TEST REPORT

Applicant:	Shenzhen RAKwireless Technology Co., Ltd.
Address:	Room 506, Building B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China
Equipment Type:	WisDuo Module
Model Name:	RAK3112 (refer to section 2.3)
Brand Name:	RAK
FCC ID:	2AF6B-3112
ISED Number:	25908-3112
Test Standard:	47 CFR Part 15 Subpart C RSS-Gen Issue 5 RSS-247 Issue 4 (refer to section 3.1)
Sample Arrival Date:	Sep. 30, 2025
Test Date:	Oct. 14, 2025 - Feb. 28, 2026
Date of Issue:	Mar. 04, 2026

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: He Yuyang **Checked by:** Ye Hongji **Approved by:** Tolan Tu

(Technical Director)

Revision History

Version	Issue Date	Revisions
Rev. 01	Feb. 05, 2026	Initial Issue
Rev. 02	Mar. 03, 2026	Update A.6 Radiated Spurious Emission and A.7 Band Edge; Update the Test Date, Test Equipment List in section 4.2 and ANNEX B TEST SETUP PHOTOS.
Rev. 03	Mar. 04, 2026	Update the Antenna Gain of Dipole Antenna

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1 GENERAL INFORMATION

1.1 Test Laboratory

Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☐ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☑ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196. The laboratory has been listed by Industry Canada to perform electromagnetic emission measurements. The recognition numbers of test site are 11524A.

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Shenzhen RAKwireless Technology Co., Ltd.
Address	Room 506, Building B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China

2.2 Manufacturer Information

Manufacturer	Shenzhen RAKwireless Technology Co., Ltd.
Address	Room 506, Building B, New Compark, Pingshan First Road, Taoyuan Street, Nanshan District, Shenzhen, Guangdong, China

2.3 General Description for Equipment under Test (EUT)

EUT Name	WisDuo Module
Model Name Under Test	RAK3112
Series Model Name	RAK3312
Description of Model name differentiation	The difference between RAK3112 and RAK3312 is that RAK3312 has an additional baseboard while RAK3112 do not. The baseboard is the extension of I/O. (this information provided by the customer)
Serial Number	AC1F09FFFE18F078
Hardware Version	RAK3112_VC
Software Version	1.0.0
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.4 Technical Information

Network and Wireless connectivity	Bluetooth BLE WIFI 802.11b, 802.11g, 802.11n LoRa

The requirement for the following technical information of the EUT was tested in this report:

Modulation Technology		DTS
Modulation Type		LoRa
Product Type		☒ Mobile ☐ Portable ☐ Fix Location
Frequency Range		The frequency range used is 902 MHz to 928 MHz.
Number of Channel		8
Tested Channel		0 (903 MHz), 4 (909.4 MHz), 7 (914.2 MHz)
Antenna Type		Dipole Antenna
		PCB Antenna
Antenna Gain	Dipole Antenna	2.37 dBi
	PCB Antenna	0.8 dBi
Antenna System (MIMO Smart Antenna)		N/A

All channel was listed on the following table:

Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
1	**903.00**	5	909.40
2	904.60	6	911.00
3	906.20	7	912.60
4	**907.80**	**8**	**914.20**

3 SUMMARY OF TEST RESULTS

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 15, Subpart C	Intentional radiators of radio frequency equipment
2	KDB Publication 558074 D01v05r02	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES
3	RSS-Gen Issue 5	General Requirements for Compliance of Radio Apparatus
4	RSS-247 Issue 4	Digital Transmission Systems,Frequency Hopping Systems and LicenceExempt Local Area Network Devices in 902-928 MHz, 2400-2483.5 MHz, 5150-5350 MHz, and 5470-5895 MHz bands
5	ANSI C63.10-2020	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

3.2 Test Verdict

No.	Description	FCC Part No.	ISED Part No.	Channel	Verdict
1	Antenna Requirement	15.203	RSS-247, 5.4 (6)	--	Pass[Note]
2	Output Power	15.247(b)	RSS-247, 5.4 (4)	ANNEX A.1	Pass
3	Occupied Bandwidth	15.247(a)	RSS-GEN, 6.6; RSS-247, 5.2 (1)	ANNEX A.2	Pass
4	Conducted Spurious Emission	15.247(d)	RSS-247, 5.5	ANNEX A.3	Pass
5	Band Edge(Authorized-band band-edge)	15.247(d)	RSS-GEN, 8.9; RSS-247, 5.5	ANNEX A.4	Pass
6	Conducted Emission	15.207	RSS-GEN, 8.8	ANNEX A.5	Pass
7	Radiated Spurious Emission	15.209 15.247(d)	RSS-247, 5.5	ANNEX A.6	Pass
8	Band Edge(Restricted-band band-edge)	15.209 15.247(d)	RSS-247, 5.5	ANNEX A.7	Pass
9	Power spectral density (PSD)	15.247(e)	RSS-247, 5.2 (2)	ANNEX A.8	Pass
Note: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.					

4 GENERAL TEST CONFIGURATIONS

4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

Relative Humidity	45% to 65%	
Atmospheric Pressure	100 kPa to 102 kPa	
Temperature	NT (Normal Temperature)	+21.1℃ to +25.9℃
Working Voltage of the EUT	NV (Normal Voltage)	3.3V

4.2 Test Equipment List

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	KEYSIGHT	N9020A	MY54420186	2025.05.21	2026.05.20
Power meter	R&S	NRP8S	101498	2025.07.07	2026.07.06
Spectrum Analyzer	R&S	FSV40	101544	2024.12.16	2025.12.15
				2025.10.30	2026.10.29
Test Antenna-Horn(18-40 GHz)	A-INFO	LB-180400KF	J211060273	2024.06.15	2027.06.14
Test Antenna-Bi-Log(30 MHz-3 GHz)	Schwarzbeck	VULB 9163	01414	2023.11.03	2026.11.02
Test Antenna-Horn(1-18 GHz)	Schwarzbeck	BBHA 9120D	02459	2023.10.26	2026.10.25
Anechoic Chamber	YIHENG	C8-966	N/A	2024.05.15	2027.05.11
EMI Receiver	Keysight	N9038A	MY55330121	2025.04.16	2026.04.15
EMI Receiver	keysight	N9038B	MY61380132	2025.04.01	2026.03.31
LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK8127	01009	2025.07.15	2026.07.14
Shielded Enclosure	YiHeng Electronic Co., Ltd	4.3m*2.9m*2.4m	235	2024.11.05	2027.11.04

4.3 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

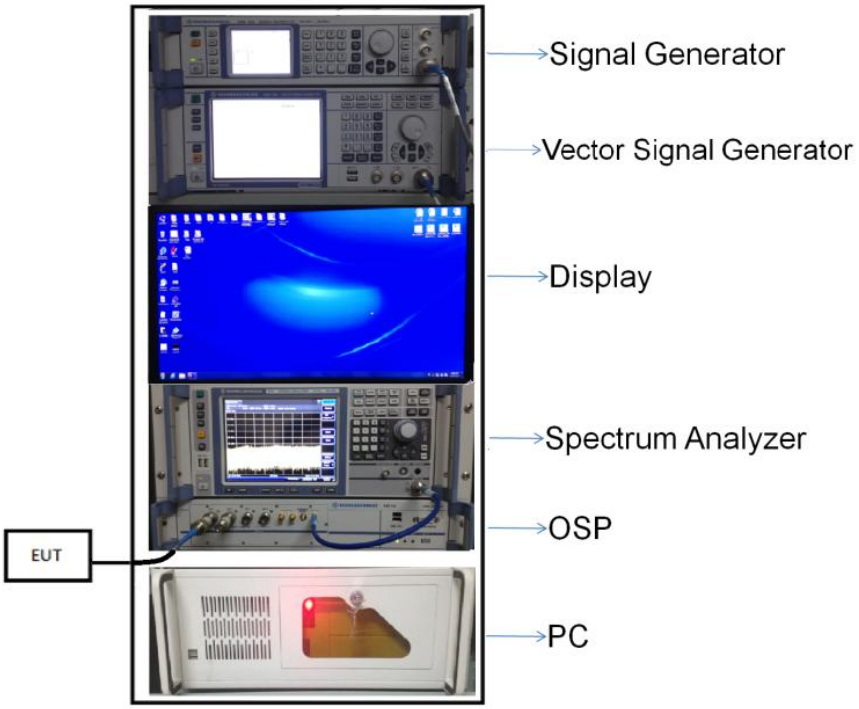
Parameters	Uncertainty
Occupied Channel Bandwidth	2.8%
RF output power, conducted	1.28 dB
Power Spectral Density, conducted	1.30 dB
Unwanted Emissions, conducted	1.84 dB
All emissions, radiated	5.36 dB
Temperature	0.8°C
Humidity	4%

4.4 Description of Test Setup

4.4.1 For Antenna Port Test

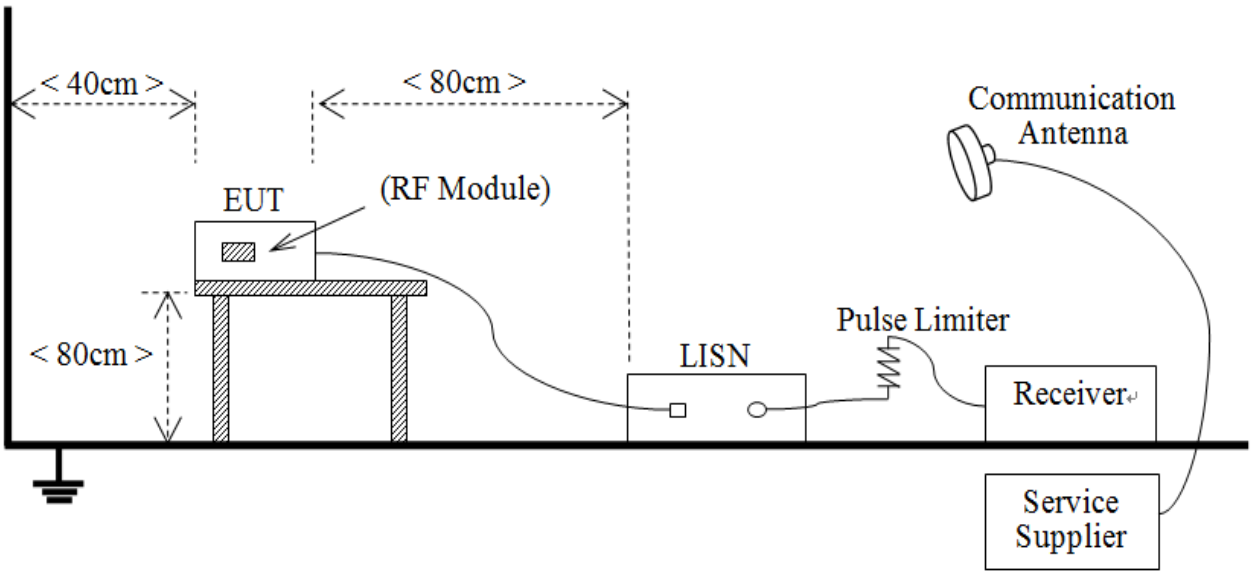
Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:
Conducted value (dBm) = 10 dBm + 0.5 dB = 10.5 dBm



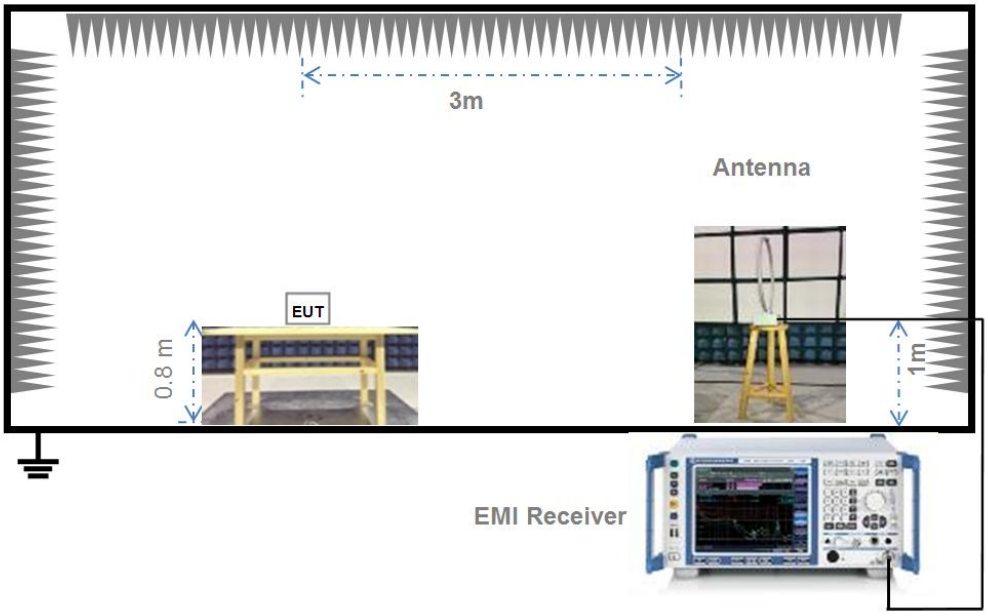
(Diagram 1)

4.4.2 For AC Power Supply Port Test



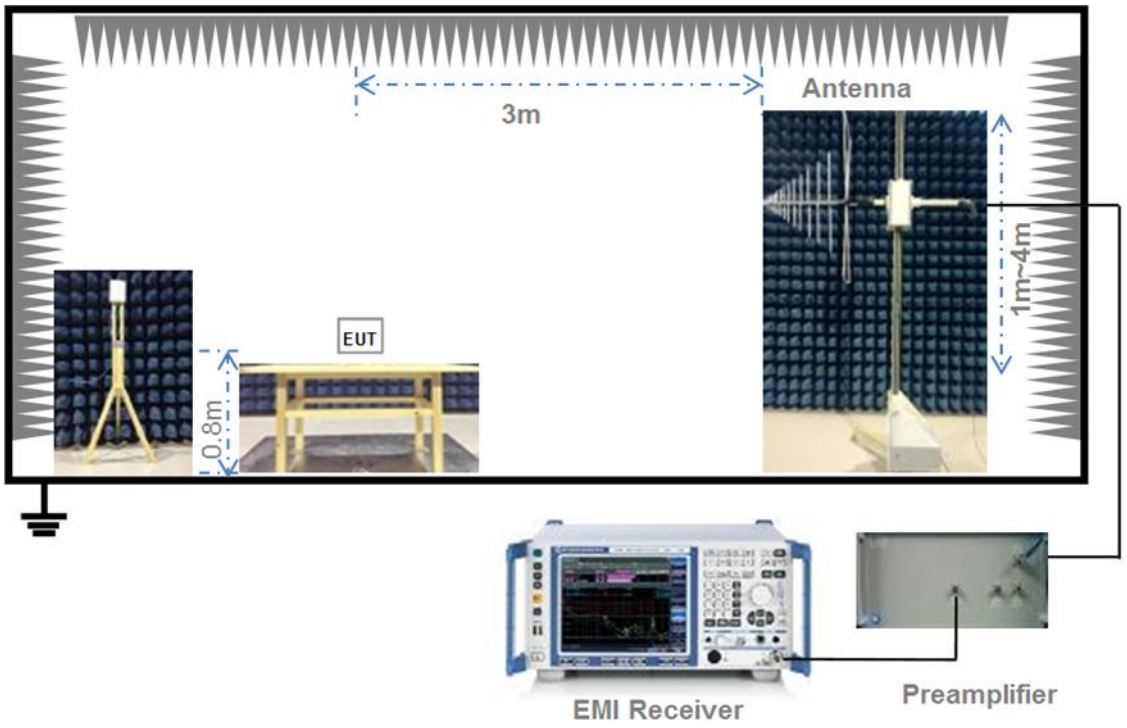
(Diagram 2)

4.4.3 For Radiated Test (Below 30 MHz)



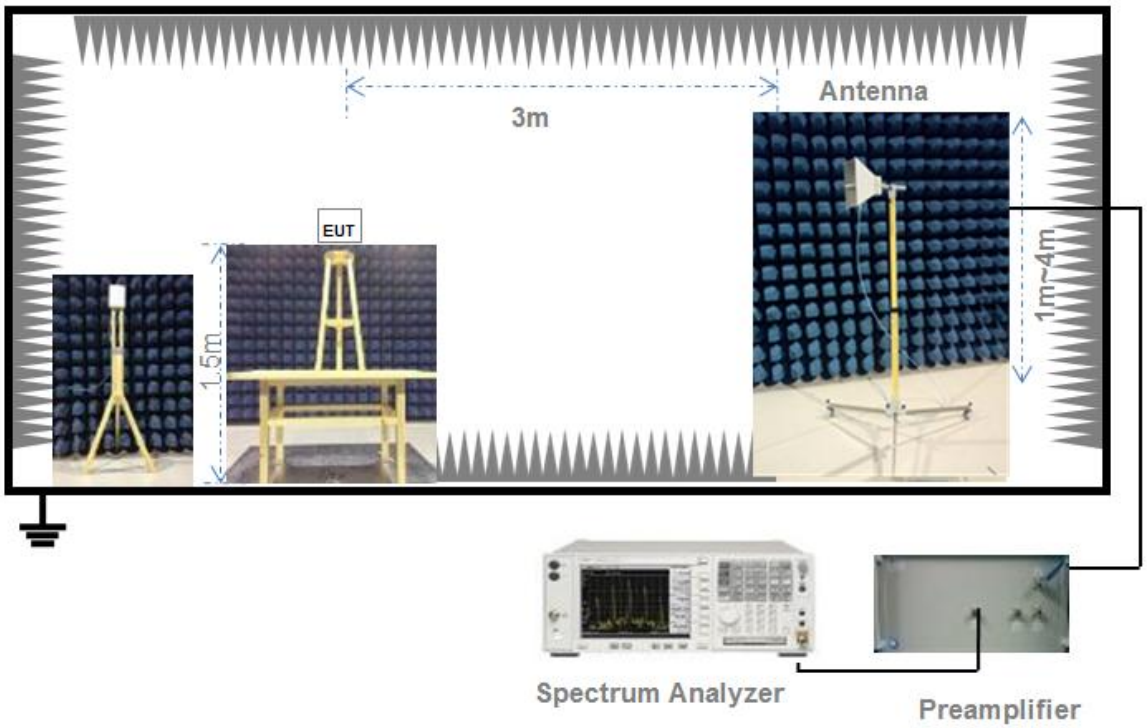
(Diagram 3)

4.4.4 For Radiated Test (30 MHz-1 GHz)



(Diagram 4)

4.4.5 For Radiated Test (Above 1 GHz)



(Diagram 5)

4.5 Measurement Results Explanation Example

4.5.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.

4.5.2 For radiated band edges and spurious emission test:

E = EIRP – 20log D + 104.8

where:

E = electric field strength in dBμV/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

EIRP= Measure Conducted output power Value (dBm) + Maximum transmit antenna gain (dBi) + the appropriate maximum ground reflection factor (dB)

5 TEST ITEMS

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §15.203 & 15.247(b); RSS-247, 5.4 (6)

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 shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

Protected Method	Description
The antenna is embedded in the product.	An embedded-in antenna design is used.

Reference Documents	Item
Photo	Please refer to the EUT Photo documents.

5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

5.2 Output Power

5.2.1 Test Limit

FCC § 15.247(b)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements.

RSS-247, 5.4 (4)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

5.2.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.2.3 Test Procedure

a) Maximum peak conducted output power

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

EIRP= Maximum peak conducted output power+ Antenna Gain.

Set the RBW ≥ DTS bandwidth.

Set VBW ≥ 3 x RBW.

Set span ≥ 3 x 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.

b) Measurements of duty cycle

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission.

Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.

Set VBW ≥ RBW. Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

5.2.4 Test Result

Please refer to ANNEX A.1.

5.3 Occupied Bandwidth

5.3.1 Limit

FCC §15.247(a); RSS-247, 5.1 (1); RSS-GEN, 6.6

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.

5.3.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.3.3 Test Procedure

Use the following spectrum analyzer settings:

Set RBW = 100 kHz.

Set the video bandwidth (VBW) ≥ 3 RBW.

Detector = Peak.

Trace mode = max hold.

Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

5.3.4 Test Result

Please refer to ANNEX A.2.

5.4 Conducted Spurious Emission

5.4.1 Limit

FCC §15.247(d); RSS-247, 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

5.4.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.4.3 Test Procedure

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).

b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).

c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

The following procedures shall be used to demonstrate compliance to these limits. Note that these procedures can be used in either an antenna-port conducted or radiated test set-up. Radiated tests must conform to the test site requirements and utilize maximization procedures defined herein.

Reference level measurement:

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to ≥ 1.5 times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW ≥ 3 x RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Emission level measurement:

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

Set the RBW = 100 kHz.

Set the VBW ≥ 3 x RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

5.4.4 Test Result

Please refer to ANNEX A.3.

5.5 Band Edge (Authorized-band band-edge)

5.5.1 Limit

FCC §15.247(d); RSS-247, 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

5.5.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.5.3 Test Procedure

The following procedures may be used to determine the peak or average field strength or power of an unwanted emission that is within 2 MHz of the authorized band edge. If a peak detector is utilized, use the procedure described in 13.2.1. Use the procedure described in 13.2.2 when using an average detector and the EUT can be configured to transmit continuously (i.e., duty cycle ≥ 98%). Use the procedure described in 13.2.3 when using an average detector and the EUT cannot be configured to transmit continuously but the duty cycle is constant (i.e., duty cycle variations are less than ± 2 percent). Use the procedure described in 13.2.4 when using an average detector for those cases where the EUT cannot be configured to transmit continuously and the duty cycle is not constant (duty cycle variations equal or exceed 2 percent).

When using a peak detector to measure unwanted emissions at or near the band edge (within 2 MHz of the authorized band), the following integration procedure can be used.

Set instrument center frequency to the frequency of the emission to be measured (must be within 2 MHz of the authorized band edge).

Set span to 2 MHz

RBW = 100 kHz.

VBW ≥ 3 x RBW.

Detector = peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweep to continue until the trace stabilizes (required measurement time may increase for low duty cycle applications)

Compute the power by integrating the spectrum over 1 MHz using the analyzer's band power measurement function with band limits set equal to the emission frequency (femission) ± 0.5 MHz. If the instrument does not have a band power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by femission ± 0.5 MHz.

5.5.4 Test Result

Please refer to ANNEX A.4.

5.6 Conducted Emission

5.6.1 Limit

FCC §15.207; RSS-GEN, 8.8

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

5.6.2 Test Setup

See section 4.4.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

5.6.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.
Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

5.6.4 Test Result

Please refer to ANNEX A.5.

5.7 Radiated Spurious Emission

5.7.1 Limit

FCC §15.209&15.247(d); RSS-GEN, 8.9; RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)
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
Above 960	500	3

Note:

1. Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

5.7.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.7.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

5.7.4 Test Result

Please refer to ANNEX A.6.

5.8 Band Edge (Restricted-band band-edge)

5.8.1 Limit

FCC §15.209&15.247(d); RSS-GEN, 8.9; RSS-247, 5.5

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

5.8.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.8.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

For transmitters operating above 1 GHz repeat the measurement with an average detector.

5.8.4 Test Result

Please refer to ANNEX A.7.

5.9 Power Spectral density (PSD)

5.9.1 Limit

FCC §15.247(e); RSS-247, 5.2 (2)

The same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

5.9.2 Test Setup

See section 4.4.1 (Diagram 1) for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

5.9.3 Test Procedure

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.

Set the VBW ≥ 3 RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

5.9.4 Test Result

Please refer to ANNEX A.8.

ANNEX A TEST RESULT

A.1 Output Power, E.I.R.P

Peak Power Test Data

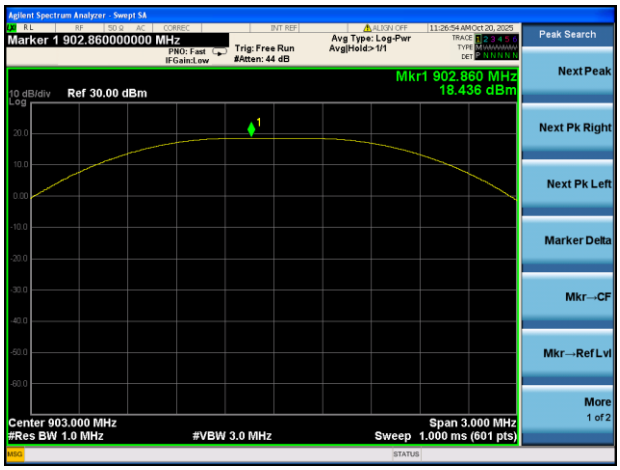
Channel	Measured Output Peak Power		Limit		Verdict
	LoRa		dBm	mW	
	dBm	mW			
Low	18.44	69.76	30	1000	Pass
Middle	18.27	67.20			Pass
High	18.13	64.97			Pass

E.I.R.P Test Data (For ISED)

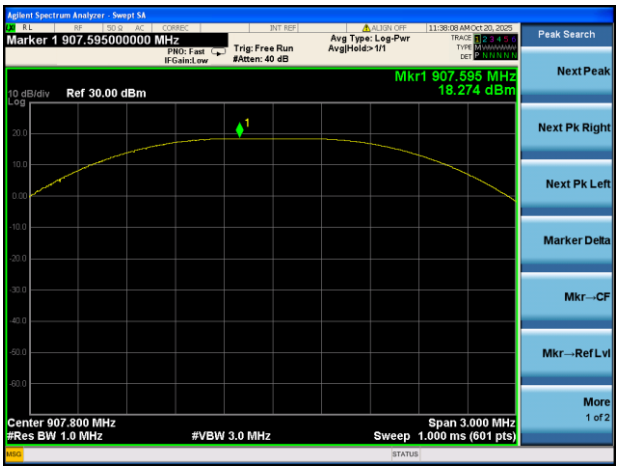
Channel	E.I.R.P		Limit		Verdict
	GFSK (BLE 1Mbps)		dBm	mW	
	dBm	mW			
Low Channel	20.81	120.50	36	4000	Pass
Middle Channel	20.64	115.88			Pass
High Channel	20.50	112.20			Pass

Test Plots

LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL

A.2 Occupied Bandwidth

Test Data

Test Mode	LoRa		
Channel	6 dB Bandwidth (kHz)	99% Bandwidth (kHz)	6 dB Bandwidth Limits (kHz)
Low Channel	0.630000	0.499080	≥500
Middle Channel	0.622500	0.501800	≥500
High Channel	0.633730	0.500610	≥500

Test Plots

6 dB Bandwidth

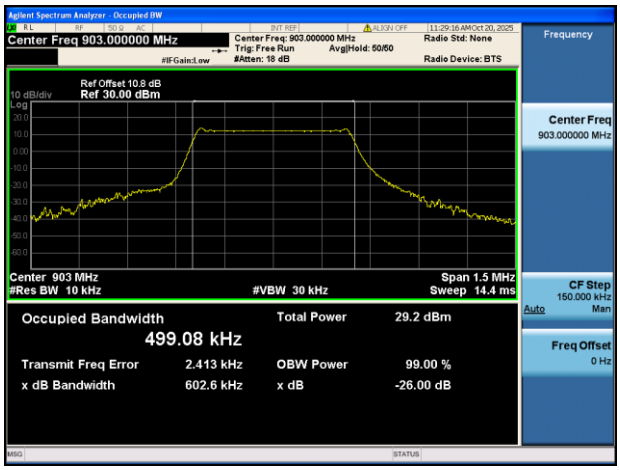
LOW CHANNEL

MIDDLE CHANNEL

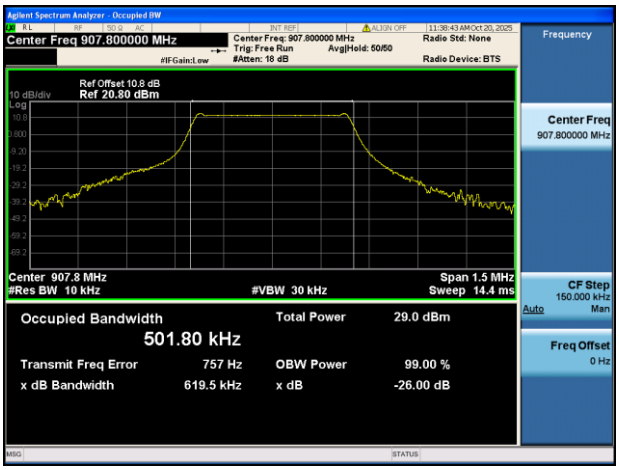
HIGH CHANNEL

99% Bandwidth

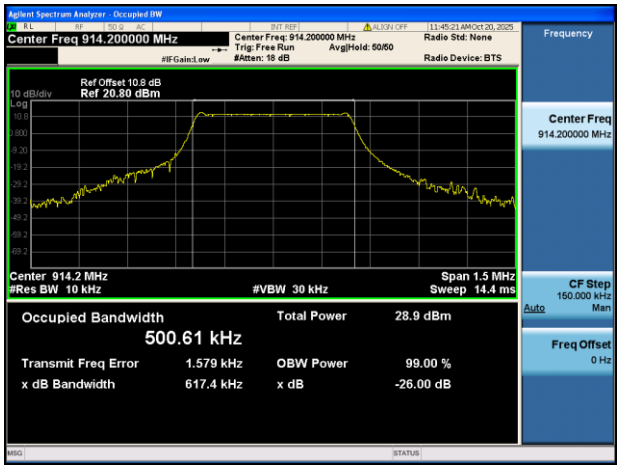
LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL



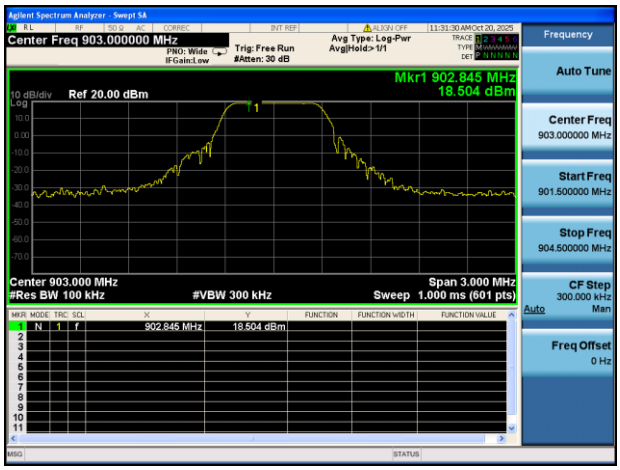
A.3 Conducted Spurious Emissions

Test Data

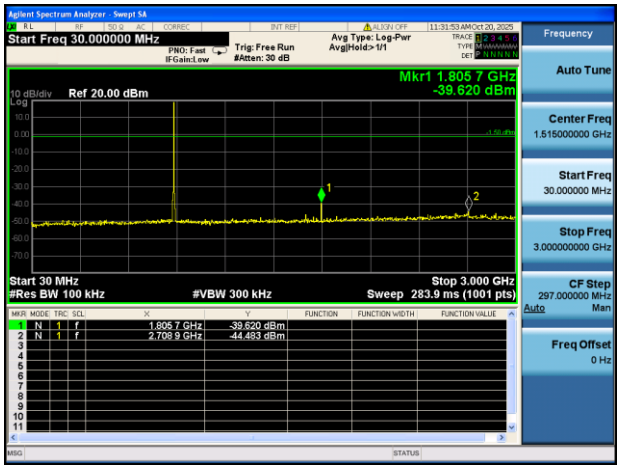
LoRa				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-36.49	18.50	-1.50	Pass
Middle	-36.24	18.32	-1.68	Pass
High	-36.33	18.16	-1.84	Pass

Test Plots

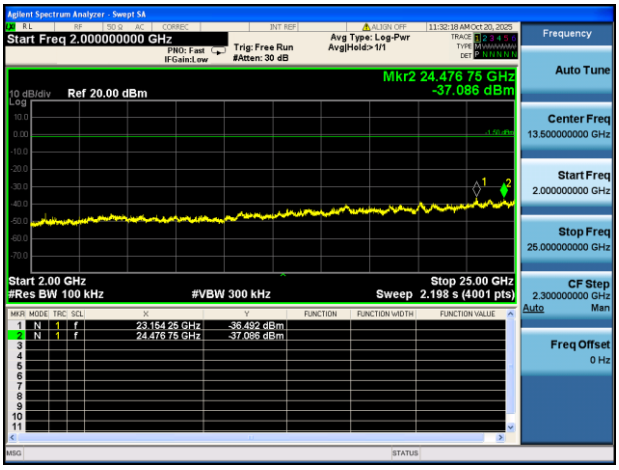
LOW CHANNEL, CARRIER LEVEL



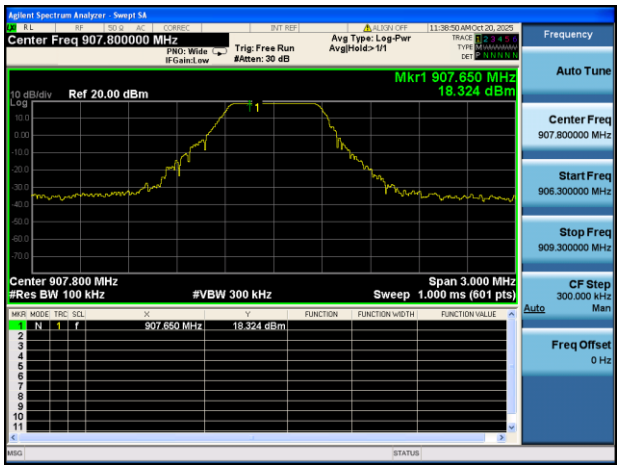
LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



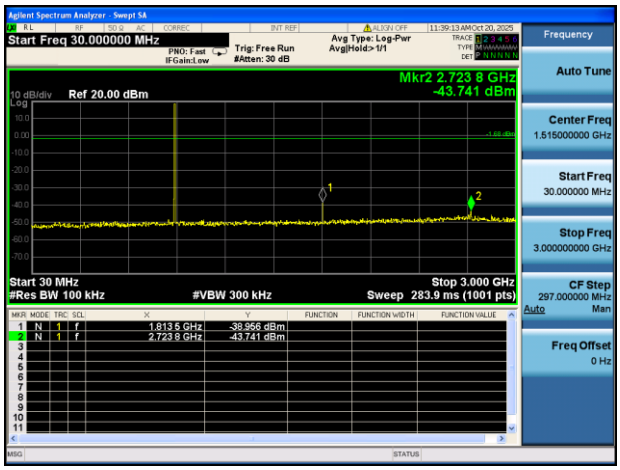
LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



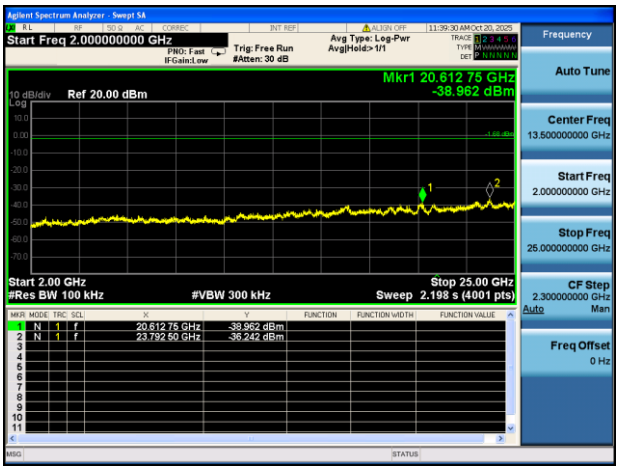
MIDDLE CHANNEL, CARRIER LEVEL



MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz

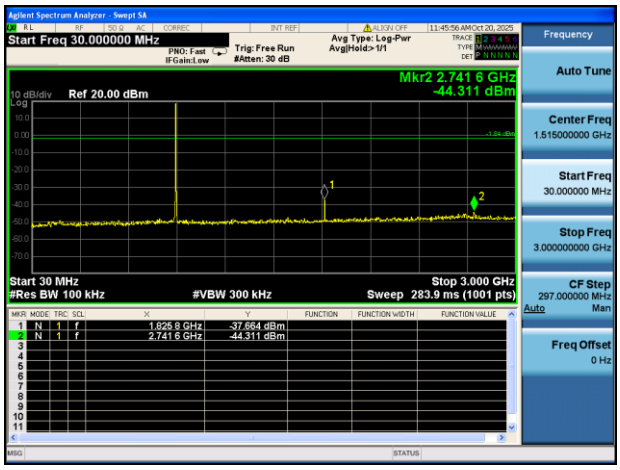


MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz

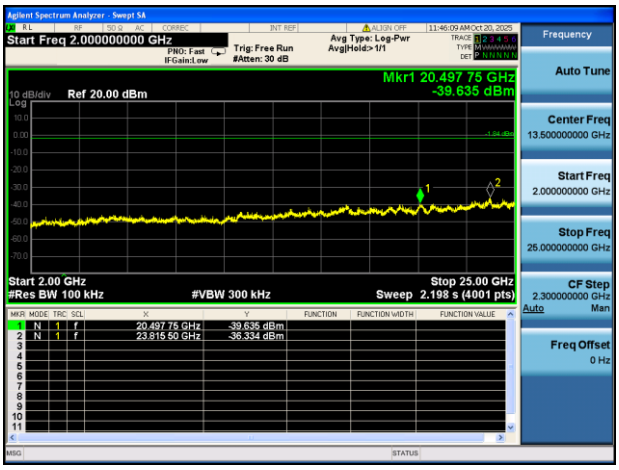


HIGH CHANNEL, CARRIER LEVEL

HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



A.4 Band Edge (Authorized-band band-edge)

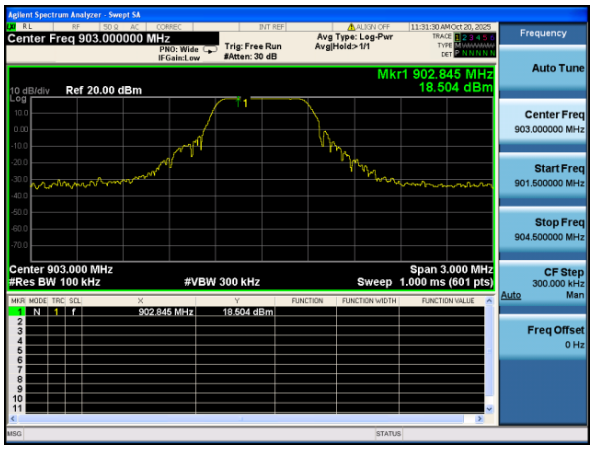
Note: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

Test Data

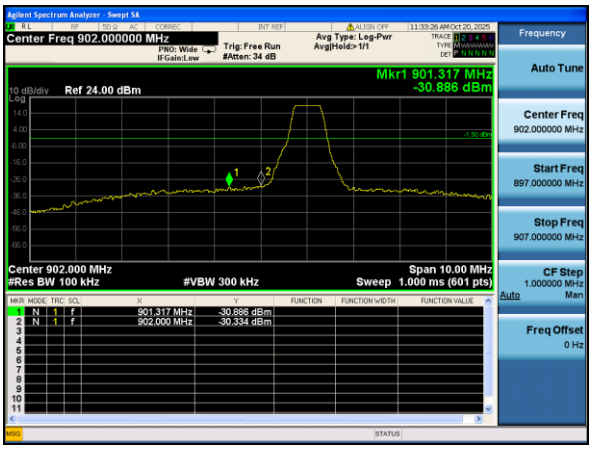
LoRa				
Channel	Measured Max. Band Edge Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low Channel	-30.89	18.50	-1.50	Pass
High Channel	-49.70	18.16	-1.84	Pass

Test Plots

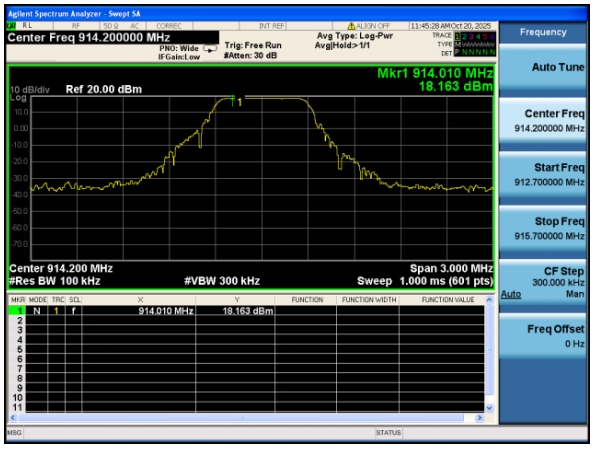
LOW CHANNEL, CARRIER LEVEL



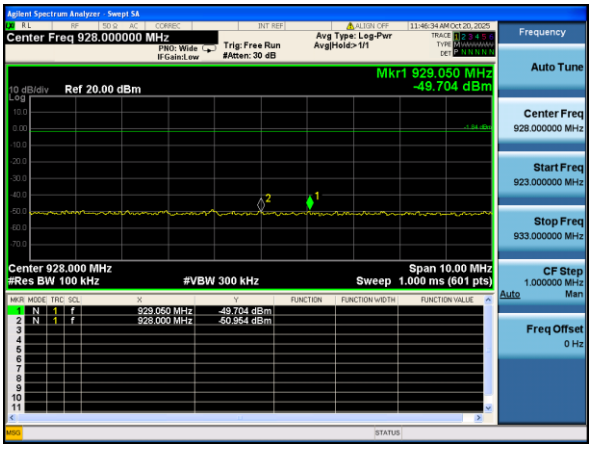
LOW CHANNEL, BAND EDGE



HIGH CHANNEL, CARRIER LEVEL



HIGH CHANNEL, BAND EDGE

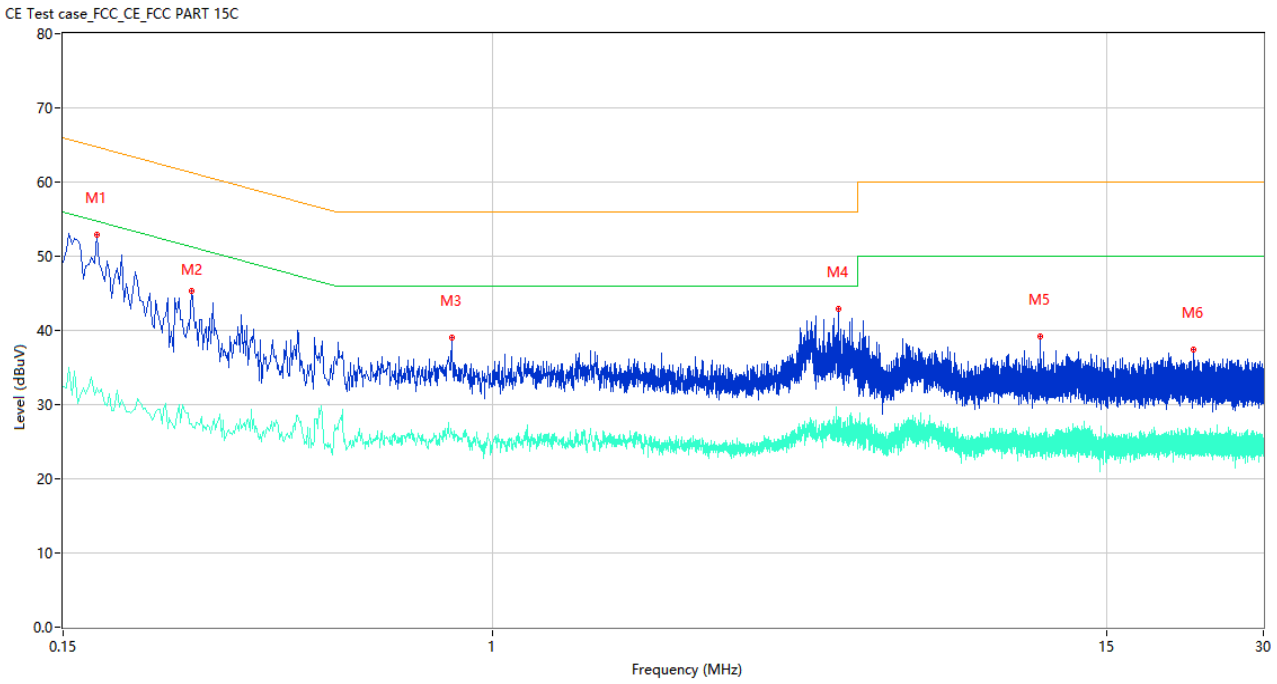


A.5 Conducted Emissions

Note [1]: The EUT is working in the Normal link mode.
Note [2]: Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 60 Hz and 240 VAC, 50 Hz) for which the device is capable of operation. So, The configuration 120 VAC, 60 Hz and 240 VAC, 50 Hz were tested respectively, but only the worst configuration (120 VAC, 60 Hz) shown here.
Note [3]: Results (dBuV) = Original reading level of Spectrum Analyzer (dBuV) + Factor (dB)

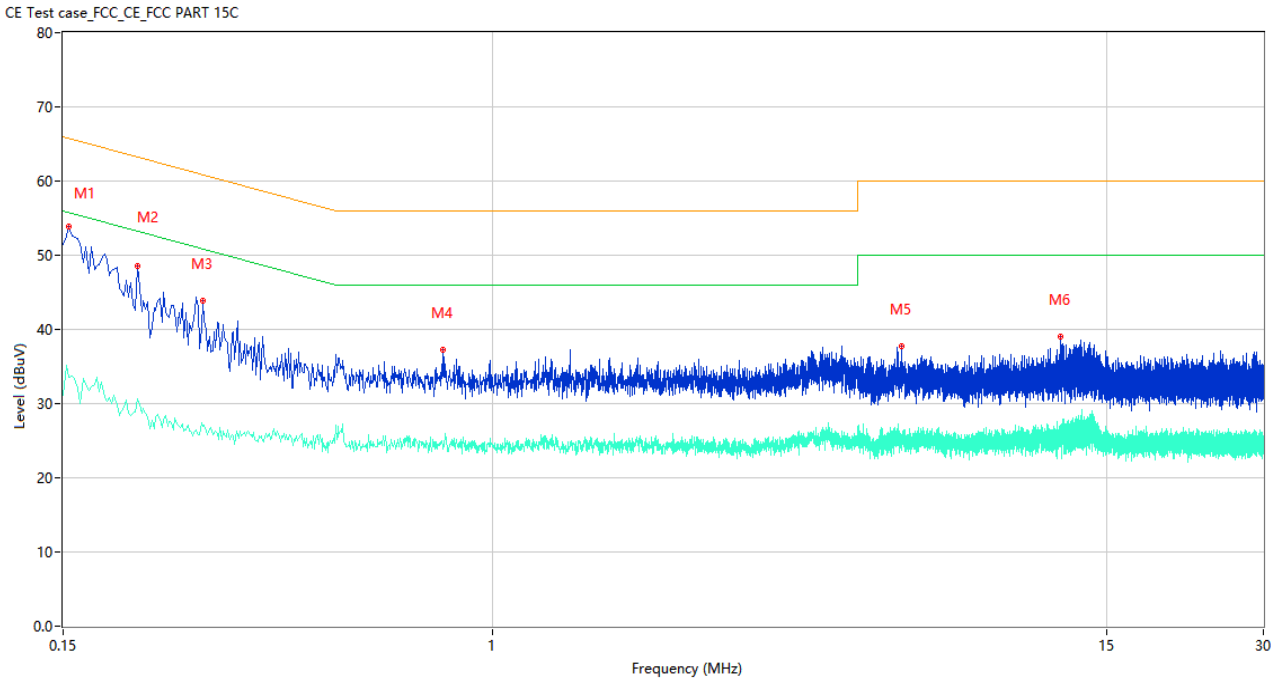
Test Data and Plots

PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.174	52.95	9.85	64.77	11.82	Peak	L	Pass
1**	0.174	32.31	9.85	54.77	22.46	AV	L	Pass
2	0.264	45.29	9.82	61.30	16.01	Peak	L	Pass
2**	0.264	27.38	9.82	51.30	23.92	AV	L	Pass
3	0.834	39.02	10.65	56.00	16.98	Peak	L	Pass
3**	0.834	26.06	10.65	46.00	19.94	AV	L	Pass
4	4.594	42.97	10.63	56.00	13.03	Peak	L	Pass
4**	4.594	28.41	10.63	46.00	17.59	AV	L	Pass
5	11.206	39.13	10.77	60.00	20.87	Peak	L	Pass
5**	11.206	24.90	10.77	50.00	25.10	AV	L	Pass
6	21.986	37.37	11.19	60.00	22.63	Peak	L	Pass
6**	21.986	25.18	11.19	50.00	24.82	AV	L	Pass

PHASE N



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.154	53.86	9.86	65.78	11.92	Peak	N	Pass
1**	0.154	33.55	9.86	55.78	22.23	AV	N	Pass
2	0.208	48.50	9.83	63.28	14.78	Peak	N	Pass
2**	0.208	30.58	9.83	53.28	22.70	AV	N	Pass
3	0.278	43.92	9.82	60.88	16.96	Peak	N	Pass
3**	0.278	26.92	9.82	50.88	23.96	AV	N	Pass
4	0.802	37.27	10.58	56.00	18.73	Peak	N	Pass
4**	0.802	24.51	10.58	46.00	21.49	AV	N	Pass
5	6.070	37.74	10.28	60.00	22.26	Peak	N	Pass
5**	6.070	23.99	10.28	50.00	26.01	AV	N	Pass
6	12.274	39.09	10.53	60.00	20.91	Peak	N	Pass
6**	12.274	27.09	10.53	50.00	22.91	AV	N	Pass

A.6 Radiated Spurious Emission

Note [1]: The symbol of “--” in the table which means not application.

Note [2]: For the test data above 1 GHz, according the ANSI C63.10-2020
, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note [3]: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Note [4]: The marked spikes near 900 MHz with circle should be ignored because they are Fundamental signal.

Test Data and Plots

Dipole Antenna

LOW CHANNEL, 30 MHz to 1 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	56.375	18.45	40.0	21.55	Peak	237.00	400	Horizontal	Pass
2	136.908	22.19	43.5	21.31	Peak	237.00	400	Horizontal	Pass
3	220.621	35.02	43.5	8.48	Peak	94.00	200	Horizontal	Pass
4	260.340	27.07	43.5	16.43	Peak	94.00	200	Horizontal	Pass
5	455.164	25.33	46.0	20.67	Peak	98.00	200	Horizontal	Pass
6	746.557	32.05	46.0	13.95	Peak	98.00	200	Horizontal	Pass

LOW CHANNEL, 30 MHz to 1 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	50.529	25.59	40.0	14.41	Peak	336.00	300	Vertical	Pass
2	138.306	30.82	43.5	12.68	Peak	336.00	300	Vertical	Pass
3	153.451	28.92	43.5	14.58	Peak	46.00	200	Vertical	Pass
4	407.207	29.10	46.0	16.90	Peak	46.00	200	Vertical	Pass
5	638.135	32.05	46.0	13.95	Peak	219.00	200	Vertical	Pass
6	774.320	38.12	46.0	7.88	Peak	219.00	200	Vertical	Pass

MIDDLE CHANNEL, 30 MHz to 1 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	53.456	20.48	40.0	19.52	Peak	190.00	200	Horizontal	Pass
2	139.842	26.02	43.5	17.48	Peak	190.00	200	Horizontal	Pass
3	218.025	34.55	43.5	8.95	Peak	81.00	200	Horizontal	Pass
4	260.635	24.25	43.5	19.25	Peak	81.00	200	Horizontal	Pass
5	461.297	28.86	46.0	17.14	Peak	272.00	200	Horizontal	Pass
6	745.332	36.24	46.0	9.76	Peak	272.00	200	Horizontal	Pass

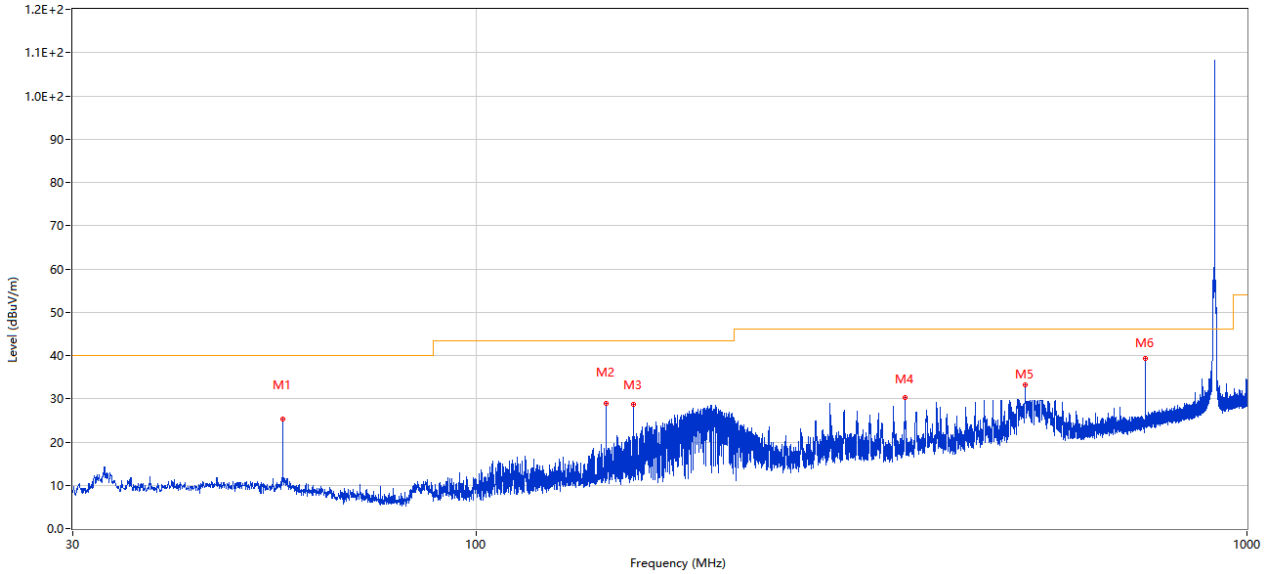
MIDDLE CHANNEL, 30 MHz to 1 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	52.416	22.42	40.0	17.58	Peak	166.00	300	Vertical	Pass
2	141.533	28.52	43.5	14.98	Peak	166.00	300	Vertical	Pass
3	158.762	28.62	43.5	14.88	Peak	105.00	100	Vertical	Pass
4	411.547	30.32	46.0	15.68	Peak	105.00	100	Vertical	Pass
5	634.605	32.56	46.0	13.44	Peak	155.00	200	Vertical	Pass
6	776.742	35.63	46.0	10.37	Peak	155.00	200	Vertical	Pass

HIGH CHANNEL, 30 MHz to 1 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	55.235	20.89	40.0	19.11	Peak	292.00	200	Horizontal	Pass
2	139.732	25.31	43.5	18.19	Peak	292.00	200	Horizontal	Pass
3	217.875	29.90	43.5	13.60	Peak	274.00	300	Horizontal	Pass
4	259.140	25.09	43.5	18.41	Peak	274.00	300	Horizontal	Pass
5	459.391	26.37	46.0	19.63	Peak	137.00	200	Horizontal	Pass
6	746.571	34.70	46.0	11.30	Peak	137.00	200	Horizontal	Pass

HIGH CHANNEL, 30 MHz to 1 GHz, ANT V

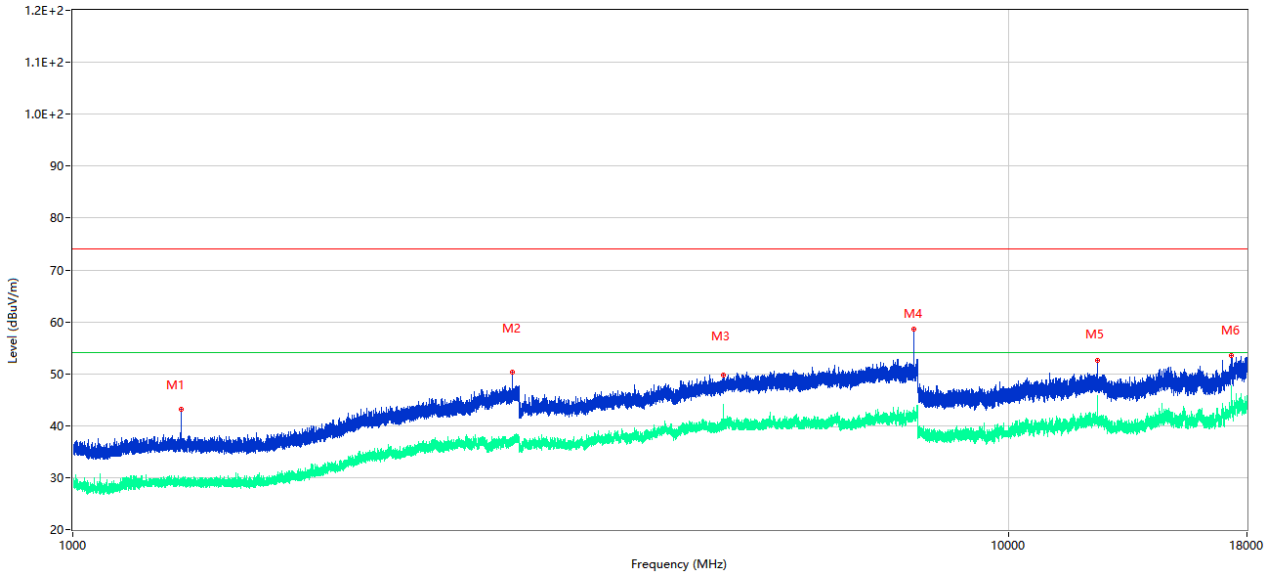


No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	51.007	24.86	40.0	15.14	Peak	93.00	300	Vertical	Pass
2	138.218	29.87	43.5	13.63	Peak	93.00	300	Vertical	Pass
3	153.716	28.36	43.5	15.14	Peak	285.00	300	Vertical	Pass
4	405.470	30.43	46.0	15.57	Peak	285.00	300	Vertical	Pass
5	639.258	32.64	46.0	13.36	Peak	319.00	200	Vertical	Pass
6	778.238	39.65	46.0	6.35	Peak	319.00	200	Vertical	Pass

LOW CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1331.489	44.16	74.0	29.84	Peak	287.00	200	Horizontal	Pass
1**	1331.489	32.42	54.0	21.58	AV	287.00	200	Horizontal	Pass
2	2971.858	50.40	74.0	23.60	Peak	207.00	200	Horizontal	Pass
2**	2971.858	39.92	54.0	14.08	AV	207.00	200	Horizontal	Pass
3	4917.094	52.64	74.0	21.36	Peak	139.00	200	Horizontal	Pass
3**	4917.094	41.95	54.0	12.05	AV	139.00	200	Horizontal	Pass
4	7623.568	53.42	74.0	20.58	Peak	346.00	300	Horizontal	Pass
4**	7623.568	38.87	54.0	15.13	AV	346.00	300	Horizontal	Pass
5	12470.472	53.05	74.0	20.95	Peak	109.00	300	Horizontal	Pass
5**	12470.472	46.02	54.0	7.98	AV	109.00	300	Horizontal	Pass
6	16855.872	54.22	74.0	19.78	Peak	278.00	200	Horizontal	Pass
6**	16855.872	40.28	54.0	13.72	AV	278.00	200	Horizontal	Pass

LOW CHANNEL 1 GHz to 18 GHz, ANT V



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1463.221	43.93	74.0	30.07	Peak	70.00	400	Vertical	Pass
1**	1463.221	30.76	54.0	23.24	AV	70.00	400	Vertical	Pass
2	2989.305	50.87	74.0	23.13	Peak	227.00	200	Vertical	Pass
2**	2989.305	36.94	54.0	17.06	AV	227.00	200	Vertical	Pass
3	4921.209	49.98	74.0	24.02	Peak	192.00	200	Vertical	Pass
3**	4921.209	43.08	54.0	10.92	AV	192.00	200	Vertical	Pass
4	7965.326	58.64	74.0	15.36	Peak	267.00	400	Vertical	Pass
4**	7965.326	41.30	54.0	12.70	AV	267.00	400	Vertical	Pass
5	12440.953	52.04	74.0	21.96	Peak	274.00	100	Vertical	Pass
5**	12440.953	46.52	54.0	7.48	AV	274.00	100	Vertical	Pass
6	17459.950	53.82	74.0	20.18	Peak	245.00	200	Vertical	Pass
6**	17459.950	47.46	54.0	6.54	AV	245.00	200	Vertical	Pass

MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1334.468	42.20	74.0	31.80	Peak	242.00	100	Horizontal	Pass
1**	1334.468	27.55	54.0	26.45	AV	242.00	100	Horizontal	Pass
2	2977.360	50.80	74.0	23.20	Peak	108.00	300	Horizontal	Pass
2**	2977.360	39.85	54.0	14.15	AV	108.00	300	Horizontal	Pass
3	4914.665	51.66	74.0	22.34	Peak	151.00	200	Horizontal	Pass
3**	4914.665	44.99	54.0	9.01	AV	151.00	200	Horizontal	Pass
4	7623.865	51.44	74.0	22.56	Peak	149.00	400	Horizontal	Pass
4**	7623.865	38.43	54.0	15.57	AV	149.00	400	Horizontal	Pass
5	12473.222	51.96	74.0	22.04	Peak	191.00	400	Horizontal	Pass
5**	12473.222	43.86	54.0	10.14	AV	191.00	400	Horizontal	Pass
6	16858.983	55.07	74.0	18.93	Peak	306.00	200	Horizontal	Pass
6**	16858.983	44.04	54.0	9.96	AV	306.00	200	Horizontal	Pass

MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1462.142	44.45	74.0	29.55	Peak	332.00	300	Vertical	Pass
1**	1462.142	31.85	54.0	22.15	AV	332.00	300	Vertical	Pass
2	2991.168	50.48	74.0	23.52	Peak	174.00	100	Vertical	Pass
2**	2991.168	36.86	54.0	17.14	AV	174.00	100	Vertical	Pass
3	4919.156	49.88	74.0	24.12	Peak	62.00	200	Vertical	Pass
3**	4919.156	39.01	54.0	14.99	AV	62.00	200	Vertical	Pass
4	7968.424	55.77	74.0	18.23	Peak	54.00	400	Vertical	Pass
4**	7968.424	43.40	54.0	10.60	AV	54.00	400	Vertical	Pass
5	12445.851	50.57	74.0	23.43	Peak	349.00	100	Vertical	Pass
5**	12445.851	41.57	54.0	12.43	AV	349.00	100	Vertical	Pass
6	17454.860	53.28	74.0	20.72	Peak	42.00	400	Vertical	Pass
6**	17454.860	44.43	54.0	9.57	AV	42.00	400	Vertical	Pass

HIGH CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1335.191	42.37	74.0	31.63	Peak	165.00	400	Horizontal	Pass
1**	1335.191	32.26	54.0	21.74	AV	165.00	400	Horizontal	Pass
2	2972.868	52.07	74.0	21.93	Peak	253.00	400	Horizontal	Pass
2**	2972.868	41.83	54.0	12.17	AV	253.00	400	Horizontal	Pass
3	4916.560	48.55	74.0	25.45	Peak	250.00	200	Horizontal	Pass
3**	4916.560	45.19	54.0	8.81	AV	250.00	200	Horizontal	Pass
4	7622.395	51.12	74.0	22.88	Peak	106.00	400	Horizontal	Pass
4**	7622.395	38.21	54.0	15.79	AV	106.00	400	Horizontal	Pass
5	12471.820	53.70	74.0	20.30	Peak	207.00	200	Horizontal	Pass
5**	12471.820	42.31	54.0	11.69	AV	207.00	200	Horizontal	Pass
6	16857.859	57.87	74.0	16.13	Peak	355.00	200	Horizontal	Pass
6**	16857.859	43.28	54.0	10.72	AV	355.00	200	Horizontal	Pass

HIGH CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1468.442	42.42	74.0	31.58	Peak	217.00	300	Vertical	Pass
1**	1468.442	30.18	54.0	23.82	AV	217.00	300	Vertical	Pass
2	2990.264	52.20	74.0	21.80	Peak	349.00	100	Vertical	Pass
2**	2990.264	37.40	54.0	16.60	AV	349.00	100	Vertical	Pass
3	4925.077	52.75	74.0	21.25	Peak	176.00	200	Vertical	Pass
3**	4925.077	39.31	54.0	14.69	AV	176.00	200	Vertical	Pass
4	7968.922	54.43	74.0	19.57	Peak	2.00	300	Vertical	Pass
4**	7968.922	43.28	54.0	10.72	AV	2.00	300	Vertical	Pass
5	12440.158	52.26	74.0	21.74	Peak	109.00	300	Vertical	Pass
5**	12440.158	44.34	54.0	9.66	AV	109.00	300	Vertical	Pass
6	17453.816	56.59	74.0	17.41	Peak	207.00	300	Vertical	Pass
6**	17453.816	43.17	54.0	10.83	AV	207.00	300	Vertical	Pass

PCB Antenna

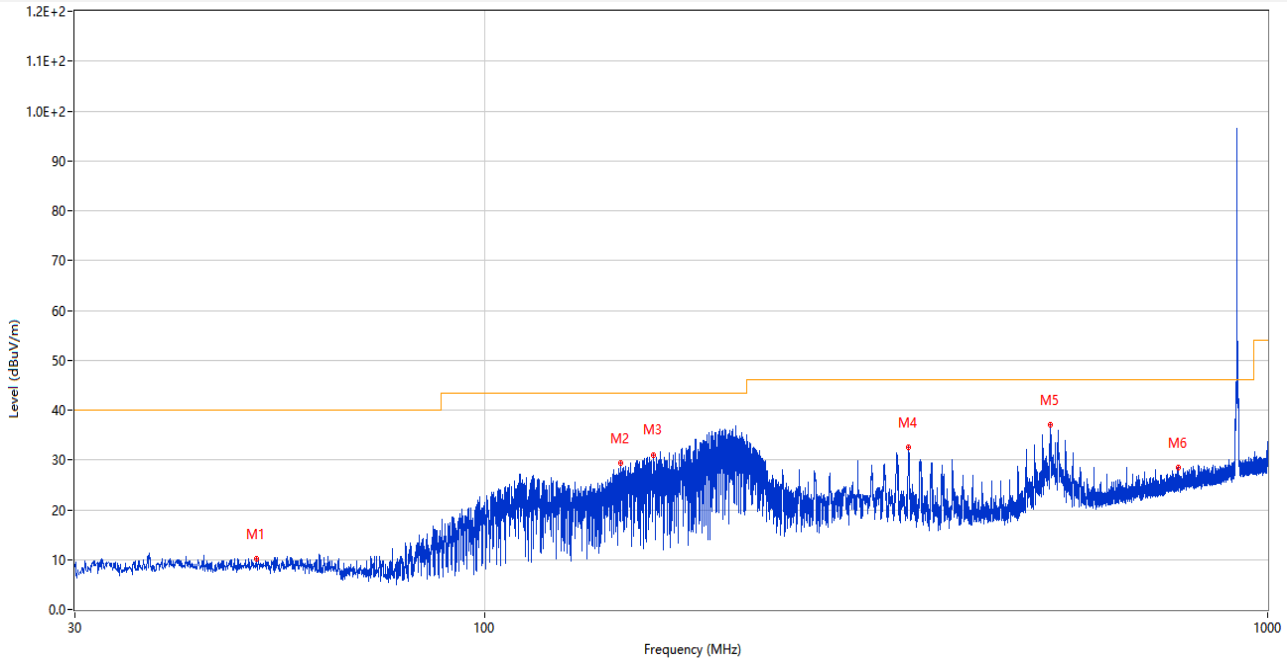
LOW CHANNEL, 30 MHz to 1 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	50.779	10.33	40.0	29.67	Peak	245.00	400	Horizontal	Pass
2	149.462	29.11	43.5	14.40	Peak	245.00	400	Horizontal	Pass
3	164.749	30.91	43.5	12.59	Peak	29.00	400	Horizontal	Pass
4	347.342	32.39	46.0	13.61	Peak	29.00	400	Horizontal	Pass
5	527.773	36.94	46.0	9.06	Peak	126.00	200	Horizontal	Pass
6	768.205	28.28	46.0	17.72	Peak	126.00	200	Horizontal	Pass

LOW CHANNEL, 30 MHz to 1 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	54.673	22.97	40.0	17.03	Peak	255.00	400	Vertical	Pass
2	140.957	28.42	43.5	15.08	Peak	255.00	400	Vertical	Pass
3	157.063	26.51	43.5	16.99	Peak	40.00	100	Vertical	Pass
4	408.199	27.66	46.0	18.34	Peak	40.00	100	Vertical	Pass
5	636.646	33.09	46.0	12.91	Peak	272.00	200	Vertical	Pass
6	777.489	36.75	46.0	9.25	Peak	272.00	200	Vertical	Pass

MIDDLE CHANNEL, 30 MHz to 1 GHz, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	51.525	10.05	40.0	29.95	Peak	330.00	100	Horizontal	Pass
2	148.937	29.27	43.5	14.24	Peak	330.00	400	Horizontal	Pass
3	164.744	30.73	43.5	12.77	Peak	334.00	200	Horizontal	Pass
4	347.603	32.28	43.5	11.22	Peak	334.00	200	Horizontal	Pass
5	527.782	37.00	46.0	9.00	Peak	352.00	200	Horizontal	Pass
6	768.005	28.19	46.0	17.81	Peak	352.00	100	Horizontal	Pass

MIDDLE CHANNEL, 30 MHz to 1 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	54.986	22.77	40.0	17.24	Peak	170.00	100	Vertical	Pass
2	140.753	28.17	43.5	15.33	Peak	170.00	200	Vertical	Pass
3	157.446	26.20	43.5	17.30	Peak	89.00	100	Vertical	Pass
4	407.507	27.66	46.0	18.34	Peak	89.00	400	Vertical	Pass
5	636.432	32.72	46.0	13.28	Peak	352.00	100	Vertical	Pass
6	777.037	36.70	46.0	9.30	Peak	352.00	200	Vertical	Pass

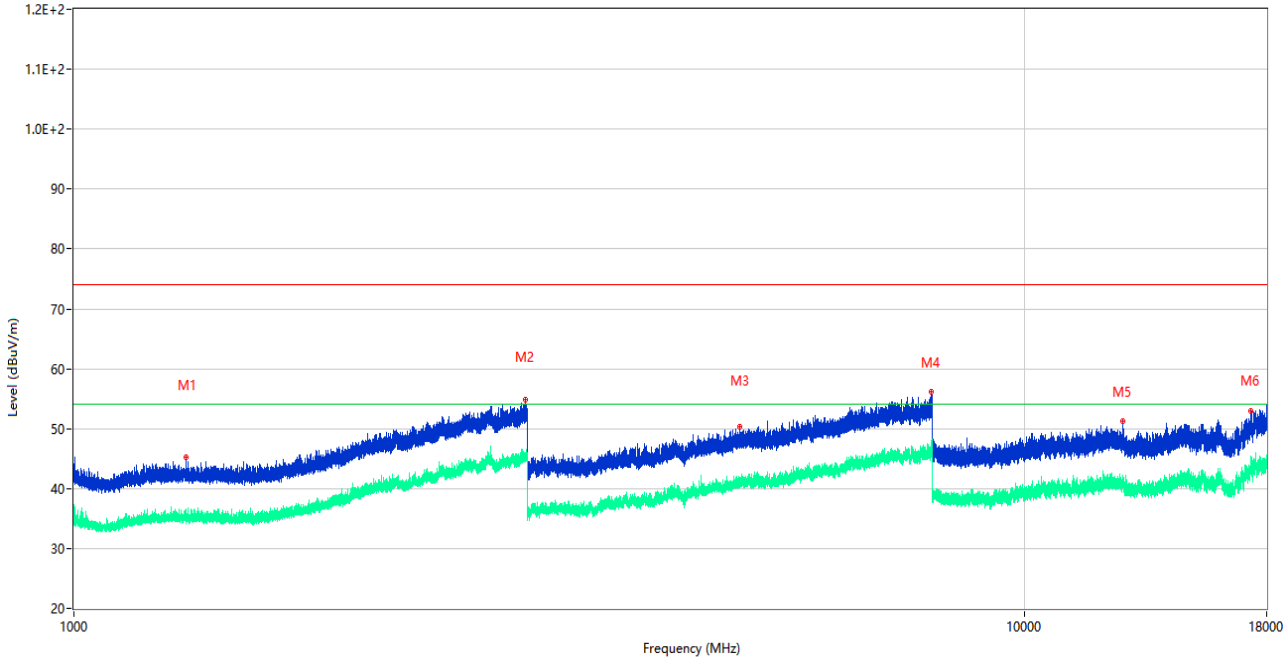
HIGH CHANNEL, 30 MHz to 1 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	51.307	10.04	40.0	29.96	Peak	219.00	100	Horizontal	Pass
2	149.499	28.75	43.5	14.75	Peak	219.00	200	Horizontal	Pass
3	164.828	31.03	43.5	12.47	Peak	258.00	300	Horizontal	Pass
4	348.060	32.21	43.5	11.29	Peak	258.00	200	Horizontal	Pass
5	528.307	36.92	46.0	9.08	Peak	115.00	100	Horizontal	Pass
6	768.247	28.23	46.0	17.77	Peak	115.00	400	Horizontal	Pass

HIGH CHANNEL, 30 MHz to 1 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	54.573	22.54	40.0	17.46	Peak	21.00	300	Vertical	Pass
2	140.462	28.05	43.5	15.45	Peak	21.00	300	Vertical	Pass
3	157.045	26.61	43.5	16.90	Peak	259.00	400	Vertical	Pass
4	408.017	27.12	46.0	18.89	Peak	259.00	400	Vertical	Pass
5	636.534	32.68	46.0	13.32	Peak	159.00	200	Vertical	Pass
6	777.154	36.24	46.0	9.76	Peak	159.00	200	Vertical	Pass

LOW CHANNEL 1 GHz to 18 GHz, ANT H



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1315.492	45.48	74.0	28.52	Peak	327.00	200	Horizontal	Pass
1**	1315.492	35.67	54.0	18.33	AV	327.00	200	Horizontal	Pass
2	2984.216	55.19	74.0	18.81	Peak	318.00	200	Horizontal	Pass
2**	2984.216	46.13	54.0	7.87	AV	318.00	200	Horizontal	Pass
3	5018.027	50.60	74.0	23.40	Peak	333.00	200	Horizontal	Pass
3**	5018.027	41.01	54.0	12.99	AV	333.00	200	Horizontal	Pass
4	7998.233	56.17	74.0	17.83	Peak	17.00	200	Horizontal	Pass
4**	7998.233	47.91	54.0	6.09	AV	17.00	200	Horizontal	Pass
5	12715.868	51.39	74.0	22.61	Peak	178.00	100	Horizontal	Pass
5**	12715.868	41.18	54.0	12.82	AV	178.00	100	Horizontal	Pass
6	17335.010	53.04	74.0	20.96	Peak	106.00	400	Horizontal	Pass
6**	17335.010	44.20	54.0	9.80	AV	106.00	400	Horizontal	Pass

LOW CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1309.405	45.23	74.0	28.77	Peak	236.00	300	Vertical	Pass
1**	1309.405	35.56	54.0	18.44	AV	236.00	300	Vertical	Pass
2	2990.440	54.95	74.0	19.06	Peak	101.00	200	Vertical	Pass
2**	2990.440	46.06	54.0	7.94	AV	101.00	200	Vertical	Pass
3	5018.175	50.64	74.0	23.36	Peak	218.00	200	Vertical	Pass
3**	5018.175	40.85	54.0	13.15	AV	218.00	200	Vertical	Pass
4	7993.259	56.28	74.0	17.72	Peak	261.00	100	Vertical	Pass
4**	7993.259	47.81	54.0	6.19	AV	261.00	100	Vertical	Pass
5	12716.629	51.24	74.0	22.76	Peak	278.00	200	Vertical	Pass
5**	12716.629	41.02	54.0	12.98	AV	278.00	200	Vertical	Pass
6	17336.293	53.27	74.0	20.73	Peak	285.00	200	Vertical	Pass
6**	17336.293	44.06	54.0	9.94	AV	285.00	200	Vertical	Pass

MIDDLE CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1307.237	45.19	74.0	28.81	Peak	73.00	400	Horizontal	Pass
1**	1307.237	35.26	54.0	18.74	AV	73.00	400	Horizontal	Pass
2	2986.433	54.70	74.0	19.30	Peak	93.00	300	Horizontal	Pass
2**	2986.433	45.82	54.0	8.18	AV	93.00	300	Horizontal	Pass
3	5013.699	50.51	74.0	23.49	Peak	215.00	200	Horizontal	Pass
3**	5013.699	40.56	54.0	13.44	AV	215.00	200	Horizontal	Pass
4	7993.609	55.94	74.0	18.06	Peak	39.00	300	Horizontal	Pass
4**	7993.609	47.62	54.0	6.38	AV	39.00	300	Horizontal	Pass
5	12709.074	51.02	74.0	22.98	Peak	179.00	300	Horizontal	Pass
5**	12709.074	40.99	54.0	13.01	AV	179.00	300	Horizontal	Pass
6	17344.594	52.70	74.0	21.30	Peak	221.00	100	Horizontal	Pass
6**	17344.594	44.04	54.0	9.96	AV	221.00	100	Horizontal	Pass

MIDDLE CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1307.670	44.96	74.0	29.04	Peak	81.00	200	Vertical	Pass
1**	1307.670	35.46	54.0	18.54	AV	81.00	200	Vertical	Pass
2	2986.355	54.85	74.0	19.15	Peak	33.00	400	Vertical	Pass
2**	2986.355	45.82	54.0	8.18	AV	33.00	400	Vertical	Pass
3	5016.843	50.18	74.0	23.82	Peak	145.00	200	Vertical	Pass
3**	5016.843	40.73	54.0	13.27	AV	145.00	200	Vertical	Pass
4	7992.663	56.12	74.0	17.88	Peak	335.00	100	Vertical	Pass
4**	7992.663	47.60	54.0	6.40	AV	335.00	100	Vertical	Pass
5	12713.058	51.13	74.0	22.87	Peak	280.00	300	Vertical	Pass
5**	12713.058	41.21	54.0	12.79	AV	280.00	300	Vertical	Pass
6	17338.345	52.94	74.0	21.06	Peak	120.00	200	Vertical	Pass
6**	17338.345	43.92	54.0	10.09	AV	120.00	200	Vertical	Pass

HIGH CHANNEL 1 GHz to 18 GHz, ANT H

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1312.709	44.82	74.0	29.18	Peak	67.00	300	Horizontal	Pass
1**	1312.709	34.93	54.0	19.07	AV	67.00	300	Horizontal	Pass
2	2989.558	54.61	74.0	19.39	Peak	178.00	200	Horizontal	Pass
2**	2989.558	45.59	54.0	8.41	AV	178.00	200	Horizontal	Pass
3	5013.490	50.22	74.0	23.78	Peak	259.00	200	Horizontal	Pass
3**	5013.490	40.49	54.0	13.51	AV	259.00	200	Horizontal	Pass
4	7999.274	55.84	74.0	18.16	Peak	267.00	200	Horizontal	Pass
4**	7999.274	47.36	54.0	6.64	AV	267.00	200	Horizontal	Pass
5	12710.795	51.01	74.0	22.99	Peak	69.00	400	Horizontal	Pass
5**	12710.795	40.41	54.0	13.59	AV	69.00	400	Horizontal	Pass
6	17344.952	52.49	74.0	21.51	Peak	89.00	100	Horizontal	Pass
6**	17344.952	43.99	54.0	10.01	AV	89.00	100	Horizontal	Pass

HIGH CHANNEL 1 GHz to 18 GHz, ANT V

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1311.696	45.82	74.0	28.18	Peak	97.00	100	Vertical	Pass
1**	1311.048	38.28	54.0	15.72	AV	97.00	100	Vertical	Pass
2	2988.473	55.12	74.0	18.89	Peak	285.00	100	Vertical	Pass
2**	2986.621	45.94	54.0	8.06	AV	285.00	100	Vertical	Pass
3	5015.267	52.63	74.0	21.37	Peak	311.00	200	Vertical	Pass
3**	5018.771	43.09	54.0	10.91	AV	311.00	200	Vertical	Pass
4	7994.150	57.64	74.0	16.37	Peak	251.00	200	Vertical	Pass
4**	7996.090	45.51	54.0	8.49	AV	251.00	200	Vertical	Pass
5	12716.180	52.90	74.0	21.10	Peak	346.00	300	Vertical	Pass
5**	12714.379	43.21	54.0	10.79	AV	346.00	300	Vertical	Pass
6	17338.777	53.46	74.0	20.54	Peak	188.00	200	Vertical	Pass
6**	17333.800	46.32	54.0	7.68	AV	188.00	200	Vertical	Pass

A.7 Band Edge (Restricted-band band-edge)

Note [1]: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.
Note [2]: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.
Note [3]: According the ANSI C63.10-2020, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.
Note [4]: The Level (dBuV/m) has been corrected by factor.
Note [5]: Both horizontal and vertical directions were pre tested, only the worst configuration has been reported in this report.

Test Data and Plots

Dipole Antenna

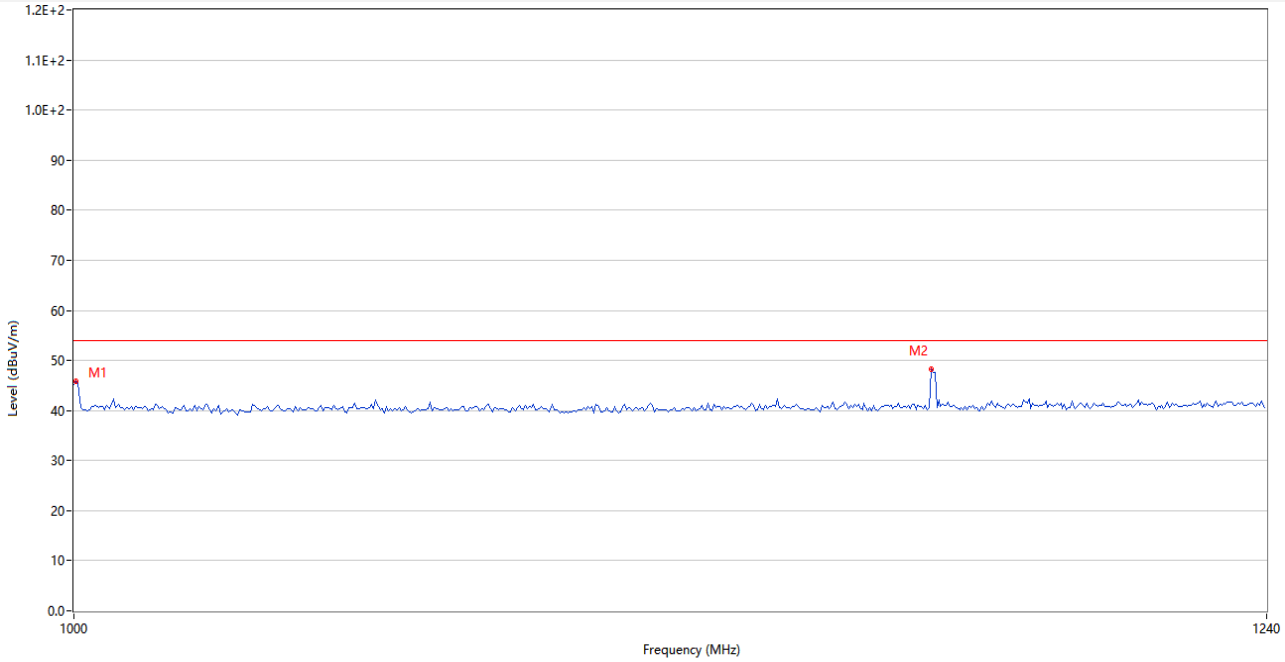
608 MHz to 614 MHz

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	611.785	42.73	54.0	11.27	Peak	238.00	100	Horizontal	Pass
2	612.780	43.23	54.0	10.77	Peak	36.00	100	Horizontal	Pass

960 MHz to 1 GHz

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	960.360	45.12	54.0	8.88	Peak	326.00	300	Horizontal	Pass
2	962.013	44.7	54.0	9.30	Peak	5.00	200	Horizontal	Pass

1 GHz to 1.24 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1009.222	45.09	54.0	8.91	Peak	72.00	200	Horizontal	Pass
2	1163.720	47.9	54.0	6.10	Peak	63.00	300	Horizontal	Pass

PCB Antenna

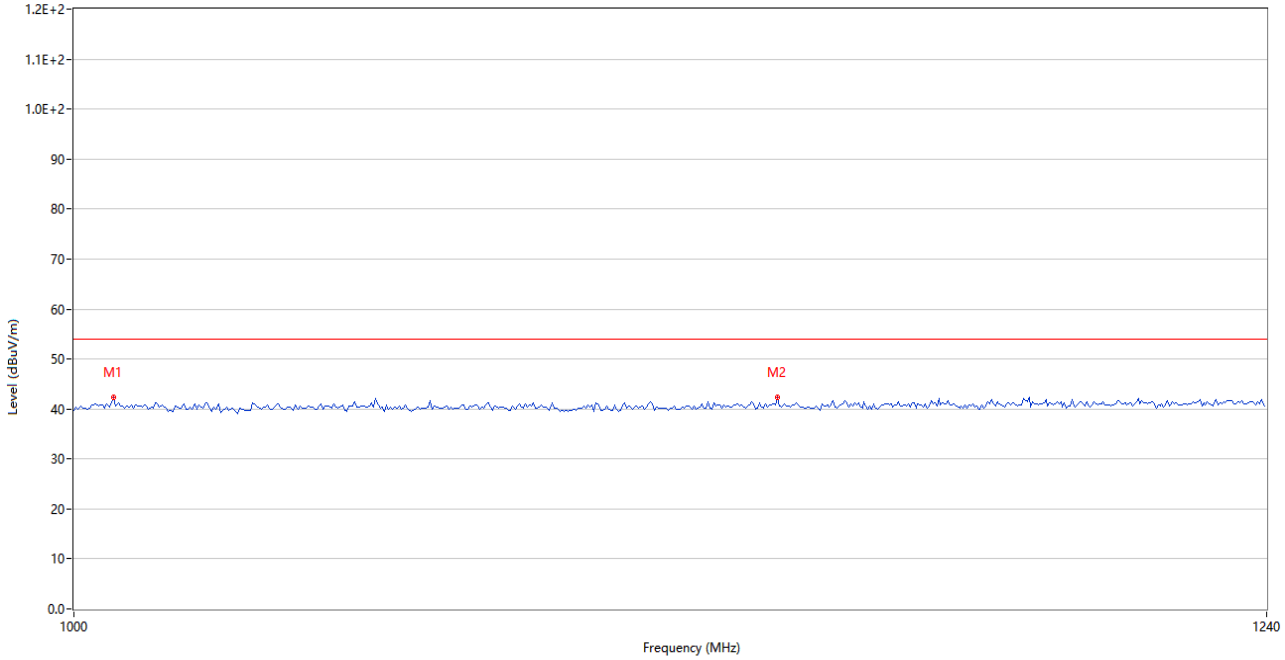
608 MHz to 614 MHz

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	606.246	38.96	54.0	15.04	Peak	285.00	300	Horizontal	Pass
2	610.367	38.66	54.0	15.34	Peak	342.00	300	Horizontal	Pass

960 MHz to 1 GHz

No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	959.246	40.1	54.0	13.90	Peak	326.00	300	Horizontal	Pass
2	963.720	41.34	54.0	12.66	Peak	139.00	300	Horizontal	Pass

1 GHz to 1.24 GHz



No.	Frequency (MHz)	Results (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1007.200	42.36	54.0	11.64	Peak	65.00	200	Horizontal	Pass
2	1135.200	42.33	54.0	11.67	Peak	248.00	200	Horizontal	Pass

A.8 Power Spectral Density (PSD)

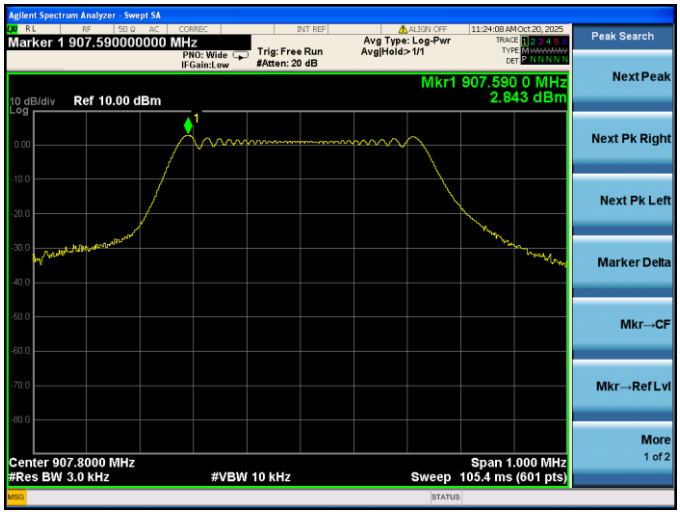
Test Data

LoRa			
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	3.49	8	Pass
Middle Channel	2.84	8	Pass
High Channel	3.28	8	Pass

Test Plots

LOW CHANNEL

MIDDLE CHANNEL



HIGH CHANNEL

ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ25A0043-AR.PDF”.

ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ25A00043-AW.PDF”.

ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ25A0043-AI.PDF”.

Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
2. The report without China inspection body and laboratory Mandatory Approval (CMA) mark has no effect of proving to the society.
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4. This report is invalid if it is altered, without the signature of the testing and approval personnel, or without the “inspection and testing dedicated stamp” or test report stamp.
5. The test data and results are only valid for the tested samples provided by the customer.
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7. Any objection shall be raised to the laboratory within 30 days after receiving the report.

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