TEST REPORT

Product Name:	Multicard Reader
Trade Mark:	N/A
Model No.:	Multicard Reader II
HVIN:	II
Report Number:	210728056RFC-1
Test Standards:	FCC 47 CFR Part 15 Subpart C RSS-210 Issue 10 RSS-Gen Issue 5
FCC ID:	2ASRAMCR01
IC:	24868-MCR01
Test Result:	PASS
Date of Issue:	December 3, 2021

Prepared for:

INVERS GmbH
Untere Industriestr. 20 D-57250 Netphen Germany

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China
TEL: +86-755-2823 0888
FAX: +86-755-2823 0886

Prepared by: Gavin Xu — Project Engineer

Reviewed by: Henry Lu — Team Leader

Approved by: Kevin Liang — Assistant Manager

Date: December 3, 2021

Version

Version No.	Date	Description
V1.0	December 3, 2021	Original

CONTENTS

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	INVERS GmbH
Address of Applicant:	Untere Industriestr. 20 D-57250 Netphen Germany
Manufacturer:	INVERS GmbH
Address of Manufacturer:	Untere Industriestr. 20 D-57250 Netphen Germany

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	Multicard Reader	
Model No.:	Multicard Reader II	
HVIN:	II	
Trade Mark:	N/A	
DUT Stage:	Identical Prototype	
EUT Supports Function:	RF ID:	13.56 MHz
		125 kHz
Sample Received Date:	September 22, 2021	
Sample Tested Date:	September 22, 2021 to October 11, 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
Type:	☑ A Type
	☑ B Type
Max. Data Rates:	26.59 kbit/s
Type of Modulation:	ASK
Number of Channels:	1
Antenna Type:	PCB trace inductor
Maximum Field Strength:	81.5 dBμV/m at 3 meter
Nominal Operating Frequency:	125 kHz
Max. Data Rates:	8 kbit/s
Type of Modulation:	ASK
Antenna Type:	Coil Inductor
Normal Test Voltage:	12 Vdc
Extreme Test Voltage:	9 to 15 Vdc
Extreme Test Temperature:	-10 °C to +50 °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
Battery	SACRED SUN	SP12-40	N/A	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 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 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	N/A (Note1&2)
The field strength of any emissions appearing outside band	FCC 47 CFR Part 15 Subpart C Section 15.225(d) /15.209 RSS-210 Issue 10, Annex B.6 & B.1 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 15.225(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
Note: 1) N/A: In this whole report not applicable. 2) This EUT is powered by batteries.			

3. EQUIPMENT LIST

Used	Equipment	Manufacturer	Model No.	Serial Number	Cal. date (mm dd, yyyy)	Cal. Due date (mm dd, yyyy)
☒	3m SAC	ETS-LINDGREN	3m	N/A	Jan. 22, 2021	Jan. 21, 2024
☒	Receiver	R&S	ESIB26	100114	Nov. 18, 2020	Nov. 17, 2021
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	Nov. 14, 2020	Nov. 13, 2021
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	Nov. 14, 2020	Nov. 13, 2021
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	Nov. 14, 2020	Nov. 13, 2021
☒	Preamplifier	HP	8447F	2805A02960	Nov. 10, 2020	Nov. 09, 2021
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	DC Source	KIKUSUI	PWR400L	LK003024	N/A	N/A
☒	Digital multimeter	FLUKE	15B+	30701460WS15	Nov. 12, 2020	Nov. 11, 2021
☒	Temp & Humidity chamber	Votisch	VT4002	58566133290020	Apr. 21, 2021	Apr. 20, 2022
☒	Spectrum Analyzer	R&S	FSV40-N	101653	Apr. 22, 2021	Apr. 21, 2022
☒	Test Software	Audix	e3	Software Version: 9.160323		

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	12	20 to 75
TL/VL	-10	9	20 to 75
TH/VL	+50	9	20 to 75
TL/VH	-10	15	20 to 75
TH/VH	+50	15	20 to 75

Remark:

1) The EUT just work in such extreme temperature of -10 °C to +50 °C and the extreme voltage of 9 V to 15 V, so here the EUT is tested in the temperature of -10 °C to +50 °C and the voltage of 9 V to 15 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
The field strength of any emissions appearing outside of the 13.110-14.010 MHz band	25.6	52	100.20	Asia Yan
Fundamental Field Strength and Emission Mask 13.110 MHz to 14.010 MHz	25.6	52	100.20	Asia Yan
99%&20DB Bandwidth	25.6	52	100.20	Asia Yan

4.2 TEST CHANNELS

Frequency	Test RF Channel 1
13.56 MHz	13.56 MHz
125 KHz	125 kHz

4.3 EUT TEST STATUS

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

4.4 TEST SETUP

4.4.1 For Radiated Emissions test setup

Figure 1. Below 30MHz

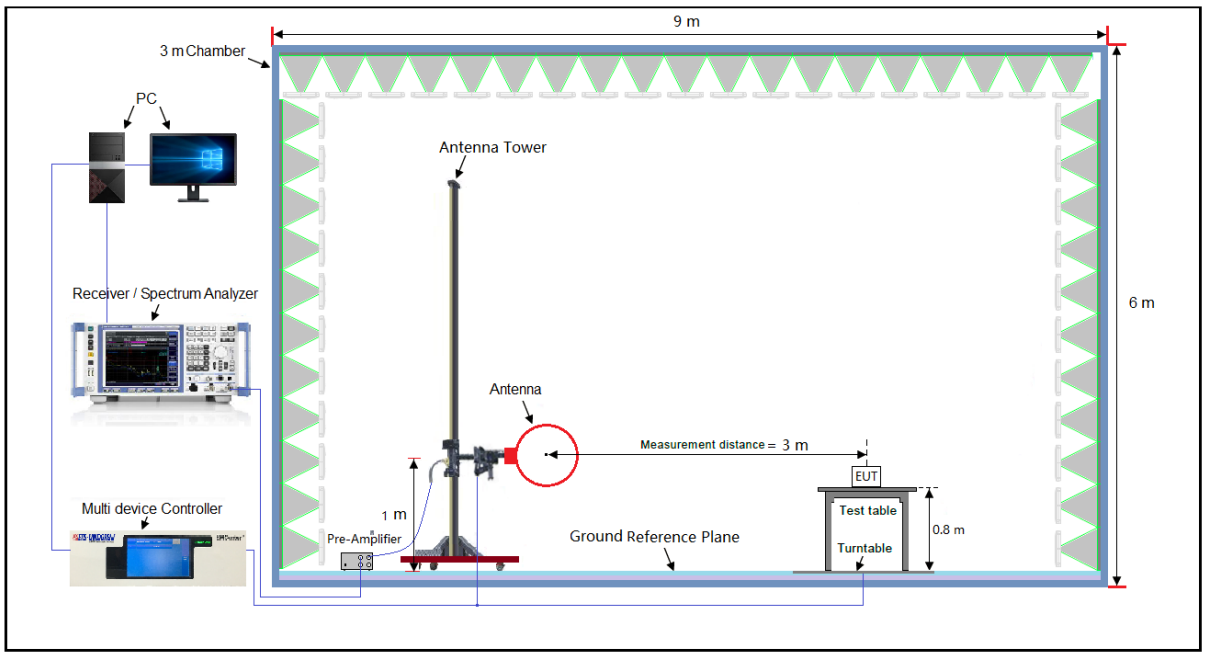
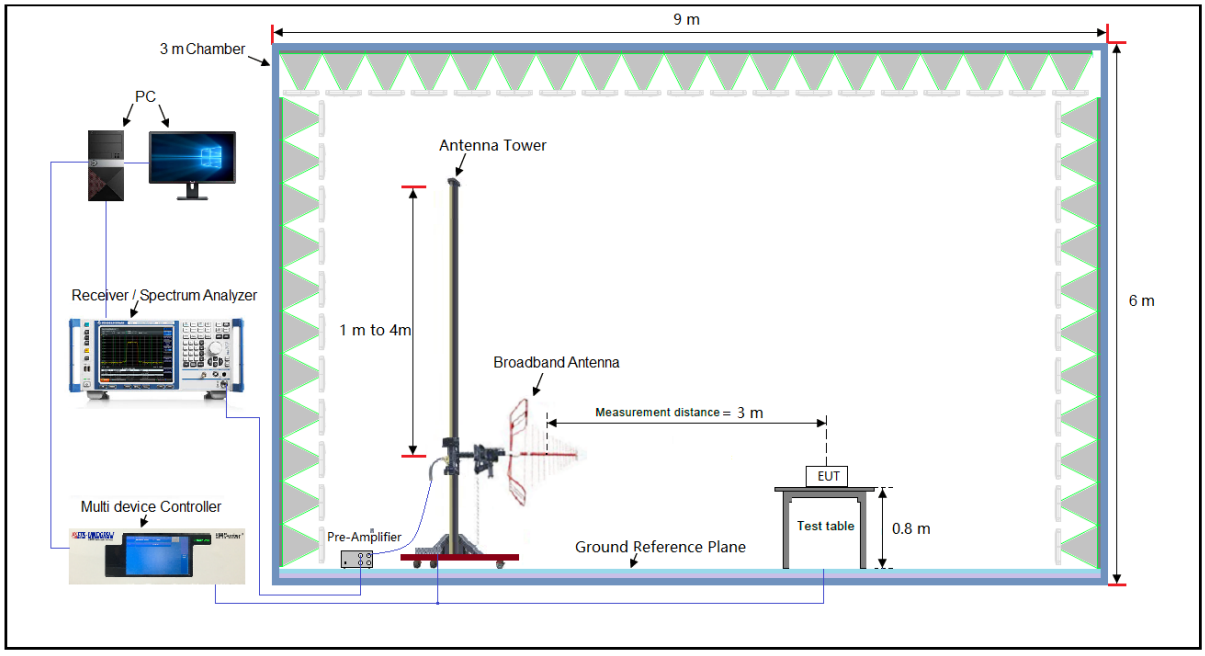
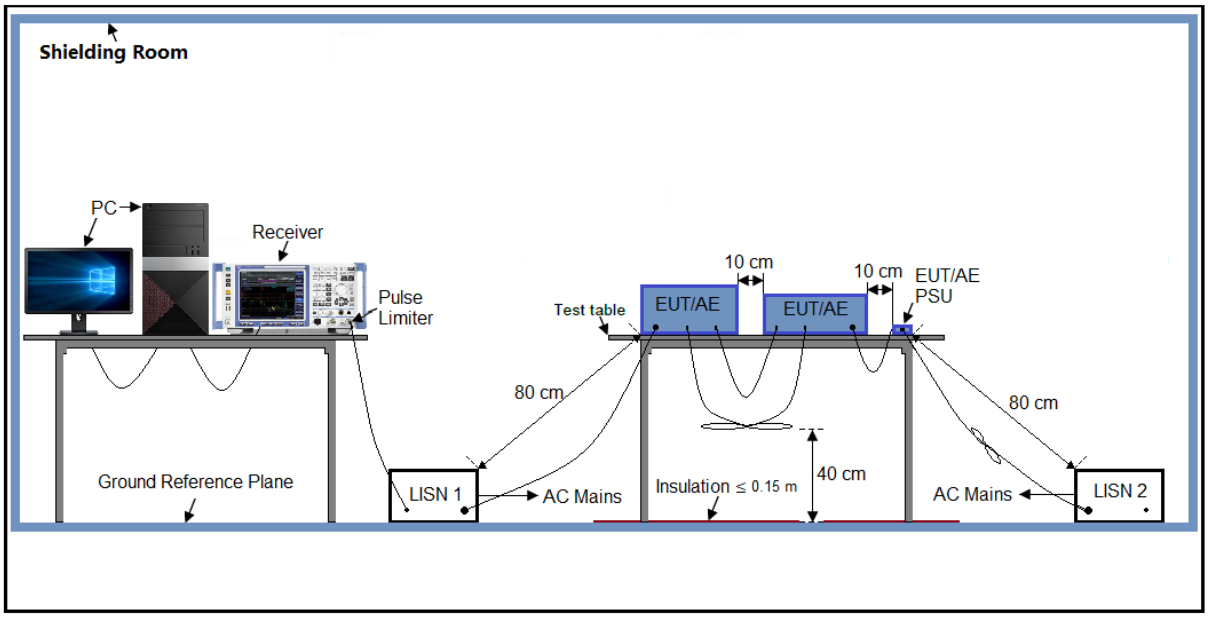


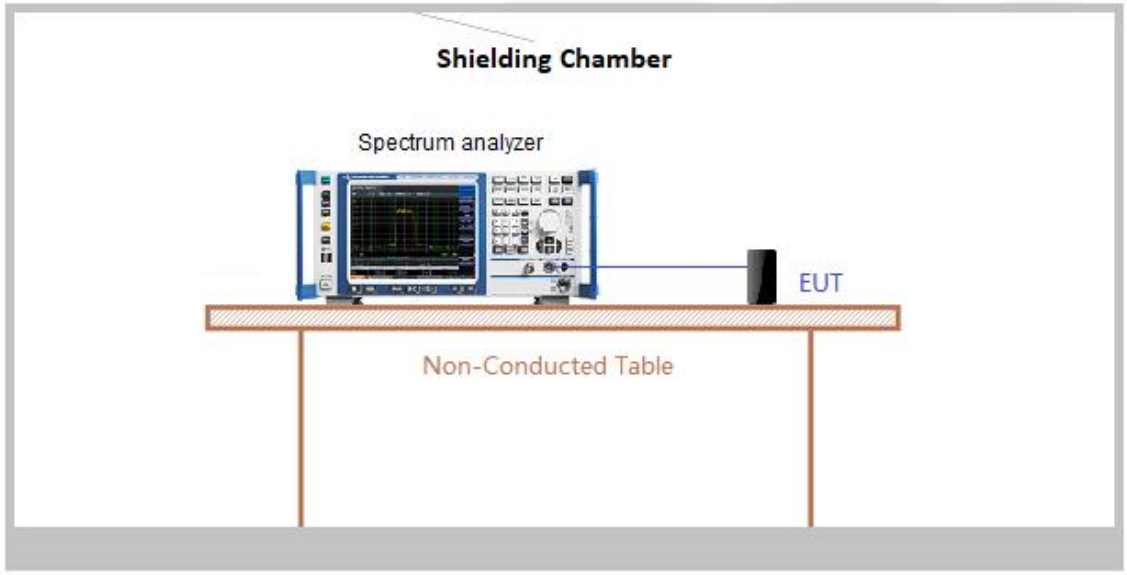
Figure 2. 30MHz to 1GHz



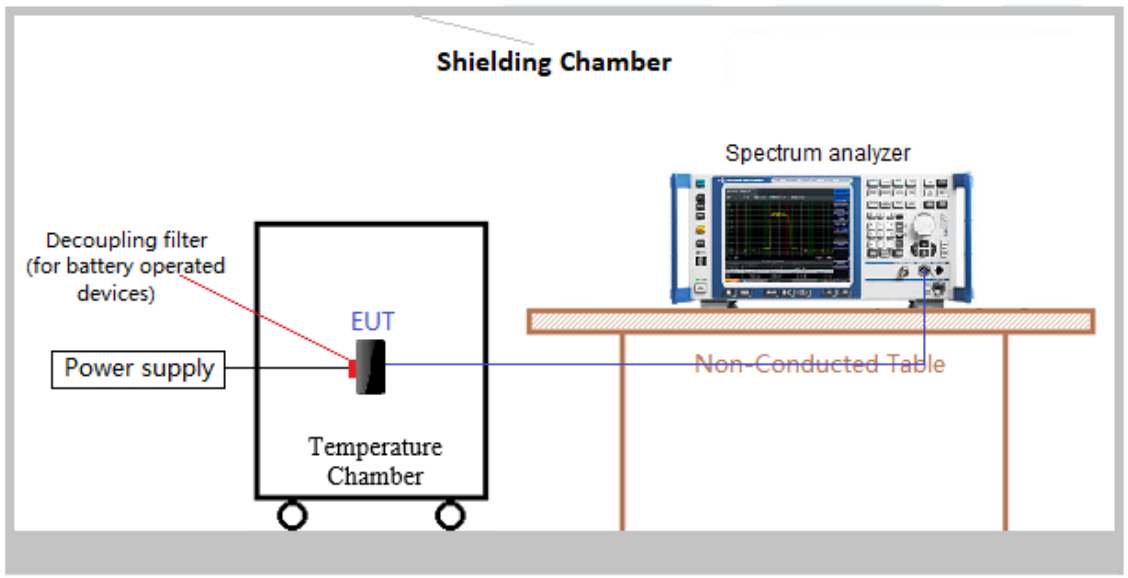
4.4.2 For Conducted Emissions test setup



4.4.3 For Conducted RF test setup



Normal Environment



Extreme Environment

4.5 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:

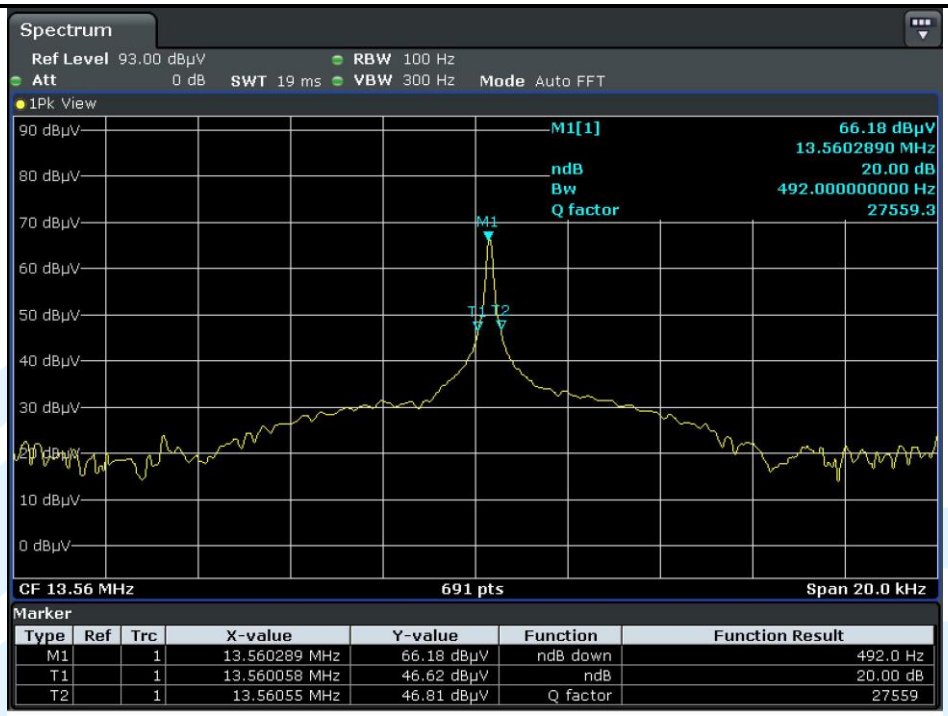
a) The spectrum analyzer center frequency is set to the nominal EUT channel center frequency
b) Span = approximately 2 to 5 times the OBW
c) RBW = 1% to 5%of the OBW
d) VBW ≥ 3*RBW
e) Sweep = auto;
f) Detector function = peak
g) Trace = max hold
h) All the trace to stabilize, use the marker-to-peak function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

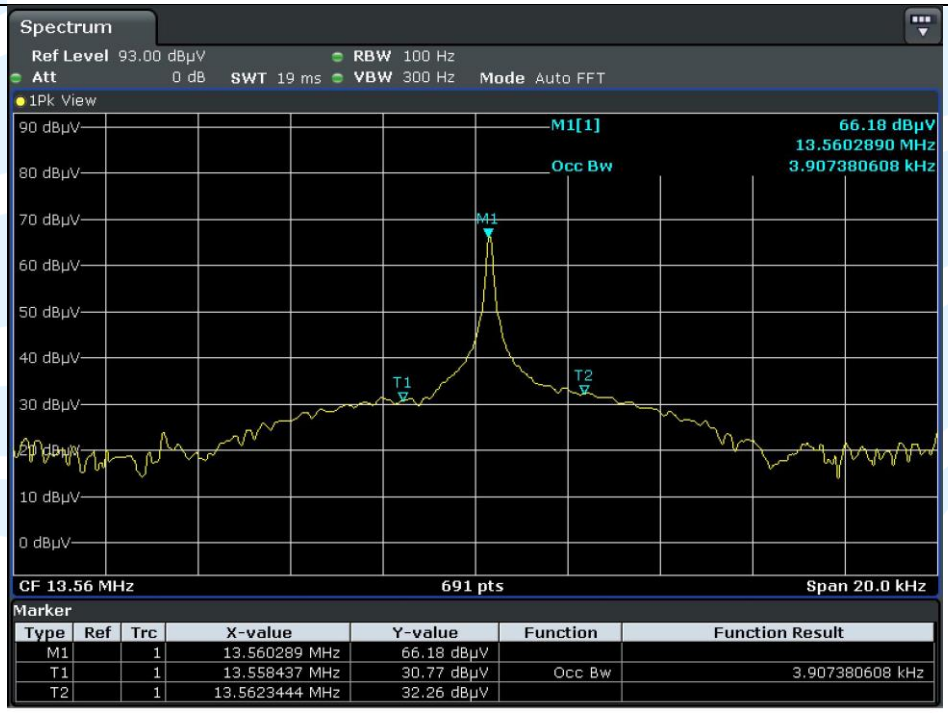
Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.

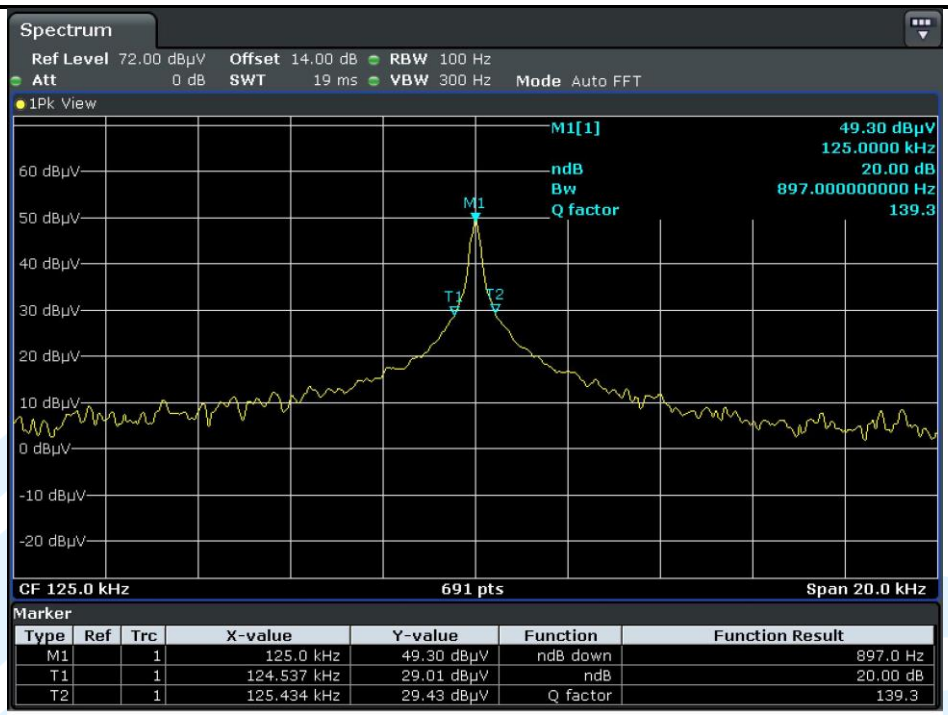
Test Setup: Refer to section 4.4.3 for details.
Instruments Used: Refer to section 3 for details
Test Mode: Transmitter mode
Test Results: Pass
Test Data:

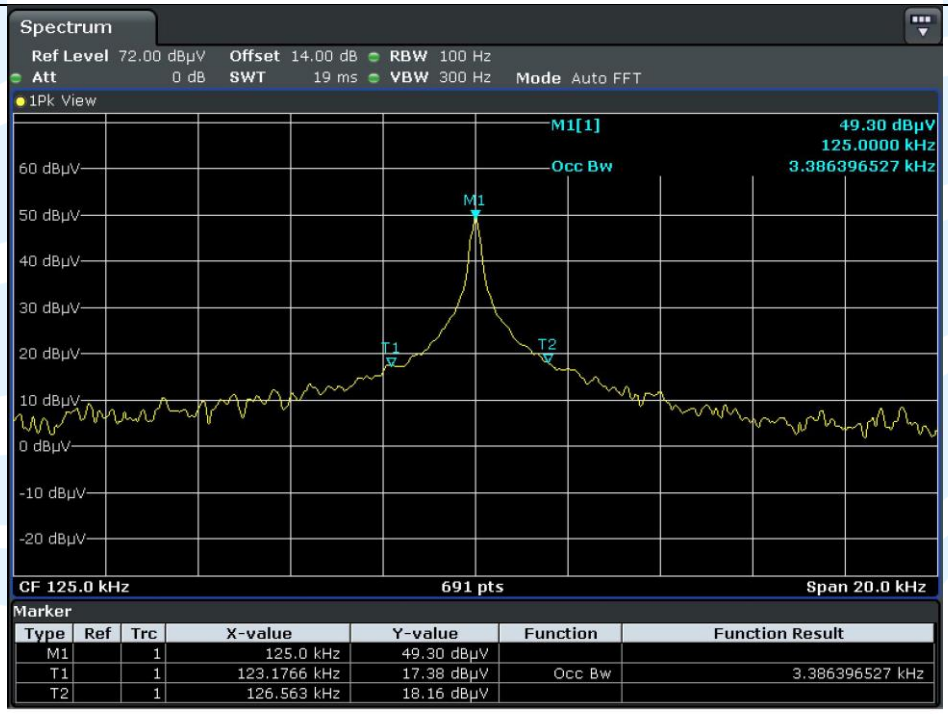
Frequency (MHz)	20 dB Bandwidth (Hz)	Limit	Pass / Fail
13.56 MHz	492	Operation within the band 13.110 MHz to 14.010 MHz	Pass
125 kHz	897	N/A	Pass

The test plot as follows:






Spectrum
Ref Level 72.00 dBµV Offset 14.00 dB RBW 100 Hz
Att 0 dB SWT 19 ms VBW 300 Hz Mode Auto FFT
1Pk View
M1[1] 49.30 dBµV
125.0000 kHz
ndB 20.00 dB
Bw 897.000000000 Hz
Q factor 139.3
60 dBµV
50 dBµV
40 dBµV
30 dBµV
20 dBµV
10 dBµV
0 dBµV
-10 dBµV
-20 dBµV
M1
T1
T2
CF 125.0 kHz
691 pts
Span 20.0 kHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 125.0 kHz 49.30 dBµV ndB down 897.0 Hz
T1 1 124.537 kHz 29.01 dBµV ndB 20.00 dB
T2 1 125.434 kHz 29.43 dBµV Q factor 139.3
Date: 28.SEP.2021 05:10:27


Spectrum
Ref Level 72.00 dBµV Offset 14.00 dB RBW 100 Hz
Att 0 dB SWT 19 ms VBW 300 Hz Mode Auto FFT
1Pk View
M1[1] 49.30 dBµV
125.0000 kHz
Occ Bw 3.386396527 kHz
60 dBµV
50 dBµV
40 dBµV
30 dBµV
20 dBµV
10 dBµV
0 dBµV
-10 dBµV
-20 dBµV
M1
T1
T2
CF 125.0 kHz
691 pts
Span 20.0 kHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 125.0 kHz 49.30 dBµV
T1 1 123.1766 kHz 17.38 dBµV Occ Bw 3.386396527 kHz
T2 1 126.563 kHz 18.16 dBµV
Date: 28.SEP.2021 05:09:35

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 4.4.1 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.

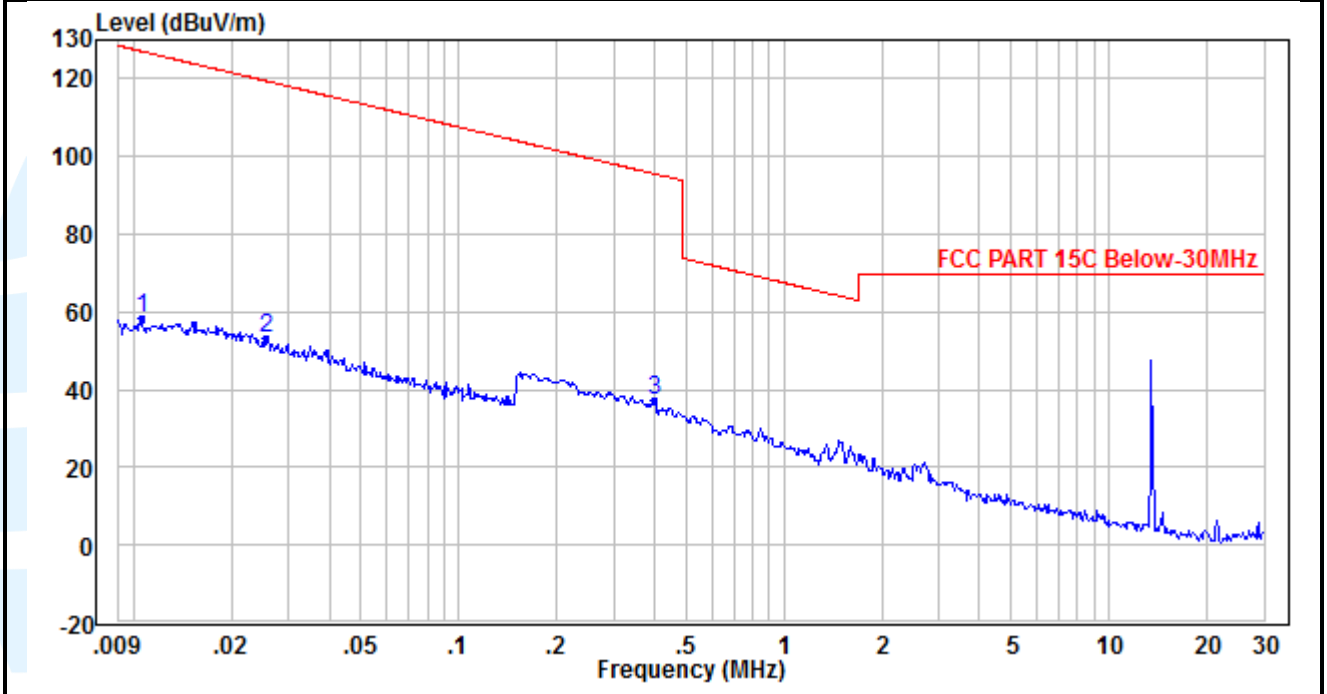
5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions 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 Z 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

13.56 MHz

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

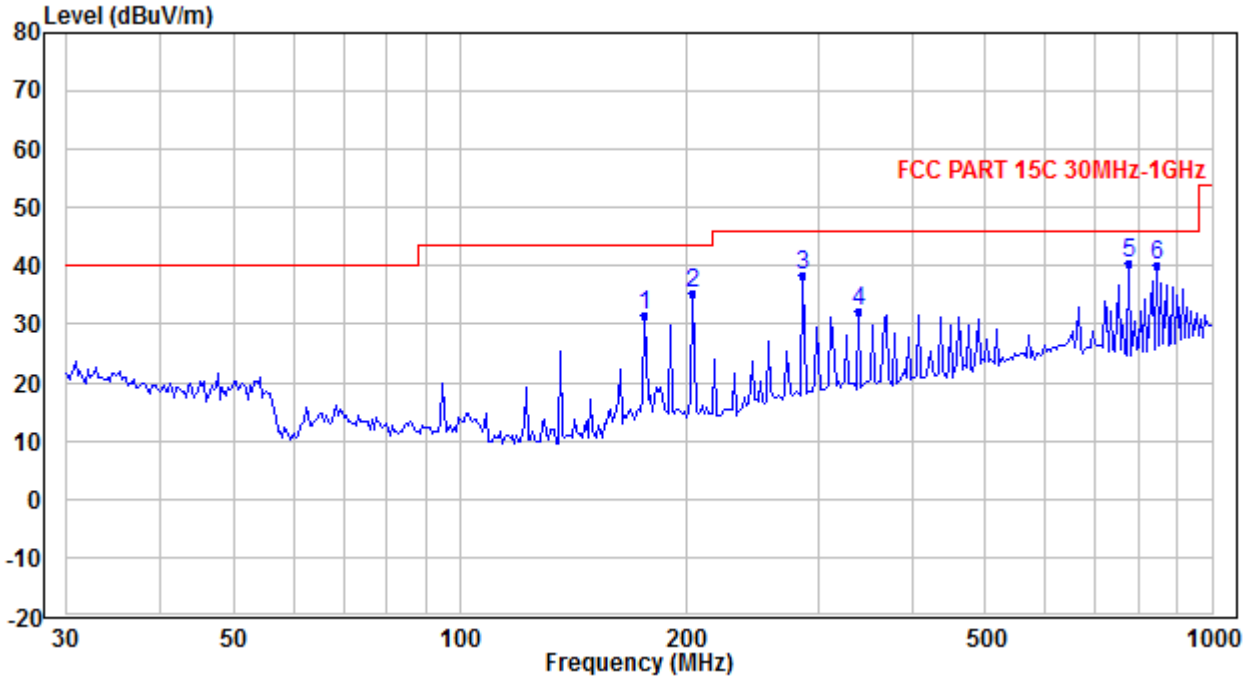


No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	0.011	39.43	18.76	58.19	127.09	-68.90	Peak
2	0.025	37.61	15.38	52.99	119.47	-66.48	Peak
3	0.397	53.33	-16.27	37.06	95.62	-58.56	Peak

13.56 MHz

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

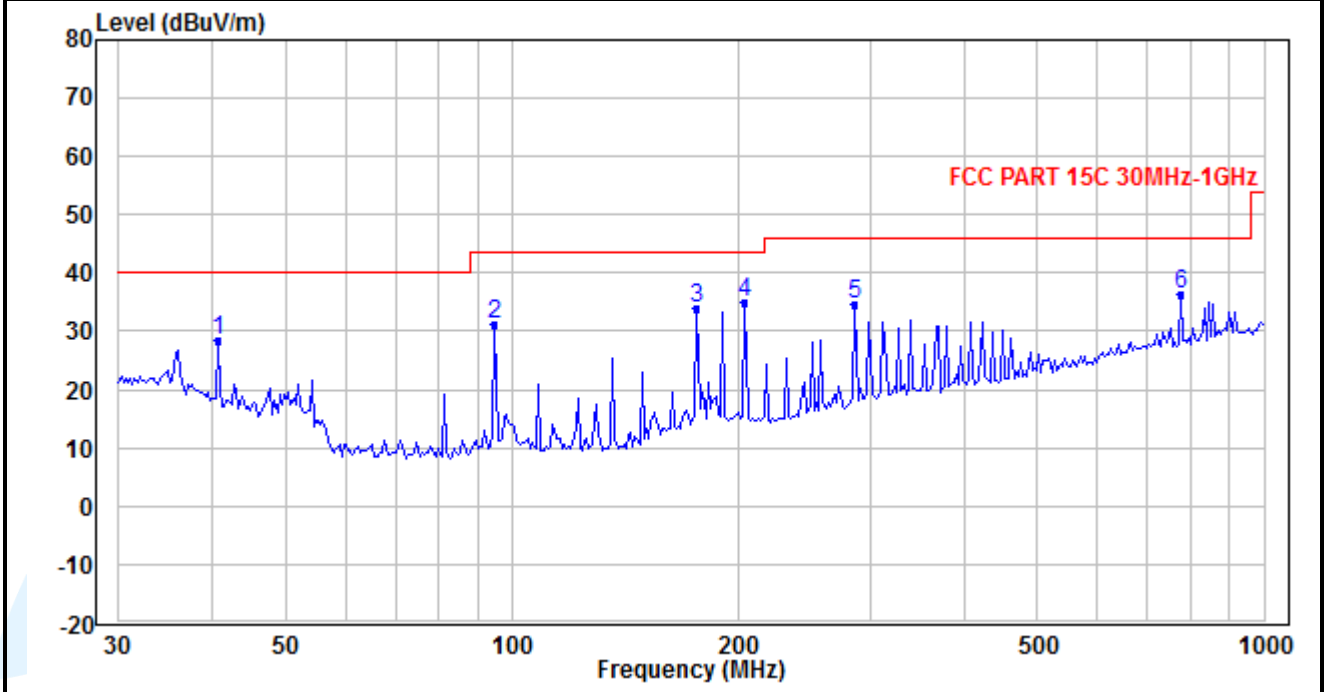
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	176.275	41.99	-10.45	31.54	43.50	-11.96	QP
2	204.305	46.30	-10.88	35.42	43.50	-8.08	QP
3	286.265	45.37	-7.11	38.26	46.00	-7.74	QP
4	338.855	37.85	-5.61	32.24	46.00	-13.76	QP
5	776.485	38.70	1.82	40.52	46.00	-5.48	QP
6	844.803	37.06	3.02	40.08	46.00	-5.92	QP

13.56 MHz

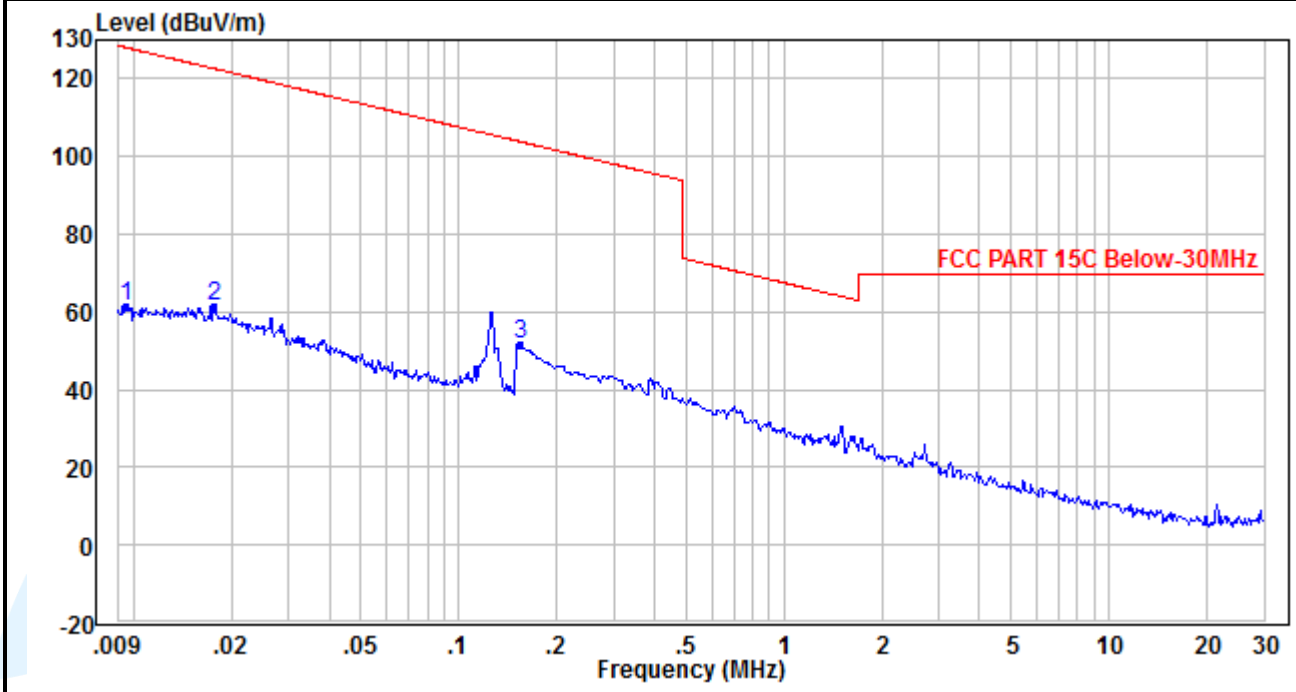
Vertical



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	40.584	36.70	-8.36	28.34	40.00	-11.66	QP
2	94.979	47.12	-15.85	31.27	43.50	-12.23	QP
3	176.275	44.29	-10.45	33.84	43.50	-9.66	QP
4	204.305	45.86	-10.88	34.98	43.50	-8.52	QP
5	286.265	41.60	-7.11	34.49	46.00	-11.51	QP
6	776.485	34.48	1.82	36.30	46.00	-9.70	QP

125 kHz

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

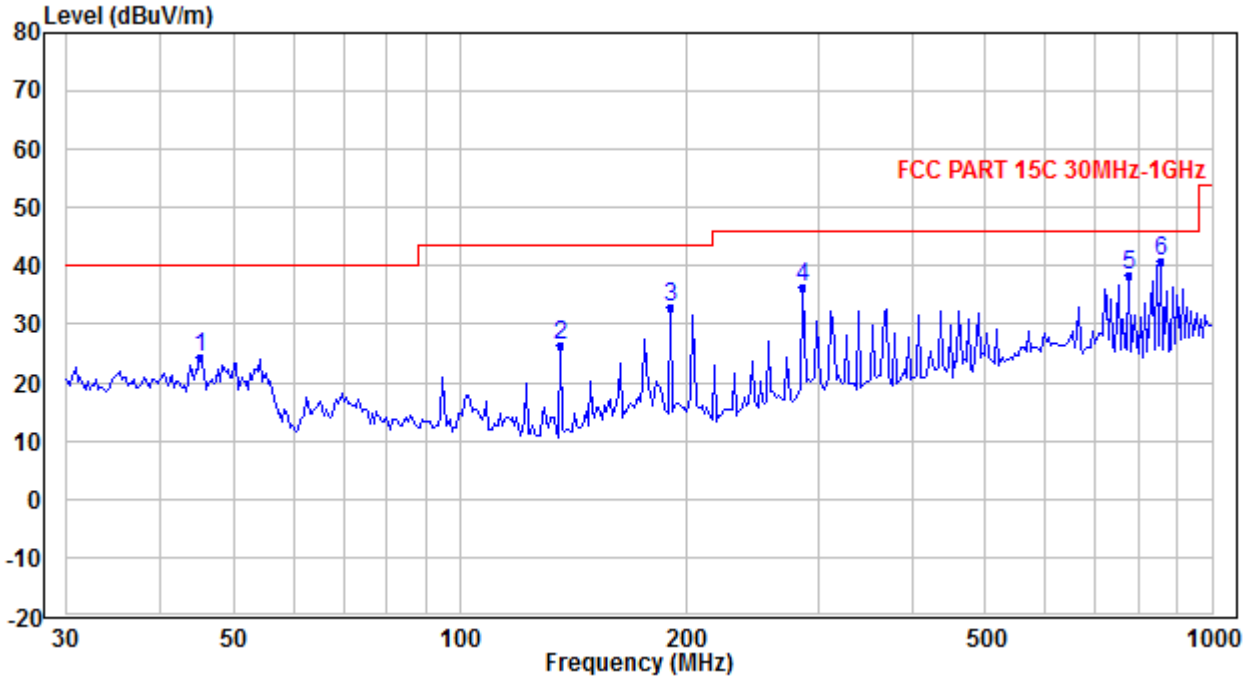


No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	0.009	42.29	19.33	61.62	128.08	-66.46	Peak
2	0.018	44.26	17.14	61.40	122.64	-61.24	Peak
3	0.155	67.37	-15.67	51.70	103.80	-52.10	Peak

125 kHz

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

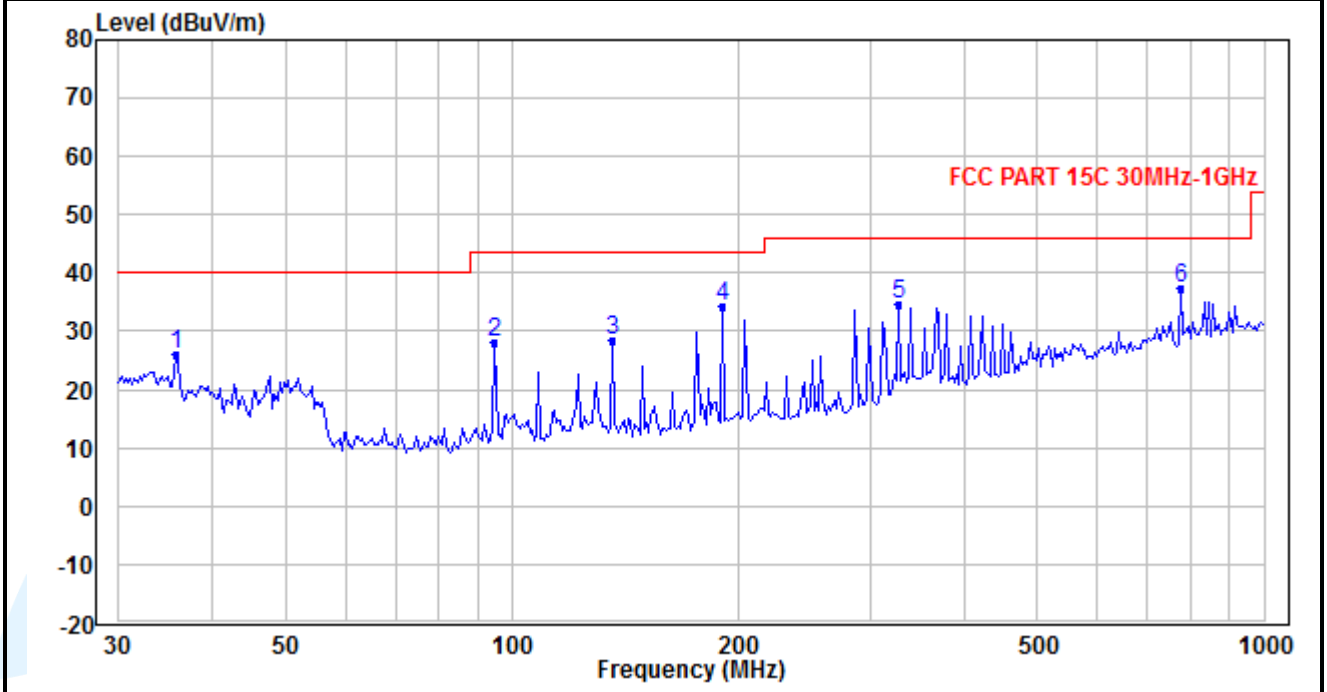
Horizontal



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	45.095	35.75	-11.52	24.23	40.00	-15.77	QP
2	135.916	41.99	-15.71	26.28	43.50	-17.22	QP
3	190.441	43.44	-10.53	32.91	43.50	-10.59	QP
4	286.265	43.37	-7.11	36.26	46.00	-9.74	QP
5	776.485	36.70	1.82	38.52	46.00	-7.48	QP
6	856.760	37.59	3.40	40.99	46.00	-5.01	QP

125 kHz

Vertical



No.	Frequency (MHz)	Reading (dBµV)	Correction factor (dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector
1	35.762	31.45	-5.43	26.02	40.00	-13.98	QP
2	94.979	44.12	-15.85	28.27	43.50	-15.23	QP
3	135.916	44.21	-15.71	28.50	43.50	-15.00	QP
4	190.441	44.86	-10.53	34.33	43.50	-9.17	QP
5	327.155	40.56	-5.88	34.68	46.00	-11.32	QP
6	776.485	35.48	1.82	37.30	46.00	-8.70	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
4. All the above radiation data, the fundamental frequency is not marked, please ignore it.

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 4.4.1 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.

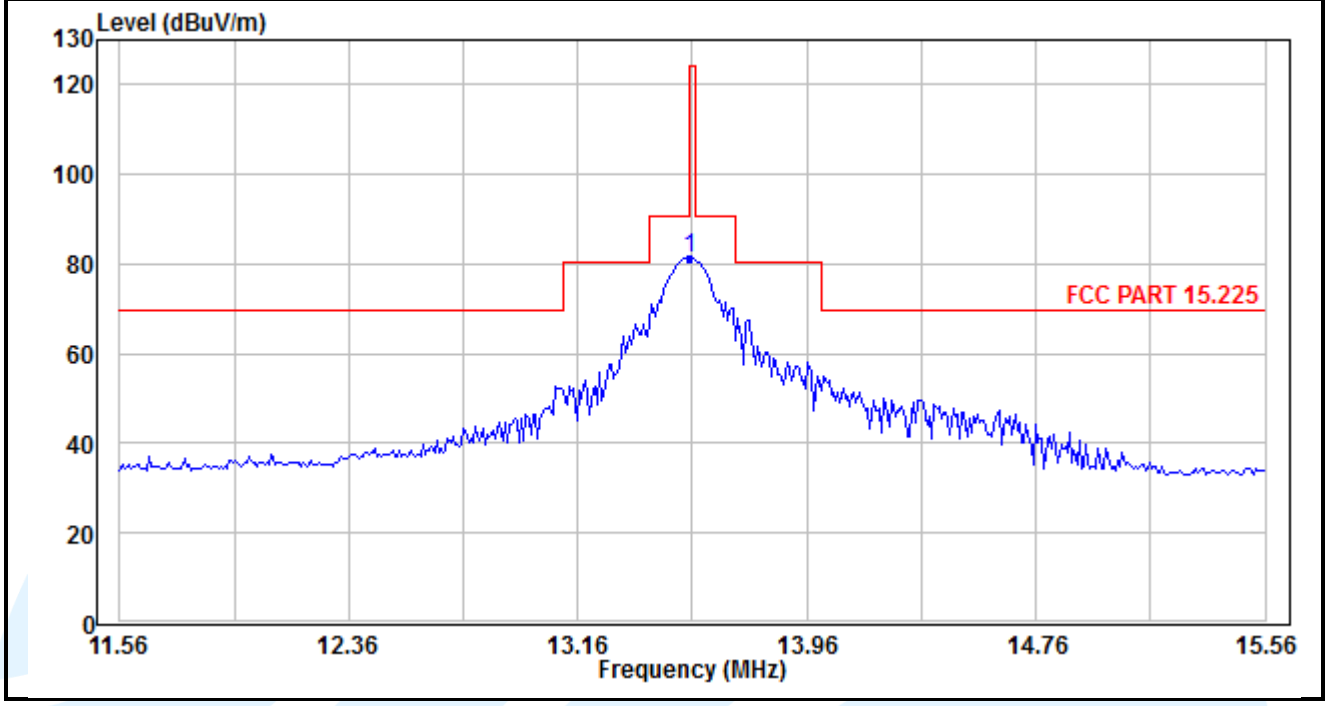
Test Result: Pass

Maximum Field Strength:

Fundamental frequency	Polari-zation	Detector	Result at 3m (dBμV/m)	Limit at 3m (dBμV/m)	Margin (dB)
13.56 MHz	Z	Peak	81.5	124	42.5

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 4.4.3 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	13.56014	13.5603	13.56022	13.56031	0.0010	0.0022	0.0016	0.0023
40	VN	13.56013	13.56008	13.56016	13.56014	0.0010	0.0006	0.0012	0.0010
30	VN	13.56026	13.56014	13.56005	13.56008	0.0019	0.0010	0.0004	0.0006
20	VN	13.56031	13.56033	13.56013	13.56024	0.0023	0.0024	0.0010	0.0018
	VL	13.56023	13.56023	13.56004	13.56026	0.0017	0.0017	0.0003	0.0019
	VH	13.56025	13.56023	13.56022	13.56002	0.0018	0.0017	0.0016	0.0001
10	VN	13.56024	13.56002	13.56032	13.56014	0.0018	0.0001	0.0024	0.0010
0	VN	13.56034	13.56002	13.56002	13.56022	0.0025	0.0001	0.0001	0.0016
-10	VN	13.56013	13.56013	13.56002	13.56002	0.0010	0.0010	0.0001	0.0001
-20	VN	13.56014	13.56061	13.56008	13.56012	0.0010	0.0045	0.0006	0.0009
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 4.4.2 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: N/A

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 ***