Certificate #4312.01

TEST REPORT

Product Name:	IP Phone
Trade Mark:	GRANDSTREAM
Model No.:	GRP2615
HVIN:	GRP2615V3
Report Number:	24032310269RFC-1
Test Standards:	FCC 47 CFR Part 15 Subpart C RSS-247 Issue 3 RSS-Gen Issue 5
FCC ID:	YZZGRP2615V3
IC:	11964A-GRP2615V3
Test Result:	PASS
Date of Issue:	July 30, 2024

Prepared for:

Grandstream Networks, Inc.
126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

Prepared by:

Shenzhen UnionTrust Quality and Technology Co., Ltd.
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Prepared by:	David Chen	Reviewed by:	Henry Lu
	David Chen Senior Project Engineer		Henry Lu Team Leader
Approved by:	Robben Chen	Date:	July 30, 2024
	Robben Chen Assistant Manager		

UnionTrust Laboratories *Certified*

Version

Version No.	Date	Description
V1.0	July 30, 2024	Original

CONTENTS

1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Grandstream Networks, Inc.
Address of Applicant:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA
Manufacturer:	Grandstream Networks, Inc.
Address of Manufacturer:	126 Brookline Ave., 3rd Floor Boston, MA 02215, USA

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	IP Phone		
Model No.:	GRP2615		
HVIN:	GRP2615V3		
Trade Mark:	GRANDSTREAM		
DUT Stage:	Identical Prototype		
EUT Supports Function: (Provided by the customer)	2.4 GHz ISM Band:	IEEE 802.11b/g/n/ax	
		Bluetooth V5.0	
	5 GHz U-NII Bands:	5 150 MHz to 5 250 MHz	IEEE 802.11a/n/ac/ax
		5 250 MHz to 5 350 MHz	IEEE 802.11a/n/ac/ax
		5 470 MHz to 5 725 MHz	IEEE 802.11a/n/ac/ax
		5 725 MHz to 5 850 MHz	IEEE 802.11a/n/ac/ax
Sample Received Date:	March 23, 2024		
Sample Tested Date:	May 2, 2024 to June 14, 2024		

Remark: The above EUT's information was provided by customer. Please refer to the specifications or user's manual for more detailed description.

1.2.2 Description of Accessories

Adapter (1)	
Model No.:	GQ12-120100-AU
Manufacture:	Dong Guan City GangQi Electronic Co., Ltd.
Input:	100-240V~50/60Hz 0.4 A Max
Output:	12.0V⎓1.0 A
DC Cable	2.5 Meter, Unshielded without ferrite

Adapter (2)	
Model No.:	F12US1200100A
Manufacture:	SHENZHEN SUNLIGHT ELECTRONIC TECHNOLOGY CO LTD
Input:	100-240V~50/60Hz 0.5 A Max
Output:	12.0V⎓1.0 A
DC Cable	2.5 Meter, Unshielded without ferrite

Adapter (3)	
Model No.:	DCT12W120100US-A2
Manufacture:	Zhuzhou Dachuan Electronic Technology Co., Ltd.
Input:	100-240V~50/60Hz 0.3 A Max
Output:	12.0V⎓1.0 A

DC Cable	2.5 Meter, Unshielded without ferrite

Cable(1)	
Description:	Ethernet Cable
Cable Type:	Unshielded without ferrite
Length:	1.5 Meter

Cable(2)	
Description:	Phone Cord
Cable Type:	Unshielded without ferrite
Length:	2.5 Meter

Others
1x Handset, 1x Phone Stand

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Band:	2400 MHz to 2483.5 MHz
Frequency Range:	2402 MHz to 2480 MHz
Bluetooth Version:	Bluetooth LE/2LE/LE Code
Type of Modulation:	GFSK
Number of Channels:	40
Channel Separation:	2 MHz
Antenna Type:	PCB Antenna
Antenna Gain: (Provided by the customer)	3.5 dBi
Maximum Peak Power:	7.30 dBm
Normal Test Voltage:	12 Vdc

1.4 OTHER INFORMATION

Operation Frequency Each of Channel
f = 2402 + 2k MHz, k = 0,…,39
Note: **f** is the operating frequency (MHz); **k** is the operating channel.

1.5 DESCRIPTION OF SUPPORT UNITS

The EUT has been tested with associated equipment below.

1) Support Equipment

Description	Manufacturer	Model No.	Serial Number	Supplied by
Notebook	DELL	Latitude 3400	16238087894	UnionTrust
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.1Meter	UnionTrust

1.6 TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

Address: Unit D/E of 9/F and 16/F, Block A, Building 6, Baoneng science and technology park, Longhua district, Shenzhen, China
Telephone: +86 (0) 755 2823 0888
Fax: +86 (0) 755 2823 0886

1.7 TEST FACILITY

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

CNAS-Lab Code: L9069
The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01
Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories
CAB identifier: CN0032

FCC Accredited Lab.
Designation Number: CN1194
Test Firm Registration Number: 259480

1.8 DEVIATION FROM STANDARDS

None.

1.9 ABNORMALITIES FROM STANDARD CONDITIONS

None.

1.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER

None.

1.11 MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Measurement Uncertainty
1	Conducted emission 9kHz-150kHz	±3.2 dB
2	Conducted emission 150kHz-30MHz	±2.7 dB
3	Radiated emission 9kHz-30MHz	± 4.7 dB
4	Radiated emission 30MHz-1GHz	± 4.9 dB
5	Radiated emission 1GHz-18GHz	± 4.8 dB
6	Radiated emission 18GHz-26GHz	± 5.1 dB
7	Radiated emission 26GHz-40GHz	± 5.1 dB
8	Conducted spurious emissions	± 2.7 dB
9	RF Power, Conducted	± 0.68 dB
10	Occupied Bandwidth	± 1.86 %
11	Radio Frequency	2.4 GHz: ± 6.5 x 10^{-8}
12	Transmission Time	± 0.19 %

2. TEST SUMMARY

Test Cases			
Test Item	**Test Requirement**	**Test Method**	**Result**
Antenna Requirement	FCC 47 CFR Part 15 Subpart C Section 15.203/15.247 (b)(4) RSS-Gen Issue 5, Section 6.8	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207 RSS-Gen Issue 5, Section 8.8	ANSI C63.10-2013 Clause 6.2	PASS
Conducted Peak Output Power	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(3) RSS-247 Issue 3, Section 5.4(d)	ANSI C63.10-2013 Clause 11.9.1.3	PASS
6dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 3, Section 5.2(a)	ANSI C63.10-2013 Clause 11.8.1	PASS
Occupied Bandwidth	RSS-Gen Issue 5, Section 6.7	RSS-Gen Issue 5, Section 6.7	PASS
Power Spectral Density	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 3, Section 5.2(b)	ANSI C63.10-2013 Clause 11.10.2	PASS
Conducted Out of Band Emission	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 3, Section 5.5	ANSI C63.10-2013 Clause 11.11	PASS
Radiated Spurious Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-Gen Issue 5, Section 6.13/8.9/8.10	ANSI C63.10-2013 Clause 11.11 & Clause 11.12	PASS
Band Edge Measurements (Radiated)	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209 RSS-247 Issue 3, Section 5.5	ANSI C63.10-2013 Clause 11.13	PASS
Disclaimer and Explanations: The declared of product specification and data (e.g. antenna gain, RF specification, etc) for EUT presented in the report are provided by the customer, and the customer takes all the responsibilities for the accuracy of product specification.			

3. EQUIPMENT LIST

Radiated Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	3m SAC	ETS-LINDGREN	3m	Euroshiedpn-CT001270-1317	11-Nov-2023	10-Nov-2026
☒	Receiver	R&S	ESIB26	100114	27-Oct-2023	26-Oct-2024
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	29-Mar-2024	28-Mar-2025
☒	Loop Antenna	ETS-LINDGREN	6502	00202525	30-Oct-2023	29-Oct-2024
☒	Broadband Antenna	ETS-LINDGREN	3142E	00201566	30-Oct-2023	29-Oct-2024
☒	6dB Attenuator	Talent	RA6A5-N-18	18103001	30-Oct-2023	29-Oct-2024
☒	Preamplifier	HP	8447F	2805A02960	31-Oct-2023	30-Oct-2024
☒	Band Rejection Filter (2400MHz~2500MHz)	Micro-Tronics	BRM50702	G248	27-Oct-2023	26-Oct-2024
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	16-Apr-2023	15-Apr-2025
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	31-Oct-2023	30-Oct-2024
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3116C-PA	00202652	30-Oct-2023	29-Oct-2024
☒	Pre-amplifier	ETS-Lindgren	00118384	00202652	30-Oct-2023	29-Oct-2024
☒	Multi device Controller	ETS-LINDGREN	7006-001	00160105	N/A	N/A
☒	Test Software	Audix	e3	Software Version: 9.160323		

Conducted Emission Test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	Receiver	R&S	ESR7	1316.3003K07-101181-K3	27-Oct-2023	26-Oct-2024
☒	Pulse Limiter	R&S	ESH3-Z2	0357.8810.54	27-Oct-2023	26-Oct-2024
☒	LISN	R&S	ESH2-Z5	860014/024	27-Oct-2023	26-Oct-2024
☒	LISN	ETS-Lindgren	3816/2SH	00201088	27-Oct-2023	26-Oct-2024
☒	Test Software	EZ-EMC	EZ-CON	Software Version: EMC-CON 3A1.1		

Conducted RF test Equipment List						
Used	**Equipment**	**Manufacturer**	**Model No.**	**Serial Number**	**Cal. date**	**Cal. Due date**
☒	EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY51440197	29-Mar-2024	28-Mar-2025
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	27-Oct-2023	26-Oct-2024
☐	MXG X-Series RF Vector Signal Generator	KEYSIGHT	N5182B	MY51350267	27-Oct-2023	26-Oct-2024

4. TEST CONFIGURATION

4.1 ENVIRONMENTAL CONDITIONS FOR TESTING

4.1.1 Normal or Extreme Test Conditions

Environment Parameter	Selected Values During Tests		
Test Condition	Ambient		
	Temperature (°C)	Voltage (V)	Relative Humidity (%)
NT/NV	+15 to +35	12	20 to 75
Remark: 1) NV: Normal Voltage; NT: Normal Temperature			

4.1.2 Record of Normal Environment and Test Sample

Test Item	Temp. (°C)	Relative Humidity (%)	Pressure (kPa)	Sample No.	Tested by
AC Power Line Conducted Emission	23.9	63.9	100.5	S202403232933-ZJA02/4	Linson Xie
Conducted Peak Output Power	24.8	53.4	100.6		Rain Wang
6dB Bandwidth & Occupied Bandwidth					
Power Spectral Density					
Conducted Out of Band Emission					
Radiated Spurious Emissions	24.3	58.6	100.2		Fire Huo
Band Edge Measurements (Radiated)					

4.2 TEST CHANNELS

Type of Modulation	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
GFSK	2402 MHz to 2480 MHz	Channel 0	Channel 19	Channel 39
		2402 MHz	2440 MHz	2480 MHz

4.3 EUT TEST STATUS

Type of Modulation	Tx Function	Description
GFSK	1Tx	1. Keep the EUT in continuously transmitting with modulation test single.

Power Setting(Provided by the customer)
Power Setting: not applicable, test used software default power level.

Test Software(Provided by the customer)
Test software name: Putty

4.4 TEST SETUP

4.4.1 For Radiated Emissions test setup

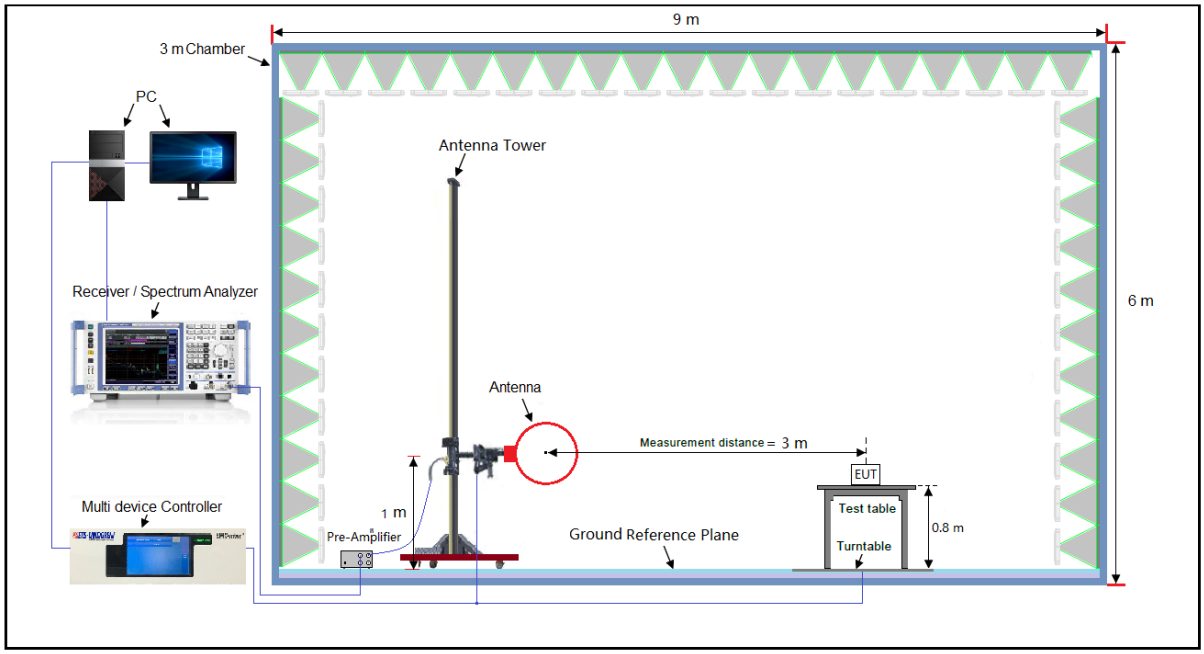


Figure 1. Below 30MHz

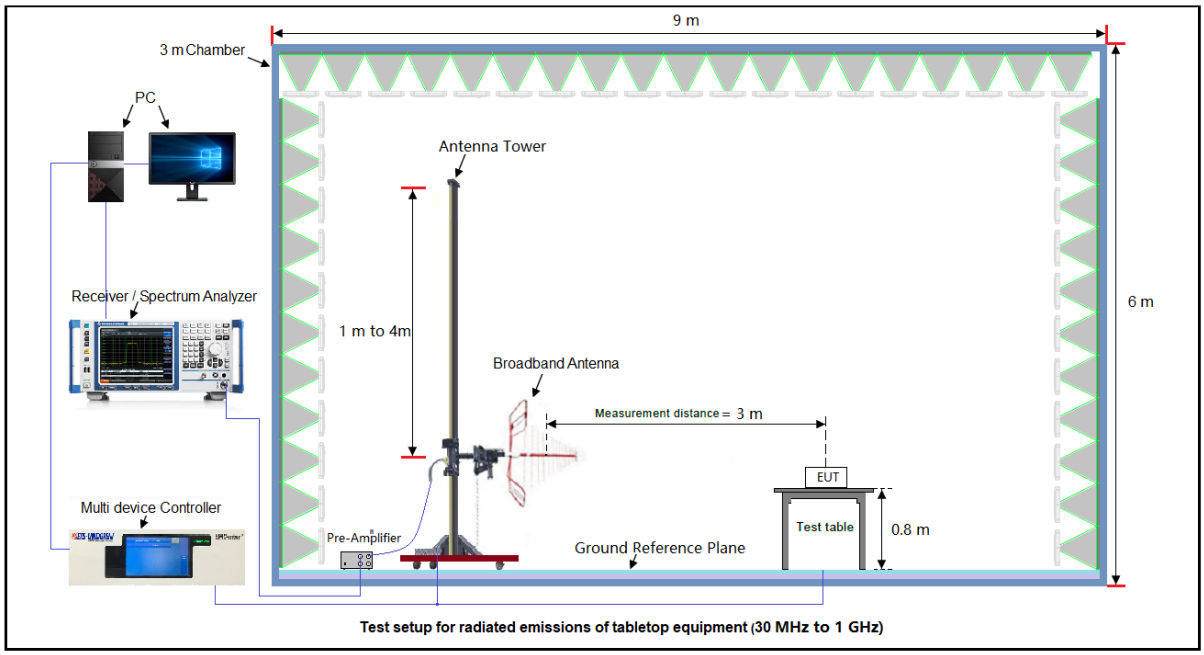


Figure 2. 30MHz to 1GHz

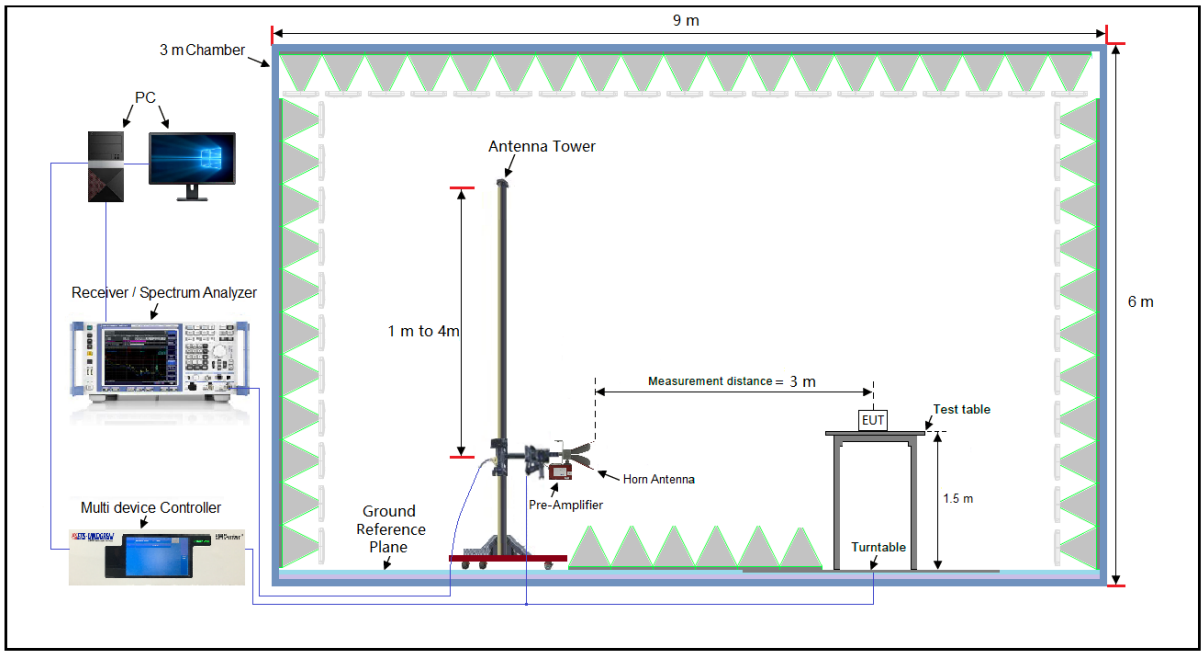
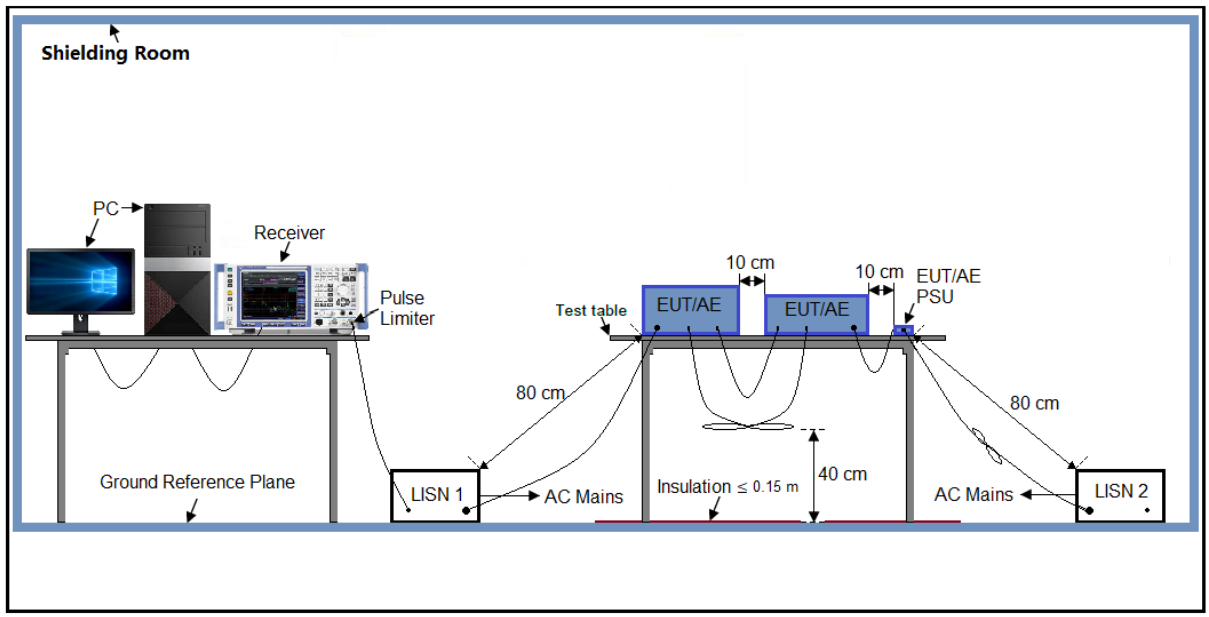
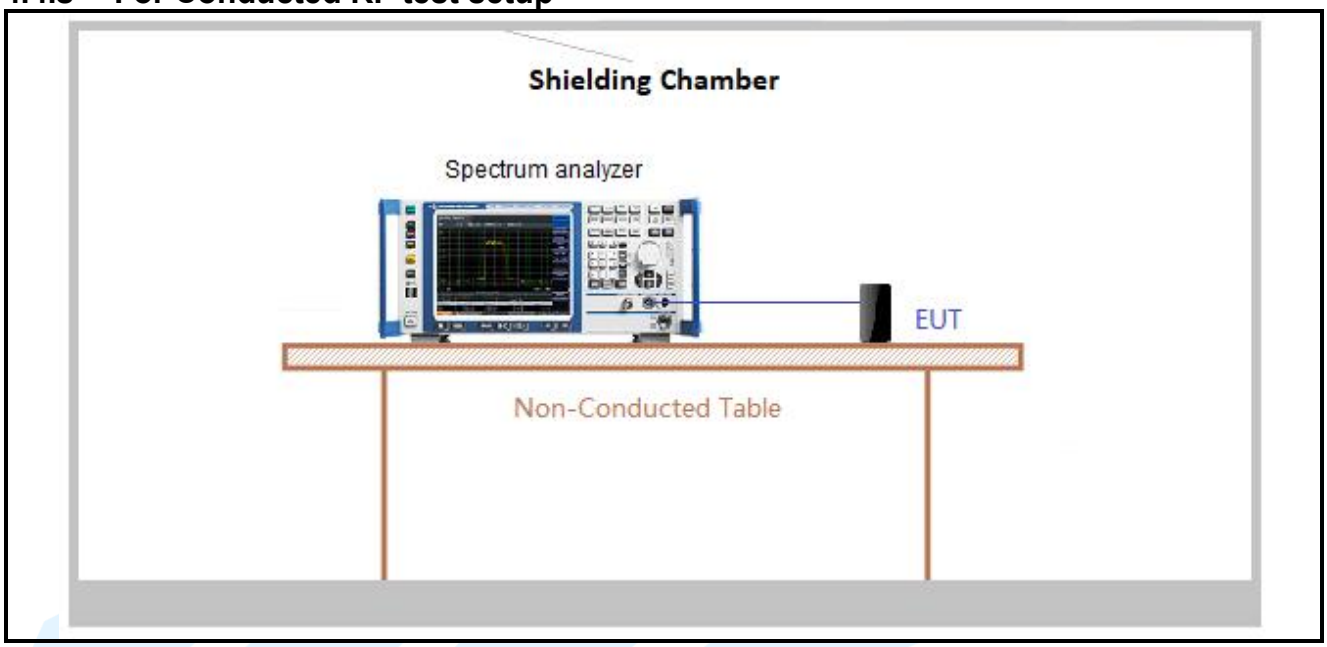


Figure 3. Above 1GHz

4.4.2 For Conducted Emissions test setup



4.4.3 For Conducted RF test setup



4.5 SYSTEM TEST CONFIGURATION

For emissions testing, the equipment under test (EUT) setup to transmit continuously to simplify the measurement methodology. Care was taken to ensure proper power supply voltages during testing. During testing, radiated emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario. Only the worst case data were recorded in this test report.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. Therefore, all final radiated testing was performed with the EUT in (see table below) orientation.

Frequency	Mode	Antenna Port	Worst-case axis positioning
Above 1GHz	1TX	Chain 0	Y axis

All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Analyzer resolution is 100 kHz or greater for frequencies below 1000 MHz. The resolution is 1 MHz or greater for frequencies above 1000 MHz. The spurious emissions more than 20 dB below the permissible value are not reported.

Radiated emission measurement were performed from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

4.6 DUTY CYCLE

Test Procedure: ANSI C63.10-2013 Clause 11.6.

Test Results

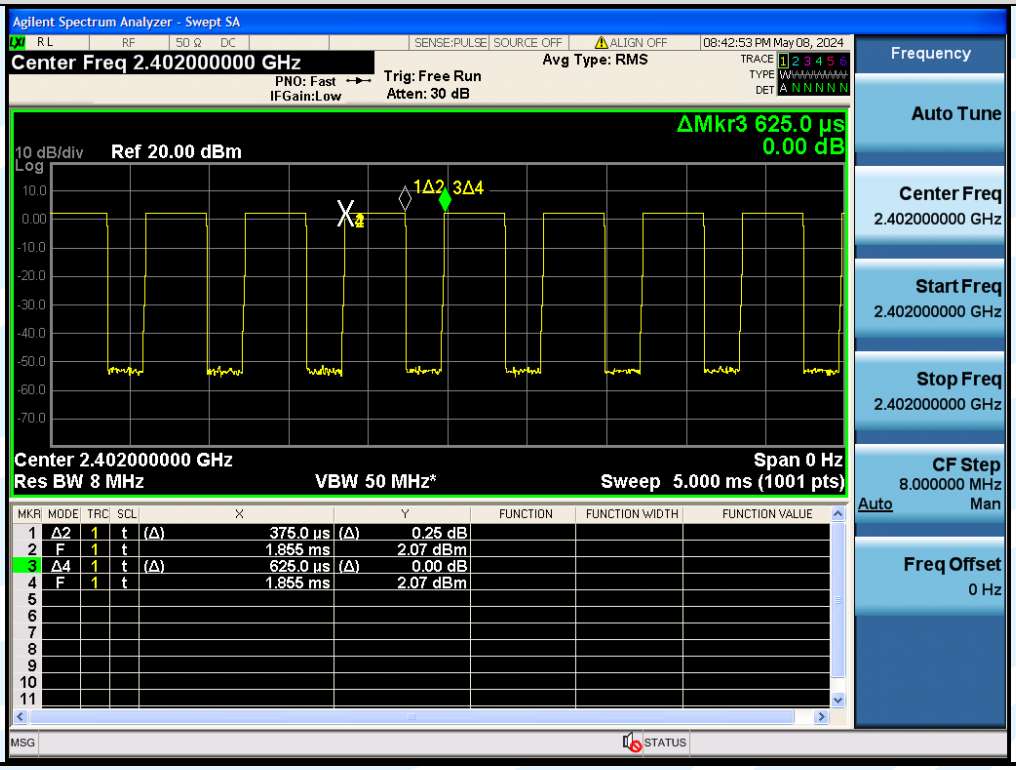
Mode	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/T Minimum VBW (kHz)
LE	0.375	0.625	0.60	60.00	2.22	2.67
2LE	0.190	0.625	0.30	30.40	5.17	5.26
LE Code (S=2)	1.040	1.880	0.55	55.32	2.57	0.96
LE Code (S=8)	3.060	3.740	0.82	81.82	0.87	0.33

Remark:

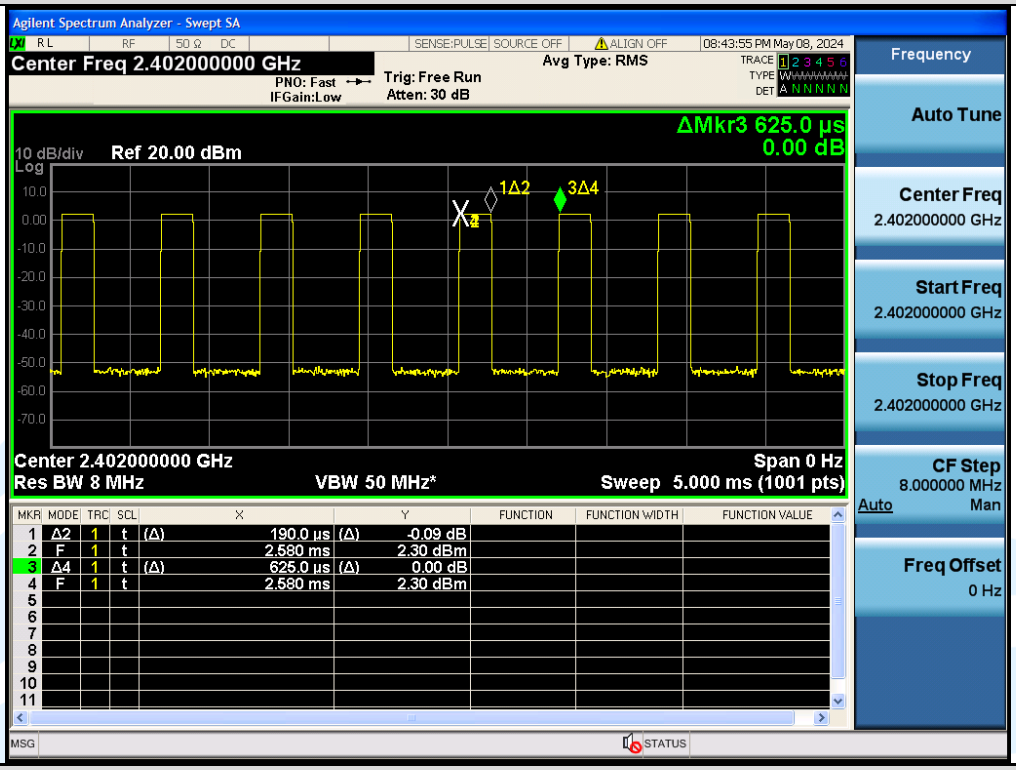
1) Duty cycle= On Time/ Period;
2) Duty Cycle factor = 10 * log(1/ Duty cycle);
3) Average factor = 20 $\log_{10}$ Duty Cycle.

The test plot as follows

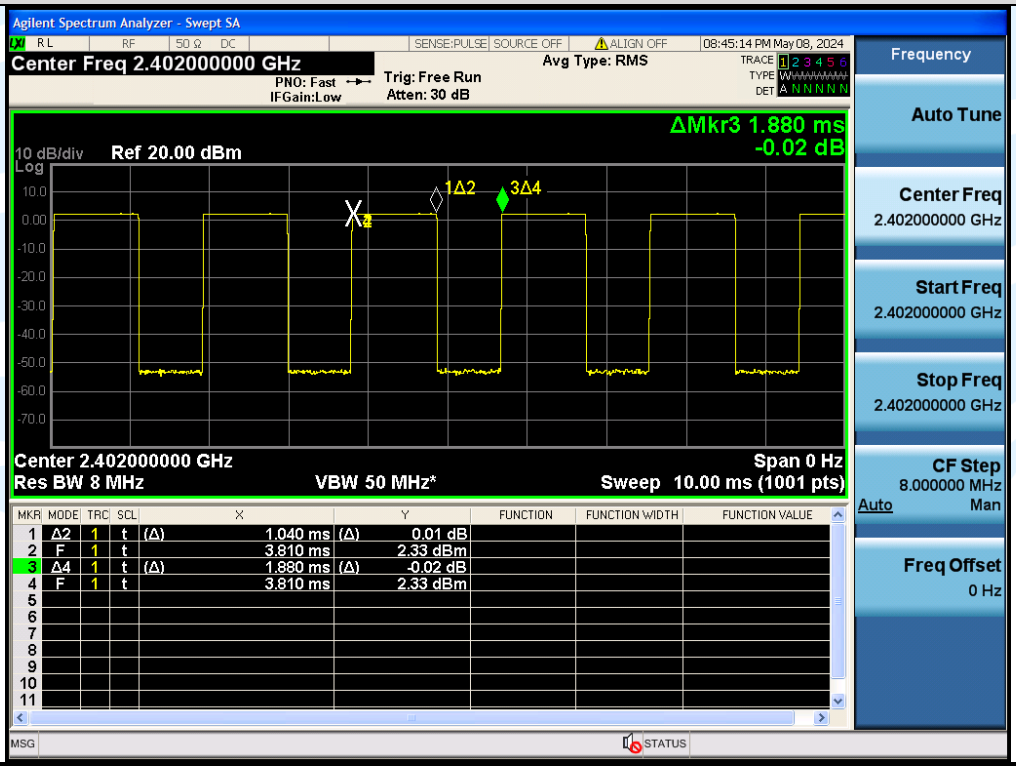
LE



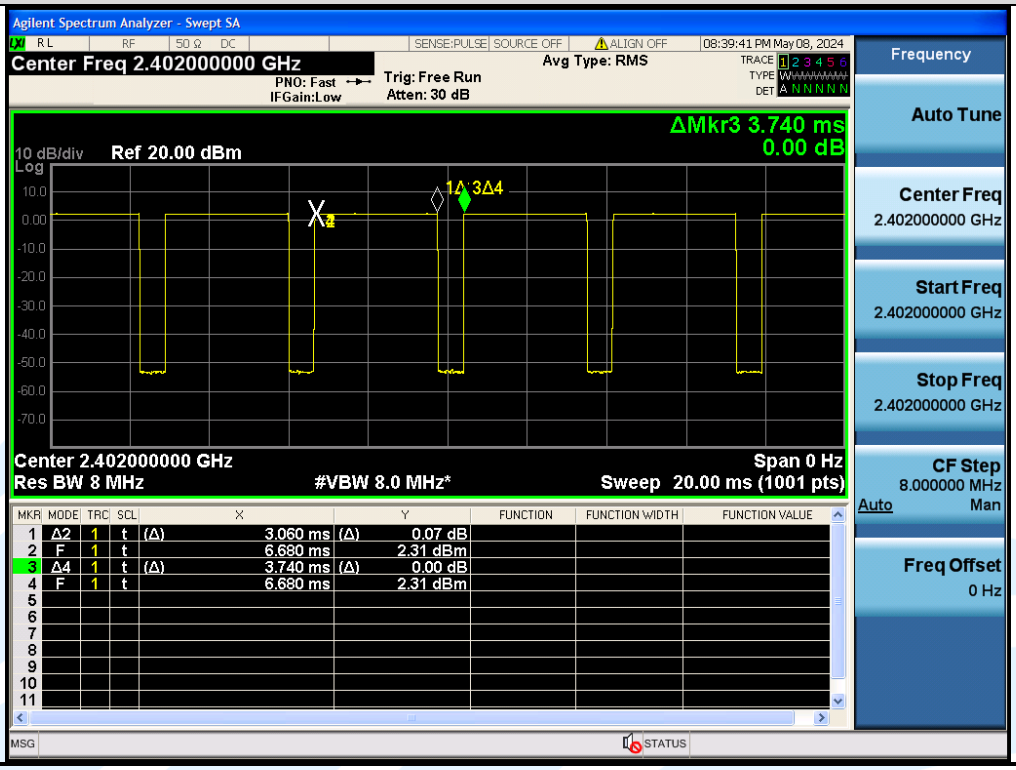
2LE



LE Code S=2



LE Code S=8


Agilent Spectrum Analyzer - Swept SA
Center Freq 2.402000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 30 dB
Avg Type: RMS
08:39:41 PM May 08, 2024
ΔMkr3 3.740 ms
0.00 dB
10 dB/div
Log
Ref 20.00 dBm
Center 2.402000000 GHz
Res BW 8 MHz
#VBW 8.0 MHz*
Span 0 Hz
Sweep 20.00 ms (1001 pts)
1 Δ2 1 t (Δ) 3.060 ms (Δ) 0.07 dB
2 F 1 t 6.680 ms 2.31 dBm
3 Δ4 1 t (Δ) 3.740 ms (Δ) 0.00 dB
4 F 1 t 6.680 ms 2.31 dBm
Frequency
Auto Tune
Center Freq
2.402000000 GHz
Start Freq
2.402000000 GHz
Stop Freq
2.402000000 GHz
CF Step
8.000000 MHz
Auto
Man
Freq Offset
0 Hz

5. RADIO TECHNICAL REQUIREMENTS SPECIFICATION

5.1 REFERENCE DOCUMENTS FOR TESTING

No.	Identity	Document Title
1	FCC 47 CFR Part 2	Frequency allocations and radio treaty matters; general rules and regulations
2	FCC 47 CFR Part 15	Radio Frequency Devices
3	RSS-247 Issue 3	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices
4	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
5	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices
6	KDB 558074 D01 15.247 Meas Guidance v05r02	Guidance for compliance measurements on Digital Transmission Systems, Frequency Hopping Spread Spectrum system, and Hybrid system devices operating under Section 15.247 of the FCC rules

5.2 ANTENNA REQUIREMENT

Standard Requirement
15.203 requirement: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. **15.247(b) (4) requirement:** The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, 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 (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi. **RSS-Gen Issue 5, Section 6.8 requirement:** According to RSS-Gen Issue 5, Section 6.8, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns.
EUT Antenna:
Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is 3.5dBi.

5.3 CONDUCTED PEAK OUTPUT POWER

Test Requirement: FCC 47 CFR Part 15 Subpart C Section15.247 (b)(3)
RSS-247 Issue 3, Section 5.4(d)

Test Method: ANSI C63.10-2013 Clause 11.9.1.3

Limit: For DTSs employing digital modulation techniques operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W.

Test Procedure:
1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter.
2. Measure out each test modes' peak or average output power, record the power level.

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

Test Setup: Refer to section 4.4.3 for details.

Instruments Used: Refer to section 3 for details

Test Results: Pass

Mode	Frequency	Max. Peak Power		Maximum e.i.r.p	Peak Power Limit	Maximum e.i.r.p Limit	Result
	(MHz)	(dBm)	(W)	(dBm)	(dBm)	(dBm)	
LE	2402	6.78	0.00476	10.28	30	36.02	Pass
	2440	7.02	0.00504	10.52	30	36.02	Pass
	2480	7.27	0.00533	10.77	30	36.02	Pass
2LE	2402	6.73	0.00471	10.23	30	36.02	Pass
	2440	6.97	0.00498	10.47	30	36.02	Pass
	2480	7.22	0.00527	10.72	30	36.02	Pass
LE Code (S=2)	2402	6.82	0.00481	10.32	30	36.02	Pass
	2440	7.05	0.00507	10.55	30	36.02	Pass
	2480	7.29	0.00536	10.79	30	36.02	Pass
LE Code (S=8)	2402	6.84	0.00483	10.34	30	36.02	Pass
	2440	7.07	0.00509	10.57	30	36.02	Pass
	2480	**7.30**	0.00537	**10.80**	30	36.02	Pass

Note:
1. The antenna gain of 3.5 dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.
2. The maximum EIRP is calculated from max output power and antenna gain, the antenna gain provided by the customer, and the customer takes all the responsibilities for the accuracy of antenna gain.

5.46 DB BANDWIDTH & OCCUPIED BANDWIDTH

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(2) RSS-247 Issue 3, Section 5.2(a) RSS-Gen Issue 5, Section 6.7
Test Method:	ANSI C63.10-2013 Clause 11.8.1 RSS-Gen Issue 5, Section 6.7
Limit:	For digital transmission systems, the minimum 6 dB bandwidth shall be 500 kHz.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: **6dB Bandwidth** a) Set RBW = 100 kHz. b) Set the video bandwidth (VBW) ≥ 3 x RBW. c) Detector = Peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. **Occupied Bandwidth** a) Set RBW = 1% to 5% of the occupied bandwidth b) Set the video bandwidth (VBW) ≥ 3 x RBW. c) Detector = Peak. d) Trace mode = max hold. e) Sweep = auto couple. f) Allow the trace to stabilize. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.4.3 for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	**Please refer to Appendix A**

5.5 POWER SPECTRAL DENSITY

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247 (e) RSS-247 Issue 3, Section 5.2(b)
Test Method:	ANSI C63.10-2013 Clause 11.10.2
Limit:	For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: a) Set analyzer center frequency to DTS channel center frequency. b) Set the span to 1.5 times the DTS bandwidth. c) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz. d) Set the VBW ⩾ 3 x RBW. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum amplitude level within the RBW. j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.4.3 for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	**Please refer to Appendix A**

5.6 CONDUCTED OUT OF BAND EMISSION

Test Requirement:	FCC 47 CFR Part 15 Subpart C Section 15.247(d) RSS-247 Issue 2, Section 5.5
Test Method:	ANSI C63.10-2013 Clause 11.11
Limit:	In any 100kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.
Test Procedure:	Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer. Use the following spectrum analyzer settings: **Step 1: Reference level measurement** a) Set instrument center frequency to DTS channel center frequency. b) Set the span to ≥ 1.5 times the DTS bandwidth. c) Set the RBW = 100 kHz. d) Set the VBW ≥ 3 x RBW. e) Detector = peak. f) Sweep time = auto couple. g) Trace mode = max hold. h) Allow trace to fully stabilize. i) Use the peak marker function to determine the maximum PSD level. Note that the channel found to contain the maximum PSD level can be used to establish the reference level. **Step 2: Emission level measurement** a) Set RBW = 100 kHz. b) Set VBW ≥ 300 kHz. c) Detector = peak. d) Sweep = auto couple. e) Trace Mode = max hold. f) Allow trace to fully stabilize. g) Use the peak marker function to determine the maximum amplitude level. Note: The cable loss and attenuator loss were offset into measure device as an amplitude offset.
Test Setup:	Refer to section 4.4.3 for details.
Instruments Used:	Refer to section 3 for details
Test Mode:	Link mode
Test Results:	**Please refer to Appendix A**

5.7 RADIATED SPURIOUS EMISSIONS

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209
RSS-Gen Issue 5, Section 6.13/8.9/8.10

Test Method: ANSI C63.10-2013 Clause 11.11 & Clause 11.12

Receiver Setup:

Frequency	RBW
0.009 MHz-0.150 MHz	200/300 kHz
0.150 MHz -30 MHz	9/10 kHz
30 MHz-1 GHz	100/120 kHz
Above 1 GHz	1 MHz

Limits:

Spurious Emissions

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009 MHz-0.490 MHz	2400/F(kHz)	--	--	300
0.490 MHz-1.705 MHz	24000/F(kHz)	--	--	30
1.705 MHz-30 MHz	30	--	--	30
30 MHz-88 MHz	100	40.0	Quasi-peak	3
88 MHz-216 MHz	150	43.5	Quasi-peak	3
216 MHz-960 MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1 GHz	500	54.0	Average	3

Remark:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000 MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation.

Test Setup: Refer to section 4.4.1 for details.

Test Procedures:

1. From 30 MHz to 1GHz test procedure as below:

1) The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2) The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3) The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4) For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
5) The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6) If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

2. Above 1GHz test procedure as below:

1) Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).

2) Test the EUT in the lowest channel ,middle channel, the Highest channel
3) The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the Y axis positioning which it is worse case.
4) Repeat above procedures until all frequencies measured was complete.

Equipment Used: Refer to section 3 for details.

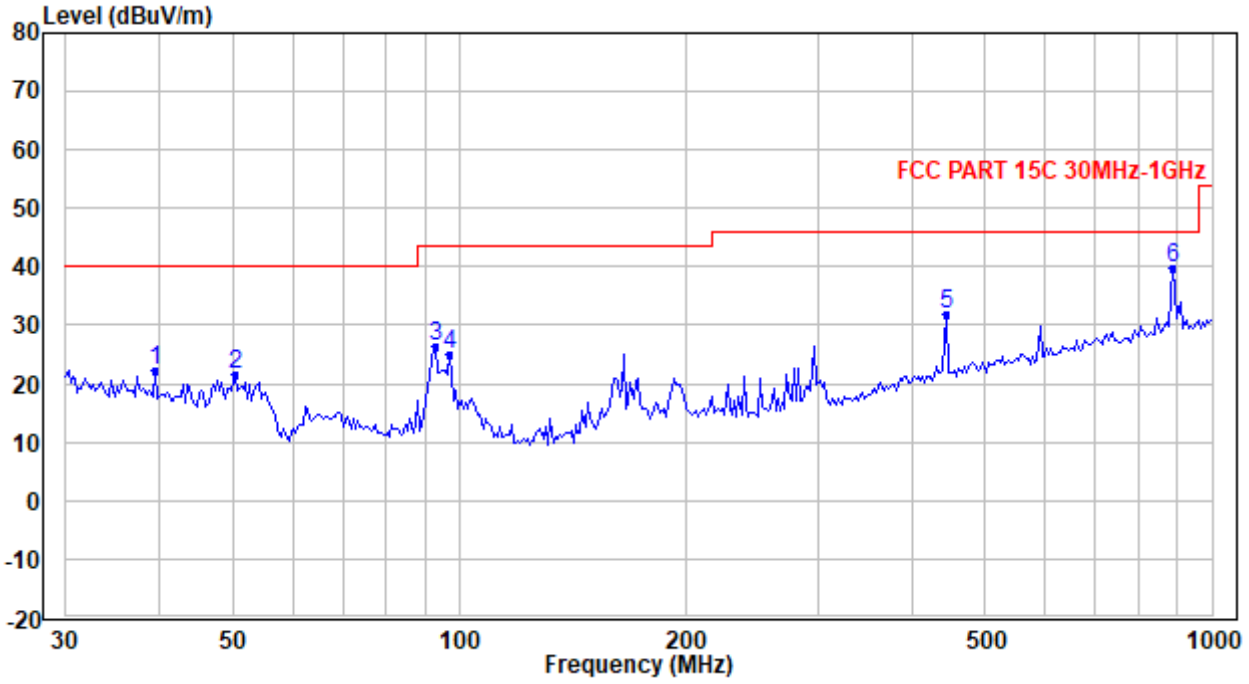
Test Result: Pass

The measurement data as follows:

Radiated Emission Test Data (9 KHz ~ 30 MHz):
The amplitude of spurious emissions attenuated more than 20 dB below the permissible value need not be reported.

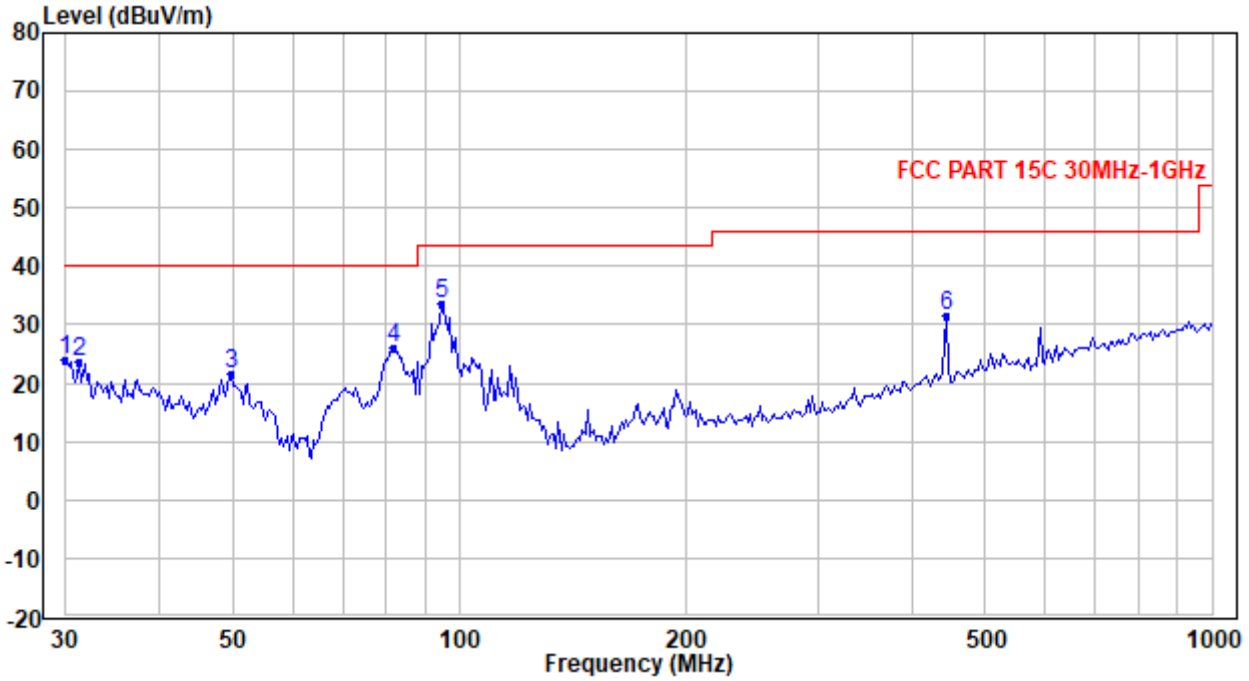
Radiated Emission Test Data (30 MHz ~ 1 GHz):
Worst-Case Configuration(2LE_Channel 0)

Horizontal



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	39.459	30.79	-8.39	22.40	40.00	-17.60	QP
2	50.461	35.20	-13.75	21.45	40.00	-18.55	QP
3	92.997	42.60	-16.09	26.51	43.50	-16.99	QP
4	97.002	41.14	-16.07	25.07	43.50	-18.43	QP
5	442.572	35.96	-3.99	31.97	46.00	-14.03	QP
6	887.398	35.21	4.58	39.79	46.00	-6.21	QP

Vertical



No.	Frequency (MHz)	Reading (dBμV/m)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector
1	30.000	28.15	-4.08	24.07	40.00	-15.93	QP
2	31.292	29.73	-6.01	23.72	40.00	-16.28	QP
3	49.757	35.14	-13.54	21.60	40.00	-18.40	QP
4	81.948	43.88	-17.75	26.13	40.00	-13.87	QP
5	94.979	49.70	-15.98	33.72	43.50	-9.78	QP
6	442.572	35.38	-3.99	31.39	46.00	-14.61	QP

Radiated Emission Test Data (Above 1GHz):								
LE_ Lowest Channel:								
No.	**Frequency (MHz)**	**Reading (dBμV)**	**Correction factor (dB/m)**	**Result (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Detector**	**Antenna Polaxis**
1	4804	36.35	-2.08	34.27	54.00	-19.73	Average	Horizontal
2	4804	52.60	-2.08	50.52	74.00	-23.48	Peak	Horizontal
3	7206	36.09	1.30	37.39	54.00	-16.61	Average	Horizontal
4	7206	51.87	1.30	53.17	74.00	-20.83	Peak	Horizontal
5	4804	36.35	-2.08	34.27	54.00	-19.73	Average	Vertical
6	4804	50.38	-2.08	48.30	74.00	-25.70	Peak	Vertical
7	7206	35.08	1.30	36.38	54.00	-17.62	Average	Vertical
8	7206	48.94	1.30	50.24	74.00	-23.76	Peak	Vertical
LE_ Middle Channel:								
1	4880	35.12	-2.05	33.07	54.00	-20.93	Average	Horizontal
2	4880	53.11	-2.05	51.06	74.00	-22.94	Peak	Horizontal
3	7320	35.01	1.31	36.32	54.00	-17.68	Average	Horizontal
4	7320	51.10	1.31	52.41	74.00	-21.59	Peak	Horizontal
5	4880	35.05	-2.05	33.00	54.00	-21.00	Average	Vertical
6	4880	51.63	-2.05	49.58	74.00	-24.42	Peak	Vertical
7	7320	35.06	1.31	36.37	54.00	-17.63	Average	Vertical
8	7320	48.79	1.31	50.10	74.00	-23.90	Peak	Vertical
LE_ Highest Channel:								
1	4960	35.94	-2.02	33.92	54.00	-20.08	Average	Horizontal
2	4960	51.97	-2.02	49.95	74.00	-24.05	Peak	Horizontal
3	7440	34.91	1.32	36.23	54.00	-17.77	Average	Horizontal
4	7440	48.67	1.32	49.99	74.00	-24.01	Peak	Horizontal
5	4960	35.82	-2.02	33.80	54.00	-20.20	Average	Vertical
6	4960	51.57	-2.02	49.55	74.00	-24.45	Peak	Vertical
7	7440	34.70	1.32	36.02	54.00	-17.98	Average	Vertical
8	7440	47.17	1.32	48.49	74.00	-25.51	Peak	Vertical

2LE_ Lowest Channel:								
No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4804	35.14	-2.08	33.06	54.00	-20.94	Average	Horizontal
2	4804	51.88	-2.08	49.80	74.00	-24.20	Peak	Horizontal
3	7206	36.03	1.30	37.33	54.00	-16.67	Average	Horizontal
4	7206	52.03	1.30	53.33	74.00	-20.67	Peak	Horizontal
5	4804	36.25	-2.08	34.17	54.00	-19.83	Average	Vertical
6	4804	50.78	-2.08	48.70	74.00	-25.30	Peak	Vertical
7	7206	35.29	1.30	36.59	54.00	-17.41	Average	Vertical
8	7206	48.69	1.30	49.99	74.00	-24.01	Peak	Vertical
2LE_ Middle Channel:								
1	4880	34.99	-2.05	32.94	54.00	-21.06	Average	Horizontal
2	4880	51.51	-2.05	49.46	74.00	-24.54	Peak	Horizontal
3	7320	35.04	1.31	36.35	54.00	-17.65	Average	Horizontal
4	7320	50.94	1.31	52.25	74.00	-21.75	Peak	Horizontal
5	4880	35.05	-2.05	33.00	54.00	-21.00	Average	Vertical
6	4880	50.85	-2.05	48.80	74.00	-25.20	Peak	Vertical
7	7320	35.04	1.31	36.35	54.00	-17.65	Average	Vertical
8	7320	47.28	1.31	48.59	74.00	-25.41	Peak	Vertical
2LE_ Highest Channel:								
1	4960	35.82	-2.02	33.80	54.00	-20.20	Average	Horizontal
2	4960	51.07	-2.02	49.05	74.00	-24.95	Peak	Horizontal
3	7440	34.94	1.32	36.26	54.00	-17.74	Average	Horizontal
4	7440	48.56	1.32	49.88	74.00	-24.12	Peak	Horizontal
5	4960	36.03	-2.02	34.01	54.00	-19.99	Average	Vertical
6	4960	50.18	-2.02	48.16	74.00	-25.84	Peak	Vertical
7	7440	34.54	1.32	35.86	54.00	-18.14	Average	Vertical
8	7440	46.97	1.32	48.29	74.00	-25.71	Peak	Vertical

LE Code (S=2)_ Lowest Channel:								
No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4804	35.14	-2.08	33.06	54.00	-20.94	Average	Horizontal
2	4804	51.59	-2.08	49.51	74.00	-24.49	Peak	Horizontal
3	7206	35.96	1.30	37.26	54.00	-16.74	Average	Horizontal
4	7206	51.57	1.30	52.87	74.00	-21.13	Peak	Horizontal
5	4804	35.14	-2.08	33.06	54.00	-20.94	Average	Vertical
6	4804	50.10	-2.08	48.02	74.00	-25.98	Peak	Vertical
7	7206	35.19	1.30	36.49	54.00	-17.51	Average	Vertical
8	7206	47.81	1.30	49.11	74.00	-24.89	Peak	Vertical
LE Code (S=2)_ Middle Channel:								
1	4880	35.42	-2.05	33.37	54.00	-20.63	Average	Horizontal
2	4880	49.23	-2.05	47.18	74.00	-26.82	Peak	Horizontal
3	7320	35.49	1.31	36.80	54.00	-17.20	Average	Horizontal
4	7320	47.26	1.31	48.57	74.00	-25.43	Peak	Horizontal
5	4880	35.45	-2.05	33.40	54.00	-20.60	Average	Vertical
6	4880	51.55	-2.05	49.50	74.00	-24.50	Peak	Vertical
7	7320	35.54	1.31	36.85	54.00	-17.15	Average	Vertical
8	7320	47.21	1.31	48.52	74.00	-25.48	Peak	Vertical
LE Code (S=2)_ Highest Channel:								
1	4960	35.24	-2.02	33.22	54.00	-20.78	Average	Horizontal
2	4960	51.51	-2.02	49.49	74.00	-24.51	Peak	Horizontal
3	7440	34.91	1.32	36.23	54.00	-17.77	Average	Horizontal
4	7440	46.96	1.32	48.28	74.00	-25.72	Peak	Horizontal
5	4960	35.27	-2.02	33.25	54.00	-20.75	Average	Vertical
6	4960	50.09	-2.02	48.07	74.00	-25.93	Peak	Vertical
7	7440	34.91	1.32	36.23	54.00	-17.77	Average	Vertical
8	7440	47.11	1.32	48.43	74.00	-25.57	Peak	Vertical

LE Code (S=8)_ Lowest Channel:								
No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
1	4804	35.73	-2.08	33.65	54.00	-20.35	Average	Horizontal
2	4804	47.36	-2.08	45.28	74.00	-28.72	Peak	Horizontal
3	7206	35.36	1.30	36.66	54.00	-17.34	Average	Horizontal
4	7206	47.11	1.30	48.41	74.00	-25.59	Peak	Horizontal
5	4804	35.52	-2.08	33.44	54.00	-20.56	Average	Vertical
6	4804	49.36	-2.08	47.28	74.00	-26.72	Peak	Vertical
7	7206	35.41	1.30	36.71	54.00	-17.29	Average	Vertical
8	7206	46.67	1.30	47.97	74.00	-26.03	Peak	Vertical
LE Code (S=8)_ Middle Channel:								
1	4880	35.42	-2.05	33.37	54.00	-20.63	Average	Horizontal
2	4880	49.23	-2.05	47.18	74.00	-26.82	Peak	Horizontal
3	7320	35.49	1.31	36.80	54.00	-17.20	Average	Horizontal
4	7320	47.26	1.31	48.57	74.00	-25.43	Peak	Horizontal
5	4880	35.45	-2.05	33.40	54.00	-20.60	Average	Vertical
6	4880	51.55	-2.05	49.50	74.00	-24.50	Peak	Vertical
7	7320	35.54	1.31	36.85	54.00	-17.15	Average	Vertical
8	7320	47.21	1.31	48.52	74.00	-25.48	Peak	Vertical
LE Code (S=8)_ Highest Channel:								
1	4960	35.24	-2.02	33.22	54.00	-20.78	Average	Horizontal
2	4960	51.51	-2.02	49.49	74.00	-24.51	Peak	Horizontal
3	7440	34.91	1.32	36.23	54.00	-17.77	Average	Horizontal
4	7440	46.96	1.32	48.28	74.00	-25.72	Peak	Horizontal
5	4960	35.27	-2.02	33.25	54.00	-20.75	Average	Vertical
6	4960	50.09	-2.02	48.07	74.00	-25.93	Peak	Vertical
7	7440	34.91	1.32	36.23	54.00	-17.77	Average	Vertical
8	7440	47.11	1.32	48.43	74.00	-25.57	Peak	Vertical

Remark:

1. Correct Factor = Antenna Factor + Cable Loss - Amplifier Gain, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result – Limit