FCC Part 15.249
RSS-GEN ISSUE 5 February 2021 AMENDMENT 2
RSS-210, ISSUE 10, April 2020 AMENDMENT
TEST REPORT

For

Jasco Products Company LLC

10 e memorial road Office Attn M Simpkins, oklahoma city, United States 73114

FCC ID: QOBZWA3016
IC: 6924A-ZWA3016

Report Type:	**Product Type:**
Original Report	In-Wall Smart Dimmer

Report Producer : Coco Lin

Report Number : RXZ2111105003RF01

Report Date : 2022-06-07

Reviewed By: Andy Shih

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Revision History

Revision	No.	Report Number	Issue Date	Description	Author/ Revised by
0.0	RXZ2111105003	RXZ2111105003RF01	2022-06-07	Original Report	Coco Lin

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1. General Information

1.1 Product Description for Equipment under Test (EUT)

Applicant	Jasco Products Company LLC
	10 e memorial road Office Attn M Simpkins, oklahoma city, United States 73114
Manufacturer	Jasco Products Company LLC
	10 e memorial road Office Attn M Simpkins, oklahoma city, United States 73114
Brand(Trade) Name	Jasco/enbrighten/Ultrapro
Product (Equipment)	In-Wall Smart Dimmer
Main Model Name	ZWA3016ENB
Series Model Name	ZWA3016JAS , ZWA3016ULT
Model Discrepancy	The major electrical and mechanical constructions of series models are identical to the basic model, except different Market segmentation. The model, ZWA3016ENB is the testing sample, and the final test data are shown on this test report.
HVIN	ZWA3016EN, ZWA3016JAS, ZWA3016ULT
Frequency Range	908.4 / 916 MHz
Antenna Specification	Metal antenna / -3.95 dBi
Power Operation (Voltage Range)	☒ AC 120V/60Hz ☐ Adapter ☐ By AC Power Cord ☐ PoE
	☐ DC Type ☐ from Battery ☐ DC Power Supply ☐ External from USB Cable ☐ External DC Adapter
	☐ Host System
Received Date	Nov. 05, 2021
Date of Test	Nov. 8, 2021 ~ Nov. 13, 2021

*All measurement and test data in this report was gathered from production sample serial number: RXZ211105003-01 (Assigned by BACL, New Taipei Laboratory).

1.2 Objective

This report is prepared on behalf of *Jasco Products Company LLC* in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commission's rules, and RSS-210, Issue 10, April 2020 Amendment of the Innovation, Science and Economic Development Canada, and RSS-Gen Issue 5, February 2021 Amendment 2, General Requirements for Compliance of Radio Apparatus.

1.3 Related Submittal(s)/Grant(s)

N/A.

1.4 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, and RSS-210, Issue 10, April 2020 Amendment of the Innovation, Science and Economic Development Canada, and RSS-Gen Issue 5, February 2021 Amendment 2, General Requirements for Compliance of Radio Apparatus.

1.5 Statement of Compliance

Decision Rule: No, (The test results do not include MU judgment)

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
The determination of the test results does not require consideration of the uncertainty of the measurement, unless the assessment is required by customer agreement, regulation or standard document specification.
Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is not responsible for the authenticity of the information provided by the applicant that affects the test results.

1.6 Measurement Uncertainty

Parameter		Uncertainty
AC Mains		+/- 2.36 dB
Occupied Bandwidth		+/- 0.35 MHz
	30 MHz~1GHz	+/- 5.22 dB
	1 GHz~18 GHz	+/- 6.12 dB
	18 GHz~40 GHz /	+/- 4.99 dB
Temperature		+/- 1.27 °C
Humidity		+/- 3 %

1.7 Environmental Conditions

Test Site	Test Data	Temperature (℃)	Relative Humidity (%)	ATM Pressure (hPa)	Test Engineer
AC Line Conducted Emissions	2021/11/13	20.5	46	1010	Ken Yu
Radiation Spurious Emissions	2021/11/8 ~ 2021/11/13	23.4 ~ 24.2	55 ~ 57	1010	Howard Chen
Emission Bandwidth	2021/11/12	23.1	55	1010	Howard Chen

1.8 Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) to collect test data is located on

☒70, Lane 169, Sec. 2, Datong Road, Xizhi Dist., New Taipei City 22183, Taiwan, R.O.C.

Bay Area Compliance Laboratories Corp. (New Taipei Laboratory) is accredited to ISO 17025 by Taiwan Accreditation Foundation (TAF code: 3732) and the FCC designation No.TW3732 under the Mutual Recognition Agreement (MRA) in FCC Test.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: TW3732.

2. System Test Configuration

2.1 Description of Test Configuration

The system was configured for testing in an engineering mode, which was provided by manufacturer.

The engineering mode was configured the system transmitting with maximum power.

Channel List

Channel	Frequency (MHz)
1	908.4
2	916.0

Tested with channel 1 and 2.

2.2 Equipment Modifications

No modification was made to the EUT.

2.3 EUT Exercise Software

Use the button to switch the test channel.

Test Frequency	Low	High
Power Level Setting	Default	Default

2.4 Support Equipment List and Details

Description	Manufacturer	Model Number	S/N
Light Bubble	Yousheng Industrial	120V, 200W	N/A

2.5 External Cable List and Details

Cable Description	Length (m)	From	To
Power Cable	0.8	EUT	Light Bubble

2.6 Test Mode

Pre-scan

AC Line Conducted Emissions and Radiated Spurious Emissions

Mode 1: Transmitting.

Mode 2: Transmitting + Dimming.

Worst case is the Mode 2: Transmitting + Dimming.

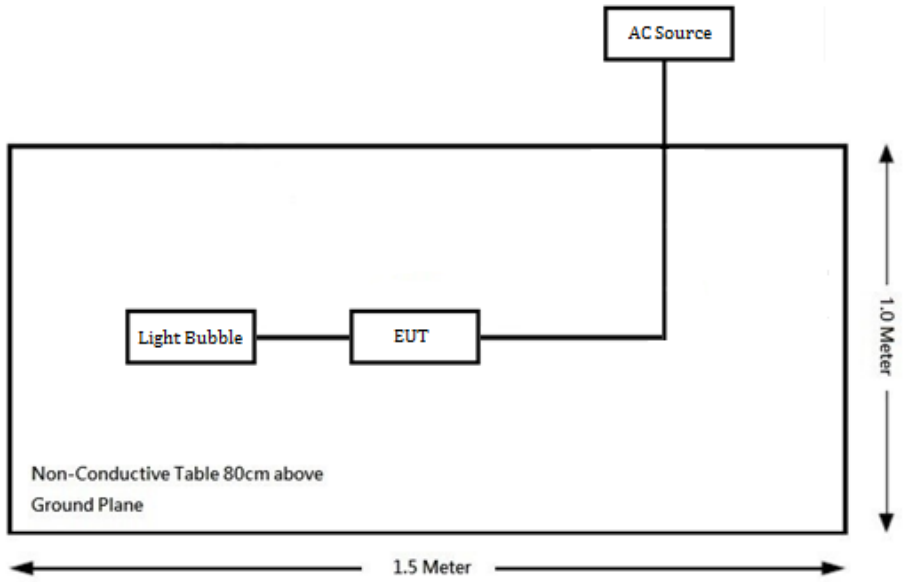
Full System (Mode 2: Transmitting + Dimming) for all test item.

2.7 Block Diagram of Test Setup

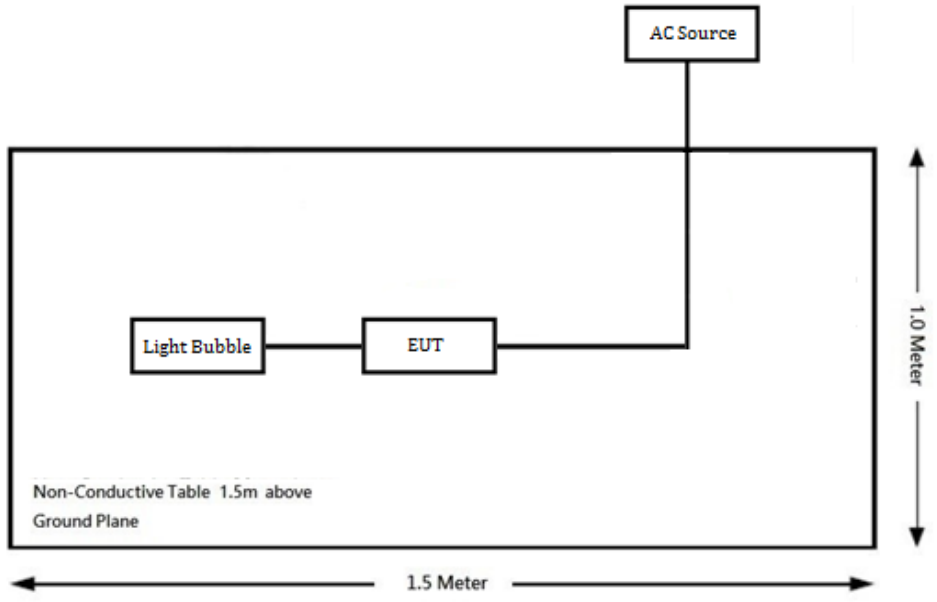
See test photographs attached in setup photos for the actual connections between EUT and support equipment.

Radiation:

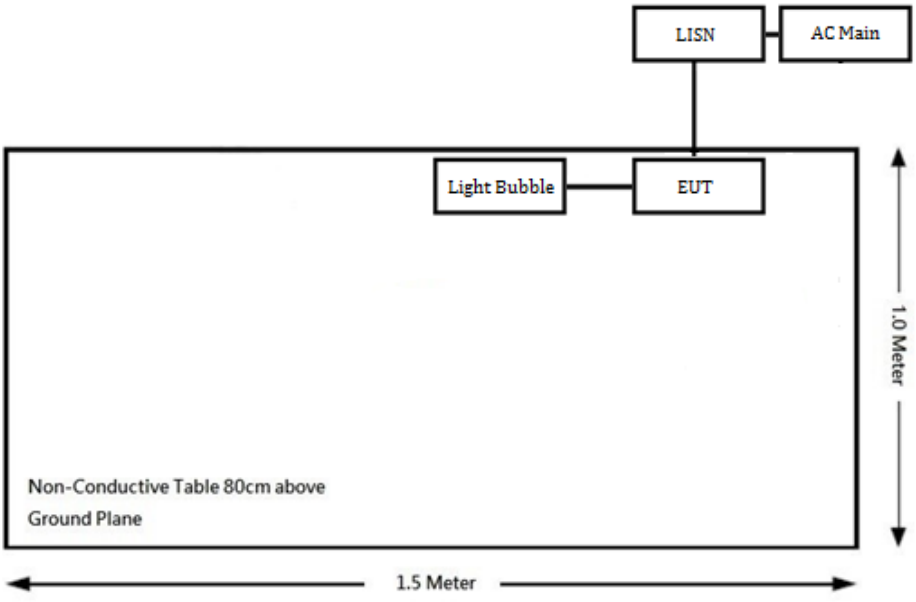
Below 1GHz:



Above 1GHz:



Conduction:


LISN
AC Main
Light Bubble
EUT
1.0 Meter
Non-Conductive Table 80cm above
Ground Plane
1.5 Meter

3. Summary of Test Results

FCC Rules	Description of Test	Results
§RSS-102 Clause 2.5.2	Exemption Limits From Routine Evaluation- RF Exposure Evaluation	Compliance
§15.203 RSS-GEN Clause 6.8	Antenna Requirement	Compliance
§15.207 (a) RSS-Gen Clause 8.8	AC Line Conducted Emissions	Compliance
§15.205, §15.209,§15.249 RSS-210 Annex B.10 RSS-Gen Clause 8.10	Radiated Emissions	Compliance
§15.215 (c) RSS-Gen Clause 6.7	20 dB Emission Bandwidth 99% Occupied Bandwidth	Compliance

4. Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
AC Line Conduction Room (CON-A)					
LISN	Rohde & Schwarz	ENV216	101612	2020/12/30	2021/12/29
EMI Test Receiver	Rohde & Schwarz	ESW8	100947	2021/7/23	2022/7/22
Pulse Limiter	Rohde & Schwarz	ESH3Z2	TXZEM104	2021/7/29	2022/7/29
RF Cable	EMEC	EM-CB5D	001	2021/6/11	2022/6/11
Software	AUDIX	E3	V9.150826k	N.C.R	N.C.R
Radiation 3M Room (966-A)					
Active Loop Antenna	ETS-Lindgren	6502	35796	2021/3/16	2022/3/15
Bilog Antenna with 6 dB Attenuator	SUNOL SCIENCES & MINI-CIRCUITS	JB6/UNAT-6+	A050115/15542_01	2021/1/19	2022/1/18
EMI Test Receiver	Rohde & Schwarz	ESR3	102099	2021/6/9	2022/6/8
Horn Antenna	EMCO	SAS-571	1020	2021/4/23	2022/4/22
Preamplifier	Sonoma	310N	130602	2021/6/8	2022/6/7
Preamplifier	A.H. system Inc.	PAM-0118P	470	2021/3/15	2022/3/14
Spectrum Analyzer	Rohde & Schwarz	FSV40	101435	2021/1/7	2022/1/6
Micro flex Cable	UTIFLEX	UFB197C-1-2362-70U-70U	225757-001	2021/2/1	2022/1/31
Coaxial Cable	COMMATE	PEWC	8Dr	2020/12/25	2021/12/24
Coaxial Cable	UTIFLEX	UFB311A-Q-1440-300300	220490-006	2021/2/1	2022/1/31
Coaxial Cable	JUNFLON	J12J102248-00-B-5	AUG-07-15-044	2020/12/25	2021/12/24
Cable	EMC	EMC105-SM-SM-10000	201003	2021/2/3	2022/2/2
Software	Farad	EZ_EMC	BACL-03A1	N.C.R	N.C.R
Conducted Room					
Spectrum Analyzer	Rohde & Schwarz	FSV40	101140	2021/1/7	2022/1/6
Cable	UTIFLEX	UFA210A	9435	2021/10/5	2022/10/4

***Statement of Traceability:** BACL Corp. attests that all of the calibrations on the equipment items listed above were traceable to the SI System of Units via the R.O.C. Center for Measurement Standards of the Electronics Testing Center, Taiwan (ETC) or to another internationally recognized National Metrology Institute (NMI), and were compliant with the current Taiwan Accreditation Foundation (TAF) requirements.*

5. RSS-102 § 2.5.2 – EXEMPTION LIMITS FROM ROUTINE EVALUATION - RF EXPOSURE EVALUATION

5.1 Applicable Standard

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

5.2 RF Exposure Evaluation Result

EIRP= 86.81 dBμV/m -95.2 = -8.39 dBm

Tune-up power = -8 dBm = 0.16 mW

Exemption from Routine Evaluation Limit is:

$1.31 \times 10^{-2} f^{0.6834} = 1.31 \times 10^{-2} \times 908.4^{0.6834} = 1.38W > 0.16mW$

Result: The device meets the exemption requirement.

6. FCC §15.203 & RSS-GEN CLAUSE 6.8 – Antenna Requirements

6.1 Applicable Standard

For intentional device, 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.

According to RSS-Gen §6.8, The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. fo transmitters with detachable antenna),
indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.
For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).
When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer. The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.
For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

6.2 Antenna Information

Type	Antenna Gain	Impedance
Metal antenna	-3.95 dBi	50Ω

Result: Compliance.

7. FCC §15.207(a) & RSS-GEN CLAUSE 8.8 – AC Line Conducted Emissions

7.1 Applicable Standard

According to §15.207

For an intentional radiator that 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 the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

According to RSS-GEN CLAUSE 8.8

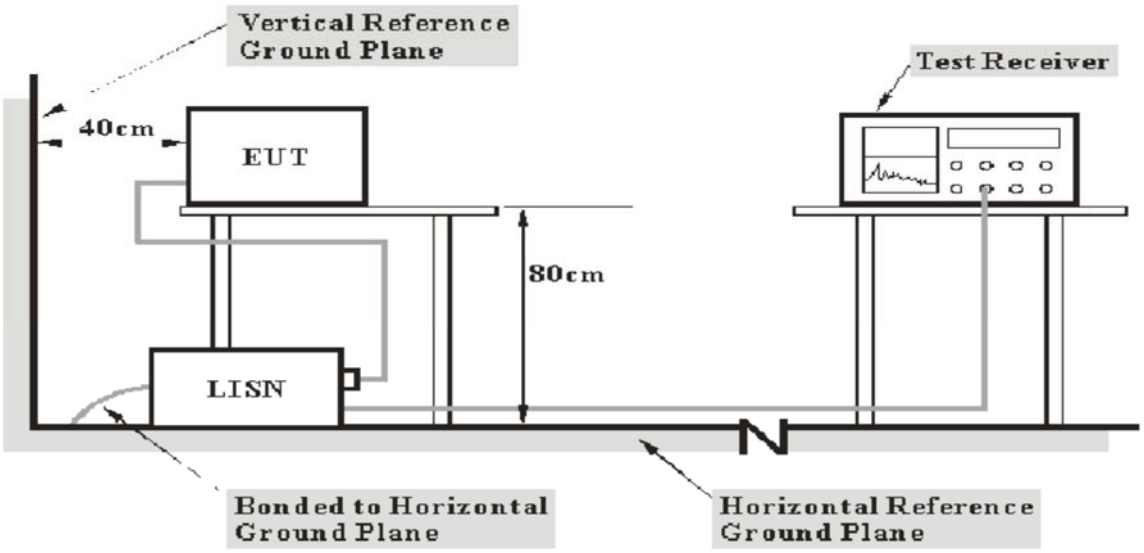
Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 μH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.

For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56 Note 1	56 to 46 Note 1
0.5-5	56	46
5-30	60	50

Note 1: Decreases with the logarithm of the frequency.

7.2 EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 and RSS-GEN limits.

7.3 EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150kHz to 30MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations

Frequency Range	IF B/W
150kHz – 30MHz	9kHz

7.4 Test Procedure

During conducted emission tests, the EUT is connected to the LISN socket.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

7.5 Corrected Factor & Margin Calculation

The factor is calculated by adding LISN/ISN VDF (Voltage Division Factor), Cable Loss and Transient Limiter Attenuation. The basic equation is as follows:

Factor = LISN VDF + Cable Loss + Transient Limiter Attenuation

The "Over Limit" column of the following data tables indicates the degree of compliance with the applicable limit. For example, an over limit of -7 dB means the emission is 7 dB below the limit. The equation for Over Limit calculation is as follows:

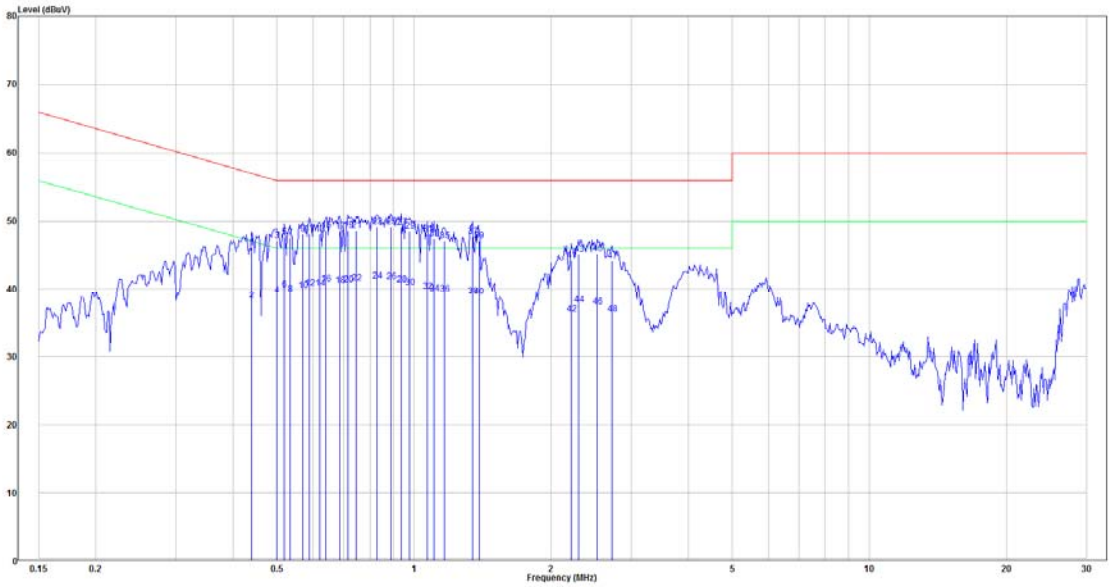
Over Limit = Level – Limit Line

7.6 Test Results

Test Mode: Transmitting + Dimming

(worst case is Low channel)

Main: AC120 V, 60 Hz, Line



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.440	26.58	19.59	46.17	57.07	-10.90	QP
2	0.440	18.76	19.59	38.35	47.07	-8.72	Average
3	0.499	27.50	19.59	47.09	56.01	-8.92	QP
4	0.499	19.53	19.59	39.12	46.01	-6.89	Average
5	0.518	28.03	19.59	47.62	56.00	-8.38	QP
6	0.518	20.30	19.59	39.89	46.00	-6.11	Average
7	0.535	27.94	19.59	47.53	56.00	-8.47	QP
8	0.535	19.75	19.59	39.34	46.00	-6.66	Average
9	0.570	28.47	19.59	48.06	56.00	-7.94	QP
10	0.570	20.20	19.59	39.79	46.00	-6.21	Average
11	0.589	28.58	19.59	48.17	56.00	-7.83	QP
12	0.589	20.57	19.59	40.16	46.00	-5.84	Average
13	0.621	28.53	19.60	48.13	56.00	-7.87	QP
14	0.621	20.61	19.60	40.21	46.00	-5.79	Average
15	0.641	29.08	19.60	48.68	56.00	-7.32	QP
16	0.641	21.20	19.60	40.80	46.00	-5.20	Average
17	0.686	28.96	19.60	48.56	56.00	-7.44	QP
18	0.686	21.00	19.60	40.60	46.00	-5.40	Average
19	0.716	29.10	19.60	48.70	56.00	-7.30	QP
20	0.716	21.08	19.60	40.68	46.00	-5.32	Average

21	0.747	29.06	19.60	48.66	56.00	-7.34	QP
22	0.747	21.35	19.60	40.95	46.00	-5.05	Average
23	0.830	29.63	19.60	49.23	56.00	-6.77	QP
24	0.830	21.69	19.60	41.29	46.00	-4.71	Average
25	0.890	29.58	19.61	49.19	56.00	-6.81	QP
26	0.890	21.56	19.61	41.17	46.00	-4.83	Average
27	0.938	29.47	19.61	49.08	56.00	-6.92	QP
28	0.938	21.09	19.61	40.70	46.00	-5.30	Average
29	0.979	28.88	19.61	48.49	56.00	-7.51	QP
30	0.979	20.67	19.61	40.28	46.00	-5.72	Average
31	1.071	28.50	19.61	48.11	56.00	-7.89	QP
32	1.071	20.13	19.61	39.74	46.00	-6.26	Average
33	1.106	27.86	19.61	47.47	56.00	-8.53	QP
34	1.106	19.78	19.61	39.39	46.00	-6.61	Average
35	1.166	27.52	19.61	47.13	56.00	-8.87	QP
36	1.166	19.64	19.61	39.25	46.00	-6.75	Average
37	1.345	28.13	19.62	47.75	56.00	-8.25	QP
38	1.345	19.30	19.62	38.92	46.00	-7.08	Average
39	1.388	27.56	19.62	47.18	56.00	-8.82	QP
40	1.388	19.26	19.62	38.88	46.00	-7.12	Average
41	2.213	24.61	19.65	44.26	56.00	-11.74	QP
42	2.213	16.62	19.65	36.27	46.00	-9.73	Average
43	2.297	25.52	19.65	45.17	56.00	-10.83	QP
44	2.297	18.00	19.65	37.65	46.00	-8.35	Average
45	2.527	25.60	19.65	45.25	56.00	-10.75	QP
46	2.527	17.66	19.65	37.31	46.00	-8.69	Average
47	2.721	24.52	19.66	44.18	56.00	-11.82	QP
48	2.721	16.60	19.66	36.26	46.00	-9.74	Average

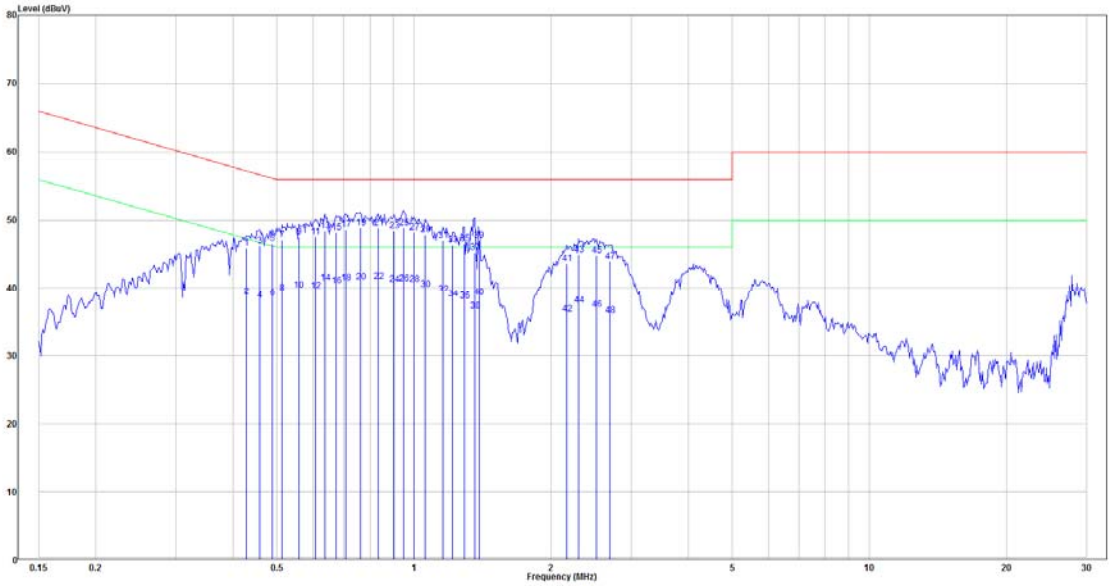
Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

Main: AC120 V, 60 Hz, Neutral



No.	Frequency	Reading	Correct	Result	Limit	Over limit	Remark
	(MHz)	(dBµV)	Factor(dB)	(dBµV)	(dBµV)	(dB)	
1	0.428	26.37	19.59	45.96	57.29	-11.33	QP
2	0.428	19.15	19.59	38.74	47.29	-8.55	Average
3	0.459	26.67	19.59	46.26	56.71	-10.45	QP
4	0.459	18.65	19.59	38.24	46.71	-8.47	Average
5	0.489	27.00	19.59	46.59	56.19	-9.60	QP
6	0.489	18.94	19.59	38.53	46.19	-7.66	Average
7	0.513	27.52	19.59	47.11	56.00	-8.89	QP
8	0.513	19.68	19.59	39.27	46.00	-6.73	Average
9	0.558	27.97	19.59	47.56	56.00	-8.44	QP
10	0.558	20.13	19.59	39.72	46.00	-6.28	Average
11	0.608	28.02	19.59	47.61	56.00	-8.39	QP
12	0.608	20.08	19.59	39.67	46.00	-6.33	Average
13	0.637	28.85	19.59	48.44	56.00	-7.56	QP
14	0.637	21.17	19.59	40.76	46.00	-5.24	Average
15	0.675	28.62	19.59	48.21	56.00	-7.79	QP
16	0.675	20.73	19.59	40.32	46.00	-5.68	Average
17	0.708	29.08	19.59	48.67	56.00	-7.33	QP
18	0.708	21.25	19.59	40.84	46.00	-5.16	Average
19	0.763	29.31	19.60	48.91	56.00	-7.09	QP
20	0.763	21.33	19.60	40.93	46.00	-5.07	Average
21	0.835	29.22	19.60	48.82	56.00	-7.18	QP
22	0.835	21.44	19.60	41.04	46.00	-4.96	Average
23	0.904	28.80	19.60	48.40	56.00	-7.60	QP

24	0.904	21.03	19.60	40.63	46.00	-5.37	Average
25	0.948	29.27	19.60	48.87	56.00	-7.13	QP
26	0.948	21.06	19.60	40.66	46.00	-5.34	Average
27	1.000	28.66	19.60	48.26	56.00	-7.74	QP
28	1.000	21.01	19.60	40.61	46.00	-5.39	Average
29	1.060	28.32	19.60	47.92	56.00	-8.08	QP
30	1.060	20.24	19.60	39.84	46.00	-6.16	Average
31	1.160	27.40	19.61	47.01	56.00	-8.99	QP
32	1.160	19.52	19.61	39.13	46.00	-6.87	Average
33	1.216	26.73	19.61	46.34	56.00	-9.66	QP
34	1.216	18.76	19.61	38.37	46.00	-7.63	Average
35	1.289	26.96	19.61	46.57	56.00	-9.43	QP
36	1.289	18.44	19.61	38.05	46.00	-7.95	Average
37	1.359	25.70	19.61	45.31	56.00	-10.69	QP
38	1.359	17.00	19.61	36.61	46.00	-9.39	Average
39	1.388	27.36	19.62	46.98	56.00	-9.02	QP
40	1.388	19.03	19.62	38.65	46.00	-7.35	Average
41	2.167	24.02	19.64	43.66	56.00	-12.34	QP
42	2.167	16.54	19.64	36.18	46.00	-9.82	Average
43	2.297	25.30	19.65	44.95	56.00	-11.05	QP
44	2.297	17.80	19.65	37.45	46.00	-8.55	Average
45	2.513	25.24	19.65	44.89	56.00	-11.11	QP
46	2.513	17.19	19.65	36.84	46.00	-9.16	Average
47	2.692	24.29	19.66	43.95	56.00	-12.05	QP
48	2.692	16.26	19.66	35.92	46.00	-10.08	Average

Note:

Level = Read Level + Factor

Over Limit = Level – Limit Line

Factor = (LISN, ISN, PLC or current probe) Factor + Cable Loss + Attenuator

8. FCC §15.209, §15.205 , §15.249 & RSS-210 ANNEX B.10, RSS-GEN CLAUSE 8.10 - Radiated Emissions

8.1 Applicable Standard

As per FCC§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 (millivolts/meter)	Field strength of harmonics (microvolts/meter)
920-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

(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.

According to RSS-210 Issue 10 Clause Annex B B.10 (a): The field strength of fundamental and harmonic emissions, measured at 3 m, shall not exceed 50 mV/m and 0.5 mV/m respectively.

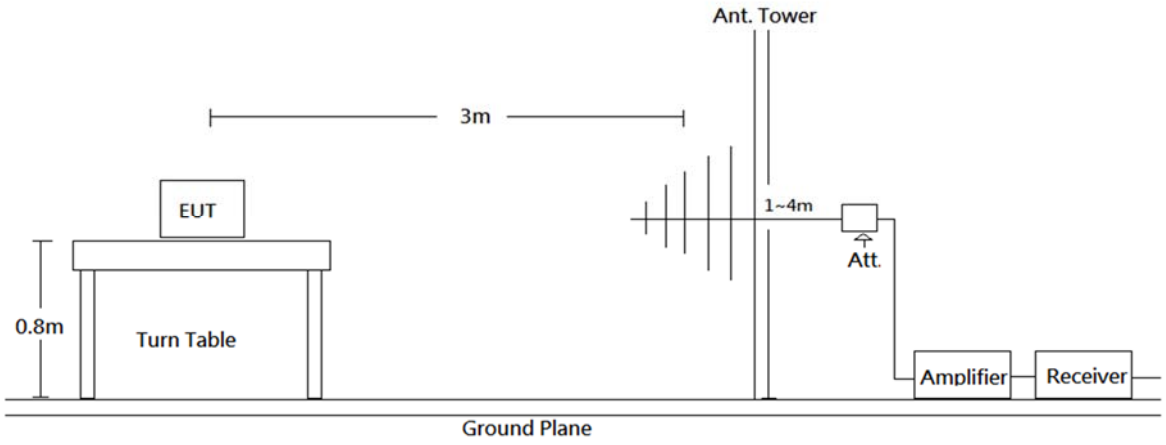
According to RSS-210 Issue 10 Clause Annex B B.10 (b): Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-GEN Issue 5, whichever is less stringent.

Field strength limits at various frequencies		
Fundamental frequency	Field strength (mV/m)	
	Fundamental emissions	Harmonic emissions
920-928 MHz	50	0.5
2400-2483.5 MHz	50	0.5
5725-5875 MHz	50	0.5
24.0-24.25 GHz	250	2.5

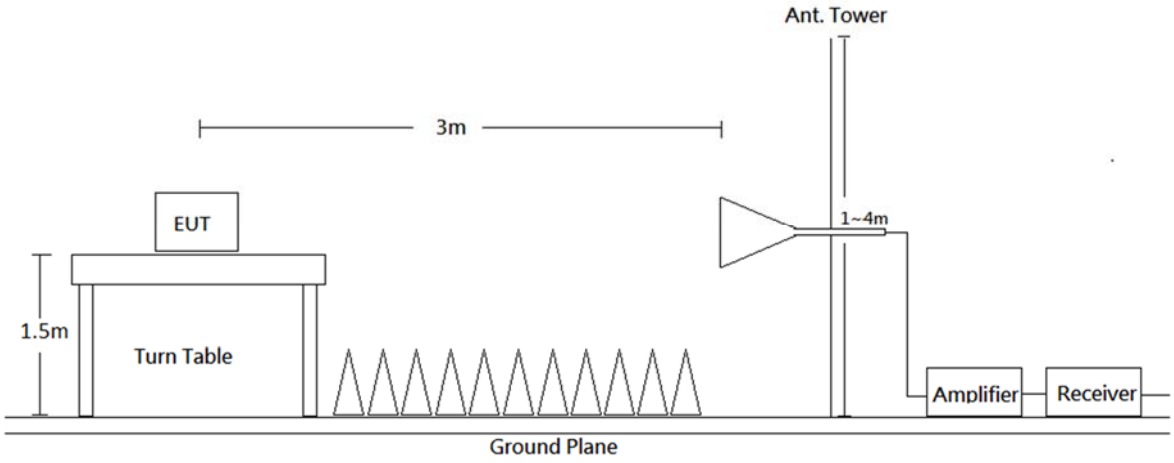
As per RSS-210 Issue 10 Clause Annex B B.10, Field strength limits are specified at a distance of 3 meters.

8.2 EUT Setup

Below 1 GHz:



Above 1 GHz:



Radiated emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.205, FCC 15.209, FCC 15.249 and RSS-GEN, RSS-210 limits.

8.3 EMI Test Receiver & Spectrum Analyzer Setup

The system was studied from 30 MHz to 10 GHz. During radiated emission testing, the EMI test setup refers to ANSI C63.10 4.1.4.2.4.

8.4 Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detector mode from 30 MHz to 1 GHz and PK and average detector modes for frequencies above 1 GHz.

8.5 Corrected Factor & Margin Calculation

The Correct Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain

The "Margin" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the limit. The equation for margin calculation is as follows:

Margin = Result – Limit

8.6 Test Results Summary

According to the data in the following table, the EUT complied with the FCC 15.205, FCC 15.209, FCC 15.249 and RSS-210, RSS-Gen Limit.

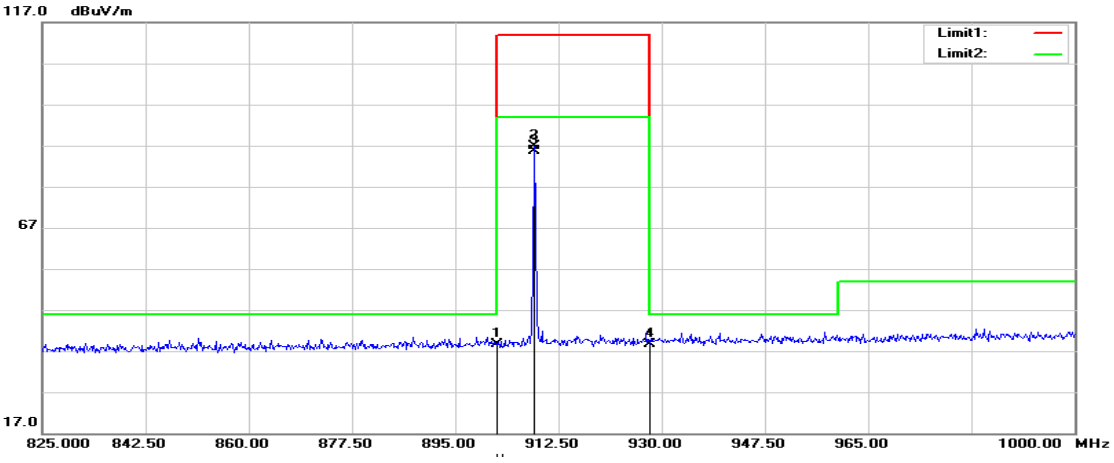
8.7 Test Results

Test Mode: Transmitting + Dimming

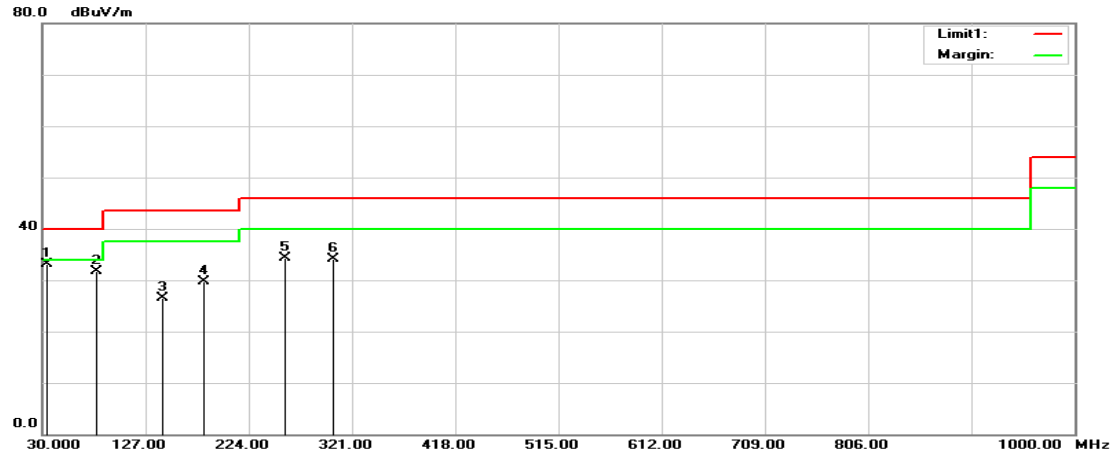
(Pre-scan with three orthogonal axis, and worse case as Z axis.)

Horizontal (worst case is Low channel)

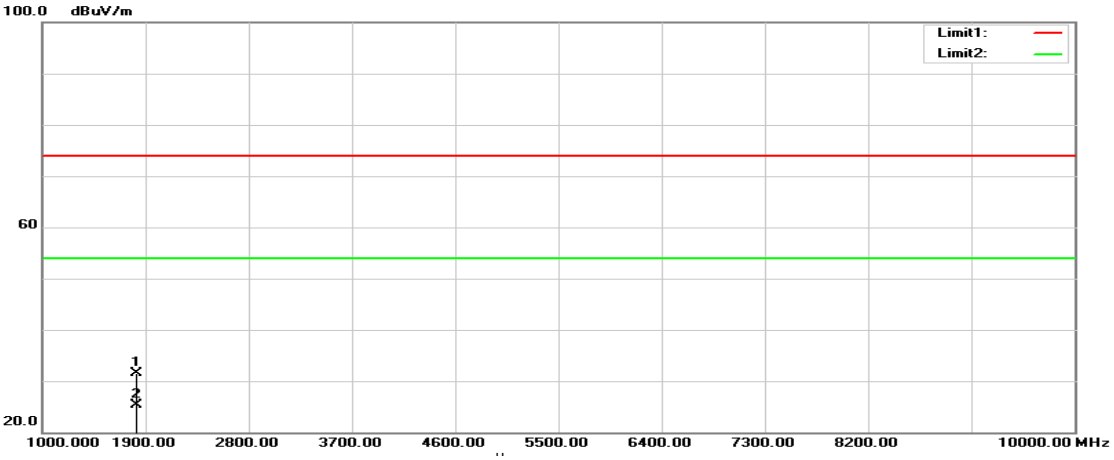
Fundamental:



30MHz-1GHz:

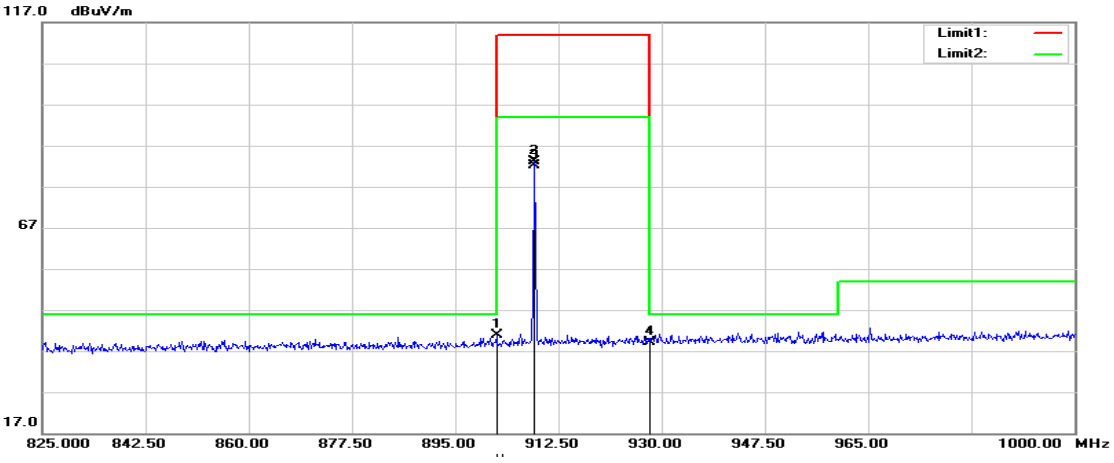


1GHz-10GHz:

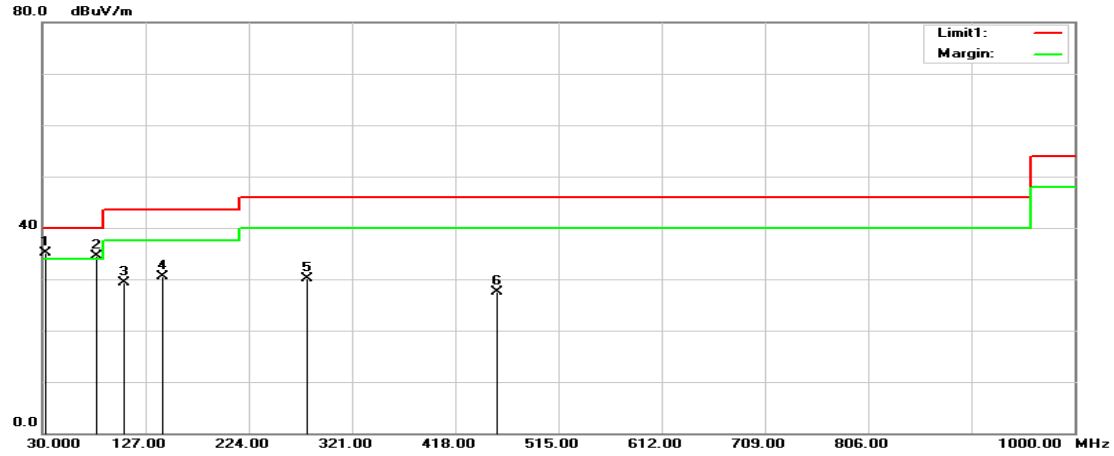


Vertical

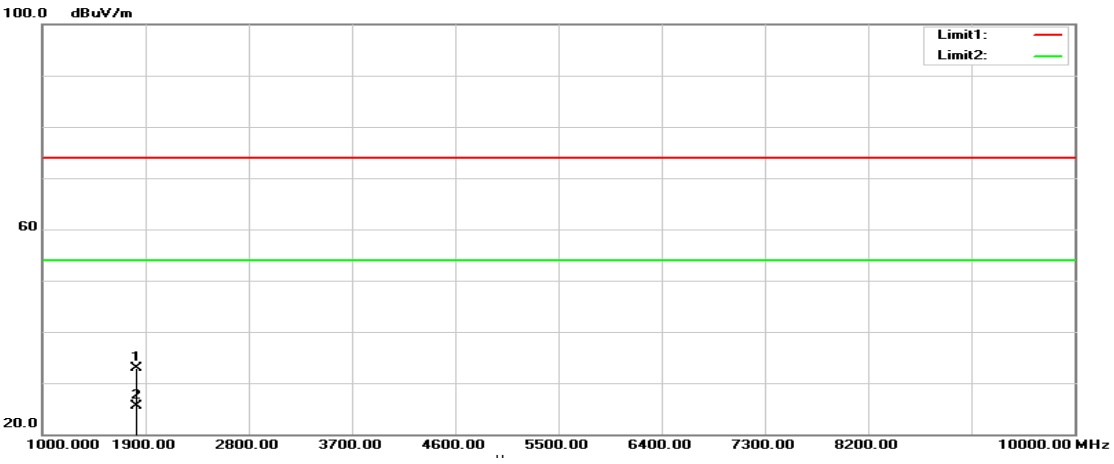
Fundamental:



30MHz-1GHz:



1GHz-10GHz:



30MHz ~ 10GHz

Horizontal

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
Low channel								
33.8800	39.65	-6.54	33.11	40.00	-6.89	100	85	peak
81.4100	48.25	-16.62	31.63	40.00	-8.37	100	25	peak
142.5200	37.38	-10.81	26.57	43.50	-16.93	100	145	peak
181.3200	42.55	-12.92	29.63	43.50	-13.87	100	74	peak
257.9500	46.19	-11.90	34.29	46.00	-11.71	100	24	peak
303.5400	44.20	-10.03	34.17	46.00	-11.83	100	241	peak
902.0000	38.20	0.48	38.68	46.00	-7.32	100	335	peak
908.4000	86.00	0.81	86.81	114.00	-27.19	100	335	peak
908.4000	84.91	0.81	85.72	94.00	-8.28	100	335	AVG
928.0000	37.48	1.26	38.74	46.00	-7.26	100	335	peak
1816.800	44.05	-12.46	31.59	74.00	-42.41	166	328	peak
1816.800	37.76	-12.46	25.30	54.00	-28.70	166	328	AVG
High channel								
902.0000	38.97	0.48	39.45	46.00	-6.55	100	345	peak
916.0000	84.47	1.06	85.53	114.00	-28.47	100	345	peak
916.0000	84.04	1.06	85.10	94.00	-8.90	100	345	AVG
928.0000	37.46	1.26	38.72	46.00	-7.28	100	345	peak
1832.000	44.10	-12.31	31.79	74.00	-42.21	171	254	peak
1832.000	37.68	-12.31	25.37	54.00	-28.63	171	254	AVG

Result = Reading + Correct Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
Spurious emissions more than 20 dB below the limit were not reported.

Vertical

Frequency (MHz)	Reading (dBµV)	Correct Factor(dB/m)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)	Remark
Low channel								
32.9100	41.17	-6.11	35.06	40.00	-4.94	100	210	peak
81.4100	51.17	-16.62	34.55	40.00	-5.45	100	14	peak
106.6300	41.72	-12.43	29.29	43.50	-14.21	100	125	peak
142.5200	41.34	-10.81	30.53	43.50	-12.97	100	11	peak
279.2900	40.29	-10.26	30.03	46.00	-15.97	100	241	peak
456.8000	33.88	-6.43	27.45	46.00	-18.55	100	22	peak
902.0000	40.34	0.48	40.82	46.00	-5.18	118	198	peak
908.4000	82.35	0.81	83.16	114.00	-30.84	118	198	peak
908.4000	81.24	0.81	82.05	94.00	-11.95	118	198	AVG
928.0000	37.79	1.26	39.05	46.00	-6.95	118	198	peak
1816.800	45.27	-12.46	32.81	74.00	-41.19	153	248	peak
1816.800	38.03	-12.46	25.57	54.00	-28.43	153	248	AVG
High channel								
902.0000	39.10	0.48	39.58	46.00	-6.42	117	174	peak
916.0000	78.98	1.06	80.04	114.00	-33.96	117	174	peak
916.0000	77.04	1.06	78.10	94.00	-15.90	117	174	AVG
928.0000	37.72	1.26	38.98	46.00	-7.02	117	174	peak
1832.000	45.28	-12.31	32.97	74.00	-41.03	158	288	peak
1832.000	37.65	-12.31	25.34	54.00	-28.66	158	288	AVG

Result = Reading + Correct Factor
Margin = Result – Limit
Correct Factor = Antenna Factor + Cable Loss – Amplifier Gain
Spurious emissions more than 20 dB below the limit were not reported.

9 FCC §15.215(c) & RSS-GEN CLAUSE 6.7 – 20 dB Bandwidth Testing and 99% OCCUPIED BANDWIDTH

9.1 Applicable Standard

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.

According to RSS-Gen Clause 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.

In some cases, the "x dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum inband power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

9.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

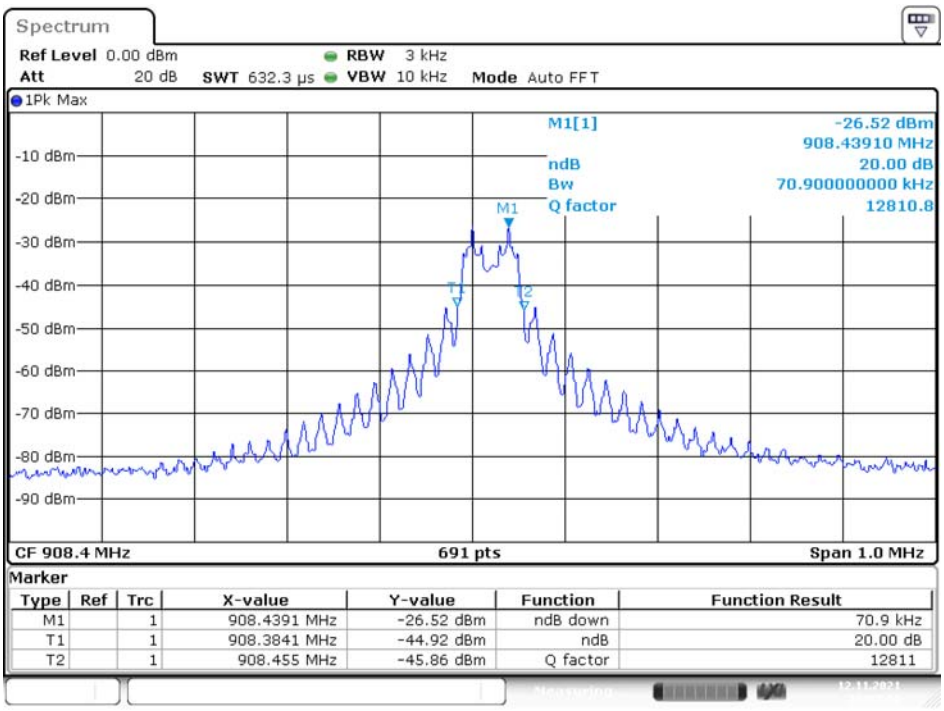
9.3 Test Results

Channel	Frequency (MHz)	20 dB Emission Bandwidth (kHz)	99% Occupied Bandwidth (kHz)
Low	908.4	70.9	94.07
High	916	112.9	112.88

Please refer to the following plots

20 dB Emission Bandwidth

Low Channel



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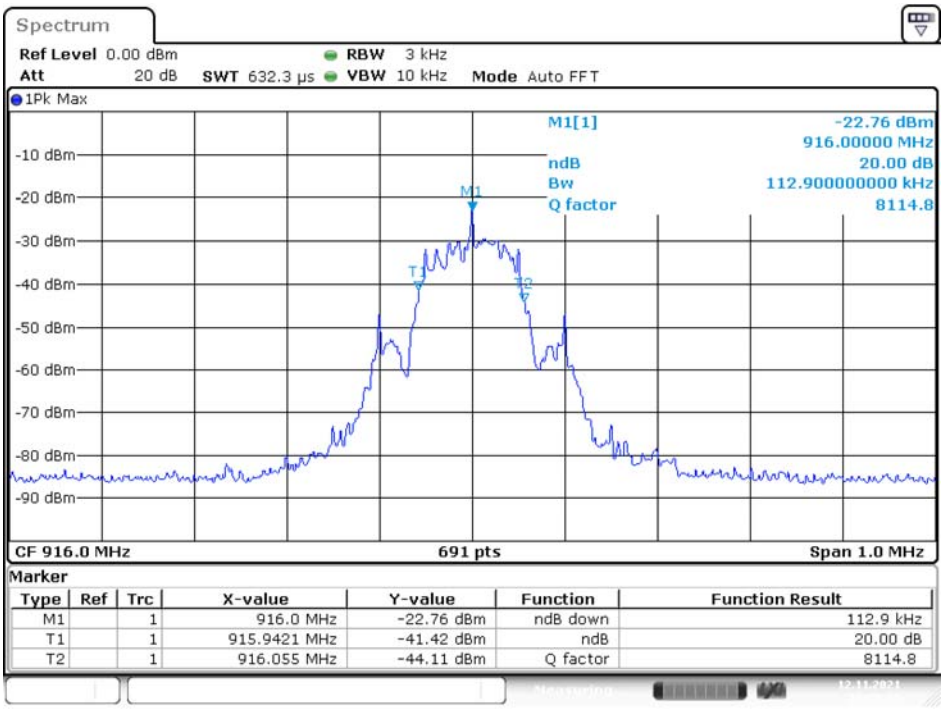
High Channel



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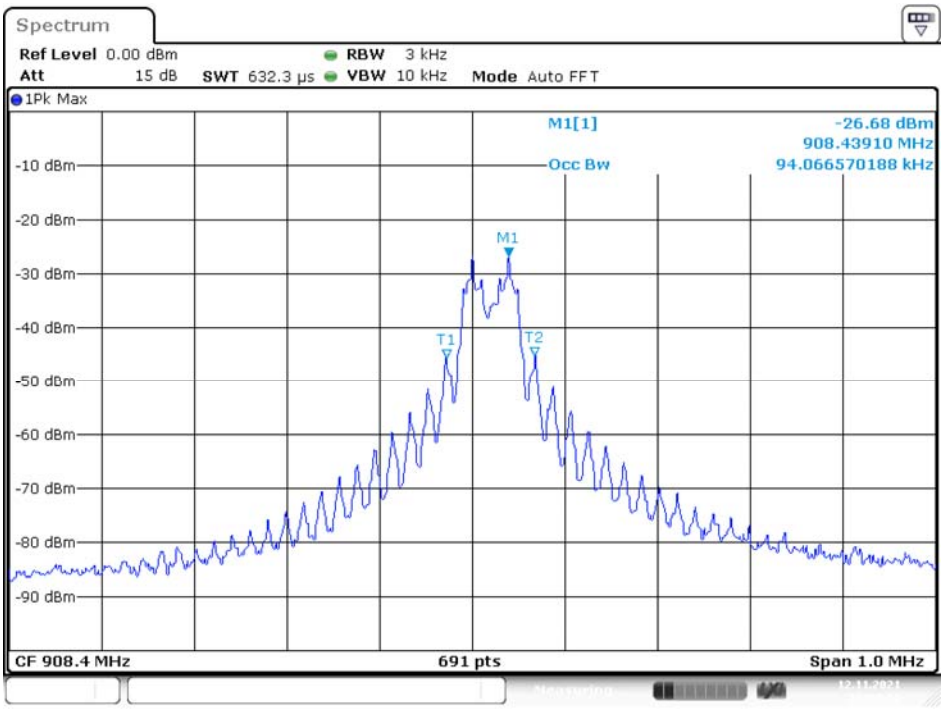
99% Occupied Bandwidth

Low Channel



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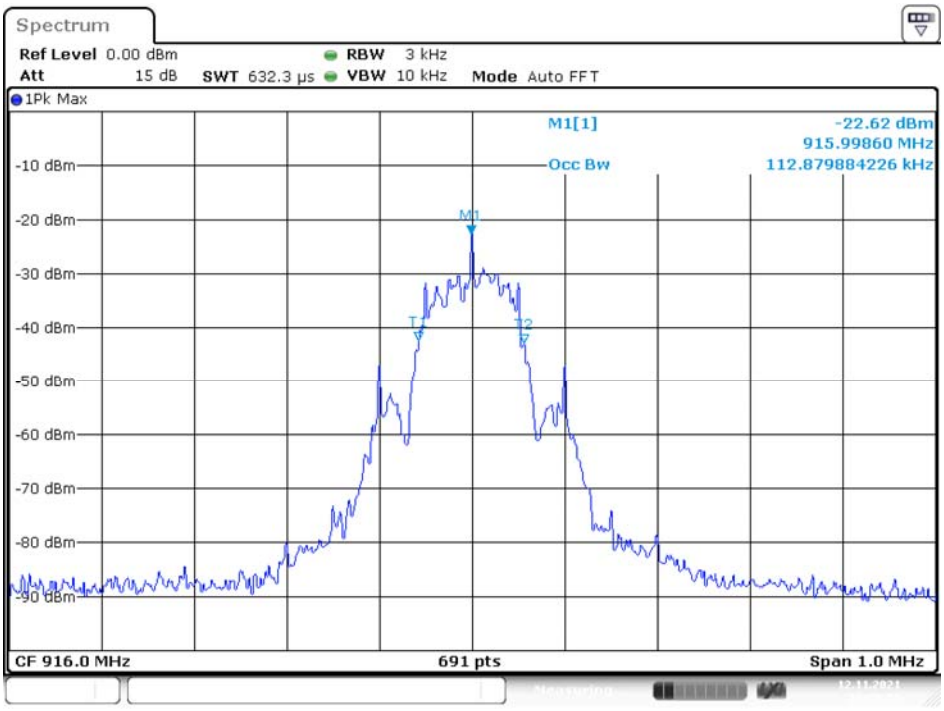
High Channel



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