

# TR 3765 B

**Equipment Under Test:** RM1262

**Requirement(s):** FCC 15.247 FHSS  
ISED RSS-247 FHSS

**Test Date(s):** 12/13/2023 – 12/19/2023

**Prepared for:** Laird Connectivity  
Attn: Jonathan Kaye  
W66 N220 Commerce Ct.  
Cedarburg, WI 53012

**Report Issued by:** Adam Alger, Laboratory Manager

Signature: *Adam Alger*

Date: 2/22/2024

**Report Reviewed by:** Adam Alger, Laboratory Manager

Signature: *Adam Alger*

Date: 1/24/2024

**Report Constructed by:** Anthony Smith, EMC Engineering Specialist

Signature: *Anthony Smith*

Date: 12/20/2023

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Report: TR 3765 B		Model: RM1262
Job: C-3765		Serial: 00082

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**Laird Connectivity Test Services in Review**

The Laird Connectivity LLC laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:



**A2LA – American Association for Laboratory Accreditation**

*Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope*

*A2LA Certificate Number: 1255.01*

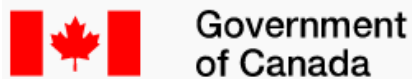
*Scope of accreditation includes all test methods listed herein unless otherwise noted*



**Federal Communications Commission (FCC) – USA**

*Accredited Test Firm Registration Number: 953492*

*Recognition of two 3 meter Semi-Anechoic Chambers*



**Innovation, Science and Economic Development Canada**

*Accredited U.S. Identification Number: US0218*

*Recognition of two 3 meter Semi-Anechoic Chambers*

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## 1 TEST REPORT SUMMARY

During **December 13<sup>th</sup> to December 19<sup>th</sup>** the Equipment Under Test (EUT), **RM1262**, as provided by **Laird Connectivity** was tested to the following requirements for the purpose of a **Class 2 Permissive Change to add an antenna**:

Requirements	Description	Specification	Method	Result
FCC: 15.247 (b)(2) IC:RSS-247 5.4 (a)	Peak Conducted Output Power	30 dBm	ANSI C63.10	Pass
FCC: 15.247 (a)(1)(i) IC: RSS-247 5.1 (c)	20 dB and Occupied Bandwidth	20 dB < 500 kHz	ANSI C63.10	Pass
FCC: 15.247 (d) IC: RSS-247 5.5	Emissions in Non-Restricted Frequency Bands 30-10000 MHz	20 dBc	ANSI C63.10	Pass
FCC: 15.247 (d) IC: RSS-GEN 8.10	Emissions in Restricted Frequency Bands 30-10000 MHz	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Pass

### Notice:

The results relate only to the item tested as configured and described in this report. Any additional configurations, modes of operation, or modifications made to the equipment under test after the specified test date(s) are at the decision of the client and may not apply to the data seen in this test report.

The decision rule for Pass / Fail assessment to the specification or standard listed in this test report has been agreed upon by the client and laboratory to be as follows:

Measurement Type	Rule
Emissions – Amplitude	1 dB below specified limit
Emissions – Frequency	1% less than the specification
Immunity	Tested at specified level

## 2 CLIENT INFORMATION

<b>Company Name</b>	Laird Connectivity
<b>Contact Person</b>	Jonathan Kaye
<b>Address</b>	W66N220 Commerce Court Cedarburg, WI, 53012

### 2.1 Equipment Under Test (EUT) Information

*The following information has been supplied by the client*

<b>Product Name</b>	RM1262
<b>Model Number</b>	RM1262
<b>Serial Number</b>	00082
<b>FCC ID</b>	SQG-RM1262
<b>IC ID</b>	3147A-RM1262

### 2.2 Product Description

LoRaWAN module operating in the 902.3-914.9 MHz range.

### 2.3 Modifications Incorporated for Compliance

None noted at time of test

### 2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

### 2.5 Additional Information

Programmed via USB cable utilizing UwTerminalX ver 1.17 (terminal emulator software).

Radio Test Firmware: RM1262\_480-00219-R128.4.1.242.gbl (non-hopping) and 480-00215-R126.4.1.186.hex (hopping).

Powered via USB.

### 2.6 Additional Information

Tested for a [Class 2 Permissive Change](#) to add a Laird FlexDIPOLE antenna with a peak gain of 2.4 dBi to the list of antennas usable by the RM1262. EUT tested via Cabinet Radiation method.

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## 2.7 RF Information

Channel Frequency (MHz)	Channel List	Data Rate (bits/sec)	Spreading Factor	Channel Bandwidth (kHz)
902.3-914.9	64 Channels	980	10	125

## 2.8 Test Channels, Duty Cycle, and Power Index

Channel	Frequency (MHz)	Power Index	Modulation Mode	Duty Cycle
0	902.3	22	LoRa	98.0
31	908.5	22	LoRa	98.0
63	914.9	22	LoRa	98.0

### 3 REFERENCES

Publication	Edition	Date	AMD 1
eCFR	-	2023	-
RSS-247	3	2024	-
RSS-GEN	5	2018	2019
ANSI C63.10	-	2013	-
KDB 178919 D01	6	2015	-

## 4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of  $k = 2$ .

References
CISPR 16-4-1
CISPR 16-4-2
CISPR 32
ANSI C63.23
A2LA P103
A2LA P103c
ETSI TR 100-028

Measurement Type	Configuration	Uncertainty $\pm$
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

Parameter	ETSI U.C. $\pm$	U.C. $\pm$
Radio Frequency, from F0	$1 \times 10^{-7}$	$0.55 \times 10^{-7}$
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

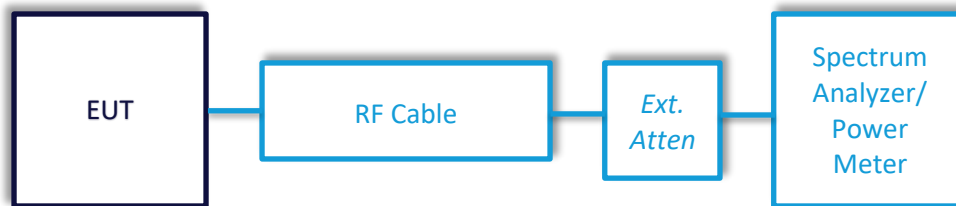


## 5 TEST DATA

### 5.1 Antenna Port Conducted Emissions

<b>Description of Measurement</b>	<p>The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter.</p> <p>The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.</p>
<b>Example Calculations</b>	<p>Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm)</p> <p>Margin (dB) = Limit (dBm) – Corrected Reading (dBm)</p>

#### Block Diagram



#### Instrumentation

Asset #	Description	Manufacturer	Model #	Serial #	Date	Due Date	Status
AA 960156	Filter - High Pass 900 MHz	KWM	HPF-L-14185	none	4/11/2023	4/11/2024	Active Calibration
AA 960173	Cable	A.H. Systems, Inc.	SAC-26G-1	388	6/13/2023	6/12/2024	Active Verification
EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/27/2023	4/27/2024	Active Calibration
EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/11/2023	4/11/2024	Active Calibration
EE 960203	Analyzer - EMI Receiver	Keysight	N9038A	MY56400072	4/11/2023	4/11/2024	Active Calibration

### 5.1.1 Antenna Port Conducted Emissions – Output Power

<b>Operator</b>	Anthony Smith	<b>QA</b>	Dylan Rosenfeldt
<b>Temperature</b>	21.4, 21.9, 21.5, 20.3°C	<b>R.H. %</b>	22.3, 29.2, 34.8, 24.6%
<b>Test Date</b>	12/13/2023, 12/14/2023, 12/15/2023, 12/19/2023	<b>Location</b>	Conducted RF Bench
<b>Requirement</b>	FCC 15.247 (b)(3) RSS-247 5.4	<b>Method</b>	ANSI C63.10 11.9.1.1

**Limits: 1W**

#### Test Parameters

<b>Frequency</b>	902.3-914.9 MHz	<b>Setup</b>	Conducted
<b>RBW</b>	1 MHz	<b>VBW</b>	3 MHz
<b>Detector(s)</b>	Peak Max Hold	<b>Sweep Time</b>	Auto

#### EUT Parameters

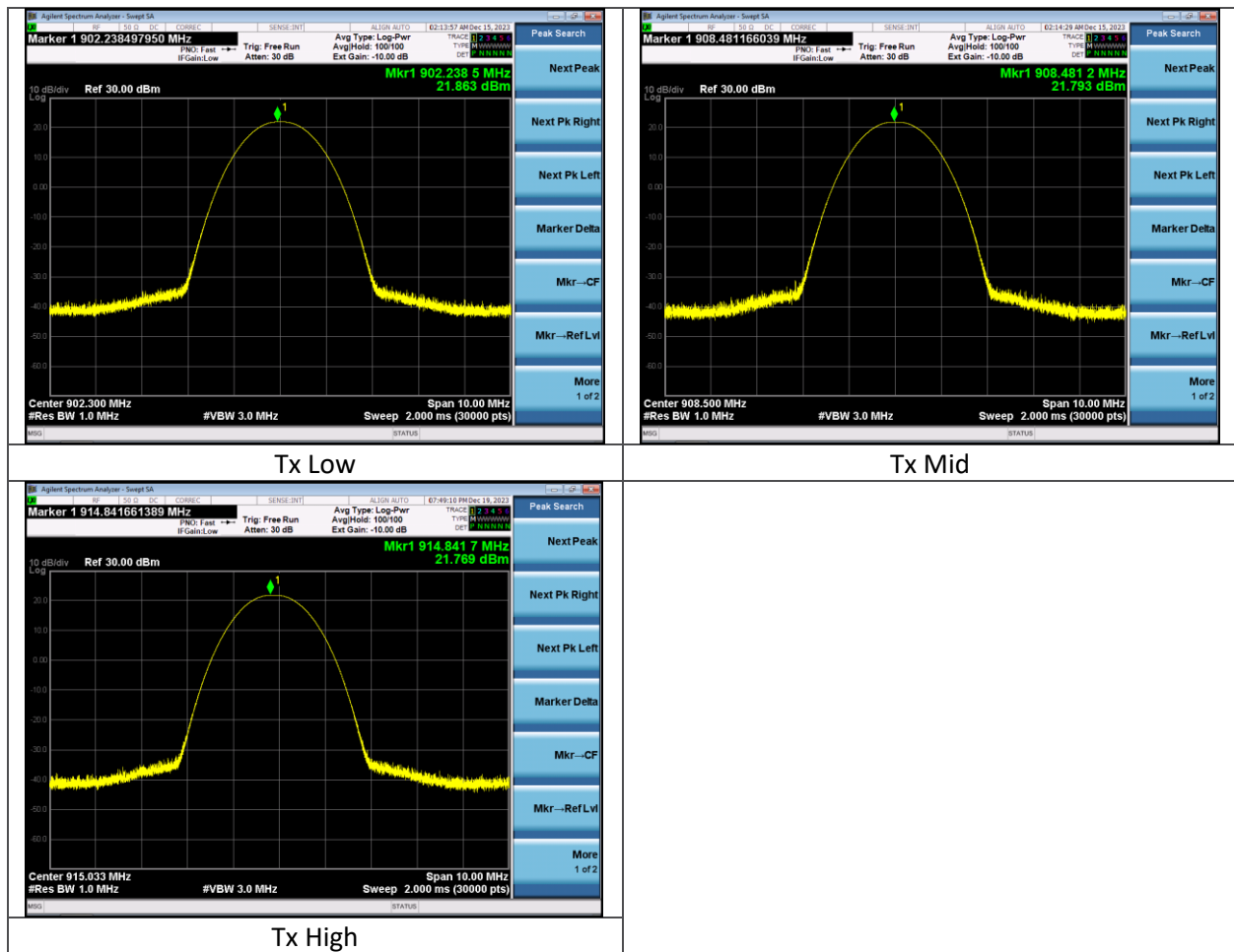
<b>Input Power</b>	USB	<b>Mode</b>	LoRa
<b>Frequency</b>	902.3, 908.5, 914.9 MHz	<b>Channel</b>	Low, Mid, High
<b>Bandwidth</b>	125 kHz	<b>Spreading Factor</b>	10

Data

Table

Frequency (MHz)	Antenna Gain (dBi)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)
902.3	2.4	21.9	30.0	8.1
908.5	2.4	21.8	30.0	8.2
914.9	2.4	21.8	30.0	8.2

Plots



### 5.1.2 Antenna Port Conducted Emissions – 20 dB and OBW

<b>Operator</b>	Anthony Smith	<b>QA</b>	Dylan Rosenfeldt
<b>Temperature</b>	21.4, 21.9, 21.5, 20.3°C	<b>R.H. %</b>	22.3, 29.2, 34.8, 24.6%
<b>Test Date</b>	12/13/2023, 12/14/2023, 12/15/2023, 12/19/2023	<b>Location</b>	Conducted RF Bench
<b>Requirement</b>	FCC 15.247 (a)(1)(i) RSS-247 5.1	<b>Method</b>	ANSI C63.10 § 11.8.2 – 20dB § 6.9.2 - OBW

**20 dB Limit: ≤ 500kHz**

#### Test Parameters

<b>Frequency</b>	902.3-914.9 MHz	<b>Setup</b>	Conducted
<b>RBW</b>	3 kHz	<b>VBW</b>	10 kHz
<b>Detector(s)</b>	Peak Max Hold	<b>Sweep Time</b>	Auto

#### EUT Parameters

<b>Input Power</b>	USB	<b>Mode</b>	LoRa
<b>Frequency</b>	902.3, 908.5, 914.9 MHz	<b>Channel</b>	Low, Mid, High
<b>Bandwidth</b>	125 kHz	<b>Spreading Factor</b>	10

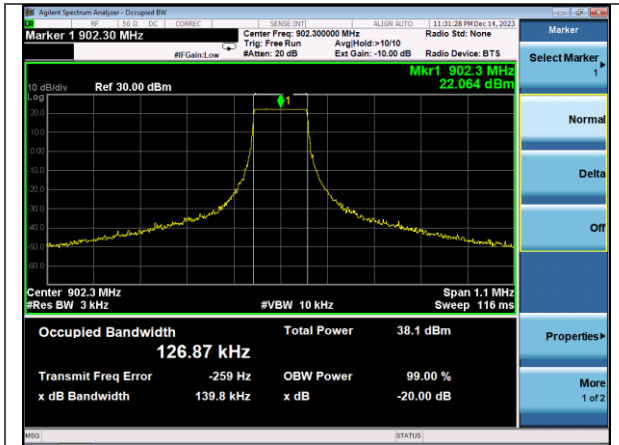
**Data**

**Table**

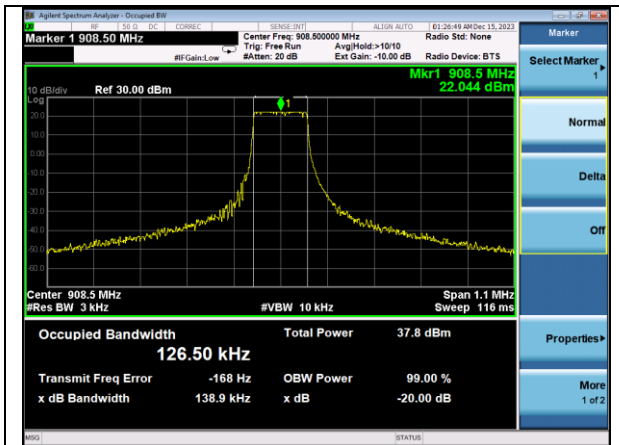
Frequency (MHz)	20 dB BW (kHz)	99% OBW (kHz)	Limit (kHz)	Margin (kHz)
902.3	139.8	126.9	500	360.2
908.5	138.9	126.5	500	361.1
914.9	139.7	126.5	500	360.3

## Plots

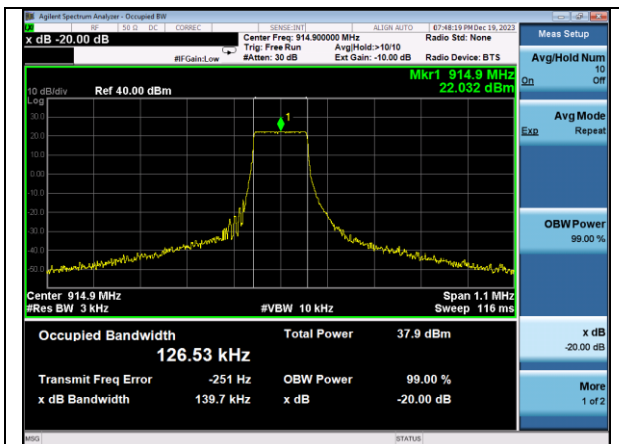
### Tx Low



### Tx Mid



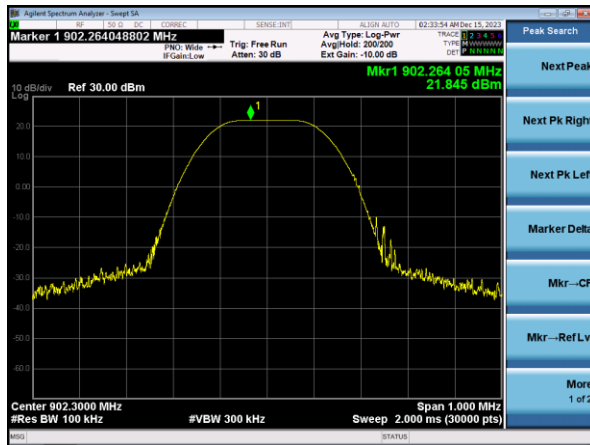
### Tx High



### 5.1.3 Antenna Port Conducted Emissions – Emissions in Non-Restricted Frequency Bands

<b>Operator</b>	Anthony Smith	<b>QA</b>	Dylan Rosenfeldt
<b>Temperature</b>	21.4, 21.9, 21.5, 20.3°C	<b>R.H. %</b>	22.3, 29.2, 34.8, 24.6%
<b>Test Date</b>	12/13/2023, 12/14/2023, 12/15/2023, 12/19/2023	<b>Location</b>	Conducted RF Bench
<b>Requirement</b>	FCC 15.247 (d) RSS-247	<b>Method</b>	ANSI C63.10 11.11.1

Limits:  $\leq 20$  dBc



Reference Level 21.8 dBm/100kHz

Limit is 1.8 dBm

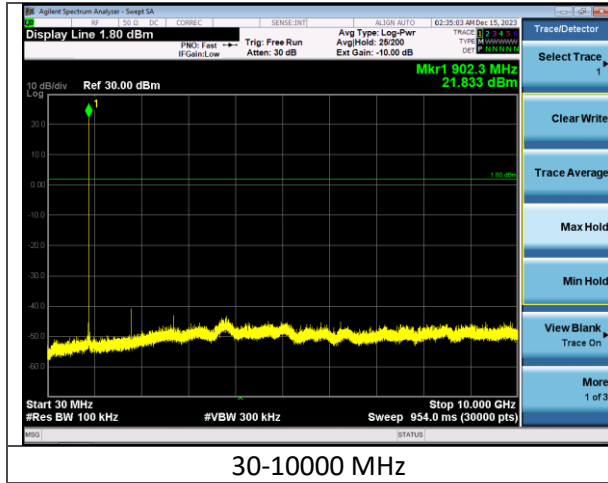
#### Test Parameters

<b>Frequency</b>	30-10000 MHz	<b>Setup</b>	Conducted
<b>RBW</b>	100 kHz	<b>VBW</b>	300 kHz
<b>Detector(s)</b>	Peak Max Hold	<b>Sweep Time</b>	Auto
<b>Notes</b>	No spurious emissions near limit		

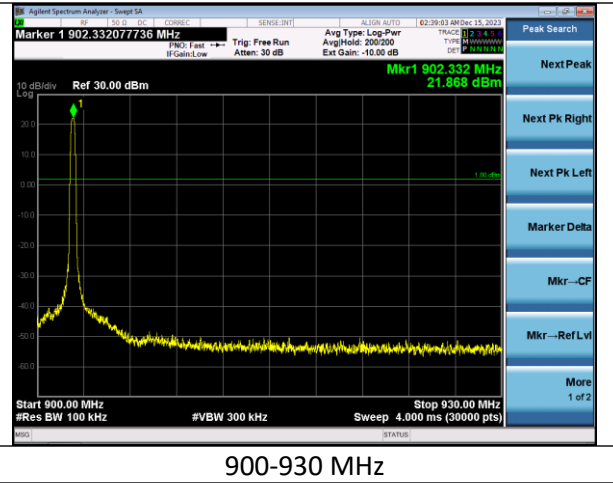
#### EUT Parameters

<b>Input Power</b>	USB	<b>Mode</b>	LoRa
<b>Frequency</b>	902.3, 908.5, 914.9 MHz	<b>Channel</b>	Low, Mid, High
<b>Bandwidth</b>	125 kHz	<b>Spreading Factor</b>	10

Data  
Plots  
Tx Low

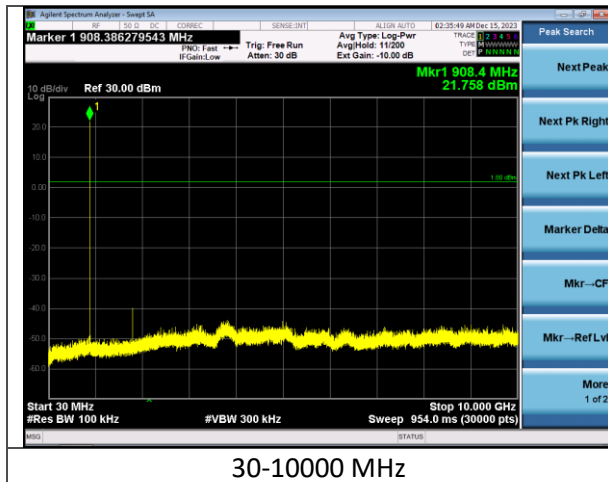


30-10000 MHz

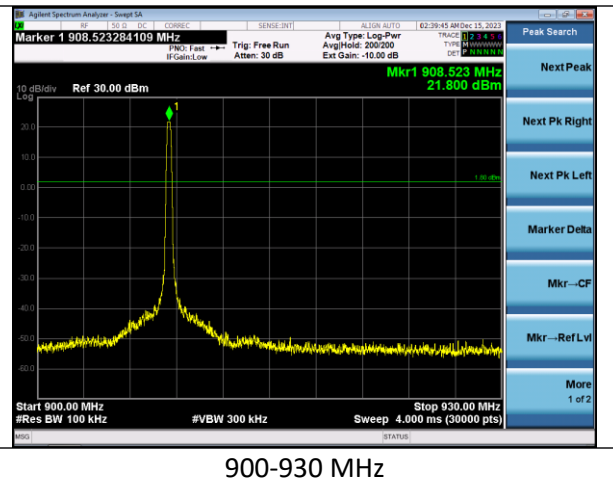


900-930 MHz

Tx Mid



30-10000 MHz

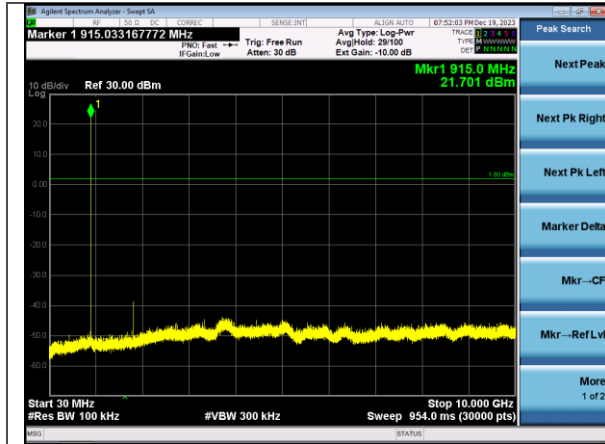


900-930 MHz

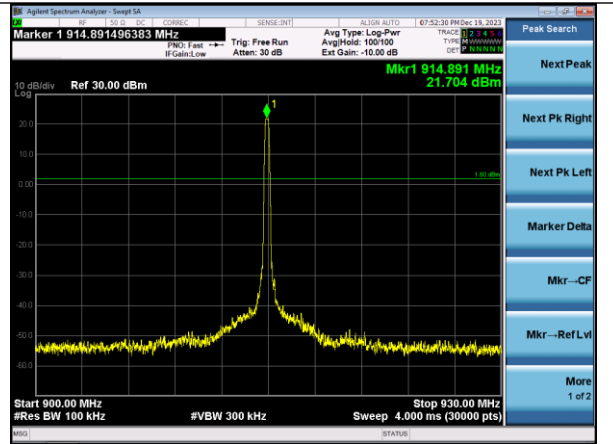
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Tx High



30-10000 MHz



900-930 MHz

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### 5.1.4 Antenna Port Conducted Emissions – Emissions in Restricted Frequency Bands

<b>Operator</b>	Anthony Smith	<b>QA</b>	Dylan Rosenfeldt
<b>Temperature</b>	21.4, 21.9, 21.5, 20.3°C	<b>R.H. %</b>	22.3, 29.2, 34.8, 24.6%
<b>Test Date</b>	12/13/2023,12/14/2023, 12/15/2023, 12/19/2023	<b>Location</b>	Conducted RF Bench
<b>Requirement</b>	FCC 15.247 (d) RSS-247	<b>Method</b>	ANSI C63.10 § 11.12.2

#### Limits:

Frequency (MHz)	Quasi Peak Limit (dBµV/m)	Average Limit (dBµV/m)	Peak Limit (dBµV/m)
30-88	40.0	-	-
88-216	43.5	-	-
216-960	46.0	-	-
960-1000	54.0	-	-
1000-25000	-	54.0	74.0

#### Test Parameters

<b>Frequency</b>	30-10000 MHz	<b>Setup</b>	Conducted
<b>RBW</b>	120 kHz Below 1 GHz 1 MHz Above 1 GHz	<b>VBW</b>	1.2 MHz Below 1 GHz 3 MHz Above 1 GHz
<b>Detector(s)</b>	Peak Max Hold	<b>Sweep Time</b>	Auto

#### EUT Parameters

<b>Input Power</b>	USB	<b>Mode</b>	LoRa
<b>Frequency</b>	902.3, 908.5, 914.9 MHz	<b>Channel</b>	Low, Mid, High, Hopping
<b>Bandwidth</b>	125 kHz	<b>Spreading Factor</b>	10

**Data**

**Table**

**Below 1 GHz**

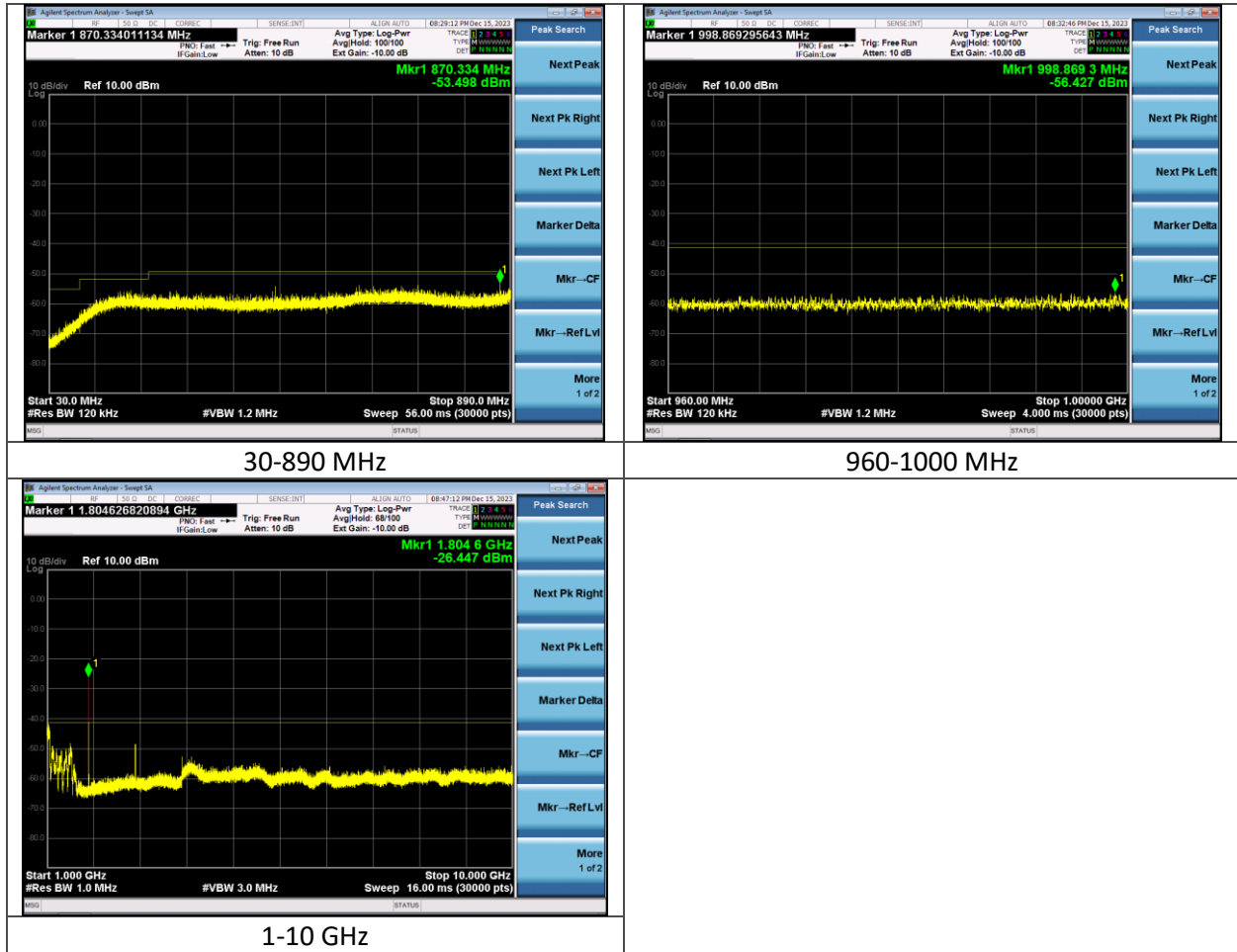
Channel	Freq (MHz)	Meas (dBm)	Antenna Gain (dBi)	GRF (dB)	Corrected Meas (EIRP)	Limit (dBm)	Margin (dB)
Low	612.2	-61.3	2.4	4.7	-54.2	-49.2	5.0
Mid	612.3	-61.3	2.4	4.7	-54.2	-49.2	5.0
High	606.5	-60.9	2.4	4.7	-53.8	-49.2	4.6
Low	980.5	-61.2	2.4	4.7	-54.1	-49.2	4.9
Mid	983.5	-61.3	2.4	4.7	-54.2	-49.2	5.0
High	987.1	-61.7	2.4	4.7	-54.6	-49.2	5.4
Hop	988.2	-62.5	2.4	4.7	-55.4	-49.2	6.2
Hop	608.3	-61.4	2.4	4.7	-54.3	-49.2	5.1

**Above 1 GHz**

Channel	Freq (MHz)	Meas (dBm)	Antenna Gain (dBi)	Corrected Meas (EIRP)	Limit (dBm)	Margin (dB)
Low	2706.9	-48.3	2.4	-45.9	-21.2	24.7
Mid	2725.7	-47.8	2.4	-45.4	-21.2	24.2
Low	2706.9	-50.3	2.4	-47.9	-41.2	6.7
Mid	2725.7	-49.9	2.4	-47.5	-41.2	6.3
Hop	2715.2	-48.4	2.4	-46.0	-21.2	24.8
High	2744.8	-48.8	2.4	-46.4	-41.2	5.2
High	2744.8	-47.2	2.4	-44.8	-21.2	23.6

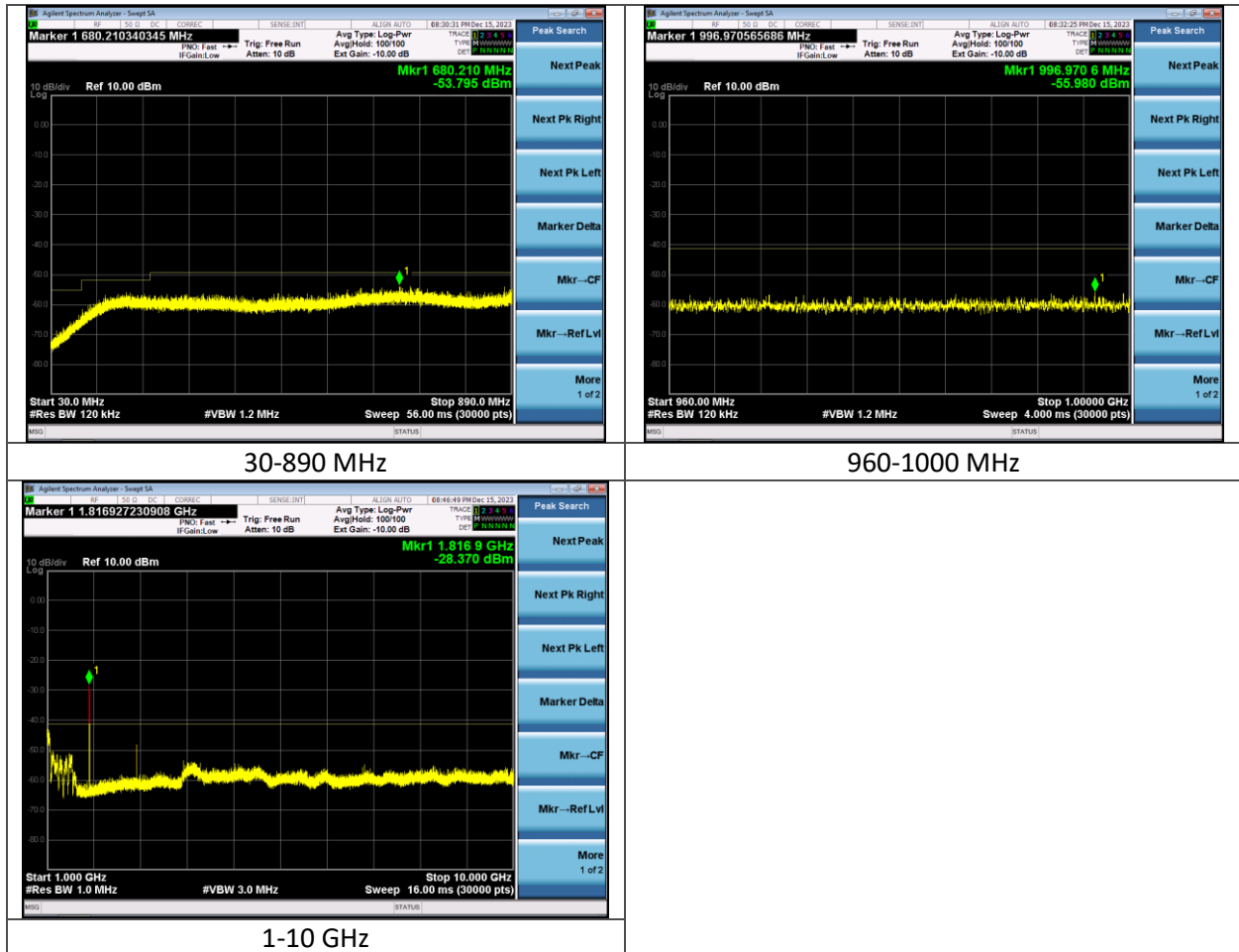
Plots

Tx Low



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Tx Mid



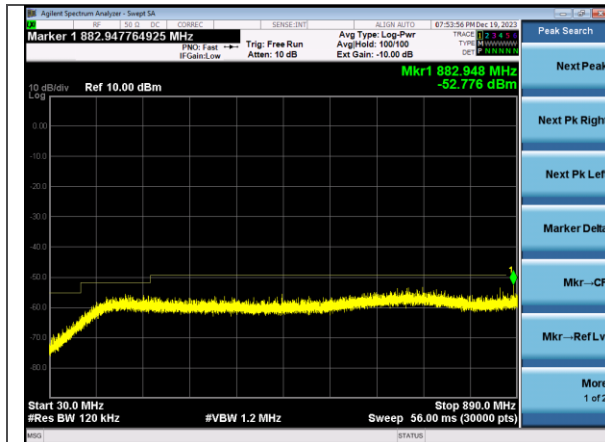
30-890 MHz

960-1000 MHz

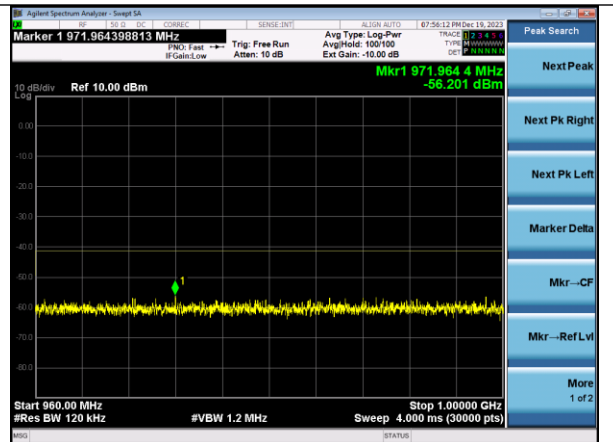
1-10 GHz

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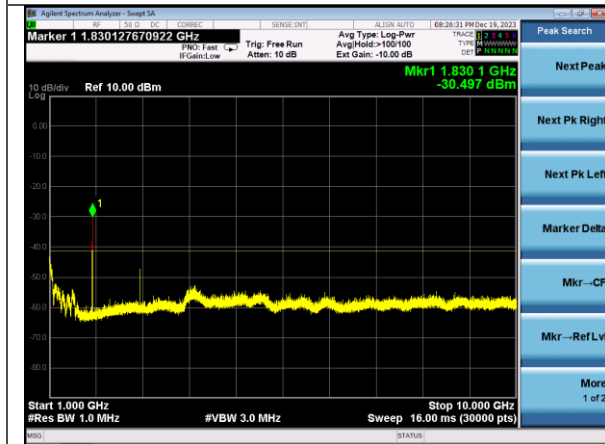
Tx High



30-890 MHz



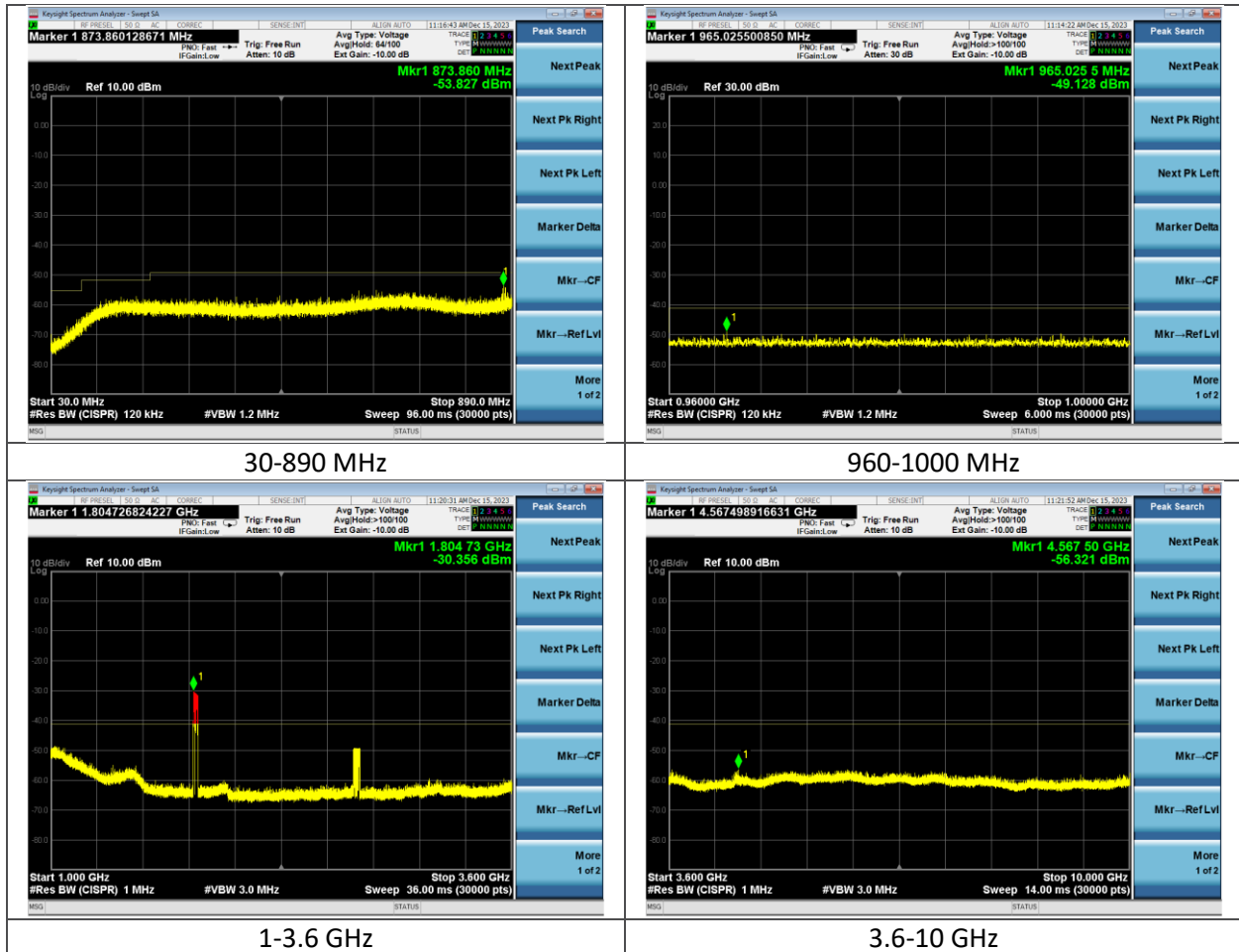
960-1000 MHz



1-10 GHz

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### Tx Hopping



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## 6 REVISION HISTORY

Version	Date	Notes	Person
0	12/20/2023	Initial Draft	Anthony Smith
1	1/9/2024	Revised Draft – Comments Addressed	Anthony Smith
2	1/24/2024	Revised Draft – Frequency Range correction	Anthony Smith
3	2/22/2024	RSS-247 Issue 3	Adam Alger

**END OF REPORT**