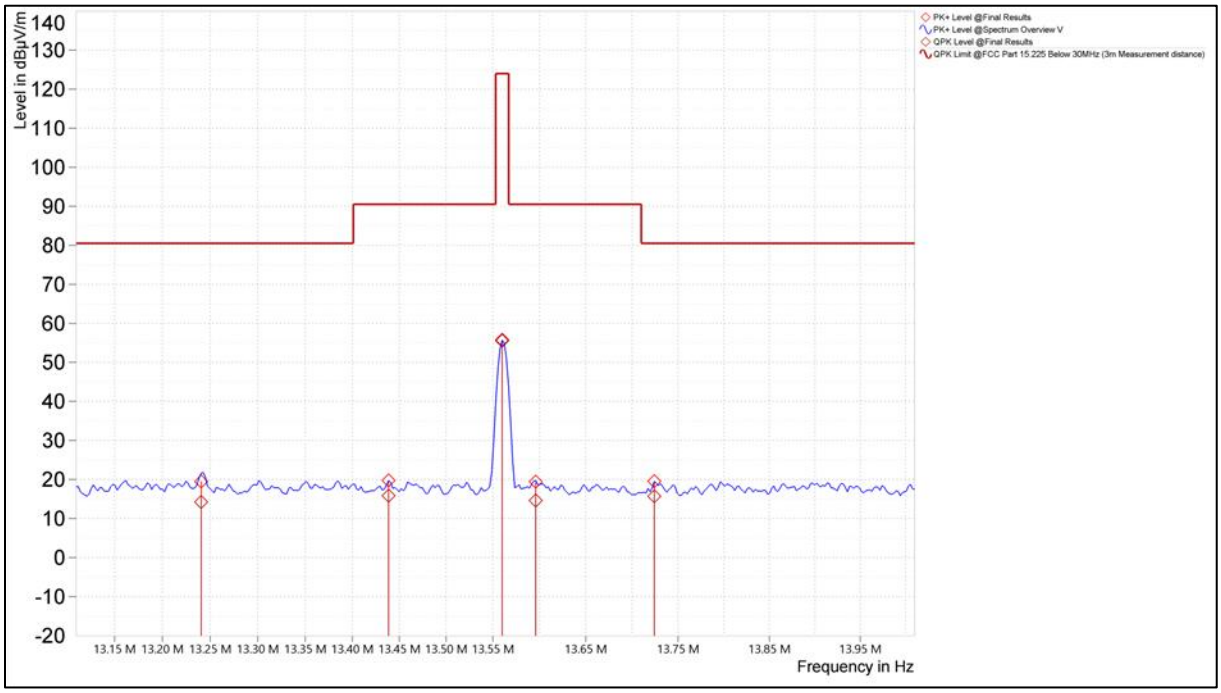


Figure 37. In-Band Emission Mask (Coaxial Loop, Ribbon RFID)

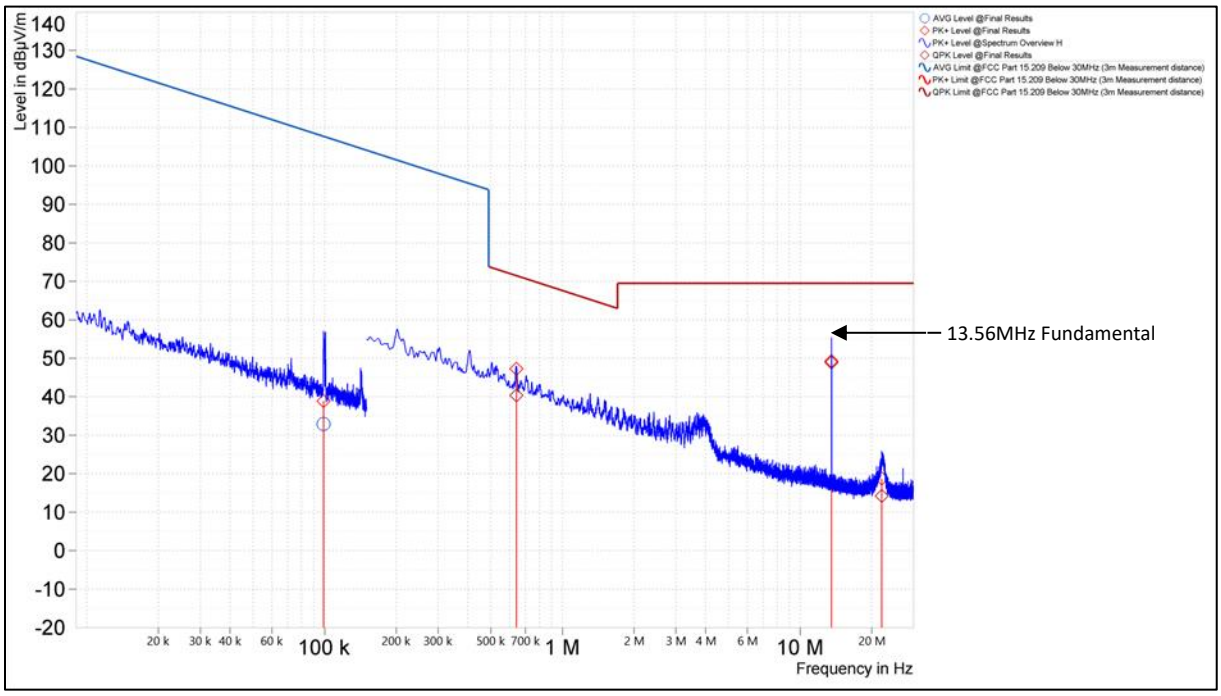


Figure 38. Out of Band Emissions Below 30MHz (Coplanar Loop, Ribbon RFID)

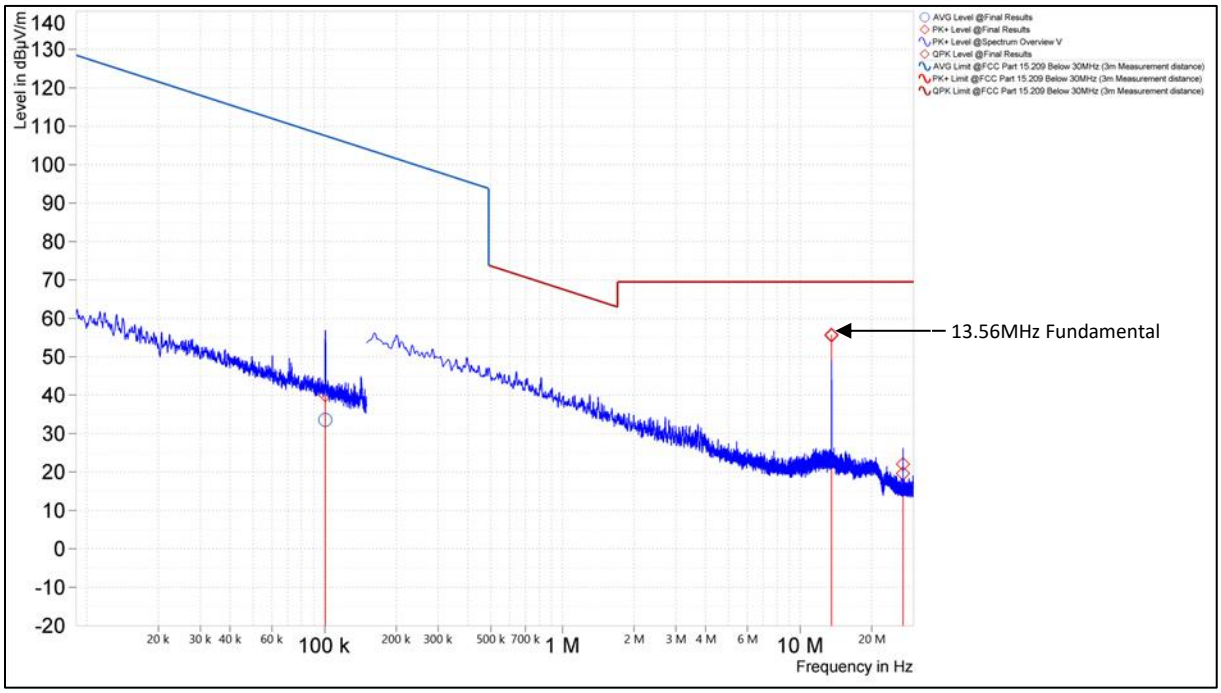


Figure 39. Out of Band Emissions Below 30MHz (Coaxial Loop, Ribbon RFID)

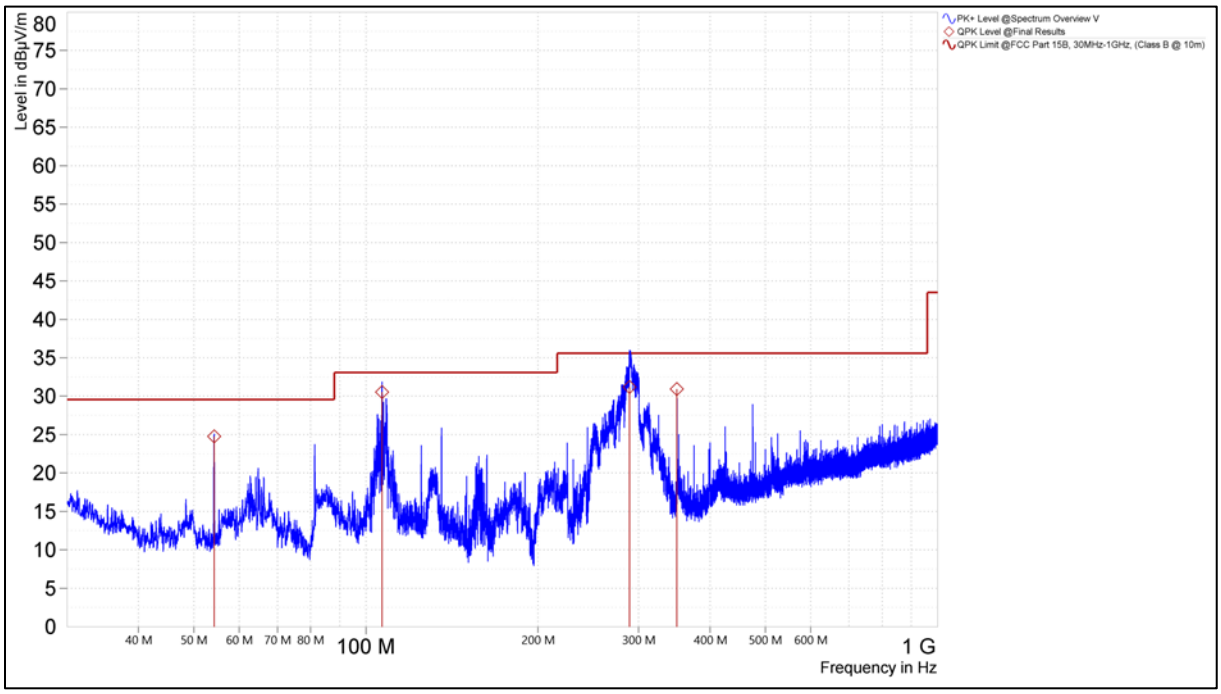


Figure 40. Out of Band Emissions Above 30MHz (Vertical Polarity, Ribbon RFID)

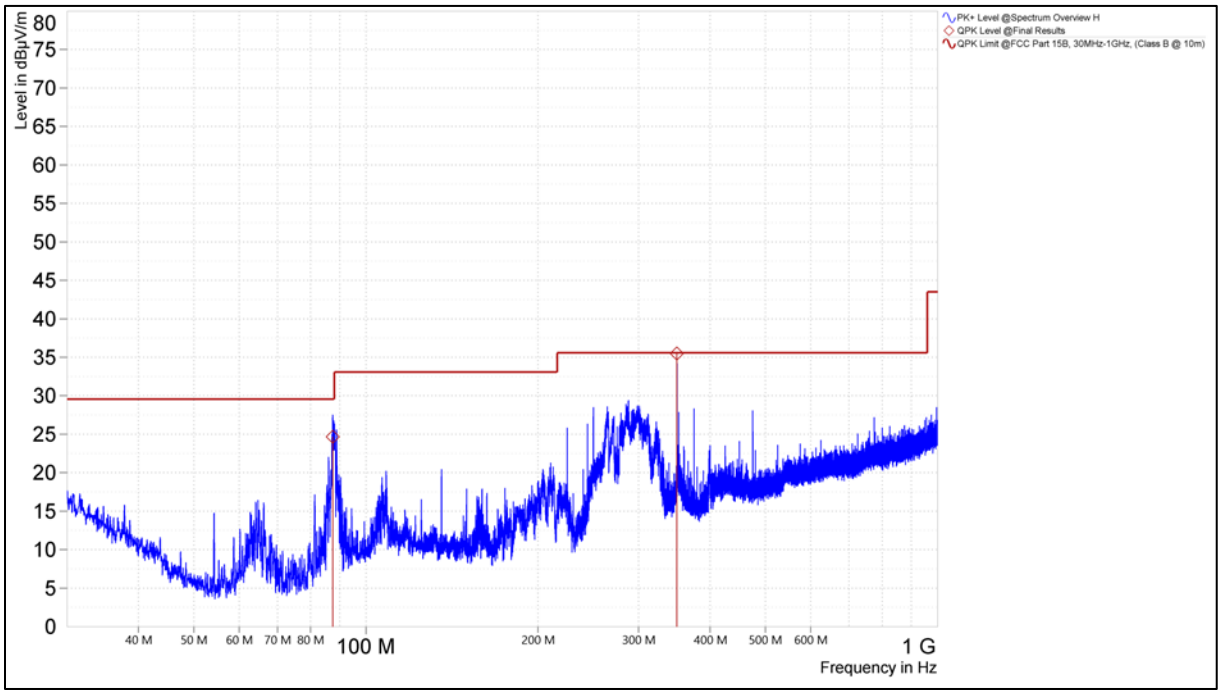


Figure 41. Out of Band Emissions Above 30MHz (Horizontal Polarity, Ribbon RFID)

Electromagnetic Compatibility Criteria for Intentional Radiators

Frequency Stability

Test Requirement(s): **15.225(e)** The frequency tolerance of the carrier signal shall be maintained within +/-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 85% to 115% 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.

RSS-210 (B.6.b) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% (± 100 ppm) 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 85% to 115% 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: Measurements are in accordance with section 6.8 of ANSI C63.10. The EUT was placed in the Environmental Chamber and allowed to reach desired temperature. A spectrum analyzer was connected to a magnetic field loop antenna and used to measure the frequency drift via a radiated path measurement. The EUT was set to transmit in the operating frequency range. Frequency drift was investigated for the extreme temperatures and nominal temperature, until the unit is stabilized then recorded the reading in tabular format with the temperature range of -20º to 50ºC. The frequency stability tests were performed with the use of a DC power supply powering the product.

Test Results: The HDP5000e was compliant with Part 15.225 (e) and RSS-210 (B.6.b) requirement(s) of this section.

Test Engineer(s): Bryan Taylor

Test Date(s): 3/4/2024 - 3/8/2024

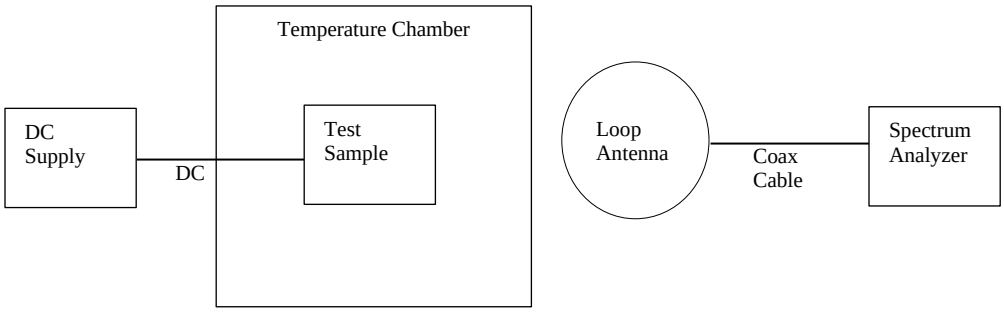


Figure 42. Temperature Stability Test Setup

Operating Freqeuncy:	13,560,000	Hz
Reference Voltage:	120	Vac
Deviation Limit:	0.01	%

Voltage %	Voltage (VAC)	Temp (°C)	Measured Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	Limit (%)
100%	120	-30	13,560,622	622	0.0046	0.01
100%	120	-20	13,560,607	607	0.0045	0.01
100%	120	-10	13,560,600	600	0.0044	0.01
100%	120	0	13,560,578	578	0.0043	0.01
100%	120	10	13,560,549	549	0.0040	0.01
100%	120	18	13,560,521	521	0.0038	0.01
100%	120	20	13,560,506	506	0.0037	1.01
100%	120	32	13,560,470	470	0.0035	0.01
100%	120	40	13,560,441	441	0.0033	0.01
100%	120	50	13,560,434	434	0.0032	0.01
115%	138	20	13,560,521	521	0.0038	0.01
85%	102	20	13,560,513	513	0.0038	0.01

Figure 43. Frequency Stability Test Results (Film RFID)

Operating Freqeuncy:	13,560,000	Hz
Reference Voltage:	120	VAC
Deviation Limit:	0.01	%

Voltage %	Voltage (VAC)	Temp (°C)	Measured Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	Limit (%)
100%	120	-30	13,560,130	130	0.0010	0.01
100%	120	-20	13,560,101	101	0.0007	0.01
100%	120	-10	13,560,057	57	0.0004	0.01
100%	120	0	13,560,048	48	0.0004	0.01
100%	120	10	13,560,043	43	0.0003	0.01
100%	120	18	13,560,028	28	0.0002	0.01
100%	120	20	13,560,007	7	0.0001	0.01
100%	120	32	13,559,921	-79	-0.0006	0.01
100%	120	40	13,559,863	-137	-0.0010	0.01
100%	120	50	13,559,905	-95	-0.0007	0.01
115%	138	20	13,560,007	7	0.0001	0.01
85%	102	20	13,560,022	22	0.0002	0.01

Figure 44. Frequency Stability Test Results (OMNIKEY 5122)

Operating Freqeuncy:	13,560,000	Hz
Reference Voltage:	120	VAC
Deviation Limit:	0.01	%

Voltage %	Voltage (VAC)	Temp (°C)	Measured Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	Limit (%)
100%	120	-30	13,560,523	523	0.0039	0.01
100%	120	-20	13,560,506	506	0.0037	0.01
100%	120	-10	13,560,499	499	0.0037	0.01
100%	120	0	13,560,492	492	0.0036	0.01
100%	120	10	13,560,448	448	0.0033	0.01
100%	120	18	13,560,426	426	0.0031	0.01
100%	120	20	13,560,419	419	0.0031	1.01
100%	120	32	13,560,397	397	0.0029	0.01
100%	120	40	13,560,398	398	0.0029	0.01
100%	120	50	13,560,383	383	0.0028	0.01
115%	138	20	13,560,441	441	0.0033	0.01
85%	102	20	13,560,412	412	0.0030	0.01

Figure 45. Frequency Stability Test Results (OMNIKEY 5127SI)

Operating Freqeuncy:	13,560,000	Hz
Reference Voltage:	120	VAC
Deviation Limit:	0.01	%

Voltage %	Voltage (VAC)	Temp (°C)	Measured Frequency (Hz)	Frequency Error (Hz)	Deviation (%)	Limit (%)
100%	120	-30	13,560,621	621	0.0046	0.01
100%	120	-20	13,560,607	607	0.0045	0.01
100%	120	-10	13,560,600	600	0.0044	0.01
100%	120	0	13,560,570	570	0.0042	0.01
100%	120	10	13,560,549	549	0.0040	0.01
100%	120	18	13,560,521	521	0.0038	0.01
100%	120	20	13,560,506	506	0.0037	1.01
100%	120	32	13,560,470	470	0.0035	0.01
100%	120	40	13,560,441	441	0.0033	0.01
100%	120	50	13,560,435	435	0.0032	0.01
115%	138	20	13,560,513	513	0.0038	0.01
85%	102	20	13,560,513	513	0.0038	0.01

Figure 46. Frequency Stability Test Results (Ribbon RFID)

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	1/23/2025
1A1083	EMI Test 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
1A1147	Bi-Log Antenna	Suno Sciences Corp	JB3	04/06/2023	04/06/2025
1A1065	EMI Receiver	Rohde & Schwarz	ESCI	8/4/2023	8/4/2024
1A1177	Pulse Limiter	Rohde & Schwarz	ESH3Z2	12/14/2023	12/14/2024
1A1122	LISN	TESEQ	NNB 51	09/21/2023	09/21/2024
1A1149	DC Milliohm Meter	GW INSTEK	GOM-802	09/24/2023	09/24/2024
1A1164	True-RMS Multimeter	Fluke	117	11/06/2023	11/06/2024
1A1225	Environmental Chamber	Espec	EXP-2H/New	5/16/2023	5/16/2024
1A1099	Generator	Com-Power	CGO-51000	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	
3A3219	DC Power Supply	Topward	6303A	See Note	

Table 19. Test Equipment List

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

End of Report