



Electromagnetic Compatibility Test Report

Tests Performed on an RF IDEas, Inc.

Wave ID, RFID Reader

Radiometrics Document RP-9208



Product Detail:			
FCC ID: M9MF80100			
IC: 6571A-F80100			
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: 2019			
Canada ISED; RSS-210, Issue 9: 2016 as required for Category I Equipment			
FCC Part 15.225			
Tests Performed For:		Test Facility:	
RF IDEas, Inc.		Radiometrics Midwest Corporation	
4020 Winnetka Av.		12 Devonwood Avenue	
Rolling Meadows, IL 60008		Romeoville, IL 60446	
Test completion Date(s):			
December 20, 2019			
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0	January 22, 2020		
1	January 23, 2020	11.3.1	Joseph Strzelecki



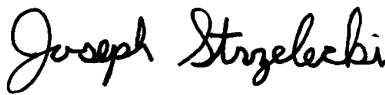
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1.0 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i>	
A RF IDEas, Inc., Wave ID, RFID Reader Models: RDR-80031AKU, RDR-80531AKU, RDR-80541AKU-RSOP, RDR-80031AK7, RDR-80531AK5, OEM-800N11KU, OEM-805N11KU This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics:</i>	<i>Test Date(s):</i>
December 6, 2019	November 26 to December 20, 2019
<i>Test Report Written and Authorized by:</i>	<i>Radiometrics' Personnel Responsible for Test:</i>
 01/22/2020 Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	Joseph Strzelecki Senior EMC Engineer Richard L. Tichgelaar EMC Technician Chris E. D'Alessio EMC Technician Dave Jarvis EMC Technician
<i>Test Witnessed By:</i>	
The tests were partially witnessed by Shiung Lo of RF IDEas, Inc.	

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Wave ID RFID Reader, 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 per RSS-210 & FCC Part 15

Environmental Phenomena	Frequency Range	Test Result
RF Radiated Emissions	30-1000 MHz	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	Pass
RF Radiated Emissions H-Field	0.009 – 30 MHz	Pass
Occupied Bandwidth	125 kHz & 13.56 MHz	Pass
Frequency Stability vs Temp & Voltage	None	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 Wave ID RFID Reader, manufactured by RF IDEas, Inc. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

The antenna has a unique connector to ensure no other antennas will be used. The antenna is internal to the EUT and it is not readily available to be modified by the end user.

3.1.2 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 only changes are in firmware that would not affect the EMC characteristics of the readers.

The other 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 is representative for the tested models.

Model Number	Description
RDR-80032AKU	Wave ID plus Desktop SE-USB SDK
RDR-80532AKU	Wave ID plus Desktop USB SDK
RDR-80531AK7	Wave ID plus Desktop Serial – 9VDC via Dongle
OEM-805N21KU	Wave ID plus OEM (no housing) – USB SDK
OEM-805N11K5	Wave ID plus OEM Serial (no housing) – 5VDC Pin 9 PWR
OEM-805N11K7	Wave ID plus OEM Serial (no housing) – 9VDC via Dongle

All of the model numbers use the same frequency determining circuitry. The 13.56 MHz and 125 kHz transmitter circuits are identical on all boards. There are two different shapes of Antennas. Each antenna was fully tested. All Main PCBA and Antenna PCBA were tested and the results of which are featured herein.

3.2 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 the USB. 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	RFID Reader	E	RF IDEas	RDR-80031AKU	F050000012
2	RFID Reader	E	RF IDEas	RDR-80531AKU	F050000014
3	RFID Reader	E	RF IDEas	RDR-80541AKU-RSOP	F05R000011
4	RFID Reader	E	RF IDEas	RDR-80541AKU-RSOP	F05R000012
5	RFID Reader	E	RF IDEas	RDR-80531AK7	F050000017
6	RFID Reader	E	RF IDEas	RDR-80531AK7	F050000018
7	RFID Reader	E	RF IDEas	RDR-80531AK5	F05S000012
8	RFID Reader	E	RF IDEas	RDR-80031AK7	F050000014
9	AC-DC 9V Power Supply	E	Generic	S008CU0900055	None
10	XPS Laptop PC	H	Dell	PP25L	CN-0N6705-70166-7A4-01-1
11	Laptop AC-DC power supply	P	Dynex	DA65NS4-00	CN-0XK850-48661-78C-289Z

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

List of Cables

QTY	Length (m)	Cable Description	Shielded?
1	0.25	USB Cable to RDR-80541AKU-RSOP Reader	Yes
1	1.8	USB Cable to all other USB Readers	Yes
1	1.8	Serial Cable to serial USB Reader	Yes
1	2.0	DC Cable from power supply to Serial readers	No
1	1.2	AC Cord to AC-DC power supply to host computer	No
1	1.3	DC Cord to Computer	No

The cable to the RDR-80541AKU-RSOP Reader will not be longer than 0.25 meters in actual use.

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	2019	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
IC RSS-210 Issue 9	2016	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: 2005 "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-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 Mo.	12/13/19
ANT-07	RMC	Log-Periodic Ant.	LP1000	1001	200-1000MHz	24 Mo.	11/19/18
ANT-53	EMCO	Loop Antenna	6507	1453	1 kHz-30 MHz	24 Mo.	12/28/17
ANT-66	ETS-Lindgren	Horn Antenna	3115	62580	1.0-18GHz	24 Mo.	03/05/19
ANT-80	AH Systems	Bicon Antenna	SAS-540	294	20-330MHz	24 Mo.	12/19/18
CAB-106A	Teledyne	Coaxial Cable	N/A	1090	DC-2 GHz	24 Mo.	05/07/18
CAB-1090	Teledyne	Coaxial Cable	N/A	1090	DC-18 GHz	24 Mo.	05/16/18
CAB-160B	Teledyne	Coaxial Cable	N/A	1090	DC-18 GHz	24 Mo.	05/09/18
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	03/14/18
LSN-17	EMCO	LISN	3810/2NM	9602-1356	0.15 - 30MHz	24 Mo.	03/04/19
REC-11	Agilent	Spectrum Analyzer	E7405A	US39110103	9kHz-3GHz	24 Mo.	04/02/18
REC-20	HP / Agilent	Spectrum Analyzer	85460A/84562A	33330A00135 3410A00178	30Hz-6GHz	24 Mo.	08/14/19

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 55032)
Radiometrics	RRECE11D	07.16.19	RF Radiated Emissions (FCC Part 15 & EN 55032)
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.		



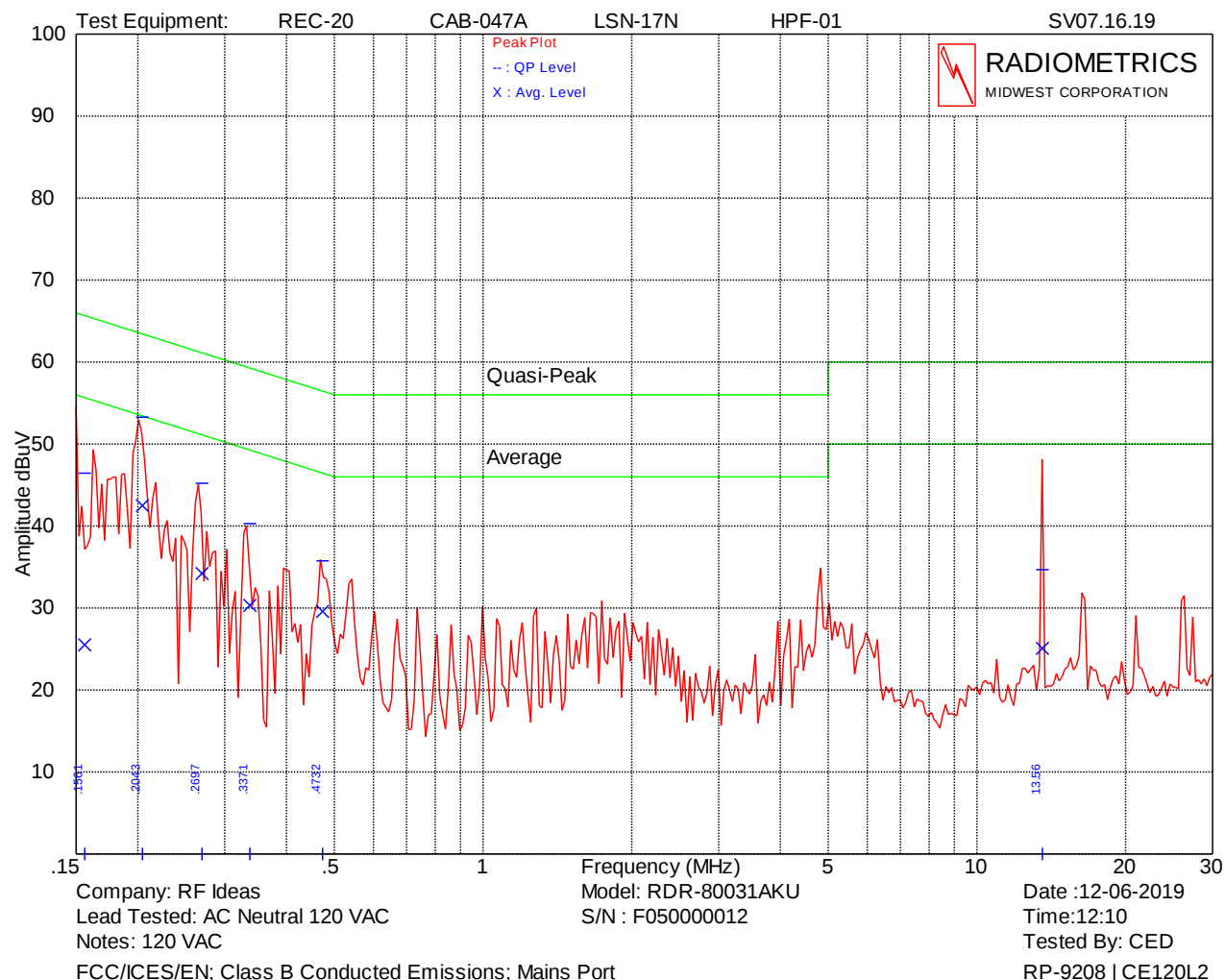
The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the host computer (with the EUT connected) power cord, after testing all modes of operation. QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.

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

- 1) First, perform the AC line conducted tests with the antenna attached were performed 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 of 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 100 Ohm. This is the characteristic impedance of the antenna.

Tested by	Chris Dalessio; Dave Jarvis
Test Dates	11/25/2019 and 12/06/2019

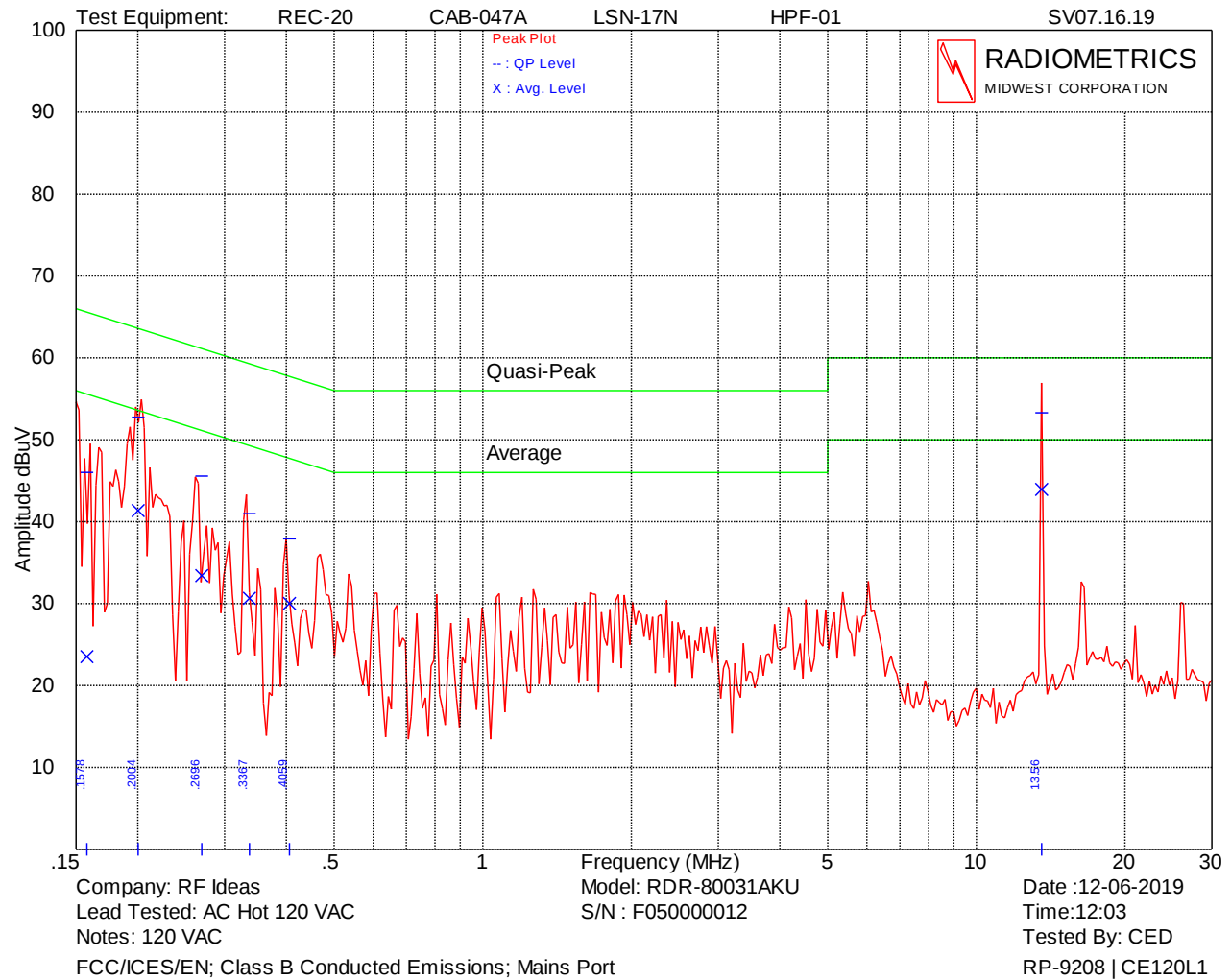
The 125 kHz and 13.56 MHz transmitter was on during the following tests.
The Limit shown in the graphs are the FCC 15.107 and RSS-GEN Table 3.



With Antenna installed

The emission at 13.56 MHz was re-measured with a resistive load in place of the antenna and was fully compliant.

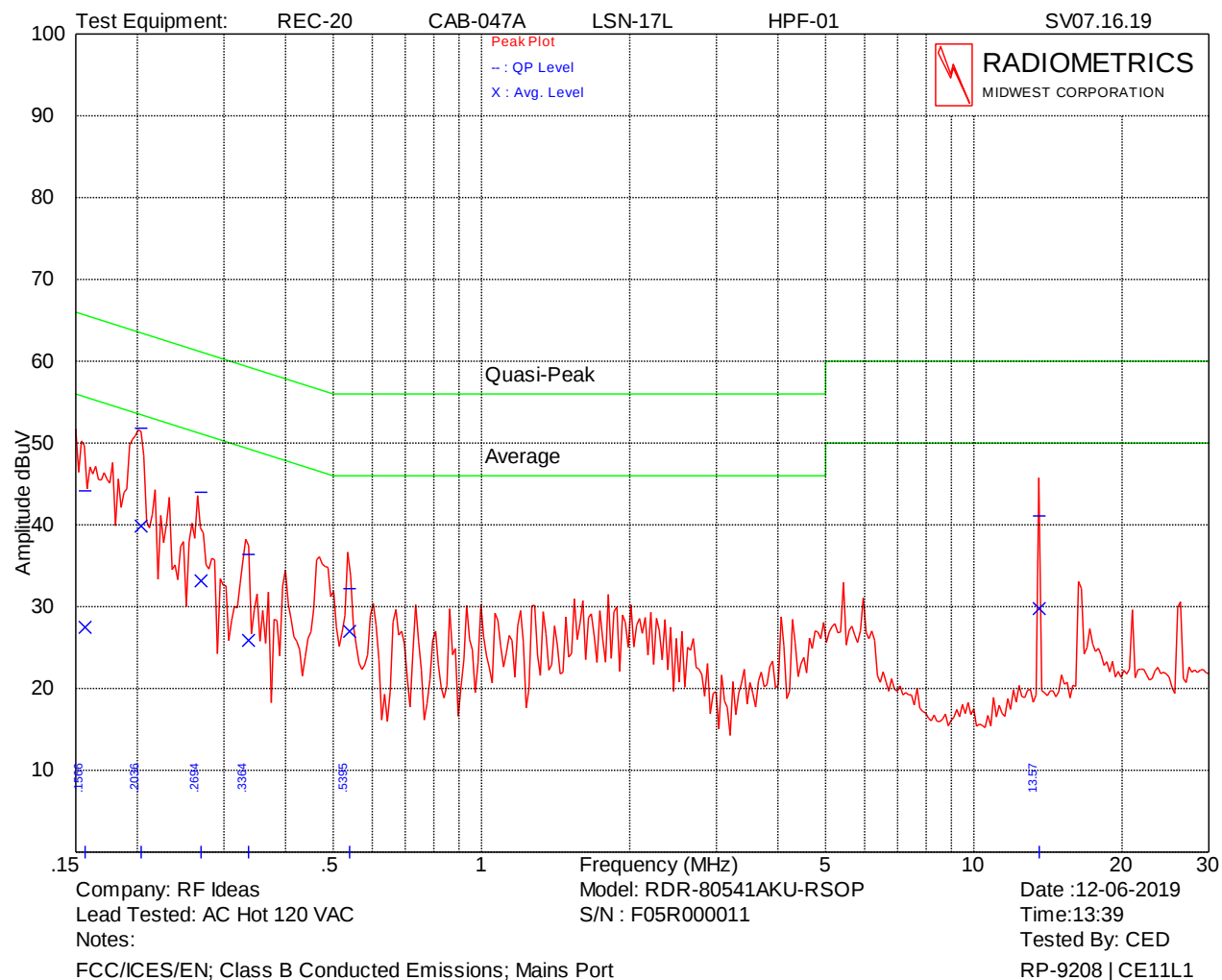
Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.156	46.4	65.7	25.5	55.7	19.2
0.204	53.3	63.4	42.5	53.4	10.2
0.270	45.2	61.1	34.2	51.1	15.9
0.337	40.3	59.3	30.3	49.3	18.9
0.473	35.8	56.5	29.6	46.5	16.9
13.569	34.7	60.0	25.1	50.0	24.9



With Antenna installed

The emission at 13.56 MHz was re-measured with a resistive load in place of the antenna and was fully compliant.

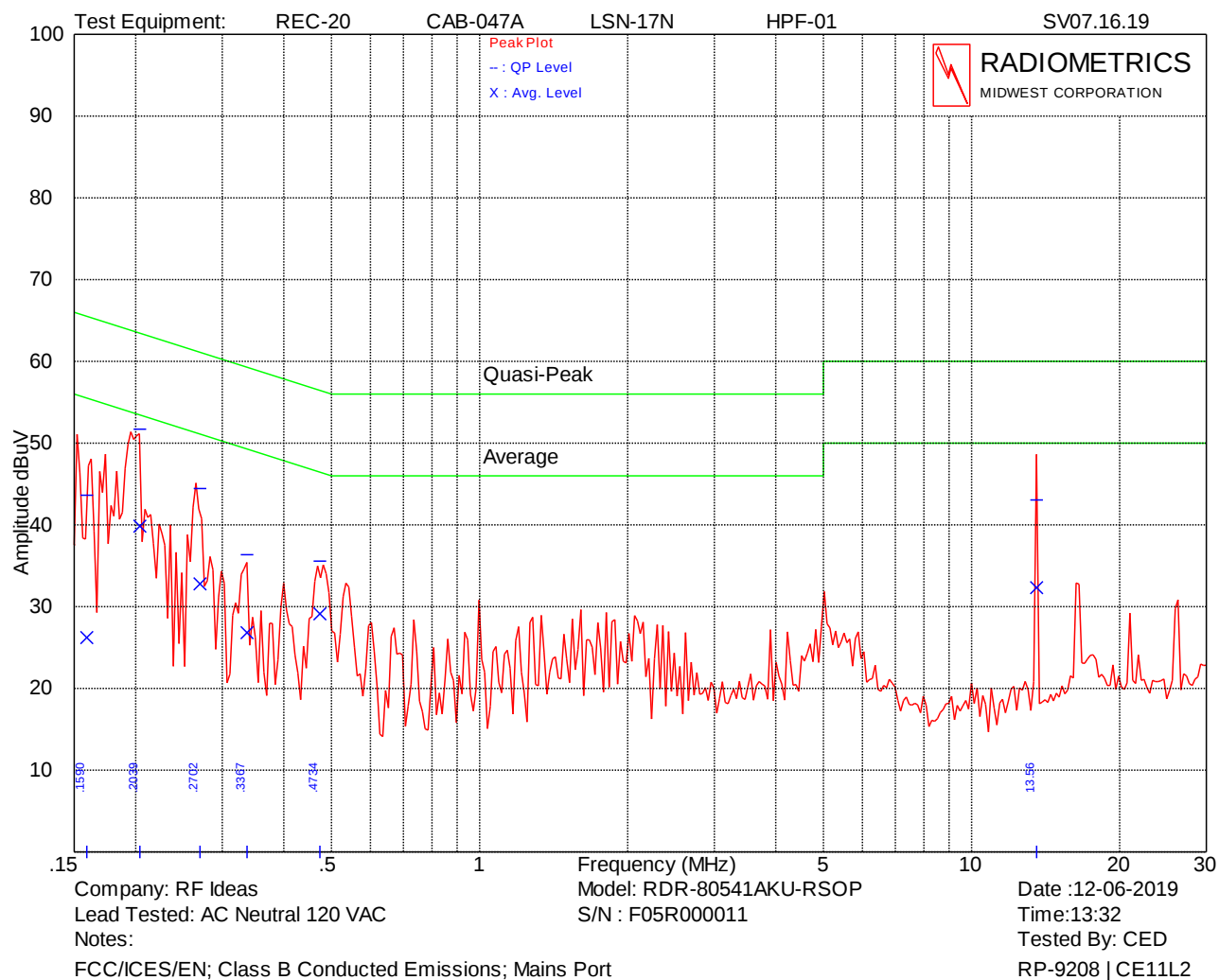
Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.158	46.0	65.6	23.5	55.6	19.6
0.200	52.8	63.6	41.4	53.6	10.8
0.270	45.6	61.1	33.4	51.1	15.6
0.337	41.0	59.3	30.6	49.3	18.3
0.406	37.9	57.7	30.0	47.7	17.7
13.561	53.3	60.0	43.9	50.0	6.1



With Antenna installed

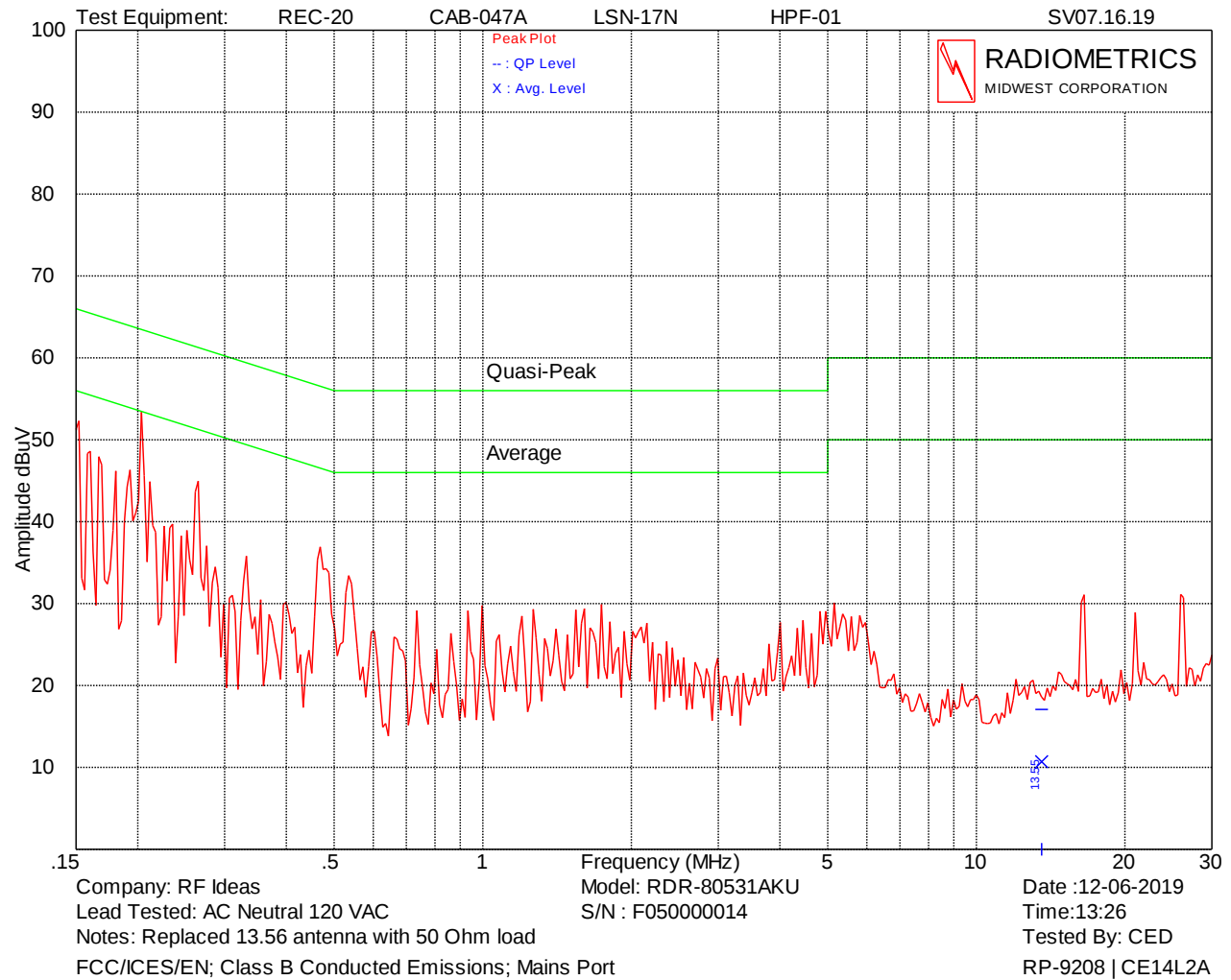
The emission at 13.56 MHz was re-measured with a resistive load in place of the antenna and was fully compliant.

Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.157	44.2	65.6	27.5	55.6	21.5
0.204	51.8	63.5	39.9	53.5	11.6
0.269	44.0	61.1	33.2	51.1	17.1
0.336	36.4	59.3	25.9	49.3	22.9
0.540	32.2	56.0	27.0	46.0	19.0
13.573	40.8	60.0	29.8	50.0	19.2



With Antenna installed

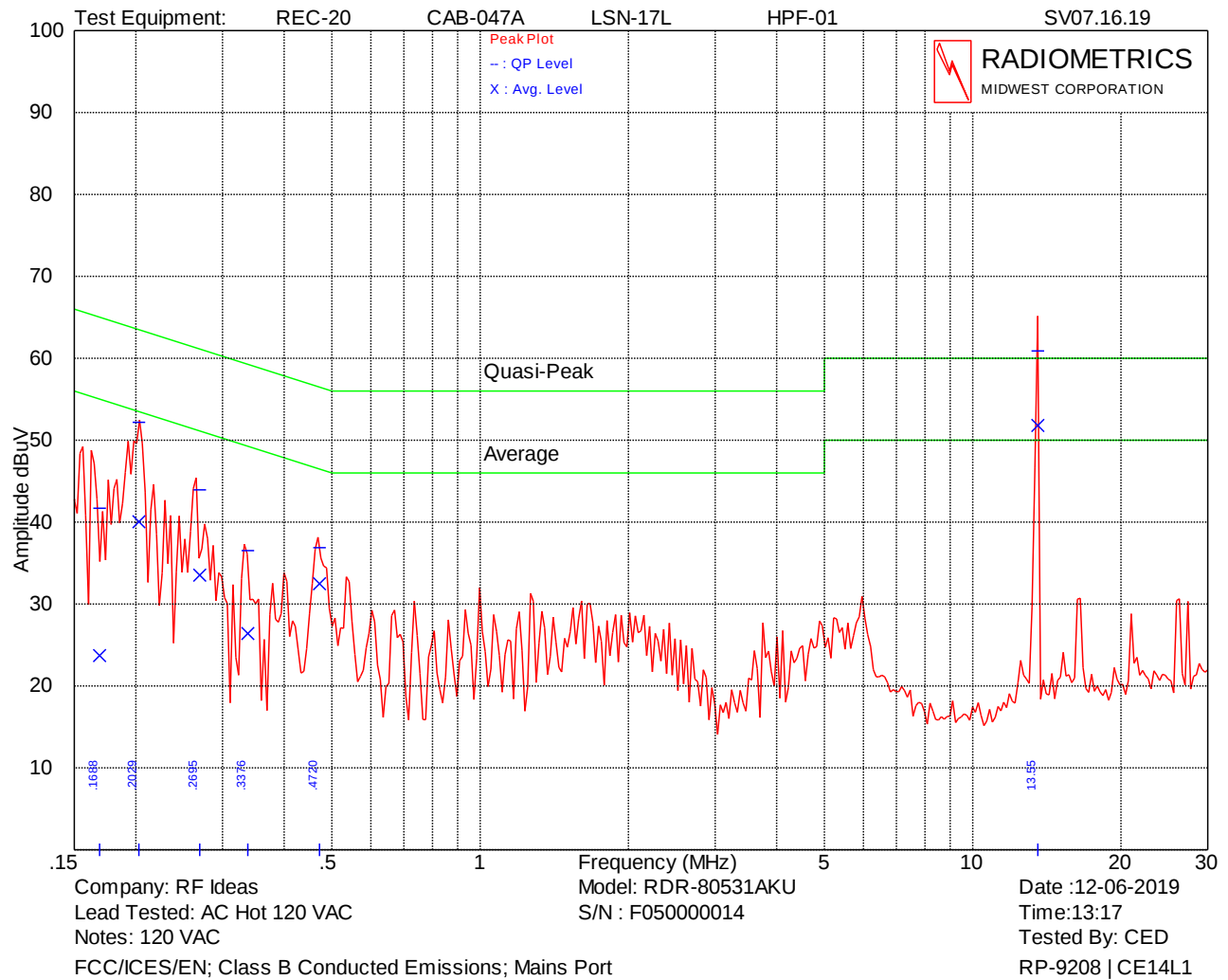
Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.159	43.6	65.5	26.2	55.5	21.9
0.204	51.7	63.4	39.8	53.4	11.7
0.270	44.5	61.1	32.8	51.1	16.7
0.337	36.3	59.3	26.8	49.3	22.5
0.473	35.6	56.5	29.1	46.5	17.3
13.562	43.0	60.0	32.3	50.0	17.0



With 50 Ohms in place of Antenna

Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
13.557	17.1	60.0	10.7	50.0	39.3

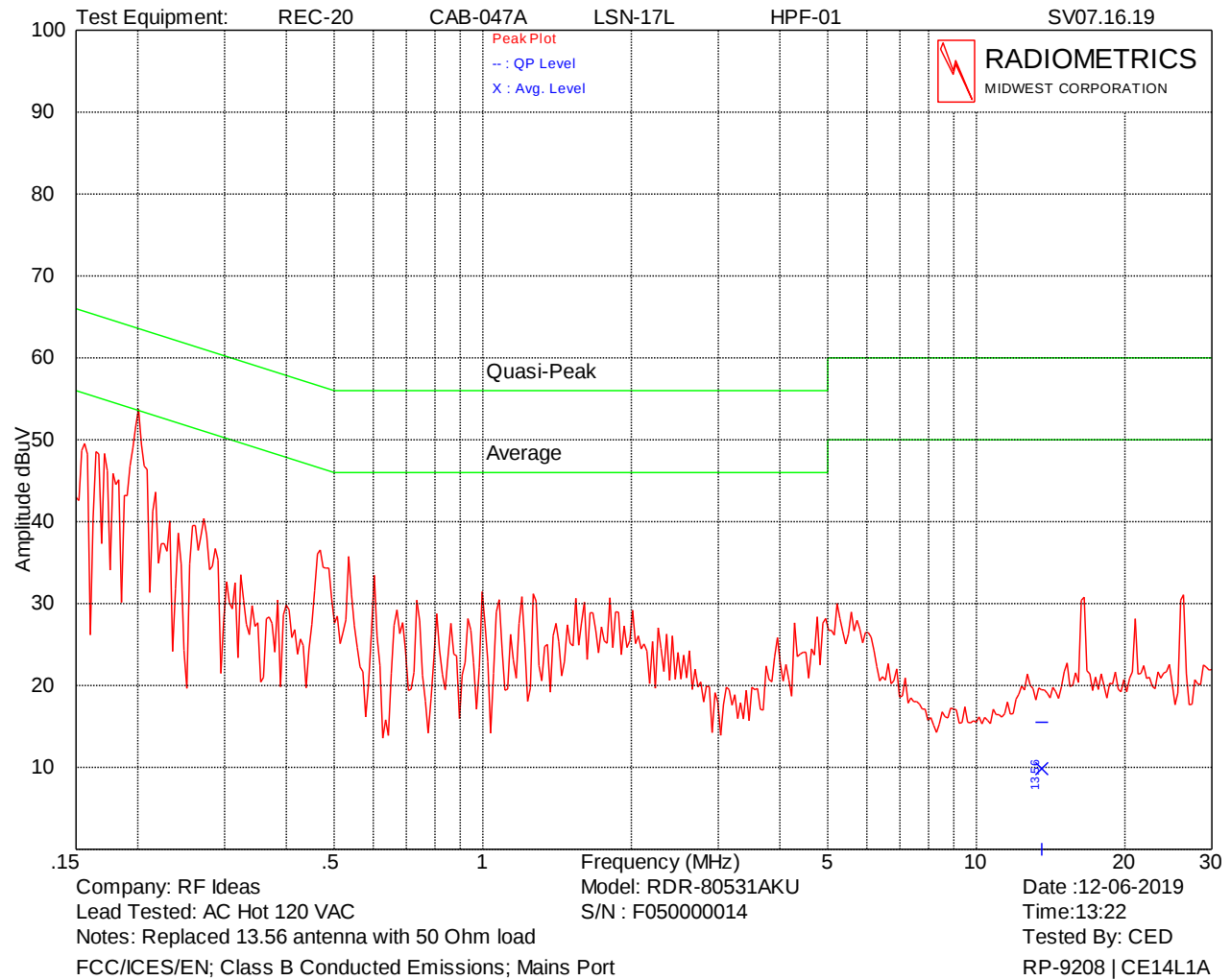
Pass by at least 10 dB at 13.56 MHz with Load in place of antenna



With Antenna installed

The emission at 13.56 MHz was re-measured with a resistive load in place of the antenna and was fully compliant.

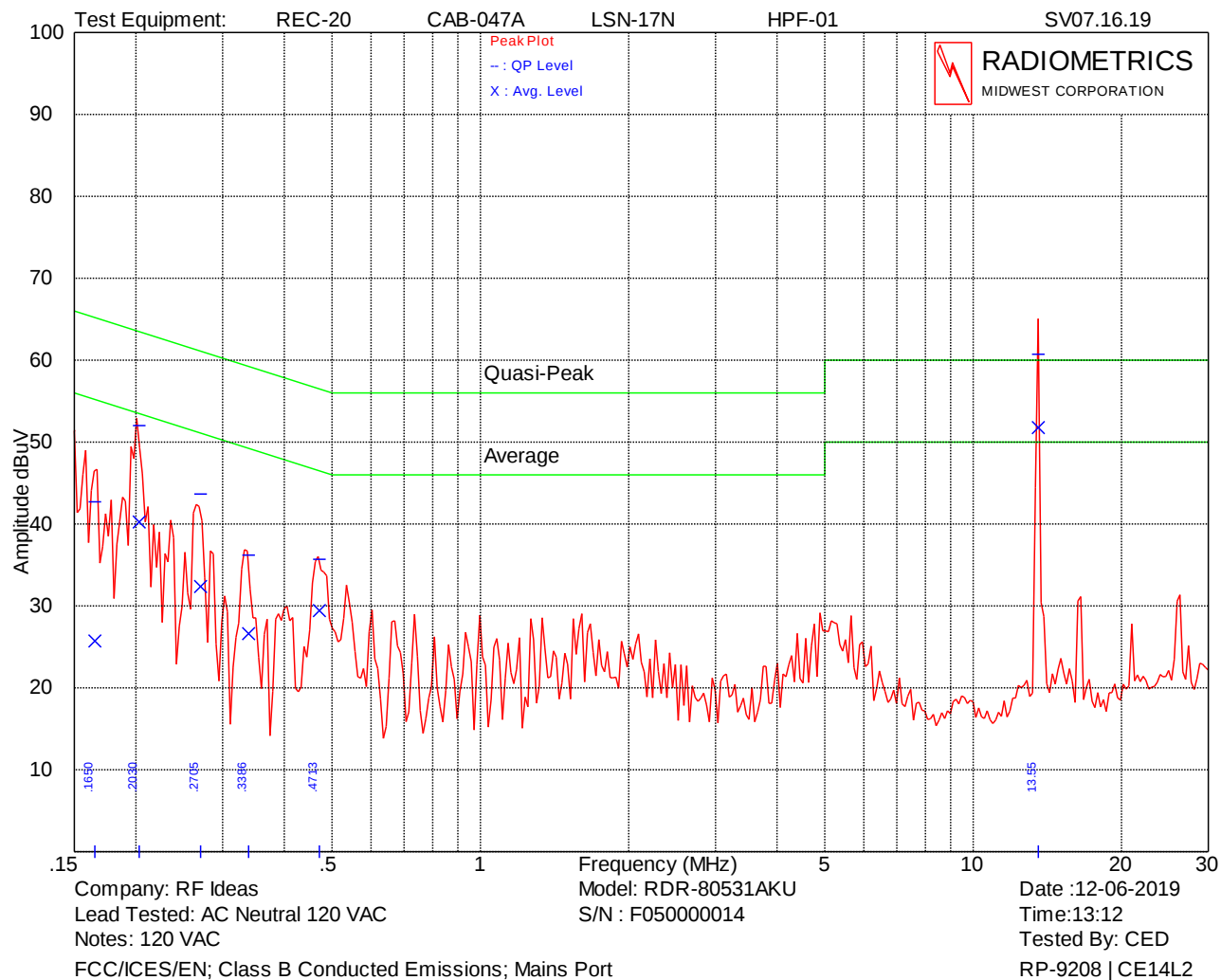
Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.169	41.7	65.0	23.7	55.0	23.3
0.203	52.2	63.5	40.1	53.5	11.3
0.270	43.9	61.1	33.5	51.1	17.2
0.338	36.5	59.3	26.4	49.3	22.7
0.472	36.9	56.5	32.5	46.5	14.0
13.560	60.9	60.0	51.8	50.0	-1.8



With 50 ohms in place of Antenna

Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
13.566	15.5	60.0	9.8	50.0	40.2

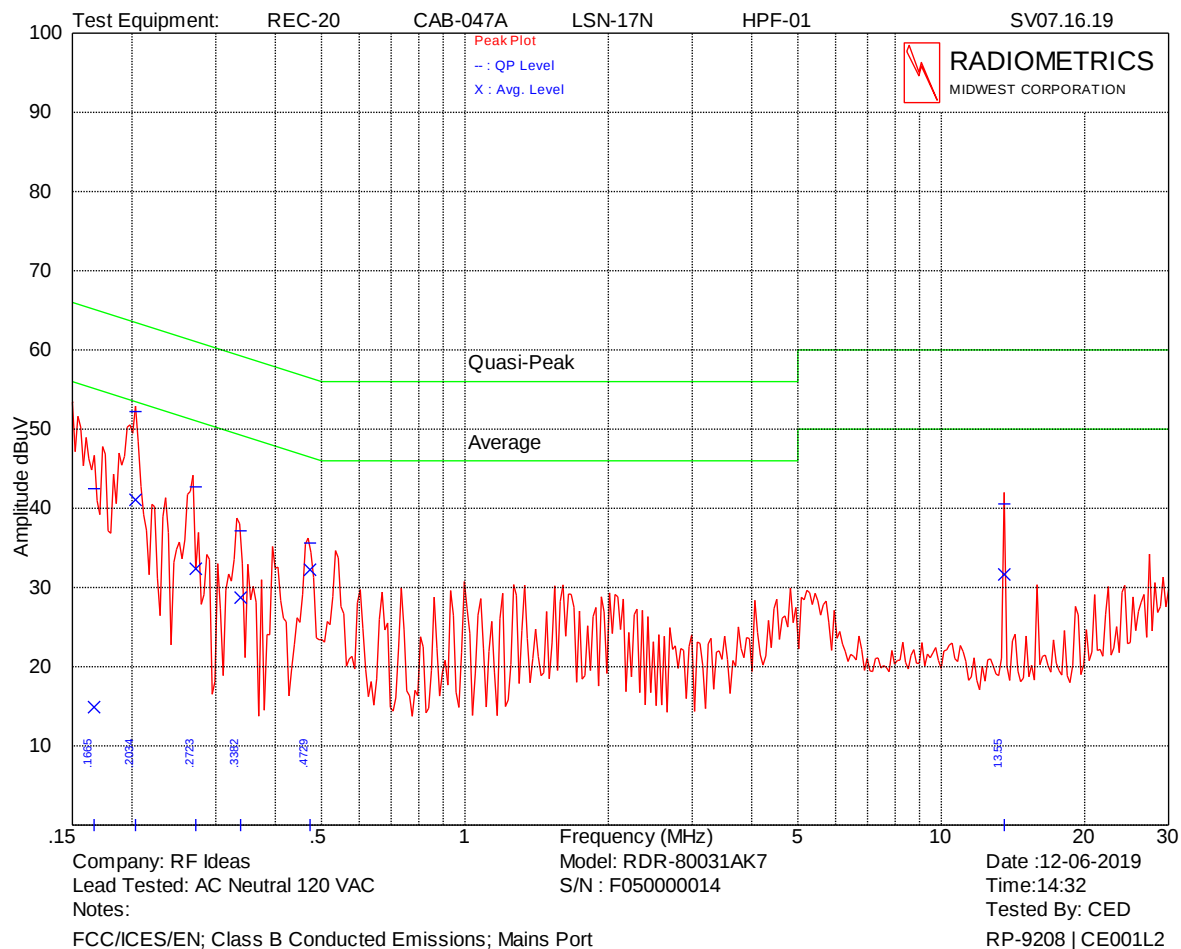
Pass by at least 10 dB at 13.56 MHz with Load in place of antenna



With Antenna installed

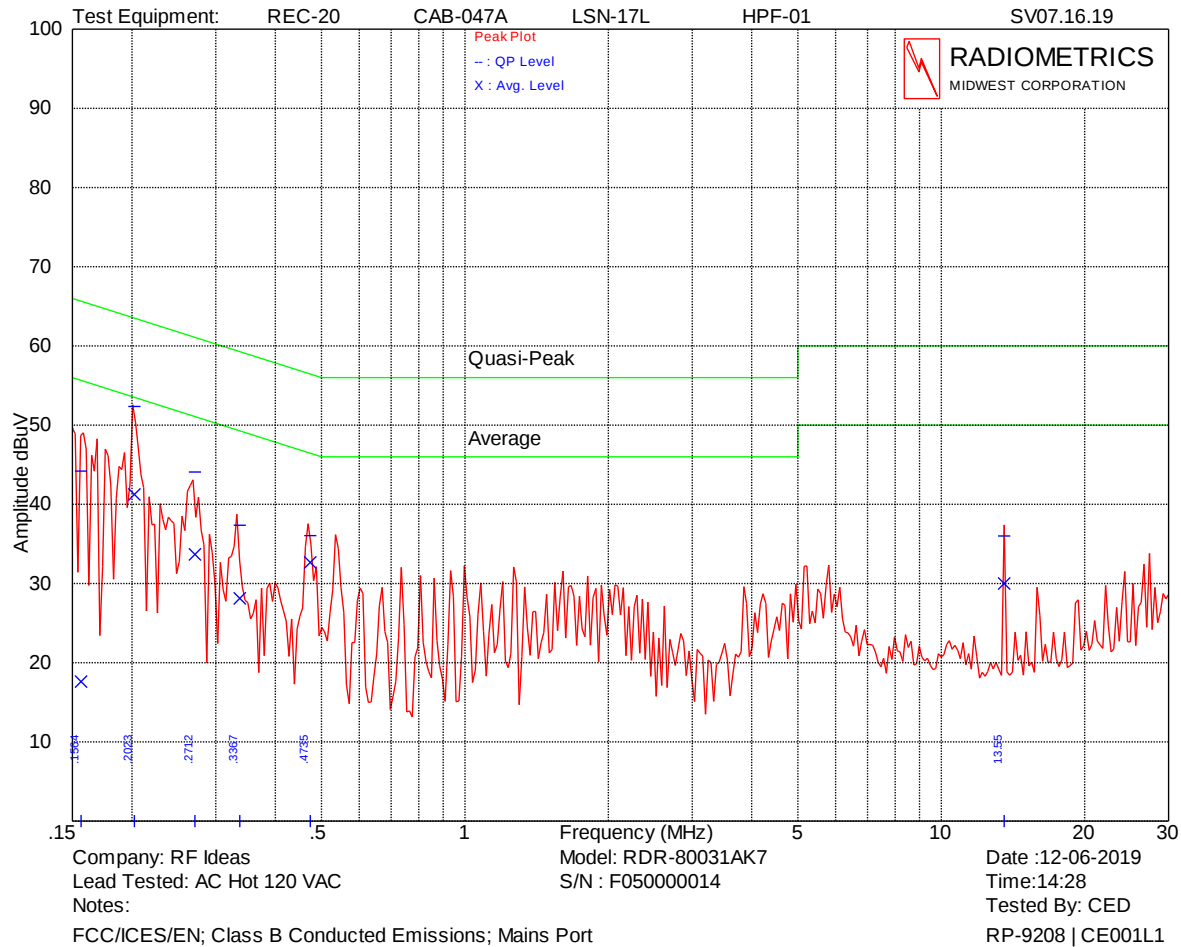
The emission at 13.56 MHz was re-measured with a resistive load in place of the antenna and was fully compliant.

Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.165	42.7	65.2	25.7	55.2	22.5
0.203	52.0	63.5	40.3	53.5	11.5
0.271	43.7	61.1	32.4	51.1	17.4
0.339	36.2	59.2	26.6	49.2	22.6
0.471	35.7	56.5	29.4	46.5	17.1
13.560	60.7	60.0	51.8	50.0	-1.8



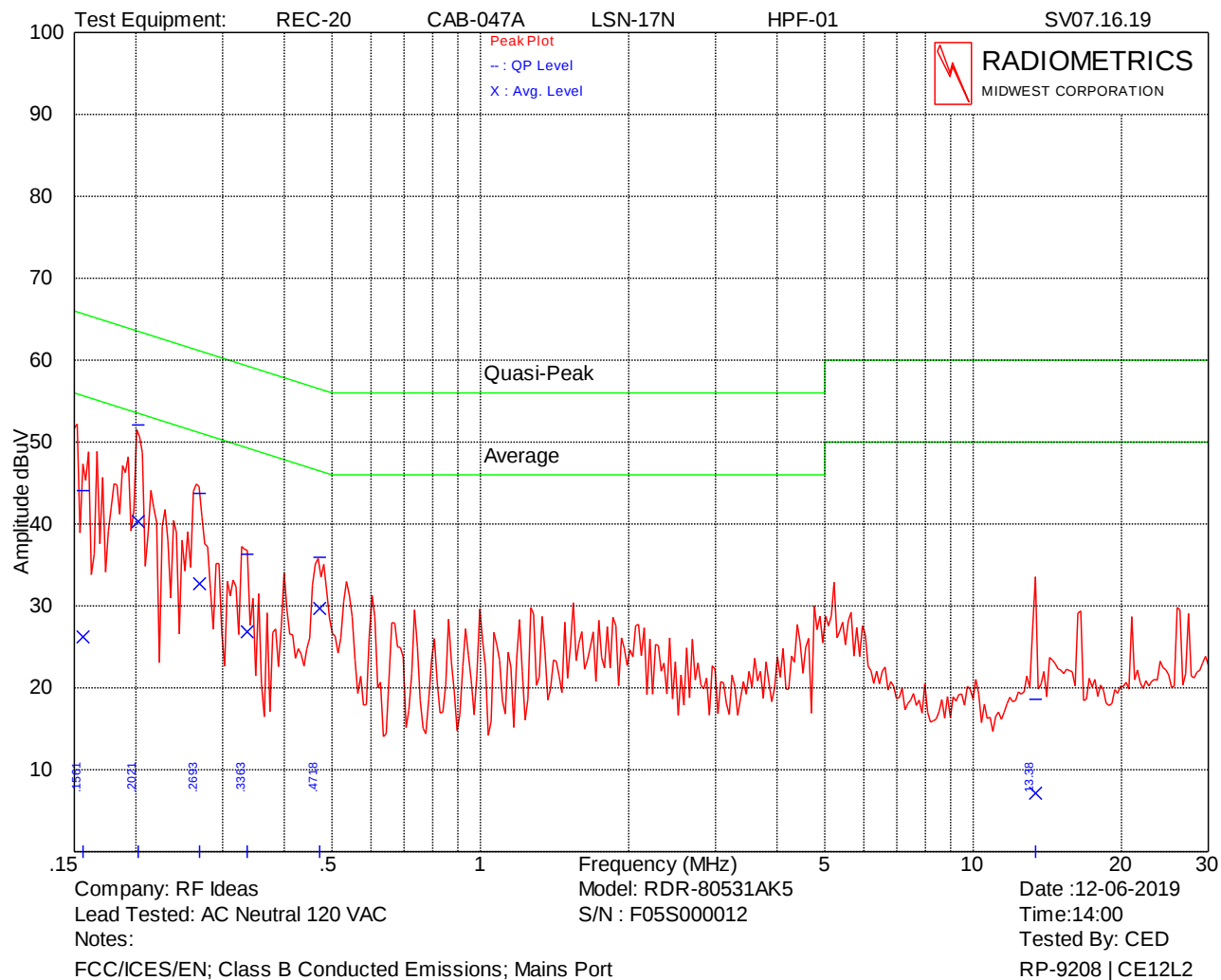
With Antenna installed

Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.167	42.5	65.1	14.9	55.1	22.7
0.203	52.2	63.5	41.1	53.5	11.3
0.272	42.7	61.0	32.4	51.0	18.3
0.338	37.2	59.2	28.7	49.2	20.5
0.473	35.6	56.5	32.2	46.5	14.2
13.558	40.5	60.0	31.6	50.0	18.4



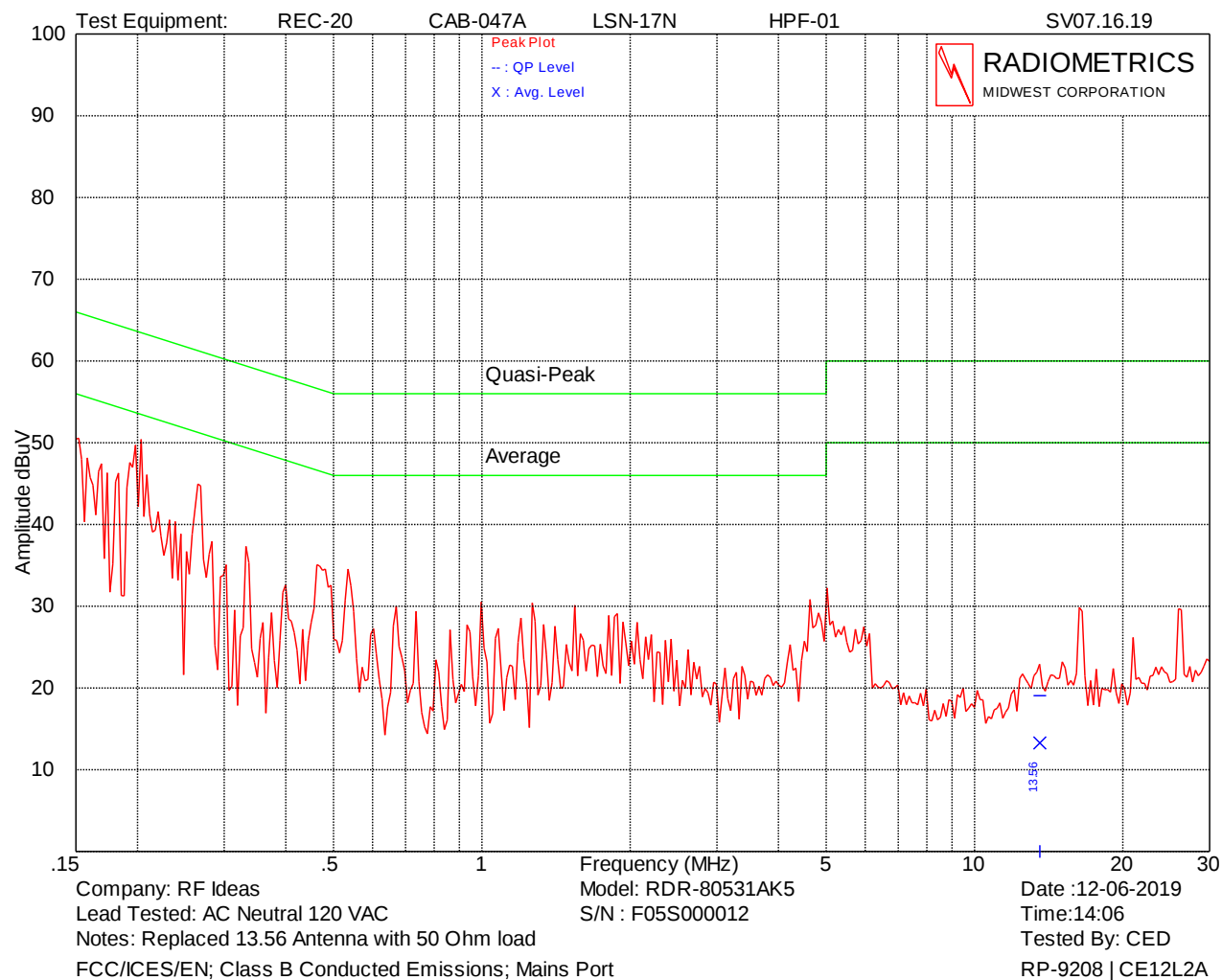
With Antenna installed

Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.156	44.2	65.7	17.6	55.7	21.5
0.202	52.4	63.5	41.3	53.5	11.2
0.271	44.1	61.1	33.7	51.1	17.0
0.337	37.3	59.3	28.1	49.3	21.2
0.474	36.0	56.5	32.7	46.5	13.8
13.550	36.1	60.0	29.9	50.0	20.1



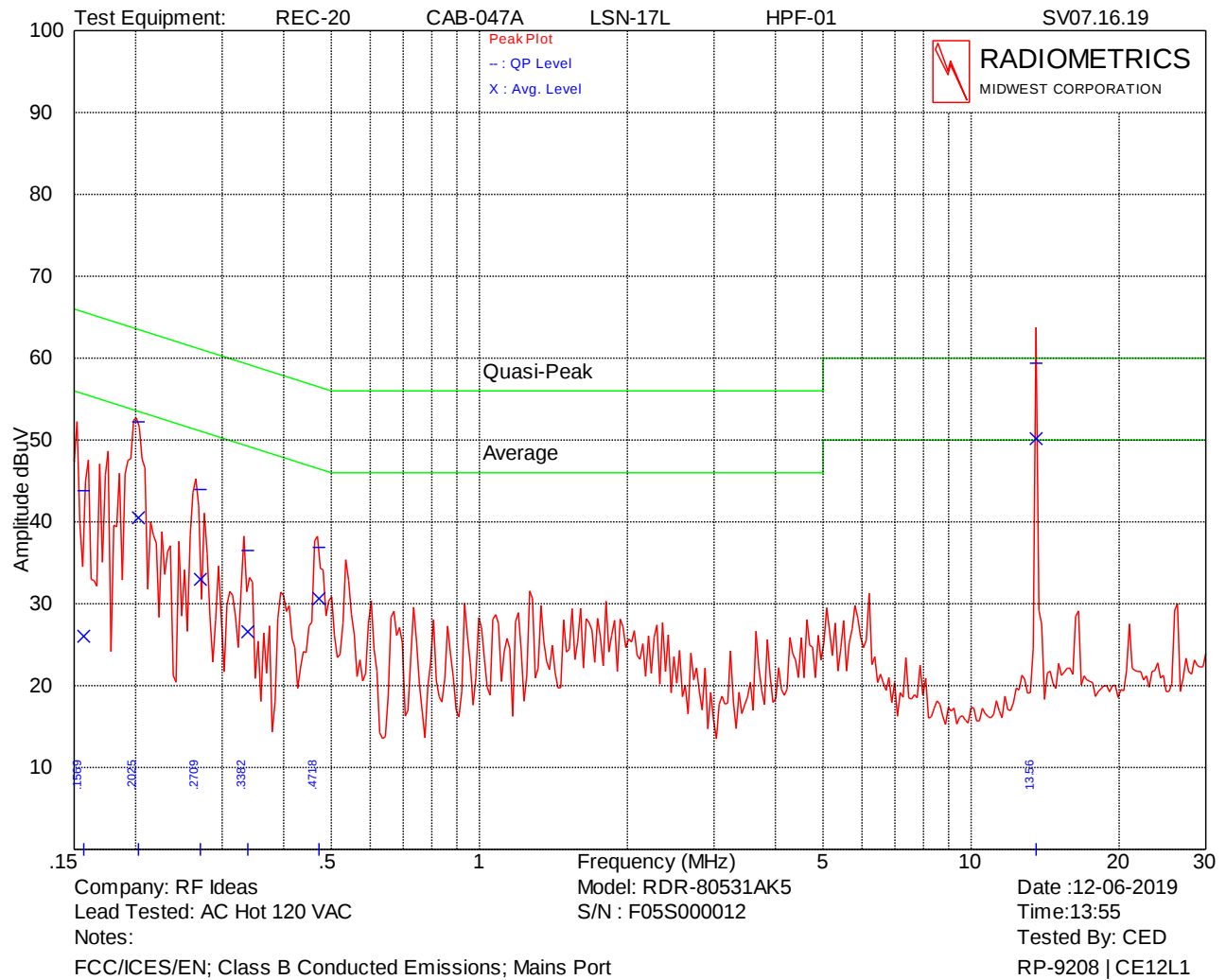
With Antenna installed

Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.156	44.1	65.7	26.2	55.7	21.6
0.202	52.1	63.5	40.3	53.5	11.4
0.269	43.7	61.1	32.7	51.1	17.4
0.336	36.3	59.3	26.9	49.3	22.4
0.472	35.9	56.5	29.7	46.5	16.8
13.382	18.6	60.0	7.1	50.0	41.4



Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
13.565	19.1	60.0	13.3	50.0	36.6

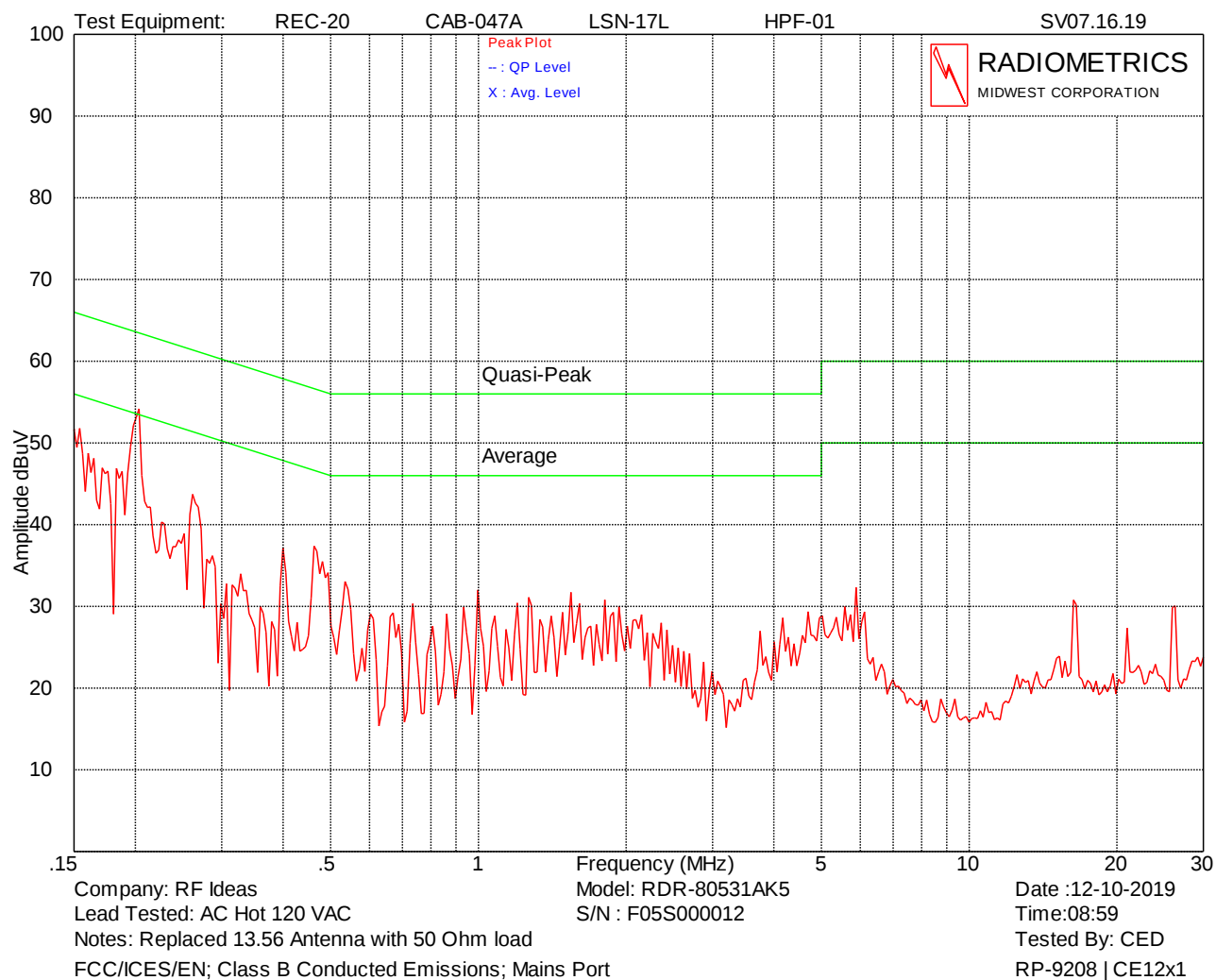
Pass by at least 10 dB at 13.56 MHz with Load in place of antenna



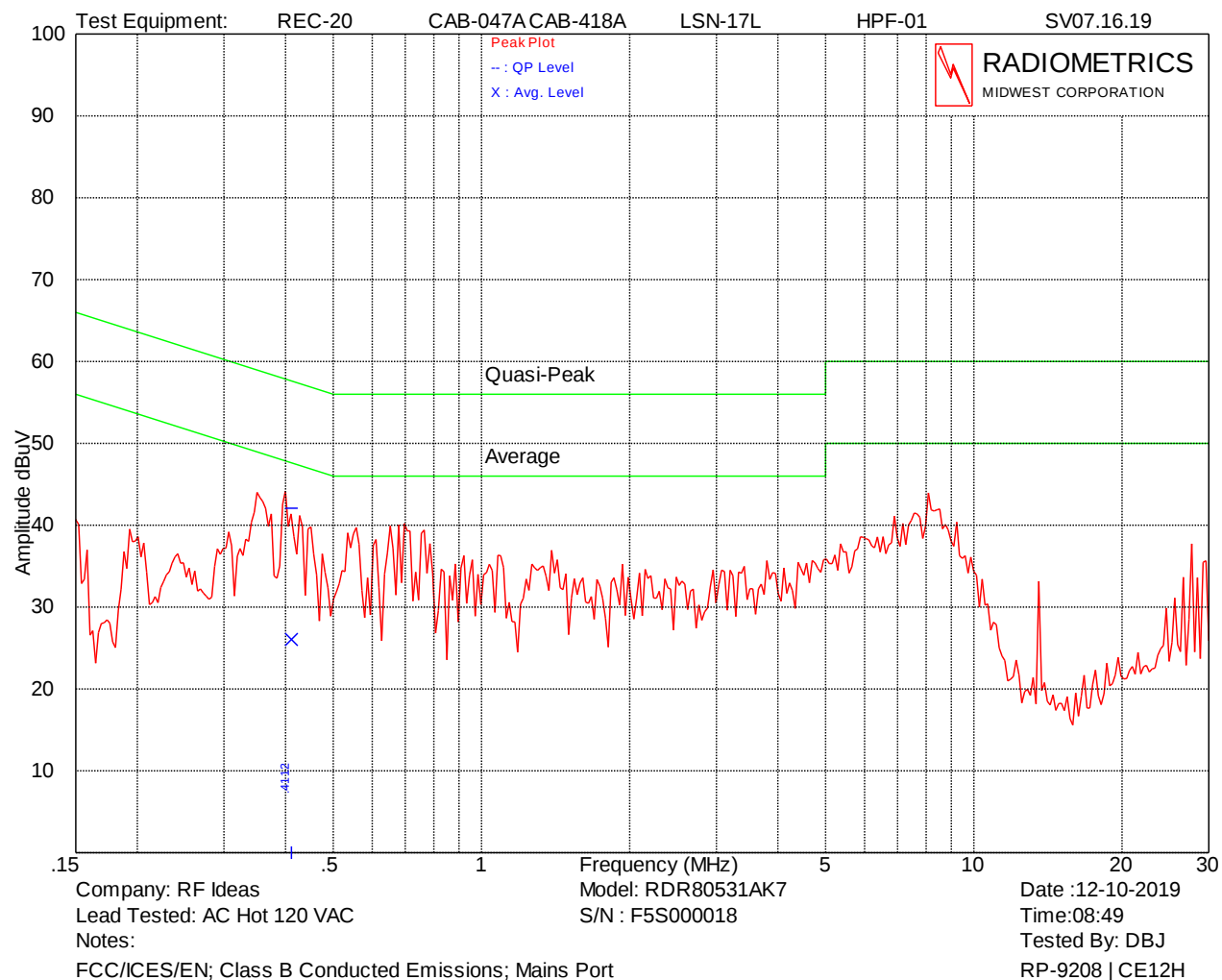
With Antenna installed

The emission at 13.56 MHz was re-measured with a resistive load in place of the antenna and was fully compliant.

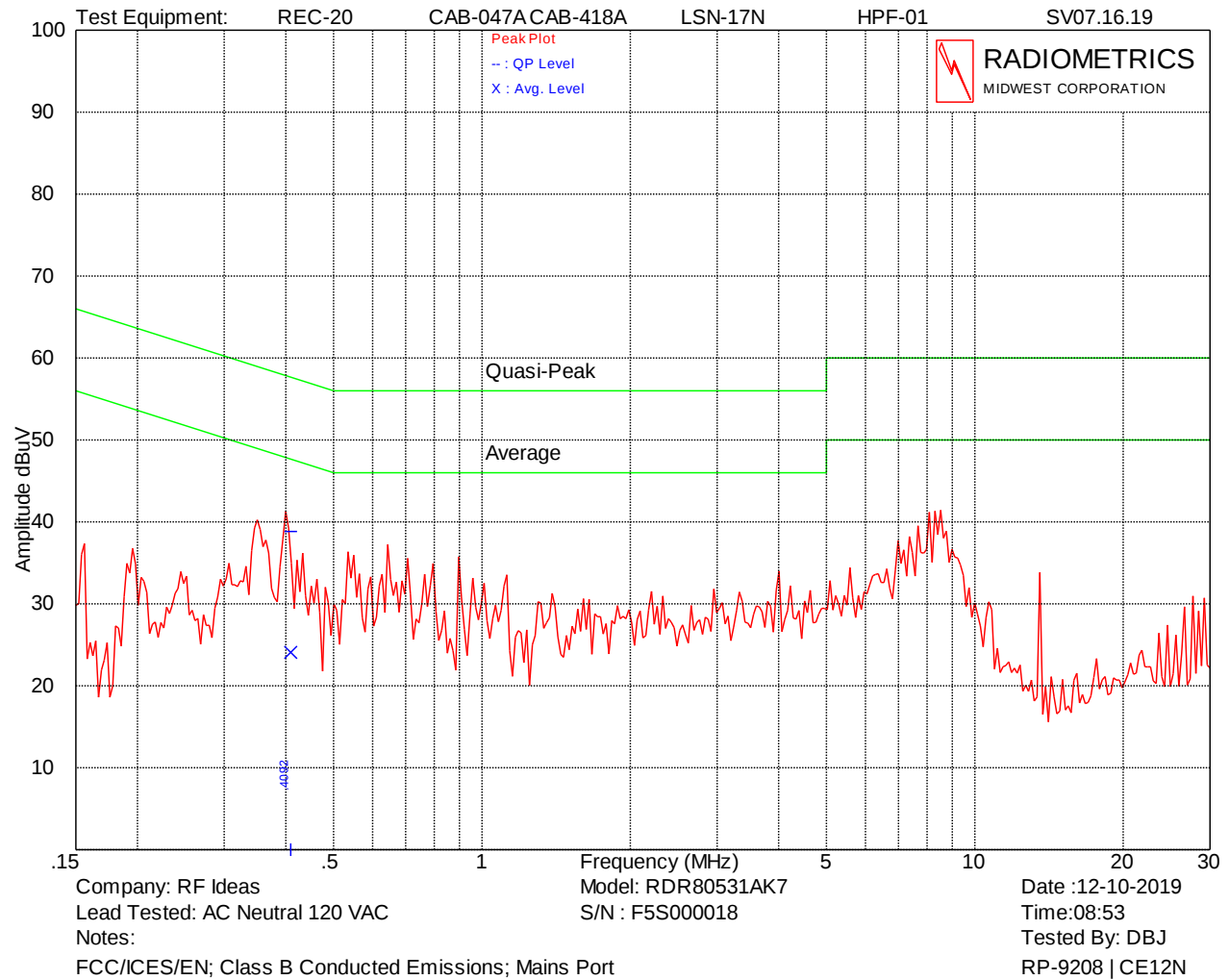
Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.157	43.8	65.6	26.0	55.6	21.8
0.203	52.2	63.5	40.5	53.5	11.3
0.271	44.0	61.1	33.0	51.1	17.1
0.338	36.5	59.2	26.6	49.2	22.7
0.472	36.9	56.5	30.6	46.5	15.9
13.560	59.4	60.0	50.2	50.0	-0.2



Pass by at least 10 dB at 13.56 MHz with Load in place of antenna

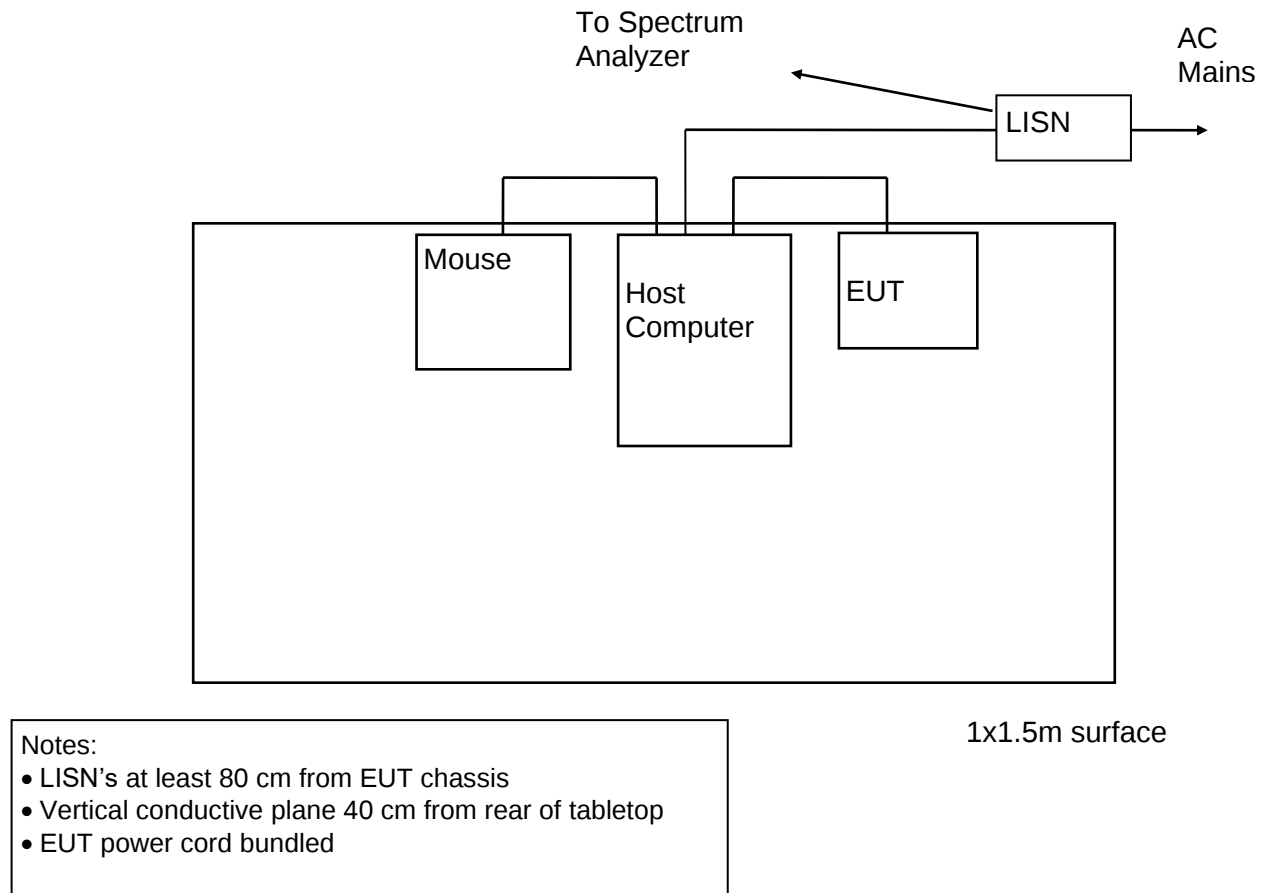


Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.411	42.1	57.6	26.0	47.6	15.6



Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.409	38.8	57.7	24.1	47.7	18.8

Judgment: Passed by at least 10 dB at 13.56 MHz with Resistive Load in place of standard Loop antenna.
Passed by at least 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 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 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 East 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. The EUT was rotated through three orthogonal axes as per 5.10.1 of ANSI C63.10 during the radiated tests.

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 Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength

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 Dates	11/25/2019 and 12/06/2019
Test Distance	3 Meters
Specification	FCC Part 15 Subpart C & RSS-210 (convert from EN 55011)
Notes	Corr. Factors = cable loss distance factor.
Abbreviations	P = peak; Q = QP Pol = Antenna Polarization; V = Vertical; H = Horizontal
EUT	Wave ID
Tested by	Chris Dalessio; Richard Tichelaar
Note	Three axis tested; worst case shown

The 125 kHz and the 13.56 Mhz transmitter were both on during the following tests.

The following shows the highest emissions during the tests.

EUT	Model RDR-80541AKU-RSOP; Serial Number: F05R000012; 11/25/2019
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Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
31.1	8.5	P	H	13.4	0.4	-3.5	18.8	40.0	21.2
37.7	21.9	P	H	11.6	0.4	-3.5	30.4	40.0	9.6
61.5	14.6	P	H	9.2	0.6	-3.5	20.8	40.0	19.2
93.0	12.1	P	H	9.8	0.7	-3.5	19.0	40.0	21.0



Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
108.5	13.0	P	H	10.8	0.8	-3.5	21.0	40.0	19.0
119.5	12.6	P	H	11.5	0.8	-3.5	21.4	40.0	18.6
135.5	16.7	P	H	12.4	0.9	-3.5	26.5	40.0	13.5
148.2	24.0	P	H	12.7	0.9	-3.5	34.1	40.0	5.9
149.9	23.7	P	H	12.8	0.9	-3.5	33.9	40.0	6.1
162.6	21.3	P	H	12.9	1.0	-3.5	31.7	40.0	8.3
165.9	18.2	P	H	13.0	1.0	-3.5	28.7	40.0	11.3
189.7	23.0	P	H	13.8	1.0	-3.5	34.3	40.0	5.7
189.8	20.4	Q	H	13.8	1.0	-3.5	31.8	40.0	8.2
191.9	21.8	P	H	13.9	1.1	-3.5	33.2	40.0	6.8
198.0	15.7	P	H	14.2	1.1	-3.5	27.4	40.0	12.6
210.1	15.3	P	H	14.7	1.1	-3.5	27.6	40.0	12.4
216.7	20.0	P	H	14.9	1.1	-3.5	32.5	40.0	7.5
221.7	14.9	P	H	15.0	1.1	-3.5	27.5	40.0	12.5
226.1	15.1	P	H	15.1	1.1	-3.5	27.8	40.0	12.2
232.2	15.6	P	H	15.1	1.2	-3.5	28.3	47.0	18.7
239.9	18.3	P	H	15.2	1.2	-3.5	31.2	47.0	15.8
243.8	18.1	P	H	15.2	1.2	-3.5	31.0	47.0	16.0
244.4	17.5	P	H	15.2	1.2	-3.5	30.3	47.0	16.7
251.0	11.0	P	H	15.5	1.2	-3.5	24.2	47.0	22.8
267.8	20.2	P	H	12.3	1.3	-3.5	30.3	47.0	16.7
270.9	19.3	P	H	12.5	1.3	-3.5	29.6	47.0	17.4
287.9	15.0	P	H	13.5	1.3	-3.5	26.3	47.0	20.7
298.6	19.3	P	H	13.8	1.3	-3.5	30.9	47.0	16.1
315.0	14.0	P	H	14.7	1.4	-3.5	26.5	47.0	20.5
325.7	19.8	P	H	14.0	1.4	-3.5	31.7	47.0	15.3
352.8	18.4	P	H	14.8	1.5	-3.5	31.1	47.0	15.9
379.9	16.5	P	H	14.5	1.5	-3.5	29.0	47.0	18.0
407.0	17.2	P	H	15.2	1.6	-3.5	30.5	47.0	16.5
434.1	18.1	P	H	16.2	1.7	-3.5	32.5	47.0	14.5
461.2	19.4	P	H	16.4	1.7	-3.5	34.0	47.0	13.0
488.3	24.3	P	H	17.3	1.8	-3.5	39.8	47.0	7.2
501.5	13.1	P	H	17.6	1.8	-3.5	29.0	47.0	18.0
502.5	14.8	P	H	17.6	1.8	-3.5	30.7	47.0	16.3
516.3	23.7	P	H	18.1	1.8	-3.5	40.1	47.0	6.9
542.5	20.3	P	H	17.3	1.9	-3.5	35.9	47.0	11.1
556.3	13.3	P	H	18.3	1.9	-3.5	30.0	47.0	17.0
583.8	15.9	P	H	18.3	1.9	-3.5	32.6	47.0	14.4
597.5	18.1	P	H	18.6	2.0	-3.5	35.2	47.0	11.8
625.0	20.1	P	H	19.5	2.0	-3.5	38.1	47.0	8.9
651.3	18.4	P	H	19.3	2.1	-3.5	36.3	47.0	10.7
666.3	15.9	P	H	19.8	2.1	-3.5	34.3	47.0	12.7
678.8	16.2	P	H	20.2	2.1	-3.5	35.0	47.0	12.0
706.3	14.1	P	H	20.8	2.2	-3.5	33.6	47.0	13.4
841.3	16.3	P	H	22.6	2.4	-3.5	37.7	47.0	9.3
868.8	16.4	P	H	22.0	2.4	-3.5	37.3	47.0	9.7
882.5	14.2	P	H	22.4	2.5	-3.5	35.5	47.0	11.5
895.0	14.8	P	H	21.8	2.5	-3.5	35.6	47.0	11.4
908.8	12.6	P	H	21.8	2.5	-3.5	33.4	47.0	13.6
950.0	11.4	P	H	23.0	2.6	-3.5	33.4	47.0	13.6
977.5	12.1	P	H	22.5	2.6	-3.5	33.7	47.0	13.3
998.8	16.1	P	H	23.5	2.6	-3.5	38.8	47.0	8.2
1000.0	9.3	P	H	23.5	2.6	-3.5	31.9	47.0	15.1
30.0	8.9	P	V	13.8	0.4	-3.5	19.6	40.0	20.4



Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
33.3	14.8	P	V	12.8	0.4	-3.5	24.5	40.0	15.5
39.9	11.2	P	V	11.2	0.4	-3.5	19.3	40.0	20.7
44.9	11.8	P	V	10.3	0.5	-3.5	19.1	40.0	20.9
51.0	12.2	P	V	9.4	0.5	-3.5	18.6	40.0	21.4
55.4	13.3	P	V	9.3	0.5	-3.5	19.6	40.0	20.4
60.9	23.4	P	V	9.2	0.6	-3.5	29.6	40.0	10.4
64.3	17.0	P	V	9.3	0.6	-3.5	23.4	40.0	16.6
69.2	18.2	P	V	9.2	0.6	-3.5	24.5	40.0	15.5
72.0	18.2	P	V	9.3	0.6	-3.5	24.6	40.0	15.4
96.9	15.4	P	V	10.1	0.7	-3.5	22.7	40.0	17.3
105.1	13.2	P	V	10.6	0.8	-3.5	21.1	40.0	18.9
120.6	12.6	P	V	11.6	0.8	-3.5	21.5	40.0	18.5
149.9	16.9	P	V	12.8	0.9	-3.5	27.1	40.0	12.9
183.0	14.8	P	V	13.6	1.0	-3.5	25.9	40.0	14.1
189.7	16.3	P	V	13.8	1.0	-3.5	27.6	40.0	12.4
196.3	11.8	P	V	14.2	1.1	-3.5	23.6	40.0	16.4
240.5	18.7	P	V	15.2	1.2	-3.5	31.6	47.0	15.4
246.6	15.9	P	V	15.3	1.2	-3.5	28.9	47.0	18.1
251.0	9.7	P	V	15.5	1.2	-3.5	22.9	47.0	24.1
272.2	14.2	P	V	12.6	1.3	-3.5	24.6	47.0	22.4
285.4	14.5	P	V	13.5	1.3	-3.5	25.8	47.0	21.2
298.6	14.7	P	V	13.8	1.3	-3.5	26.3	47.0	20.7
315.0	19.1	P	V	14.7	1.4	-3.5	31.7	47.0	15.3
325.7	14.3	P	V	14.0	1.4	-3.5	26.2	47.0	20.8
344.6	16.3	P	V	14.0	1.5	-3.5	28.3	47.0	18.7
352.8	14.7	P	V	14.8	1.5	-3.5	27.5	47.0	19.5
434.1	17.3	P	V	16.2	1.7	-3.5	31.6	47.0	15.4
461.2	18.9	P	V	16.4	1.7	-3.5	33.5	47.0	13.5
488.3	22.2	P	V	17.3	1.8	-3.5	37.8	47.0	9.2
501.5	14.8	P	V	17.6	1.8	-3.5	30.7	47.0	16.3
516.3	23.9	P	V	18.1	1.8	-3.5	40.3	47.0	6.7
542.5	20.1	P	V	17.3	1.9	-3.5	35.7	47.0	11.3
556.3	13.4	P	V	18.3	1.9	-3.5	30.1	47.0	16.9
570.0	16.7	P	V	18.4	1.9	-3.5	33.4	47.0	13.6
597.5	16.3	P	V	18.6	2.0	-3.5	33.4	47.0	13.6
611.3	16.0	P	V	18.7	2.0	-3.5	33.2	47.0	13.8
625.0	18.0	P	V	19.5	2.0	-3.5	36.0	47.0	11.0
633.8	16.3	P	V	19.7	2.0	-3.5	34.5	47.0	12.5
651.3	17.9	P	V	19.3	2.1	-3.5	35.8	47.0	11.2
678.8	16.6	P	V	20.2	2.1	-3.5	35.4	47.0	11.6
706.3	15.3	P	V	20.8	2.2	-3.5	34.8	47.0	12.2
787.5	13.4	P	V	21.3	2.3	-3.5	33.4	47.0	13.6
813.8	12.6	P	V	20.8	2.4	-3.5	32.3	47.0	14.7
868.8	12.0	P	V	22.0	2.4	-3.5	32.9	47.0	14.1
968.8	10.9	P	V	23.2	2.6	-3.5	33.2	47.0	13.8
1000.0	10.7	P	V	23.5	2.6	-3.5	33.3	47.0	13.7



Configuration	Model RDR-80031AKU, S/N F050000012; 11/25/2019
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Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
30.0	9.1	P	H	13.8	0.4	0.0	23.3	40.0	16.7
31.7	14.0	P	H	13.2	0.4	0.0	27.6	40.0	12.4
55.4	12.7	P	H	9.3	0.5	0.0	22.5	40.0	17.5
58.7	14.3	P	H	9.2	0.5	0.0	24.1	40.0	15.9
63.7	17.0	P	H	9.3	0.6	0.0	26.9	40.0	13.1
119.0	15.7	P	H	11.5	0.8	0.0	28.0	40.0	12.0
120.1	17.0	P	H	11.6	0.8	0.0	29.5	40.0	10.5
135.5	15.8	P	H	12.4	0.9	0.0	29.1	40.0	10.9
143.8	15.4	P	H	12.6	0.9	0.0	28.9	40.0	11.1
149.3	14.0	P	H	12.8	0.9	0.0	27.8	40.0	12.2
162.6	14.2	P	H	12.9	1.0	0.0	28.1	40.0	11.9
177.5	13.7	P	H	13.3	1.0	0.0	28.0	40.0	12.0
203.5	14.0	P	H	14.4	1.1	0.0	29.5	40.0	10.5
221.2	14.9	P	H	15.0	1.1	0.0	31.1	40.0	8.9
225.6	14.5	P	H	15.1	1.1	0.0	30.8	40.0	9.2
226.1	15.9	P	H	15.1	1.1	0.0	32.2	40.0	7.8
232.2	15.5	P	H	15.1	1.2	0.0	31.8	47.0	15.2
249.5	11.1	P	H	11.9	1.2	0.0	24.2	47.0	22.8
251.0	11.5	P	H	15.5	1.2	0.0	28.2	47.0	18.8
266.5	14.1	P	H	12.3	1.3	0.0	27.6	47.0	19.4
270.9	17.4	P	H	12.5	1.3	0.0	31.2	47.0	15.8
271.5	15.8	P	H	12.6	1.3	0.0	29.6	47.0	17.4
287.9	15.9	P	H	13.5	1.3	0.0	30.7	47.0	16.3
298.6	23.0	P	H	13.8	1.3	0.0	38.1	47.0	8.9
325.7	21.9	P	H	14.0	1.4	0.0	37.3	47.0	9.7
339.0	16.6	P	H	13.9	1.4	0.0	32.0	47.0	15.0
352.5	9.9	Q	H	14.7	1.5	0.0	26.1	47.0	20.9
352.8	24.4	P	H	14.8	1.5	0.0	40.6	47.0	6.4
379.9	11.0	P	H	14.5	1.5	0.0	27.1	47.0	19.9
432.2	14.2	P	H	16.3	1.7	0.0	32.1	47.0	14.9
434.1	14.9	P	H	16.2	1.7	0.0	32.8	47.0	14.2
461.2	14.0	P	H	16.4	1.7	0.0	32.1	47.0	14.9
461.2	14.9	P	H	16.4	1.7	0.0	33.0	47.0	14.0
461.2	15.7	P	H	16.4	1.7	0.0	33.8	47.0	13.2
474.4	15.1	P	H	16.8	1.7	0.0	33.7	47.0	13.3
488.3	16.3	P	H	17.3	1.8	0.0	35.3	47.0	11.7
501.5	17.3	P	H	17.6	1.8	0.0	36.7	47.0	10.3
502.5	17.1	P	H	17.6	1.8	0.0	36.5	47.0	10.5
530.0	18.4	P	H	17.6	1.9	0.0	37.9	47.0	9.1
542.5	14.7	P	H	17.3	1.9	0.0	33.8	47.0	13.2
583.8	13.7	P	H	18.3	1.9	0.0	33.9	47.0	13.1
583.8	15.2	P	H	18.3	1.9	0.0	35.5	47.0	11.5
611.3	14.4	P	H	18.7	2.0	0.0	35.1	47.0	11.9
637.5	13.4	P	H	19.6	2.1	0.0	35.1	47.0	11.9
665.0	13.7	P	H	19.7	2.1	0.0	35.6	47.0	11.4
778.8	10.9	P	H	21.5	2.3	0.0	34.7	47.0	12.3
821.3	12.1	P	H	21.3	2.4	0.0	35.8	47.0	11.2
896.3	12.8	P	H	21.7	2.5	0.0	36.9	47.0	10.1
922.5	12.7	P	H	23.6	2.5	0.0	38.8	47.0	8.2
950.0	13.8	P	H	23.0	2.6	0.0	39.4	47.0	7.6
977.5	16.3	P	H	22.5	2.6	0.0	41.4	47.0	5.6



Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
1000.0	10.6	P	H	23.5	2.6	0.0	36.8	47.0	10.2
30.0	9.3	P	V	13.8	0.4	0.0	23.4	40.0	16.6
44.4	13.7	P	V	10.3	0.5	0.0	24.5	40.0	15.5
54.3	13.9	P	V	9.3	0.5	0.0	23.7	40.0	16.3
54.3	14.5	P	V	9.3	0.5	0.0	24.3	40.0	15.7
58.7	17.4	P	V	9.2	0.5	0.0	27.2	40.0	12.8
59.8	19.4	P	V	9.2	0.5	0.0	29.2	40.0	10.8
63.7	18.4	P	V	9.3	0.6	0.0	28.3	40.0	11.7
69.8	17.5	P	V	9.2	0.6	0.0	27.3	40.0	12.7
71.4	15.9	P	V	9.3	0.6	0.0	25.8	40.0	14.2
72.0	15.5	P	V	9.3	0.6	0.0	25.4	40.0	14.6
90.8	18.0	P	V	9.8	0.7	0.0	28.5	40.0	11.5
122.8	19.0	P	V	11.8	0.8	0.0	31.6	40.0	8.4
135.5	19.6	P	V	12.4	0.9	0.0	32.9	40.0	7.1
143.8	20.5	P	V	12.6	0.9	0.0	34.0	40.0	6.0
149.3	18.1	P	V	12.8	0.9	0.0	31.9	40.0	8.1
162.6	17.8	P	V	12.9	1.0	0.0	31.7	40.0	8.3
203.5	14.7	P	V	14.4	1.1	0.0	30.2	40.0	9.8
238.3	13.6	P	V	15.2	1.2	0.0	30.0	47.0	17.0
250.8	9.7	P	V	11.9	1.2	0.0	22.8	47.0	24.2
251.0	11.4	P	V	15.5	1.2	0.0	28.1	47.0	18.9
270.9	13.3	P	V	12.5	1.3	0.0	27.0	47.0	20.0
276.6	13.6	P	V	13.1	1.3	0.0	28.0	47.0	19.0
298.6	19.9	P	V	13.8	1.3	0.0	35.0	47.0	12.0
325.7	19.2	P	V	14.0	1.4	0.0	34.6	47.0	12.4
352.8	21.1	P	V	14.8	1.5	0.0	37.4	47.0	9.6
432.2	13.3	P	V	16.3	1.7	0.0	31.2	47.0	15.8
434.1	15.8	P	V	16.2	1.7	0.0	33.6	47.0	13.4
477.6	12.0	P	V	16.7	1.8	0.0	30.5	47.0	16.5
481.3	11.6	P	V	16.9	1.8	0.0	30.3	47.0	16.7
501.5	12.4	P	V	17.6	1.8	0.0	31.8	47.0	15.2
502.5	13.3	P	V	17.6	1.8	0.0	32.7	47.0	14.3
516.3	14.3	P	V	18.1	1.8	0.0	34.2	47.0	12.8
530.0	14.1	P	V	17.6	1.9	0.0	33.6	47.0	13.4
542.5	13.0	P	V	17.3	1.9	0.0	32.2	47.0	14.8
542.5	13.9	P	V	17.3	1.9	0.0	33.1	47.0	13.9
570.0	13.3	P	V	18.4	1.9	0.0	33.6	47.0	13.4
583.8	15.9	P	V	18.3	1.9	0.0	36.2	47.0	10.8
597.5	16.0	P	V	18.6	2.0	0.0	36.6	47.0	10.4
625.0	15.6	P	V	19.5	2.0	0.0	37.2	47.0	9.8
637.5	14.3	P	V	19.6	2.1	0.0	36.0	47.0	11.0
666.3	14.9	P	V	19.8	2.1	0.0	36.9	47.0	10.1
678.8	13.9	P	V	20.2	2.1	0.0	36.3	47.0	10.7
706.3	13.3	P	V	20.8	2.2	0.0	36.2	47.0	10.8
706.3	16.0	P	V	20.8	2.2	0.0	38.9	47.0	8.1
732.5	13.9	P	V	20.3	2.2	0.0	36.4	47.0	10.6
841.3	12.5	P	V	22.6	2.4	0.0	37.5	47.0	9.5
842.5	11.3	P	V	22.7	2.4	0.0	36.4	47.0	10.6
868.8	12.7	P	V	22.0	2.4	0.0	37.2	47.0	9.8
977.5	14.0	P	V	22.5	2.6	0.0	39.2	47.0	7.8
1000.0	10.6	P	V	23.5	2.6	0.0	36.7	47.0	10.3



Configuration Model RDR-80531AKU, S/N F050000014, without SIM Card; 11/25/2019

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
30.0	10.3	P	H	13.8	0.4	0.0	24.5	40.0	15.5
56.0	14.2	P	H	9.3	0.5	0.0	24.0	40.0	16.0
63.7	17.1	P	H	9.3	0.6	0.0	27.0	40.0	13.0
110.7	14.8	P	H	10.9	0.8	0.0	26.5	40.0	13.5
115.6	17.2	P	H	11.3	0.8	0.0	29.3	40.0	10.7
120.6	17.4	P	H	11.6	0.8	0.0	29.8	40.0	10.2
121.7	17.5	P	H	11.8	0.8	0.0	30.1	40.0	9.9
135.5	15.7	P	H	12.4	0.9	0.0	28.9	40.0	11.1
143.8	15.6	P	H	12.6	0.9	0.0	29.1	40.0	10.9
149.3	14.6	P	H	12.8	0.9	0.0	28.3	40.0	11.7
153.8	13.2	P	H	12.8	0.9	0.0	26.9	40.0	13.1
156.0	13.8	P	H	12.8	1.0	0.0	27.5	40.0	12.5
162.6	14.4	P	H	12.9	1.0	0.0	28.3	40.0	11.7
203.4	18.2	Q	H	14.4	1.1	0.0	33.7	40.0	6.3
203.5	17.8	P	H	14.4	1.1	0.0	33.3	40.0	6.7
226.1	17.0	P	H	15.1	1.1	0.0	33.2	40.0	6.8
233.3	17.1	P	H	15.1	1.2	0.0	33.3	47.0	13.7
251.0	11.5	P	H	15.5	1.2	0.0	28.2	47.0	18.8
266.5	13.9	P	H	12.3	1.3	0.0	27.5	47.0	19.5
270.9	17.9	P	H	12.5	1.3	0.0	31.6	47.0	15.4
287.9	16.4	P	H	13.5	1.3	0.0	31.2	47.0	15.8
298.6	21.5	P	H	13.8	1.3	0.0	36.6	47.0	10.4
315.0	14.1	P	H	14.7	1.4	0.0	30.2	47.0	16.8
325.7	20.7	P	H	14.0	1.4	0.0	36.2	47.0	10.8
335.8	14.7	P	H	13.9	1.4	0.0	30.0	47.0	17.0
352.8	23.0	P	H	14.8	1.5	0.0	39.3	47.0	7.7
366.0	13.9	P	H	14.4	1.5	0.0	29.9	47.0	17.1
384.3	13.6	P	H	14.5	1.5	0.0	29.6	47.0	17.4
407.0	13.9	P	H	15.2	1.6	0.0	30.7	47.0	16.3
432.2	16.0	P	H	16.3	1.7	0.0	33.9	47.0	13.1
434.1	16.2	P	H	16.2	1.7	0.0	34.1	47.0	12.9
461.2	17.2	P	H	16.4	1.7	0.0	35.3	47.0	11.7
474.4	16.1	P	H	16.8	1.7	0.0	34.6	47.0	12.4
480.1	14.0	P	H	16.8	1.8	0.0	32.5	47.0	14.5
488.3	16.6	P	H	17.3	1.8	0.0	35.7	47.0	11.3
502.5	17.4	P	H	17.6	1.8	0.0	36.8	47.0	10.2
516.3	15.1	P	H	18.1	1.8	0.0	35.1	47.0	11.9
530.0	16.6	P	H	17.6	1.9	0.0	36.0	47.0	11.0
542.5	13.5	P	H	17.3	1.9	0.0	32.7	47.0	14.3
597.5	15.8	P	H	18.6	2.0	0.0	36.4	47.0	10.6
611.3	14.7	P	H	18.7	2.0	0.0	35.4	47.0	11.6
625.0	15.5	P	H	19.5	2.0	0.0	37.0	47.0	10.0
637.5	13.2	P	H	19.6	2.1	0.0	34.9	47.0	12.1
663.8	14.5	P	H	19.6	2.1	0.0	36.3	47.0	10.7
692.5	14.1	P	H	20.5	2.1	0.0	36.7	47.0	10.3
755.0	10.4	P	H	21.5	2.2	0.0	34.1	47.0	12.9
763.8	14.4	P	H	21.4	2.3	0.0	38.0	47.0	9.0
831.3	12.5	P	H	21.9	2.4	0.0	36.8	47.0	10.2
895.0	13.7	P	H	21.8	2.5	0.0	38.0	47.0	9.0
922.5	13.3	P	H	23.6	2.5	0.0	39.4	47.0	7.6
949.2	13.5	Q	H	23.0	2.6	0.0	39.0	47.0	8.0



Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
950.0	16.1	P	H	23.0	2.6	0.0	41.6	47.0	5.4
977.5	16.0	P	H	22.5	2.6	0.0	41.1	47.0	5.9
990.0	14.2	P	H	23.3	2.6	0.0	40.2	47.0	6.8
1000.0	10.9	P	H	23.5	2.6	0.0	37.1	47.0	9.9
30.0	9.5	P	V	13.8	0.4	0.0	23.6	40.0	16.4
40.5	13.3	P	V	11.1	0.4	0.0	24.8	40.0	15.2
42.2	13.6	P	V	10.6	0.5	0.0	24.6	40.0	15.4
48.8	12.8	P	V	9.7	0.5	0.0	23.0	40.0	17.0
52.7	12.9	P	V	9.4	0.5	0.0	22.8	40.0	17.2
54.3	14.3	P	V	9.3	0.5	0.0	24.1	40.0	15.9
57.6	20.8	P	V	9.2	0.5	0.0	30.5	40.0	9.5
60.4	18.2	P	V	9.2	0.5	0.0	27.9	40.0	12.1
61.5	24.2	P	V	9.2	0.6	0.0	33.9	40.0	6.1
63.7	18.5	P	V	9.3	0.6	0.0	28.4	40.0	11.6
70.9	16.3	P	V	9.3	0.6	0.0	26.2	40.0	13.8
72.5	16.8	P	V	9.3	0.6	0.0	26.7	40.0	13.3
78.6	16.6	P	V	9.4	0.6	0.0	26.6	40.0	13.4
83.6	18.0	P	V	9.5	0.7	0.0	28.2	40.0	11.8
106.8	18.3	P	V	10.7	0.8	0.0	29.8	40.0	10.2
114.5	19.9	P	V	11.2	0.8	0.0	31.9	40.0	8.1
120.1	18.9	P	V	11.6	0.8	0.0	31.3	40.0	8.7
121.7	18.9	P	V	11.8	0.8	0.0	31.6	40.0	8.4
135.5	20.7	P	V	12.4	0.9	0.0	34.0	40.0	6.0
143.8	19.8	P	V	12.6	0.9	0.0	33.3	40.0	6.7
144.0	18.1	Q	V	12.6	0.9	0.0	31.6	40.0	8.4
149.3	19.6	P	V	12.8	0.9	0.0	33.3	40.0	6.7
162.6	19.8	P	V	12.9	1.0	0.0	33.7	40.0	6.3
174.8	13.6	P	V	13.2	1.0	0.0	27.8	40.0	12.2
203.4	17.2	Q	V	14.4	1.1	0.0	32.7	40.0	7.3
235.5	11.2	P	V	15.1	1.2	0.0	27.5	47.0	19.5
237.2	12.1	P	V	15.1	1.2	0.0	28.4	47.0	18.6
251.0	11.3	P	V	15.5	1.2	0.0	28.0	47.0	19.0
257.7	12.2	P	V	12.1	1.2	0.0	25.6	47.0	21.4
268.4	19.2	P	V	12.3	1.3	0.0	32.8	47.0	14.2
276.6	18.0	P	V	13.1	1.3	0.0	32.3	47.0	14.7
298.6	19.6	P	V	13.8	1.3	0.0	34.8	47.0	12.2
310.0	14.2	P	V	14.9	1.4	0.0	30.5	47.0	16.5
315.0	14.6	P	V	14.7	1.4	0.0	30.7	47.0	16.3
325.7	20.5	P	V	14.0	1.4	0.0	35.9	47.0	11.1
352.8	20.8	P	V	14.8	1.5	0.0	37.1	47.0	9.9
366.0	13.5	P	V	14.4	1.5	0.0	29.4	47.0	17.6
407.0	14.3	P	V	15.2	1.6	0.0	31.1	47.0	15.9
425.9	14.4	P	V	16.3	1.6	0.0	32.4	47.0	14.6
432.2	16.6	P	V	16.3	1.7	0.0	34.6	47.0	12.4
434.1	14.1	P	V	16.2	1.7	0.0	32.0	47.0	15.0
448.0	11.3	P	V	16.1	1.7	0.0	29.1	47.0	17.9
460.5	13.1	P	V	16.3	1.7	0.0	31.2	47.0	15.8
501.5	12.4	P	V	17.6	1.8	0.0	31.8	47.0	15.2
528.8	12.5	P	V	17.6	1.9	0.0	32.0	47.0	15.0
597.5	14.4	P	V	18.6	2.0	0.0	35.0	47.0	12.0
611.3	14.9	P	V	18.7	2.0	0.0	35.7	47.0	11.3
625.0	16.3	P	V	19.5	2.0	0.0	37.8	47.0	9.2
637.5	13.6	P	V	19.6	2.1	0.0	35.3	47.0	11.7
651.3	14.4	P	V	19.3	2.1	0.0	35.8	47.0	11.2



Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
665.0	14.7	P	V	19.7	2.1	0.0	36.5	47.0	10.5
678.8	13.2	P	V	20.2	2.1	0.0	35.5	47.0	11.5
692.5	13.0	P	V	20.5	2.1	0.0	35.6	47.0	11.4
732.5	13.5	P	V	20.3	2.2	0.0	36.0	47.0	11.0
796.3	10.7	P	V	20.3	2.3	0.0	33.3	47.0	13.7
841.3	13.0	P	V	22.6	2.4	0.0	38.0	47.0	9.0
853.8	11.3	P	V	22.6	2.4	0.0	36.3	47.0	10.7
871.3	11.0	P	V	22.0	2.4	0.0	35.5	47.0	11.5
923.8	10.3	P	V	23.4	2.5	0.0	36.2	47.0	10.8
977.5	12.9	P	V	22.5	2.6	0.0	38.0	47.0	9.0
1000.0	11.2	P	V	23.5	2.6	0.0	37.3	47.0	9.7

Configuration	Model RDR-80031AK7, S/N F050000014, with SIM Card. 11/25/2019
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Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
30.0	10.2	P	H	13.8	0.4	0.0	24.4	40.0	15.6
59.8	14.3	P	H	9.2	0.5	0.0	24.0	40.0	16.0
63.7	17.6	P	H	9.3	0.6	0.0	27.5	40.0	12.5
120.1	19.1	P	H	11.6	0.8	0.0	31.5	40.0	8.5
135.5	14.7	P	H	12.4	0.9	0.0	27.9	40.0	12.1
143.8	14.5	P	H	12.6	0.9	0.0	28.0	40.0	12.0
149.3	13.1	P	H	12.8	0.9	0.0	26.8	40.0	13.2
162.6	14.3	P	H	12.9	1.0	0.0	28.2	40.0	11.8
203.5	8.7	Q	H	14.4	1.1	0.0	24.2	40.0	15.8
226.1	16.0	P	H	15.1	1.1	0.0	32.3	40.0	7.7
251.0	10.7	P	H	15.5	1.2	0.0	27.5	47.0	19.5
266.5	13.9	P	H	12.3	1.3	0.0	27.4	47.0	19.6
270.9	15.8	P	H	12.5	1.3	0.0	29.6	47.0	17.4
287.9	15.8	P	H	13.5	1.3	0.0	30.6	47.0	16.4
298.6	22.0	P	H	13.8	1.3	0.0	37.2	47.0	9.8
325.7	21.9	P	H	14.0	1.4	0.0	37.4	47.0	9.6
352.8	24.4	P	H	14.8	1.5	0.0	40.6	47.0	6.4
434.1	13.8	P	H	16.2	1.7	0.0	31.7	47.0	15.3
461.2	17.0	P	H	16.4	1.7	0.0	35.1	47.0	11.9
474.4	14.7	P	H	16.8	1.7	0.0	33.3	47.0	13.7
488.3	16.0	P	H	17.3	1.8	0.0	35.0	47.0	12.0
501.5	16.6	P	H	17.6	1.8	0.0	36.0	47.0	11.0
502.5	15.6	P	H	17.6	1.8	0.0	35.0	47.0	12.0
516.3	15.9	P	H	18.1	1.8	0.0	35.8	47.0	11.2
528.8	17.5	P	H	17.6	1.9	0.0	37.0	47.0	10.0
611.3	15.5	P	H	18.7	2.0	0.0	36.2	47.0	10.8
675.0	14.3	P	H	20.7	2.1	0.0	37.1	47.0	9.9
765.0	15.5	P	H	21.4	2.3	0.0	39.2	47.0	7.8
922.5	12.2	P	H	23.6	2.5	0.0	38.4	47.0	8.6
977.5	15.3	P	H	22.5	2.6	0.0	40.4	47.0	6.6
1000.0	11.8	P	H	23.5	2.6	0.0	38.0	47.0	9.0
30.0	9.2	P	V	13.8	0.4	0.0	23.4	40.0	16.6
59.8	18.1	P	V	9.2	0.5	0.0	27.9	40.0	12.1
71.4	16.7	P	V	9.3	0.6	0.0	26.6	40.0	13.4
111.2	19.1	P	V	11.0	0.8	0.0	30.9	40.0	9.1



Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
121.7	18.9	P	V	11.8	0.8	0.0	31.6	40.0	8.4
135.5	20.1	P	V	12.4	0.9	0.0	33.4	40.0	6.6
143.8	20.0	P	V	12.6	0.9	0.0	33.5	40.0	6.5
149.3	19.0	P	V	12.8	0.9	0.0	32.7	40.0	7.3
162.6	19.1	P	V	12.9	1.0	0.0	33.0	40.0	7.0
176.4	13.4	P	V	13.2	1.0	0.0	27.6	40.0	12.4
203.5	19.2	P	V	14.4	1.1	0.0	34.7	40.0	5.3
238.3	13.6	P	V	15.2	1.2	0.0	30.0	47.0	17.0
251.0	11.1	P	V	15.5	1.2	0.0	27.8	47.0	19.2
257.7	12.0	P	V	12.1	1.2	0.0	25.3	47.0	21.7
275.3	13.2	P	V	12.9	1.3	0.0	27.4	47.0	19.6
298.6	17.3	P	V	13.8	1.3	0.0	32.5	47.0	14.5
315.0	13.8	P	V	14.7	1.4	0.0	29.9	47.0	17.1
325.7	19.5	P	V	14.0	1.4	0.0	34.9	47.0	12.1
352.8	19.6	P	V	14.8	1.5	0.0	35.8	47.0	11.2
434.1	14.3	P	V	16.2	1.7	0.0	32.2	47.0	14.8
472.5	11.9	P	V	16.8	1.7	0.0	30.4	47.0	16.6
501.5	12.8	P	V	17.6	1.8	0.0	32.2	47.0	14.8
516.3	12.3	P	V	18.1	1.8	0.0	32.2	47.0	14.8
528.8	14.3	P	V	17.6	1.9	0.0	33.8	47.0	13.2
583.8	12.6	P	V	18.3	1.9	0.0	32.9	47.0	14.1
597.5	14.6	P	V	18.6	2.0	0.0	35.2	47.0	11.8
625.0	13.6	P	V	19.5	2.0	0.0	35.1	47.0	11.9
660.0	16.5	P	V	19.4	2.1	0.0	38.0	47.0	9.0
722.5	13.5	P	V	20.0	2.2	0.0	35.6	47.0	11.4
811.3	15.5	P	V	20.5	2.4	0.0	38.4	47.0	8.6
923.8	10.6	P	V	23.4	2.5	0.0	36.5	47.0	10.5
1000.0	11.0	P	V	23.5	2.6	0.0	37.1	47.0	9.9

Configuration	Model RDR-80531AK7, S/N F055000018. 9 VAC adapter; 12/06/2019
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Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
30.0	9.0	P	H	13.8	0.4	0.0	23.2	40.0	16.8
59.8	19.6	P	H	9.2	0.5	0.0	29.4	40.0	10.6
63.7	16.5	P	H	9.3	0.6	0.0	26.4	40.0	13.6
81.4	18.4	P	H	9.3	0.7	0.0	28.4	40.0	11.6
128.9	18.0	P	H	12.1	0.8	0.0	31.0	40.0	9.0
143.8	20.4	P	H	12.6	0.9	0.0	33.9	40.0	6.1
180.8	14.3	P	H	13.4	1.0	0.0	28.7	40.0	11.3
203.5	7.7	Q	H	14.4	1.1	0.0	23.2	40.0	16.8
226.7	15.6	P	H	15.1	1.1	0.0	31.8	40.0	8.2
251.0	11.0	P	H	15.5	1.2	0.0	27.7	47.0	19.3
266.5	14.6	P	H	12.3	1.3	0.0	28.1	47.0	18.9
270.9	15.4	P	H	12.5	1.3	0.0	29.2	47.0	17.8
287.9	16.1	P	H	13.5	1.3	0.0	30.9	47.0	16.1
298.6	17.7	P	H	13.8	1.3	0.0	32.9	47.0	14.1
315.0	15.5	P	H	14.7	1.4	0.0	31.6	47.0	15.4
325.7	25.4	P	H	14.0	1.4	0.0	40.8	47.0	6.2
335.8	19.1	P	H	13.9	1.4	0.0	34.4	47.0	12.6
352.5	12.9	Q	H	14.7	1.5	0.0	29.1	47.0	17.9



Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
384.3	15.2	P	H	14.5	1.5	0.0	31.2	47.0	15.8
432.2	16.1	P	H	16.3	1.7	0.0	34.0	47.0	13.0
461.2	16.9	P	H	16.4	1.7	0.0	35.0	47.0	12.0
474.4	18.0	P	H	16.8	1.7	0.0	36.5	47.0	10.5
502.5	16.1	P	H	17.6	1.8	0.0	35.5	47.0	11.5
516.3	17.3	P	H	18.1	1.8	0.0	37.2	47.0	9.8
556.3	15.2	P	H	18.3	1.9	0.0	35.4	47.0	11.6
583.8	14.2	P	H	18.3	1.9	0.0	34.5	47.0	12.5
666.3	12.8	P	H	19.8	2.1	0.0	34.8	47.0	12.2
807.5	10.4	P	H	20.3	2.4	0.0	33.0	47.0	14.0
948.8	9.6	P	H	23.0	2.6	0.0	35.2	47.0	11.8
1000.0	12.4	P	H	23.5	2.6	0.0	38.5	47.0	8.5
30.0	13.3	P	V	13.8	0.4	0.0	27.5	40.0	12.5
37.2	20.8	Q	V	11.7	0.4	0.0	32.9	40.0	7.1
44.9	20.4	P	V	10.3	0.5	0.0	31.1	40.0	8.9
49.9	15.0	P	V	9.5	0.5	0.0	25.0	40.0	15.0
58.7	20.0	P	V	9.2	0.5	0.0	29.7	40.0	10.3
81.4	24.0	P	V	9.3	0.7	0.0	34.0	40.0	6.0
96.3	18.0	P	V	10.0	0.7	0.0	28.7	40.0	11.3
129.4	16.6	P	V	12.1	0.8	0.0	29.5	40.0	10.5
135.5	20.1	P	V	12.4	0.9	0.0	33.4	40.0	6.6
143.8	20.9	P	V	12.6	0.9	0.0	34.4	40.0	5.6
168.7	11.1	P	V	13.0	1.0	0.0	25.1	40.0	14.9
203.5	18.2	P	V	14.4	1.1	0.0	33.7	40.0	6.3
237.7	12.0	P	V	15.2	1.2	0.0	28.4	47.0	18.6
251.0	11.6	P	V	15.5	1.2	0.0	28.3	47.0	18.7
270.9	16.0	P	V	12.5	1.3	0.0	29.8	47.0	17.2
287.9	15.7	P	V	13.5	1.3	0.0	30.5	47.0	16.5
298.6	15.9	P	V	13.8	1.3	0.0	31.0	47.0	16.0
325.7	19.8	P	V	14.0	1.4	0.0	35.2	47.0	11.8
352.8	18.2	P	V	14.8	1.5	0.0	34.5	47.0	12.5
384.3	15.0	P	V	14.5	1.5	0.0	31.1	47.0	15.9
407.0	14.7	P	V	15.2	1.6	0.0	31.5	47.0	15.5
432.2	14.7	P	V	16.3	1.7	0.0	32.6	47.0	14.4
479.5	11.9	P	V	16.8	1.8	0.0	30.5	47.0	16.5
501.5	11.0	P	V	17.6	1.8	0.0	30.4	47.0	16.6
516.3	13.2	P	V	18.1	1.8	0.0	33.2	47.0	13.8
528.8	14.2	P	V	17.6	1.9	0.0	33.7	47.0	13.3
556.3	12.9	P	V	18.3	1.9	0.0	33.1	47.0	13.9
583.8	13.1	P	V	18.3	1.9	0.0	33.3	47.0	13.7
597.5	13.3	P	V	18.6	2.0	0.0	33.9	47.0	13.1
611.3	14.2	P	V	18.7	2.0	0.0	34.9	47.0	12.1
637.5	12.8	P	V	19.6	2.1	0.0	34.4	47.0	12.6
665.0	13.0	P	V	19.7	2.1	0.0	34.8	47.0	12.2
678.8	14.1	P	V	20.2	2.1	0.0	36.4	47.0	10.6
811.3	10.2	P	V	20.5	2.4	0.0	33.0	47.0	14.0
916.3	12.0	P	V	22.4	2.5	0.0	36.9	47.0	10.1
1000.0	10.4	P	V	23.5	2.6	0.0	36.5	47.0	10.5



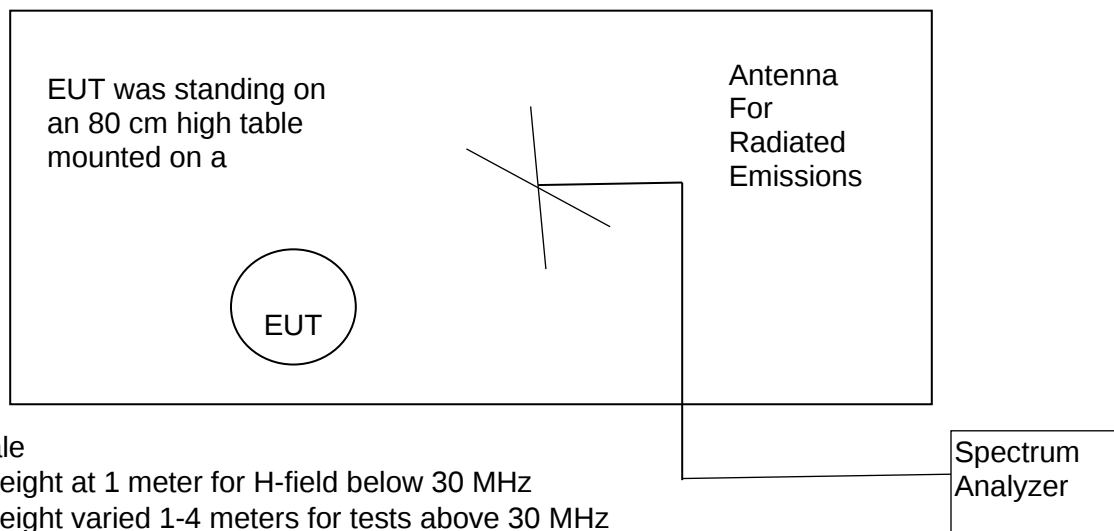
Test Date	12/06/2019
Configuration	Model RDR-80531AK5, S/N F05S000012

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Antenna Factor	Cable & Amp Factors	Distance Factor dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
60.9	14.5	P	H	9.2	0.8	0.0	24.5	40.0	15.5
95.7	11.5	P	H	10.0	1.0	0.0	22.5	40.0	17.5
120.1	13.4	P	H	11.6	1.1	0.0	26.2	40.0	13.8
132.2	14.1	P	H	12.2	1.2	0.0	27.4	40.0	12.6
143.8	13.0	P	H	12.6	1.2	0.0	26.9	40.0	13.1
203.5	17.7	P	H	14.4	1.5	0.0	33.6	40.0	6.4
222.8	13.5	P	H	15.0	1.5	0.0	30.0	40.0	10.0
243.8	13.3	P	H	15.2	1.6	0.0	30.1	47.0	16.9
270.9	23.3	P	H	12.5	1.7	0.0	37.5	47.0	9.5
286.7	18.9	P	H	13.5	1.8	0.0	34.2	47.0	12.8
298.6	23.0	P	H	13.8	1.8	0.0	38.6	47.0	8.4
325.7	20.3	P	H	14.0	1.9	0.0	36.2	47.0	10.8
352.8	23.8	Q	H	14.8	2.0	0.0	40.5	47.0	6.5
384.3	18.6	P	H	14.5	2.0	0.0	35.1	47.0	11.9
432.2	18.4	P	H	16.3	2.2	0.0	36.9	47.0	10.1
461.2	18.3	P	H	16.4	2.3	0.0	37.0	47.0	10.0
488.3	15.8	P	H	17.3	2.3	0.0	35.4	47.0	11.6
516.3	16.4	P	H	18.1	2.4	0.0	36.9	47.0	10.1
542.5	16.3	P	H	17.3	2.5	0.0	36.0	47.0	11.0
570.0	14.9	P	H	18.4	2.5	0.0	35.8	47.0	11.2
597.5	15.0	P	H	18.6	2.6	0.0	36.2	47.0	10.8
625.0	15.5	P	H	19.5	2.7	0.0	37.7	47.0	9.3
651.3	13.7	P	H	19.3	2.7	0.0	35.7	47.0	11.3
666.3	15.4	P	H	19.8	2.8	0.0	37.9	47.0	9.1
760.0	11.8	P	H	21.4	3.0	0.0	36.2	47.0	10.8
960.0	8.7	P	H	23.8	3.4	0.0	35.8	47.0	11.2
45.5	21.5	P	V	10.1	0.7	0.0	32.3	40.0	7.7
68.1	11.2	Q	V	9.3	0.8	0.0	21.3	40.0	18.7
95.7	17.6	P	V	10.0	1.0	0.0	28.6	40.0	11.4
120.1	21.5	P	V	11.6	1.1	0.0	34.2	40.0	5.8
143.8	20.2	Q	V	12.6	1.2	0.0	34.0	40.0	6.0
203.5	17.6	Q	V	14.4	1.5	0.0	33.5	40.0	6.5
239.9	13.9	P	V	15.2	1.6	0.0	30.7	47.0	16.3
271.5	16.5	P	V	12.6	1.7	0.0	30.8	47.0	16.2
298.6	19.3	P	V	13.8	1.8	0.0	34.9	47.0	12.1
325.7	17.3	P	V	14.0	1.9	0.0	33.2	47.0	13.8
352.8	20.1	P	V	14.8	2.0	0.0	36.9	47.0	10.1
381.8	11.0	P	V	14.5	2.0	0.0	27.5	47.0	19.5
485.1	11.4	P	V	17.1	2.3	0.0	30.8	47.0	16.2
528.8	12.6	P	V	17.6	2.4	0.0	32.6	47.0	14.4
556.3	13.4	P	V	18.3	2.5	0.0	34.1	47.0	12.9
570.0	13.2	P	V	18.4	2.5	0.0	34.1	47.0	12.9
611.3	13.5	P	V	18.7	2.6	0.0	34.8	47.0	12.2
666.3	18.6	P	V	19.8	2.8	0.0	41.1	47.0	5.9
752.5	10.3	P	V	21.6	2.9	0.0	34.9	47.0	12.1
960.0	8.9	P	V	23.8	3.4	0.0	36.1	47.0	10.9

Judgment: Passed by 5.3 dB

**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 an AC outlet with low-pass filter on turntable

Frequency Range	Receive Antenna	Spectrum Analyzer
0.01 to 30 MHz	ANT-53	REC-21
30 to 200 MHz	ANT-80	REC-21
200 to 1000 MHz	ANT-06/07	REC-21

11.3 Magnetic Field Measurements and Decay Factor Calculations

Radiated emission measurements are performed with an EMCO shielded loop antenna. The antenna was 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 kHz to 490 kHz, the Specification Distance is 300m therefore the distance factor is $2 \cdot 20 \cdot \log(300/3) = 80$ dB.

From 490 kHz to 30 MHz, the Specification Distance is 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	12/06/2019
EUT	Model RDR-30081CKU; Serial Number: BT000051
Test Distance	3 Meters
Specification	FCC 15 & RSS-GEN
Notes	A shielded Loop Antenna was used for this test.
Tested by	Chris Dalessio; Joseph Strzelecki

Notes:

#1: Model RDR-80531AK7; Serial Number F05S000018

#2: Model RDR-80031AK7; Serial Number F050000014

#3: Model RDR-80541AKU-RSOP; Serial Number F05R000011

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	60.8	19.1	3.0	2.0	0.1	-80.0	0.0	25.7	25.7	#1
250.0	48.6	18.9	3.0	2.0	0.1	-80.0	-12.4	19.6	32.0	#1
375.0	44.9	18.9	3.0	2.0	0.1	-80.0	-16.1	16.1	32.2	#1
500.0	42.5	18.8	3.0	2.0	0.1	-40.0	21.4	33.6	12.2	#1
13560	54.4	16.8	3.0	2.0	0.4	-40.0	31.6	40.5	8.9	#1
27120	14.9	16.0	3.0	2.0	0.5	-40.0	-8.6	29.5	38.1	#1
125.0	61.2	19.1	3.0	2.0	0.1	-80.0	0.4	25.7	25.3	#2
250.0	48.8	18.9	3.0	2.0	0.1	-80.0	-12.2	19.6	31.8	#2
375.0	45.1	18.9	3.0	2.0	0.1	-80.0	-15.9	16.1	32.0	#2
500.0	42.1	18.8	3.0	2.0	0.1	-40.0	21.0	33.6	12.6	#2
13560	54.3	16.8	3.0	2.0	0.4	-40.0	31.5	40.5	9.0	#2
27120	15.3	16.0	3.0	2.0	0.5	-40.0	-8.2	29.5	37.7	#2
125.0	59.7	19.1	3.0	2.0	0.1	-80.0	-1.1	25.7	26.8	#3
250.0	45.0	18.9	3.0	2.0	0.1	-80.0	-16.0	19.6	35.6	#3
375.0	44.2	18.9	3.0	2.0	0.1	-80.0	-16.8	16.1	32.9	#3
500.0	42.0	18.8	3.0	2.0	0.1	-40.0	20.9	33.6	12.7	#3
13560	55.7	16.8	3.0	2.0	0.4	-40.0	32.9	40.5	7.6	#3
27120	20.0	16.0	3.0	2.0	0.5	-40.0	-3.5	29.5	33.0	#3

The limit shown at 13.56 MHz in the above table is the lowest limit from 15.225 sections (a), (b) and (c).

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.

The lower limit (40.5 dBuV/m) was used for all frequencies from 13.110-14.010 MHz.

All other limits are general limits of FCC 15.209 or the RSS-Gen.

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 7.6 dB.

11.4 Occupied Bandwidth Data

The occupied bandwidth of the RF output was measured using a spectrum analyzer using a peak detector function and a narrow resolution bandwidth. 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.

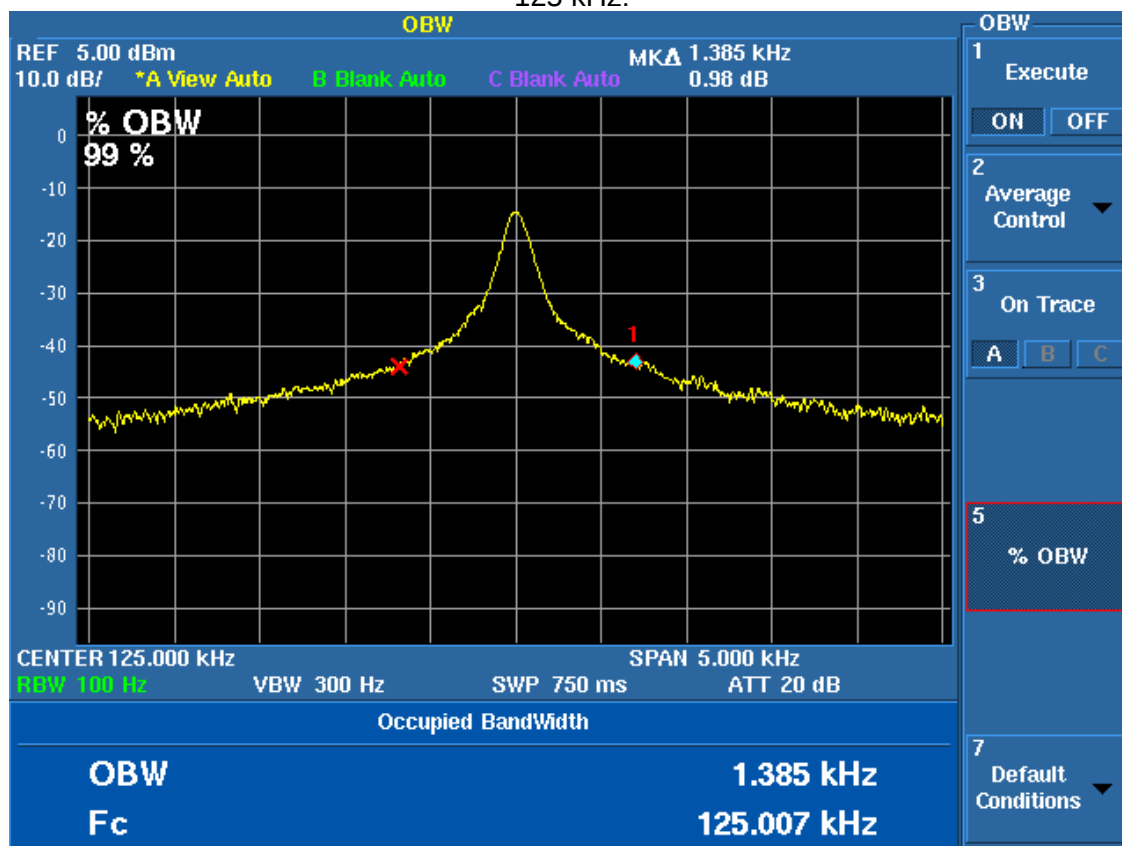
Model	RDR-80031AK7 RDR-80541AKU-RSOP RDR-80031AKU	Specification	FCC Part 15.225 RSS-210
Test Personnel	Richard Tichgelaar	Test Date	12/09/2019

99% OBW = 2.35 kHz

Judgement: Pass

Figure 3. Occupied Bandwidth Plot

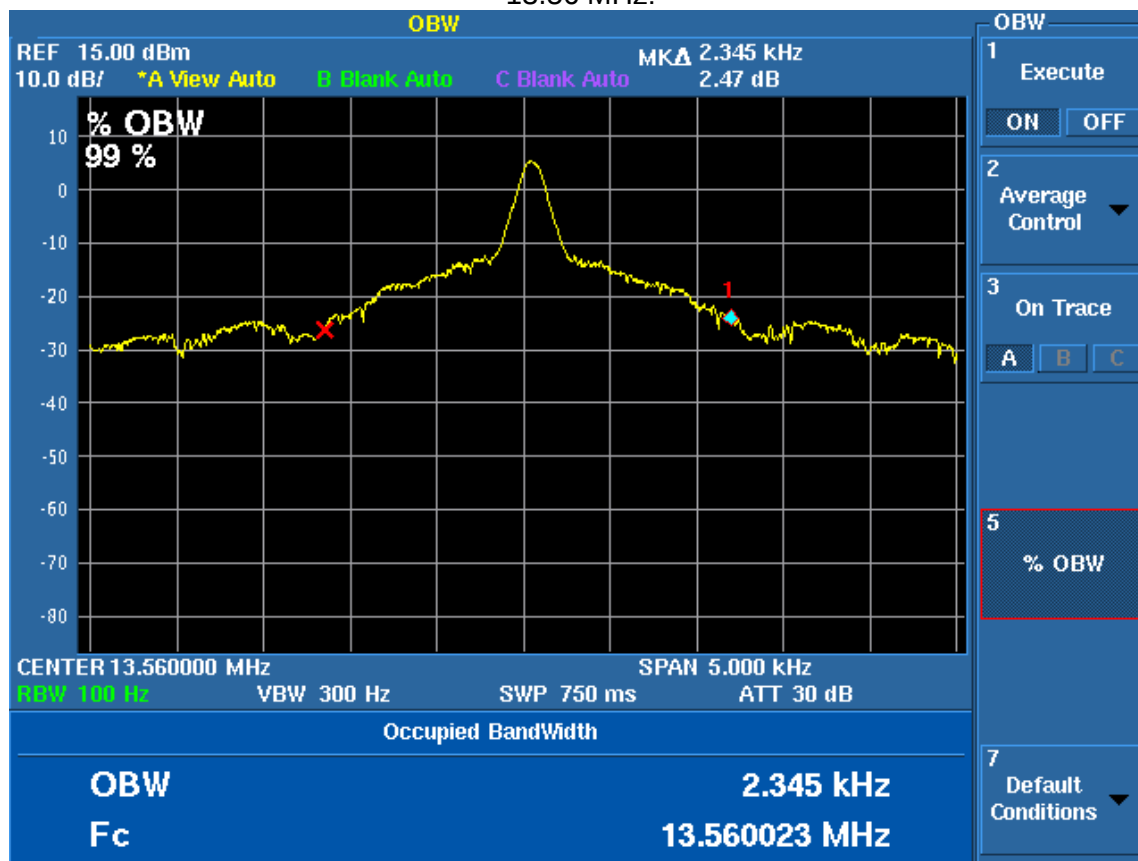
125 kHz:



Worst case OBW



13.56 MHz:



Worst case OBW

11.5 Frequency Stability

The tests were in accordance to 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-80031AK7	Specification	FCC Part 15.225 RSS-210 Section A2.6
Serial Number	F050000014	Test Date	12/10/2019
Test Personnel	Dave Jarvis	Test Location	Chamber B
Test Equipment	Spectrum Analyzer (REC-21); Temperature Chamber TC-01 Power Supply (PSA-02)		
Notes	10 minutes at each Temperature; 1 min at each voltage		
Nominal Frequency	13.560110 MHz		

Volts VAC	Freq. (MHz)	Deviation %	PPM
102.0	13.560085	-0.00018	-1.84
120.0	13.560100	-0.00007	-0.74
138.0	13.560090	-0.00015	-1.47

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



Temp. Deg C	Freq. (@0min.)	Freq. (@2min.)	Freq. (@5min.)	Freq. (@10min.)	Change from Nominal			
	(MHz)	(MHz)	(MHz)	(MHz)	% 0 min.	% 2 min.	% 5 min	% 10 min.
50	11:40	13.560090	13.560085	13.560085	-0.00015	-0.00018	-0.00018	-0.00015
40	11:55	13.560095	13.560095	13.560095	-0.00011	-0.00011	-0.00011	-0.00007
30	12:10	13.560120	13.560115	13.560125	0.00007	0.00004	0.00011	0.00000
20	11:25	13.560110	13.560100	13.560105	0.00000	-0.00007	-0.00004	-0.00004
10	13:00	13.560170	13.560200	13.560210	0.00044	0.00066	0.00074	0.00077
0	13:15	13.560230	13.560240	13.560235	0.00088	0.00096	0.00092	0.00092
-10	13:30	13.560225	13.560240	13.560235	0.00085	0.00096	0.00092	0.00096
-20	13:50	13.560215	13.560235	13.560215	0.00077	0.00092	0.00077	0.00092

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

Judgement: Pass

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
Frequency counter at Finch BLE; REC-21	136 Hz
99% Occupied Bandwidth using REC-43	1% of frequency span
Temperature THM-03	0.6 Deg C