



FCC TEST REPORT

**Test report
On Behalf of
Hangzhou Roombanker Technology Co., Ltd.
For
Smart Linux Gateway
Model No.: DSGW-091**

FCC ID: 2AUXBDSGW-091

Prepared for : Hangzhou Roombanker Technology Co., Ltd.
A#801 Wantong center, Hangzhou, China

Prepared By : Shenzhen Tongzhou Testing Co., Ltd
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Date of Test: 2022/10/8 ~ 2022/10/25

Date of Report: 2022/10/25

Report Number: TZ220903661-E5

The test report apply only to the specific sample(s) tested under stated test conditions
It is not permitted to copy extracts of these test result without the written permission of the test
laboratory.



TEST RESULT CERTIFICATION

Applicant's name.....: Hangzhou Roombanker Technology Co., Ltd.

Address: A#801 Wantong center, Hangzhou, China

Manufacture's Name: Hangzhou Roombanker Technology Co., Ltd.

Address: A#801 Wantong center, Hangzhou, China

Product description

Trade Mark.....: Dusun

Product name.....: Smart Linux Gateway

Model and/or type reference .: DSGW-091

Standards: FCC Rules and Regulations Part 15 Subpart C Section 15.249
ANSI C63.10: 2013

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Date of Test.....:

Date (s) of performance of tests: 2022/10/8 ~ 2022/10/25

Date of Issue.....: 2022/10/25

Test Result: **Pass**

Testing Engineer :

Anna Hu

(Anna Hu)

Technical Manager :

Hugo Chen

(Hugo Chen)

Authorized Signatory :

Andy Zhang

(Andy Zhang)



Revision History

Revision	Issue Date	Revisions	Revised By
00	2022/10/25	Initial Issue	Andy Zhang



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1. GENERAL INFORMATION

1.1. Description of Device (EUT)

Product Name	: Smart Linux Gateway
Model Number	: DSGW-091
Model Difference Declaration	: N/A
Test Model	: DSGW-091
Power Supply	: Input: DC 5V,2A
Hardware version	: 5-1-9-009760
Software version	: V1.0
Sample ID	: TZ220903661-1#&TZ220903661-2#

LoRa

LoRa-Hybrid Mode

Frequency Range	: 902.3 – 914.9 MHz
Channel Number	: 64 Channels
Modulation Technology	: LORA

LoRa-DTS Mode

Frequency Range	: 923.3 – 927.5 MHz
Channel Number	: 8 Channels
Modulation Technology	: LORA
Antenna Type And Gain	: External Antenna / 2.44 dBi(Max)

Bluetooth

Bluetooth Version	: V5.2
Frequency Range	: 2402 – 2480 MHz
Channel Number	: 40 Channels for BLE (DTS)
Modulation Technology	: GFSK for BLE (DTS)
Data Rates	: BLE (DTS): 1Mbps
Antenna Type And Gain	: FPC Antenna / -0.09dBi(Max)

Zigbee

Frequency Range	: 2415 – 2480 MHz
Channel Number	: 14 Channels
Modulation Technology	: O-QPSK
Data Rates	: 250 kbps
Antenna Type And Gain	: PCB Antenna / 0.0dBi(Max)

Z-Wave

Frequency Range	: 908.4 – 916 MHz
Channel Number	: Channel 1: 908.4MHz / Channel 2: 916MHz
Modulation Technology	: FSK
Antenna Type And Gain	: FPC Antenna / -1.8dBi(Max)

Note 1: Antenna position refer to EUT Photos

Note 2: The above information supplied by the applicant



1.2 EUT configuration

The following peripheral devices and interface cables were connected during the measurement:

- - supplied by the manufacturer
- - supplied by the lab

○	Adapter	Model:	MDY-10-EH
		Input:	100-240VAC 50/60Hz 0.7A
		Output:	DC 5.0V,3.0A; DC 9.0V,3.0A; DC 12.0V,2.25A; DC 20.0V,1.35A
		Lab. Code:	SZTZ-ZB-EMC-010

1.3 External I/O Cable

I/O Port Description	Quantity	Cable
DC port	1	N/A
RJ45 port	1	N/A

1.4. Description of Test Facility

FCC

Designation Number: CN1275

Test Firm Registration Number: 167722

Shenzhen Tongzhou Testing Co.,Ltd has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA

Certificate Number: 5463.01

Shenzhen Tongzhou Testing Co.,Ltd has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

IC

ISED#: 22033

CAB identifier: CN0099

Shenzhen Tongzhou Testing Co.,Ltd has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010

1.5. 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 Shenzhen Tongzhou Testing Co.,Ltd’s 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.



1.6. Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	$\pm 3.08\text{dB}$	(1)
	:	30MHz~1000MHz	$\pm 3.92\text{dB}$	(1)
	:	1GHz~40GHz	$\pm 4.28\text{dB}$	(1)
Conduction Uncertainty	:	150kHz~30MHz	$\pm 2.71\text{dB}$	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.



1.7. Description of Test Modes

The EUT has been tested under operating condition.

All test modes were tested, only the result of the worst case was recorded in the report.

Channel List & Frequency

Channel	Frequency(MHz)	Channel	Frequency(MHz)
1	908.4	2	916.0

Test Channel

Channel	Transmitting Frequency (MHz)
1	908.4
2	916.0



2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen Tongzhou Testing Co.,Ltd

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.249 under the FCC Rules Part 15 Subpart C.

2.3. General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 6.2.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 6.3 of ANSI C63.10-2013



3. SYSTEM TEST CONFIGURATION

3.1. Justification

The system was configured for testing in a continuous transmits condition.

3.2. EUT Exercise Software

The system was configured for Bluetooth testing in a continuous transmits condition and change test channels by software (PuTTY 0.73Zigbee) provided by application.

3.3. Special Accessories

No.	Equipment	Manufacturer	Model No.	Serial No.	Length	shielded/ unshielded	Notes
1	PC	ASUS	K43S	X16-96081	/	/	/

3.4. Block Diagram/Schematics

Please refer to the related document

3.5. Equipment Modifications

Shenzhen Tongzhou Testing Co.,Ltd has not done any modification on the EUT.

3.6. Test Setup

Please refer to the test setup photo.



4. SUMMARY OF TEST RESULTS

Applied Standard: FCC Part 15 Subpart C			
FCC Rules	Description of Test	Test Sample	Result
/	Duty Cycle	TZ220903661-1#	Compliant
§15.249(a), §15.249(c), §15.249(e)	Field strength of fundamental	TZ220903661-1#	Compliant
§15.205, §15.249(d)	Emissions at Restricted Band	TZ220903661-1#	Compliant
§15.207(a)	Conducted Emissions	TZ220903661-1# TZ220903661-2#	Compliant
§15.203	Antenna Requirements	N/A	Compliant
§15.215	20 dB Bandwidth	TZ220903661-1#	Compliant



5. TEST RESULT

5.1. On Time and Duty Cycle

5.1.1. Standard Applicable

None; for reporting purpose only.

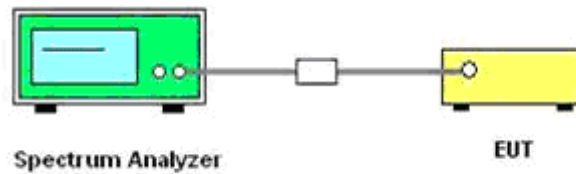
5.1.2. Measuring Instruments and Setting

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

5.1.3. Test Procedures

1. Set the centre frequency of the spectrum analyzer to the transmitting frequency;
2. Set the span=0MHz, RBW=8MHz, **VBW=8MHz**, Sweep time=100ms;
3. Detector = peak;
4. Trace mode = Single hold.

5.1.4. Test Setup Layout



5.1.5. EUT Operation during Test

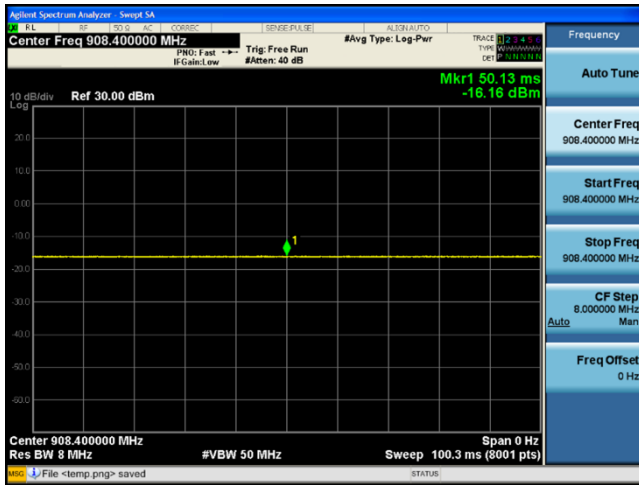
The EUT was programmed to be in continuously transmitting mode.

5.1.6. Test result

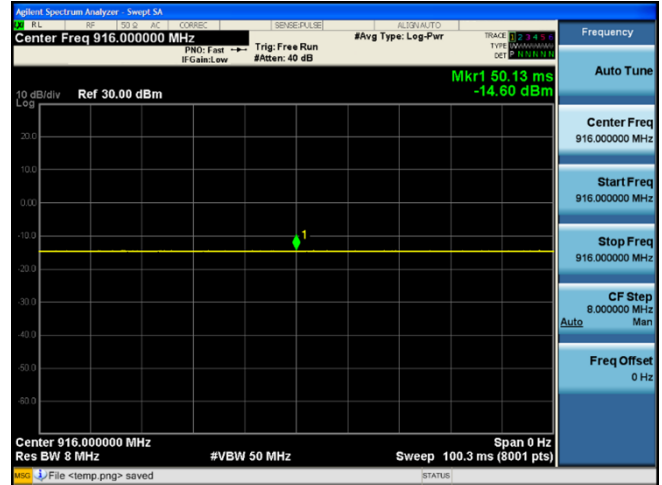
Frequency(MHz)	On Time B (ms)	Period (ms)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW(KHz)
908.4	100	100	1	100	0	0.010
916.0	100	100	1	100	0	0.010



On Time and Duty Cycle



908.4MHz



916.0MHz



5.2. Radiated Emissions Measurement

5.2.1. Standard Applicable

15.205 (a) 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 §15.249 (d): Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation

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

According to §15.249 (a): Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental		Field strength of harmonics	
	millivolts/meter	dBuV/m	microvolts/meter	dBuV/m
902-928 MHz	50	94	500	54
2400-2483.5 MHz	50	94	500	54
5725-5875 MHz	50	94	500	54
24.0-24.25 GHz	250	108	2500	68

As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. 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. For point-to-point operation under paragraph (b) of this section, the peak field



strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth

5.2.2. 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	10 th 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

5.2.3. 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 1.3 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 ($\pm 45^\circ$) 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 ($\pm 45^\circ$) 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:

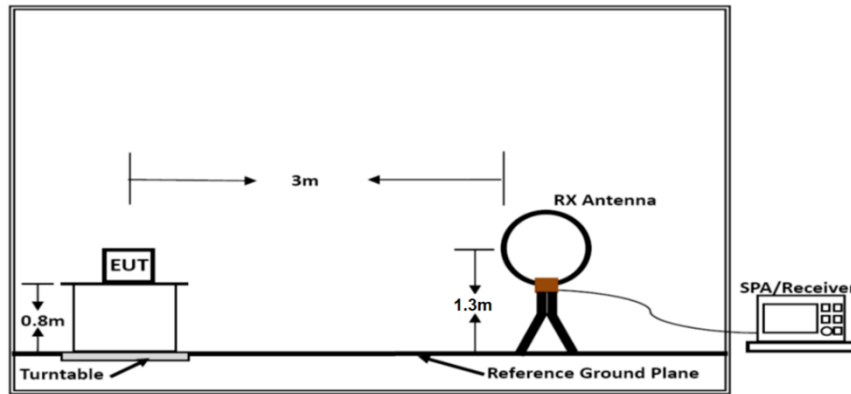
- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

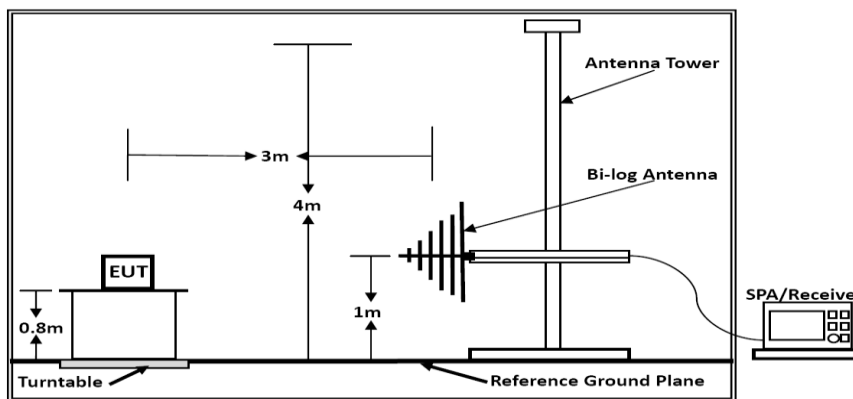
- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

5.2.4. Test Setup Layout

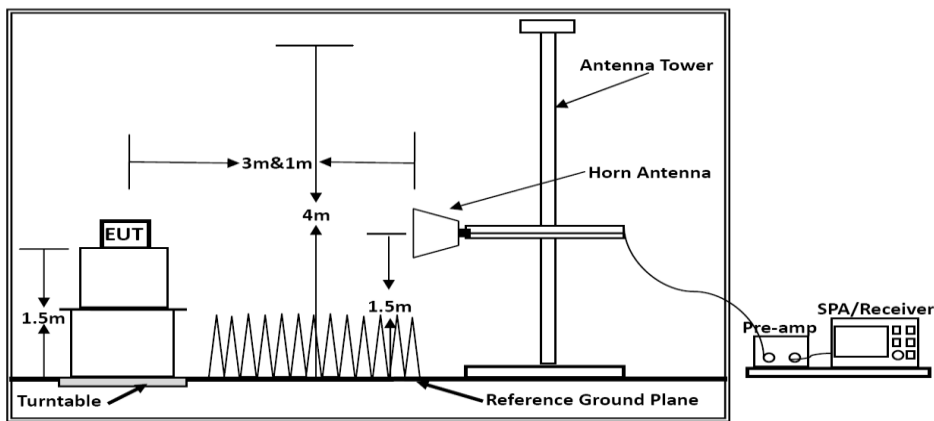
For radiated emissions below 30MHz



Below 30MHz



Below 1GHz



Above 1GHz

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

Distance extrapolation factor = $20 \log(\text{specific distance [3m]} / \text{test distance [1m]})$ (dB);
 Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

5.2.5. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

6.6.6. Radiated Emissions



Temperature	22.8°C	Humidity	56%
Test Engineer	Anna Hu	Configurations	Low Channel/High Channel

(i) Results of Radiated Emissions (9 kHz~30MHz)

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

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

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

PASS.

Only record the worst test result in this report.

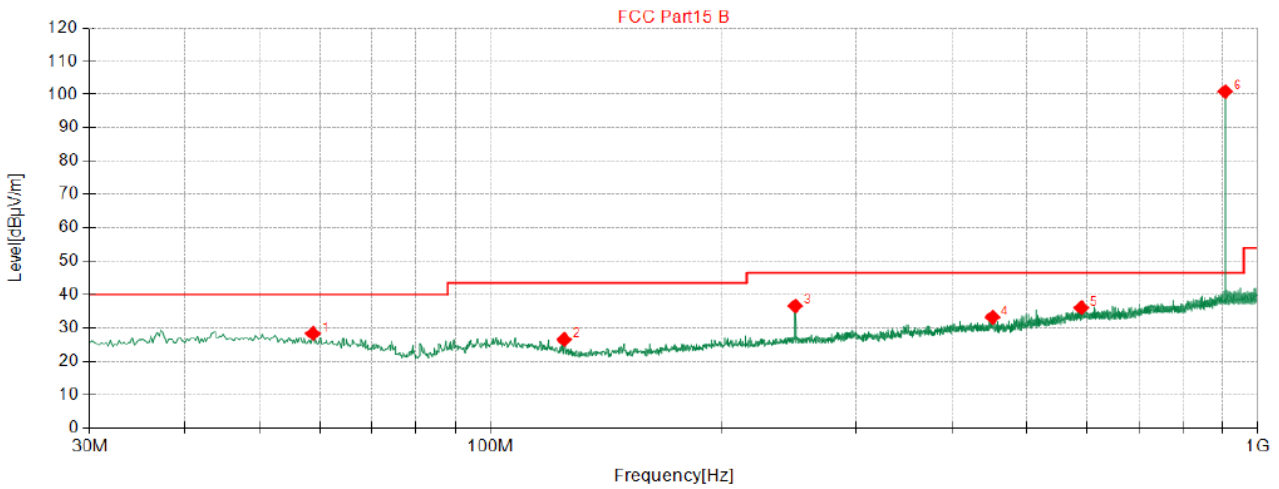
The test data please refer to following page.



(ii) Results of Radiated Emissions (30MHz ~1GHz)

Below 1GHz (Low Channel)

Vertical



◆ QP Detector

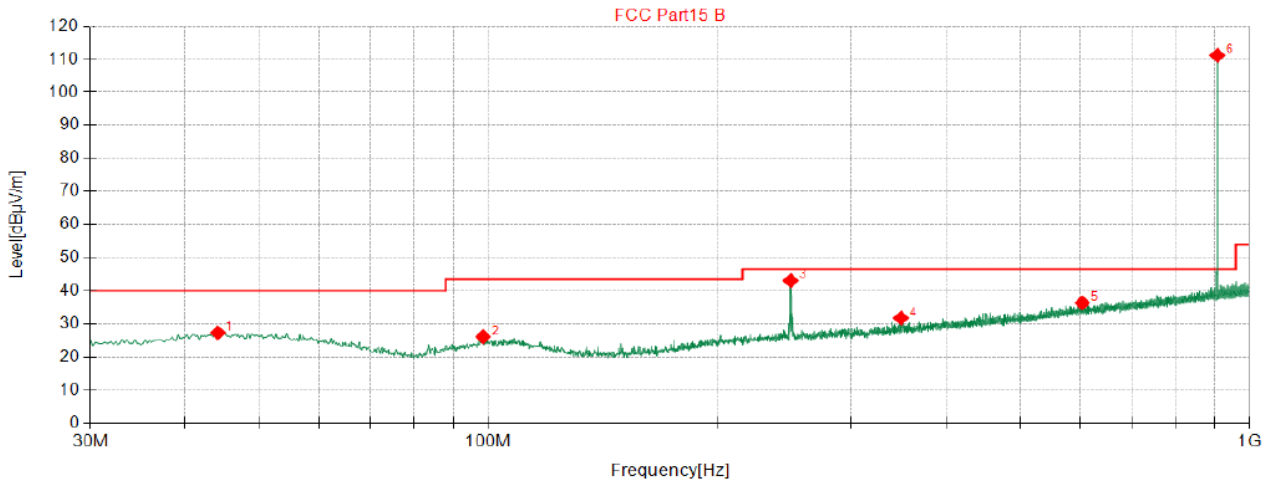
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	58.71	43.24	-14.90	28.34	40.00	11.66	100	338	Vertical
2	124.8	43.96	-17.41	26.55	43.50	16.95	100	208	Vertical
3	249.8	50.38	-13.77	36.61	46.50	9.89	100	174	Vertical
4	451.7	42.67	-9.45	33.22	46.50	13.28	100	20	Vertical
5	589.8	42.10	-6.02	36.08	46.50	10.42	100	42	Vertical
6	908.4	101.97	-1.09	100.88	114.0	13.12	100	329	Vertical

Final Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	AV Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	908.4	81.21	-0.94	80.27	94.0	13.73	100	354	Vertical

Average Power = 80.27 – 95.2 = -14.93 dBm

***Note:

1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]
2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]



◆ QP Detector

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Peak Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	44.13	41.34	-14.04	27.30	40.00	12.70	100	345	Horizontal
2	98.51	42.35	-16.23	26.12	43.50	17.38	100	118	Horizontal
3	249.8	56.96	-13.87	43.09	46.50	3.41	100	252	Horizontal
4	348.8	43.22	-11.45	31.77	46.50	14.73	100	232	Horizontal
5	603.3	41.88	-5.55	36.33	46.50	10.17	100	17	Horizontal
6	908.4	112.08	-1.09	110.99	114.0	3.01	100	354	Horizontal

Final Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	AV Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	908.4	90.82	-1.09	89.73	94.0	4.27	100	354	Horizontal

Average Power = 89.73 – 95.2 = -5.47 dBm

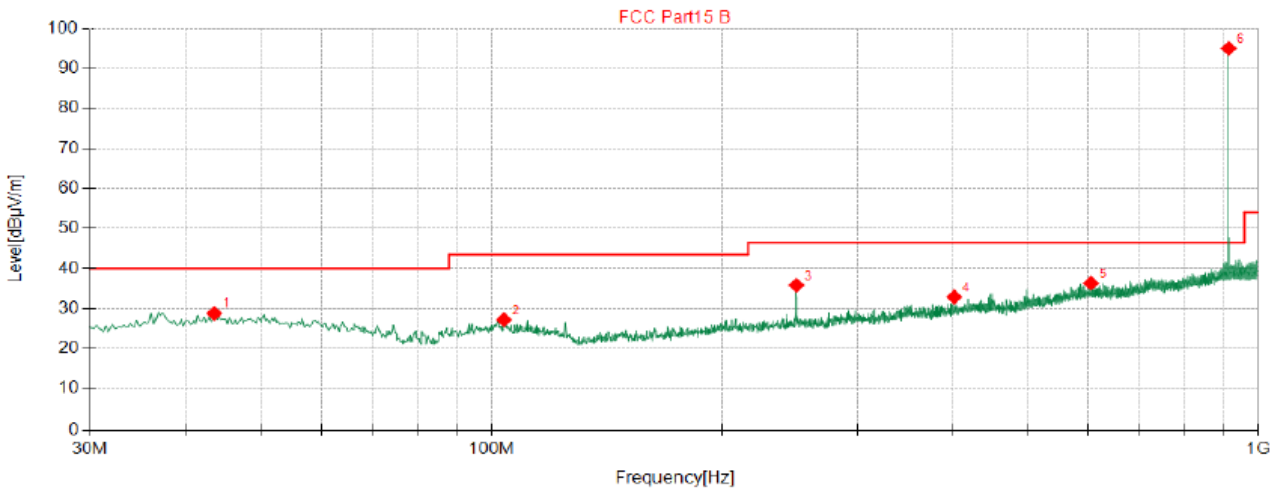
***Note:

1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]
2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]



Below 1GHz (High Channel)

Vertical



◆ QP Detector

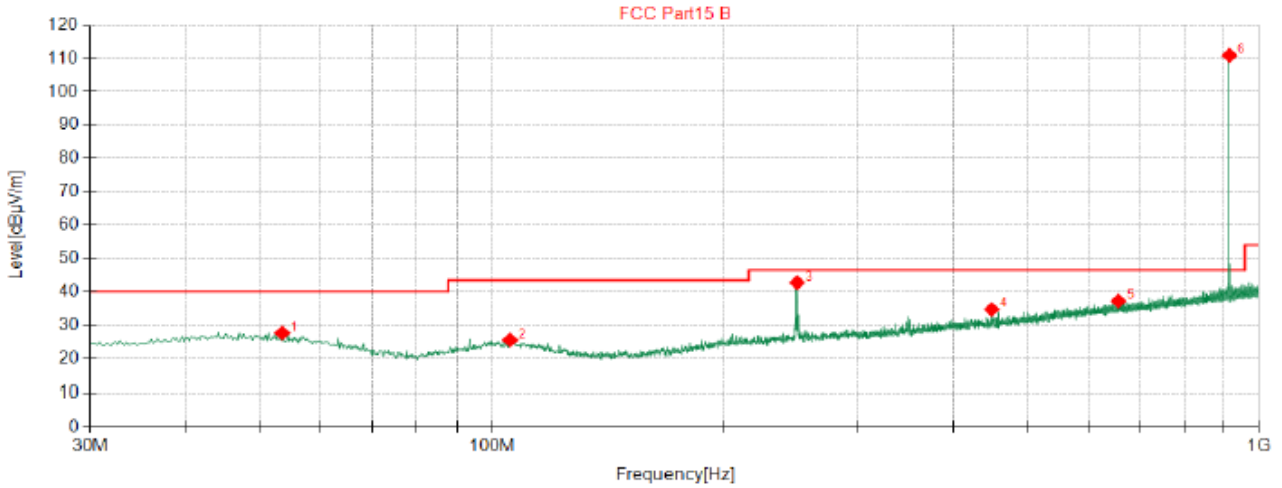
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	43.48	42.84	-14.05	28.79	40.00	11.21	100	244	Vertical
2	103.7	42.67	-15.47	27.20	43.50	16.30	100	96	Vertical
3	249.8	49.59	-13.77	35.82	46.50	10.68	100	154	Vertical
4	401.2	42.88	-10.01	32.87	46.50	13.63	100	234	Vertical
5	605.0	42.18	-5.87	36.31	46.50	10.19	100	325	Vertical
6	916.0	95.91	-0.95	94.96	114	-19.04	100	53	Vertical

Final Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	AV Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	916.0	79.15	-0.95	78.2	94.0	15.8	100	354	Vertical

Average Power = 78.2 – 95.2 = -17.0 dBm

***Note:

1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]
2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]



◆ QP Detector

Suspected Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	53.49	42.31	-14.69	27.62	40.00	12.38	100	71	Horizontal
2	105.4	41.52	-16.00	25.52	43.50	17.98	100	239	Horizontal
3	249.8	56.62	-13.87	42.75	46.50	3.75	100	74	Horizontal
4	448.4	43.77	-9.08	34.69	46.50	11.81	100	239	Horizontal
5	656.1	42.10	-4.90	37.20	46.50	9.30	100	135	Horizontal
6	916.0	111.70	-0.95	110.75	114.0	3.25	100	314	Horizontal

Final Data List									
NO.	Freq. [MHz]	Reading [dBµV]	Factor [dB/m]	AV Level [dBµV/m]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	916.0	87.13	-0.95	86.18	94.0	7.82	100	354	Horizontal

Average Power = 86.18 – 95.2 = -9.02 dBm

***Note:

1. Level [dBµV/m] = Reading [dBµV] + Factor [dB/m]
2. Margin [dB] = Limit [dBµV/m] - Level [dBµV/m]

*(iii) Results for Radiated Emissions (1GHz – 10GHz)*

Low Channel: 908.4MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
1817.66	47.02	33.06	35.04	3.94	48.98	74.00	25.02	Peak	Horizontal
1817.65	48.95	33.06	35.04	3.94	50.91	74.00	23.09	Peak	Vertical
2725.62	49.65	33.06	35.04	3.94	51.61	74.00	22.39	Peak	Horizontal
2725.44	49.48	33.06	35.04	3.94	51.44	74.00	22.56	Peak	Vertical

Low Channel: 916MHz

Freq. MHz	Reading dBuv	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuv/m	Limit dBuv/m	Margin dB	Remark	Pol.
1832.46	44.68	33.16	35.15	3.96	46.65	74.00	27.35	Peak	Horizontal
1832.38	46.08	33.16	35.15	3.96	48.05	74.00	25.95	Peak	Vertical
2748.96	49.47	33.16	35.15	3.96	51.44	74.00	22.56	Peak	Horizontal
2748.71	47.21	33.16	35.15	3.96	49.18	74.00	24.82	Peak	Vertical

Notes:

1. Measuring frequencies from 9 KHz - 10th harmonic or 26.5GHz (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. $Measured = Reading + Ant. Fac - Pre. Fac. + Cab. Loss$; $Margin = Limit - Measured$

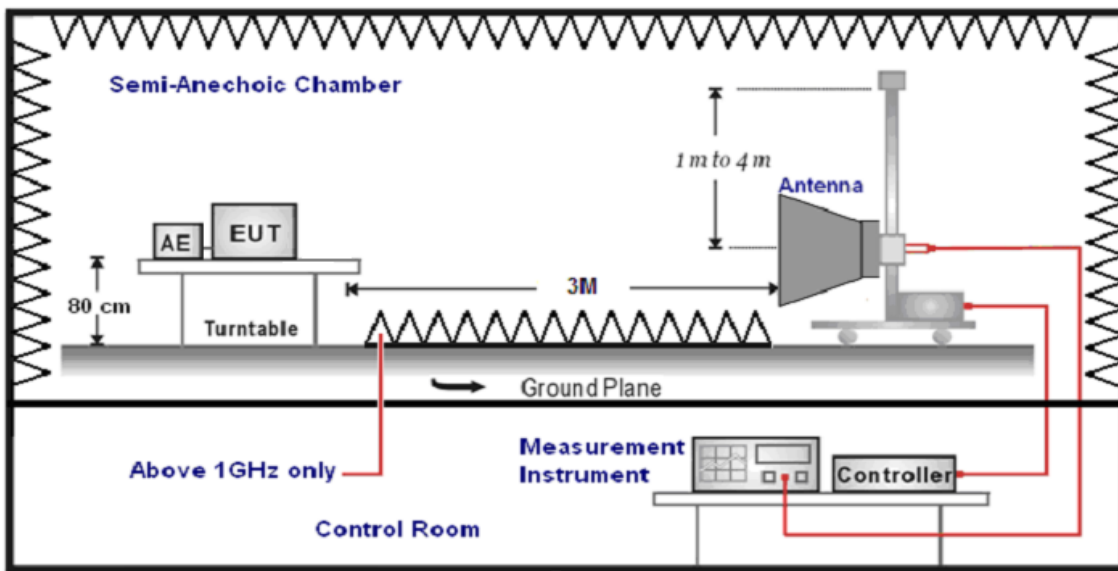
5.3. Band-edge measurements for radiated emissions

5.3.1 Standard Applicable

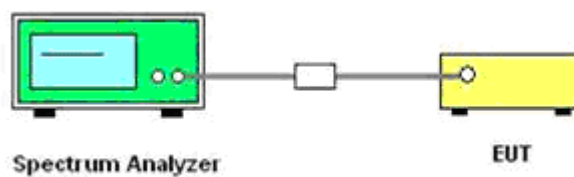
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

5.3.2 Test Setup Layout

For Radiated



For Conducted



5.3.3. Measuring Instruments and Setting

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

5.3.4. Test Procedures

Radiated Method:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0° to 360° to acquire the highest emissions from EUT.



3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed..
5. The distance between test antenna and EUT was 3 meter:
6. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto Average Value: RBW=1MHz/VBW=10Hz, Sweep time=Auto	Peak

Conducted Method:

According to KDB 558074 D01 for Antenna-port conducted measurement. Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to an EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=1/B for AV detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency (see 12.2.2, 12.2.3, and 12.2.4 for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Convert the result ant EIRP level to an equivalent electric field strength using the following relationship:

$$E = \text{EIRP} - 20\log D + 104.77 = \text{EIRP} + 95.23$$

Where:

E = electric field strength in dBμV/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.
12. Per KDB662911 D01 section b) In cases where a combination of conducted measurements and cabinet radiated measurements are permitted to demonstrate compliance with absolute radiated out-of-band and spurious limits (e.g., KDB Publications 558074 for DTS and 789033 for U-NII), the conducted measurements must be combined with directional gain to compute the radiated levels of the out-of-band and spurious emissions as described in this section.
13. Compare the resultant electric field strength level to the applicable regulatory limit.
14. Perform radiated spurious emission test duress until all measured frequencies were complete.



5.3.5 Test Results

Pass

According to 15.205, the restrict band is far from working frequency, it consider to compliance with 15.205(a) from radiated emission result in 5.2.7 of this report



5.4. Power line conducted emissions

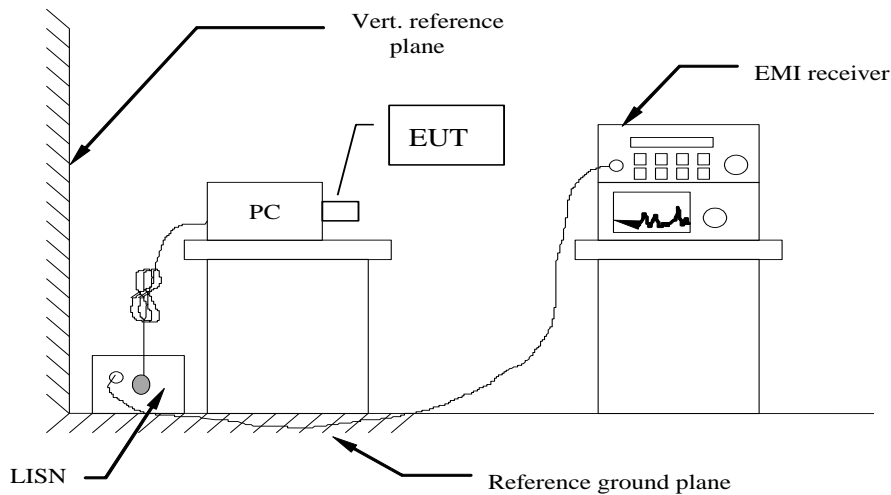
5.4.1 Standard Applicable

According to §15.207 (a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBµV)	
	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

* Decreasing linearly with the logarithm of the frequency

5.4.2 Block Diagram of Test Setup



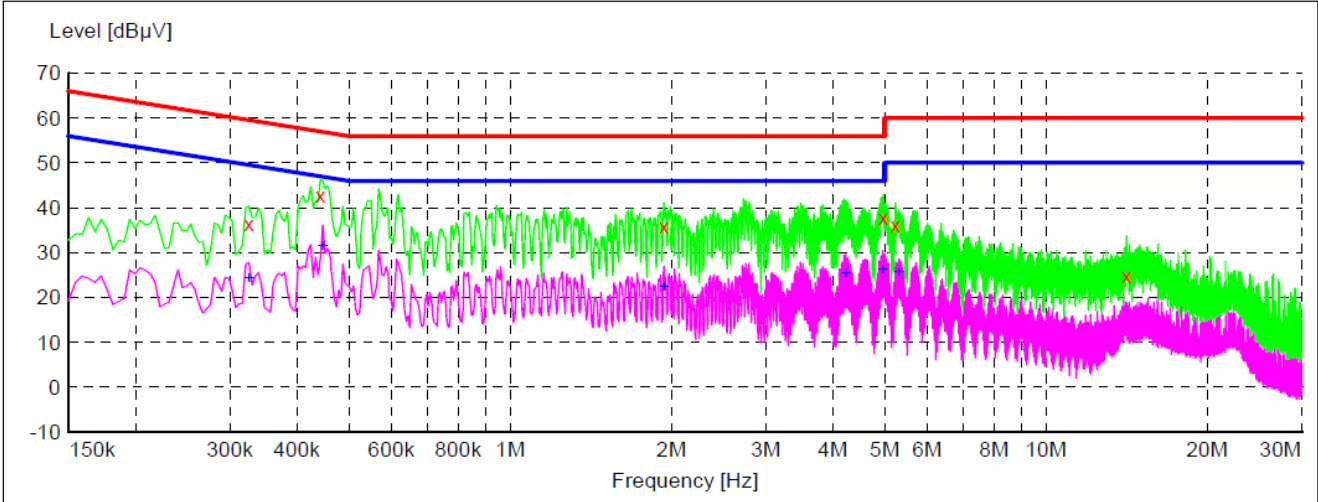
5.4.3 Test Results

Temperature	24.5°C	Humidity	56%
Test Engineer	Anna Hu	Configurations	

Pass



Neutral Line



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.325500	36.30	10.1	60	23.3	QP	N	GND
0.442500	42.70	10.0	57	14.3	QP	N	GND
1.936500	35.70	9.7	56	20.3	QP	N	GND
4.974000	37.70	9.8	56	18.3	QP	N	GND
5.235000	36.10	9.8	60	23.9	QP	N	GND
14.118000	24.90	9.8	60	35.1	QP	N	GND

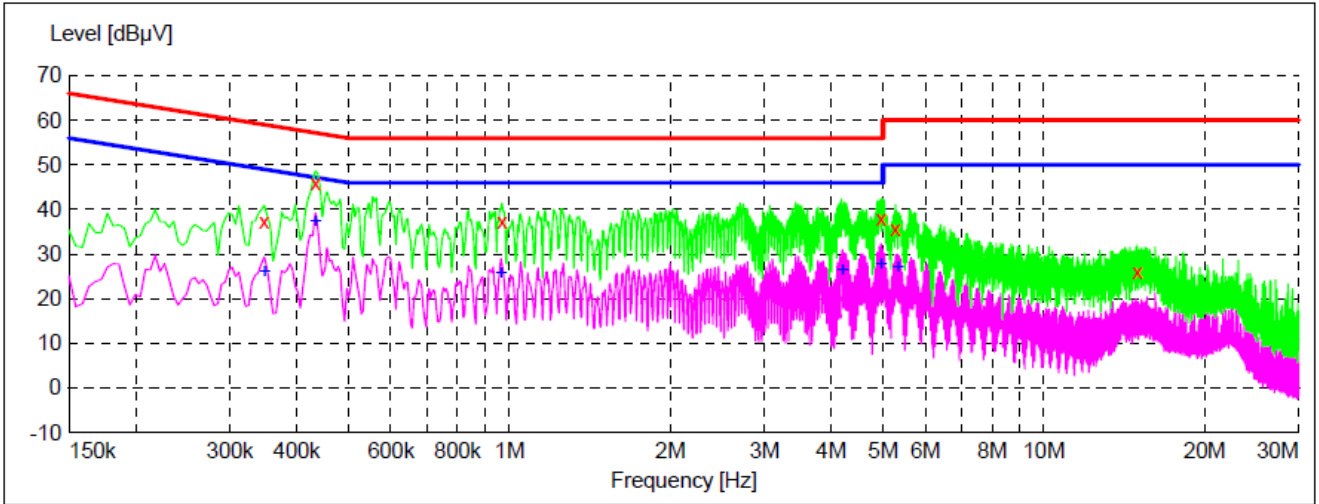
Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.325500	24.20	10.1	50	25.4	AV	N	GND
0.447000	31.30	10.0	47	15.6	AV	N	GND
1.936500	22.40	9.7	46	23.6	AV	N	GND
4.231500	25.40	9.7	46	20.6	AV	N	GND
4.956000	26.10	9.8	46	19.9	AV	N	GND
5.316000	25.70	9.8	50	24.3	AV	N	GND

Note:

1. Margin(dB)= Limit(dBµV) - -Level(dBµV)
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz), Step size: 4 kHz, Scan time: auto.
4. Pre-scan all modes and recorded the worst case results in this report



Live Line



Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.348000	37.10	10.1	59	21.9	QP	L1	GND
0.433500	45.90	10.0	57	11.3	QP	L1	GND
0.969000	37.10	9.8	56	18.9	QP	L1	GND
4.956000	38.00	9.8	56	18.0	QP	L1	GND
5.280000	35.70	9.8	60	24.3	QP	L1	GND
14.950500	26.00	9.8	60	34.0	QP	L1	GND

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.348000	26.00	10.1	49	23.0	AV	L1	GND
0.433500	37.20	10.0	47	10.0	AV	L1	GND
0.964500	25.60	9.8	46	20.4	AV	L1	GND
4.195500	26.40	9.7	46	19.6	AV	L1	GND
4.956000	27.70	9.8	46	18.3	AV	L1	GND
5.325000	27.00	9.8	50	23.0	AV	L1	GND

Note:

1. Margin(dB)= Limit(dBµV) - -Level(dBµV)
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz), Step size: 4 kHz, Scan time: auto.
4. Pre-scan all modes and recorded the worst case results in this report



5.5. Antenna Requirements

5.5.1. Standard Applicable

According to antenna requirement of §15.203.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

5.5.2. Antenna Connected Construction

5.5.2.1. Standard Applicable

According to § 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.

5.5.2.2. Antenna Connector Construction

The directional gains of antenna used for transmitting is 0.0dBi, and the antenna is a Internal antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

5.5.2.3. Results: Compliance.



5.6. 20 dB Spectrum Bandwidth Measurement

5.6.1. Standard Applicable

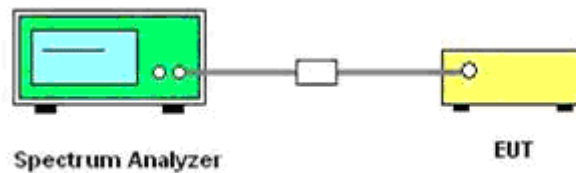
According to antenna requirement of §15.215

(c) 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 the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated

5.4.2. Test Procedures

1. Set the centre frequency of the spectrum analyzer to the transmitting frequency;
2. Set the span=0MHz, RBW=100kHz, VBW=300kHz, Sweep time=100ms;
3. Detector = peak;
4. Trace mode = Single hold.

5.6.3. Test Setup Layout



5.6.4. EUT Operation during Test

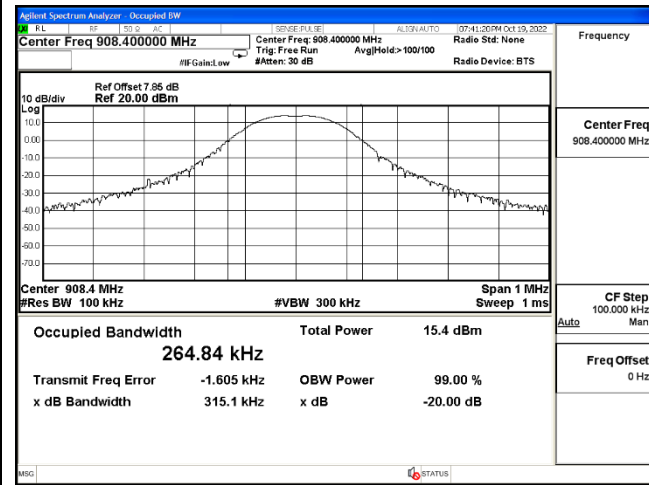
The EUT was programmed to be in continuously transmitting mode.

5.4.5. Test Result

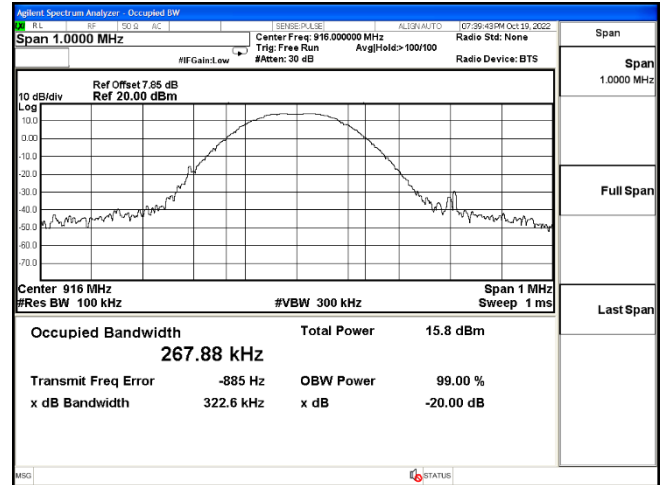
Frequency(MHz)	20 dB Bandwidth (kHz)
908.4	315.1
916.0	322.6



On Time and Duty Cycle



908.4MHz



916.0MHz



6. LIST OF MEASURING EQUIPMENTS

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
1	MXA Signal Analyzer	Keysight	N9020A	MY52091623	2022/1/13	2023/1/12
2	Power Sensor	Agilent	U2021XA	MY5365004	2022/1/13	2023/1/12
3	Power Meter	Agilent	U2531A	TW53323507	2022/1/13	2023/1/12
4	Loop Antenna	schwarzbeck	FMZB1519B	00023	2019/11/16	2022/11/15
5	Wideband Antenna	schwarzbeck	VULB 9163	958	2019/11/16	2022/11/15
6	Horn Antenna	schwarzbeck	9120D-1141	1574	2019/11/16	2022/11/15
7	EMI Test Receiver	R&S	ESCI	100849/003	2022/1/12	2023/1/11
8	Controller	MF	MF7802	N/A	N/A	N/A
9	Amplifier	schwarzbeck	BBV 9743	209	2022/1/12	2023/1/11
10	Amplifier	Tonscend	TSAMP-0518SE	--	2022/1/12	2023/1/11
11	RF Cable(below 1GHz)	HUBER+SUHNER	RG214	N/A	2022/1/12	2023/1/11
12	RF Cable(above 1GHz)	HUBER+SUHNER	RG214	N/A	2022/1/14	2023/1/13
12	Artificial Mains	ROHDE & SCHWARZ	ENV 216	101333-IP	2022/1/13	2023/1/12
14	EMI Test Software	ROHDE & SCHWARZ	ESK1	V1.71	N/A	N/A
15	RE test software	Tonscend	JS32-RE	V2.0.2.0	N/A	N/A
16	Test Software	Tonscend	JS1120-3	V2.5.77.0418	N/A	N/A
17	Horn Antenna	A-INFO	LB-180400-KF	J211020657	2022/10/12	2024/10/11
18	Amplifier	CDSA	PAP-1840	17021	2022/10/10	2023/10/09
19	Spectrum Analyzer	R&S	FSP40	100550	2022/1/10	2023/1/9



7. TEST SETUP PHOTOGRAPHS OF EUT

Please refer to separated files for Test Setup Photos of the EUT.

8. EXTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for External Photos of the EUT.

9. INTERIOR PHOTOGRAPHS OF THE EUT

Please refer to separated files for Internal Photos of the EUT.

-----THE END OF REPORT-----