Electromagnetic Compatibility Test Report

Tests Performed on an RF IDeas, Inc.

Dual Frequency Card Reader

Models RDR-30032DKU-IMP & RDR-30532DKU-IMP

Radiometrics Document RP-9600A

ACCREDITED
TESTING CERT #1495.01

Product Detail:	
FCC ID: M9MW30100 IC: 6571A-W30100 Equipment type: Dual Frequency Card Reader	
Test Standards:	
US CFR Title 47, Chapter I, FCC Part 15 Subpart C FCC Part 15 CFR Title 47: 2022 Canada ISED; RSS-GEN, Issue 5: 2021 Canada ISED; RSS-210, Issue 10: 2019 This report concerns: Original Equipment FCC Parts 15.209 and 15.225	
Tests Performed For:	*Test Facility:*
rf IDEAS, Inc. 425 Martindale Road, Suite 1680 Schaumburg, IL 60148	**Radiometrics Midwest Corporation** 12 East Devonwood Avenue Romeoville, IL 60446
Test Completion Date	
May 5, 2022	

Document RP-9600 Revisions:

Rev.	Issue Date	Revised By
0	May 24, 2022	
1	June 1, 2022	Joseph Strzelecki

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1.0 ADMINISTRATIVE DATA

Equipment Under Test:	
A RF IDeas, Inc., Dual Frequency Card Reader Models: RDR-30532DKU-IMP and RDR-30032DKU-IMP Serial Numbers: WBIC000033 and WBIC000036 This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics:	*Test Date(s):*
April 21, 2022	April 21 thru May 5, 2022
Test Report Written and Authorized By:	*Test Witnessed By:*
Joseph Strzelecki Senior EMC Engineer	The tests were partially witnessed by Shiung Lo rf IDeas, Inc.
Radiometrics' Personnel Responsible for Test:	*EUT Checked By:*
Joseph Strzelecki 05/24/2022 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Chris Dalessio EMC Technician	Joseph Strzelecki Radiometrics The above personnel certifies: (1) The EUT had no loss of performance beyond the manufacture's performance level during the immunity tests. (2) A functional test was performed on the EUT after the immunity tests and no damage was sustained.

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Dual Frequency Card Reader, Models RDR-30532DKU-IMP and RDR-30032DKU-IMP, manufactured by RF IDeas, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions	30-1000 MHz	RSS-210 & FCC Part 15	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	RSS-210 & FCC Part 15	Pass
RF Radiated Emissions H-Field	0.009 – 30 MHz	RSS-210 & FCC Part 15	Pass
Occupied Bandwidth	125 kHz and 13.56 MHz	RSS-210 & FCC Part 15	Pass

Since the 13.56 MHz fundamental signal met the general limits of 15.209 and RSS-GEN section 8.9, the following tests are not required:

1. Frequency stability testing of FCC 15.225 and RSS-210 B6.
2. Mask compliance of FCC 15.225 b), c), d) and RSS-210 Annex B6. It met the requirements of the most stringent limits.

2.1 RF Exposure Compliance Requirements

Since the effective power output is less than 1 mW, the EUT meets the FCC requirement for RF exposure and is exempt from RSS-102. There are no power level adjustments and the antenna is permanently attached. The detailed calculations for RF Exposure are presented in a separate document.

3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a dual frequency card reader, Models RDR-30532DKU-IMP and RDR-30032DKU-IMP, manufactured by RF IDeas, Inc. The difference between the two model numbers being that the RDR-30032DKU-IMP has an RS-232 interface and the model RDR-30532DKU has a USB interface. Both products have the same PCB, with either the USB or the serial port populated. The EUT was in good working condition during the tests, with no known defects.

3.2 Product Family

The following table is the product family list of the readers that use the same electronics and PCB as the ones tested in this report.

The untested model numbers listed below are electrically identical with the same electromagnetic emissions and electromagnetic compatibility characteristics as those tested, therefore the tests on the model numbers below are representative for the tested models.

Model Number	Description
RDR-30531DKU	WAVE ID SP Plus V3 Keystroke PACK ID Black USB Reader
RDR-30532DKU	WAVE ID SP Plus V3 SDK iClass ID/SE/SEOS PACK ID Black USB Reader
RDR-30031DKU	WAVE ID SP Plus V3 Keystroke iClass ID/SE/SEOS Imprivata Black USB Reader
RDR-30032DKU	WAVE ID SP Plus V3 SDK iClass ID/SE/SEOS Imprivata Black USB Reader
RDR-30532DKU-IMP	**Tested Sample** WAVE ID SP Plus V3 SDK Imprivata Black USB Reader
RDR-30032DKU-IMP	**Tested Sample** WAVE ID SP Plus V3 SDK iClass ID/SE/SEOS Imprivata Black USB Imprivata Reader

The Antenna PCB is a part number PCB-1098-09 and is the same for all versions of the product.
The Main PCB is a part number PCB-1125-03 and is the same for all versions of the product. The RDR-300DKU series products have one less part populated in the Digital section of the product than is in the RDR-305DKU products.

3.2.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

The antenna is permanently attached to the PCB. The antenna is internal to the EUT and it is not readily available to be modified by the end user.

3.3 Related Submittals

RF IDeas, Inc. is not submitting any other products simultaneously for equipment authorization related to the EUT.

4.0 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations. Power was supplied at 115 VAC, 60 Hz single-phase to the host computer. The EUT was powered from either the USB or PS/2 port.

The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
2	Card Reader: USB version	E	RF IDeas	RDR-30032DKU-IMP	WBIC000036
	Card Reader: USB version	E	RF IDeas	RDR-30532DKU-IMP	WBIC0000033
3	Latitude Laptop PC	H	HP	Elite x2	5CG545482P
4	Laptop AC-DC power supply	P	HP	854055-002	A000133
6	Mouse (MS-01)	P	IBM	MO09KZ	23-001330

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

List of Cables

QTY	Length (m)	Cable Description	Shielded?
1	1.8	USB Cable from Reader to Host computer	Yes
1	1.2	AC Cord to AC-DC power supply to host computer	No
1	1.5	DC Cord to Computer	No

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.3 Equipment Modifications

No modifications were made at Radiometrics in order to meet the requirements listed in this report.

5.0 TEST SPECIFICATIONS

Document	Date	Title
FCC CFR Title 47	2020	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
IC RSS-210 Issue 10	2019	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 5	2019	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)

6.0 TEST PROCEDURE DOCUMENTS

The tests were performed using the procedures from the following specifications:

Document	Date	Title
ANSI C63.4-2014	2014	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	2013	American National Standard for Testing Unlicensed Wireless Devices

7.0 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2017 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber E: Is a custom-made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

Test Station F: Is an area that measures 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6-inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number IC8727A-1.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

8.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

9.0 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

10.0 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
ANT-53	EMCO	Loop Antenna	6507	1453	1 kHz-30 MHz	24 Mo	03/10/22
ANT-66	ETS-Lindgren	Horn Antenna	3115	62580	1.0-18GHz	24 Mo.	03/11/21

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
ANT-68	EMCO	Log-Periodic Ant.	93146	9604-4456	200-1000MHz	24 Mo.	02/07/22
ANT-80	AH Systems	Bicon Antenna	SAS-540	294	20-330MHz	24 Mo.	01/05/21
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	03/07/22
LSN-01	Electrometrics	50 uH LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	08/23/21
REC-20	HP / Agilent	Spectrum Analyzer	85460A/84562A	33330A00135 3410A00178	30Hz-6GHz	24 Mo.	08/18/21
REC-21	Agilent	Spectrum Analyzer	E7405A	MY45118341	9kHz-26.5GHz	24 Mo.	02/24/22
TC-01	GS Blue M Electric	Temperature Chamber	ETC-04S-E	0003-ETC-201	-40 to 100 Deg C	24 Mo.	10/16/20
TMP-01	Fluke	Temperature meter	80T-150UA	38280311	N/A	12 Mo.	06/07/21

Note: All calibrated equipment is subject to periodic checks.

Software Company	Test Software Name	Version	Applicable Tests
Radiometrics	EN550XX0	07.16.19	RF Conducted Emissions (FCC Part 15 & EN 55011/22)
Radiometrics	REREC11D	07.16.19	RF Radiated Emissions (FCC Part 15 & EN 55011/22)
Agilent	PSA/ESA-E/L/EMC	2.4.0.42	Bandwidth and screen shots

11.0 TEST SECTIONS

11.1 AC Conducted Emissions

The tests and limits are in accordance with FCC section 15.207 and RSS Gen section 8.8.

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on a semi-log graph generated by the computer. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

FCC/IC Limits of Conducted Emissions at the AC Mains Ports

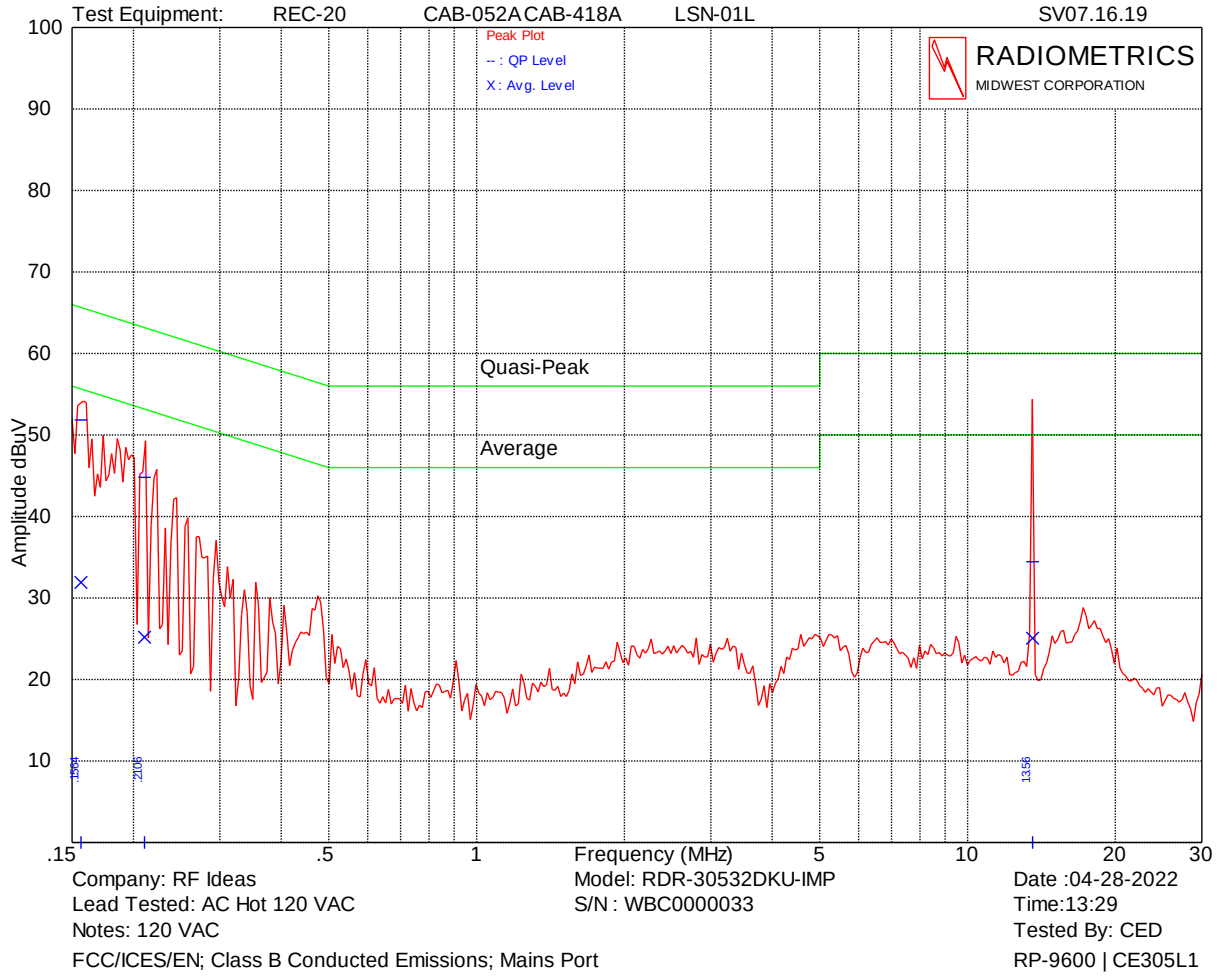
Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 – 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the host computer (with the EUT connected) power cord, after testing all modes of operation.

In accordance with the FCC rules regarding transmitters below 30 MHz.

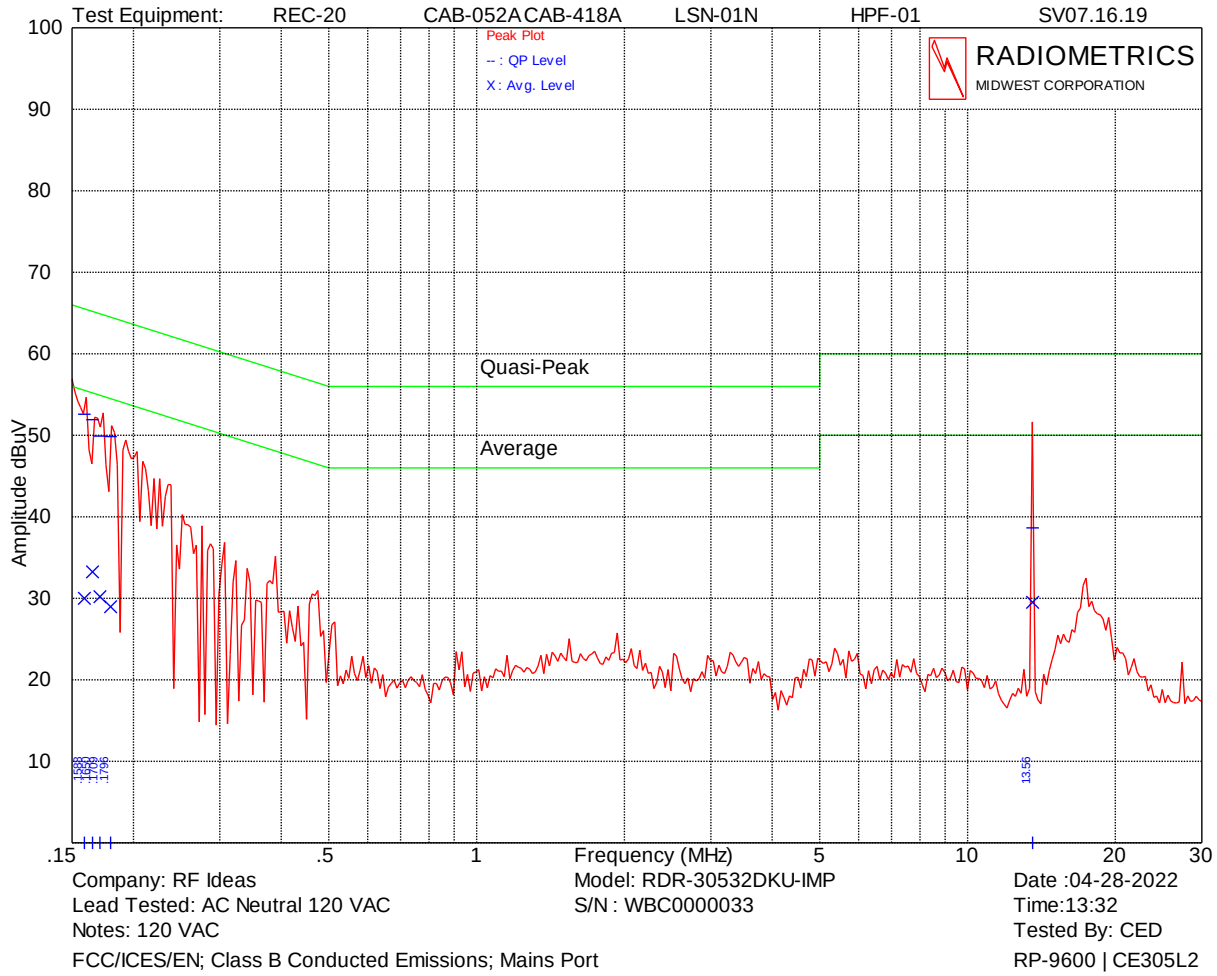
Test Date : April 28, 2022
QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.
The Limit shown above is RSS-GEN Table 3.

Model: RDR-30532DKU-IMP



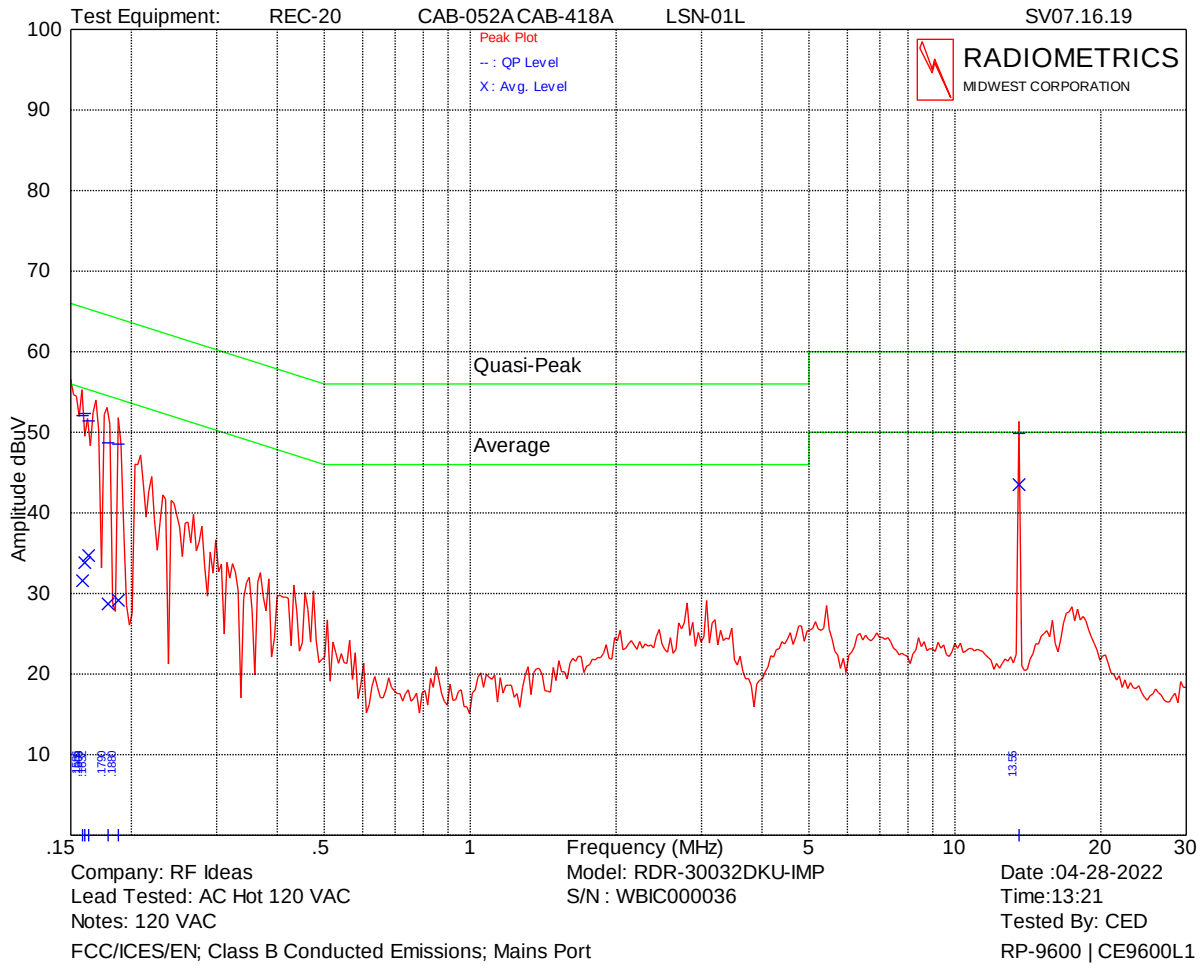
Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.156	51.8	65.7	31.9	55.7	13.8
0.211	44.8	63.2	25.2	53.2	18.4
13.569	34.4	60.0	25.1	50.0	24.9

Model: RDR-30532DKU-IMP



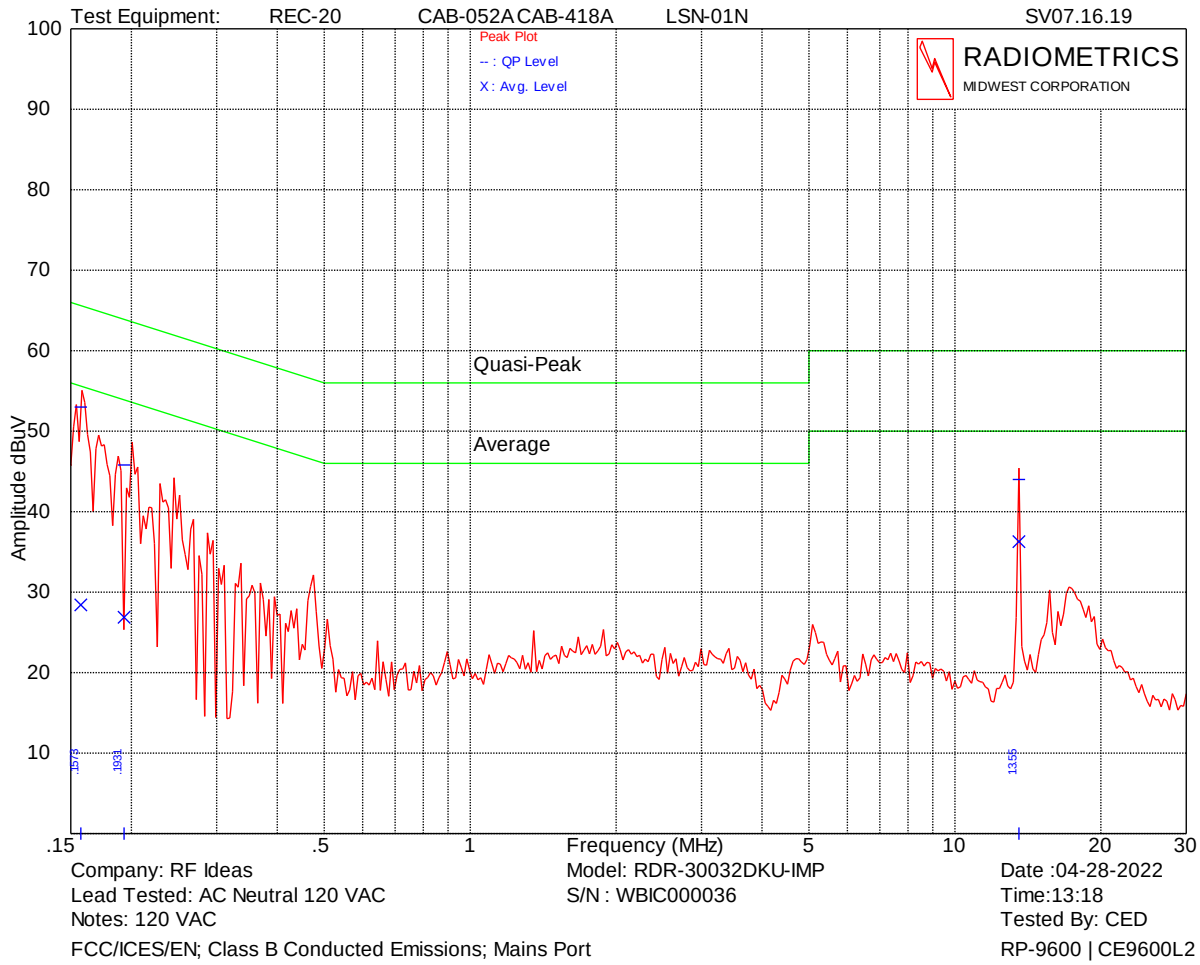
Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.159	52.6	65.5	30.0	55.5	12.9
0.171	49.9	64.9	30.2	54.9	15.0
0.165	51.9	65.2	33.2	55.2	13.3
0.180	49.8	64.5	29.0	54.5	14.7
13.566	38.6	60.0	29.5	50.0	20.5

Model: RDR-30032DKU-IMP



Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.159	52.1	65.5	31.6	55.5	13.5
0.160	52.3	65.4	33.8	55.4	13.1
0.163	51.4	65.3	34.7	55.3	13.9
0.179	48.7	64.5	28.7	54.5	15.8
0.188	48.5	64.1	29.1	54.1	15.6
13.559	49.9	60.0	43.5	50.0	6.5

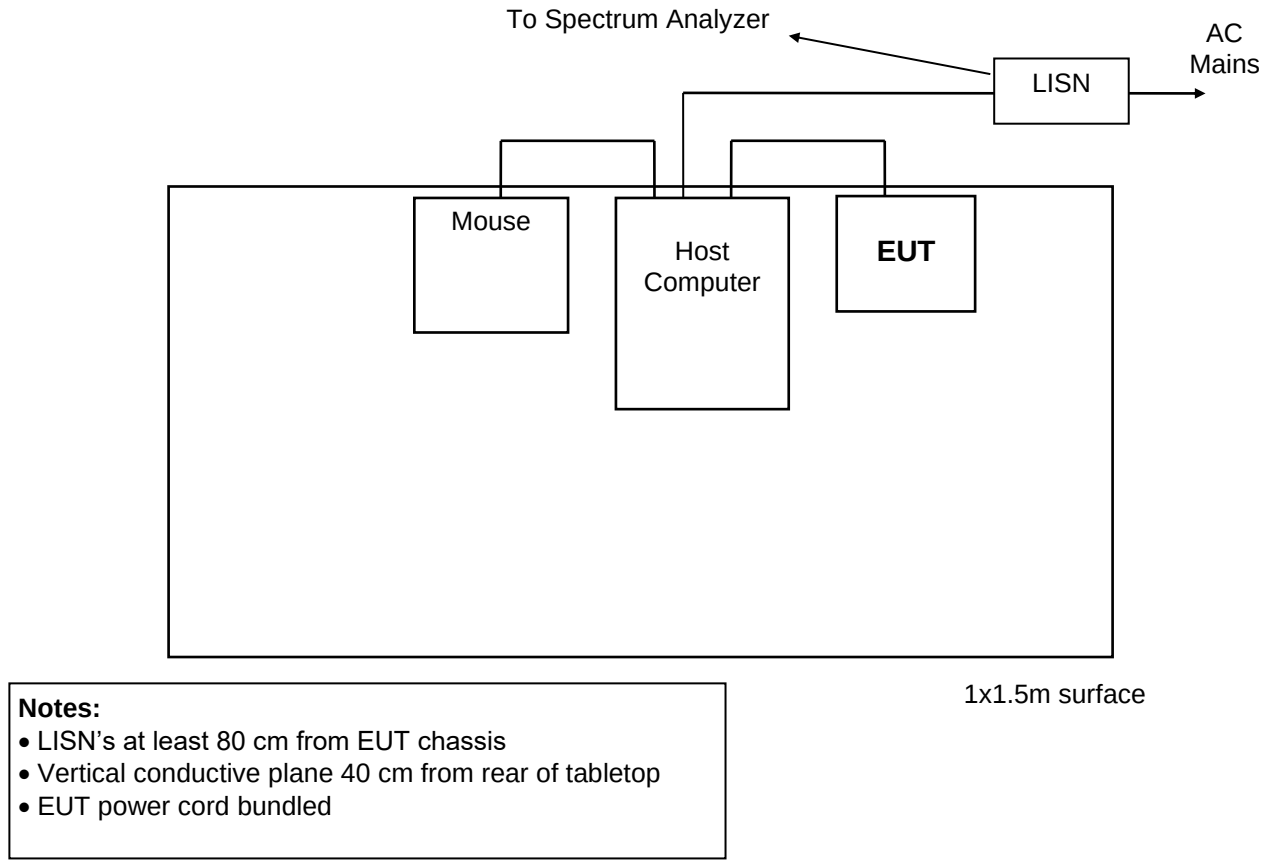
Model: RDR-30032DKU-IMP



Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.157	53.0	65.6	28.4	55.6	12.6
0.193	45.8	63.9	26.9	53.9	18.1
13.553	44.2	60.0	35.5	50.0	14.5

Judgment: Passed by at least 6 dB.

Figure 1. Conducted Emissions Test Setup



11.2 Radiated RF Emissions

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 kHz and the bandwidth from 30 MHz to 1000 MHz is 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. Figure 4 herein lists the details of the test equipment used during radiated emissions tests.

Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4 and CISPR 16-1. Chamber E is located at 12 Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 1000 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. All measurements may be performed using either the peak, average or quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector or average function as required by the specification for final determination of compliance.

The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground.

Radiated Emissions Field Strength Limits

Frequency Range (MHz)	Test Distance (meters)	Class B Limits	
		uV/m	dB(uV/m)
0.009-0.490	300	2400/F(kHz)	20*LOG(2400/kHz)
0.490-1.705	30	24000/F(kHz)	20*LOG(24000/kHz)
1.705-30.0	30	30	29.5
30 - 88	3	100	40.0
88 - 216	3	150	43.5
216 - 960	3	200	46.0
Above 960	3	500	54.0

The emission limits shown in the above table are based on measurements using 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.

11.2.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Attenuation Factor, and by subtracting the Amplifier Gain from the measured reading. Each antenna, cable and amplifier has individual factors across its usable frequency range. The antenna factor converts the voltage reading in dBuV to field strength in dBuV/meter. The equation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength in dBuV/m
RA = Receiver Amplitude in dBuV
AF = Antenna Factor in dB/m
CF = Cable Attenuation Factor in dB
AG = Amplifier Gain in dB

11.2.2 Radiated Emissions Test Results

Test Date	04/21 & 28/2022
Test Distance	3 Meters
Specification	FCC Part 15 Subpart C & RSS-210
Notes	The actual FCC limits are in uV/m. The data in the table below coverted the limit to dBuV/m The QP data is the final measure of Compliance
Abbreviations	P = peak; Q = QP Pol = Antenna Polarization; V = Vertical; H = Horizontal

EUT				RDR-30032DKU-IMP; S/N WBIC000036					
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable & Amp Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
35.5	16.5	P	H	12.3	0.6	0.0	29.4	40.0	10.6
47.1	12.7	P	H	10.0	0.7	0.0	23.4	40.0	16.6
59.3	13.2	P	H	9.3	0.8	0.0	23.3	40.0	16.7
67.6	15.8	P	H	9.2	0.9	0.0	25.9	40.0	14.1
82.5	14.7	P	H	9.5	1.0	0.0	25.2	40.0	14.8
93.5	16.7	P	H	9.9	1.0	0.0	27.6	43.5	15.9
108.5	16.9	P	H	10.9	1.1	0.0	28.9	43.5	14.6
120.1	18.3	P	H	11.6	1.2	0.0	31.1	43.5	12.4

EUT	RDR-30032DKU-IMP; S/N WBIC000036

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable & Amp Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
133.3	13.7	P	H	12.3	1.2	0.0	27.2	43.5	16.3
148.2	14.6	P	H	12.7	1.3	0.0	28.6	43.5	14.9
162.6	17.7	P	H	13.0	1.4	0.0	32.1	43.5	11.4
180.3	17.6	P	H	13.6	1.5	0.0	32.7	43.5	10.8
194.6	14.1	P	H	14.2	1.5	0.0	29.8	43.5	13.7
218.4	14.7	P	H	14.8	1.6	0.0	31.1	46.0	14.9
239.9	21.3	P	H	15.2	1.7	0.0	38.2	46.0	7.8
264.0	12.5	P	H	12.4	1.8	0.0	26.7	46.0	19.3
279.1	13.7	P	H	13.1	1.8	0.0	28.6	46.0	17.4
291.7	12.9	P	H	13.6	1.8	0.0	28.3	46.0	17.7
308.7	14.2	P	H	14.9	1.9	0.0	31.0	46.0	15.0
325.7	19.4	P	H	14.2	2.0	0.0	35.6	46.0	10.4
352.8	16.0	P	H	14.4	2.0	0.0	32.4	46.0	13.6
379.9	14.8	P	H	14.8	2.1	0.0	31.7	46.0	14.3
407.0	14.5	P	H	15.5	2.2	0.0	32.2	46.0	13.8
434.1	13.7	P	H	16.0	2.3	0.0	32.0	46.0	14.0
461.2	15.9	P	H	16.8	2.4	0.0	35.1	46.0	10.9
488.3	15.5	P	H	17.0	2.4	0.0	34.9	46.0	11.1
570.0	12.6	P	H	18.4	2.6	0.0	33.6	46.0	12.4
597.5	12.9	P	H	18.7	2.7	0.0	34.3	46.0	11.7
625.0	12.4	P	H	19.1	2.8	0.0	34.3	46.0	11.7
678.8	11.8	P	H	20.9	2.9	0.0	35.6	46.0	10.4
771.3	9.5	P	H	21.0	3.1	0.0	33.6	46.0	12.4
841.3	9.2	P	H	22.1	3.2	0.0	34.5	46.0	11.5
928.8	8.6	P	H	23.1	3.4	0.0	35.1	46.0	10.9
42.2	23.1	P	V	10.8	0.7	0.0	34.6	40.0	5.4
42.2	17.2	Q	V	10.8	0.7	0.0	28.7	40.0	11.3
54.3	19.4	P	V	9.4	0.8	0.0	29.6	40.0	10.4
65.9	20.0	P	V	9.3	0.8	0.0	30.1	40.0	9.9
79.2	15.3	P	V	9.4	0.9	0.0	25.6	40.0	14.4
94.6	24.5	P	V	10.0	1.0	0.0	35.5	43.5	8.0
94.6	19.5	Q	V	10.0	1.0	0.0	30.5	43.5	13.0
108.5	17.9	P	V	10.9	1.1	0.0	29.9	43.5	13.6
120.1	18.4	P	V	11.6	1.2	0.0	31.2	43.5	12.3
134.4	13.9	P	V	12.3	1.2	0.0	27.4	43.5	16.1
157.1	16.1	P	V	12.9	1.4	0.0	30.4	43.5	13.1
176.4	17.0	P	V	13.5	1.4	0.0	31.9	43.5	11.6
201.3	14.4	P	V	14.4	1.5	0.0	30.3	43.5	13.2
230.6	15.4	P	V	15.0	1.7	0.0	32.1	46.0	13.9
270.3	11.6	P	V	12.6	1.8	0.0	26.0	46.0	20.0
277.2	11.3	P	V	13.0	1.8	0.0	26.1	46.0	19.9
325.7	14.1	P	V	14.2	2.0	0.0	30.3	46.0	15.7
379.9	14.1	P	V	14.8	2.1	0.0	31.0	46.0	15.0
407.0	15.3	P	V	15.5	2.2	0.0	33.0	46.0	13.0
434.1	12.9	P	V	16.0	2.3	0.0	31.2	46.0	14.8
461.2	15.2	P	V	16.8	2.4	0.0	34.4	46.0	11.6
488.3	13.3	P	V	17.0	2.4	0.0	32.7	46.0	13.3
516.3	11.4	P	V	18.7	2.5	0.0	32.6	46.0	13.4
542.5	13.8	P	V	18.0	2.6	0.0	34.4	46.0	11.6
570.0	14.4	P	V	18.4	2.6	0.0	35.4	46.0	10.6
597.5	13.2	P	V	18.7	2.7	0.0	34.6	46.0	11.4

EUT	RDR-30032DKU-IMP; S/N WBIC000036								
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable & Amp Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
651.3	12.0	P	V	19.8	2.8	0.0	34.6	46.0	11.4
731.3	8.1	P	V	21.0	3.0	0.0	32.1	46.0	13.9
818.8	8.9	P	V	21.5	3.2	0.0	33.6	46.0	12.4
887.5	8.4	P	V	22.7	3.3	0.0	34.4	46.0	11.6
951.3	8.0	P	V	23.4	3.5	0.0	34.9	46.0	11.1

Where there is both peak and quasi peak data, the quasi-peak is the final determination of compliance.

EUT	RDR-30532DKU-IMP; S/N WBC0000033								
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable & Amp Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
35.5	15.9	P	H	12.3	0.6	0.0	28.8	40.0	11.2
54.3	12.9	P	H	9.4	0.8	0.0	23.1	40.0	16.9
57.6	12.7	P	H	9.3	0.8	0.0	22.8	40.0	17.2
68.1	12.6	P	H	9.2	0.9	0.0	22.7	40.0	17.3
93.0	15.2	P	H	9.9	1.0	0.0	26.1	43.5	17.4
108.5	17.0	P	H	10.9	1.1	0.0	29.0	43.5	14.5
114.0	15.8	P	H	11.2	1.1	0.0	28.1	43.5	15.4
120.1	15.8	P	H	11.6	1.2	0.0	28.6	43.5	14.9
131.1	11.0	P	H	12.2	1.2	0.0	24.4	43.5	19.1
139.4	12.7	P	H	12.5	1.3	0.0	26.5	43.5	17.0
162.6	15.1	P	H	13.0	1.4	0.0	29.5	43.5	14.0
183.0	14.7	P	H	13.7	1.5	0.0	29.9	43.5	13.6
189.7	14.4	P	H	13.9	1.5	0.0	29.8	43.5	13.7
242.7	22.8	P	H	15.2	1.7	0.0	39.7	46.0	6.3
259.6	21.5	P	H	12.3	1.7	0.0	35.5	46.0	10.5
278.5	16.1	P	H	13.0	1.8	0.0	30.9	46.0	15.1
289.8	14.8	P	H	13.6	1.8	0.0	30.2	46.0	15.8
325.7	20.1	P	H	14.2	2.0	0.0	36.3	46.0	9.7
352.8	17.2	P	H	14.4	2.0	0.0	33.6	46.0	12.4
379.9	15.4	P	H	14.8	2.1	0.0	32.3	46.0	13.7
407.0	15.1	P	H	15.5	2.2	0.0	32.8	46.0	13.2
461.2	14.5	P	H	16.8	2.4	0.0	33.7	46.0	12.3
488.3	12.3	P	H	17.0	2.4	0.0	31.7	46.0	14.3
570.0	12.8	P	H	18.4	2.6	0.0	33.8	46.0	12.2
651.3	11.7	P	H	19.8	2.8	0.0	34.3	46.0	11.7
678.8	13.6	P	H	20.9	2.9	0.0	37.4	46.0	8.6
706.3	11.9	P	H	21.3	2.9	0.0	36.1	46.0	9.9
747.5	10.9	P	H	20.9	3.0	0.0	34.8	46.0	11.2
818.8	8.1	P	H	21.5	3.2	0.0	32.8	46.0	13.2
907.5	10.1	P	H	22.9	3.4	0.0	36.4	46.0	9.6
965.0	8.1	P	H	23.5	3.5	0.0	35.1	54.0	18.9
35.5	21.6	P	V	12.3	0.6	0.0	34.5	40.0	5.5
35.5	12.4	Q	V	12.3	0.6	0.0	25.3	40.0	14.7
40.5	22.2	P	V	11.1	0.7	0.0	34.0	40.0	6.0
54.3	19.3	P	V	9.4	0.8	0.0	29.5	40.0	10.5
57.6	15.0	P	V	9.3	0.8	0.0	25.1	40.0	14.9
66.5	18.3	P	V	9.3	0.8	0.0	28.4	40.0	11.6
92.4	18.4	Q	V	9.9	1.0	0.0	29.3	43.5	14.2

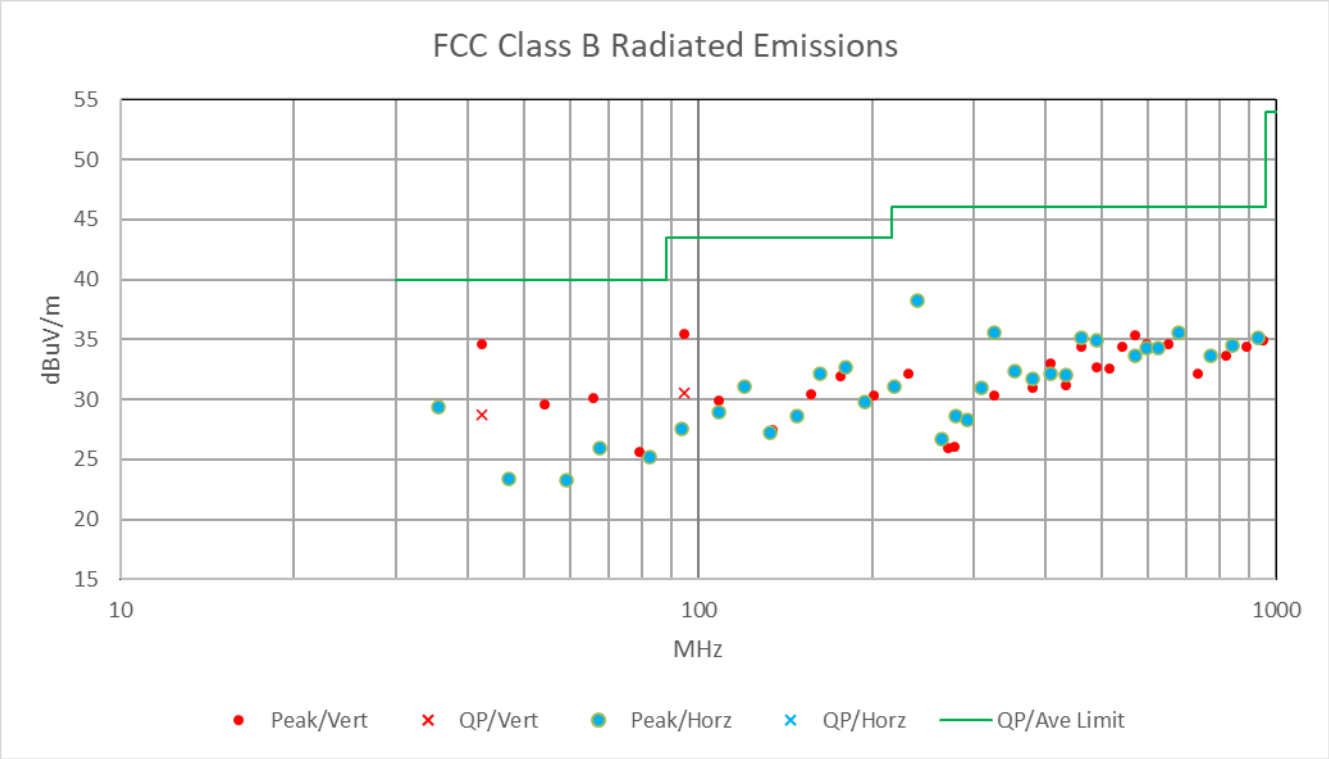
EUT	RDR-30532DKU-IMP; S/N WBC0000033								
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable & Amp Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
92.4	24.7	P	V	9.9	1.0	0.0	35.6	43.5	7.9
114.0	18.0	P	V	11.2	1.1	0.0	30.3	43.5	13.2
120.1	16.8	P	V	11.6	1.2	0.0	29.6	43.5	13.9
138.8	10.6	P	V	12.5	1.3	0.0	24.4	43.5	19.1
162.6	13.4	P	V	13.0	1.4	0.0	27.8	43.5	15.7
183.6	13.6	P	V	13.7	1.5	0.0	28.8	43.5	14.7
208.5	11.3	P	V	14.6	1.6	0.0	27.5	43.5	16.0
243.8	14.6	P	V	15.3	1.7	0.0	31.6	46.0	14.4
261.5	13.4	P	V	12.3	1.7	0.0	27.4	46.0	18.6
279.7	11.9	P	V	13.1	1.8	0.0	26.8	46.0	19.2
325.7	15.7	P	V	14.2	2.0	0.0	31.9	46.0	14.1
347.8	13.4	P	V	14.4	2.0	0.0	29.8	46.0	16.2
379.9	14.7	P	V	14.8	2.1	0.0	31.6	46.0	14.4
407.0	13.2	P	V	15.5	2.2	0.0	30.9	46.0	15.1
434.1	13.5	P	V	16.0	2.3	0.0	31.8	46.0	14.2
461.2	13.4	P	V	16.8	2.4	0.0	32.6	46.0	13.4
488.3	13.2	P	V	17.0	2.4	0.0	32.6	46.0	13.4
570.0	13.6	P	V	18.4	2.6	0.0	34.6	46.0	11.4
581.3	13.1	P	V	18.6	2.7	0.0	34.4	46.0	11.6
678.8	12.4	P	V	20.9	2.9	0.0	36.2	46.0	9.8
768.8	11.8	P	V	21.0	3.1	0.0	35.9	46.0	10.1
837.5	8.9	P	V	22.0	3.2	0.0	34.1	46.0	11.9
926.3	8.5	P	V	23.0	3.4	0.0	34.9	46.0	11.1

Where there is both peak and quasi peak data, the quasi-peak is the final determination of compliance.

Judgment: Passed by 6.3 dB

Radiated emissions in a graphical format. The following charts have the same data as the previous tables.

RDR-30032DKU-IMP



RDR-30532DKU-IMP

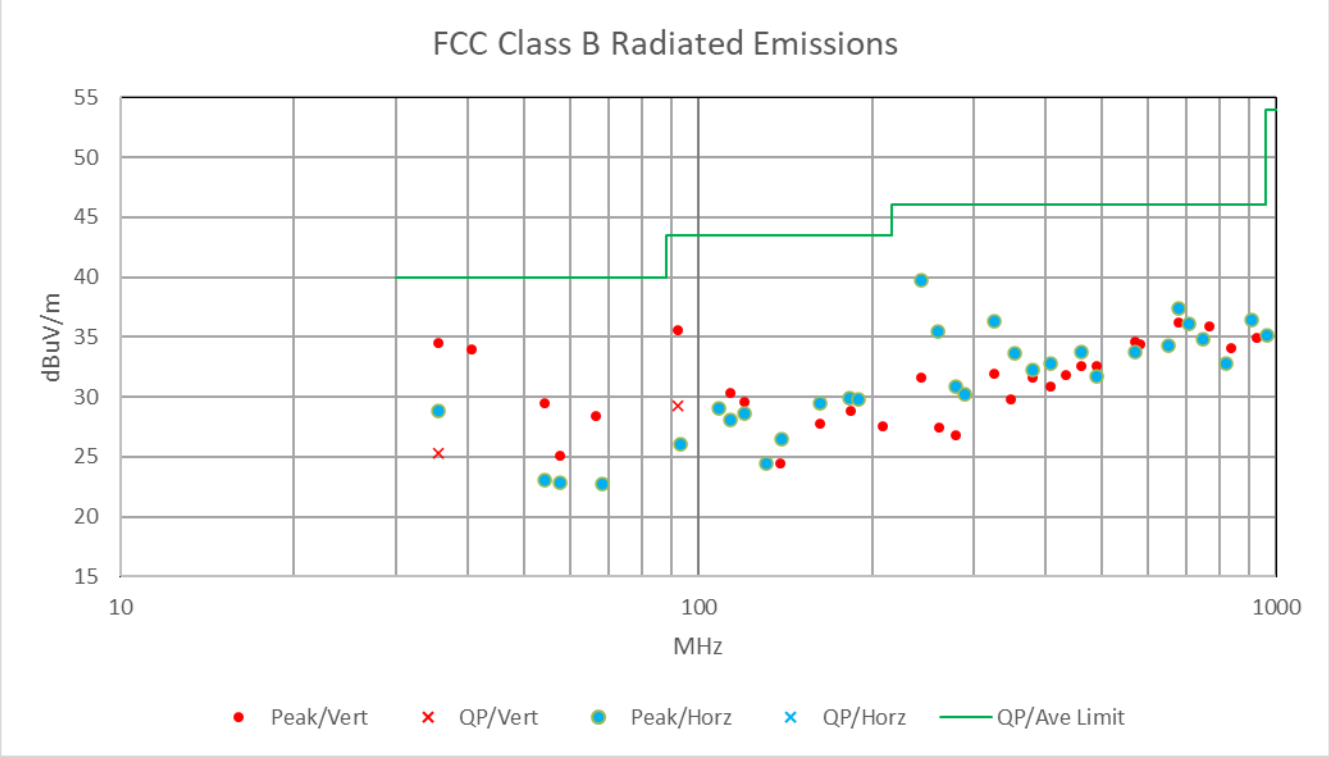
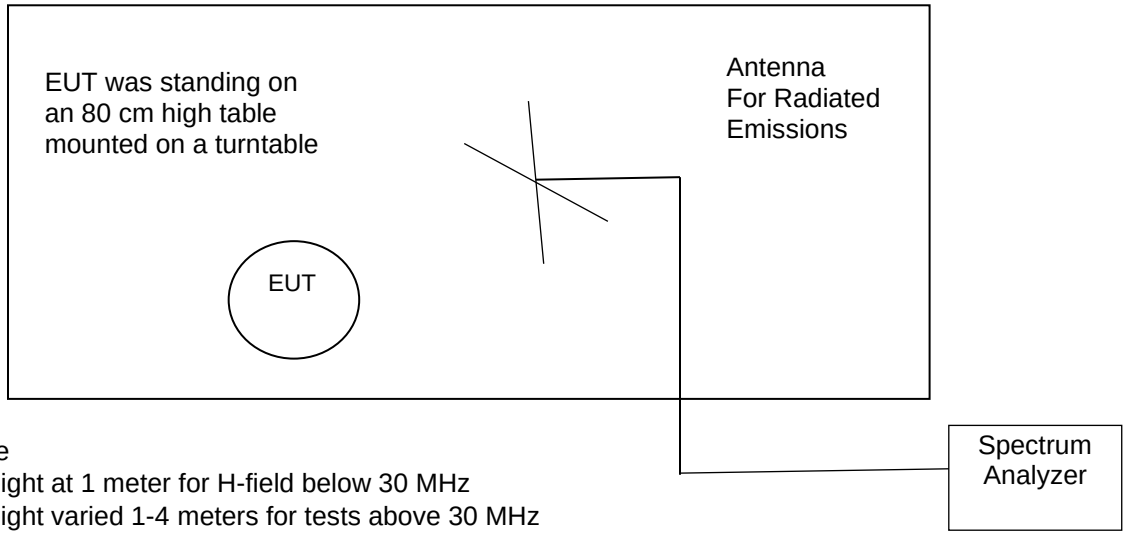


Figure 2. Drawing of Radiated Emissions Test Setup

Chamber E, anechoic



Notes:
- Not to Scale
- Antenna height at 1 meter for H-field below 30 MHz
- Antenna height varied 1-4 meters for tests above 30 MHz
- Distance from antenna to tested system is 3 meters
- AC cords not shown. They are connected to AC outlet with low-pass filter on turntable

Frequency Range	Receive Antenna	Pre-Amplifier	Spectrum Analyzer
0.01 to 30 MHz	ANT-53	None; Active ANT	REC-21
30 to 200 MHz	ANT-80	Internal	REC-21
200 to 1000 MHz	ANT-68	Internal	REC-21

Figure 3. Radiated Emissions Test Setup for Frequencies Below 30MHz

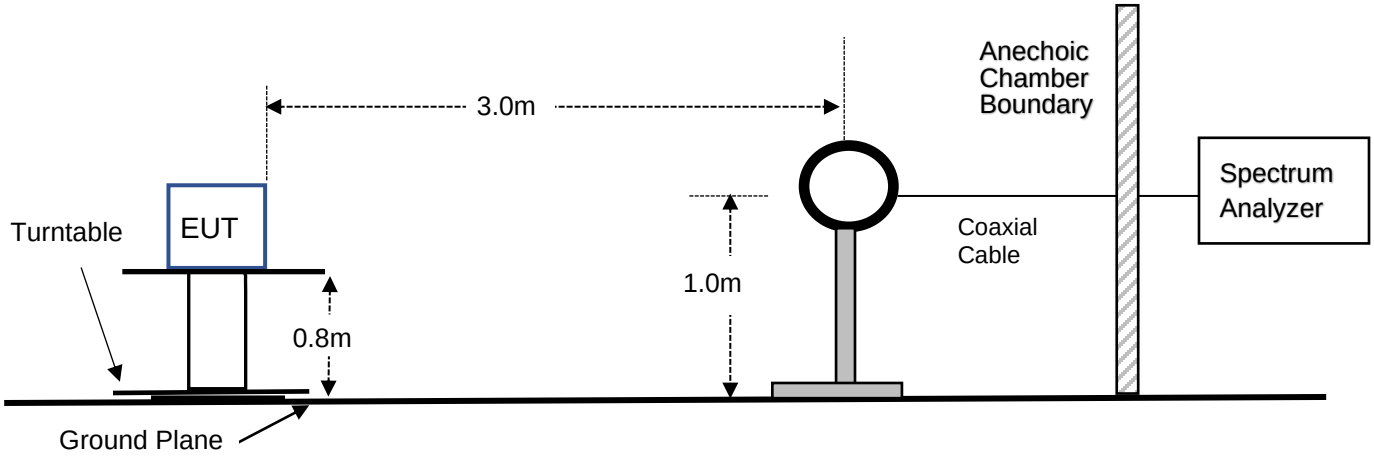
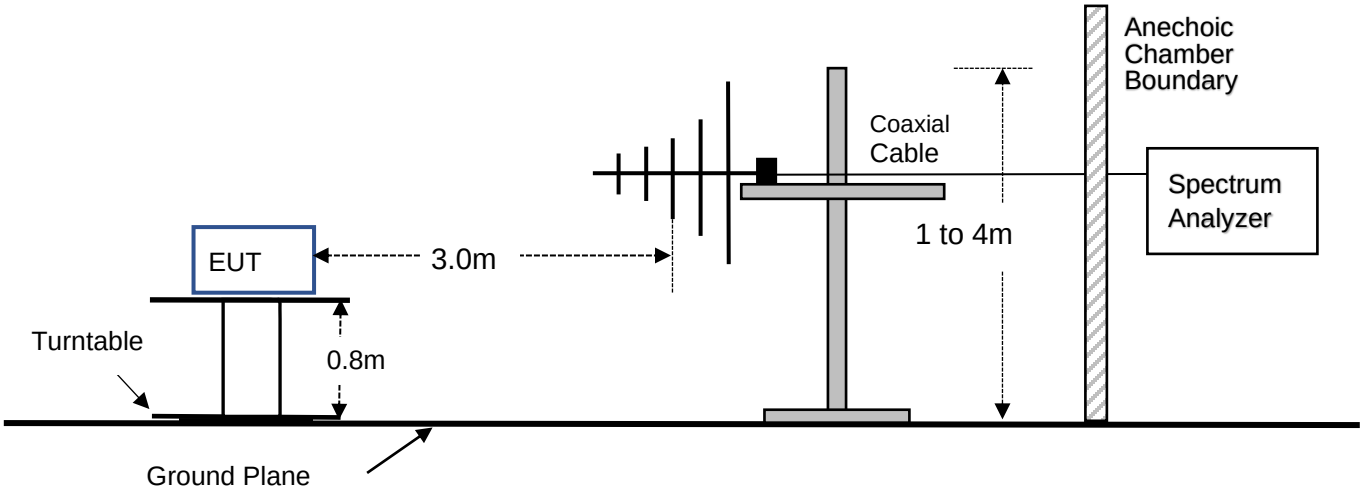


Figure 4. Radiated Emissions Test Setup for Frequencies from 30MHz to 1000MHz



11.3 Magnetic Field Measurements and Decay Factor Calculations

Radiated emission measurements are performed with an EMCO shielded loop antenna. The antenna and the EUT were rotated in order to find the maximize readings.

The distance correction factor is calculated as follows:
The distance factor in (dB) = DE*20*Log(TD/SD)
Where: DE = Decay Exponent (2.0 is used for this)
TD = Test distance in meters. This is 3 meters
SD = Specifciation Distance in meters
From 9 to 490 kHz, the SD = 300m, therefore the distance factor is 2*20*LOG(300/3) = 80 dB.
From 0.49 to 30 MHz, the SD = 30m, therefore the distance factor is 2*20*LOG(30/3) = 40 dB.

11.3.1 Magnetic Field Radiated Emissions Results (0.009 to 30 MHz)

Test Date	03/31/2022
Test Distance	3 Meters
Specification	FCC 15 & RSS-GEN
Products	Model: RDR-30032DKU-IMP; S/N WBIC000036; #1 Model: RDR-30532DKU-IMP; S/N WBC0000033; #2

Freq (kHz)	Peak reading dBuV	Loop Ant Factor dB/m	Test Dist. (m)	Decay exp	Cable Loss dB	FCC Distance factor dB	Field Strength dBuV/m	RSS & FCC Limit dBuV/m	Margin under limit	Notes
125.0	59.3	18.9	3.0	2.0	0.1	-80.0	-1.7	25.7	27.4	EUT #1
250.0	43.9	18.6	3.0	2.0	0.1	-80.0	-17.4	19.6	37.0	EUT #1
375.0	42.9	18.4	3.0	2.0	0.1	-80.0	-18.6	16.1	34.7	EUT #1
500.0	40.8	18.3	3.0	2.0	0.1	-40.0	19.2	33.6	14.4	EUT #1
13560	51.0	16.0	3.0	2.0	0.4	-40.0	27.4	29.5	2.1	EUT #1
27120	21.1	15.3	3.0	2.0	0.5	-40.0	-3.1	29.5	32.6	EUT #1
125.0	59.0	18.9	3.0	2.0	0.1	-80.0	-2.0	25.7	27.7	EUT #2
250.0	44.3	18.6	3.0	2.0	0.1	-80.0	-17.0	19.6	36.6	EUT #2
375.0	42.1	18.4	3.0	2.0	0.1	-80.0	-19.4	16.1	35.5	EUT #2
500.0	40.6	18.3	3.0	2.0	0.1	-40.0	19.0	33.6	14.6	EUT #2
13560	50.6	16.0	3.0	2.0	0.4	-40.0	27.0	29.5	2.5	EUT #2
27120	22.3	15.3	3.0	2.0	0.5	-40.0	-1.9	29.5	31.4	EUT #2
Column numbers										
1	2	3	4	5	6	7	8	9	10	11

Notes on Columns:
Column #1. Frequency of Tested Emission.
Column #2. Uncorrected readings from the spectrum analyzer (Peak)
Column #3. Antenna factor converts dBuV to dBuV/m
Column #4. Test Distance in meters
Column #5. Decay Exponent
Column #6. Cable Loss
Column #7. Distance factor (dB) = (Decay Exponent)*20*Log(Test Distance/Specification Distance)
Column #8. Total field strength. This = Columns 2 + 3 + 6 + 7
Column #9. FCC and Canada Limit in dBuV/m
Column #10. This is the margin under the limit for that row.
Column #11. The EUT (Equipment Under Test) is the product tested.

All limits are the general limits of FCC 15.209 or the RSS-Gen.
The emissions were scanned from 10 kHz to 30 MHz.

No other emissions were detected from 10 kHz to 30 MHz within 10 dB of the 15.209 or the RSS-GEN limits.

Judgement: Passed by 2.1 dB.

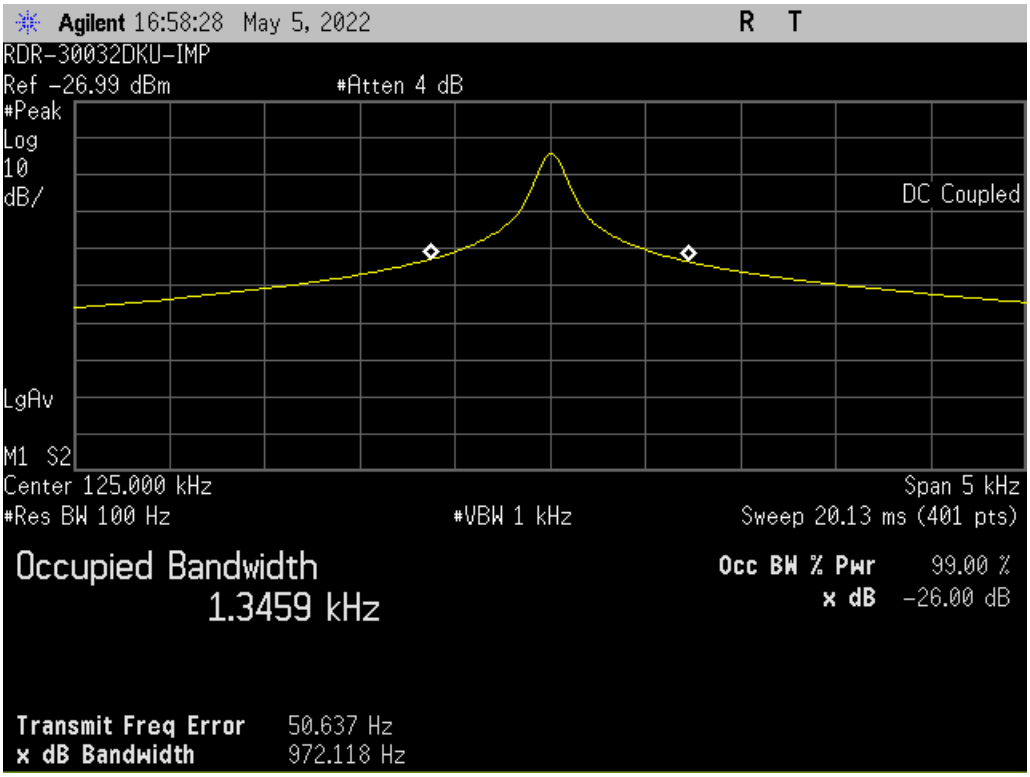
11.4 Occupied Bandwidth Data

The occupied bandwidth of the RF output was measured using a spectrum analyzer. A broadband antenna was used to receive the modulated signal. The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The spectrum analyzer display was digitized and plotted. The plots of the occupied bandwidth for the EUT are supplied on the following page.

Product	99% OBW	
	125 kHz signal	13.56 MHz Signal
30032	1.3459 kHz	2.5274 kHz
30532	1.3108 kHz	2.5317 kHz

Judgement: Pass

Figure 5. Occupied Bandwidth Plots 125 kHz



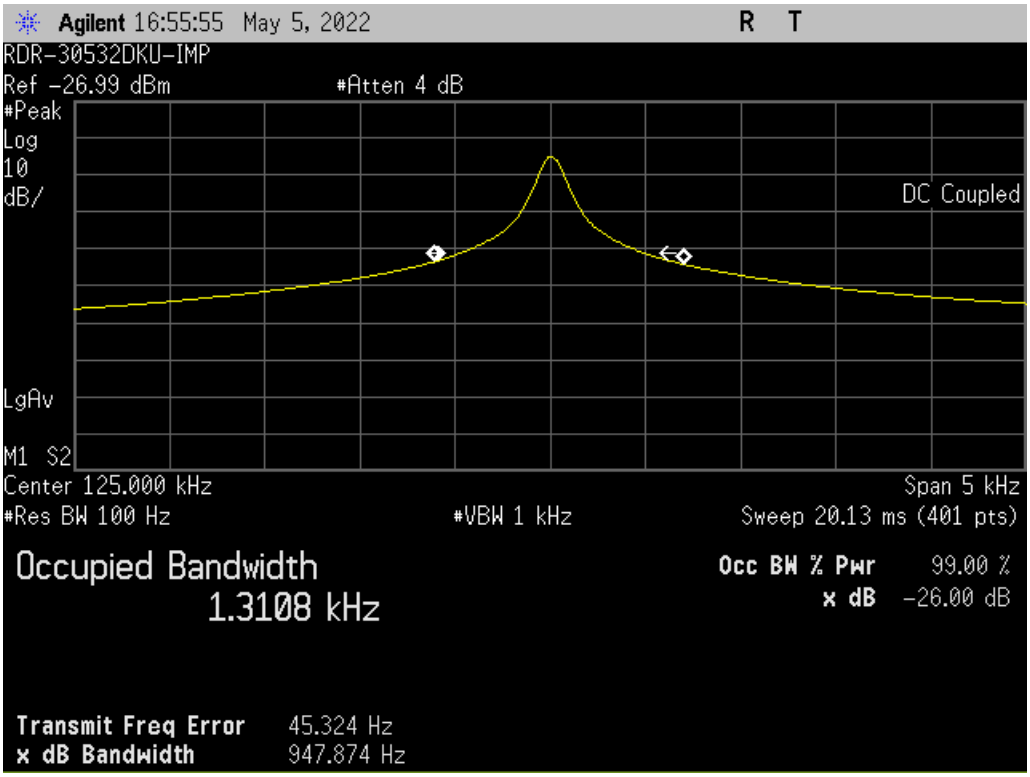
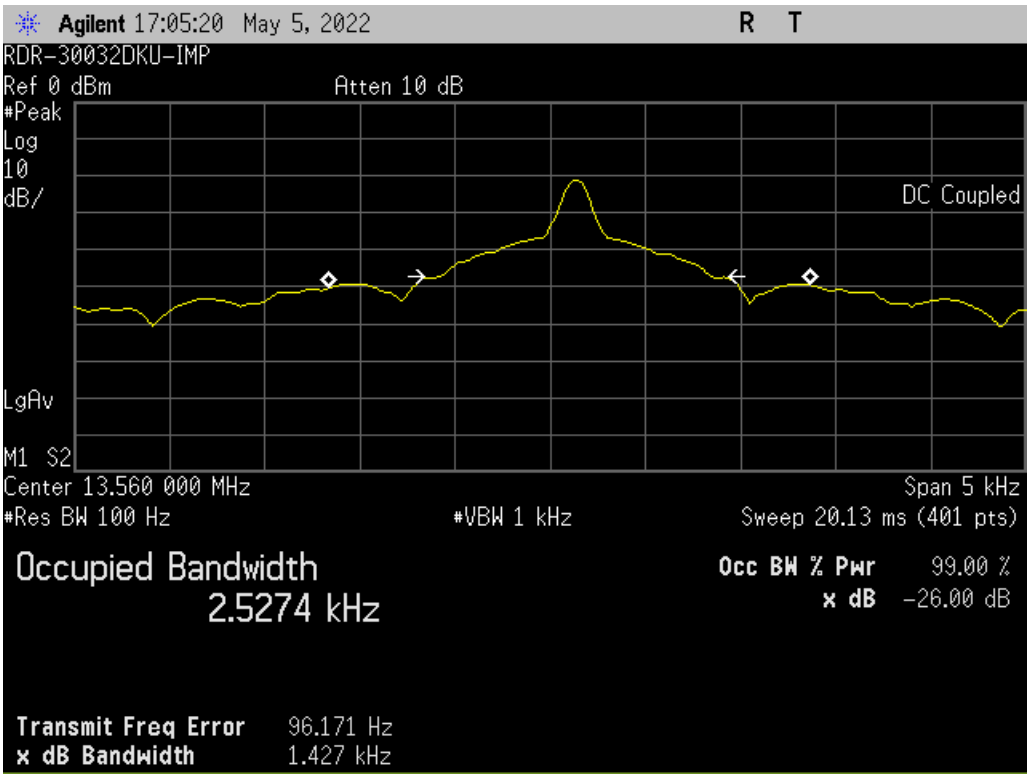
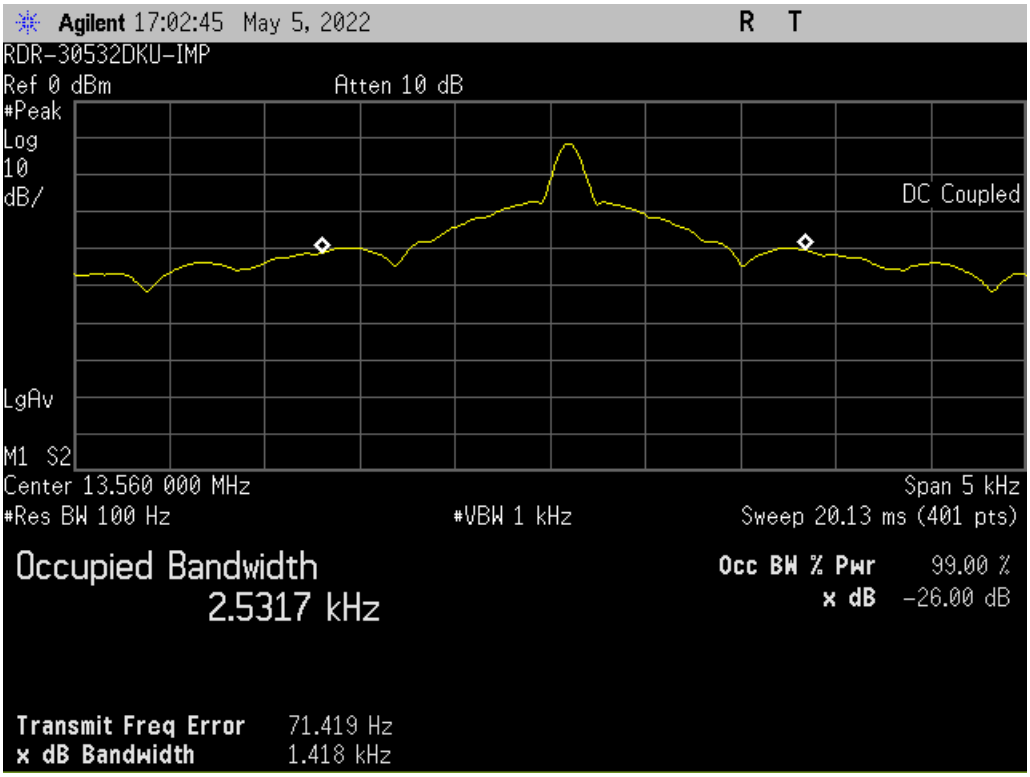


Figure 6. Occupied Bandwidth Plots 13.56 MHz





12.0 MEASUREMENT INSTRUMENTATION UNCERTAINTY

The uncertainties represent expanded uncertainties expressed at approximately the 95% confidence level using a coverage factor of k=2 in accordance with CISPR 16-4-2.

Measurement	Uncertainty
Conducted Emissions, LISN method, 150 kHz to 30 MHz	2.7 dB
Radiated Emissions, H-field, 3 meters, 9 kHz to 30 MHz	2.7 dB
Radiated Emissions, E-field, 3 meters, 30 to 200 MHz	3.3 dB
Radiated Emissions, E-field, 3 meters, 200 to 1000 MHz	4.9 dB
99% Occupied Bandwidth	1% of frequency span
Temperature THM-03	0.6 Deg C

13.0 REVISION HISTORY

RP-9600A Revisions:			
Rev.	Affected Sections	Description	Rationale
1	Cover	Added FCC 15.225 and RSS-210 to List of tests	This is needed for 13.56 MHz devices
1	2.0	Added note explain why Masks and Frequency stability tests are not needed.	Clarification needed