

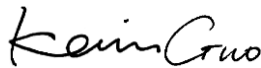
MEASUREMENT REPORT

FCC PART 15.247/ IC RSS-247

FCC ID: 2ASC3WA0867A
IC: 24992-WA0867A
Applicant: Positec Technology (China) Co., Ltd.

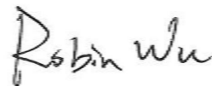
Application Type: Certification
Product: Gateway
Model No.: WA0867.A
Brand Name: WORX
FCC Classification: Digital Transmission System (DTS)
FCC Rule Part(s): Part 15 Subpart C (Section 15.247)
IC Rule(s): RSS-247 Issue 2, RSS-GEN Issue 5
Test Procedure(s): ANSI C63.10-2013
Test Date: December 16 ~ December 26, 2019

Reviewed By:



(Kevin Guo)

Approved By:



(Robin Wu)



The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Suzhou) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
1908RSU009-U1	Rev. 01	Initial Report	02-27-2020	Valid

CONTENTS

Description	Page
1. INTRODUCTION	6
1.1. Scope	6
1.2. MRT Test Location.....	6
2. PRODUCT INFORMATION.....	7
2.1. Feature of Equipment under Test	7
2.2. Product Specification Subjective to this Report	7
2.3. Description of Available Antennas	8
2.4. Description of Antenna RF Port	8
2.5. Test Mode	8
2.6. Test Software	8
2.7. Duty Cycle	9
2.8. EMI Suppression Device(s)/Modifications.....	9
2.9. Labeling Requirements	10
3. DESCRIPTION of TEST	11
3.1. Evaluation Procedure.....	11
3.2. AC Line Conducted Emissions.....	11
3.3. Radiated Emissions	12
4. ANTENNA REQUIREMENTS	13
5. TEST EQUIPMENT CALIBRATION DATE.....	14
6. MEASUREMENT UNCERTAINTY.....	16
7. TEST RESULT	17
7.1. Summary	17
7.2. 99%Bandwidth Measurement	18
7.2.1. Test Limit	18
7.2.2. Test Procedure used	18
7.2.3. Test Setting	18
7.2.4. Test Setup	18
7.2.5. Test Result	19
7.3. 6dB Bandwidth Measurement	20
7.3.1. Test Limit	20
7.3.2. Test Procedure used	20
7.3.3. Test Setting	20
7.3.4. Test Setup	20

7.3.5.	Test Result	21
7.4.	Output Power Measurement	22
7.4.1.	Test Limit	22
7.4.2.	Test Procedure Used.....	22
7.4.3.	Test Setting	22
7.4.4.	Test Setup	22
7.4.5.	Test Result	23
7.5.	Power Spectral Density Measurement.....	24
7.5.1.	Test Limit	24
7.5.2.	Test Procedure Used.....	24
7.5.3.	Test Setting	24
7.5.4.	Test Setup	25
7.5.5.	Test Result	26
7.6.	Conducted Band Edge and Out-of-Band Emissions.....	28
7.6.1.	Test Limit	28
7.6.2.	Test Procedure Used.....	28
7.6.3.	Test Settintg	28
7.6.4.	Test Setup	29
7.6.5.	Test Result	30
7.7.	Radiated Spurious Emission Measurement.....	32
7.7.1.	Test Limit	32
7.7.2.	Test Procedure Used.....	32
7.7.3.	Test Setting	32
7.7.4.	Test Setup	34
7.7.5.	Test Result	35
7.8.	AC Conducted Emissions Measurement	39
7.8.1.	Test Limit	39
7.8.2.	Test Setup	39
7.8.3.	Test Result	40
8.	CONCLUSION	42
	Appendix A - Test Setup Photograph.....	43
	Appendix B - EUT Photograph	44

General Information

Applicant:	Positec Technology (China) Co., Ltd.
Applicant Address:	18, Dongwang Road, Suzhou Industrial park, Jiangsu 215123, P.R. China
Manufacturer:	Positec Technology (China) Co., Ltd.
Manufacturer Address:	18, Dongwang Road, Suzhou Industrial park, Jiangsu 215123, P.R. China
Test Site:	MRT Technology (Suzhou) Co., Ltd
Test Site Address:	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China
Test Device Serial No.:	N/A ☐ Production ☒ Pre-Production ☐ Engineering

Test Facility / Accreditations

Measurements were performed at MRT Laboratory located in Tian'edang Rd., Suzhou, China.

- MRT facility is a FCC registered (MRT Designation No. CN1166) test facility with the site description report on file and has met all the requirements specified in ANSI C63.4-2014.
- MRT facility is an IC registered (MRT Reg. No. 11384A-1) test laboratory with the site description on file at Industry Canada.
- MRT facility is a VCCI registered (R-20025, G-20034, C-20020, T-20020) test laboratory with the site description on file at VCCI Council.
- MRT Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) under the American Association for Laboratory Accreditation Program (A2LA Cert. No. 3628.01) in EMC, Telecommunications, Radio and SAR testing.



1. INTRODUCTION

1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Innovation, Science and Economic Development Canada and Certification and Engineering Bureau.

1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taihu Lake. These measurement tests were conducted at the MRT Technology (Suzhou) Co., Ltd. Facility located at D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China. The measurement facility compliant with the test site requirements specified in ANSI C63.4-2014.



2. PRODUCT INFORMATION

2.1. Feature of Equipment under Test

Product Name:	Gateway
Model No.:	WA0867.A
Brand Name:	WORX
Operating Frequency:	911MHz
Wi-Fi Specification:	802.11b/g/n
Working Voltage:	AC 120V/60Hz

2.2. Product Specification Subjective to this Report

Operating Frequency:	911MHz
Type of Modulation:	ASK
Channel Number:	1
Antenna Information:	Refer to section 2.3

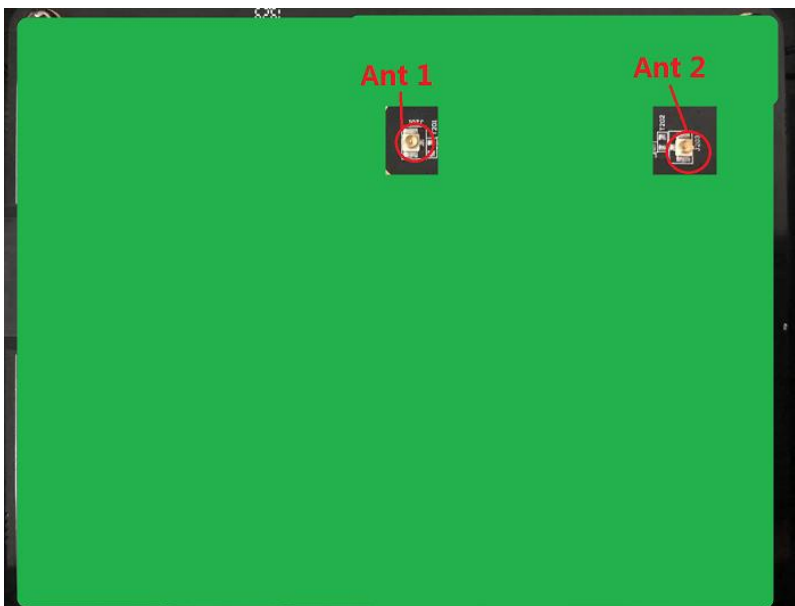
Note: For other features of the EUT, test report will be issued separately.

2.3. Description of Available Antennas

Antenna No.	Type	Frequency Band (MHz)	Max Peak Gain (dBi)
1	Dipole	911	1.3dBi
2			1.3dBi

Note: The EUT supports SISO only.

2.4. Description of Antenna RF Port

Gateway Antenna RF Port		
--	RF Port	
Software Control Port	Ant 1	Ant 2
		

2.5. Test Mode

Test Mode
Mode 1: Transmit at 911MHz by Ant 1.
Mode 2: Transmit at 911MHz by Ant 2.

2.6. Test Software

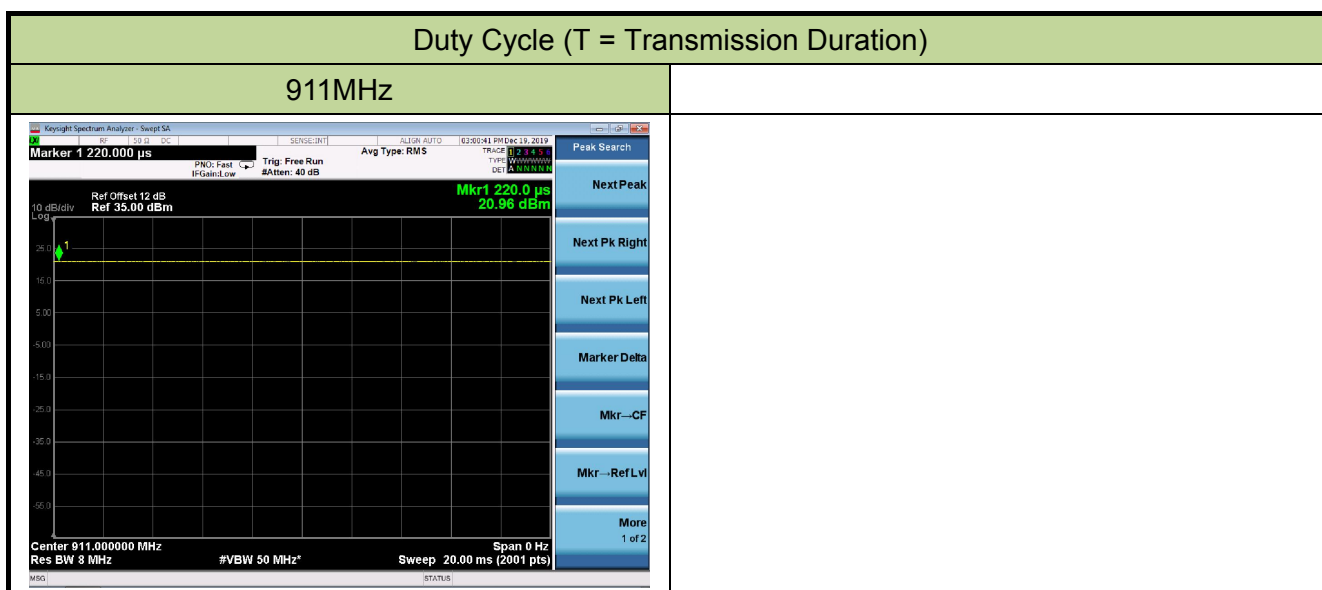
The test utility software used during testing was engineering directive order by manufacturer.

2.7. Duty Cycle

2.4G Transmitter, the maximum achievable duty cycles for all modes were determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz, and detector = RMS. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100.

The duty cycles are as follows:

Test Mode	Duty Cycle
Gateway	100%



2.8. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.9. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase.

However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

RSP-100 Issue 12 Section 5

In addition to complying with the applicable RSSs and RSP-100, each unit of a product model (i.e. of a radio apparatus) shall meet the labelling requirements set out in this section prior to being marketed in Canada or imported into Canada.

If the dimensions of the product are extremely small or it is not practical to place the label or marking on the product, and if electronic labelling cannot be implemented, the label shall be placed in a prominent location in the user manual supplied with the product, as agreed upon with ISED prior to the certification application. The user manual may be in an electronic format; if it is not supplied to the user, the user manual must be readily available.

3. DESCRIPTION of TEST

3.1. Evaluation Procedure

The measurement procedures described in the American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices (ANSI C63.10-2013), and the guidance was used in the measurement of the device.

Deviation from measurement procedure.....None

3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 8'x4'x4' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment whichever determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.

For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.

Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, whichever produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.

4. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

“An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antenna of the device is **permanently attached**.
- There are no provisions for connection to an external antenna.

Conclusion:

The device unit complies with the requirement of §15.203.

5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions - SR2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06185	1 year	2020/04/15
Two-Line V-Network	R&S	ENV 216	MRTSUE06002	1 year	2020/06/13
Two-Line V-Network	R&S	ENV 216	MRTSUE06003	1 year	2020/06/13
Thermohygrometer	Testo	608-H1	MRTSUE06404	1 year	2020/08/08
Shielding Room	MIX-BEP	Chamber-SR2	MRTSUE06215	N/A	N/A

Radiated Emissions - AC1

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESR7	MRTSUE06001	1 year	2020/08/01
PXA Signal Analyzer	Keysight	9030B	MRTSUE06395	1 year	2020/09/03
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/13
Bilog Period Antenna	Schwarzbeck	VULB 9168	MRTSUE06172	1 year	2020/03/31
Broad Band Horn Antenna	Schwarzbeck	BBHA 9120D	MRTSUE06023	1 year	2020/10/13
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2020/12/17
Microwave System Amplifier	Agilent	83017A	MRTSUE06076	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Thermohygrometer	Testo	608-H1	MRTSUE06403	1 year	2020/08/08
Anechoic Chamber	TDK	Chamber-AC1	MRTSUE06212	1 year	2020/04/30

Radiated Emission - AC2

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
Spectrum Analyzer	Keysight	N9038A	MRTSUE06125	1 year	2020/08/01
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2020/11/13
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06022	1 year	2020/10/13
Horn Antenna	Schwarzbeck	BBHA9120D	MRTSUE06171	1 year	2020/10/27
Broad Band Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06024	1 year	2020/12/17
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06176	1 year	2020/11/15
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2020/06/11
Temperature/Humidity Meter	Minggao	ETH529	MRTSUE06170	1 year	2020/12/13
Anechoic Chamber	RIKEN	Chamber-AC2	MRTSUE06213	1 year	2020/04/30

Conducted Test Equipment - TR3

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EXA Signal Analyzer	Agilent	N9020A	MRTSUE06106	1 year	2020/04/15
EXA Signal Analyzer	Keysight	N9010B	MRTSUE06452	1 year	2020/07/11
Signal Analyzer	R&S	FSV40	MRTSUE06218	1 year	2020/04/15
Power Meter	Agilent	U2021XA	MRTSUE06030	1 year	2020/11/17
USB wideband power sensor	Keysight	U2021XA	MRTSUE06446	1 year	2020/06/30
USB wideband power sensor	Keysight	U2021XA	MRTSUE06447	1 year	2020/06/30
Bluetooth Test Set	Anritsu	MT8852B-042	MRTSUE06389	1 year	2020/06/13
Audio Analyzer	Agilent	U8903B	MRTSUE06143	1 year	2020/06/13
Modulation Analyzer	HP	8901A	MRTSUE06098	1 year	2020/10/10
Wideband Radio Communication Tester	R&S	CMW 500	MRTSUE06243	1 year	2020/11/07
DC Power Supply	GWINSTEK	DPS-3303C	MRTSUE06064	N/A	N/A
Temperature & Humidity Chamber	BAOYT	BYH-150CL	MRTSUE06051	1 year	2020/11/07
Thermohygrometer	testo	608-H1	MRTSUE06401	1 year	2020/08/08

Software	Version	Function
EMI Software	V3	EMI Test Software

6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT 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 $k = 2$.

AC Conducted Emission Measurement - SR2	
The maximum measurement uncertainty is evaluated as:	
9kHz~150kHz: 3.84dB	
150kHz~30MHz: 3.46dB	
Radiated Emission Measurement - AC1	
The maximum measurement uncertainty is evaluated as:	
Horizontal:	30MHz~300MHz: 4.07dB
	300MHz~1GHz: 3.63dB
	1GHz~18GHz: 4.16dB
Vertical:	30MHz~300MHz: 4.18dB
	300MHz~1GHz: 3.60dB
	1GHz~18GHz: 4.76dB
Radiated Emission Measurement - AC2	
The maximum measurement uncertainty is evaluated as:	
Horizontal:	30MHz~300MHz: 3.75dB
	300MHz~1GHz: 3.53dB
	1GHz~18GHz: 4.28dB
Vertical:	30MHz~300MHz: 3.86dB
	300MHz~1GHz: 3.53dB
	1GHz~18GHz: 4.33dB

7. TEST RESULT

7.1. Summary

FCC Section(s)	IC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
N/A	RSS-Gen [6.7]	99% Bandwidth	N/A	Conducted	Pass	Section 7.2
15.247(a)(2)	RSS-247 [5.2]	6dB Bandwidth	$\geq 500\text{kHz}$		Pass	Section 7.3
15.247(b)(3)	RSS-247 [5.4(d)]	Output Power	$\leq 1\text{Watt}$ & $\text{EIRP} \leq 4\text{Watt}$		Pass	Section 7.4
15.247(e)	RSS-247 [5.2]	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$		Pass	Section 7.5
15.247(d)	RSS-247 [5.5]	Band Edge / Out-of-Band Emissions	$\leq 30\text{dBc}$ (Average)		Pass	Section 7.6
15.205 15.209	RSS-247 [5.5]	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 7.7
15.207	RSS-Gen [8.8]	AC Conducted Emissions 150kHz - 30MHz	$< \text{FCC } 15.207$ limits	Line Conducted	Pass	Section 7.8

Notes:

- 1) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
- 2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.

7.2. 99%Bandwidth Measurement

7.2.1.Test Limit

N/A

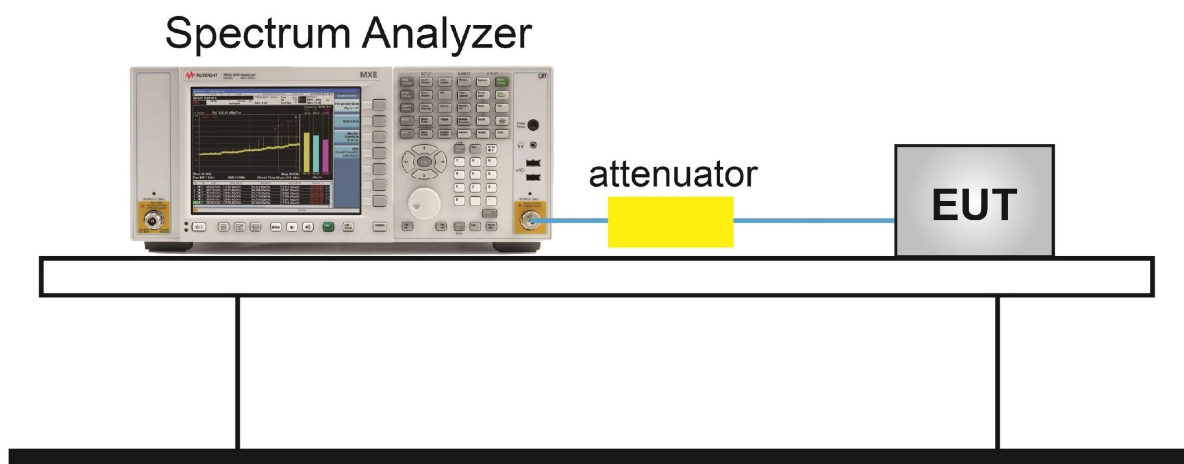
7.2.2.Test Procedure used

ANSI C63.10-2013 Section 6.9.3

7.2.3.Test Setting

1. Set center frequency to the nominal EUT channel center frequency.
2. Span = 1.5 times to 5.0 times the OBW.
3. RBW = 1 % to 5 % of the OBW.
4. VBW $\geq 3 \times$ RBW.
5. Detector = Peak.
6. Trace mode = max hold.
7. Use the 99 % power bandwidth function of the instrument.

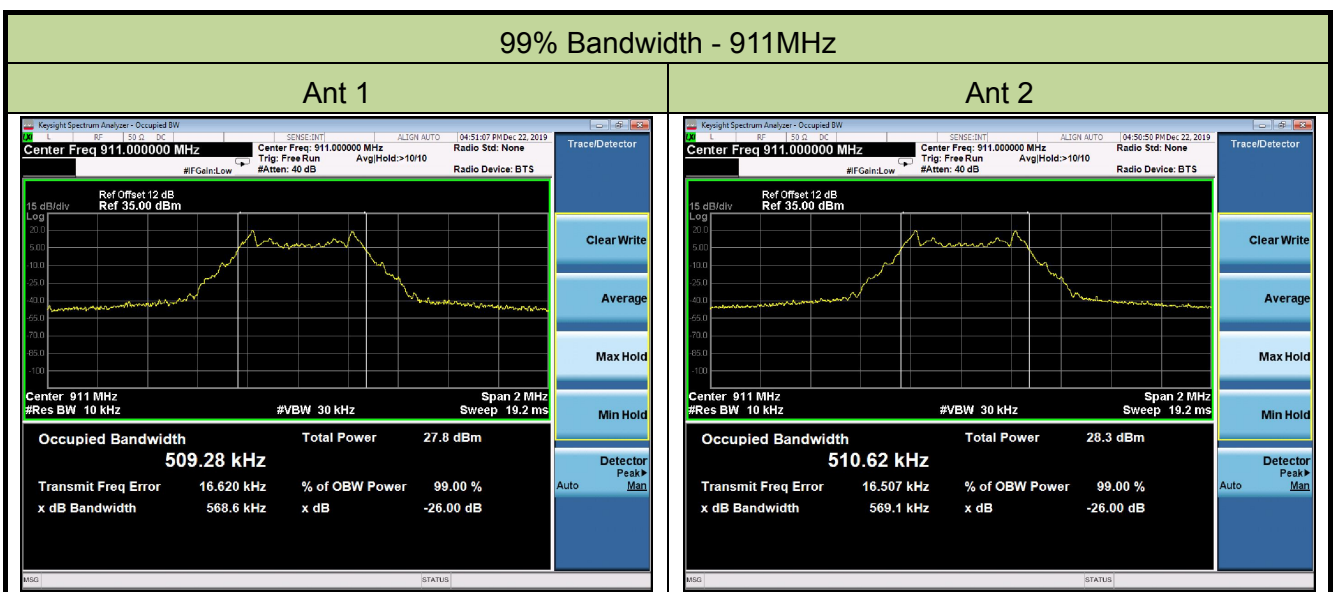
7.2.4.Test Setup



7.2.5. Test Result

Product	Gateway	Temperature	25°C
Test Engineer	Ternence Wang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/12/22

Test Mode	Frequency (MHz)	99% Bandwidth (MHz)	Result
Ant 1	911	0.51	Pass
Ant 2	911	0.51	Pass



7.3. 6dB Bandwidth Measurement

7.3.1. Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

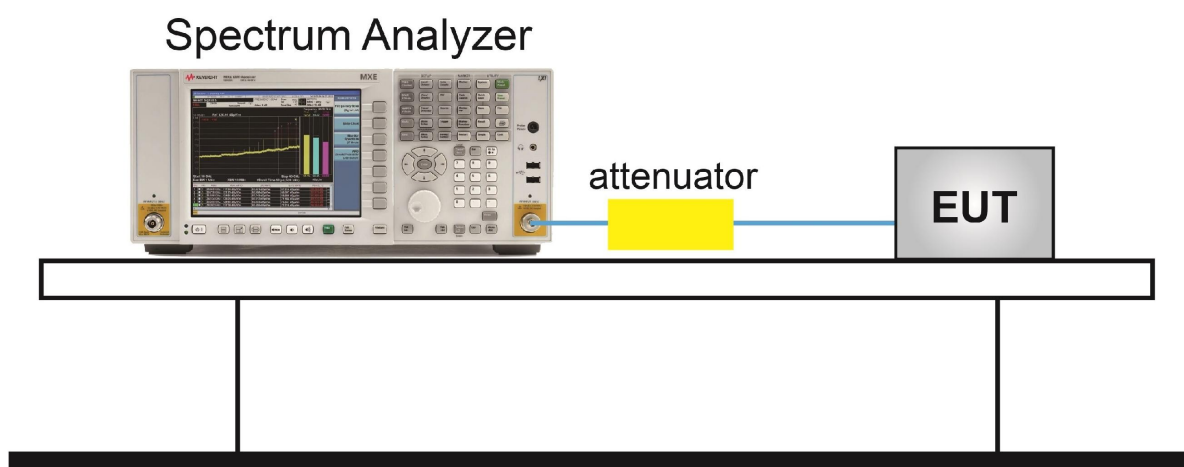
7.3.2. Test Procedure used

ANSI C63.10-2013 - Section 11.8

7.3.3. Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to $X = 6$. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3. $VBW \geq 3 \times RBW$
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace was allowed to stabilize

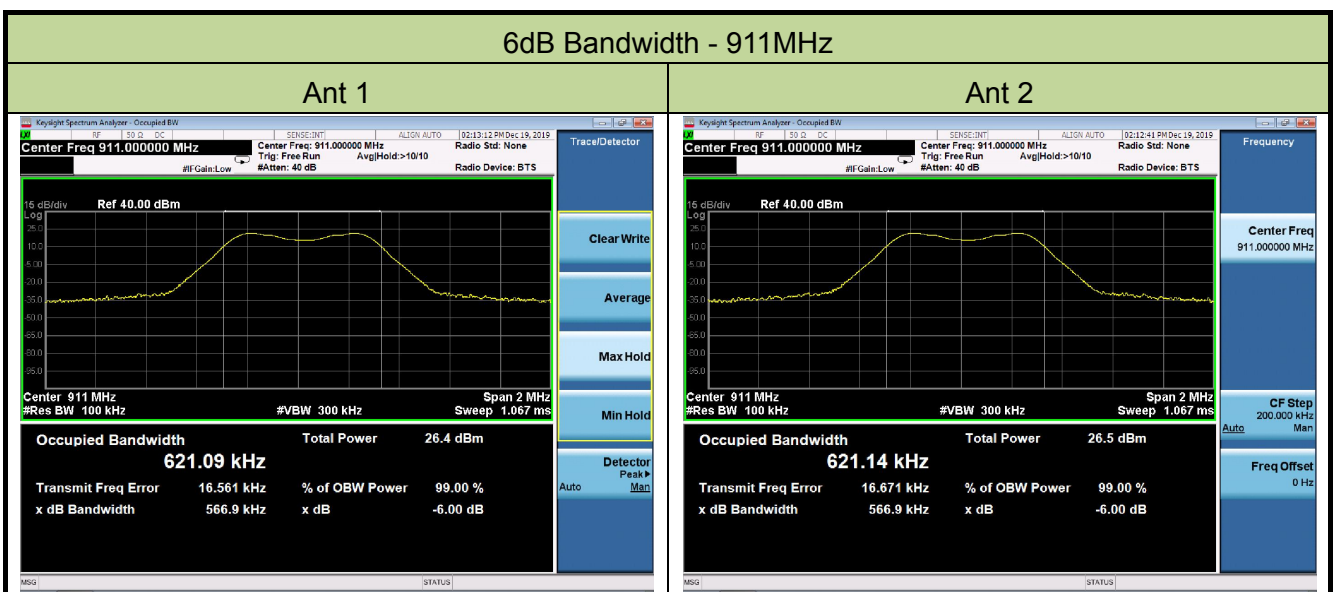
7.3.4. Test Setup



7.3.5. Test Result

Product	Gateway	Temperature	25°C
Test Engineer	Ternence Wang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/12/19

Test Mode	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Ant 1	911	0.57	≥ 0.5	Pass
Ant 2	911	0.57	≥ 0.5	Pass



7.4. Output Power Measurement

7.4.1. Test Limit

The maximum out power shall be less 1 Watt (30dBm) and the E.I.R.P shall not exceed 4 Watt (36.02dBm).

The conducted output power limit specified in paragraph FCC Part 15.247(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs FCC Part 15.247(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

7.4.2. Test Procedure Used

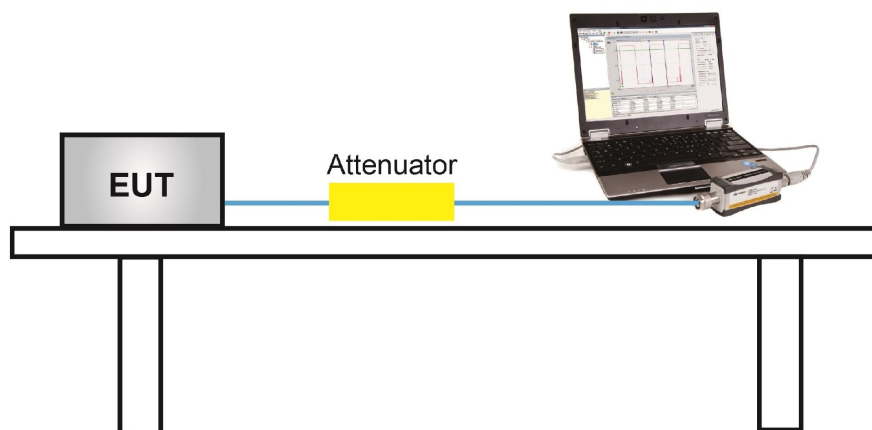
ANSI C63.10 - Section 11.9.2.3.2

7.4.3. Test Setting

Average Power Measurement

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

7.4.4. Test Setup



7.4.5. Test Result

Product	Gateway	Temperature	23°C
Test Engineer	Ternence Wang	Relative Humidity	51%
Test Site	TR3	Test Date	2019/12/19

Test Mode	Freq. (MHz)	Average Power (dBm)	Limit (dBm)	E.I.R.P (dBm)	E.I.R.P Limit (dBm)	Result
Ant 1	911	9.07	≤ 30.00	10.37	≤ 36.02	Pass
Ant 2	911	9.22	≤ 30.00	10.52	≤ 36.02	Pass

Note: E.I.R.P (dBm) = Average Power (dBm) + Antenna Gain (dBi), Antenna Gain = 1.3 dBi.

7.5. Power Spectral Density Measurement

7.5.1. Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

The same method of determining the conducted output power shall be used to determine the power spectral density.

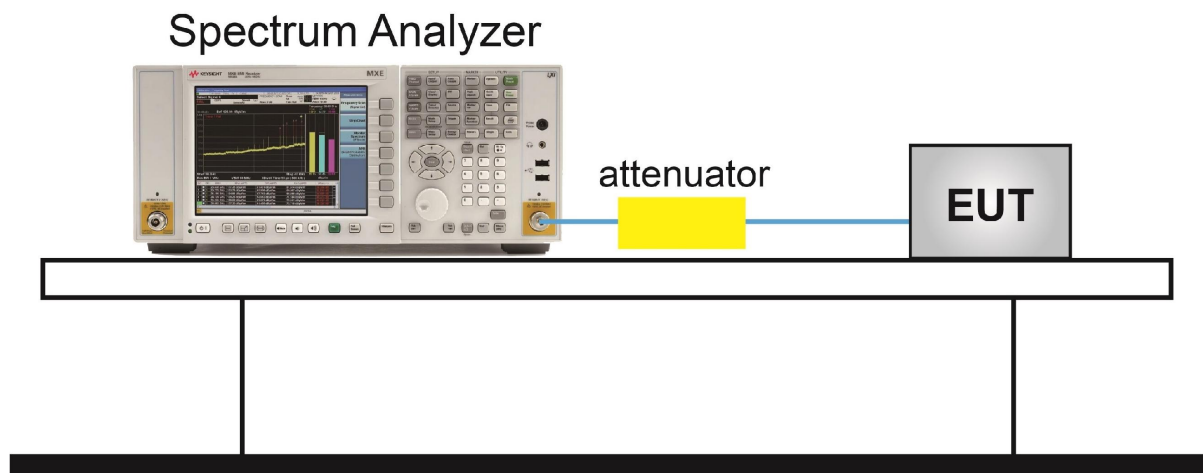
7.5.2. Test Procedure Used

ANSI C63.10 Section 11.10.5

7.5.3. Test Setting

1. Measure the duty cycle (x) of the transmitter output signal.
2. Set instrument center frequency to DTS channel center frequency.
3. Set span to at least 1.5 times the OBW.
4. RBW = 10 kHz.
5. VBW = 30 kHz.
6. Detector = RMS.
7. Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$.
8. Sweep time = auto couple.
9. Don't use sweep triggering. Allow sweep to "free run".
10. Employ trace averaging (RMS) mode over a minimum of 100 traces.
11. Use the peak marker function to determine the maximum amplitude level.
12. Add $10 \log (1/x)$, where x is the duty cycle measured in step (a), to the measured PSD to compute the average PSD during the actual transmission time.

7.5.4.Test Setup



7.5.5. Test Result

Product	Gateway	Temperature	23°C
Test Engineer	Ternence Wang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/12/19

Test Mode	Freq. (MHz)	AVGPSD (dBm / 10kHz)	Duty Cycle (%)	Final AVGPSD (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
Ant 1	911	12.97	100	7.74	≤ 8.00	Pass
Ant 2	911	13.18	100	7.95	≤ 8.00	Pass

Note: Final AVGPSD (dBm / 3kHz) = AVGPSD (dBm / 10kHz) + 10*Log(3/10).

Power Spectral Density – 911MHz

Ant 1



Ant 2



7.6. Conducted Band Edge and Out-of-Band Emissions

7.6.1. Test Limit

The limit for out-of-band spurious emissions at the band edge is 30dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100 kHz bandwidth per the PSD procedure.

7.6.2. Test Procedure Used

ANSI C63.10 Section 11.11

7.6.3. Test Setting

Reference level measurement

1. Set instrument center frequency to DTS channel center frequency
2. Set the span to ≥ 1.5 times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW $\geq 3 \times$ RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

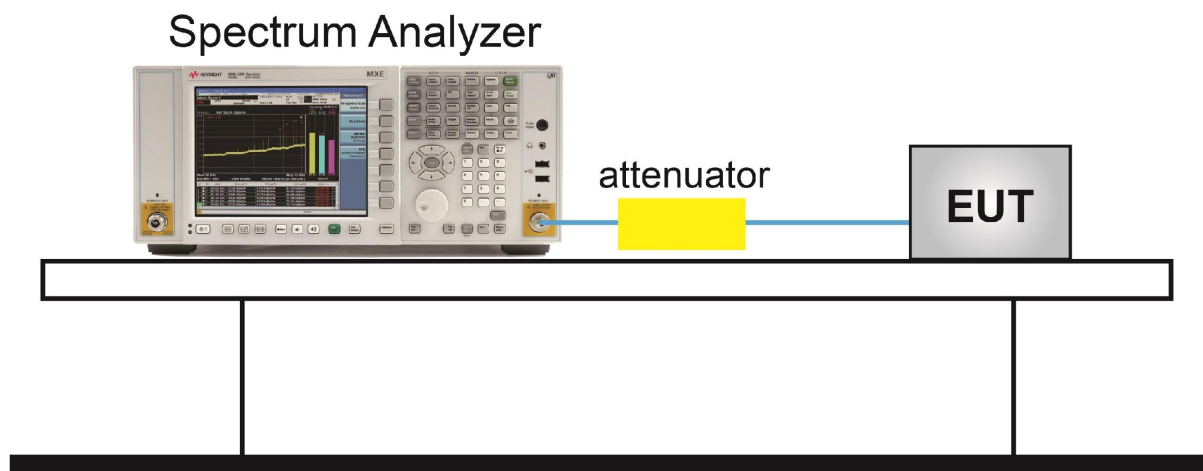
Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 1.3MHz
3. VBW = 4MHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Notes

1. RBW was set to 1.3MHz rather than 100 kHz in order to increase the measurement speed.
2. The display line shown in the following plots denotes the limit at 30dB below the fundamental emission level measured in a 100 kHz bandwidth. However, since the traces in the following plots are measured with a 1.3MHz RBW, the display line may not necessarily appear to be 30dB below the level of the fundamental in a 1.3MHz bandwidth.
3. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present

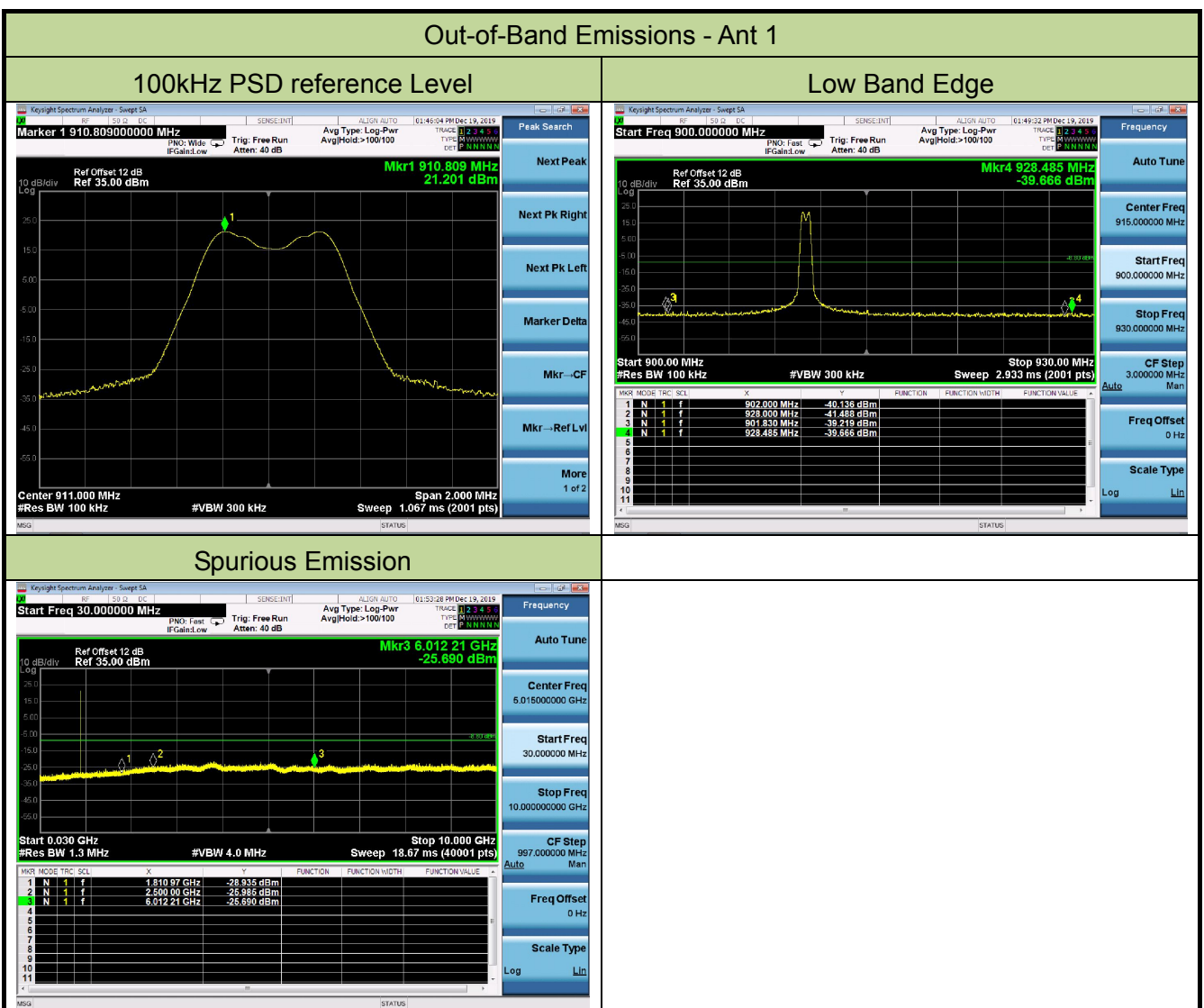
7.6.4.Test Setup



7.6.5. Test Result

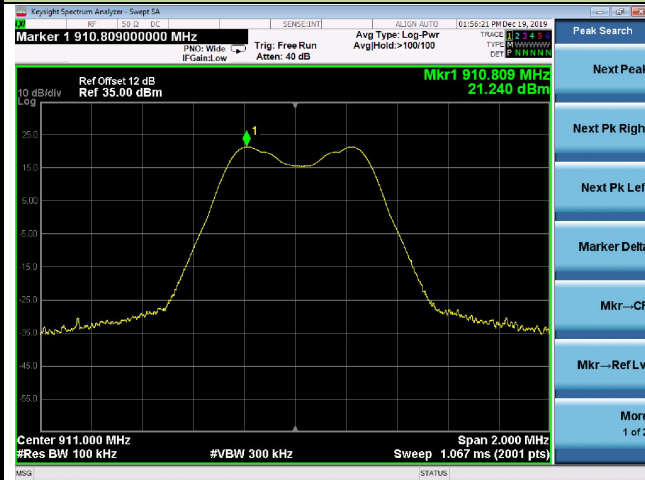
Product	Gateway	Temperature	23°C
Test Engineer	Ternence Wang	Relative Humidity	52%
Test Site	TR3	Test Date	2019/12/19

Test Mode / Bandwidth	Frequency (MHz)	Limit	Result
Ant 1	911	30dBc	Pass
Ant 2	911	30dBc	Pass

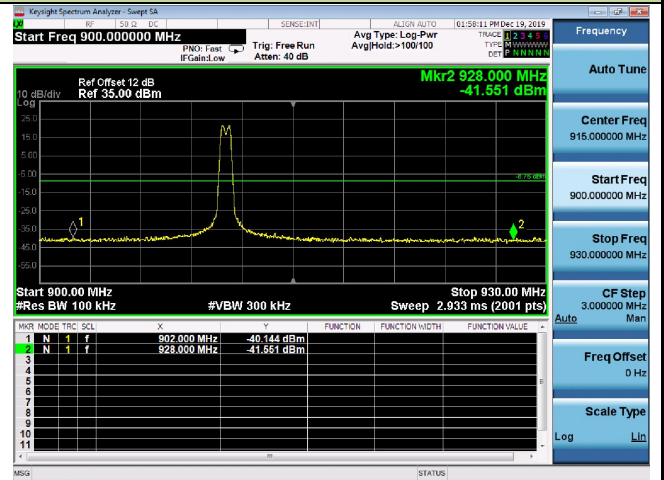


Out-of-Band Emissions - Ant 2

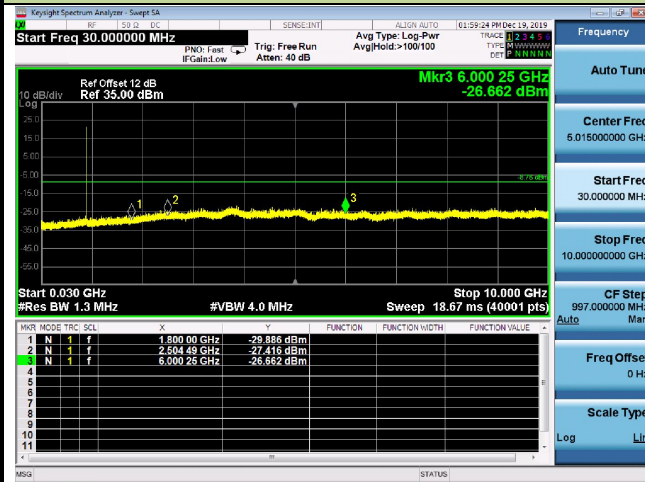
100kHz PSD reference Level



Low Band Edge



Spurious Emission



7.7. Radiated Spurious Emission Measurement

7.7.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [V/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

7.7.2. Test Procedure Used

ANSI C63.10 Section 6.3 (General Requirements)

ANSI C63.10 Section 6.4 (Standard test method below 30MHz)

ANSI C63.10 Section 6.5 (Standard test method above 30MHz to 1GHz)

ANSI C63.10 Section 6.6 (Standard test method above 1GHz)

7.7.3. Test Setting

Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Quasi-Peak Measurements below 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Span was set greater than 1MHz
3. RBW = as specified in Table 1
4. Detector = CISPR quasi-peak
5. Sweep time = auto couple
6. Trace was allowed to stabilize

Peak Measurements above 1GHz

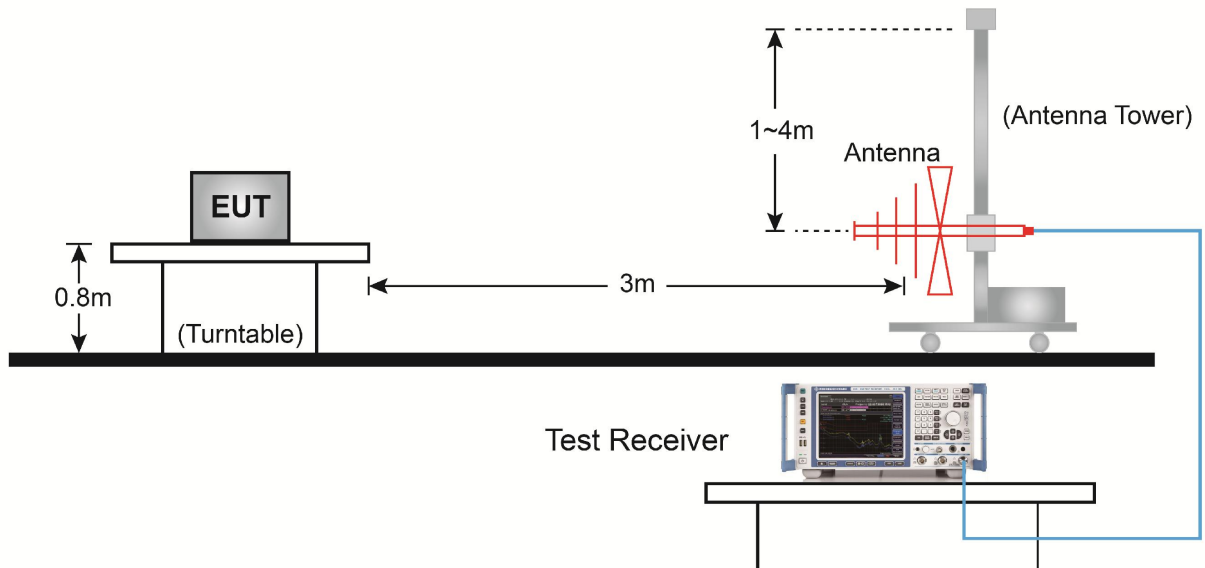
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Average Measurements above 1GHz (Method VB)

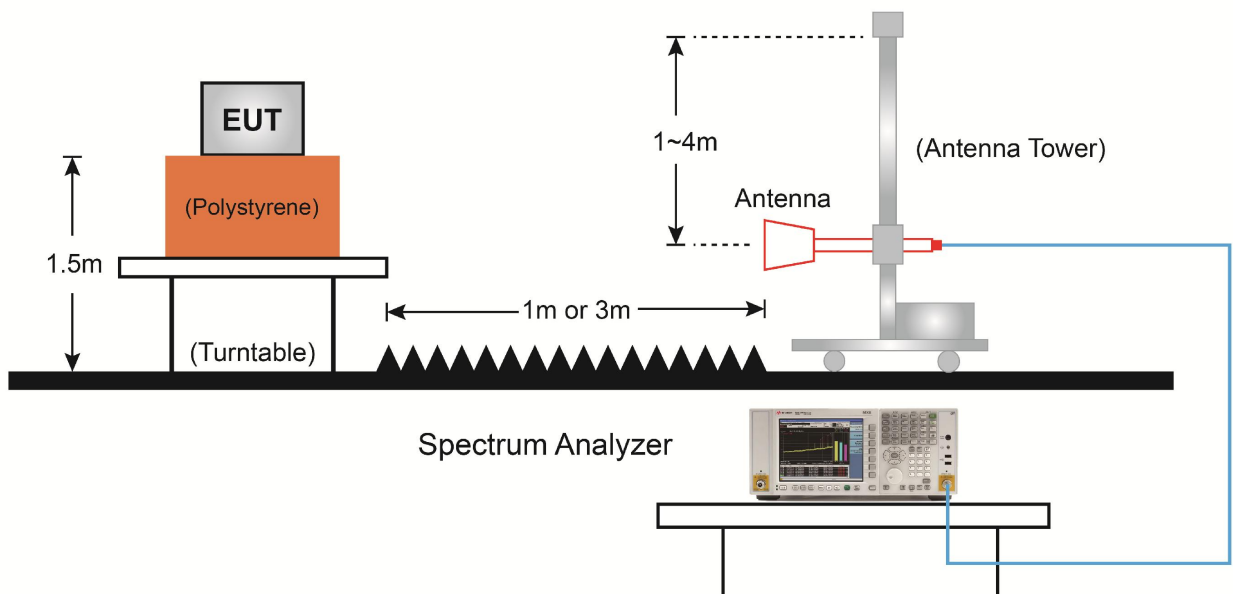
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW; If the EUT is configured to transmit with duty cycle $\geq 98\%$, set VBW = 10Hz
If the EUT duty cycle is $< 98\%$, set $\text{VBW} \geq 1/T$. T is the minimum transmission duration
4. Detector = Peak
5. Sweep time = auto
6. Trace mode = max hold
7. Trace was allowed to stabilize

7.7.4. Test Setup

Below 1GHz Test Setup:



Above 1GHz Test Setup:



7.7.5. Test Result

Product	Gateway	Temperature	26°C
Test Engineer	Kyrie Xie	Relative Humidity	56%
Test Site	AC1	Test Date	2019/12/19
Test Mode:	Ant 1	Frequency:	911MHz
Remark:	1. Average measurement was not performed if peak level lower than average limit (54dBμV/m). 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
*	1824.5	50.4	-4.0	46.4	86.5	-40.1	Peak	Horizontal
	2734.0	48.8	-0.1	48.7	74.0	-25.3	Peak	Horizontal
	4553.0	42.9	5.0	47.9	74.0	-26.1	Peak	Horizontal
*	5471.0	46.3	7.0	53.3	86.5	-33.2	Peak	Horizontal
	2734.0	49.0	-0.1	48.9	74.0	-25.1	Peak	Vertical
	4553.0	45.5	5.0	50.5	74.0	-23.5	Peak	Vertical
*	5462.5	50.0	7.0	57.0	86.5	-29.5	Peak	Vertical
*	6380.5	43.0	8.8	51.8	86.5	-34.7	Peak	Vertical

Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (116.5dBμV/m) or FCC 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

Product	Gateway	Temperature	26°C
Test Engineer	Kyrie Xie	Relative Humidity	56%
Test Site	AC1	Test Date	2019/12/19
Test Mode:	Ant 2	Frequency:	911MHz
Remark:	1. Average measurement was not performed if peak level lower than average limit (54dBμV/m). 2. Other frequency was 20dB below limit line within 1-18GHz, there is not show in the report.		

Mark	Frequency (MHz)	Reading Level (dBμV)	Factor (dB)	Measure Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Polarization
	2734.0	49.5	-0.1	49.4	74.0	-24.6	Peak	Horizontal
	4553.0	43.5	5.0	48.5	74.0	-25.5	Peak	Horizontal
*	5462.5	45.3	7.0	52.3	86.4	-34.1	Peak	Horizontal
*	6372.0	41.0	8.8	49.8	86.4	-36.6	Peak	Horizontal
	2734.0	48.4	-0.1	48.3	74.0	-25.7	Peak	Vertical
	4553.0	44.4	5.0	49.4	74.0	-24.6	Peak	Vertical
*	5462.5	49.2	7.0	56.2	86.4	-30.2	Peak	Vertical
*	6380.5	45.9	8.8	54.7	86.4	-31.7	Peak	Vertical

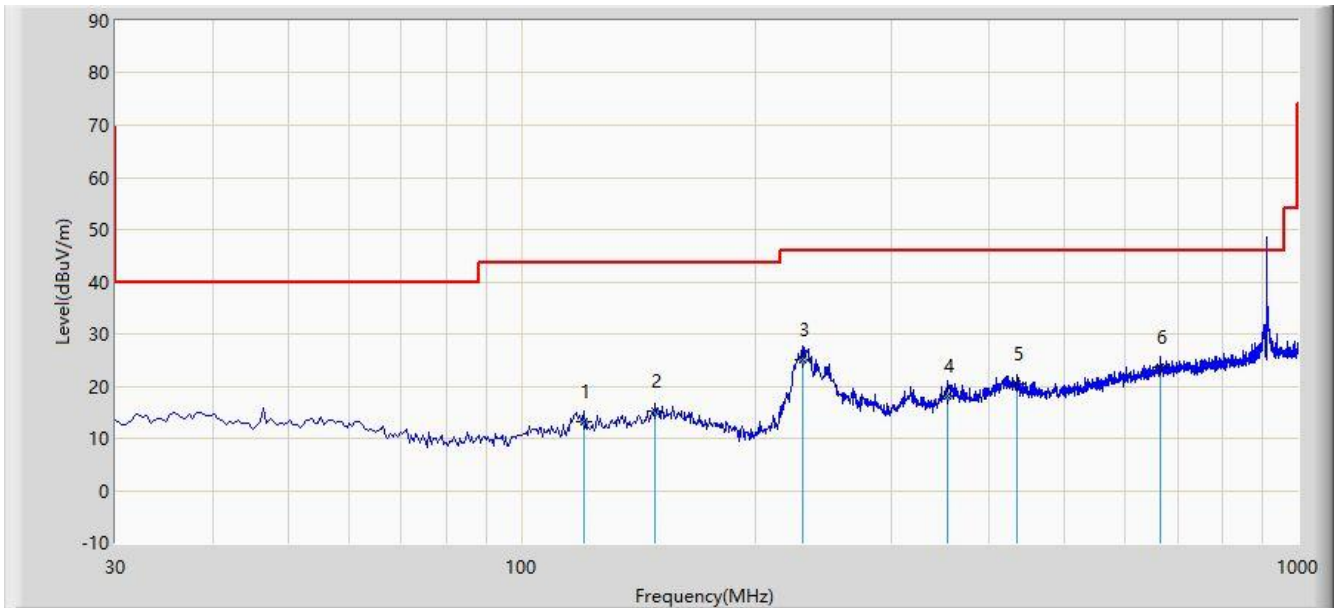
Note 1: "*" is not in restricted band, its limit is 30dBc of the fundamental emission level (116.4dBμV/m) or FCC 15.209 which is higher.

Note 2: Measure Level (dBμV/m) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m) - Pre_Amplifier Gain (dB)

The worst case of Radiated Emission below 1GHz:

Site: AC1	Time: 2019/12/20 - 21:49
Limit: FCC_Part15.209_RSE(3m)	Engineer: Kyrie Xie
Probe: VULB 9168 _20-2000MHz	Polarity: Horizontal
EUT: Gateway	Power: AC 120V/60Hz
Test Mode: There is the worst case within frequency range 30MHz~1GHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		*	120.210	13.292	0.100	-30.208	43.500	13.192	QP
2			148.825	15.292	0.130	-28.208	43.500	15.161	QP
3			229.840	25.024	12.470	-20.976	46.000	12.554	QP
4			353.980	18.163	2.580	-27.837	46.000	15.583	QP
5			434.900	20.567	3.100	-25.433	46.000	17.467	QP
6			664.800	23.739	2.100	-22.261	46.000	21.640	QP

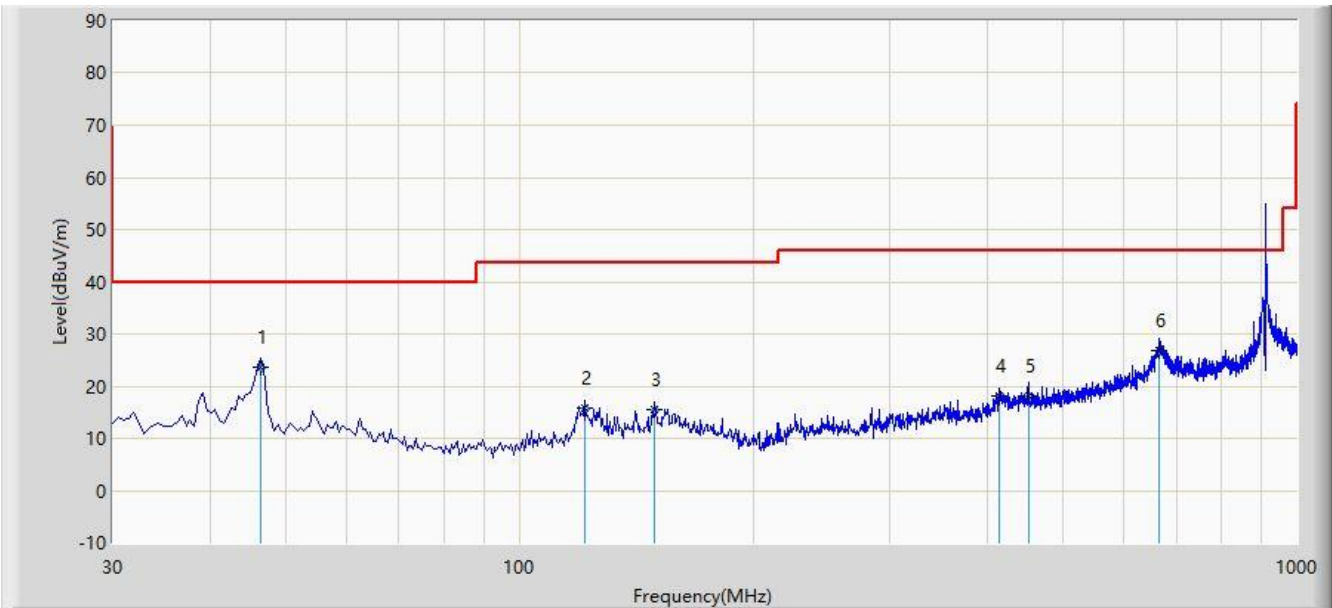
Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

Note 3: We don't mark the fundamental frequency (911MHz) in the data plot as above.

Site: AC1	Time: 2019/12/20 - 21:52
Limit: FCC_Part15.209_RSE(3m)	Engineer: Kyrie Xie
Probe: VULB 9168 _20-2000MHz	Polarity: Vertical
EUT: Gateway	Power: AC 120V/60Hz
Test Mode: There is the worst case within frequency range 30MHz~1GHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV/m)	Factor (dB)	Type
1			46.490	23.601	9.400	-16.399	40.000	14.200	QP
2			121.180	15.681	2.410	-27.819	43.500	13.271	QP
3			149.310	15.413	0.230	-28.087	43.500	15.183	QP
4			414.000	18.021	1.100	-27.979	46.000	16.920	QP
5			452.435	17.979	0.100	-28.021	46.000	17.879	QP
6		*	666.320	26.804	5.140	-19.196	46.000	21.664	QP

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)

Note 2: The test trace is same as the ambient noise and the amplitude of the emissions are attenuated more than 20dB below the permissible (the test frequency range: 9kHz ~ 30MHz, 18GHz ~ 25GHz), therefore no data appear in the report.

Note 3: We don't mark the fundamental frequency (911MHz) in the data plot as above.

7.8. AC Conducted Emissions Measurement

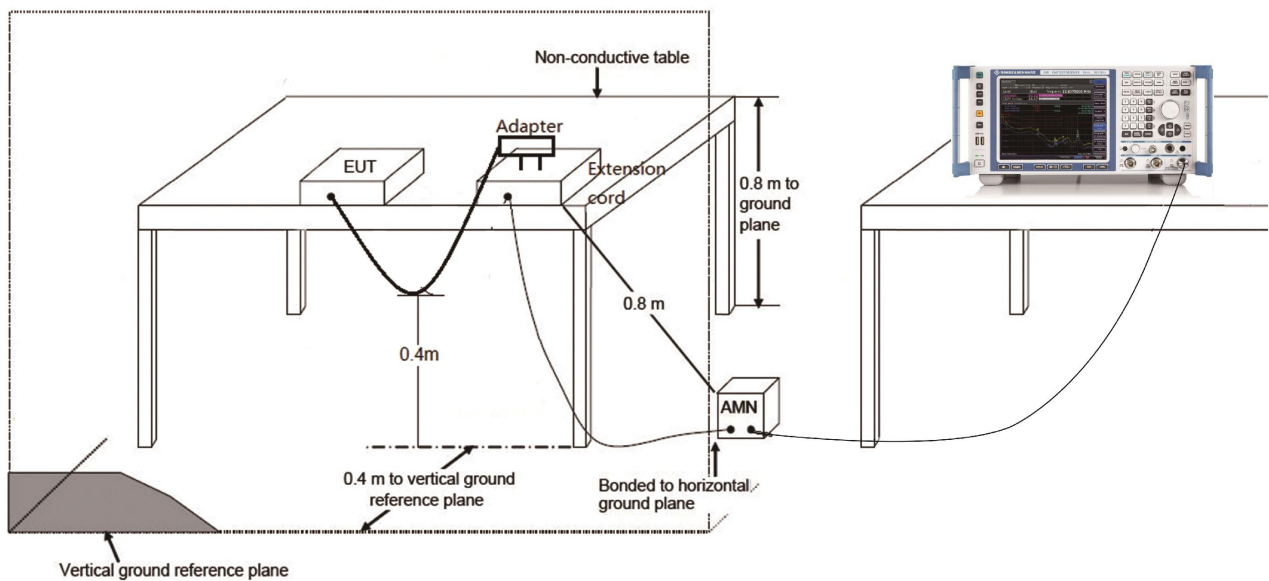
7.8.1. Test Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dB μ V)	Average (dB μ V)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

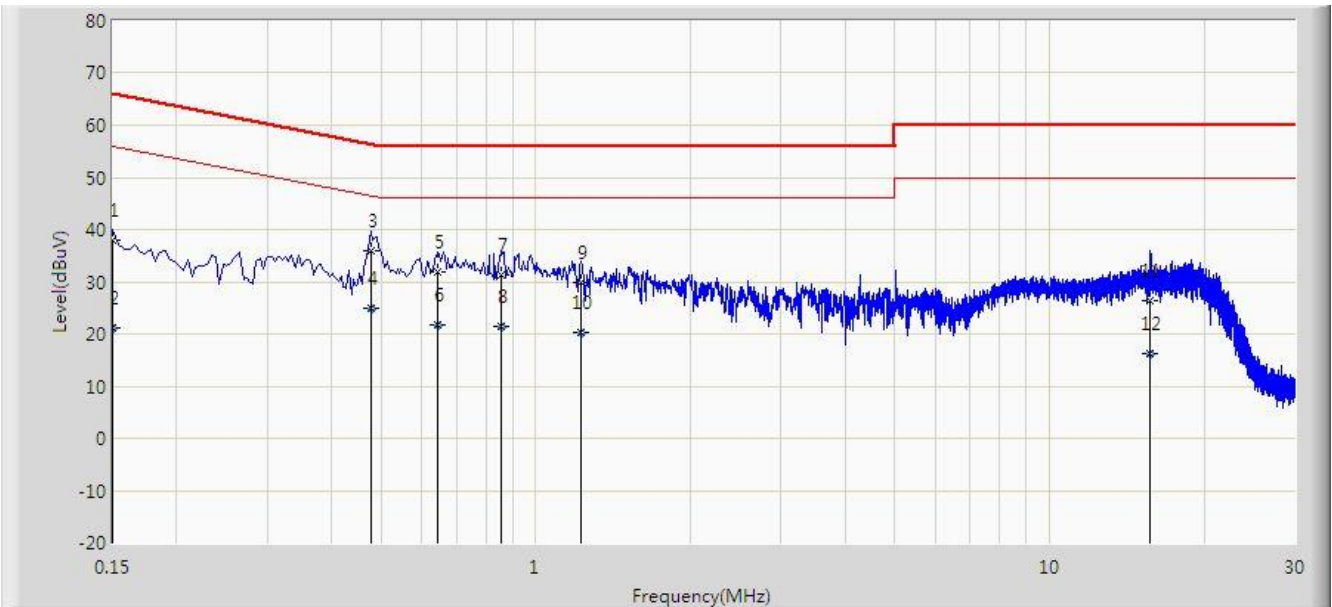
Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

7.8.2. Test Setup



7.8.3.Test Result

Site: SR2	Time: 2019/12/19 - 13:16
Limit: FCC_Part15.207_CE_AC Power	Engineer: Liz Yuan
Probe: ENV216_101683_Filter On	Polarity: Line
EUT: Gateway	Power: AC 120V/60Hz
Test Mode: Transmit at 911MHz	

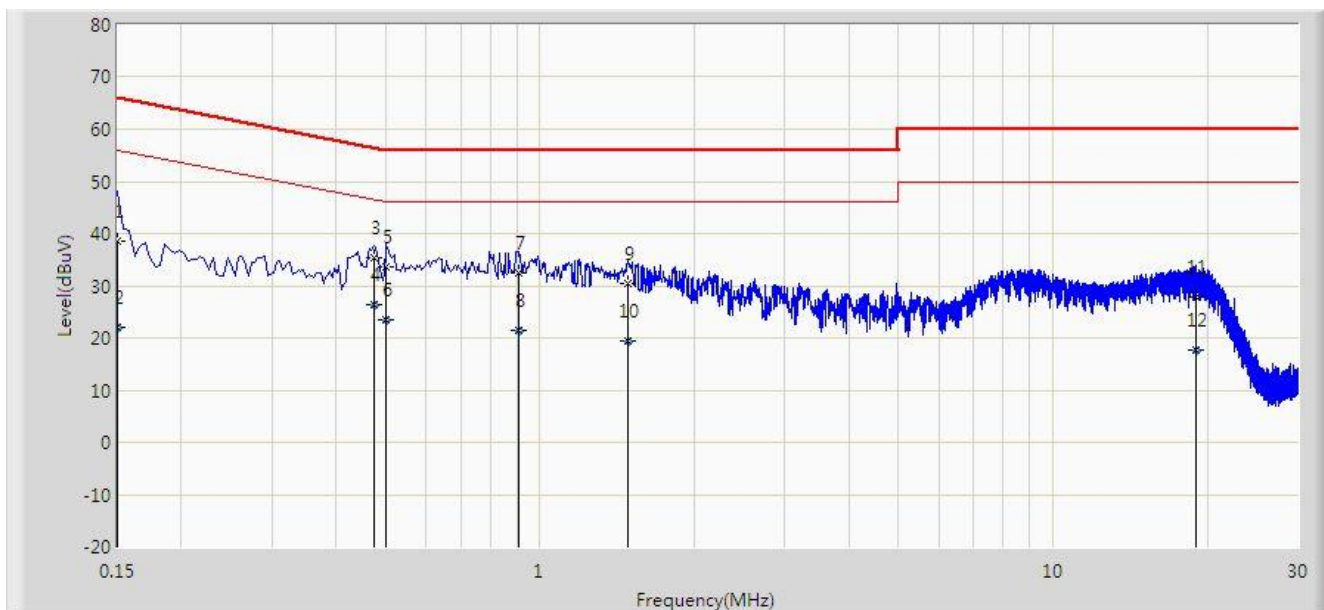


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV)	Factor (dB)	Type
1		*	0.150	38.016	26.848	-27.984	66.000	11.168	QP
2			0.150	21.166	9.998	-34.834	56.000	11.168	AV
3			0.478	36.016	25.868	-20.357	56.374	10.149	QP
4			0.478	25.058	14.909	-21.316	46.374	10.149	AV
5			0.646	31.856	21.765	-24.144	56.000	10.091	QP
6			0.646	21.689	11.598	-24.311	46.000	10.091	AV
7			0.858	31.303	21.321	-24.697	56.000	9.982	QP
8			0.858	21.321	11.340	-24.679	46.000	9.982	AV
9			1.226	29.756	19.856	-26.244	56.000	9.900	QP
10			1.226	20.194	10.293	-25.806	46.000	9.900	AV
11			15.706	26.514	16.447	-33.486	60.000	10.067	QP
12			15.706	16.314	6.247	-33.686	50.000	10.067	AV

Note: Measure Level (dBμV) = Reading Level (dBμV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

Site: SR2	Time: 2019/12/19 - 13:21
Limit: FCC_Part15.207_CE_AC Power	Engineer: Liz Yuan
Probe: ENV216_101683_Filter On	Polarity: Neutral
EUT: Gateway	Power: AC 120V/60Hz
Test Mode: Transmit at 911MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Margin (dB)	Limit (dBuV)	Factor (dB)	Type
1		*	0.150	38.418	27.276	-27.582	66.000	11.142	QP
2			0.150	21.891	10.749	-34.109	56.000	11.142	AV
3			0.474	35.218	25.051	-21.225	56.444	10.167	QP
4			0.474	26.508	16.341	-19.935	46.444	10.167	AV
5			0.502	33.663	23.485	-22.337	56.000	10.177	QP
6			0.502	23.377	13.199	-22.623	46.000	10.177	AV
7			0.906	32.608	22.647	-23.392	56.000	9.961	QP
8			0.906	21.443	11.482	-24.557	46.000	9.961	AV
9			1.482	30.464	20.573	-25.536	56.000	9.891	QP
10			1.482	19.339	9.448	-26.661	46.000	9.891	AV
11			19.010	27.964	17.820	-32.036	60.000	10.144	QP
12			19.010	17.560	7.416	-32.440	50.000	10.144	AV

Note: Measure Level (dBuV) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB)

8. CONCLUSION

The data collected relate only the item(s) tested and show that the device is in compliance with Part 15C of the FCC Rules and ISED Rules.

The End

Appendix A - Test Setup Photograph

Refer to “ 1908RSU009-UT” file.

Appendix B - EUT Photograph

Refer to “ 1908RSU009-UE” file.