



Electromagnetic Compatibility Test Report

Tests Performed on an rf IDEas, Inc.

13.56 MHz RFID Reader; PMN: Wave ID Solo Mini

Models: RDR-7M36BKU-IMP & RDR-7536BKU-IMP

Radiometrics Document RP-9681A



<i>Product Detail:</i>		
FCC ID: M9MW7M3X		
IC: 6571A-W7M3X		
Equipment type: RFID Reader		
<i>Test Standards:</i>		
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 Part 15.225		
<i>Tests Performed For:</i>		<i>Test Facility:</i>
rf IDEAS, Inc.		Radiometrics Midwest Corporation
425 Martindale Road, Suite 1680		12 East Devonwood Avenue
Schaumburg, IL 60148		Romeoville, IL 60446
<i>Test Completion Date</i>		
December 6, 2022		
Document RP-9681A Revisions:		
Rev.	Issue Date	Revised By
0	December 7, 2022	



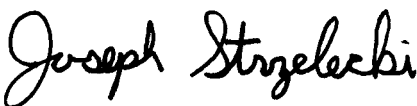
Table of Contents

1.0 ADMINISTRATIVE DATA.....	3
2.0 TEST SUMMARY AND RESULTS.....	3
2.1 RF Exposure Compliance Requirements.....	4
3.0 EQUIPMENT UNDER TEST (EUT) DETAILS.....	4
3.1 EUT Description	4
3.2 Product Family.....	4
3.2.1 FCC Section 15.203 & RSS-GEN Antenna Requirements	4
3.3 Related Submittals	4
4.0 TESTED SYSTEM DETAILS	5
4.1 Tested System Configuration.....	5
4.2 Special Accessories	5
4.3 Equipment Modifications.....	5
5.0 TEST SPECIFICATIONS	5
6.0 TEST PROCEDURE DOCUMENTS	5
7.0 RADIOMETRICS' TEST FACILITIES.....	6
8.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS	6
9.0 CERTIFICATION	6
10.0 TEST EQUIPMENT TABLE	6
11.0 TEST SECTIONS.....	7
11.1 AC Conducted Emissions	7
11.2 Radiated RF Emissions	17
11.2.1 Field Strength Calculation	18
11.2.2 Radiated Emissions Test Results.....	18
11.3 Magnetic Field Measurements and Decay Factor Calculations.....	25
11.3.1 Magnetic Field Radiated Emissions Results (0.009 to 30 MHz).....	26
11.4 Occupied Bandwidth Data	27
11.5 Frequency Stability	29
11.5.1 Test Results for Frequency Stability	29
12.0 MEASUREMENT INSTRUMENTATION UNCERTAINTY	30
13.0 REVISION HISTORY	30

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1.0 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> An rf IDEas, Inc., 13.56 MHz RFID Reader PMN: Wave ID Solo Mini Model: RDR-7M36BKU-IMP; Serial Number: W7M1000076 Model: RDR-7536BKU-IMP; Serial Number: W7MC000011 This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics:</i> July 22, 2022	<i>Test Date(s):</i> July 22 to December 6, 2022
<i>Test Report Written and Authorized By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> The tests were partially witnessed by Shiung Lo rf IDEas, Inc.
<i>Radiometrics' Personnel Responsible for Test:</i>  12/07/2022 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Chris Dalessio EMC Technician	<i>EUT Checked By:</i> 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 13.56 MHz RFID, Models RDR-7M36BKU-IMP and RDR-7536BKU-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	13.56 MHz	RSS-210 & FCC Part 15	Pass
Frequency Stability vs Temp & Voltage	13.56 MHz	RSS-210 & FCC Part 15	Pass



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 13.56 MHz RFID reader, manufactured by RF IDEas, Inc. The EUT was in good working condition during the tests, with no known defects.

Product information

Model Number	RDR-7M36BKU-IMP
Firmware Version	WNC010306UIM700
Software Version	5.3.3

Model Number	RDR-7536BKU-IMP
Firmware Version	WNC010306UIM700
Software Version	5.3.3

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	Firmware Version	Description of differences
RDR-7M36BKU-IMP	WNC010306UIM700	MIFARE Secure Imprivata (Tested Sample)
RDR-7536BKU-IMP	WNC010306UIM700	MIFARE Imprivata (Tested Sample)
RDR-7M31BKU	WNC010300UPX700	Keystroke MIFARE Secure
RDR-7536BKU	WNC010306UPX700	MIFARE Secure

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-1125-04 and is the same for all versions of the product. All four are WAVE ID Solo Mini CCID/FIDO V3 Black USB Readers.

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. The wiring was consistent with the manufacturer's recommendations. Power was supplied at 115 VAC, 60 Hz single-phase to the host computer. The EUT was powered from the USB 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
1	13.56 MHz RFID Reader	E	rf IDEas	RDR-7M36BKU-IMP	W7M1000076
2	13.56 MHz RFID Reader	E	rf IDEas	RDR-7536BKU-IMP	W7MC000011
3	Latitude Laptop PC	H	HP	Elite x2	5CG545482P
4	Laptop AC-DC power supply	P	HP	854055-002	A000133

* 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 absorbers. 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 with 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-68	EMCO	Log-Periodic Ant.	93146	9604-4456	200-1000MHz	24 Mo.	02/07/22



RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
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
REC-22	Rohde Schwarz	Spectrum Analyzer	ESIB 26	100145	26.5 GHz	24 Mo	11/17/21
TC-01	GS Blue M Electric	Temperature Chamber	ETC-04S-E	0003-ETC-201	-40 to 100 Deg C	24 Mo.	10/14/22
TMP-01	Fluke	Temperature meter	80T-150UA	38280311	N/A	24 Mo.	06/07/21

Note: All calibrated equipment is subject to periodic checks.

Software Company	Test Software Name	Version	Applicable Tests
Radiometrics	EN550XX0	07.21.22	RF Conducted Emissions (FCC/CE)
Radiometrics	RREC11D	07.25.22	RF Radiated Emissions (FCC/CE)
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:

The transmitter was tested with a dummy load under the following conditions:

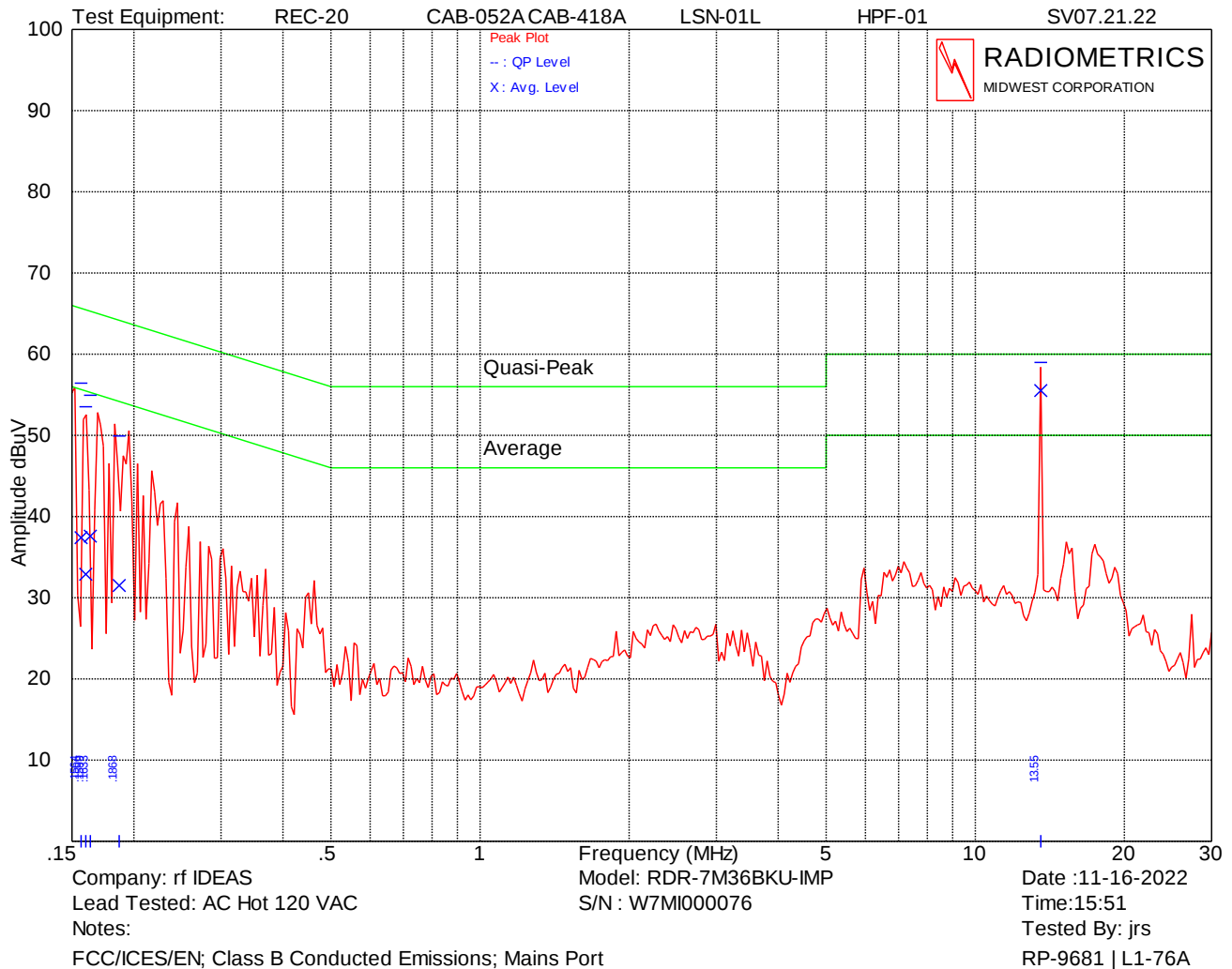
- 1) First, the AC line conducted tests were performed with the antenna attached to determine if the EUT complies with the 15.207 limits outside the transmitter's fundamental emission band.
- 2) The AC line conducted emissions were retested with a dummy load to make sure the device complies with the 15.207 limits inside the transmitter's fundamental emission band. Only the fundamental TX emission band needs to be retested. The load was 50 Ohm. This is the characteristic impedance of the antenna.

Test Dates : November 16 and December 6, 2022

QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.



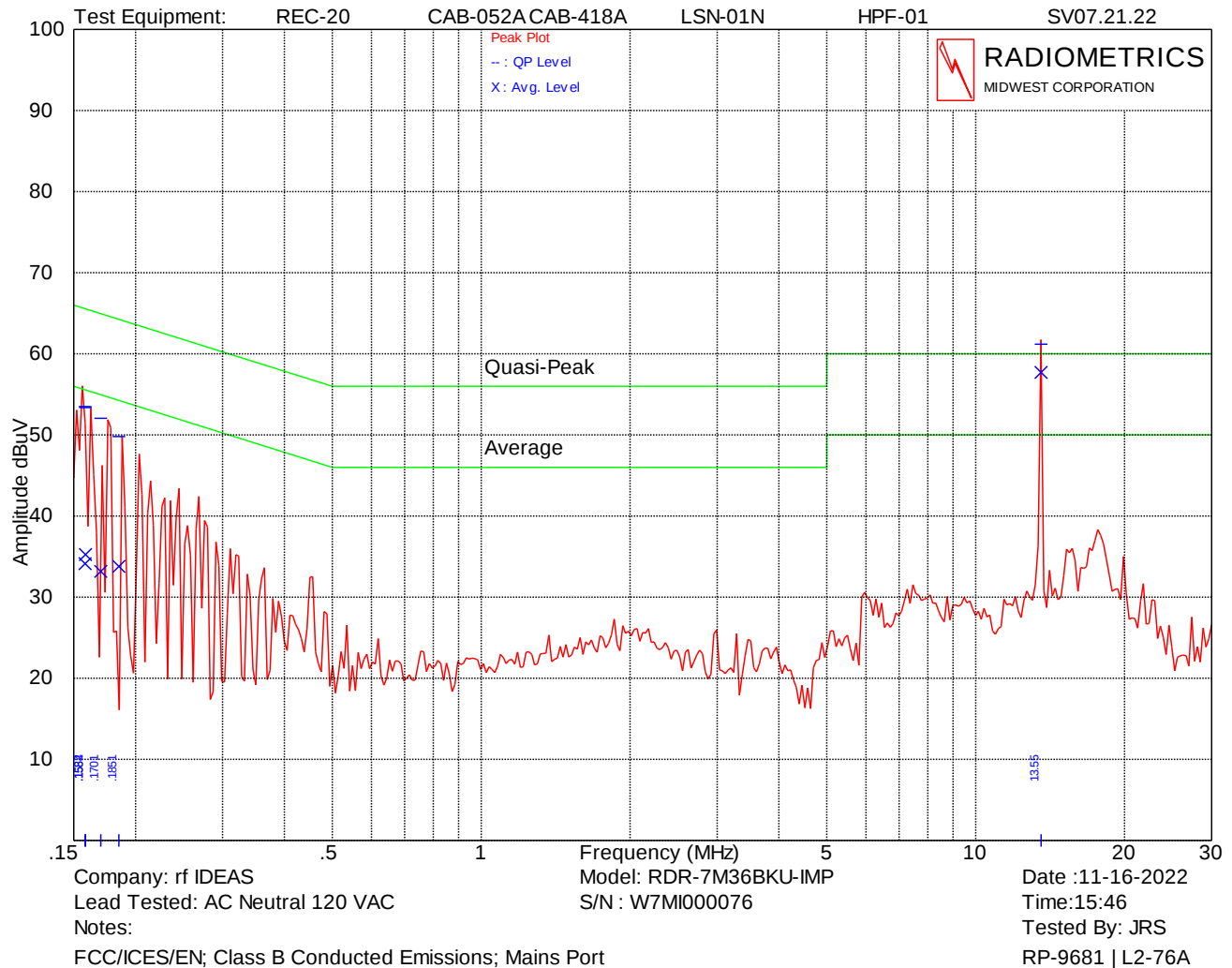
Model: RDR-7M36BKU-IMP; With standard Antenna installed



Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.156	56.4	65.6	37.4	55.6	9.2
0.160	53.5	65.5	32.9	55.5	11.9
0.163	54.9	65.3	37.6	55.3	10.4
0.187	49.9	64.2	31.5	54.2	14.3
13.560	59.0	60.0	55.5	50.0	-5.5



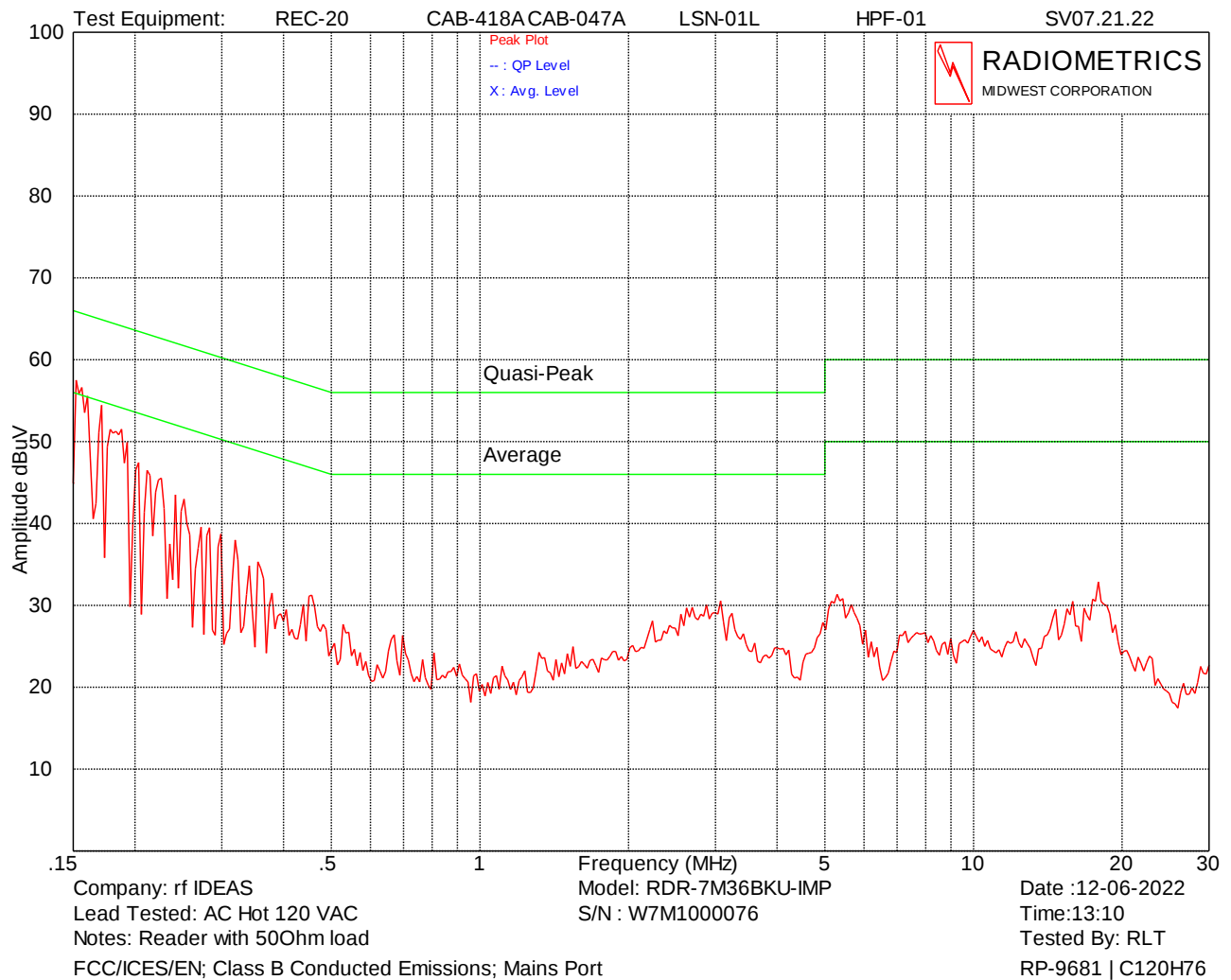
Model: RDR-7M36BKU-IMP; With standard Antenna installed



Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.158	53.5	65.6	34.1	55.6	12.1
0.170	52.0	65.0	33.2	55.0	12.9
0.185	49.8	64.3	33.8	54.3	14.5
13.560	61.2	60.0	57.7	50.0	-7.7

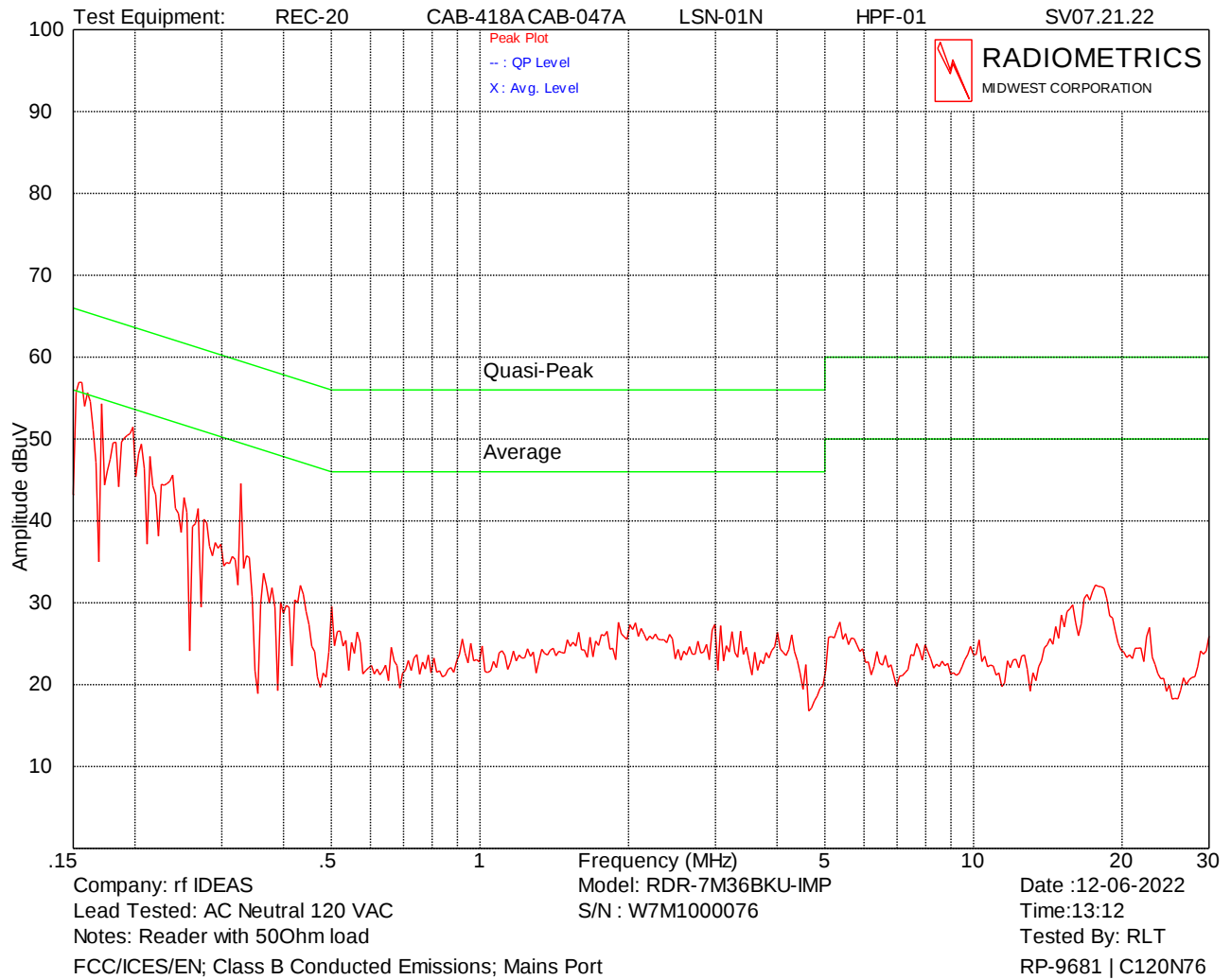


Model: RDR-7M36BKU-IMP; With Resistor in place of antenna



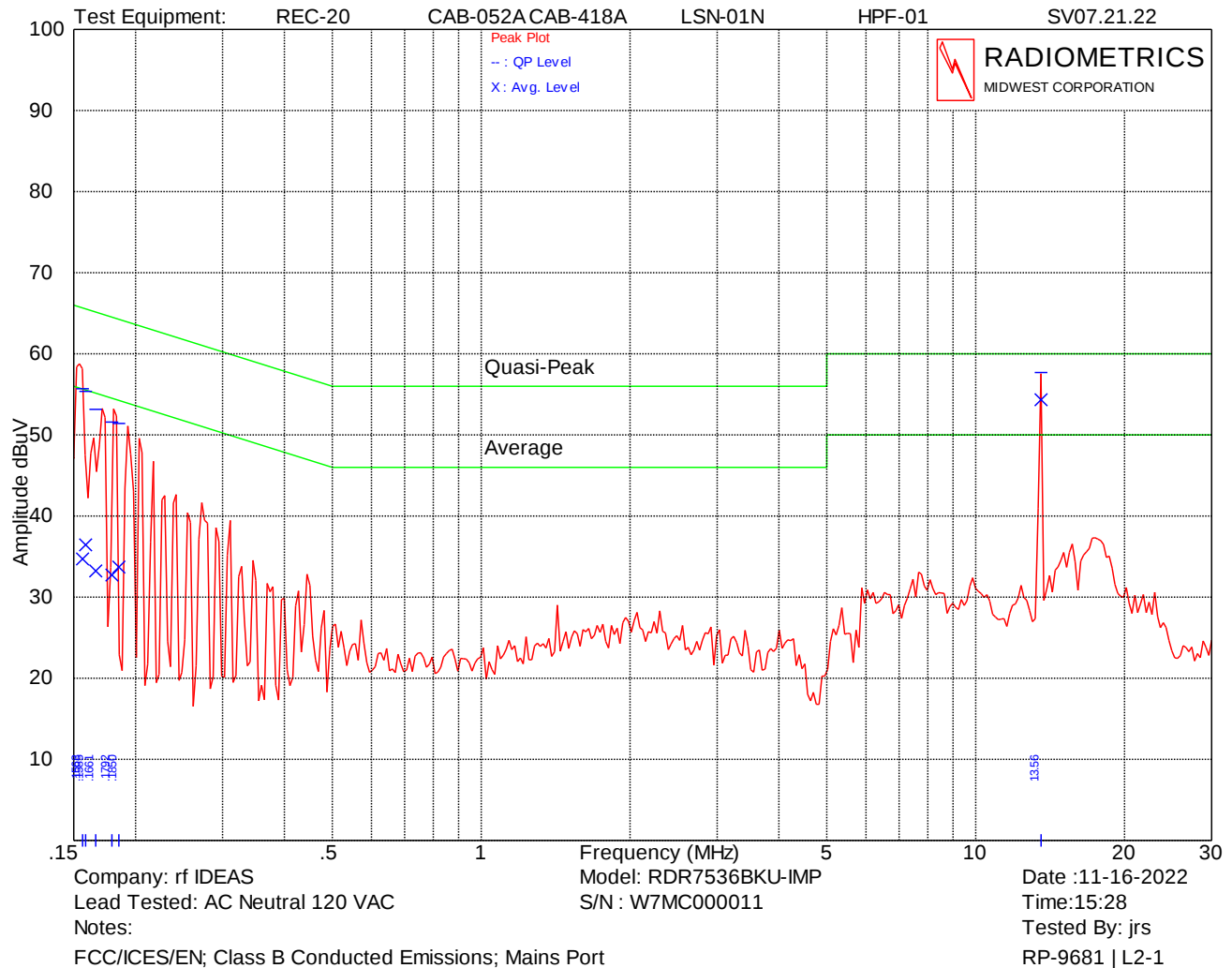


Model: RDR-7M36BKU-IMP; With Resistor in place of antenna



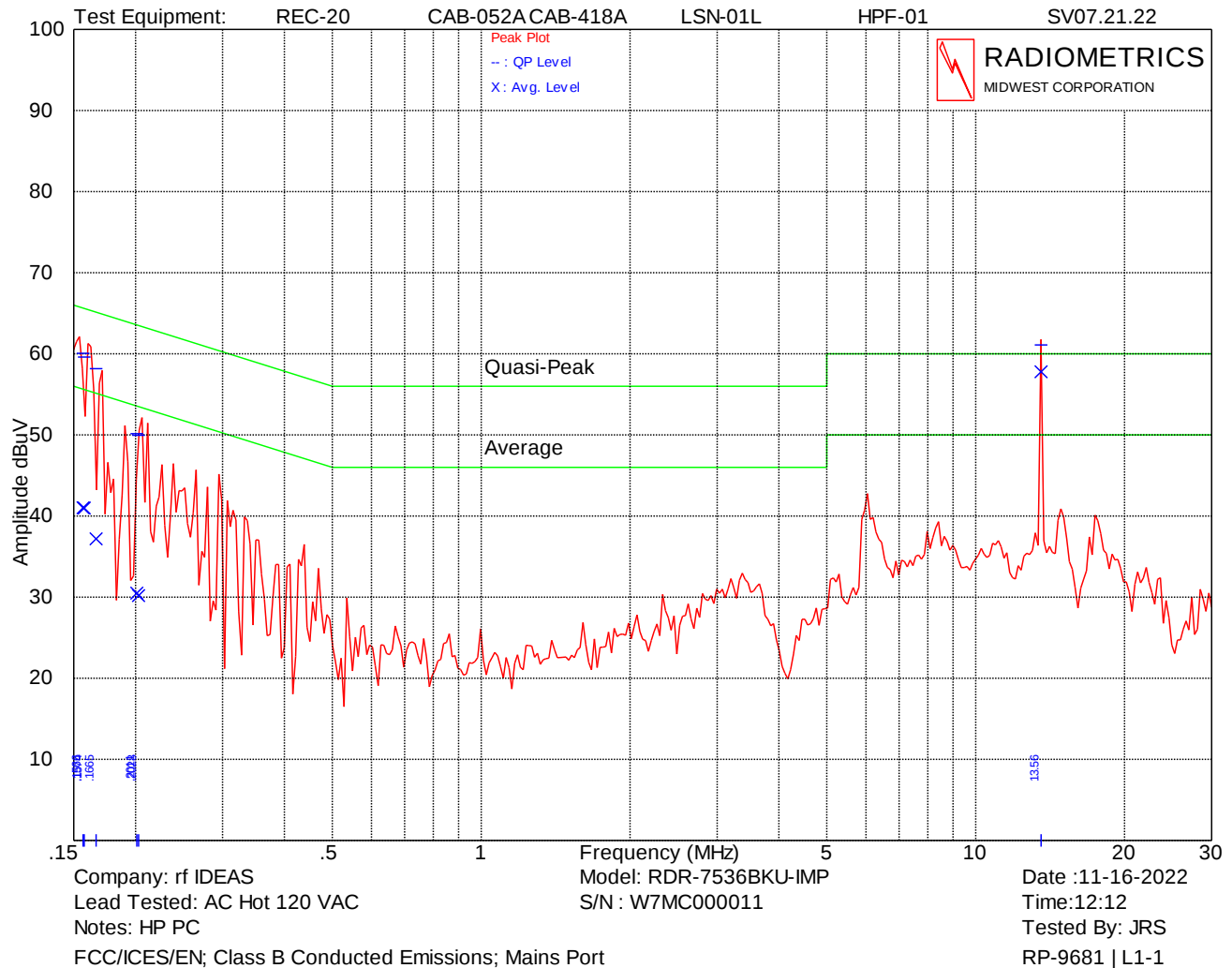


Model: RDR-7536BKU-IMP; With standard Antenna installed





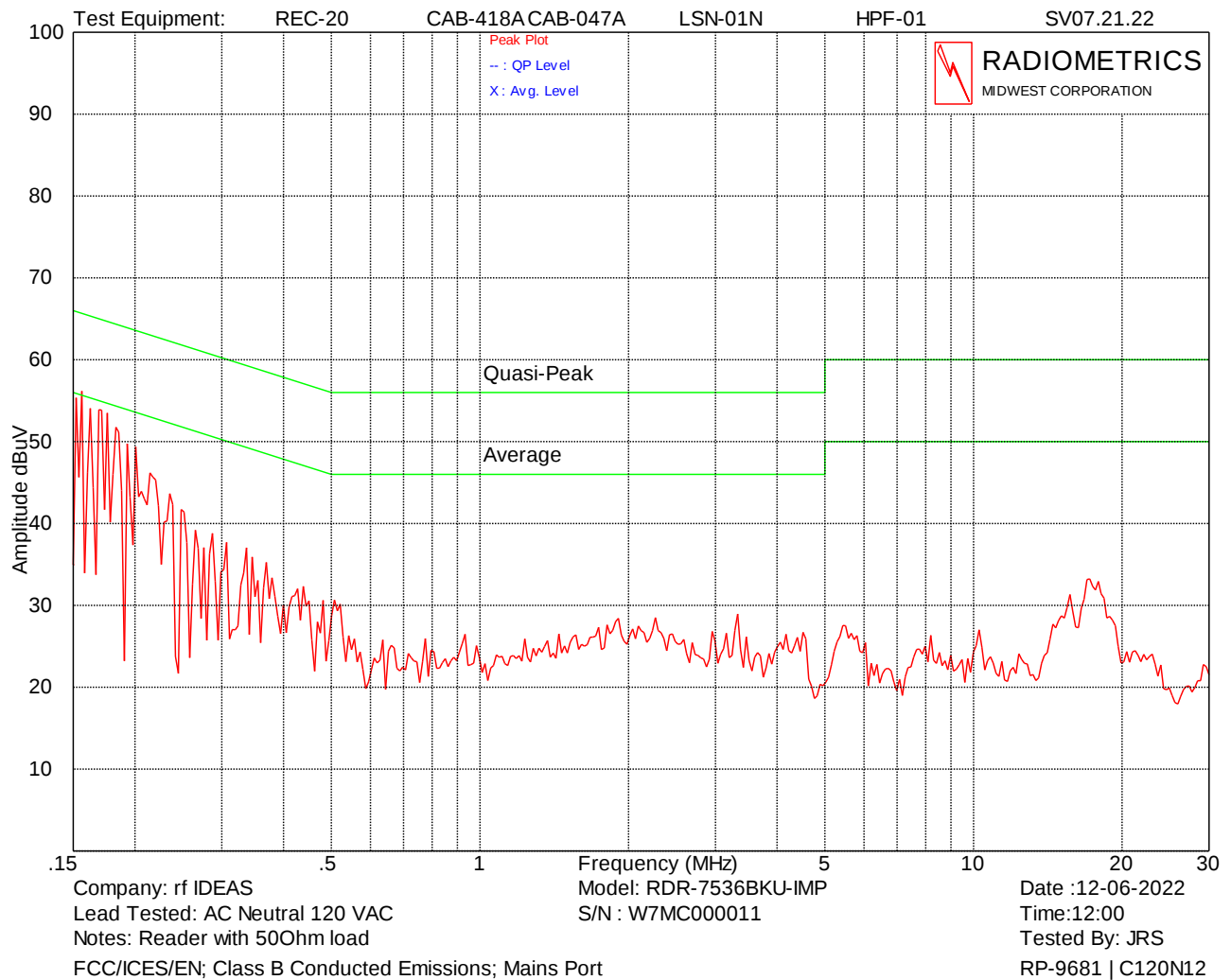
Model: RDR-7536BKU-IMP; With standard Antenna installed



Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.157	60.1	65.6	41.0	55.6	5.6
0.167	58.2	65.1	37.2	55.1	7.0
0.201	50.2	63.6	30.5	53.6	13.4
0.203	50.0	63.5	30.2	53.5	13.5
13.560	57.6	60.0	54.1	50.0	-4.1
13.561	61.1	60.0	57.8	50.0	-7.8

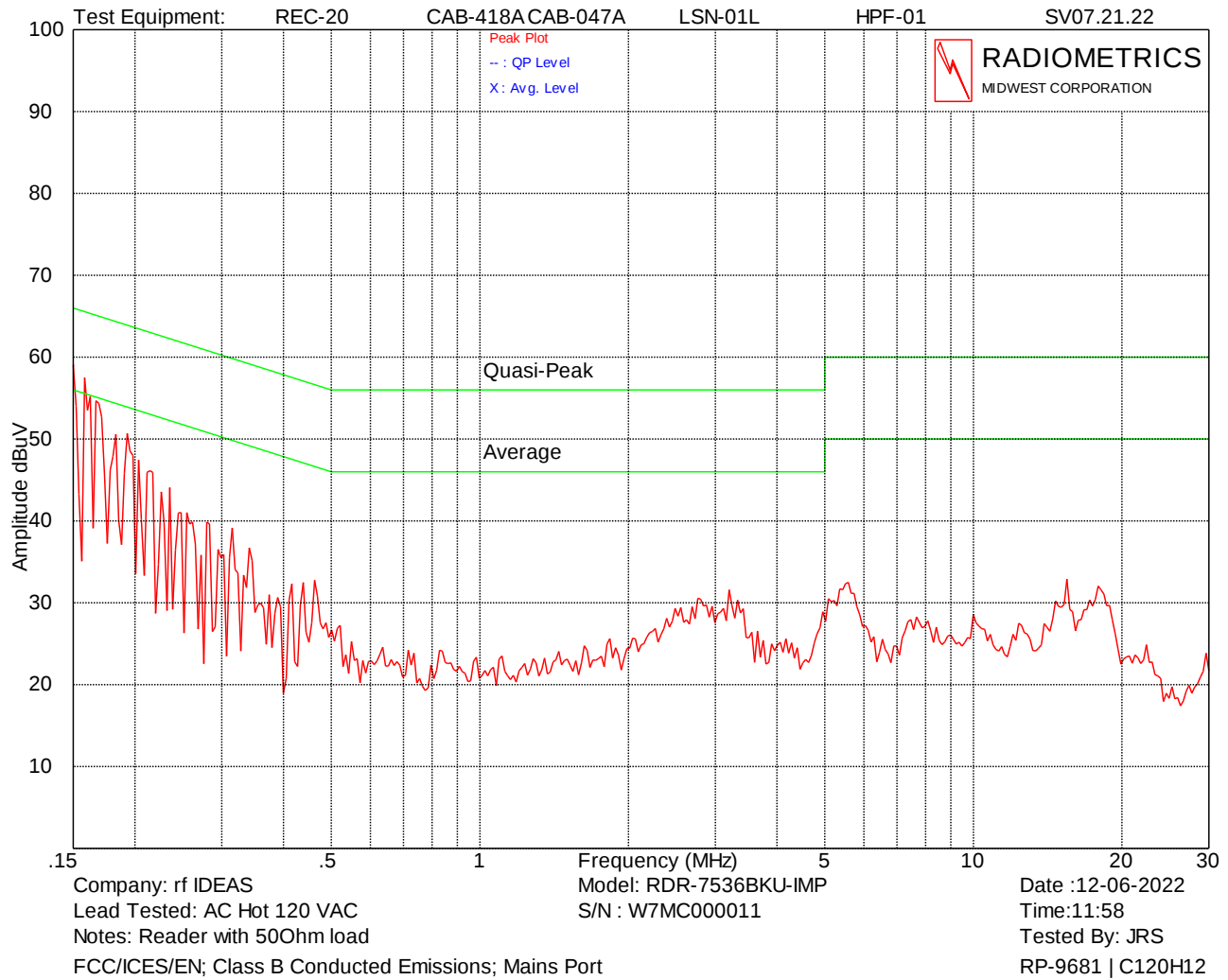


Model: RDR-7536BKU-IMP; With Resistor in place of antenna



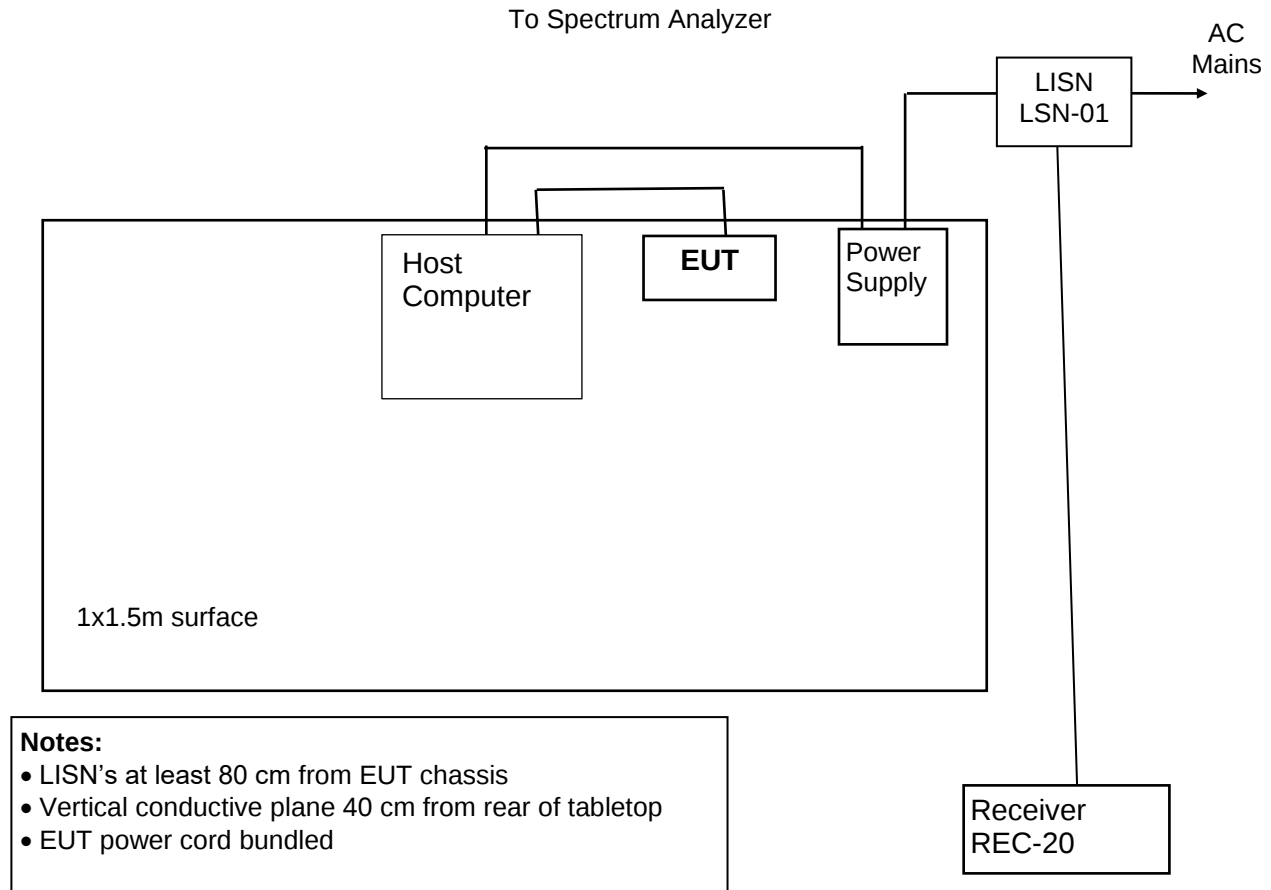


Model: RDR-7536BKU-IMP; With Resistor in place of antenna



Judgment: Passed by at least 15 dB at 13.56 MHz with Resistive Load in place of standard Loop antenna.

Judgment: Passed by at least 5.6 dB at all frequencies except 13.56 MHz with standard Loop antenna installed.

**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	07/22/2022 & 12/02/2022
Test Distance	3 Meters
Tested by	Chris Dalessio
Specification	FCC Part 15 Subpart C & RSS-210
Notes	The actual FCC limits are in uV/m. The data in the table below covered 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-7M36BKU-IMP; S/N W7M1000076; 07/22/2022							
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
33.9	14.3	P	H	12.7	0.6	0.0	27.6	40.0	12.4
41.0	10.2	P	H	11.0	0.7	0.0	21.9	40.0	18.1
48.8	9.8	P	H	9.8	0.7	0.0	20.3	40.0	19.7
54.3	14.3	P	H	9.4	0.8	0.0	24.5	40.0	15.5
64.8	20.3	P	H	9.2	0.8	0.0	30.3	40.0	9.7
78.6	12.6	P	H	9.4	1.0	0.0	23.0	40.0	17.0



EUT		RDR-7M36BKU-IMP; S/N W7M1000076; 07/22/2022							
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
88.0	10.8	P	H	9.7	1.0	0.0	21.5	40.0	18.5
94.6	16.9	P	H	10.0	1.0	0.0	27.9	43.5	15.6
95.2	15.5	P	H	10.0	1.0	0.0	26.5	43.5	17.0
108.5	14.7	P	H	10.9	1.1	0.0	26.7	43.5	16.8
121.2	10.8	P	H	11.7	1.2	0.0	23.7	43.5	19.8
126.1	10.7	P	H	11.9	1.2	0.0	23.8	43.5	19.7
137.2	10.0	P	H	12.4	1.3	0.0	23.7	43.5	19.8
144.9	10.5	P	H	12.7	1.3	0.0	24.5	43.5	19.0
150.4	10.8	P	H	12.8	1.3	0.0	24.9	43.5	18.6
162.6	19.8	P	H	13.0	1.4	0.0	34.2	43.5	9.3
176.4	14.9	P	H	13.5	1.5	0.0	29.9	43.5	13.6
189.7	13.7	P	H	13.9	1.5	0.0	29.1	43.5	14.4
204.6	12.1	P	H	14.5	1.6	0.0	28.2	43.5	15.3
210.1	11.2	P	H	14.7	1.6	0.0	27.5	43.5	16.0
219.5	10.9	P	H	14.9	1.6	0.0	27.4	46.0	18.6
236.6	12.9	P	H	15.1	1.7	0.0	29.7	46.0	16.3
248.8	16.6	P	H	15.4	1.7	0.0	33.7	46.0	12.3
270.9	14.5	P	H	12.6	1.8	0.0	28.9	46.0	17.1
298.6	13.2	P	H	13.9	1.9	0.0	29.0	46.0	17.0
325.7	23.0	P	H	14.2	2.0	0.0	39.2	46.0	6.8
352.8	19.0	P	H	14.4	2.1	0.0	35.5	46.0	10.5
379.9	19.5	P	H	14.8	2.1	0.0	36.4	46.0	9.6
407.0	19.4	P	H	15.5	2.2	0.0	37.1	46.0	8.9
434.1	18.3	P	H	16.0	2.3	0.0	36.6	46.0	9.4
461.2	18.5	P	H	16.8	2.4	0.0	37.7	46.0	8.3
488.3	19.7	P	H	17.0	2.5	0.0	39.2	46.0	6.8
516.3	14.4	P	H	18.7	2.6	0.0	35.7	46.0	10.3
542.5	10.5	P	H	18.0	2.6	0.0	31.1	46.0	14.9
581.3	18.1	P	H	18.6	2.7	0.0	39.4	46.0	6.6
597.5	12.3	P	H	18.7	2.7	0.0	33.7	46.0	12.3
625.0	11.2	P	H	19.1	2.8	0.0	33.1	46.0	12.9
678.8	12.5	P	H	20.9	2.9	0.0	36.3	46.0	9.7
787.5	11.9	P	H	21.1	3.2	0.0	36.2	46.0	9.8
813.8	11.9	P	H	21.5	3.2	0.0	36.6	46.0	9.4
893.8	8.2	P	H	22.8	3.4	0.0	34.4	46.0	11.6
902.5	9.7	P	H	22.8	3.4	0.0	35.9	46.0	10.1
946.3	8.4	P	H	23.3	3.5	0.0	35.2	46.0	10.8
961.3	8.1	P	H	23.4	3.5	0.0	35.0	54.0	19.0
36.1	17.1	P	V	12.1	0.6	0.0	29.8	40.0	10.2
40.5	24.7	P	V	11.1	0.7	0.0	36.5	40.0	3.5
40.5	22.8	Q	V	11.1	0.7	0.0	34.6	40.0	5.4
43.3	21.7	P	V	10.6	0.7	0.0	33.0	40.0	7.0
49.3	21.2	P	V	9.8	0.7	0.0	31.7	40.0	8.3
54.3	21.6	P	V	9.4	0.8	0.0	31.8	40.0	8.2
63.2	20.7	P	V	9.3	0.8	0.0	30.8	40.0	9.2
67.6	15.6	P	V	9.2	0.9	0.0	25.7	40.0	14.3
72.0	21.5	P	V	9.3	0.9	0.0	31.7	40.0	8.3
78.6	18.5	P	V	9.4	1.0	0.0	28.9	40.0	11.1
79.2	18.6	P	V	9.4	1.0	0.0	29.0	40.0	11.0
93.0	16.4	P	V	9.9	1.0	0.0	27.3	43.5	16.2
93.5	16.7	P	V	9.9	1.0	0.0	27.6	43.5	15.9
108.5	17.9	P	V	10.9	1.1	0.0	29.9	43.5	13.6



EUT		RDR-7M36BKU-IMP; S/N W7M1000076; 07/22/2022							
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
113.4	14.4	P	V	11.2	1.1	0.0	26.7	43.5	16.8
128.9	11.5	P	V	12.1	1.2	0.0	24.8	43.5	18.7
148.8	10.8	P	V	12.7	1.3	0.0	24.8	43.5	18.7
157.1	17.8	P	V	12.9	1.4	0.0	32.1	43.5	11.4
162.6	15.7	P	V	13.0	1.4	0.0	30.1	43.5	13.4
172.5	13.7	P	V	13.3	1.4	0.0	28.4	43.5	15.1
195.2	20.1	P	V	14.2	1.5	0.0	35.8	43.5	7.7
195.2	9.9	Q	V	14.2	1.5	0.0	25.6	43.5	17.9
196.9	11.6	P	V	14.3	1.5	0.0	27.4	43.5	16.1
217.9	19.7	P	V	14.8	1.6	0.0	36.1	46.0	9.9
217.9	9.4	Q	V	14.8	1.6	0.0	25.8	46.0	20.2
221.2	13.4	P	V	14.9	1.6	0.0	29.9	46.0	16.1
234.4	15.2	P	V	15.0	1.7	0.0	31.9	46.0	14.1
236.6	11.8	P	V	15.1	1.7	0.0	28.6	46.0	17.4
262.1	18.4	P	V	12.3	1.8	0.0	32.5	46.0	13.5
281.0	17.8	P	V	13.2	1.8	0.0	32.8	46.0	13.2
301.2	11.0	P	V	14.1	1.9	0.0	27.0	46.0	19.0
306.2	12.1	P	V	14.6	1.9	0.0	28.6	46.0	17.4
325.7	15.1	P	V	14.2	2.0	0.0	31.3	46.0	14.7
342.1	13.6	P	V	14.4	2.0	0.0	30.0	46.0	16.0
352.8	14.5	P	V	14.4	2.1	0.0	31.0	46.0	15.0
379.9	14.8	P	V	14.8	2.1	0.0	31.7	46.0	14.3
407.0	16.2	P	V	15.5	2.2	0.0	33.9	46.0	12.1
434.1	14.2	P	V	16.0	2.3	0.0	32.5	46.0	13.5
461.2	16.6	P	V	16.8	2.4	0.0	35.8	46.0	10.2
488.3	16.3	P	V	17.0	2.5	0.0	35.8	46.0	10.2
516.3	12.1	P	V	18.7	2.6	0.0	33.4	46.0	12.6
542.5	11.3	P	V	18.0	2.6	0.0	31.9	46.0	14.1
570.0	12.6	P	V	18.4	2.7	0.0	33.7	46.0	12.3
581.3	14.8	P	V	18.6	2.7	0.0	36.1	46.0	9.9
597.5	15.2	P	V	18.7	2.7	0.0	36.6	46.0	9.4
625.0	14.1	P	V	19.1	2.8	0.0	36.0	46.0	10.0
678.8	11.8	P	V	20.9	2.9	0.0	35.6	46.0	10.4
752.5	8.2	P	V	20.9	3.1	0.0	32.2	46.0	13.8
822.5	8.5	P	V	21.6	3.3	0.0	33.4	46.0	12.6
841.3	10.5	P	V	22.1	3.3	0.0	35.9	46.0	10.1
885.0	8.9	P	V	22.7	3.4	0.0	35.0	46.0	11.0
952.5	8.4	P	V	23.4	3.5	0.0	35.3	46.0	10.7

EUT		RDR-7536BKU-IMP; S/N W7MC000011; 12/02/2022							
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
36.4	17.4	P	H	12.0	0.6	0.0	30.0	40.0	10.0
44.8	15.4	P	H	10.3	0.7	0.0	26.4	40.0	13.6
49.7	17.1	P	H	9.7	0.7	0.0	27.5	40.0	12.5
54.3	15.9	P	H	9.4	0.8	0.0	26.1	40.0	13.9
55.0	22.4	P	H	9.4	0.8	0.0	32.6	40.0	7.4
56.1	15.4	P	H	9.3	0.8	0.0	25.5	40.0	14.5
69.6	15.7	P	H	9.3	0.9	0.0	25.9	40.0	14.1
72.0	17.7	P	H	9.3	0.9	0.0	27.9	40.0	12.1



EUT		RDR-7536BKU-IMP; S/N W7MC000011; 12/02/2022							
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
78.4	12.8	P	H	9.4	1.0	0.0	23.2	40.0	16.8
90.2	13.8	P	H	9.8	1.0	0.0	24.6	43.5	18.9
102.8	14.8	P	H	10.5	1.1	0.0	26.4	43.5	17.1
108.5	18.4	P	H	10.9	1.1	0.0	30.4	43.5	13.1
122.0	16.1	P	H	11.8	1.2	0.0	29.1	43.5	14.4
135.3	14.6	P	H	12.4	1.3	0.0	28.3	43.5	15.2
155.2	17.3	P	H	12.9	1.3	0.0	31.5	43.5	12.0
172.2	15.2	P	H	13.3	1.4	0.0	29.9	43.5	13.6
189.9	18.0	P	H	13.9	1.5	0.0	33.4	43.5	10.1
201.9	16.6	P	H	14.4	1.5	0.0	32.5	43.5	11.0
215.8	14.7	P	H	14.8	1.6	0.0	31.1	43.5	12.4
229.5	15.8	P	H	15.0	1.7	0.0	32.5	46.0	13.5
248.3	14.5	P	H	15.4	1.7	0.0	31.6	46.0	14.4
257.6	14.5	P	H	12.2	1.7	0.0	28.4	46.0	17.6
270.7	13.9	P	H	12.6	1.8	0.0	28.3	46.0	17.7
287.1	12.7	P	H	13.4	1.8	0.0	27.9	46.0	18.1
325.4	19.7	P	H	14.2	2.0	0.0	35.9	46.0	10.1
352.7	14.8	P	H	14.4	2.1	0.0	31.3	46.0	14.7
379.7	13.3	P	H	14.8	2.1	0.0	30.2	46.0	15.8
385.0	11.1	P	H	15.0	2.2	0.0	28.3	46.0	17.7
406.9	14.7	P	H	15.5	2.2	0.0	32.4	46.0	13.6
433.9	13.1	P	H	16.0	2.3	0.0	31.4	46.0	14.6
461.1	12.4	P	H	16.8	2.4	0.0	31.6	46.0	14.4
488.1	14.5	P	H	17.0	2.5	0.0	34.0	46.0	12.0
515.5	12.1	P	H	18.7	2.6	0.0	33.4	46.0	12.6
542.5	15.4	P	H	18.0	2.6	0.0	36.0	46.0	10.0
569.6	15.9	P	H	18.4	2.7	0.0	37.0	46.0	9.0
596.6	16.7	P	H	18.7	2.7	0.0	38.1	46.0	7.9
623.6	12.4	P	H	19.1	2.8	0.0	34.3	46.0	11.7
651.2	11.6	P	H	19.8	2.8	0.0	34.2	46.0	11.8
678.2	15.6	P	H	20.9	2.9	0.0	39.4	46.0	6.6
705.2	11.3	P	H	21.3	3.0	0.0	35.6	46.0	10.4
739.7	10.6	P	H	20.9	3.1	0.0	34.6	46.0	11.4
853.4	9.9	P	H	22.4	3.3	0.0	35.6	46.0	10.4
884.9	10.4	P	H	22.7	3.4	0.0	36.5	46.0	9.5
990.0	11.3	P	H	23.9	3.6	0.0	38.8	54.0	15.2
34.0	21.7	P	V	12.7	0.6	0.0	35.0	40.0	5.0
34.0	17.7	Q	V	12.7	0.6	0.0	31.0	40.0	9.0
40.6	22.2	P	V	11.1	0.7	0.0	34.0	40.0	6.0
45.3	21.8	P	V	10.3	0.7	0.0	32.8	40.0	7.2
47.9	24.9	P	V	9.8	0.7	0.0	35.4	40.0	4.6
47.9	18.5	Q	V	9.8	0.7	0.0	29.0	40.0	11.0
54.3	21.4	P	V	9.4	0.8	0.0	31.6	40.0	8.4
58.8	16.8	P	V	9.3	0.8	0.0	26.9	40.0	13.1
62.5	17.2	P	V	9.3	0.8	0.0	27.3	40.0	12.7
68.5	17.4	P	V	9.2	0.9	0.0	27.5	40.0	12.5
71.8	17.8	P	V	9.3	0.9	0.0	28.0	40.0	12.0
79.6	19.5	P	V	9.4	1.0	0.0	29.9	40.0	10.1
92.6	15.6	P	V	9.9	1.0	0.0	26.5	43.5	17.0
105.9	13.8	P	V	10.7	1.1	0.0	25.6	43.5	17.9
118.9	14.0	P	V	11.5	1.2	0.0	26.7	43.5	16.8
129.1	13.7	P	V	12.1	1.2	0.0	27.0	43.5	16.5



EUT		RDR-7536BKU-IMP; S/N W7MC000011; 12/02/2022							
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cable Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
138.2	13.9	P	V	12.5	1.3	0.0	27.7	43.5	15.8
148.1	13.9	P	V	12.7	1.3	0.0	27.9	43.5	15.6
157.6	14.2	P	V	12.9	1.4	0.0	28.5	43.5	15.0
168.3	13.9	P	V	13.2	1.4	0.0	28.5	43.5	15.0
180.2	14.5	P	V	13.6	1.5	0.0	29.6	43.5	13.9
189.9	17.0	P	V	13.9	1.5	0.0	32.4	43.5	11.1
202.1	14.9	P	V	14.4	1.6	0.0	30.9	43.5	12.6
215.8	13.9	P	V	14.8	1.6	0.0	30.3	43.5	13.2
225.8	14.5	P	V	14.9	1.6	0.0	31.0	46.0	15.0
240.8	14.7	P	V	15.2	1.7	0.0	31.6	46.0	14.4
270.4	11.4	P	V	12.6	1.8	0.0	25.8	46.0	20.2
279.0	11.5	P	V	13.1	1.8	0.0	26.4	46.0	19.6
295.9	11.3	P	V	13.8	1.9	0.0	27.0	46.0	19.0
325.4	14.9	P	V	14.2	2.0	0.0	31.1	46.0	14.9
352.7	14.6	P	V	14.4	2.1	0.0	31.1	46.0	14.9
406.9	15.9	P	V	15.5	2.2	0.0	33.6	46.0	12.4
433.9	15.6	P	V	16.0	2.3	0.0	33.9	46.0	12.1
461.1	15.4	P	V	16.8	2.4	0.0	34.6	46.0	11.4
488.1	18.9	P	V	17.0	2.5	0.0	38.4	46.0	7.6
515.5	12.0	P	V	18.7	2.6	0.0	33.3	46.0	12.7
542.5	15.0	P	V	18.0	2.6	0.0	35.6	46.0	10.4
569.6	12.5	P	V	18.4	2.7	0.0	33.6	46.0	12.4
581.1	14.2	P	V	18.6	2.7	0.0	35.5	46.0	10.5
596.6	15.1	P	V	18.7	2.7	0.0	36.5	46.0	9.5
623.6	11.3	P	V	19.1	2.8	0.0	33.2	46.0	12.8
650.7	12.6	P	V	19.7	2.8	0.0	35.1	46.0	10.9
678.2	12.5	P	V	20.9	2.9	0.0	36.3	46.0	9.7
742.2	15.9	P	V	20.9	3.1	0.0	39.9	46.0	6.1
755.3	11.3	P	V	20.9	3.1	0.0	35.3	46.0	10.7
845.3	9.8	P	V	22.2	3.3	0.0	35.3	46.0	10.7
927.9	8.4	P	V	23.1	3.4	0.0	34.9	46.0	11.1

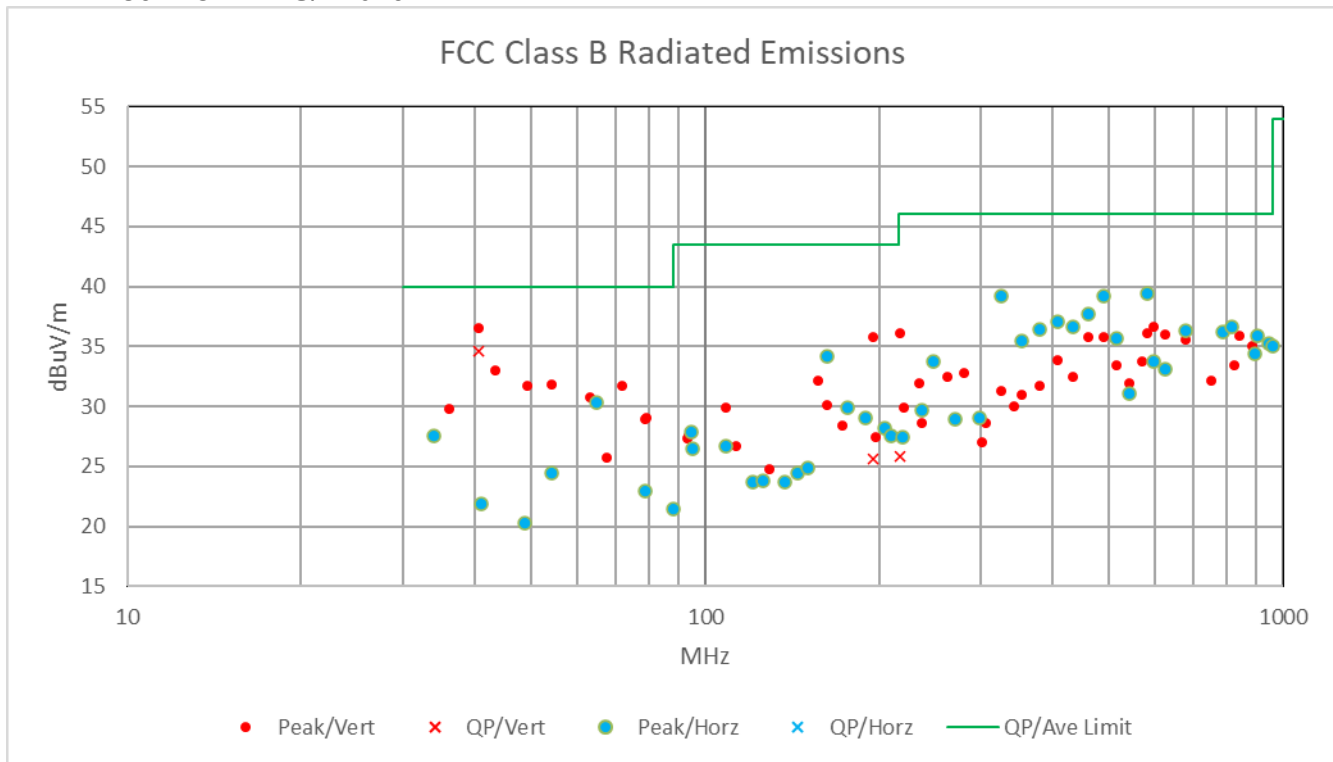
Where there is both peak and quasi peak data, the quasi-peak is the final determination of compliance.

Judgment: Passed by 5.4 dB



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

RDR-7M36BKU-IMP S/N: 076



RDR-7536BKU-IMP S/N: 011

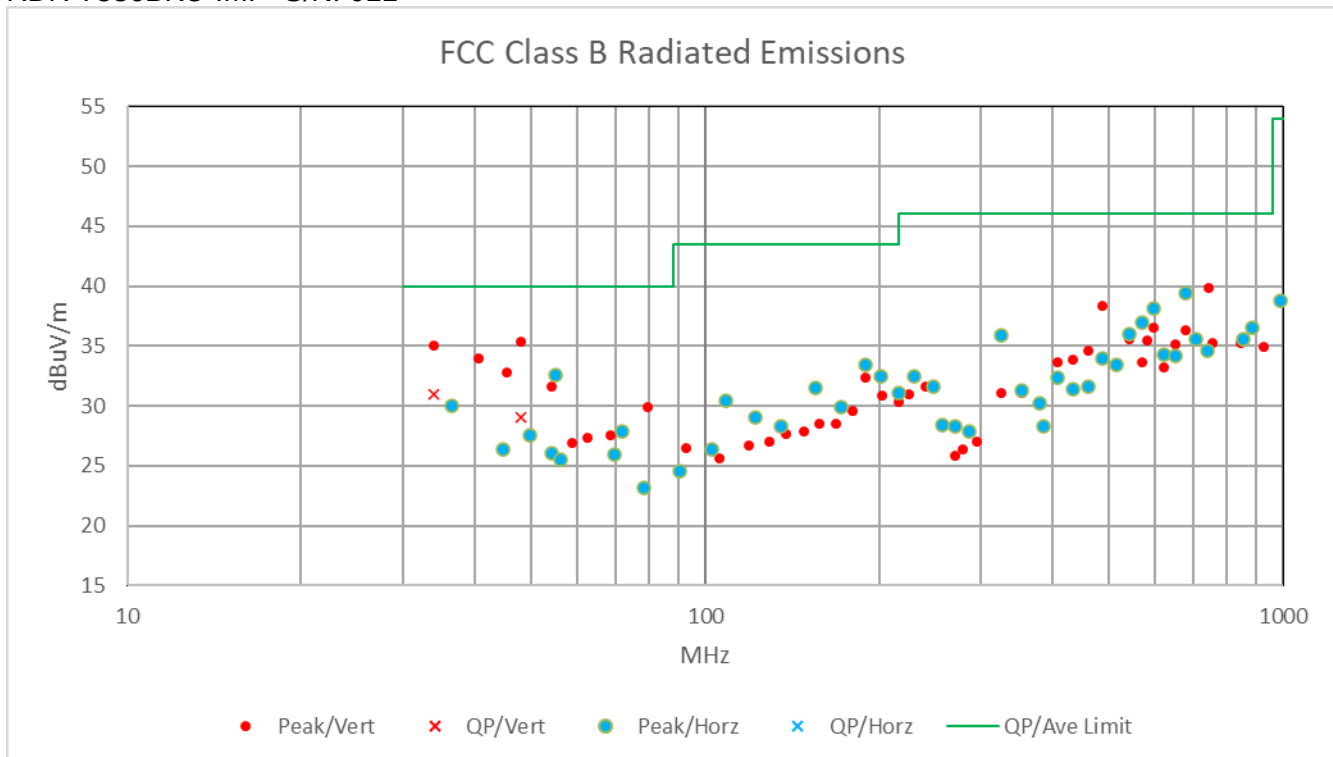
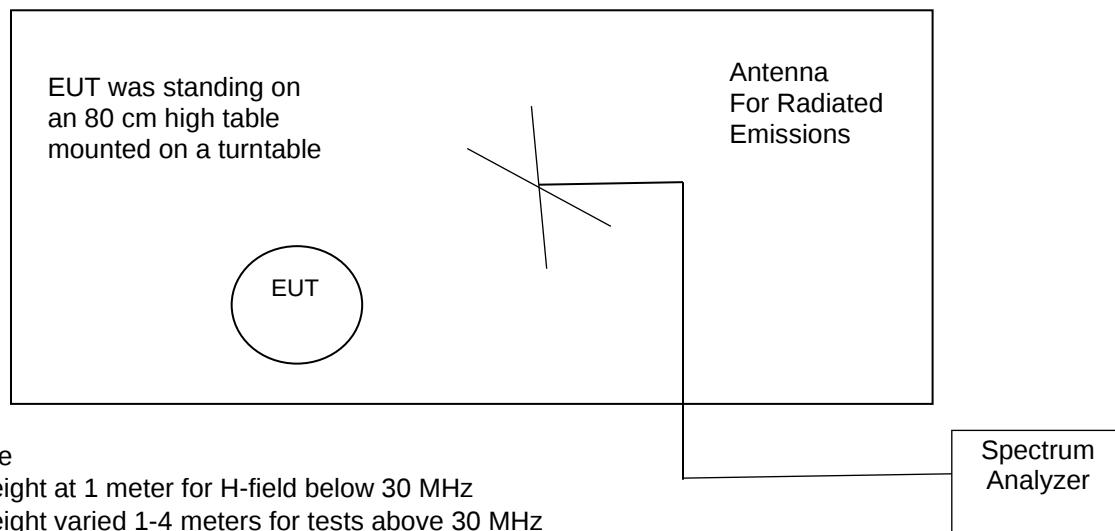




Figure 2. Drawing of Radiated Emissions Test Setup

Chamber E, anechoic

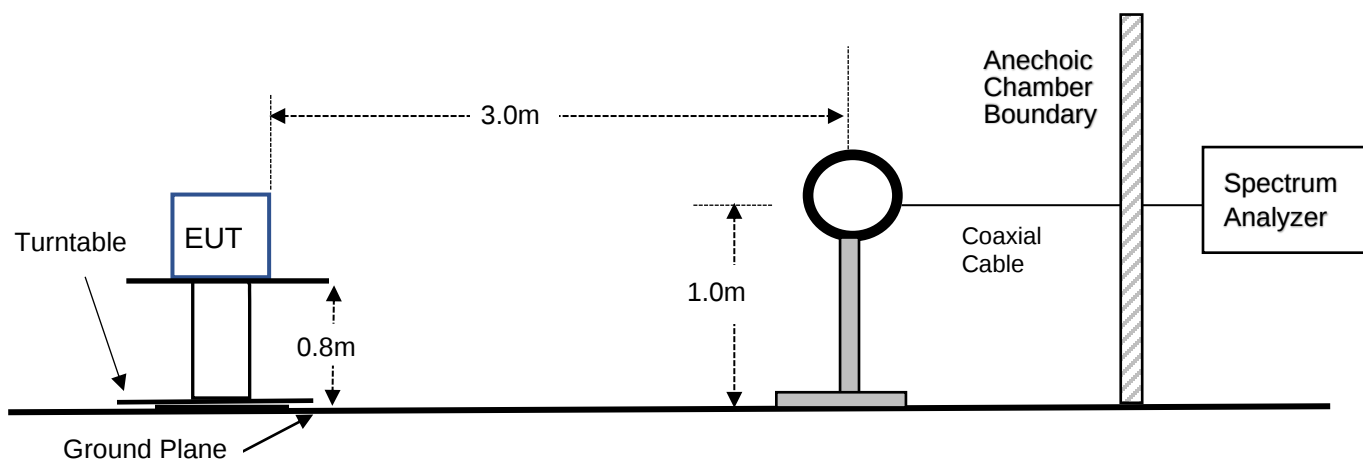


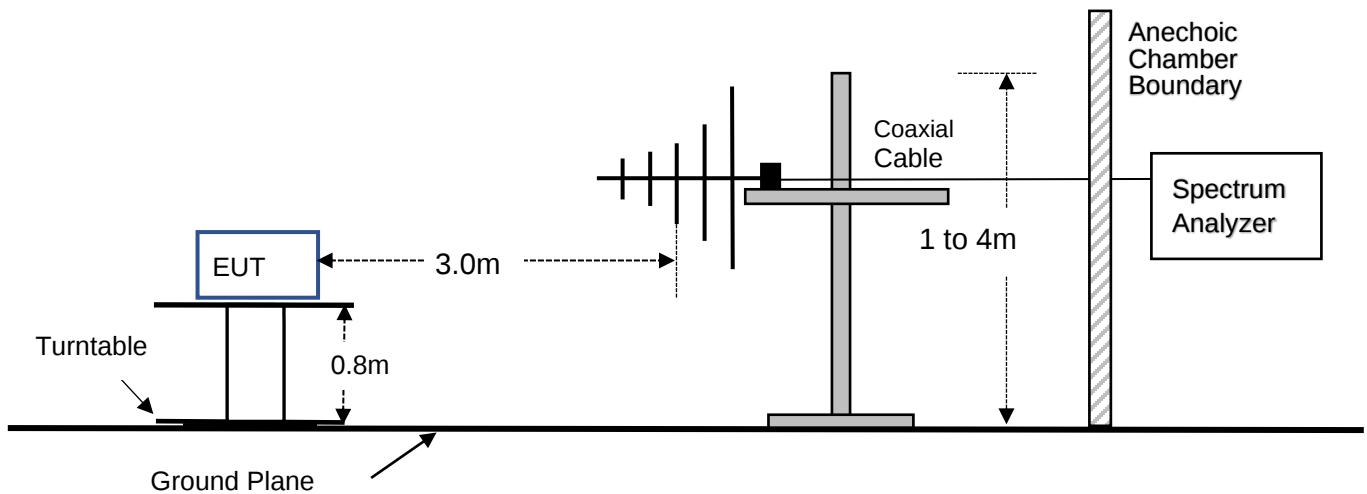
Notes:

- 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) = $DE \cdot 20 \cdot \log(TD/SD)$

Where: DE = Decay Exponent (2.0 is used for this)

TD = Test distance in meters. This is 3 meters

SD = Specification Distance in meters

From 9 to 490 kHz, the SD = 300m, therefore the distance factor is $2 \cdot 20 \cdot \log(300/3) = 80$ dB.

From 0.49 to 30 MHz, the SD = 30m, therefore the distance factor is $2 \cdot 20 \cdot \log(30/3) = 40$ dB.

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

Test Date	07/22/2022 & 12/02/2022
Tested by	Chris Dalessio
Test Distance	3 Meters
Specification	FCC 15 & RSS-GEN
Products	Model: RDR-7M36BKU-IMP; S/N W7M1000076; #1 Model: RDR-7536BKU-IMP; S/N W7MC000011; #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
13560	53.1	16.0	3.0	2.0	0.4	-40.0	29.5	40.5	11.0	EUT #1
27120	19.4	15.3	3.0	2.0	0.5	-40.0	-4.8	29.5	34.3	EUT #1
13560	52.9	16.0	3.0	2.0	0.4	-40.0	29.3	40.5	11.2	EUT #2
27120	18.9	15.3	3.0	2.0	0.5	-40.0	-5.3	29.5	34.8	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.

The limit from 13.553-13.567 MHz at 30 meters is 15,848 uV/m which = 84 dBuV/m in accordance with FCC 15.225 (c) and RSS-210 section B.6 (a).

The limit drops to 334uV/m from 13.410-13.553 MHz and 13.567-13.710 MHz, and 106uV/m = 40.5 dBuV/m from the bands 13.110-13.410 MHz and 13.710-14.010 MHz.

Therefore, it met all limits since the general limits are lower than the FCC 15.225 and the RSS-210 section B.6 (a) limits.

The emissions were scanned from 10 kHz to 30 MHz, including 13.11 and 14.01 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 at least 10 dB.



RSS-210 Section B.6 and FCC section 15.225 limits, corrected for 3 meters.

Agilent 13:24:36 Sep 19, 2022

R T

S/N 076

Ref 110 dB μ V/m

Atten 15 dB

Peak
Log
10
dB/

PASS LIMIT 1

90.5

80.5

V1 S2
S3 FC
A AA

Start 13.11 MHz

Stop 14.01 MHz

#Res BW 9 kHz

#VBW 30 kHz

Sweep 25.33 ms (401 pts)

Notes:

1. The top limit of 124 dBuV/m is off scale, above the plot.
2. 40 dB is added to the limits to convert from 30 to 3 meters.

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.

Products	Model: RDR-7M36BKU-IMP; S/N W7M1000076
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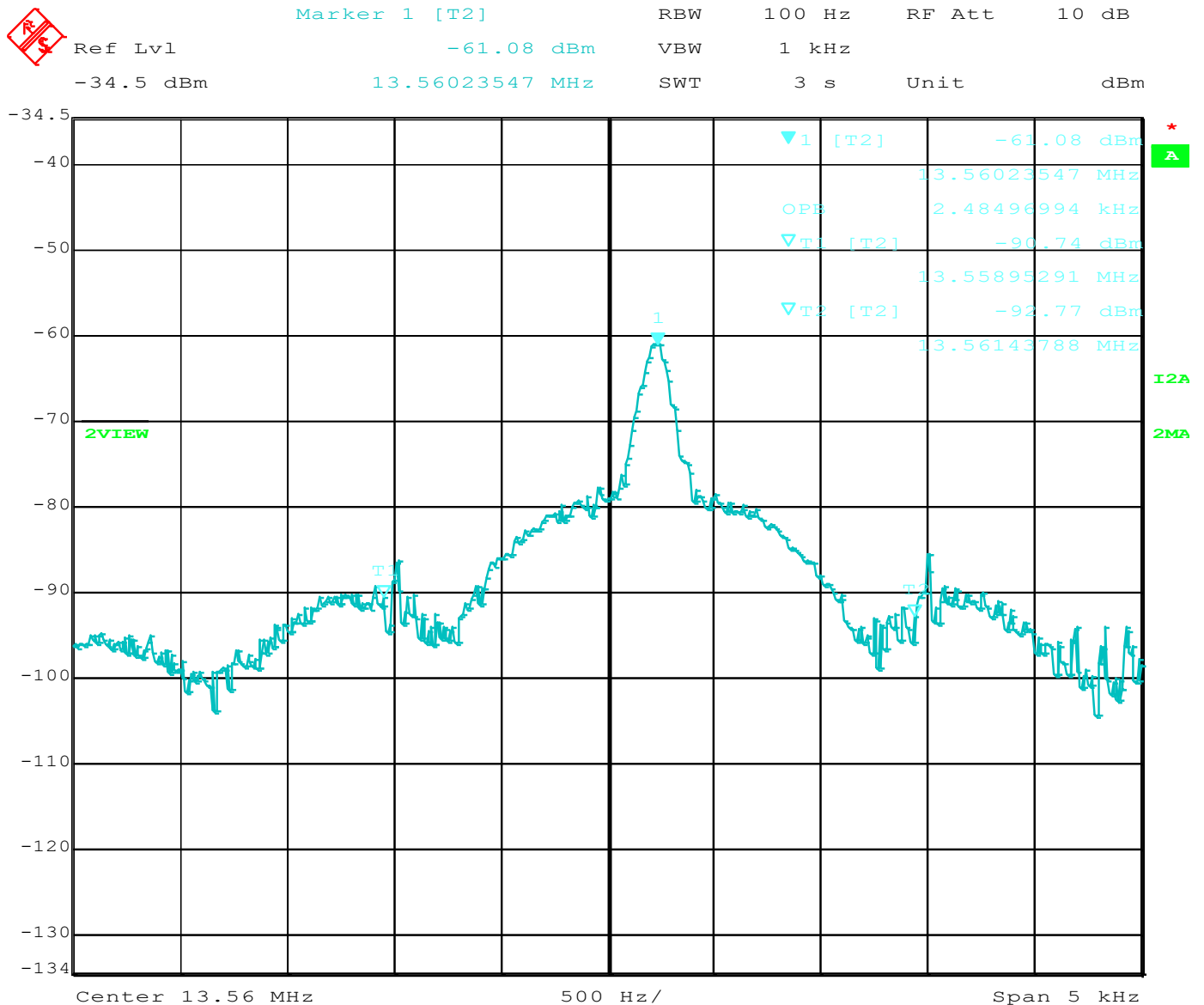
Spectrum Analyzer = REC-22; August 18, 2022; Tested by Joseph Strzelecki

99% OBW = 2.485 kHz

Judgement: Pass

Only one sample was tested, since all models use the same frequency determining circuitry.

Figure 5. Occupied Bandwidth Plot 13.56 MHz



Date: 18.AUG.2022 10:39:46



11.5 Frequency Stability

The tests were in accordance with FCC 15.225 and RSS-210 Section A2.6. Since the product is USB powered, a desktop PC was used to power the device. The input power to the desktop PC was varied by 15%, using a variable AC supply.

11.5.1 Test Results for Frequency Stability

Model	RDR-7M36BKU-IMP	Specification	FCC Part 15.225 RSS-210 Section A2.6
Serial Number	WB7M1000076	Test Date	11/04/2022
Test Personnel	Chris D'Alessio	Test Location	Chamber B
Test Equipment	Spectrum Analyzer (REC-21); Temperature Chamber TC-01		
Notes	10 minutes at each Temperature; 1 min at each voltage		
Nominal Frequency	13.560010 MHz		

Volts VAC	Freq. (MHz)	Deviation %	PPM
102.0	13.560110	0.00007	0.74
120.0	13.560105	0.00004	0.37
138.0	13.560108	0.00006	0.59

Nominal = 13.560100

Temp. Deg C	Freq. (@0min.) (MHz)	Freq. (@2min.) (MHz)	Freq. (@5min.) (MHz)	Freq. (@10min.) (MHz)	Change from Nominal			
					% 0 min.	% 2 min.	% 5 min	% 10 min.
50	13.560052	13.560056	13.560050	13.560053	-0.00035	-0.00032	-0.00037	-0.00035
40	13.560066	13.560059	13.560061	13.560059	-0.00025	-0.00030	-0.00029	-0.00030
30	13.560177	13.560077	13.560067	13.560042	0.00057	-0.00017	-0.00024	-0.00043
20	13.560108	13.560097	13.560100	13.560096	0.00006	-0.00002	0.00000	-0.00003
10	13.560168	13.560143	13.560125	13.560131	0.00050	0.00032	0.00018	0.00023
0	13.560185	13.560177	13.560168	13.560183	0.00063	0.00057	0.00050	0.00061
-10	13.560188	13.560182	13.560181	13.560182	0.00065	0.00060	0.00060	0.00060
-20	13.560188	13.560177	13.560108	13.560182	0.00065	0.00057	0.00006	0.00060

Max deviation is 65 ppm

Test Requirements: Limit is 100 ppm or 0.01% deviation.

Judgement: Pass

Only one sample was tested, since all models use the same frequency determining circuitry.



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-9681A Revisions:			
Rev.	Affected Sections	Description	Rationale