Electromagnetic Compatibility Test Report

Tests Performed on an rf IDeas, Inc.

Model OEM-305N11KU-BGM-S Wave ID Plus RFID reader,

Radiometrics Document RP-9589

ACCREDITED
TESTING CERT #1495.01

Product Detail:
FCC ID: M9MF30100 IC: 6571A-F30100 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: 2021 Canada ISED; RSS-210, Issue 10: 2019 as required for Category I Equipment This report concerns: Class II Permissive Change FCC Part 15.225 RSS-210

Tests Performed For:	*Test Facility:*
rf IDeas, Inc. 425 Martingale Road, Suite 1680 Schaumburg, IL 60173-2052	**Radiometrics Midwest Corporation** 12 Devonwood Avenue Romeoville, IL 60446-1349 (815) 293-0772

Test Date(s):
January 28 thru February 3, 2022

Document RP-9589 Revisions:

Rev.	Issue Date	Revised By
0	March 18, 2022	
1	March 25, 2022	Joseph Strzelecki
2	March 30, 2022	Joseph Strzelecki

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1.0 ADMINISTRATIVE DATA

Equipment Under Test:	
An rf IDeas, Inc., Wave ID Plus RFID reader Model: OEM-305N11KU-BGM-S Serial Numbers: FNA10000100 & FNA 1000098 This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics:	*Test Date(s):*
January 14, 2022	January 28 thru February 3, 2022
Test Report Written and Authorized By:	*Test Witnessed By:*
Joseph Strzelecki Senior EMC Engineer	The tests were not witnessed by personnel from rf IDeas, Inc.
Radiometrics' Personnel Responsible for Test:	*EUT Checked By:*
Joseph Strzelecki 03/30/2022 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Jeffrey Tomes Senior EMC Technician Chris D'Alessio EMC Technician	Joseph Strzelecki Jeffrey Tomes Chris D'Alessio Radiometrics

2.0 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Wave ID Plus RFID reader, model OEM-305N11KU-BGM-S, 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

The Frequency Stability test was not repeated, since the frequency determining circuitry was not changed. It fully complied in the original submittal.

The EUT was found to be fully compliant in accordance with the rules for a Class II permissive change.

IEC 17025 Decision Rule:
The declaration of pass or fail is based on the specifications listed above. The declaration of pass or fail did not consider measurement uncertainty.

The bluetooth transmitter fundamental and its harmonics were not measured, since there were no changes to the Bluetooth circuitry. The 13.56 MHz NFC transmitter fundamental and 2nd harmonic were not measured, since there were no changes to the NFC circuitry. The harmonics of the NFC above 30 MHz were found to be compliant.

3.0 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Wave ID Plus, RFID reader, manufactured by rf IDeas, Inc. The EUT was in good working condition during the tests, with no known defects.

The EUT has a Bluetooth and an NFC transmitter. The Bluetooth is a 2.4 GHz, BLE (Bluetooth low energy) transceiver. The NFC (near field communication) is a 13.56 RFID transceiver.

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

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
OEM-305N11KU-BGM	WAVE ID Mobile OEM V2 Pack ID Keystroke module USB Reader
OEM-305N11KU-BGM-X	WAVE ID Mobile OEM V2 Pack ID Keystroke module USB Reader without cable
OEM-305N11KU-BGM-S	WAVE ID Mobile OEM V2 Pack ID Keystroke Expandable module USB Reader **(Tested Sample)**
OEM-305N11KU-BGM-S-X	WAVE ID Mobile OEM V2 Pack ID Keystroke Expandable module USB Reader without cable

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	OEM-305N11KU-BGM-S	FNA10000100
2	RFID Reader	E	rf IDeas	OEM-305N11KU-BGM-S	FNA 1000098
3	Latitude Laptop PC	H	HP	Elite x2	5CG545482P
4	Laptop AC-DC power supply	P	HP	854055-002	None

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

List of Cables

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

4.2 Special Accessories

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

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

4.4 Description of Permissive Change

The series inductors on the antenna had been changed to 180nH (L1 & L2) and C1 to 33pF. The Original had L1 & L2 were 100nH & C3 was 39pF. The RFID BLE reader will not get a housing.

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	2019	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 5	2019	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)

6.0 TEST PROCEDURE DOCUMENTS

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

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

7.0 RADIOMETRICS' TEST FACILITIES

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

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

Chamber E: Is a custom-made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber. The floor has a 9' x 9' section of microwave absorber for testing above 1 GHz.

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 IC 3124A-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 and the data contained herein was taken with calibrated test equipment. The results relate only to the EUT listed herein.

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.	01/18/22
ANT-53	EMCO	Loop Antenna	6507	1453	1 kHz-30 MHz	24 Mo	02/04/20
ANT-80	AH Systems	Bicon Antenna	SAS-540	294	20-330MHz	24 Mo.	01/05/21
LSN-01	Electrometrics	50 uH LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	08/23/21
REC-11	Agilent	Spectrum Analyzer	E7405A	US39110103	9kHz-3GHz	24 Mo.	04/16/20
REC-20	HP / Agilent	Spectrum Analyzer	85460A/84562A	33330A00135 3410A00178	30Hz-6GHz	24 Mo.	08/18/21
REC-44	Agilent	Spectrum Analyzer	E4440A	US40420673	3Hz-26.5GHz	24 Mo.	02/25/20
THM-03	Fluke	Temp/Humid Meter	971	95850465	N/A	12 Mo.	05/25/21

Note: All calibrated equipment is subject to periodic checks.

The test equipment was in calibration during the tests.

Software Company	Test Software Name	Version	Applicable Tests
Radiometrics	EN550XX0	07.16.19	RF Conducted Emissions (FCC Part 15 & EN 55032)
Radiometrics	REREC11D	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

12.0 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.

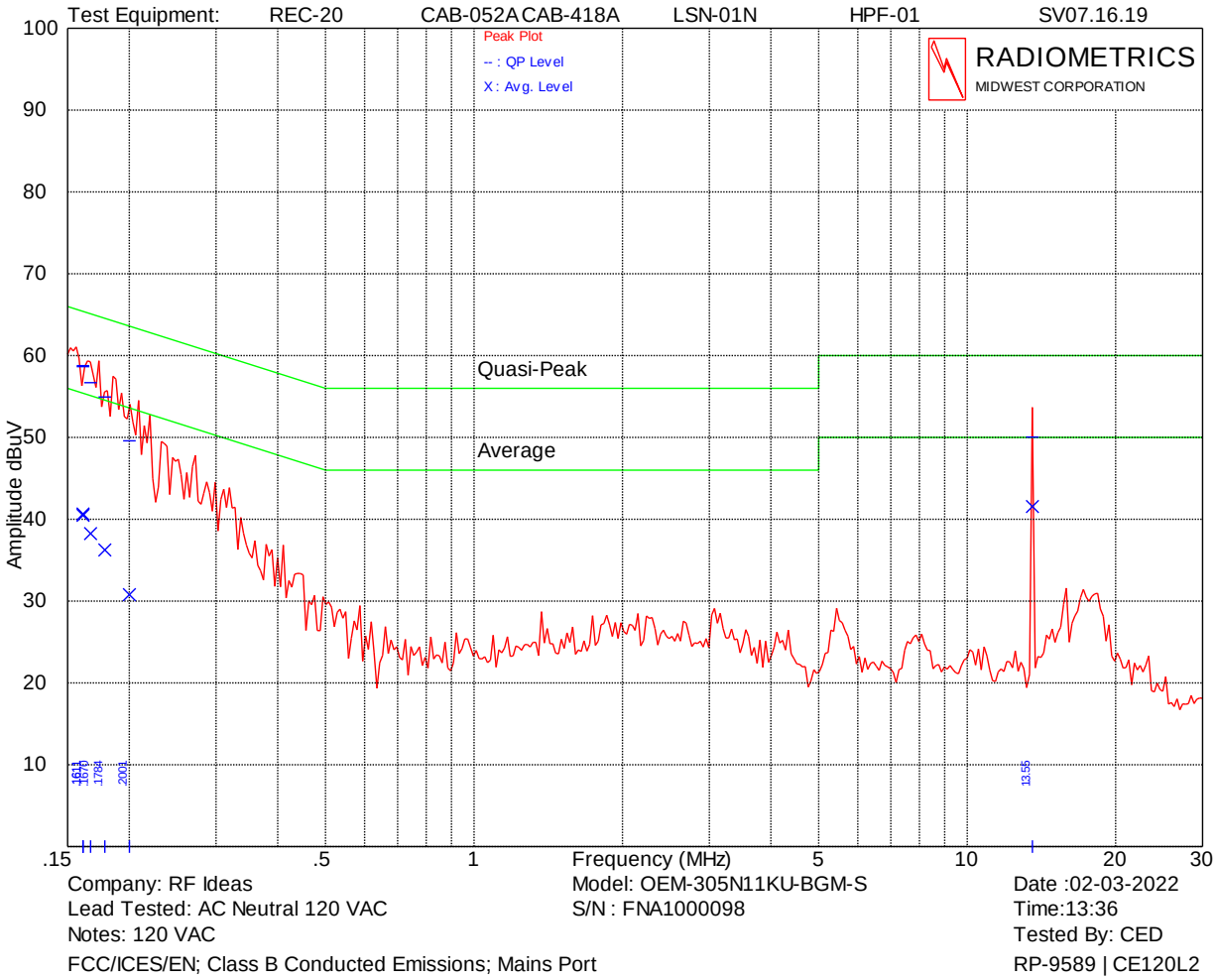
Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into 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 Limits of Conducted Emissions at the AC Mains Ports

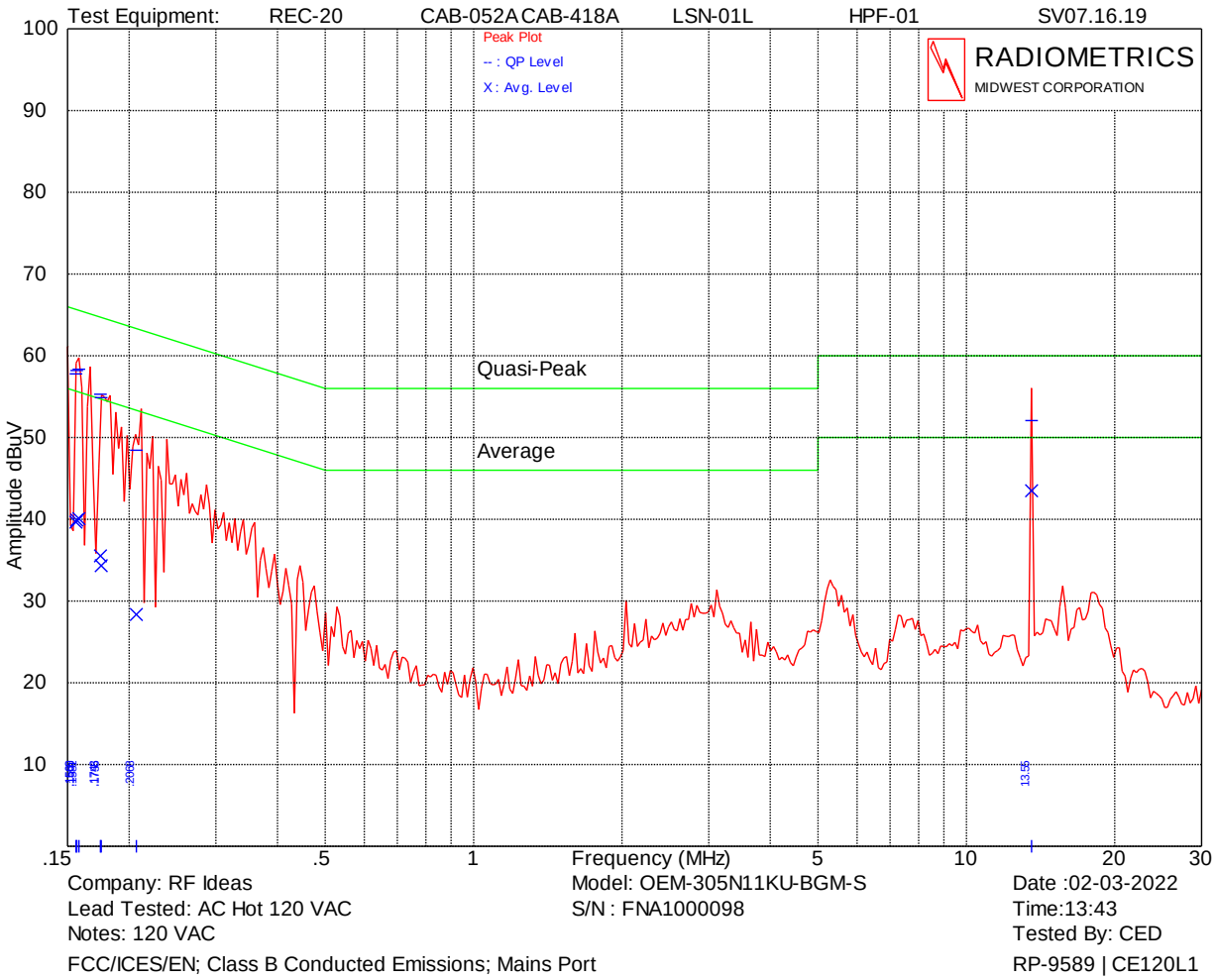
Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 – 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

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 EUT power supply, after testing all modes of operation.

Test Date : 02/03/2022
The Amplitude is the final corrected value with cable and LISN Loss.



Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.161	58.6	65.4	40.7	55.4	6.8
0.167	56.7	65.1	38.2	55.1	8.4
0.178	54.9	64.6	36.2	54.6	9.6
0.200	49.6	63.6	30.8	53.6	14.0
13.558	50.0	60.0	41.6	50.0	8.4



Frequency (MHz)	QP Amp. (dBuV)	QP Limit (dBuV)	Average Amp. (dBuV)	Average Limit (dBuV)	Margin Under Limit (dB)
0.156	57.8	65.7	39.6	55.7	7.9
0.157	58.2	65.6	39.9	55.6	7.4
0.158	58.3	65.6	40.1	55.6	7.2
0.175	55.3	64.7	35.5	54.7	9.4
0.176	54.9	64.7	34.3	54.7	9.8
0.207	48.5	63.3	28.4	53.3	14.9
13.559	52.1	60.0	43.0	50.0	7.0

Judgment: Pass by at least 7 dB.

12.1 Radiated RF Emissions

The procedures were in accordance to ANSI C63.10 & C63.4. 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 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. The test setup drawing herein lists the details of the test equipment used during radiated emissions tests.

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. Chamber E is located at 12 Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 2,000 MHz was slowly scanned. 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.

Unintentional 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

12.1.1 Radiated Emissions Field Strength Sample 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 antenna factor converts the voltage reading in dBuV to field strength in dBuV/meter. The basic equation is as follows:

FS = RA + AF + CF - AG

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

12.2 Radiated Emissions Results

Test Date	01/28/2022
Test Distance	3 Meters
Specification	FCC Part 15 Subpart B
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; P = peak; Q = QP
Configuration	OEM-305N11KU-BGM-S; S/N FNA10000100; PCB-1080-03E; C51, C62=560pF; C50, C63=22pF; PCB-1098-03E; L1/2=180 nH; C1=33 pF, X Position

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
33.3	8.7	P	H	12.9	0.6	0.0	22.2	40.0	17.8	
40.7	5.3	P	H	11.1	0.7	0.0	17.1	40.0	22.9	
88.6	10.2	P	H	9.7	1.0	0.0	20.9	43.5	22.6	
101.8	6.9	P	H	10.4	1.1	0.0	18.4	43.5	25.1	
102.6	9.6	P	H	10.5	1.1	0.0	21.2	43.5	22.3	
108.5	7.3	P	H	10.9	1.1	0.0	19.3	43.5	24.2	
119.9	6.3	P	H	11.6	1.2	0.0	19.1	43.5	24.4	
131.7	13.7	P	H	12.2	1.2	0.0	27.1	43.5	16.4	
135.7	18.9	P	H	12.4	1.3	0.0	32.6	43.5	10.9	
144.2	15.3	P	H	12.6	1.3	0.0	29.2	43.5	14.3	
149.3	22.2	P	H	12.7	1.3	0.0	36.2	43.5	7.3	
176.2	16.1	P	H	13.5	1.4	0.0	31.0	43.5	12.5	
189.9	12.2	P	H	13.9	1.5	0.0	27.6	43.5	15.9	
192.1	12.3	P	H	14.1	1.5	0.0	27.9	43.5	15.6	
198.0	9.6	P	H	14.3	1.5	0.0	25.4	43.5	18.1	
217.1	10.7	P	H	14.8	1.6	0.0	27.1	46.0	18.9	
249.2	14.2	P	H	15.4	1.7	0.0	31.3	46.0	14.7	
271.3	16.9	P	H	12.3	1.8	0.0	31.0	46.0	15.0	
288.1	12.9	P	H	13.3	1.8	0.0	28.0	46.0	18.0	
298.2	16.8	P	H	13.9	1.9	0.0	32.6	46.0	13.4	
330.1	16.6	P	H	14.1	2.0	0.0	32.7	46.0	13.3	
352.4	15.3	P	H	14.2	2.0	0.0	31.5	46.0	14.5	
379.7	16.7	P	H	14.8	2.1	0.0	33.6	46.0	12.4	
407.0	16.9	P	H	15.5	2.2	0.0	34.6	46.0	11.4	
433.9	16.6	P	H	16.0	2.3	0.0	34.9	46.0	11.1	
447.3	12.2	P	H	16.4	2.3	0.0	30.9	46.0	15.1	
461.2	20.2	P	H	16.8	2.4	0.0	39.4	46.0	6.6	
474.6	15.3	P	H	17.1	2.4	0.0	34.8	46.0	11.2	
488.1	17.1	P	H	17.4	2.4	0.0	36.9	46.0	9.1	
501.7	13.2	P	H	17.8	2.5	0.0	33.5	46.0	12.5	
529.2	10.9	P	H	18.0	2.5	0.0	31.4	46.0	14.6	
542.5	12.9	P	H	18.0	2.6	0.0	33.5	46.0	12.5	
580.8	15.8	P	H	18.6	2.7	0.0	37.1	46.0	8.9	
596.7	11.6	P	H	18.7	2.7	0.0	33.0	46.0	13.0	
624.2	15.3	P	H	19.0	2.8	0.0	37.1	46.0	8.9	
650.8	14.1	P	H	19.6	2.8	0.0	36.5	46.0	9.5	
678.3	11.1	P	H	20.8	2.9	0.0	34.8	46.0	11.2	
705.0	9.7	P	H	20.9	2.9	0.0	33.5	46.0	12.5	
746.7	10.2	P	H	20.8	3.0	0.0	34.0	46.0	12.0	
786.7	8.3	P	H	20.9	3.1	0.0	32.3	46.0	13.7	
813.3	7.6	P	H	21.4	3.2	0.0	32.2	46.0	13.8	
867.5	8.2	P	H	22.7	3.3	0.0	34.2	46.0	11.8	
895.0	9.3	P	H	22.5	3.3	0.0	35.1	46.0	10.9	
921.7	10.1	P	H	22.7	3.4	0.0	36.2	46.0	9.8	

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
949.2	10.7	P	H	22.9	3.5	0.0	37.1	46.0	8.9	
976.7	9.0	P	H	23.4	3.5	0.0	35.9	54.0	18.1	
33.3	12.9	P	V	12.9	0.6	0.0	26.4	40.0	13.6	
42.9	12.6	P	V	10.6	0.7	0.0	23.9	40.0	16.1	
54.7	12.6	P	V	9.4	0.8	0.0	22.8	40.0	17.2	
68.7	13.3	P	V	9.2	0.9	0.0	23.4	40.0	16.6	
100.7	12.0	P	V	10.3	1.1	0.0	23.4	43.5	20.1	
135.7	6.2	P	V	12.4	1.3	0.0	19.9	43.5	23.6	
149.3	13.8	P	V	12.7	1.3	0.0	27.8	43.5	15.7	
171.1	10.4	P	V	13.3	1.4	0.0	25.1	43.5	18.4	
198.3	7.6	P	V	14.3	1.5	0.0	23.4	43.5	20.1	
246.2	13.3	P	V	15.3	1.7	0.0	30.3	46.0	15.7	
248.1	14.2	P	V	15.4	1.7	0.0	31.3	46.0	14.7	
249.9	14.2	P	V	11.9	1.7	0.0	27.8	46.0	18.2	
260.0	13.9	P	V	12.0	1.7	0.0	27.6	46.0	18.4	
279.3	10.6	P	V	12.9	1.8	0.0	25.3	46.0	20.7	
291.1	6.7	P	V	13.5	1.8	0.0	22.0	46.0	24.0	
337.3	10.3	P	V	14.1	2.0	0.0	26.4	46.0	19.6	
379.7	8.3	P	V	14.8	2.1	0.0	25.2	46.0	20.8	
402.4	15.9	P	V	15.4	2.2	0.0	33.5	46.0	12.5	
414.1	14.7	P	V	15.6	2.2	0.0	32.5	46.0	13.5	
433.9	11.1	P	V	16.0	2.3	0.0	29.4	46.0	16.6	
447.3	7.5	P	V	16.4	2.3	0.0	26.2	46.0	19.8	
461.2	15.5	P	V	16.8	2.4	0.0	34.7	46.0	11.3	
474.6	14.3	P	V	17.1	2.4	0.0	33.8	46.0	12.2	
488.1	14.6	P	V	17.4	2.4	0.0	34.4	46.0	11.6	
505.0	14.3	P	V	18.1	2.5	0.0	34.9	46.0	11.1	
529.2	8.5	P	V	18.0	2.5	0.0	29.0	46.0	17.0	
569.2	12.4	P	V	18.4	2.6	0.0	33.4	46.0	12.6	
580.8	10.2	P	V	18.6	2.7	0.0	31.5	46.0	14.5	
596.7	10.1	P	V	18.7	2.7	0.0	31.5	46.0	14.5	
623.3	10.9	P	V	19.0	2.8	0.0	32.7	46.0	13.3	
650.8	9.6	P	V	19.6	2.8	0.0	32.0	46.0	14.0	
678.3	7.4	P	V	20.8	2.9	0.0	31.1	46.0	14.9	
705.0	6.4	P	V	20.9	2.9	0.0	30.2	46.0	15.8	
879.2	6.5	P	V	22.8	3.3	0.0	32.6	46.0	13.4	
895.0	7.9	P	V	22.5	3.3	0.0	33.7	46.0	12.3	
921.7	10.8	P	V	22.7	3.4	0.0	36.9	46.0	9.1	
949.2	10.7	P	V	22.9	3.5	0.0	37.1	46.0	8.9	
976.7	5.9	P	V	23.4	3.5	0.0	32.8	54.0	21.2	

Configuration	Y Position

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
33.7	7.9	P	H	12.8	0.6	0.0	21.3	40.0	18.7	
40.7	6.7	P	H	11.1	0.7	0.0	18.5	40.0	21.5	
90.0	5.5	P	H	9.7	1.0	0.0	16.2	43.5	27.3	
101.8	7.8	P	H	10.4	1.1	0.0	19.3	43.5	24.2	
108.5	7.9	P	H	10.9	1.1	0.0	19.9	43.5	23.6	
122.1	7.7	P	H	11.8	1.2	0.0	20.7	43.5	22.8	
131.7	10.5	P	H	12.2	1.2	0.0	23.9	43.5	19.6	
135.7	19.1	P	H	12.4	1.3	0.0	32.8	43.5	10.7	

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
143.8	15.1	P	H	12.6	1.3	0.0	29.0	43.5	14.5	
149.3	22.6	P	H	12.7	1.3	0.0	36.6	43.5	6.9	
149.3	21.0	Q	H	12.7	1.3	0.0	35.0	43.5	8.5	
162.6	9.8	P	H	13.0	1.4	0.0	24.2	43.5	19.3	
176.2	16.1	P	H	13.5	1.4	0.0	31.0	43.5	12.5	
192.1	12.2	P	H	14.1	1.5	0.0	27.8	43.5	15.7	
217.1	10.7	P	H	14.8	1.6	0.0	27.1	46.0	18.9	
240.0	10.9	P	H	15.2	1.7	0.0	27.8	46.0	18.2	
249.2	12.6	P	H	15.4	1.7	0.0	29.7	46.0	16.3	
264.6	17.0	P	H	12.0	1.8	0.0	30.8	46.0	15.2	
298.2	17.1	P	H	13.9	1.9	0.0	32.9	46.0	13.1	
331.8	17.8	P	H	14.1	2.0	0.0	33.9	46.0	12.1	
352.4	14.8	P	H	14.2	2.0	0.0	31.0	46.0	15.0	
379.7	16.0	P	H	14.8	2.1	0.0	32.9	46.0	13.1	
407.0	16.4	P	H	15.5	2.2	0.0	34.1	46.0	11.9	
420.4	8.4	P	H	15.7	2.2	0.0	26.3	46.0	19.7	
433.9	16.5	P	H	16.0	2.3	0.0	34.8	46.0	11.2	
447.3	12.9	P	H	16.4	2.3	0.0	31.6	46.0	14.4	
461.2	20.4	P	H	16.8	2.4	0.0	39.6	46.0	6.4	
474.6	16.1	P	H	17.1	2.4	0.0	35.6	46.0	10.4	
488.1	16.4	P	H	17.4	2.4	0.0	36.2	46.0	9.8	
497.3	6.4	P	H	17.6	2.5	0.0	26.5	46.0	19.5	
501.7	13.9	P	H	17.8	2.5	0.0	34.2	46.0	11.8	
515.0	13.1	P	H	18.7	2.5	0.0	34.3	46.0	11.7	
542.5	11.6	P	H	18.0	2.6	0.0	32.2	46.0	13.8	
555.8	9.0	P	H	18.2	2.6	0.0	29.8	46.0	16.2	
580.8	18.0	P	H	18.6	2.7	0.0	39.3	46.0	6.7	
596.7	14.3	P	H	18.7	2.7	0.0	35.7	46.0	10.3	
624.2	15.7	P	H	19.0	2.8	0.0	37.5	46.0	8.5	
650.8	14.5	P	H	19.6	2.8	0.0	36.9	46.0	9.1	
678.3	11.1	P	H	20.8	2.9	0.0	34.8	46.0	11.2	
705.0	9.3	P	H	20.9	2.9	0.0	33.1	46.0	12.9	
746.7	8.2	P	H	20.8	3.0	0.0	32.0	46.0	14.0	
786.7	7.1	P	H	20.9	3.1	0.0	31.1	46.0	14.9	
867.5	9.1	P	H	22.7	3.3	0.0	35.1	46.0	10.9	
922.5	11.5	P	H	22.7	3.4	0.0	37.6	46.0	8.4	
976.7	7.7	P	H	23.4	3.5	0.0	34.6	54.0	19.4	
34.4	12.7	P	V	12.6	0.6	0.0	25.9	40.0	14.1	
40.7	12.3	P	V	11.1	0.7	0.0	24.1	40.0	15.9	
54.3	12.2	P	V	9.4	0.8	0.0	22.4	40.0	17.6	
61.7	21.8	P	V	9.3	0.8	0.0	31.9	40.0	8.1	
67.6	10.8	P	V	9.2	0.9	0.0	20.9	40.0	19.1	
93.0	12.2	P	V	9.9	1.0	0.0	23.1	43.5	20.4	
101.1	9.7	P	V	10.4	1.1	0.0	21.2	43.5	22.3	
135.7	6.6	P	V	12.4	1.3	0.0	20.3	43.5	23.2	
149.3	12.9	P	V	12.7	1.3	0.0	26.9	43.5	16.6	
164.4	8.0	P	V	13.1	1.4	0.0	22.5	43.5	21.0	
198.3	6.5	P	V	14.3	1.5	0.0	22.3	43.5	21.2	
231.1	5.7	P	V	15.0	1.7	0.0	22.4	46.0	23.6	
251.2	12.4	P	V	11.9	1.7	0.0	26.0	46.0	20.0	
268.4	12.9	P	V	12.1	1.8	0.0	26.8	46.0	19.2	
287.3	6.2	P	V	13.3	1.8	0.0	21.3	46.0	24.7	
333.9	10.3	P	V	14.1	2.0	0.0	26.4	46.0	19.6	
379.7	8.8	P	V	14.8	2.1	0.0	25.7	46.0	20.3	

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
407.0	12.1	P	V	15.5	2.2	0.0	29.8	46.0	16.2	
419.2	10.4	P	V	15.7	2.2	0.0	28.3	46.0	17.7	
433.9	11.4	P	V	16.0	2.3	0.0	29.7	46.0	16.3	
461.2	16.3	P	V	16.8	2.4	0.0	35.5	46.0	10.5	
474.6	14.8	P	V	17.1	2.4	0.0	34.3	46.0	11.7	
488.1	15.7	P	V	17.4	2.4	0.0	35.5	46.0	10.5	
501.7	12.3	P	V	17.8	2.5	0.0	32.6	46.0	13.4	
539.2	11.4	P	V	18.0	2.6	0.0	32.0	46.0	14.0	
569.2	12.1	P	V	18.4	2.6	0.0	33.1	46.0	12.9	
596.7	13.2	P	V	18.7	2.7	0.0	34.6	46.0	11.4	
624.2	11.8	P	V	19.0	2.8	0.0	33.6	46.0	12.4	
650.8	10.4	P	V	19.6	2.8	0.0	32.8	46.0	13.2	
719.2	5.9	P	V	21.0	3.0	0.0	29.9	46.0	16.1	
890.0	9.0	P	V	22.6	3.3	0.0	34.9	46.0	11.1	
922.5	11.0	P	V	22.7	3.4	0.0	37.1	46.0	8.9	
949.2	9.6	P	V	22.9	3.5	0.0	36.0	46.0	10.0	
990.0	6.2	P	V	23.8	3.5	0.0	33.5	54.0	20.5	

Configuration	Z Position

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
33.7	7.6	P	H	12.8	0.6	0.0	21.0	40.0	19.0	
54.3	9.2	P	H	9.4	0.8	0.0	19.4	40.0	20.6	
90.0	5.8	P	H	9.7	1.0	0.0	16.5	43.5	27.0	
101.8	6.9	P	H	10.4	1.1	0.0	18.4	43.5	25.1	
108.5	7.9	P	H	10.9	1.1	0.0	19.9	43.5	23.6	
135.7	18.7	P	H	12.4	1.3	0.0	32.4	43.5	11.1	
149.3	21.9	P	H	12.7	1.3	0.0	35.9	43.5	7.6	
149.3	20.5	Q	H	12.7	1.3	0.0	34.5	43.5	9.0	
160.4	9.7	P	H	13.0	1.4	0.0	24.1	43.5	19.4	
176.2	15.9	P	H	13.5	1.4	0.0	30.8	43.5	12.7	
192.1	12.6	P	H	14.1	1.5	0.0	28.2	43.5	15.3	
217.1	10.9	P	H	14.8	1.6	0.0	27.3	46.0	18.7	
244.0	12.2	P	H	15.3	1.7	0.0	29.2	46.0	16.8	
255.8	19.1	P	H	12.0	1.7	0.0	32.8	46.0	13.2	
271.3	17.2	P	H	12.3	1.8	0.0	31.3	46.0	14.7	
298.2	17.6	P	H	13.9	1.9	0.0	33.4	46.0	12.6	
325.5	16.2	P	H	14.2	2.0	0.0	32.4	46.0	13.6	
332.2	15.8	P	H	14.1	2.0	0.0	31.9	46.0	14.1	
352.4	13.6	P	H	14.2	2.0	0.0	29.8	46.0	16.2	
379.7	15.8	P	H	14.8	2.1	0.0	32.7	46.0	13.3	
407.0	16.6	P	H	15.5	2.2	0.0	34.3	46.0	11.7	
420.4	8.0	P	H	15.7	2.2	0.0	25.9	46.0	20.1	
433.9	15.6	P	H	16.0	2.3	0.0	33.9	46.0	12.1	
447.3	12.9	P	H	16.4	2.3	0.0	31.6	46.0	14.4	
461.2	20.7	P	H	16.8	2.4	0.0	39.9	46.0	6.1	
474.6	17.1	P	H	17.1	2.4	0.0	36.6	46.0	9.4	
488.1	18.1	P	H	17.4	2.4	0.0	37.9	46.0	8.1	
501.7	13.9	P	H	17.8	2.5	0.0	34.2	46.0	11.8	
529.2	11.1	P	H	18.0	2.5	0.0	31.6	46.0	14.4	
569.2	11.8	P	H	18.4	2.6	0.0	32.8	46.0	13.2	

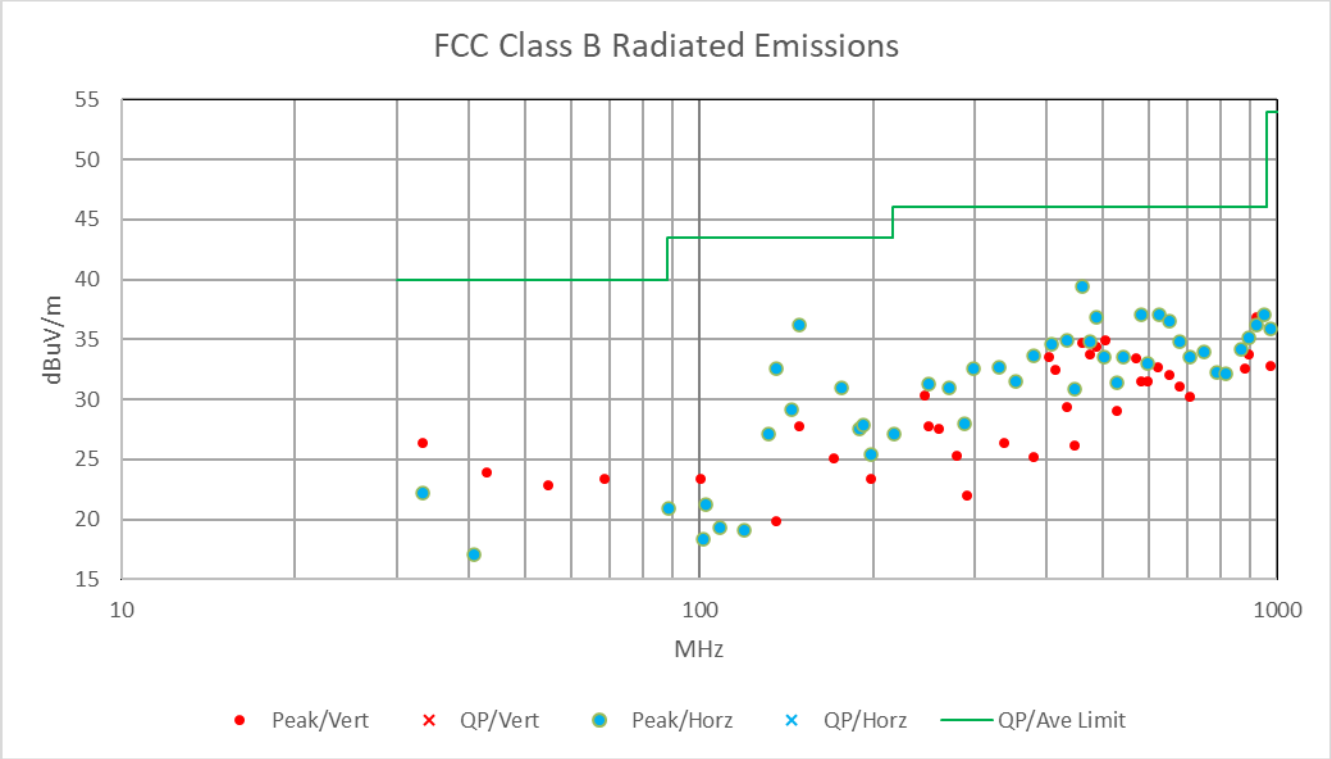
Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor dB/m	Cbl/amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
580.8	17.4	P	H	18.6	2.7	0.0	38.7	46.0	7.3	
624.2	14.9	P	H	19.0	2.8	0.0	36.7	46.0	9.3	
650.8	15.5	P	H	19.6	2.8	0.0	37.9	46.0	8.1	
678.3	11.7	P	H	20.8	2.9	0.0	35.4	46.0	10.6	
705.0	10.8	P	H	20.9	2.9	0.0	34.6	46.0	11.4	
759.2	8.3	P	H	20.8	3.0	0.0	32.1	46.0	13.9	
786.7	9.0	P	H	20.9	3.1	0.0	33.0	46.0	13.0	
813.3	7.4	P	H	21.4	3.2	0.0	32.0	46.0	14.0	
854.2	7.8	P	H	22.3	3.2	0.0	33.3	46.0	12.7	
895.0	10.8	P	H	22.5	3.3	0.0	36.6	46.0	9.4	
921.7	10.7	P	H	22.7	3.4	0.0	36.8	46.0	9.2	
949.2	10.4	P	H	22.9	3.5	0.0	36.8	46.0	9.2	
976.7	7.8	P	H	23.4	3.5	0.0	34.7	54.0	19.3	
33.7	11.6	P	V	12.8	0.6	0.0	25.0	40.0	15.0	
40.7	15.9	P	V	11.1	0.7	0.0	27.7	40.0	12.3	
56.2	11.3	P	V	9.3	0.8	0.0	21.4	40.0	18.6	
68.7	11.2	P	V	9.2	0.9	0.0	21.3	40.0	18.7	
93.4	11.8	P	V	9.9	1.0	0.0	22.7	43.5	20.8	
101.8	11.0	P	V	10.4	1.1	0.0	22.5	43.5	21.0	
131.3	5.1	P	V	12.2	1.2	0.0	18.5	43.5	25.0	
149.0	11.1	P	V	12.7	1.3	0.0	25.1	43.5	18.4	
159.7	6.9	P	V	13.0	1.4	0.0	21.3	43.5	22.2	
196.1	6.9	P	V	14.2	1.5	0.0	22.6	43.5	20.9	
228.2	6.1	P	V	15.0	1.6	0.0	22.7	46.0	23.3	
277.6	6.3	P	V	12.8	1.8	0.0	20.9	46.0	25.1	
302.0	13.9	P	V	14.2	1.9	0.0	30.0	46.0	16.0	
325.5	8.0	P	V	14.2	2.0	0.0	24.2	46.0	21.8	
379.7	9.5	P	V	14.8	2.1	0.0	26.4	46.0	19.6	
407.0	11.3	P	V	15.5	2.2	0.0	29.0	46.0	17.0	
418.3	7.4	P	V	15.7	2.2	0.0	25.3	46.0	20.7	
431.8	7.0	P	V	15.9	2.3	0.0	25.2	46.0	20.8	
433.9	13.8	P	V	16.0	2.3	0.0	32.1	46.0	13.9	
447.3	7.5	P	V	16.4	2.3	0.0	26.2	46.0	19.8	
461.2	16.5	P	V	16.8	2.4	0.0	35.7	46.0	10.3	
474.6	15.3	P	V	17.1	2.4	0.0	34.8	46.0	11.2	
488.1	17.4	P	V	17.4	2.4	0.0	37.2	46.0	8.8	
497.7	6.2	P	V	17.6	2.5	0.0	26.3	46.0	19.7	
515.0	13.2	P	V	18.7	2.5	0.0	34.4	46.0	11.6	
542.5	14.3	P	V	18.0	2.6	0.0	34.9	46.0	11.1	
569.2	14.7	P	V	18.4	2.6	0.0	35.7	46.0	10.3	
596.7	15.2	P	V	18.7	2.7	0.0	36.6	46.0	9.4	
624.2	12.6	P	V	19.0	2.8	0.0	34.4	46.0	11.6	
650.8	11.6	P	V	19.6	2.8	0.0	34.0	46.0	12.0	
678.3	7.9	P	V	20.8	2.9	0.0	31.6	46.0	14.4	
786.7	5.3	P	V	20.9	3.1	0.0	29.3	46.0	16.7	
867.5	6.5	P	V	22.7	3.3	0.0	32.5	46.0	13.5	
895.0	11.1	P	V	22.5	3.3	0.0	36.9	46.0	9.1	
921.7	14.1	P	V	22.7	3.4	0.0	40.2	46.0	5.8	
949.2	13.7	P	V	22.9	3.5	0.0	40.1	46.0	5.9	
990.0	9.3	P	V	23.8	3.5	0.0	36.6	54.0	17.4	

Note1 : Peak reading is below Average limits, so average readings not performed for that frequency.

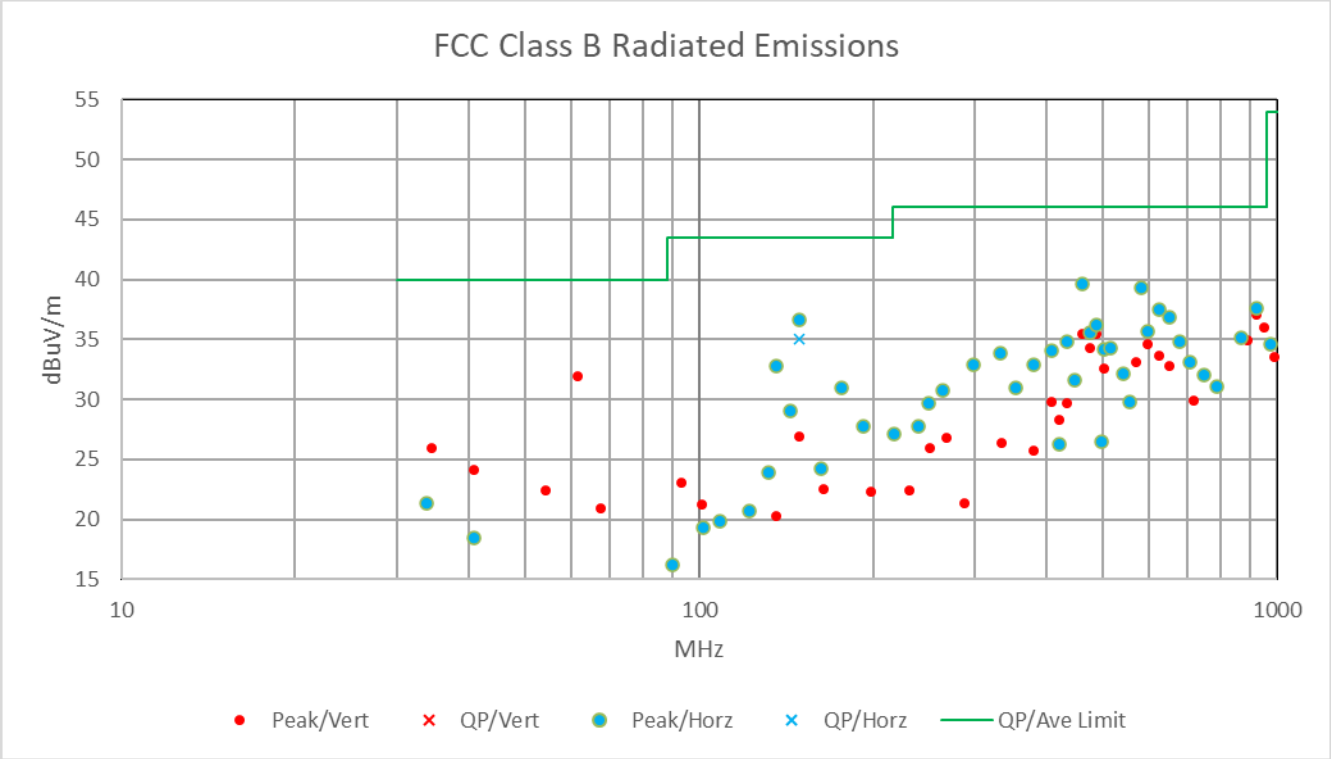
Judgment: Passed by 8.5 dB

Tabulated data from above represented graphically.

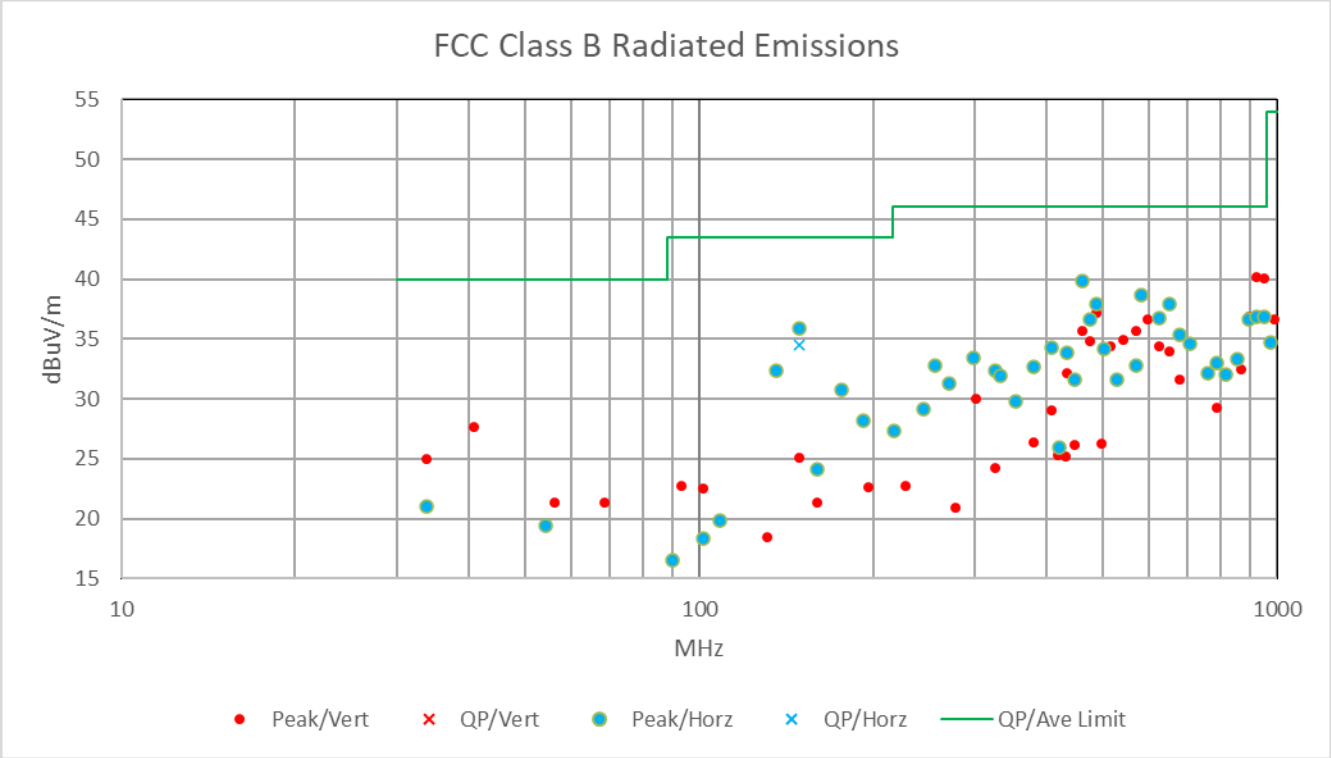
X Position



Y Position



Z Position



12.3 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*20*Log(TD/SD)
Where: DE = Decay Exponent (2.0 is used for this)
TD = Test distance in meters. This is 3 meters
SD = Specifciation Distance in meters

From 9 kHz to 490 kHz, the Specifcation Distance is 300m, therefore the distance factor is 2*20*LOG(300/3) = 80 dB.
From 490 kHz to 30 MHz, the Specifcation Distance is 30m, therefore the distance factor is 2*20*LOG(30/3) = 40 dB.

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

Test Date	01/28/2022
EUT	Model: OEM-305N11KU-BGM-S; Serial Number: FNA1000100
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

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	Serial Number
125.0	61.2	18.9	3.0	2.0	0.1	-80.0	0.2	25.7	25.5	FNA1000100
250.0	34.4	18.6	3.0	2.0	0.1	-80.0	-26.9	19.6	46.5	FNA1000100
375.0	33.1	18.4	3.0	2.0	0.1	-80.0	-28.4	16.1	44.5	FNA1000100
13560	53.1	16.0	3.0	2.0	0.4	-40.0	29.5	40.5	11.0	FNA1000100
27120	12.5	15.3	3.0	2.0	0.5	-40.0	-11.7	29.5	41.2	FNA1000100

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.

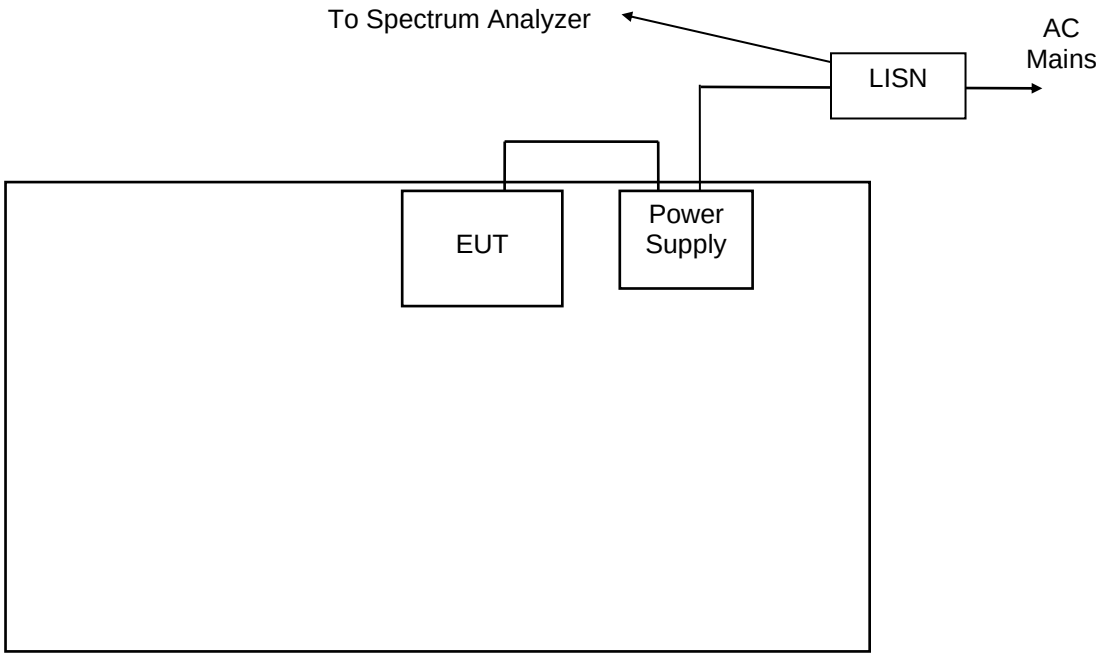
All other limits are general limits of FCC 15.209 or the RSS-Gen.

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 at least 3.3 dB.

13.0 GENERAL TEST SETUPS

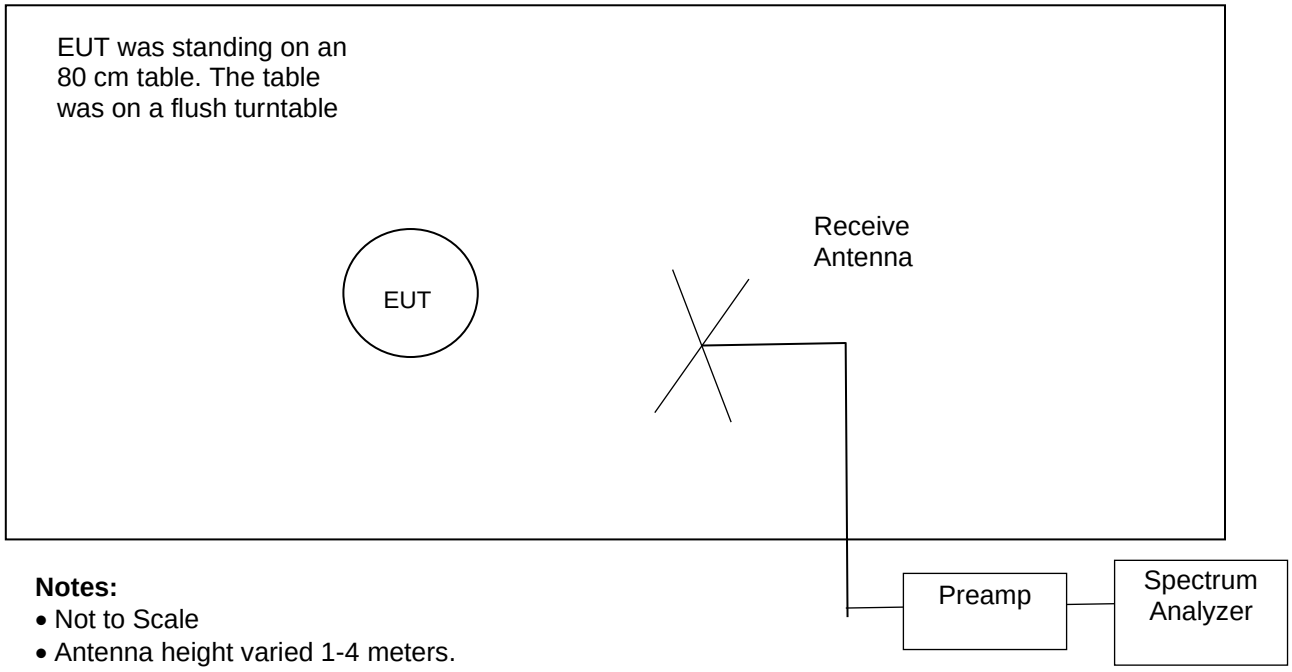
Figure 1. Conducted Emissions Test Setup



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

Figure 2. Drawing of Radiated Emissions Setup

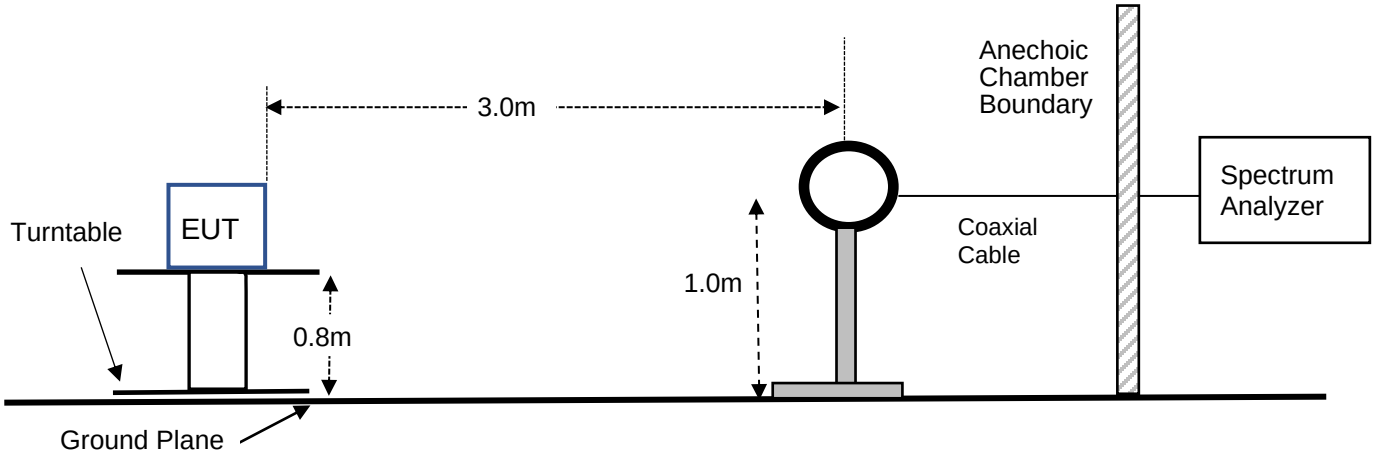
Chamber E, anechoic



Notes:
- Not to Scale
- Antenna height varied 1-4 meters.
- Distance from antenna to tested system is 3 meters.
- AC cords not shown. They are connected to AC outlet with low-pass filter on the turntable.

Frequency Range	Receive Antenna	Spectrum Analyzer
0.01 to 30 MHz	ANT-53	REC-44
30 to 200 MHz	ANT-80	REC-44
200 to 1000 MHz	ANT-06	REC-44

Radiated Emissions Test Setup for Frequencies Below 30MHz (Side View)



Radiated Emissions Test Setup for Frequencies from 30MHz to 1000MHz (Side View)

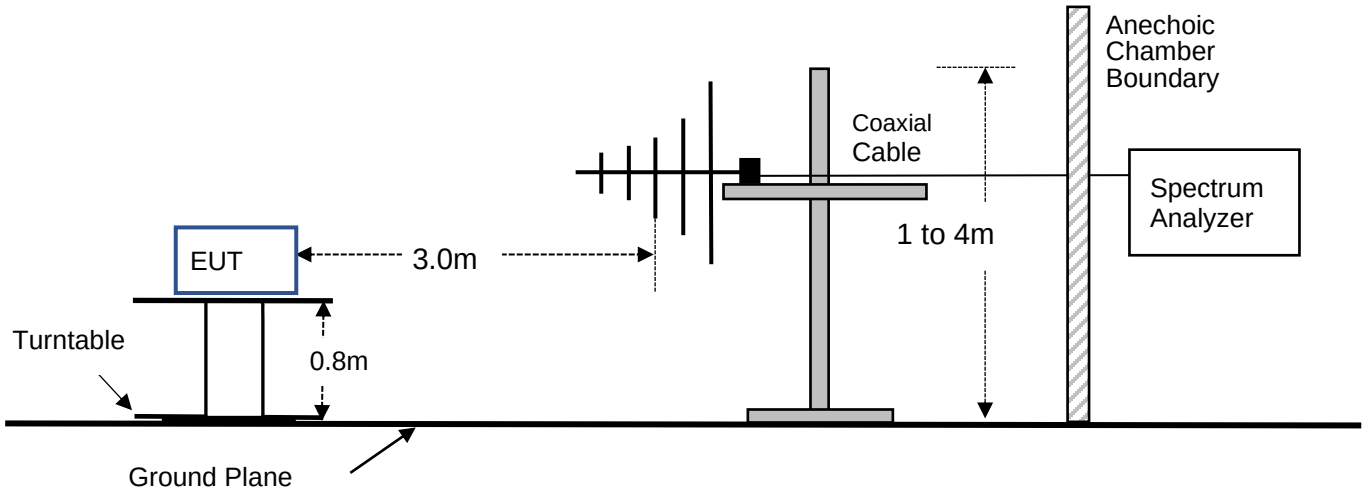


Figure 3. Photographs of Conducted Emissions Test Setup

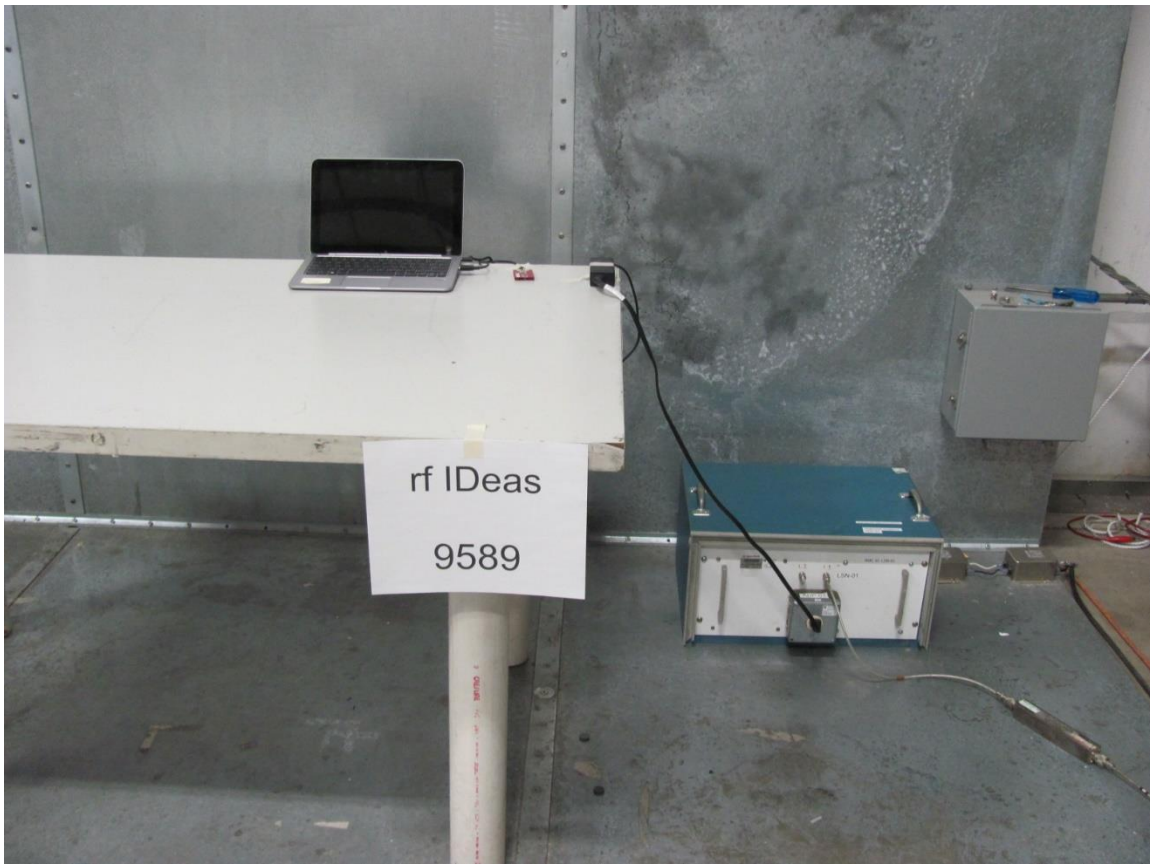



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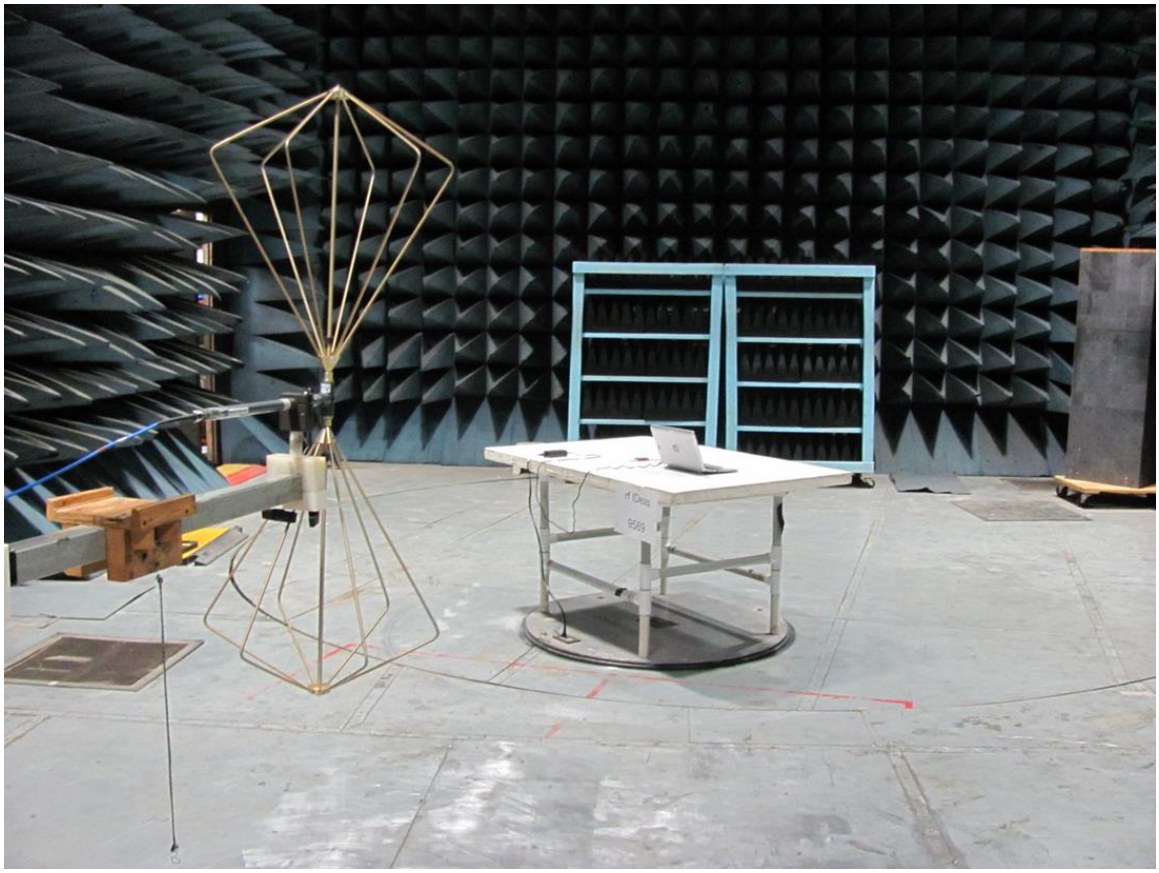
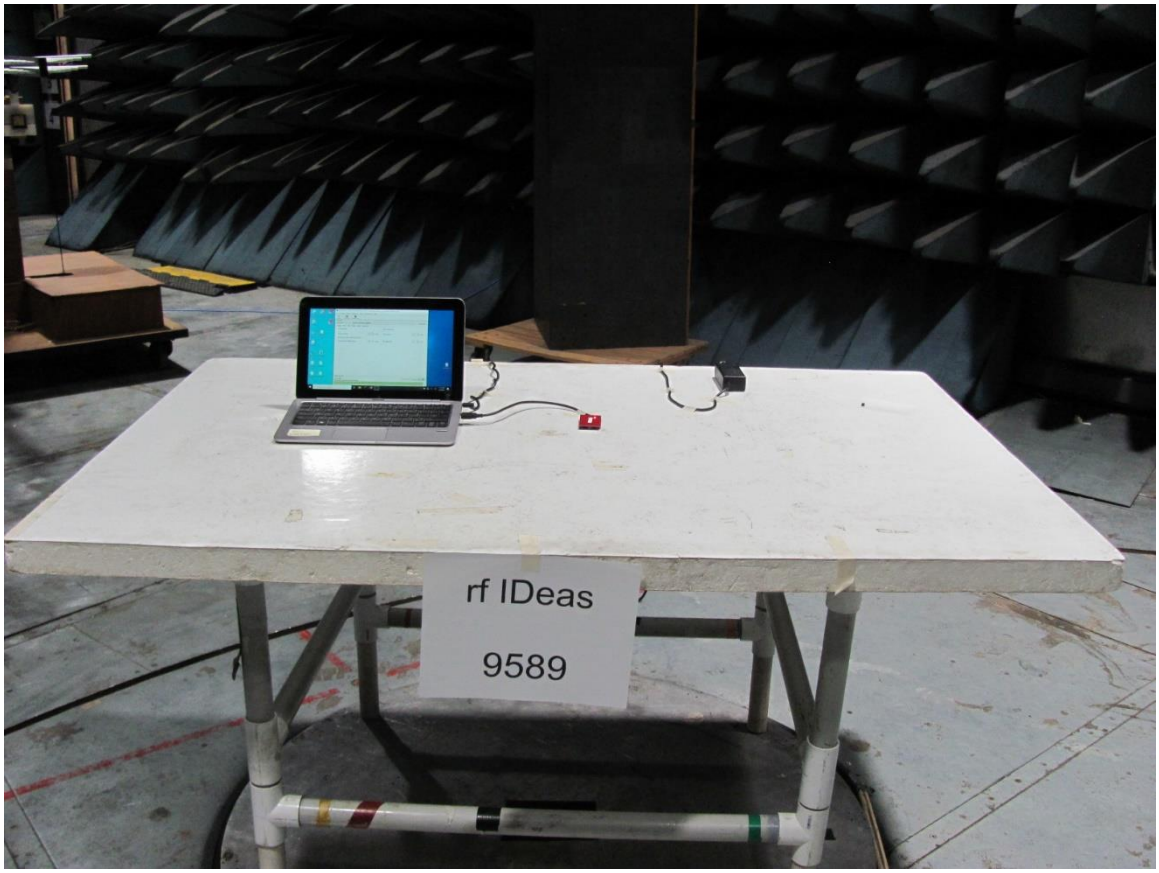
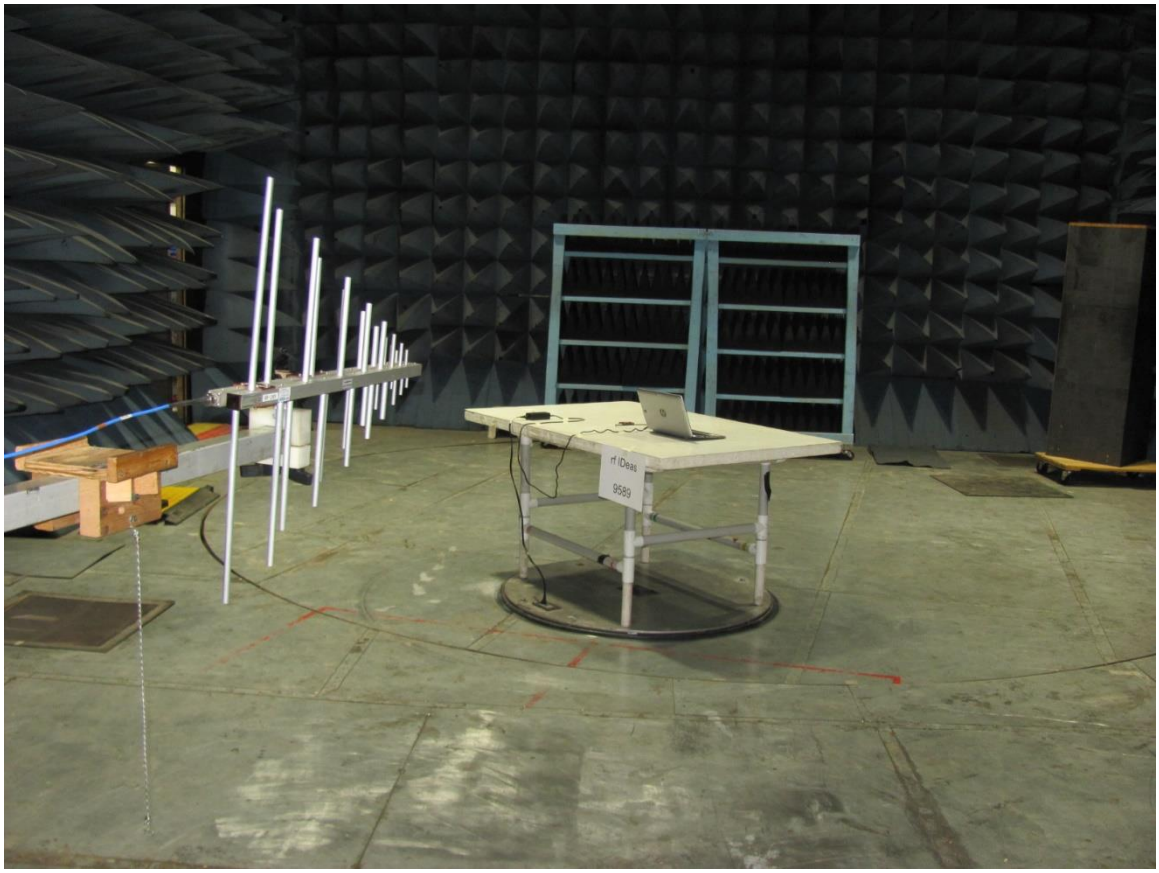
Figure 4. Photographs of Radiated Emissions Test Setup







13.1 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.

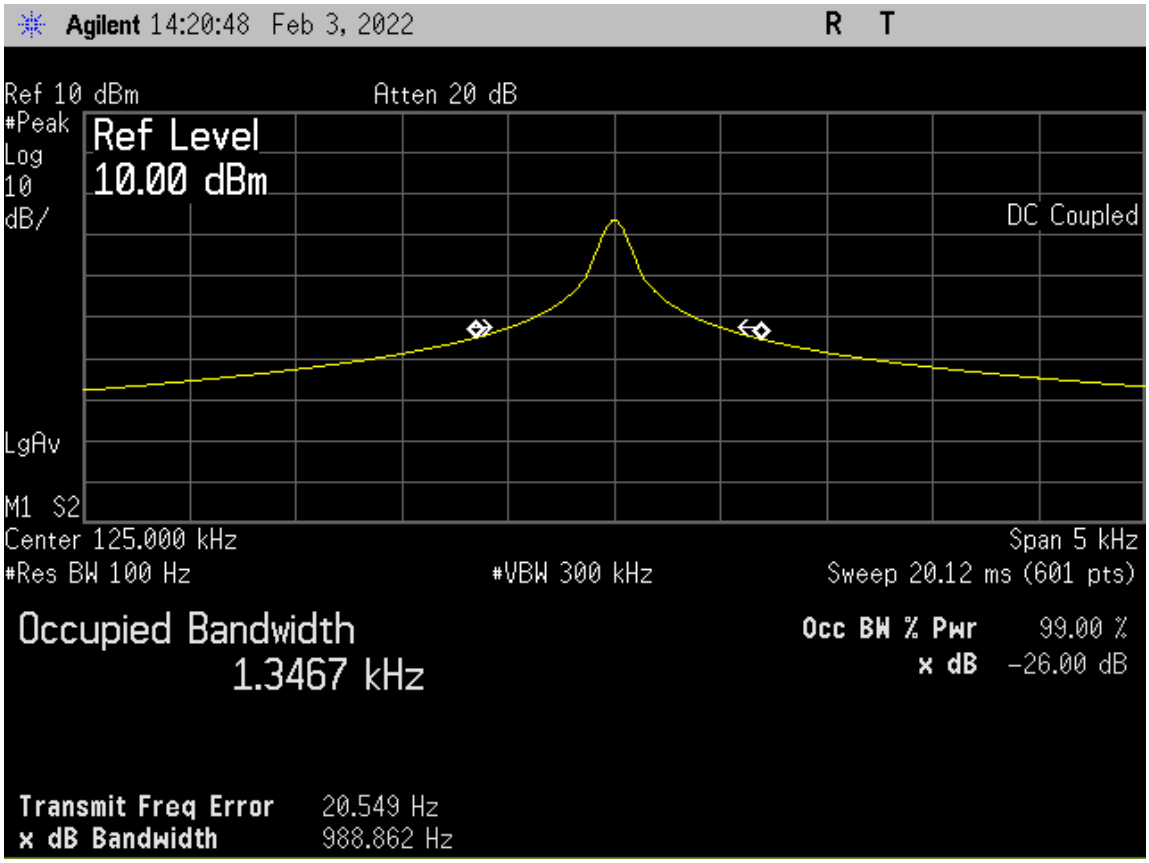
Model	OEM-305N11KU-BGM-S	Specification	FCC Part 15.225 RSS-210
Test Personnel	Joseph Strzelecki	Test Date	02/03/2022

99% OBW = 1.3467 kHz for 125 kHz Signal
99% OBW = 2.2467 kHz for 13.56 MHz Signal

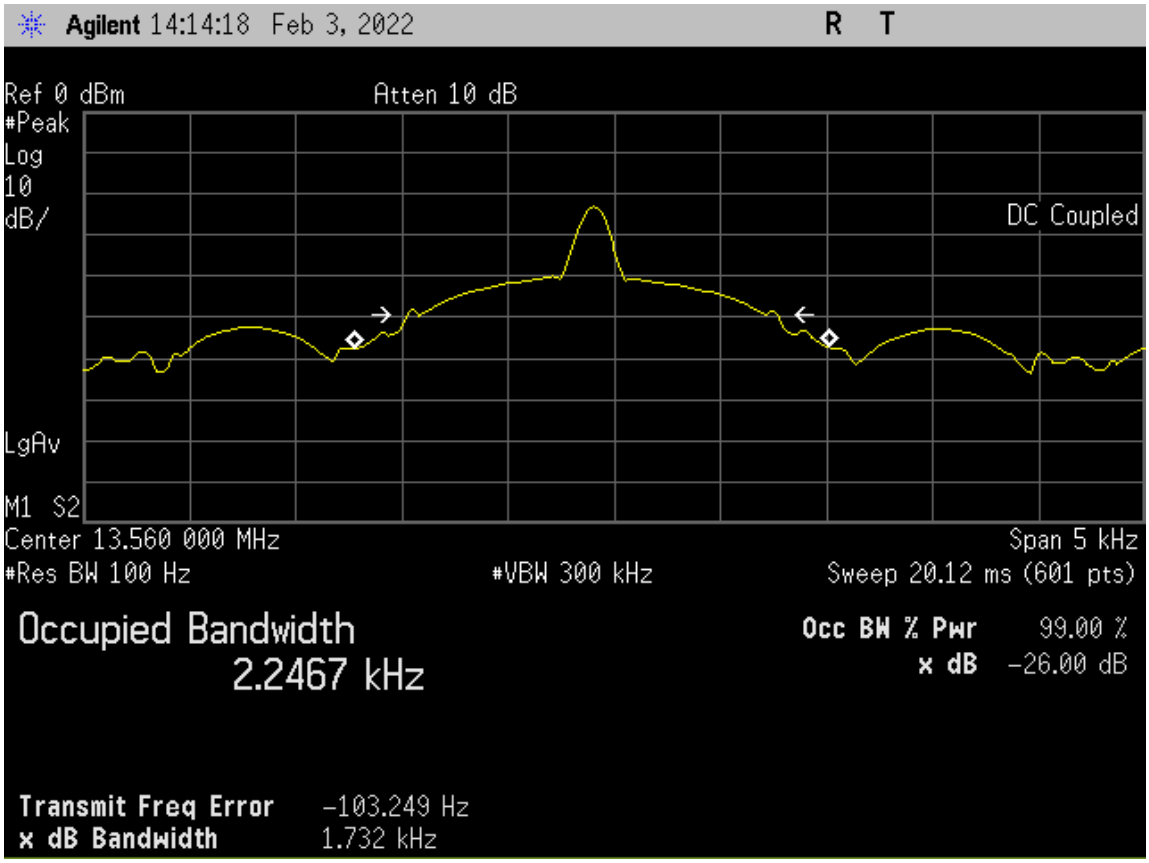
Judgement: Pass

Figure 5. Occupied Bandwidth Plots

125 kHz:



13.56 MHz:



14.0 MEASUREMENT INSTRUMENTATION UNCERTAINTY

Measurement	Uncertainty
Conducted Emissions, LISN method, 150 kHz to 30 MHz	2.2 dB
Radiated Emissions, E-field, 3 meters, 30 to 200 MHz	4.7 dB
Radiated Emissions, E-field, 3 meters, 200 to 1000 MHz	6.2 dB
Radiated Emissions, E-field, 3 meters, 1 to 6 GHz	5.0 dB
Temperature THM-02	0.6 Deg C

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.

15.0 REVISION HISTORY

Document RP-9589 Revisions:			
Rev.	Affected Sections	Description	Rationale
1	Cover, table of contents	rf IDeas' address	Typographical error in address, table of contents
2	Cover, 2.0	Change type of permissive change	Should be Class II instead of Class I