DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía,
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29507456

ISED CABid: ES1909
Lab. Company Number: 4621A

Test Report No:
78153RRF.001A1

Test Report
USA FCC Part 15.247, 15.209
CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Square Tracker Xtreme
(*) Trademark	Sensative AB
(*) Model and /or type reference	3307002
(*) Derived model not tested	3302002, 3303002, 3306002, 3310002, 3311002, 3312002, 3313002
Other identification of the product	FCC ID: 2AHIR-005 IC: 21254-005
(*) Features	Compact Indoor/Outdoor asset tracker, Air pressure sensor(enabling 3D positioning), Motion controlled HW version: R5 SW version: R12
Applicant	Sensative AB Mobilvägen 10 223 62 LUND, SWEDEN
Test method requested, standard	USA FCC Part 15.247 (10-1-23 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-23 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 3 (August 2023). CANADA RSS-Gen Issue 5 amendment 2 (February 2021). 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	IN COMPLIANCE
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456) Fecha: 2024.07.26 13:27:05 +02'00'
Date of issue	2024-07-26
Report template No	FDT08_25 (*) "Data provided by the client"

Index

Acronyms

Acronym ID	Acronym Description
Detector	Detector used
Equipment	Equipment Type
Freq	Frequency
Freq Rng	Frequency Range
MP	Measurement Point
Mod	Modulation
Mode	Mode
Pol	Polarization
Port	Active Port
Unwanted Freq	Unwanted Emissions Frequency
Unwanted Lvl	Unwanted Emissions Level

Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

DEKRA Testing and Certification S.A.U. is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification S.A.U. is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

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

DEKRA Testing and Certification S.A.U. 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 Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. 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.

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.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

The total uncertainty of the measurement system for the radiated emissions of EUT from 30 MHz to 1 GHz is: Measurement uncertainty ≤ ± 5,35 dB with factor (k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 1 GHz to 10 GHz is: Measurement uncertainty ≤ ± 4,32 dB with factor (k = 2).

The total uncertainty of the measurement system for the conducted testing of EUT is:
RF Peak Output Power: Measurement uncertainty ≤ ± 0,80 dB
RF Average Output Power: Measurement uncertainty ≤ ± 0,99 dB
Power Spectral Density: Measurement uncertainty ≤ ± 0,99 dB
6dB Bandwidth: Measurement uncertainty ≤ ± 2,84 %
Occupied Channel Bandwidth: Measurement uncertainty ≤ ± 1,17 %
Conducted Band-edge spurious emissions: Measurement uncertainty ≤ ± 1,76 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 a compact Indoor/Outdoor asset tracker, Air pressure sensor (enabling 3D positioning), Motion controlled.

3. Derived models not tested. These models have been declared by the supplier of the sample as being the same as the model under test.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results. The laboratory is not responsible for such information and it is not covered by accreditation.

SENSATIVE	Sensative Confidential	Page 1(1)
Prepared by: Dhiraj Paryani	Document number:	Revision: A
Approved by:	Date: 2024-01-18	Remarks:

Sensative AB
Mobilvägen 10, 223 62 Lund, Sweden

Product Similarity Declaration

Date: January 12th, 2024

FCC ID: 2AHIR-005

Model Numbers: *3302002, 3303002, 3306002, 3307002, 3310002, 3311002, 3312002, 3313002*

To Whom It May Concern,

We, Sensative AB, hereby declare that our product (Square LoRa Sensors) Model Number: 3302002, 3303002, 3306002, 3307002, 3310002, 3311002, 3312002, 3313002 board, Schematic, Hardware version, Software version, structure and internal photos are same, named differently due to marketing purposes.

Should you have any questions or comments regarding this matter, please have my best attention.

Sincerely,

Name / Title: Mats Pettersson / CTO
Company: Sensative AB
Address: Mobilvägen 10, 223 62 Lund, Sweden
Tel: +46 70 510 03 84
E-Mail: Mats.Pettersson@sensative.com

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial Nº	Date of Reception	Application
S/01	78153C_4	Square Xtreme Tracker	3307002	104605044	2024-02-08	Element Under Test
S/02	78153C_2	Square Xtreme Tracker	3307002	104605444	2024-02-08	Element Under Test
S/01 & S/02	78153C_1	Mobile Handset	SMA14P	35211713871877	2024-02-08	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Samples used for conducted tests
S/02	Samples used for radiated tests

Test sample description

<table>
<tr><td rowspan="2">Ports…… :</td><td rowspan="2">Port name and description</td><td colspan="4">Cable</td></tr>
<tr><td>Specified max length [m]</td><td>Attached during test</td><td>Shielded</td><td>Coupled to patient(3)</td></tr>
<tr><td></td><td>.....</td><td>.....</td><td>[ ]</td><td>[ ]</td><td>[ ]</td></tr>
<tr><td>Supplementary information to the ports…… :</td><td colspan="5">No External Cable connection</td></tr>
<tr><td rowspan="4">Rated power supply .....:</td><td colspan="2" rowspan="2">Voltage and Frequency</td><td colspan="4">Reference poles</td></tr>
<tr><td>L1</td><td>L2</td><td>L3</td><td>N</td><td>PE</td></tr>
<tr><td>[ ]</td><td>AC: .....</td><td>[ ]</td><td>[ ]</td><td>[ ]</td><td>[ ]</td><td>[ ]</td></tr>
<tr><td>[X]</td><td colspan="5">DC: 3.0v Built-in LiMnO2 battery</td></tr>
<tr><td>Rated Power .....:</td><td colspan="6">.....</td></tr>
<tr><td>Clock frequencies.....:</td><td colspan="6">32KHz, 32MHz</td></tr>
<tr><td>Other parameters .....:</td><td colspan="6">.....</td></tr>
<tr><td>Software version .....:</td><td colspan="6">R12</td></tr>
<tr><td>Hardware version .....:</td><td colspan="6">R5</td></tr>
<tr><td>Dimensions in cm (W x H x D) ....:</td><td colspan="6">60 x 60 x 13 mm</td></tr>
<tr><td rowspan="5">Mounting position .....:</td><td>[ ]</td><td colspan="5">Table top equipment</td></tr>
<tr><td>[ ]</td><td colspan="5">Wall/Ceiling mounted equipment</td></tr>
<tr><td>[ ]</td><td colspan="5">Floor standing equipment</td></tr>
<tr><td>[ ]</td><td colspan="5">Hand-held equipment</td></tr>
<tr><td>[X]</td><td colspan="5">Other: Movable Assets</td></tr>
<tr><td rowspan="2">Modules/parts.....:</td><td colspan="3">Module/parts of test item</td><td>Type</td><td>Manufacturer</td></tr>
<tr><td colspan="3">.....</td><td>.....</td><td>.....</td></tr>
<tr><td rowspan="2">Accessories (not part of the test item) .....:</td><td colspan="3">Description</td><td>Type</td><td>Manufacturer</td></tr>
<tr><td colspan="3">.....</td><td>.....</td><td>.....</td></tr>
<tr><td rowspan="4">Documents as provided by the applicant.....:</td><td colspan="3">Description</td><td>File name</td><td>Issue date</td></tr>
<tr><td colspan="3">Technical description Square LoRa family Rev B</td><td>Technical... pdf</td><td>2024-02-01</td></tr>
<tr><td colspan="3">Square LoRa family - Product Similarity Declaration...</td><td>.....</td><td>2024-01-18</td></tr>
<tr><td colspan="3">.....</td><td>.....</td><td>.....</td></tr>
</table>

(3) Only for Medical Equipment

Identification of the client

Sensative AB
Mobilvägen 10, 223 62 LUND, SWEDEN

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2024-02-20
Date (finish)	2024-05-10

Document history

Report number	Date	Description
78153RRF.001	2024-05-24	First release.
78153RRF.001A1	2024-07-26	Second release. It is modified due to some minor typos. This modification test report cancels and replaces the test report 78153RRF.001

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Sergio Carrasco and Rafael Fernández.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
06791	SEMIANECHOIC ABSORBER LINED CHAMBER IV	FACT 3 200 STP	ETS LINDGREN	N/A
06792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
06609	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2025-04-22
06615	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2025-04-04
06143	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2027-01-22
06144	PRE-AMPLIFIER G>40dB 10MHz-6GHz	BLNA 0160-01N	BONN ELEKTRONIK	2024-07-25
06165	EMI TEST RECEIVER 9kHz-7GHz	ESR7	ROHDE AND SCHWARZ	2025-12-27
06496	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK	2026-12-01
03783	PRE-AMPLIFIER G>30dB 1GHz-18GHz	BLMA 0118-3A	BONN ELEKTRONIK	2025-03-15
04716	SIGNAL AND SPECTRUM ANALYZER 2Hz-50GHz	FSW50	ROHDE AND SCHWARZ	2024-08-12
04848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A
06793	SHIELDED ROOM	S101	ETS LINDGREN	N/A
06611	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2025-04-04
06668	SIGNAL AND SPECTRUM ANALYZER 10Hz-40GHz	FSV40	ROHDE AND SCHWARZ	2024-12-14
00922	POWER SUPPLY DC 40 V / 40 A	NGPE 40/40	ROHDE AND SCHWARZ	N/A
07760	DIGITAL MULTIMETER	175	FLUKE	2024-11-08

Testing verdicts

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

Summary

Appendix A: LoRa US 902-928 MHz.

FCC PART 15 PARAGRAPH/ RSS-247			
Requirement – Test case		**Verdict**	**Remark**
FCC 15.247 (a)(1) / RSS-247 5.1 (b)	20 dB Bandwidth and Carrier frequency separation	P	
FCC 15.247 (a)(1)(i) / RSS-247 5.1 (c)	Number of hopping channels	P	
FCC 15.247 (f) / RSS-247 5.3 (a)	Time of occupancy (Dwell Time)	P	
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	P	
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	P	
FCC 15.247 (f) / RSS-247 5.3. (b)	Power spectral density for hybrid systems	P	
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
Supplementary information and remarks: Note: Equipment classified as hybrid system.			

Appendix A: Test results. LoRa US 902-928 MHz

INDEX

TEST CONDITIONS

(*): Data provided by the client.

POWER SUPPLY (*):

Vnominal:	3 Vdc
Type of Power Supply:	Built-in LiMnO2 battery.

ANTENNA (*):

Type of Antenna:	Omnidirectional external antenna.
Maximum Declared External Antenna Gain:	+1.7 dBi

TEST FREQUENCIES (*):

Modulation	Low Channel:	Middle Channel	High Channel
LoRa US 902-928 MHz	902.3 MHz	908.7 MHz	914.9 MHz

During transmitter test the EUT was controlled by a SW tool provided by the client to operate in a continuous transmit mode on the modulation schemes and test channels as required.

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the spectrum analyzer using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.

RADIATED MEASUREMENTS:

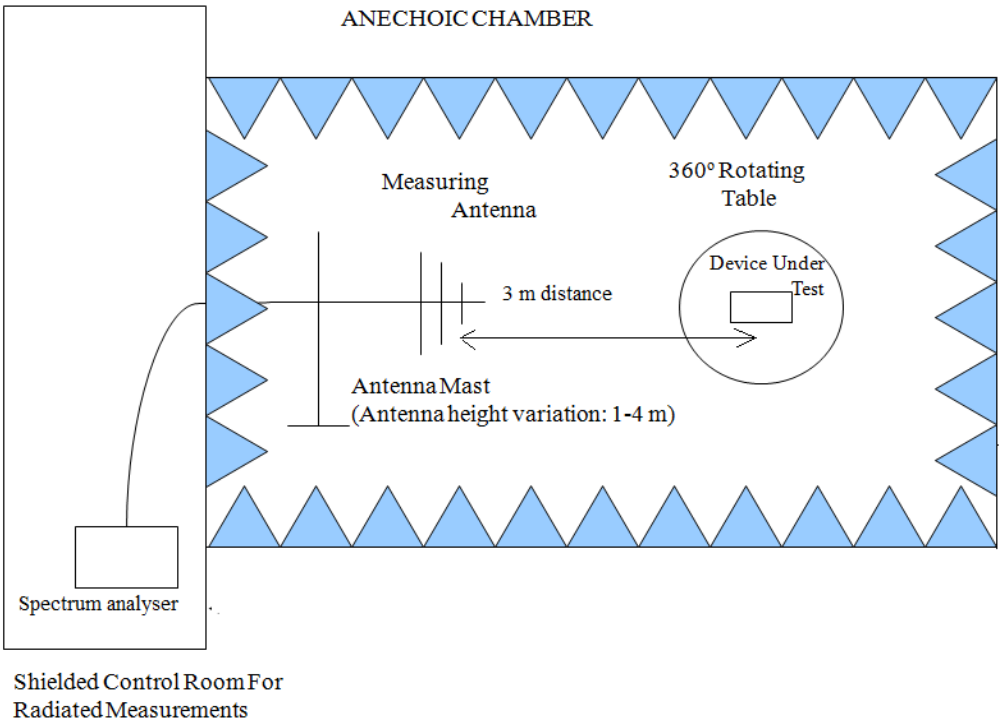
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-10 GHz Double ridge horn antenna) is situated at a distance of 3 m.

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 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

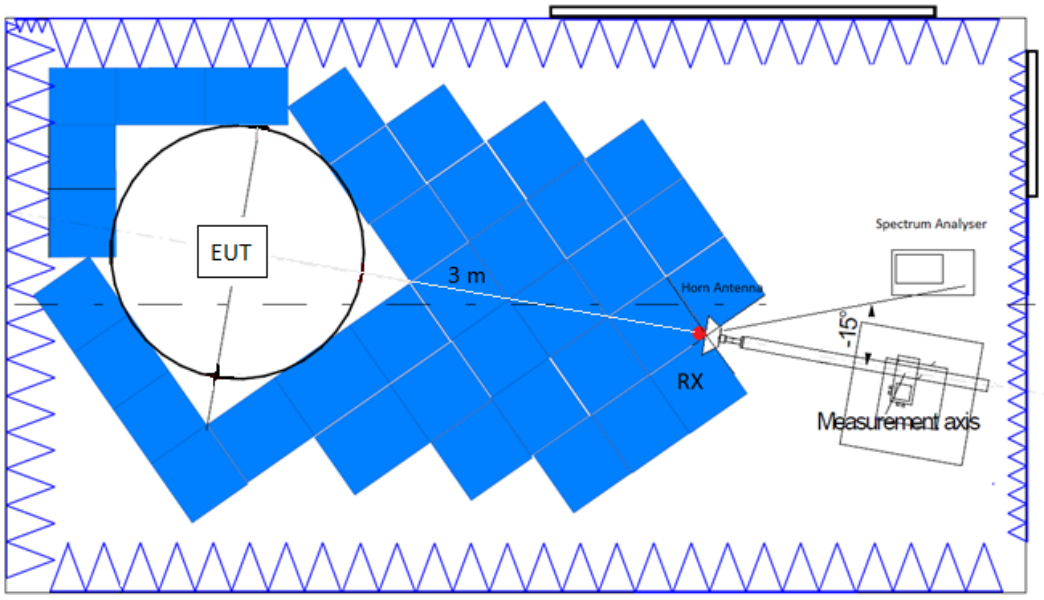
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 10 GHz:



Occupied Channel Bandwidth 99%

Limits

* RSS-Gen Clause 6.7:

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.

The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Modulation: LoRa

Results

Freq (MHz)	Occ Ch BW (kHz)	-26 dBc bandwidth (kHz)
902.30	130.11	161.9456
908.70	129.99	163.1822
914.90	130.02	165.4695

Verdict

Pass

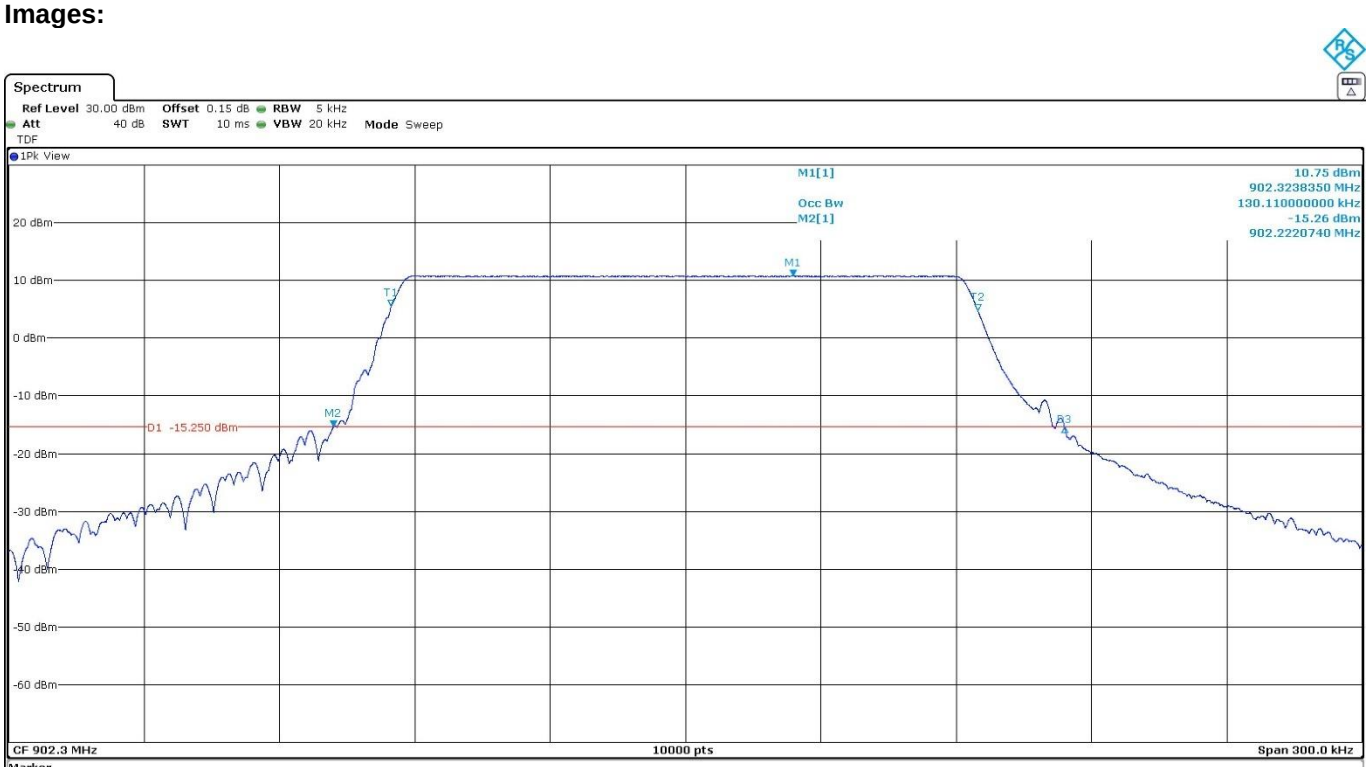
Attachments

Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 902.3

Mode = SISO Active Port = 1

Images:



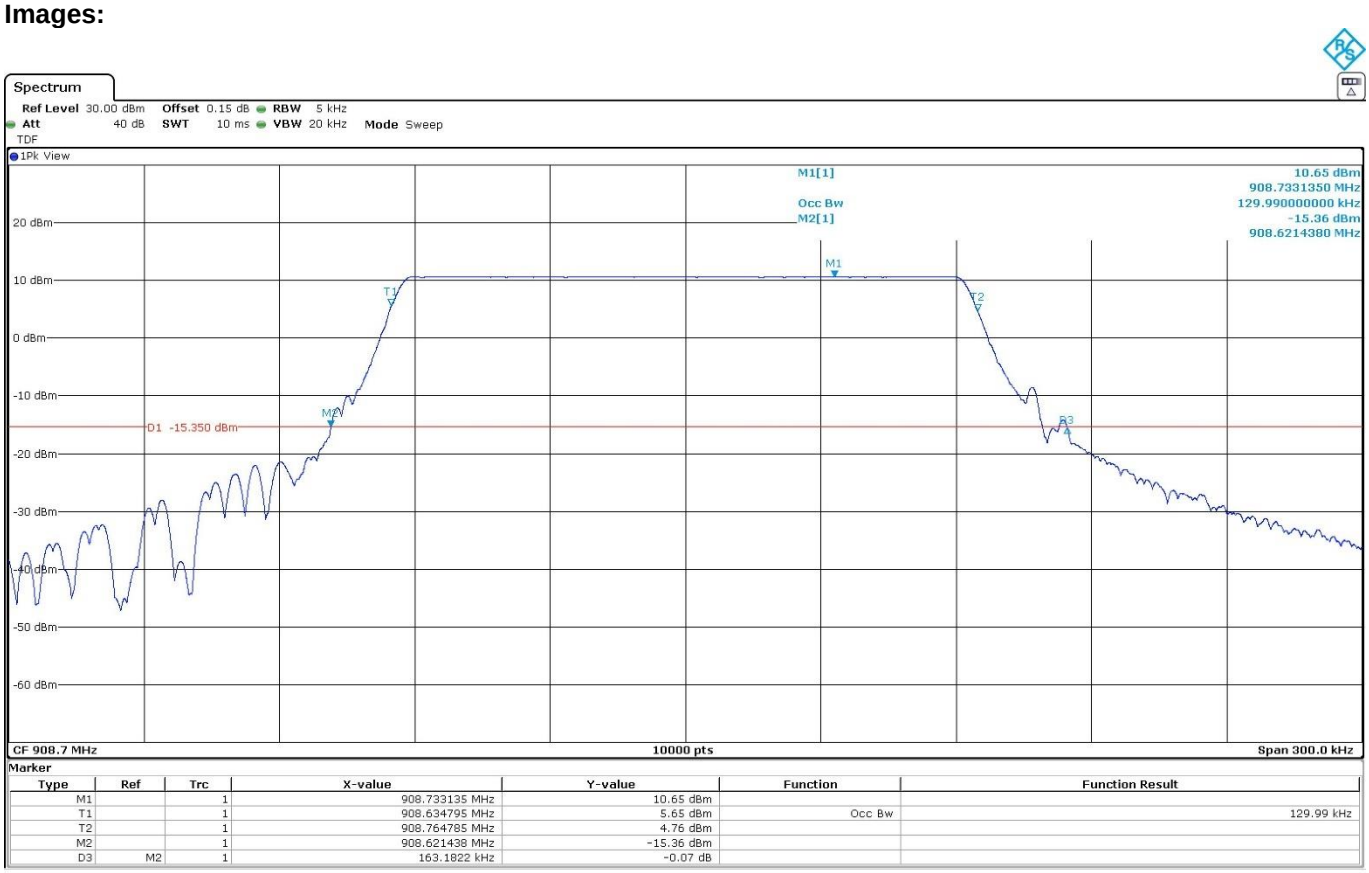
Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	902.323835 MHz	10.75 dBm		
T1		1	902.234735 MHz	5.54 dBm	Occ Bw	130.11 kHz
T2		1	902.364845 MHz	4.76 dBm		
M2		1	902.222074 MHz	-15.26 dBm		
D3	M2	1	161.9456 kHz	-0.08 dB		

Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 908.7

Mode = SISO Active Port = 1

Images:

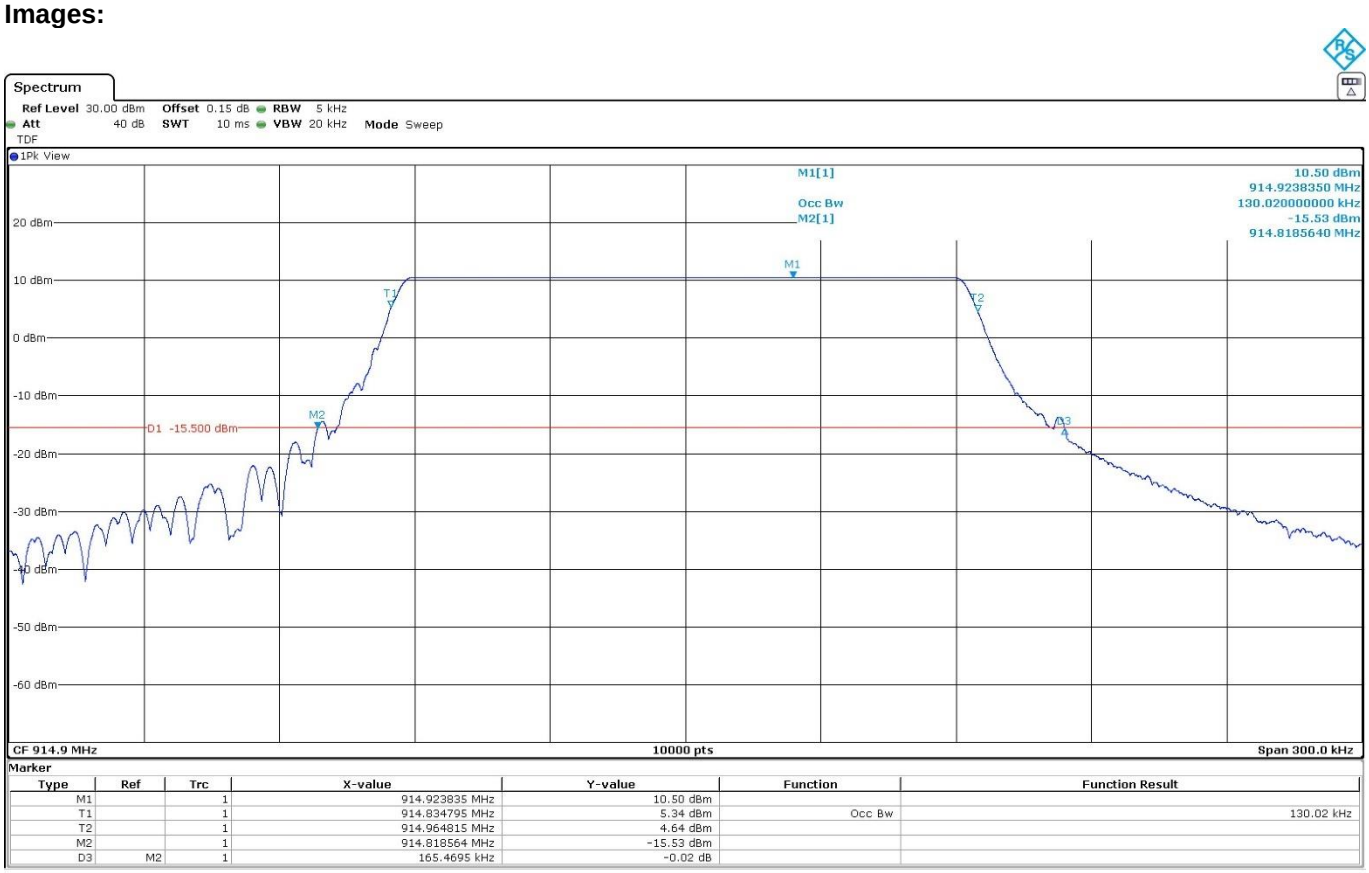


Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 914.9

Mode = SISO Active Port = 1

Images:



Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	914.923835 MHz	10.50 dBm		
T1		1	914.834795 MHz	5.34 dBm	Occ Bw	130.02 kHz
T2		1	914.964815 MHz	4.64 dBm		
M2		1	914.818564 MHz	-15.53 dBm		
D3	M2	1	165.4695 kHz	-0.02 dB		

FCC 15.247 (a)(1) / RSS-247 5.1 (b) 20 dB Bandwidth and Carrier frequency separation

Limits

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

Results

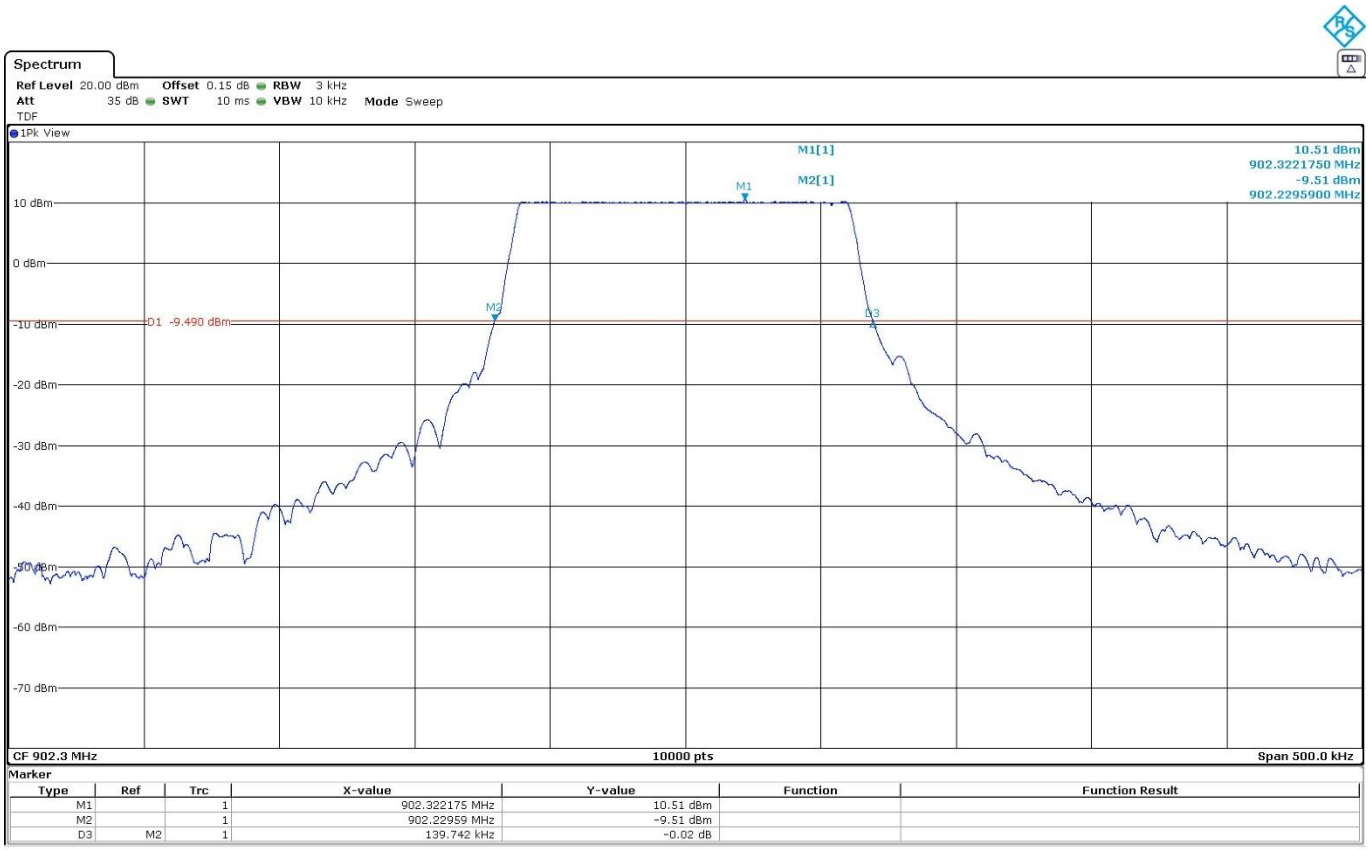
Freq (MHz)	20 dB Spectrum bandwidth (kHz) (kHz)
902.30	139.742
908.70	139.092
914.90	139.469

Verdict

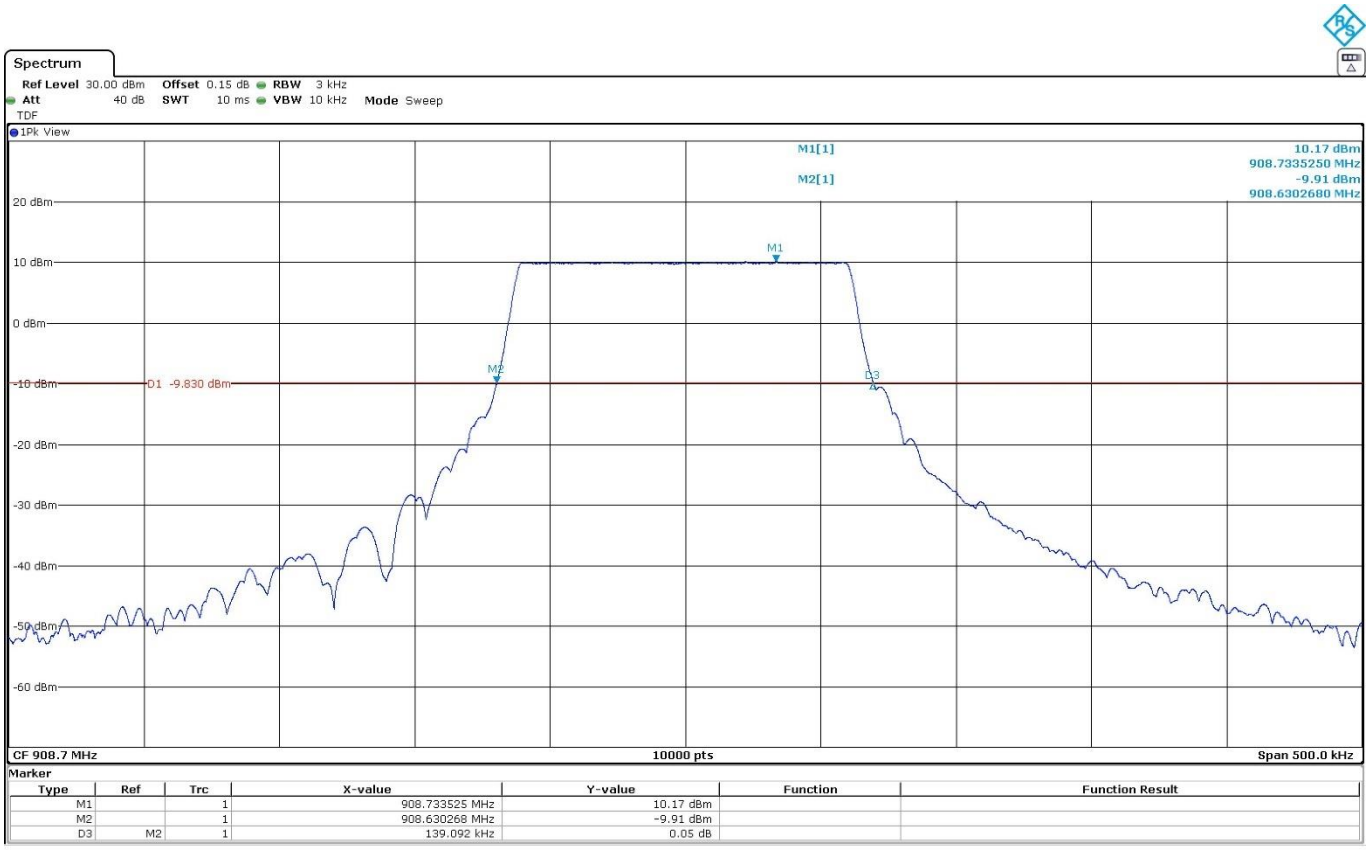
Pass

Attachments

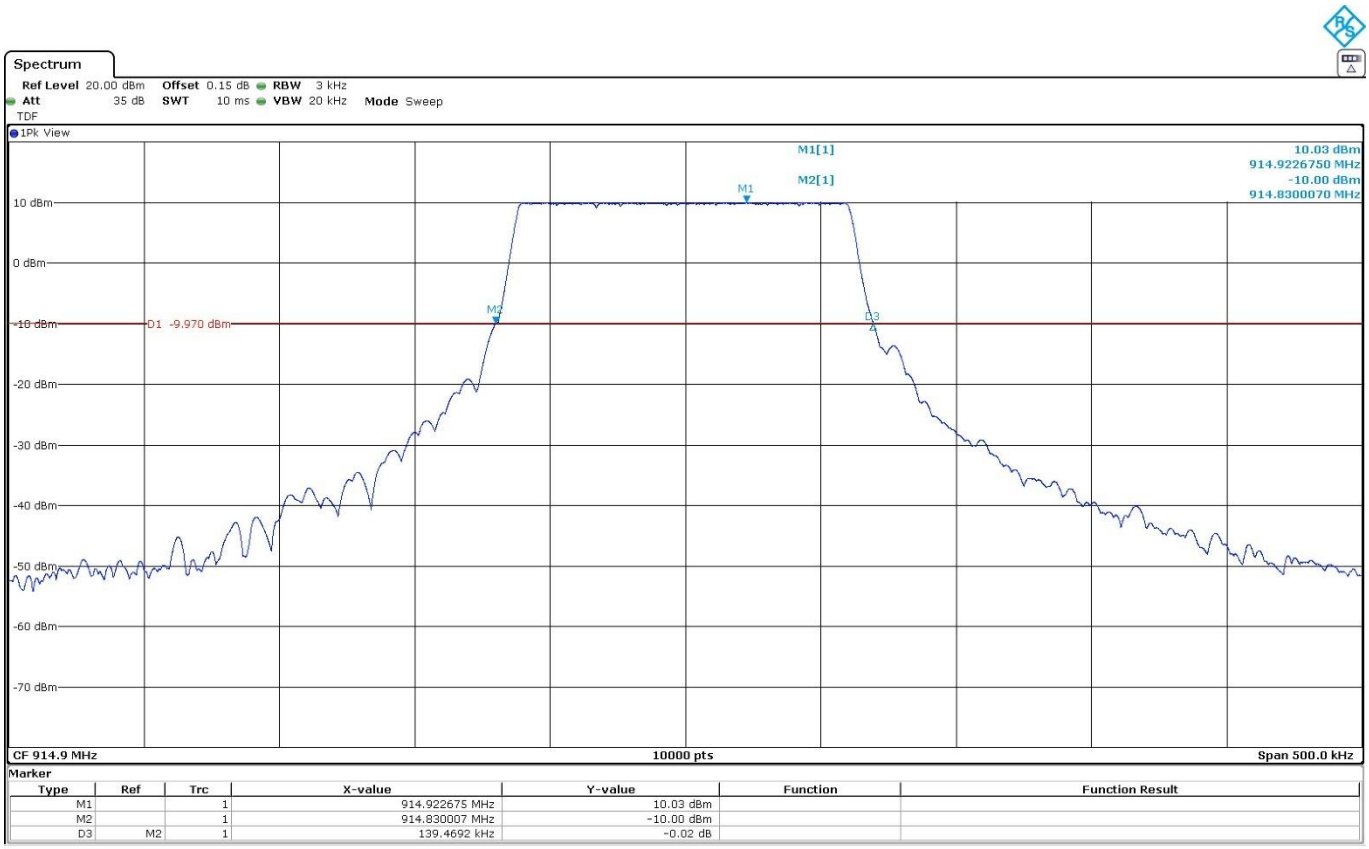
- Low Channel:



- Middle Channel:

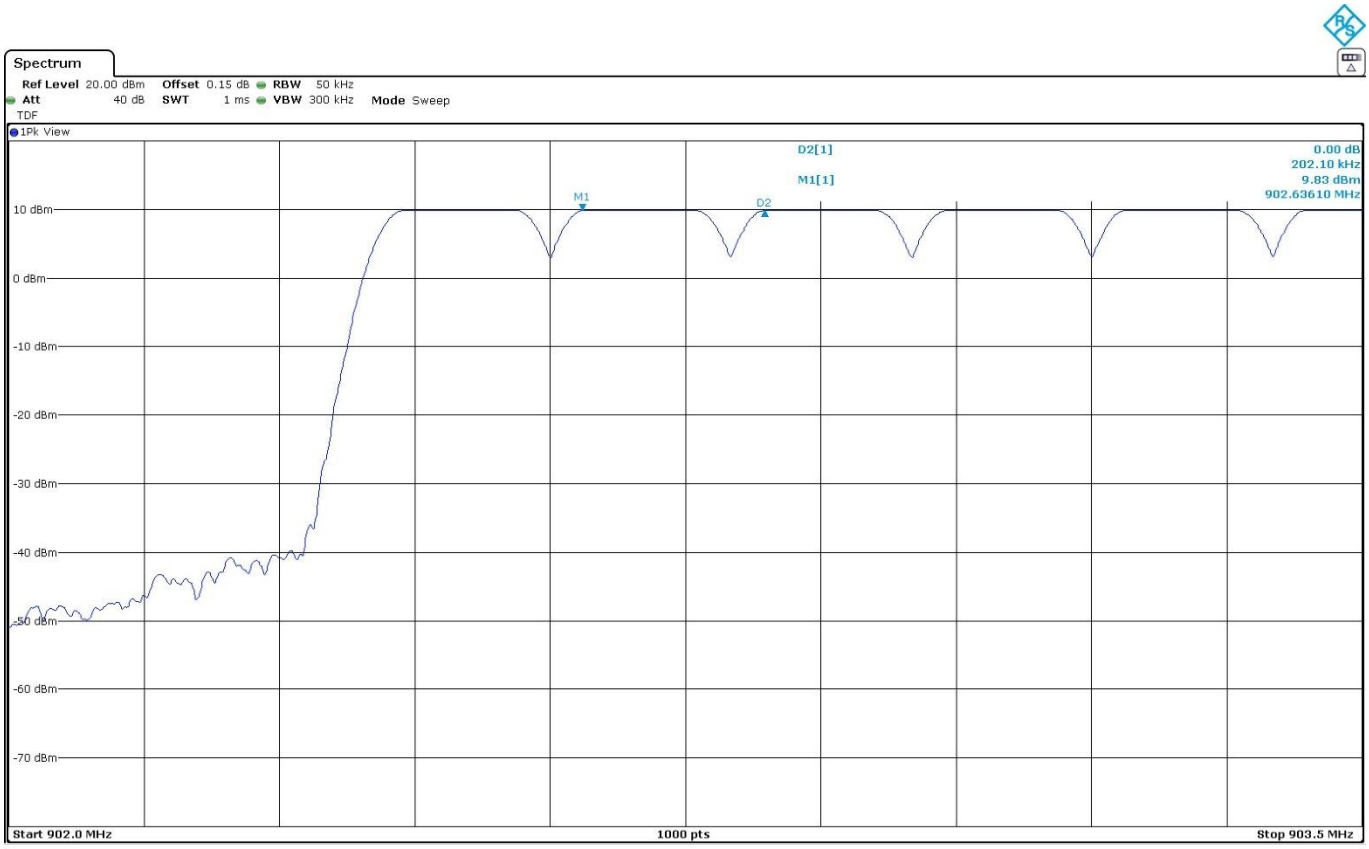


- High Channel:



Carrier frequency separation:

202.10 kHz



The hopping-channel carrier frequencies are separated by a minimum of the 20 dB bandwidth of the hopping channel.

Verdict

Pass

FCC 15.247 (f) / RSS-247 5.3 (a) Time of occupancy (Dwell Time) for hybrid systems

Limits

Hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4.

Results

Operation as a frequency hopping system using 64 hopping channels:

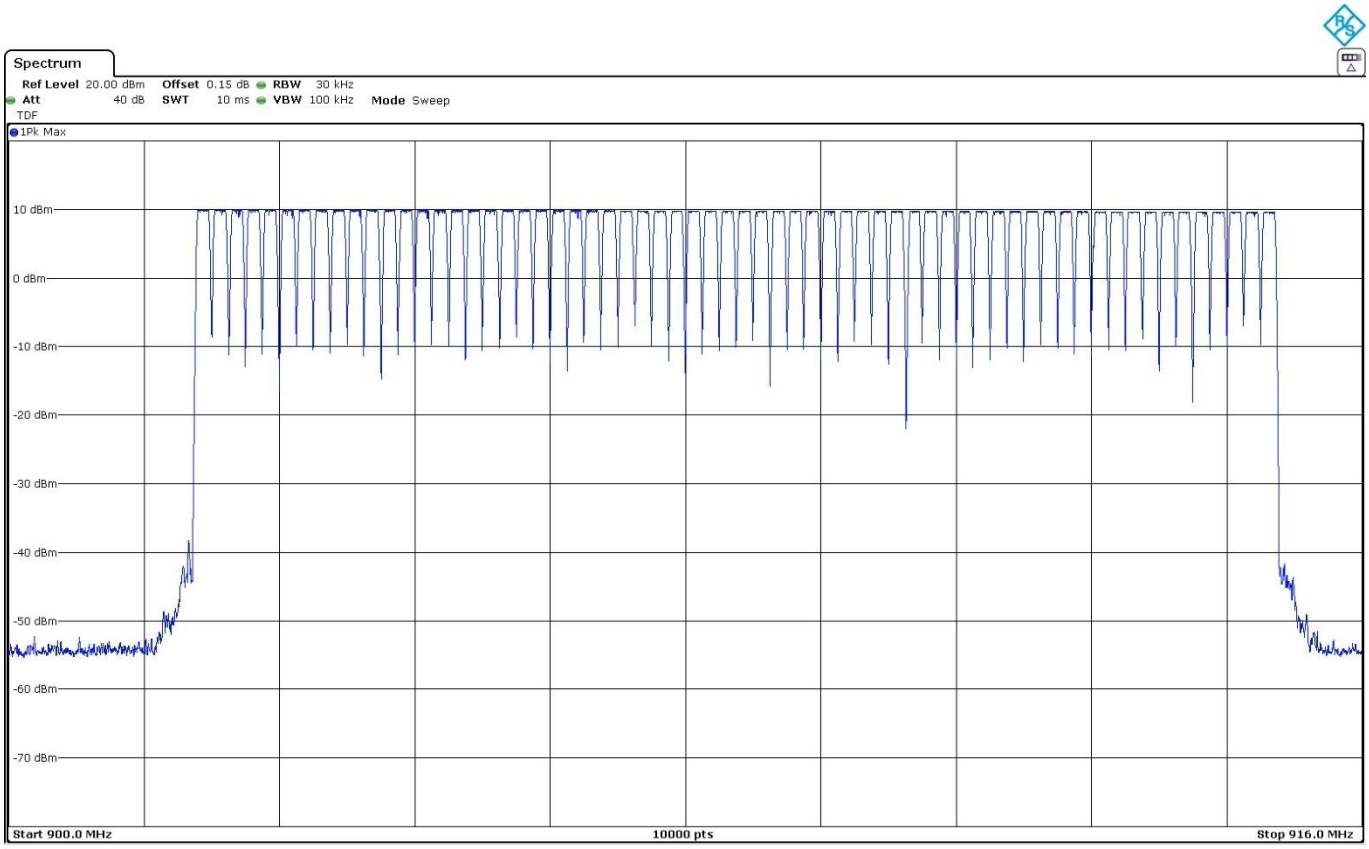
- Time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4:

  64 hopping channels × 0.4 s = 25.6 s

  Measurement is performed over a period of 0.6 seconds (worst case).

- TX time per hop: 247.393 ms (see next plots)

- Number of hops over a period of 0.6 s: 1 (see next plots)



- **Average Time of Occupancy** = 247.393 ms × 64 hops = 15.83 s per 25.6 s.

  Average Time of Occupancy is less than 25.6 s per time period in seconds equal to the number of hopping frequencies employed (64) multiplied by 0.4.

Verdict

Pass

RSS-247 5.3 (b) / FCC 15.247 (f) Power spectral density for hybrid systems

Limits

Hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques.

The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

Modulation: LoRa

Results

The maximum power spectral density level was measured using the method AVGPSD-2 according to clause 11.10.5 (trace averaging across ON and OFF times of the EUT transmissions, followed by duty cycle correction) of ANSI C.63.10-2013.

Measured Duty Cycle: x = 0.344025175
Duty Cycle Correction: 10×log (1/x) = 4.634

Freq (MHz)	AVG PSD (dBm)	PSD with duty cycle correction (dBm)
902.30	0.54	5.174
908.70	1.39	6.024
914.90	1.35	5.984

Verdict

Pass

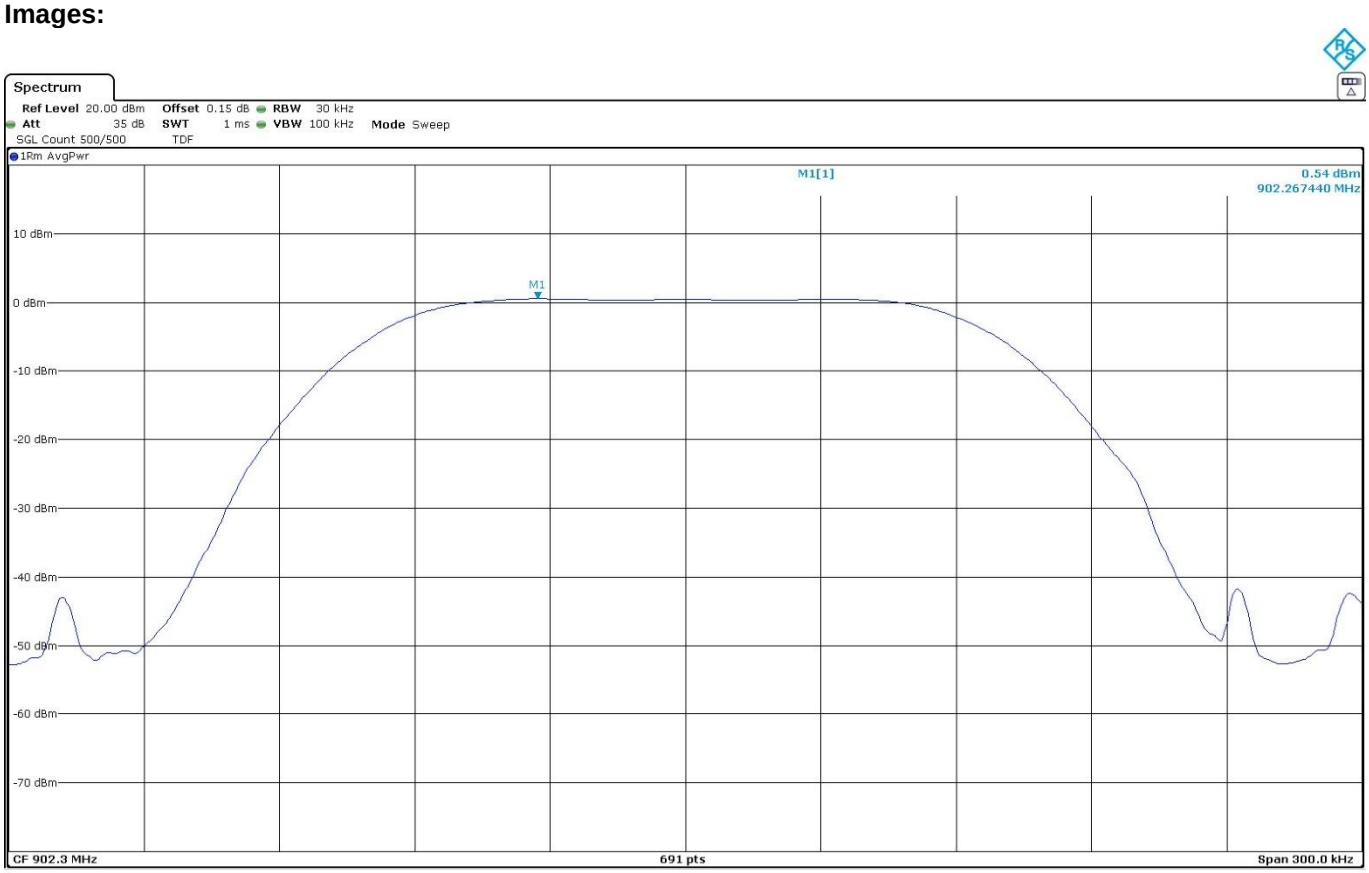
Attachments

Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 902.3

Mode = SISO Active Port = 1

Images:

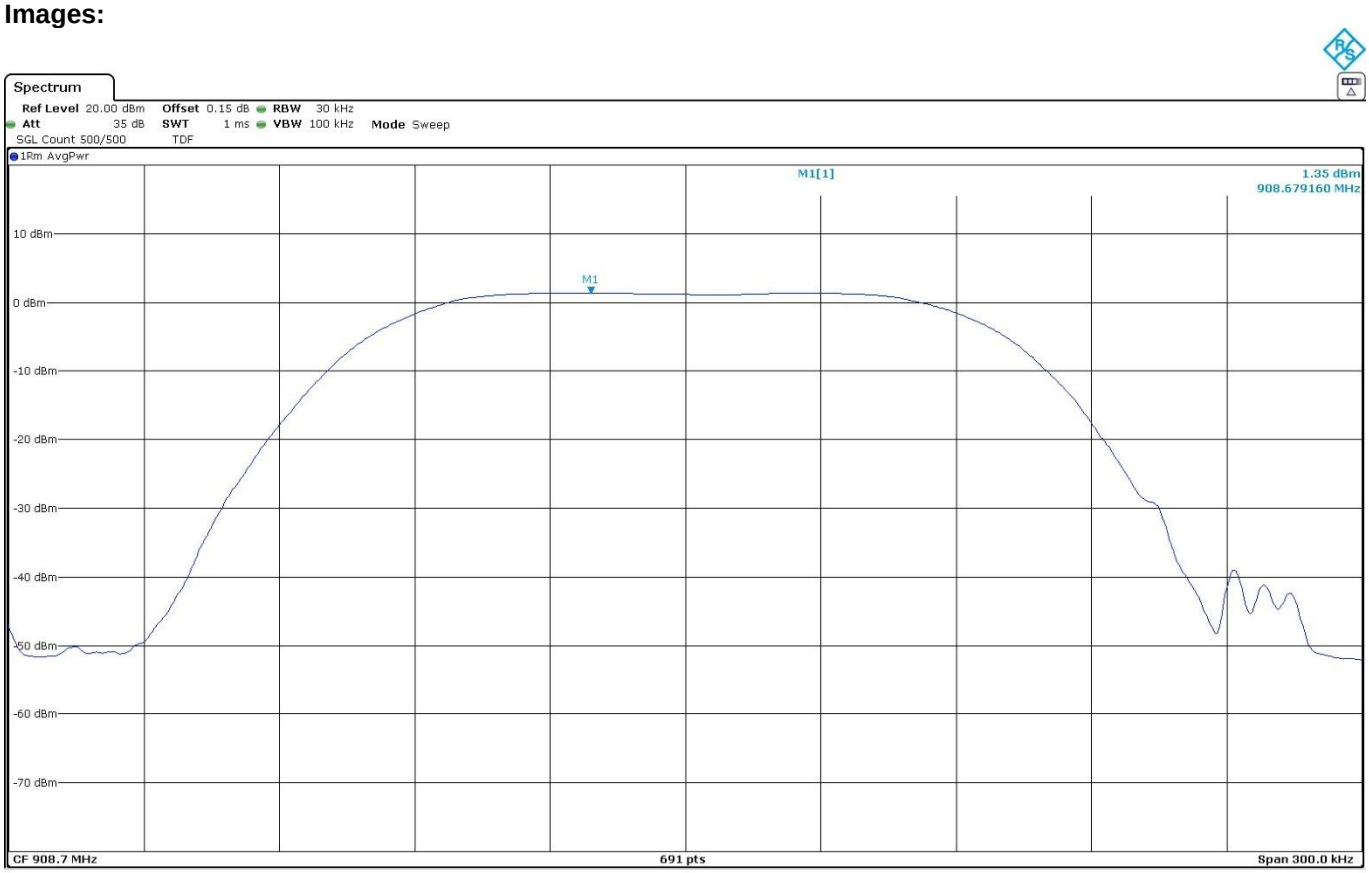


Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 908.7

Mode = SISO Active Port = 1

Images:

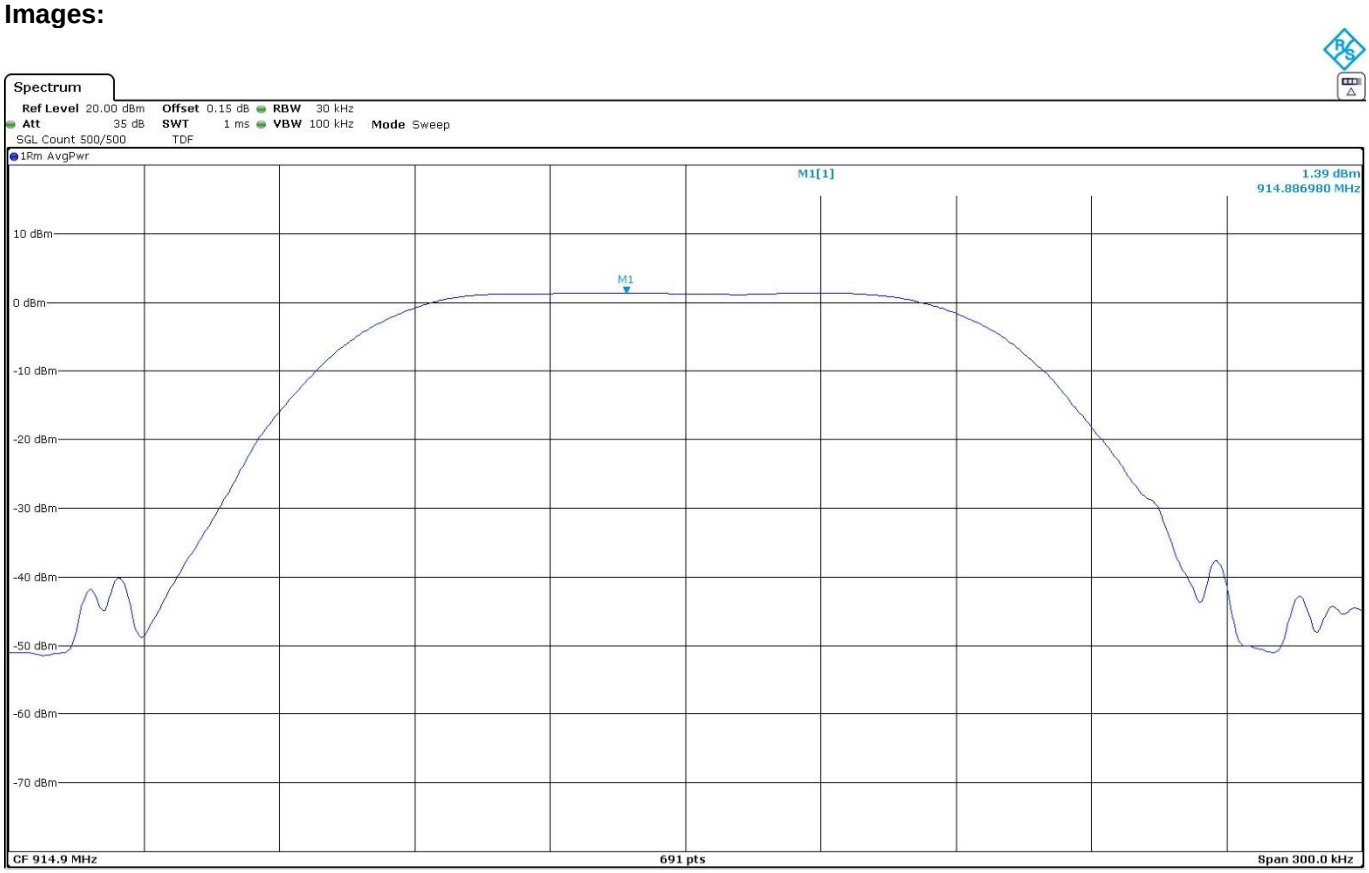


Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 914.9

Mode = SISO Active Port = 1

Images:



RSS-247 5.4 (d) / FCC 15.247 (b) (3) Maximum output power and antenna gain for hybrid systems

Limits

* FCC 15.247:
For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels. Hybrid systems shall comply with the 1 W limit.

* RSS-247:
For FHSS operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hop set uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hop set uses less than 50 hopping channels.
As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power.

Modulation: LoRa

Results

The maximum conducted (average) output power was measured using the method AVGSA-2 according to clause 11.9.2.2.4 (trace averaging across ON and OFF times of the EUT transmissions, followed by duty cycle correction) of ANSI C.63.10-2013.

The e.i.r.p. power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: +1.7 dBi

Measured Duty Cycle: x = 0.344025175
Duty Cycle Correction: 10×log (1/x) = 4.634097756

The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Freq (MHz)	AVG Power (dBm)	Power with ducy cycle correction (dBm)	E.I.R.P. (dBm)
902.30	6.47	11.10	12.80
908.70	6.18	10.81	12.51
914.90	5.77	10.40	12.10

Verdict

Pass

Maximum Average Output Power:

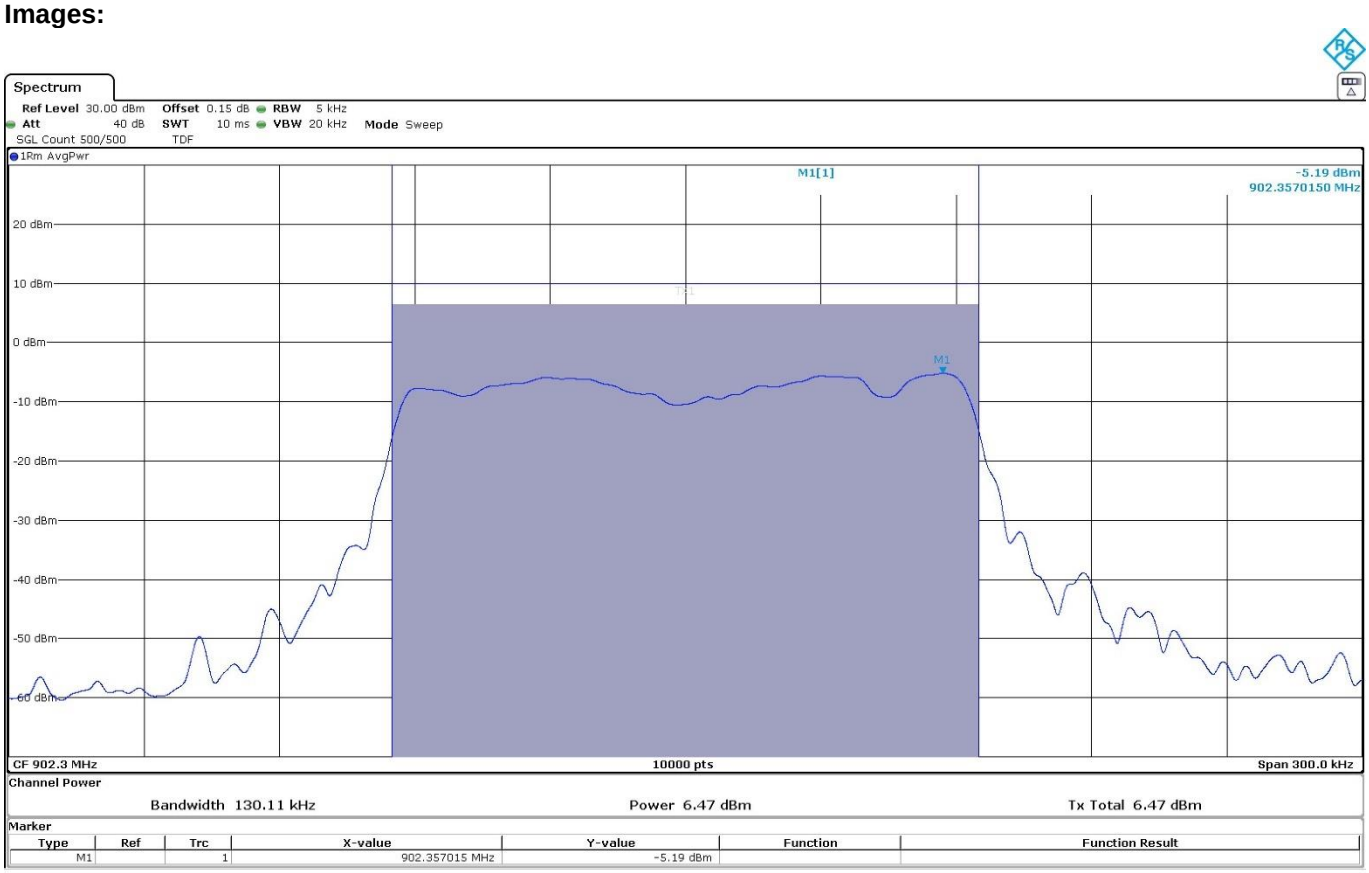
Attachments

Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 902.3

Mode = SISO Active Port = 1

Images:

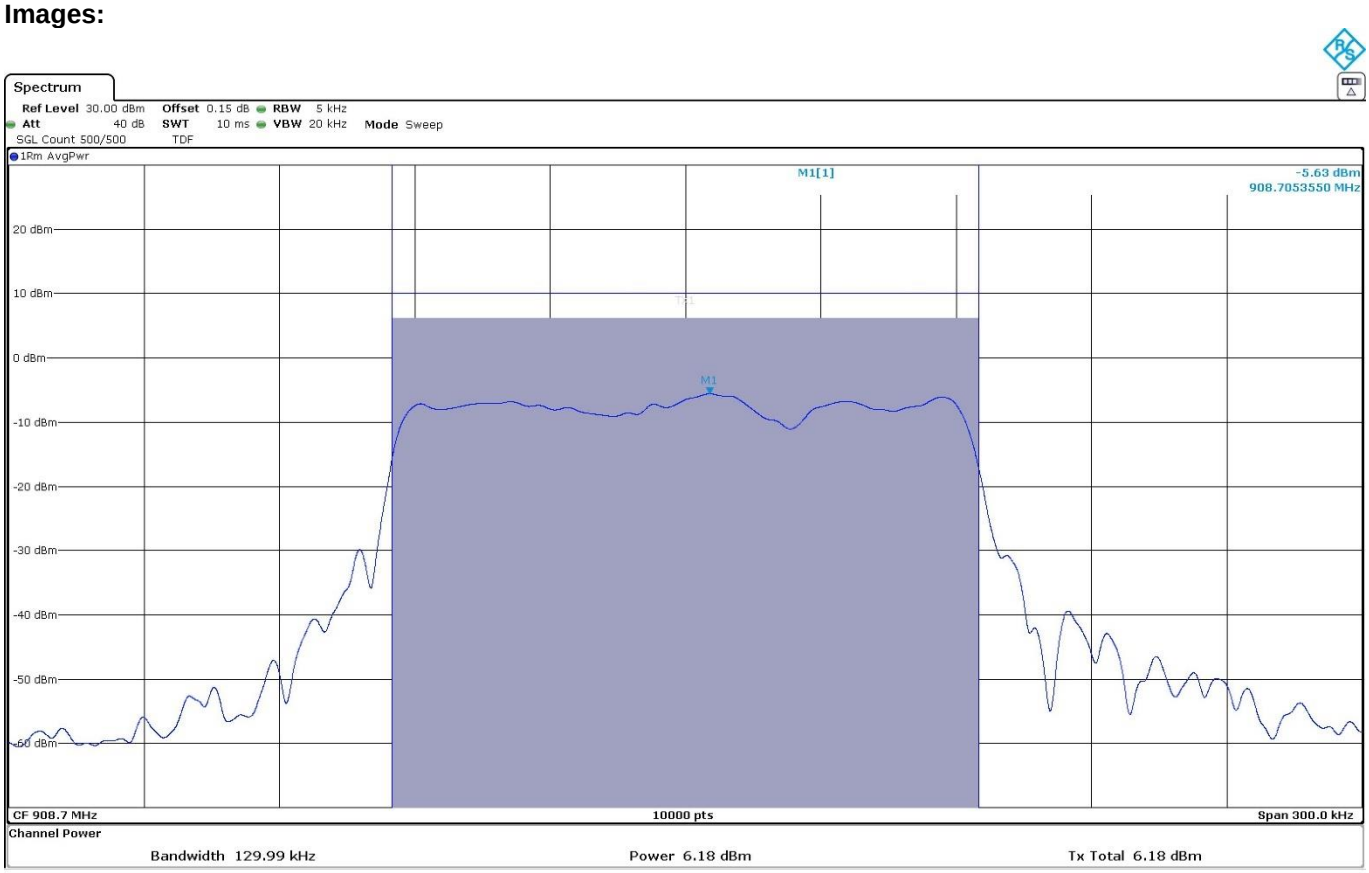


Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 908.7

Mode = SISO Active Port = 1

Images:

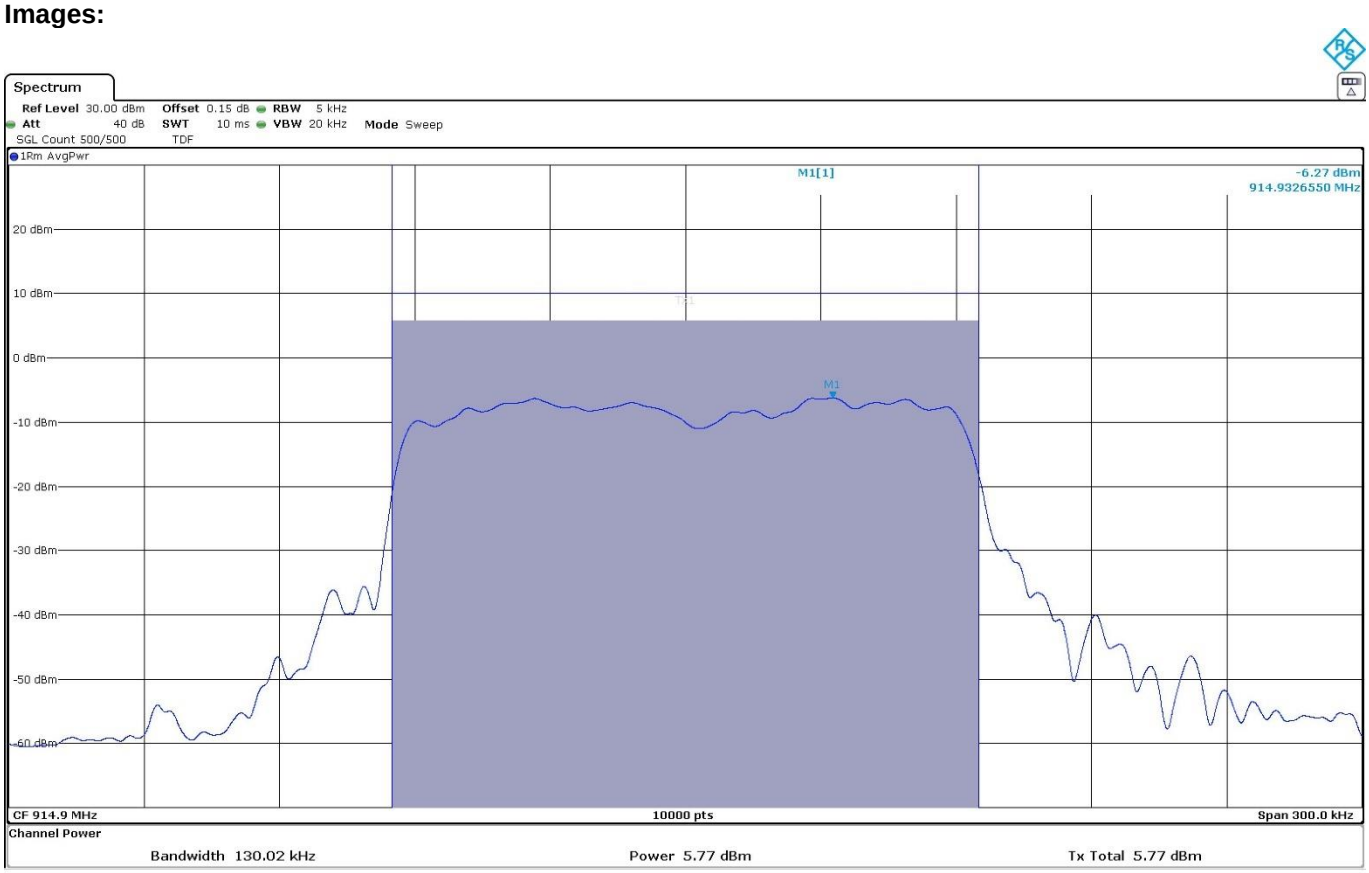


Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 914.9

Mode = SISO Active Port = 1

Images:



RSS-247 5.5 / FCC 15.247 (d) Band-edge emissions compliance (Transmitter)

Limits

In any 100 kHz bandwidths outside the frequency band in which the 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, provided the transmitter demonstrates compliance with the peak conducted power limits.

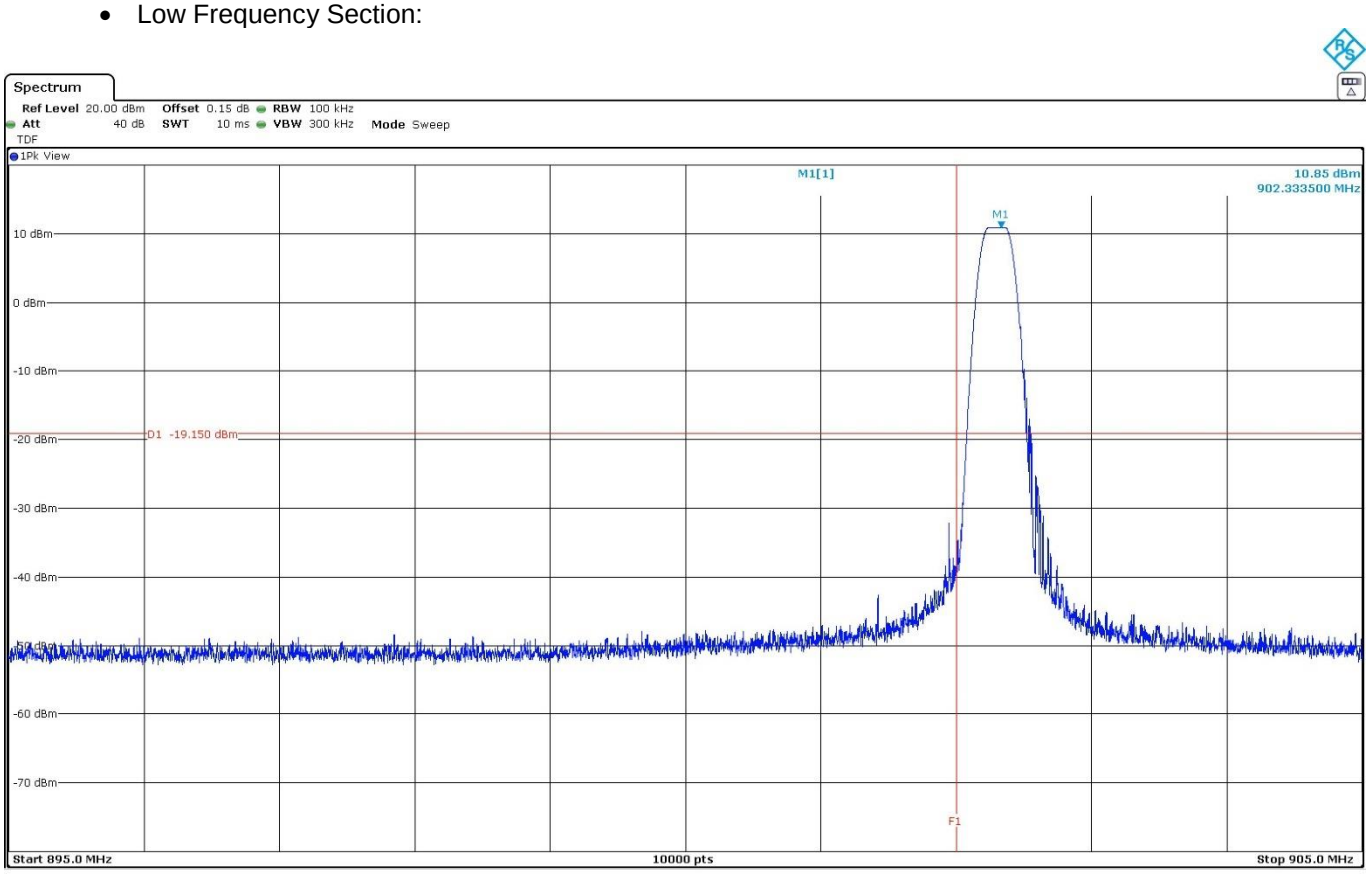
If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Modulation: LoRa

Results

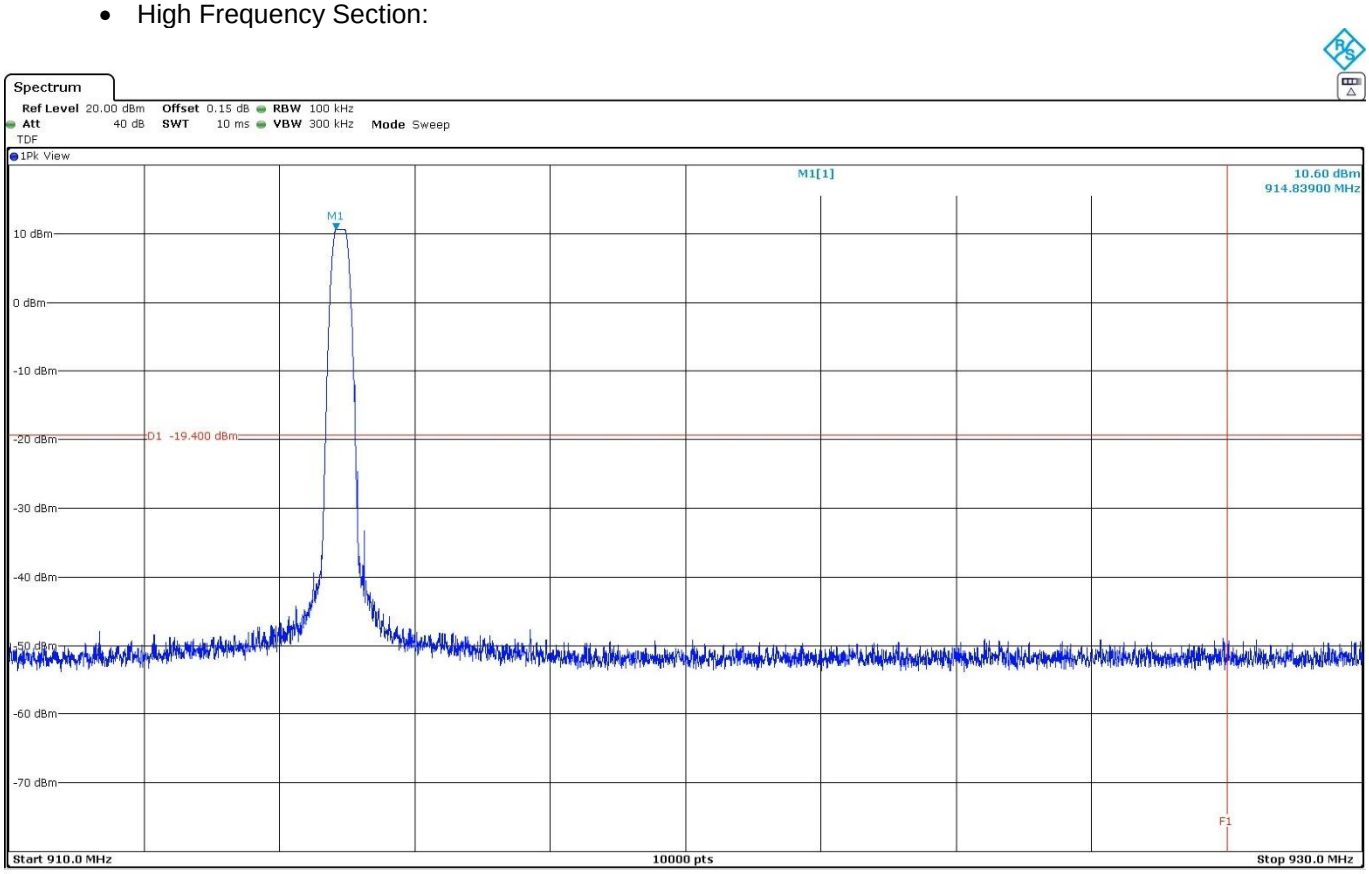
Attachments

- Hopping OFF:
    - Low Frequency Section:



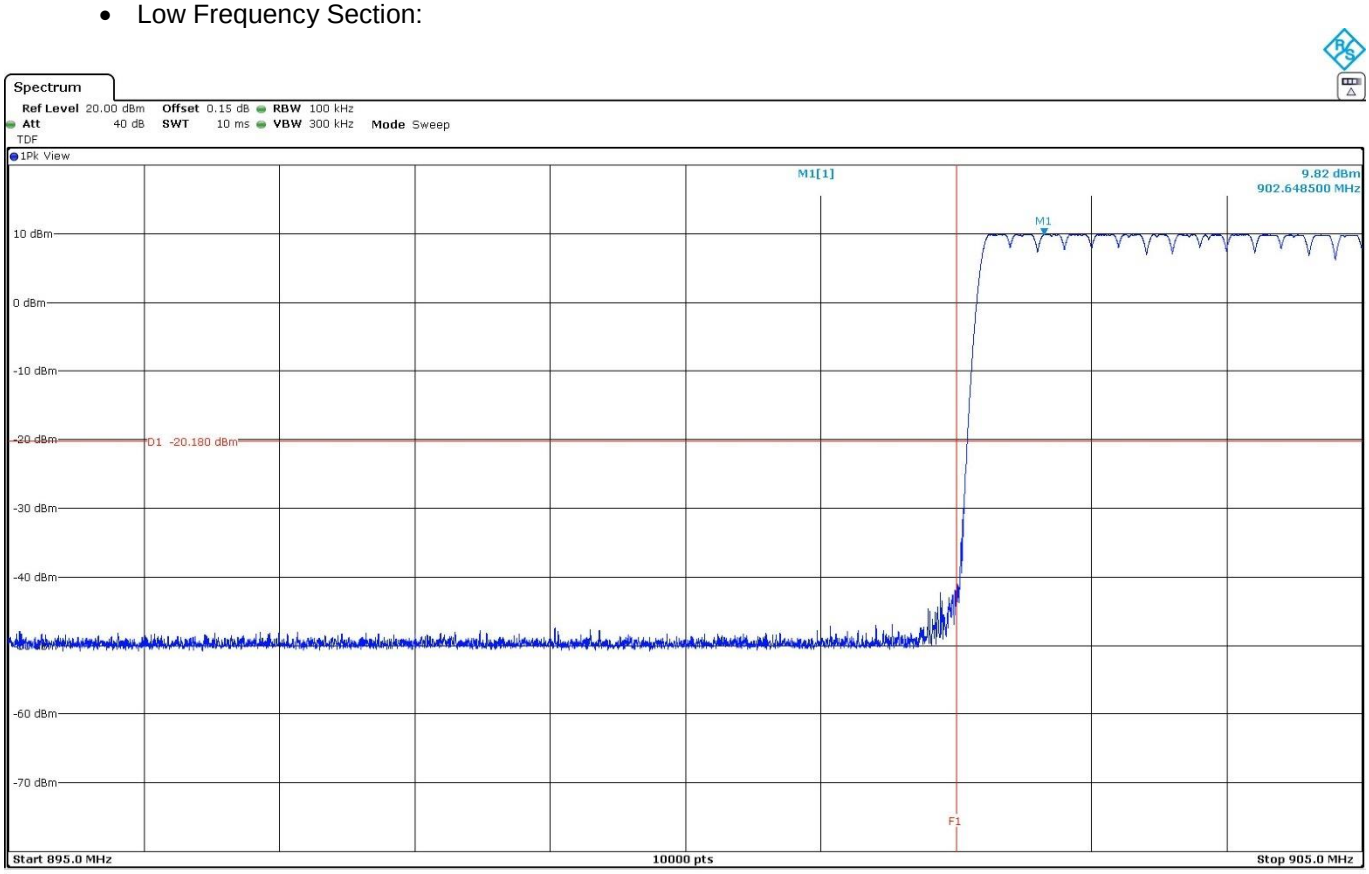
- Hopping OFF:

  - High Frequency Section:



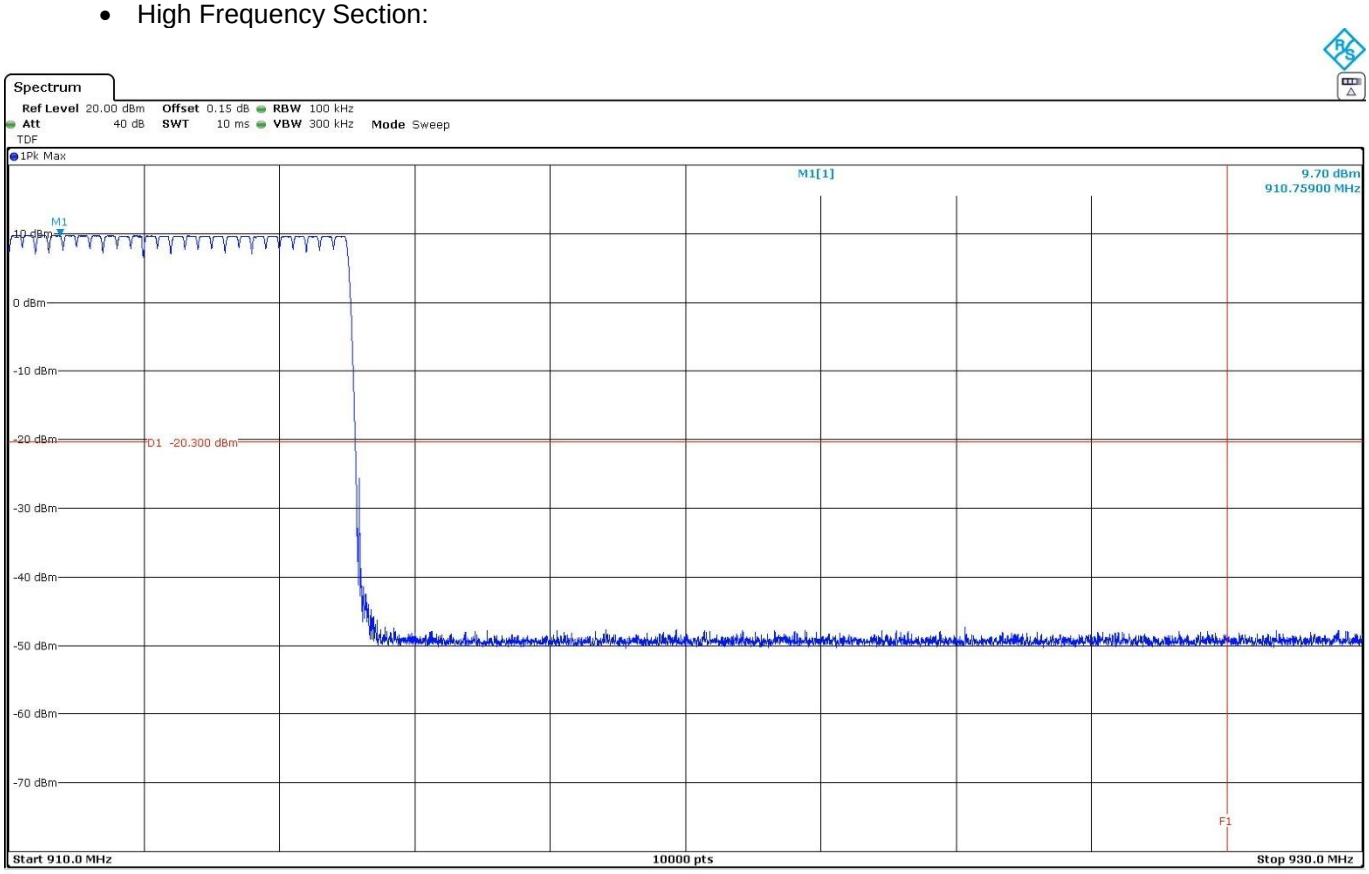
- Hopping ON:

  - Low Frequency Section:



- Hopping ON:

  - High Frequency Section:



Verdict

Pass

RSS-247 5.5 / FCC 15.247 (d) Emission limitations radiated (Transmitter)

Limits

* FCC 15.247:
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 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
Above 960	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.

Modulation: LoRa

Frequency range tested for Radiated emissions

Start frequency: no radiofrequency signal generated in the device found below 10^{th} sub-armonic, no further investigation required.
Stop frequency: it has been performed the radiated spurious emissions until 10^{th} armonic.

Results

No spurious detected at less than 20 dB from the limit.

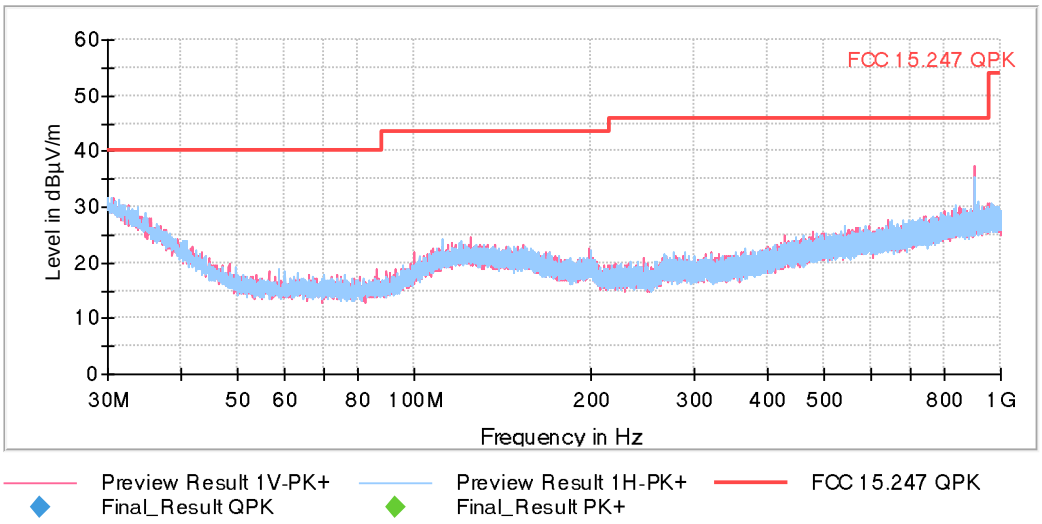
Verdict

Pass

Attachments

Frequency Range GHz = [0.03, 1]	Equipment Type = Hybrid
Modulation = LoRa	Frequency MHz = 902.3
MIMO Mode = SISO	Active Port = 1

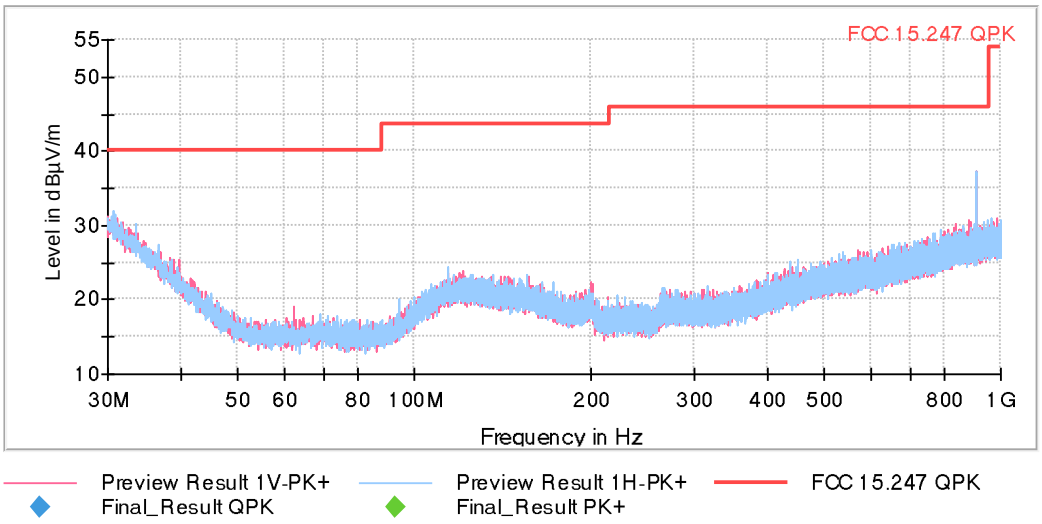
Images:



The highest peak is the carrier of the Lora technology.

Frequency Range GHz = [0.03, 1]	Equipment Type = Hybrid
Modulation = LoRa	Frequency MHz = 908.7
MIMO Mode = SISO	Active Port = 1

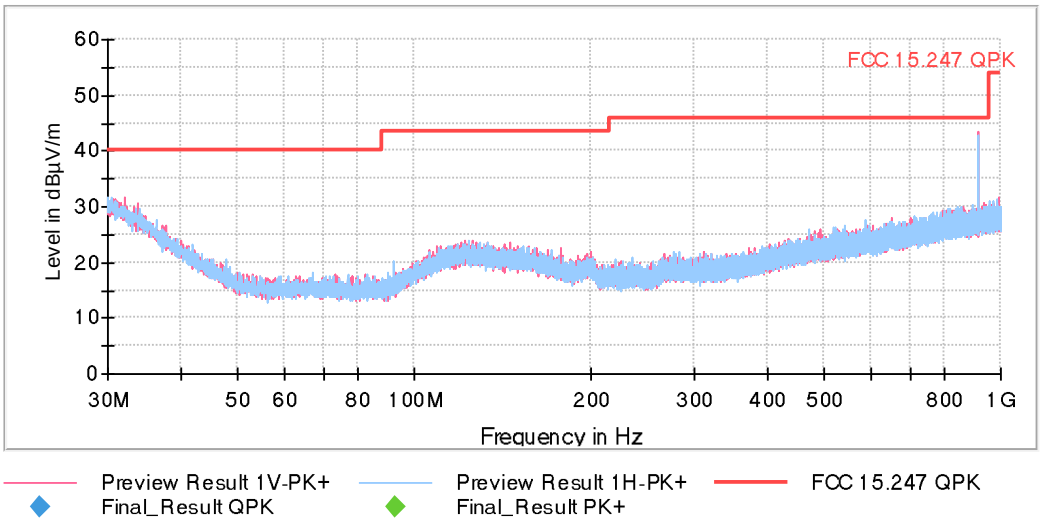
Images:



The highest peak is the carrier of the Lora technology.

Frequency Range GHz = [0.03, 1]	Equipment Type = Hybrid
Modulation = LoRa	Frequency MHz = 914.9
MIMO Mode = SISO	Active Port = 1

Images:



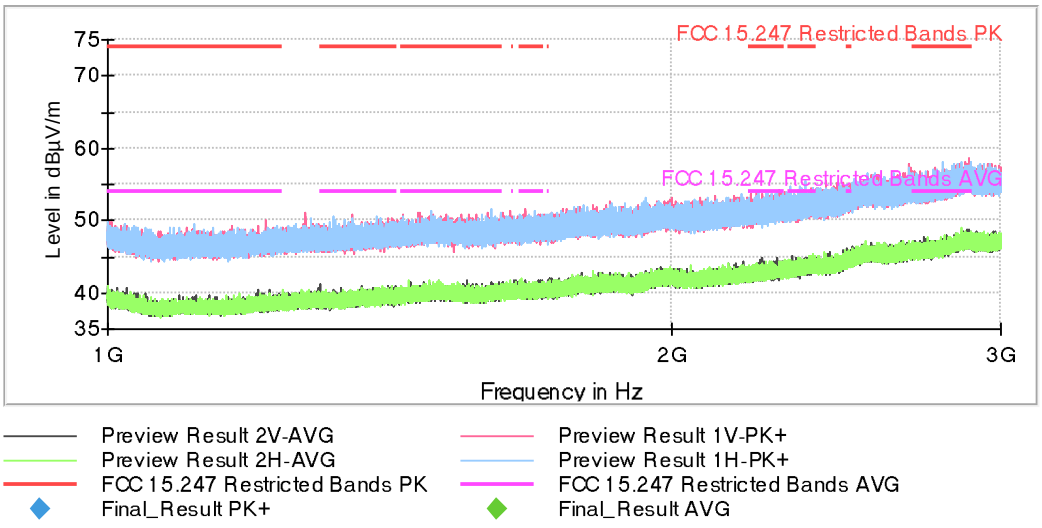
The highest peak is the carrier of the Lora technology.

Tables:
Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB

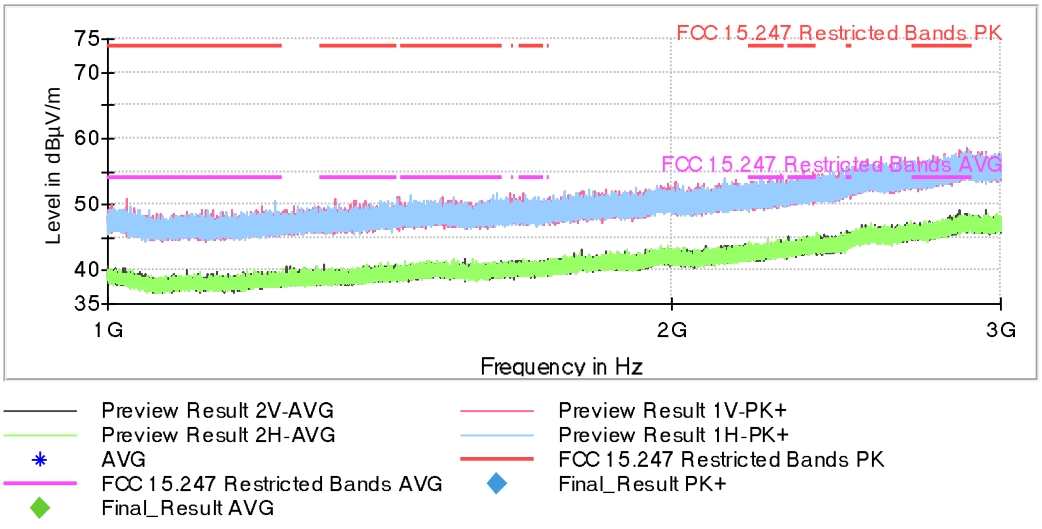
Frequency Range GHz = [1, 3]	Equipment Type = Hybrid
Modulation = LoRa	Frequency MHz = 902.3
MIMO Mode = SISO	Active Port = 1

Images:



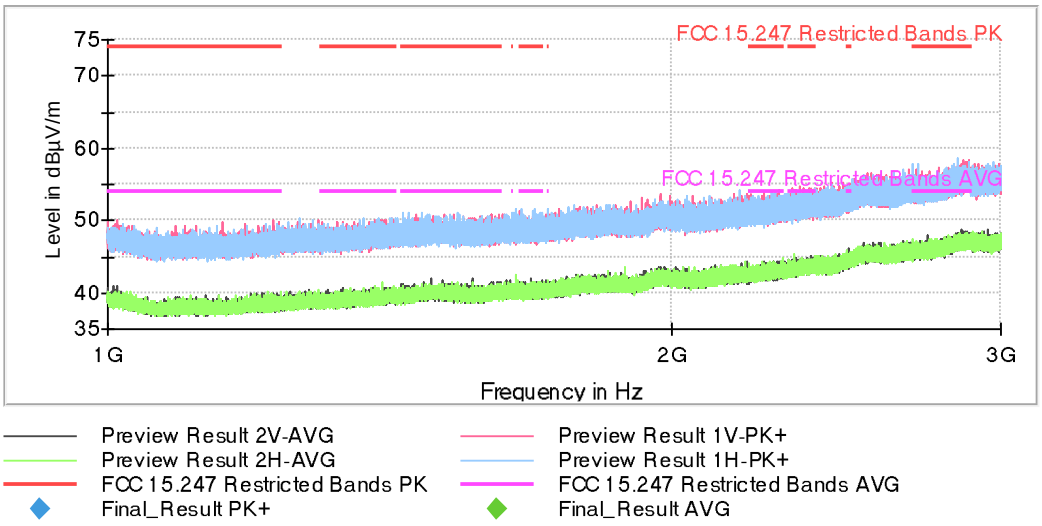
Frequency Range GHz = [1, 3]	Equipment Type = Hybrid
Modulation = LoRa	Frequency MHz = 908.7
MIMO Mode = SISO	Active Port = 1

Images:



Frequency Range GHz = [1, 3]	Equipment Type = Hybrid
Modulation = LoRa	Frequency MHz = 914.9
MIMO Mode = SISO	Active Port = 1

Images:



Tables:
Spectrum Analyzer Parameters

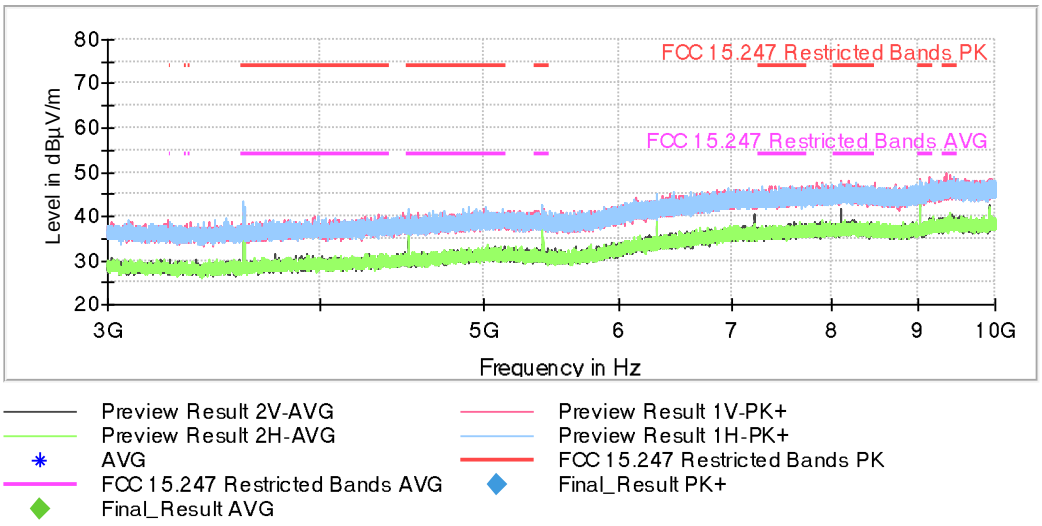
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
1 GHz - 3 GHz	30,769 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

Frequency Range GHz = [3, 10] Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 902.3

MIMO Mode = SISO Active Port = 1

Images:



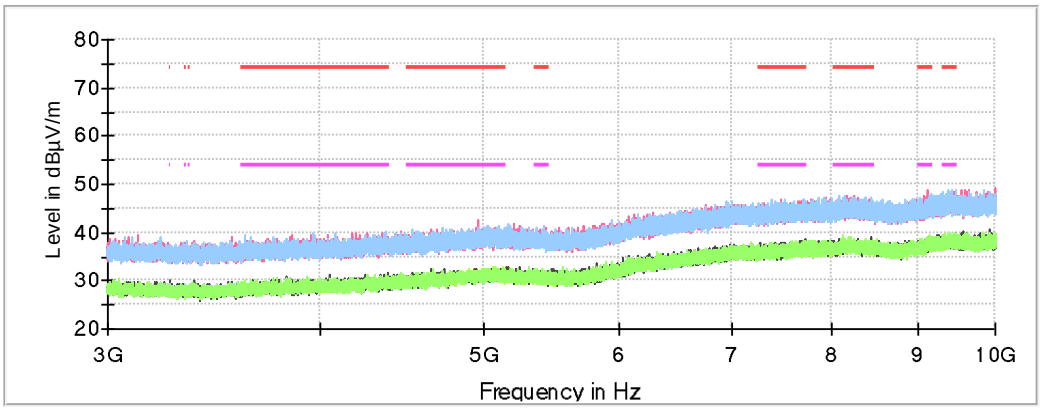
Preview Result 2V-AVG
Preview Result 2H-AVG
AVG
FCC 15.247 Restricted Bands AVG
Final_Result AVG
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands PK
Final_Result PK+

Frequency Range GHz = [3, 10] Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 908.7

MIMO Mode = SISO Active Port = 1

Images:



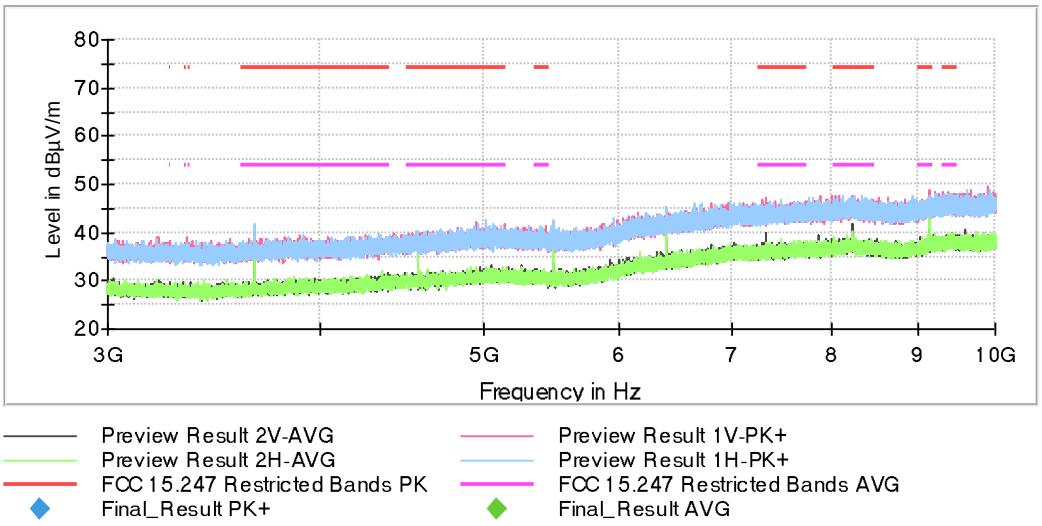
Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

Frequency Range GHz = [3, 10] Equipment Type = Hybrid

Modulation = LoRa Frequency MHz = 914.9

MIMO Mode = SISO Active Port = 1

Images:



Tables:

Spectrum Analyzer Parameters

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
3 GHz - 10 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	30 dB