



<b>Prüfbericht-Nr.:</b> <i>Test report no.:</i>	<b>DE22B1XH 001</b>	<b>Auftrags-Nr.:</b> <i>Order no.:</i>	<b>168378550</b> <b>P00257266</b>	<b>Seite 1 von 25</b> <i>Page 1 of 25</i>	
<b>Kunden-Referenz-Nr.:</b> <i>Client reference no.:</i>	<b>N/A</b>	<b>Auftragsdatum:</b> <i>Order date:</i>	<b>2022-06-22</b>		
<b>Auftraggeber:</b> <i>Client:</i>	<b>KERLINK SA</b> 1, Rue Jacqueline Auriol 35235 Thorignone-Fouillard FRANCE				
<b>Prüfgegenstand:</b> <i>Test item:</i>	<b>Wirnet™ iZeptoCell</b>				
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type no.:</i>	<b>PDTIOT-IZEC900</b> (Trademark: Kerlink)				
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	<b>Test Report</b>				
<b>Prüfgrundlage:</b> <i>Test specification:</i>	47 CFR 15.247 47 CFR 15.207 47 CFR 15.209		RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 February 2021		
<b>Wareneingangsdatum:</b> <i>Date of sample receipt:</i>	2022-06-27		Please refer to Photo Document		
<b>Prüfmuster-Nr.:</b> <i>Test sample no.:</i>	A003283029-001~020				
<b>Prüfzeitraum:</b> <i>Testing period:</i>	2022-07-06 – 2022-07-29				
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.				
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.				
<b>Prüfergebnis*:</b> <i>Test result*:</i>	Pass				
<b>geprüft von:</b> <i>tested by:</i>	 <b>Lin Lin</b>		<b>genehmigt von:</b> <i>authorized by:</i>	 <b>Hardy Suo</b>	
<b>Datum:</b> <i>Date:</i>	2022-08-18		<b>Ausstellungsdatum:</b> <i>Issue date:</i>	2022-08-19	
<b>Stellung / Position:</b>	<b>Sachverständige(r)/Expert</b>		<b>Stellung / Position:</b>	<b>Sachverständige(r)/Expert</b>	
<b>Sonstiges / Other:</b>	FCC ID: 2AFYS-KLKZEC900 IC: 20637-KLKZEC900		HVIN: PDTIOT-IZEC900		
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <i>Condition of the test item at delivery:</i>	<b>Prüfmuster vollständig und unbeschädigt</b> <i>Test item complete and undamaged</i>				
<b>* Legende:</b>	1 = sehr gut P(ass) = entspricht o.g. Prüfgrundlage(n)	2 = gut F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	3 = befriedigend N/A = nicht anwendbar	4 = ausreichend N/T = nicht getestet	5 = mangelhaft
<b>* Legend:</b>	1 = very good P(ass) = passed a.m. test specification(s)	2 = good F(ail) = failed a.m. test specification(s)	3 = satisfactory N/A = not applicable	4 = sufficient N/T = not tested	5 = poor
<b>Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.</b> <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>					

V05

## Test Summary

**5.1.1 ANTENNA REQUIREMENT***RESULT: Pass***5.1.2 MAXIMUM CONDUCTED OUTPUT POWER***RESULT: Pass***5.1.3 CONDUCTED POWER SPECTRAL DENSITY***RESULT: Pass***5.1.4 6dB BANDWIDTH***RESULT: Pass***5.1.5 20dB BANDWIDTH***RESULT: Pass***5.1.6 99% BANDWIDTH***RESULT: Pass***5.1.7 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH***RESULT: Pass***5.1.8 RADIATED SPURIOUS EMISSION***RESULT: Pass***5.1.9 CARRIER FREQUENCY SEPARATION***RESULT: Pass***5.1.10 NUMBER OF HOPPING FREQUENCY***RESULT: Pass***5.1.11 TIME OF OCCUPANCY***RESULT: Pass***5.1.12 CONDUCTED EMISSION ON AC MAINS***RESULT: Pass*

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# 1 General Remarks

## 1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Test Results

Appendix B: Photographs of the Test Set-up

## 1.2 List of Document Change

No.	Report No.	Description
1	DE22B1XH 001	First released.

# 2 Test Sites

## 2.1 Test Facilities

**TÜV Rheinland (Shenzhen) Co., Ltd.**

362 Huanguan Road Middle Longhua District, Shenzhen 518110 People's Republic of China

FCC Registration No.: 694916 & IC Registration Number: 25069

## 2.2 List of Test and Measurement Instruments

**Table 1: List of Test and Measurement Equipment**

<b>Radio Spectrum Testing (TS8997)</b>				
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Cal. until (DD.MM.YYYY)</b>
Signal Analyzer	R&S	FSV 40	101441	01.08.2023
OSP	R&S	OSP 150	101017	02.12.2022
Control PC	DELL	OptiPlex 7050	FTJZ9P2	N/A
Test Software	R&S	WMS32 (V11.00.00)	N/A	N/A
Power Meter	R&S	NRP2	107105	02.12.2022
Wideband Power Sensor	R&S	NRP-Z81	105677	01.08.2023
Shielding Room 8#	Albatross	SR8	APC17151-SR8	22.06.2024
<b>Unwanted Emission Testing (TS9975)</b>				
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Cal. until (DD.MM.YYYY)</b>
EMI Test Receiver	R&S	ESR 7	102021	02.08.2023

Signal Analyzer	R&S	FSV 40	101439	01.08.2023
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	01.08.2023
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	02.08.2023
Amplifier	R&S	SCU-18F	180070	02.08.2023
Amplifier	R&S	SCU40A	100475	02.08.2023
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	06.08.2024
Double-Ridged Antenna (1 -18 GHz)	ETS-LINDGREN	3117	00218717	06.08.2024
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	08.09.2022
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	06.08.2024
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	22.06.2024
<b>Conducted Emission</b>				
<b>Equipment</b>	<b>Manufacturer</b>	<b>Model</b>	<b>Serial No.</b>	<b>Cal. until (DD.MM.YYYY)</b>
EMI Test Receiver	R&S	ESR3	102680	27.02.2023
Artificial Mains Network	R&S	ENV216	101445	27.02.2023
EMC32 test software	R&S	EMC32 (Ver.10.50.00)	N/A	N/A

## 2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

## 2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

## 2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Parameter	Uncertainty (k=2)
Occupied Channel Bandwidth	± 2.08 %
RF output power, conducted	± 0.99 dB
RF power density, conducted	± 0.99 dB
Unwanted Emissions, conducted	± 0.89 dB
All emissions, radiated	± 4.17 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB

## 2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

## 2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at 362 Huanguan Road Middle Longhua District, Shenzhen 518110 People's Republic of China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

## 3 General Product Information

### 3.1 Product Function and Intended Use

The EUT is Wirnet™ iZeptoCell gateway is part of the global Long-Range Radio fixed network to provide M2M connectivity link between low power end-point and Internet Access. The Wirnet™ iZeptoCell is based on LoRa® technology. It is compatible and interoperable with existing LoRaWAN LPWAN.

The certified module has been integrated into the EUT. The EUT contains transmitter module ME310G1-WW (FCC ID: RI7ME310G1WW and IC: 5131A-ME310G1WW).

Following LoRa's configurations are used in the EUT:

Data Rate	Configuration	Indicative physical bit rate [bit/sec]
1	LoRa Modulation: SF9 / Bandwidth 125 kHz	1760
8	LoRa Modulation: SF12 / Bandwidth 500 kHz	980
9	LoRa Modulation: SF11 / Bandwidth 500 kHz	1760
10	LoRa Modulation: SF10 / Bandwidth 500 kHz	3900
11	LoRa Modulation: SF9 / Bandwidth 500 kHz	7000
12	LoRa Modulation: SF8 / Bandwidth 500 kHz	12500
13	LoRa Modulation: SF7 / Bandwidth 500 kHz	21900

For details refer to the User Manual, Technical Description and Circuit Diagram.

### 3.2 Ratings and System Details

**Table 2: Technical Specification of EUT**

General Information of EUT	Value
Kind of Equipment	Wirnet™ iZeptoCell
Type Designation	PDTIOT-IZEC900
Trademark	Kerlink
FCC ID	2AFYS-KLKZEC900
IC	20637-KLKZEC900
HVIN	PDTIOT-IZEC900
Hardware Version	V2C
Operating Voltage	USB operated (DC 4.5V~5.5V)
Technical Specification of Lora DTS	
Operating Frequency	923.3 - 927.5MHz
Type of Modulation	Lora
Data Rate	SF7 – SF12 / DR8 – DR13
Channel Number	8 channels
Channel Separation	600 KHz

Occupied Bandwidth	500 KHz
<b>Technical Specification of Lora Hybrid</b>	
Frequency Range	903.9MHz - 905.3MHz
Type of Modulation	Lora
Data Rate	SF9 / DR1
Channel Number	8 channels
Channel Separation	200 KHz
Occupied Bandwidth	125 KHz
<b>Technical Specification of Lora Hybrid</b>	
Operating Frequency	904.6MHz
Type of Modulation	Lora
Data Rate	SF11 / DR9
Channel Number	1 channel
Occupied Bandwidth	500 KHz

**Table 3: RF Channel and Frequency of Lora DTS**

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
<b>0</b>	<b>923.3</b>	2	924.5	<b>4</b>	<b>925.7</b>	6	926.9
1	923.9	3	925.1	5	926.3	<b>7</b>	<b>927.5</b>

**Table 4: RF Channel and Frequency of Lora Hybrid**

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
<b>0</b>	<b>903.9</b>	2	904.3	4	904.7	6	905.1
1	904.1	<b>3</b>	<b>904.5</b>	5	904.9	<b>7</b>	<b>905.3</b>

### 3.3 Independent Operation Modes

The basic operation modes are:

- A. On, Lora transmitting mode (DTS & Hybrid)
  - 1) Low Channel
  - 2) Middle Channel
  - 3) High Channel
- B. On, Transmitting on Hopping channel (Hybrid)
- C. On, Normal working
- D. Off



### 3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

### 3.5 Submitted Documents

- |   |  |
|---|--|
| <input checked="" type="checkbox"/> User Manual     | <input checked="" type="checkbox"/> Rating Label   |
| <input checked="" type="checkbox"/> Circuit Diagram | <input checked="" type="checkbox"/> PCB Layout     |
| <input checked="" type="checkbox"/> Block Diagram   | <input checked="" type="checkbox"/> Photo Document |
| <input checked="" type="checkbox"/> Schematics      | <input checked="" type="checkbox"/> Parts List     |
| <input type="checkbox"/> Model Difference Letter    |  |

## 4 Test Set-up and Operation Modes

### 4.1 Principle of Configuration Selection

**Radio Spectrum:** The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

**Emission:** The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

### 4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013 and KDB 558074 D01 v05r02.

According to clause 3.1, all tests were performed on model PDTIOT-IZEC900 in this report.

**Table 5: List of Frequencies under Test**

Operation Mode	Operational Frequency band or bands (MHz)	Low channel (MHz)	Middle channel (MHz)	High channel (MHz)
DTS	923.3 MHz to 927.5 MHz	923.3	925.7	927.5
Hybrid (SF9)	903.9 MHz to 905.3 MHz	903.9	904.5	905.3
Hybrid (SF11)	903.9 MHz to 905.3 MHz	/	904.6	/

### 4.3 Special Accessories and Auxiliary Equipment

**Table 6: Auxiliary Equipment Used during Test**

Description	Manufacturer	Model	S/N	Rating
Laptop PC	Dell	E5430	9V28XY1	N/A
Wirnet iFemtoCell-evolution 915	Kerlink	PDTIOT-IFE04	005DGa010003	N/A

### 4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF). No additional measures were employed to achieve compliance.

## 4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 30MHz)

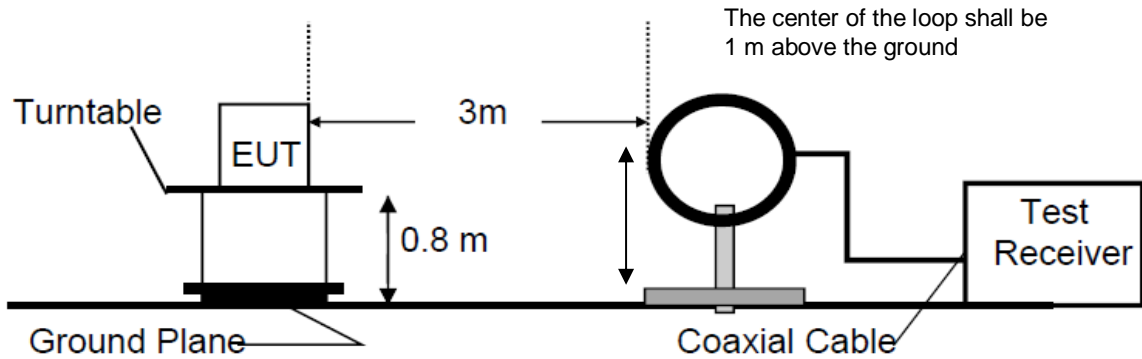


Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

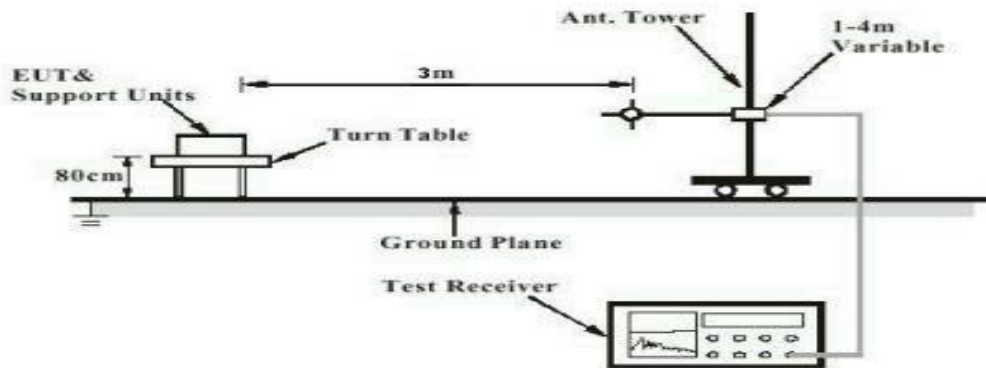


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

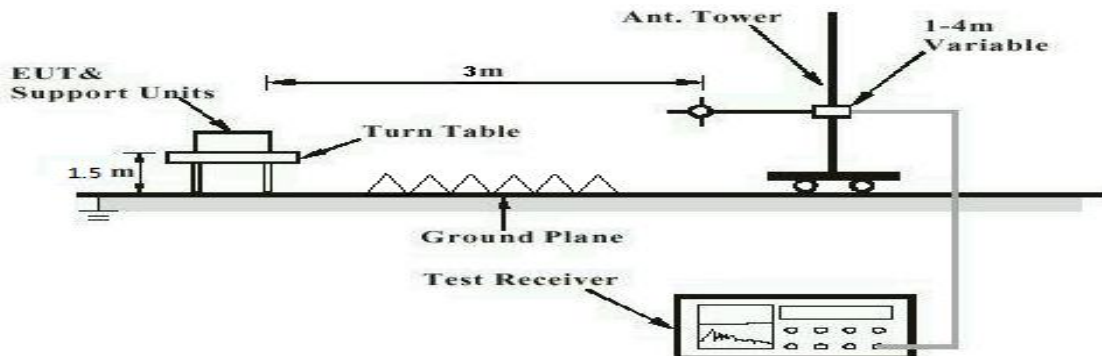


Diagram of Measurement Configuration for Mains Conduction Measurement

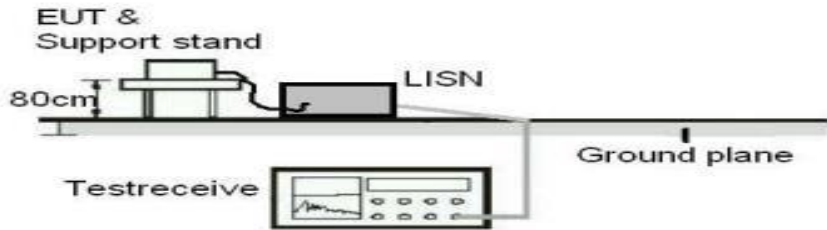
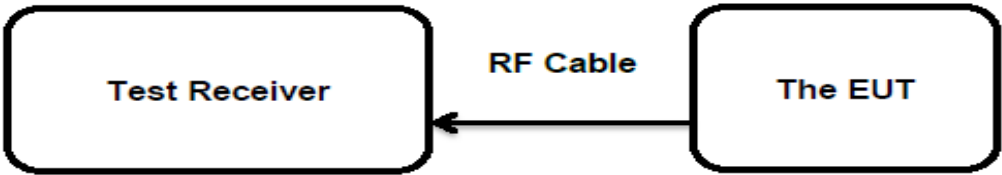


Diagram of Measurement Configuration for Conducted Transmitter Measurement



## 5 Test Results

### 5.1 Transmitter Requirement & Test Suites

#### 5.1.1 Antenna Requirement

**RESULT:**

**Pass**

**Test Specification**

Test standard : FCC Part 15.247(b)(4) and Part 15.203  
RSS-Gen Clause 6.8

According to the manufacturer declared, the EUT has a Ceramic antenna, the maximum directional gain of antenna is 2.0 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement.

Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

## 5.1.2 Maximum Conducted Output Power

**RESULT:**
**Pass**
**Test Specification**

Test standard	:	FCC Part 15.247(b)(2)&(3) RSS-247 Clause 5.4(a)&(d)
Basic standard	:	ANSI C63.10: 2013
Limits	:	< 1.0 W (30 dBm) for antenna gain less than 6dBi
Kind of test site	:	Shielded Room

**Test Setup**

Date of testing	:	2022-07-13 to 2022-07-15
Input voltage	:	DC 5V from USB port
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25 °C
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

**Table 7: Test Result of Maximum Conducted Output Power, Lora DTS**

Test Mode	Test Channel (MHz)	Measured Conducted Power		Limit
		(dBm)	(W)	
Lora DTS SF7	923.3	23.70	0.2344	< 1.0 W (30 dBm)
	925.7	23.32	0.2148	
	927.5	23.07	0.2028	
Lora DTS SF12	923.3	23.67	0.2328	
	925.7	23.50	0.2239	
	927.5	23.11	0.2046	
Lora Hybrid SF11	904.6	23.57	0.2275	
<b>Max. Measured Value</b>		23.70	0.2344	

**Table 8: Test Result of Maximum Conducted Output Power, Lora Hybrid**

Test Mode	Test Channel (MHz)	Measured Conducted Power		Limit (W)
		(dBm)	(W)	
Lora Hybrid SF9	903.9	19.77	0.0948	< 1.0 W (30 dBm)
	904.5	19.77	0.0948	
	905.3	19.80	0.0955	
<b>Max. Measured Value</b>		19.80	0.0955	

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain (G) : 2.0 dBi,  
Maximum e.i.r.p.= 25.70dBm = 0.3715W, which is far below the 4 W

### 5.1.3 Conducted Power Spectral Density

**RESULT:**
**Pass**
**Test Specification**

Test standard	:	FCC Part 15.247(e), FCC Part 15.247(f) RSS-247 Clause 5.2(b), RSS-247 Clause 5.3
Basic standard	:	ANSI C63.10: 2013
Limits	:	< 8 dBm / 3kHz for antenna gain less than 6dBi
Kind of test site	:	Shielded Room

**Test Setup**

Date of testing	:	2022-07-13 to 2022-07-15
Input voltage	:	DC 5V from USB port
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25 °C
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

**Table 9: Test Result of Maximum Power Spectral Density, Lora DTS**

Test Mode	Test Channel (MHz)	Measured Power Spectral Density (dBm/3KHz)
Lora DTS SF7	923.3	3.59
	925.7	3.79
	927.5	2.85
Lora DTS SF12	923.3	6.26
	925.7	6.53
	927.5	5.33
Lora DTS SF11	904.6	5.16
<b>Maximum Measured Value</b>		<b>6.53</b>

**Table 10: Test Result of Maximum Power Spectral Density, Lora Hybrid**

Test Mode	Test Channel (MHz)	Measured Power Spectral Density (dBm/3KHz)
Lora Hybrid SF9	903.9	5.96
	904.5	6.12
	905.3	7.16
<b>Maximum Measured Value</b>		<b>7.16</b>

### 5.1.4 6dB Bandwidth

**RESULT:**
**Pass**
**Test Specification**

Test standard	:	FCC Part 15.247(a)(2) RSS-247 Clause 5.2(a)
Basic standard	:	ANSI C63.10: 2013
Limits	:	At least 500kHz for bandwidth(DTS)
Kind of test site	:	Shielded Room

**Test Setup**

Date of testing	:	2022-07-13
Input voltage	:	DC 5V from USB port
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25 °C
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.

**Table 11: Test Result of 6dB Bandwidth, Lora DTS**

Test Mode	Test Channel (MHz)	6dB Bandwidth (kHz)	Limit (MHz)
Lora DTS SF7	923.3	631.0	>500KHz
	925.7	642.5	
	927.5	628.1	
Lora DTS SF12	923.3	639.7	
	925.7	636.8	
	927.5	631.0	
Lora DTS SF11	904.6	639.7	
<b>Minimum Measured Value</b>		642.5	



### 5.1.5 20dB Bandwidth

**RESULT:**
**Pass**
**Test Specification**

Test standard	:	FCC Part 15.247(a)(1) (i) RSS-247 Clause 5.1(a)
Basic standard	:	ANSI C63.10: 2013 Not more than 500kHz and
Limits	:	< 250KHz for at least 50 hopping frequencies >=250KHz for at least 25 hopping frequencies
Kind of test site	:	Shielded Room

**Test Setup**

Date of testing	:	2022-07-15
Input voltage	:	DC 5V from USB port
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25 °C
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.

**Table 12: Test Result of 20dB Bandwidth, Lora Hybrid**

Test Mode	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Limit (MHz)
Lora Hybrid SF9	903.9	138.93	<500KHz
	904.5	138.35	
	905.3	138.93	

### 5.1.6 99% Bandwidth

**RESULT:**
**Pass**
**Test Specification**

Test standard : RSS-Gen Clause 6.7  
 Basic standard : ANSI C63.10: 2013  
 Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2022-07-14 to 2022-07-15  
 Input voltage : DC 5V from USB port  
 Operation mode : A  
 Test channel : Low / Middle / High  
 Ambient temperature : 25 °C  
 Relative humidity : 56 %  
 Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A.

**Table 13: Test Result of 99% Bandwidth, Lora DTS**

Test Mode	Test Channel (MHz)	99% Bandwidth (KHz)	Limit (MHz)
Lora DTS SF7	923.3	509.49	/
	925.7	499.50	
	927.5	501.50	
Lora DTS SF12	923.3	503.50	
	925.7	503.50	
	927.5	503.50	
Lora DTS SF11	904.6	497.50	
<b>Minimum Measured Value</b>		509.49	

**Table 14: Test Result of 99% Bandwidth, Lora Hybrid**

Test Mode	Test Channel (MHz)	99% Bandwidth (KHz)	Limit (MHz)
Lora Hybrid SF9	903.9	123.73	/
	904.5	124.46	
	905.3	125.18	
<b>Minimum Measured Value</b>		125.18	

## 5.1.7 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

**RESULT:****Pass****Test Specification**

Test standard	:	FCC Part 15.247(d) RSS-247 Clause 5.5
Basic standard	:	ANSI C63.10: 2013
Limits	:	20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	:	Shielded Room

**Test Setup**

Date of testing	:	2022-07-13 to 2022-07-14
Input voltage	:	DC 5V from USB port
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	25 °C
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix A.

## 5.1.8 Radiated Spurious Emission

**RESULT:****Pass****Test Specification**

Test standard	:	FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Clause 3.3
Basic standard	:	ANSI C63.10: 2013
Limits	:	Refer to 15.209(a) of FCC part 15.247(d)
Kind of test site	:	3m Semi-anechoic Chamber

**Test Setup**

Date of testing	:	2022-07-06 to 2022-07-08
Input voltage	:	DC 5V from USB port
Operation mode	:	A
Test channel	:	Low / Middle / High
Ambient temperature	:	Refer to test result
Relative humidity	:	Refer to test result
Atmospheric pressure	:	101 kPa

**Remark:**

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix A.

## 5.1.9 Carrier Frequency Separation

**RESULT:**
**Pass**
**Test Specification**

Test standard : FCC Part 15.247(a)(1)  
 RSS-247 Clause 5.1(b)

Basic standard : ANSI C63.10: 2013

Limits :  $\geq 20$ dB bandwidth

Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2022-07-15

Input voltage : DC 5V from USB port

Operation mode : B

Test channel : Low / Middle / High

Ambient temperature : 25 °C

Relative humidity : 56 %

Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix A.

**Table 15: Test Result of Carrier Frequency Separation**

Test Mode	Channel	Channel Frequency (MHz)	Measured Channel Separation (KHz)	Limit (kHz)	Result
Lora Hybrid (FHSS SF9)	Low Channel	903.894	205.691	$\geq 20$ dB bandwidth	Pass
	Adjacency Channel	903.688			
	Middle Channel	904.500	214.278		Pass
	Adjacency Channel	904.286			
	High Channel	905.098	212.831		Pass
	Adjacency Channel	904.886			

Note:

The limit is maximum 20 dB bandwidth: 138.93KHz.

### 5.1.10 Number of Hopping Frequency

**RESULT:**
**Pass**
**Test Specification**

Test standard	:	FCC part 15.247(a)(1)(iii) RSS-247 Clause 5.1(d)
Basic standard	:	ANSI C63.10: 2013
Limits	:	≥ 15 non-overlapping channels
Kind of test site	:	Shielded Room

**Test Setup**

Date of testing	:	2022-07-15
Input voltage	:	DC 5V from USB port
Operation mode	:	B
Ambient temperature	:	25 °C
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.

**Table 16: Test result of hopping channel number**

Test Mode	Hopping frequencies	Limit
Lora Hybrid (FHSS SF9)	8	/

## 5.1.11 Time of Occupancy

**RESULT:**
**Pass**
**Test Specification**

Test standard : FCC part 15.247(f)  
 RSS-247 Clause 5.3  
 Basic standard : ANSI C63.10: 2013  
 Limits : < 0.4s  
 Kind of test site : Shielded Room

**Test Setup**

Date of testing : 2022-07-15  
 Input voltage : DC 5V from USB port  
 Operation mode : B  
 Test channel : Low / Middle / High  
 Ambient temperature : 25 °C  
 Relative humidity : 56 %  
 Atmospheric pressure : 101 kPa

**Table 17: Test result of Channel Occupancy**

Test Mode	Period (s)	Channel Occupancy Time (ms)	Limit (ms)
Lora Hybrid (FHSS SF9)	20	182.93	400

## 5.1.12 Conducted Emission on AC Mains

**RESULT:****Pass****Test Specification**

Test standard	:	FCC Part 15.207(a) RSS-Gen Clause 8.8
Basic standard	:	ANSI C63.10: 2013
Frequency range	:	0.15 – 30MHz
Limits	:	FCC Part 15.207(a) RSS-Gen Table 3
Kind of test site	:	Shielded Room

**Test Setup**

Date of testing	:	2022-07-29
Input voltage	:	DC 5V from USB port
Operation mode	:	C
Earthing	:	Not connected
Ambient temperature	:	23.7 °C
Relative humidity	:	53.4 %
Atmospheric pressure	:	101 kPa

For the measurement records, refer to the appendix A.



## 6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the Appendix B.

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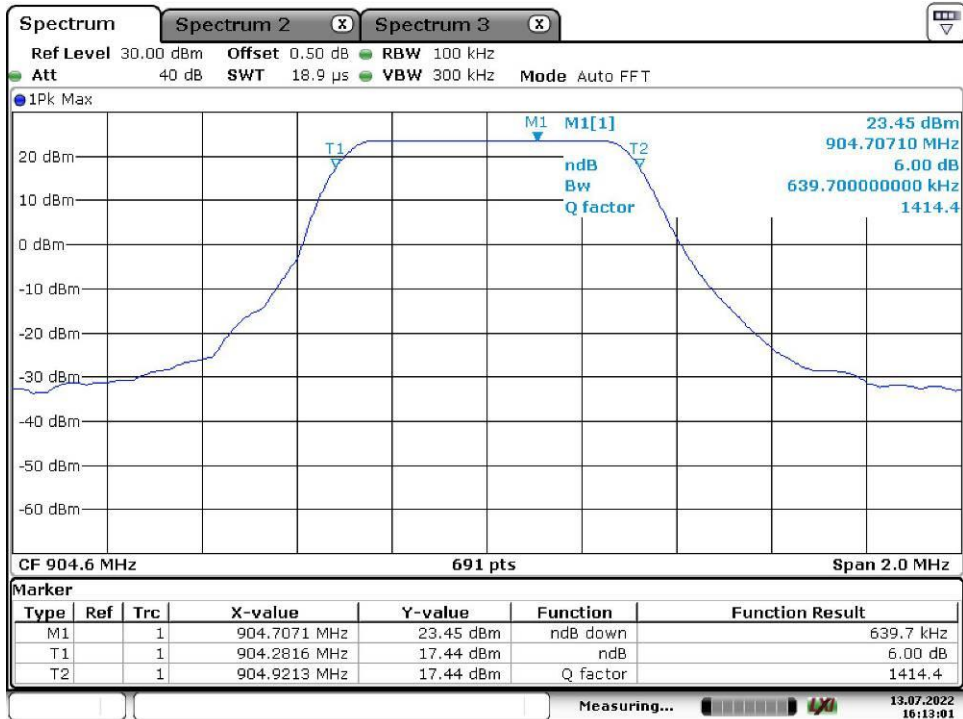
===== END OF REPORT =====

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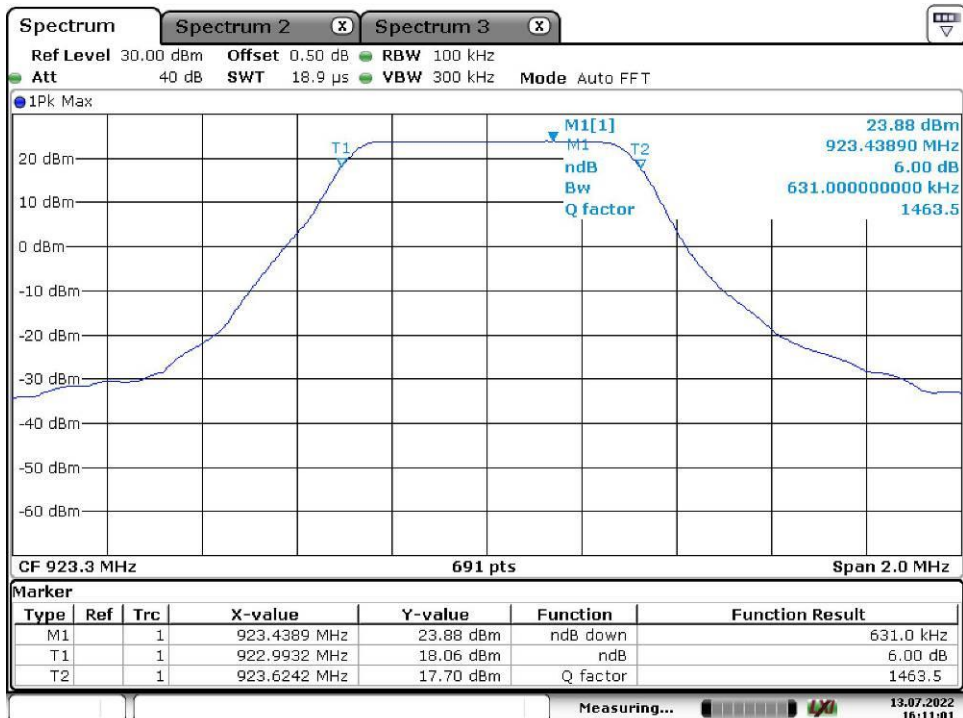
### Appendix A.1: 6dB Bandwidth

Lora Hybrid SF11  
904.6MHz



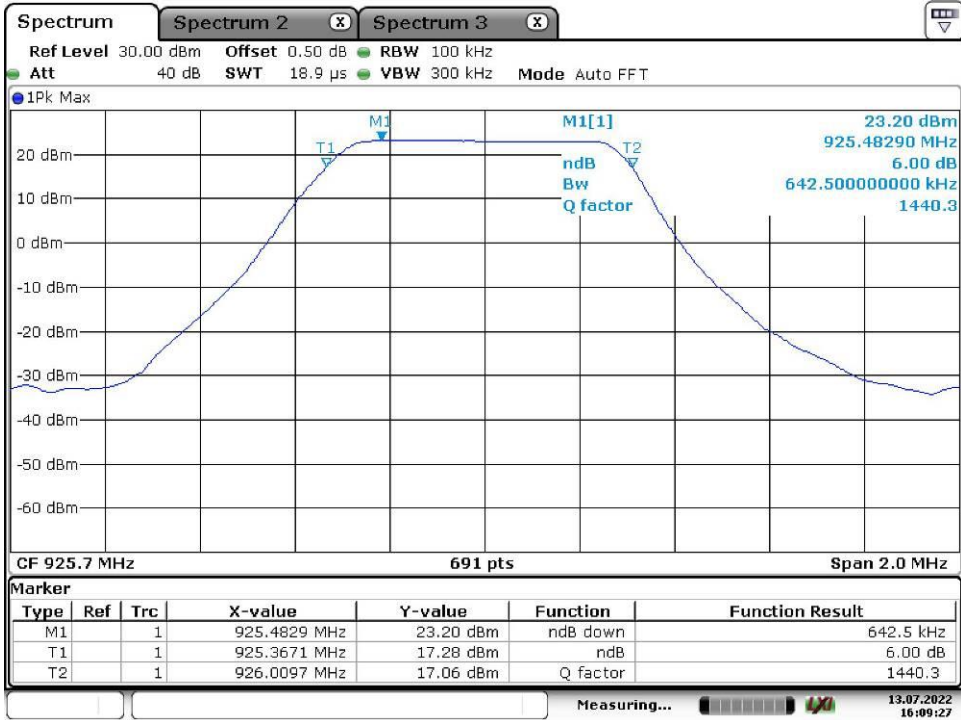
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Lora DTS SF7  
Low Channel



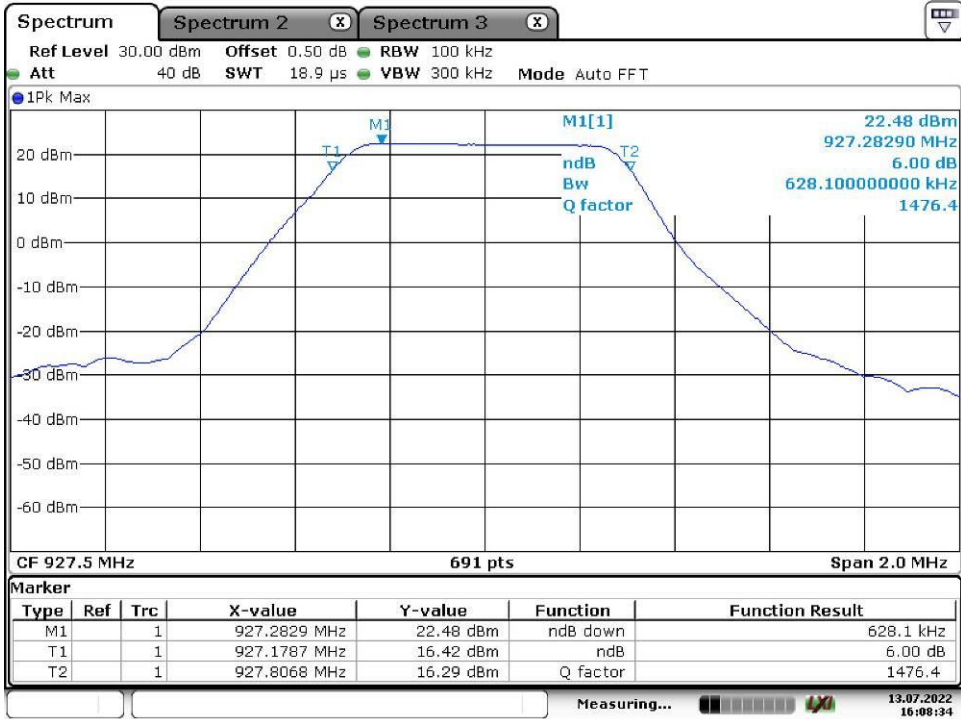
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Middle Channel



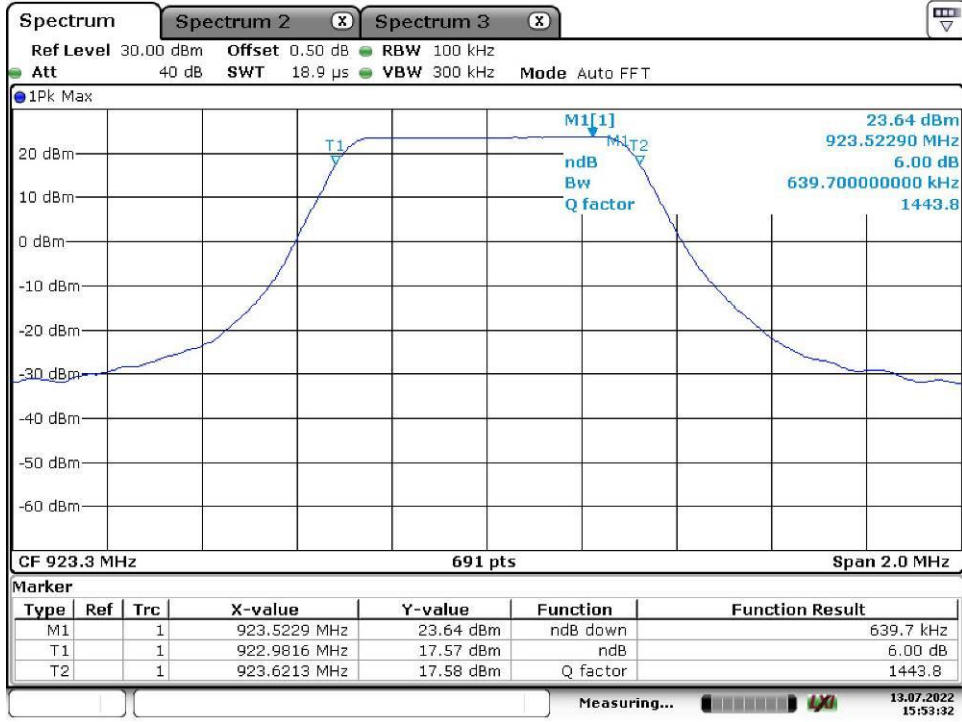
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High Channel



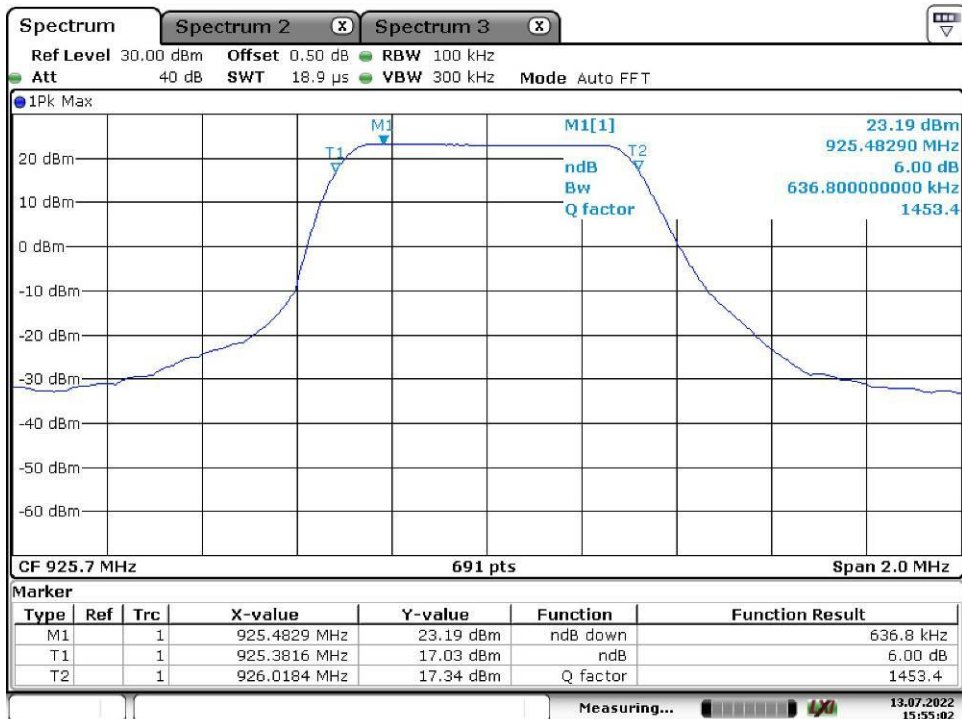
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Lora DTS SF12  
Low Channel



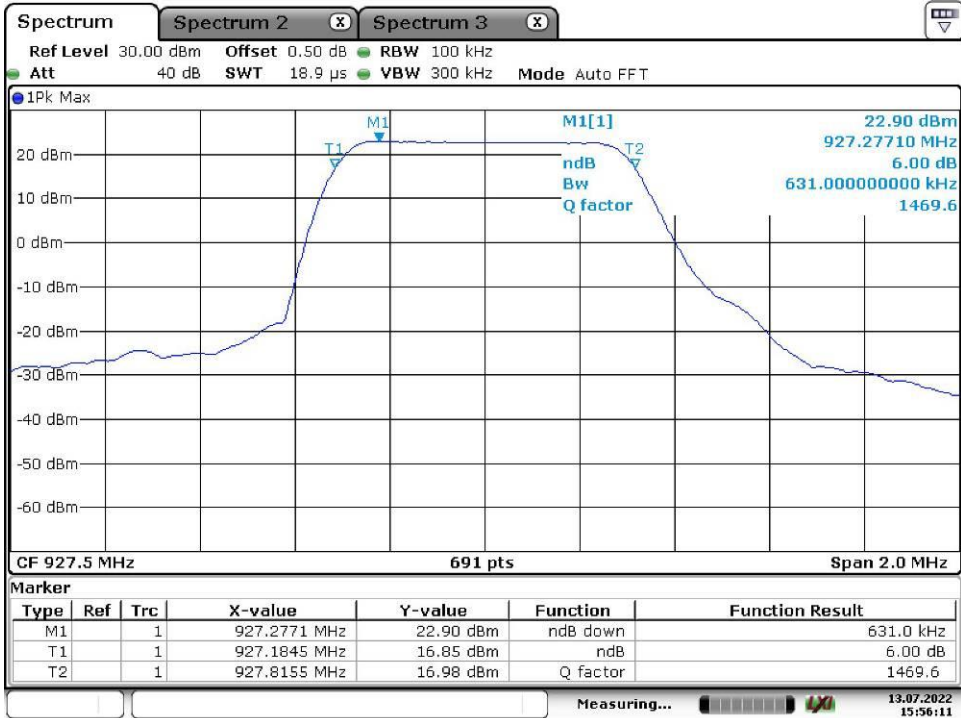
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Middle Channel



Date: 13.JUL.2022 15:55:02

High Channel



Date: 13.JUL.2022 15:56:11

### Appendix A.2: 20dB Bandwidth

#### Lora Hybrid SF9 Low Channel



Date: 15.JUL.2022 15:18:12

#### Middle Channel



Date: 15.JUL.2022 15:15:27

High Channel

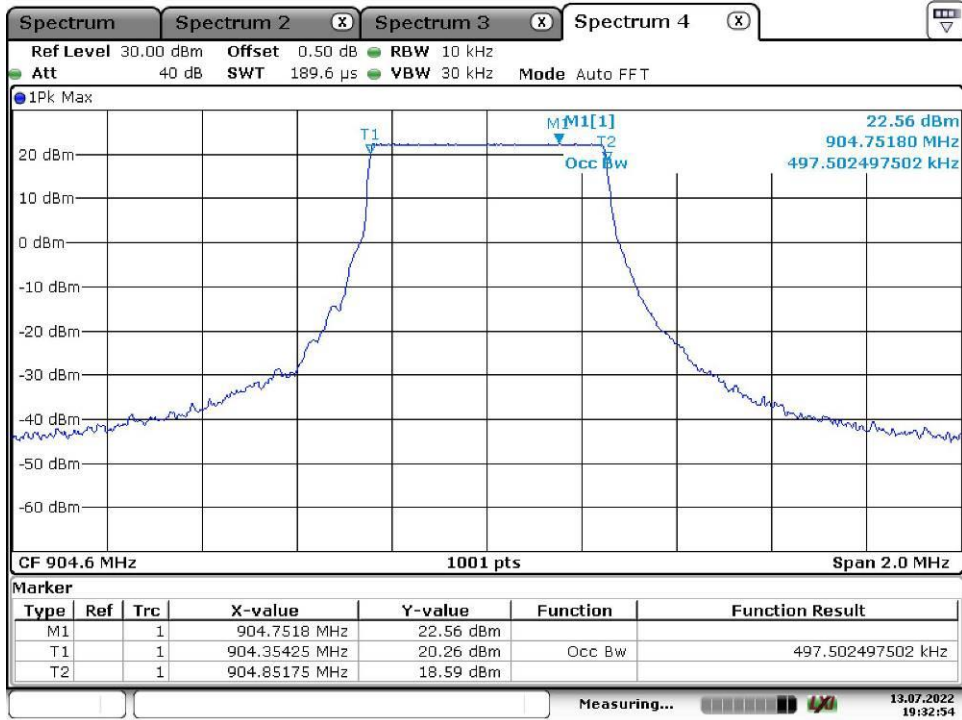


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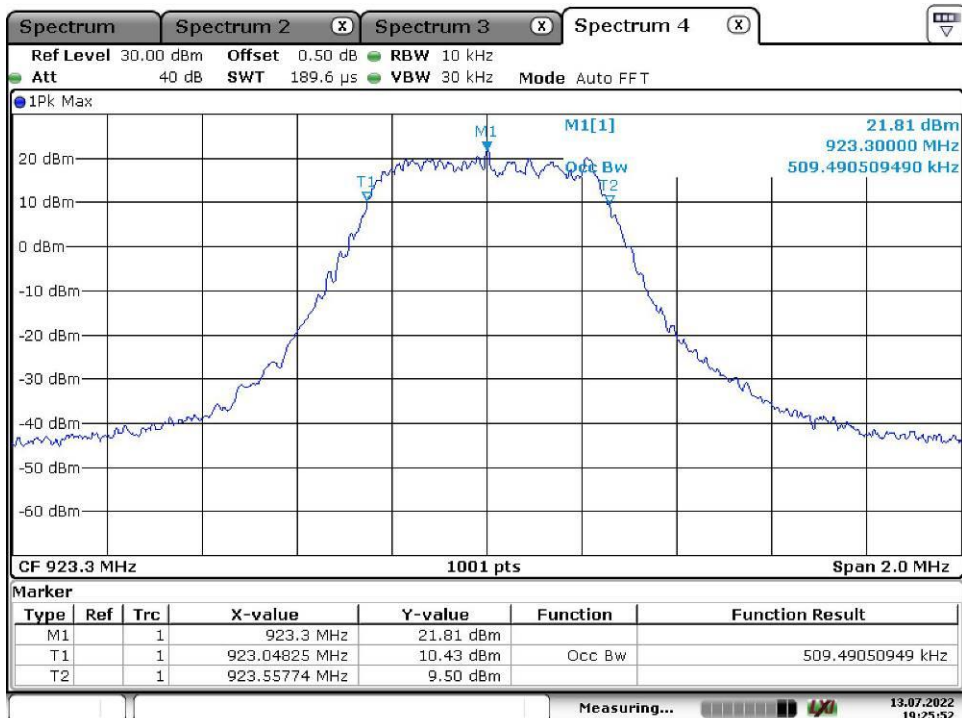
### Appendix A.3: 99% Bandwidth

Lora Hybrid SF11  
904.6MHz



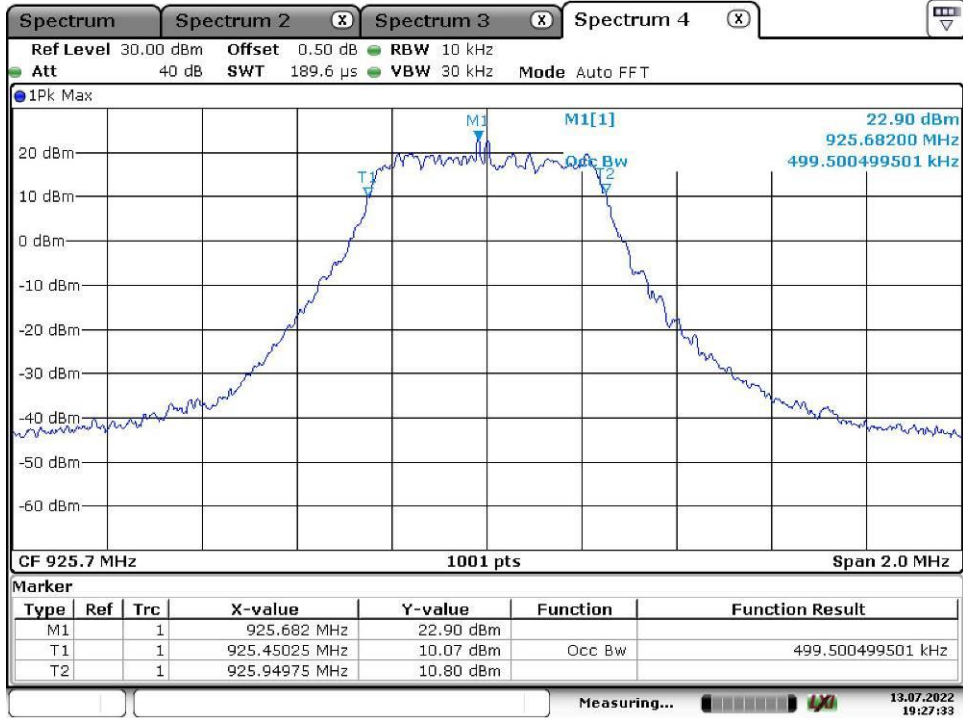
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Lora DTS SF7  
Low Channel



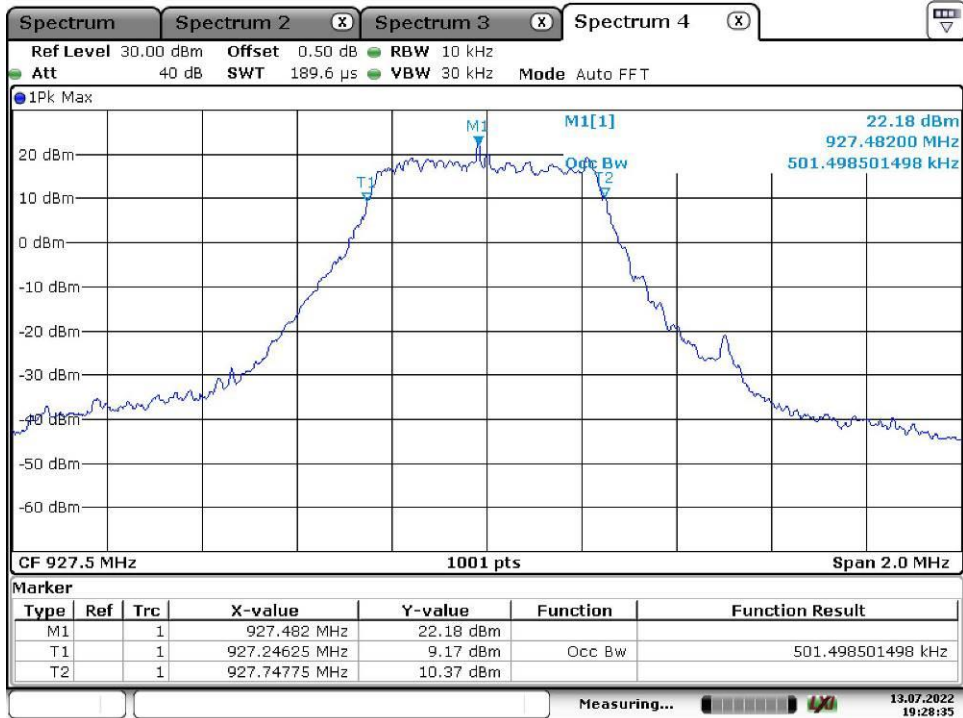
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Middle Channel



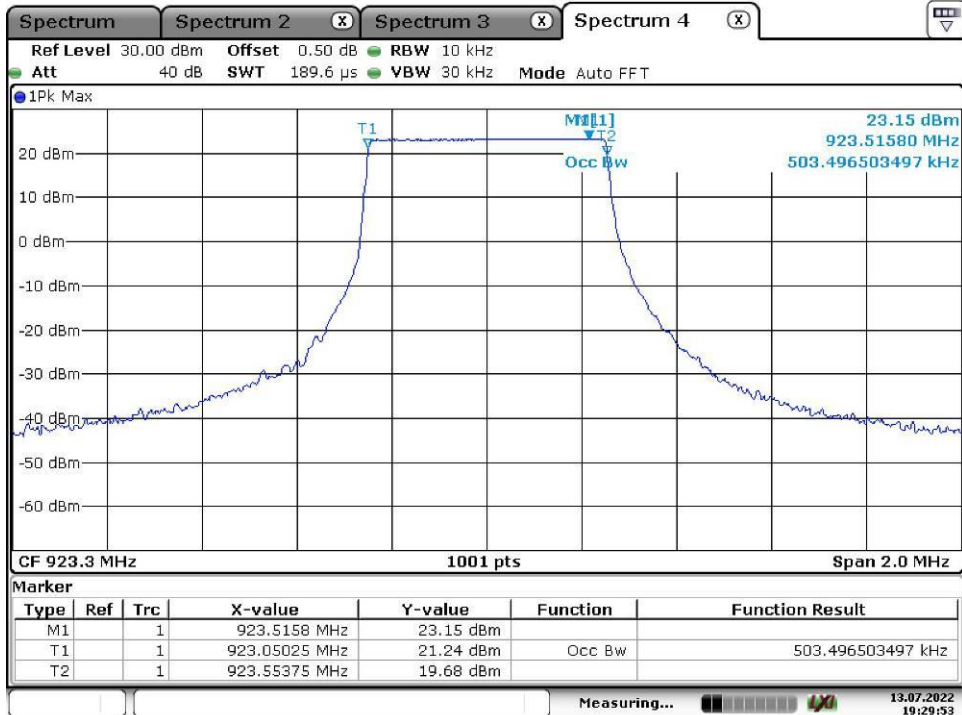
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High Channel



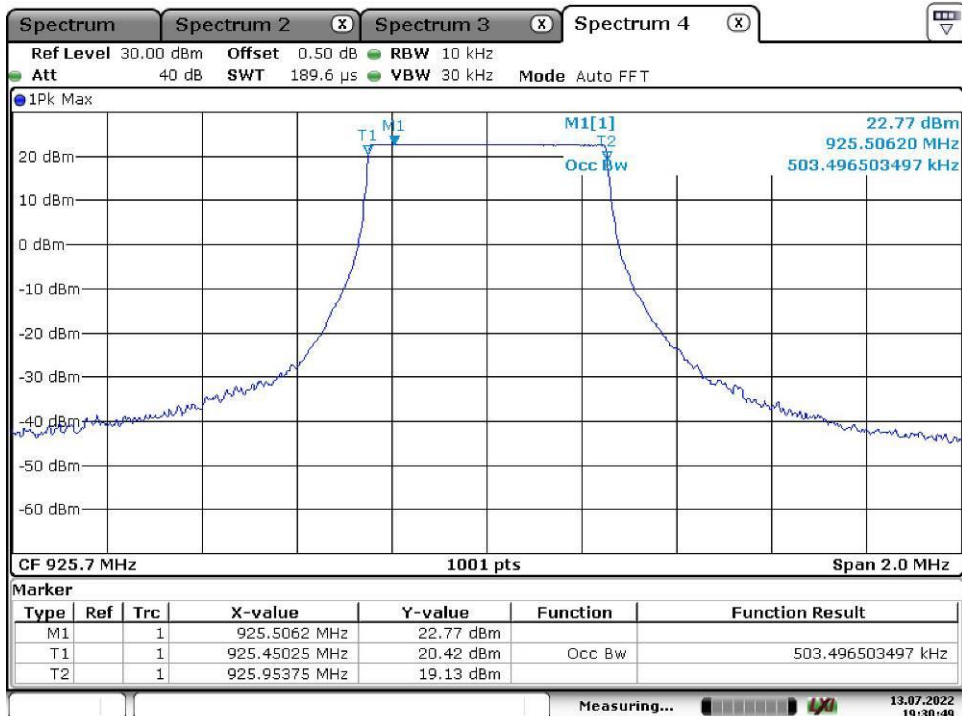
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Lora DTS SF12  
Low Channel



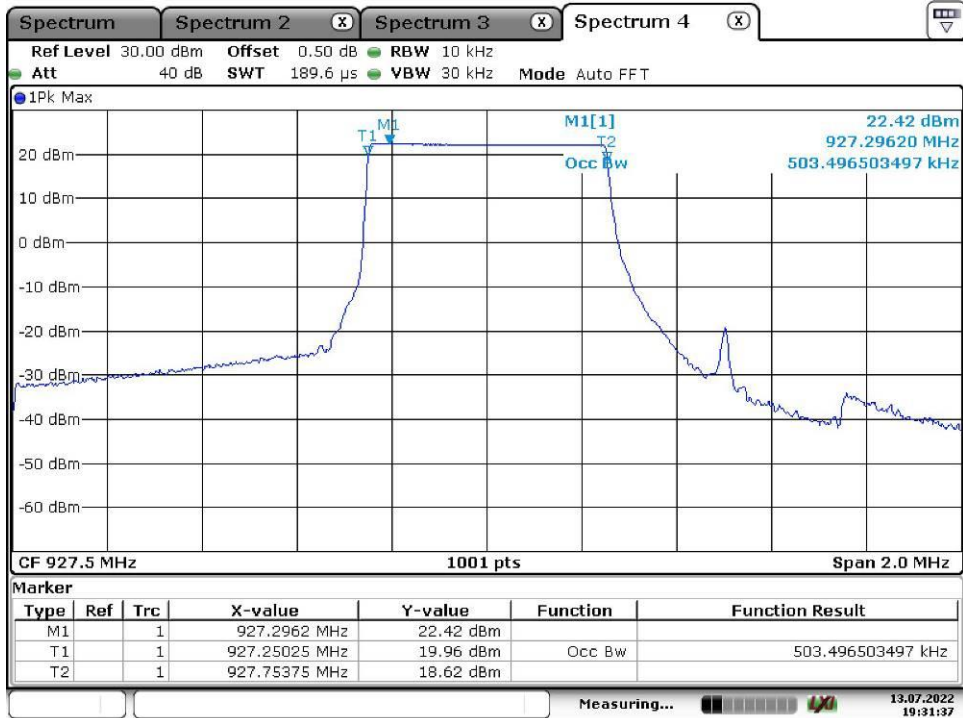
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Middle Channel



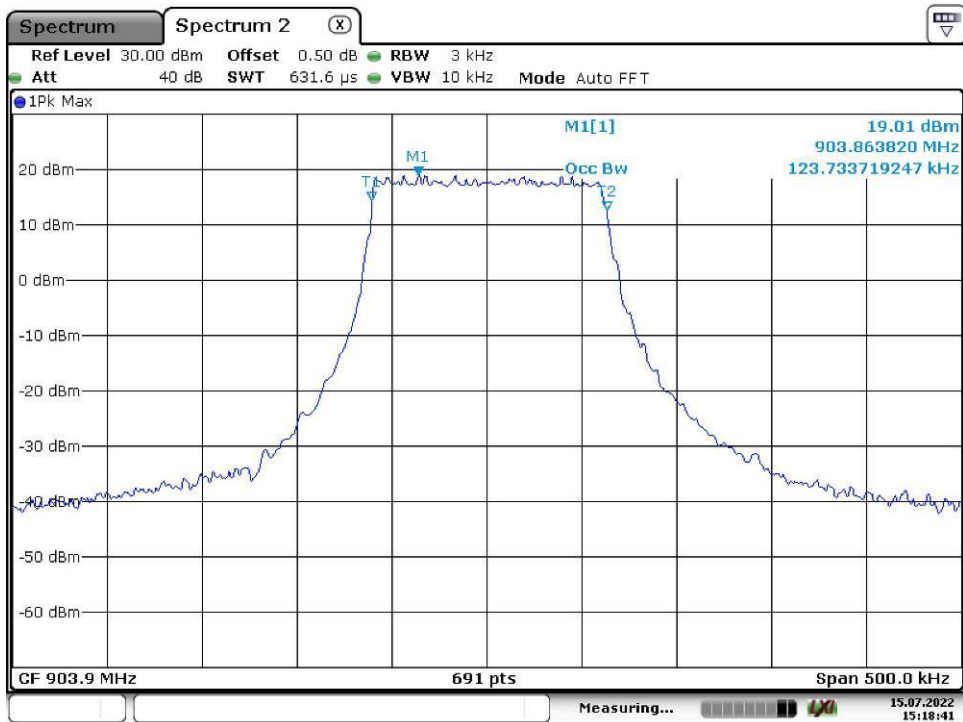
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High Channel



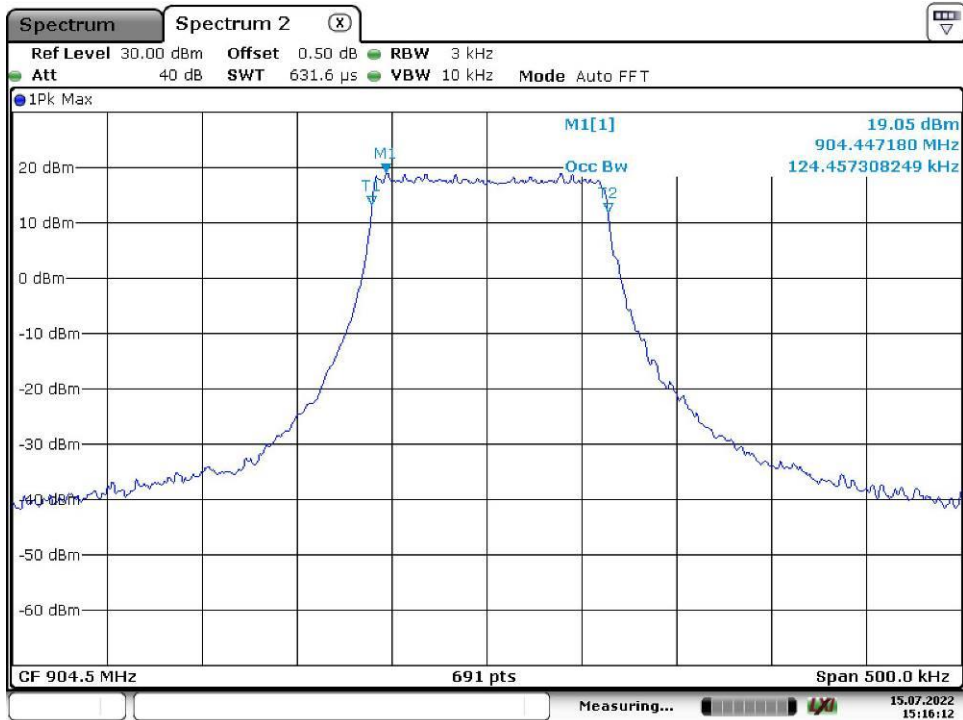
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Lora Hybrid SF9  
Low Channel



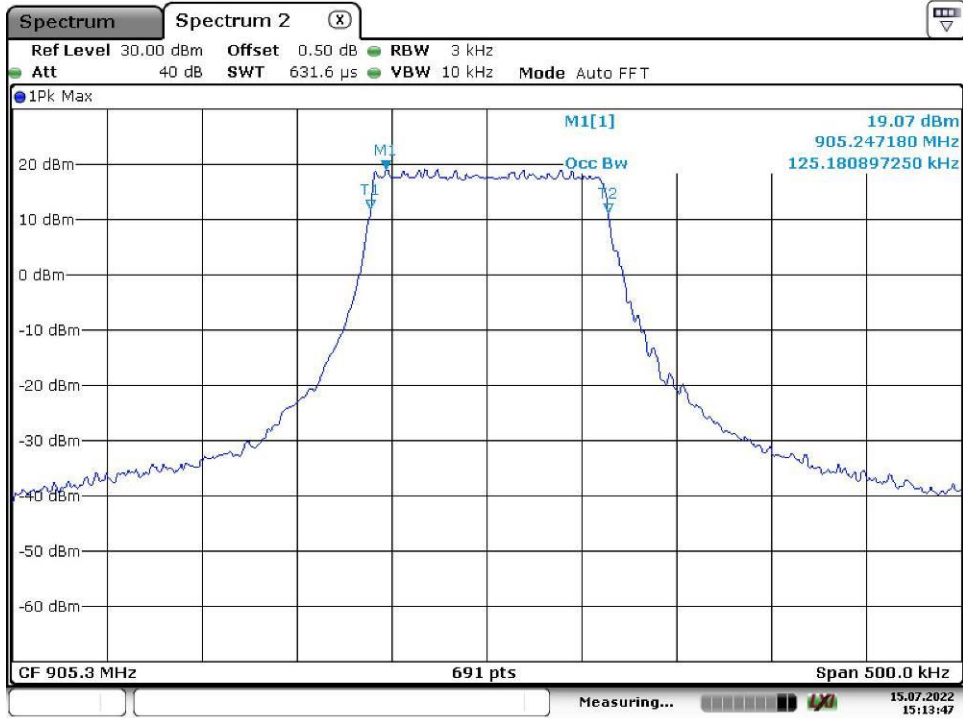
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Middle Channel



Date: 15.JUL.2022 15:16:12

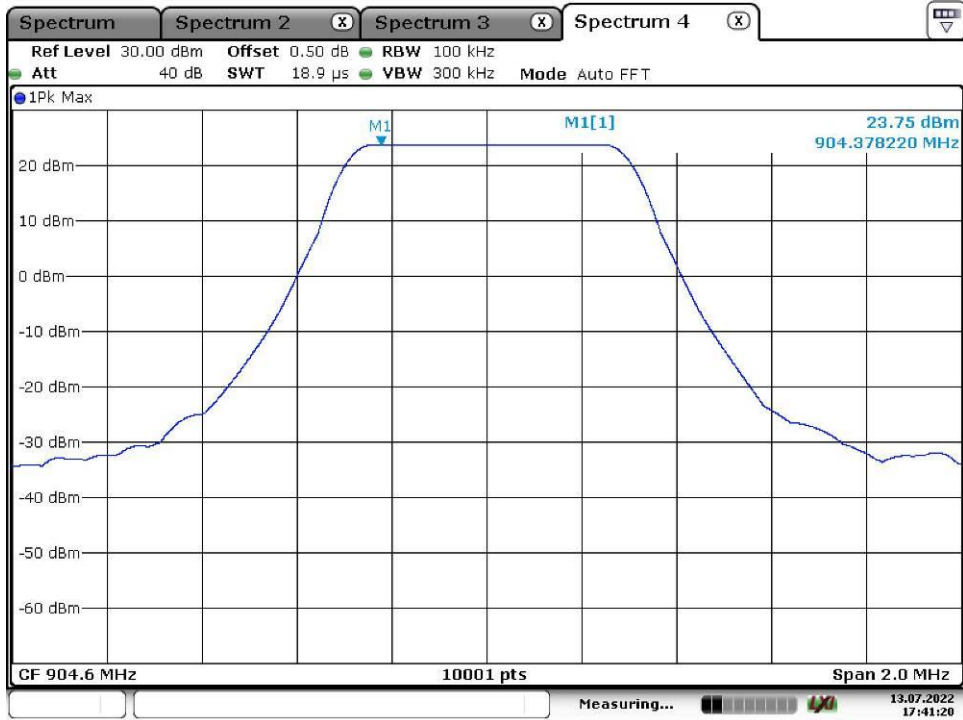
High Channel



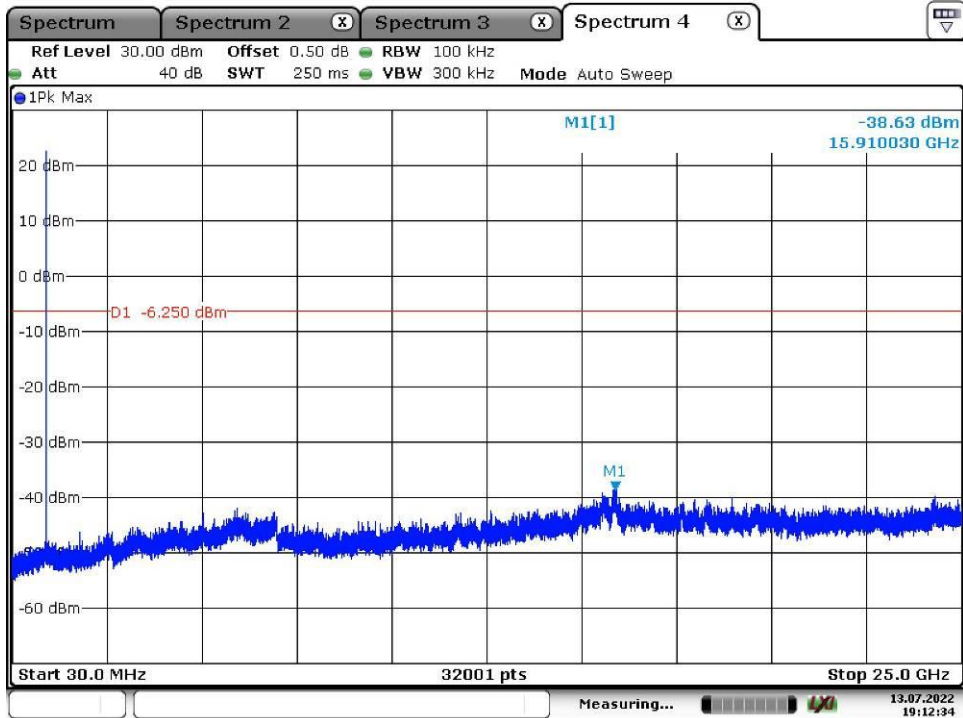
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### Appendix A.4: Conducted Spurious Emissions Measured in 100 kHz Bandwidth

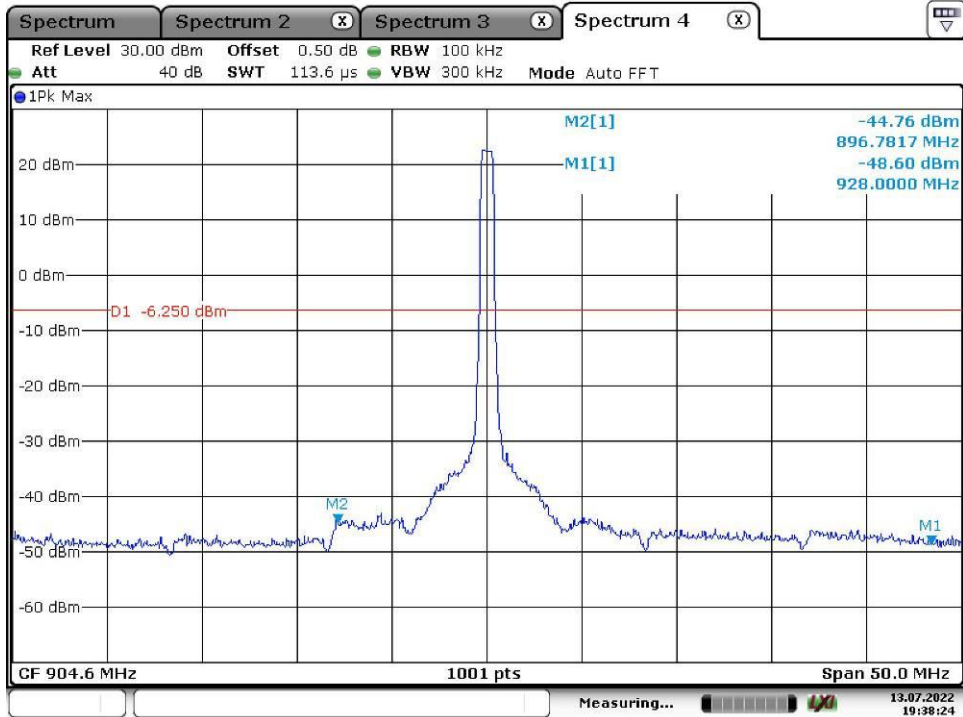
Lora Hybrid SF11  
904.6MHz



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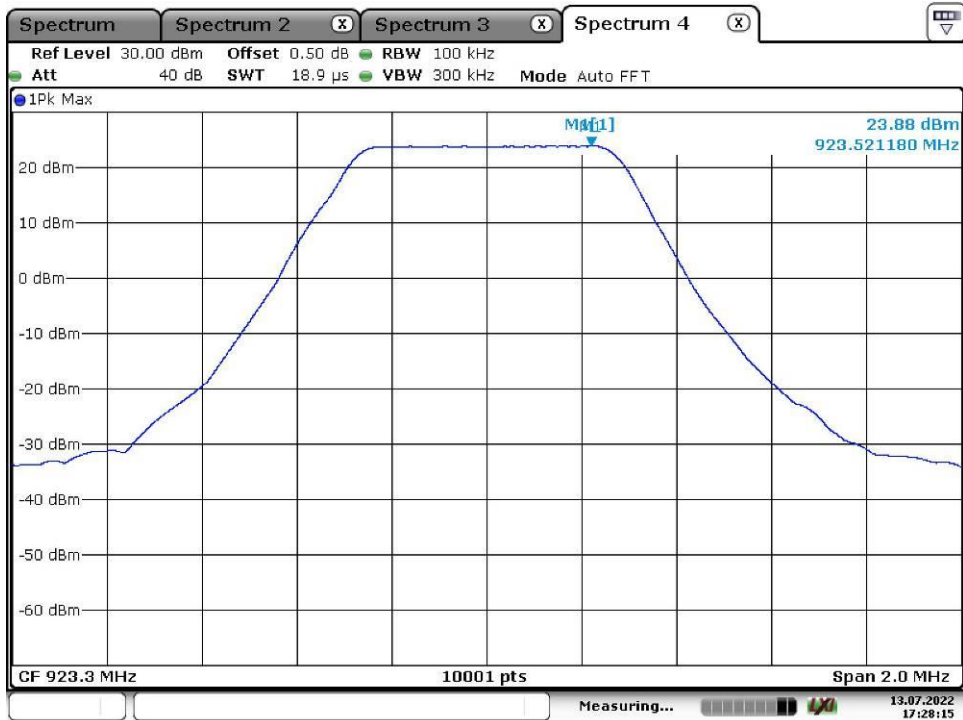


Date: 13.JUL.2022 19:12:34



Date: 13.JUL.2022 19:38:24

Lora DTS SF7  
Low Channel



Date: 13.JUL.2022 17:28:15