TEST REPORT

Client Information:

Applicant:	Preferred Security Components Inc. of PA
Applicant add.:	510 West King Street, Shippensbrug, PA 17257 USA
Manufacturer:	Preferred Security Components Inc. of PA
Manufacturer add.:	510 West King Street, Shippensbrug, PA 17257 USA

Product Information:

Product Name:	CW Sounder
Model No./HVIN:	CW-SOU
Brand Name:	Cartell
FCC ID:	2AUXCCWSOU
IC:	25651-CWSOU

Applicable standards:

FCC 47 CFR PART 15 SUBPART C 15.247
RSS-247 Issue 2
RSS-Gen Issue 5

Prepared By:

Dongguan Yaxu (AiT) Technology Limited

No.22, Jinqianling 3rd Street, Jitigang, Huangjiang,Dongguan,
Guangdong, China

Tel.: +86-769-8202 0499 Fax.: +86-769-8202 0495

Date of Receipt:	Aug. 13, 2022	Date of Test: Sep. 05, 2022~Sep. 16,2022	
Date of Issue:	Sep. 16, 2022	Test Result:	Pass

This device described above has been tested by Dongguan Yaxu (AiT) Technology Limited and the test results show that the equipment under test (EUT) is in compliance with the FCC/ISED requirements. And it is applicable only to the tested sample identified in the report.

Note: This report shall not be reproduced except in full, without the written approval of Dongguan Yaxu (AiT) Technology Limited, this document may be altered or revised by Dongguan Yaxu (AiT) Technology Limited, personal only, and shall be noted in the revision of the document. This test report must not be used by the client to claim product endorsement.

Reviewed by: Simba Huang — Simba Huang

Approved by: Seal.chen — Seal.chen

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Revision History

Revision	Issue Date	Revisions	Revised By
000	Sep. 16, 2022	Initial Issue	Seal Chen

2 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	FCC §15.203, RSS-Gen Section 6.8	Pass
Maximum Conducted Output Power	§15.247 (b)(3) RSS-247 Section 5.4(a)	Pass
Power Spectral Density	§15.247 (e) RSS-247 Section 5.2(b)	Pass
6dB Bandwidth	§15.247 (a)(2) RSS-247 Section 5.2(a)	Pass
Occupied Bandwidth	RSS-Gen §6.7	Pass
Radiated Spurious Emissions	§15.205/15.209 RSS-Gen Section §6.13/8.9	Pass
Conducted Spurious Emissions & Band Edges Emissions	§15.205/15.209 RSS-247 Section 5.5/ Section 8.10	Pass
Conducted Emissions	RSS-Gen§8.8	Pass

Note

1. Test according to ANSI C63.10:2013 and RSS-Gen.

2. The measurement uncertainty is not included in the test result.

3. Test results in other test report (RF Exposure Evaluation Report)

2.1 Statement of the Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. To CISPR 16 – 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements” and is documented in the AiT quality system acc. To DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

2.2 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	0.009MHz-30MHz	3.10dB	(1)
Radiated Emission	30MHz-1GHz	3.75dB	(1)
Radiated Emission	1GHz-18GHz	3.88dB	(1)
Radiated Emission	18GHz-40GHz	3.88dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	1.20dB	(1)
Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.			

3 Test Facility

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

.CNAS- Registration No: L6177

Dongguan Yaxu (AiT) technology Limited is accredited to ISO/IEC 17025:2017 general Requirements for the competence of testing and calibration laboratories (CNAS-CL01 Accreditation Criteria for the competence of testing and calibration laboratories) on Aug.04, 2020

FCC-Registration No.: 703111 Designation Number: CCH-205313

Dongguan Yaxu (AiT) technology Limited has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

IC —Registration No.: 6819A CAB identifier: CN0122

The 3m Semi-anechoic chamber of Dongguan Yaxu (AiT) technology Limited has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 6819A

A2LA-Lab Cert. No.: 6317.01

Dongguan Yaxu (AiT) technology Limited has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

3.1 Deviation from standard

None

3.2 Abnormalities from standard conditions

None

3.3 Test Location

Dongguan Yaxu (AiT) Technology Limited

Address: No.22, Jinqianling 3rd Street, Jitigang, Huangjiang,Dongguan, Guangdong, China

Tel.: +86-769-8202 0499

Fax.: +86-769-8202 0495

4 General Information

4.1 General Description of EUT

EUT Name:	CW Sounder
Model No./HVIN:	CW-SOU
Serial Model:	N/A
Test sample(s) ID:	22080910-1
Sample(s) Status:	N/A
Serial No.:	N/A
Operation frequency:	915 MHz
Channel Number:	1
Channel separation:	N/A
Modulation Technology:	OOK
Antenna Type:	Internal Antenna
Antenna gain:	Maximum 0 dBi
Hardware version.:	N/A
Software version.:	N/A
Power supply Range:	83-305V 0.07A 47-63HZ 8W
Power Supply:	120V, 60Hz
Model different:	N/A
Note:	For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

4.2 Test frequencies

EUT channels and frequencies list:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
00	915	-	-	-	-

4.3 EUT Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	Signal cord
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

4.4 Test Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	Signal cord
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

5 Description of Test conditions

5.1 E.U.T. Operation

Power supply:	120V/60Hz
Temperature:	20.0 -25.0 °C
Humidity:	38-50 % RH
Atmospheric Pressure:	1000 -1010 mbar
Test frequencies and frequency range:	(i) Except where otherwise specified, measurements shall be performed for each frequency band of operation for which the radio apparatus is to be certified, with the device operating at the frequencies in each band of operation shown in the table below: In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given in the table below:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

Remark: Test frequency is 915MHz.

6 Equipments List for All Test Items

No	Test Equipment	Manufacturer	Model No	Serial No	Cal. Date	Cal. Due Date
1	Spectrum Analyzer	R&S	FSV40	101470	2022.09.02	2023.09.01
2	EMI Measuring Receiver	R&S	ESR	101660	2022.09.02	2023.09.01
3	Low Noise Pre Amplifier	HP	HP8447E	1937A01855	2022.09.02	2023.09.01
4	Low Noise Pre Amplifier	Tsj	MLA-0120-A02-34	2648A04738	2022.09.02	2023.09.01
5	Passive Loop	ETS	6512	00165355	2022.09.04	2025.09.03
6	TRILOG Super Broadband test Antenna	SCHWARZBECK	VULB9160	9160-3206	2021.08.29	2024.08.28
7	Broadband Horn Antenna	SCHWARZBECK	BBHA9120D	452	2021.08.29	2024.08.28
8	SHF-EHF Horn Antenna 15-40GHz	SCHWARZBECK	BBHA9170	BBHA9170367d	2020.11.24	2023.11.23
9	EMI Test Receiver	R&S	ESCI	100124	2022.09.02	2023.09.01
10	LISN	Kyoritsu	KNW-242	8-837-4	2022.09.02	2023.09.01
11	LISN	R&S	ESH3-Z2	0357.8810.54-101161-S2	2022.09.02	2023.09.01
12	Pro.Temp&Humi.chamber	MENTEK	MHP-150-1C	MAA08112501	2022.09.02	2023.09.01
13	RF Automatic Test system	MW	MW100-RFCB	21033016	2022.09.02	2023.09.01
14	Signal Generator	Agilent	N5182A	MY50143009	2022.09.02	2023.09.01
15	Wideband Radio communication tester	R&S	CMW500	1201.0002K50	2022.09.02	2023.09.01
16	RF Automatic Test system	MW	MW100-RFCB	21033016	2022.09.02	2023.09.01
17	DC power supply	ZHAOXIN	RXN-305D-2	28070002559	N/A	N/A
18	RE Software	EZ	EZ-EMC_RE	Ver.AIT-03A	N/A	N/A
19	CE Software	EZ	EZ-EMC_CE	Ver.AIT-03A	N/A	N/A
20	RF Software	MW	MTS 8310	2.0.0.0	N/A	N/A
21	temporary antenna connector(Note)	NTS	R001	N/A	N/A	N/A
Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.						

7 Test Result

7.1 Antenna Requirement

Standard requirement

For intentional device, according to FCC 47 CFR Section 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

RSS-GEN section 6.8

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the licence-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

Licence-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the licence-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of licence-exempt transmitter and antenna type, with the transmitter output power set at the maximum level.8 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

EUT Antenna

The antenna is Internal Antenna. The maximum gain of the antenna is 0 dBi.

Test result: The unit does meet the FCC &RSSrequirements.

6.1 Maximum Conducted Output Peak Power Measurement

6.3.1 Standard requirement:

For systems using digital modulation in the 2400-2483.5 MHz and 5725-5850 MHz band, the limit for maximum peak conducted output power is 30dBm. The limited has to be reduced by the amount in dB that the gain of the antenna exceeds 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi without any corresponding reduction in transmitter peak output power.

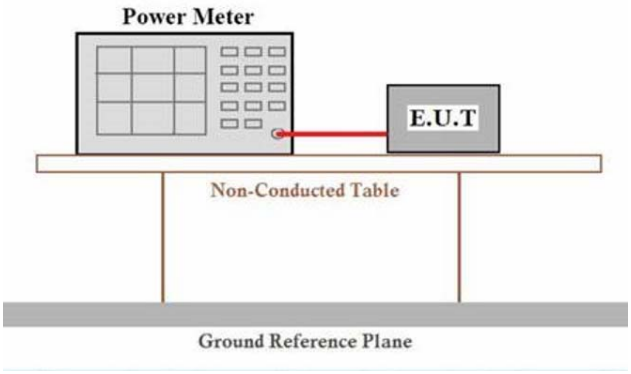
6.3.2 Measuring Instruments:

Please refer to equipment's list in this report.

6.3.3 Test Procedures:

Maximum peak conducted output power, The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

6.3.4 Test Setup Layout



6.3.5 EUT Operation during Test

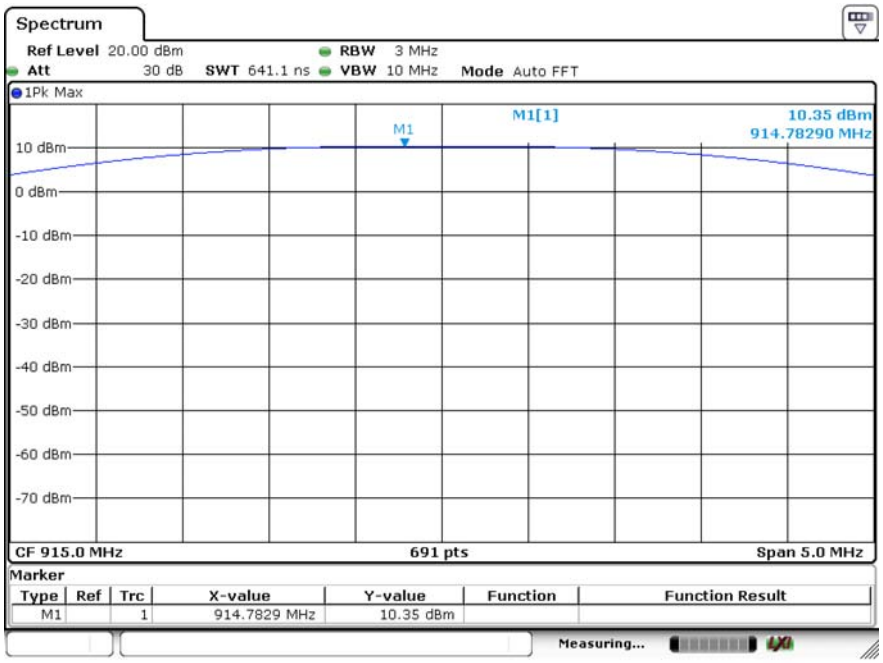
The EUT was programmed to be in continuously transmitting mode.

6.3.6 Test result

PASS

Test Mode	Frequency	Peak Output Power (dBm)	Limit (dBm)	Result
TX	915 MHz	10.35	30	Pass

The Lowest Channel 00: 915MHz



7.2 6 dB Spectrum Bandwidth Measurement

7.2.1 Standard requirement:

DTSs include systems that employ digital modulation techniques resulting in spectral characteristics similar to direct sequence systems. The following applies to the bands 902-928 MHz and 2400-2483.5 MHz:

a). The minimum 6 dB bandwidth shall be 500 kHz.

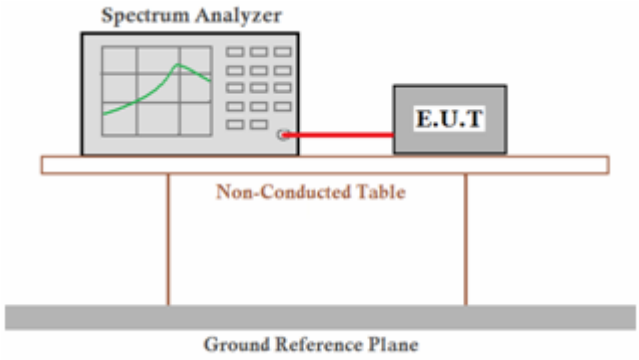
7.2.2 Measuring Instruments:

Please refer to equipment's list in this report.

7.2.3 Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. Set RBW/VBW = 100 KHz/300KHz.
3. Measured the 6dB bandwidth by related function of the spectrum analyzer.

7.2.4 Test Setup Layout



7.2.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

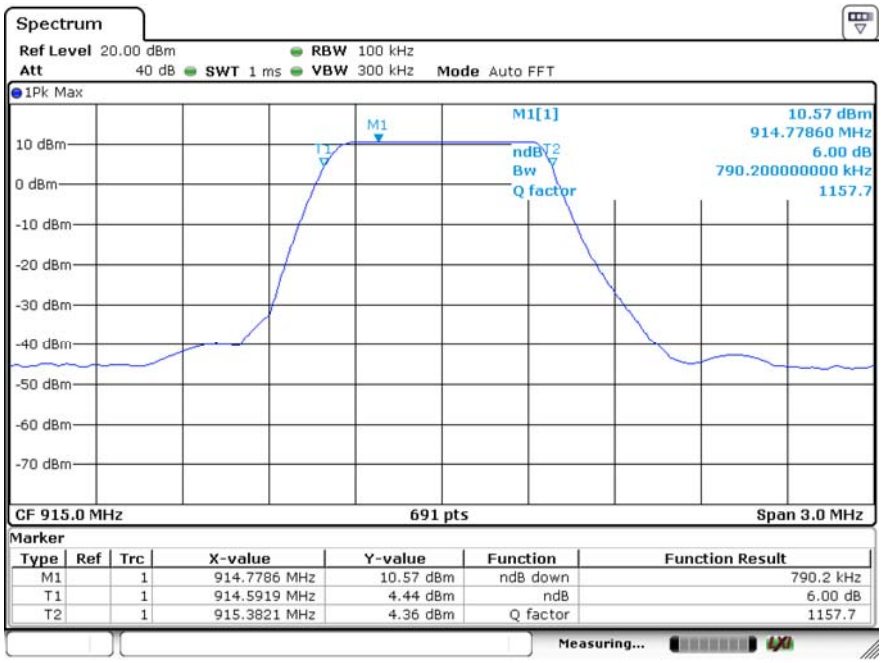
7.2.6 Test results

Test Date: 2022-09-05 Temperature: 26℃

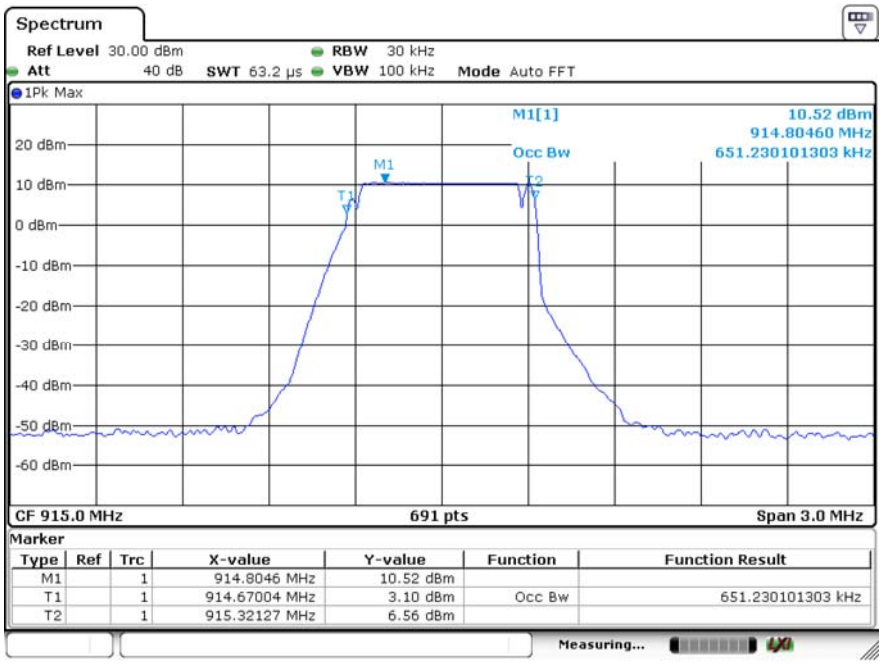
Atmospheric pressure: 1007 pha Humidity: 60%

Test Channel	Frequency (MHz)	6 dB Bandwidth (KHz)	99% Bandwidth (KHz)	Limit (KHz)
00	915	790.2	651.23	≧500

Channel 0: 915MHz



Channel 0: 915MHz



7.3 Power Spectral Density

6.5.1 Standard requirement:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

6.5.2 Measuring Instruments and Setting:

Please refer to equipment's list in this report.

6.5.3 Test Procedures

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.

2. The power was monitored at the coupler port with a Spectrum Analyzer. The power level was set to the maximum level.

3. Set the RBW = 3 kHz.

4. Set the VBW ≥ 3*RBW

5. Set the span to 1.5 times the DTS channel bandwidth.

6. Detector = peak.

7. Sweep time = auto couple.

8. Trace mode = max hold.

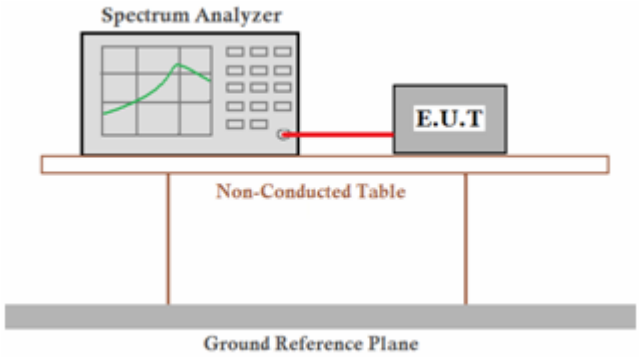
9. Allow trace to fully stabilize.

10. Use the peak marker function to determine the maximum power level.

11. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

12. The resulting peak PSD level must be 8 dBm.

6.5.4 Test Setup Layout



6.5.5 EUT Operation during Test

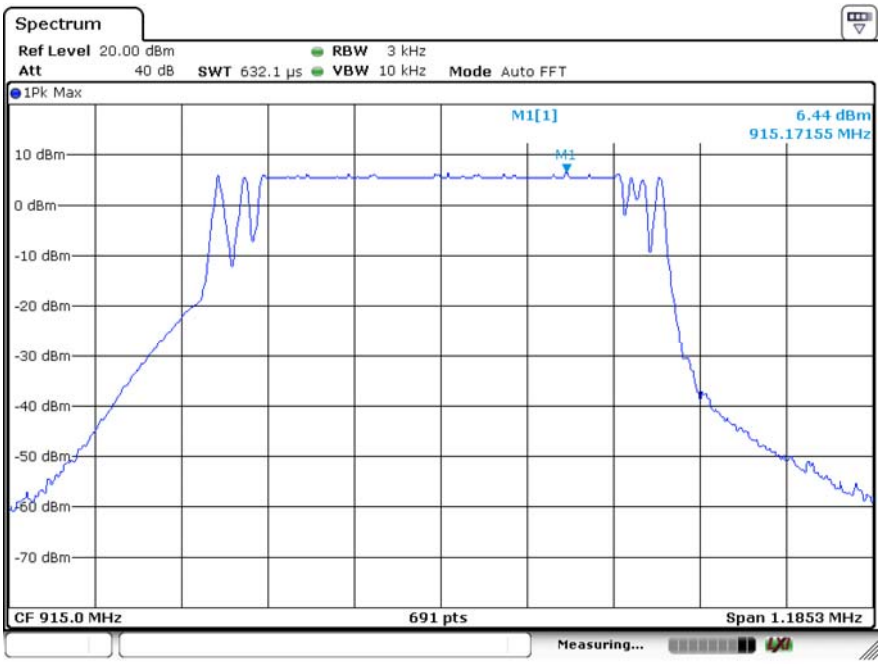
The EUT was programmed to be in continuously transmitting mode.

6.5.6 Test result

Test Mode	Channel frenqucy (MHz)	Power Density	Limit (dBm/3kHz)	Result
		PSD (dBm/3kHz)		
TX	915	6.44	8	Pass

PSD

The Lowest Channel 00: 915MHz



6.2 Conducted Spurious Emissions and Band Edges Test

6.6.1 Standard requirement:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.6.2 Measuring Instruments and Setting:

Please refer to equipment list in this report. The following table is the setting of the spectrum analyzer.

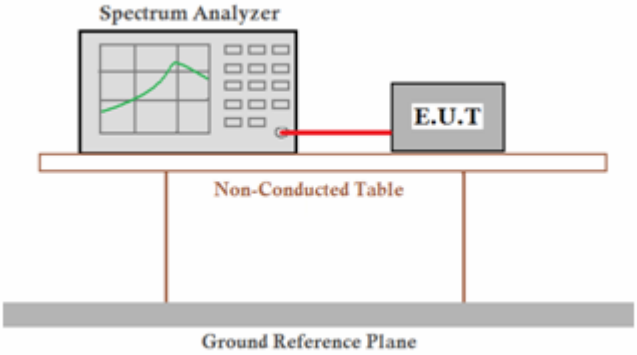
Spectrum Parameter	Setting
Detector	Peak
Attenuation	Auto
RB / VB (Emission in restricted band)	100KHz/300KHz

6.6.3 Test Procedures

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz

The spectrum from 9 kHz to 10GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

6.6.4 Test Setup Layout

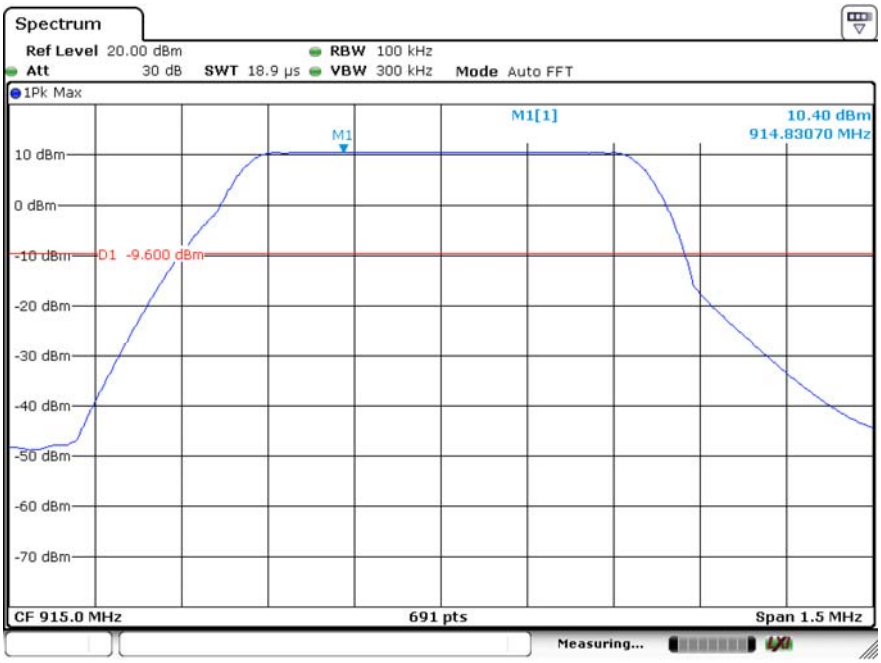


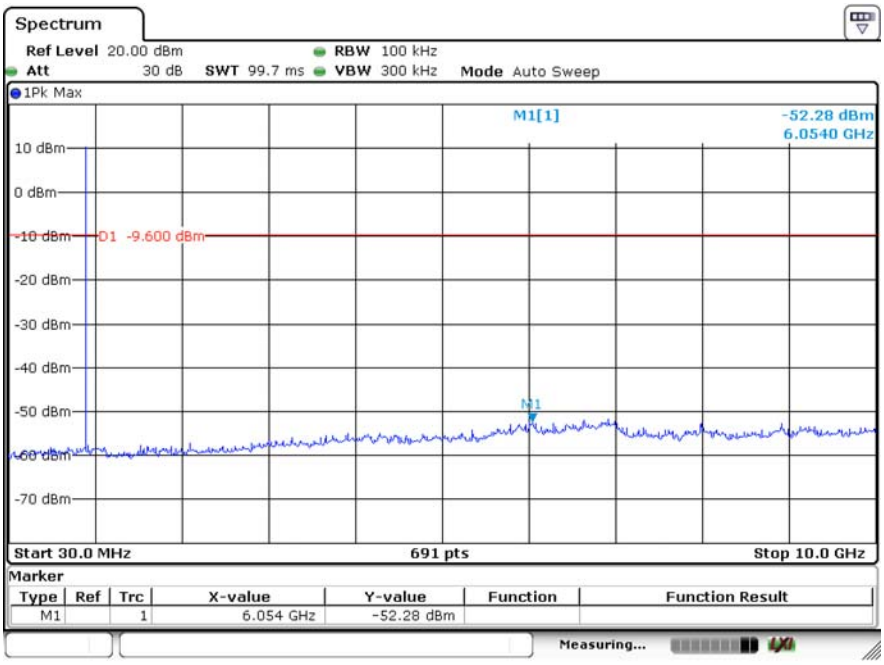
6.6.5 EUT Operation during Test

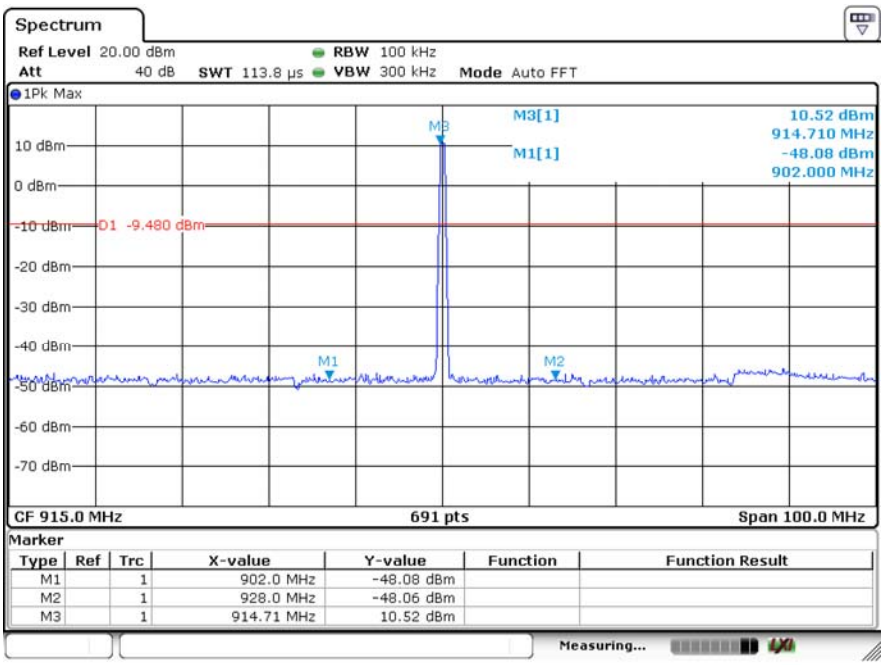
The EUT was programmed to be in continuously transmitting mode.

6.6.6 Test result

The Lowest Channel 00: 915MHz






Spectrum
Ref Level 20.00 dBm
RBW 100 kHz
Att 40 dB
SWT 113.8 µs
VBW 300 kHz
Mode Auto FFT
1Pk Max
M3[1]
10.52 dBm
914.710 MHz
M1[1]
-48.08 dBm
902.000 MHz
10 dBm
0 dBm
-10 dBm
D1 -9.480 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
M1
M2
M3
CF 915.0 MHz
691 pts
Span 100.0 MHz
Marker
Type Ref Trc X-value Y-value Function Function Result
M1 1 902.0 MHz -48.08 dBm
M2 1 928.0 MHz -48.06 dBm
M3 1 914.71 MHz 10.52 dBm
Measuring...

7.4 Field Strength of Fundamental& Field Strength of Unwanted Emissions

6.8.1 Standard requirement:

15.205 (a)& RSS-Gen Section 8.9, Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
\1\ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293.	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(\2\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.247 (d)& RSS-247 Section 5.5: 20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

6.8.2 Measuring Instruments and Setting:

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

6.8.3 Test Procedures

1) Sequence of testing 9 kHz to 30 MHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna height is 1.0 meter.

--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).

--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height changes from 1 to 3 meter.

--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.

--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 3 meter.

--- The EUT was set into operation.

Premeasurement:

--- The turntable rotates from 0° to 315° using 45° steps.

--- The antenna is polarized vertical and horizontal.

--- The antenna height scan range is 1 meter to 2.5 meter.

--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

--- The final measurement will be performed with minimum the six highest peaks.

--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.

--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.

--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.

--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.

--- Auxiliary equipment and cables were positioned to simulate normal operation conditions

--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.

--- The measurement distance is 1 meter.

--- The EUT was set into operation.

Premeasurement:

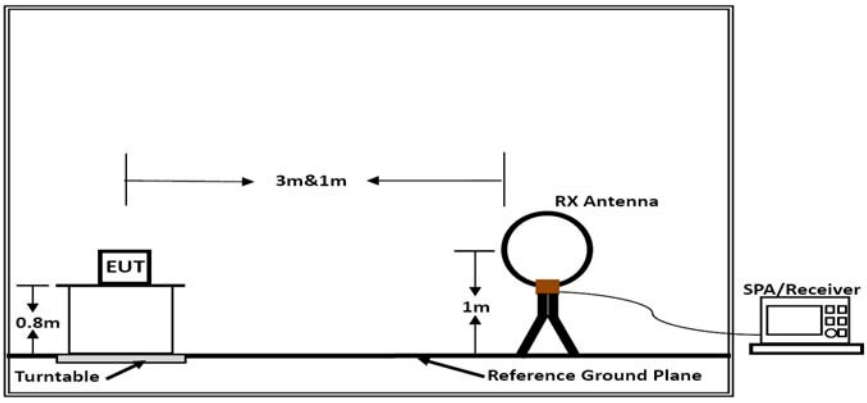
--- The antenna is moved spherical over the EUT in different polarisations of the antenna.

Final measurement:

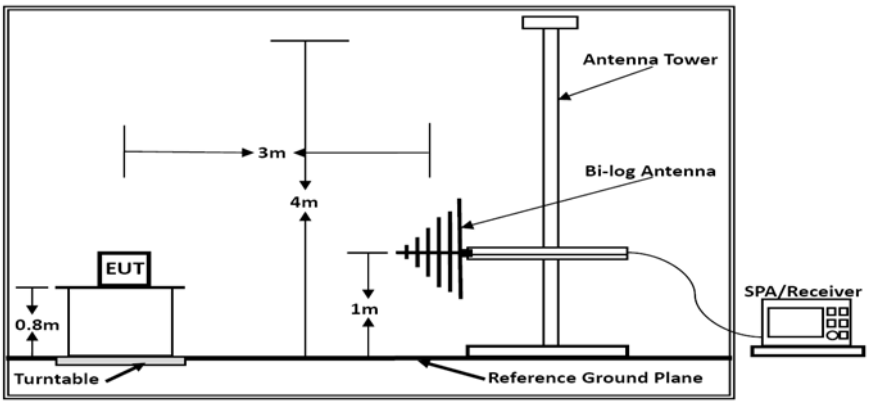
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

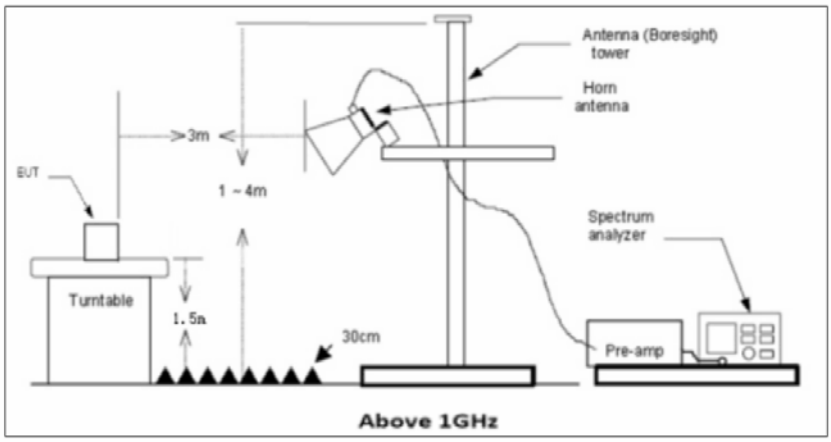
6.8.4 Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade form 3m to 1m.

Distance extrapolation factor = 20 log (specific distance [3m] / test distance [1m]) (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

6.8.5 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.8.6 Test result

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Temperature	24.4℃	Humidity	52.4%
Test Engineer	Simba Huang	Configurations	IEEE 802.11b/g/n

Remarks:

1. *Only the worst case Main Antenna test data.*
2. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

■ **Results of Radiated Emissions (9 KHz~30MHz)**

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

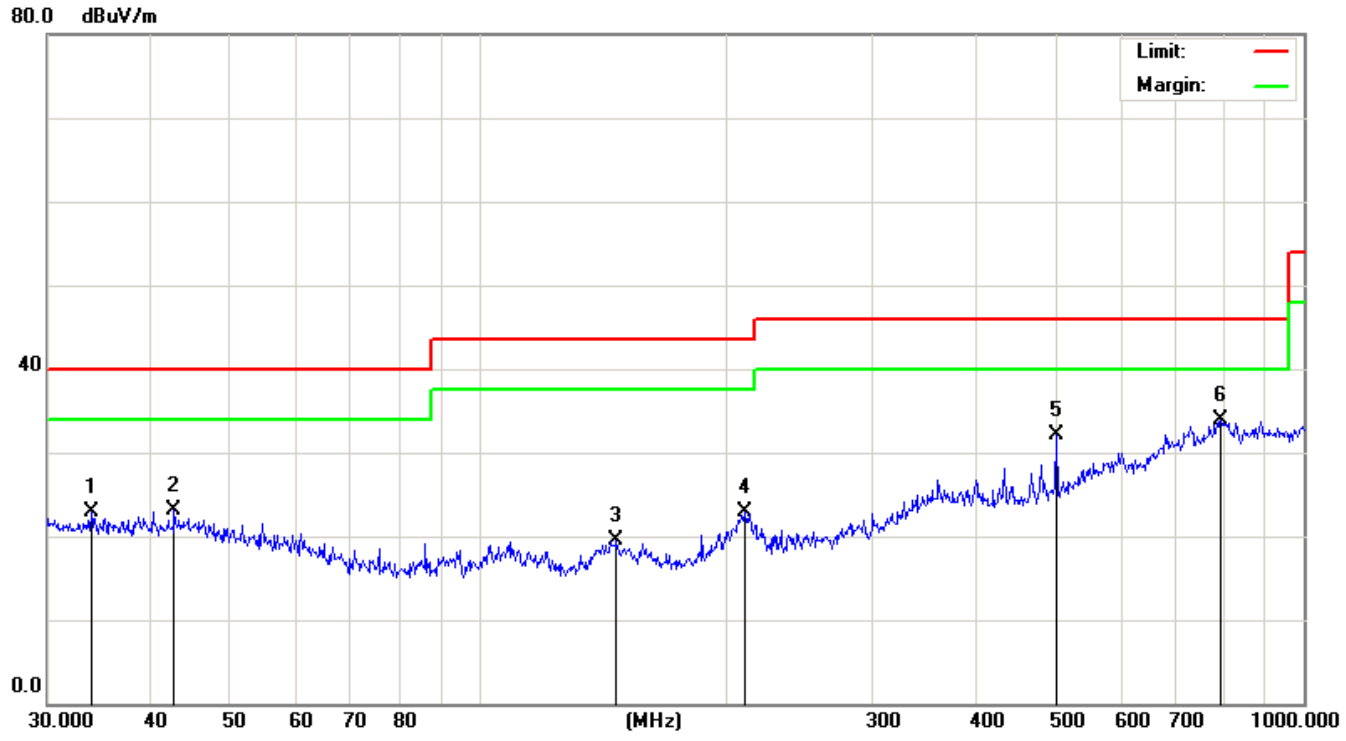
The emission from 9 kHz to 30MHz was pre-tested and found the result was 20dB lower than the limit, and the permissible value has no need to be reported.

Distance extrapolation factor = 40 log (specific distance / test distance) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor.

■ **Results of Radiated Emissions (30MHz~1GHz)**

Pre-scan all test modes, worst case test result recorded.

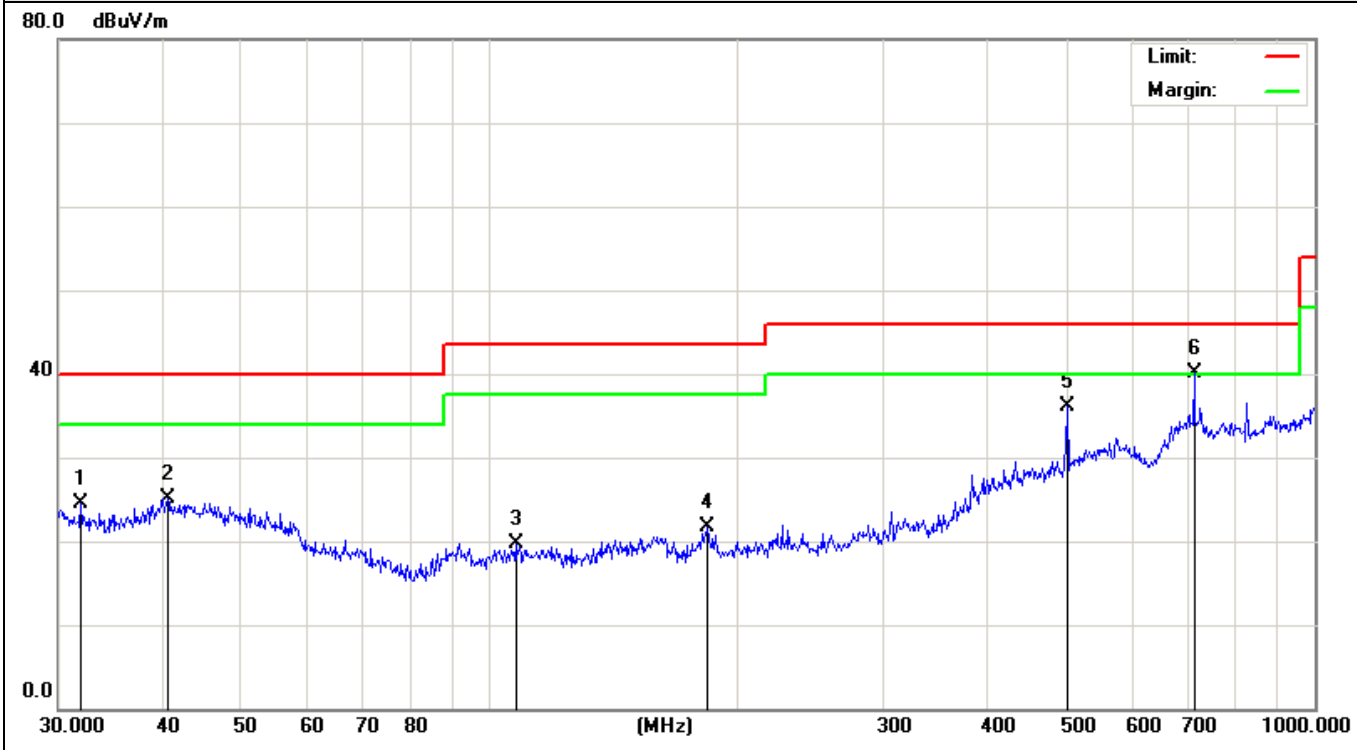
Model name:	CW-SOU	Test Date :	2022-09-05
Polarization :	Vertical	Test Result:	☒ Pass ☐ Fail



Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Measurement Result=Reading Level +Correct Factor;
Over Limit= Measurement Result- Limit;

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		33.9174	27.80	-4.91	22.89	40.00	-17.11	QP
2		42.7496	27.55	-4.42	23.13	40.00	-16.87	QP
3		146.8877	27.04	-7.46	19.58	43.50	-23.92	QP
4		210.0482	26.83	-3.93	22.90	43.50	-20.60	QP
5		501.1790	33.11	-1.01	32.10	46.00	-13.90	QP
6	*	793.3960	27.06	6.83	33.89	46.00	-12.11	QP

Model name:	CW-SOU	Test Date :	2022-09-05
Polarization :	Horizontal	Test Result:	☒ Pass ☐ Fail



Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier.
Measurement Result=Reading Level +Correct Factor;
Over Limit= Measurement Result- Limit;

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB	Detector
1		31.9546	28.50	-3.94	24.56	40.00	-15.44	QP
2		40.7016	27.12	-1.94	25.18	40.00	-14.82	QP
3		107.5101	26.85	-7.22	19.63	43.50	-23.87	QP
4		183.8440	27.35	-5.71	21.64	43.50	-21.86	QP
5		501.1790	33.65	2.54	36.19	46.00	-9.81	QP
6	*	714.1734	33.76	6.43	40.19	46.00	-5.81	QP

Results for Radiated Emissions (1- 10GHz)

Test channel:	Lowest channel

H

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV/m)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	
1830.400	67.37	-9.42	57.95	74.00	-16.05	peak
1830.400	56.28	-9.42	46.86	54.00	-7.14	AVG
2745.600	52.78	-3.13	49.65	74.00	-24.35	peak
2745.600	40.91	-3.13	37.78	54.00	-16.22	AVG

V

Frequency	Meter Reading	Factor	Emission Level	Limits	Margin	Detector Type
(MHz)	(dBμV/m)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	
1830.400	64.33	-9.42	54.91	74.00	-19.09	peak
1830.400	52.64	-9.42	43.22	54.00	-10.78	AVG
2745.600	50.42	-3.13	47.29	74.00	-26.71	peak
2745.600	40.71	-3.13	37.58	54.00	-16.42	AVG

Remarks:

1). Measuring frequencies from 9 KHz - 10th harmonic or 10GHz (which is less), No emission found between lowest internal used/generated frequency to 30MHz.
2). Radiated emissions *measured in frequency range from 9 KHz~10th harmonic or 26.5GHz (which is less) were made with an instrument using Peak detector mode.*
3). Data of measurement within this frequency range shown "---" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
4). Margin= Final Level – Limit
5).Final Level =Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
6). All the modes have been tested and the only shows the worst case GFSK mode

7.5 Occupied Bandwidth

Standard requirement:

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

According to RSS-Gen section 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.

Measuring Instruments:

Please refer to equipment’s list in this report.

Test Procedures

Frequency separation test procedure：

1). Place the EUT on the table and set it in transmitting mode.

2). Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the Spectrum Analyzer.

3). Set center frequency of Spectrum Analyzer = middle channel.

4). Set the Spectrum Analyzer Span = wide enough to capture the peaks of two adjacent channels, Sweep = auto.

5). Max hold, mark 2 peaks of hopping channel and record the 2 peaks frequency.

6dB bandwidth test procedure：

1). Span = approximately 2 to 3 times the 6 dB bandwidth, centered on a hopping channel.

2). RBW ≥1% of the 6 dB bandwidth, VBW ≥RBW.

3). Detector function = peak.

4). Trace = max hold.

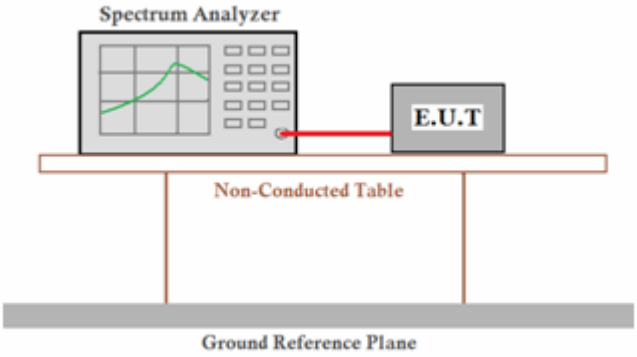
99% bandwidth test procedure：

1). The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.

2). Set RBW = 1%~5% OBW; VBW≥3*RBW;

3). Measured the 99% occupied bandwidth by related function of the spectrum analyzer.

Test Setup Layout



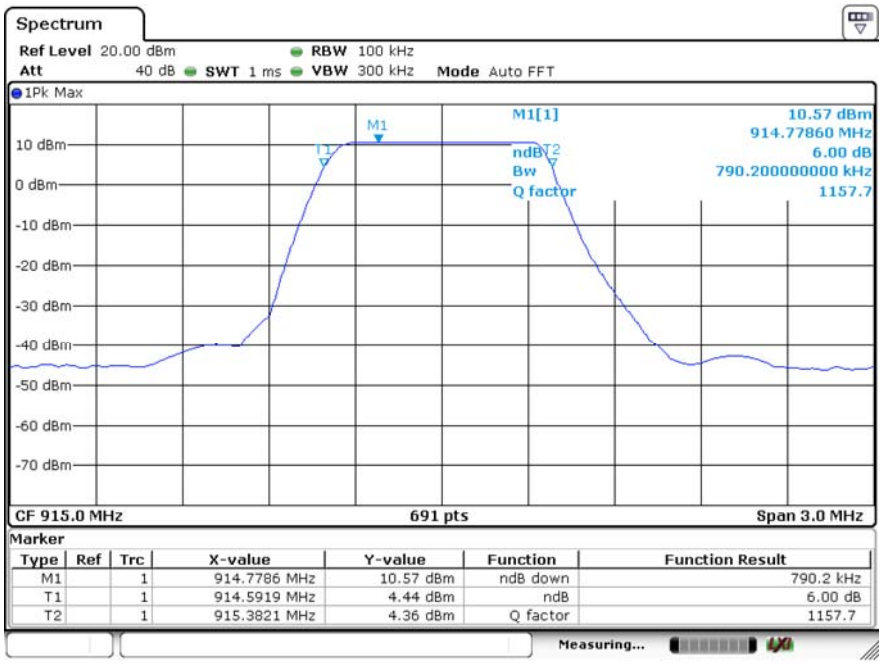
EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

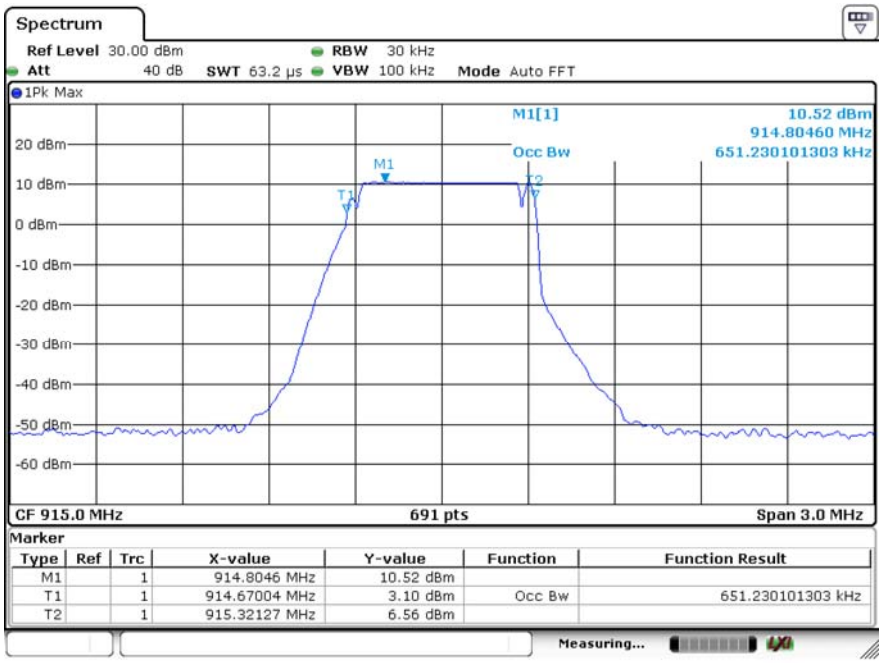
Test result

Test Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	99% Bandwidth (MHz)	Limit （kHz）
TX	00	915	0.7902	0.6512	⩾500

6dB bandwidth
Channel: 0



99% bandwidth
Channel: 0



7.6 Conducted Emissions at Mains Terminals 150 kHz to 30 MHz

Test Requirement: Section 15.207(a)&RSS-Gen 8.8

TEST METHOD: Section 15.207(a)&RSS-Gen clause 8.8 & ANSI C63.10: Clause 6.2

Frequency Range: 150 kHz to 30 MHz

Detector: for pre-scan (9 kHz Resolution Bandwidth)

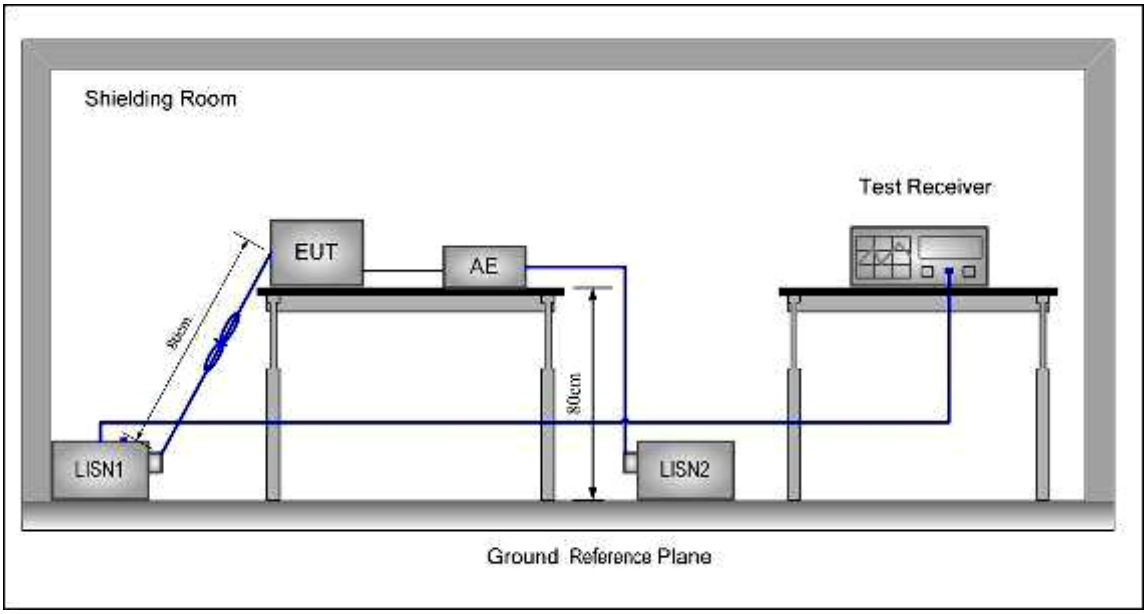
Test Limit

Limits for conducted disturbance at the mains ports of class B

Frequency Range (MHz)	**Class B Limit 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
NOTE 1 The limit decreases linearly with the logarithm of the frequency in the range 0,15 MHz to 0,50 MHz.		

EUT Operation: Test in normal operating mode. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage.

Test Configuration:



Test procedure:

1. The mains terminal disturbance voltage test was conducted in a shielded room.

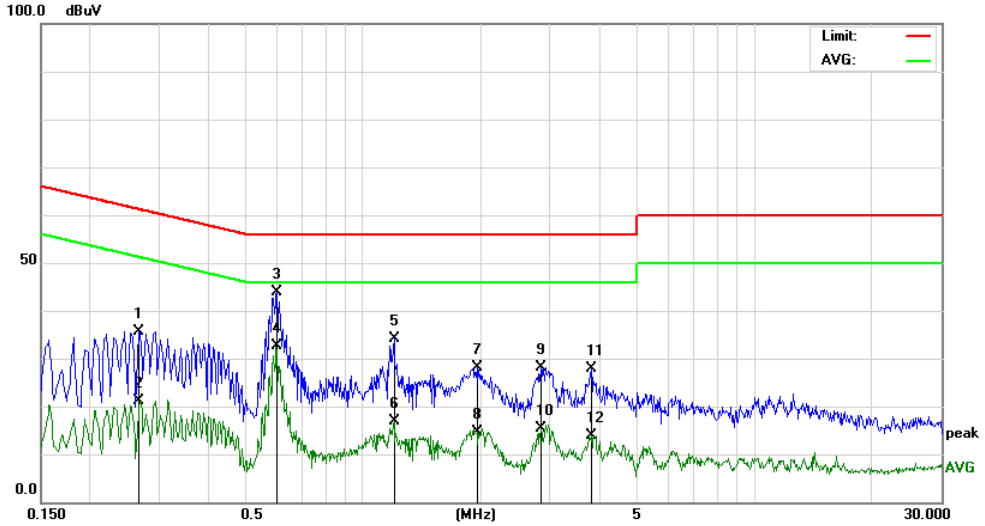
2. The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the 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.

3. 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, but separated from metallic contact with the ground reference plane by 0.1m of insulation.

4. 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.

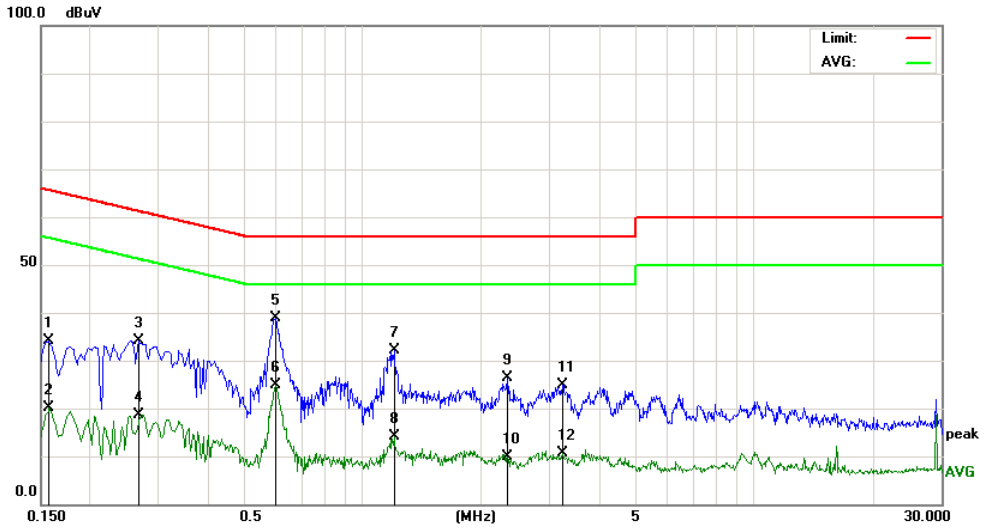
7.6.1 Test Result

Power	:	120V/60Hz	Phase	:	Line
Test Mode 1	:	TX CH00	Temperature	:	26 °C
Memo	:		Humidity	:	59%



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.2660	24.80	10.84	35.64	61.24	-25.60	QP
2		0.2660	10.29	10.84	21.13	51.24	-30.11	AVG
3	*	0.6020	33.99	9.99	43.98	56.00	-12.02	QP
4		0.6020	22.58	9.99	32.57	46.00	-13.43	AVG
5		1.1980	24.30	9.95	34.25	56.00	-21.75	QP
6		1.1980	7.01	9.95	16.96	46.00	-29.04	AVG
7		1.9580	18.09	9.99	28.08	56.00	-27.92	QP
8		1.9580	4.58	9.99	14.57	46.00	-31.43	AVG
9		2.8500	18.21	10.03	28.24	56.00	-27.76	QP
10		2.8500	5.25	10.03	15.28	46.00	-30.72	AVG
11		3.8340	17.81	10.05	27.86	56.00	-28.14	QP
12		3.8340	3.85	10.05	13.90	46.00	-32.10	AVG

Power	:	120V/60Hz	Phase	:	Neutral
Test Mode 1	:	TX CH00	Temperature	:	26 °C
Memo	:		Humidity	:	59 %



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1580	22.34	11.75	34.09	65.56	-31.47	QP
2		0.1580	8.34	11.75	20.09	55.56	-35.47	AVG
3		0.2660	23.33	10.84	34.17	61.24	-27.07	QP
4		0.2660	7.91	10.84	18.75	51.24	-32.49	AVG
5	*	0.5980	28.94	9.99	38.93	56.00	-17.07	QP
6		0.5980	14.96	9.99	24.95	46.00	-21.05	AVG
7		1.1980	22.27	9.95	32.22	56.00	-23.78	QP
8		1.1980	4.24	9.95	14.19	46.00	-31.81	AVG
9		2.3420	16.48	10.00	26.48	56.00	-29.52	QP
10		2.3420	-0.22	10.00	9.78	46.00	-36.22	AVG
11		3.2380	14.91	10.04	24.95	56.00	-31.05	QP
12		3.2380	0.67	10.04	10.71	46.00	-35.29	AVG

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

8 Photographs

Refer to Test Setup Photos

End of Report