

TEST REPORT

EUT Description	LoRaWAN
Brand Name	RIVAIOT
Model Name	LGW915SH
Additional Model No	NA
FCC ID	2BWC6LGW915SH
Date of Test Start/End	2026-09-15 / 2026-09-27

Applicant	AdoModel Tech Inc
Address	6679Peachtree Industrial Blvd Suite N, Peachtree Corners, GA30092
Manufacturers	Same as Application
Address	Same as Application
Factory	Same as Application
Address	Same as Application

Reference Standards	47 CFR Part 15, Subpart C 15.247 (see section 1)
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Test Report identification	RL20260830006EF Rev. 00
Revision Control	This test report revision replaces any previous test report revision. (see Document Changes)

Test Result:	Pass*
*The EUT complied with the test item(s) of the above standard (s), refer to the test summary for details.	

Authorized for issue by:

 Jim Chen / Project Engineer	 Jason Li / Reviewer
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Document Changes

Status	Date of issue	Revision	Description of the performed changes
Active	2026-09-28	Rev. 00	None (original version).



2 Test Summary

Radio Spectrum Technical Requirement				
Item	Standard	Method	Requirement	Result
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)	Pass
Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence		N/A	47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)	Pass

Radio Spectrum Matter Part				
Item	Standard	Method	Requirement	Result
Conducted Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass
6dB Bandwidth		ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 Section 6.10.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Output power		ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 Section 6.4,6.5	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Radiated Spurious Emissions		ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 Section 6.6	47 CFR Part 15, Subpart C 15.205 & 15.209	Pass
Conducted spurious & Band Edge Emission		ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
Power Spectral Density		ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 Section 6.9.2	47 CFR Part 15, Subpart C 15.247(a)(1)	Pass
Radiated Band Edge Emission		ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
Antenna Requirement		FCC Part 15: 15.203	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass



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4 General Information

4.1 Details of E.U.T.

EUT Description:	LoRaWAN
Model No.:	LGW915SH
Trade Mark:	RIVAIOT
Hardware Version:	V 5.3
Software Version:	1.0.13
EUT Serial Number	S/N:26526D00001
Power Adapter	Manufacturer: Shenzhen Quanzhengtong Technology Co., Ltd.
	Model No:QZT-1202000
	Output :DC12V/2A,24W
Operation Frequency:	TX:902.3MHz to 914.9MHz RX:923.3MHz~927.5MHz
Modulation Technique:	LoRa Chirp Spread Spectrum (CSS), FHSS as applicable
Modulation Type:	LoRa Chirp Spread Spectrum
Number of Channels:	64
Antenna Type:	FPC Antenna (Main: CON7110, Diversity: CON7111)
Antenna Gain*:	☒ Provided by client
	3dBi
RF Cable:	900MHz ~ 1000MHz (1.0dB)

Since the above data and/or information is provided by the client relevant results or conclusions of this report are only made for these data and/or information , Radiolink test lab is not responsible for the authenticity, integrity and results of the data and information and/or the validity of the conclusion.

Remark:As above information is provided and confirmed by the applicant. Radiolink test lab is not liable to the accuracy, suitability, reliability or/and integrity of the information.

4.2 Test frequencies and settings

Channel	Frequency	Data rate [kbit/s]	Modulation
US11,CH3	902.3MHz	100	LoRa CSS
US12,CH3	914.9MHz	100	LoRa CSS

Note:The EUT's highest TX channel (914.9 MHz) was used for upper band-edge evaluation; emissions above 928 MHz comply with § 15.247(d) 20 dBc and restricted-band limits.

4.3 Environment Parameter

Environment Parameter	1020 mbar Selected Values During Tests	
Relative Humidity	38.8-50.8 % RH Ambient	
Value	Temperature(°C)	Voltage(V)
NT/NV	20	12
LT/LV	-50	9
HT/HV	100	24

Note:

NV:Normal Voltage

LV:Low Extreme Test Voltage

HV:High Extreme Test Voltage

NT:Normal Temperature

LT:Low Extreme Test Temperature

HT:High Extreme Test Temperature

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4.4 Description of Support Units

Description	Manufacturer	Model No.	Serial No.
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The EUT has been tested as an independent unit.			

4.5 Measurement Uncertainty

Test Item	Measurement Uncertainty
Conducted Emissions at AC Power Line (150kHz-30MHz)	$\pm 3.2\text{dB}$
Radiated Emissions which fall in the restricted bands	$\pm 3.7\text{dB}$ (Below 1GHz), $\pm 4.7\text{dB}$ (Above 1GHz)
Radiated Spurious Emissions Below 1GHz	$\pm 3.7\text{dB}$
Radiated Spurious Emissions Above 1GHz	$\pm 4.7\text{dB}$
Conducted Peak Output Power	$\pm 0.8\text{dB}$
20dB Bandwidth	$\pm 3\%$
Carrier Frequencies Separation	$\pm 7.25 \times 10^{-8}$
Hopping Channel Number	$\pm 7.25 \times 10^{-8}$
Dwell Time	$\pm 0.37\%$
Power Spectrum Density	$\pm 0.35\text{dB}$
Conducted Band Edges Measurement	$\pm 2.7\text{dB}$
Conducted Spurious Emissions	$\pm 2.7\text{dB}$
Remark: The U_{lab} (lab Uncertainty) is less than $U_{\text{CISPR/ETSI}}$ (CISPR/ETSI Uncertainty), so the test results – compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit; – non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.	

4.6 Test Location

All tests were performed at:

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No tests were sub-contracted.

4.7 Test Facility

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

. A2LA (Certificate No. 7572.01)

Radiolink Testing (Shenzhen) Co., Ltd, Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 7572.01.

4.8 Deviation from Standards

None

4.9 Abnormalities from Standard Conditions

None

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5 Equipment List

Transmitter unwanted emissions in the spurious domain/ Receiver spurious emissions					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
3m Anechoic Chamber	TDK	966	RL01-01	2024/11/22	2027/11/21
Horn Antenna(1GHz-18GHz)	Schwarzbeck	BBHA 9120D	RL03-01	2025/3/28	2028/3/27
BiConiLog Antenna(30MHz-3GHz)	Schwarzbeck	VULB9163	RL03-02	2025/4/7	2028/4/6
Active Loop Antenna(9kHz-30MHz)	Schwarzbeck	FMZB 1519B	RL03-03	2025/3/28	2028/3/27
MXE EMI Receiver(3Hz-8.4GHz)	KEYSIGHT	N9038A	RL04-01	2026/4/03	2027/4/02
EXA Signal Analyzer(10Hz-44GHz)	KEYSIGHT	N9010B	RL04-03	2026/4/3	2027/4/2
Pre-Amplifier(500MHz-18GHz)	Tonscend	TPA-011845	RL06-02	2026/4/3	2027/4/2
Pre-Amplifier(0.4GHz-8GHz)	TST PASS	LNA04080G30	RL06-05	2026/4/3	2027/4/2
Attenuation Clamp(150kHz-1000MHz)	Teseq	KEMA 801A	RL07-09	2026/4/13	2027/4/12
AC Power Source	Preen	KDF-11002G	RL08-03	2026/4/3	2027/4/2
Intelligent Line Power Conditioner	Preen	APS-11040GG	RL08-04	2026/4/3	2027/4/2
Coaxial Cable(9kHz-30MHz)	Radiolink	N/A	RL20-01	2026/4/3	2027/4/2
Coaxial Cable(30MHz-1000MHz)	Radiolink	N/A	RL20-02	2026/4/3	2027/4/2
Coaxial Cable(1GHz-18GHz)	Radiolink	N/A	RL20-03	2026/6/10	2027/6/9
Coaxial Cable(9kHz-30MHz)	Radiolink	N/A	RL20-05	2026/4/3	2027/4/2
Measurement Software	AUDIX	e3 V9	N/A	N/A	N/A



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Conducted Emissions at Mains Terminals (150kHz-30MHz)					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Shielding Room	TDK	643	RL01-01	2025/03/31	2028/03/30
EMI Test Receiver	Rohde & Schwarz	ESPI-3	RL04-02	2026/04/03	2027/04/02
V-LISN(9kHz-30MHz)	Rohde & Schwarz	NSLK 8127 RC	RL07-01	2026/04/03	2027/04/02
Measurement Software	AUDIX	e3 V9	N/A	N/A	N/A

RF Conducted Test					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
EXA Signal Analyzer(10Hz-44GHz)	KEYSIGHT	N9010B	RL04-03	2026/4/3	2027/4/2
MXG Vector Signal Generator(100kHz-6GHz)	N5182A	N5182A	RL05-05	2026/4/3	2027/4/2
SIGNAL GENERATOR(10MHz-20GHz)	SMP22	SMP22	RL05-06	2026/4/3	2027/4/2
Wideband Radio Communication Tester	CMW 500	CMW 500	RL05-07	2026/4/3	2027/4/2
Measurement Software	TST	TSTPASS V2.0	N/A	N/A	N/A

General used equipment					
Equipment	Manufacturer	Model No.	Inventory No.	Cal Date	Cal Due Date
Electronic Hygrothermograph	deli	8838	RL02-02	2026/5/7	2027/5/6
Electronic Hygrothermograph	deli	8838	RL02-03	2026/4/23	2027/4/22
Electronic Hygrothermograph	deli	8838	RL02-04	2026/4/23	2027/4/22
Electronic Hygrothermograph	deli	8838	RL02-05	2026/4/8	2027/4/07
Barometer	Shanghai Mengte Instrument	DYM3	RL02-01	2026/4/8	2027/4/7

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6 Emission Test Results

6.1 Antenna Requirement

6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(b)(4)

FCC requirement:

15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, 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.

The antenna is FPC Antenna and no consideration of replacement. The best case gain of the antenna is 3 dBi.

Note:

The antenna gain are derived from the gain information report provided by the manufacturer.

Remark:

As above information is provided and confirmed by the applicant. Radiolink test lab is not liable to the accuracy, suitability, reliability or/and integrity of the information.



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6.2 Other requirements Frequency Hopping Spread Spectrum System Hopping Sequence

6.2.1 Test Requirement:

47 CFR Part 15, Subpart C 15.247(a)(1),(g),(h)

6.2.2 Conclusion

Standard Requirement:

The system hops to channel frequencies selected from a pseudorandom ordered list of hopping frequencies at the system hopping rate. Each frequency is used equally on average. The system complies with 47 CFR Part 15.247(a)(1), (g), and (h).

Compliance for section 15.247(a)(1):

The LoRa device operates in the 902-928 MHz band using Frequency Hopping Spread Spectrum (FHSS). The system employs 64 hopping channels with 125 kHz bandwidth (starting at 902.3 MHz). The hopping sequence is pseudorandomly generated by the LoRa protocol state machine. The dwell time on any single frequency is ≤ 0.4 seconds (average within 20 seconds), and the number of hopping channels (64) exceeds the minimum requirement of 50 for this band. The system transmits both continuous data and short bursts under this FHSS mechanism.

Compliance for section 15.247(g):

The system transmits packets within the 902-928 MHz band. All hopping frequencies are within the authorized band, and the 20 dB bandwidth of each channel is approximately 125 kHz. The receiver input bandwidth matches the hopping channel bandwidths.

Compliance for section 15.247(h):

The system incorporates intelligence to avoid hopping on occupied channels (adaptive hopping). However, it is designed not to coordinate with other FHSS systems to avoid simultaneous occupancy of individual hopping frequencies by multiple transmitters.



7 Radio Spectrum Matter Test Results

7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207
Test Method: ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024
Section 6.2

Limit:

Frequency of emission(MHz)	Conducted limit(dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.
Detector: Peak for pre-scan (9kHz resolution bandwidth) 0.15M to 30MHz

7.1.1 E.U.T. Operation

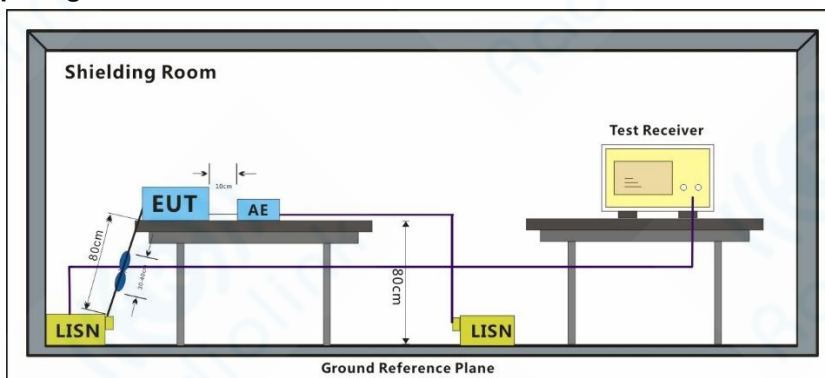
Operating Environment:

Temperature: 22.3 °C Humidity: 48 % RH Atmospheric Pressure: 1020 mbar

7.1.2 Test Mode Description

Mode Code	Description
1	TX mode Keep the EUT transmitting continuously with LoRa/CSS modulation (FHSS as applicable) at maximum power and worst-case SF/BW/channel settings in 902 - 928 MHz. All applicable modes were evaluated; only worst-case data is recorded.

7.1.3 Test Setup Diagram



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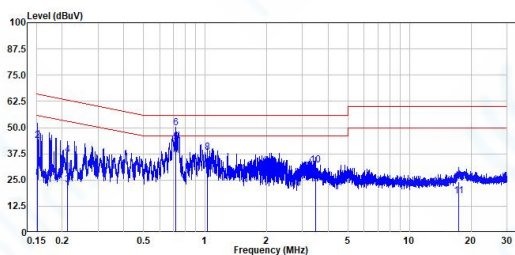
7.1.4 Measurement Procedure and Data

- 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 $50\Omega/50\mu\text{H} + 50\Omega$ 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.

Remark : $\text{Level} = \text{Read Level} + \text{Cable Loss} + \text{LISN Factor}$



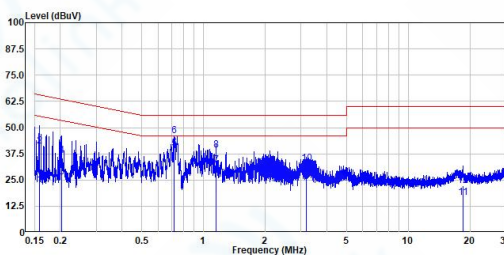
Line: US11,CH3



Site : chamber
Condition: Line
EUT : LoRa-DTU
Mode : US11,CH3
Note :

Result	Freq	Level	Limit	LISN	Cable	Read	Over	Pol/Phase
	MHz	dBuV	Line	Factor	Loss	Level	Limit	
1 Pass	0.152	24.40	55.90	0.05	9.81	Average	14.54	-31.50 Line
2 Pass	0.152	43.59	65.90	0.05	9.81	QP	33.73	-22.31 Line
3 Pass	0.212	22.50	53.13	0.11	9.94	Average	12.45	-30.63 Line
4 Pass	0.212	37.08	63.13	0.11	9.94	QP	27.03	-26.05 Line
5 PP	0.719	42.93	46.00	0.10	10.51	Average	32.32	-3.07 Line
6 QP	0.719	49.78	56.00	0.10	10.51	QP	39.17	-6.22 Line
7 Pass	1.026	29.77	46.00	0.11	10.60	Average	19.06	-16.23 Line
8 Pass	1.026	38.12	56.00	0.11	10.60	QP	27.41	-17.88 Line
9 Pass	3.463	24.83	46.00	0.15	10.61	Average	14.07	-21.17 Line
10 Pass	3.463	31.96	56.00	0.15	10.61	QP	21.20	-24.04 Line
11 Pass	17.360	17.30	58.00	0.63	10.48	Average	6.27	-32.62 Line
12 Pass	17.360	24.14	68.00	0.63	10.48	QP	13.03	-35.86 Line

Neutral :US11,CH3



Site : chamber
Condition: Neutral
EUT : LoRa-DTU
Mode : US11,CH3
Note :

Result	Freq	Level	Limit	LISN	Cable	Read	Over	Pol/Phase
	MHz	dBuV	Line	Factor	Loss	Level	Limit	
1 Pass	0.158	22.79	55.56	0.17	9.82	Average	12.80	-32.77 Neutral
2 Pass	0.158	40.97	65.56	0.17	9.82	QP	30.98	-24.59 Neutral
3 Pass	0.203	26.26	53.48	0.15	9.93	Average	16.18	-27.22 Neutral
4 Pass	0.203	36.75	63.48	0.15	9.93	QP	26.67	-26.73 Neutral
5 PP	0.721	40.95	46.00	0.17	10.51	Average	29.37	-5.95 Neutral
6 QP	0.721	46.05	56.00	0.17	10.51	QP	35.37	-9.95 Neutral
7 Pass	1.156	31.92	46.00	0.17	10.61	Average	21.14	-14.08 Neutral
8 Pass	1.156	39.14	56.00	0.17	10.61	QP	28.36	-16.86 Neutral
9 Pass	3.184	24.66	46.00	0.20	10.62	Average	13.84	-21.34 Neutral
10 Pass	3.184	32.82	56.00	0.20	10.62	QP	22.00	-23.18 Neutral
11 Pass	18.462	16.61	50.00	0.64	10.48	Average	5.49	-33.39 Neutral
12 Pass	18.462	22.29	60.00	0.64	10.48	QP	11.17	-37.71 Neutral

7.2 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209
Test Method: ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024
Section 6.10.5
Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
216-960	200	3
960-1000	500	3
Above 1000	500(AV)	3
	5000(PK)	3

Remark: 1 The EUT operates under FCC Part 15 Subpart C (15.247) as a Frequency Hopping Spread Spectrum (FHSS) device.

2 For frequencies above 1000 MHz (and specific low frequency bands), limits are based on average (Avg) peak (PK) detection. The field strength limit is 500 $\mu\text{V/m}$ (54 dB $\mu\text{V/m}$) and 5000 $\mu\text{V/m}$ (74 dB $\mu\text{V/m}$, PK) at 3m.,

3 Per FCC 15.35(b), the peak field strength shall not exceed the maximum permitted average limit by more than 20 dB (i.e., 74 dB $\mu\text{V/m}$ Peak @3m).

4 In-band conducted emissions (power, bandwidth, bandedge) are evaluated per 15.247. Radiated spurious emissions falling in restricted bands (per 15.205) are evaluated per 15.209 with Peak and Average detectors.

7.2.1 E.U.T. Operation

Operating Environment:
Temperature: 24.5 °C Humidity: 50.8 % RH Atmospheric Pressure: 1020 mbar

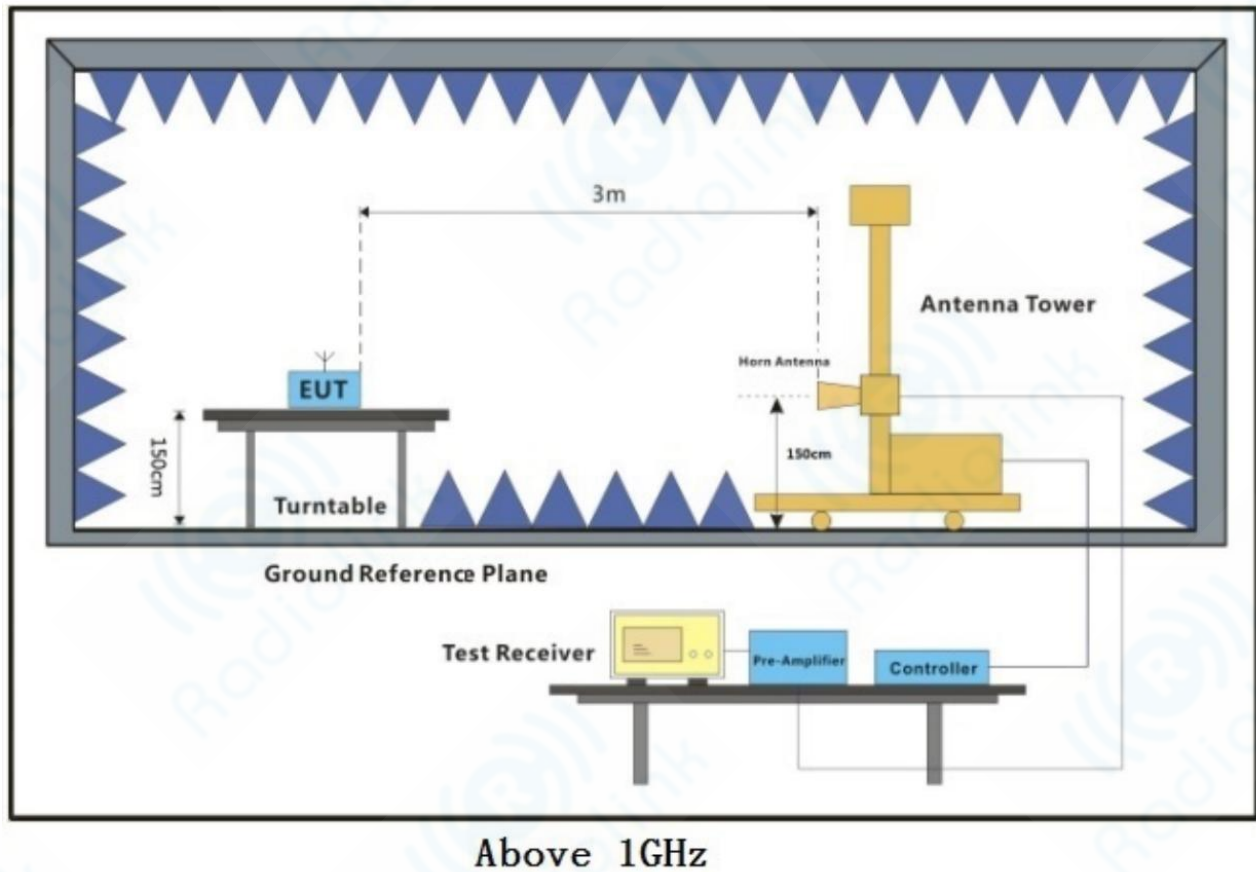
7.2.2 Test Mode Description

Mode Code	Description
1	TX mode – Keep the EUT in continuously transmitting mode with LoRa/CSS modulation (FHSS as implemented/configured, operating within 902–928 MHz). Worst-case configuration was selected (maximum output power, worst-case SF/BW/channel, antenna polarization/height/azimuth, and applicable TX channel conditions). All supported modes/channels/configurations were evaluated as applicable, and only the worst-case data is recorded in the report.

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7.2.3 Test Setup Diagram



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7.2.4 Measurement Procedure and Data

7.2.4 Measurement Procedure and Data

- a. For above 1 GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. The test receiver/spectrum analyzer was set to Peak Detect (Max Hold) for preliminary survey, and Average Detect (per FCC 15.35(b)) for final compliance measurement above 1 GHz. For measurements in/near the 902 – 928 MHz operating band and restricted bands, Peak and Average detectors were used as applicable.
- e. Emissions that were more than 20 dB below the applicable limit (or met the 10 dB margin per lab practice) were captured via Peak sweep. Emissions near the limit or in restricted bands were measured using both Peak and Average detectors and reported.
- f. The EUT (LoRa/CSS spread spectrum device, FHSS as implemented/configured) was set to continuous TX / fixed-channel test mode as required for worst-case radiated evaluation. Preliminary tests were performed on the lowest operating TX channel near 902.3 MHz, middle channel 912 MHz, and highest TX operating channel 914.9 MHz (with 920 MHz / upper band-edge evaluation within the authorized 902 – 928 MHz band as applicable). Worst-case configuration was selected for final data: maximum output power, worst-case SF/BW/channel, antenna polarization, height and azimuth/orientation (X, Y, Z as applicable).
- i. Repeat above procedures (X, Y, Z orientations if applicable, polarizations, and height scans) until all worst-case frequencies were captured.
- j. Repeat above procedures until all frequencies measured was complete.

Remark 1: Level = Read Level + Cable Loss + Antenna Factor - Preamp Factor

Remark 2: For frequencies above 1 GHz, limits are based on Average detection (500 $\mu\text{V/m}$ @3m = 54 dB $\mu\text{V/m}$). Per FCC 15.35(b), the Peak field strength shall not exceed the max permitted Average limit by more than 20 dB (74 dB $\mu\text{V/m}$ Peak @3m). Both Peak and Avg plots are provided for >1 GHz restricted bands.

Remark 3: The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) and Average detection (AV) at frequency above 1 GHz. For 902 – 928 MHz and adjacent/restricted-band measurements, instrument RBW/VBW and detector settings were selected per ANSI C63.10 and the emission type being measured.

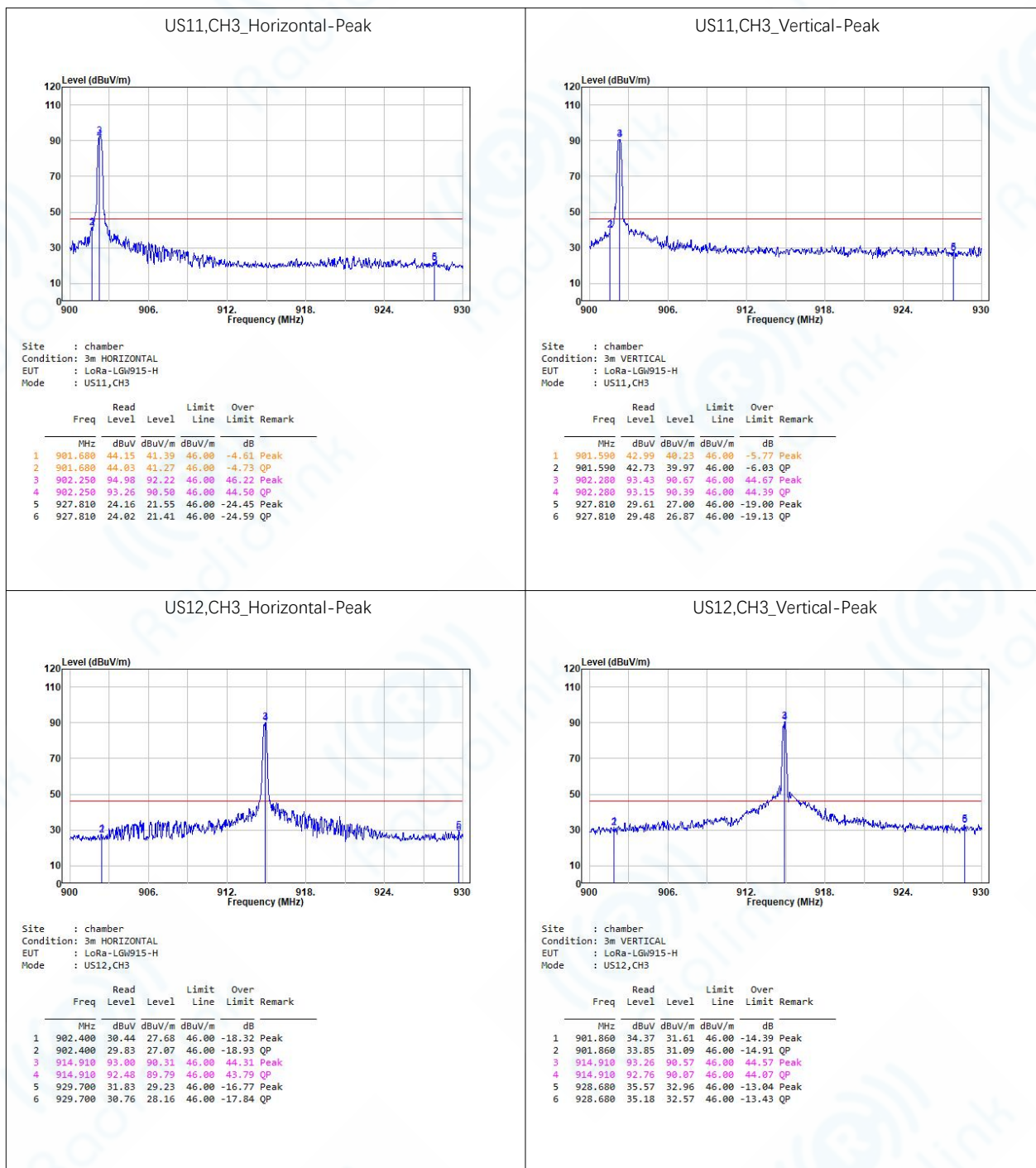
Remark 4: In-band conducted parameters (99% OBW, Power, PSD, bandedge as applicable) evaluated per FCC § 15.247. Radiated testing performed under continuous TX / worst-case LoRa/CSS (FHSS as implemented) configuration; worst-case channel/polarization/antenna height/orientation and modulation parameters (SF/BW as configured) selected.

Remark 5: The 46 dB $\mu\text{V/m}$ line/marker shown in 902 – 928 MHz plots is for reference/restricted-band/spurious display only. In-band/ § 15.247 band-edge compliance is based on 20 dBc (Peak)/30 dB (RMS) per § 15.247(d) as applicable; restricted-band absolute limits per § 15.205/ § 15.209 are also considered (54 dB $\mu\text{V/m}$ AV, 74 dB $\mu\text{V/m}$ PK @3m above/below as applicable).



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Remake: The EUT does not transmit above 914.9 MHz; therefore, 914.9 MHz represents the worst-case upper in-band condition. Emissions outside 928 MHz were measured and compared against the 20 dBc attenuation requirement. The 13.8 MHz offset between 914.9 MHz and 928 MHz provides conservative margin; any out-of-band emissions at 928 MHz and above are below the restricted-band limits and the 20 dBc relative criterion.

7.3 Radiated Spurious Emissions Below 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024
Section 6.4,6.5

Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
960-1000	500	3

7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 23.5 °C

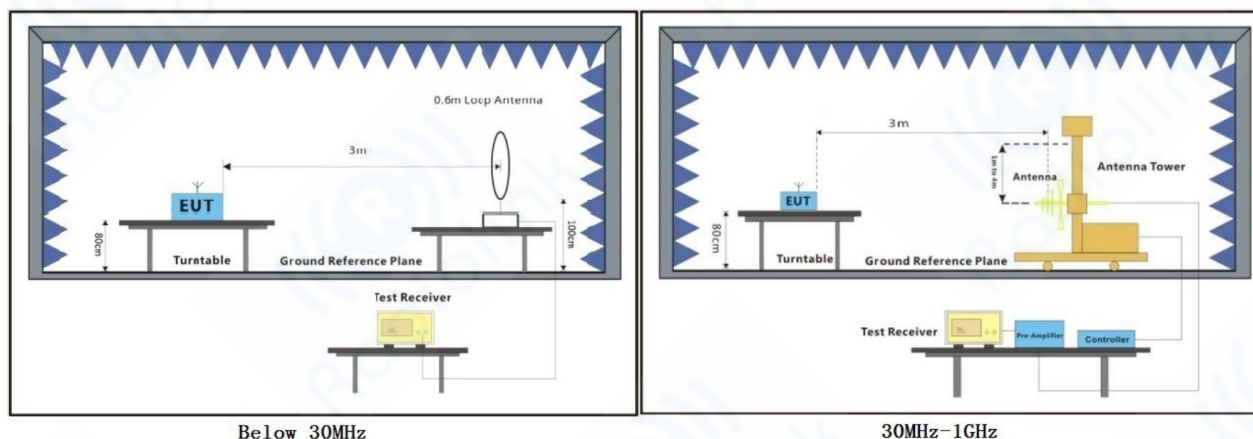
Humidity: 46.8 % RH

Atmospheric Pressure: 1020 mbar

7.3.2 Test Mode Description

Mode Code	Description
1	TX mode – Keep the EUT in continuously transmitting mode with LoRa/CSS modulation (FHSS as implemented/configured, operating within 902–928 MHz). Worst-case configuration was selected (maximum output power, worst-case SF/BW/channel, antenna polarization/height/azimuth, and applicable TX channel conditions). All supported modes/channels/configurations were evaluated as applicable, and only the worst-case data is recorded in the report.

7.3.3 Test Setup Diagram



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7.3.4 Measurement Procedure and Data

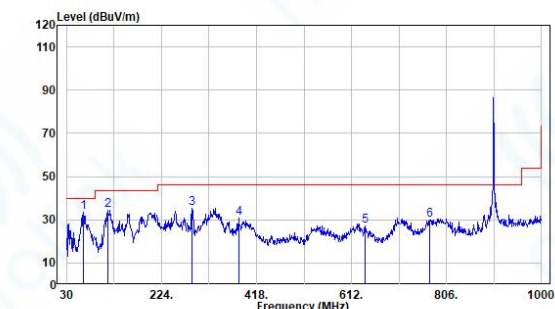
- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- d. 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 rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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 quasi-peak method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. Repeat above procedures (X, Y, Z orientations if applicable, polarizations, and height scans) until all worst-case frequencies were captured.
- i. Repeat above procedures until all frequencies measured was complete.

Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
2. Scan from 9kHz to 30MHz, the disturbance below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.



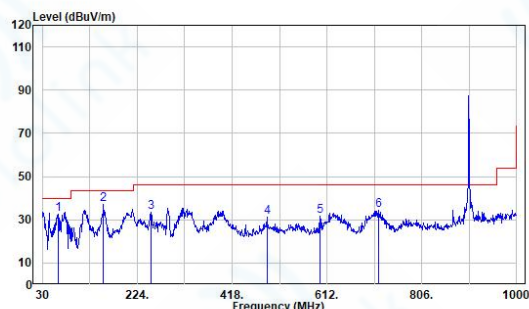
US11,CH3_Horizontal-Peak



Site : chamber
Condition: 3m HORIZONTAL
EUT : LoRa-LGW915-H
Mode : US11,CH3

	Read	Level	Limit	Over	
Freq	Level	Level	Line	Limit	Remark
MHz	dBuV	dBuV/m	dBuV/m	dB	
1 63.950	49.13	33.55	40.00	-6.45	Peak
2 114.390	42.05	34.22	43.50	-9.28	Peak
3 287.050	48.65	35.49	46.00	-10.51	Peak
4 382.110	41.51	30.74	46.00	-15.26	Peak
5 639.160	33.18	27.02	46.00	-18.98	Peak
6 771.080	34.57	30.01	46.00	-15.99	Peak

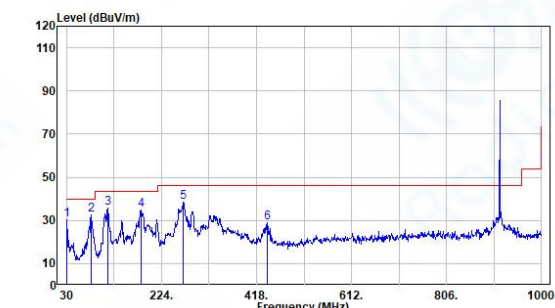
US11,CH3_Vertical-Peak



Site : chamber
Condition: 3m VERTICAL
EUT : LoRa-LGW915-H
Mode : US11,CH3

	Read	Level	Limit	Over	
Freq	Level	Level	Line	Limit	Remark
MHz	dBuV	dBuV/m	dBuV/m	dB	
1 62.980	47.66	32.41	40.00	-7.59	Peak
2 155.130	49.82	36.98	43.50	-6.52	Peak
3 253.100	47.20	33.62	46.00	-12.38	Peak
4 489.780	40.17	31.38	46.00	-14.62	Peak
5 597.450	38.07	31.59	46.00	-14.41	Peak
6 717.730	39.97	34.52	46.00	-11.48	Peak

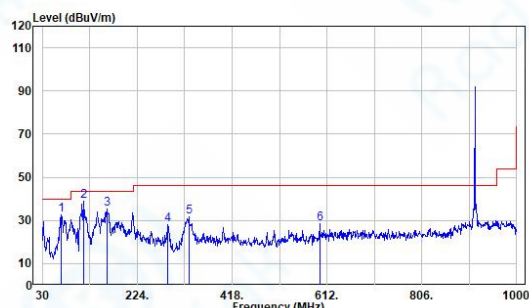
US12,CH3_Horizontal-Peak



Site : chamber
Condition: 3m HORIZONTAL
EUT : LoRa-LGW915-H
Mode : US12,CH3

	Read	Level	Limit	Over	
Freq	Level	Level	Line	Limit	Remark
MHz	dBuV	dBuV/m	dBuV/m	dB	
1 30.970	45.89	30.12	40.00	-9.88	Peak
2 81.410	51.98	32.55	40.00	-7.45	Peak
3 114.390	43.45	35.62	43.50	-7.88	Peak
4 183.260	43.76	34.04	43.50	-8.66	Peak
5 268.620	51.80	38.41	46.00	-7.59	Peak
6 439.340	38.50	28.88	46.00	-17.12	Peak

US12,CH3_Vertical-Peak



Site : chamber
Condition: 3m VERTICAL
EUT : LoRa-LGW915-H
Mode : US12,CH3

	Read	Level	Limit	Over	
Freq	Level	Level	Line	Limit	Remark
MHz	dBuV	dBuV/m	dBuV/m	dB	
1 67.830	49.31	32.44	40.00	-7.56	Peak
2 115.360	46.86	39.06	43.50	-4.44	Peak
3 161.920	46.57	35.54	43.50	-7.96	Peak
4 287.050	41.07	27.91	46.00	-18.09	Peak
5 329.730	43.70	31.51	46.00	-14.49	Peak
6 597.450	35.04	28.56	46.00	-17.44	Peak

7.4 Radiated Spurious Emissions Above 1GHz

Test Requirement 47 CFR Part 15, Subpart C 15.205 & 15.209

Test Method: ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024
Section 6.6

Measurement Distance: 3m

Limit:

Frequency(MHz)	Field strength(microvolts/meter)	Measurement distance(meters)
Above 1000	500 (Average)	3
	5000 (Peak)	3

7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 24.5 °C

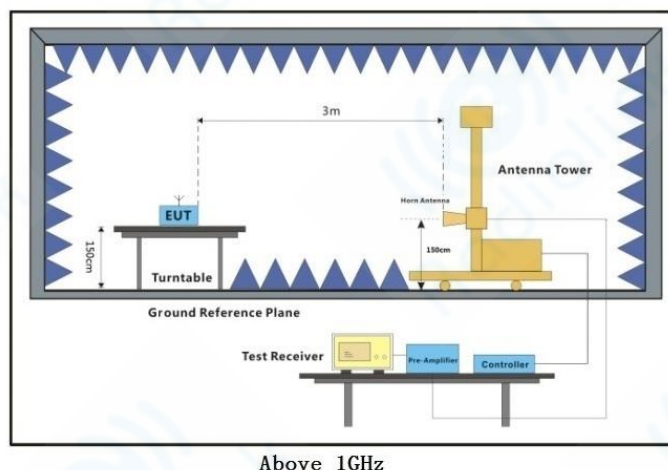
Humidity: 50.8 % RH

Atmospheric Pressure: 1020 mbar

7.4.2 Test Mode Description

Mode Code	Description
1	TX mode – Keep the EUT in continuously transmitting mode with LoRa/CSS modulation (FHSS as implemented/configured, operating within 902–928 MHz). Worst-case configuration was selected (maximum output power, worst-case SF/BW/channel, antenna polarization/height/azimuth, and applicable TX channel conditions). All supported modes/channels/configurations were evaluated as applicable, and only the worst-case data is recorded in the report.

7.4.3 Test Setup Diagram



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7.4.4 Measurement Procedure and Data

- a. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. 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.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. 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 or average method as specified and then reported in a data sheet.
- g. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- h. Repeat above procedures (X, Y, Z orientations if applicable, polarizations, and height scans) until all worst-case frequencies were captured.
- i. Repeat above procedures until all frequencies measured was complete.

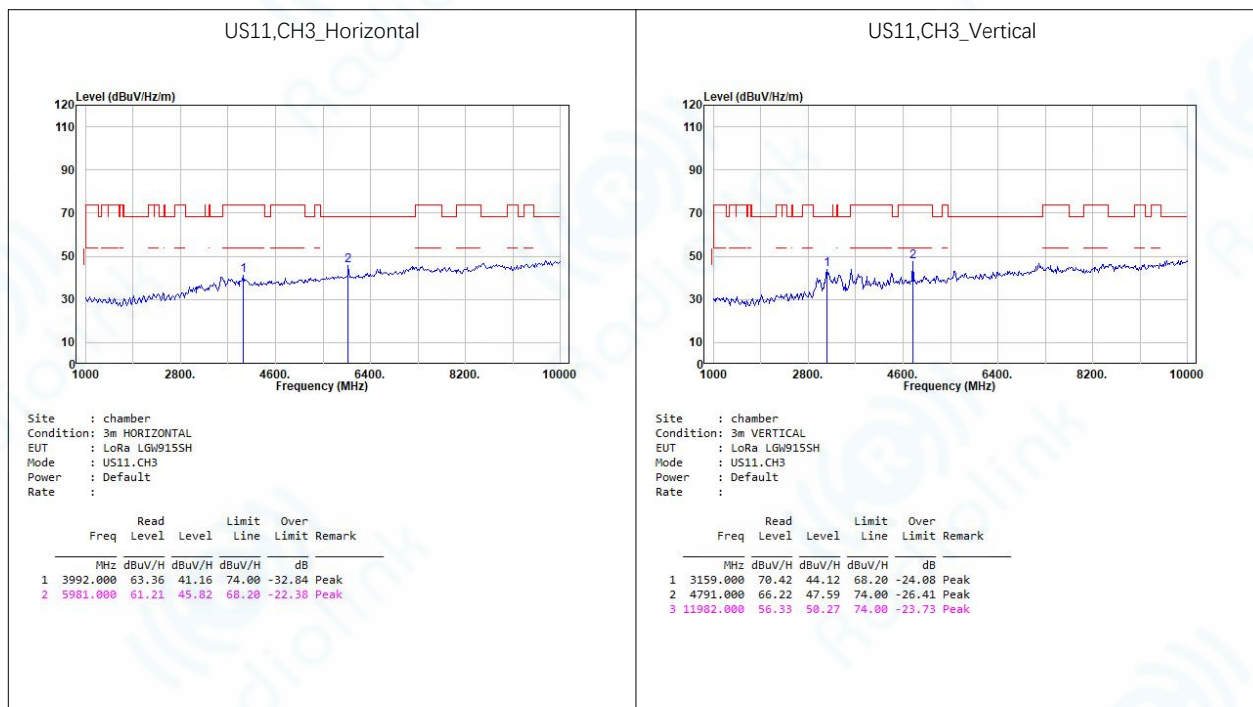
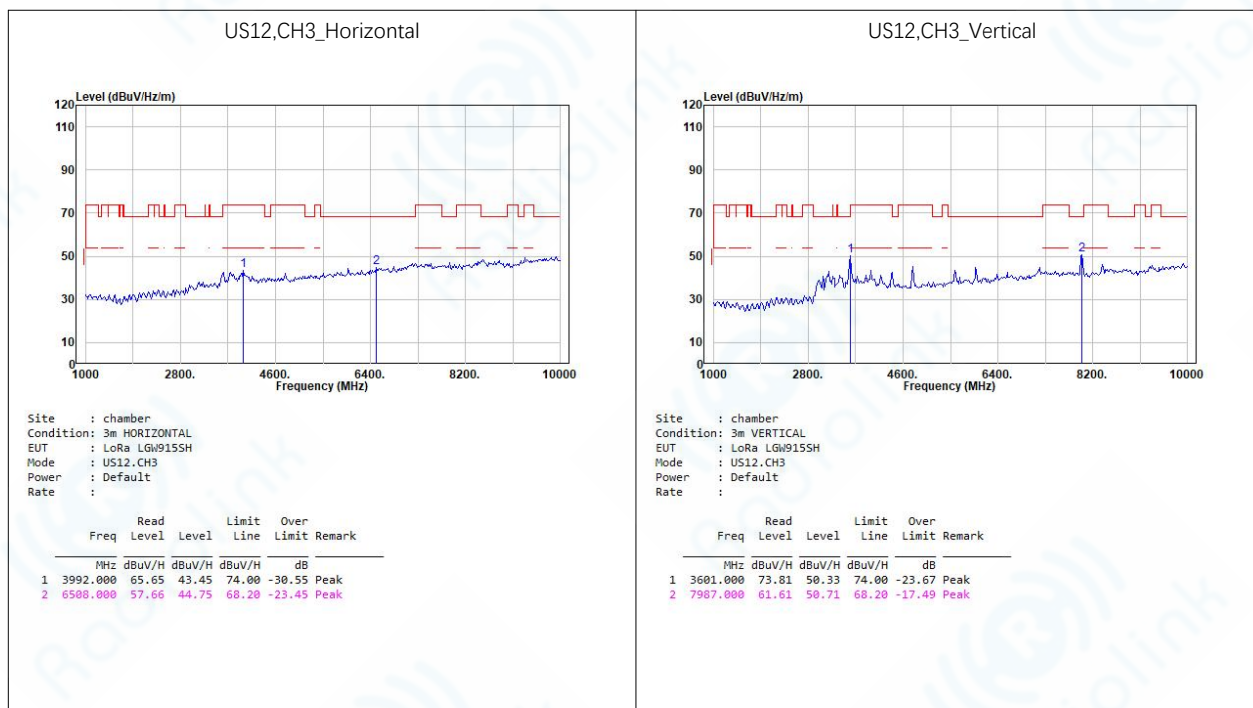
Remark:

1. Level= Read Level+ Cable Loss+ Antenna Factor- Preamp Factor
2. Scan from 1 GHz to 10 GHz. Emissions above 9.28 GHz (10th harmonic of the highest fundamental frequency, 928 MHz) were very low. The points marked on the plots are the highest emissions found during testing; therefore, only these points are displayed. Spurious emissions attenuated more than 20 dB below the applicable limit need not be reported.
3. As shown in this section, for frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.
4. Peak detection: RBW=1 MHz, VBW=1 MHz (or 3 MHz for rapid sweep). Average detection: RBW=1 MHz, VBW sufficiently narrow (10 Hz – 1 MHz) for stable avg trace. EUT tested in continuous TXmode(LoRa/CSS, fixed-channel/worst-case SF-BW-channel, max power, worst-case polarization/height/azimuth/orientation) per FCC § 15.247.
5. Fundamental/band-edge/spurious measurements conducted with RBW=1 MHz. EUT configured for continuous modulated TX (LoRa/CSS, fixed-channel). ANSI C63.10 continuous-wave averaging (VBW $\geq 1/T$ or narrowed for AVG) applied per FCC § 15.247(d), replacing burst-duty-cycle formulas.



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Note:

1. The Measurement (Result Level) is calculated by Reading Level adding the Correct Factor(maybe including Ant.Factor and the Cable Factor etc.). The basic equation is as follows:

Result Level= Reading Level + Correct Factor(including Ant.Factor, Cable Factor etc.)

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7.5 Conducted Peak Output Power

Test Requirement	47 CFR Part 15, Subpart C 15.247(b)(3) RSS-247 Section 6.2.2.2(a)
Test Method:	ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 Section 11.9.1

Limit:

Frequency range(MHz)	Output power of the intentional radiator(watt)
902-928	1 for ≥ 50 hopping channels
	0.25 for $25 \leq$ hopping channels < 50
	1 for digital modulation

7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 22.2 °C Humidity: 40.0 % RH Atmospheric Pressure: 1020 mbar

7.5.2 Test Mode Description

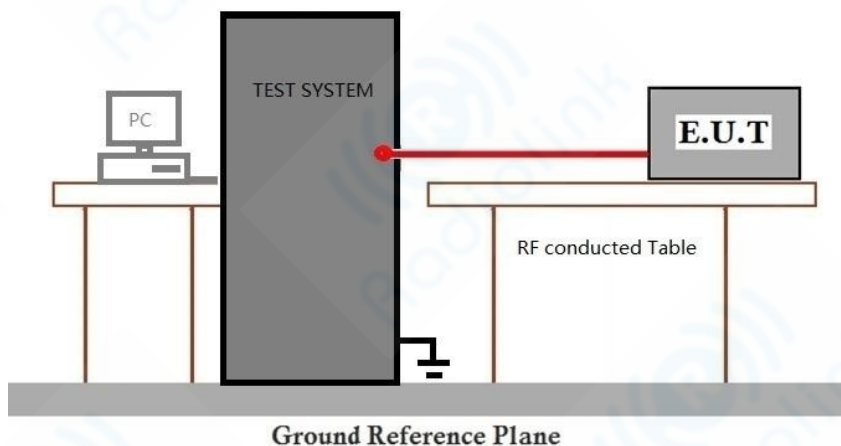
Mode Code	Description
1	<p>ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024, section 11.9.1 Maximum peak conducted output power.</p> <p>The following procedure shall be used when an instrument with a resolution bandwidth that is greater than the DTS bandwidth is available to perform the measurement:</p> <ol style="list-style-type: none"> Set the RBW $\geq$ DTS bandwidth. Set VBW $\geq [3 \times \text{RBW}]$. Set span $\geq [3 \times \text{RBW}]$. Sweep time = auto couple. Detector = peak. Trace mode = max hold. Allow trace to fully stabilize. Use peak marker function to determine the peak amplitude level.



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7.5.3 Test Setup Diagram



7.5.4 Measurement Procedure and Data

Note: Since the verify power the same operating range bandwidth and smaller power can be covered by the higher power.

Please Refer to Appendix for Details



7.6 20dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247(a)(1)
Test Method: ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024
Section 6.9.2

Limit:

20 dB bandwidth of the hopping channel	Hopping frequencies	Average time of occupancy
less than 250 kHz	least 50 hopping frequencies	shall not be greater than 0.4 seconds within a 20 second period
250 kHz to 500kHz	least 25 hopping frequencies	shall not be greater than 0.4 seconds within a 10 second period.

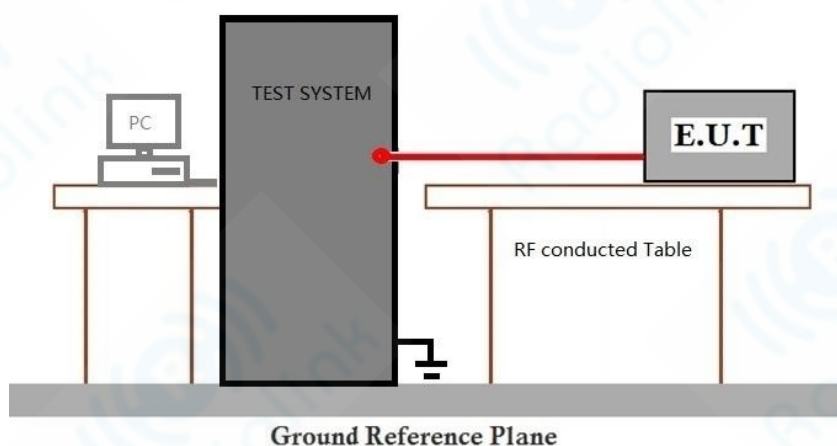
7.6.1 E.U.T. Operation

Operating Environment:
Temperature: 20.2 °C Humidity: 52.0 % RH Atmospheric Pressure: 1020 mbar

7.6.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	1	Hopping function enabled. EUT transmits LoRa FHSS signal at maximum transmit power with worst-case data rate. Measure 20dB bandwidth of a single hopping channel, measured at frequencies where the widest bandwidth occurs.

7.6.3 Test Setup Diagram



7.6.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.7 Carrier Frequencies Separation

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)
Test Method: ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024
Section 7.8.2

Limit:

Hopping channel carrier frequencies shall be separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. For 2400–2483.5 MHz band with output power ≤ 0.125 W: 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

7.7.1 E.U.T. Operation

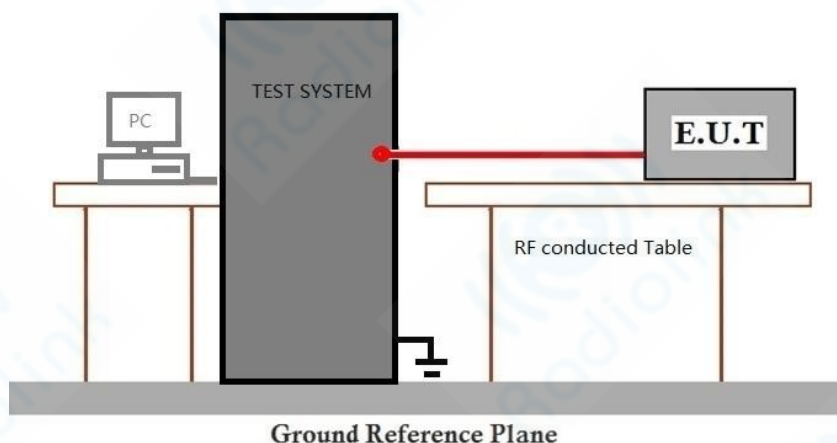
Operating Environment:

Temperature: 20.2 °C Humidity: 52.0 % RH Atmospheric Pressure: 1020 mbar

7.7.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	Hopping function enabled. EUT transmits LoRa FHSS signal at maximum transmit power, operating on hopping sequence. Measure carrier frequency separation between adjacent hopping channels

7.7.3 Test Setup Diagram



7.7.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.8 Hopping Channel Number

Test Requirement	47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method:	ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024 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; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.

7.8.1 E.U.T. Operation

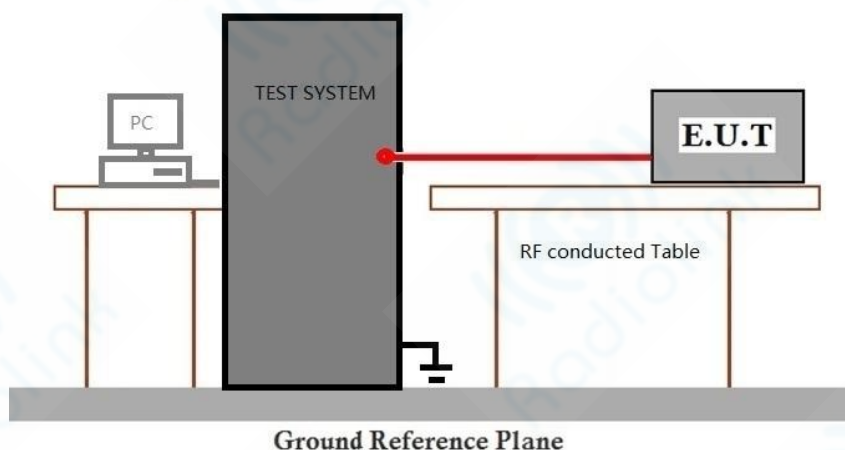
Operating Environment:

Temperature: 20.2 °C Humidity: 52.0 % RH Atmospheric Pressure: 1020 mbar

7.8.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	Keep the EUT in hopping mode, continuous transmission with maximum transmit power and worst-case LoRa data rate, hopping function enabled.

7.8.3 Test Setup Diagram



7.8.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.9 Dwell Time

Test Requirement 47 CFR Part 15, Subpart C 15.247a(1)(iii)
Test Method: ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024
Section 7.8.4

Limit:

Frequency(MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)

7.9.1 E.U.T. Operation

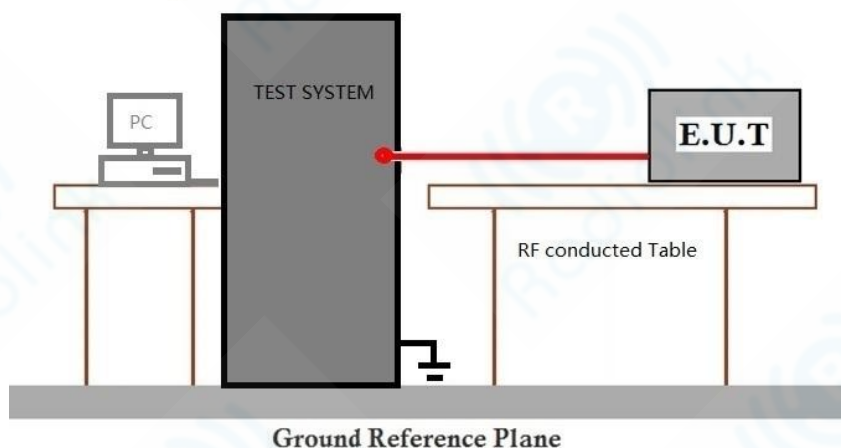
Operating Environment:

Temperature: 20.2 °C Humidity: 52.0 % RH Atmospheric Pressure: 1020 mbar

7.9.2 Test Mode Description

Pre-scan / Final test	Mode Code	Description
Final test	01	Hopping function enabled. EUT transmits LoRa FHSS signal at maximum transmit power and worst-case data rate. Spectrum analyzer set to zero span at selected hopping channel to measure the time of occupancy (dwell time) per hop. Record the average occupancy time on each hopping channel over the required measurement window.

7.9.3 Test Setup Diagram



7.9.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.10 Conducted Band Edges Measurement

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)
Test Method: ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024
Section 6.10.4

Limit:

In any 100 kHz bandwidth outside the operating band: at least 20 dB below the maximum in-band desired power within 100 kHz bandwidth. If RMS averaging method is used for conducted power compliance, minimum attenuation is 30 dB. Emissions in restricted bands shall comply with §15.209(a).

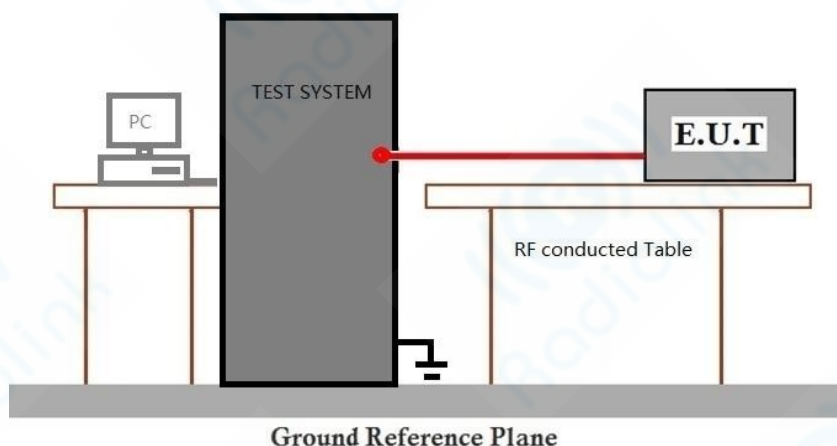
7.10.1 E.U.T. Operation

Operating Environment:
Temperature: 22.2 °C Humidity: 40.0 % RH Atmospheric Pressure: 1020 mbar

7.10.2 Test Mode Description

Mode Code	Description
1	Hopping function enabled. EUT transmits LoRa FHSS signal at maximum transmit power and worst-case data rate. Conducted band edge emissions are measured at upper and lower authorized band edges. Spectrum analyzer RBW set to 100 kHz, peak detector, max hold. Cable and attenuator losses are compensated.

7.10.3 Test Setup Diagram



7.10.4 Measurement Procedure and Data

Please Refer to Appendix for Details

7.11 Conducted Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.247(d)
Test Method: ANSI C63.10-2020 + Cor.1-2023 + C63.10a-2024 + Errata to C63.10a-2024
Section 11.11

Limit:

In any 100 kHz bandwidth outside the operating band: at least 20 dB below the maximum in-band desired power within 100 kHz bandwidth. If RMS averaging method is used for conducted power compliance, minimum attenuation is 30 dB. Emissions in restricted bands shall comply with §15.209(a).

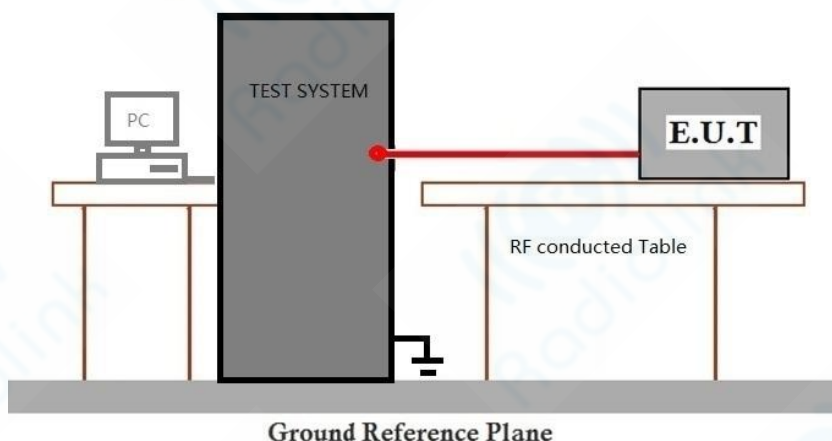
7.11.1 E.U.T. Operation

Operating Environment:
Temperature: 22.2 °C Humidity: 40.0 % RH Atmospheric Pressure: 1020 mbar

7.11.2 Test Mode Description

Mode Code	Description
1	Hopping function enabled. EUT transmits LoRa FHSS signal at maximum transmit power and worst-case data rate. Conducted band edge emissions are measured at upper and lower authorized band edges. Spectrum analyzer RBW set to 100 kHz, peak detector, max hold. Cable and attenuator losses are compensated.

7.11.3 Test Setup Diagram



7.11.4 Measurement Procedure and Data

Please Refer to Appendix for Details



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8 Test Setup Photo

Refer to Appendix A_Setup Photo **Conducted Emissions**(1.1)

Refer to Appendix A_Setup Photo **RF** (1.2)

Refer to Appendix A_Setup Photo **Receiver spurious emissions**(1.3)



9 Appendix

1. Bandwidth

1.1 Test Result

1.1.1 OBW

Mode	TX Type	Frequency (MHz)	ANT	99% Occupied Bandwidth (MHz)		Verdict
				Result	Limit	
Lora	SISO	902.3	1	0.120	/	Pass
		908.5	1	0.120	/	Pass
		914.9	1	0.120	/	Pass

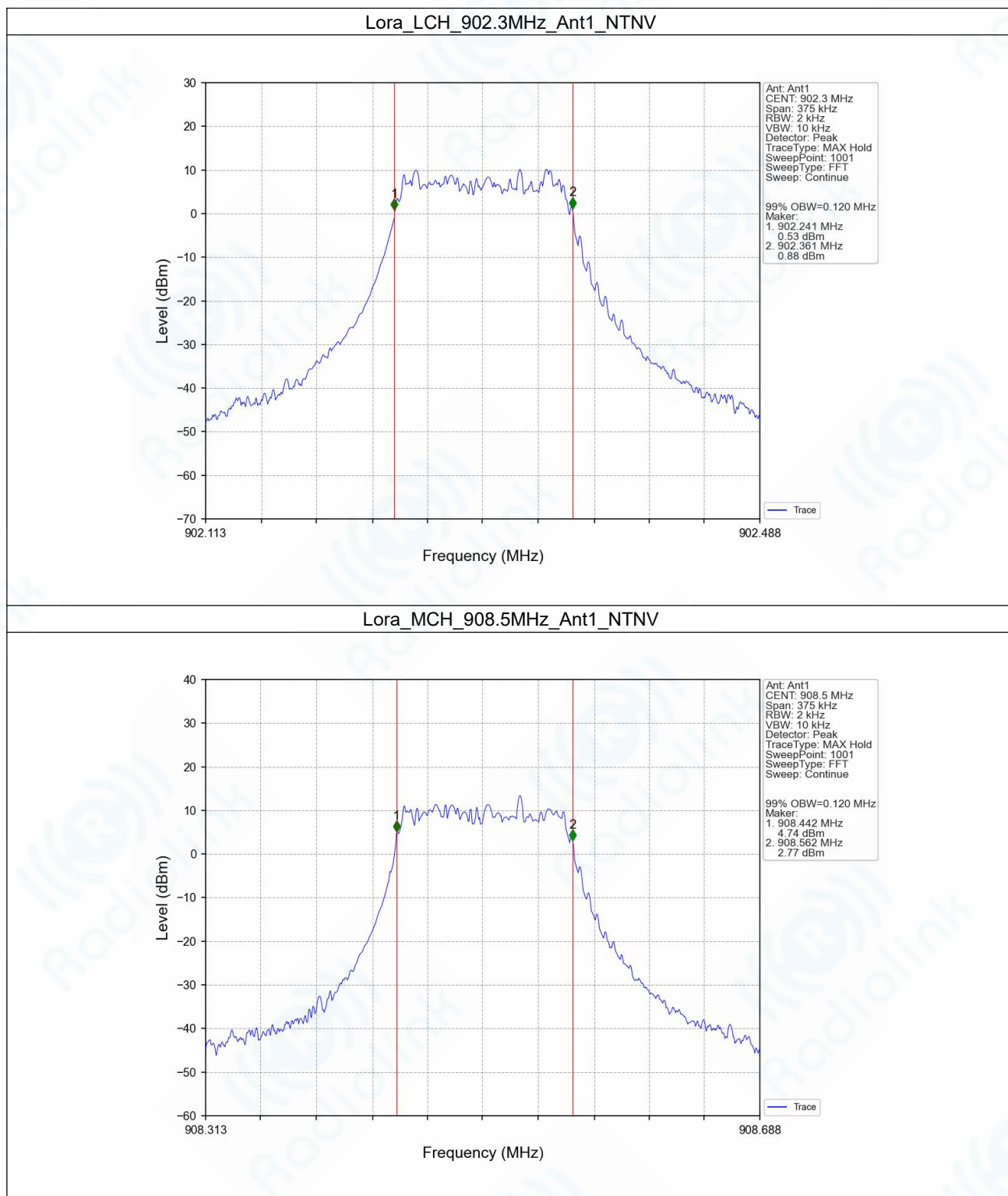
1.1.2 20dB BW

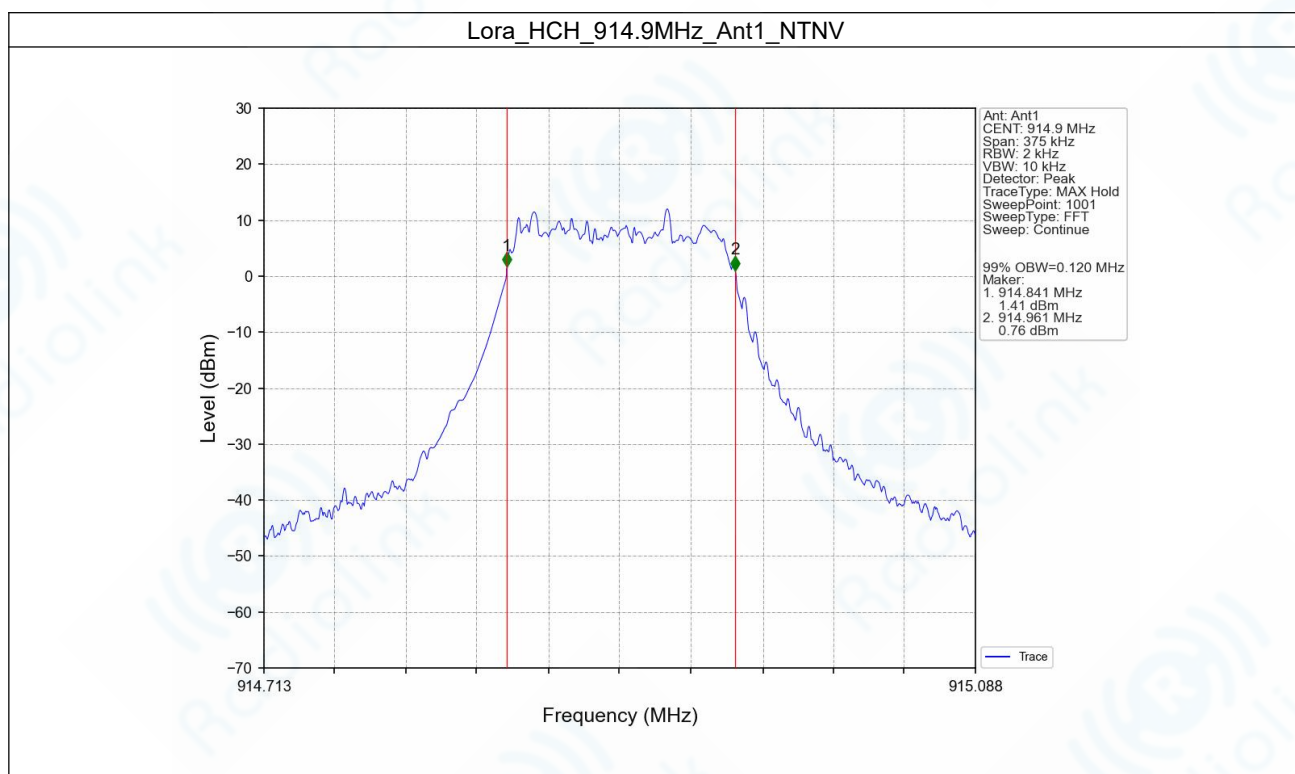
Mode	TX Type	Frequency (MHz)	ANT	20dB Bandwidth (MHz)		Verdict
				Result	Limit	
Lora	SISO	902.3	1	0.134	/	Pass
		908.5	1	0.135	/	Pass
		914.9	1	0.134	/	Pass



1.2 Test Graph

1.2.1 OBW

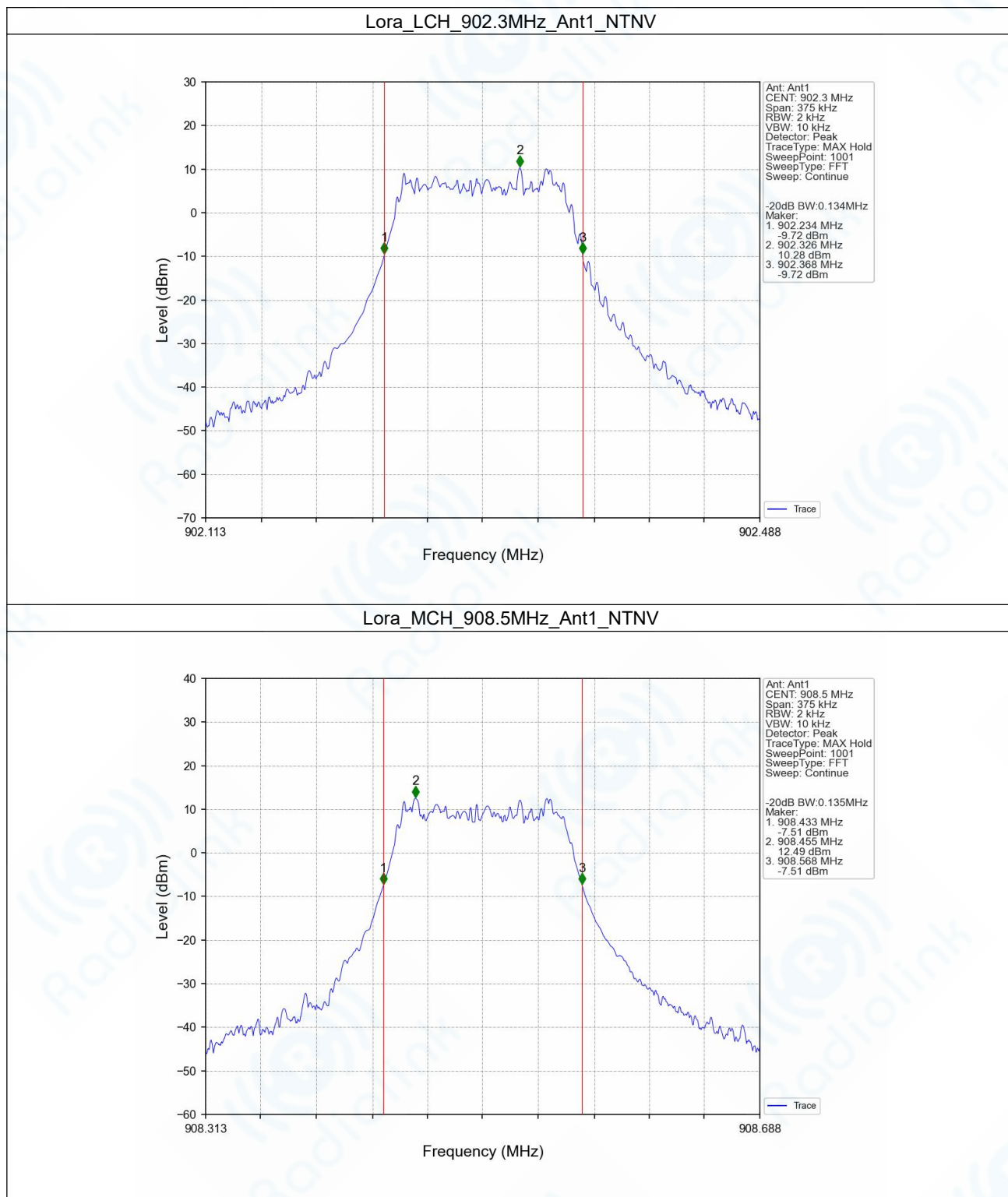


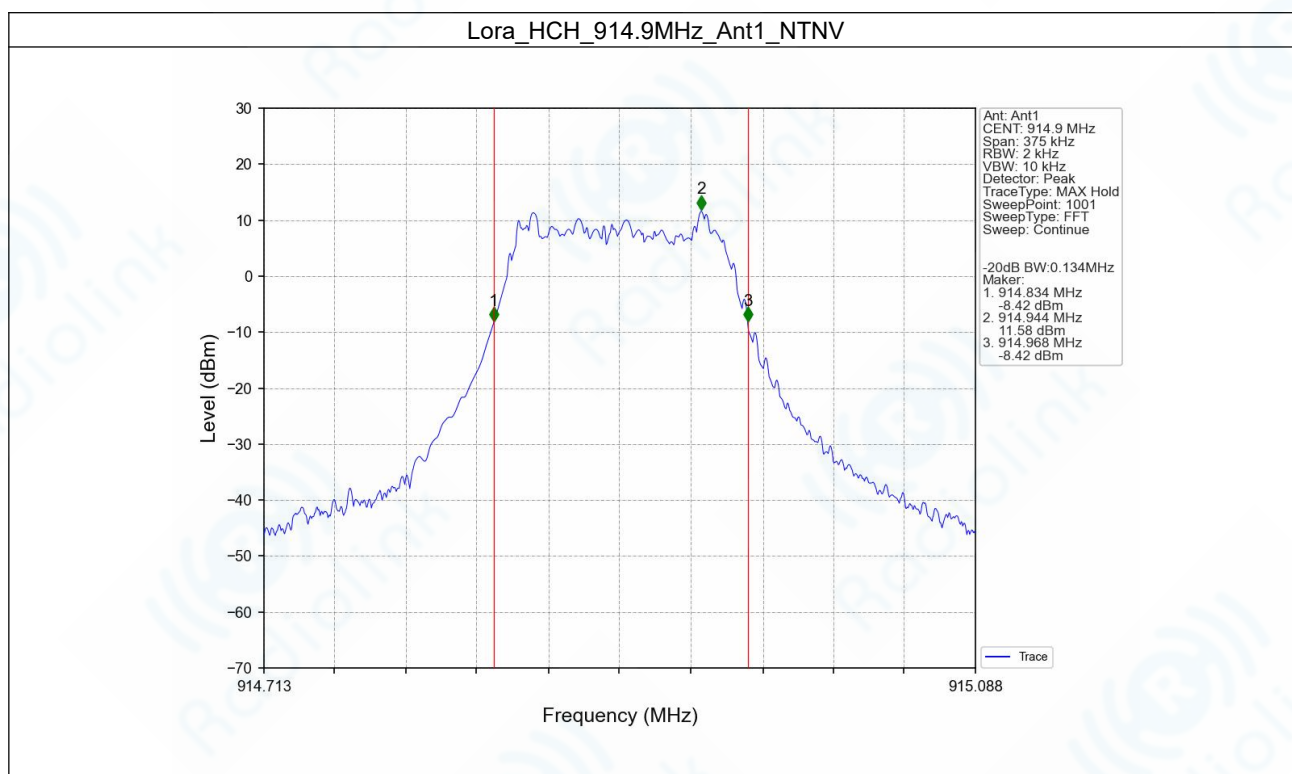


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1.2.2 20dB BW





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2. Maximum Conducted Output Power

2.1 Test Result

2.1.1 Power

Mode	TX Type	Frequency (MHz)	Maximum Peak Conducted Output Power (dBm)		Verdict
			ANT1	Limit	
Lora	SISO	902.3	15.39	<=30	Pass
		908.5	18.35	<=30	Pass
		914.9	17.09	<=30	Pass

Note1: Antenna Gain: Ant1: 3.00dBi;

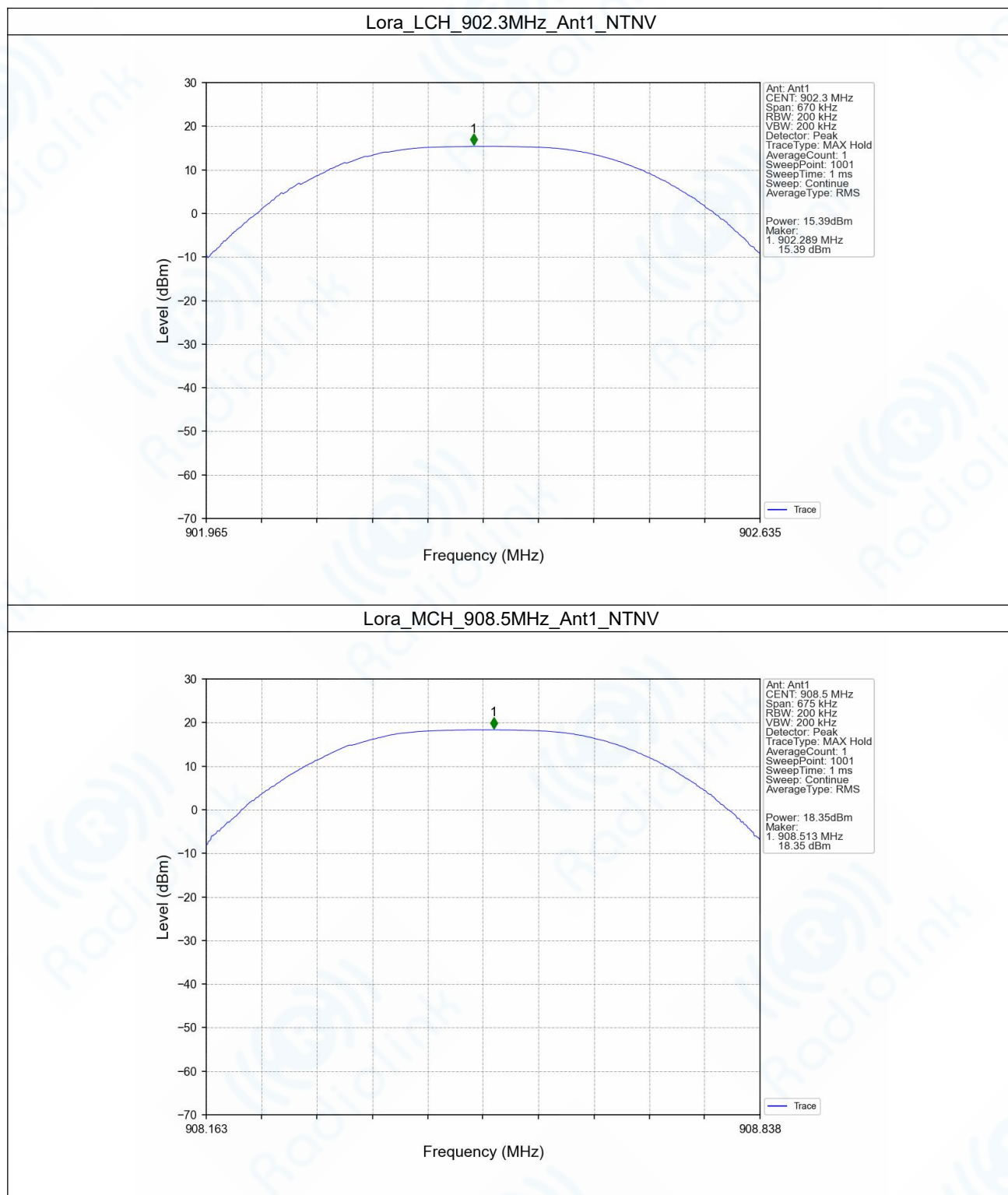


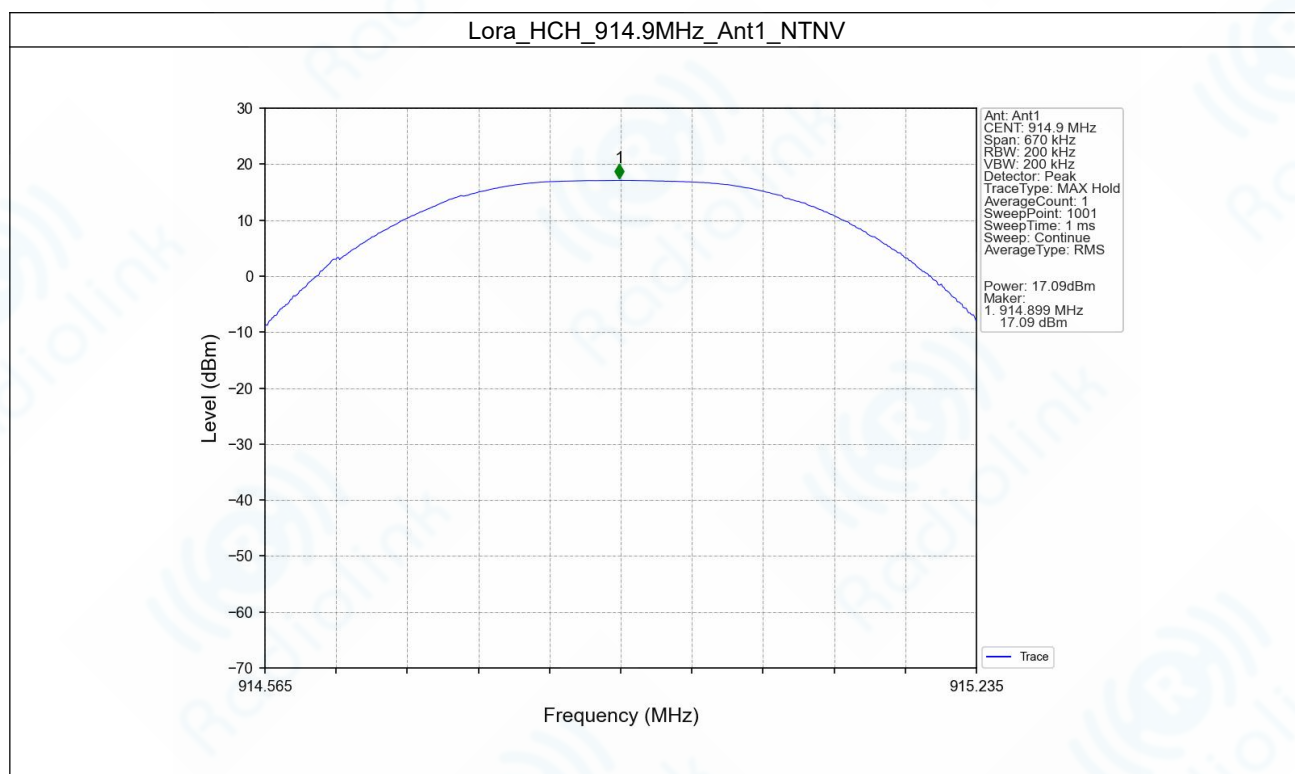
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2.2 Test Graph

2.2.1 Power





3. Carrier Frequency Separation

3.1 Test Result

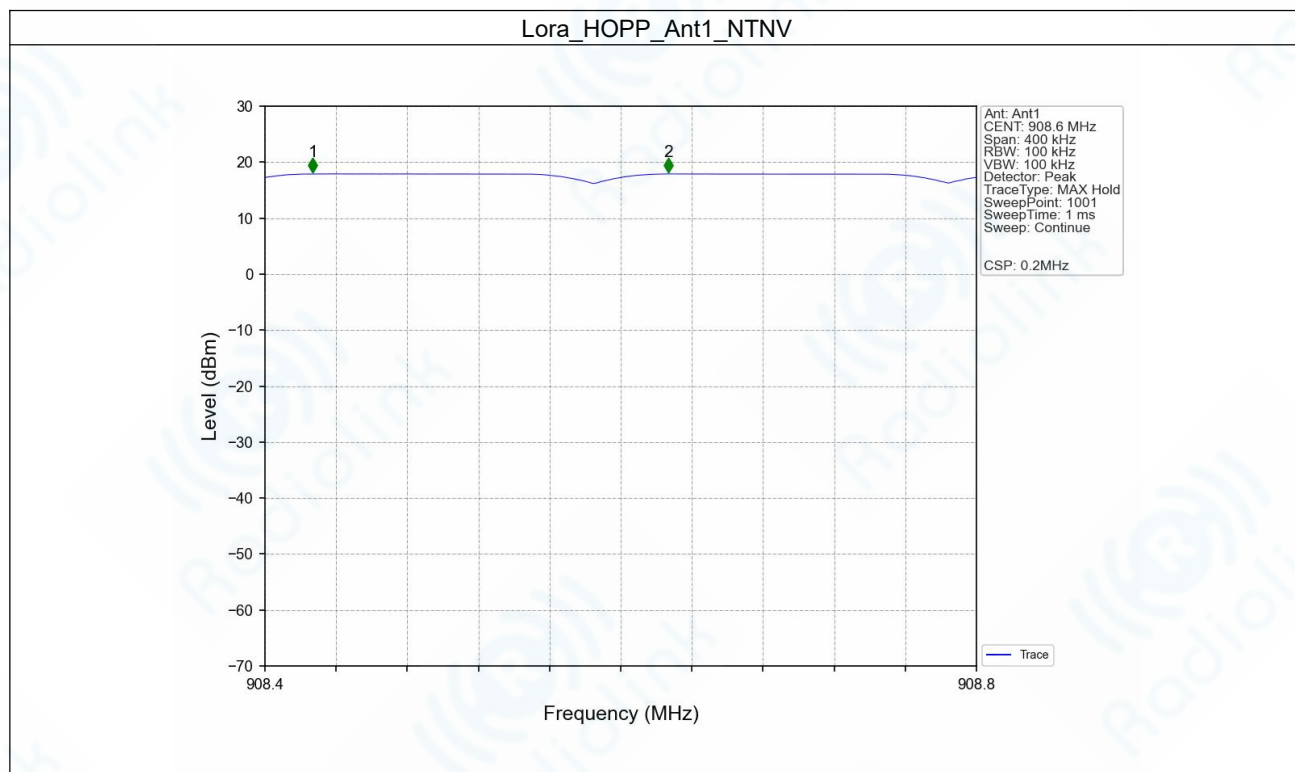
3.1.1 Ant1

Ant1						
Mode	TX Type	Frequency (MHz)	Channel Separation (MHz)	20dB Bandwidth (MHz)	Limit (MHz)	Verdict
Lora	SISO	HOPP	0.200	0.135	≥ 0.135	Pass



3.2 Test Graph

3.2.1 Ant1



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4. Number of Hopping Frequencies

4.1 Test Result

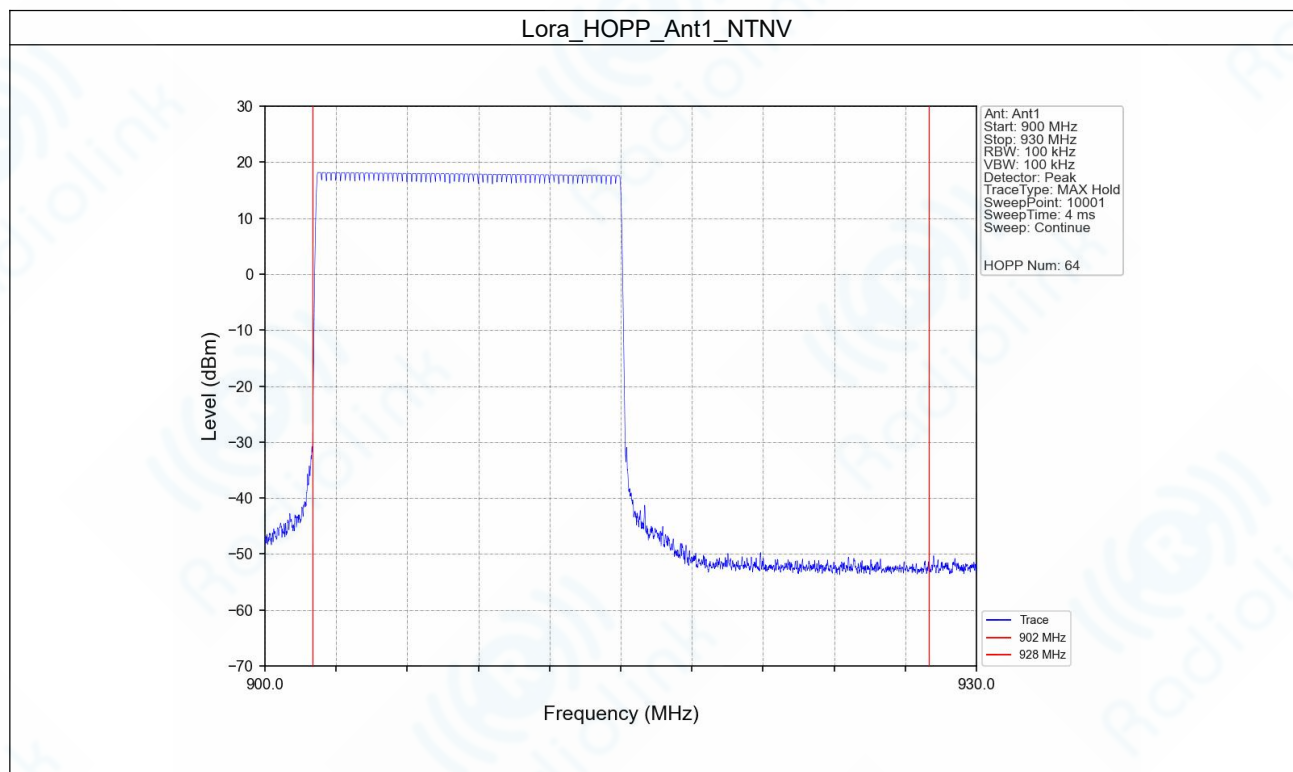
4.1.1 HoppNum

Mode	TX Type	Frequency (MHz)	Num of Hopping Frequencies		Verdict
			ANT1	Limit	
Lora	SISO	HOPP	64	>=50	Pass



4.2 Test Graph

4.2.1 HoppNum



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5. Time of Occupancy (Dwell Time)

5.1 Test Result

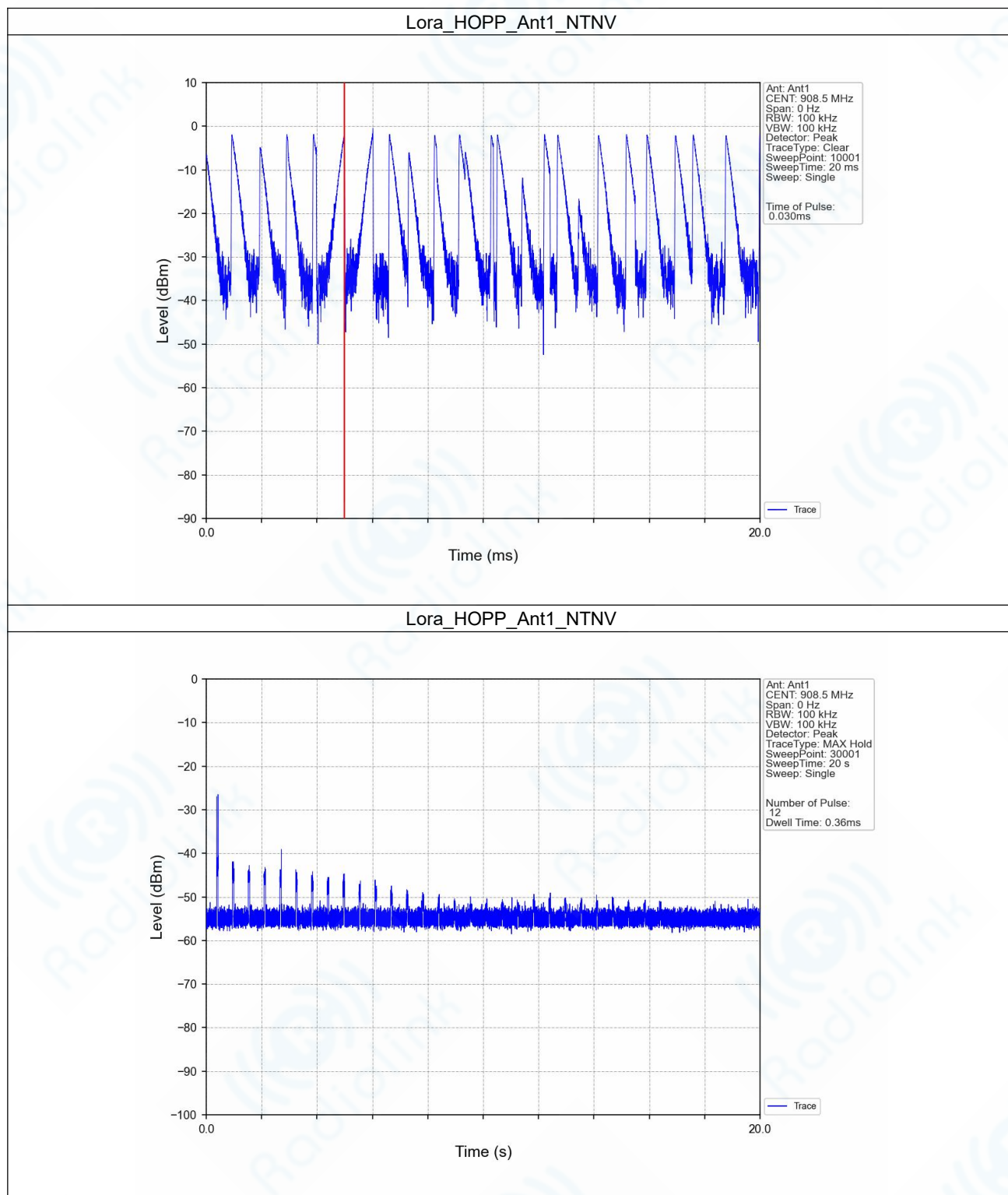
5.1.1 Ant1

Ant1								
Mode	TX Type	Frequency (MHz)	Duration of Single Pulse (ms)	Observation Period (s)	Num of Pulse in Observation Period	Dwell Time (ms)	Limit (ms)	Verdict
Lora	SISO	HOPP	0.030	20.000	12	0.360	<=400	Pass



5.2 Test Graph

5.2.1 Ant1



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6. Unwanted Emissions In Non-restricted Frequency Bands

6.1 Test Result

6.1.1 Ref

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)
Lora	SISO	902.3	1	15.62
		908.5	1	18.54
		914.9	1	17.31

6.1.2 CSE

Mode	TX Type	Frequency (MHz)	ANT	Level of Reference (dBm)	Limit (dBm)	Verdict
Lora	SISO	902.3	1	15.62	-4.38	Pass
		908.5	1	18.54	-1.46	Pass
		914.9	1	17.31	-2.69	Pass
		HOPP	1	18.48	-1.52	Pass
				18.48	-1.52	Pass

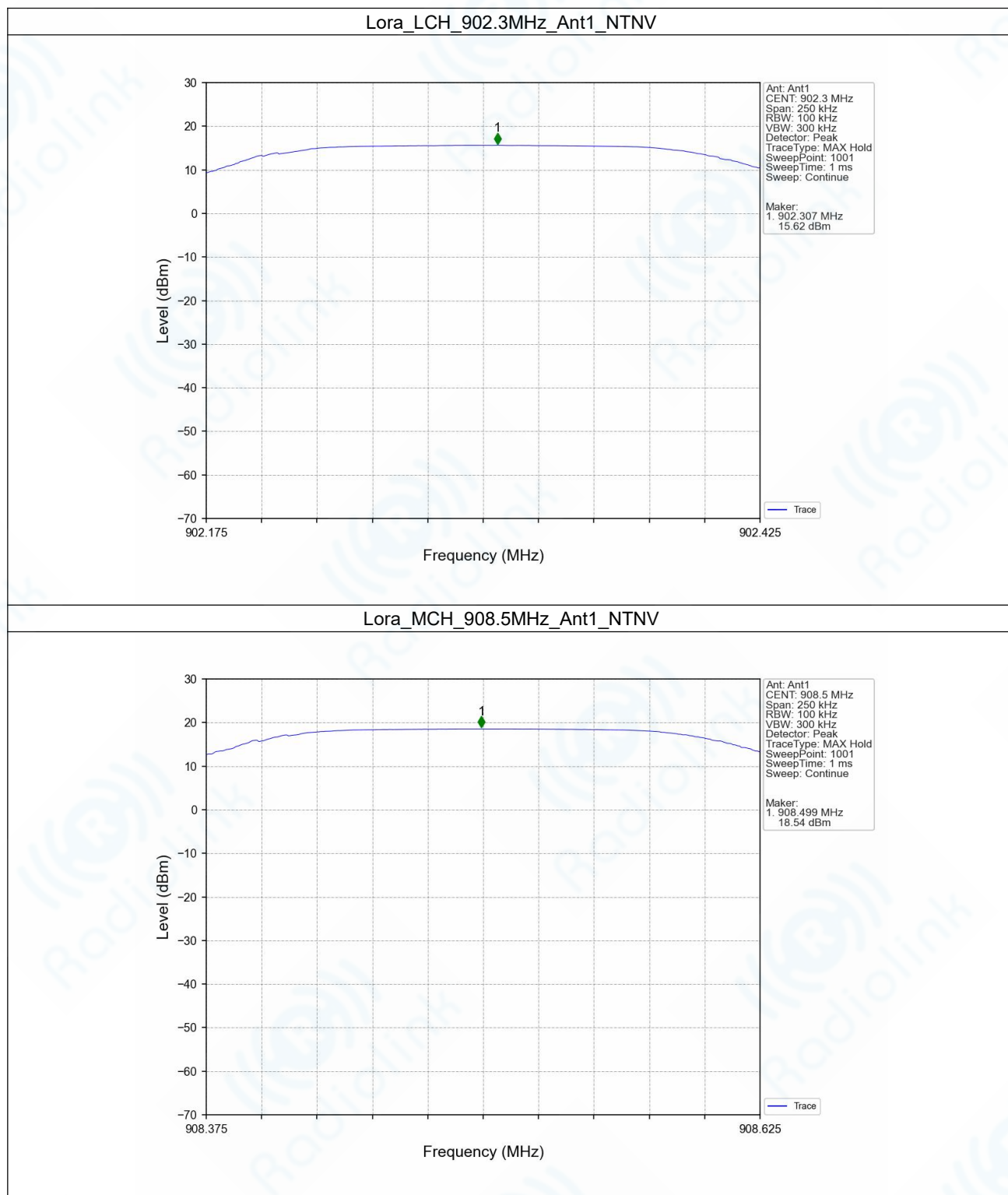


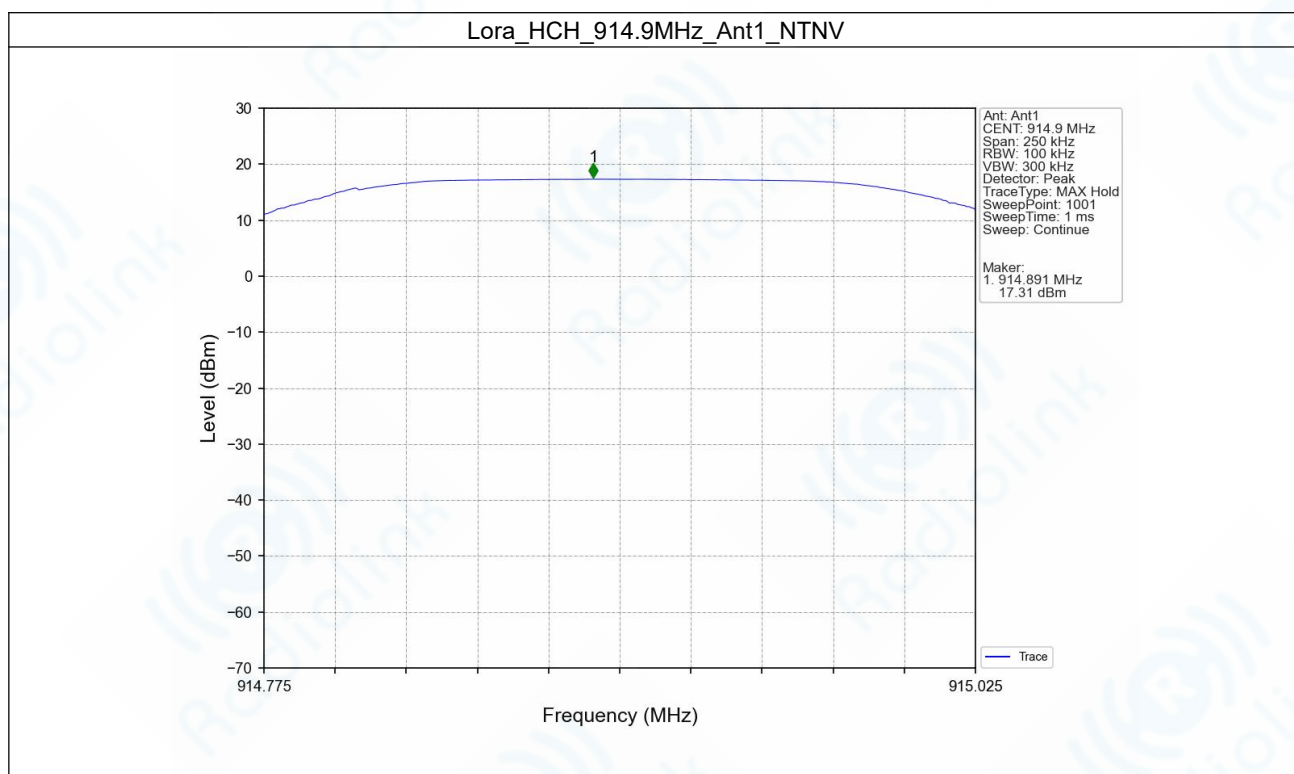
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6.2 Test Graph

6.2.1 Ref

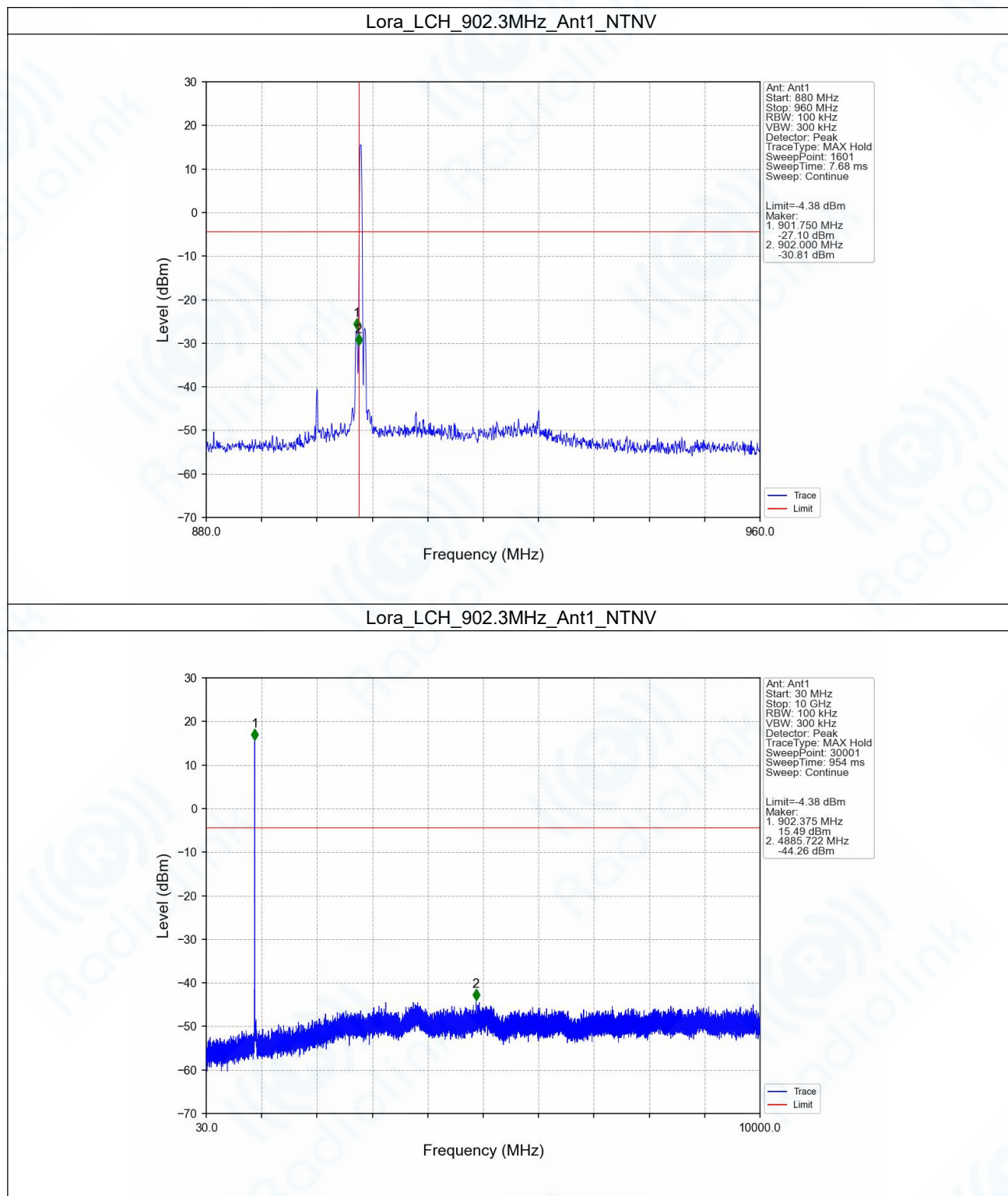




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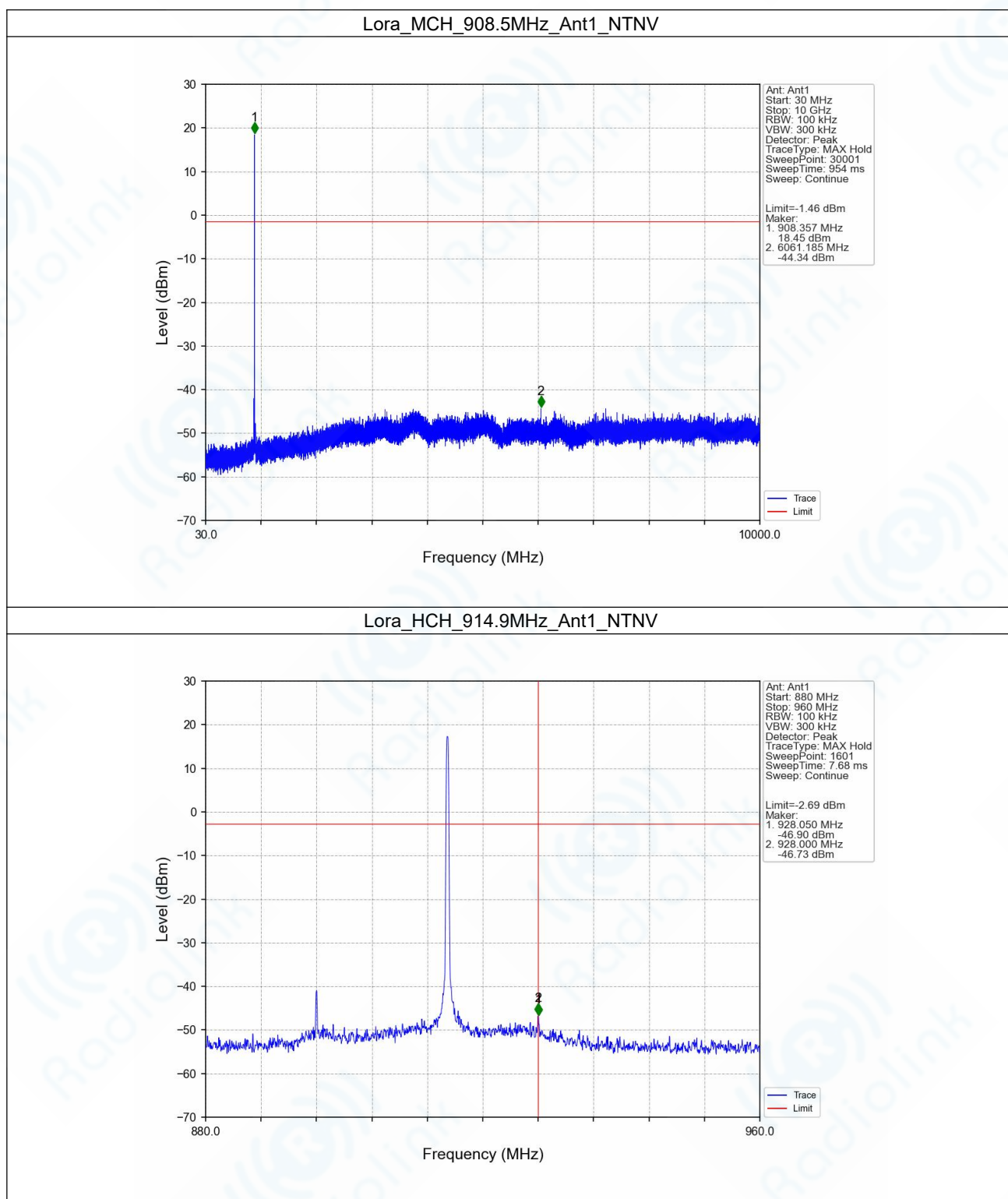
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6.2.2 CSE



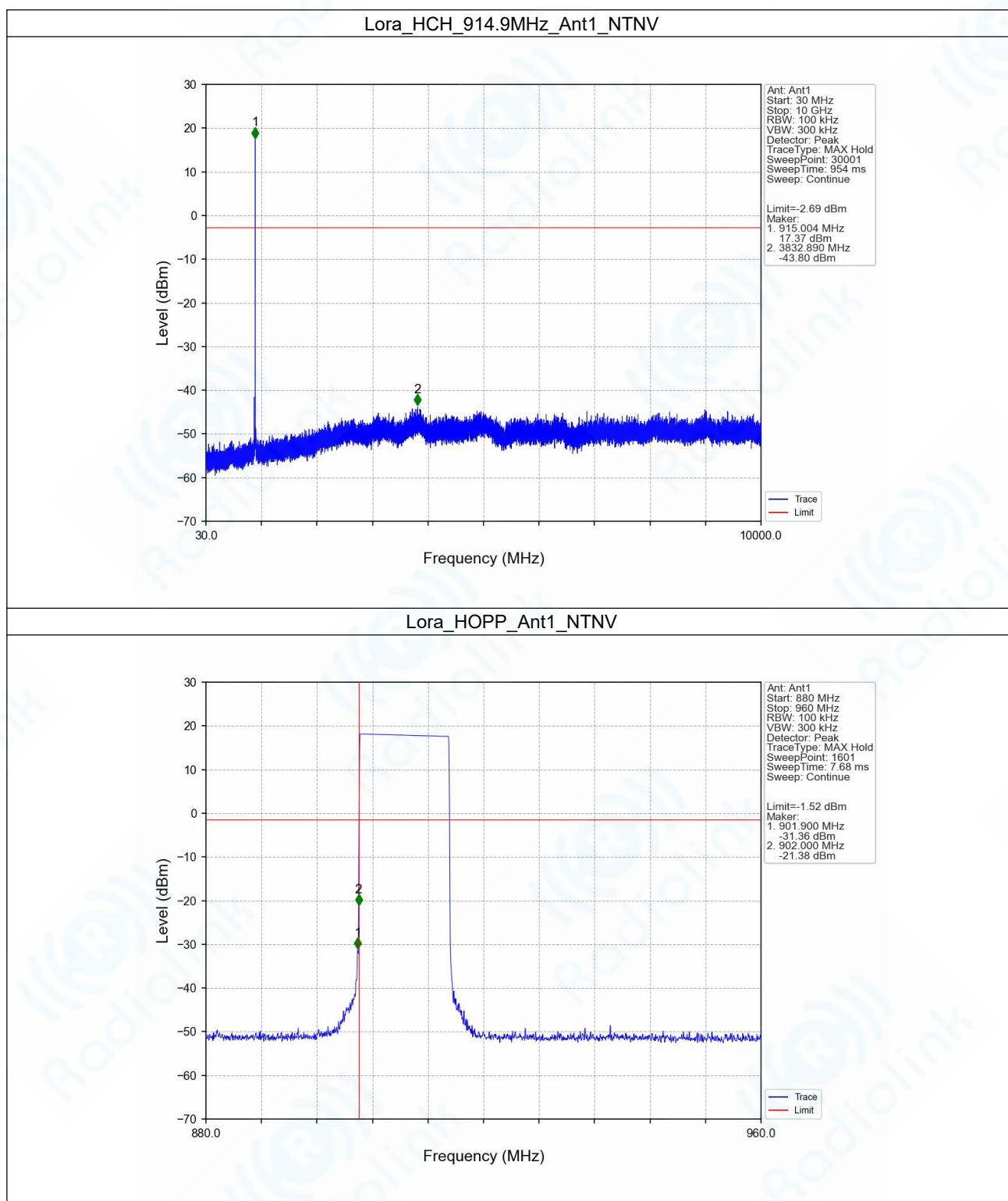
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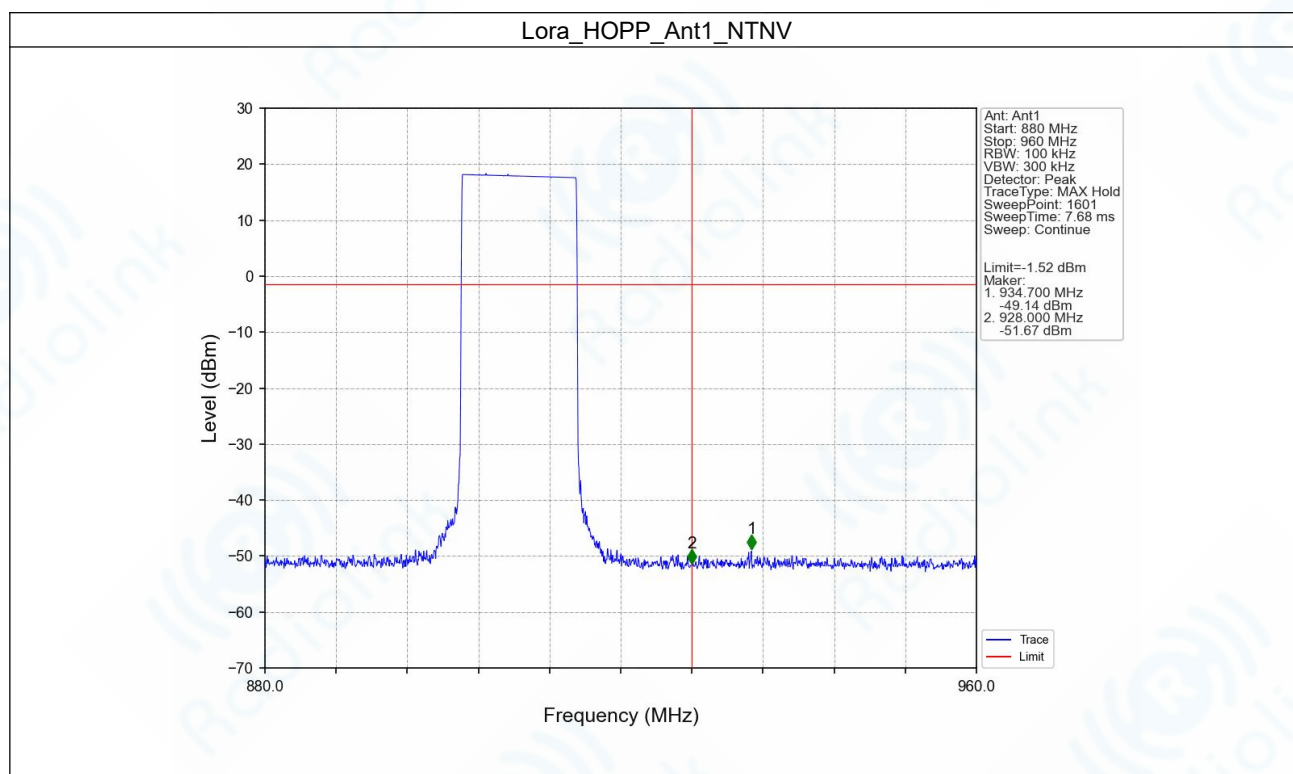
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- End of the Report -



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