



FCC LISTED,
REGISTRATION NUMBER:
2764.01

ISED LISTED
REGISTRATION NUMBER:
23595-1

Test Report No:
4733ERM.002A3

Partial Test Report

USA FCC Part 15.247, 15.209, 15.207; & CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices.

(*) Identification of item tested	The NanoTag is a wireless smart label used for temperature monitoring and location tracking
(*) Trademark	NanoTag
(*) Model and /or type reference	NanoTag US915
Other identification of the product	Contains FCC ID: 2ASD7-S76S HW version: v2.2.0.0 SW Version: fcc-v0.0.1
(*) Features	LoRaWAN
(*) Manufacturer	CubeWorks 1600 Huron Pkwy Ann Arbor, MI 48109, USA
Test method requested, standard	USA FCC Part 15.247 (10-1-21 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-21 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 amendment 1 (March 2019). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	See Appendix A
Approved by (name / position & signature)	Domingo Galvez EMC&RF Lab Manager 
Date of issue	2025-08-26
Report template No	FDT08_24 (*) "Data provided by the client"

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Acronyms

Acronym ID	Acronym Description
# of Tx Chains	Number of Transmission Chains
26Ebw	Emission Bandwidth
Avg COT	Average Channel Occupancy Time
BW	Bandwidth
Equipment	Equipment Type
Freq	Frequency
Freq Sep	Frequency Separation
Inband Peak Lvl	Inband Peak Level
Lvl	Level
MP	Measurement Point
Mod	Modulation
NHC	Number of Hopping Channels
NHp	Number of hops over the period
Occ Ch BW	Occupied Channel Bandwidth
Peak Power	Maximum Peak Conducted Output Power
Port	Active Port

Competences and guarantees

DEKRA Certification Inc. is a testing laboratory accredited by A2LA (The American Association for Laboratory Accreditation), to perform the tests indicated in the Certificate 2764.01

DEKRA Certification Inc. is a testing laboratory competent to carry out the tests described in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Certification Inc. has a calibration and maintenance program for its measurement equipment.

DEKRA Certification Inc. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Certification at the time of performance of the test.

DEKRA Certification Inc. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

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General conditions

- 1. This report is only referred to the item that has undergone the test.
- 2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
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- 4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Certification Inc. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Certification internal document PODT000.

Test case	Frequency (MHz)	U (k=2)	Units
Radiated Spurious Emission	30-180	4.27	dB
	180-1000	3.14	dB
	1000-18000	3.30	dB
	18000-40000	3.49	dB

Data provided by the client

The following data has been provided by the client:

- 1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested").
 - 2. The sample consists of NanoTag, a wireless smart label used for temperature monitoring and location tracking
- DEKRA declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

Sample S/01 is composed of the following elements, accessories and auxiliary equipment:

Id	Control Number	Description	Manufacturer/ Model	Serial N°	Date of Reception	Application
S/01	4229/01	RF Sample (902.3MHz)	CubeWorks	NanoTag US915	2023/8/7	Element Under Test
S/01	4229/02	RF Sample (908.5MHz)	CubeWorks	NanoTag US915	2023/8/7	Element Under Test
S/01	4229/03	RF Sample (914.9MHz)	CubeWorks	NanoTag US915	2023/8/7	Element Under Test

Notes referenced to samples during the project:

Id	Note
S/01	Sample S/01 was used for the test(s): All test(S) indicated in appendix A

Test sample description

Test Sample description (compulsory information for EMC and RF testing services)

Ports..... :	Port name and description		Cable								
			Specified length [m]	Attached during test	Shielded	Coupled to patient					
	No Data Provided			☐	☐	☐					
				☐	☐	☐					
				☐	☐	☐					
				☐	☐	☐					
				☐	☐	☐					
Supplementary information to the ports..... :	There are no user available ports. The antenna and the DC input are soldered to the PCB and have no user access.										
Rated power supply	Voltage and Frequency		Reference poles								
			L1	L2	L3	N PE					
	☐	AC:	☐	☐	☐	☐					
	☐	AC:	☐	☐	☐	☐					
	☒	DC: 3V/120mA internal non-rechargeable battery									
	☐	DC:									
Rated Power	0.6W										
Clock frequencies.....	32MHz, 32.768kHz										
Other parameters	No Data Provided										
Software version	fcc-v0.0.1										
Hardware version	v2.2.0.0										
Dimensions in cm (W x H x D) :	9.4 x 12 x 0.12										
Mounting position	☐	Table top equipment									
	☒	Wall/Ceiling mounted equipment									
	☐	Floor standing equipment									
	☐	Hand-held equipment									
	☒	Other: Mounted on boxes, cars, trucks and other items									
Modules/parts.....	Module/parts of test item		Type		Manufacturer						
	NanoTag US915		Flex PCB		CubeWorks						
Accessories (not part of the test item).....	Description		Type		Manufacturer						
	No Data Provided										

Documents as provided by the applicant..... :	Description	File name	Issue date
	Declaration Equipment Data	FDT30_18 Declaration Equipment Data - Nanotag	2024/10/25
Copy of marking plate:			
No Marking plate found.			

Identification of the client

CubeWorks
1600 Huron Pkwy
Ann Arbor, MI 48109,
USA

Testing period and place

Test Location	DEKRA Certification Inc.
Date (start)	2023-08-11
Date (finish)	2023-08-25

Document history

Report number	Date	Description
4733ERM.002	2025-01-28	First release.
4733ERM.002A1	2025-03-14	Second release. The type of power supply was updated in Test Conditions, type of equipment in Product information was updated, technology was updated in the Summary section, and a statement regarding frequency range 9kHz – 30 MHz was added to Test Case details section. This modified test report cancels and replaces the report 4733ERM.002
4733ERM.002A2	2025-08-06	Third release. The DSS is removed in the equipment type from the product information. This modified test report cancels and replaces the report 4733ERM.002A2
4733ERM.002A3	2025-08-26	Fourth release. Typo error in the product information section. This modified test report cancels and replaces the report 4733ERM.002A3

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the semi-anechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Koji Nishimoto and Yuri Barone.

Testing verdicts

Fail	F
Inconclusive	I
Not applicable	N/A
Not measured	N/M
Pass	P

Summary

LoRaWAN

FCC PART 15 PARAGRAPH / RSS-247			
Requirement	Test case	Verdict	Remark
RSS-247 5.2 (a) / FCC 15.247 (a) (2) - 6 dB Bandwidth		N/M	Refer 1
FCC 2.1049 - 99dBw Occupied Channel Bandwidth 99%		N/M	Refer 1
RSS-247 5.2 (b) / FCC 15.247 (e) - Power spectral density		N/M	Refer 1
RSS-247 5.4 (d) / FCC 15.247 (b) (1) - Maximum Average Conducted Output Power		N/M	Refer 1
RSS-247 5.5 / FCC 15.247 (d) - Band-edge emissions compliance (Transmitter) -		N/M	Refer 1
RSS-247 5.5 / FCC 15.247 (d) - Emissions compliance (Transmitter) - Conducted		N/M	Refer 1
RSS-247 5.5 / FCC 15.247 (d) - Emissions compliance (Transmitter) - Radiated		P	N/A
<u>Supplementary information and remarks:</u>			
1. Test not requested.			

List of equipment used during the test

Radiated Measurements

CONTROL NUMBER	DESCRIPTION	Serial No	LAST CALIBRATION	NEXT CALIBRATION
878	Power supply (AMETEK / PROG-DC-PS)	1707A01783	N/A	N/A
1010	ESR7 EMI Test Receiver	101790	2022-10-14	2024-10-14
1014	FSV40 Signal Analyzer 40ghz	101626	2022-08-01	2024-08-01
1058	3115 Double-Ridged Waveguide Horn Antenna 1-18 GHz	211373	2023-06-26	2026-06-26
1064	3142E Biconilog Antenna	208600	2021-12-13	2024-12-13
1108	Ethernet SNMP Thermometer- CR Room	60038026954	2022-10-18	2024-10-18
1111	Ethernet SNMP Thermometer	60038026577	2022-10-18	2024-10-18
1179	Semi-Anechoic Chamber	F169021	N/A	N/A
1314	Wireless Measurement Software R&S EMC32	1040-OT102236	N/A	N/A
1461	Low Noise Preamplifier (1-18GHz)	Bonn Elektronik	2022-06-01	2024-06-01

Appendix A: Test results. LoRa

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PRODUCT INFORMATION

(*): Data provided by the client.

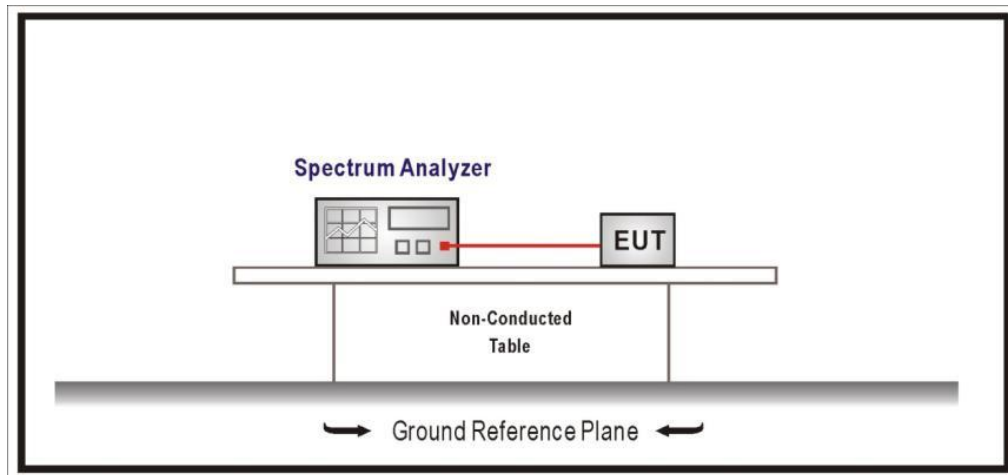
Information	Description
Modulation	LoRa
Maximum RF Output Power	20 dBm
Operation mode	
- Operating Frequency Range	902-928 MHz ISM
- Nominal Channel Bandwidth	125kHz
Extreme operating conditions	
- Temperature range	15 °C to 35 °C
Antenna type	PCB Dipole
Antenna gain	-2.82dBi
Nominal Voltage	
- Supply Voltage	3V
- Type of power source	Battery powered
Equipment type	DSS

TEST CONDITIONS

(*): Data provided by the client.

TEST CONDITIONS	DESCRIPTION
TC#01	<u>Power supply (V):</u> Battery Operated : 3V <u>Type of power supply:</u> DC voltage from internal non-rechargeable battery. <u>Temperature (°C):</u> $T_{nom} = +15 \text{ to } +35$ $T_{min} = \text{N/A}$ $T_{max} = \text{N/A}$ The subscript nom indicates normal test conditions. The subscripts min and max indicate extreme test conditions (minimum and maximum respectively). N/A: Not Applicable. (*): Declared by applicant. <u>Test Frequencies for Radiated tests:</u> Lowest channel: 902.3 MHz Middle channel: 908.5 MHz Highest channel: 914.9 MHz

CONDUCTED MEASUREMENTS:



RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at 3 m for the frequency range 30-1000 MHz (Bilog antenna) and 1-18 GHz Double ridge horn antennas.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

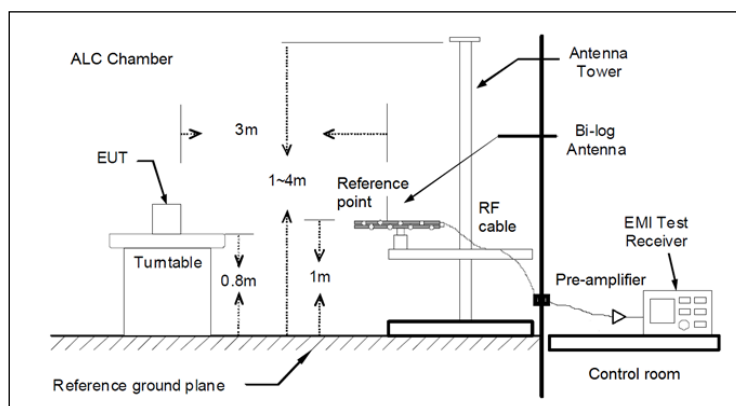


Fig A1: Radiated measurements Setup $f < 1 \text{ GHz}$

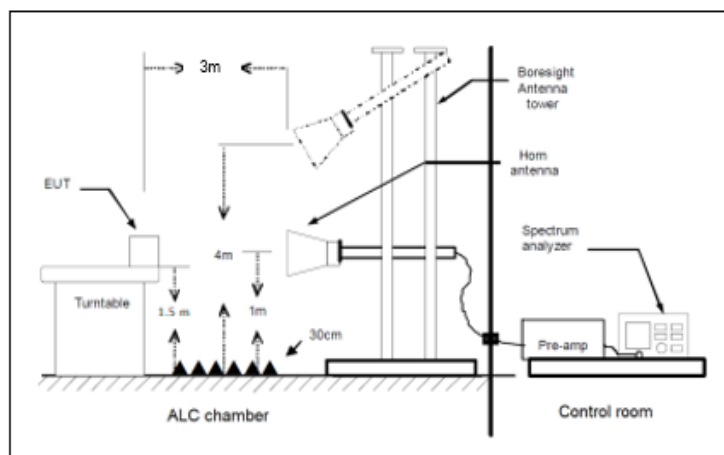


Fig A2: Radiated measurements setup $f > 1-18 \text{ GHz}$

TEST CASES DETAILS

RSS-247 5.5 / FCC 15.247 (d) - Emissions compliance (Transmitter) - Radiated

Limits

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) / RSS-Gen):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/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	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required

The following tables and plots show the results for the worst case

Verdict

Pass

Sample ID: S/01
The result for worst operation is shown below.

Results

Frequency range 9KHz – 30 MHz

No radiofrequency signal generated in the device found below 10⁹ sub-harmonic, no further investigation required.

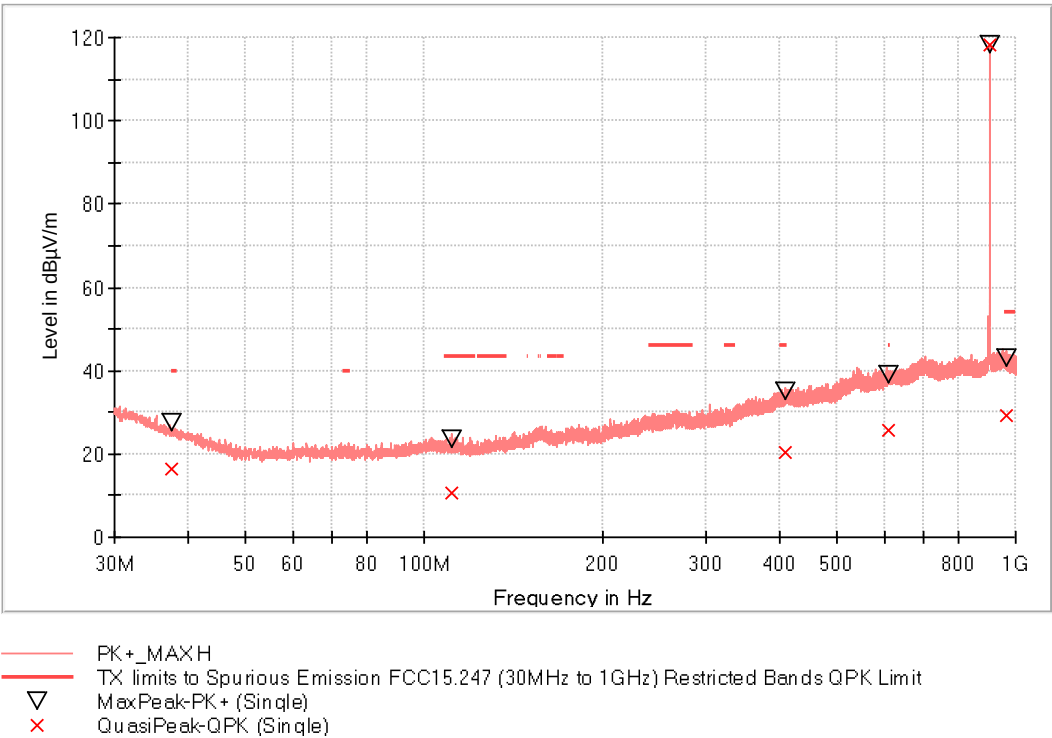
Frequency range 0.03 - 1 GHz

The spurious emissions below 1 GHz do not depend on the operating channel and modulation selected in the EUT.

Low Channel

Frequency MHz = 902.30000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [0.03, 1]

Images:

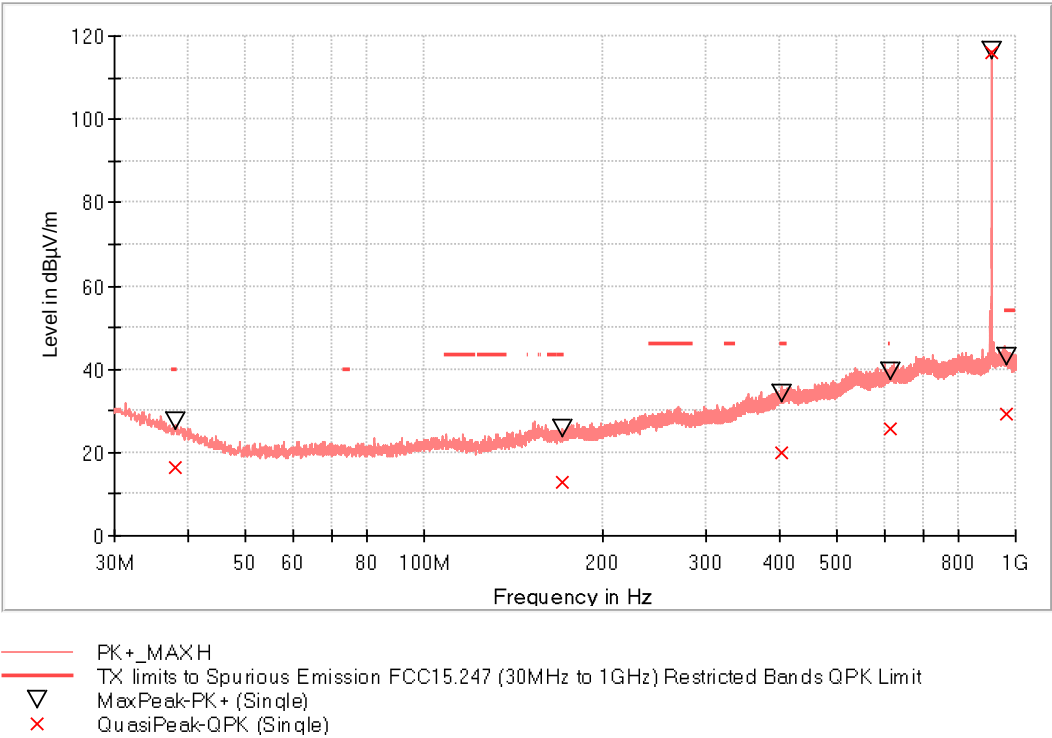


Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)	Comment
37.517500	27.4	16.6	H	23.4	40.0	
111.431500	23.3	10.8	H	32.8	43.5	
408.833500	35.1	20.5	V	25.5	46.0	
610.108500	39.1	25.5	V	20.5	46.0	
902.321000	118.3	118.2	H	---	---	Fundamental
962.218500	42.8	29.2	V	24.9	54.0	

Middle Channel

Frequency MHz = 908.50000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [0.03, 1]

Images:

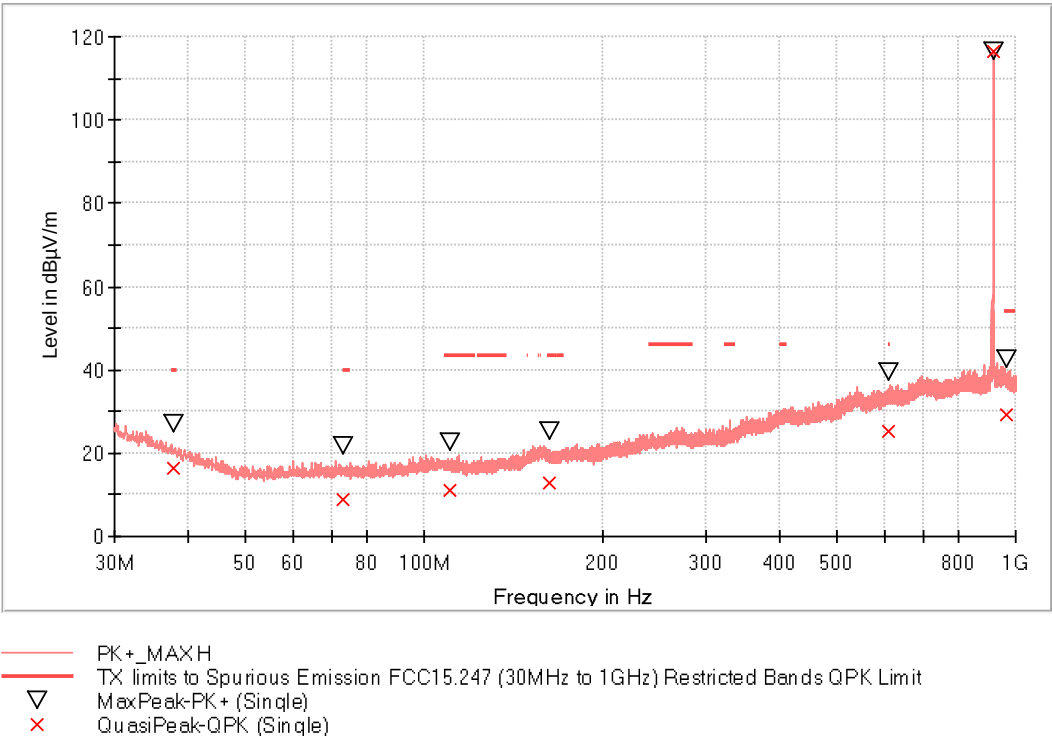


Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)	Comment
38.051000	27.3	16.2	V	23.8	40.0	
170.892500	25.8	13.0	H	30.5	43.5	
401.510000	34.2	20.1	V	26.0	46.0	
611.951500	39.6	25.5	V	20.5	46.0	
908.432000	116.3	116.2	H	---	---	Fundamental
967.359500	42.8	29.3	H	24.7	54.0	

High Channel

Frequency MHz = 914.90000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [0.03, 1]

Images:



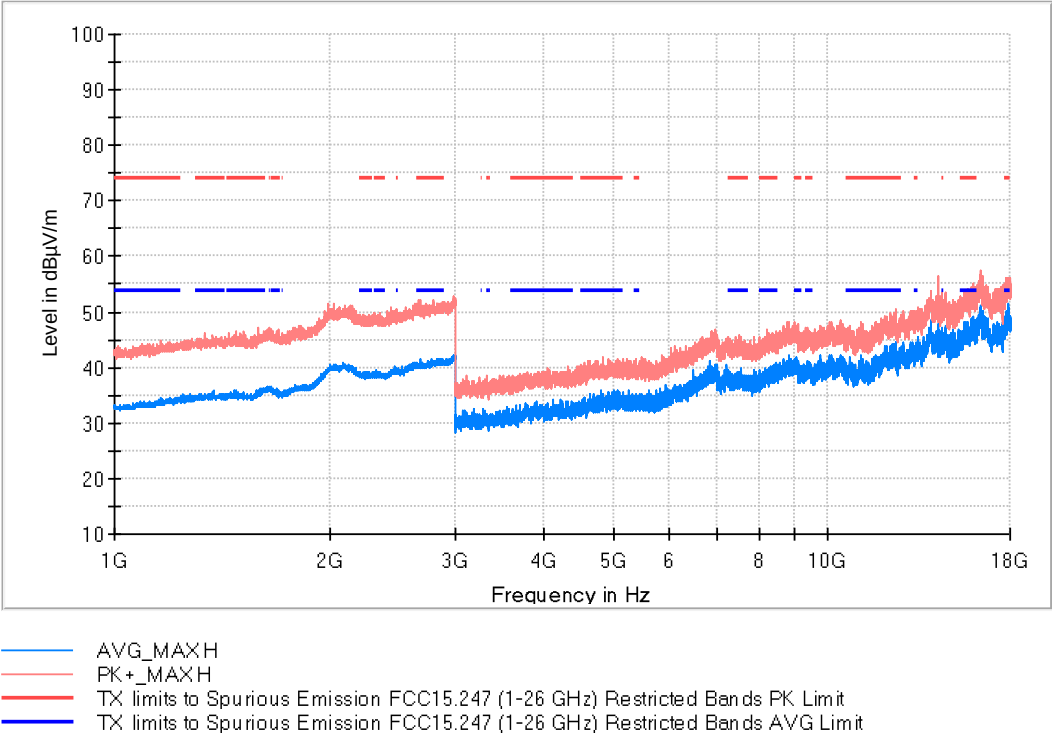
Frequency (MHz)	MaxPeak (dBµV/m)	QuasiPeak (dBµV/m)	Pol	Margin - QPK (dB)	Limit - QPK (dBµV/m)	Comment
37.808500	27.0	16.3	H	23.7	40.0	
73.116500	21.5	9.0	H	31.0	40.0	
110.655500	22.7	10.9	H	32.7	43.5	
162.453500	25.4	13.0	H	30.5	43.5	
611.515000	39.2	25.4	V	20.6	46.0	
914.882500	116.4	116.3	H	---	---	Fundamental
964.110000	42.4	29.1	H	24.9	54.0	

Frequency range 1 - 18 GHz

Lowest Channel

Frequency MHz = 902.30000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [1, 18]

Images:



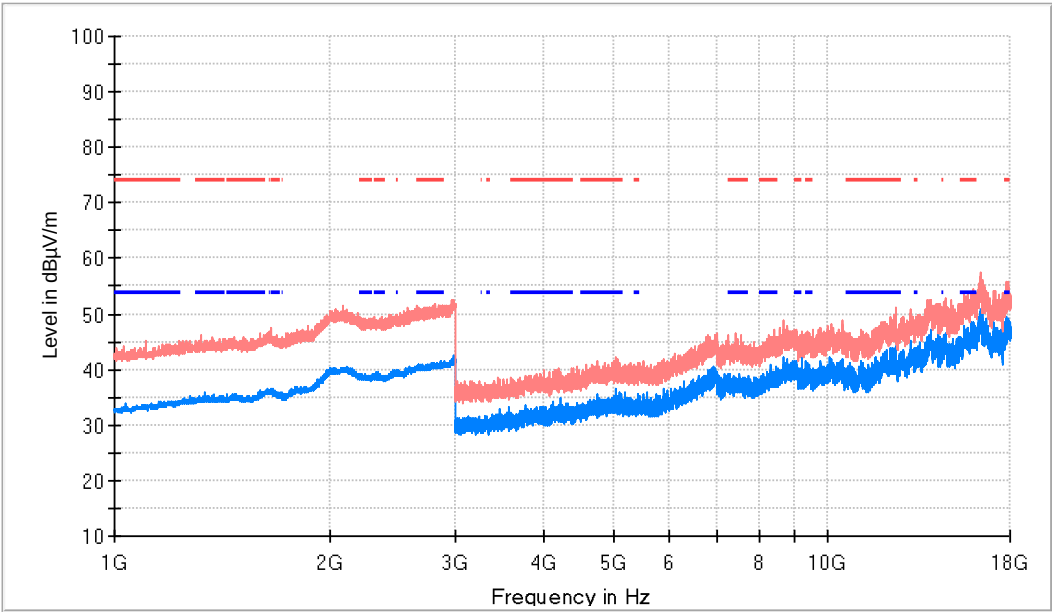
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2881.000000	49.9	41.5	V	12.5	54.0
15997.00000	53.0	49.2	V	4.8	54.0
17856.00000	54.5	51.4	H	2.6	54.0

Frequency range 1 - 18 GHz

Middle Channel

Frequency MHz = 908.50000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [1, 18]

Images:



— AVG_MAXH
— PK+_MAXH
— TX limits to Spurious Emission FCC15.247 (1-26 GHz) Restricted Bands PK Limit
— TX limits to Spurious Emission FCC15.247 (1-26 GHz) Restricted Bands AVG Limit

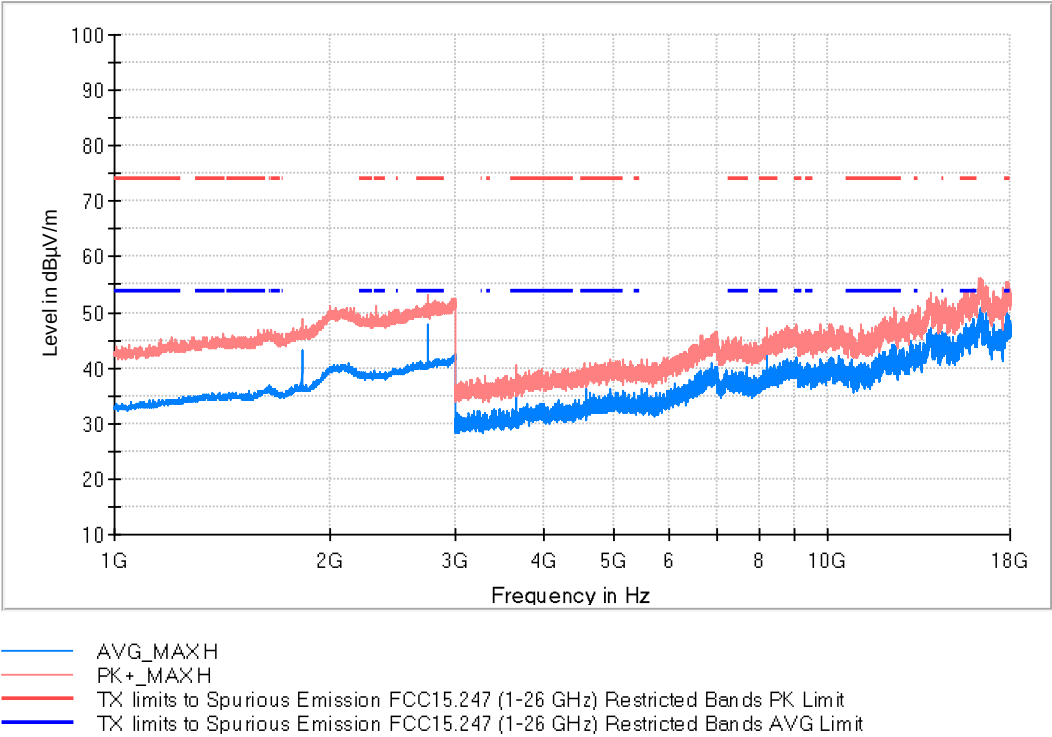
Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)
2857.50000	50.7	41.5	H	12.5	54.0
16011.0000	52.0	48.6	V	5.4	54.0
17785.0000	53.0	49.3	H	4.7	54.0

Frequency range 1 - 18 GHz

Highest Channel

Frequency MHz = 914.90000, Equipment Type = LORA 900 MHz, Frequency Range GHz = [1, 18]

Images:



Frequency (MHz)	PK+_MAXH (dBµV/m)	AVG_MAXH (dBµV/m)	Pol	Margin - AVG (dB)	Limit - AVG (dBµV/m)	Comment
1830.000000	48.4	43.3	H	---	---	2nd Harmonic
2745.000000	53.3	47.8	H	6.2	54.0	3rd Harmonic
16022.000000	52.5	48.9	H	5.1	54.0	
17788.000000	54.9	50.5	H	3.5	54.0	

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
30 MHz - 1 GHz	48.5 kHz	PK+	100 kHz	1 s

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time
1 GHz - 3 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s
3 GHz - 18 GHz	500 kHz	PK+ ; AVG	1 MHz	1 s