FCC TEST REPORT

Product Name:	RFID Reader
Trade Mark:	iretailer
Model No.:	IRD8066
Add. Model No.:	IRD80a** (a=00-99, the symbol "*" can be A-Z or blank), IRD85a** (a=00-99, the symbol "*" can be A-Z or blank), IRD28a** (a=0-9, the symbol "*" can be A-Z or blank)
Report Number:	24073012956RFC-1
Test Standards:	FCC 47 CFR Part 15 Subpart C
FCC ID:	2BH38IRD8066
Test Result:	PASS
Date of Issue:	September 26, 2024

Prepared for:

Shanghai Lianbai Electronics Co., Ltd.
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Prepared by:

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UnionTrust Laboratories UnionTrust *Certified*

Version

Version No.	Date	Description
V1.0	September 26, 2024	Original

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1. GENERAL INFORMATION

1.1 CLIENT INFORMATION

Applicant:	Shanghai Lianbai Electronics Co., Ltd.
Address of Applicant:	2/F, Block 16, MCG, 379 Suide Road, Putuo District, Shanghai
Manufacturer:	Shanghai Lianbai Electronics Co., Ltd.
Address of Manufacturer:	2/F, Block 16, MCG, 379 Suide Road, Putuo District, Shanghai

1.2 EUT INFORMATION

1.2.1 General Description of EUT

Product Name:	RFID Reader
Model No.:	IRD8066
Add. Model No.:	IRD80a** (a=00-99, the symbol "*" can be A-Z or blank), IRD85a** (a=00-99, the symbol "*" can be A-Z or blank), IRD28a** (a=0-9, the symbol "*" can be A-Z or blank)
Trade Mark:	iretailer
DUT Stage:	Identical Prototype
EUT Supports Function: (Provided by the customer)	902 - 928 MHz
Software Version:	V4.1 (Provided by the customer)
Hardware Version:	V1.8 (Provided by the customer)
Sample Received Date:	August 7, 2024
Sample Tested Date:	August 23, 2024 to September 20, 2024
Note: The additional model is identical with the test model IRD8066 except the model number for marketing purpose.	

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

None.

1.3 PRODUCT SPECIFICATION SUBJECTIVE TO THIS STANDARD

Frequency Band:	902 MHz to 928 MHz
Frequency Range:	902.5 MHz to 927.5 MHz
Type of Modulation:	ASK
Number of Channels:	51
Channel Separation:	500 KHz
Channel Bandwidth:	250 kHz
Antenna Type: (Provided by the customer)	Internal Antenna
Antenna Gain: (Provided by the customer)	8 dBi
Maximum Peak Power:	25.35 dBm
Normal Test Voltage:	48 Vdc

1.4 OTHER INFORMATION

Channel List for 125kHz Bandwidth in 902.5 MHz to 927.5 MHz							
Channel No.	**Frequency (MHz)**	**Channel No.**	**Frequency (MHz)**	**Channel No.**	**Frequency (MHz)**	**Channel No.**	**Frequency (MHz)**
1	902.5	**17**	910.5	**33**	918.5	**49**	926.5
2	903	**18**	911	**34**	919	**50**	927
3	903.5	**19**	911.5	**35**	919.5	**51**	927.5
4	904	**20**	912	**36**	920	**--**	---
5	904.5	**21**	912.5	**37**	920.5	**--**	---
6	905	**22**	913	**38**	921	**--**	---
7	905.5	**23**	913.5	**39**	921.5	**--**	---
8	906	**24**	914	**40**	922	**--**	---
9	906.5	**25**	914.5	**41**	922.5	**--**	---
10	907	**26**	915	**42**	923	**--**	---
11	907.5	**27**	915.5	**43**	923.5	**--**	---
12	908	**28**	916	**44**	924	**--**	---
13	908.5	**29**	916.5	**45**	924.5	**--**	---
14	909	**30**	917	**46**	925	**--**	---
15	909.5	**31**	917.5	**47**	925.5	**--**	---
16	910	**32**	918	**48**	926	**--**	---

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	Lenovo	E450	SL10G10780	UnionTrust
Mouse	DELL	MS111	CN-011D3V-738	UnionTrust
POE	CISCO	MA-INJ-4	QS-6593-01N A02	UnionTrust

2) Support Cable

Cable No.	Description	Connector	Length	Supplied by
1	Antenna Cable	SMA	0.3 Meter	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 518109
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

FCC 47 CFR Part 15 Subpart C 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)	N/A	PASS
AC Power Line Conducted Emission	FCC 47 CFR Part 15 Subpart C Section 15.207	ANSI C63.10-2013 Section 6.2	PASS
Conducted Peak Output Power	FCC 47 CFR Part 15 Subpart C Section 15.247 (b)(2)	ANSI C63.10-2013 Section 7.8.5	PASS
20 dB Bandwidth	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)(i)	ANSI C63.10-2013 Section 6.9.2	PASS
Carrier Frequencies Separation	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013 Section 7.8.2	PASS
Number of Hopping Channel	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)(i)	ANSI C63.10-2013 Section 7.8.3	PASS
Dwell Time	FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)(i)	ANSI C63.10-2013 Section 7.8.4	PASS
Conducted Out of Band Emission	FCC 47 CFR Part 15 Subpart C Section 15.247(d)	ANSI C63.10-2013 Section 6.10.4 & Section 7.8.8	PASS
Radiated Emissions	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209	ANSI C63.10-2013 Section 6.3 & 6.5 & 6.6	PASS
Band Edge Measurement	FCC 47 CFR Part 15 Subpart C Section 15.205/15.209	ANSI C63.10-2013 Section 6.10.5	PASS

Note:

1) N/A: In this whole report not applicable.

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
☒	Double-Ridged Waveguide Horn Antenna (Pre-amplifier)	ETS-LINDGREN	3117-PA	00201541	1-Apr-2024	31-Mar-2025
☒	Pre-amplifier	ETS-Lindgren	00118385	00201874	1-Apr-2024	31-Mar-2025
☐	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	101181	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		

RF Conducted 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
☐	EXA Spectrum Analyzer	KEYSIGHT	N9020A	MY51286807	27-Oct-2023	26-Oct-2024
☒	USB Wideband Power Sensor	KEYSIGHT	U2021XA	MY55430035	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	48	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	23.1	59.3	100.1	S202408084100-ZJB01/1	Linson Xie
Conducted Peak Output Power	23.6	51.2	99.5	S202408074092-ZJA01/4	Rain Wang
20 dB Bandwidth					
Carrier Frequencies Separation					
Number of Hopping Channel					
Dwell Time					
Conducted Out of Band Emission					
Radiated Emissions	23.2	58.8	100.2		Jackson Wu
Band Edge Measurement					

4.2 TEST CHANNELS

Type of Modulation	Tx/Rx Frequency	Test RF Channel Lists		
		Lowest(L)	Middle(M)	Highest(H)
ASK	902.5 MHz to 927.5 MHz	Channel 1	Channel 26	Channel 51
		902.5 MHz	915 MHz	927.5 MHz

4.3 EUT TEST STATUS

Modulation Mode	Tx Function	Description
ASK	1Tx	Keep the EUT in continuously transmitting with modulation test single.

Power Setting (Provided by the customer)
18

Test Software (Provided by the customer)
RFID Control Manager

4.4 TEST SETUP

4.5.1 For Radiated Emissions test setup

Figure 1. Below 30MHz

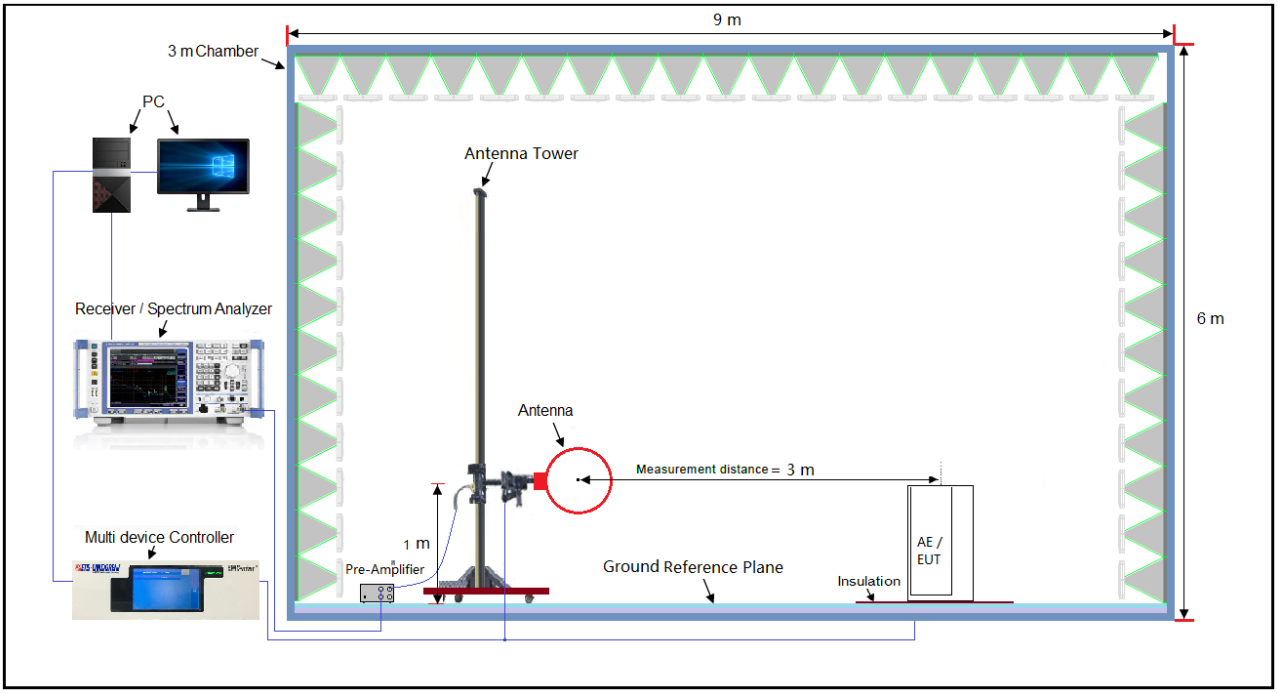


Figure 2. 30MHz to 1GHz

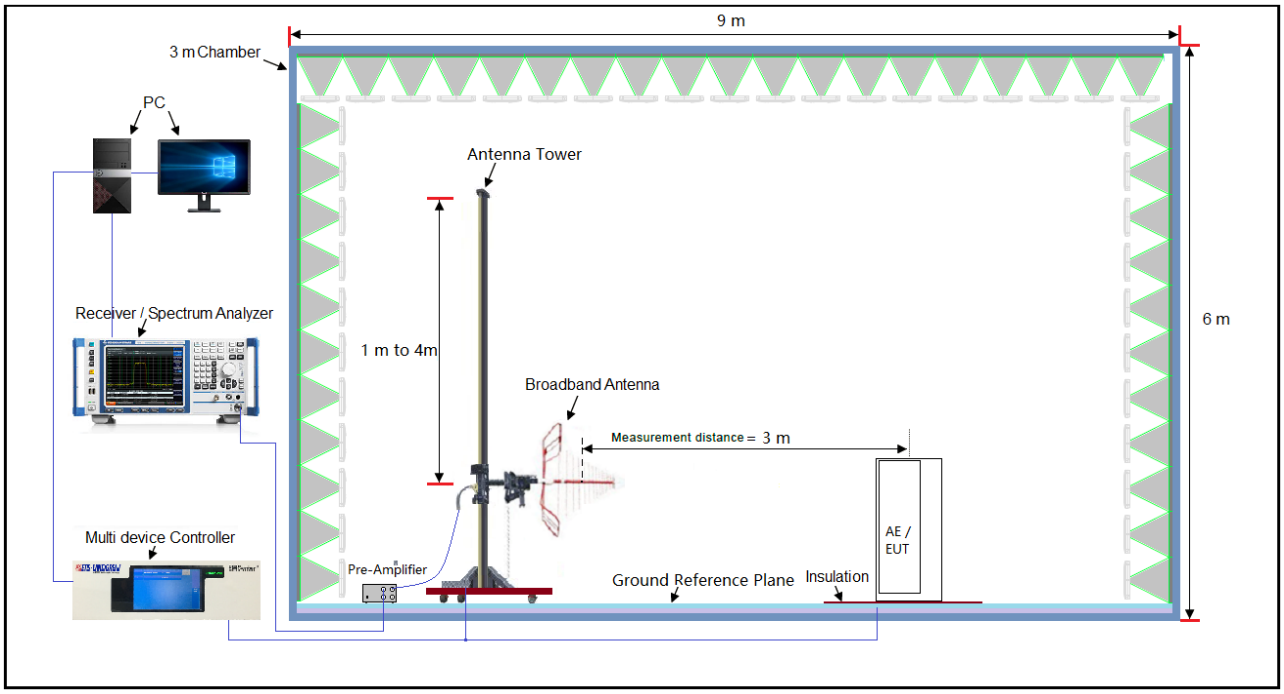
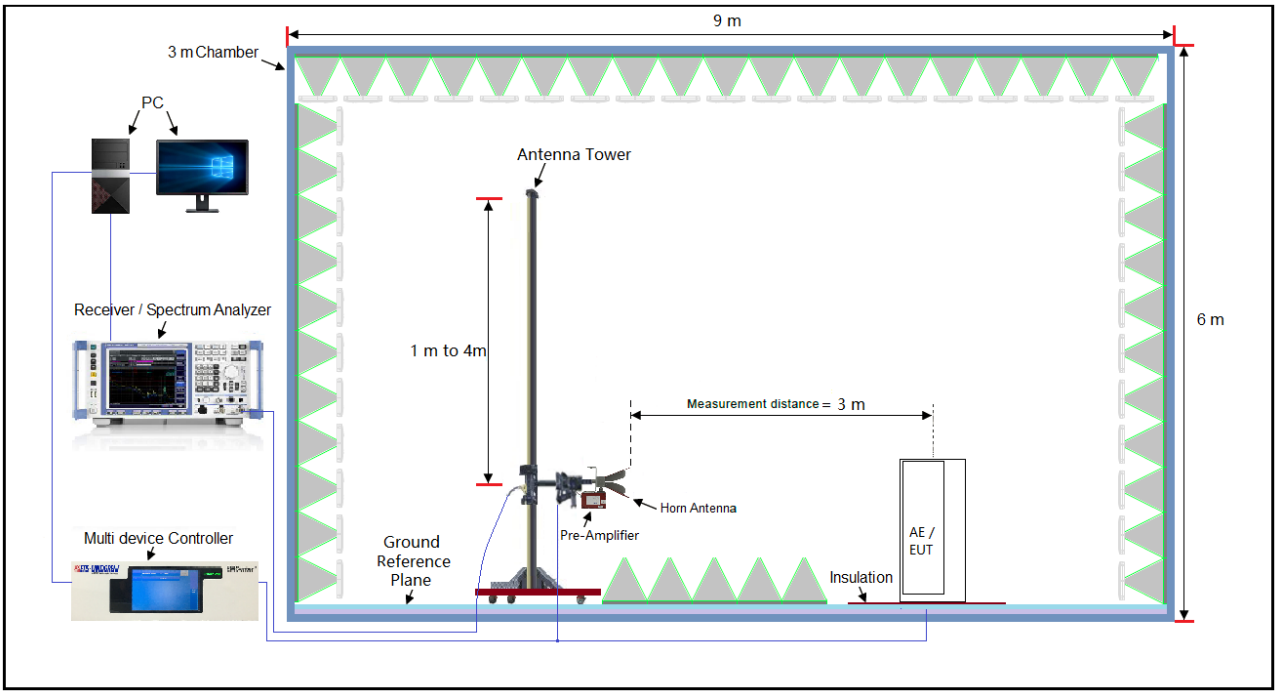
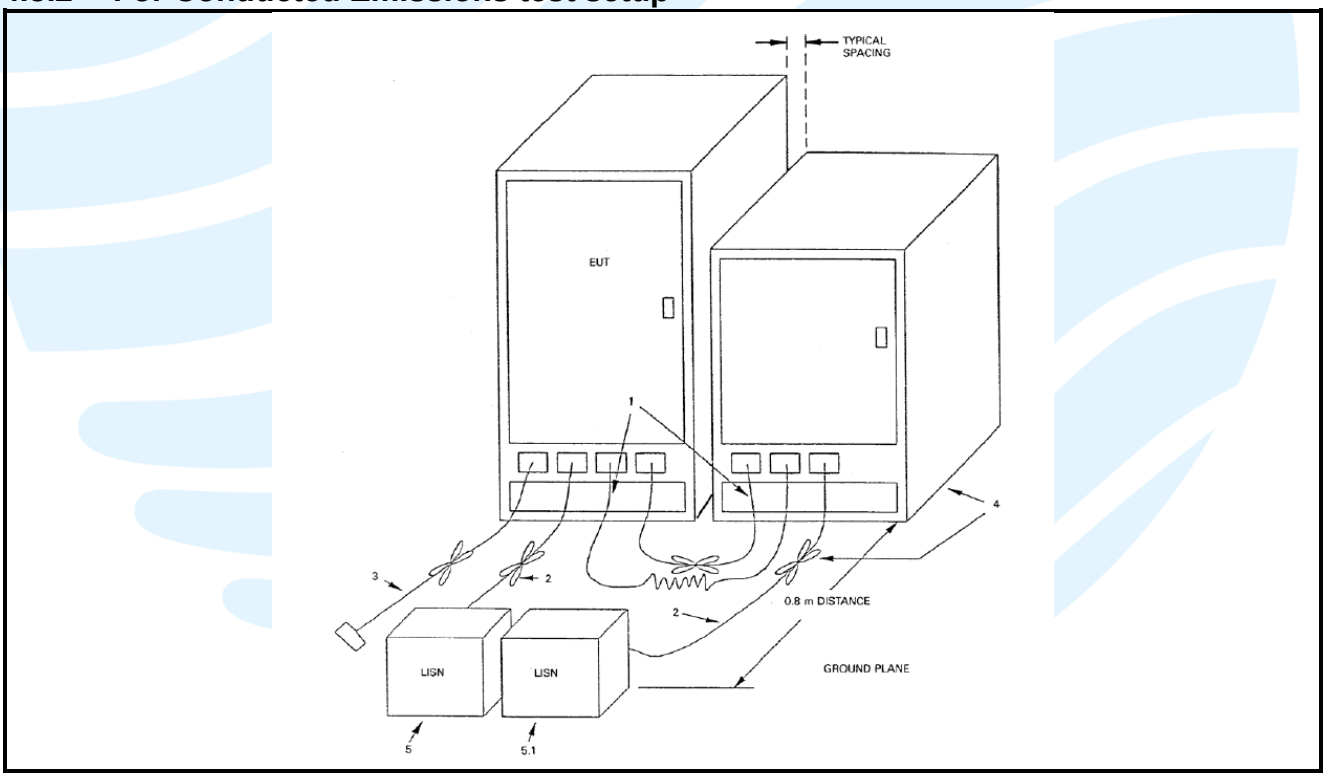


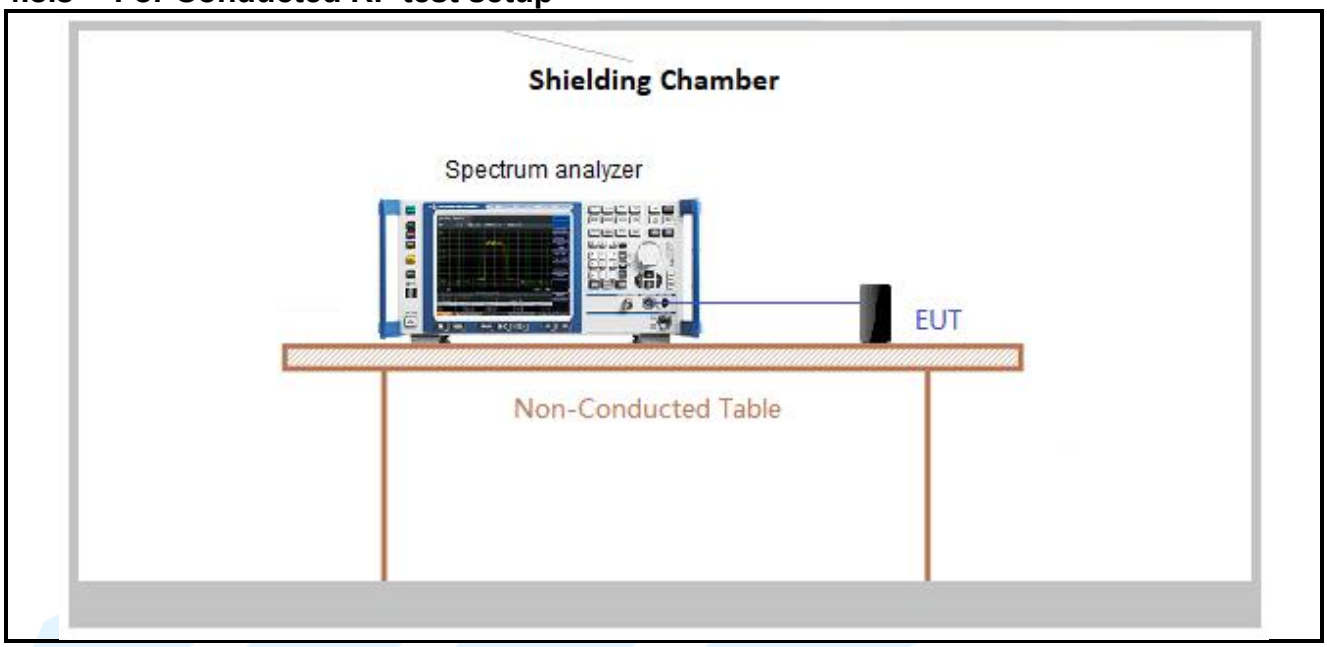
Figure 3. Above 1GHz



4.5.2 For Conducted Emissions test setup



4.5.3 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 orientation.

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

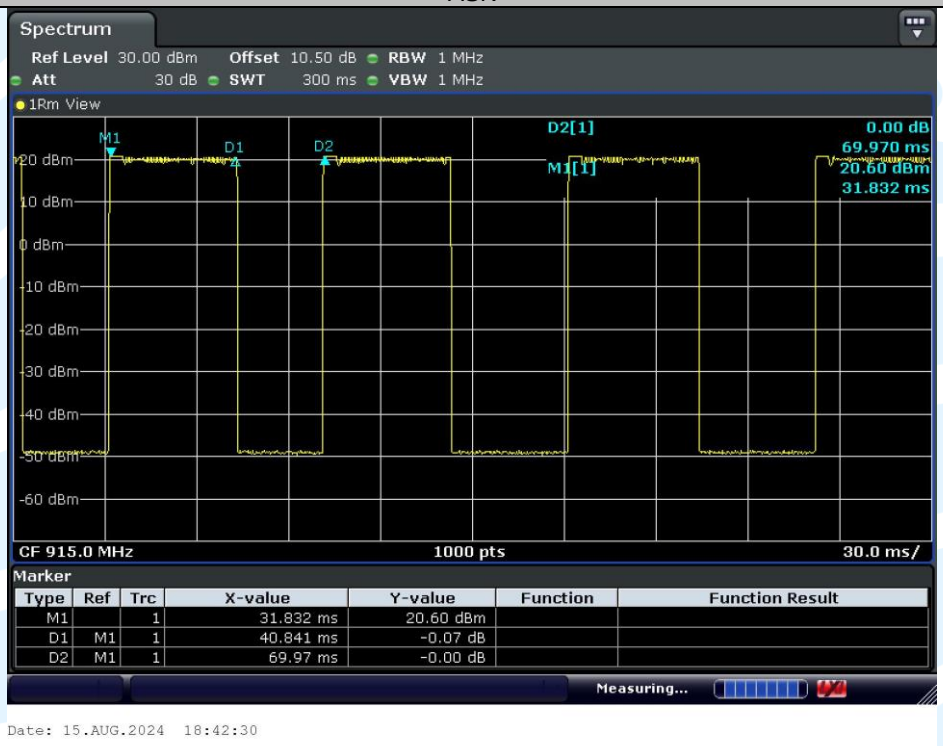
Modulation	On Time (msec)	Period (msec)	Duty Cycle (linear)	Duty Cycle (%)	Duty Cycle Factor (dB)	1/ T Minimum VBW (kHz)
ASK	40.84	69.97	0.58	58.37	2.34	0.02

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 plots as follows

ASK



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	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices
4	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.
EUT Antenna:
Antenna in the interior of the equipment and no consideration of replacement. The gain of the antenna is 8 dBi.

5.3 CONDUCTED PEAK OUTPUT POWER

Test Requirement: FCC 47 CFR Part 15 Subpart C Section15.247 (b)(2)

Test Method: ANSI C63.10-2013 Section 7.8.5

Limit: For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Test Procedure: Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.

a) Use the following spectrum analyzer settings:
   1) Span: Approximately 5 x 20 dB bandwidth, centered on a hopping channel.
   2) RBW > 20 dB bandwidth of the emission being measured.
   3) VBW ≥ RBW.
   4) Sweep: Auto.
   5) Detector function: Peak.
   6) Trace: Max hold.

b) Allow trace to stabilize.
c) Use the marker-to-peak function to set the marker to the peak of the emission.
d) The indicated level is the peak output power, after any corrections for external attenuators and cables.
e) A plot of the test results and setup description shall be included in the test report.

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Results: **Please refer to Appendix A**

5.4 20 DB BANDWIDTH

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)(i)

Test Method: ANSI C63.10-2013 Section 6.9.2

Limit: For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 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:

a) Span = approximately 2 to 5 times the OBW, centered on a hopping channel.
b) RBW = 1% to 5% of the OBW.
c) VBW ≥ 3 x RBW
d) Sweep = auto;
e) Detector function = peak
f) Trace = max hold
g) All the trace to stabilize, use the marker-to-peak function to set the marker to the peak of the emission, use the marker-delta function to measure and record the 20dB down bandwidth of the emission.

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

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: **Please refer to Appendix A**

5.5 CARRIER FREQUENCIES SEPARATION

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247 (a)(1)

Test Method: ANSI C63.10-2013 Section 7.8.2

Limit: Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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) Span: Wide enough to capture the peaks of two adjacent channels.
b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
c) Video (or average) bandwidth (VBW) ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.
h) Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

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

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: **Please refer to Appendix A**

5.6 NUMBER OF HOPPING CHANNEL

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247(a)(1)(i)

Test Method: ANSI C63.10-2013 Section 7.8.3

Limit: For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 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:

a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
b) RBW < 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.
c) VBW ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) 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 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: **Please refer to Appendix A**

5.7 DWELL TIME

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247(a)(1)(i)

Test Method: ANSI C63.10-2013 Section 7.8.4

Limit: For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 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:

a) Span = zero span, centered on a hopping channel
b) RBW shall be ≤ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
c) Sweep = As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d) Detector function = peak
e) Trace = max hold
f) Use the marker-delta function to determine the dwell time

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

Test Setup: Refer to section 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Link mode

Test Results: **Please refer to Appendix A**

5.8 CONDUCTED OUT OF BAND EMISSION

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.247(d)

Test Method: ANSI C63.10-2013 Section 6.10.4 & Section 7.8.8

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: Measurement Procedure REF

a) Set instrument center frequency to 2400 MHz or 2483.5 MHz.
b) Wide enough to capture the peak level of the emission operating on the channel closest to the band edge, as well as any modulation products that fall outside of the authorized band of operation.
c) Set the RBW = 100 kHz.
d) Set the VBW ≥ 3 x RBW.
e) Detector = peak.
f) Sweep time = auto couple.
g) Sweep points ≥ 2 x Span/RBW
h) Trace mode = max hold.
i) Allow the trace to stabilize.
j) Set the marker on the emission at the band edge, or on the highest modulation product outside of the band, if this level is greater than that at the band edge. Enable the marker-delta function, and then use the marker-to-peak function to move the marker to the peak of the in-band emission.

Step 2: Measurement Procedure OOBE

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 4.5.3 for details.

Instruments Used: Refer to section 3 for details

Test Mode: Hopping Frequencies Transmitter mode

Test Results: **Please refer to Appendix A**

5.9 RADIATED SPURIOUS EMISSIONS

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209

Test Method: ANSI C63.10-2013 Section 6.3 & 6.5 & 6.6

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 4.5.1 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.

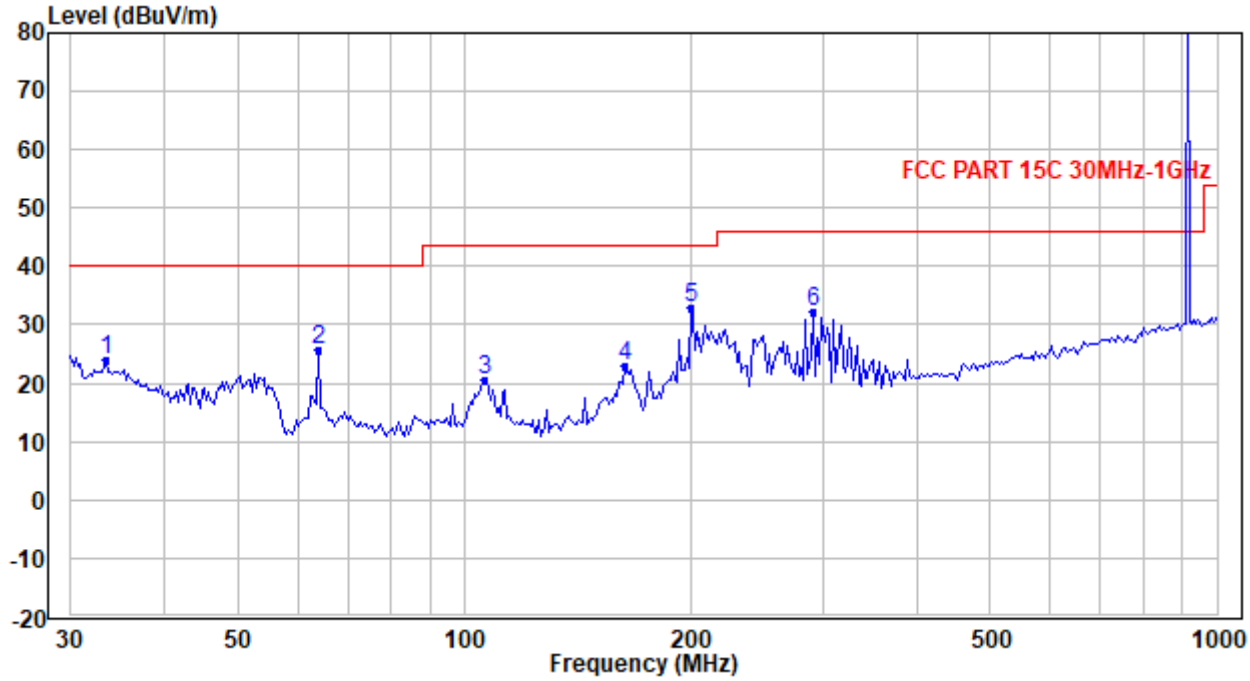
Test Result: Pass

The worst 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 is not required to be report.

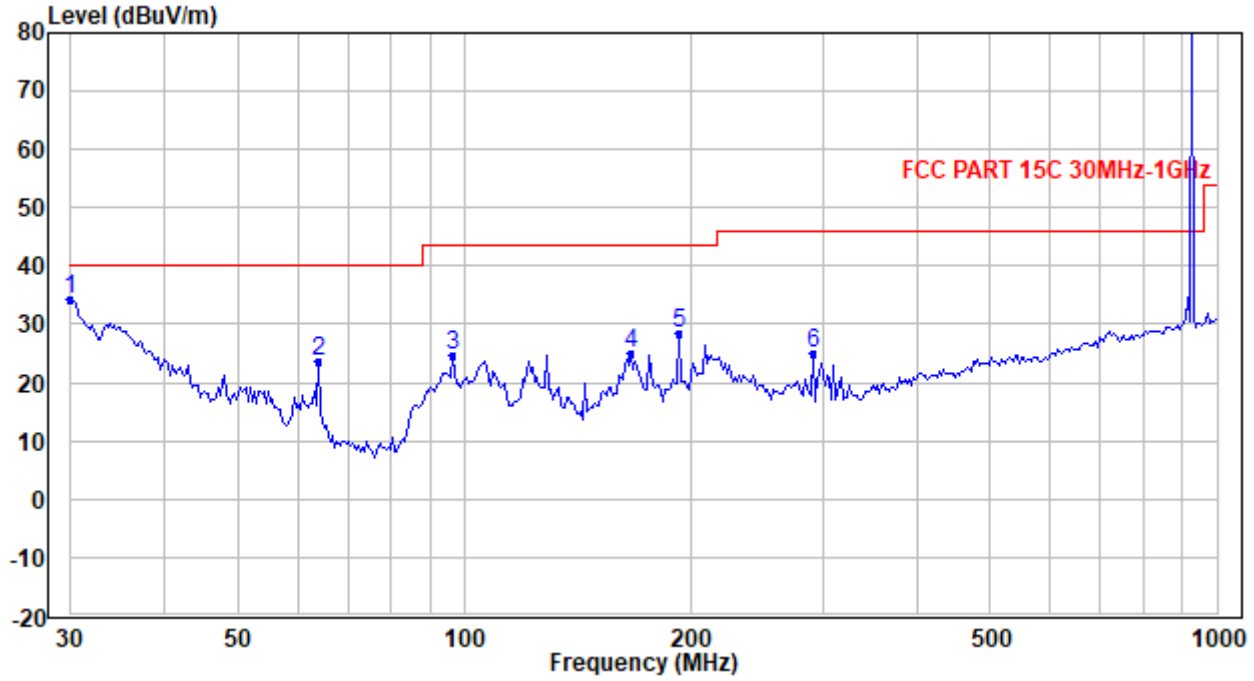
Radiated Emission Test Data (30 MHz ~ 1 GHz):
Worst-Case Configuration

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	33.335	30.54	-6.46	24.08	40.00	-15.92	QP
2	64.080	43.04	-17.28	25.76	40.00	-14.24	QP
3	106.281	35.98	-15.31	20.67	43.50	-22.83	QP
4	163.162	36.26	-13.44	22.82	43.50	-20.68	QP
5	200.043	43.88	-10.97	32.91	43.50	-10.59	QP
6	290.317	41.59	-9.25	32.34	46.00	-13.66	QP

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Correction factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	30.000	38.41	-4.08	34.33	40.00	-5.67	QP
2	64.080	40.88	-17.28	23.60	40.00	-16.40	QP
3	96.323	40.66	-16.00	24.66	43.50	-18.84	QP
4	166.639	37.44	-12.58	24.86	43.50	-18.64	QP
5	193.137	39.94	-11.38	28.56	43.50	-14.94	QP
6	290.317	34.37	-9.25	25.12	46.00	-20.88	QP

Radiated Emission Test Data:								
Ant. 1_ Lowest Channel_902.5MHz:								
No.	**Frequency (MHz)**	**Reading (dBμV)**	**Correction factor (dB/m)**	**Result (dBμV/m)**	**Limit (dBμV/m)**	**Margin (dB)**	**Detector**	**Antenna Polaxis**
1	1805.464	43.76	-10.43	33.33	54.00	-20.67	Average	Horizontal
2	1805.464	48.76	-10.43	38.33	74.00	-35.67	Peak	Horizontal
3	2707.500	41.02	-6.10	34.92	54.00	-19.08	Average	Horizontal
4	2707.500	46.02	-6.10	39.92	74.00	-34.08	Peak	Horizontal
5	3597.016	48.73	-2.98	45.75	54.00	-8.25	Average	Horizontal
6	3597.016	53.73	-2.98	50.75	74.00	-23.25	Peak	Horizontal
7	5395.512	52.22	-0.34	51.88	74.00	-22.12	Average	Horizontal
8	5395.512	52.22	-0.34	51.88	74.00	-22.12	Peak	Horizontal
9	6308.894	48.56	1.26	49.82	54.00	-4.18	Average	Horizontal
10	6308.894	53.56	1.26	54.82	74.00	-19.18	Peak	Horizontal
11	2123.366	41.95	-8.92	33.03	54.00	-20.97	Average	Vertical
12	2123.366	46.95	-8.92	38.03	74.00	-35.97	Peak	Vertical
13	2707.500	40.37	-6.10	34.27	54.00	-19.73	Average	Vertical
14	2707.500	45.37	-6.10	39.27	74.00	-34.73	Peak	Vertical
15	3597.016	45.97	-2.98	42.99	54.00	-11.01	Average	Vertical
16	3597.016	50.97	-2.98	47.99	74.00	-26.01	Peak	Vertical
17	5395.512	43.78	-0.34	43.44	54.00	-10.56	Average	Vertical
18	5395.512	48.78	-0.34	48.44	74.00	-25.56	Peak	Vertical
19	6308.894	48.66	1.26	49.92	54.00	-4.08	Average	Vertical
20	6308.894	53.66	1.26	54.92	74.00	-19.08	Peak	Vertical
Ant. 1_Middle Channel_915MHz:								
1	1826.501	43.88	-10.35	33.53	54.00	-20.47	Average	Horizontal
2	1826.501	48.88	-10.35	38.53	74.00	-35.47	Peak	Horizontal
3	2745.000	42.51	-6.04	36.47	54.00	-17.53	Average	Horizontal
4	2745.000	46.51	-6.04	40.47	74.00	-33.53	Peak	Horizontal
5	6382.405	45.65	1.38	47.03	54.00	-6.97	Average	Horizontal
6	6382.405	50.65	1.38	52.03	74.00	-21.97	Peak	Horizontal
7	2123.366	42.28	-8.92	33.36	54.00	-20.64	Average	Vertical
8	2123.366	47.28	-8.92	38.36	74.00	-35.64	Peak	Vertical
9	2745.000	41.58	-6.04	35.54	54.00	-18.46	Average	Vertical
10	2745.000	46.58	-6.04	40.54	74.00	-33.46	Peak	Vertical
11	3638.928	43.45	-2.84	40.61	54.00	-13.39	Average	Vertical
12	3638.928	48.45	-2.84	45.61	74.00	-28.39	Peak	Vertical
13	6382.405	48.58	1.38	49.96	54.00	-4.04	Average	Vertical
14	6382.405	53.58	1.38	54.96	74.00	-19.04	Peak	Vertical

No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
Ant. 1_Highest Channel_927.5MHz:								
1	1847.783	45.91	-10.28	35.63	54.00	-18.37	Average	Horizontal
2	1847.783	49.91	-10.28	39.63	74.00	-34.37	Peak	Horizontal
3	2782.500	42.31	-5.98	36.33	54.00	-17.67	Average	Horizontal
4	2782.500	46.31	-5.98	40.33	74.00	-33.67	Peak	Horizontal
5	6494.281	44.92	1.53	46.45	54.00	-7.55	Average	Horizontal
6	6494.281	48.92	1.53	50.45	74.00	-23.55	Peak	Horizontal
7	1847.783	45.04	-10.28	34.76	54.00	-19.24	Average	Vertical
8	1847.783	49.04	-10.28	38.76	74.00	-35.24	Peak	Vertical
9	2782.500	43.62	-5.98	37.64	54.00	-16.36	Average	Vertical
10	2782.500	47.62	-5.98	41.64	74.00	-32.36	Peak	Vertical
11	6494.281	46.57	1.53	48.10	54.00	-5.90	Average	Vertical
12	6494.281	50.57	1.53	52.10	74.00	-21.90	Peak	Vertical

No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
Ant. 2_ Lowest Channel_902.5MHz:								
1	1805.464	47.75	-10.43	37.32	54.00	-16.68	Average	Horizontal
2	1805.464	51.75	-10.43	41.32	74.00	-32.68	Peak	Horizontal
3	2707.500	42.25	-6.10	36.15	54.00	-17.85	Average	Horizontal
4	2707.500	46.25	-6.10	40.15	74.00	-33.85	Peak	Horizontal
5	3597.016	48.60	-2.98	45.62	54.00	-8.38	Average	Horizontal
6	3597.016	53.60	-2.98	50.62	74.00	-23.38	Peak	Horizontal
7	5395.512	45.36	-0.34	45.02	54.00	-8.98	Average	Horizontal
8	5395.512	50.36	-0.34	50.02	74.00	-23.98	Peak	Horizontal
9	6308.894	50.79	1.26	52.05	54.00	-1.95	Average	Horizontal
10	6308.894	55.79	1.26	57.05	74.00	-16.95	Peak	Horizontal
11	1805.464	46.22	-10.43	35.79	54.00	-18.21	Average	Vertical
12	1805.464	50.22	-10.43	39.79	74.00	-34.21	Peak	Vertical
13	2707.500	42.32	-6.10	36.22	54.00	-17.78	Average	Vertical
14	2707.500	46.32	-6.10	40.22	74.00	-33.78	Peak	Vertical
15	3597.016	48.35	-2.98	45.37	54.00	-8.63	Average	Vertical
16	3597.016	53.35	-2.98	50.37	74.00	-23.63	Peak	Vertical
17	5395.512	46.23	-0.34	45.89	54.00	-8.11	Average	Vertical
18	5395.512	51.23	-0.34	50.89	74.00	-23.11	Peak	Vertical
19	6308.894	50.59	1.26	51.85	54.00	-2.15	Average	Vertical
20	6308.894	55.59	1.26	56.85	74.00	-17.15	Peak	Vertical

No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
Ant. 2_Middle Channel_915MHz:								
1	1826.501	46.13	-10.35	35.78	54.00	-18.22	Average	Horizontal
2	1826.501	51.13	-10.35	40.78	74.00	-33.22	Peak	Horizontal
3	2745.000	41.30	-6.04	35.26	54.00	-18.74	Average	Horizontal
4	2745.000	46.30	-6.04	40.26	74.00	-33.74	Peak	Horizontal
5	6382.405	49.54	1.38	50.92	54.00	-3.08	Average	Horizontal
6	6382.405	54.54	1.38	55.92	74.00	-18.08	Peak	Horizontal
7	1826.501	46.65	-10.35	36.30	54.00	-17.70	Average	Vertical
8	1826.501	50.65	-10.35	40.30	74.00	-33.70	Peak	Vertical
9	2745.000	42.21	-6.04	36.17	54.00	-17.83	Average	Vertical
10	2745.000	46.21	-6.04	40.17	74.00	-33.83	Peak	Vertical
11	6382.405	49.58	1.38	50.96	54.00	-3.04	Average	Vertical
12	6382.405	54.58	1.38	55.96	74.00	-18.04	Peak	Vertical
Ant. 2_Highest Channel_927.5MHz:								
1	1847.783	48.22	-10.28	37.94	54.00	-16.06	Average	Horizontal
2	1847.783	51.22	-10.28	40.94	74.00	-33.06	Peak	Horizontal
3	2782.500	42.97	-5.98	36.99	54.00	-17.01	Average	Horizontal
4	2782.500	45.97	-5.98	39.99	74.00	-34.01	Peak	Horizontal
5	1847.783	45.81	-10.28	35.53	54.00	-18.47	Average	Vertical
6	1847.783	49.81	-10.28	39.53	74.00	-34.47	Peak	Vertical
7	2782.500	42.47	-5.98	36.49	54.00	-17.51	Average	Vertical
8	2782.500	46.47	-5.98	40.49	74.00	-33.51	Peak	Vertical
9	6494.281	47.17	1.53	48.70	54.00	-5.30	Average	Vertical
10	6494.281	51.17	1.53	52.70	74.00	-21.30	Peak	Vertical

No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
Ant. 3_ Lowest Channel_902.5MHz:								
1	1805.000	44.43	-10.43	34.00	54.00	-20.00	Average	Horizontal
2	1805.000	47.43	-10.43	37.00	74.00	-37.00	Peak	Horizontal
3	2707.500	43.58	-6.10	37.48	54.00	-16.52	Average	Horizontal
4	2707.500	46.58	-6.10	40.48	74.00	-33.52	Peak	Horizontal
5	3597.016	51.39	-2.98	48.41	54.00	-5.59	Average	Horizontal
6	3597.016	54.39	-2.98	51.41	74.00	-22.59	Peak	Horizontal
7	5395.512	49.67	-0.34	49.33	54.00	-4.67	Average	Horizontal
8	5395.512	52.67	-0.34	52.33	74.00	-21.67	Peak	Horizontal
9	6308.894	49.64	1.26	50.90	54.00	-3.10	Average	Horizontal
10	6308.894	53.01	1.26	54.27	74.00	-19.73	Peak	Horizontal
11	1805.464	49.46	-10.43	39.03	54.00	-14.97	Average	Vertical
12	1805.464	52.46	-10.43	42.03	74.00	-31.97	Peak	Vertical
13	2707.500	43.01	-6.10	36.91	54.00	-17.09	Average	Vertical
14	2707.500	46.01	-6.10	39.91	74.00	-34.09	Peak	Vertical
15	3597.016	51.94	-2.98	48.96	54.00	-5.04	Average	Vertical
16	3597.016	54.94	-2.98	51.96	74.00	-22.04	Peak	Vertical
17	6308.894	51.23	1.26	52.49	54.00	-1.51	Average	Vertical
18	6308.894	54.23	1.26	55.49	74.00	-18.51	Peak	Vertical
Ant. 3_Middle Channel_915MHz:								
1	1830.000	44.06	-10.34	33.72	54.00	-20.28	Average	Horizontal
2	1830.000	47.06	-10.34	36.72	74.00	-37.28	Peak	Horizontal
3	2745.000	43.18	-6.04	37.14	54.00	-16.86	Average	Horizontal
4	2745.000	46.18	-6.04	40.14	74.00	-33.86	Peak	Horizontal
5	3638.928	47.67	-2.84	44.83	54.00	-9.17	Average	Horizontal
6	3638.928	50.67	-2.84	47.83	74.00	-26.17	Peak	Horizontal
7	1826.501	46.28	-10.35	35.93	54.00	-18.07	Average	Vertical
8	1826.501	49.28	-10.35	38.93	74.00	-35.07	Peak	Vertical
9	2745.000	45.01	-6.04	38.97	54.00	-15.03	Average	Vertical
10	2745.000	48.01	-6.04	41.97	74.00	-32.03	Peak	Vertical
11	3638.928	46.63	-2.84	43.79	54.00	-10.21	Average	Vertical
12	3638.928	49.63	-2.84	46.79	74.00	-27.21	Peak	Vertical
13	6382.405	48.61	1.38	49.99	54.00	-4.01	Average	Vertical
14	6382.405	51.61	1.38	52.99	74.00	-21.01	Peak	Vertical

No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
Ant. 3_Highest Channel_927.5MHz:								
1	1855.000	42.71	-10.26	32.45	54.00	-21.55	Average	Horizontal
2	1855.000	45.71	-10.26	35.45	74.00	-38.55	Peak	Horizontal
3	2782.500	42.78	-5.98	36.80	54.00	-17.20	Average	Horizontal
4	2782.500	45.78	-5.98	39.80	74.00	-34.20	Peak	Horizontal
5	6494.281	46.63	1.53	48.16	54.00	-5.84	Average	Horizontal
6	6494.281	49.63	1.53	51.16	74.00	-22.84	Peak	Horizontal
7	1847.783	46.13	-10.28	35.85	54.00	-18.15	Average	Vertical
8	1847.783	50.13	-10.28	39.85	74.00	-34.15	Peak	Vertical
9	2782.500	41.91	-5.98	35.93	54.00	-18.07	Average	Vertical
10	2782.500	45.91	-5.98	39.93	74.00	-34.07	Peak	Vertical
11	3702.714	44.69	-2.63	42.06	54.00	-11.94	Average	Vertical
12	3702.714	48.69	-2.63	46.06	74.00	-27.94	Peak	Vertical
13	6494.281	44.79	1.53	46.32	54.00	-7.68	Average	Vertical
14	6494.281	48.79	1.53	50.32	74.00	-23.68	Peak	Vertical

No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
Ant. 4_ Lowest Channel_902.5MHz:								
1	1805.000	44.51	-10.43	34.08	54.00	-19.92	Average	Horizontal
2	1805.000	48.51	-10.43	38.08	74.00	-35.92	Peak	Horizontal
3	2707.500	43.34	-6.10	37.24	54.00	-16.76	Average	Horizontal
4	2707.500	46.34	-6.10	40.24	74.00	-33.76	Peak	Horizontal
5	6308.894	47.22	1.26	48.48	54.00	-5.52	Average	Horizontal
6	6308.894	51.22	1.26	52.48	74.00	-21.52	Peak	Horizontal
7	1805.464	48.01	-10.43	37.58	54.00	-16.42	Average	Vertical
8	1805.464	52.01	-10.43	41.58	74.00	-32.42	Peak	Vertical
9	2707.500	42.35	-6.10	36.25	54.00	-17.75	Average	Vertical
10	2707.500	46.35	-6.10	40.25	74.00	-33.75	Peak	Vertical
11	3597.016	50.63	-2.98	47.65	54.00	-6.35	Average	Vertical
12	3597.016	55.63	-2.98	52.65	74.00	-21.35	Peak	Vertical
13	5395.512	46.56	-0.34	46.22	54.00	-7.78	Average	Vertical
14	5395.512	50.56	-0.34	50.22	74.00	-23.78	Peak	Vertical
15	6308.894	51.14	1.26	52.40	54.00	-1.60	Average	Vertical
16	6308.894	55.40	1.26	56.66	74.00	-17.34	Peak	Vertical

No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Detector	Antenna Polaxis
Ant. 4_Middle Channel_915MHz:								
1	1830.000	43.37	-10.34	33.03	54.00	-20.97	Average	Horizontal
2	1830.000	47.37	-10.34	37.03	74.00	-36.97	Peak	Horizontal
3	2745.000	42.92	-6.04	36.88	54.00	-17.12	Average	Horizontal
4	2745.000	46.92	-6.04	40.88	74.00	-33.12	Peak	Horizontal
5	1826.501	46.04	-10.35	35.69	54.00	-18.31	Average	Vertical
6	1826.501	50.04	-10.35	39.69	74.00	-34.31	Peak	Vertical
7	2745.000	42.48	-6.04	36.44	54.00	-17.56	Average	Vertical
8	2745.000	46.48	-6.04	40.44	74.00	-33.56	Peak	Vertical
9	6382.405	49.07	1.38	50.45	54.00	-3.55	Average	Vertical
10	6382.405	52.07	1.38	53.45	74.00	-20.55	Peak	Vertical
Ant. 4_Highest Channel_927.5MHz:								
1	1847.783	45.97	-10.28	35.69	54.00	-18.31	Average	Horizontal
2	1847.783	49.97	-10.28	39.69	74.00	-34.31	Peak	Horizontal
3	2782.500	42.30	-5.98	36.32	54.00	-17.68	Average	Horizontal
4	2782.500	46.30	-5.98	40.32	74.00	-33.68	Peak	Horizontal
5	1847.783	45.87	-10.28	35.59	54.00	-18.41	Average	Vertical
6	1847.783	49.87	-10.28	39.59	74.00	-34.41	Peak	Vertical
7	2782.500	42.50	-5.98	36.52	54.00	-17.48	Average	Vertical
8	2782.500	46.50	-5.98	40.52	74.00	-33.48	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.

5.10 BAND EDGE MEASUREMENTS (RADIATED)

Test Requirement: FCC 47 CFR Part 15 Subpart C Section 15.205/15.209

Test Method: ANSI C63.10-2013 Section 6.10.5

Limits:

Radiated emissions which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a).

Frequency	Limit (dBμV/m @3m)	Remark
30 MHz-88 MHz	40.0	Quasi-peak Value
88 MHz-216 MHz	43.5	Quasi-peak Value
216 MHz-960 MHz	46.0	Quasi-peak Value
960 MHz-1 GHz	54.0	Quasi-peak Value
Above 1 GHz	54.0	Average Value
	74.0	Peak Value

Test Setup: Refer to section 4.5.1 for details.

Test Procedures:

Radiated band edge measurements at 902 MHz and 928 MHz were made with the unit transmitting in the low end of the channel range and the high end closest to the restricted bands respectively. The emissions were made on the 966 Semi-Chamber. Use (resolution bandwidth (RBW) = 1 MHz, video bandwidth (VBW) = 3 MHz for peak levels and RBW = 1 MHz and VBW = 10 Hz or 1/T for average levels).

1. Use radiated spurious emission test procedure described in clause 5.10. The transmitter output (antenna port) was connected to the test receiver.
2. Set the PK and AV limit line.
3. Record the fundamental emission and emissions out of the band-edge.
4. Determine band-edge compliance as required.

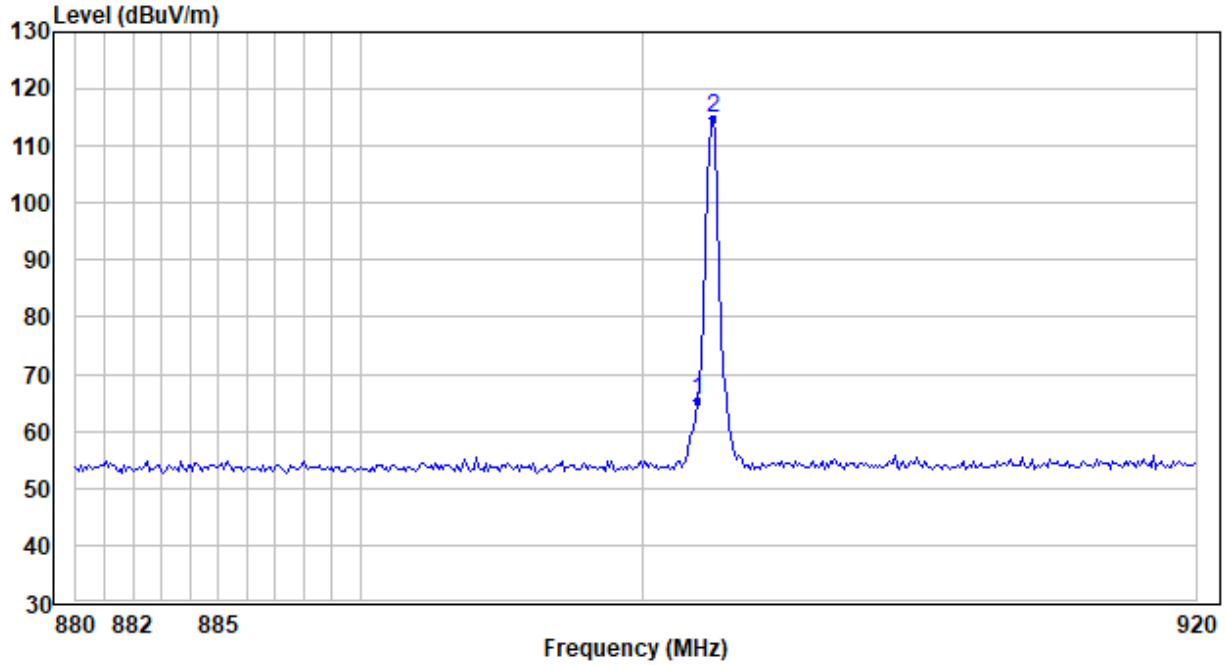
Equipment Used: Refer to section 3 for details.

Test Result: Pass

The worst measurement data as follows:

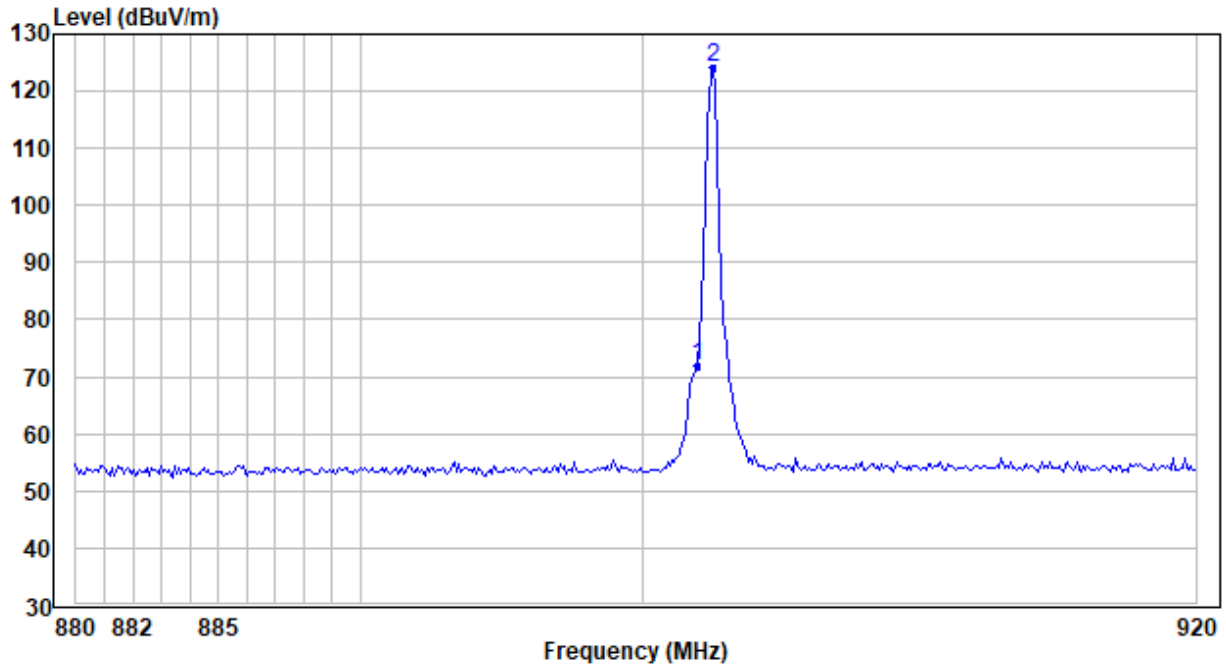
Ant. 1_ 902.5MHz

Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
902.000	65.33	49.54	20	Pass
902.525	114.87			

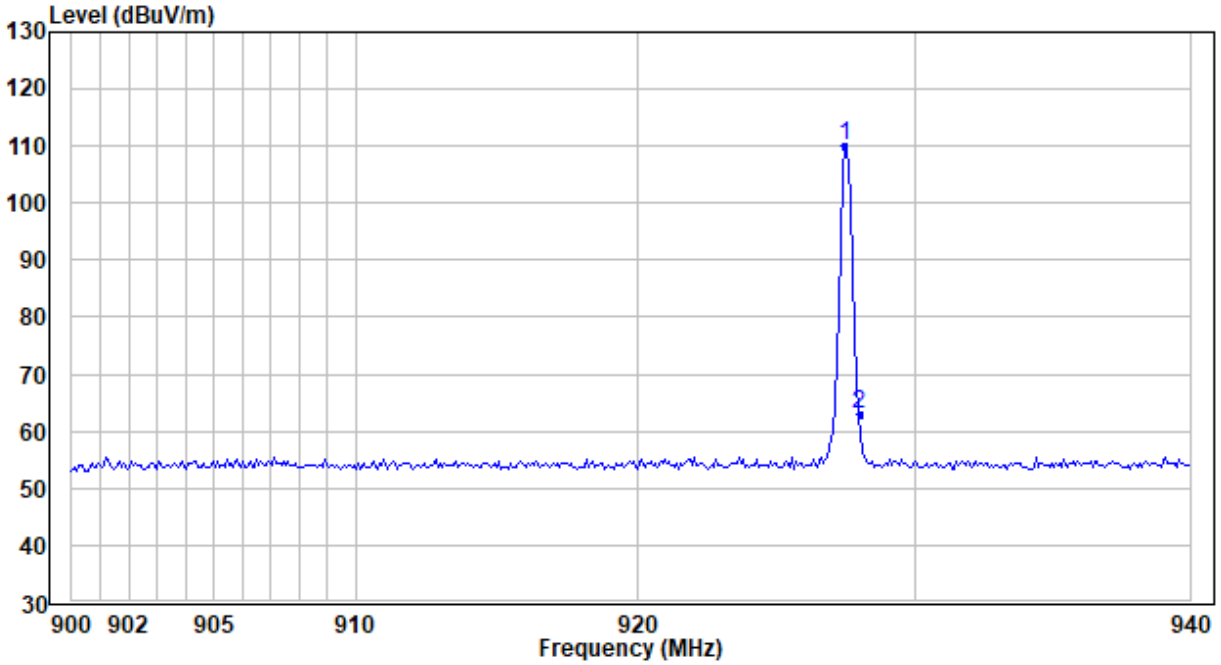
Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
902.000	71.90	52.33	20	Pass
902.525	124.23			

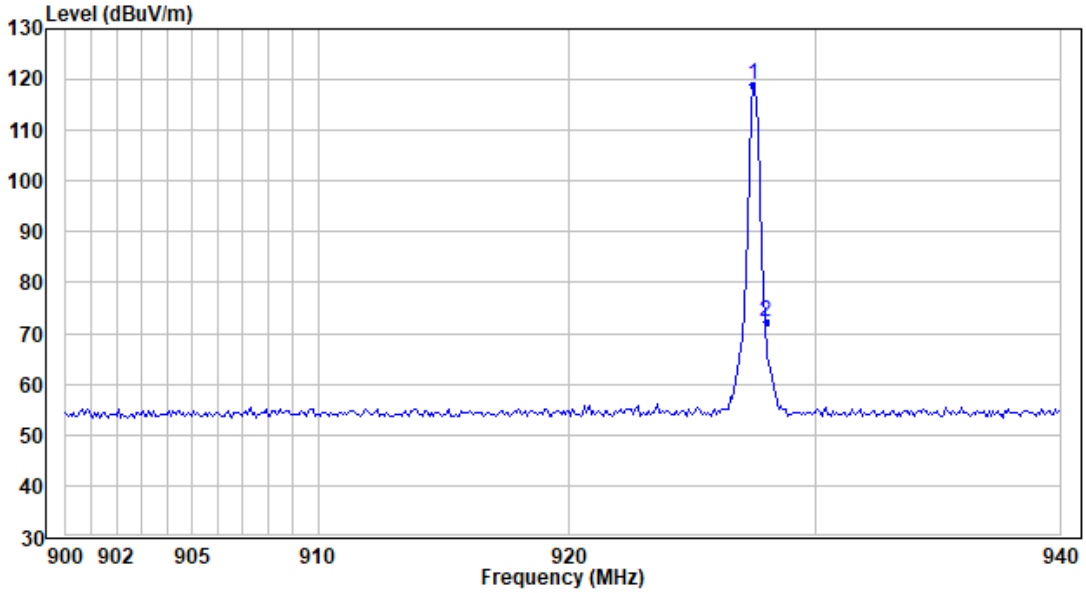
Ant. 1_ 927.5MHz

Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
927.495	110.23	41.10	20	Pass
928.000	63.13			

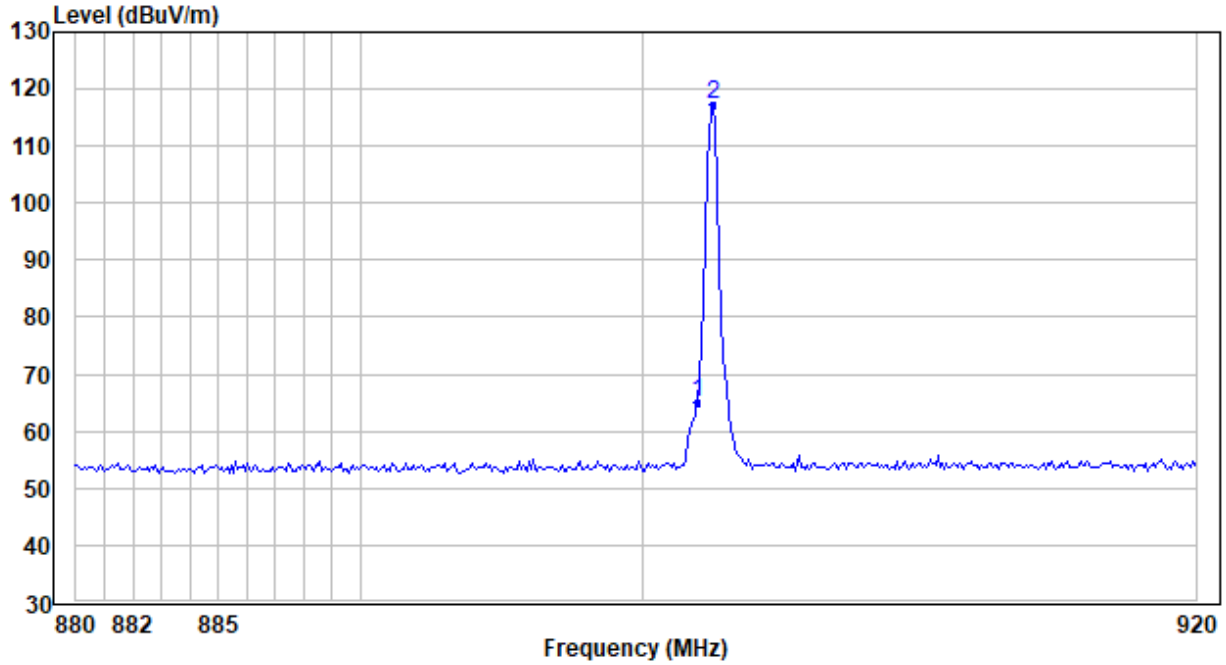
Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
927.495	119.15	46.88	20	Pass
928.000	72.27			

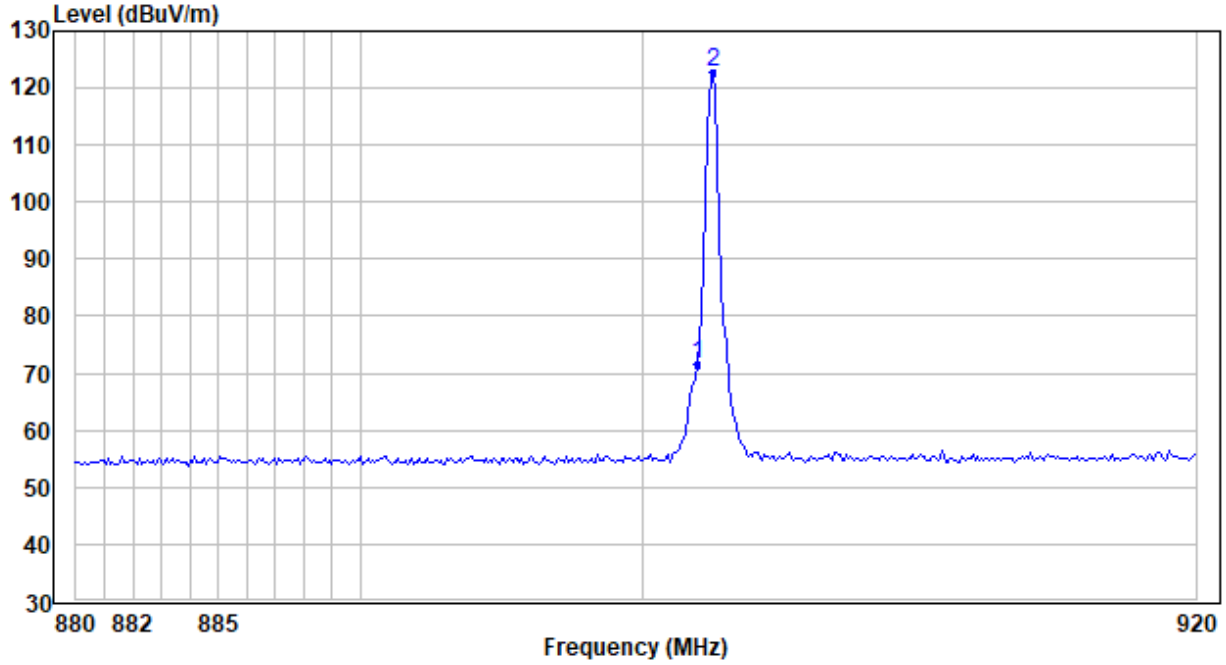
Ant. 2_ 902.5MHz

Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
902.000	65.12	52.12	20	Pass
902.525	117.24			

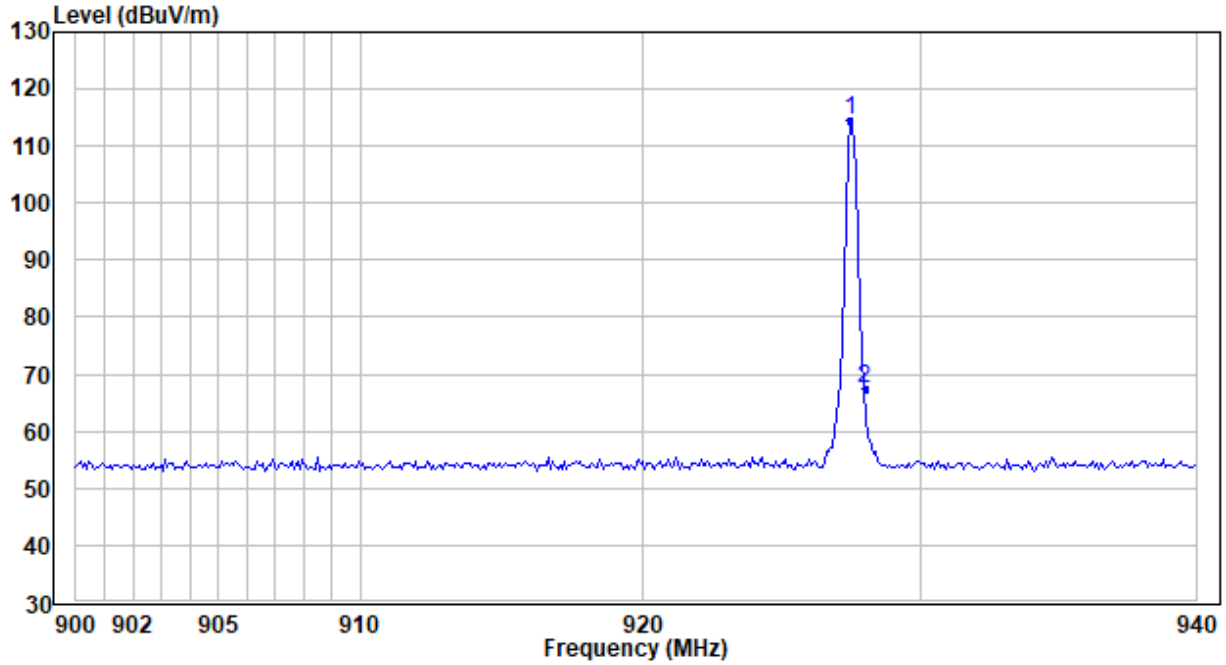
Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
902.000	71.74	51.06	20	Pass
902.525	122.80			

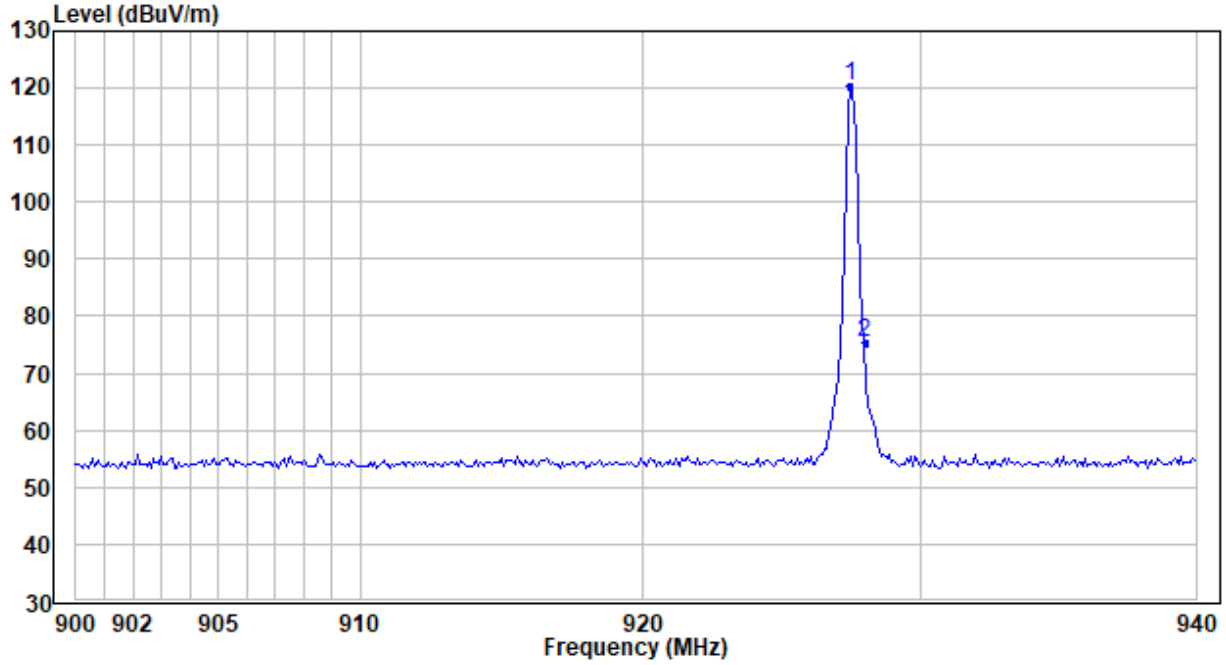
Ant. 2_ 927.5MHz

Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
927.495	114.51	47.14	20	Pass
928.000	67.37			Pass

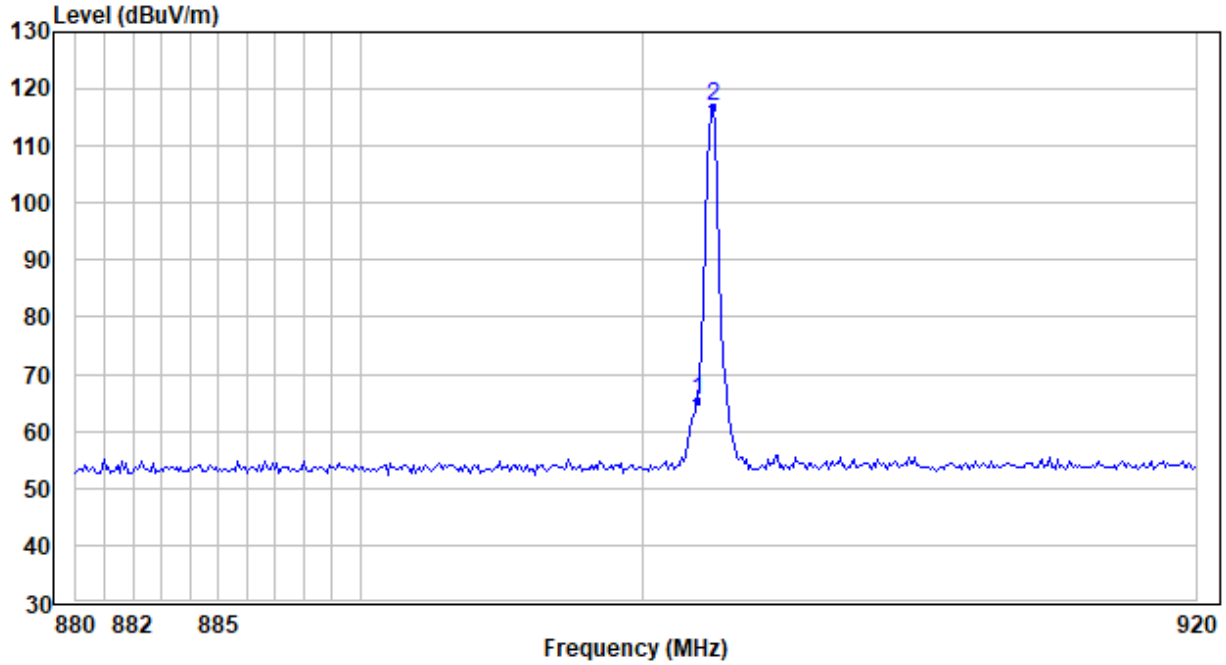
Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
927.495	120.38	44.99	20	Pass
928.000	75.39			Pass

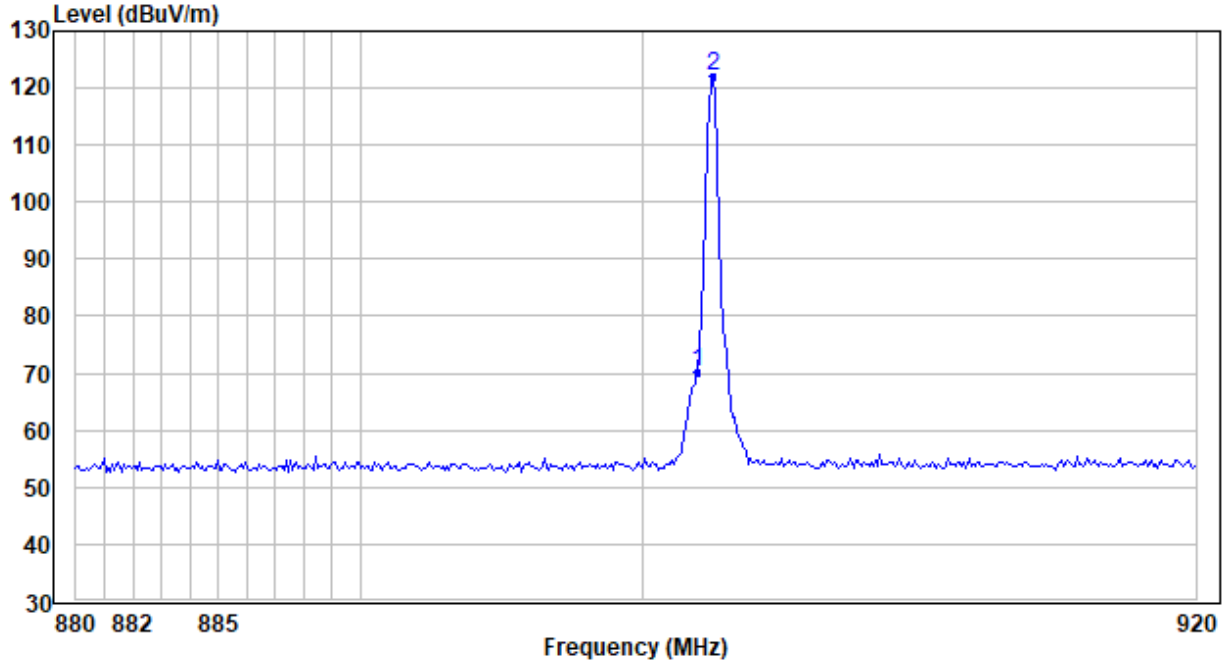
Ant. 3_ 902.5MHz

Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
902.000	65.37	51.58	20	Pass
902.525	116.95			

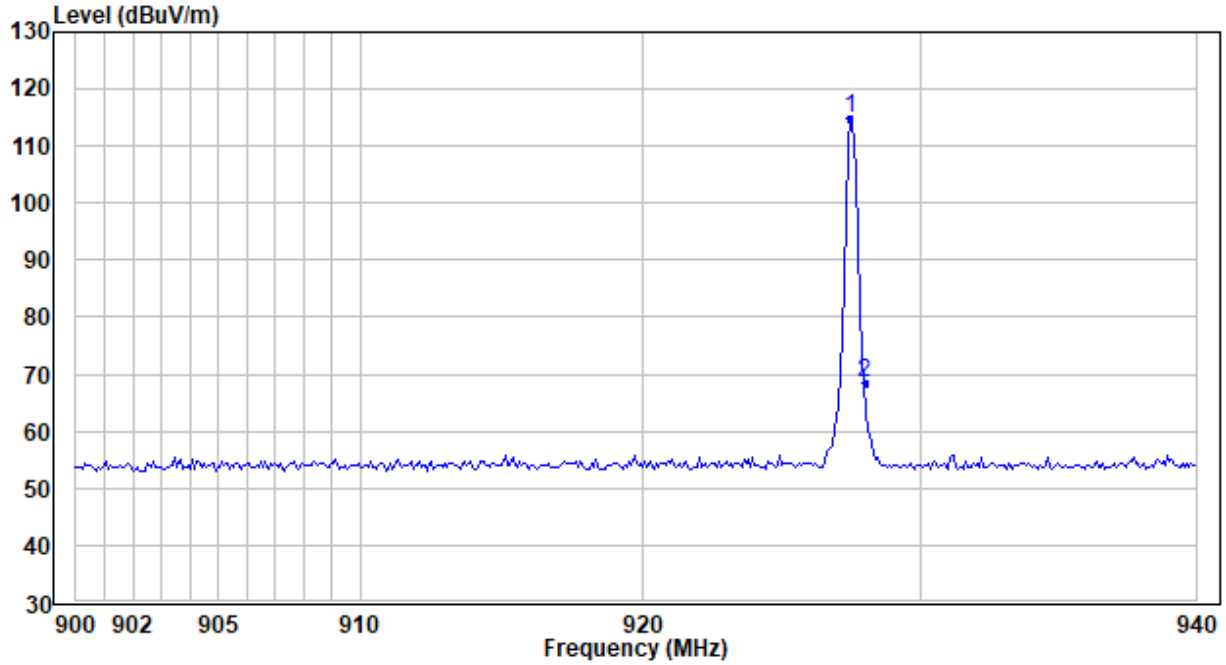
Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
902.000	70.26	51.69	20	Pass
902.525	121.95			

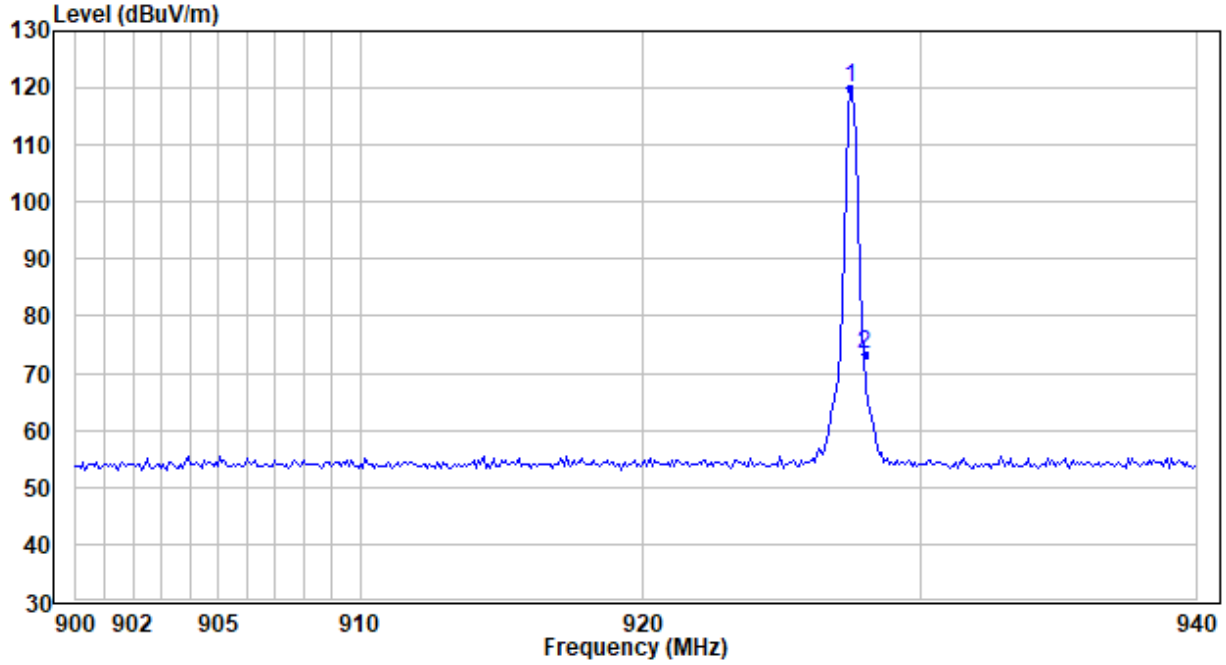
Ant. 3_ 927.5MHz

Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
927.495	114.93	46.53	20	Pass
928.000	68.40			

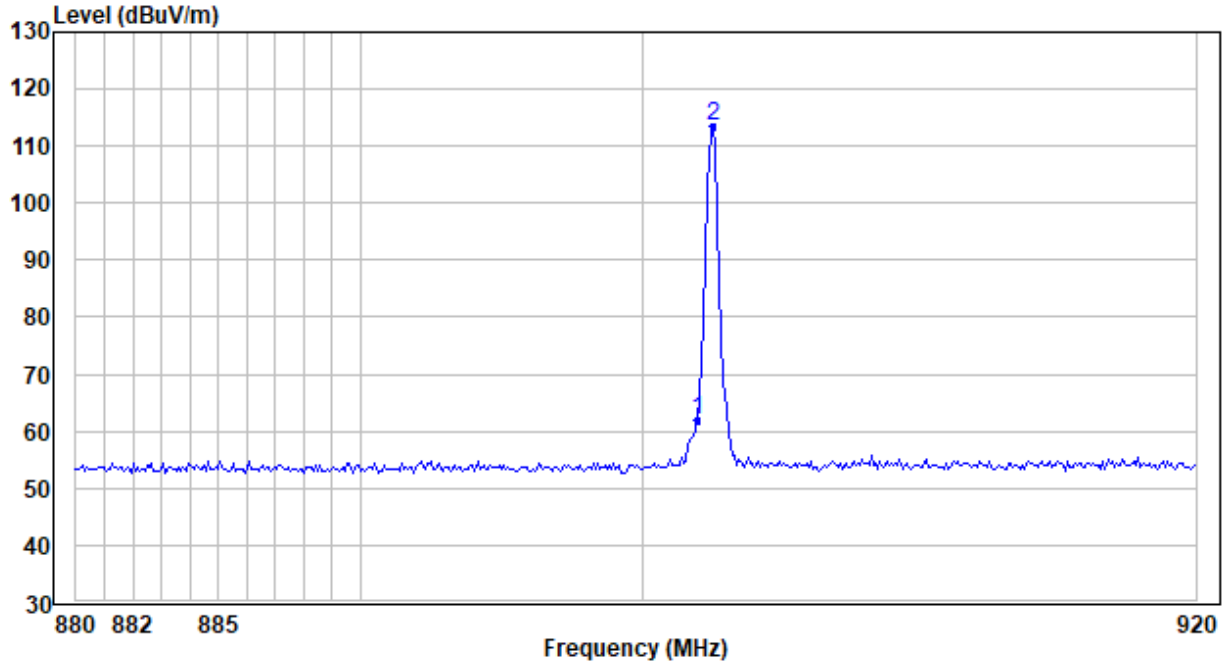
Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
927.495	119.94	46.72	20	Pass
928.000	73.22			

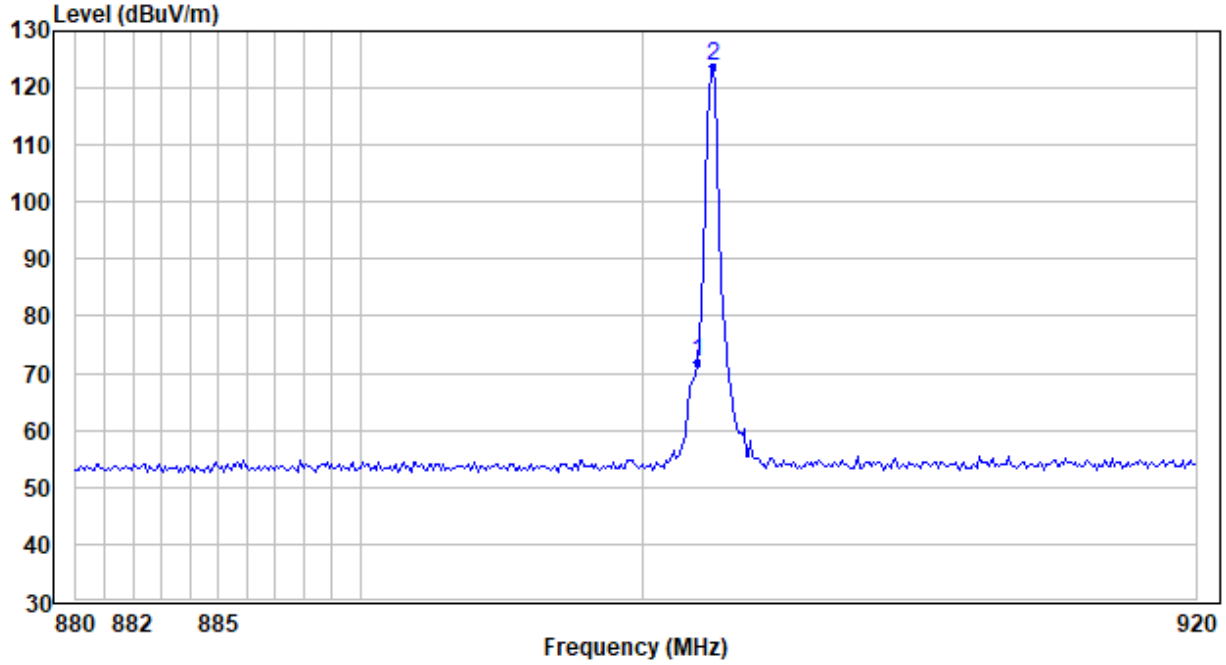
Ant. 4_ 902.5MHz

Test Channel:	Lowest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
902.000	62.11	51.43	20	Pass
902.525	113.54			

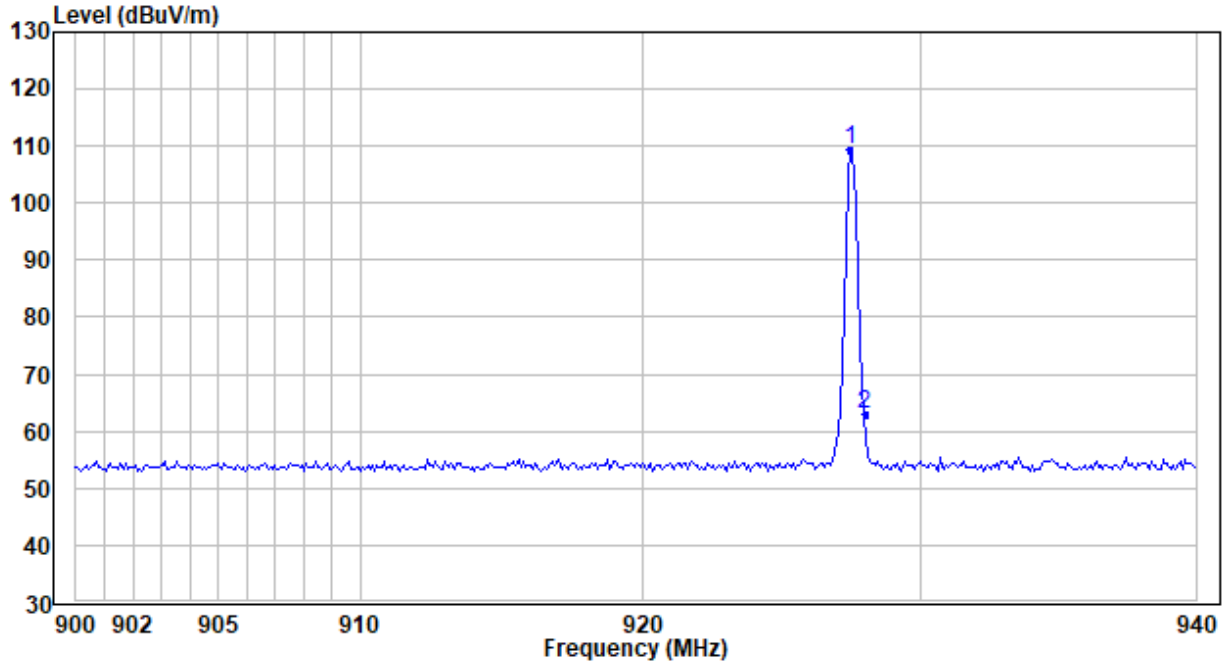
Test Channel:	Lowest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
902.000	71.85	52.10	20	Pass
902.525	123.95			

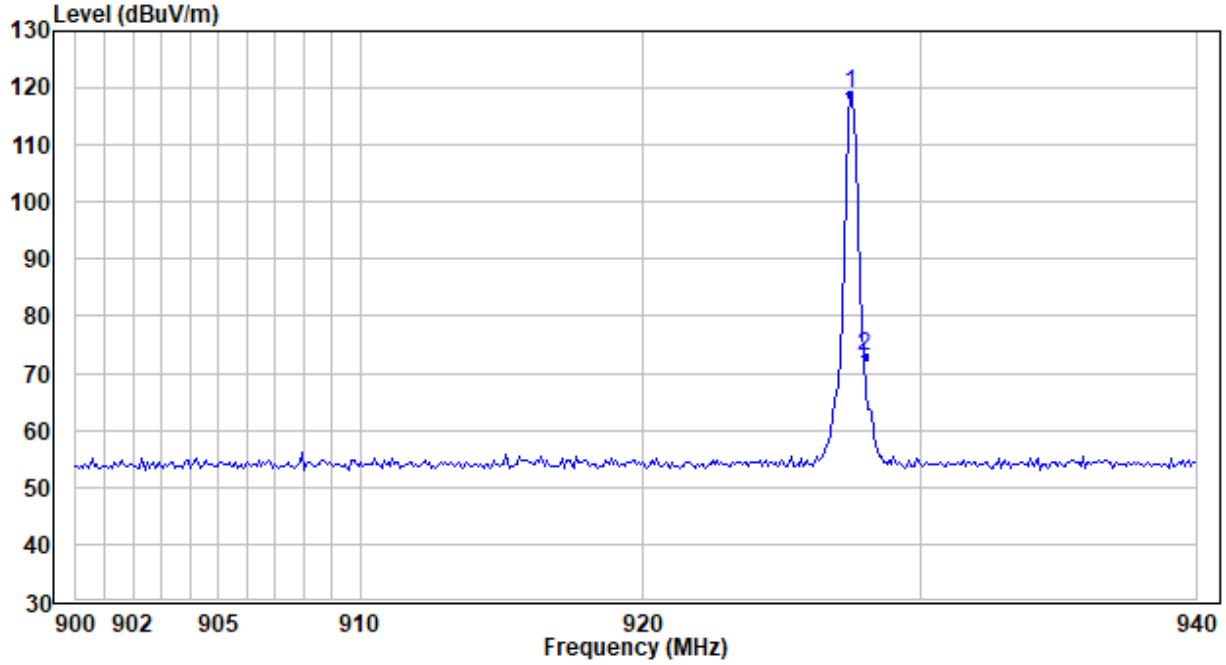
Ant. 4_ 927.5MHz

Test Channel:	Highest Channel	Ant. Polar. :	Horizontal



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
927.495	109.28	46.24	20	Pass
928.000	63.04			

Test Channel:	Highest Channel	Ant. Polar. :	Vertical



Frequency (MHz)	Peak level (dBuv/m)	Delta (dBc)	Attenuation required (dBc)	Conclusion
927.495	119.03	45.95	20	Pass
928.000	73.08			

5.11 CONDUCTED EMISSION

Test Requirement: 47 CFR Part 15C Section 15.207

Test Method: ANSI C63.10-2013 Section 6.2

Limits:

Frequency range (MHz)	Limits (dB(μV)	
	Quasi-peak	Average
0,15 to 0,50	66 to 56	56 to 46
0,50 to 5	56	46
5 to 30	60	50

Remark:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 to 0.50 MHz.

Test Setup: Refer to section 4.5.2 for details.

Test Procedures:

Test frequency range :150KHz-30MHz

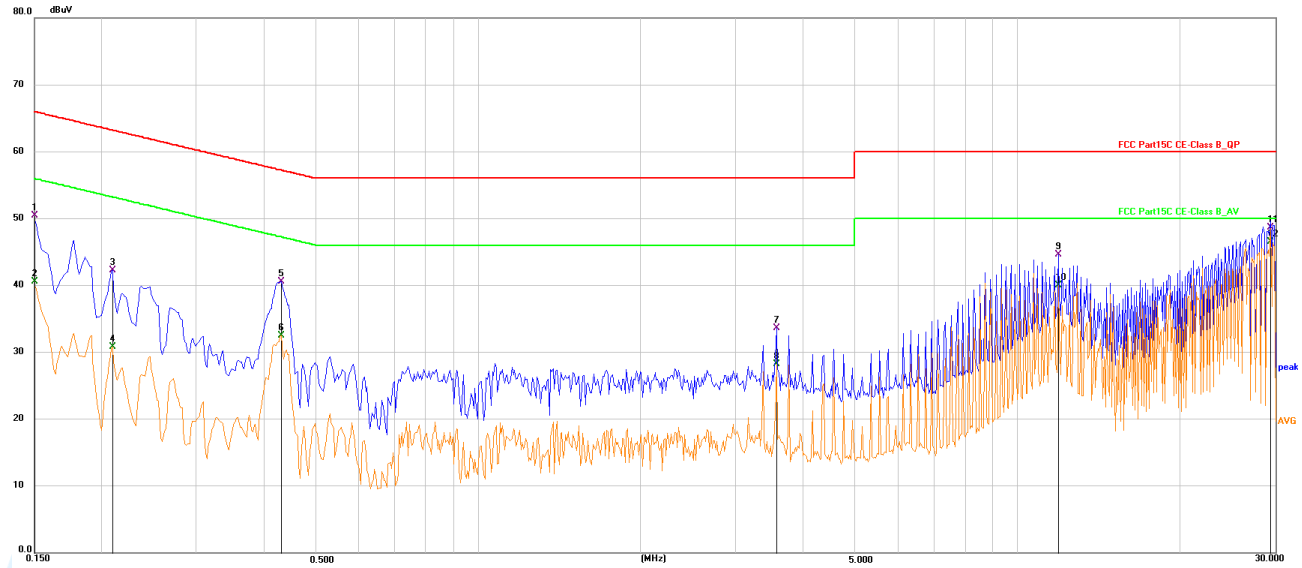
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.

Equipment Used: Refer to section 3 for details.

Test Result: Pass

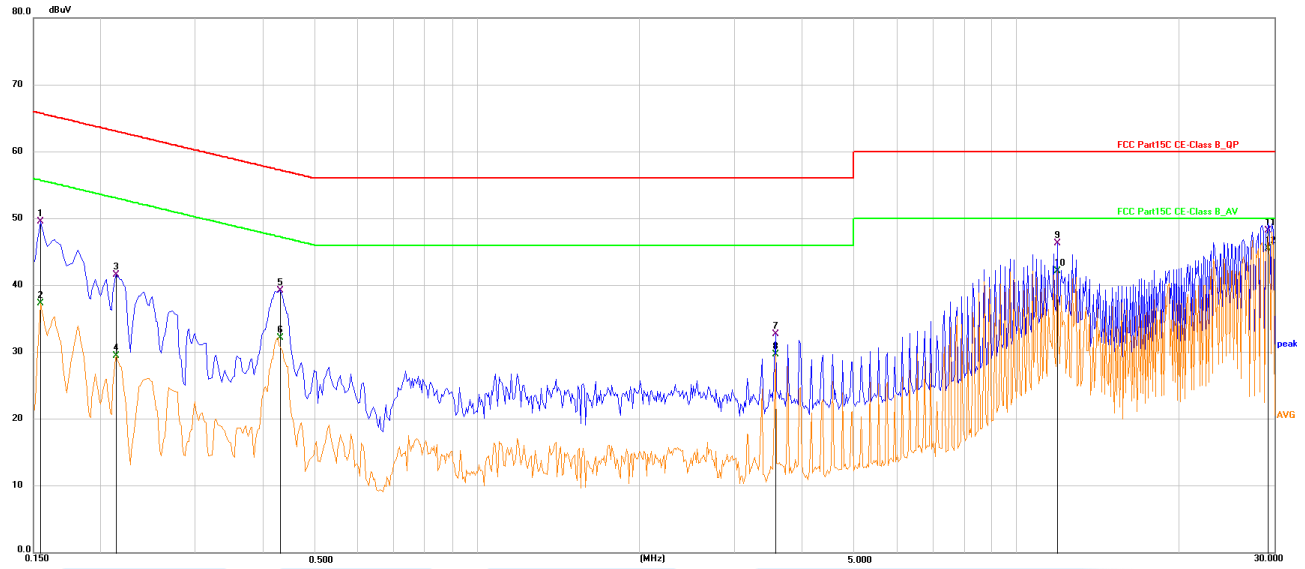
The worst measurement data as follows:
Quasi Peak and Average:
RF LINK

Live Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.1500	40.25	10.20	50.45	66.00	-15.55	QP
2	0.1500	30.35	10.20	40.55	56.00	-15.45	AVG
3	0.2084	32.14	10.16	42.30	63.27	-20.97	QP
4	0.2084	20.64	10.16	30.80	53.27	-22.47	AVG
5	0.4290	30.37	10.14	40.51	57.27	-16.76	QP
6	0.4290	22.37	10.14	32.51	47.27	-14.76	AVG
7	3.5655	23.41	10.24	33.65	56.00	-22.35	QP
8	3.5655	18.01	10.24	28.25	46.00	-17.75	AVG
9	11.8902	34.13	10.49	44.62	60.00	-15.38	QP
10	11.8902	29.48	10.49	39.97	50.00	-10.03	AVG
11	29.5260	37.69	10.91	48.60	60.00	-11.40	QP
12	29.5260	35.60	10.91	46.51	50.00	-3.49	AVG

Neutral Line



No.	Frequency (MHz)	Reading (dBμV)	Correction factor (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)	Detector
1	0.1544	39.38	10.18	49.56	65.76	-16.20	QP
2	0.1544	27.13	10.18	37.31	55.76	-18.45	AVG
3	0.2130	31.50	10.06	41.56	63.09	-21.53	QP
4	0.2130	19.43	10.06	29.49	53.09	-23.60	AVG
5	0.4290	28.96	10.21	39.17	57.27	-18.10	QP
6	0.4290	21.98	10.21	32.19	47.27	-15.08	AVG
7	3.5655	22.44	10.25	32.69	56.00	-23.31	QP
8	3.5655	19.39	10.25	29.64	46.00	-16.36	AVG
9	11.8902	35.74	10.50	46.24	60.00	-13.76	QP
10	11.8902	31.66	10.50	42.16	50.00	-7.84	AVG
11	29.3262	37.33	10.88	48.21	60.00	-11.79	QP
12	29.3262	34.66	10.88	45.54	50.00	-4.46	AVG

Remark:

1. Correct Factor = LISN Factor + Cable Loss + Pulse Limiter Factor, the value was added to Original Receiver Reading by the software automatically.
2. Result = Reading + Correct Factor.
3. Margin = Result - Limit
4. An initial pre-scan was performed on the Phase and neutral lines with peak detector. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

APPENDIX A RF TEST DATA

A.1 20DB EMISSION BANDWIDTH

Test Mode	Antenna	Freq(MHz)	20dB EBW[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant1	902.5	0.0682	≤0.25	PASS
		915	0.0665	≤0.25	PASS
		927.5	0.0724	≤0.25	PASS

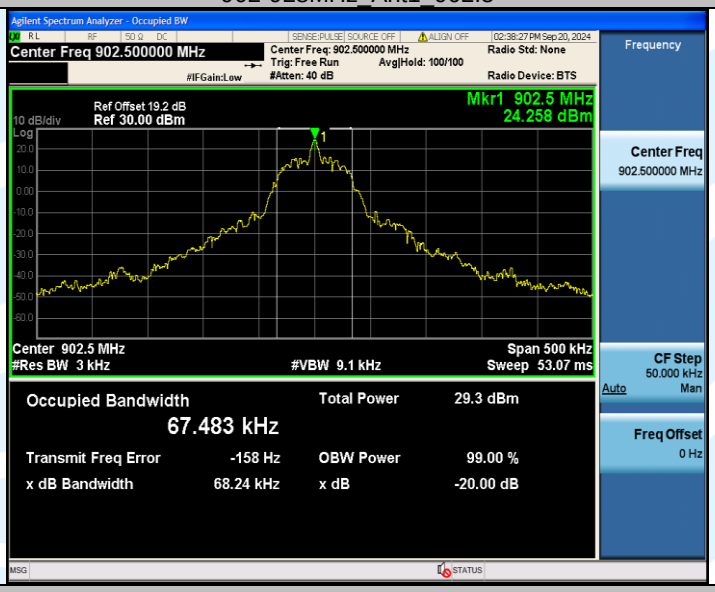
Test Mode	Antenna	Freq(MHz)	20dB EBW[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant2	902.5	0.0692	≤0.25	PASS
		915	0.0661	≤0.25	PASS
		927.5	0.0720	≤0.25	PASS

Test Mode	Antenna	Freq(MHz)	20dB EBW[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant3	902.5	0.0685	≤0.25	PASS
		915	0.0690	≤0.25	PASS
		927.5	0.0703	≤0.25	PASS

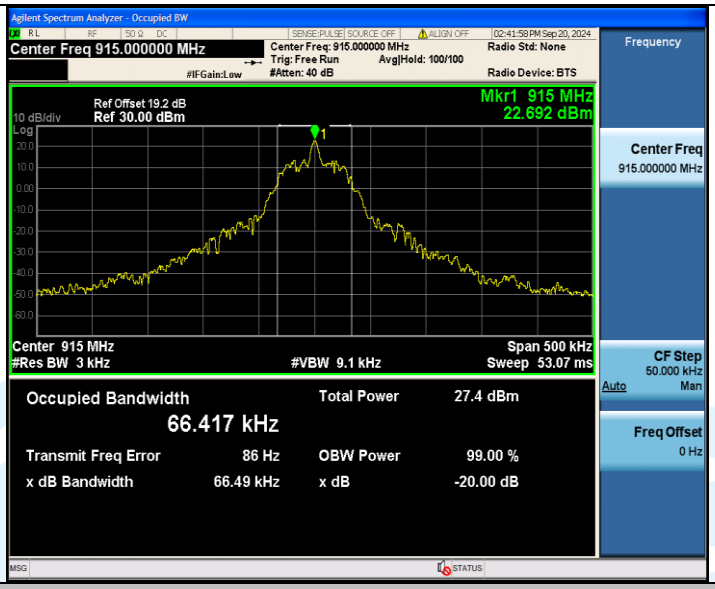
Test Mode	Antenna	Freq(MHz)	20dB EBW[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant4	902.5	0.0692	≤0.25	PASS
		915	0.0684	≤0.25	PASS
		927.5	0.0681	≤0.25	PASS

Test Graphs

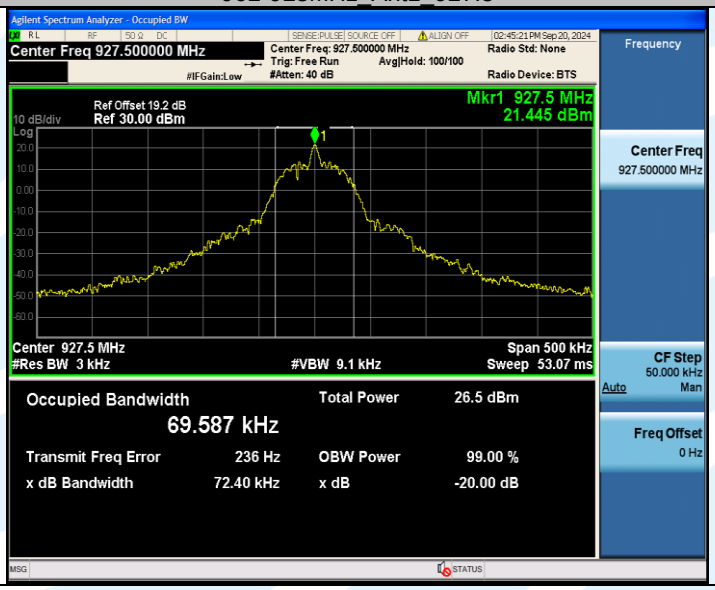
902-928MHz_Ant1_902.5



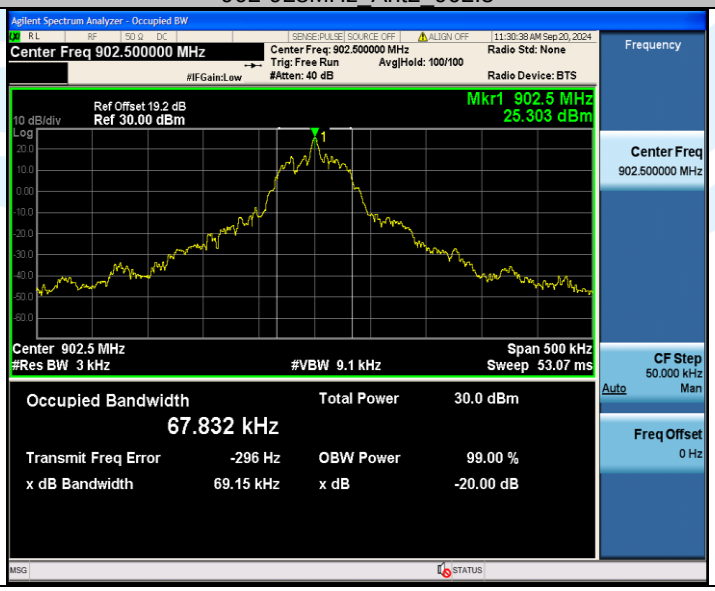
902-928MHz_Ant1_915



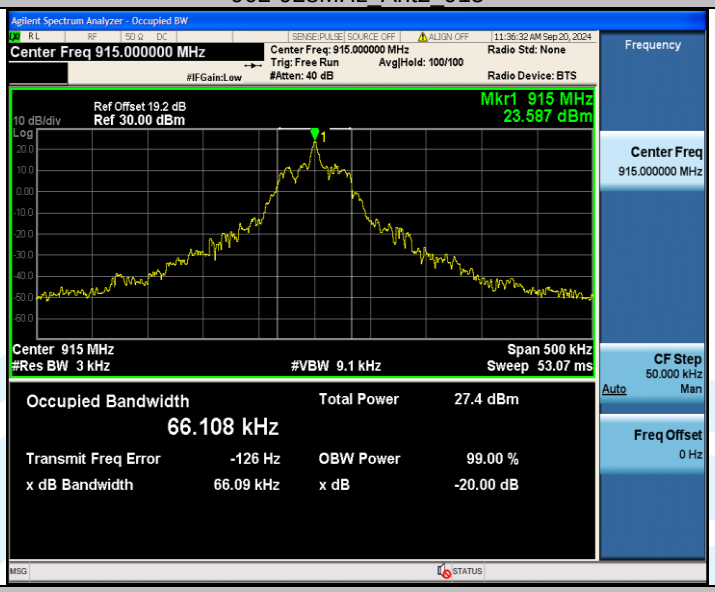
902-928MHz_Ant1_927.5



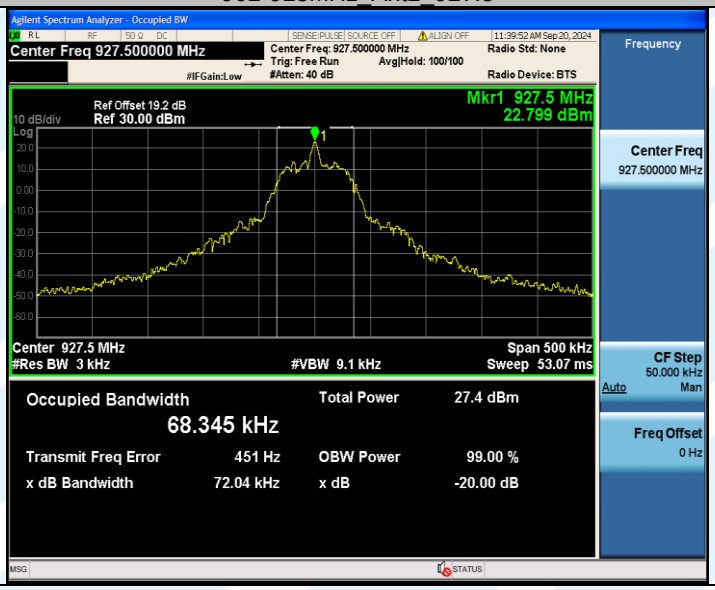
902-928MHz_Ant2_902.5



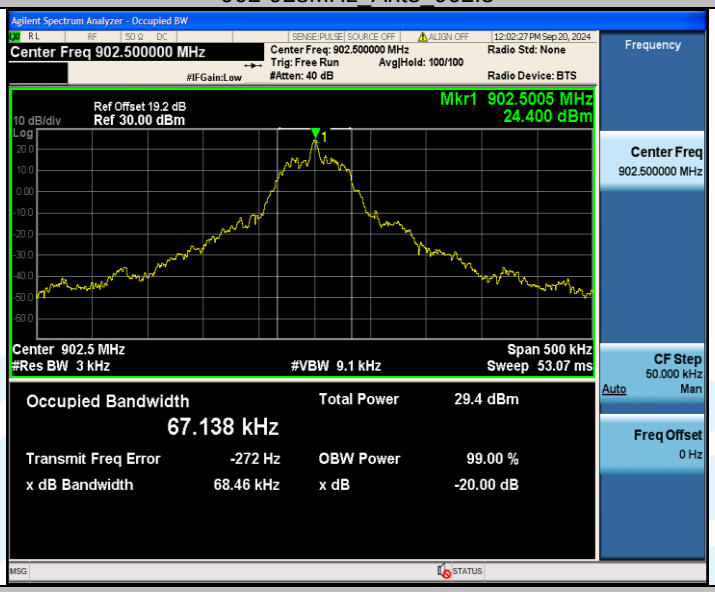
902-928MHz_Ant2_915



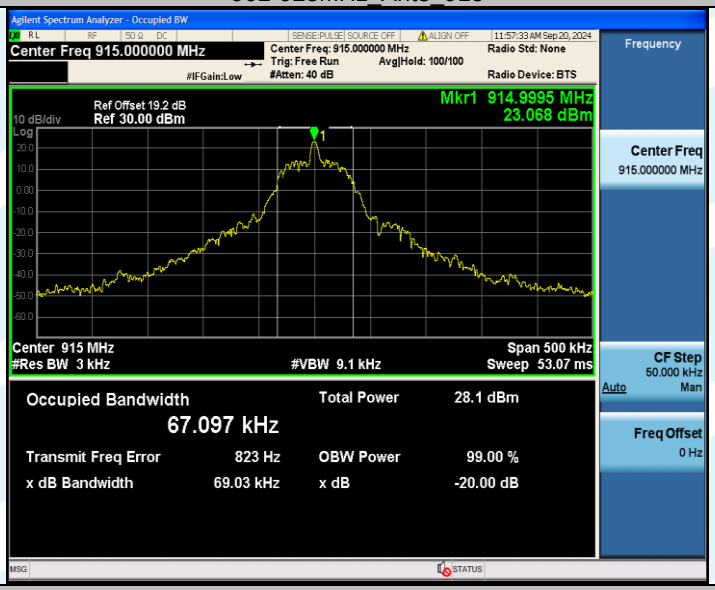
902-928MHz_Ant2_927.5



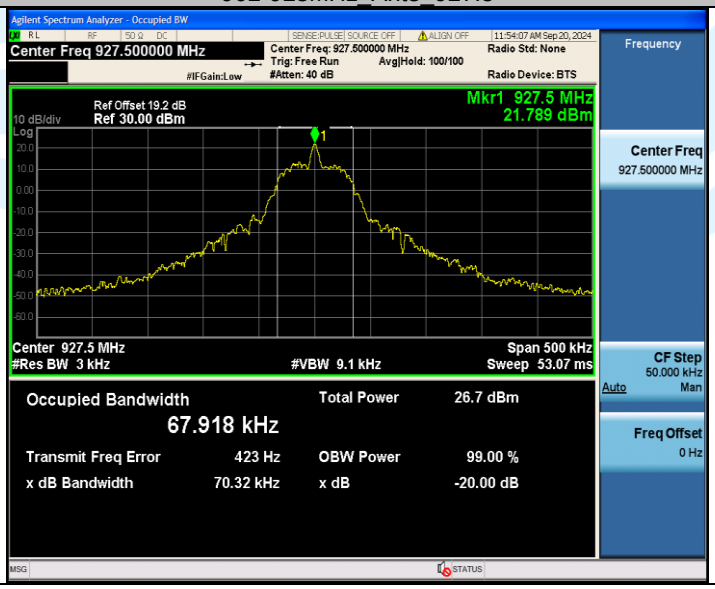
902-928MHz_Ant3_902.5



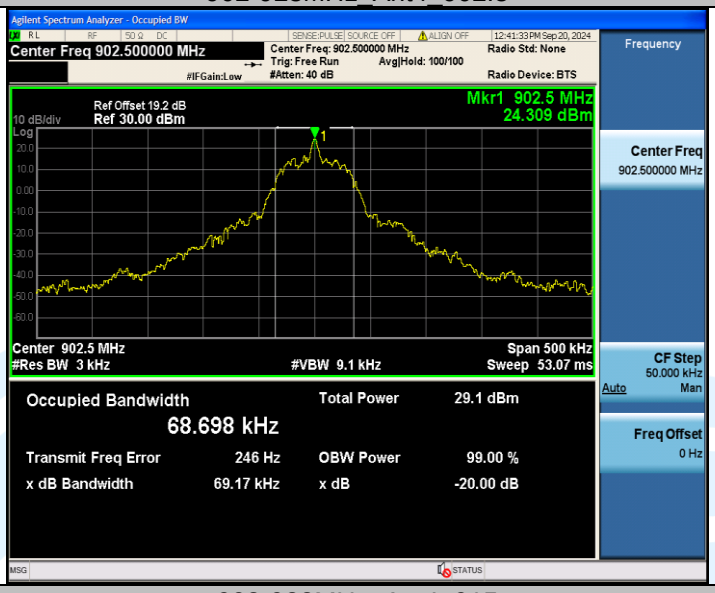
902-928MHz_Ant3_915



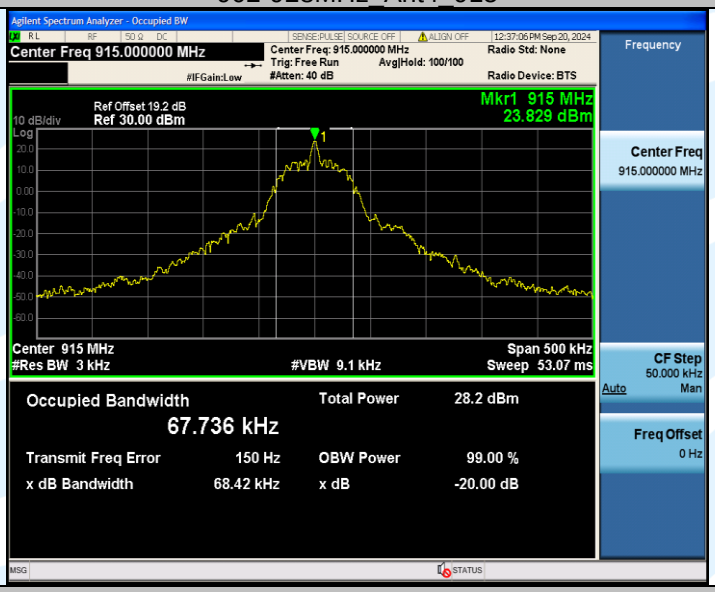
902-928MHz_Ant3_927.5



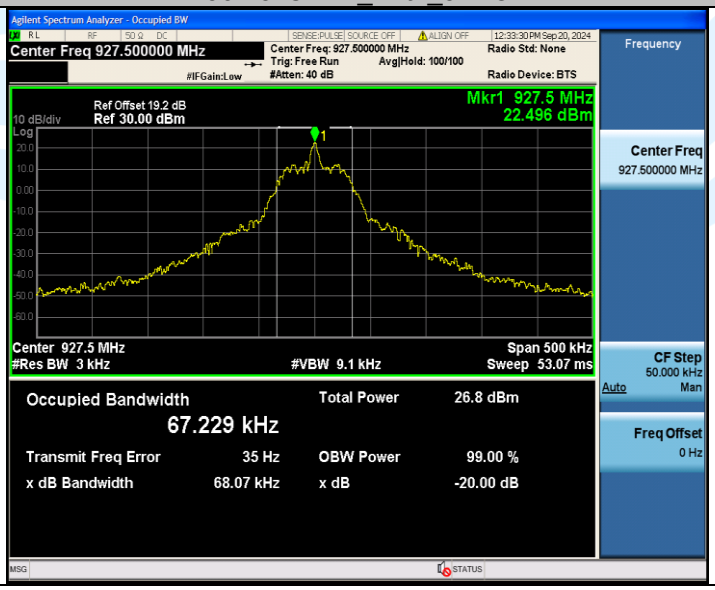
902-928MHz_Ant4_902.5



902-928MHz_Ant4_915



902-928MHz_Ant4_927.5



A.2 OCCUPIED CHANNEL BANDWIDTH

Test Mode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant1	902.5	0.06939	902.4649	902.5342	---	---
		915	0.06741	914.9668	915.0342	---	---
		927.5	0.06905	927.4662	927.5352	---	---

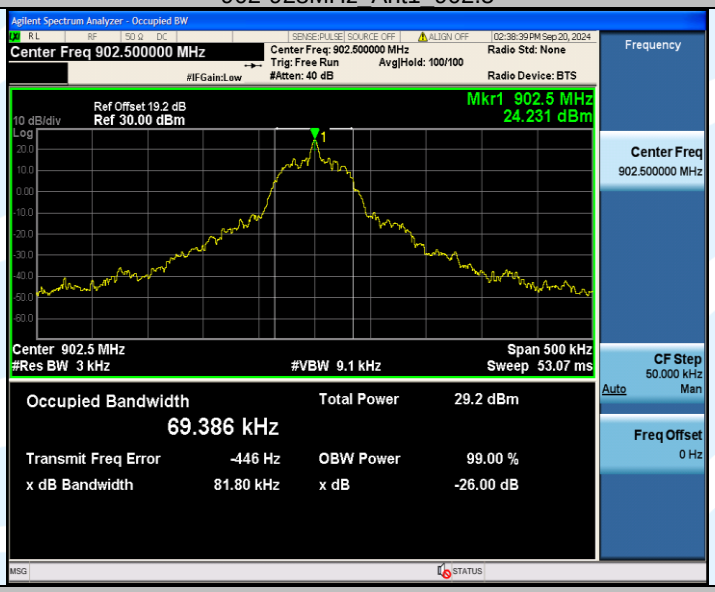
Test Mode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant2	902.5	0.06906	902.4659	902.5349	---	---
		915	0.06704	914.9666	915.0337	---	---
		927.5	0.06756	927.4667	927.5342	---	---

Test Mode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant3	902.5	0.06680	902.4666	902.5334	---	---
		915	0.06691	914.9661	915.0330	---	---
		927.5	0.06862	927.4651	927.5337	---	---

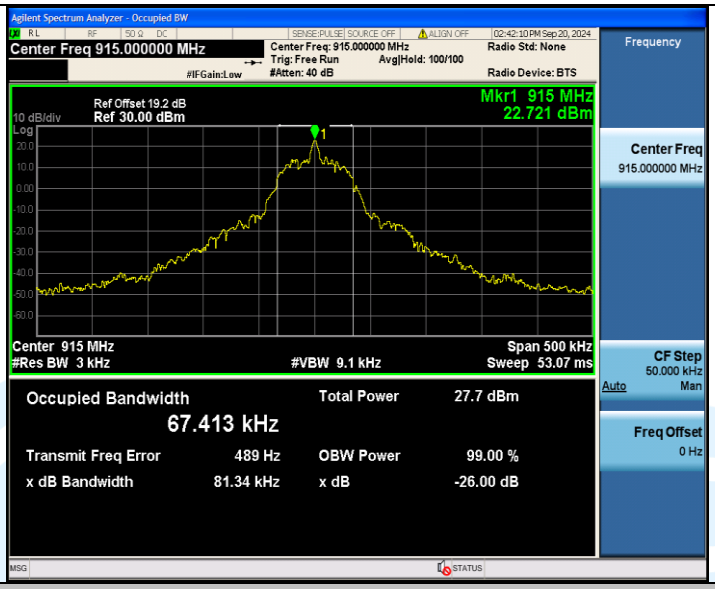
Test Mode	Antenna	Freq(MHz)	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant4	902.5	0.06749	902.4661	902.5336	---	---
		915	0.06794	914.9660	915.0339	---	---
		927.5	0.06737	927.4668	927.5342	---	---

Test Graphs

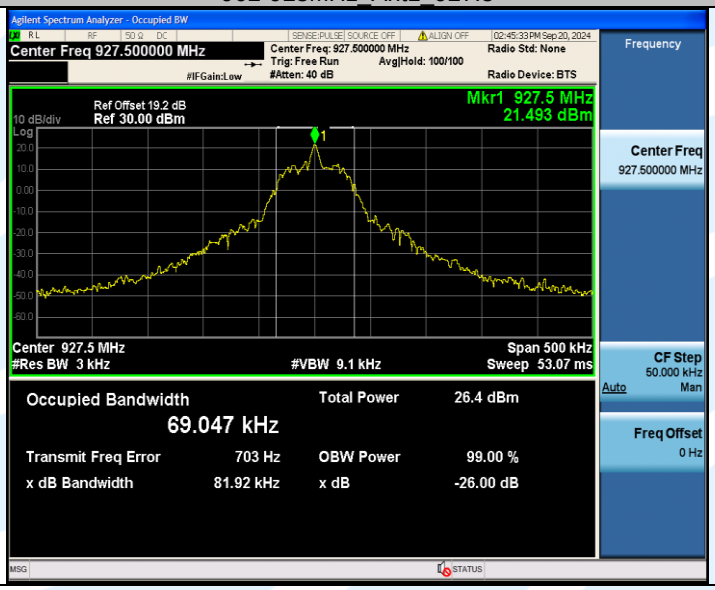
902-928MHz_Ant1_902.5



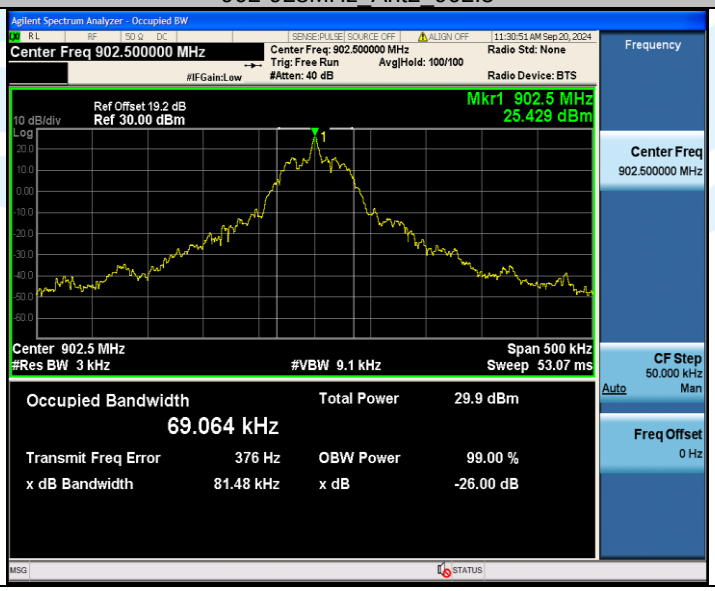
902-928MHz_Ant1_915



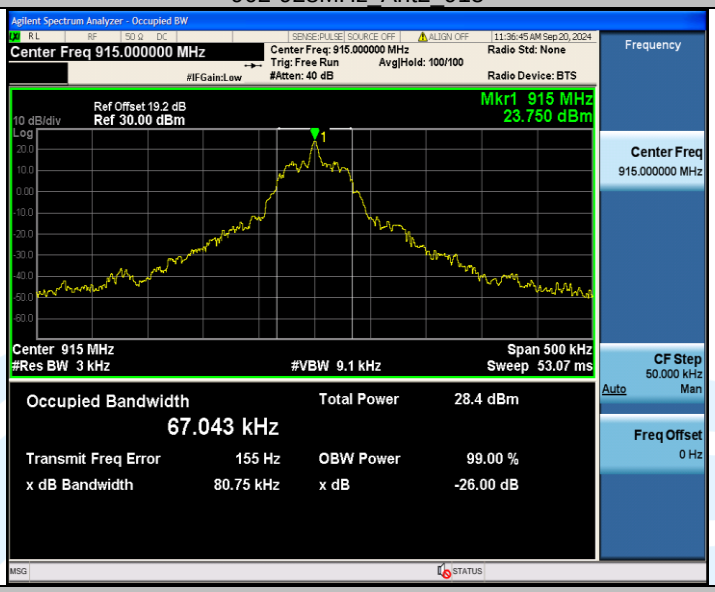
902-928MHz_Ant1_927.5



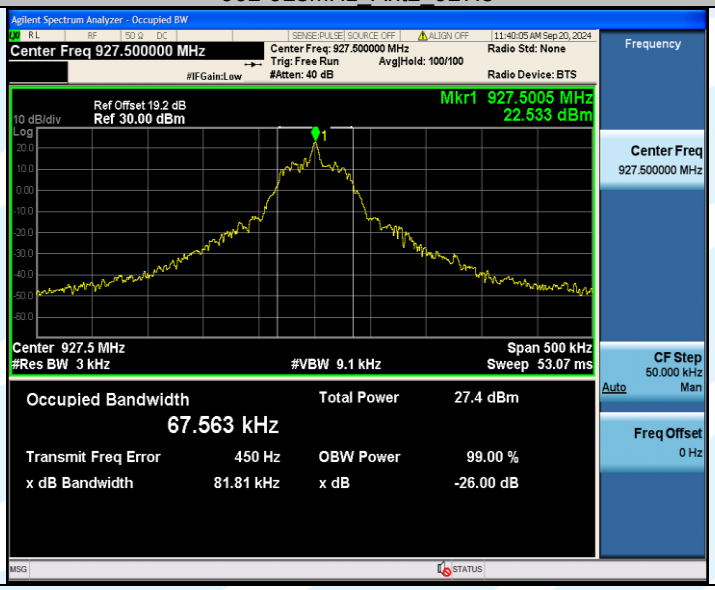
902-928MHz_Ant2_902.5



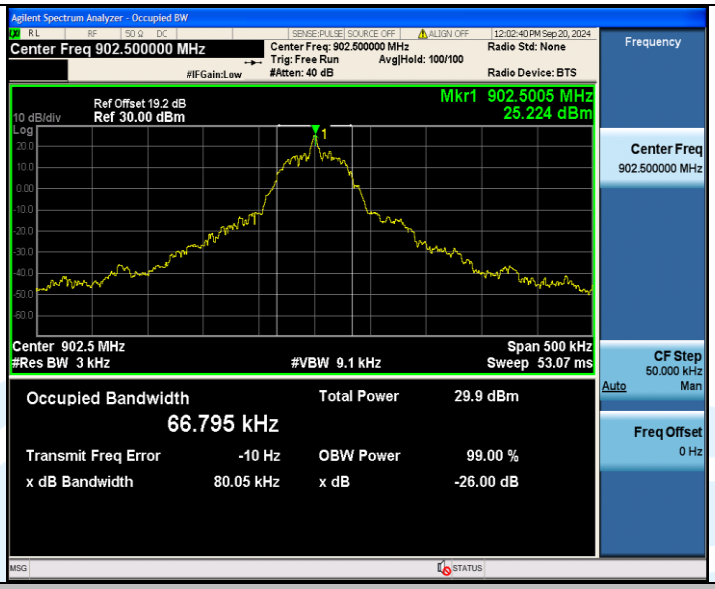
902-928MHz_Ant2_915



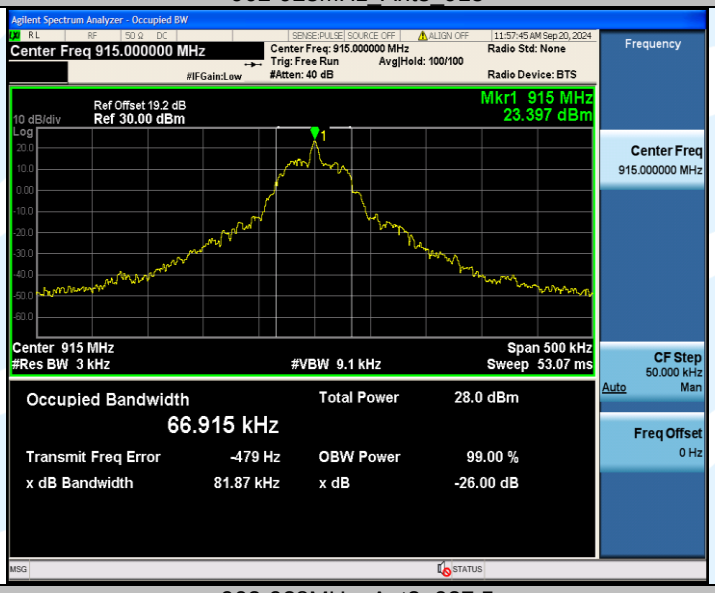
902-928MHz_Ant2_927.5



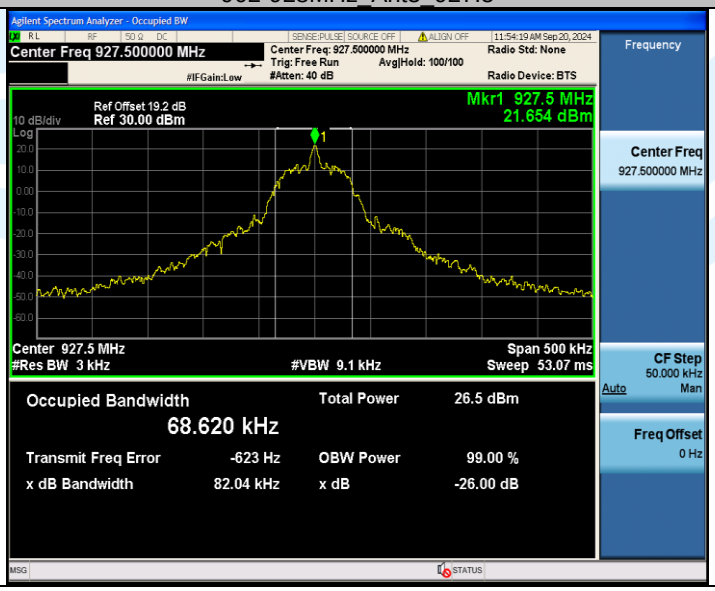
902-928MHz_Ant3_902.5



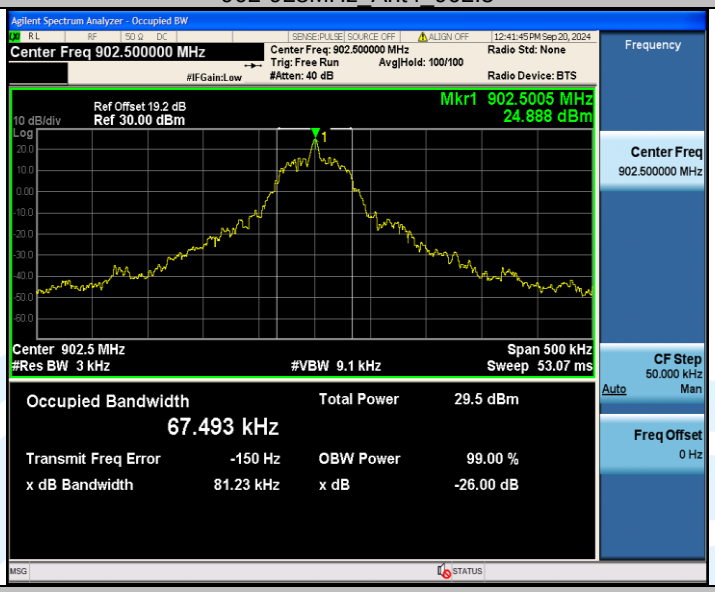
902-928MHz_Ant3_915



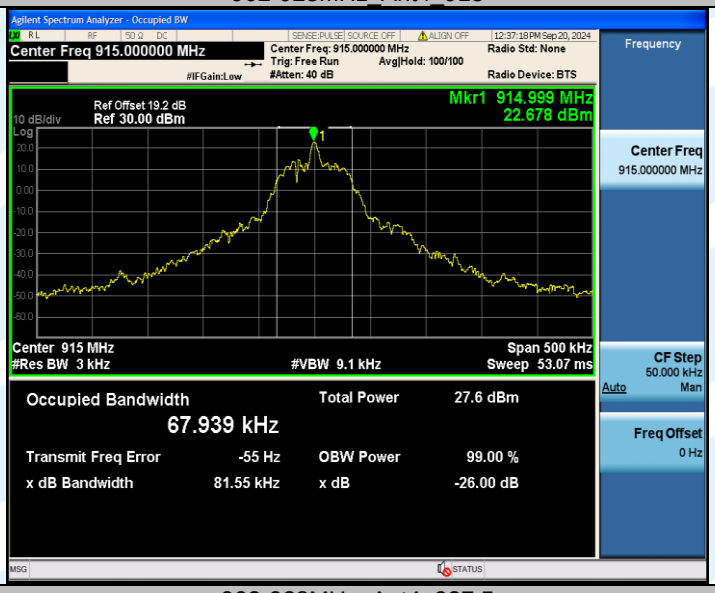
902-928MHz_Ant3_927.5



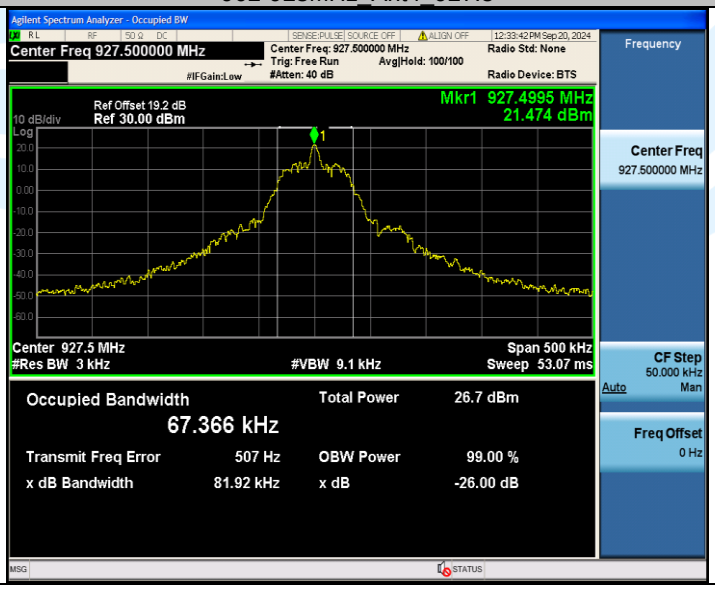
902-928MHz_Ant4_902.5



902-928MHz_Ant4_915



902-928MHz_Ant4_927.5



A.3 MAXIMUM CONDUCTED OUTPUT POWER

Test Mode	Antenna	Freq(MHz)	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	Verdict
902-928MHz	Ant1	902.5	24.26	≤28	PASS
		915	22.73	≤28	PASS
		927.5	21.55	≤28	PASS

Test Mode	Antenna	Freq(MHz)	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	Verdict
902-928MHz	Ant2	902.5	25.35	≤28	PASS
		915	23.81	≤28	PASS
		927.5	22.73	≤28	PASS

Test Mode	Antenna	Freq(MHz)	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	Verdict
902-928MHz	Ant3	902.5	25.24	≤28	PASS
		915	22.86	≤28	PASS
		927.5	21.65	≤28	PASS

Test Mode	Antenna	Freq(MHz)	Conducted Peak Powert[dBm]	Conducted Limit[dBm]	Verdict
902-928MHz	Ant4	902.5	24.22	≤28	PASS
		915	22.69	≤28	PASS
		927.5	21.47	≤28	PASS

A.4 CARRIER FREQUENCY SEPARATION

Test Mode	Antenna	Freq(MHz)	Result[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant1	Hop	0.5	≥ MAX { 25 kHz, BW_{20dB} }	PASS

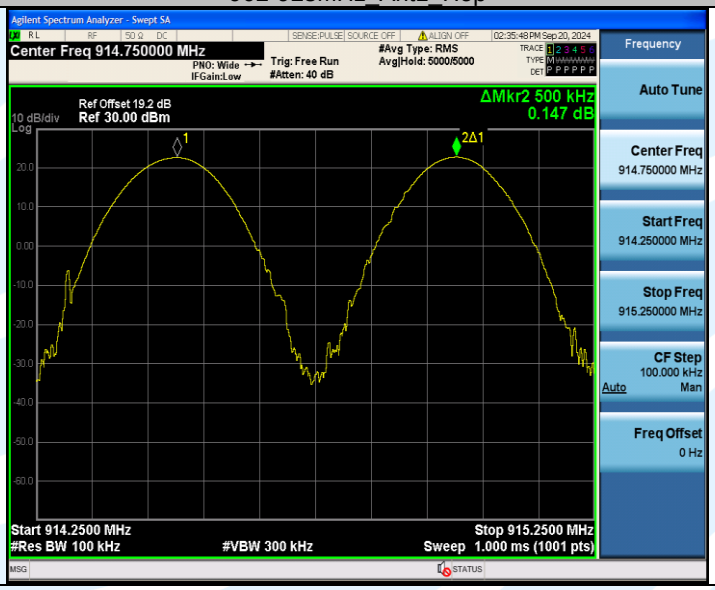
Test Mode	Antenna	Freq(MHz)	Result[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant2	Hop	0.497	≥ MAX { 25 kHz, BW_{20dB} }	PASS

Test Mode	Antenna	Freq(MHz)	Result[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant3	Hop	0.501	≥ MAX { 25 kHz, BW_{20dB} }	PASS

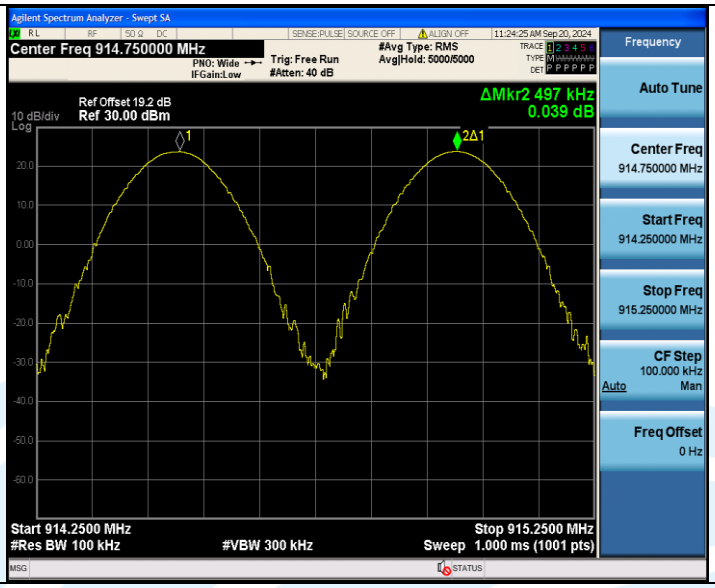
Test Mode	Antenna	Freq(MHz)	Result[MHz]	Limit[MHz]	Verdict
902-928MHz	Ant4	Hop	0.499	≥ MAX { 25 kHz, BW_{20dB} }	PASS

Test Graphs

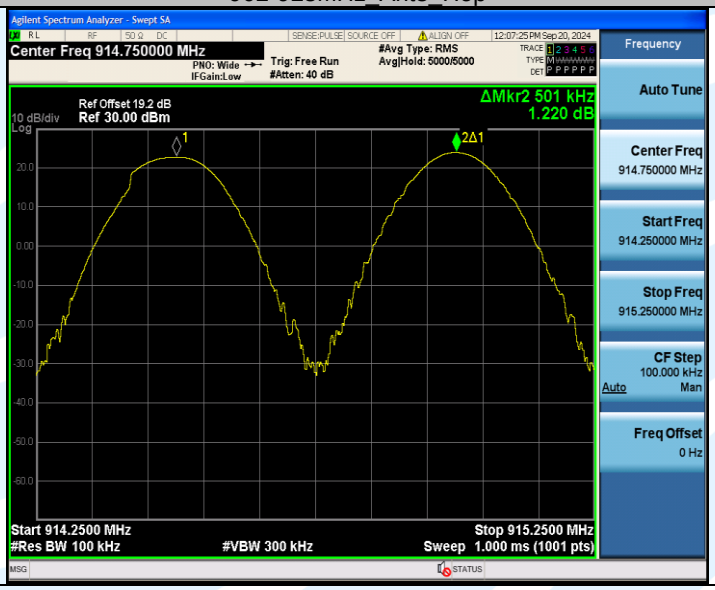
902-928MHz_Ant1_Hop



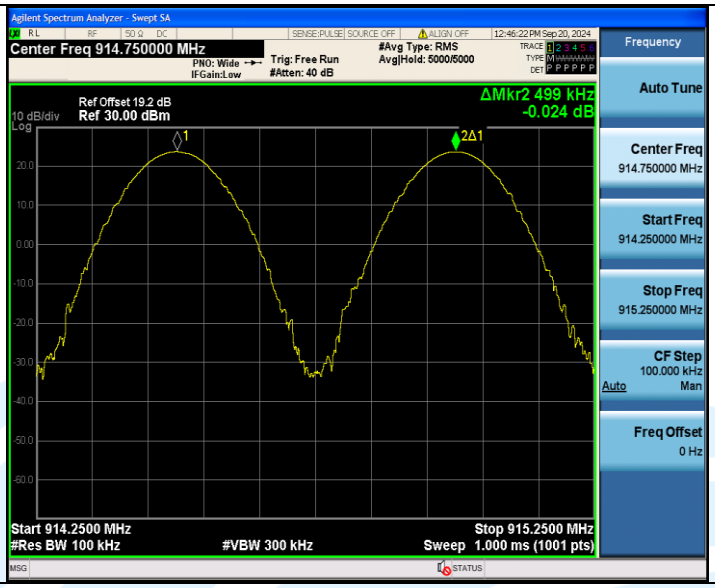
902-928MHz_Ant2_Hop



902-928MHz_Ant3_Hop



902-928MHz_Ant4_Hop


Agilent Spectrum Analyzer - Swept SA
Center Freq 914.750000 MHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 40 dB
#Avg Type: RMS
Avg|Hold: 5000/5000
12:46:22 PM Sep 20, 2024
Ref Offset 19.2 dB
10 dB/div
Ref 30.00 dBm
Log
ΔMkr2 499 kHz
-0.024 dB
Start 914.2500 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 915.2500 MHz
Sweep 1.000 ms (1001 pts)
Frequency
Auto Tune
Center Freq
914.750000 MHz
Start Freq
914.250000 MHz
Stop Freq
915.250000 MHz
CF Step
100.000 kHz
Auto
Man
Freq Offset
0 Hz

A.5 TIME OF OCCUPANCY

Test Mode	Antenna	Freq(MHz)	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
902-928MHz	Ant1	Hop	42.963	6	0.258	≤0.4	PASS

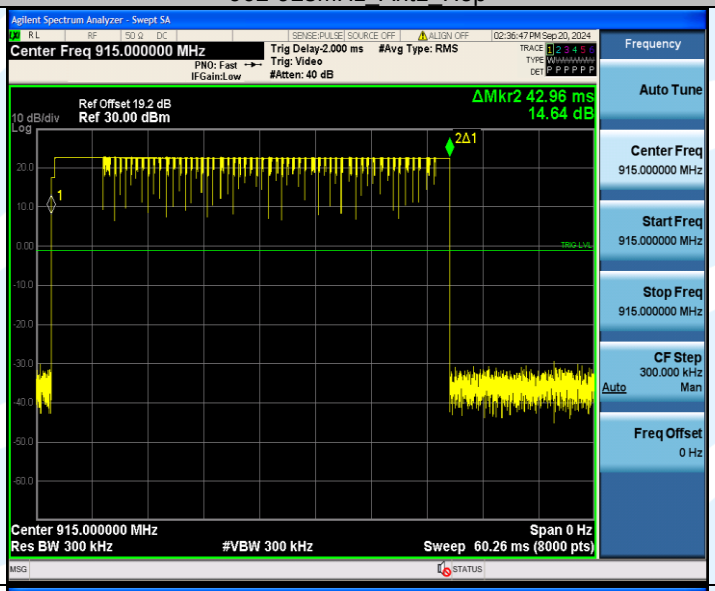
Test Mode	Antenna	Freq(MHz)	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
902-928MHz	Ant2	Hop	42.759	6	0.257	≤0.4	PASS

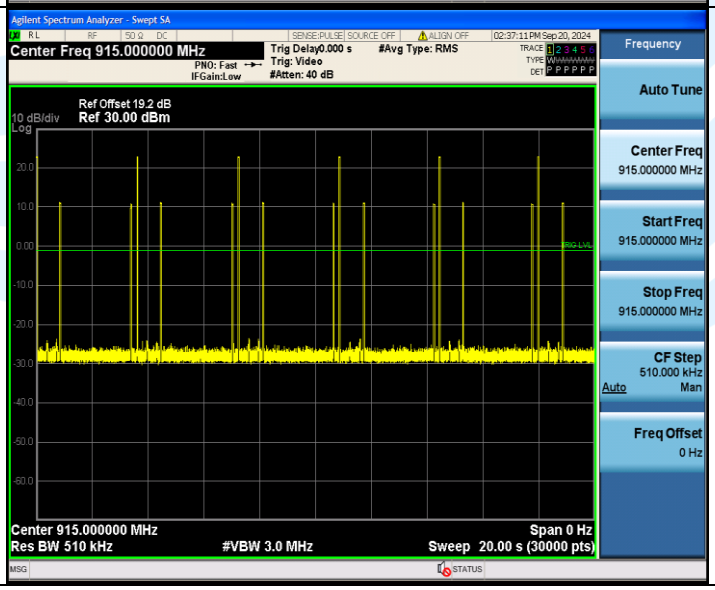
Test Mode	Antenna	Freq(MHz)	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
902-928MHz	Ant3	Hop	43.045	6	0.258	≤0.4	PASS

Test Mode	Antenna	Freq(MHz)	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
902-928MHz	Ant4	Hop	43.098	6	0.259	≤0.4	PASS

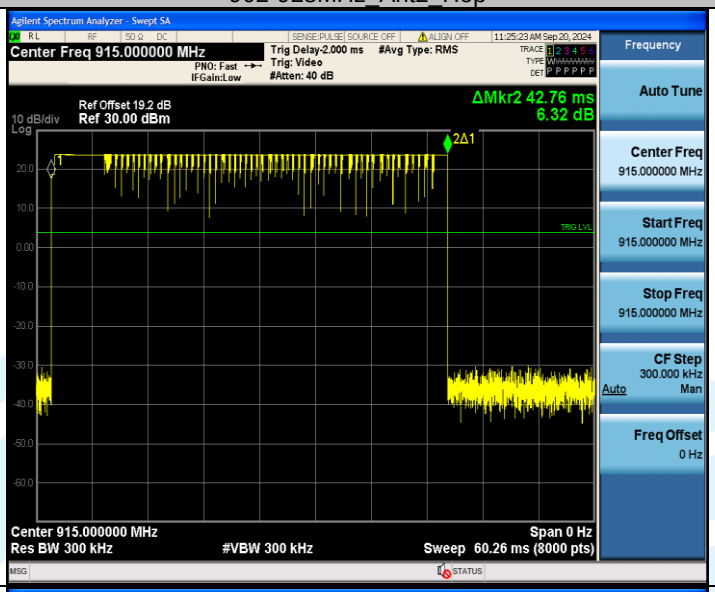
Test Graphs

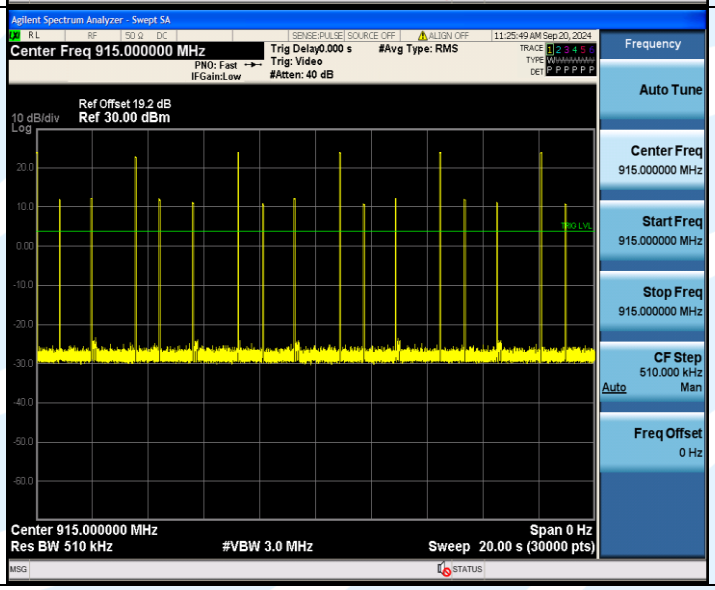
902-928MHz_Ant1_Hop



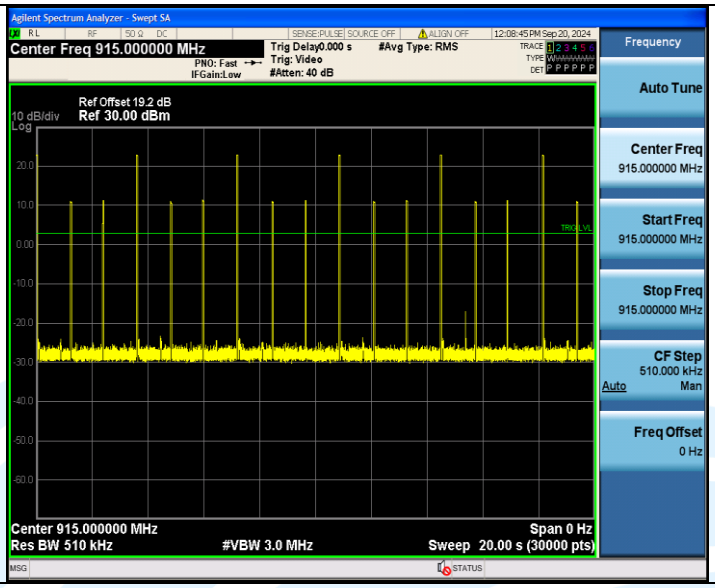


902-928MHz_Ant2_Hop

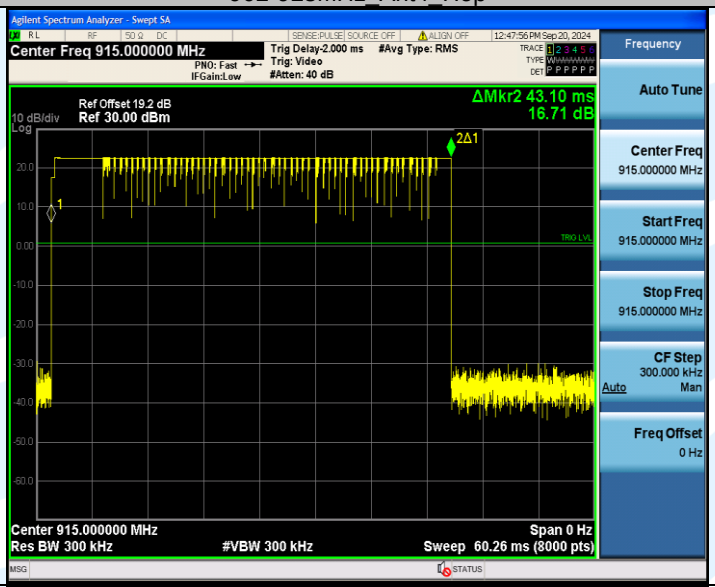


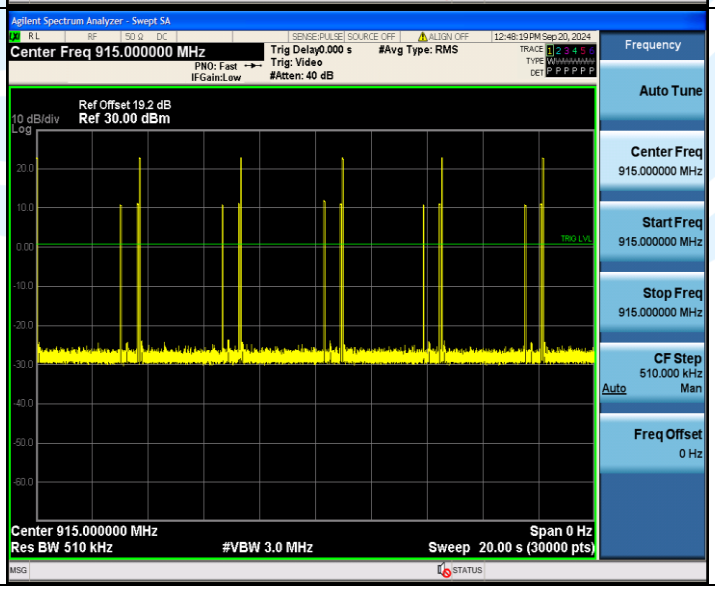


902-928MHz_Ant3_Hop



902-928MHz_Ant4_Hop





A.6 NUMBER OF HOPPING CHANNELS

Test Mode	Antenna	Freq(MHz)	Result[Num]	Limit[Num]	Verdict
902-928MHz	Ant1	Hop	51	≥50	PASS

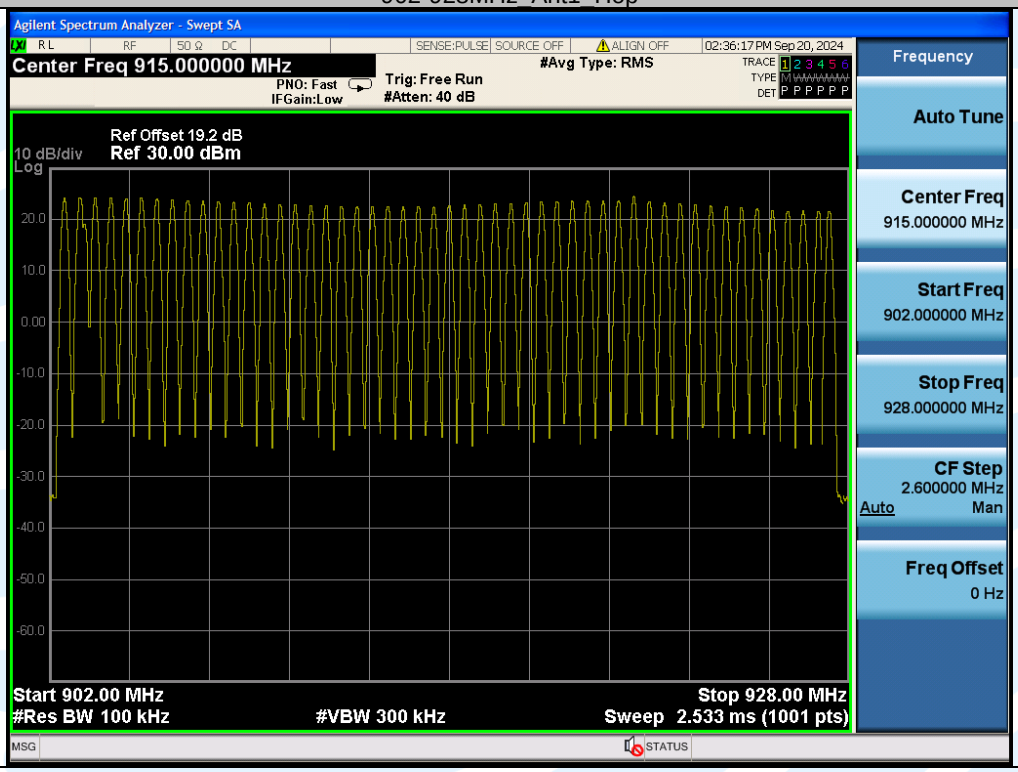
Test Mode	Antenna	Freq(MHz)	Result[Num]	Limit[Num]	Verdict
902-928MHz	Ant2	Hop	51	≥50	PASS

Test Mode	Antenna	Freq(MHz)	Result[Num]	Limit[Num]	Verdict
902-928MHz	Ant3	Hop	51	≥50	PASS

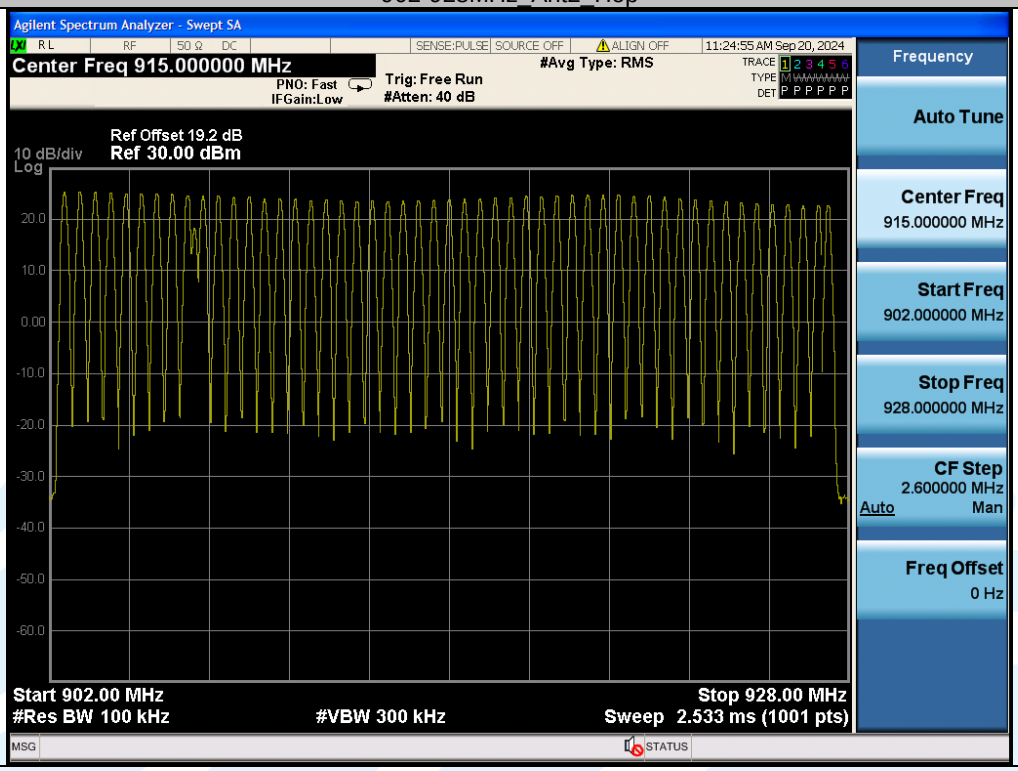
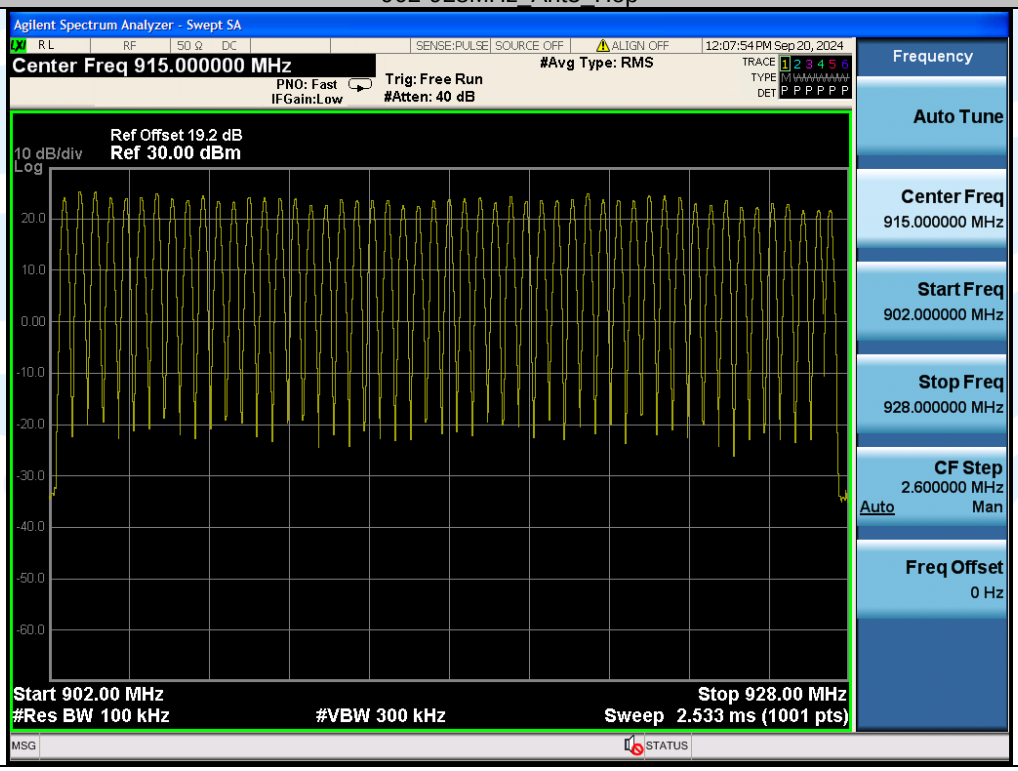
Test Mode	Antenna	Freq(MHz)	Result[Num]	Limit[Num]	Verdict
902-928MHz	Ant4	Hop	51	≥50	PASS

Test Graphs

902-928MHz_Ant1_Hop



902-928MHz_Ant2_Hop



902-928MHz_Ant3_Hop