



Electromagnetic Compatibility Test Report

Tests Performed on an RF IDEas, Inc.

Dual Frequency RFID Readers

Models RDR-80031BK5, RDR-80031BK6, RDR-80531BK5, & RDR-80531BK6

Radiometrics Document RP-9709A



<i>Product Detail:</i>		
FCC ID: M9MRNS0200 IC: 6571A-RNS0200 Equipment type: Dual Frequency 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: 2020		
This report concerns: Original Grant FCC Parts 15.209 and 15.225		
<i>Tests Performed For:</i>		<i>Test Facility:</i>
rf IDEAS, Inc. 425 Martingale Road, Suite 1680 Schaumburg, IL 60148		Radiometrics Midwest Corporation 12 East Devonwood Avenue Romeoville, IL 60446
<i>Test Completion Date</i>		
January 9, 2023		
Document RP-9709A Revisions:		
Rev.	Issue Date	Revised By
0	January 26, 2023	
1	January 31, 2023	Joseph Strzelecki



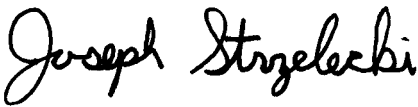
Table of Contents

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.....	5
3.3 Related Submittals.....	5
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	6
6.0 TEST PROCEDURE DOCUMENTS	6
7.0 RADIOMETRICS' TEST FACILITIES.....	6
8.0 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS	7
9.0 CERTIFICATION	7
10.0 TEST EQUIPMENT TABLE	7
11.0 TEST SECTIONS.....	7
11.1 AC Conducted Emissions.....	7
11.2 Radiated RF Emissions	22
11.2.1 Field Strength Calculation	23
11.2.2 Radiated Emissions Test Results	23
11.3 Magnetic Field Measurements and Decay Factor Calculations	33
11.3.1 Magnetic Field Radiated Emissions Results (0.009 to 30 MHz).....	34
11.4 Occupied Bandwidth Data	36
11.5 Frequency Stability	39
11.5.1 Test Results for Frequency Stability	39
12.0 MEASUREMENT INSTRUMENTATION UNCERTAINTY	40
13.0 REVISION HISTORY	41

Notice: This report must not be reproduced (except in full) without the written approval of Radiometrics Midwest Corporation.



1.0 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> A RF IDEas, Inc., Dual Frequency RFID Reader Model: RDR-80031BK5, RDR-80031BK6, RDR-80531BK5, and RDR-80531BK6; Serial Numbers: This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics:</i> July 27, 2022	<i>Test Date(s):</i> September 16 thru January 9, 2023
<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>  01/26/2022 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) are four Dual Frequency RFID Readers, RDR-80031BK5, RDR-80031BK6, RDR-80531BK5, and RDR-80531BK6, manufactured by RF IDEas, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

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



Test Matrix

Model Number	Serial Number	Conducted Emissions	Radiated Emissions 30-1000 MHz	Radiated Emissions 0.009–30 MHz	Occupied Bandwidth	Frequency Stability
RDR-80031BK5	WS2I200051	Pass	Pass	Pass	Pass	Pass
RDR-80031BK6	WS2I200054	Pass	Pass	Pass	Pass	Pass
RDR-80531BK5	W2SB00027	Pass	Pass	NP	NP	NP
RDR-80531BK6	W2SC00026	Pass	Pass	NP	NP	NP

NP= Not performed

The non-radio portion of the product is approved under the FCC’s Supplier’s Declaration of Conformity Procedures.

2.1 RF Exposure Compliance Requirements

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

3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Dual Frequency RFID Reader, Models RDR-80031BK5, RDR-80031BK6, RDR-80531BK5, and RDR-80531BK6, manufactured by RF IDEas, Inc. The EUT was in good working condition during the tests, with no known defects.

3.2 Product Family

The following table is the product family list of the readers that use the same electronics and PCB as the ones tested in this report. The readers all have the same firmware number of WNC010300SPX700.H. The untested model numbers listed below are electrically identical with the same electromagnetic emissions and electromagnetic compatibility characteristics as those tested, therefore the tests on the model numbers below are representative for the tested models.

Model Number	Description
RDR-80031BK2	WAVE ID Plus Mini w/iClass SE & Seos Black 5V PS/2 RS-232 reader
RDR-80031BK5	Tested Sample WAVE ID Plus Mini w/iClass SE & Seos Black 5V pin 9 RS-232 reader
RDR-80031BK6	Tested Sample WAVE ID Plus Mini w/iClass SE & Seos Black 9V Pin9 RS-232 reader
RDR-80031BK7	WAVE ID Plus Mini w/iClass SE & Seos Black 9V ext p.s. RS-232 reader
RDR-80031BK8	WAVE ID Plus Mini w/iClass SE & Seos Black 5V ext ps RS-232 reader
RDR-80031BK9	WAVE ID Plus Mini w/iClass SE & Seos Black 5V USB pwr tap RS-232 reader
RDR-80531BK2	WAVE ID Plus Mini Black5V PS/2 RS-232 reader
RDR-80531BK5	Tested Sample WAVE ID Plus Mini Black5V pin 9 RS-232 reader
RDR-80531BK6	Tested Sample WAVE ID Plus Mini Black9V Pin9 RS-232 reader
RDR-80531BK7	WAVE ID Plus Mini Black 9V ext p.s. RS-232 reader
RDR-80531BK8	WAVE ID Plus Mini Black 5V ext ps RS-232 reader
RDR-80531BK9	WAVE ID Plus Mini Black 5V USB pwr tap RS-232 reader



3.2.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

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

3.3 Related Submittals

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

4.0 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations. Power was supplied at 115 VAC, 60 Hz single-phase to the host computer. The EUT was powered from 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	RFID Card Reader	E	RF IDEas	RDR-80031BK5	WS2I100051
2	RFID Card Reader	E	RF IDEas	RDR-80031BK6	WS2I200054
3	RFID Card Reader	E	RF IDEas	RDR-80531BK5	W2SB00027
4	RFID Card Reader	E	RF IDEas	RDR-80531BK6	W2SC00026
5	Latitude Laptop PC	H	HP	Elite x2	5CG545482P
6	Laptop AC-DC power supply	P	HP	854055-002	A000133
7	AC-DC power supply; 5V	P	Phihong	PSAC05R-050	P15200430A1
8	AC-DC power supply; 9V	P	CUI, Inc	SMI68-12 090066	P/N: SMI68-9-4-P5
9	USB-RS232 Serial Adaptor	P	Cables Unlimited	USB-2920	X000AOOMJR

* 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 cable from external power supply to EUT	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	2022	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
IC RSS-210 Issue 10	2020	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 5	2021	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)

6.0 TEST PROCEDURE DOCUMENTS

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

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

7.0 RADIOMETRICS' TEST FACILITIES

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

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

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

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

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

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

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance 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-66	ETS-Lindgren	Horn Antenna	3115	62580	1.0-18GHz	24 Mo.	03/11/21
ANT-68	EMCO	Log-Periodic Ant.	93146	9604-4456	200-1000MHz	24 Mo.	02/07/22
ANT-80	AH Systems	Bicon Antenna	SAS-540	294	20-330MHz	24 Mo.	01/05/21
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	03/07/22
LSN-01	Electrometrics	50 uH LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	08/23/21
REC-20	HP / Agilent	Spectrum Analyzer	85460A/84562A	33330A00135 3410A00178	30Hz-6GHz	24 Mo.	08/18/21
REC-21	Agilent	Spectrum Analyzer	E7405A	MY45118341	9kHz-26.5GHz	24 Mo.	02/24/22
REC-31	Agilent	Spectrum Analyzer	E7402A	US41160415	9kHz-3GHz	24 Mo.	05/28/21
REC-44	Agilent	Spectrum Analyzer	E4440A	US40420673	3Hz-26.5GHz	24 Mo.	03/31/22
TC-01	GS Blue M Electric	Temperature Chamber	ETC-04S-E	0003-ETC-201	-40 to 100 Deg C	24 Mo.	10/16/20
TMP-01	Fluke	Temperature meter	80T-150UA	38280311	N/A	12 Mo.	06/07/21

Note: All calibrated equipment is subject to periodic checks.

Software Company	Test Software Name	Version	Applicable Tests
Radiometrics	EN550XX0	07.21.22	RF Conducted Emissions (FCC/CE)
Radiometrics	REREC11D	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.

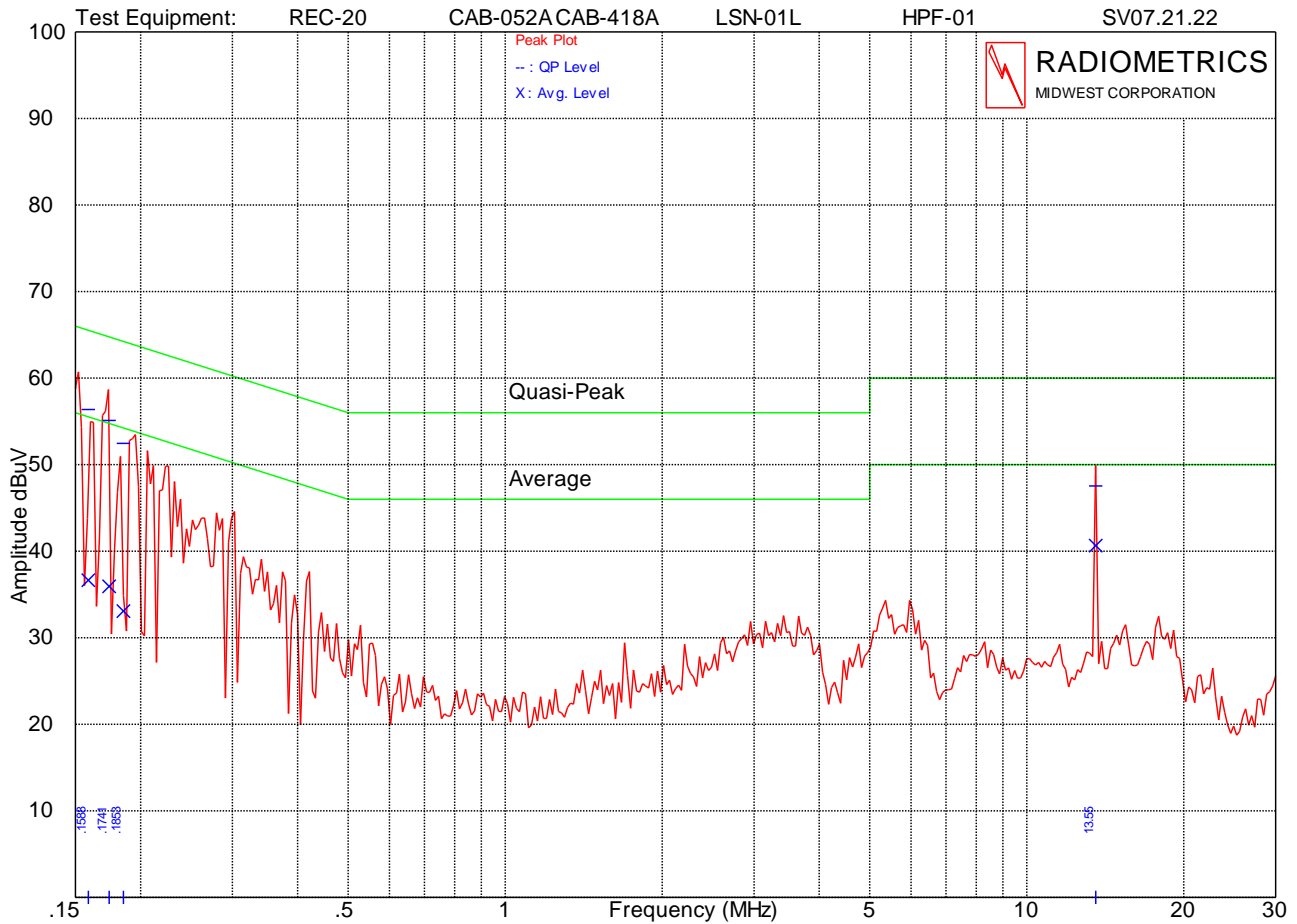
The transmitter was tested with a dummy load under the following conditions:

- 1) First, the AC line conducted tests with the antenna attached were performed to determine if the EUT complies with the 15.207 limits outside of 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 Date : October 6, 2022

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

The Limit shown above is RSS-GEN Table 3.



Company: RF Ideas
 Lead Tested: AC Hot 120 VAC
 Notes: 120 VAC 60 Hz
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80031BK5
 S/N: WS21100051

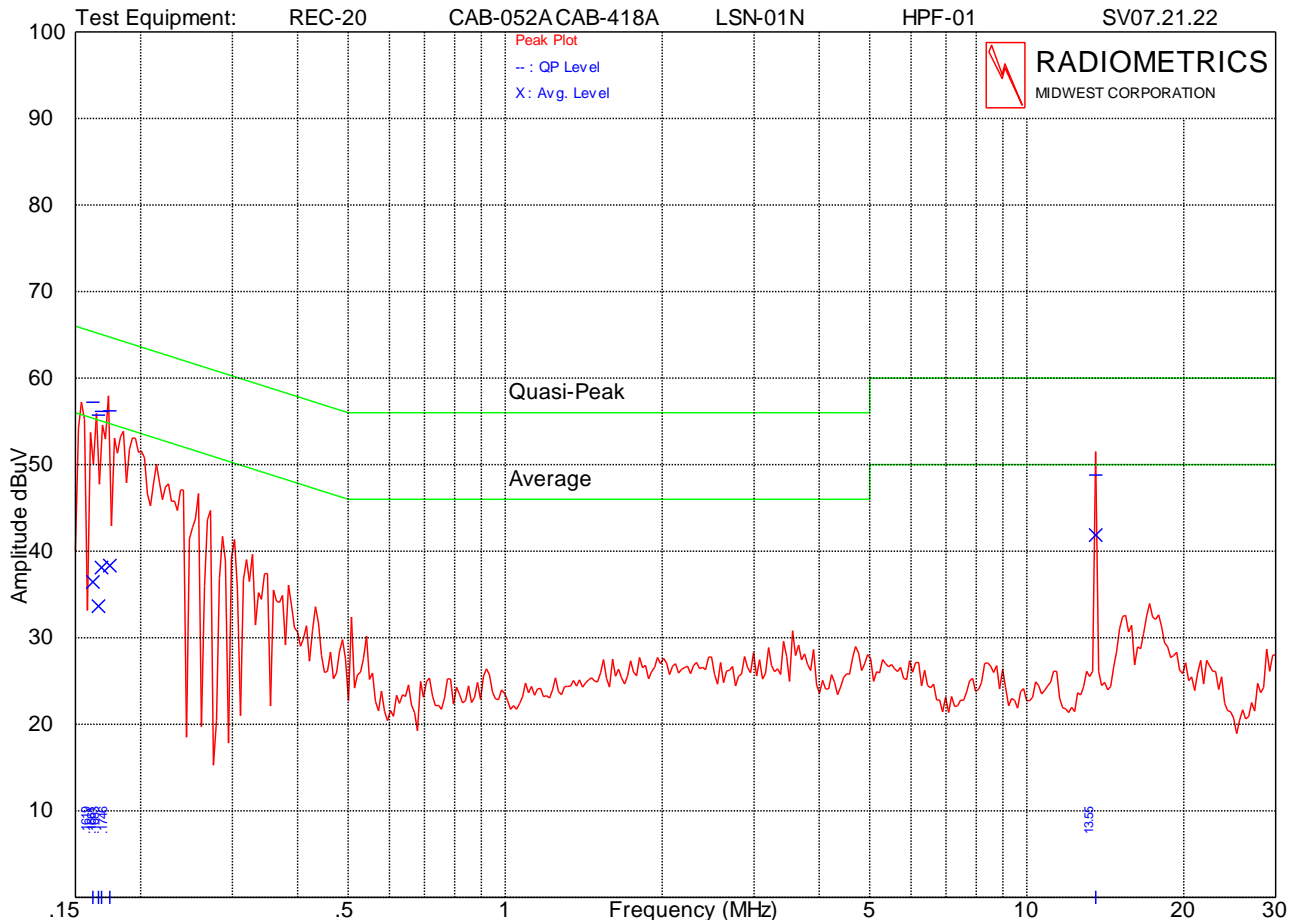
Date :10-06-2022
 Time:08:31
 Tested By: CED
 RP-9709 | CE51L1

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.159	56.4	65.5	36.6	55.5	9.2
0.174	55.1	64.8	35.9	54.8	9.7
0.185	52.5	64.2	33.1	54.2	11.8
13.560	47.5	60.0	40.6	50.0	9.4

EUT powered by Computer USB Port

With standard antenna installed

Judgement: Pass all frequencies



Company: RF Ideas
 Lead Tested: AC Neutral 120 VAC
 Notes: 120 VAC 60 Hz
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80031BK5
 S/N: WS21100051

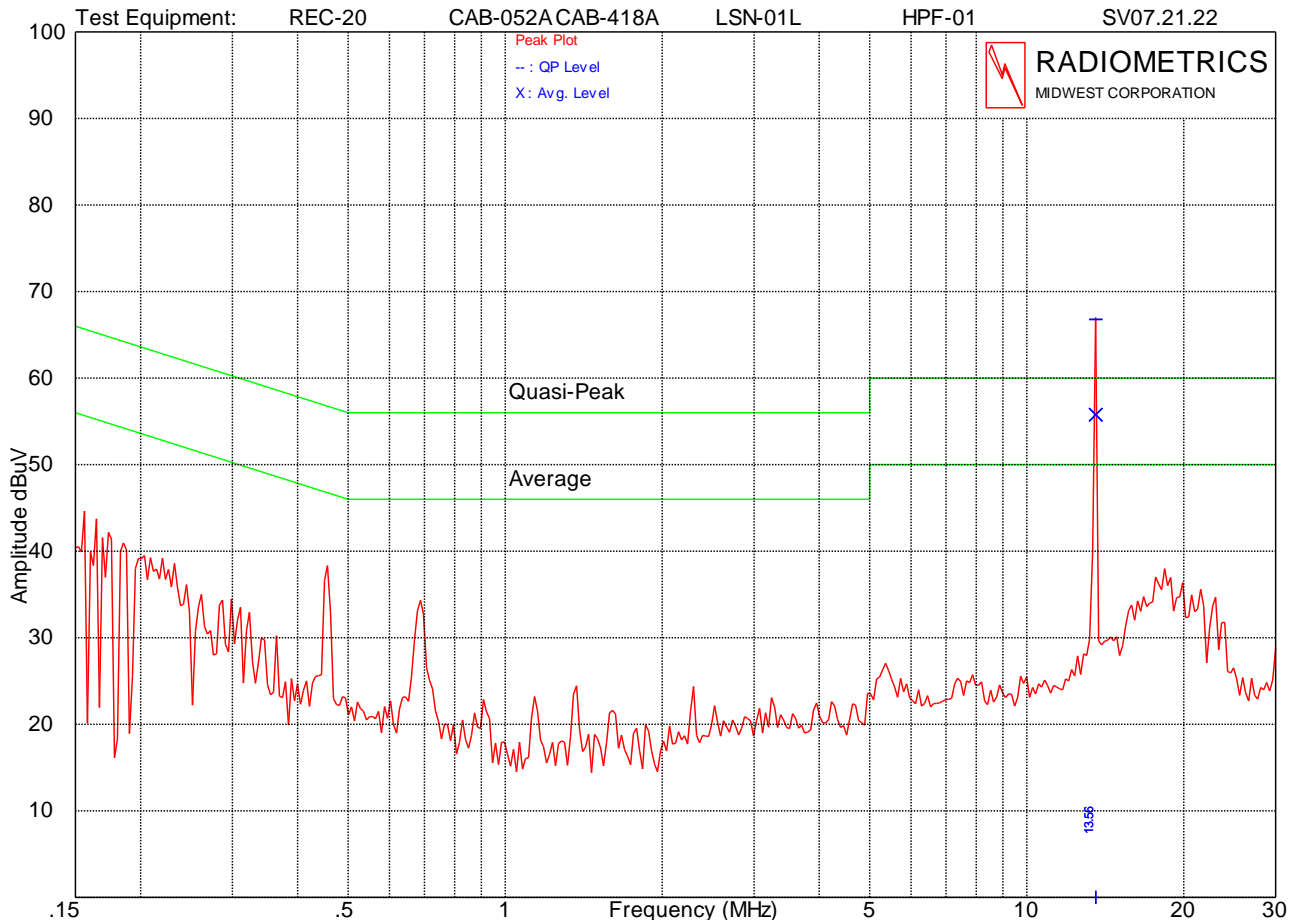
Date :10-06-2022
 Time:08:35
 Tested By: CED
 RP-9709 | CE51L2

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.162	57.2	65.4	36.4	55.4	8.2
0.166	55.7	65.2	33.6	55.2	9.4
0.168	56.2	65.0	38.1	55.0	8.9
0.175	56.2	64.7	38.3	54.7	8.5
13.559	48.8	60.0	41.9	50.0	8.1

EUT powered by Computer USB Port

With standard antenna installed

Judgement: Pass all frequencies



Company: RF Ideas
 Lead Tested: AC Hot 120 VAC
 Notes: 120 VAC 60 Hz
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80031BK6
 S/N : WS21200054

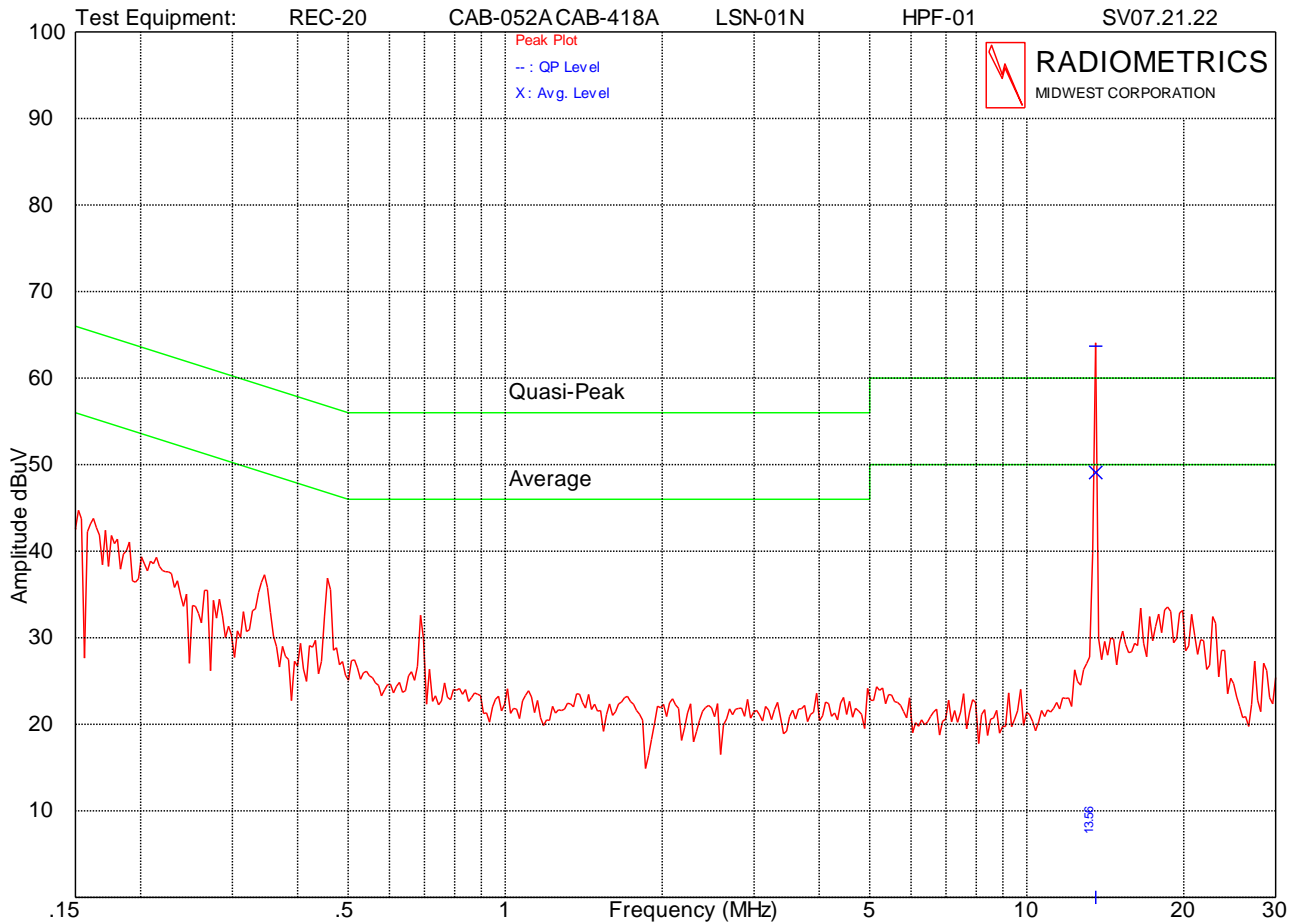
Date :10-06-2022
 Time:09:15
 Tested By: CED
 RP-9709 | CE54L1

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
13.561	66.8	60.0	55.8	50.0	-6.8

EUT powered by SMI68-12 090066 Power Supply

With standard antenna installed

Judgement: Pass all frequencies except 13.56 MHz. That frequency was repeated with a load in place of the antenna and found to be compliant.



Company: RF Ideas
 Lead Tested: AC Neutral 120 VAC
 Notes: 120 VAC 60 Hz
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80031BK6
 S/N : WS21200054

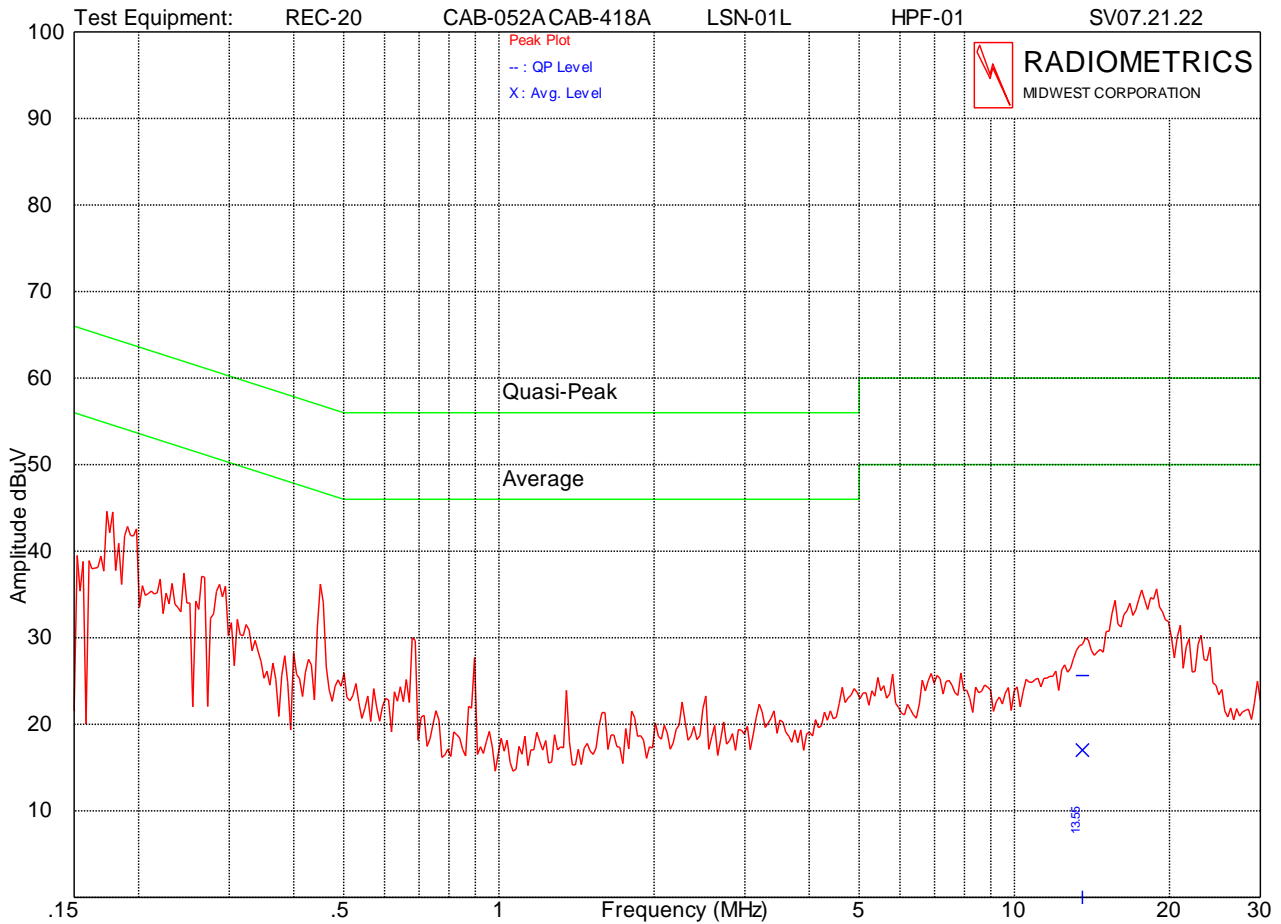
Date :10-06-2022
 Time:09:19
 Tested By: CED
 RP-9709 | CE54L2

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
13.562	63.7	60.0	49.1	50.0	-3.7

EUT powered by SMI68-12 090066 Power Supply

With standard antenna installed

Judgement: Pass all frequencies except 13.56 MHz. That frequency was repeated with a load in place of the antenna and found to be compliant.



Company: RF Ideas
Lead Tested: AC Hot 120 VAC
Notes: 120 VAC 60 Hz with 50 Ohm Load antenna
FCC/ICES/EN; Class B Conducted Emissions; Mains Port

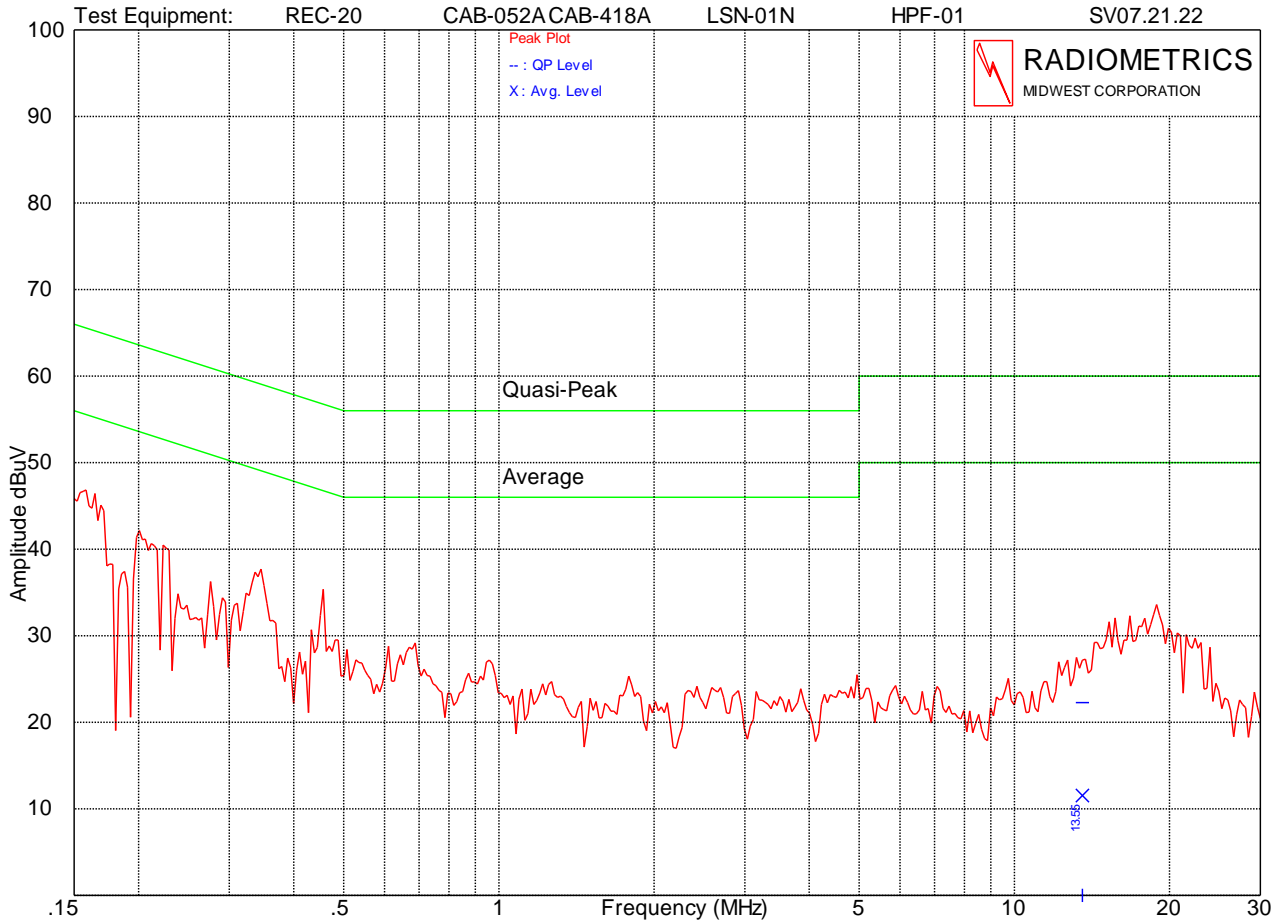
Model: RDR-80031BK6
S/N : WS2I200054

Date : 10-06-2022
Time: 09:30
Tested By: CED
RP-9709 | CE54L1A

EUT powered by SMI68-12 090066 Power Supply

With resistive load in place of 13.56 MHz Antenna

Judgment: Passed by at least 15 dB at 13.56 MHz with Resistive Load in place of standard Loop antenna.
Passed by at least 6 dB at all other frequencies.



Company: RF Ideas
 Lead Tested: AC Neutral 120 VAC
 Notes: 120 VAC 60 Hz with 50 Ohm Load antenna
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80031BK6
 S/N : WS2I200054

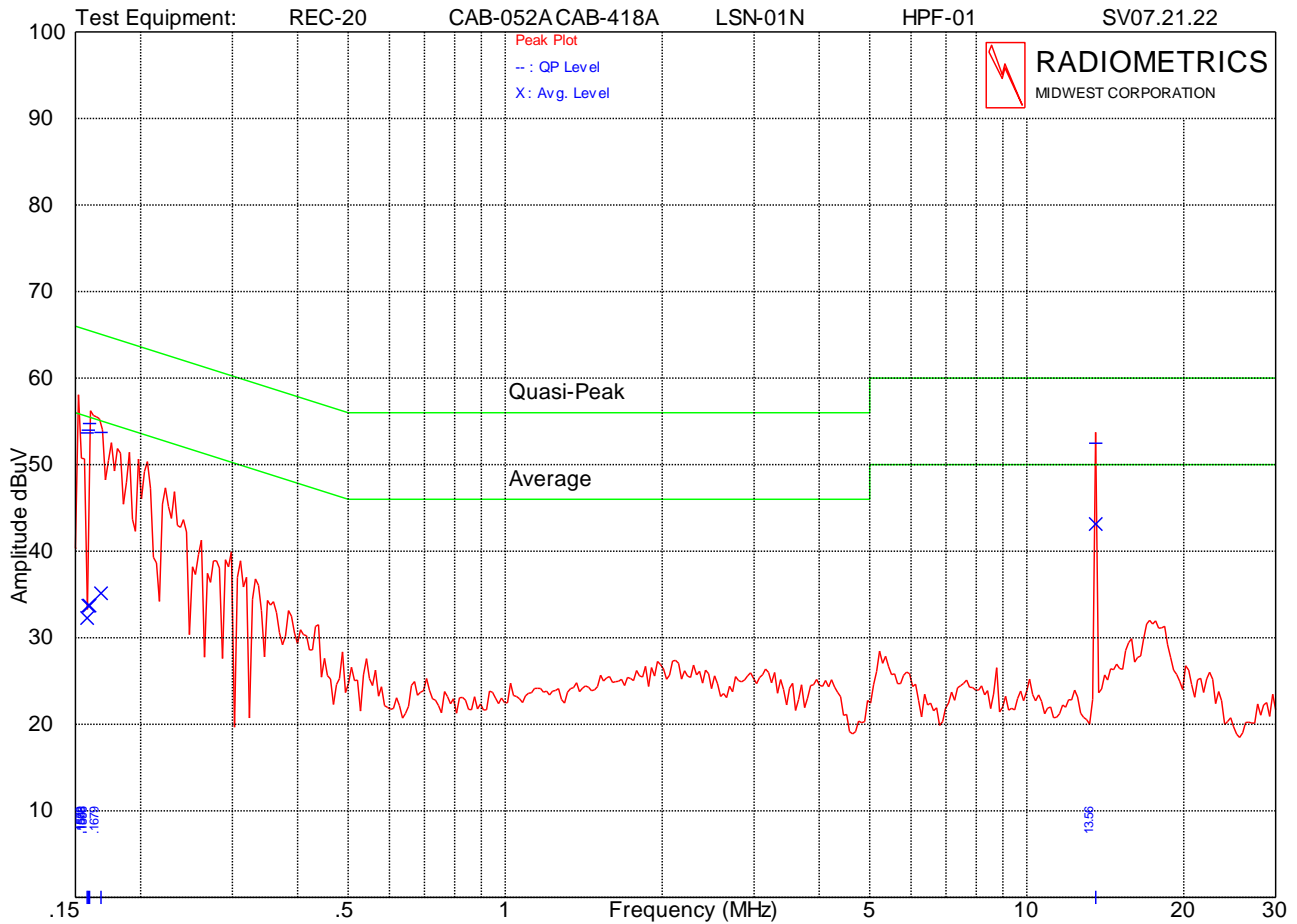
Date : 10-06-2022
 Time: 09:27
 Tested By: CED
 RP-9709 | CE54L2A

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
13.553	22.3	60.0	11.5	50.0	37.7

EUT powered by SMI68-12 090066 Power Supply

With resistive load in place of 13.56 MHz Antenna

Judgment: Passed by at least 15 dB at 13.56 MHz with Resistive Load in place of standard Loop antenna. Passed by at least 6 dB at all other frequencies.



Company: RF Ideas
 Lead Tested: AC Neutral 120 VAC
 Notes: 120 VAC 60 Hz
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80531BK5
 S/N: W2SB00027

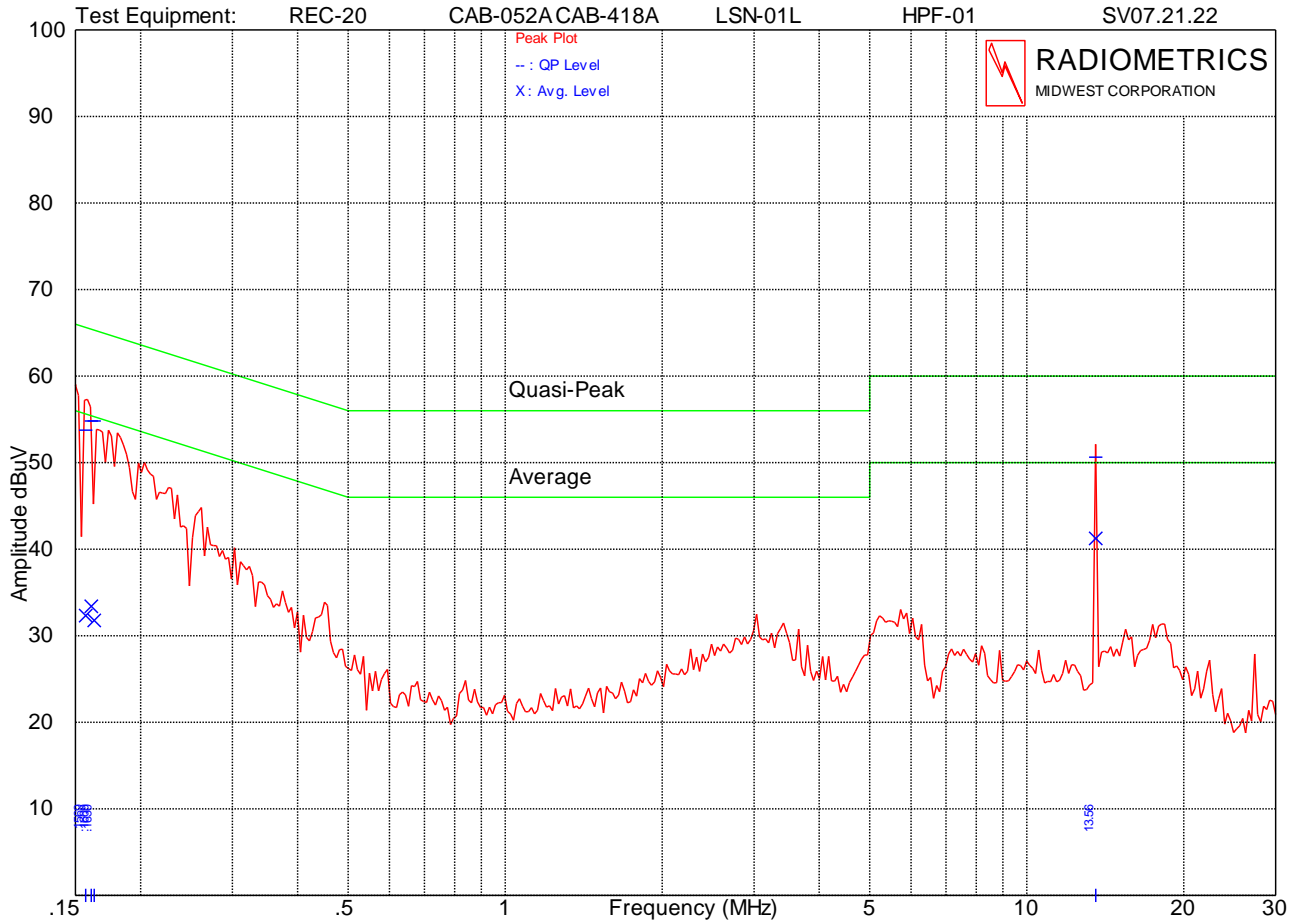
Date :10-06-2022
 Time:08:48
 Tested By: CED
 RP-9709 | CE27L2

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.158	53.7	65.6	32.3	55.6	11.9
0.159	54.0	65.5	33.7	55.5	11.5
0.160	54.8	65.5	33.7	55.5	10.7
0.168	53.7	65.1	35.1	55.1	11.3
13.560	52.5	60.0	43.1	50.0	6.9

EUT powered by Computer

With standard antenna installed

Judgement: Pass all frequencies



Company: RF Ideas
 Lead Tested: AC Hot 120 VAC
 Notes: 120 VAC 60 Hz
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80531BK5
 S/N : W2SB00027

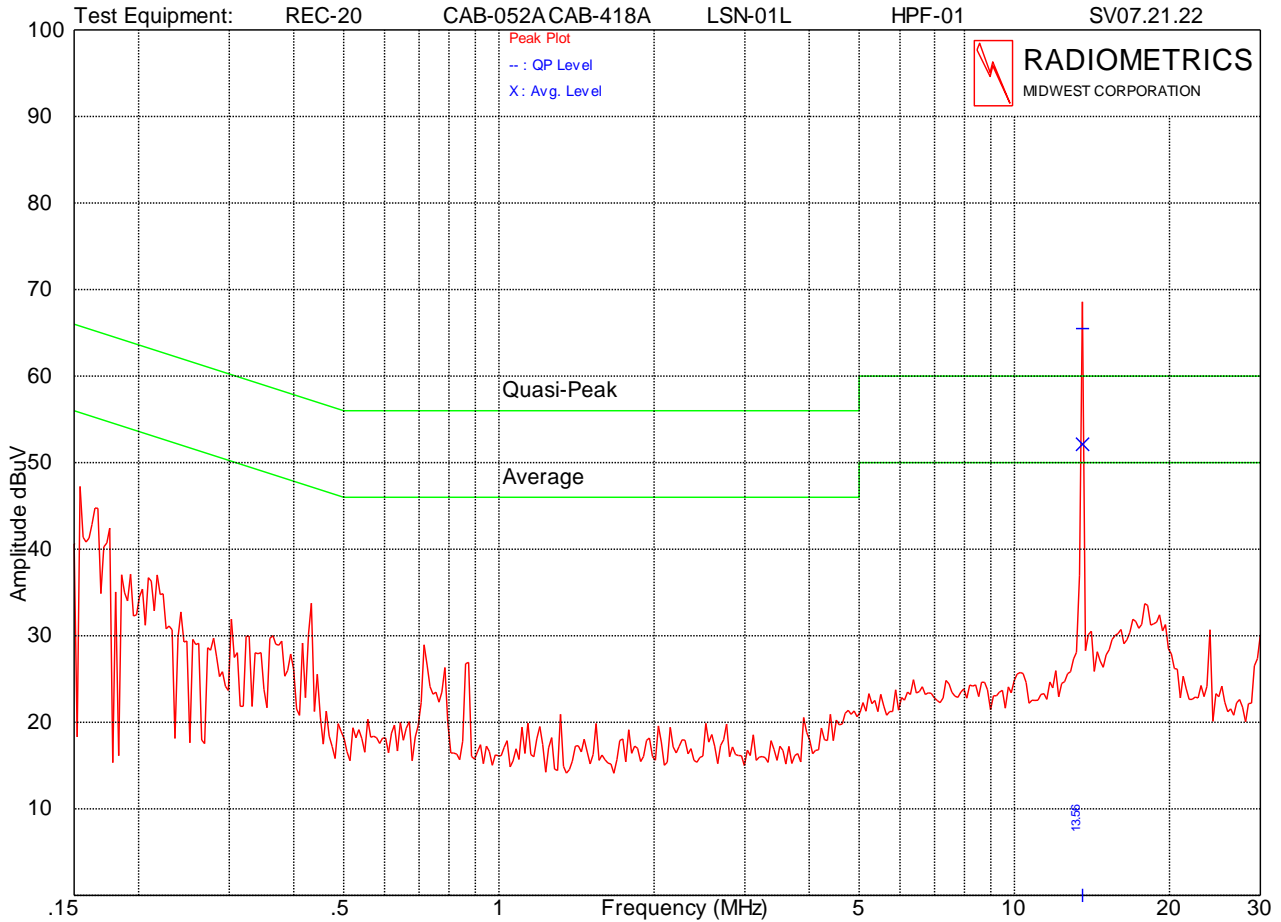
Date :10-06-2022
 Time:08:53
 Tested By: CED
 RP-9709 | CE27L1

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
0.157	53.8	65.6	32.3	55.6	11.9
0.161	54.8	65.4	33.4	55.4	10.6
0.163	54.8	65.3	31.8	55.3	10.5
13.561	50.6	60.0	41.3	50.0	8.8

EUT powered by Computer USB Port

With standard antenna installed

Judgement: Pass all frequencies



Company: RF Ideas
 Lead Tested: AC Hot 120 VAC
 Notes: 120 VAC 60 Hz
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80531BK6
 S/N : W2SC00026

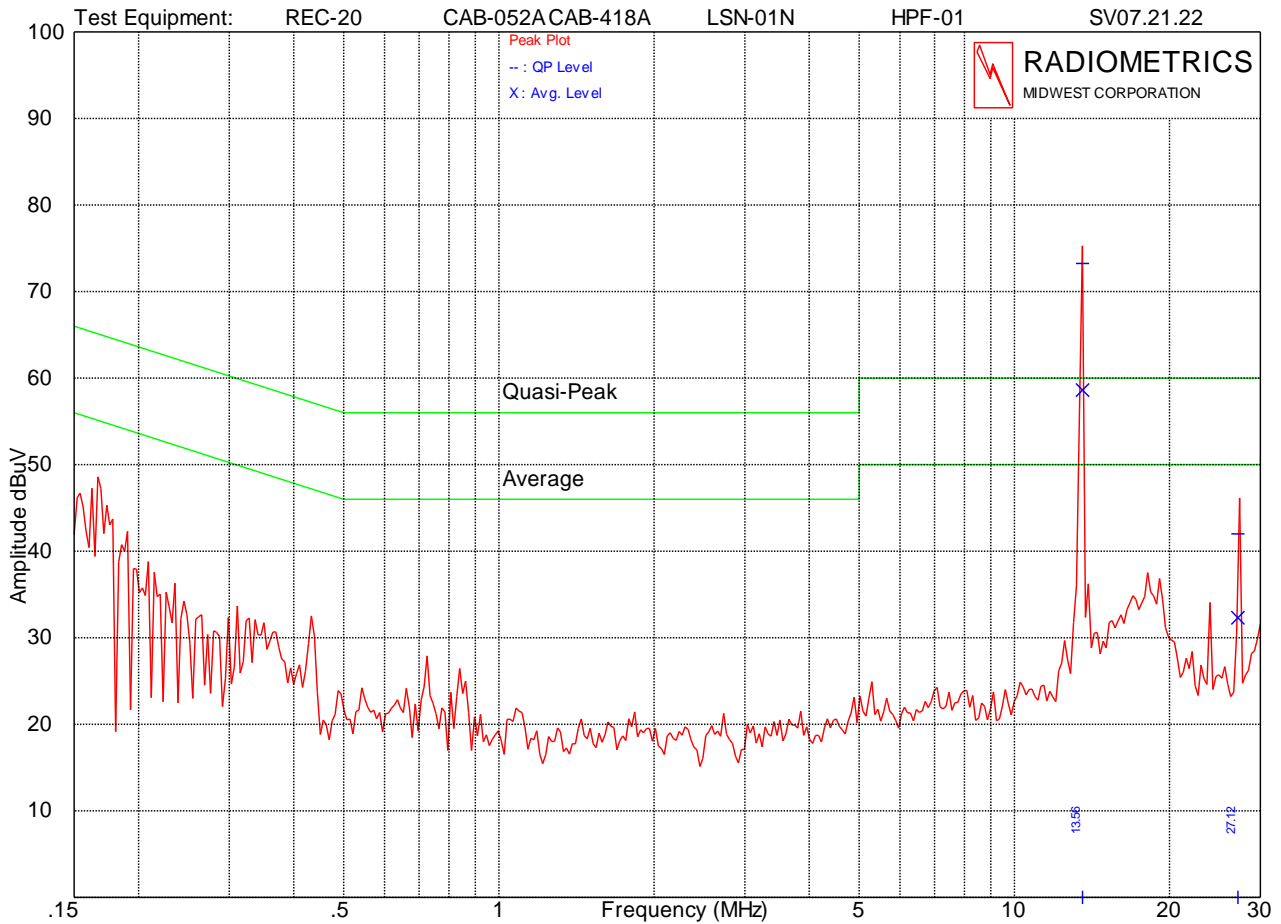
Date : 10-06-2022
 Time: 10:07
 Tested By: CED
 RP-9709 | CE26L1C

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
13.562	66.1	60.0	53.9	50.0	-6.1

EUT powered by SMI68-12 090066 Power Supply

With standard antenna installed

Judgement: Pass all frequencies except 13.56 MHz. That frequency was repeated with a load in place of the antenna and found to be compliant.

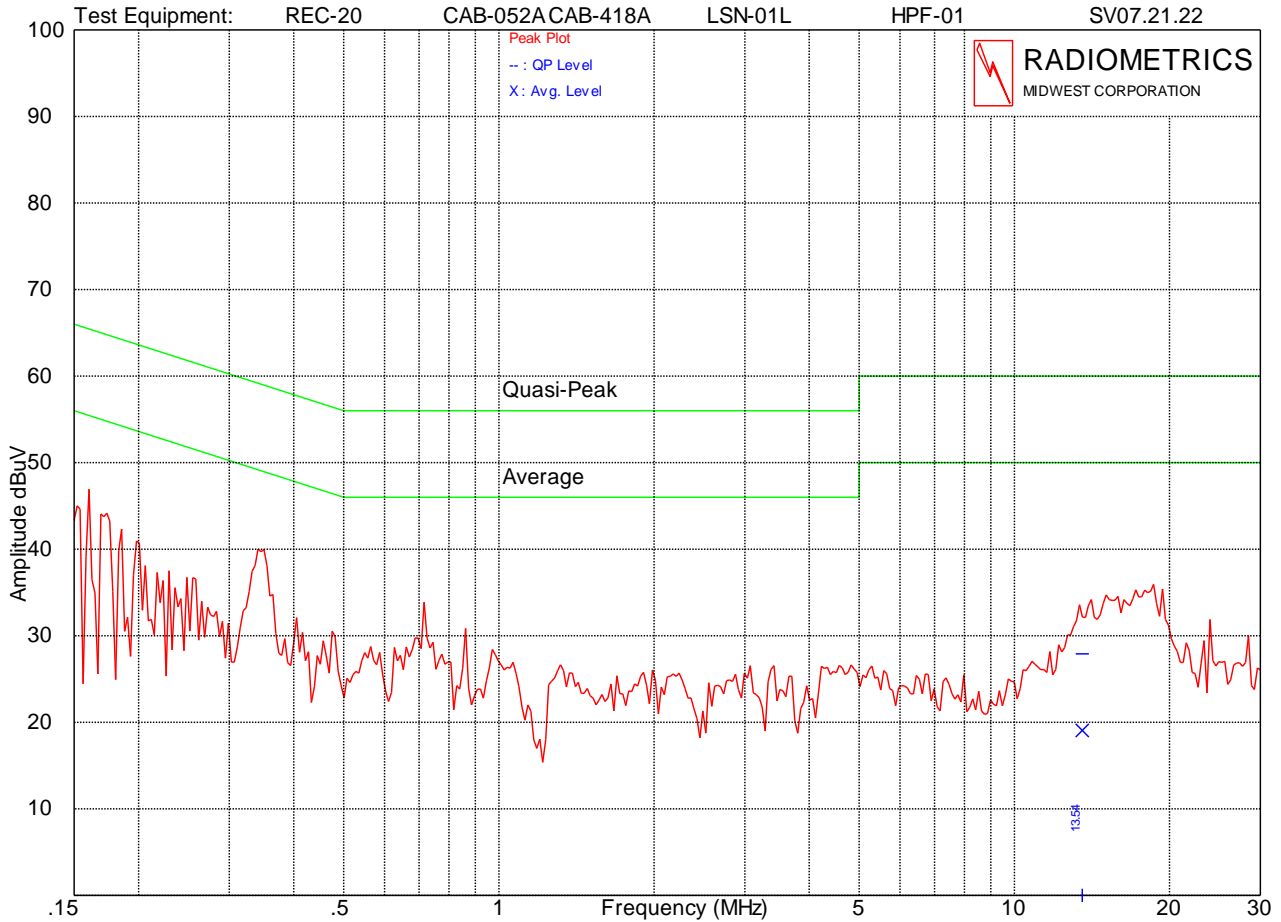


Company: RF Ideas
 Model: RDR-80531BK6
 S/N : W2SC00026
 Date : 10-06-2022
 Time: 10:19
 Tested By: CED
 RP-9709 | CE26L2C

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
13.561	73.3	60.0	58.6	50.0	-13.3
27.354	41.8	60.0	32.5	50.0	17.5

EUT powered by SMI68-12 090066 Power Supply

Judgement: Pass all frequencies except 13.56 MHz. That frequency was repeated with a load in place of the antenna and found to be compliant.



Company: RF Ideas
 Lead Tested: AC Hot 120 VAC
 Notes: 120 VAC 60 Hz With 50 Ohm Load
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80531BK6
 S/N : W2SC00026

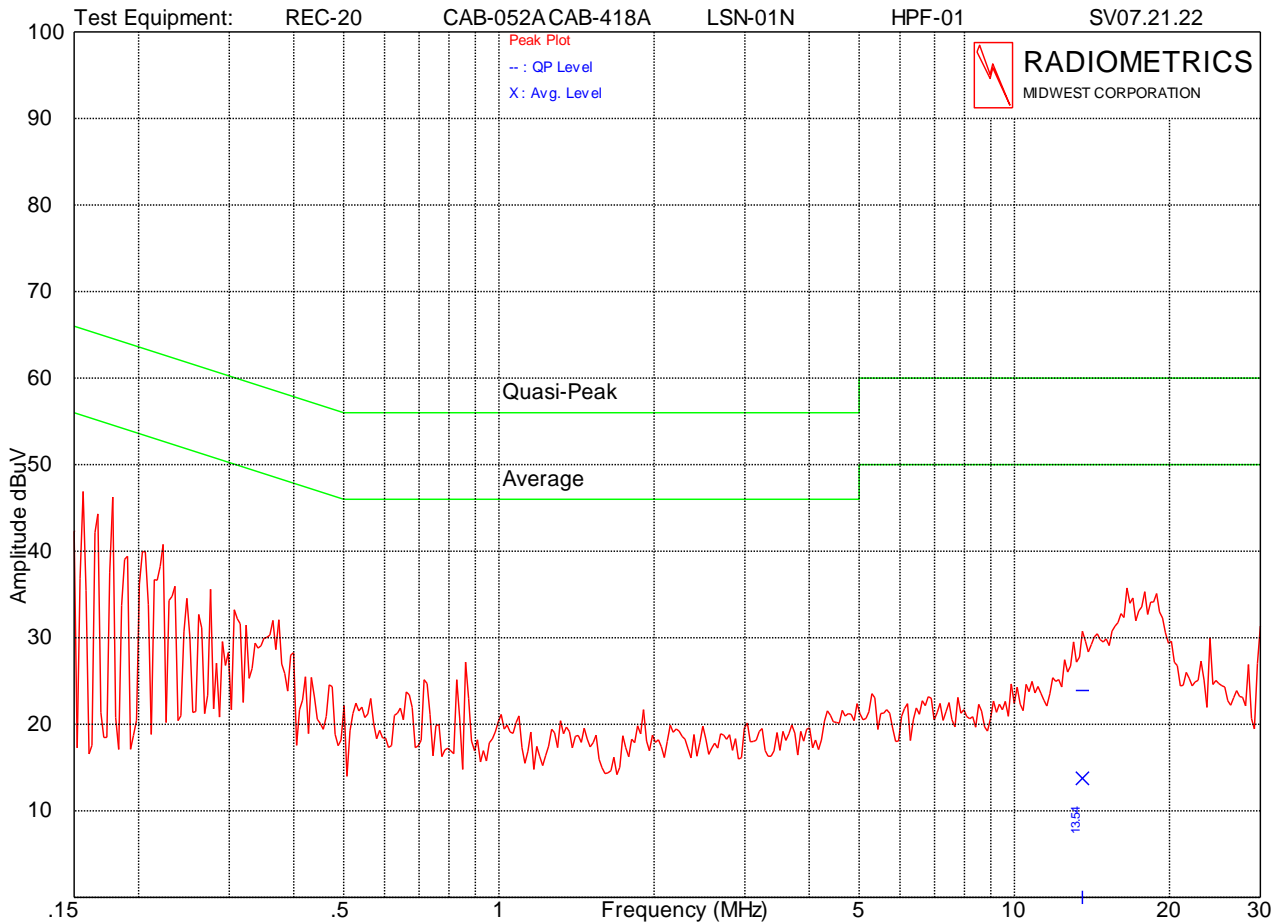
Date : 10-06-2022
 Time: 10:38
 Tested By: CED
 RP-9709 | CE26L1D

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
13.544	27.9	60.0	19.1	50.0	30.9

EUT powered by SMI68-12 090066 Power Supply

With resistive load in place of 13.56 MHz Antenna

Judgment: Passed by at least 15 dB at 13.56 MHz with Resistive Load in place of standard Loop antenna. Passed by at least 6 dB at all other frequencies.



Company: RF Ideas
 Lead Tested: AC Neutral 120 VAC
 Notes: 120 VAC 60 Hz With 50 Ohm Load
 FCC/ICES/EN; Class B Conducted Emissions; Mains Port

Model: RDR-80531BK6
 S/N : W2SC00026

Date : 10-06-2022
 Time: 10:35
 Tested By: CED
 RP-9709 | CE26L2D

Frequency (MHz)	QP Amplitude (dBuV)	QP Limit (dBuV)	Average Amplitude (dBuV)	Average Limit (dBuV)	Margin (dB)
13.549	23.9	60.0	13.8	50.0	36.1

EUT powered by SMI68-12 090066 Power Supply

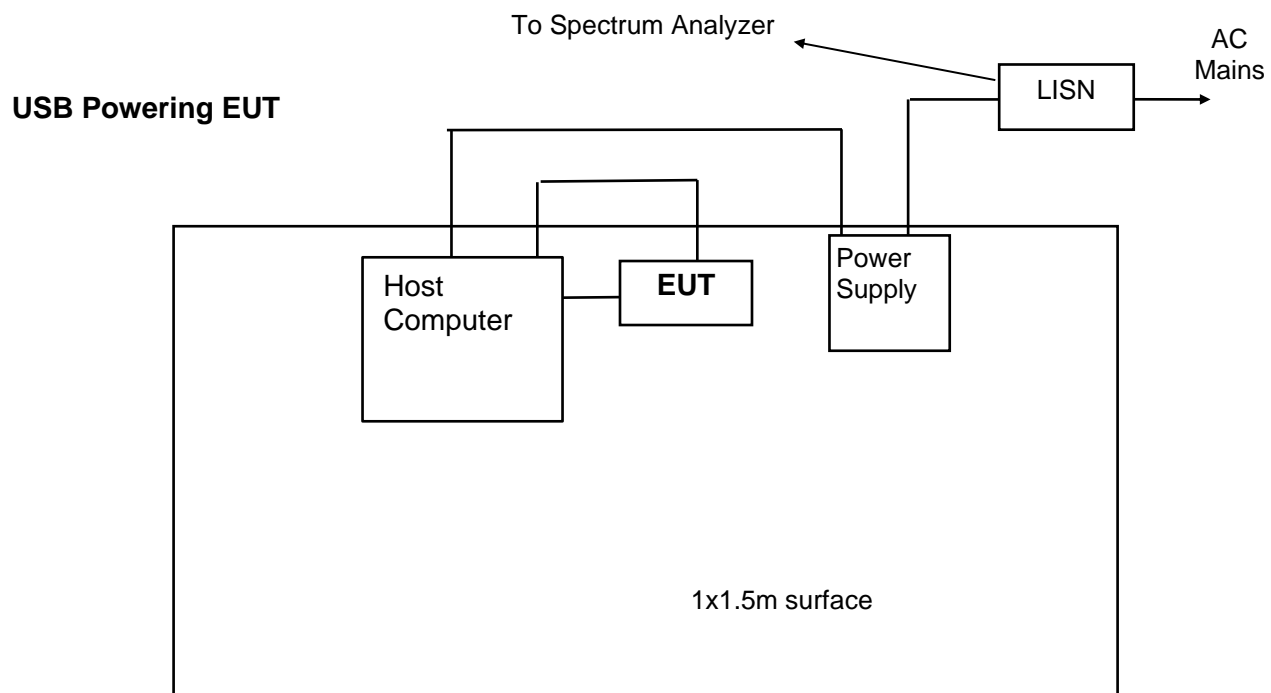
With resistive load in place of 13.56 MHz Antenna

Judgment: Passed by at least 15 dB at 13.56 MHz with Resistive Load in place of standard Loop antenna.
 Passed by at least 6 dB at all other frequencies.

Judgement Overall: Pass by at least 6 dB.

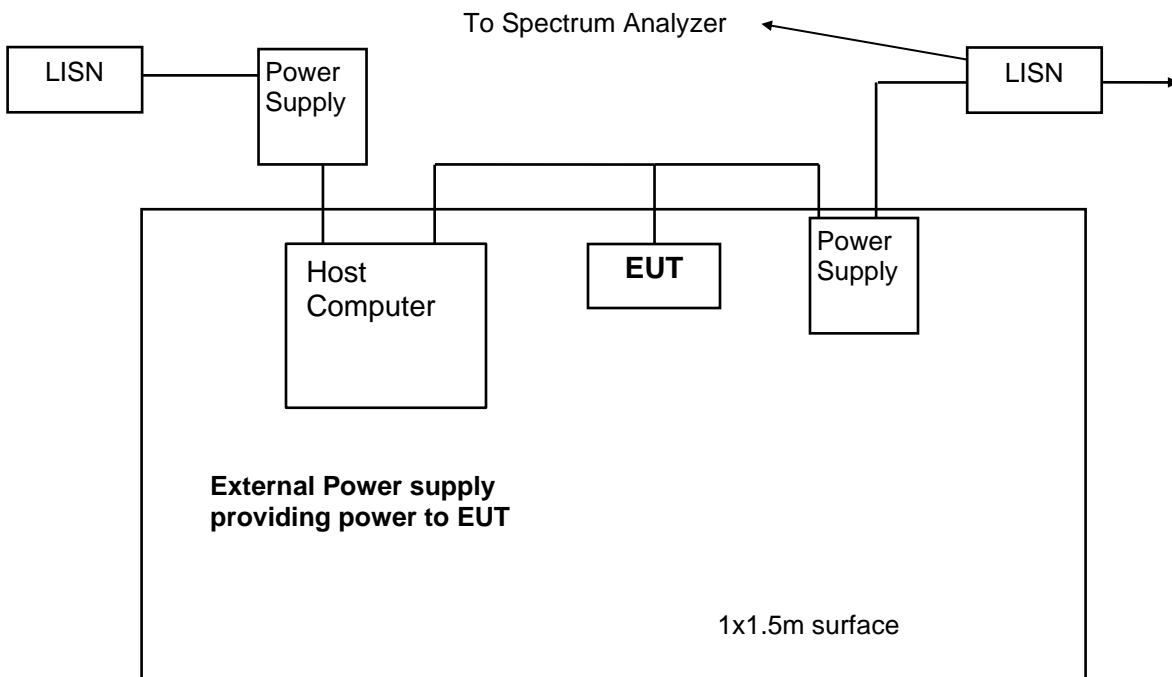


Figure 1. Conducted Emissions Test Setup



Notes:

- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of tabletop



- Notes:**
- LISN's at least 80 cm from EUT chassis
 - Vertical conductive plane 40 cm from rear of tabletop

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

Table with 4 columns: Frequency Range (MHz), Test Distance (meters), Class B Limits (uV/m), and Class B Limits (dB(uV/m)). Rows include frequency ranges from 0.009-0.490 MHz to Above 960 MHz.

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 (30-1000 MHz)

Summary table with 2 columns: Test Date (September 30, 2022), Test Distance (3 Meters), Specification (FCC Part 15 Subpart C & RSS-210), Notes (The actual FCC limits are in uV/m...), Abbreviations (P = peak; Q = QP Pol = Antenna Polarization; V = Vertical; H = Horizontal).

Main test results table with 10 columns: EUT (RDR-80031BK6; S/N: W52I200054; Powered with 9V External supply), 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. Rows show data for frequencies 45.0, 56.5, 68.1, 82.4, 90.0, and 101.9 MHz.



EUT RDR-80031BK6; S/N: W52I200054; Powered with 9V External supply									
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
113.6	17.6	P	H	11.2	1.1	0.0	29.9	43.5	13.6
129.8	13.5	P	H	12.1	1.2	0.0	26.8	43.5	16.7
135.5	17.8	P	H	12.4	1.3	0.0	31.5	43.5	12.0
143.0	18.7	P	H	12.6	1.3	0.0	32.6	43.5	10.9
161.2	15.8	P	H	13.0	1.4	0.0	30.2	43.5	13.3
169.4	17.1	P	H	13.2	1.4	0.0	31.7	43.5	11.8
178.9	16.5	P	H	13.6	1.5	0.0	31.6	43.5	11.9
192.4	17.1	P	H	14.1	1.5	0.0	32.7	43.5	10.8
217.4	16.5	P	H	14.8	1.6	0.0	32.9	46.0	13.1
237.5	15.4	P	H	15.1	1.7	0.0	32.2	46.0	13.8
256.8	17.0	P	H	12.2	1.7	0.0	30.9	46.0	15.1
261.6	20.2	P	H	12.3	1.8	0.0	34.3	46.0	11.7
279.3	17.1	P	H	13.1	1.8	0.0	32.0	46.0	14.0
296.2	13.0	P	H	13.8	1.9	0.0	28.7	46.0	17.3
306.0	13.0	P	H	14.6	1.9	0.0	29.5	46.0	16.5
325.4	15.4	P	H	14.2	2.0	0.0	31.6	46.0	14.4
352.7	14.5	P	H	14.4	2.1	0.0	31.0	46.0	15.0
379.7	18.8	P	H	14.8	2.1	0.0	35.7	46.0	10.3
406.9	17.3	P	H	15.5	2.2	0.0	35.0	46.0	11.0
433.9	17.7	P	H	16.0	2.3	0.0	36.0	46.0	10.0
461.1	14.9	P	H	16.8	2.4	0.0	34.1	46.0	11.9
488.1	11.1	P	H	17.0	2.5	0.0	30.6	46.0	15.4
515.5	10.1	P	H	18.7	2.6	0.0	31.4	46.0	14.6
542.5	11.2	P	H	18.0	2.6	0.0	31.8	46.0	14.2
596.6	15.7	P	H	18.7	2.7	0.0	37.1	46.0	8.9
623.6	11.1	P	H	19.1	2.8	0.0	33.0	46.0	13.0
705.2	10.2	P	H	21.3	3.0	0.0	34.5	46.0	11.5
786.3	11.0	P	H	21.0	3.2	0.0	35.2	46.0	10.8
821.3	8.1	P	H	21.6	3.3	0.0	33.0	46.0	13.0
888.4	8.3	P	H	22.7	3.4	0.0	34.4	46.0	11.6
963.0	10.8	P	H	23.4	3.5	0.0	37.7	54.0	16.3
34.9	22.9	P	V	12.5	0.6	0.0	36.0	40.0	4.0
34.9	15.2	Q	V	12.5	0.6	0.0	28.3	40.0	11.7
43.3	26.3	P	V	10.5	0.7	0.0	37.5	40.0	2.5
43.3	20.7	Q	V	10.5	0.7	0.0	31.9	40.0	8.1
53.7	25.5	P	V	9.5	0.8	0.0	35.8	40.0	4.2
53.7	20.9	Q	V	9.4	0.8	0.0	31.1	40.0	8.9
65.0	24.6	P	V	9.2	0.8	0.0	34.6	40.0	5.4
65.2	20.9	Q	V	9.3	0.8	0.0	31.0	40.0	9.0
72.3	24.7	P	V	9.3	0.9	0.0	34.9	40.0	5.1
72.5	20.1	Q	V	9.3	0.9	0.0	30.3	40.0	9.7
79.3	21.4	Q	V	9.4	1.0	0.0	31.8	40.0	8.2
87.1	26.1	P	V	9.6	1.0	0.0	36.7	40.0	3.3
87.1	23.1	Q	V	9.6	1.0	0.0	33.7	40.0	6.3
103.2	13.7	P	V	10.5	1.1	0.0	25.3	43.5	18.2
120.9	13.1	P	V	11.7	1.2	0.0	26.0	43.5	17.5
144.6	16.9	P	V	12.6	1.3	0.0	30.8	43.5	12.7
157.4	14.0	P	V	12.9	1.4	0.0	28.3	43.5	15.2
181.1	13.2	P	V	13.6	1.5	0.0	28.3	43.5	15.2
198.6	14.9	P	V	14.3	1.5	0.0	30.7	43.5	12.8
235.3	13.7	P	V	15.1	1.7	0.0	30.5	46.0	15.5
255.0	15.4	P	V	12.1	1.7	0.0	29.2	46.0	16.8



EUT RDR-80031BK6; S/N: W52I200054; Powered with 9V External supply									
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
279.5	12.4	P	V	13.1	1.8	0.0	27.3	46.0	18.7
293.1	10.6	P	V	13.6	1.9	0.0	26.1	46.0	19.9
342.6	11.6	P	V	14.4	2.0	0.0	28.0	46.0	18.0
379.7	14.6	P	V	14.8	2.1	0.0	31.5	46.0	14.5
406.9	13.8	P	V	15.5	2.2	0.0	31.5	46.0	14.5
424.1	12.2	P	V	15.7	2.3	0.0	30.2	46.0	15.8
433.9	15.8	P	V	16.0	2.3	0.0	34.1	46.0	11.9
461.1	16.4	P	V	16.8	2.4	0.0	35.6	46.0	10.4
488.1	14.3	P	V	17.0	2.5	0.0	33.8	46.0	12.2
515.5	12.3	P	V	18.7	2.6	0.0	33.6	46.0	12.4
542.5	11.5	P	V	18.0	2.6	0.0	32.1	46.0	13.9
596.6	11.9	P	V	18.7	2.7	0.0	33.3	46.0	12.7
656.7	8.3	P	V	20.1	2.9	0.0	31.3	46.0	14.7
747.2	10.5	P	V	20.9	3.1	0.0	34.5	46.0	11.5
826.3	8.1	P	V	21.7	3.3	0.0	33.1	46.0	12.9
892.4	8.5	P	V	22.8	3.4	0.0	34.7	46.0	11.3
949.4	7.6	P	V	23.3	3.5	0.0	34.4	46.0	11.6

EUT RDR-80031BK5; S/N: W52I200051; Powered with External 5V Power Supply									
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
33.3	14.6	P	H	12.9	0.6	0.0	28.1	40.0	11.9
56.8	20.4	P	H	9.3	0.8	0.0	30.5	40.0	9.5
66.9	12.7	P	H	9.3	0.8	0.0	22.8	40.0	17.2
85.3	17.1	P	H	9.5	1.0	0.0	27.6	40.0	12.4
93.7	13.1	P	H	9.9	1.0	0.0	24.0	43.5	19.5
112.5	22.6	P	H	11.1	1.1	0.0	34.8	43.5	8.7
112.5	14.4	Q	H	11.1	1.1	0.0	26.6	43.5	16.9
124.5	16.4	P	H	11.9	1.2	0.0	29.5	43.5	14.0
136.4	12.3	P	H	12.4	1.3	0.0	26.0	43.5	17.5
161.4	20.4	P	H	13.0	1.4	0.0	34.8	43.5	8.7
161.4	11.7	Q	H	13.0	1.4	0.0	26.1	43.5	17.4
174.5	17.4	P	H	13.4	1.4	0.0	32.2	43.5	11.3
178.2	14.9	P	H	13.5	1.5	0.0	29.9	43.5	13.6
190.6	14.4	P	H	14.0	1.5	0.0	29.9	43.5	13.6
197.5	14.3	P	H	14.3	1.5	0.0	30.1	43.5	13.4
216.9	12.2	P	H	14.8	1.6	0.0	28.6	46.0	17.4
249.0	14.3	P	H	15.4	1.7	0.0	31.4	46.0	14.6
264.1	13.2	P	H	12.4	1.8	0.0	27.4	46.0	18.6
292.6	14.1	P	H	13.6	1.9	0.0	29.6	46.0	16.4
325.4	18.6	P	H	14.2	2.0	0.0	34.8	46.0	11.2
352.7	13.9	P	H	14.4	2.1	0.0	30.4	46.0	15.6
379.7	18.0	P	H	14.8	2.1	0.0	34.9	46.0	11.1
393.3	11.6	P	H	15.3	2.2	0.0	29.1	46.0	16.9
406.9	18.8	P	H	15.5	2.2	0.0	36.5	46.0	9.5
433.9	21.7	P	H	16.0	2.3	0.0	40.0	46.0	6.0
461.1	19.4	P	H	16.8	2.4	0.0	38.6	46.0	7.4
488.1	20.1	P	H	17.0	2.5	0.0	39.6	46.0	6.4
515.5	14.0	P	H	18.7	2.6	0.0	35.3	46.0	10.7
542.5	14.3	P	H	18.0	2.6	0.0	34.9	46.0	11.1



EUT RDR-80031BK5; S/N: W52I200051; Powered with External 5V Power Supply									
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
569.6	15.4	P	H	18.4	2.7	0.0	36.5	46.0	9.5
596.6	14.4	P	H	18.7	2.7	0.0	35.8	46.0	10.2
623.6	11.9	P	H	19.1	2.8	0.0	33.8	46.0	12.2
693.7	10.5	P	H	21.2	2.9	0.0	34.6	46.0	11.4
754.8	7.6	P	H	20.9	3.1	0.0	31.6	46.0	14.4
800.3	8.1	P	H	21.3	3.2	0.0	32.6	46.0	13.4
813.8	11.3	P	H	21.5	3.2	0.0	36.0	46.0	10.0
840.8	11.5	P	H	22.1	3.3	0.0	36.9	46.0	9.1
960.5	9.5	P	H	23.4	3.5	0.0	36.4	54.0	17.6
34.0	19.6	P	V	12.7	0.6	0.0	32.9	40.0	7.1
42.8	26.0	P	V	10.6	0.7	0.0	37.3	40.0	2.7
42.8	21.3	Q	V	10.7	0.7	0.0	32.7	40.0	7.3
53.7	27.3	P	V	9.5	0.8	0.0	37.6	40.0	2.4
53.7	21.1	Q	V	9.4	0.8	0.0	31.3	40.0	8.7
84.4	26.2	P	V	9.5	1.0	0.0	36.7	40.0	3.3
84.4	21.5	Q	V	9.5	1.0	0.0	32.0	40.0	8.0
128.9	14.7	P	V	12.1	1.2	0.0	28.0	43.5	15.5
153.4	19.5	P	V	12.8	1.3	0.0	33.6	43.5	9.9
185.3	10.5	P	V	13.8	1.5	0.0	25.8	43.5	17.7
207.0	11.0	P	V	14.6	1.6	0.0	27.2	43.5	16.3
226.4	11.7	P	V	14.9	1.6	0.0	28.2	46.0	17.8
234.6	13.1	P	V	15.0	1.7	0.0	29.8	46.0	16.2
274.2	10.1	P	V	12.8	1.8	0.0	24.7	46.0	21.3
325.4	13.1	P	V	14.2	2.0	0.0	29.3	46.0	16.7
334.0	10.8	P	V	14.3	2.0	0.0	27.1	46.0	18.9
348.4	11.2	P	V	14.4	2.0	0.0	27.6	46.0	18.4
352.7	11.2	P	V	14.4	2.1	0.0	27.7	46.0	18.3
376.9	10.8	P	V	14.7	2.1	0.0	27.6	46.0	18.4
379.7	12.2	P	V	14.8	2.1	0.0	29.1	46.0	16.9
406.9	15.5	P	V	15.5	2.2	0.0	33.2	46.0	12.8
433.9	18.6	P	V	16.0	2.3	0.0	36.9	46.0	9.1
461.1	15.0	P	V	16.8	2.4	0.0	34.2	46.0	11.8
488.1	18.0	P	V	17.0	2.5	0.0	37.5	46.0	8.5
515.5	15.3	P	V	18.7	2.6	0.0	36.6	46.0	9.4
542.5	12.4	P	V	18.0	2.6	0.0	33.0	46.0	13.0
569.6	11.0	P	V	18.4	2.7	0.0	32.1	46.0	13.9
596.6	11.4	P	V	18.7	2.7	0.0	32.8	46.0	13.2
623.6	10.5	P	V	19.1	2.8	0.0	32.4	46.0	13.6
747.2	11.1	P	V	20.9	3.1	0.0	35.1	46.0	10.9
943.4	10.5	P	V	23.2	3.5	0.0	37.2	46.0	8.8

EUT RDR-80531BK5; S/N W2SB200027; USB Power from PC									
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
34.0	13.3	P	H	12.7	0.6	0.0	26.6	40.0	13.4
48.1	9.9	P	H	9.8	0.7	0.0	20.4	40.0	19.6
57.0	13.5	P	H	9.3	0.8	0.0	23.6	40.0	16.4
67.8	14.7	P	H	9.2	0.9	0.0	24.8	40.0	15.2
92.2	22.9	P	H	9.9	1.0	0.0	33.8	43.5	9.7
104.8	12.6	P	H	10.6	1.1	0.0	24.3	43.5	19.2



EUT		RDR-80531BK5; S/N W2SB200027; USB Power from PC							
Freq. MHz	Meter Reading dBuV	Decet.	Ant. Pol.	Ant Factor dB/m	Cable Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
113.4	17.5	P	H	11.2	1.1	0.0	29.8	43.5	13.7
122.5	18.0	P	H	11.8	1.2	0.0	31.0	43.5	12.5
136.0	13.8	P	H	12.4	1.3	0.0	27.5	43.5	16.0
150.1	17.6	P	H	12.8	1.3	0.0	31.7	43.5	11.8
157.2	14.5	P	H	12.9	1.4	0.0	28.8	43.5	14.7
172.5	11.9	P	H	13.3	1.4	0.0	26.6	43.5	16.9
189.1	18.4	P	H	13.9	1.5	0.0	33.8	43.5	9.7
199.5	15.0	P	H	14.3	1.5	0.0	30.8	43.5	12.7
240.4	15.0	P	H	15.2	1.7	0.0	31.9	46.0	14.1
249.0	16.6	P	H	15.4	1.7	0.0	33.7	46.0	12.3
259.8	16.4	P	H	12.3	1.8	0.0	30.5	46.0	15.5
282.5	10.9	P	H	13.2	1.8	0.0	25.9	46.0	20.1
298.4	14.2	P	H	13.9	1.9	0.0	30.0	46.0	16.0
325.4	12.7	P	H	14.2	2.0	0.0	28.9	46.0	17.1
336.8	11.7	P	H	14.3	2.0	0.0	28.0	46.0	18.0
352.7	12.2	P	H	14.4	2.1	0.0	28.7	46.0	17.3
360.5	11.9	P	H	14.4	2.1	0.0	28.4	46.0	17.6
372.9	11.3	P	H	14.5	2.1	0.0	27.9	46.0	18.1
379.7	13.6	P	H	14.8	2.1	0.0	30.5	46.0	15.5
384.5	12.8	P	H	14.9	2.2	0.0	29.9	46.0	16.1
395.6	13.7	P	H	15.3	2.2	0.0	31.2	46.0	14.8
410.2	14.3	P	H	15.5	2.2	0.0	32.0	46.0	14.0
420.0	14.7	P	H	15.7	2.3	0.0	32.7	46.0	13.3
433.9	15.3	P	H	16.0	2.3	0.0	33.6	46.0	12.4
461.1	14.5	P	H	16.8	2.4	0.0	33.7	46.0	12.3
488.1	14.8	P	H	17.0	2.5	0.0	34.3	46.0	11.7
542.5	10.4	P	H	18.0	2.6	0.0	31.0	46.0	15.0
581.1	18.2	P	H	18.6	2.7	0.0	39.5	46.0	6.5
596.6	12.8	P	H	18.7	2.7	0.0	34.2	46.0	11.8
623.6	11.4	P	H	19.1	2.8	0.0	33.3	46.0	12.7
646.1	11.6	P	H	19.5	2.8	0.0	33.9	46.0	12.1
735.2	8.2	P	H	21.0	3.1	0.0	32.3	46.0	13.7
818.8	8.3	P	H	21.5	3.2	0.0	33.0	46.0	13.0
885.4	8.3	P	H	22.7	3.4	0.0	34.4	46.0	11.6
40.6	25.0	P	V	11.1	0.7	0.0	36.8	40.0	3.2
40.6	20.1	P	V	11.1	0.7	0.0	31.9	40.0	8.1
54.3	17.3	P	V	9.4	0.8	0.0	27.5	40.0	12.5
67.8	20.0	P	V	9.2	0.9	0.0	30.1	40.0	9.9
78.0	14.6	P	V	9.3	1.0	0.0	24.9	40.0	15.1
92.2	17.5	P	V	9.9	1.0	0.0	28.4	43.5	15.1
102.1	14.0	P	V	10.4	1.1	0.0	25.5	43.5	18.0
115.6	16.0	P	V	11.3	1.1	0.0	28.4	43.5	15.1
122.9	19.1	P	V	11.8	1.2	0.0	32.1	43.5	11.4
141.7	13.8	P	V	12.6	1.3	0.0	27.7	43.5	15.8
152.1	15.0	P	V	12.8	1.3	0.0	29.1	43.5	14.4
167.8	10.7	P	V	13.2	1.4	0.0	25.3	43.5	18.2
189.1	15.9	P	V	13.9	1.5	0.0	31.3	43.5	12.2
207.4	11.0	P	V	14.6	1.6	0.0	27.2	43.5	16.3
231.1	11.0	P	V	15.0	1.7	0.0	27.7	46.0	18.3
249.0	16.1	P	V	15.4	1.7	0.0	33.2	46.0	12.8
256.8	14.8	P	V	12.2	1.7	0.0	28.7	46.0	17.3
298.4	11.2	P	V	13.9	1.9	0.0	27.0	46.0	19.0



EUT		RDR-80531BK5; S/N W2SB200027; USB Power from PC							
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
325.4	12.0	P	V	14.2	2.0	0.0	28.2	46.0	17.8
353.2	11.0	P	V	14.4	2.1	0.0	27.5	46.0	18.5
379.7	11.4	P	V	14.8	2.1	0.0	28.3	46.0	17.7
406.9	15.6	P	V	15.5	2.2	0.0	33.3	46.0	12.7
415.4	9.6	P	V	15.6	2.3	0.0	27.5	46.0	18.5
418.5	12.0	P	V	15.6	2.3	0.0	29.9	46.0	16.1
427.3	15.2	P	V	15.8	2.3	0.0	33.3	46.0	12.7
433.9	12.1	P	V	16.0	2.3	0.0	30.4	46.0	15.6
461.1	15.7	P	V	16.8	2.4	0.0	34.9	46.0	11.1
488.1	13.1	P	V	17.0	2.5	0.0	32.6	46.0	13.4
550.6	12.1	P	V	18.1	2.6	0.0	32.8	46.0	13.2
596.6	12.2	P	V	18.7	2.7	0.0	33.6	46.0	12.4
623.6	10.6	P	V	19.1	2.8	0.0	32.5	46.0	13.5
648.1	12.8	P	V	19.6	2.8	0.0	35.2	46.0	10.8
655.2	10.1	P	V	20.0	2.8	0.0	32.9	46.0	13.1
729.2	8.3	P	V	21.0	3.0	0.0	32.3	46.0	13.7
786.3	8.9	P	V	21.0	3.2	0.0	33.1	46.0	12.9
808.8	8.1	P	V	21.4	3.2	0.0	32.7	46.0	13.3
856.9	8.2	P	V	22.5	3.3	0.0	34.0	46.0	12.0
859.4	8.8	P	V	22.5	3.3	0.0	34.6	46.0	11.4
910.4	7.9	P	V	22.9	3.4	0.0	34.2	46.0	11.8
967.0	8.1	P	V	23.5	3.5	0.0	35.1	54.0	18.9

EUT		RDR-80531BK6; S/N: W2SC00026; Powered with 9V External supply							
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
34.6	12.2	P	H	12.5	0.6	0.0	25.3	40.0	14.7
56.5	17.9	P	H	9.3	0.8	0.0	28.0	40.0	12.0
61.4	16.2	P	H	9.3	0.8	0.0	26.3	40.0	13.7
82.4	16.3	P	H	9.4	1.0	0.0	26.7	40.0	13.3
101.7	15.5	P	H	10.4	1.1	0.0	27.0	43.5	16.5
105.7	15.7	P	H	10.7	1.1	0.0	27.5	43.5	16.0
110.5	14.7	P	H	11.0	1.1	0.0	26.8	43.5	16.7
118.7	17.9	P	H	11.5	1.2	0.0	30.6	43.5	12.9
128.9	12.2	P	H	12.1	1.2	0.0	25.5	43.5	18.0
147.7	11.6	P	H	12.7	1.3	0.0	25.6	43.5	17.9
155.9	16.1	P	H	12.9	1.4	0.0	30.4	43.5	13.1
162.1	17.5	P	H	13.0	1.4	0.0	31.9	43.5	11.6
175.8	11.3	P	H	13.5	1.4	0.0	26.2	43.5	17.3
189.9	15.7	P	H	13.9	1.5	0.0	31.1	43.5	12.4
192.6	16.2	P	H	14.0	1.5	0.0	31.7	43.5	11.8
210.3	11.0	P	H	14.7	1.6	0.0	27.3	43.5	16.2
234.2	15.1	P	H	15.0	1.7	0.0	31.8	46.0	14.2
249.0	16.9	P	H	15.4	1.7	0.0	34.0	46.0	12.0
264.4	15.7	P	H	12.4	1.8	0.0	29.9	46.0	16.1
279.0	12.4	P	H	13.1	1.8	0.0	27.3	46.0	18.7
316.9	13.8	P	H	14.7	2.0	0.0	30.5	46.0	15.5
325.4	14.1	P	H	14.2	2.0	0.0	30.3	46.0	15.7
336.8	13.4	P	H	14.3	2.0	0.0	29.7	46.0	16.3
352.7	16.4	P	H	14.4	2.1	0.0	32.9	46.0	13.1



EUT RDR-80531BK6; S/N: W2SC00026; Powered with 9V External supply									
Freq. MHz	Meter Reading dBuV	Decet.	Ant. Pol.	Ant Factor dB/m	Cable Factors dB	Dist. Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB
379.7	14.7	P	H	14.8	2.1	0.0	31.6	46.0	14.4
406.9	15.2	P	H	15.5	2.2	0.0	32.9	46.0	13.1
433.9	14.3	P	H	16.0	2.3	0.0	32.6	46.0	13.4
461.1	12.8	P	H	16.8	2.4	0.0	32.0	46.0	14.0
488.1	13.3	P	H	17.0	2.5	0.0	32.8	46.0	13.2
515.5	10.3	P	H	18.7	2.6	0.0	31.6	46.0	14.4
569.6	12.3	P	H	18.4	2.7	0.0	33.4	46.0	12.6
623.6	11.8	P	H	19.1	2.8	0.0	33.7	46.0	12.3
678.2	11.9	P	H	20.9	2.9	0.0	35.7	46.0	10.3
803.3	8.1	P	H	21.4	3.2	0.0	32.7	46.0	13.3
878.4	9.1	P	H	22.7	3.3	0.0	35.1	46.0	10.9
959.0	8.6	P	H	23.4	3.5	0.0	35.5	46.0	10.5
32.0	14.0	P	V	13.3	0.6	0.0	27.9	40.0	12.1
40.6	24.5	P	V	11.1	0.7	0.0	36.3	40.0	3.7
40.6	17.1	Q	V	11.2	0.7	0.0	29.0	40.0	11.0
56.5	21.3	P	V	9.3	0.8	0.0	31.4	40.0	8.6
67.8	22.9	P	V	9.2	0.9	0.0	33.0	40.0	7.0
81.5	21.6	P	V	9.4	1.0	0.0	32.0	40.0	8.0
99.7	16.9	P	V	10.3	1.1	0.0	28.3	43.5	15.2
117.8	16.6	P	V	11.5	1.2	0.0	29.3	43.5	14.2
135.3	14.4	P	V	12.4	1.3	0.0	28.1	43.5	15.4
144.8	17.6	P	V	12.6	1.3	0.0	31.5	43.5	12.0
163.0	15.3	P	V	13.0	1.4	0.0	29.7	43.5	13.8
182.0	10.7	P	V	13.6	1.5	0.0	25.8	43.5	17.7
193.9	12.0	P	V	14.1	1.5	0.0	27.6	43.5	15.9
213.6	10.8	P	V	14.7	1.6	0.0	27.1	43.5	16.4
229.3	11.8	P	V	15.0	1.7	0.0	28.5	46.0	17.5
249.0	17.4	P	V	15.4	1.7	0.0	34.5	46.0	11.5
279.3	10.7	P	V	13.1	1.8	0.0	25.6	46.0	20.4
352.7	12.0	P	V	14.4	2.1	0.0	28.5	46.0	17.5
379.7	11.1	P	V	14.8	2.1	0.0	28.0	46.0	18.0
396.8	11.3	P	V	15.3	2.2	0.0	28.8	46.0	17.2
406.9	13.5	P	V	15.5	2.2	0.0	31.2	46.0	14.8
419.5	11.9	P	V	15.6	2.3	0.0	29.8	46.0	16.2
432.4	13.2	P	V	16.0	2.3	0.0	31.5	46.0	14.5
461.1	11.4	P	V	16.8	2.4	0.0	30.6	46.0	15.4
488.1	11.7	P	V	17.0	2.5	0.0	31.2	46.0	14.8
542.5	11.7	P	V	18.0	2.6	0.0	32.3	46.0	13.7
569.6	10.7	P	V	18.4	2.7	0.0	31.8	46.0	14.2
596.6	10.9	P	V	18.7	2.7	0.0	32.3	46.0	13.7
623.6	11.4	P	V	19.1	2.8	0.0	33.3	46.0	12.7
678.2	10.8	P	V	20.9	2.9	0.0	34.6	46.0	11.4
748.7	8.7	P	V	20.9	3.1	0.0	32.7	46.0	13.3
800.3	8.7	P	V	21.3	3.2	0.0	33.2	46.0	12.8
868.9	8.4	P	V	22.7	3.3	0.0	34.4	46.0	11.6
925.9	8.5	P	V	23.0	3.4	0.0	34.9	46.0	11.1

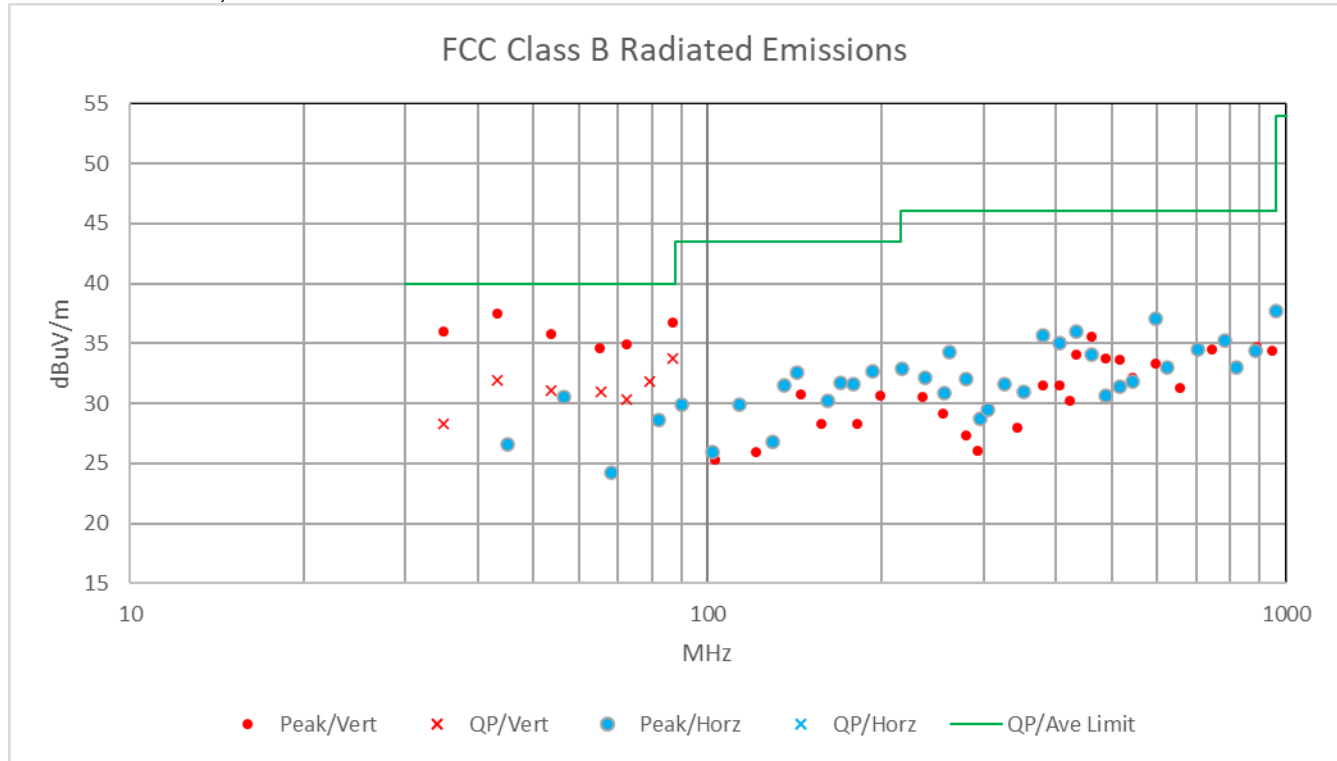
Where there is both peak and quasi peak data, the quasi-peak is the final determination of compliance.

Judgment: Passed by 6.3 dB

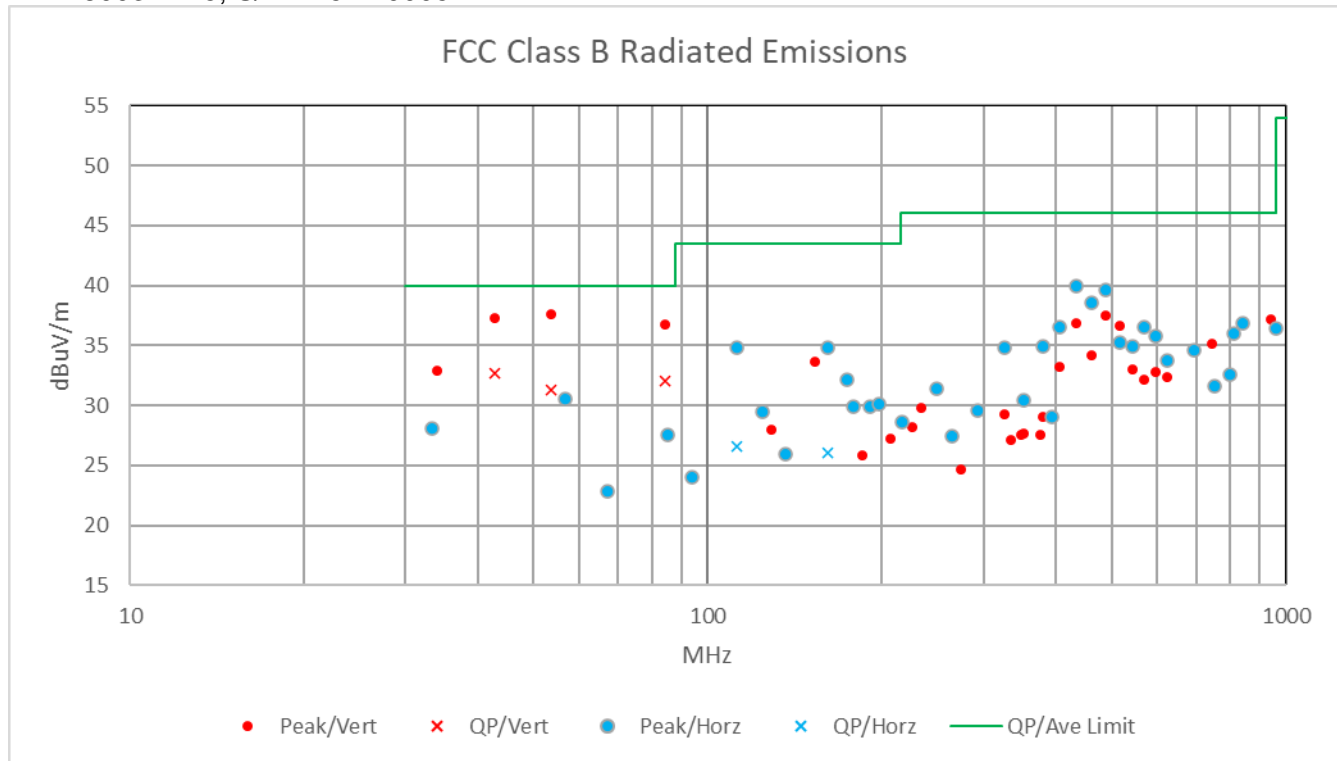


Radiated emissions in a graphical format. The following chart has the same data as the previous tables.

RDR-80031BK6; S/N: W52I200054

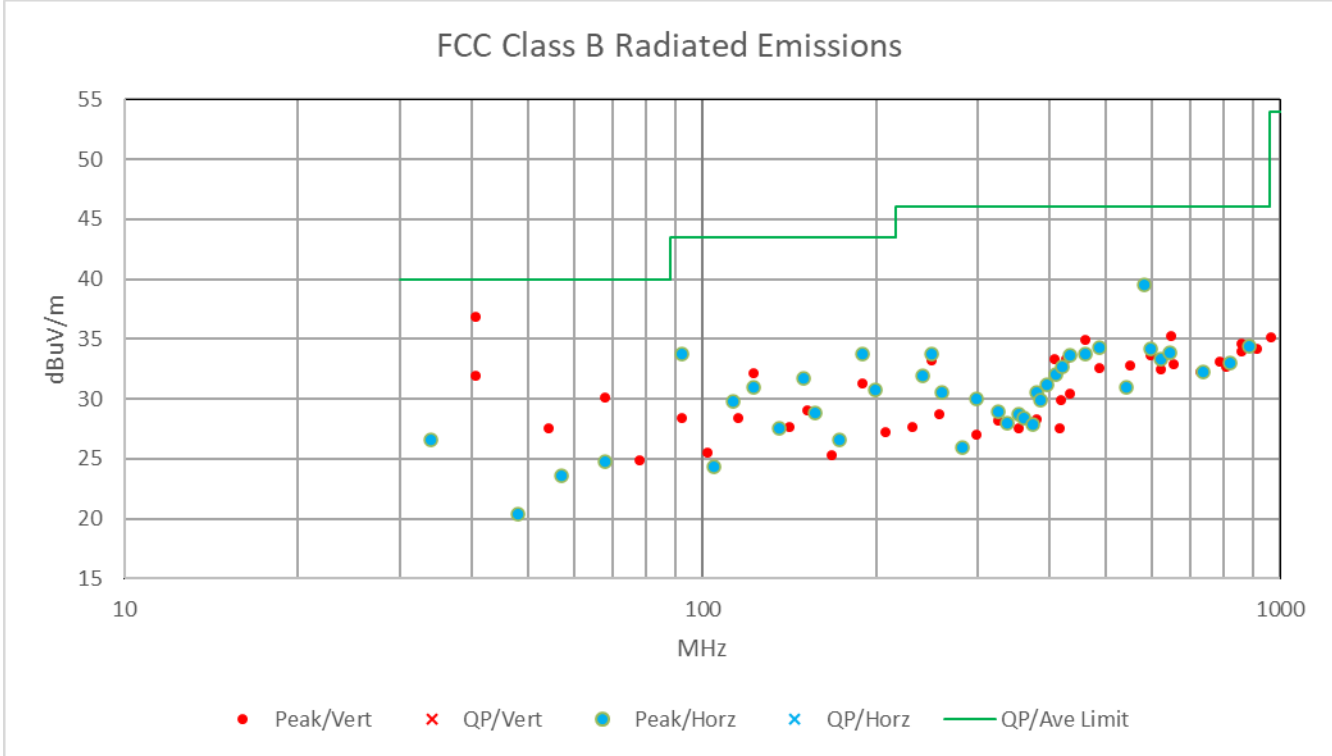


RDR-80031BK5; S/N: W52I200051





RDR-80531BK5; S/N W2SB200027



80531BK6; S/N: W2SC00026

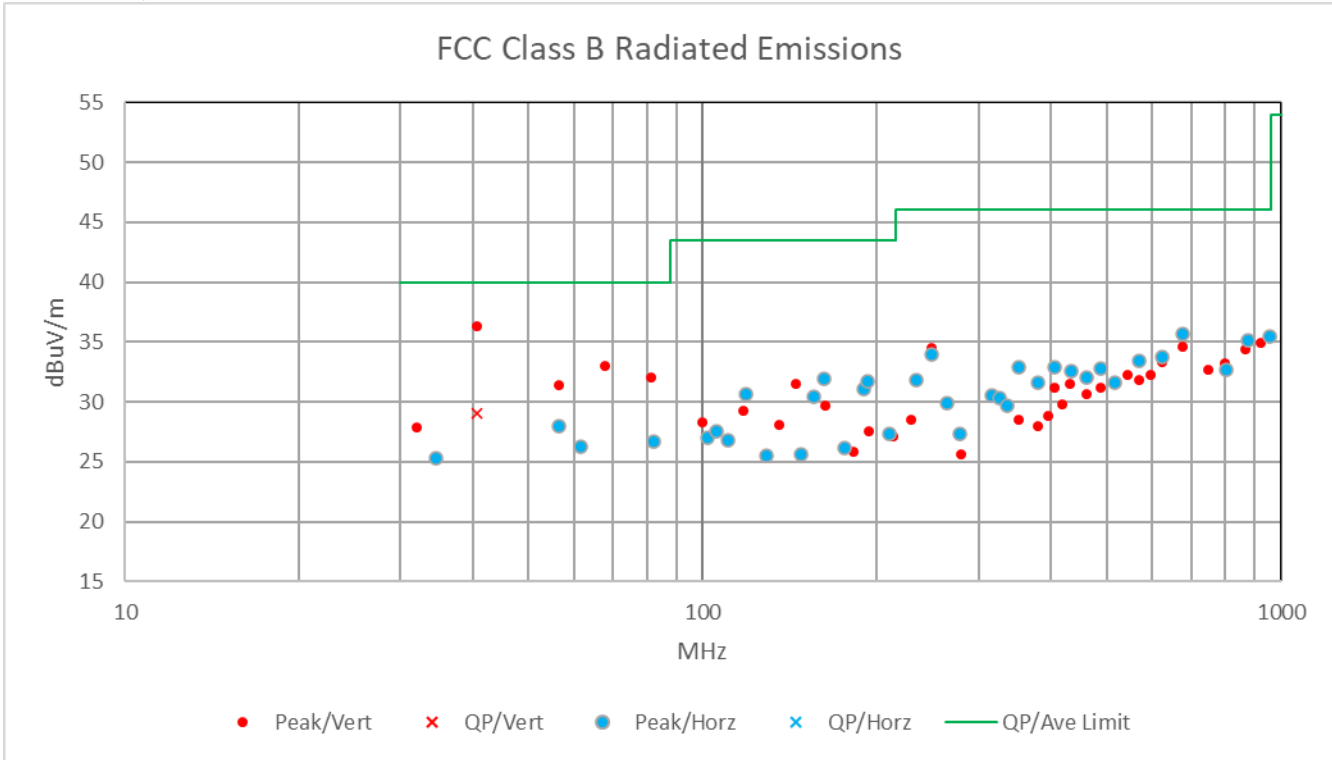
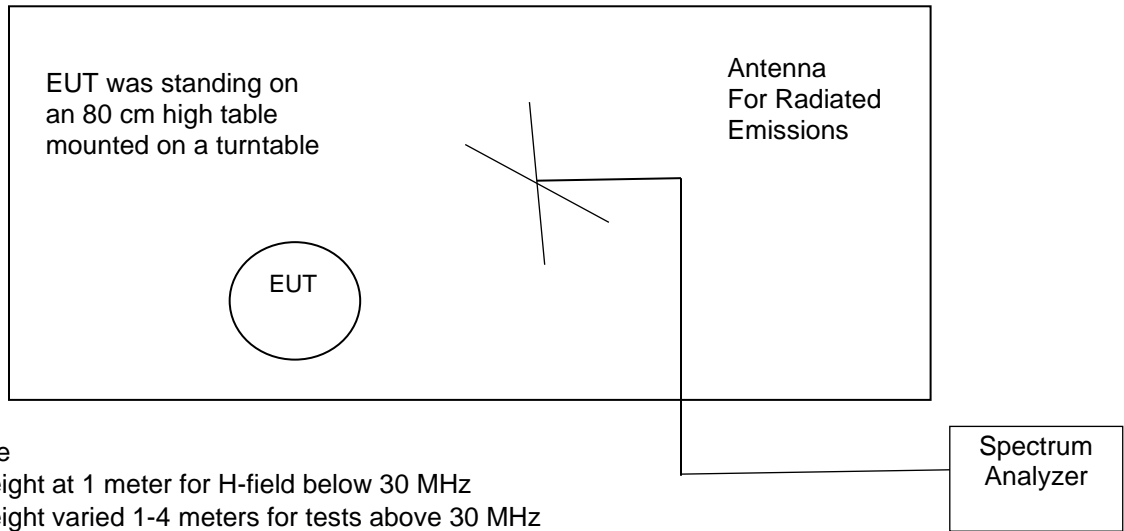




Figure 2. Drawing of Radiated Emissions Test Setup

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 Antenna	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

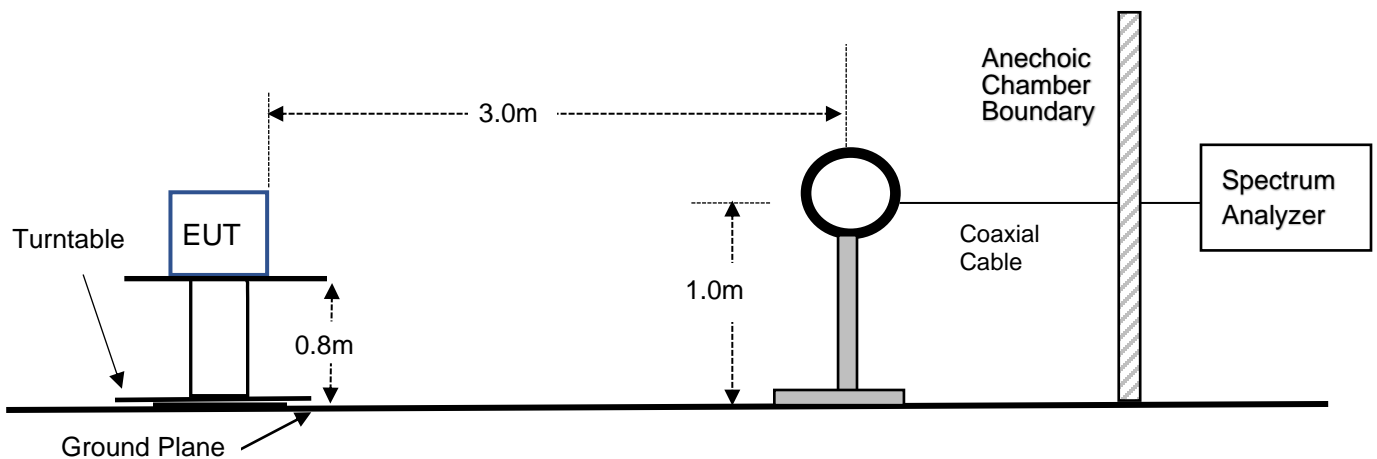
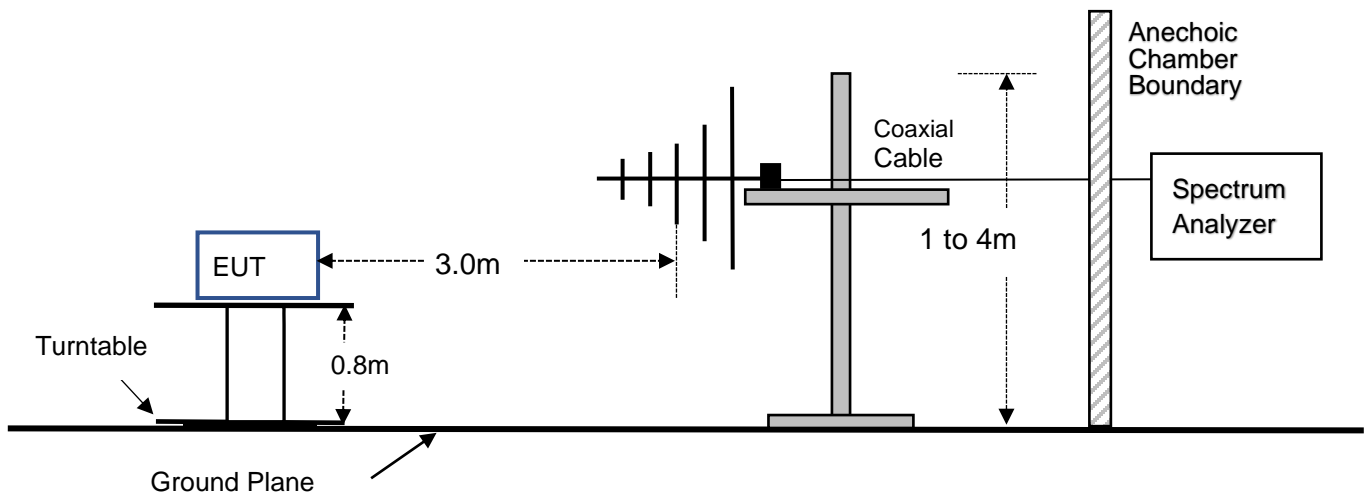




Figure 4. Radiated Emissions Test Setup for Frequencies from 30MHz to 1000MHz



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 Radiated Emissions Tests Results (0.009 to 30 MHz)

Test Date	September 30, 2022
Test Distance	3 Meters
Specification	FCC 15 & RSS-GEN
Product	Model: See Below

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	EUT RDR-
125.0	56.1	18.9	3.0	2.0	0.1	-80.0	-4.9	25.7	30.6	80031BK5
250.0	40.5	18.6	3.0	2.0	0.1	-80.0	-21.2	19.6	40.8	80031BK5
375.0	35.6	18.4	3.0	2.0	0.1	-80.0	-25.9	16.1	42.0	80031BK5
500.0	31.2	18.3	3.0	2.0	0.1	-40.0	9.6	33.6	24.0	80031BK5
13560	51.7	16.0	3.0	2.0	0.4	-40.0	28.1	40.5	12.4	80031BK5
27120	19.9	15.3	3.0	2.0	0.5	-40.0	-4.3	29.5	33.8	80031BK5
125.0	57.0	18.9	3.0	2.0	0.1	-80.0	-4.0	25.7	29.7	80031BK6
250.0	39.9	18.6	3.0	2.0	0.1	-80.0	-21.4	19.6	41.0	80031BK6
375.0	34.8	18.4	3.0	2.0	0.1	-80.0	-26.7	16.1	42.8	80031BK6
500.0	30.3	18.3	3.0	2.0	0.1	-40.0	8.7	33.6	24.9	80031BK6
13560	52.1	16.0	3.0	2.0	0.4	-40.0	28.5	40.5	12.0	80031BK6
27120	19.6	15.3	3.0	2.0	0.5	-40.0	-4.6	29.5	34.1	80031BK6
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 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. Therefore it also met 15.225 (a) (b) since the (a) & (b) limits are less stringent than (c).

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 at least 10 dB.



Products

Model: RDR-80031BK5; S/N WS21100051
Model: RDR-80031BK6; S/N WS21200054

Agilent 12:23:45 Oct 5, 2022

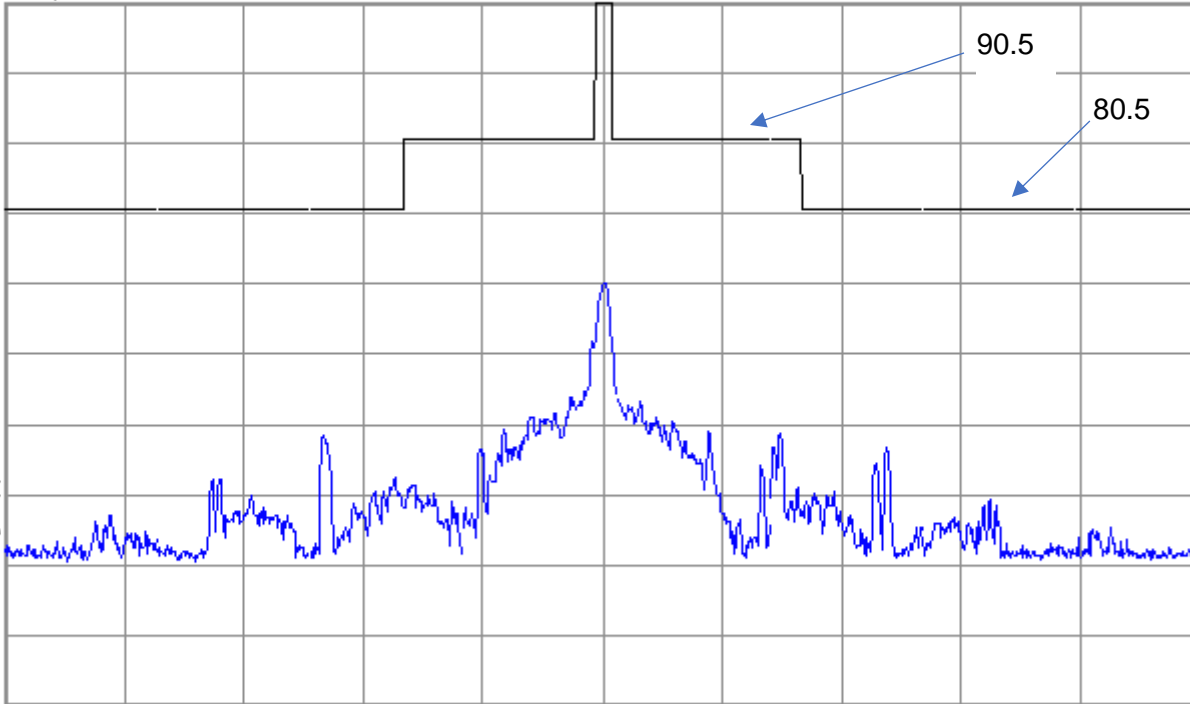
R T

FCC-ISED Limits; BK5

Ref 110 dB μ V

Atten 15 dB

Peak
Log
10
dB/



Start 13.11 MHz

#Res BW 9 kHz

#VBW 30 kHz

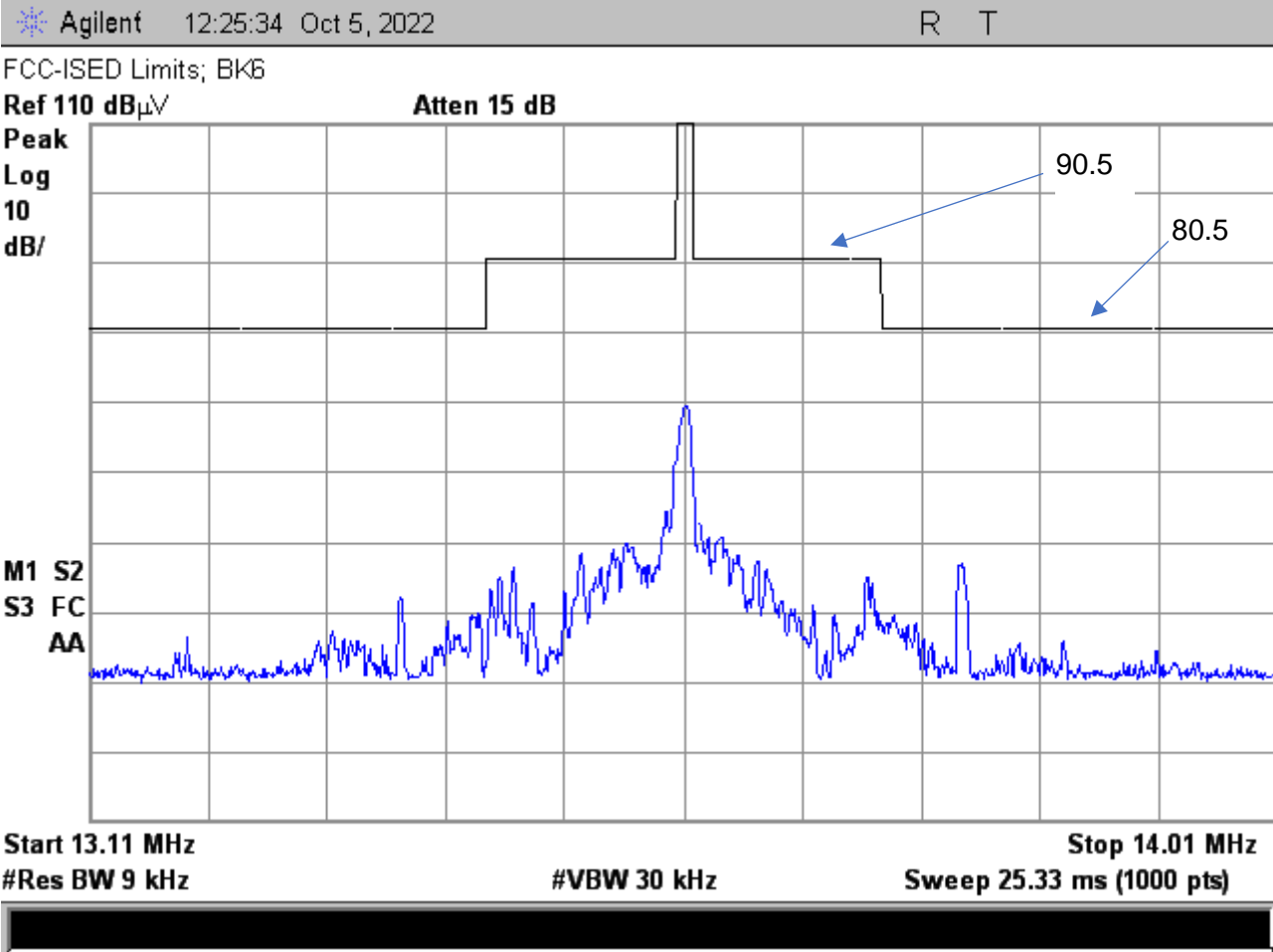
Stop 14.01 MHz

Sweep 25.33 ms (1000 pts)

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

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.



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

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.

Product	99% OBW	
	125 kHz signal	13.56 MHz Signal
RDR-80031BK5	1.2124 kHz	2.6173 kHz
RDR-80031BK6	1.1940 kHz	2.7003 kHz

Judgement: Pass



Figure 5. Occupied Bandwidth Plot 125 kHz

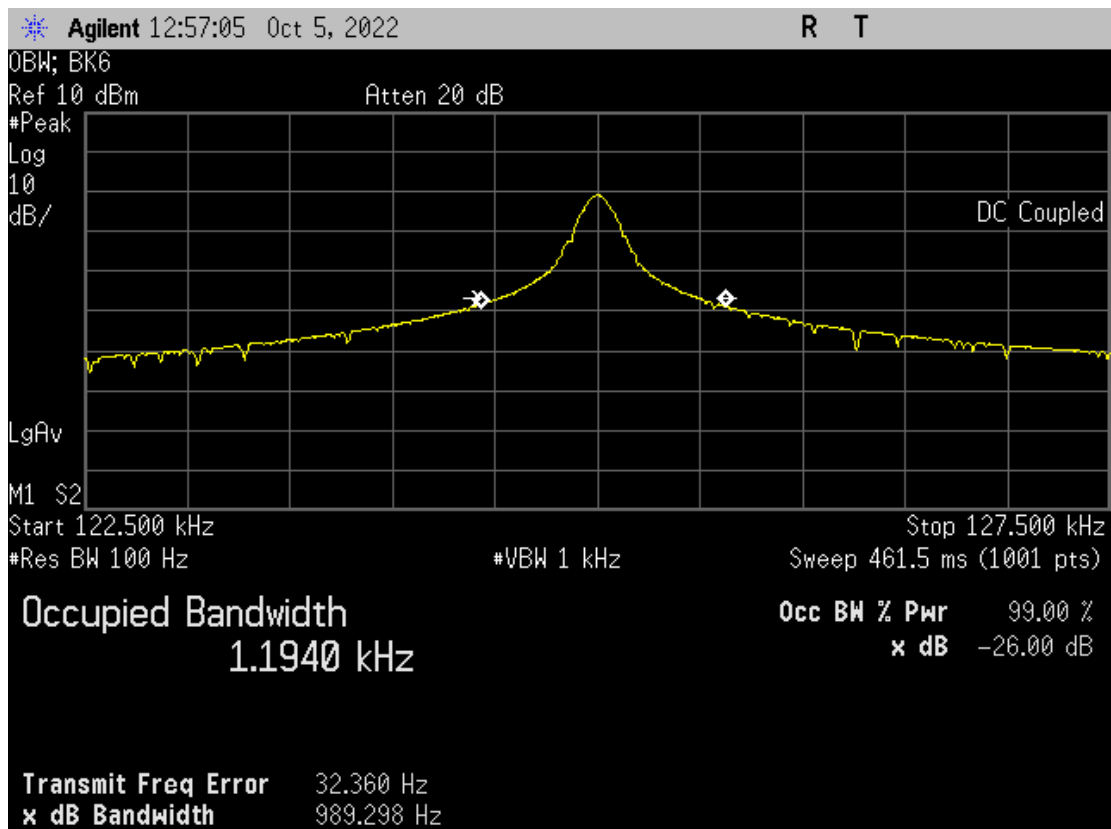
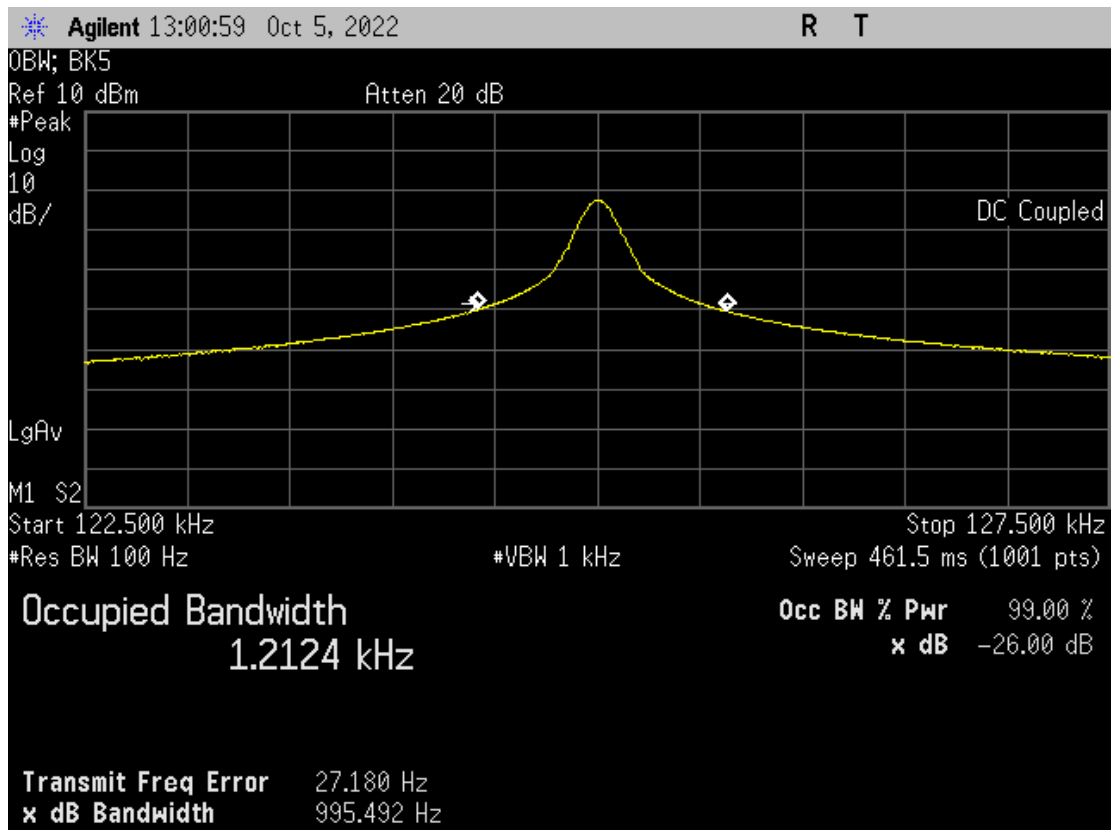
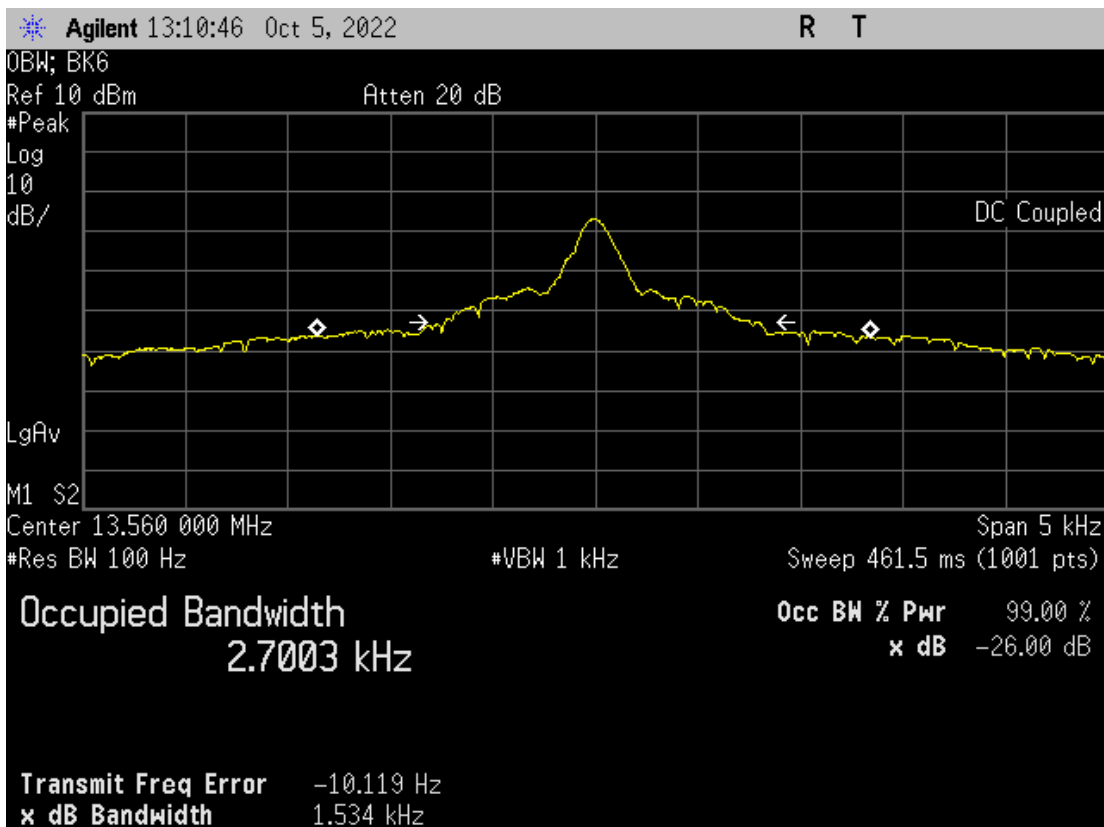
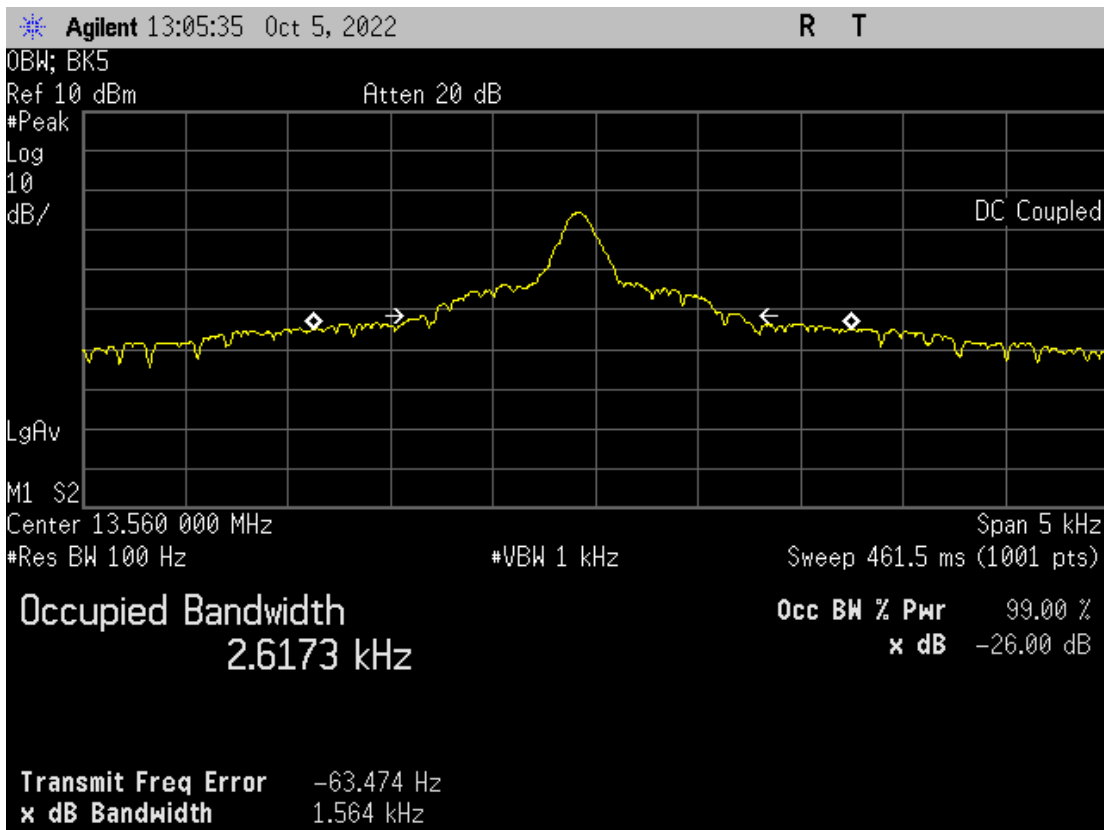




Figure 6. Occupied Bandwidth Plot 13.56 MHz





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-80031BK6	Specification	FCC Part 15.225 RSS-210 Section A2.6
Serial Number	W52I200054	Test Date	01/09/2023
Test Personnel	Joseph Strzelecki	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	13.55990 MHz		

Volts VAC	Freq. (MHz)	Deviation %	PPM
102.0	13.559920	0.00015	1.47
120.0	13.559900	0.00000	0.00
138.0	13.559910	0.00007	0.74

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	13.55990	13.55997	13.55998	13.55980	0.00000	0.00052	0.00059	-0.00074
40	13.55992	13.55997	13.56000	13.56000	0.00015	0.00052	0.00074	0.00074
30	13.55999	13.56001	13.55980	13.56005	0.00066	0.00081	-0.00074	0.00111
20	13.56000	13.56002	13.55990	13.55980	0.00074	0.00088	0.00000	-0.00074
10	13.56000	13.56001	13.55990	13.55980	0.00074	0.00081	0.00000	-0.00074
0	13.56008	13.56008	13.56010	13.56000	0.00133	0.00133	0.00147	0.00074
-10	13.56005	13.56008	13.56008	13.56006	0.00111	0.00133	0.00133	0.00118
-20	13.56001	13.56004	13.56010	13.56007	0.00081	0.00103	0.00147	0.00125

Max deviation is 14.75 ppm

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

Judgement: Pass



Model	RDR-80031BK5	Specification	FCC Part 15.225 RSS-210 Section A2.6
Serial Number	W52I200051	Test Date	01/09/2023
Test Personnel	Joseph Strzelecki	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	13.55994 MHz		

Volts VAC	Freq. (MHz)	Deviation %	PPM
102.0	13.559890	-0.00007	-0.74
120.0	13.559900	0.00000	0.00
138.0	13.559900	0.00000	0.00

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	13.55984	13.55984	13.55986	13.55981	-0.00074	-0.00074	-0.00059	-0.00096
40	13.55993	13.55991	13.55992	13.55987	-0.00007	-0.00022	-0.00015	-0.00052
30	13.55986	13.55987	13.55995	13.55991	-0.00059	-0.00052	0.00007	-0.00022
20	13.55994	13.55993	13.55994	13.55998	0.00000	-0.00007	0.00000	0.00029
10	13.55998	13.55997	13.55996	13.55998	0.00029	0.00022	0.00015	0.00029
0	13.55997	13.55999	13.55997	13.55999	0.00022	0.00037	0.00022	0.00037
-10	13.55998	13.55999	13.55994	13.55998	0.00029	0.00037	0.00000	0.00029
-20	13.56008	13.56000	13.56008	13.56010	0.00103	0.00044	0.00103	0.00118

Max deviation is 11.8 ppm

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
99% Occupied Bandwidth	1% of frequency span
Temperature THM-03	0.6 Deg C



Revision History

RP-9709A Revisions:			
Rev.	Affected Sections	Description	Rationale
1	Cover, 1.0, 2.0. 3.1	Changed “Dual Frequency Card Reader” to “Dual Frequency RFID Reader”	Typographical error
1	2.0	Added information on SDoC Authorization	Clarification
1	3.2	Added firmware number to paragraph above Product Family table	Clarification