TEST REPORT

Product Name:	NFC Module
Trade Mark:	Prowise
Model No. / HVIN:	PN7150
Add. Model No. / HVIN:	N/A
Report Number:	210205008RFC-1
Test Standards:	FCC 47 CFR Part 15 Subpart C RSS-210 Issue 10 RSS-Gen Issue 5
FCC ID:	2AQ5RNFCPN7150
IC:	24301-NFCPN7150
Test Result:	PASS
Date of Issue:	March 25, 2021

Prepared for:

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Prepared by:

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Date: March 25, 2021

Version

Version No.	Date	Description
V1.0	March 25, 2021	Original

CONTENTS

1. GENERAL INFORMATION 4
   1.1 CLIENT INFORMATION 4
   1.2 EUT INFORMATION 4
      1.2.1 GENERAL DESCRIPTION OF EUT 4
      1.2.2 DESCRIPTION OF ACCESSORIES 4
   1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD 4
   1.4 OTHER INFORMATION 5
   1.5 DESCRIPTION OF SUPPORT UNITS 5
   1.6 TEST LOCATION 5
   1.7 TEST FACILITY 5
   1.8 DEVIATION FROM STANDARDS 5
   1.9 ABNORMALITIES FROM STANDARD CONDITIONS 5
   1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER 6
   1.11 MEASUREMENT UNCERTAINTY 6
2. TEST SUMMARY 7
3. EQUIPMENT LIST 8
4. TEST CONFIGURATION 9
   4.1 ENVIRONMENTAL CONDITIONS FOR TESTING 9
      4.1.1 NORMAL OR EXTREME TEST CONDITIONS 9
      4.1.2 RECORD OF NORMAL ENVIRONMENT 9
   4.2 TEST CHANNELS 9
   4.3 EUT TEST STATUS 9
   4.4 PRE-SCAN 10
      4.4.1 PRE-SCAN UNDER ALL DATA RATES 10
      4.4.2 USED FOR TESTING OF WORST-CASE DATA RATES 10
   4.5 TEST SETUP 11
      4.5.1 FOR RADIATED EMISSIONS TEST SETUP 11
      4.5.2 FOR CONDUCTED EMISSIONS TEST SETUP 12
      4.5.3 FOR CONDUCTED RF TEST SETUP 12
   4.6 SYSTEM TEST CONFIGURATION 13
5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION 14
   5.1 REFERENCE DOCUMENTS FOR TESTING 14
   5.2 ANTENNA REQUIREMENT 14
   5.3 99% & 20DB BANDWIDTH 14
   5.4 THE FIELD STRENGTH OF ANY EMISSIONS APPEARING OUTSIDE OF THE 13.110-14.010 MHZ BAND 16
   5.5 FUNDAMENTAL FIELD STRENGTH AND EMISSION MASK 13.110 MHZ TO 14.010 MHZ 21
   5.6 FREQUENCY TOLERANCE 23
   5.7 AC POWER LINE CONDUCTED EMISSION 24

APPENDIX 1 PHOTOS OF TEST SETUP 27
APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS 27

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Shenzhen KTC Commercial Display Technology CO., LTD.
Address of Applicant:	No.4023, Northern Wuhe Road, Bantian Street, Longgang District, Shenzhen City, Guangdong Province, P.R. China
Manufacturer:	Shenzhen KTC Commercial Display Technology CO., LTD.
Address of Manufacturer:	No.4023, Northern Wuhe Road, Bantian Street, Longgang District, Shenzhen City, Guangdong Province, P.R. China

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	NFC Module
Model No. / HVIN:	PN7150
Add. Model No. / HVIN:	N/A
Trade Mark:	Prowise
DUT Stage:	Production Unit
EUT Supports Function:	13.56 MHz
Software Version:	1.0.25
Hardware Version:	A2
Sample Received Date:	February 7, 2021
Sample Tested Date:	February 28, 2021 to March 4, 2021

1.2.2 Description of Accessories

None.

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Band:	13.110 MHz to 14.010 MHz
Nominal Operating Frequency:	13.56 MHz
Work in Modes:	☑ Card Emulation
	☑ Reader/Writer
	☐ Peer-to-Peer
NFC Type:	☑ NFC A Type
	☑ NFC B Type
	☑ NFC F Type
	☑ NFC V Type
Max. Data Rates:	848 Kbps
Type of Modulation:	ASK
Number of Channels:	1
Antenna Type:	Integral Antenna
Maximum Field Strength:	61.07 dBμV/m at 3 meter
Normal Test Voltage:	3.3 Vdc
Extreme Test Voltage:	3.0 Vdc to 3.6 Vdc
Extreme Test Temperature:	-30 °C to +85 °C

1.4 OTHER INFORMATION

None

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	DELL	Latitude 3400	6GJQKT2	UnionTrust
mouse	DELL	MS111	CN-011D3V-738	UnionTrust

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China, China 518109
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC/EN 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9KHz-150KHz	±3.8 dB
2	Conducted emission 150KHz-30MHz	±3.4 dB
3	Radiated emission 9KHz-30MHz	±4.9 dB
4	Radiated emission 30MHz-1GHz	±4.7 dB
5	Radiated emission 1GHz-18GHz	±5.1 dB
6	Radiated emission 18GHz-26GHz	±5.2 dB
7	Radiated emission 26GHz-40GHz	±5.2 dB

2. TEST SUMMARY

FCC 47 CFR Part 15 Subpart C Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203 RSS-Gen Issue 5, Section 6.8	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207 RSS-Gen Issue 5, Section 8.8	ANSI C63.10-2013 Clause 6.2	PASS
The field strength of any emissions appearing outside of the 13.110-14.010 MHz band	FCC 47 CFR Part 15 Subpart C Section 15.225(d) /15.209 RSS-210 Issue 10, Annex B.6 RSS-Gen Issue 5, section 8.9	ANSI C63.10-2013 Section 6.3/ 6.4/ 6.5	PASS
Fundamental Field Strength and Emission Mask 13.110 MHz to 14.010 MHz	FCC 47 CFR Part 15 Subpart C Section 15.227(a) (b) (c) /15.205 RSS-210 Issue 10, Annex B.6 RSS-Gen Issue 5, section 8.9	ANSI C63.10-2013 Section 6.3/ 6.4	PASS
99% & 20DB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.215(c) RSS-Gen Issue 5, section 6.7	ANSI C63.10-2013 Section 6.9	Pass
Frequency Tolerance	FCC 47 CFR Part 15 Subpart C Section 15.225(e) RSS-210 Issue 10, Annex B.6	ANSI C63.10-2013 Section 6.8	Pass

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	3M Chamber & Accessory Equipment	ETS-LINDGREN	3M	N/A	Dec. 03, 2018	Dec. 03, 2021
☒	Receiver	R&S	ESIB26	100114	Nov. 18, 2020	Nov. 17, 2021
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	Nov. 14, 2019	Nov. 13, 2022
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 14, 2019	Nov. 13, 2022
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 10, 2020	Nov. 9, 2021
☒	Preamplifier	HP	8447F	2805A02960	Nov. 10, 2020	Nov. 9, 2021
☐	Horn Antenna	ETS-LINDGREN	3117	00164202	Nov. 14, 2019	Nov. 13, 2022
☐	Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201874	Nov. 10, 2020	Nov. 9, 2021
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	Receiver	R&S	ESR7	1316.3003K07 -101181-K3	Nov. 18, 2020	Nov. 17, 2021
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	Nov. 18, 2020	Nov. 17, 2021
☒	LISN	R&S	ESH2-Z5	860014/024	Nov. 18, 2020	Nov. 17, 2021
☐	LISN	ETS-Lindgren	3816/2SH	00201088	Nov. 18, 2020	Nov. 17, 2021
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted RF test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date (mm dd, yyyy)**	**Cal. Due date (mm dd, yyyy)**
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	Nov. 10, 2020	Nov. 9, 2021
☒	Receiver	R&S	ESR7	1316.3003K07 -101181-K3	Nov. 18, 2020	Nov. 17, 2021
☒	DC Source	KIKUSUI	PWR400L	LK003024	Sep. 04, 2020	Sep. 03, 2021
☐	Temp & Humidity chamber	Espec	GL(U)04KA(W)	16921H201P3	Sep. 02, 2020	Sep. 01, 2021
☒	Temp & Humidity chamber	Votisch	VT4002	58566133290020	May 11, 2020	May 10, 2021

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Test Environment	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
TN/VN	+15 to +35	3.3	20 to 75
TL/VL	-30	3.0	20 to 75
TH/VL	+85	3.0	20 to 75
TL/VH	-30	3.6	20 to 75
TH/VH	+85	3.6	20 to 75

Remark:

1) The EUT just work in such extreme temperature of -30 °C to +85 °C and the extreme voltage of 3.0 V to 3.6 V, so here the EUT is tested in the temperature of -30 °C to +85 °C and the voltage of 3.0 V to 3.6 V.
2) VN: Normal Voltage; TN: Normal Temperature;
TL: Low Extreme Test Temperature; TH: High Extreme Test Temperature;
VL: Low Extreme Test Voltage; VH: High Extreme Test Voltage.

4.1.2 Record of Normal Environment

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)	Tested by
Conducted Emission	22.9	54.0	99.93	Tripp Jiang
The field strength of any emissions appearing outside of the 13.110-14.010 MHz band	25.8	50.0	100.24	Andy Lin
Fundamental Field Strength and Emission Mask 13.110 MHz to 14.010 MHz	25.8	50.0	100.24	Andy Lin
99%&20DB Bandwidth	24.4	53.7	100.10	Gavin Xu

4.2 TEST CHANNELS

Frequency	Test RF Channel
13.56 MHz	Channel 1
	13.56 MHz

4.3 EUT TEST STATUS

Frequency	Tx Function	Description
13.56 MHz	1Tx	1. Keep the EUT in continuously transmitting during the test.

4.4 PRE-SCAN

4.4.1 Pre-scan under all data rates

Pre-scan under all data rates				
Frequency	**Work in Modes**	**Type**	**Data Rate (Kbps)**	**H-field dBμv/m at 3 m distance**
13.56 MHz	Card Emulation	A	106	61.07
			212	61.07
			424	61.07
			848	61.07
		B	106	61.07
			212	61.07
			424	61.07
			848	61.07
		F	106	61.07
			212	61.07
			424	61.07
			848	61.07
		V	106	61.07
			212	61.07
			424	61.07
			848	61.07
	Reader/Writer	From Card Emulation mode Worst-case data rates		61.07
	Peer-to-Peer	From Card Emulation mode Worst-case data rates		61.07

4.4.2 Used for testing of worst-case data rates

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, work in modes and data rates. Selected for the final test as listed below.

Frequency	**Work in Modes**	**Type**	**Data Rate (Kbps)**
13.56 MHz	☐ Card Emulation ☑ Reader/Writer ☐ Peer-to-Peer	☑ A ☐ B ☐ F ☐ V	☑ 106 ☐ 212 ☐ 424 ☐ 848
Remark: The mark"☑" means is chosen for testing; The mark"☐" means is not chosen for testing.			

4.5 TEST SETUP

4.5.1 For Radiated Emissions test setup

Figure 1. Below 30MHz

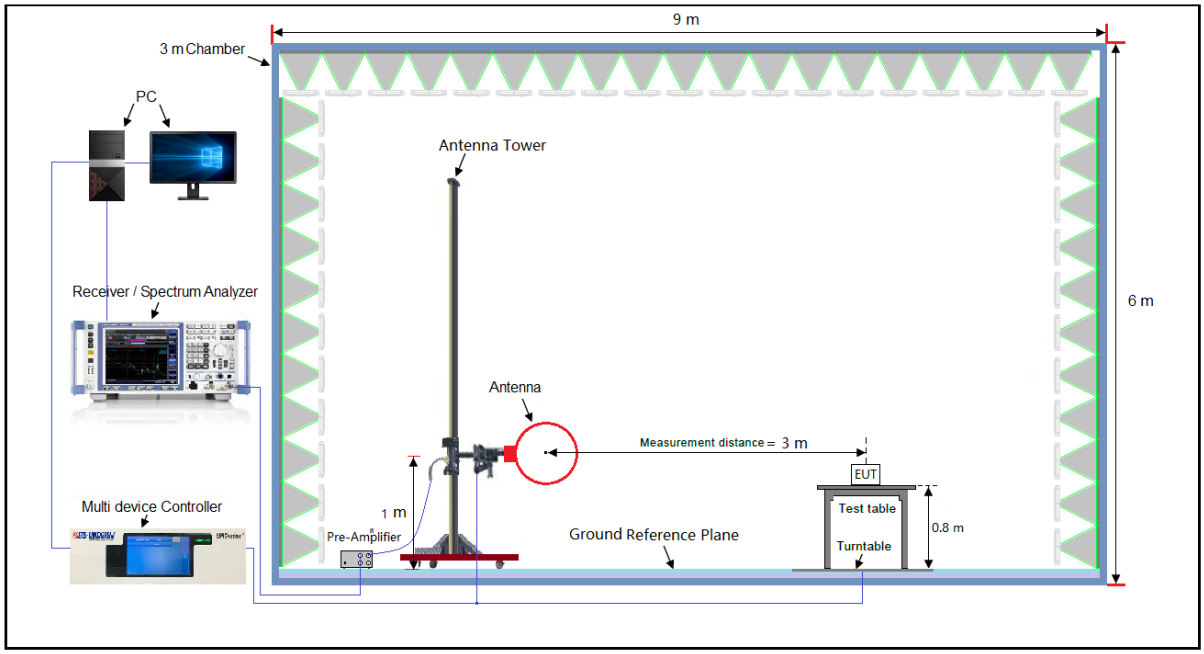
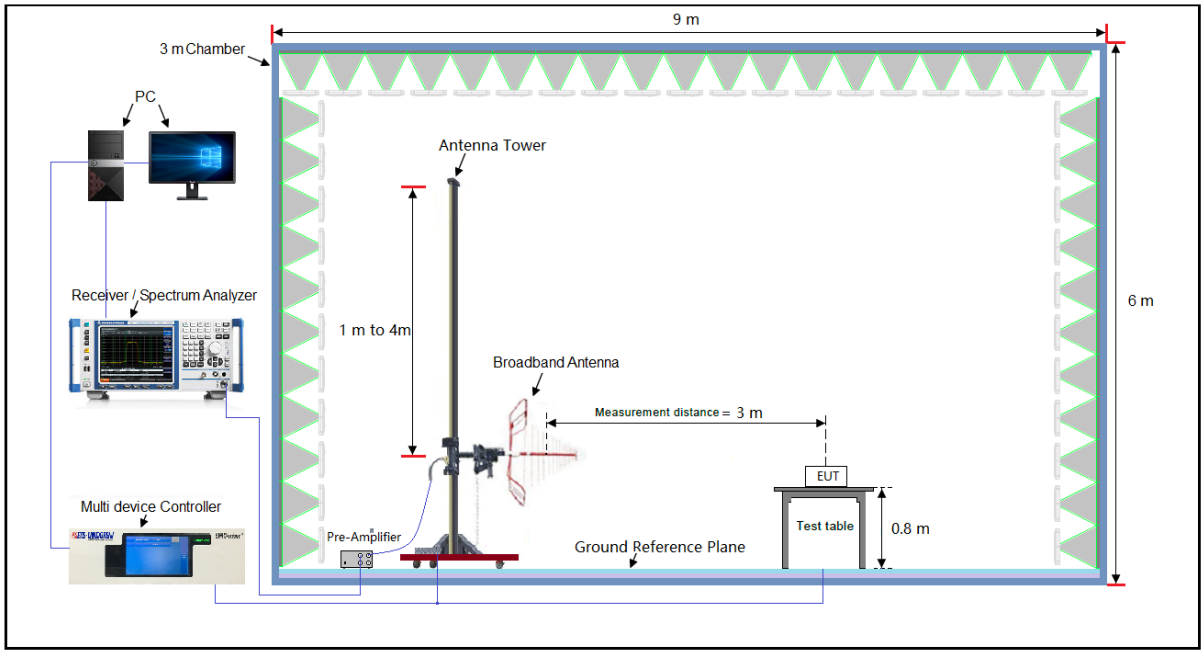
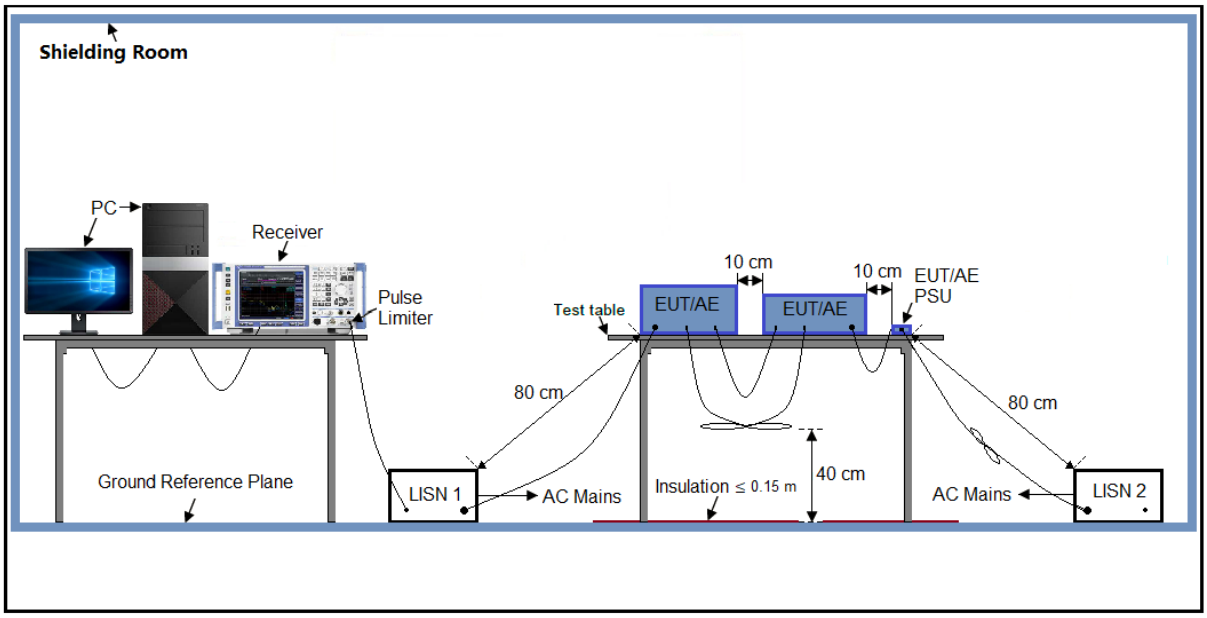


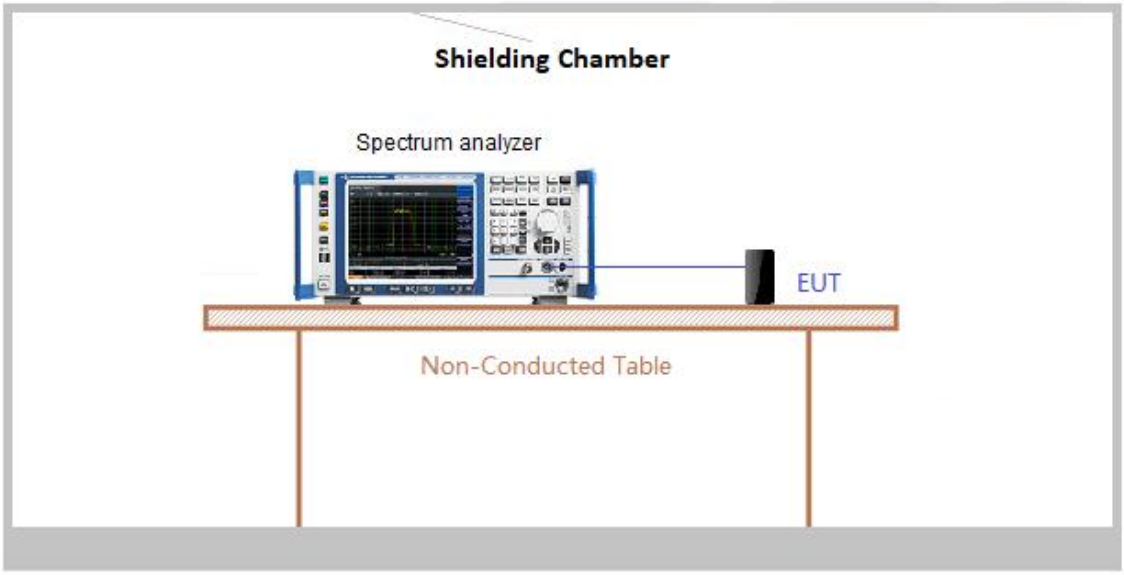
Figure 2. 30MHz to 1GHz



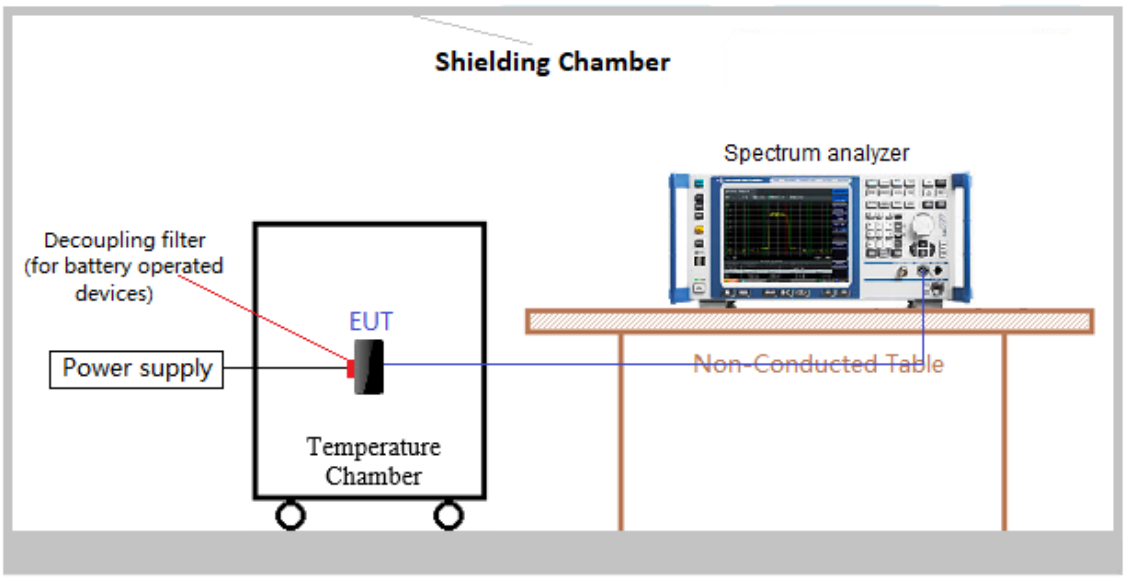
4.5.2 For Conducted Emissions test setup



4.5.3 For Conducted RF test setup



Normal Environment



Extreme Environment

4.6 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Only the worst case data were recorded in this test report.

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 15	Radio Frequency Devices
2	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices
3	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
4	RSS-210 Issue 10	Licence-Exempt Radio Apparatus: Category I Equipment

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203& requirement: 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, 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. **RSS-Gen Issue 5, Section 6.8 requirement:** According to RSS-Gen Issue 5, Section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.
EUT Antenna:
This product has a permanent antenna, fulfill the requirement of this section.

5.3 99% & 20DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.215(c)
RSS-Gen Issue 5, section 6.7

Test Method: ANSI C63.10-2013 Section 6.9

Limit: Operation within the band 13.110 MHz to 14.010 MHz

Requirement : Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that 20dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equip compliance with the 20dB attenuation specification may base on measurement at the intentional radiator's antenna output terminal unless the intentional radiator uses a permanently attached antenna, in which case compliance shall be. Demonstrated by measuring the radiated emissions.

Test Procedure: Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
Use the following spectrum analyzer settings:

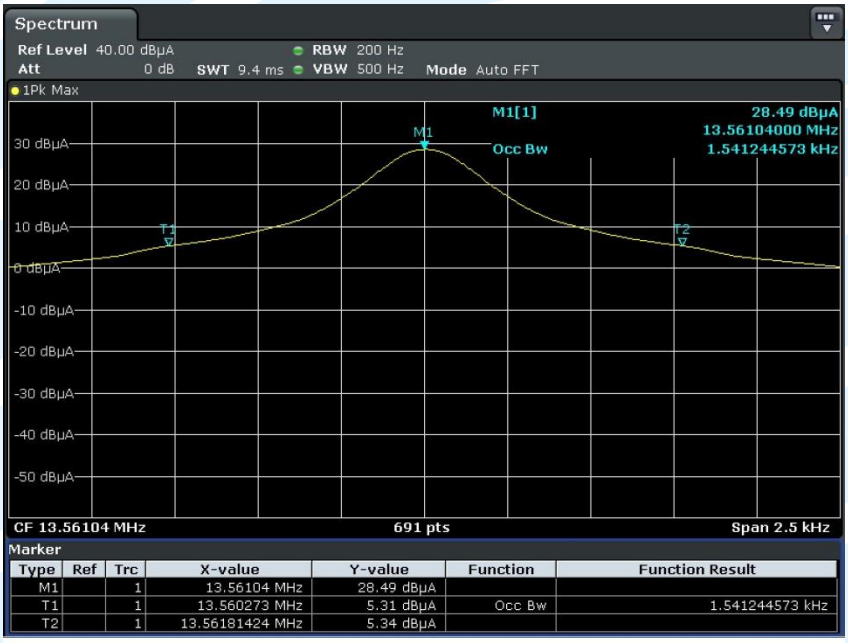
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency
b) Span = approximately 2 to 5 times the OBW
c) RBW = 1% to 5%of the OBW
d) VBW ≥ 3*RBW
e) Sweep = auto;
f) Detector function = peak
g) Trace = max hold
h) All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down bandwidth of the emission.

Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

Test Setup: Refer to section 4.5.3 for details.
Instruments Used: Refer to section 3 for details
Test Mode: Transmitter mode
Test Results: Pass
Test Data:

Frequency (MHz)	20 dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit	Pass / Fail
13.56 MHz	4.89	1.54	Operation within the band 13.110 MHz to 14.010 MHz	Pass

The test plot as follows:



5.4 THE FIELD STRENGTH OF ANY EMISSIONS APPEARING OUTSIDE OF THE 13.110-14.010 MHZ BAND

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.225(d) /15.209
RSS-210 Issue 10, Annex B.6
RSS-Gen Issue 5, section 8.9

Test Method: ANSI C63.10-2013 Section 6.3/ 6.4/ 6.5

Receiver Setup:

Frequency	RBW
0.009 MHz-0.150 MHz	200/300 kHz
0.150 MHz -30 MHz	9/10 kHz
30 MHz-1 GHz	100/120 kHz
Above 1 GHz	1 MHz

Limits:

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.

Spurious Emissions

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009 MHz-0.490 MHz	2400/F(kHz)	--	--	300
0.490 MHz-1.705 MHz	24000/F(kHz)	--	--	30
1.705 MHz-30 MHz	30	--	--	30
30 MHz-88 MHz	100	40.0	Quasi-peak	3
88 MHz-216 MHz	150	43.5	Quasi-peak	3
216 MHz-960 MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1 GHz	500	54.0	Average	3

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (μV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.
4. For Below 30MHz, the measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

   Example:

   Field strength limit for 13.56MHz = 15848 μV/m at 30m
   = 84 dBμV/m at 30m
   = 84 dBμV/m + 40log(30/3) dB at 3m
   = 124 dBμV/m at 3m

Test Setup: Refer to section 4.5.1 for details.

Test Procedures:

1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to

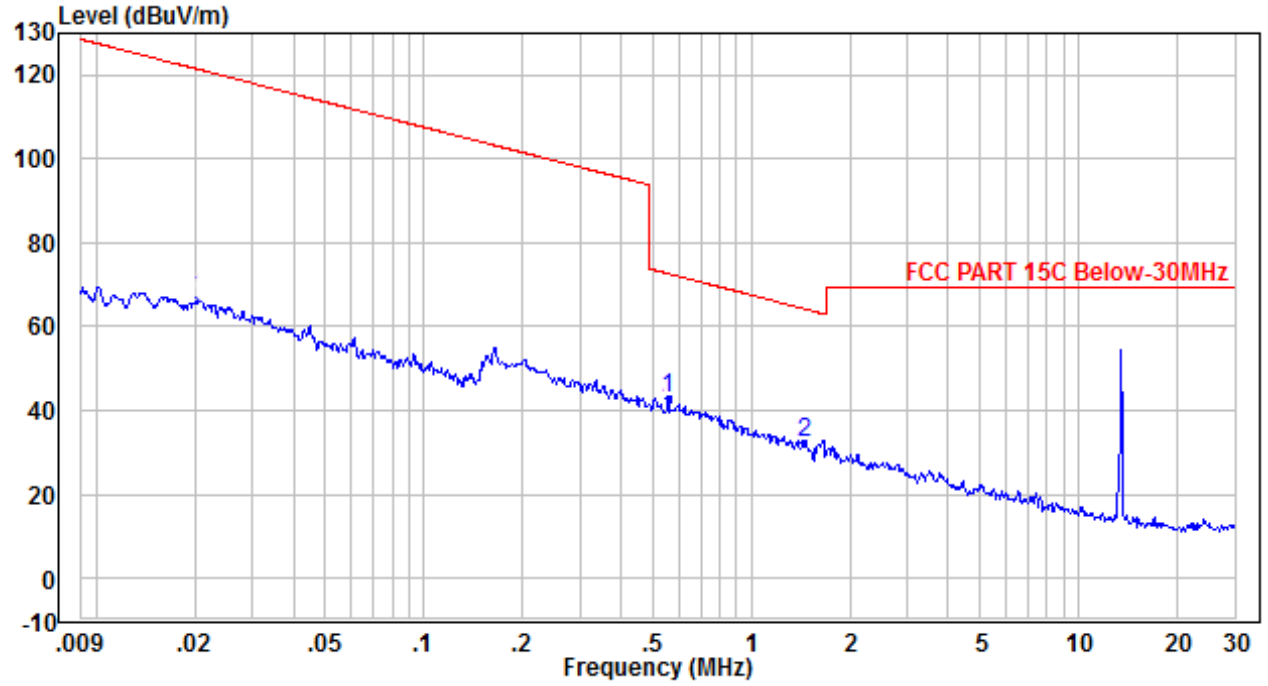
heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.

5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
7) The radiation measurements are performed in X, Y, Z axis positioning. And found the Y axis positioning which it is worse case, only the test worst case mode is recorded in the report.(for portable and mobile devices)

Equipment Used: Refer to section 3 for details.

Test Result: Pass

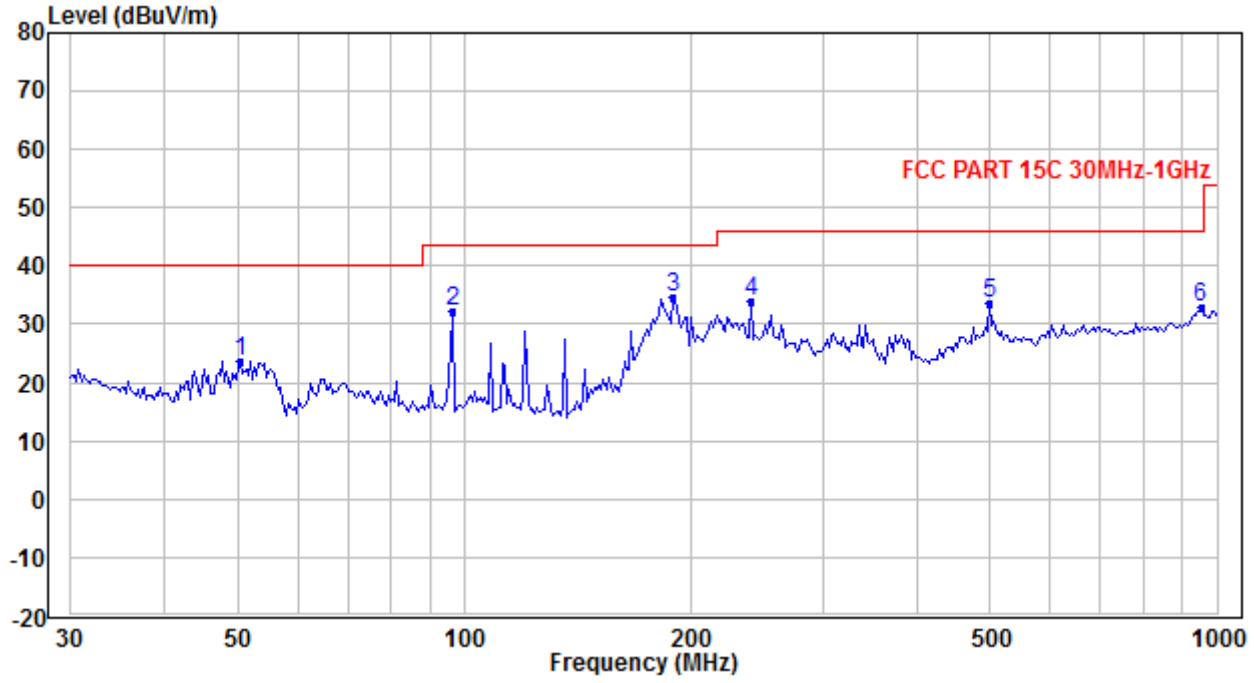
Radiated Emission Test Data (9 KHz ~ 30MHz):



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	0.560	61.04	-18.18	42.86	72.64	-29.78	QP
2	1.455	50.20	-17.91	32.29	64.29	-32.00	QP

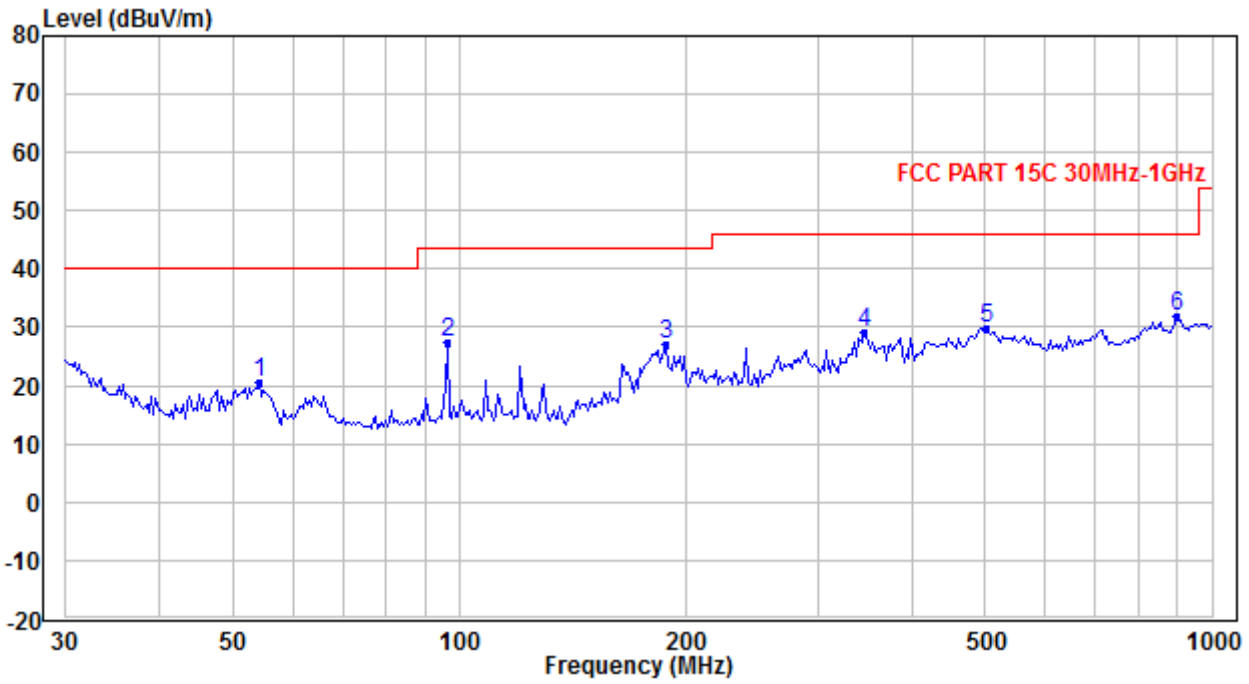
Radiated Emission Test Data (30 MHz ~ 1 GHz):

Horizontal



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	50.461	38.07	-14.44	23.63	40.00	-16.37	QP
2	96.323	44.72	-12.62	32.10	43.50	-11.40	QP
3	189.108	45.04	-10.39	34.65	43.50	-8.85	QP
4	240.144	42.06	-7.94	34.12	46.00	-11.88	QP
5	498.730	35.85	-2.09	33.76	46.00	-12.24	QP
6	952.000	26.51	6.34	32.85	46.00	-13.15	QP

Vertical



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	54.135	35.17	-14.72	20.45	40.00	-19.55	QP
2	96.323	40.16	-12.62	27.54	43.50	-15.96	QP
3	187.783	37.43	-10.36	27.07	43.50	-16.43	QP
4	346.074	33.82	-4.54	29.28	46.00	-16.72	QP
5	502.247	31.39	-1.44	29.95	46.00	-16.05	QP
6	899.958	27.47	4.37	31.84	46.00	-14.16	QP

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit

5.5 FUNDAMENTAL FIELD STRENGTH AND EMISSION MASK 13.110 MHZ TO 14.010 MHZ

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.227(a) (b) (c) /15.205
RSS-210 Issue 10, Annex B.6
RSS-Gen Issue 5, section 8.9

Test Method: ANSI C63.10-2013 Section 6.3/ 6.4

Limits:

(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.

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBμV/m) = 20 log Emission level (μV/m).
3. For Below 30MHz, the measured field strength was extrapolated to distance 30 meters, using the formula that the limit of field strength varies as the inverse distance square (40dB per decade of distance)

Example:

Field strength limit for 13.56MHz = 15848 μV/m at 30m
= 84 dBμV/m at 30m
= 84 dBμV/m + 40log(30/3) dB at 3m
= 124 dBμV/m at 3m

Test Setup: Refer to section 4.5.1 for details.

Test Procedures:

As the radiation test, set the RBW=10kHz VBW=30kHz, observed the outside band of 13.110 MHz to 14.010 MHz, than mark the higher-level emission for comparing with the FCC rules.

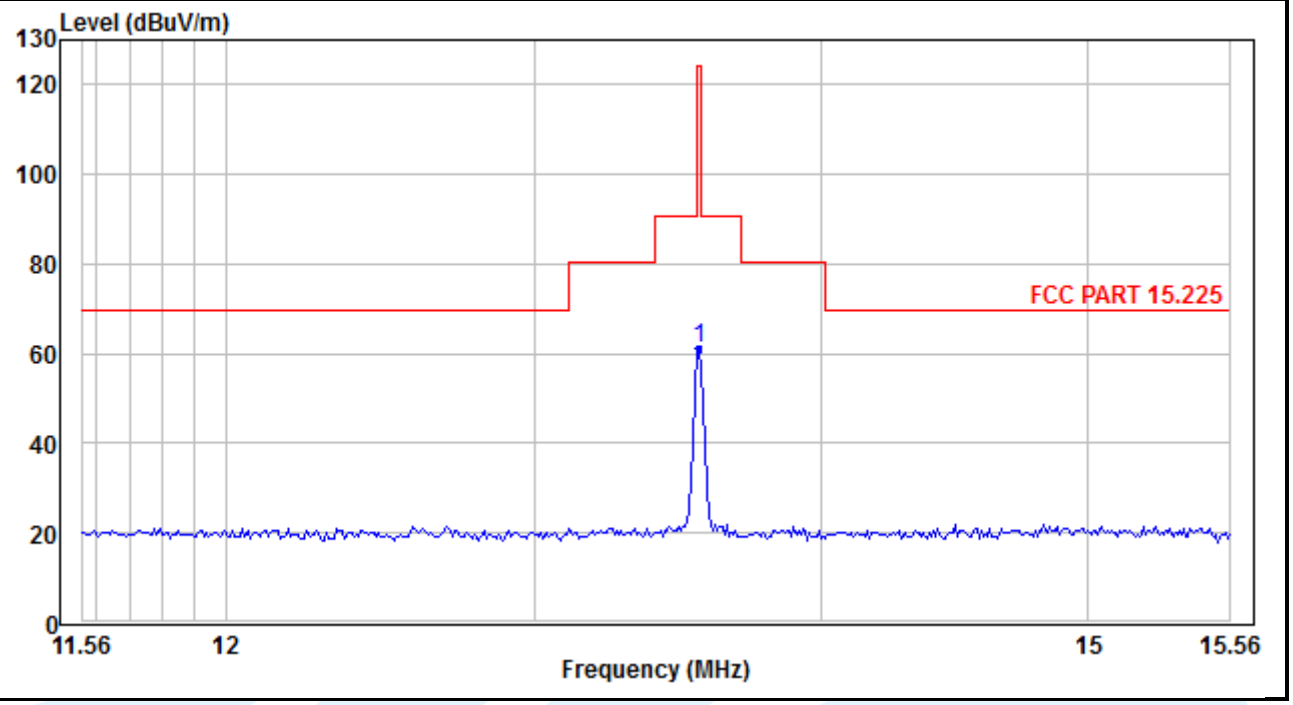
Equipment Used: Refer to section 3 for details.

Test Result: Pass

Fundamental frequency	Detector	Result at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
13.56 MHz	Peak	61.07	124	62.93

Emission Mask:

The worst case test plots as below.



5.6 FREQUENCY TOLERANCE

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.225(e)
RSS-210 Issue 10, Annex B.6

Test Method: ANSI C63.10-2013 Section 6.8

Limits:

The frequency tolerance of the carrier signal shall be maintained within ±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.

Test Setup: Refer to section 4.5.3 for details.

Test Procedures:

1) The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2) Turn the EUT on and couple its output to a spectrum analyzer.
3) Turn the EUT off and set the chamber to the highest temperature specified.
4) Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
5) Repeat step c) and d) with the temperature chamber set to the lowest temperature.
6) The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

Frequency Tolerance VS Temperature and Voltage									
Temp.(°C)	Voltage	Test time (minutes)							
		0	2	5	10	0	2	5	10
		Measured Frequency (MHz)				Frequency Drift (%)			
50	VN	13.56055	13.56055	13.56034	13.56036	0.0041	0.0041	0.0025	0.0027
40	VN	13.56032	13.56072	13.56042	13.56017	0.0024	0.0053	0.0031	0.0011
30	VN	13.5605	13.56054	13.56015	13.56023	0.0037	0.0040	0.0011	0.0017
20	VN	13.56065	13.56065	13.56018	13.56025	0.0048	0.0048	0.0010	0.0018
	VL	13.56048	13.56049	13.56080	13.56013	0.0036	0.0036	0.0059	0.0010
	VH	13.56057	13.56053	13.56011	13.56042	0.0039	0.0039	0.0008	0.0031
10	VN	13.56063	13.56067	13.56043	13.56023	0.0046	0.0049	0.0032	0.0017
0	VN	13.56069	13.56043	13.56013	13.56047	0.0046	0.0032	0.0010	0.0035
-10	VN	13.56031	13.56056	13.56019	13.56046	0.0023	0.0041	0.0014	0.0034
-20	VN	13.56044	13.56043	13.56018	13.56057	0.0032	0.0032	0.0014	0.0042
Limit: ±0.01 %									

5.7 AC POWER LINE CONDUCTED EMISSION

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.207
RSS-Gen Issue 5, Section 8.8

Test Method: ANSI C63.10-2013 Clause 6.2

Limits:

Frequency range (MHz)	Limits (dB(μV))	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Remark:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

Test Setup: Refer to section 4.5.2 for details.

Test Procedures:

Test frequency range :150KHz-30MHz

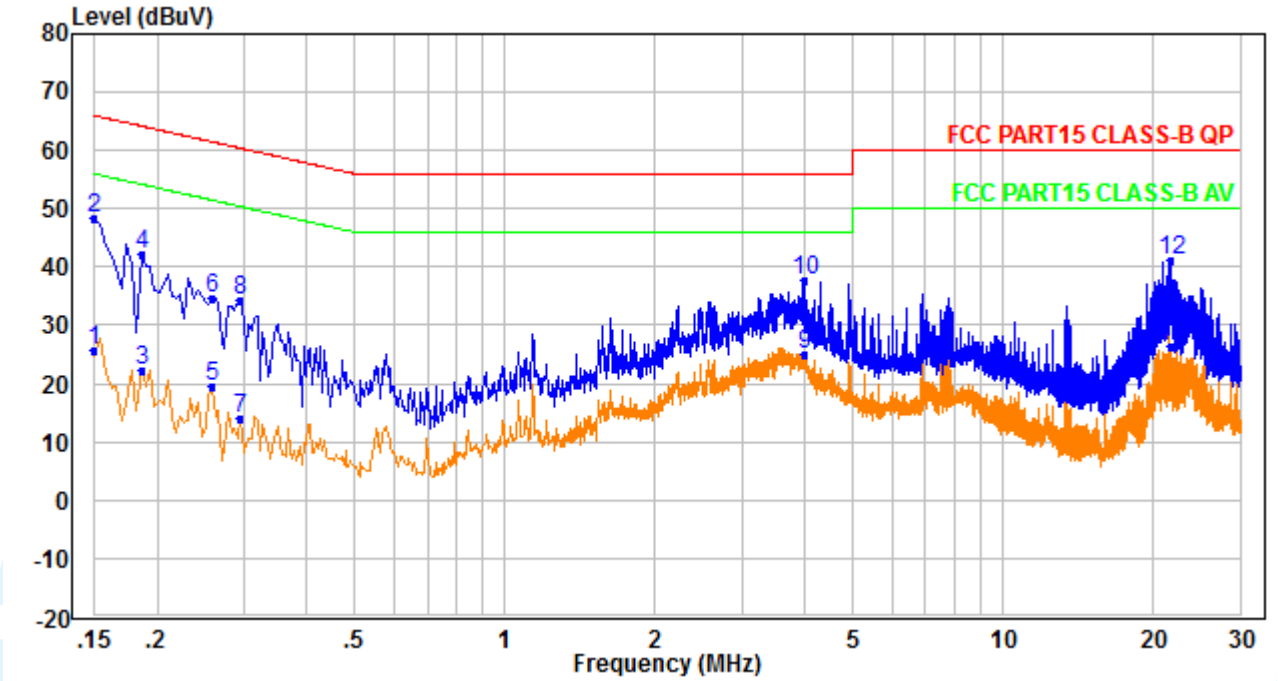
7) The mains terminal disturbance voltage test was conducted in a shielded room.
8) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
9) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
10) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
11) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

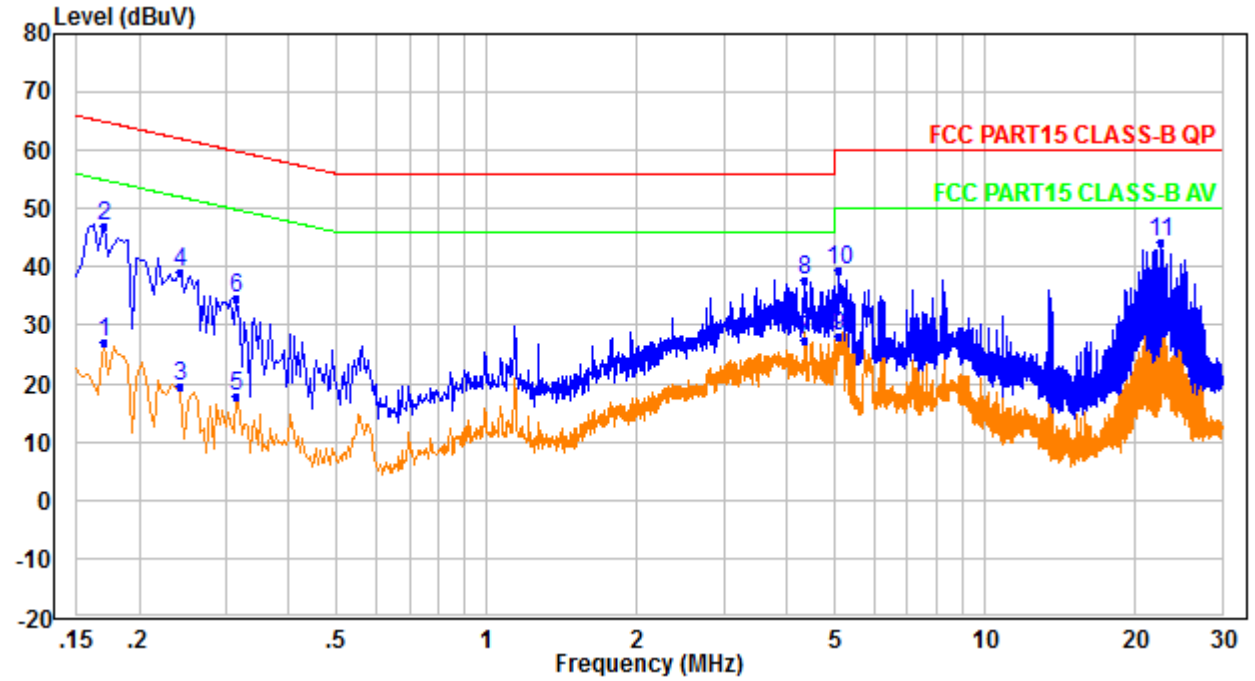
The measurement data as follows:
Quasi Peak and Average:
Mode: NFC Link

Live Line



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	0.150	16.11	9.75	25.86	56.00	-30.14	Average
2	0.150	38.50	9.75	48.25	66.00	-17.75	QP
3	0.186	12.39	9.74	22.13	54.21	-32.08	Average
4	0.186	32.54	9.74	42.28	64.21	-21.93	QP
5	0.258	9.86	9.75	19.61	51.50	-31.89	Average
6	0.258	24.98	9.75	34.73	61.50	-26.77	QP
7	0.294	4.43	9.75	14.18	50.41	-36.23	Average
8	0.294	24.43	9.75	34.18	60.41	-26.23	QP
9	4.002	15.06	10.11	25.17	46.00	-20.83	Average
10	4.002	27.70	10.11	37.81	56.00	-18.19	QP
11	21.749	15.76	10.55	26.31	50.00	-23.69	Average
12	21.749	30.78	10.55	41.33	60.00	-18.67	QP

Neutral Line



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	0.170	17.39	9.75	27.14	54.96	-27.82	Average
2	0.170	37.32	9.75	47.07	64.96	-17.89	QP
3	0.242	9.69	9.74	19.43	52.03	-32.60	Average
4	0.242	29.47	9.74	39.21	62.03	-22.82	QP
5	0.314	8.10	9.75	17.85	49.86	-32.01	Average
6	0.314	24.81	9.75	34.56	59.86	-25.30	QP
7	4.354	17.43	10.09	27.52	46.00	-18.48	Average
8	4.354	27.74	10.09	37.83	56.00	-18.17	QP
9	5.098	17.81	10.15	27.96	50.00	-22.04	Average
10	5.098	29.28	10.15	39.43	60.00	-20.57	QP
11	22.597	33.64	10.57	44.21	60.00	-15.79	Average
12	22.597	18.35	10.57	28.92	50.00	-21.08	QP

Remark:

1. Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Factor, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result - Limit
4. An initial pre-scan was performed on the Phase and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

APPENDIX 1 PHOTOS OF TEST SETUP

See test photos attached in Appendix 1 for the actual connections between Product and support equipment.

APPENDIX 2 PHOTOS OF EUT CONSTRUCTIONAL DETAILS

Refer to Appendix 2 for EUT external and internal photos.

*** End of Report ***
