




FCC ISED RF Test Report

Test Report Number	HME-20071441-LC-FCC-IC-DXX
FCC ID ISED ID	BYM7001 1860A-7001
Applicant	HM Electronics Inc
Applicant Address	2848 Whiptail Loop, Carlsbad, CA 92010 USA
Product Name	Base Station
Model (s)	7001
Date of Receipt	06/18/2020
Date of Test	06/18/2020 – 10/20/2020
Report Issue Date	10/20/2020
Test Standards	47CFR Part 15.225 RSS-210 Issue 10: Dec 2019
Test Result	PASS
	<p>Issued by:</p> <p>Vista Compliance Laboratories 1261 Puerta Del Sol, San Clemente, CA 92673 USA www.vista-compliance.com</p>
 <hr/> <p>Daniel Bruno (Test Technician)</p>	 <hr/> <p>David Zhang (Technical Manager)</p>
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REVISION HISTORY

Report Number	Version	Description	Issued Date
HME-20071441-LC-FCC-IC-DXX	01	Initial report	10/20/2020

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1 Test Summary

Test Item	Test Requirement	Test Method	Result
Antenna Requirement	47 CFR Part 15.203	ANSI C63.10 (2013)	Pass
Occupied Bandwidth	RSS-Gen Issue 5, Mar 2019	RSS-Gen Issue 5, Mar 2019	Pass
Emission Mask Limit in the band of 13.110 – 14.010 MHz	47 CFR Part 15.225 RSS-210 Issue 10: Dec 2019	ANSI C63.10 (2013)	Pass
Radiated Spurious Emission below 30MHz	47 CFR Part 15.225 RSS-210 Issue 10: Dec 2019	ANSI C63.10 (2013)	Pass
Radiated Spurious Emissions below 1GHz	47 CFR Part 15.225 RSS-210 Issue 10: Dec 2019	ANSI C63.10 (2013)	Pass
AC Power Line Conducted Emissions	47 CFR Part 15.207 RSS-Gen Issue 5, Mar 2019	ANSI C63.10 (2013)	Pass
Frequency Stability	47 CFR Part 15.225 RSS-210 Issue 10: Dec 2019	ANSI C63.10 (2013)	Pass

2 General Information

2.1 Applicant

Applicant	HM Electronics Inc
Applicant address	2848 Whiptail Loop, Carlsbad, CA 92010 USA
Manufacturer	HM Electronics Inc
Manufacturer Address	2848 Whiptail Loop, Carlsbad, CA 92010 USA

2.2 Product information

Product Name	Base Station
Model Number	7001
Family Models	N/A
Serial Number	F21Z0010
Frequency Band	BLE: 2402-2480MHz NFC: 13.56MHz
Type of modulation	BLE: GFSK NFC: ASK
Equipment Class	DTS, DXX
Antenna Information	BLE: Internal PCB antenna, 3 dBi gain NFC: Internal coil antenna
Clock Frequencies	N/A
Input Power	48VDC Input
Power Adapter Manufacturer/Model	AC/DC Power supply, Model: CP-8072 Input: 100-240VAC, 50-60Hz, 1.2 A Max Output: 48VDC, 1.88A, 90W Max
Power Adapter SN	N/A
Hardware version	N/A
Software version	N/A
Simultaneous Transmission	BLE and NFC can transmit simultaneously
Additional Info	N/A

2.3 Test standard and method

Test standard	47CFR Part 15.225 RSS-210 Issue 10: Dec 2019
Test method	ANSI C63.10-2013

3 Test Site Information

Lab performing tests	Vista Laboratories, Inc.
Lab Address	1261 Puerta Del Sol, San Clemente, CA 92673 USA
Phone Number	+1 (949) 393-1123
Website	www.vista-compliance.com

Test Condition	Temperature	Humidity	Atmospheric Pressure
RF Testing	23.5°C	58.2%	996 mbar
Radiated Emission Testing	23.5°C	58.2%	996 mbar

4 Modification of EUT / Deviations from Standards

The EUT is an engineering test sample loaded with RF testing firmware specifically designed to support the RF TX/RX measurement in different aspects.

5 Test Configuration and Operation

5.1 EUT Test Configuration

The EUT is powered by external AC/DC power adaptor. EUT was set to continuous transmission mode during TX testing.

The following software was used for testing.

Software	Description
EMISoft Vasona	EMC/RF Spurious emission test software used during testing
Putty.exe	To set EUT into continuous TX and RX mode under different modulation, data rate and channel, etc.
nRF connect v3.4.1	Set BLE into required transmitter and receiver test mode

5.2 Supporting Equipment

Description	Manufacturer	Model #	Serial #
Laptop	Dell	Latitude E6440	FFF4JC2
Gigabit PoE Switch	BV-Tech	PoE-SW501G	20180300239

6 Uncertainty of Measurement

Test item	Measurement Uncertainty (dB)
RF Output Power (Conducted)	±1.2 dB
Power Spectral Density	±0.9 dB
Unwanted Emission (conducted)	±2.6 dB
Occupied Channel Bandwidth	±5 %
Radiated Emission (9KHz-30MHz)	±3.5 dB
Radiated Emission (30MHz-1GHz)	±4.6 dB
Radiated Emission (1-18GHz)	±4.9 dB
Radiated Emission (18-40GHz)	±3.5 dB

7 Test Results

7.1 Antenna Requirement

7.1.1 Requirement

Per § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

7.1.2 Result

Analysis:

- EUT uses internal coil antenna. No standard RF connector is used.

Conclusion:

- EUT complies with antenna requirement in § 15.203.

7.2 Occupied Bandwidth (99%)

7.2.1 Requirement

RSS-Gen §6.7

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

7.2.2 Test Setup



7.2.3 Test Procedure

According to section RSS-Gen §6.7

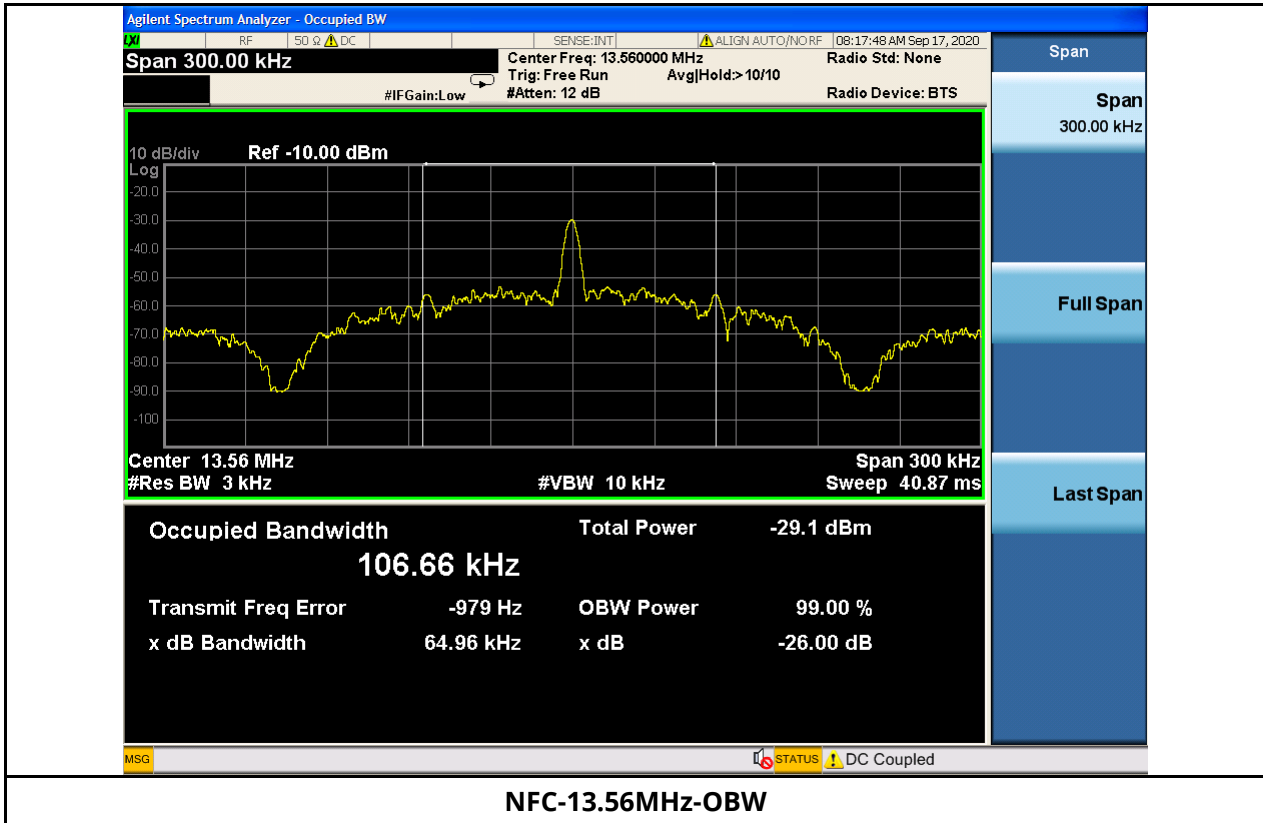
The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq 3 \times$ RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

1. Set RBW = 1% to 5% of the actual occupied BW.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Span = large enough to capture all products of the modulation process
7. Allow the trace to stabilize.
8. Use automatic bandwidth measurement capability on instrument to obtain BW result.

7.2.4 Test Result

Mode/ Bandwidth	Frequency (MHz)	Measured 99% OBW (KHz)	Limit (KHz)	Result
NFC	13.56	106.66	N/A	Pass

7.2.5 Test Plots



7.3 Emission Mask Limit in the band of 13.110 – 14.010 MHz

7.3.1 Requirement

Per §15.225 Operation within the band 13.110–14.010 MHz:

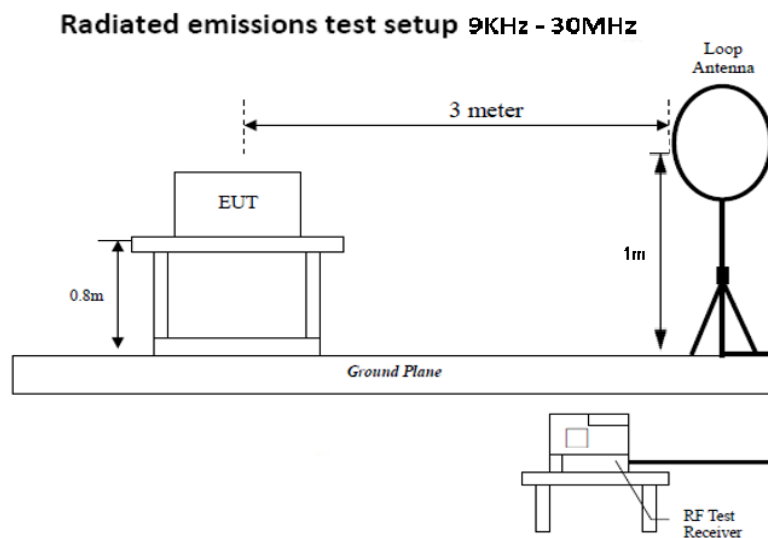
- (a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Per RSS-210, B.6, Band 13.110-14.010 MHz

(a) the field strength of any emission shall not exceed the following limits:

- (i) 15.848 mV/m (84 dB μ V/m) at 30 m, within the band 13.553-13.567 MHz
- (ii) 334 μ V/m (50.5 dB μ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz
- (iii) 106 μ V/m (40.5 dB μ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz
- (iv) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz

7.3.2 Test Setup



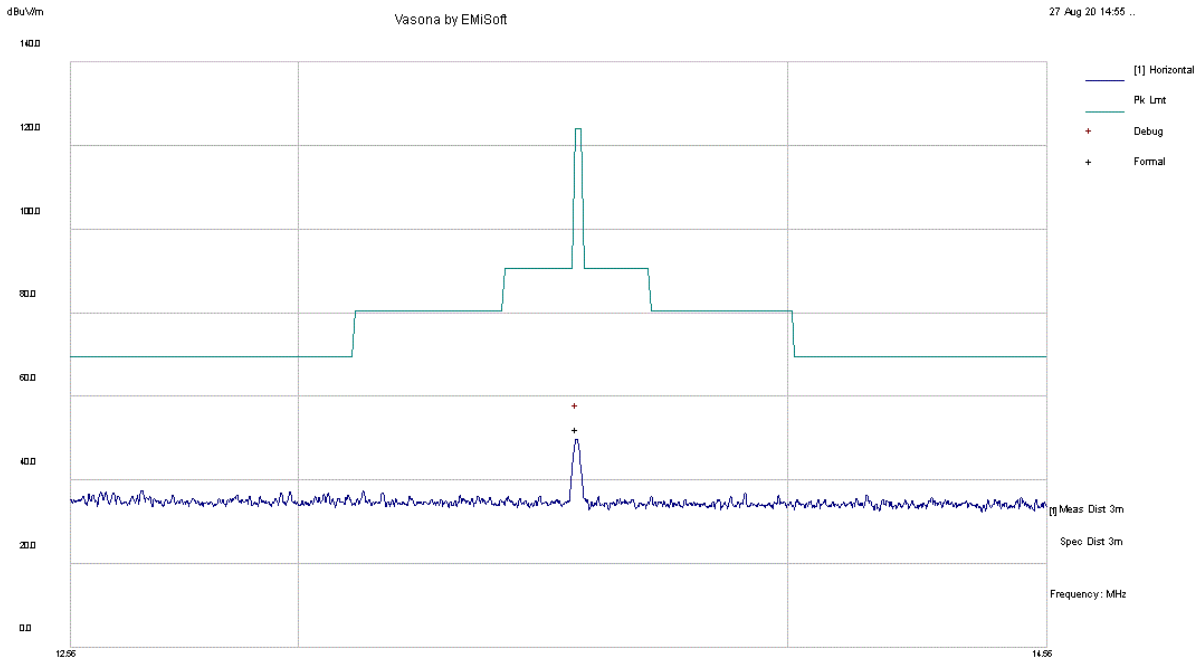
7.3.3 Test Procedure

According to section 6.4 of ANSI C63.10-2013 The process will be repeated in 3 EUT orientations.

1. The EUT was placed on a non-conducting table and switched on and allowed to warm up to its normal operating condition. Measuring loop antenna is placed at 1m height and at 3m distance away from EUT.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna orientation at both 0 deg and 90 deg.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. Steps 2 and 4 were repeated for the next frequency point, until all selected frequency points were measured.

7.3.4 Test Result

Test Standard:	15.225, RSS-210	Mode:	NFC TX
Frequency Range:	Below 30MHz	Test Date:	08/27/2020
Antenna Type/Polarity:	Loop / 0 deg	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass

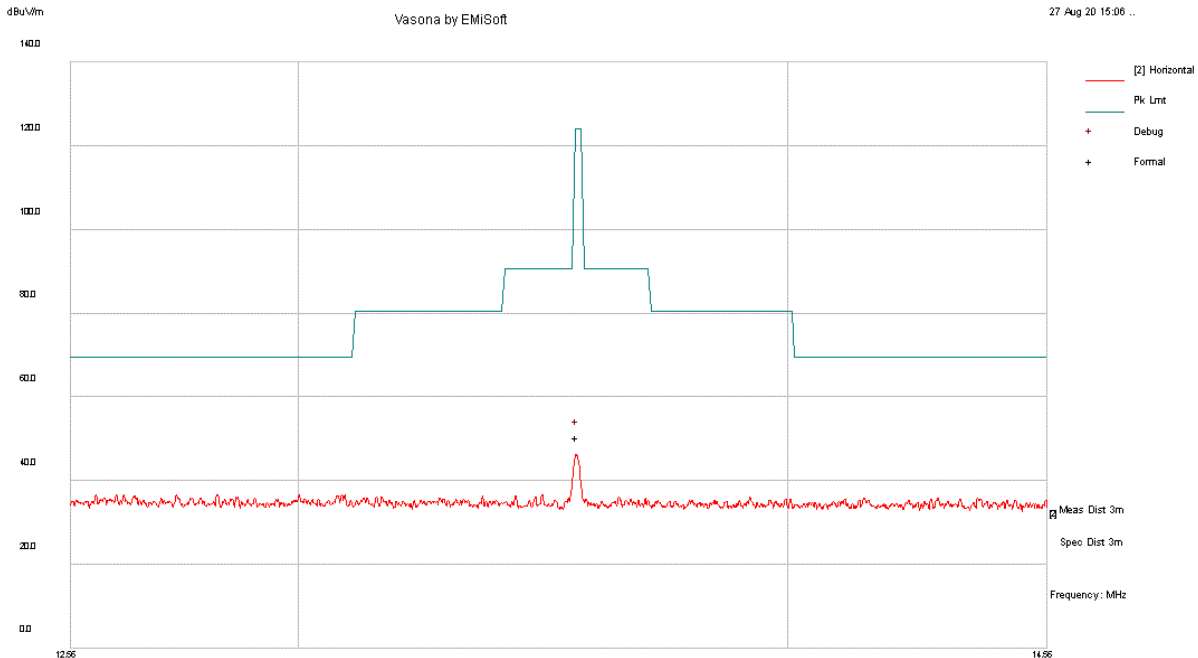


Radiated Emissions Template: FCC 15.225 (3m) below 30M
 Filename: c:\users\camara\google drive\2020\hme-20071441-lc_fcc_ic_dxx_testing\test results\rf\info\emission mask\01_rfc-0 deg-13.56_emi

10 Res On [MHz]

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
13.559	35.8	1.3	15.1	52.3	Peak Max	0 deg	100	146	124.0	-71.7	Pass

Test Standard:	15.225, RSS-210	Mode:	NFC TX
Frequency Range:	Below 30MHz	Test Date:	08/27/2020
Antenna Type/Polarity:	Loop / 90 deg	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Radiated Emissions Template: FCC 15.225 (3m) below 30M
 Filename: c:\users\kamara\google drive\2020\hme-20071441-lc_fcc_ised_ce\fcc_ised_testing\test results\info\emission mask\02_NFC-90 deg-13.56_emi

10 Res 00 #114

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
13.561	33.9	1.3	15.1	50.4	Peak Max	90 deg	100	282	124.0	-73.6	Pass

7.4 Radiated Spurious Emission below 30MHz

7.4.1 Requirement

Per §15.225 Operation within the band 13.110–14.010 MHz:

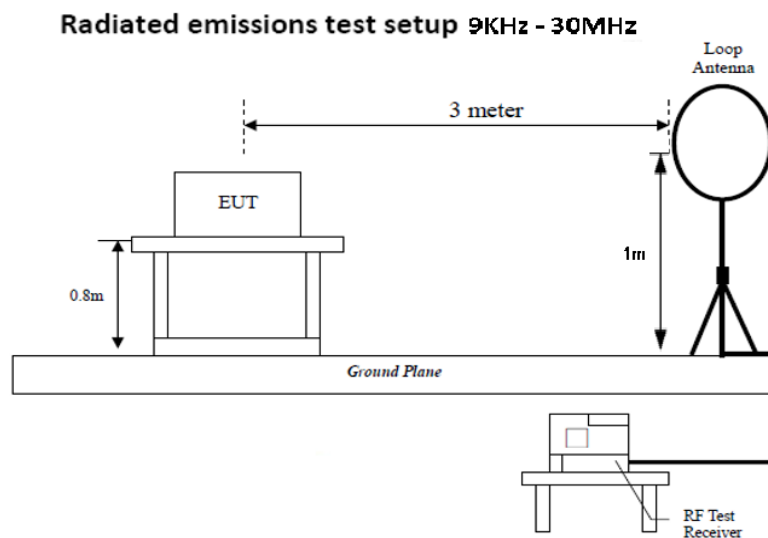
- (a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Per RSS-210, B.6, Band 13.110-14.010 MHz

(a) the field strength of any emission shall not exceed the following limits:

- (i) 15.848 mV/m (84 dB μ V/m) at 30 m, within the band 13.553-13.567 MHz
- (ii) 334 μ V/m (50.5 dB μ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz
- (iii) 106 μ V/m (40.5 dB μ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz
- (iv) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz

7.4.2 Test Setup



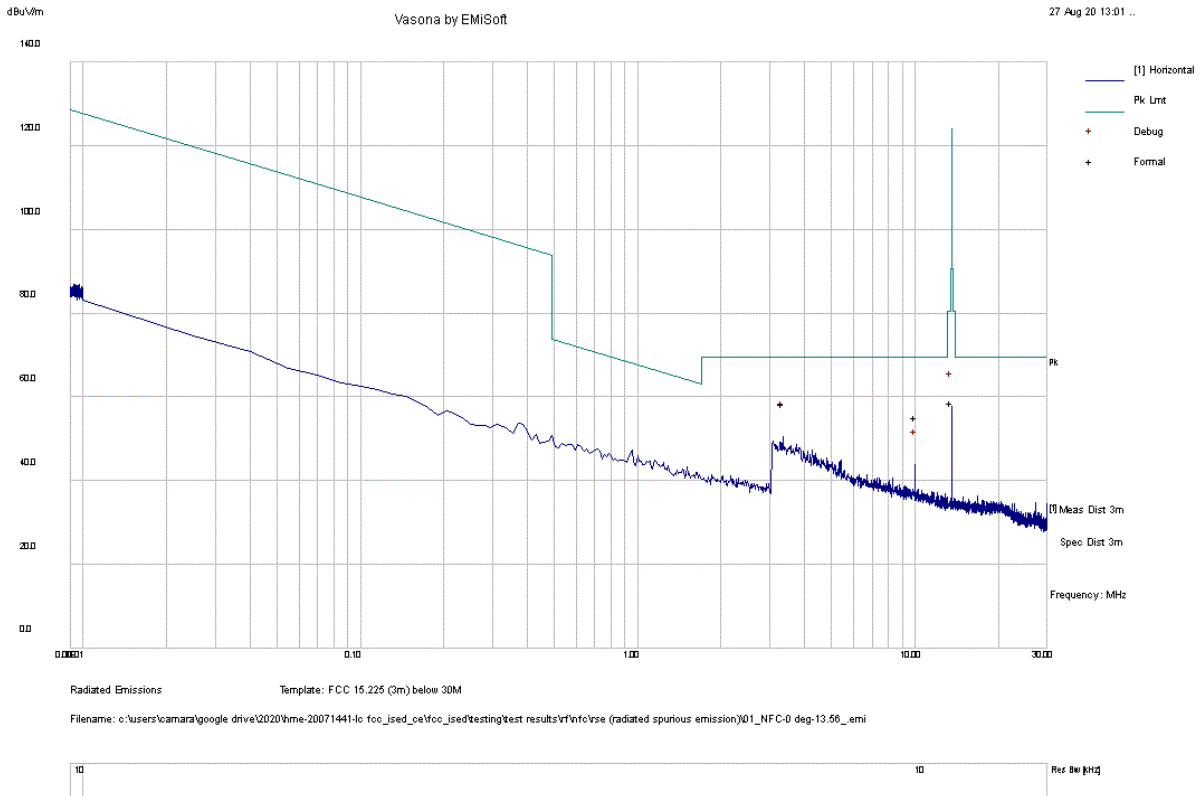
7.4.3 Test Procedure

According to section 6.4 of ANSI C63.10-2013 The process will be repeated in 3 EUT orientations.

1. The EUT was placed on a non-conducting table and switched on and allowed to warm up to its normal operating condition. Measuring loop antenna is placed at 1m height and at 3m distance away from EUT.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna orientation at both 0 deg and 90 deg.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. Steps 2 and 4 were repeated for the next frequency point, until all selected frequency points were measured.

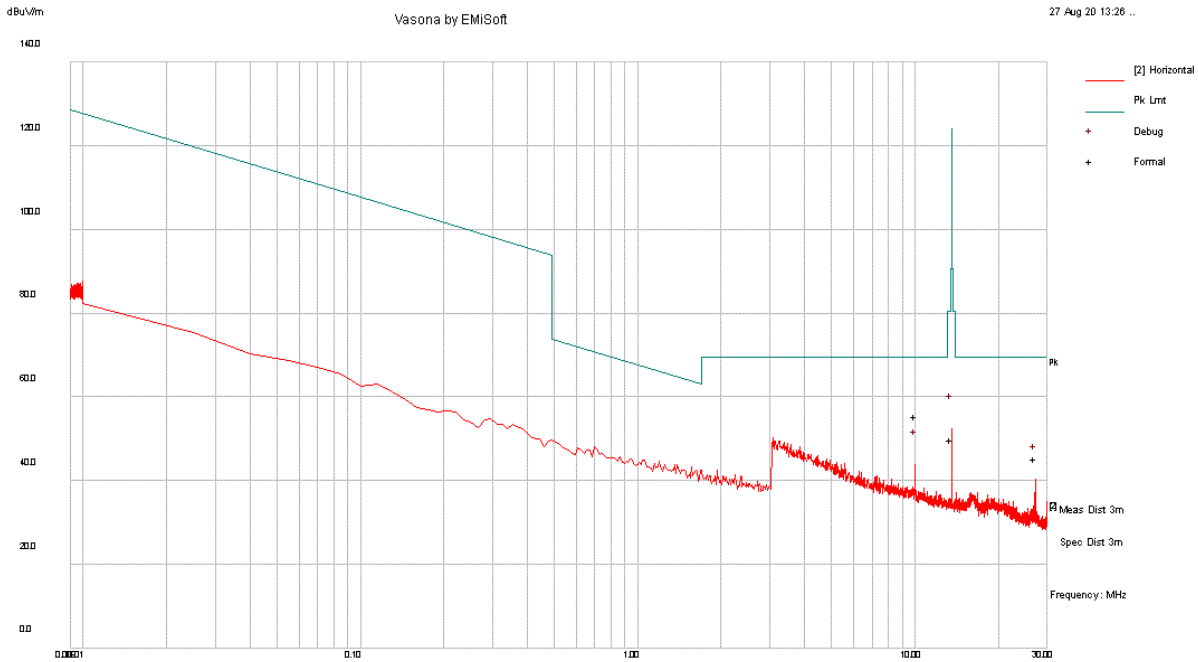
7.4.4 Test Result

Test Standard:	15.225, RSS-210	Mode:	NFC TX
Frequency Range:	Below 30MHz	Test Date:	08/27/2020
Antenna Type/Polarity:	Loop / 0 deg	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
3.322	42.4	0.9	15.1	58.3	Peak Max	0 deg	100	257	69.5	-11.2	Pass
9.999	38.6	1	15.5	55.1	Peak Max	0 deg	100	262	69.5	-14.4	Pass

Test Standard:	15.225, RSS-210	Mode:	NFC TX
Frequency Range:	Below 30MHz	Test Date:	08/27/2020
Antenna Type/Polarity:	Loop / 90 deg	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass



Radiated Emissions Template: FCC 15.225 (3m) below 30M
 Filename: c:\users\kamara\google drive\2020\hme-20071441-lc_fcc_ised_ce\foe_ised\testing\test results\vr\info\vrse (radiated spurious emission)02_NFC-90 deg-13.56_emi

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
10.000	38.9	1	15.5	55.4	Peak Max	90 deg	284	164	69.5	-14.1	Pass
27.118	29.5	2.1	13.8	45.5	Peak Max	90 deg	251	201	69.5	-24	Pass

7.5 Radiated Spurious Emissions below 1GHz

7.5.1 Requirement

Per §15.225 Operation within the band 13.110–14.010 MHz:

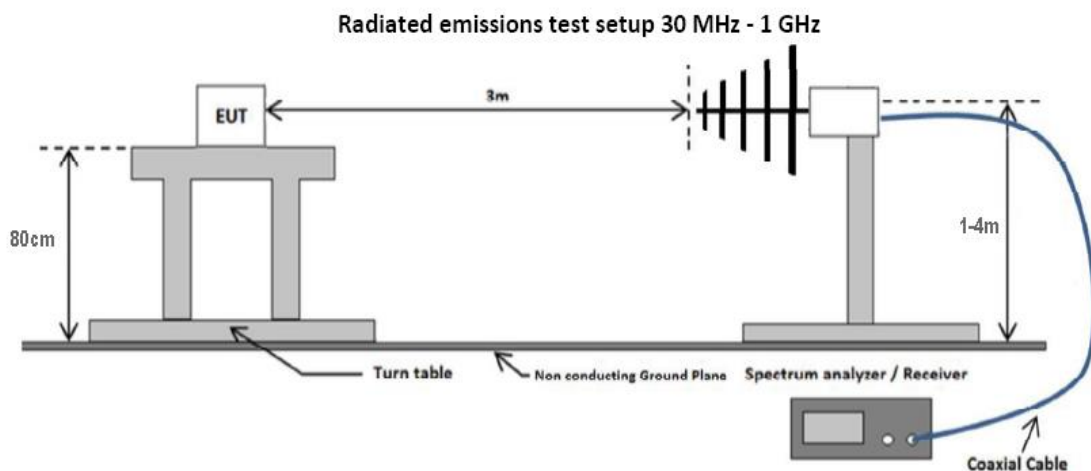
- (a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.
- (b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.
- (c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.
- (d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

Per RSS-210, B.6, Band 13.110-14.010 MHz

(a) the field strength of any emission shall not exceed the following limits:

- (i) 15.848 mV/m (84 dB μ V/m) at 30 m, within the band 13.553-13.567 MHz
- (ii) 334 μ V/m (50.5 dB μ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz
- (iii) 106 μ V/m (40.5 dB μ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz
- (iv) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz

7.5.2 Test Setup



7.5.3 Test Procedure

According to section 6.5 of ANSI C63.10-2013 as well as the procedures for maximizing and measuring radiated emissions that are described in ANSI C63.10 was followed. Boresight antenna mast was used during the scanning to point to EUT to maximize the emission. The process will be repeated in 3 EUT orientations.

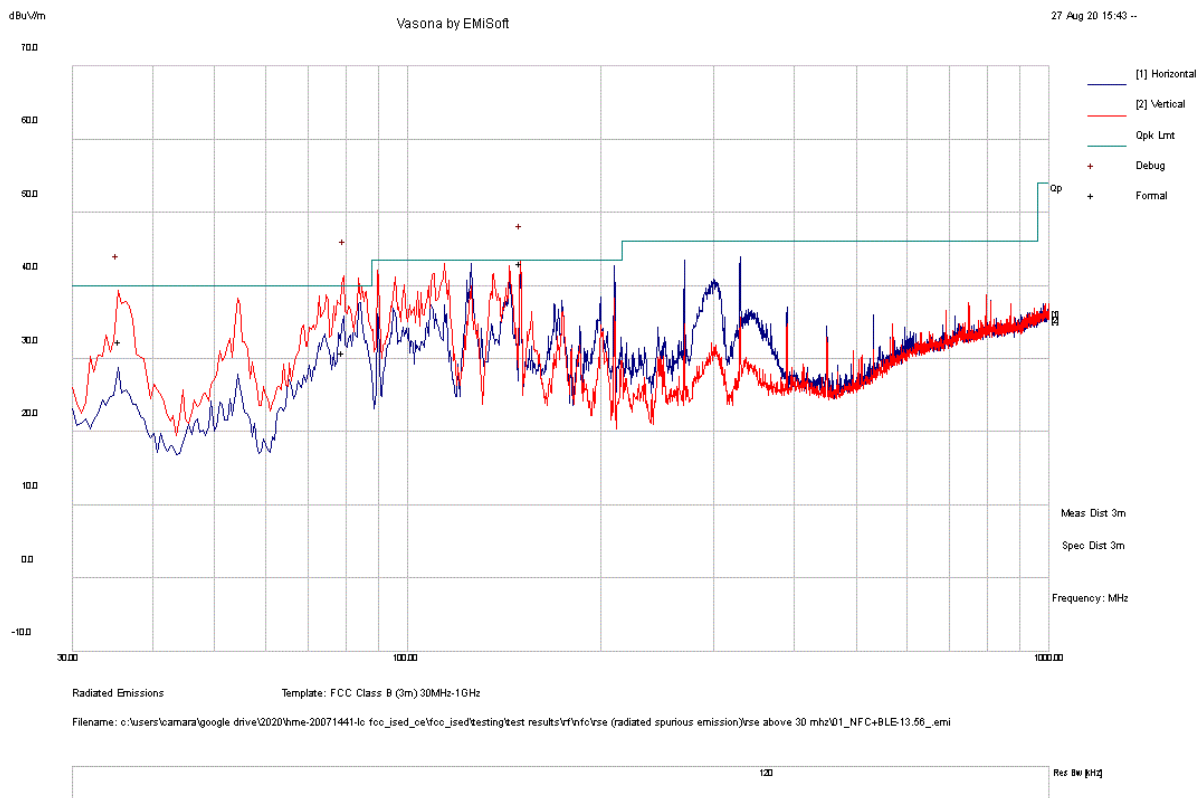
1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterization. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
3. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 300 Hz for frequency below 150KHz.
4. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 10 kHz for frequency between 150KHz – 30MHz.
5. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-Peak detection at frequency between 30MHz - 1GHz.
6. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz with Peak detection for Peak and average measurement at frequency above 1GHz.
7. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.

7.5.4 Test Result

RADIATED EMISSIONS BELOW 1 GHZ

Test Standard:	15.225, RSS-210	Mode:	NFC TX
Frequency Range:	30 MHz - 1 GHz	Test Date:	08/27/2020
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass

NFC

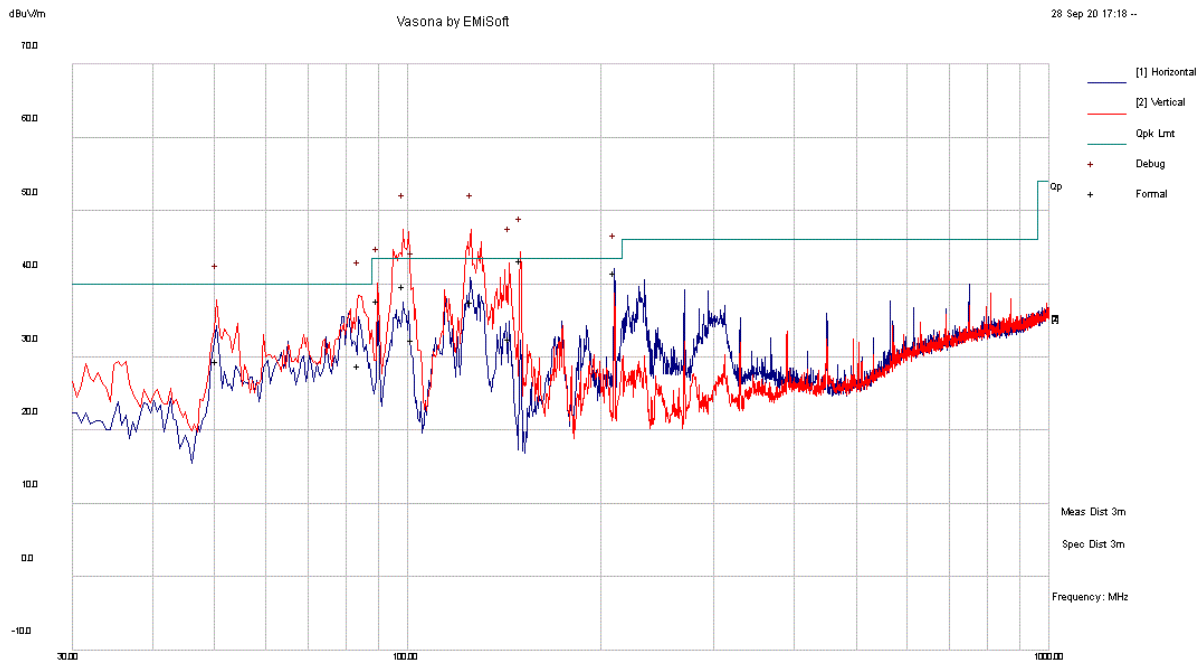


Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
79.445	52.2	3.3	-24.7	30.8	Quasi Max	V	189	242	40	-9.2	Pass
149.933	61.2	4.2	-22.3	43.2	Quasi Max	V	100	6	43.5	-0.3	Pass
35.577	48.6	2.4	-18.6	32.4	Quasi Max	V	125	165	40	-7.6	Pass

Note: The emission at 149.933MHz with limited margin is from digital circuit, not from RF transmitter. See the data under ITE mode for comparison.

Test Standard:	15.225, RSS-210	Mode:	BLE + NFC co-located
Frequency Range:	30 - 1000 MHz	Test Date:	08/27/2020
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	N/A	Test Result:	Pass

BLE + NFC co-located



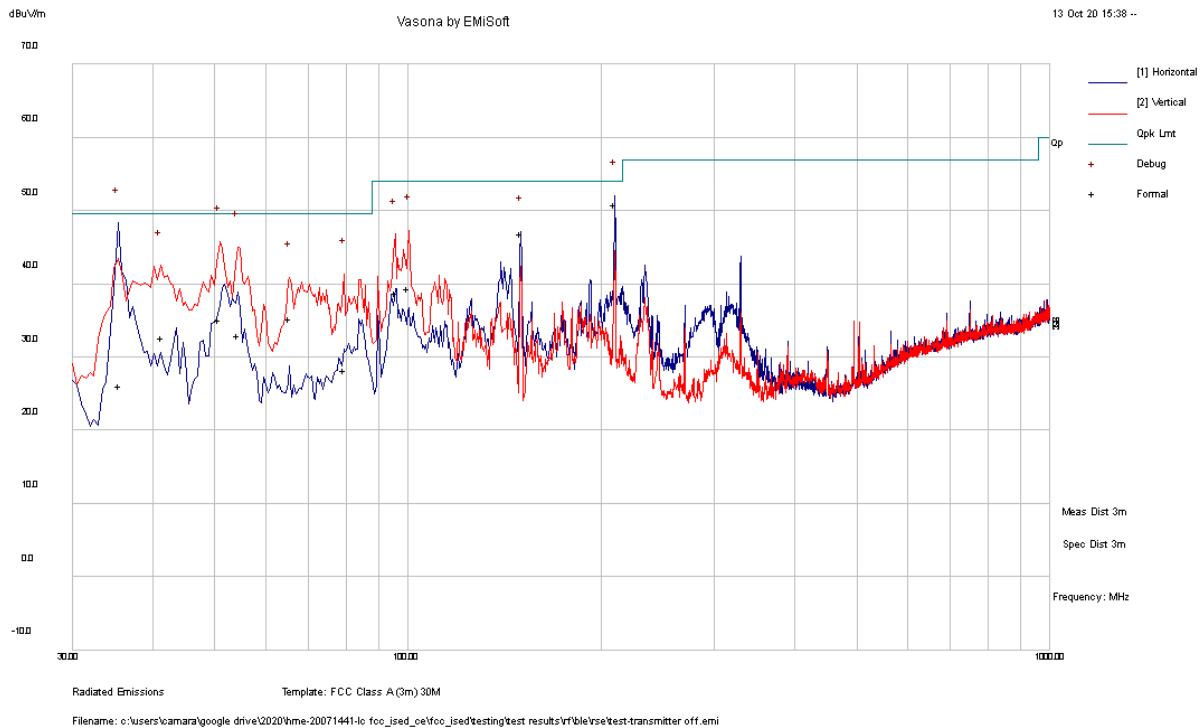
Radiated Emissions Template: FCC Class B (3m) 30MHz-1GHz
Filename: c:\users\camara\google drive\2020\hme-20071441-lc_fcc_ised_ce\foe_ised\testing\test results\rf\ble\rsse\06_RSSE-Below 1GHz-co-location_emi

Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
98.61	59.90	3.50	-23.70	39.70	Quasi Max	V	108	179	43.50	-3.80	Pass
125.58	56.50	3.90	-22.90	37.60	Quasi Max	V	164	12	43.50	-5.90	Pass
149.95	61.30	4.20	-22.30	43.20	Quasi Max	V	108	0	43.50	-0.30	Pass
144.05	50.90	4.20	-22.40	32.60	Quasi Max	V	100	24	43.50	-10.90	Pass
210.04	57.70	4.80	-20.90	41.60	Quasi Max	H	126	182	43.50	-1.90	Pass
83.78	50.20	3.40	-24.60	28.90	Quasi Max	V	198	248	40.00	-11.10	Pass
50.49	51.60	2.80	-25.00	29.50	Quasi Max	V	151	0	40.00	-10.50	Pass
89.89	58.90	3.40	-24.60	37.80	Quasi Max	V	178	0	43.50	-5.70	Pass
101.58	52.40	3.60	-23.50	32.50	Quasi Max	V	172	355	43.50	-11.00	Pass

Note: The emission at 149.95 MHz and 210.04 MHz with limited margin are from digital circuit, not from RF transmitter. See the data under ITE mode for comparison.

Test Standard:	FCC Part 15B, ICES-003	Mode:	ITE mode (TX off)
Frequency Range:	30 - 1000 MHz	Test Date:	10/20/2020
Antenna Type/Polarity:	Bi-Log/Hor & Ver	Test Personnel:	Daniel Bruno
Remark:	Class A	Test Result:	Pass

ITE mode (Transmitter off)



Frequency MHz	Raw dBuV	Cable Loss	AF dB	Level dBuV/m	Measurement Type	Pol	Hgt cm	Azt Deg	Limit dBuV/m	Margin dB	Pass/Fail
209.97	66.98	4.84	-20.95	50.87	Quasi Max	H	100	26	54.00	-3.13	Pass
35.52	42.19	2.41	-18.53	26.07	Quasi Max	H	343	162	49.60	-23.53	Pass
50.87	57.39	2.81	-25.03	35.17	Quasi Max	V	101	1	49.60	-14.43	Pass
54.37	55.19	2.89	-25.09	32.99	Quasi Max	V	286	189	49.60	-16.61	Pass
100.13	59.53	3.57	-23.60	39.50	Quasi Max	V	104	284	54.00	-14.50	Pass
149.96	64.99	4.25	-22.30	46.94	Quasi Max	H	218	6	54.00	-7.06	Pass
95.69	59.26	3.51	-24.01	38.77	Quasi Max	V	127	156	54.00	-15.23	Pass
41.40	51.86	2.58	-21.74	32.70	Quasi Max	V	268	281	49.60	-16.90	Pass
79.48	49.71	3.31	-24.67	28.35	Quasi Max	V	234	152	49.60	-21.25	Pass
65.54	56.83	3.09	-24.62	35.31	Quasi Max	V	113	173	49.60	-14.29	Pass

Note: These data are for comparison purpose only. The emission at around 150 MHz and 210 MHz exist when transmitters are off. Limit here is Class A limit.

7.6 Conducted Emissions

7.6.1 Requirement

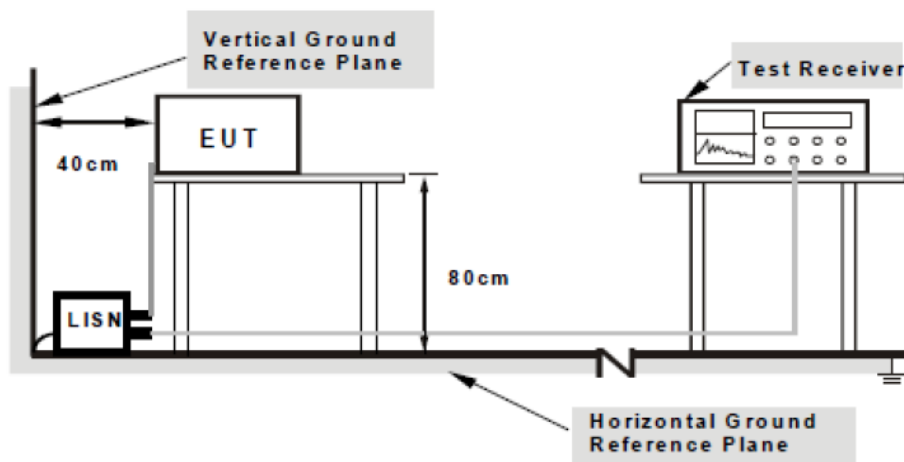
Per § 15.207 (a) and RSS-Gen, an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Limits for Conducted Emissions at the Mains Ports

Section	Frequency ranges (MHz)	Limit (dBuV)	
		QP	Average
Class B devices	0.15 - 0.5	66 - 56	56 - 46
	0.5 - 5	56	46
	5 - 30	60	50

NOTE 1 The lower limit shall apply at the transition frequencies.

7.6.2 Test setup



- Note:**
1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

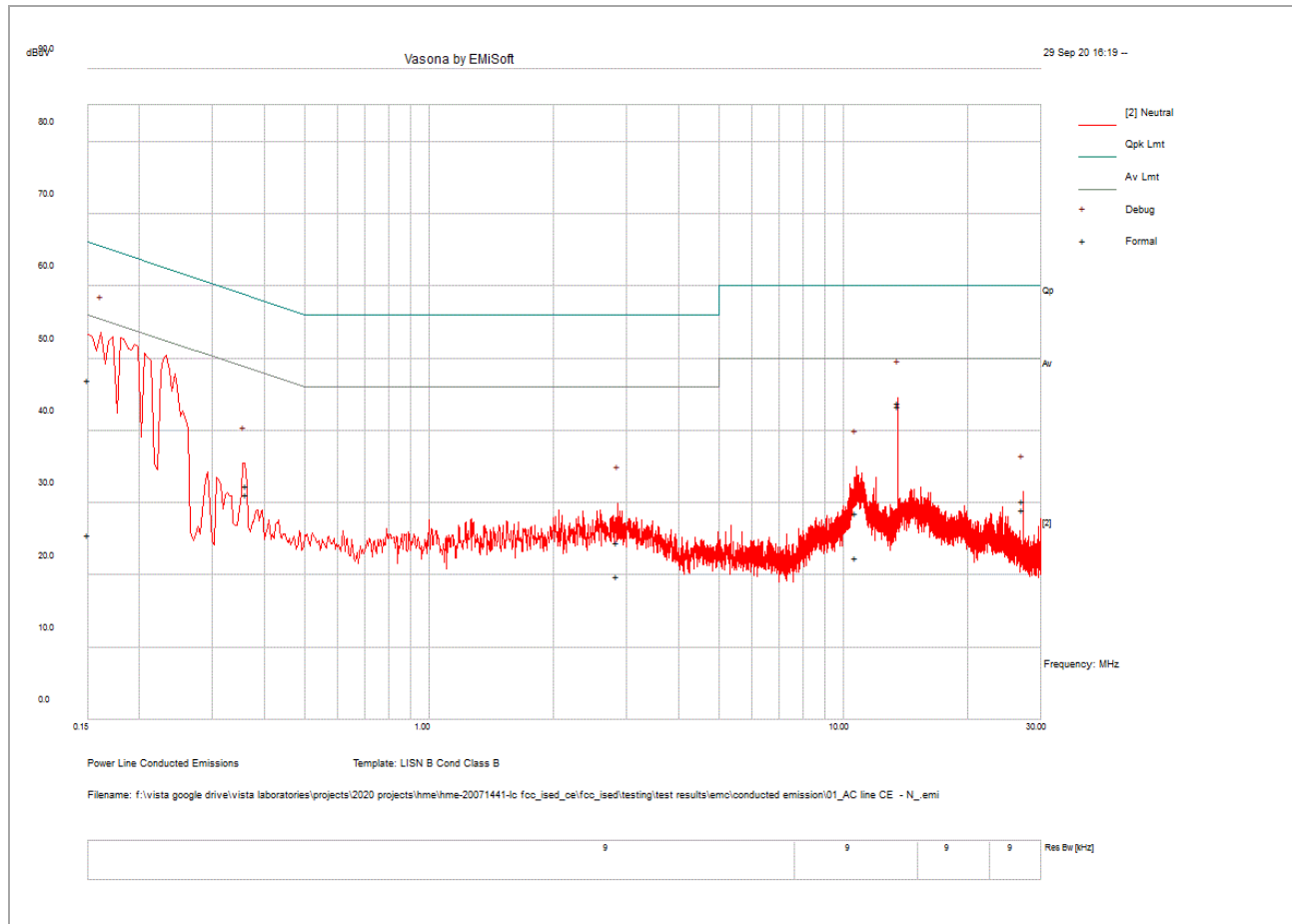
7.6.3 Test Procedure

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment was powered separately from another main supply.
5. The EUT was switched on and allowed to warm up to its normal operating condition.
6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
7. High peaks, relative to the limit line, were then selected.
8. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made
9. All possible modes of operation were investigated. Only the worst case emissions were measured and reported. All other emissions were relatively insignificant.

7.6.4 Test Result

Live Line

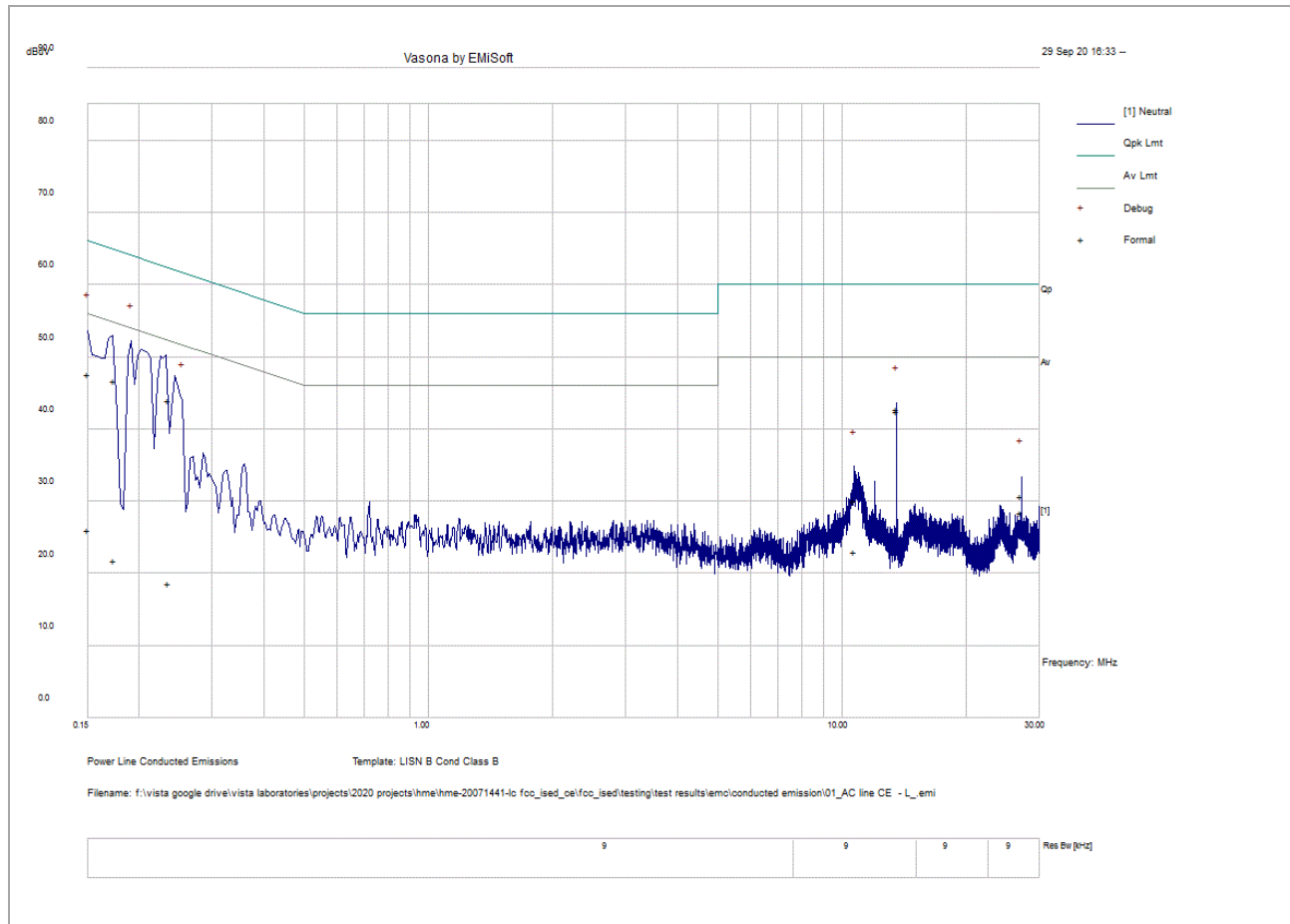
Test Standard:	Part 15.207, RSS-Gen	Mode:	Normal
Frequency Range:	0.15-30MHz	Test Date:	08/14/2020
Antenna Type/Polarity:	N/A	Test Personnel:	Daniel Bruno
Remark:	Class B, 120VAC, 60Hz	Test Result:	Pass



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Meas. Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.150	37.00	10.10	0.00	47.100	Quasi Peak	Live	66.00	-18.90	Pass
13.559	32.80	10.60	0.40	43.800	Quasi Peak	Live	60.00	-16.20	Pass
0.361	21.80	10.10	0.50	32.400	Quasi Peak	Live	58.70	-26.30	Pass
10.736	17.50	10.60	0.60	28.600	Quasi Peak	Live	60.00	-31.40	Pass
2.844	14.10	10.30	0.20	24.600	Quasi Peak	Live	56.00	-31.40	Pass
27.119	18.00	10.90	1.50	30.400	Quasi Peak	Live	60.00	-29.60	Pass
0.150	15.60	10.10	0.00	25.600	Average	Live	56.00	-30.40	Pass
13.559	32.50	10.60	0.40	43.500	Average	Live	50.00	-6.50	Pass
0.361	20.50	10.10	0.50	31.200	Average	Live	48.70	-17.50	Pass
10.736	11.40	10.60	0.60	22.500	Average	Live	50.00	-27.50	Pass
2.844	9.40	10.30	0.20	19.900	Average	Live	46.00	-26.10	Pass
27.119	16.80	10.90	1.50	29.200	Average	Live	50.00	-20.80	Pass

Neutral Line

Test Standard:	Part 15.207, RSS-Gen	Mode:	Normal
Frequency Range:	0.15-30MHz	Test Date:	08/14/2020
Antenna Type/Polarity:	N/A	Test Personnel:	Daniel Bruno
Remark:	Class B, 120VAC, 60Hz	Test Result:	Pass



Frequency (MHz)	Raw (dBuV)	Cable Loss (dB)	Factors (dB)	Level (dBuV)	Meas. Type	Line	Limit (dBuV)	Margin (dB)	Pass /Fail
0.173	36.60	10.10	0.10	46.70	Quasi Peak	Neutral	64.80	-18.10	Pass
0.150	37.60	10.10	0.00	47.70	Quasi Peak	Neutral	66.00	-18.30	Pass
13.559	31.70	10.60	0.40	42.80	Quasi Peak	Neutral	60.00	-17.20	Pass
0.236	34.00	10.10	-0.10	44.00	Quasi Peak	Neutral	62.20	-18.30	Pass
10.726	19.00	10.60	0.60	30.10	Quasi Peak	Neutral	60.00	-29.90	Pass
27.117	18.40	10.90	1.50	30.80	Quasi Peak	Neutral	60.00	-29.20	Pass
0.173	11.70	10.10	0.10	21.90	Average	Neutral	54.80	-32.90	Pass
0.150	16.10	10.10	0.00	26.20	Average	Neutral	56.00	-29.80	Pass
13.559	31.60	10.60	0.40	42.60	Average	Neutral	50.00	-7.40	Pass
0.236	8.70	10.10	-0.10	18.60	Average	Neutral	52.20	-33.60	Pass
10.726	11.90	10.60	0.60	23.00	Average	Neutral	50.00	-27.00	Pass
27.117	16.20	10.90	1.50	28.50	Average	Neutral	50.00	-21.50	Pass

7.7 Frequency Stability

7.7.1 Requirement

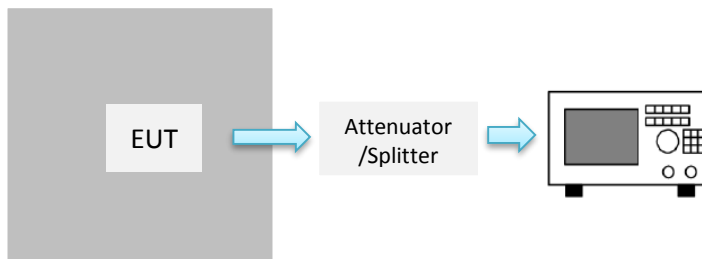
Per §15.225 Operation within the band 13.110–14.010 MHz:

(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+ 50$ degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

Per RSS-210, B.6, Band 13.110-14.010 MHz

(b) the carrier frequency stability shall not exceed ± 100 ppm

7.7.2 Test Setup



7.7.3 Test Procedure

According to section 6.8 of ANSI C63.10-2013

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW $\geq 3 \times$ RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be ≥ 6 dB.

1. Set RBW = 1% to 5% of the actual occupied BW.
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Span = large enough to capture all products of the modulation process
7. Allow the trace to stabilize.
8. Use automatic bandwidth measurement capability on instrument to obtain BW result.

7.7.4 Test Result

Frequency Stability versus Temperature: The Frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20°C to $+50^{\circ}\text{C}$ at normal supply voltage.

Reference Frequency: 13.56MHz at 20°C at 120VAC

Frequency Stability							
Temperature	Test Mode	Frequency (MHz)	Measured Freq.	Freq. Drift (%)	Freq. Deviation (Limit: 0.01%)	Result	
50	NFC	13.56	13.5590	-0.007	<0.01	Pass	
40	NFC	13.56	13.5594	-0.004	<0.01	Pass	
30	NFC	13.56	13.5594	-0.004	<0.01	Pass	
20	NFC	13.56	Reference				
10	NFC	13.56	13.5594	-0.004	<0.01	Pass	
0	NFC	13.56	13.5594	-0.004	<0.01	Pass	
-10	NFC	13.56	13.5594	-0.004	<0.01	Pass	
-20	NFC	13.56	13.5595	-0.004	<0.01	Pass	

Frequency Stability versus Input Voltage: The Frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$, the frequency of the transmitter was measured at 85% and at 115% of the rated power supply voltage at a 20°C environmental temperature.

Carrier Frequency: 13.56MHz at 20°C at 120VAC

Measured Voltage $\pm 15\%$ of nominal (AC)	Measured Freq. (MHz)	Freq. Drift (%)	Freq. Deviation (Limit: 0.01%)	Pass/Fail
138 VAC	13.5594	-0.004	<0.01	Pass
102 VAC	13.5594	-0.004	<0.01	Pass

8 EUT and Test Setup Photos

See FCC exhibits

9 Test Instrument List

Equipment	Manufacturer	Model	Instrument Number	Cal. Date	Cal. Due
Semi-Anechoic Chamber	ETS-Lindgren	10M	VL001	10/18/19	10/18/20
Shielding Control Room	ETS-Lindgren	Series 81	VL006	N/A	N/A
Spectrum Analyzer	Keysight	N9020A	MY50110074	6/17/20	6/17/21
EMC Test Receiver	R&S	ESL6	100230	6/14/20	6/14/21
LISN (9KHz – 30MHz)	EMCO	3816/2	9705-1066	5/4/20	5/4/21
LISN (9KHz – 30MHz)	Com-Power	LI-550C	20140050	01/29/2020	01/29/2021
LISN (9KHz – 30MHz)	Com-Power	LI-550C	20140051	01/29/2020	01/29/2021
Bi-Log Antenna	ETS-Lindgren	3142E	217921	11/15/2019	11/15/2020
Horn Antenna (1-18GHz)	Electro-Metrics	EM-6961	6292	5/14/2020	5/14/2021
Horn Antenna (18-40GHz)	Com-Power	AH-840	101109	6/24/20	6/24/21
Preamplifier	RF Bay, Inc.	LPA-10-20	11180621	7/16/2020	7/16/2021
True RMS Multi-meter	UNI-T	UT181A	C173014829	5/5/2020	5/5/2021
Temp / Humidity / Pressure Meter	PCE Instruments	PCE-THB 40	R062028	5/15/2020	5/15/2021
RF Attenuator	Pasternack	PE7005-3	VL061	7/16/2020	7/16/2021
Preamplifier 100KHz - 40GHz	Aeroflex	33711-392-77150-11	064	7/16/2020	7/16/2021
EM Center Control	ETS-Lindgren	7006-001	160136	N/A	N/A
Turn Table	ETS-Lindgren	2181-3.03	VL002	N/A	N/A
Boresight Antenna Tower	ETS-Lindgren	2171B	VL003	N/A	N/A
Loop Antenna (9k-30MHz)	Com-Power	AL-130	121012	5/16/20	5/16/21
RE test cable(below 6GHz)	Vista	RE-6GHz-01	RE-6GHz-01	7/16/2020	7/16/2021
RE test cable (1-18GHz)	PhaseTrack	II-240	RE-18GHz-01	7/16/2020	7/16/2021
RE test cable (>18GHz)	Sucoflex	104	344903/4	7/16/2020	7/16/2021
Pulse limiter	Com-Power	LIT-930A	531727	7/16/2020	7/16/2021
CE test cable #1	FIRST RF	FRF-C-1002-001	CE-6GHz-01	7/16/2020	7/16/2021
CE test cable#2	FIRST RF	FRF-C-1002-001	CE-6GHz-02	7/16/2020	7/16/2021
Vector Signal Generator	Keysight	N5182A	US47080548	6/17/20	6/17/21
RF Power Amplifier (80-1000MHz)	Ophir	5226FE	1013/1815	N/A	N/A
RF Power Amplifier (700-6000MHz)	Ophir	5293FE	1063/1815	N/A	N/A
Horn Antenna (1-18GHz)	FT-RF	HA-07M18G-NF	180010HA	N/A	N/A
Temperature/Humidity Chamber	Bemco	FBW1.5-100/350	3621-9	06/27/2020	06/27/2021