FCC and ISED Test Report

PervasID Limited
Reader, Model: RFID DAS 9316

In accordance with FCC 47 CFR Part 15C and ISED RSS-247 and ISED RSS-GEN
(900 MHz FHSS)

Prepared for: PervasID Limited
St John's Inovation Centre
Cowley Road
Cambridge
CB4 OWS
UNITED KINGDOM

FCC ID: 2AQQW1107 IC: 24482-2307

COMMERCIAL-IN-CONFIDENCE

Document 75961807-02 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matthew Russell	Chief Engineer	Authorised Signatory	08 October 2024

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C and ISED RSS-247 and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	George Williams	08 October 2024	

FCC Accreditation
492497/UK2010 Octagon House, Fareham Test Laboratory

ISED Accreditation
12669A/UK0003 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2023, ISED RSS-247: Issue 3 (2023-08) and ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02) for the tests detailed in section 1.3.

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Registered number: SC215164

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Contents

Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	08-Oct-2024

Table 1

1.2 Introduction

Applicant	PervasID Limited
Manufacturer	PervasID Limited
Model Number(s)	9316
Serial Number(s)	17502948-0094
Hardware Version(s)	Original Reader V6.7.8 Modified Reader V6.7.10 (after return to TUV) 16-port Multiplexer V2.0.0
Software Version(s)	Software: v4.2.2.12 Firmware V3.9.0.18
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2023 ISED RSS-247: Issue 3 (2023-08) ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02)
Order Number	PO-1221
Date	17-June-2024
Date of Receipt of EUT	02-July-2024
Start of Test	10-July-2024
Finish of Test	13-September-2024
Name of Engineer(s)	George Williams
Related Document(s)	ANSI C63.4 (2014) ANSI C63.10 (2020) KDB 662911 D01 v02r01

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C and ISED RSS-247 and ISED RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: RFID Transceiver - 900 MHz FHSS						
-	15.203	-	-	Antenna Requirements	Pass	The EUT meets this requirement as it is always professionally installed. See application form for details.
2.1	15.247 (d) and 15.209	3.3 and 5.5	6.13 and 8.9	Spurious Radiated Emissions	Pass	ANSI C63.10 (2020) ANSI C63.4 (2014)
2.2	15.247 (d), and N/A	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2020)
2.3	15.247 (a)(1)	5.1		Frequency Hopping Systems - Average Time of Occupancy	Pass	ANSI C63.10 (2020)
2.4	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Channel Separation	Pass	ANSI C63.10 (2020)
2.5	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Number of Hopping Channels	Pass	ANSI C63.10 (2020)
2.6	15.247 (a)(1)	5.1	6.7	Frequency Hopping Systems - 20 dB Bandwidth	Pass	ANSI C63.10 (2020)
2.7	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2020) KDB 662911 D01 v02r01

Table 2

1.4 Application Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment including the technologies the product supports)*	UHF RFID Distributed Antenna System - intended use detection and monitoring of UHF RFID tags
Manufacturer:	PervasID Ltd
Model:	9316
Part Number:	N/A
Hardware Version:	Motherboard v6.7.8; Mux-DB v2.0.2; Multiplexer v2.0.0
Software Version:	Software: v4.2; Radio FW: 3.9
FCC ID of the product under test – see guidance here	2AQQW1107
IC ID of the product under test – see guidance here	24482-2307

Table 3

Intentional Radiators

Technology	ISM (RFID)					
Frequency Range (MHz to MHz)	902 - 928					
Conducted Declared Output Power (dBm)	33					
Antenna Gain (dBi)	8.5					
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)						
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	PR-ASK					
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	TBD					
Bottom Frequency (MHz)	902.75					
Middle Frequency (MHz)	915.25					
Top Frequency (MHz)	927.25					

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	927.25 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	902.75 MHz
Class A Digital Device (Use in commercial, industrial or business environment) ☒ Class B Digital Device (Use in residential environment only) ☐	

Table 5

AC Power Source

AC supply frequency:		Hz
Voltage		V
Max current:		A
Single Phase ☐ Three Phase ☐		

Table 6

DC Power Source

Nominal voltage:	24	V
Extreme upper voltage:	25.2	V
Extreme lower voltage:	23.8	V
Max current:	4	A

Table 7

Battery Power Source

Voltage:		V
End-point voltage:		V *(Point at which the battery will terminate)*
Alkaline ☐ Leclanche ☐ Lithium ☐ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)*		
Other ☐ Please detail:		

Table 8

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☐

Table 9

Temperature

Minimum temperature:	0	°C
Maximum temperature:	30	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)		dB

Table 11

Antenna Characteristics

Antenna connector ☒			State impedance	50	Ohm
Temporary antenna connector ☐			State impedance		Ohm
Integral antenna ☐	Type:		Gain		dBi
External antenna ☒	Type:	Circular polarised Directional	Gain	8.5	dBic
For external antenna only: Standard Antenna Jack ☐ If yes, describe how user is prohibited from changing antenna (if not professional installed): Equipment is only ever professionally installed ☒ Non-standard Antenna Jack ☒					

Table 12

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

Table 13

I hereby declare that the information supplied is correct and complete.

Name: Martin Neuhaus
Position held: Chief Engineer
Date: 27 June 2024

1.5 Product Information

1.5.1 Technical Description

The Equipment under test (EUT) was a PervasID Limited Track Master, Model: RFID DAS 9316

The primary function of the EUT is as a Radio Frequency Identification (RFID) reader system for automating inventory and asset tracking.

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 EUT Modification Record

The table below details modifications made to the EUT during the test programme.

The modifications incorporated during each test are recorded on the appropriate test pages.

Modification State	Description of Modification still fitted to EUT	Modification Fitted By	Date Modification Fitted
Model: 9316, Serial Number: 17502948-0094			
0	As supplied by the customer	Not Applicable	Not Applicable
1	Changed frequency of 5V switching voltage regulator (U50) and improved filtering to reduce harmonic noise	Dave Hand, PervasID	30-Aug-24

Table 14

1.8 Test Location

TÜV SÜD conducted the following tests at our Octagon House Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: RFID Transceiver - 900 MHz FHSS		
Spurious Radiated Emissions	George Williams	UKAS
Authorised Band Edges	George Williams	UKAS
Frequency Hopping Systems - Average Time of Occupancy	George Williams	UKAS
Frequency Hopping Systems - Channel Separation	George Williams	UKAS
Frequency Hopping Systems - Number of Hopping Channels	George Williams	UKAS
Frequency Hopping Systems - 20 dB Bandwidth	George Williams	UKAS
Maximum Conducted Output Power	George Williams	UKAS

Table 15

Office Address:

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire
PO15 5RL
United Kingdom

2 Test Details

2.1 Spurious Radiated Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) & 15.209
ISED RSS-247, Clause 3.3 & 5.5
ISED RSS-GEN, Clause 6.13 & 8.9

2.1.2 Equipment Under Test and Modification State

S/N: 17502948-0094 - Modification State 1

2.1.3 Date of Test

13-September-2024

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.5.2.6 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10 clause 4.1.5.2.1.

The EUT was placed on the non-conducting platform in a manner typical of a normal installation.

Ports on the EUT were terminated with loads as described in ANSI C63.4 clause 6.2.4.

The plots shown are the characterisation of the EUT. The limits on the plots represent the most stringent case for restricted bands, (74/54 dBuV/m) when compared to 20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

Where formal measurements have been necessary, the results have been presented in the emissions table.

The EUT was powered by 120V AC supplied to the AC-DC 24V transformer.

2.1.5 Example Test Setup Diagram

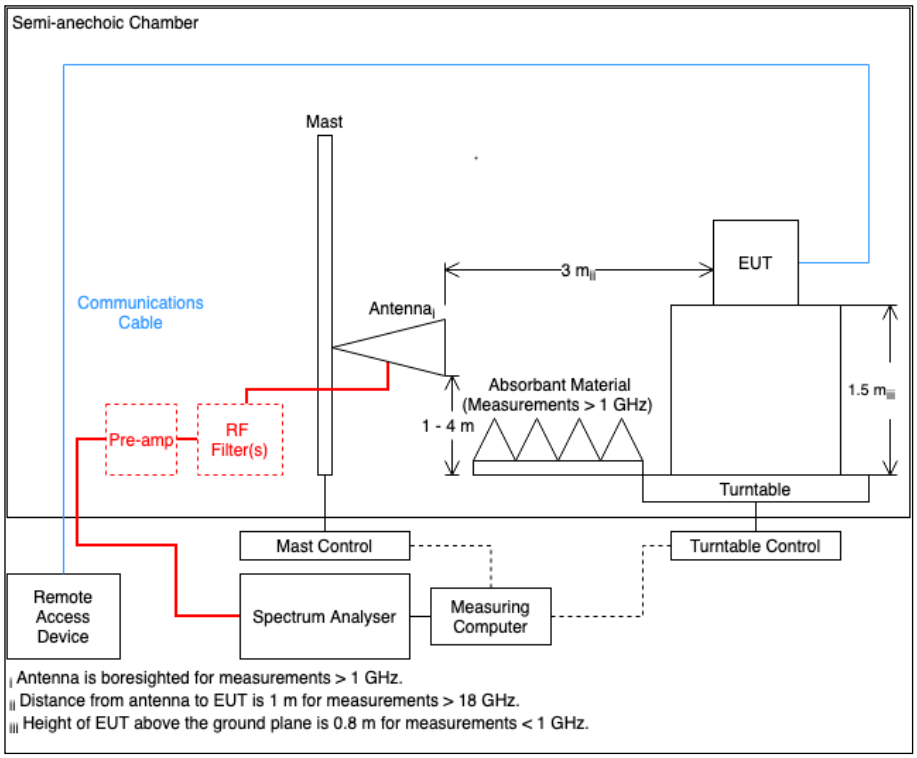

Figure 1

2.1.6 Environmental Conditions

Ambient Temperature	23.6 - 23.8 °C
Relative Humidity	36.9 - 47.9 %

2.1.7 Test Results

RFID Transceiver - 900 MHz FHSS

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
335.108	39.00	46.00	-7.00	Q-Peak	28	110	Horizontal

Table 16 - 902.75 MHz, 30 MHz to 10 GHz

No other emissions found within 10 dB of the limit.

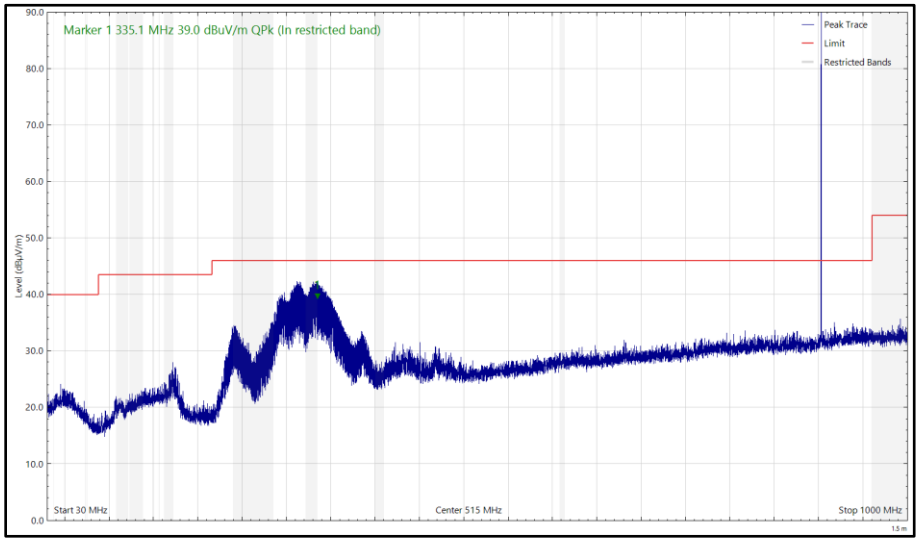

Figure 2 - 902.75 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

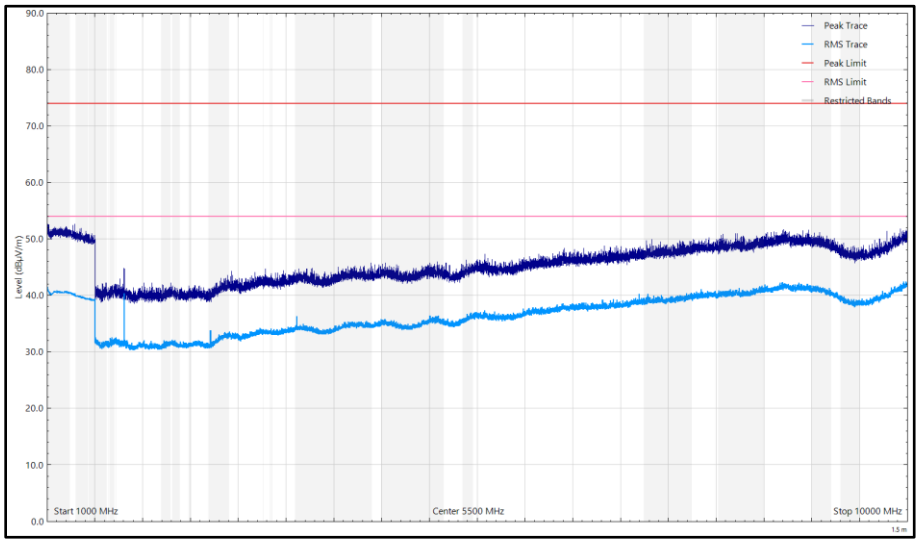

Figure 3 - 902.75 MHz, 1 GHz to 10 GHz, Horizontal

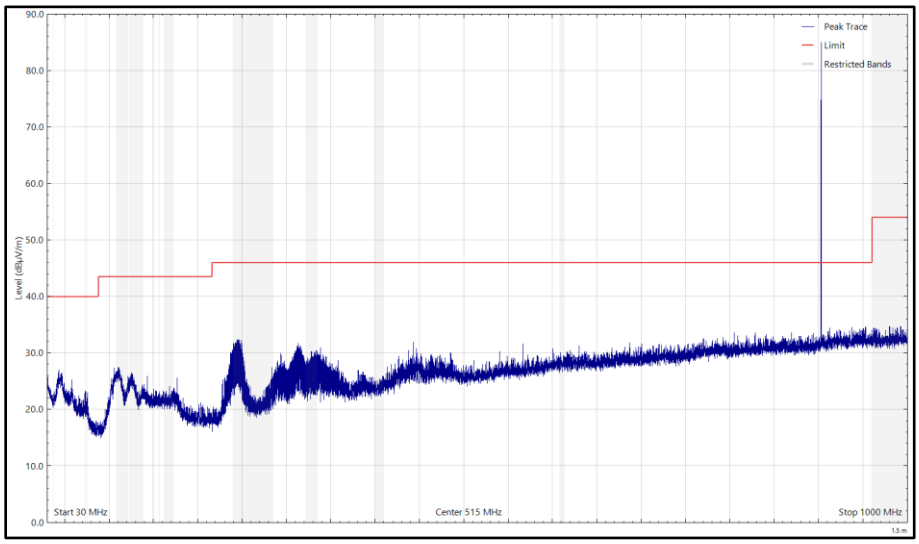

Figure 4 - 902.75 MHz, 30 MHz to 1 GHz, Vertical (Peak)

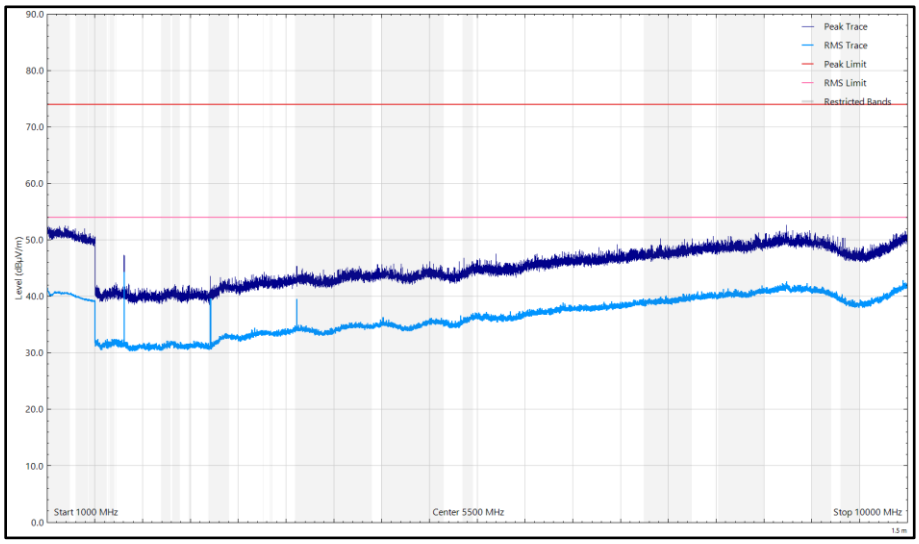

Figure 5 - 902.75 MHz, 1 GHz to 10 GHz, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
286.233	38.01	46.00	-7.99	Q-Peak	268	110	Horizontal
330.752	39.48	46.00	-6.52	Q-Peak	30	100	Horizontal
1830.520	50.25	54.00	-3.75	RMS	38	133	Vertical
2745.790	48.96	54.00	-5.04	CISPR Avg	154	104	Vertical
3660.910	48.64	54.00	-5.36	CISPR Avg	41	193	Vertical
3660.930	44.27	54.00	-9.73	CISPR Avg	38	110	Horizontal

Table 17 - 915.25 MHz, 30 MHz to 10 GHz

No other emissions found within 10 dB of the limit.

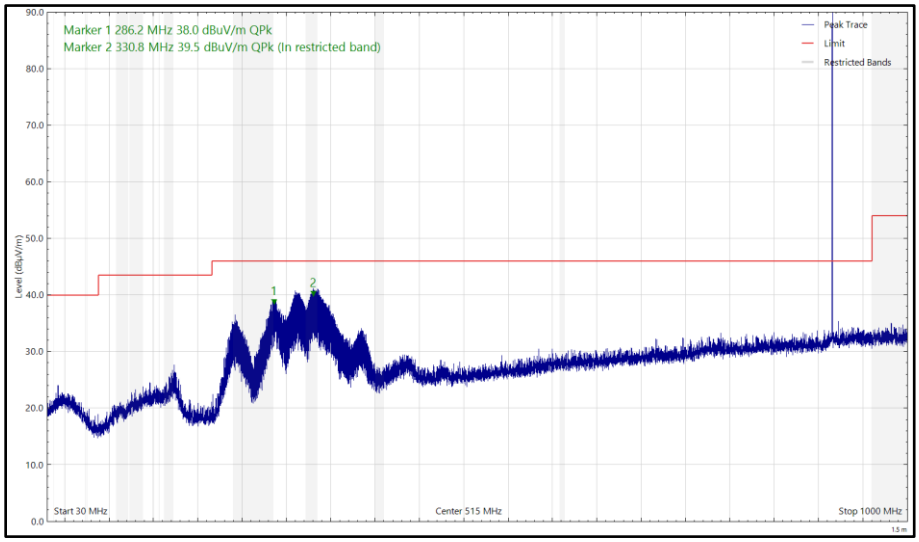

Figure 6 - 915.25 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

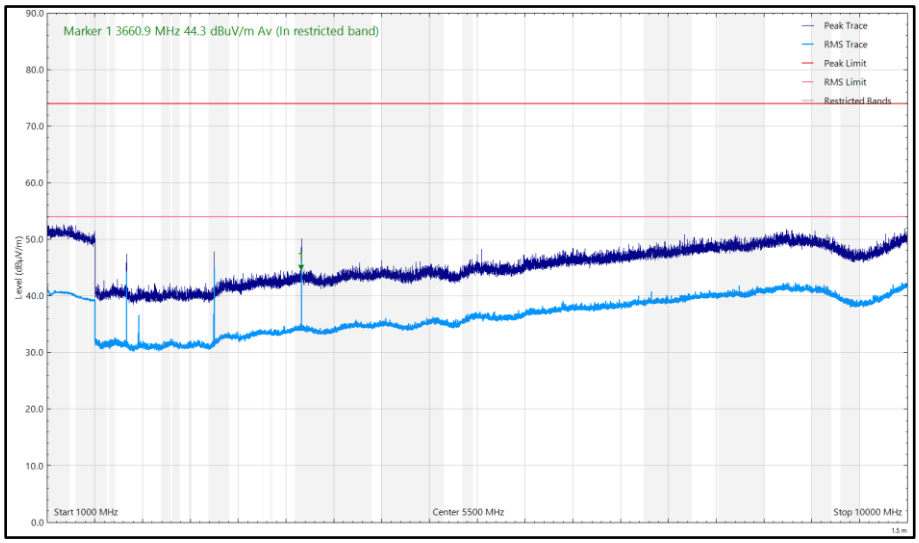

Figure 7 - 915.25 MHz, 1 GHz to 10 GHz, Horizontal

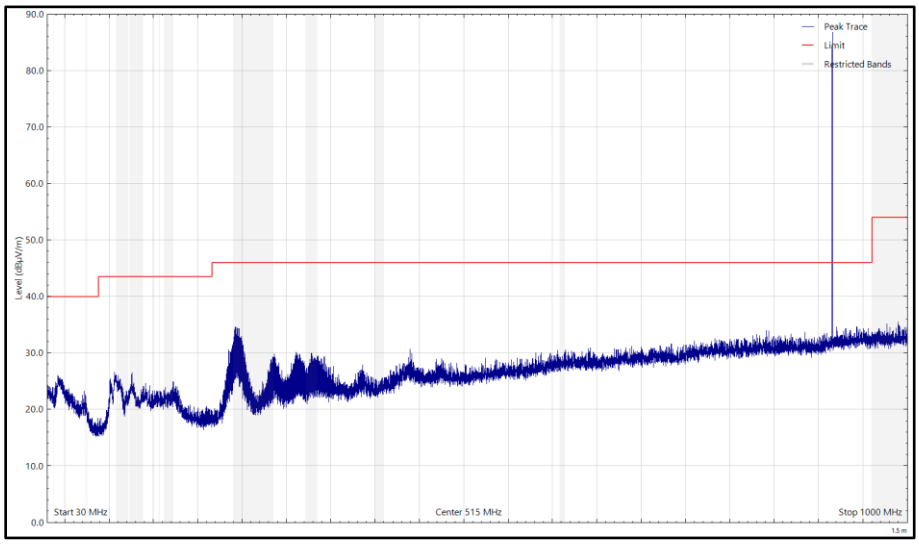

Figure 8 - 915.25 MHz, 30 MHz to 1 GHz, Vertical (Peak)

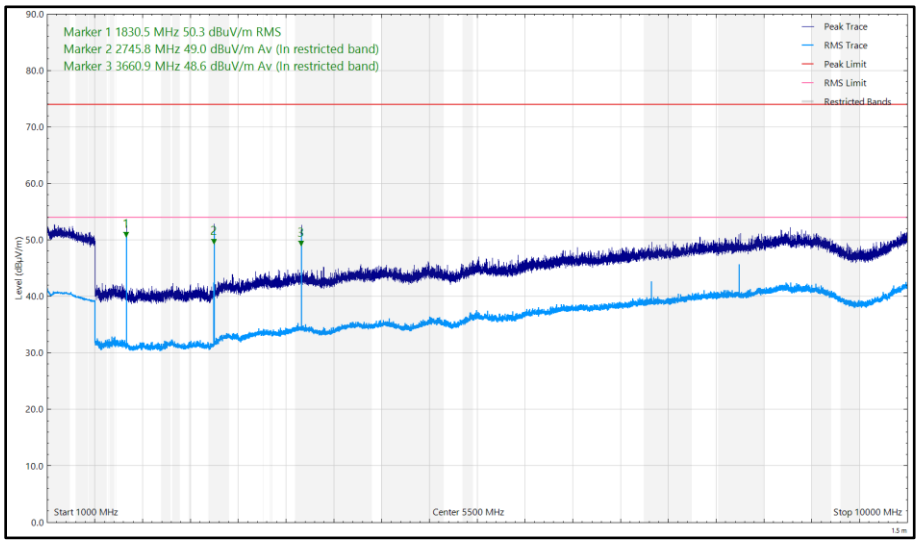

Figure 9 - 915.25 MHz, 1 GHz to 10 GHz, Vertical

Frequency (MHz)	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Detector	Angle (°)	Height (cm)	Polarisation
333.143	38.83	46.00	-7.17	Q-Peak	36	100	Horizontal
2781.610	48.47	54.00	-5.53	CISPR Avg	163	171	Vertical
2781.700	44.46	54.00	-9.54	CISPR Avg	233	100	Horizontal
3708.865	52.53	54.00	-1.47	CISPR Avg	213	101	Vertical
3709.040	48.87	54.00	-5.13	CISPR Avg	113	105	Horizontal

Table 18 - 927.25 MHz, 30 MHz to 10 GHz

No other emissions found within 10 dB of the limit.

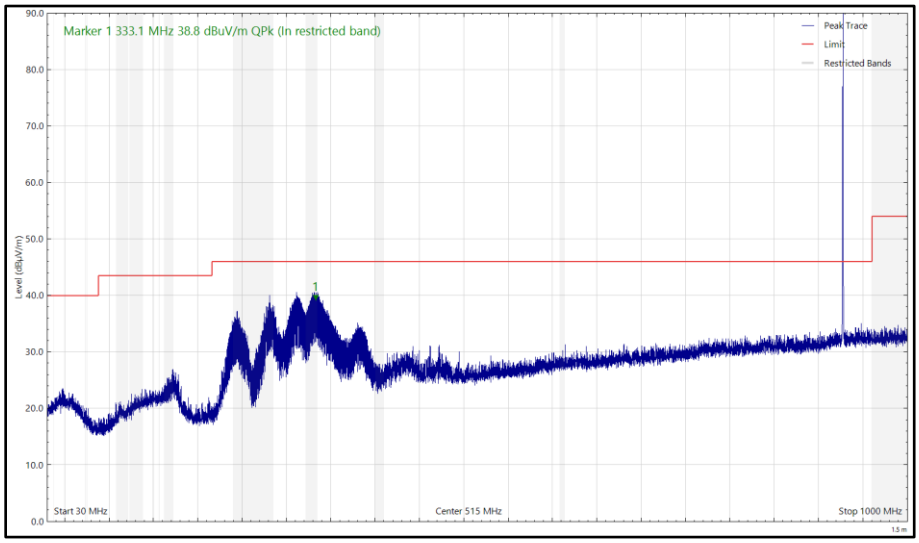

Figure 10 - 927.25 MHz, 30 MHz to 1 GHz, Horizontal (Peak)

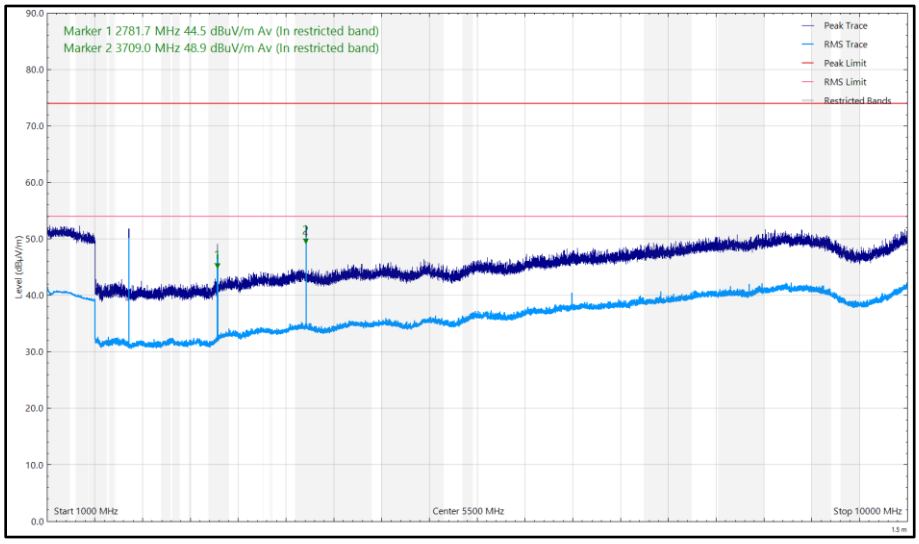

Figure 11 - 927.25 MHz, 1 GHz to 10 GHz, Horizontal

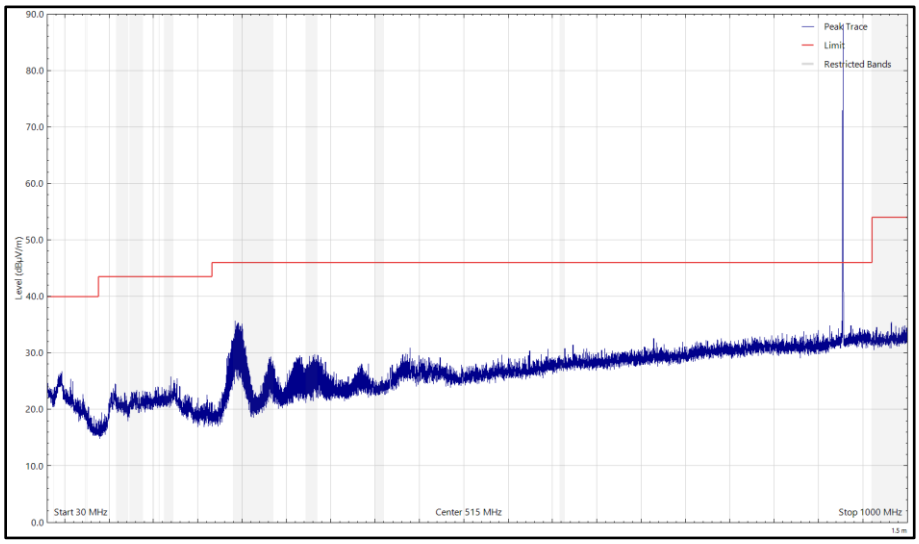

Figure 12 - 927.25 MHz, 30 MHz to 1 GHz, Vertical (Peak)

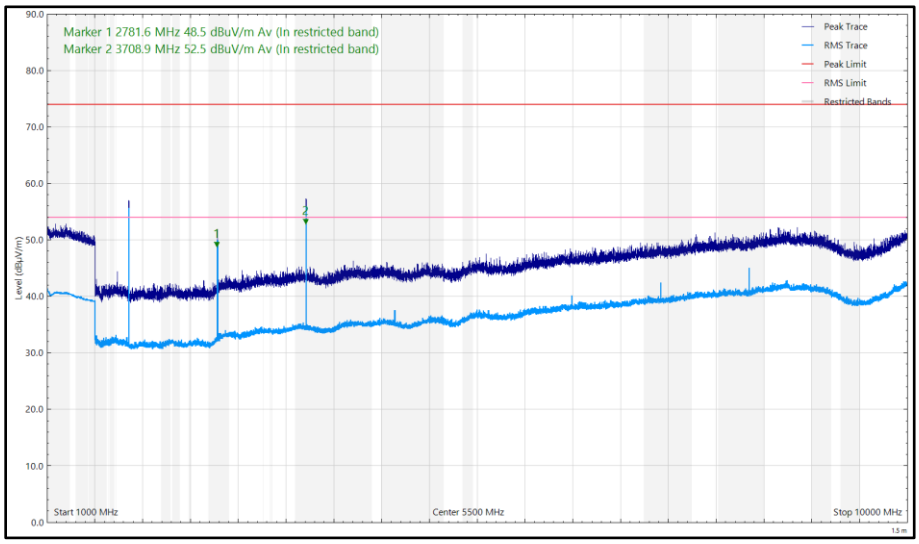

Figure 13 - 927.25 MHz, 1 GHz to 10 GHz, Vertical

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, 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, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, 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)

ISED RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

In addition, radiated emissions which fall in the restricted bands, as defined in RSS-GEN, clause 8.10, must also comply with the radiated emission limits specified in RSS-GEN clause 8.9.

2.1.8 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Programmable Power Supply	Iso-tech	IPS 2010	2437	-	O/P Mon
True RMS Multimeter	Fluke	179	4006	12	22-Mar-2025
High Pass filter	Wainwright	WHKX12-1290-1500-18000-80SS	4961	12	29-May-2025
3m Semi-Anechoic Chamber	Rainford	RF Chamber 11	5136	36	24-Nov-2024
Mast	Maturo	TAM 4.0-P	5158	-	TU
Mast and Turntable Controller	Maturo	Maturo NCD	5159	-	TU
Turntable	Maturo	TT 15WF	5160	-	TU
Pre-Amplifier (1 GHz to 26.5 GHz)	Agilent Technologies	8449B	5445	12	23-May-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	13-May-2025
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5500	6	26-Nov-2024
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	23-May-2025
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-02000AMSAMS/A	5518	12	18-Apr-2025
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	5611	12	15-Oct-2024
Antenna (Tri-log, 30 MHz to 1 GHz)	Schwarzbeck	VULB 9168	5942	24	24-May-2026
Attenuator (4 dB)	Pasternack	PE7074-4	6202	24	24-May-2026
Cable (N to N 8m)	Junkosha	MWX221-08000NMSNMS/B	6330	12	17-Feb-2025
EMC Test Receiver	Rohde & Schwarz	ESW44	6334	12	31-May-2025
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	6561	12	18-Jun-2025

Table 19

TU - Traceability Unscheduled
O/P Mon – Output Monitored using calibrated equipment.

2.2 Authorised Band Edges

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d)
ISED RSS-247, Clause 5.5

2.2.2 Equipment Under Test and Modification State

S/N: 17502948-0094 - Modification State 0

2.2.3 Date of Test

11-July-2024

2.2.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.

The EUT was connected via an attenuator to the spectrum analyser and the test was performed using conducted methods.

Testing was performed on the port with the highest conducted output power. (Port 1B).
The EUT was powered using 120V AC power supplied to the AC-DC (24V) transformer.

2.2.5 Environmental Conditions

Ambient Temperature	24.1 °C
Relative Humidity	53.9 %

2.2.6 Test Results

RFID Transceiver - 900 MHz FHSS

Mode	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	902.00	902.00	-39.62
Static	928.00	928.00	-37.52
Hopping	902.00	902.00	-40.57
Hopping	928.00	928.00	-39.56

Table 20

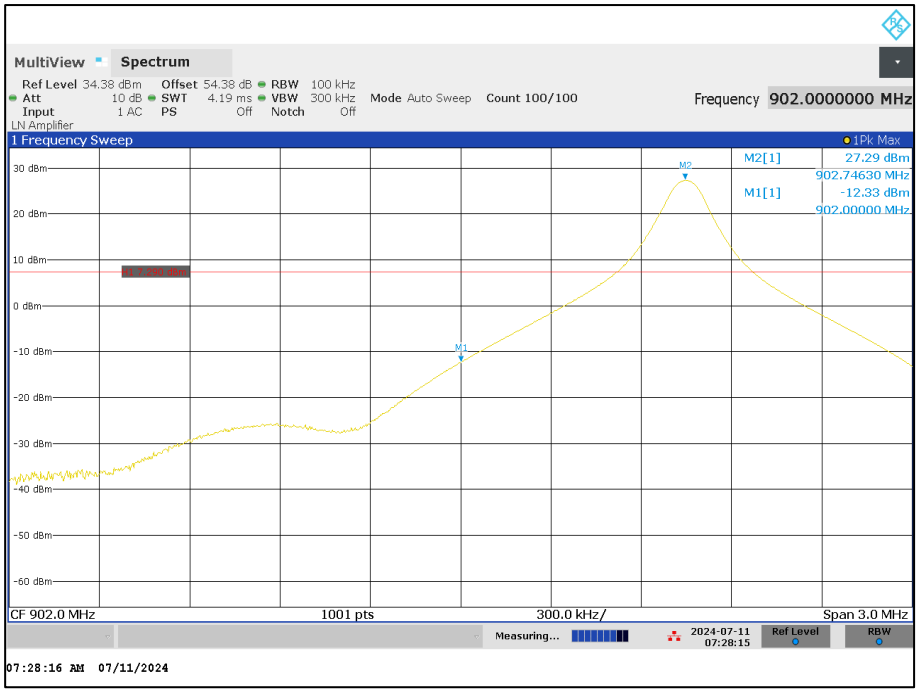

Figure 14 - Static, 902.00 MHz - Band Edge Frequency 902.00 MHz

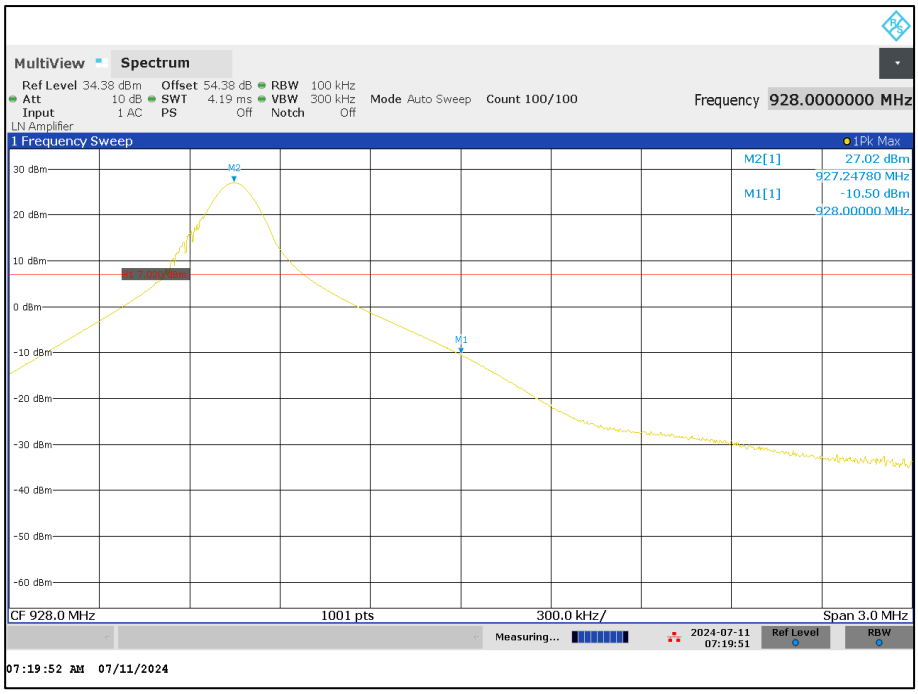

Figure 15 - Static, 928.00 MHz - Band Edge Frequency 928.00 MHz

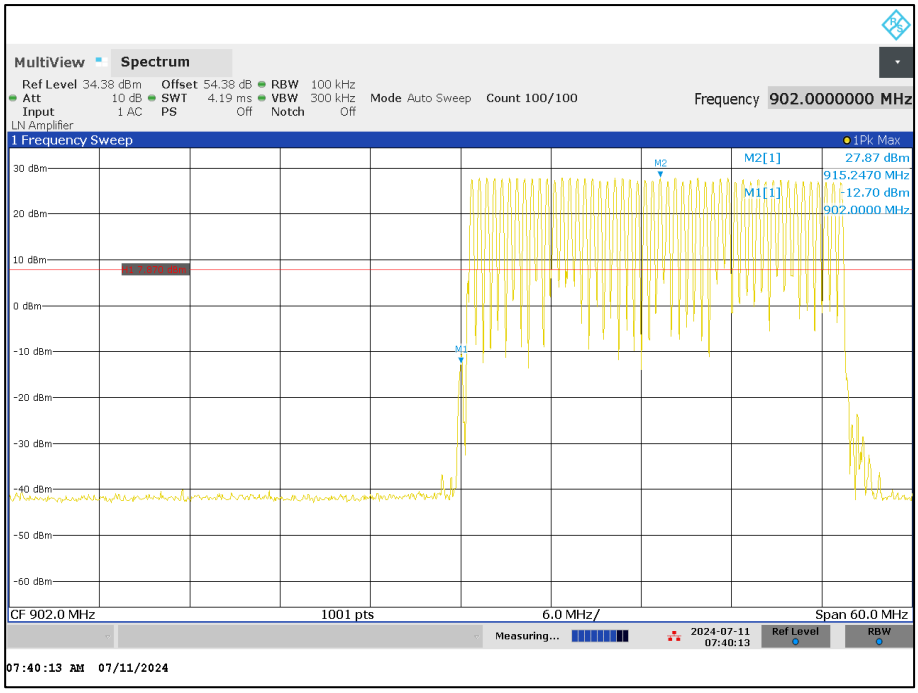

Figure 16 - Hopping, 902.00 MHz - Band Edge Frequency 902.00 MHz

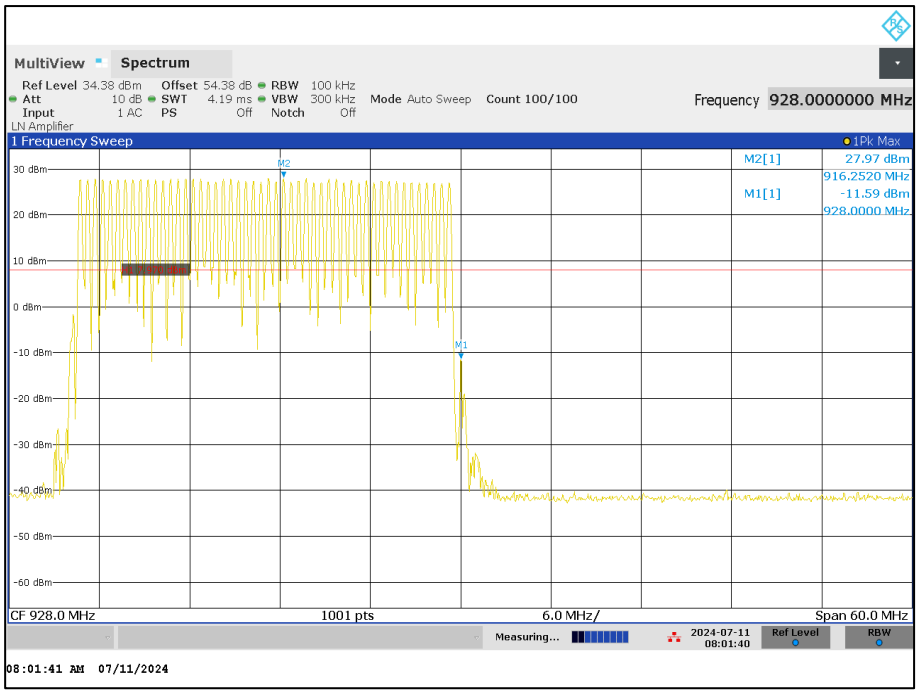

Figure 17 - Hopping, 928.00 MHz - Band Edge Frequency 928.00 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

ISED RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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 that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
True RMS Multimeter	Fluke	179	4006	12	22-Mar-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	13-May-2025
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5500	6	26-Nov-2024
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	23-May-2025
Coaxial Fixed Attenuator DC-18GHz 5W 10dB	RF-Lambda	RFS5G18B10SMP	6181	12	16-Aug-2024
EMC Test Receiver	Rohde & Schwarz	ESW44	6334	12	31-May-2025
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	6561	12	18-Jun-2025

Table 21

2.3 Frequency Hopping Systems - Average Time of Occupancy

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1

2.3.2 Equipment Under Test and Modification State

S/N: 17502948-0094 - Modification State 0

2.3.3 Date of Test

12-July-2024

2.3.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.4.
The EUT was powered by a 120V AC supply into the AC-DC (24V) Transformer

2.3.5 Environmental Conditions

Ambient Temperature	20.6 - 21.1 °C
Relative Humidity	41.8 - 55.0 %

2.3.6 Test Results

RFID Transceiver - 900 MHz FHSS

Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
399.6	1	399.6

Table 22

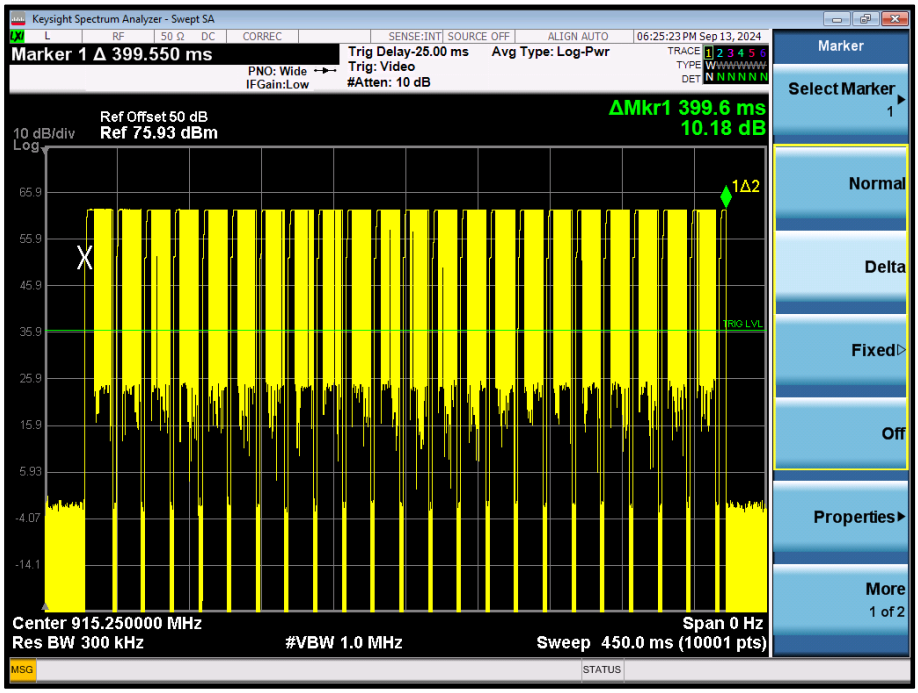

Figure 18 - Dwell Time

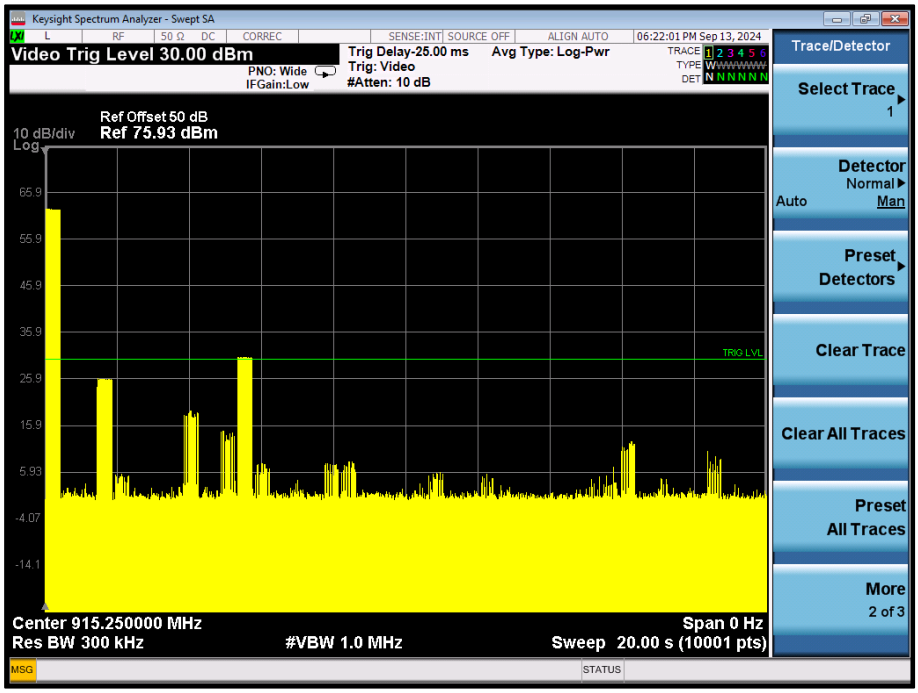

Figure 19 - Total Average Time of Occupancy

FCC 47 CFR Part 15, Limit Clause (a)(1)(i)

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Industry Canada RSS-247, Limit Clause 5.1 (c)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period.

2.3.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5 and RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Multimeter	Fluke	87	1427	12	09-Feb-2025
EXA Signal Analyser	Keysight Technologies	N9010B	4969	24	07-Feb-2026
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5500	6	26-Nov-2024
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	23-May-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5605	12	07-Nov-2024
Coaxial Fixed Attenuator DC-18GHz 5W 10dB	RF-Lambda	RFS5G18B10SMP	6181	12	16-Aug-2024
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	6561	12	18-Jun-2025

Table 23

O/P Mon – Output Monitored using calibrated equipment.

2.4 Frequency Hopping Systems - Channel Separation

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1

2.4.2 Equipment Under Test and Modification State

S/N: 17502948-0094 - Modification State 0

2.4.3 Date of Test

12-July-2024

2.4.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.2.
The EUT was powered by 120V AC into the AC-DC (24V) Transformer.

2.4.5 Environmental Conditions

Ambient Temperature	21.1 °C
Relative Humidity	50.0 %

2.4.6 Test Results

RFID Transceiver - 900 MHz FHSS

Modulation	Lower Channel Nominal Frequency (MHz)	Upper Channel Nominal Frequency (MHz)	Channel Separation (kHz)
ASK	902.75	903.25	499.790
ASK	915.25	915.75	499.790
ASK	926.75	927.25	499.790

Table 24 - Carrier Frequency Separation

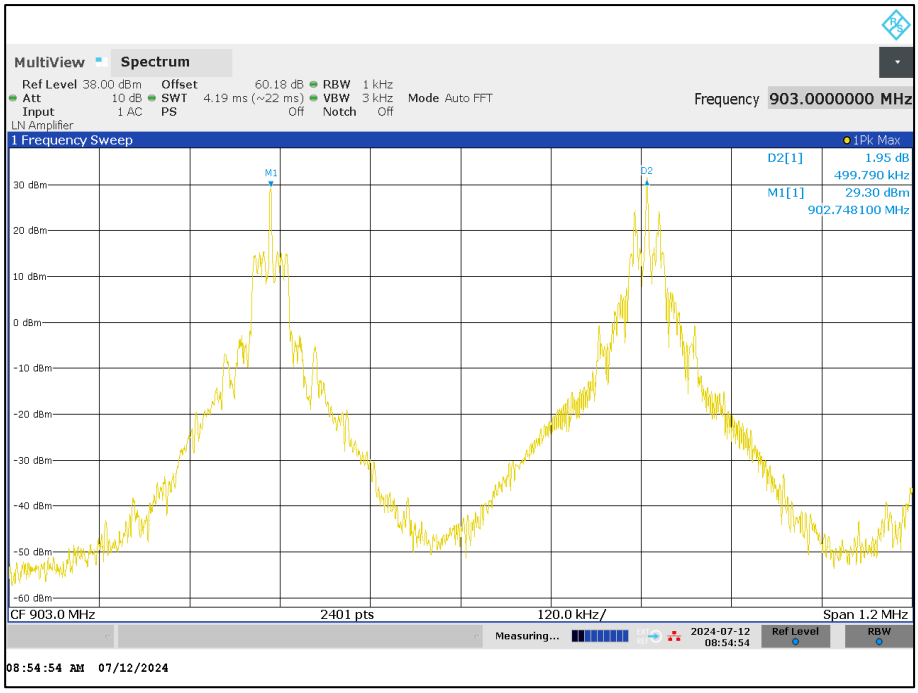

Figure 20 - ASK, 902.75 MHz / 903.25 MHz

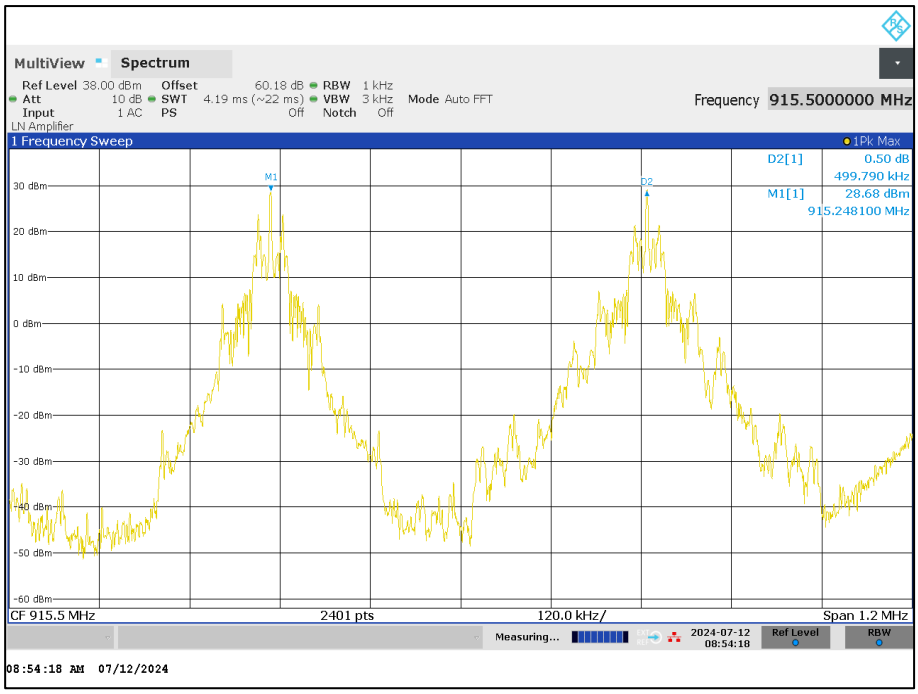

Figure 21 – ASK, 915.25 MHz / 915.75 MHz

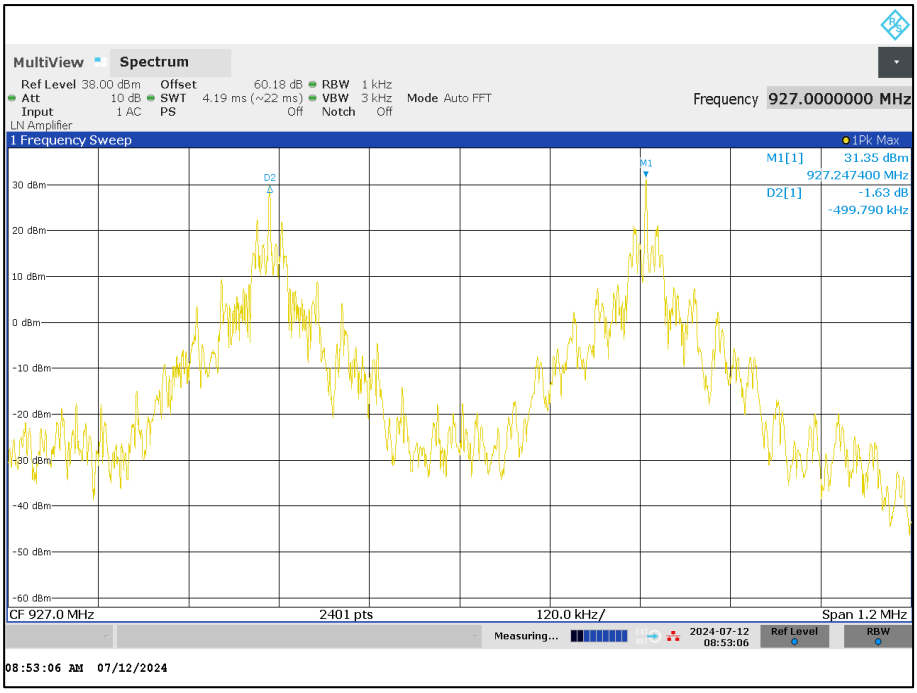

Figure 22 – ASK, 926.75 MHz / 927.25 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(i)

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

ISED RSS-247, Limit Clause 5.1 (c)

For FHSs in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

2.4.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Multimeter	Fluke	87	1427	12	09-Feb-2025
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5500	6	26-Nov-2024
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	23-May-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5605	12	07-Nov-2024
Coaxial Fixed Attenuator DC-18GHz 5W 10dB	RF-Lambda	RFS5G18B10SMP	6181	12	16-Aug-2024
EMC Test Receiver	Rohde & Schwarz	ESW44	6334	12	31-May-2025
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	6561	12	18-Jun-2025

Table 25

O/P Mon – Output Monitored using calibrated equipment.

2.5 Frequency Hopping Systems - Number of Hopping Channels

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1

2.5.2 Equipment Under Test and Modification State

S/N: 17502948-0094 - Modification State 0

2.5.3 Date of Test

12-July-2024

2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.3.
The EUT was powered through a 120V AC Supply connected to the AC-DC (24V) transformer.

2.5.5 Environmental Conditions

Ambient Temperature	22.1 °C
Relative Humidity	50.0 %

2.5.6 Test Results

RFID Transceiver - 900 MHz FHSS

Number of Hopping Channels: 50

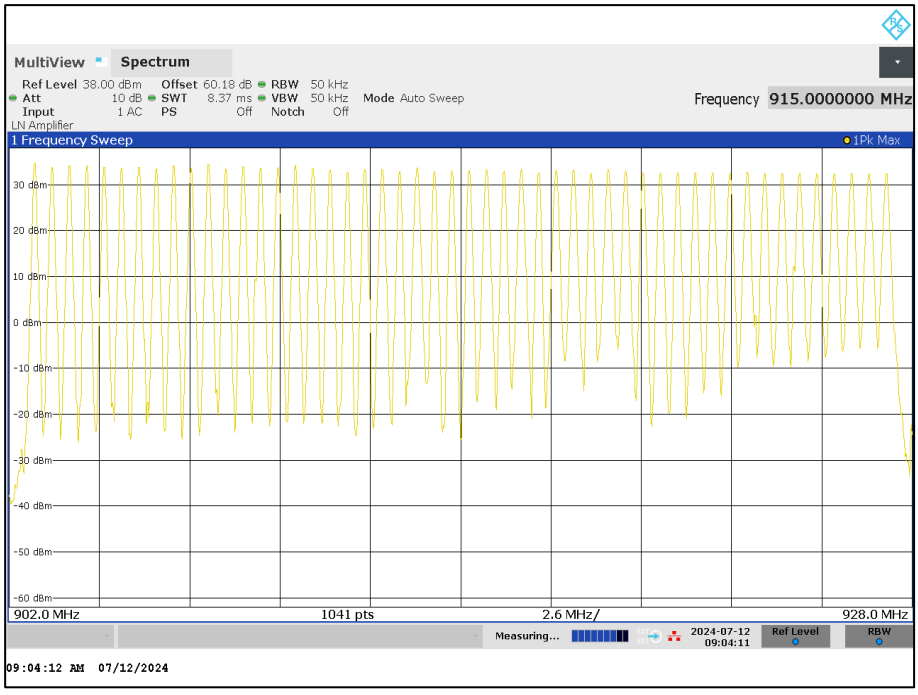

Figure 23 - Measurement Frequency Range: 902 - 928 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(i) and ISED RSS-247, Limit Clause 5.1 (3)

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies.

If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.

2.5.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Multimeter	Fluke	87	1427	12	09-Feb-2025
AC Programmable Power Supply	iTech	IT7324	5227	-	O/P Mon
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5500	6	26-Nov-2024
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	23-May-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5605	12	07-Nov-2024
Coaxial Fixed Attenuator DC-18GHz 5W 10dB	RF-Lambda	RFS5G18B10SMP	6181	12	16-Aug-2024
EMC Test Receiver	Rohde & Schwarz	ESW44	6334	12	31-May-2025
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	6561	12	18-Jun-2025

Table 26

O/P Mon – Output Monitored using calibrated equipment.

2.6 Frequency Hopping Systems - 20 dB Bandwidth

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1
ISED RSS-GEN, Clause 6.7

2.6.2 Equipment Under Test and Modification State

S/N: 17502948-0094 - Modification State 0

2.6.3 Date of Test

11-July-2024

2.6.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.2.

The EUT was powered via 120V AC power into the AC-DC (24V) transformer.

The 902.75 MHz result was taken on port 3B.

The 915.25 MHz result was taken on port 1B.

The 927.25 MHz result was taken on port 3B.

2.6.5 Environmental Conditions

Ambient Temperature	24.1 °C
Relative Humidity	53.9 %

2.6.6 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
True RMS Multimeter	Fluke	179	4006	12	22-Mar-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	13-May-2025
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5500	6	26-Nov-2024
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	23-May-2025
Coaxial Fixed Attenuator DC-18GHz 5W 10dB	RF-Lambda	RFS5G18B10SMP	6181	12	16-Aug-2024
EMC Test Receiver	Rohde & Schwarz	ESW44	6334	12	31-May-2025
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	6561	12	18-Jun-2025

Table 27

2.6.7 Test Results

RFID Transceiver - 900 MHz FHSS

Modulation	20 dB Bandwidth (kHz)		
	902.75 MHz	915.25 MHz	927.25 MHz
ASK	47.56	47.90	48.60

Table 28 - 20 dB Bandwidth

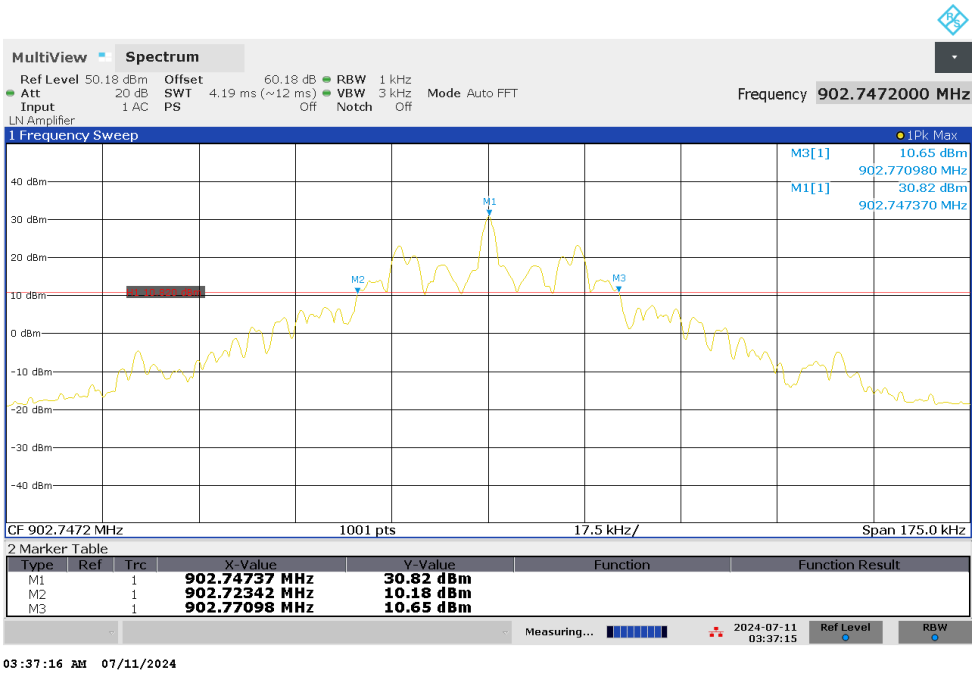

Figure 24 - ASK, 902.75 MHz

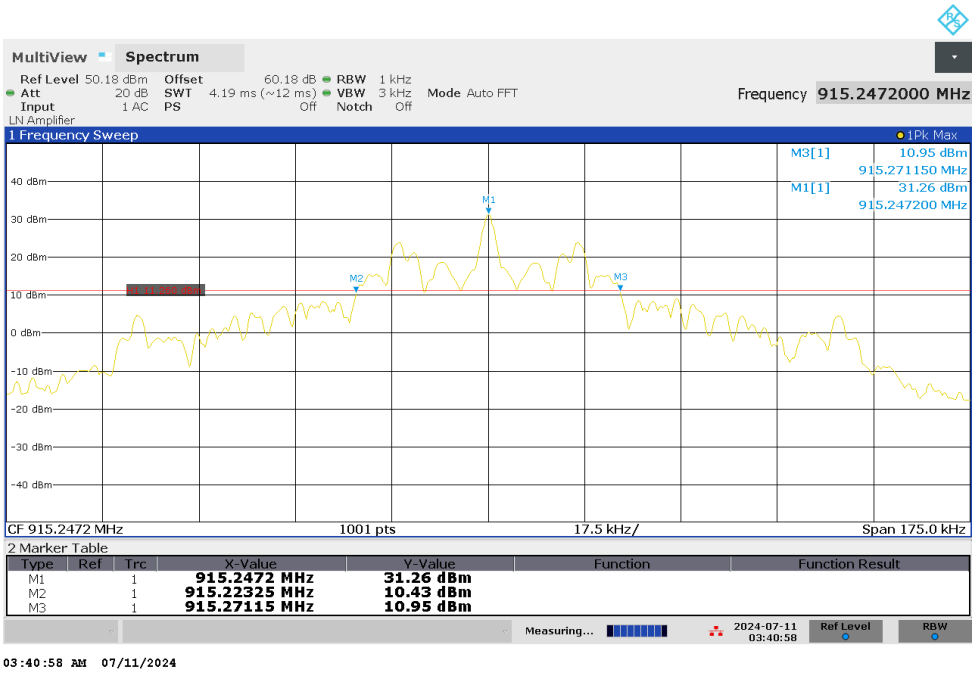

Figure 25 - ASK, 915.25 MHz

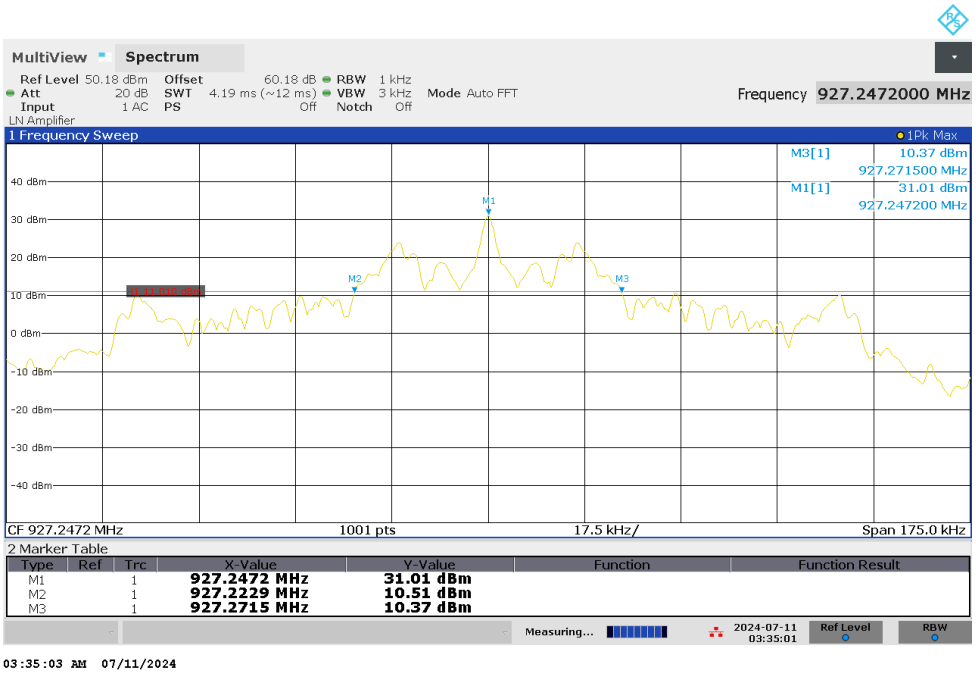

Figure 26 – ASK, 927.25 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(i) and ISED RSS-247, Limit Clause 5.1 (3)

The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

2.7 Maximum Conducted Output Power

2.7.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)
ISED RSS-247, Clause 5.4
ISED RSS-GEN, Clause 6.12

2.7.2 Equipment Under Test and Modification State

,S/N: 17502948-0094 - Modification State 0

2.7.3 Date of Test

10-July-2024 to 11-July-2024

2.7.4 Test Method

The test was performed in accordance with ANSI C63.10 clause 7.8.5 using a spectrum analyser.
All measurement results have been recorded with the assumption of a 10m "RG58" cable, the loss of this cable is 5.8dB. The manufacturer will ensure that any combination of antenna and cable comply with the limit.
The EUT was powered with 120V AC power into the AC-DC (24V) transformer.

2.7.5 Environmental Conditions

Ambient Temperature	24.1 °C
Relative Humidity	53.9 %

2.7.6 Test Results

RFID Transceiver - 900 MHz FHSS

Modulation: ASK

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Maximum Antenna Gain (dBi)*	Verdict	Detector	EUT Port
902.75	27.38	30	-2.62	8.62	Pass	PEAK	1A
902.75	27.28	30	-2.72	8.72	Pass	PEAK	2A
902.75	27.21	30	-2.79	8.79	Pass	PEAK	3A
902.75	27.16	30	-2.84	8.84	Pass	PEAK	4A
902.75	27.14	30	-2.86	8.86	Pass	PEAK	5A
902.75	27.29	30	-2.71	8.71	Pass	PEAK	6A
902.75	26.98	30	-3.02	9.02	Pass	PEAK	7A
902.75	27.17	30	-2.83	8.83	Pass	PEAK	8A
902.75	27.32	30	-2.68	8.68	Pass	PEAK	1B
902.75	27.20	30	-2.80	8.80	Pass	PEAK	2B
902.75	26.97	30	-2.43	8.43	Pass	PEAK	3B
902.75	27.57	30	-3.03	9.03	Pass	PEAK	4B
902.75	27.27	30	-2.73	8.73	Pass	PEAK	5B
902.75	27.00	30	-3.00	9.00	Pass	PEAK	6B
902.75	26.93	30	-3.07	9.07	Pass	PEAK	7B
902.75	27.32	30	-2.68	8.68	Pass	PEAK	8B

Table 29 - Conducted Output Power Results, 902.75 MHz

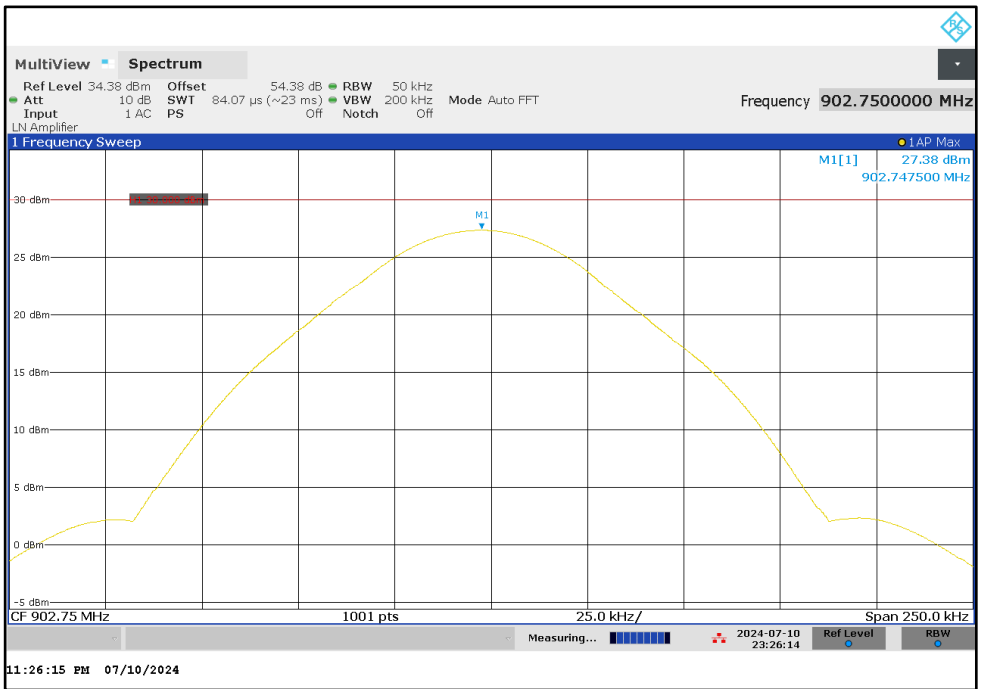

Figure 27 - Conducted Output Power, 902.75 MHz, Port 1A

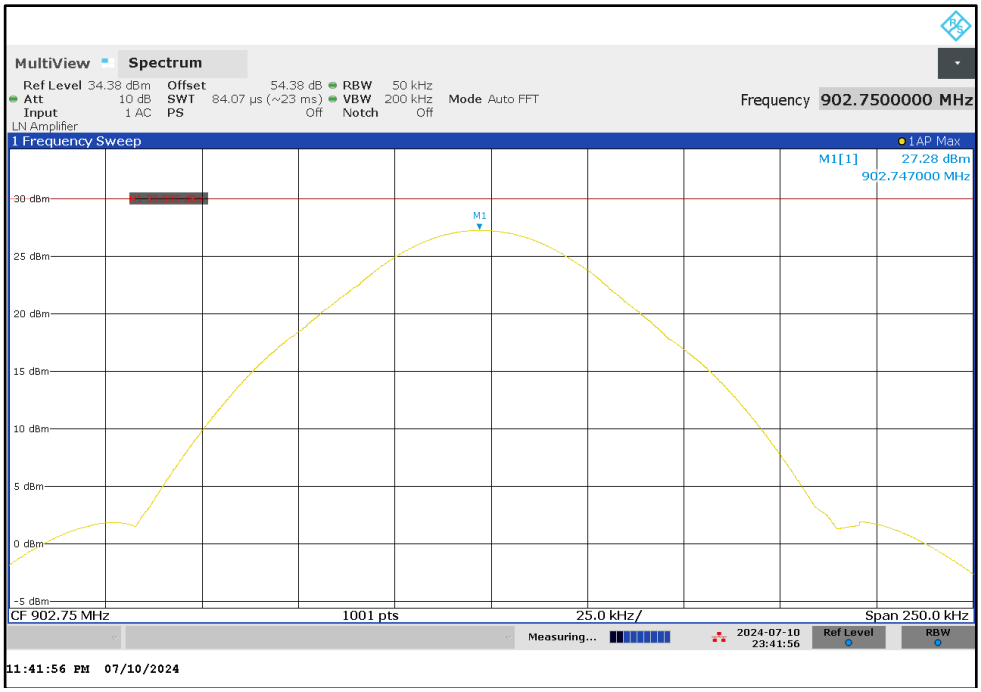

Figure 28 - Conducted Output Power, 902.75 MHz, Port 2A

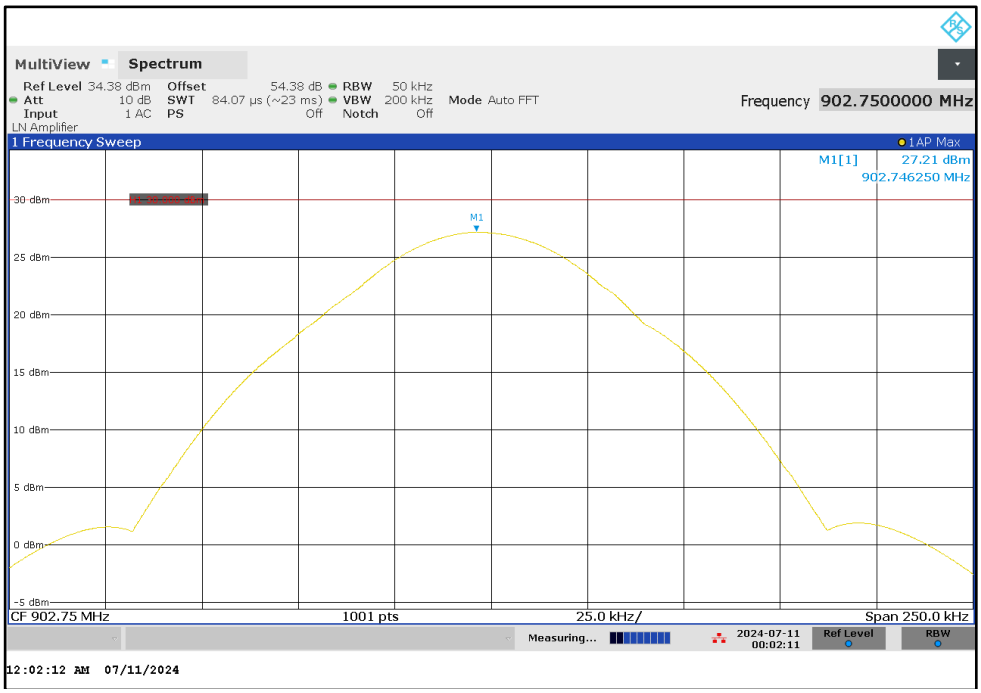

Figure 29 - Conducted Output Power, 902.75 MHz, Port 3A

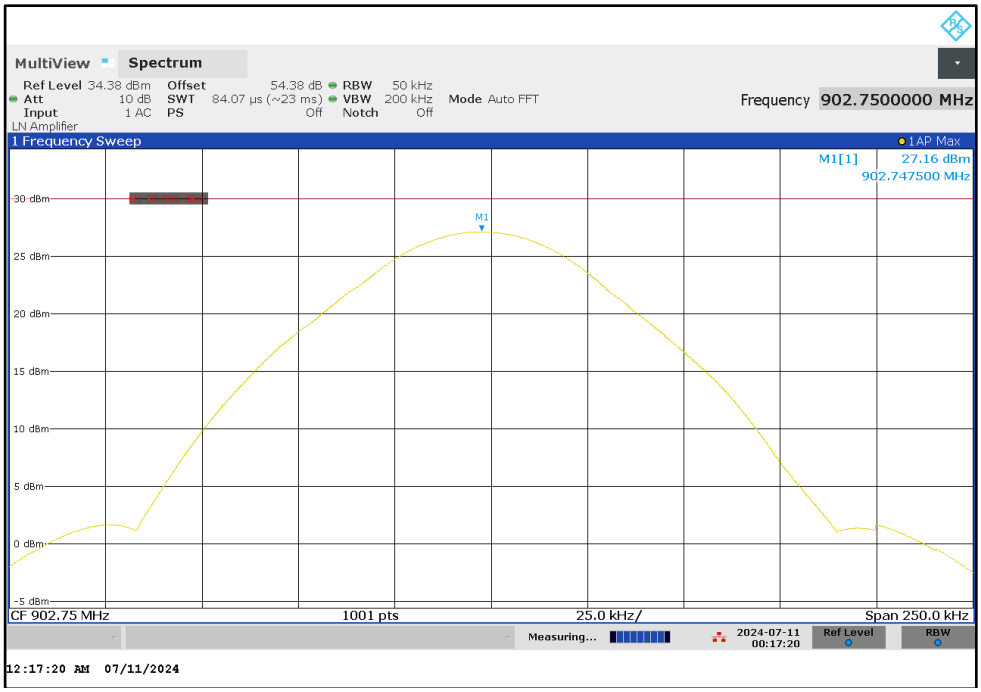

Figure 30 - Conducted Output Power, 902.75 MHz, Port 4A

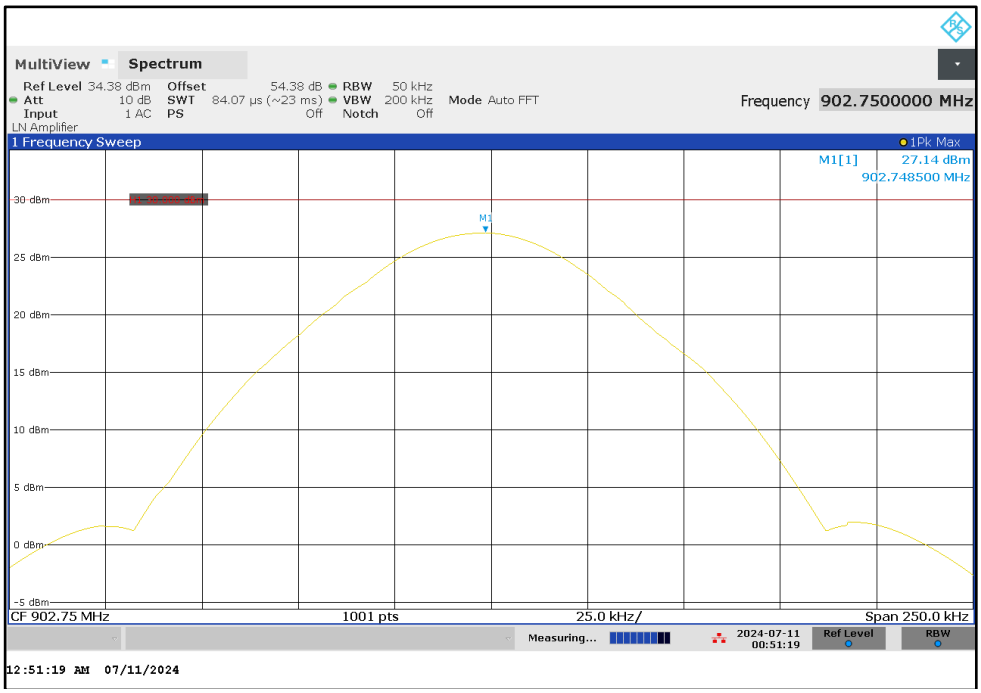

Figure 31 - Conducted Output Power, 902.75 MHz, Port 5A

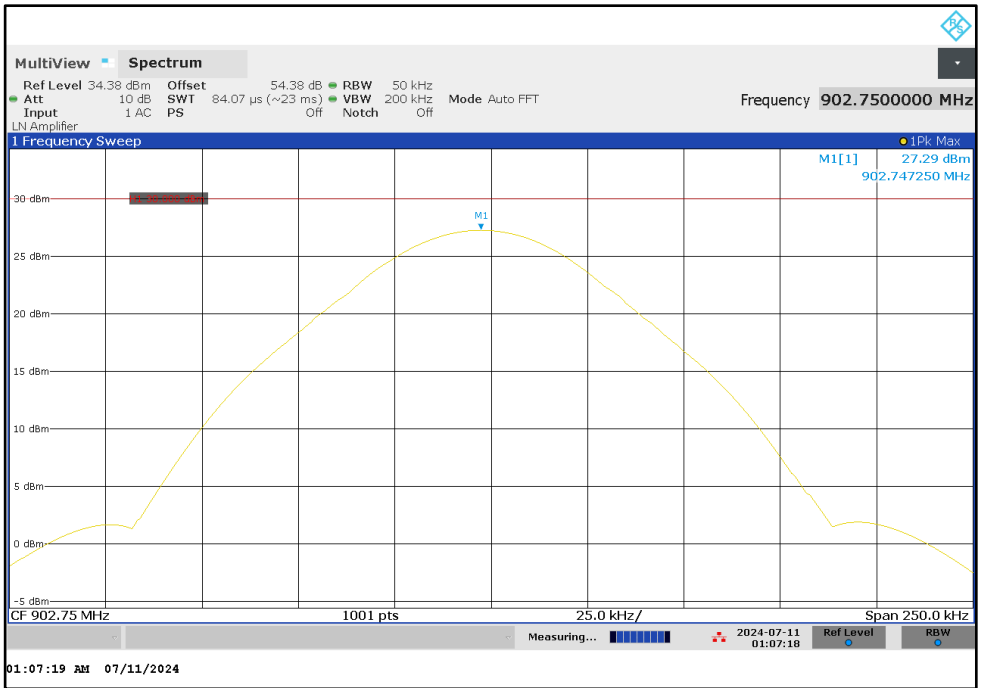

Figure 32 - Conducted Output Power, 902.75 MHz, Port 6A

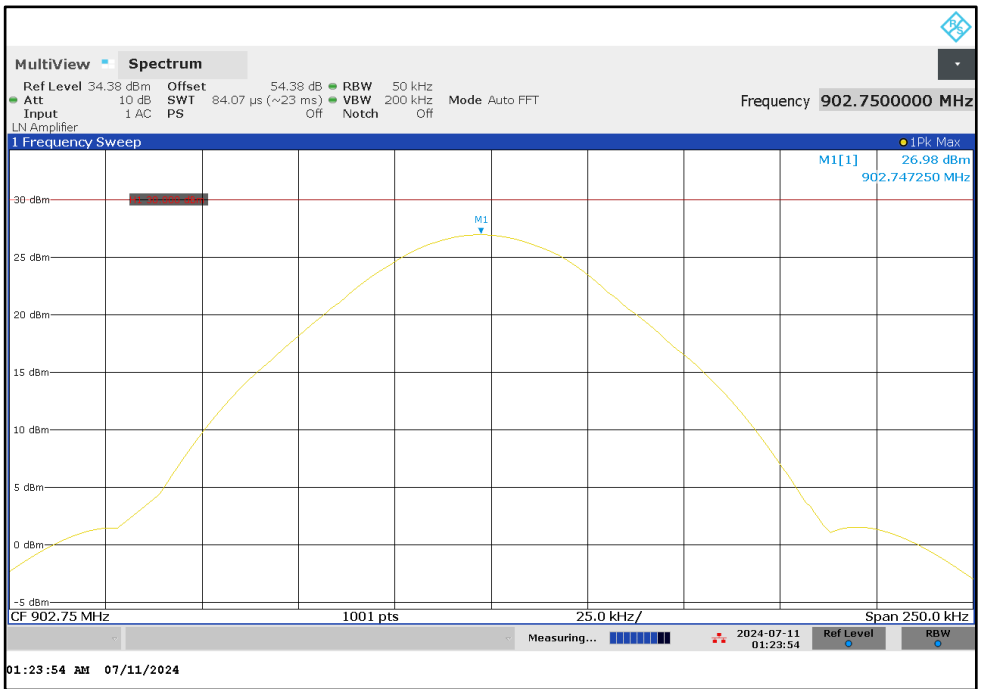

Figure 33 - Conducted Output Power, 902.75 MHz, Port 7A

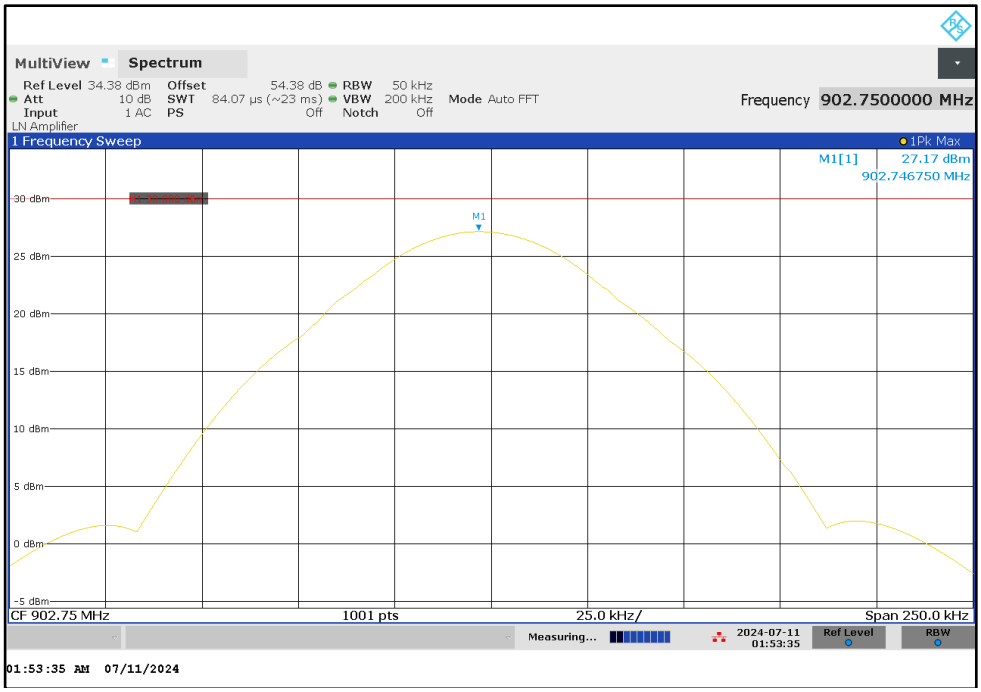

Figure 34 - Conducted Output Power, 902.75 MHz, Port 8A

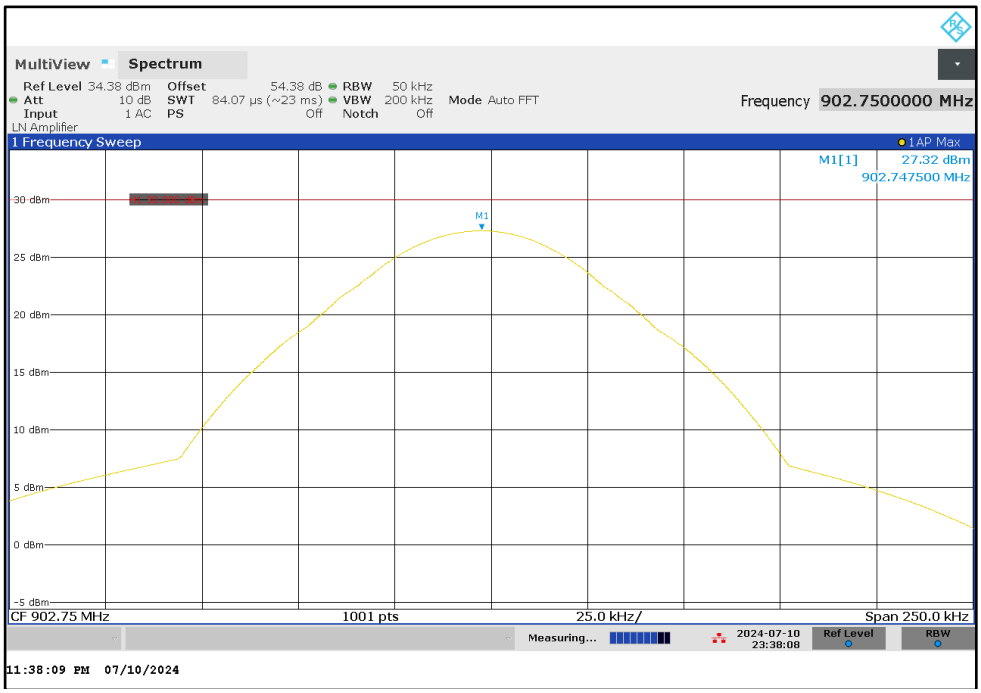

Figure 35 - Conducted Output Power, 902.75 MHz, Port 1B

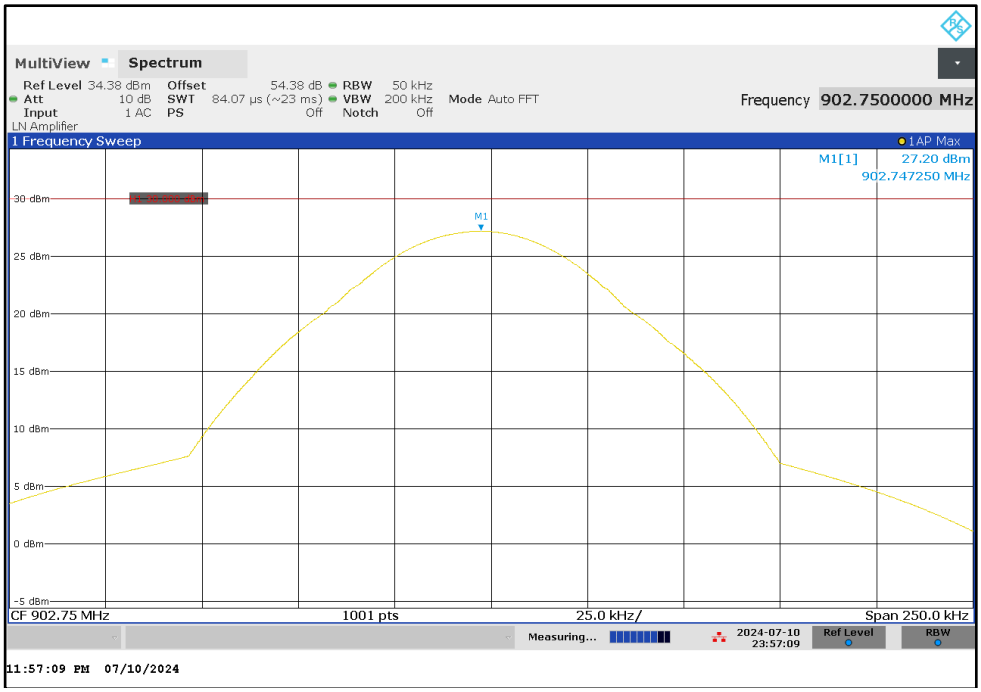

Figure 36 - Conducted Output Power, 902.75 MHz, Port 2B

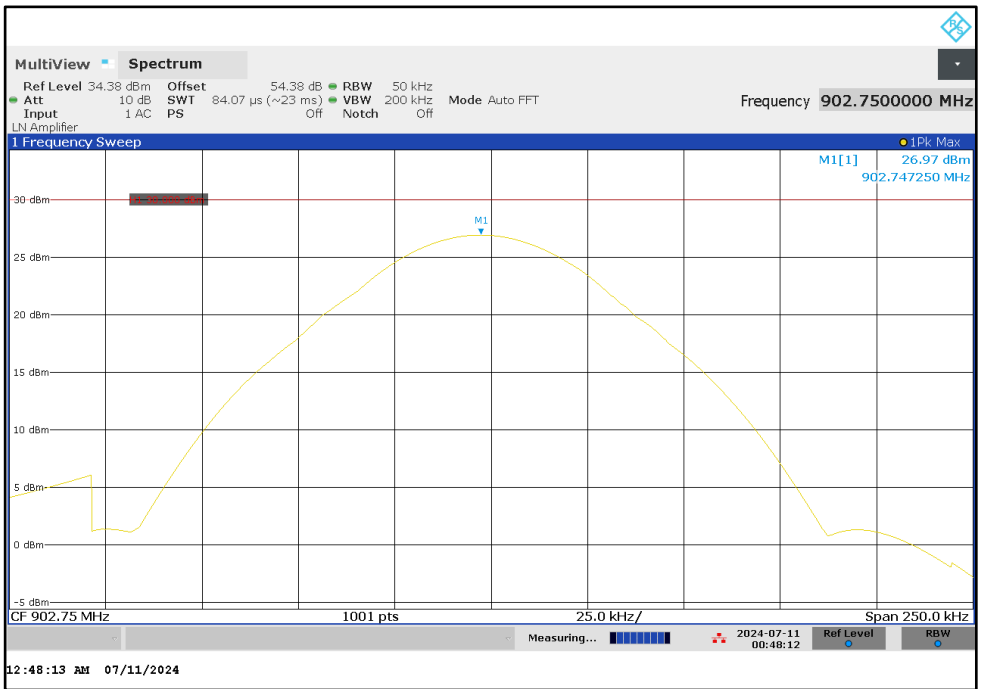

Figure 37 - Conducted Output Power, 902.75 MHz, Port 3B

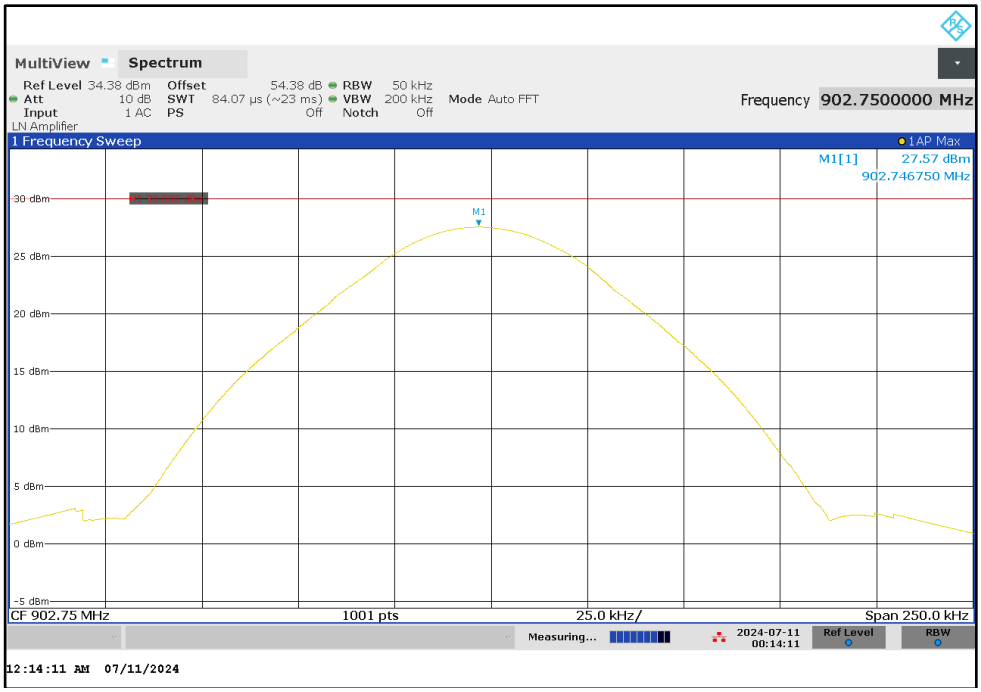

Figure 38 - Conducted Output Power, 902.75 MHz, Port 4B

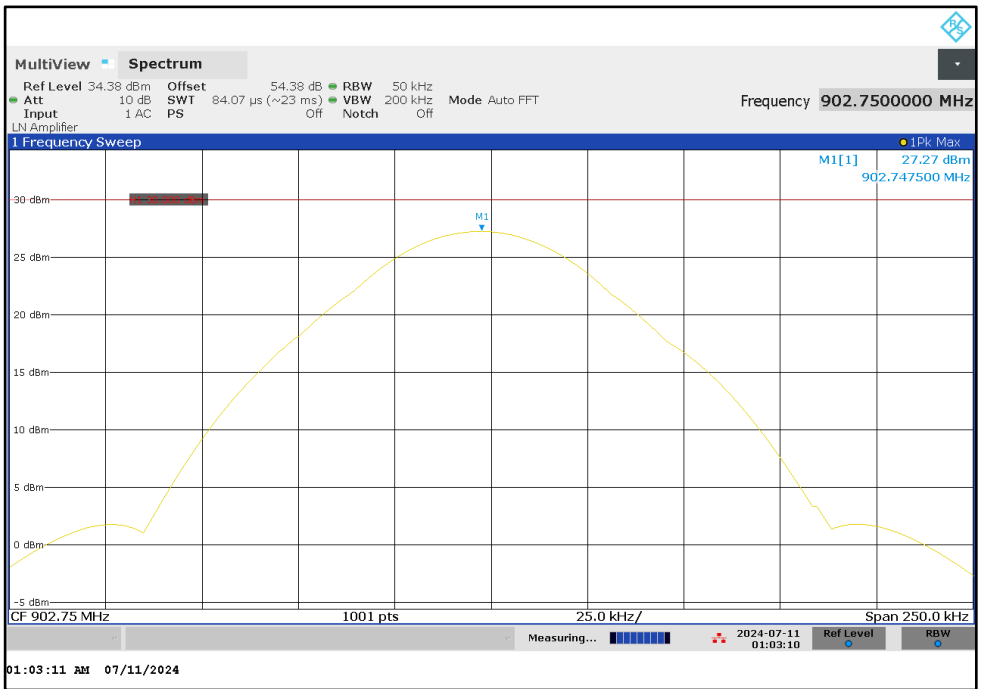

Figure 39 - Conducted Output Power, 902.75 MHz, Port 5B

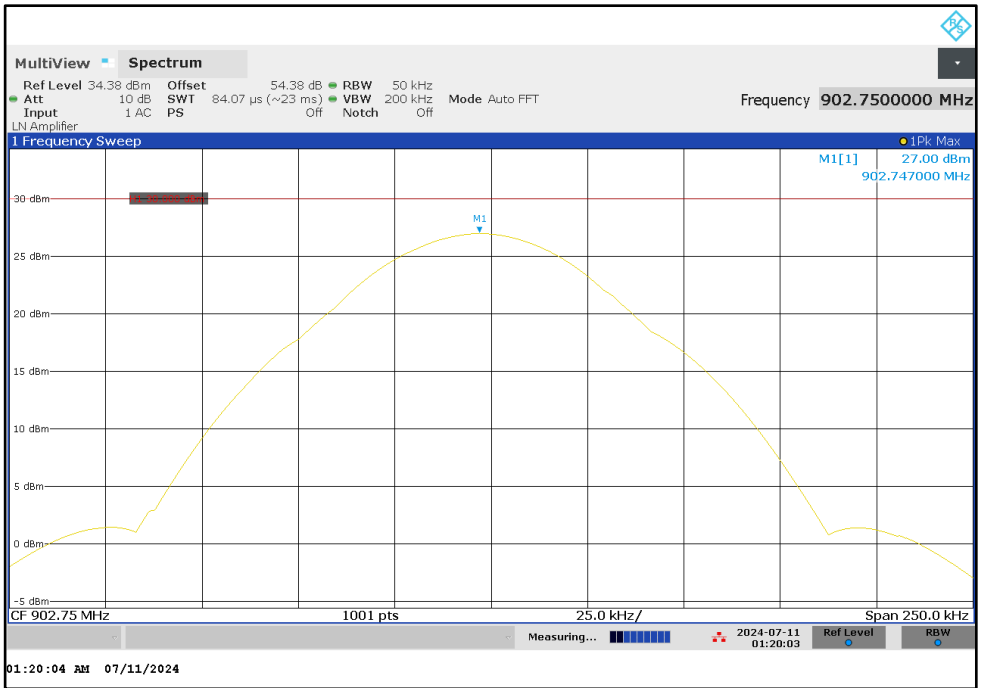

Figure 40 - Conducted Output Power, 902.75 MHz, Port 6B

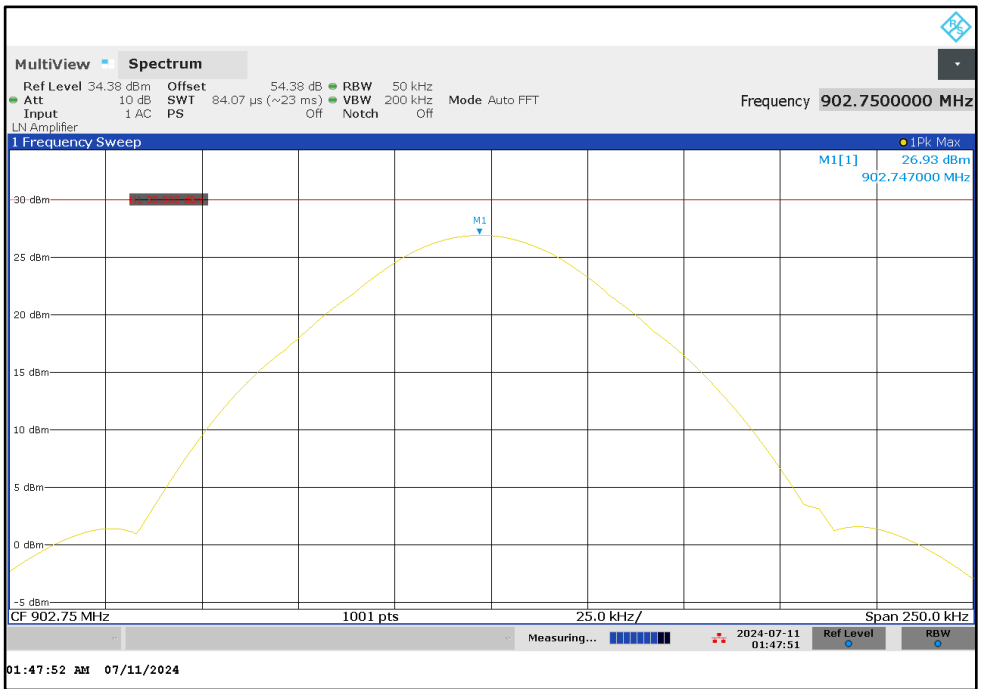

Figure 41 - Conducted Output Power, 902.75 MHz, Port 7B

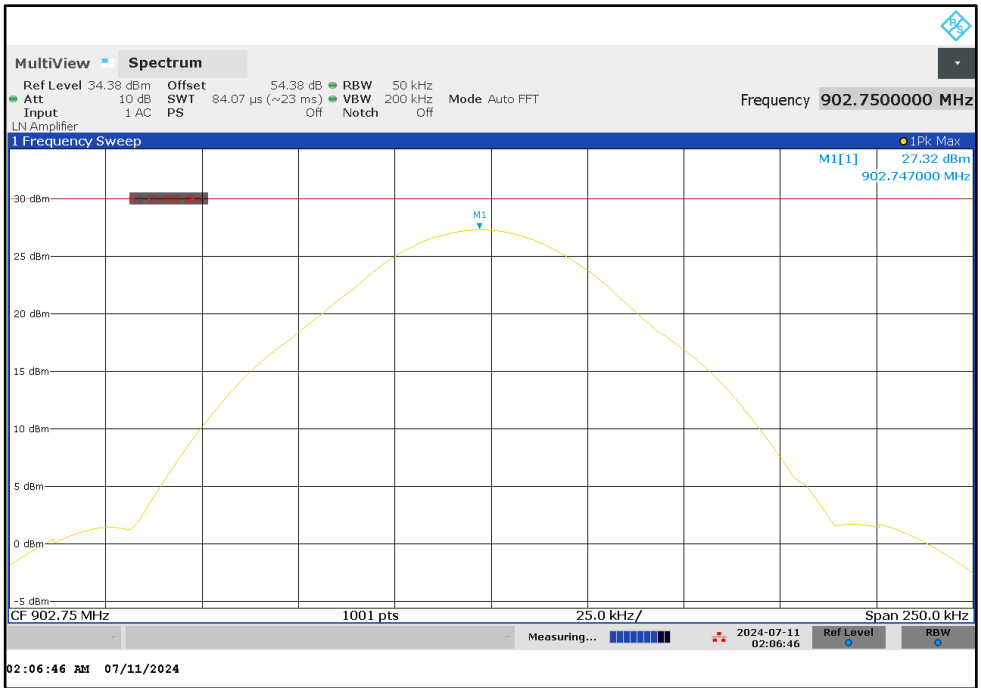

Figure 42 - Conducted Output Power, 902.75 MHz, Port 8B

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Maximum Antenna Gain (dBi)*	Verdict	Detector	EUT Port
915.25	27.02	30	-2.98	8.98	Pass	PEAK	1A
915.25	26.89	30	-3.11	9.11	Pass	PEAK	2A
915.25	26.98	30	-3.02	9.02	Pass	PEAK	3A
915.25	26.82	30	-3.18	9.18	Pass	PEAK	4A
915.25	26.97	30	-3.03	9.03	Pass	PEAK	5A
915.25	26.89	30	-3.11	9.11	Pass	PEAK	6A
915.25	26.85	30	-3.15	9.15	Pass	PEAK	7A
915.25	26.99	30	-3.01	9.01	Pass	PEAK	8A
915.25	27.82	30	-2.18	8.18	Pass	PEAK	1B
915.25	27.06	30	-2.94	8.94	Pass	PEAK	2B
915.25	27.66	30	-2.34	8.35	Pass	PEAK	3B
915.25	27.34	30	-2.66	8.66	Pass	PEAK	4B
915.25	27.52	30	-2.48	8.48	Pass	PEAK	5B
915.25	27.53	30	-2.47	8.47	Pass	PEAK	6B
915.25	27.63	30	-2.37	8.37	Pass	PEAK	7B
915.25	27.64	30	-2.36	8.36	Pass	PEAK	8B

Table 30 - Conducted Output Power Results, 915.25 MHz

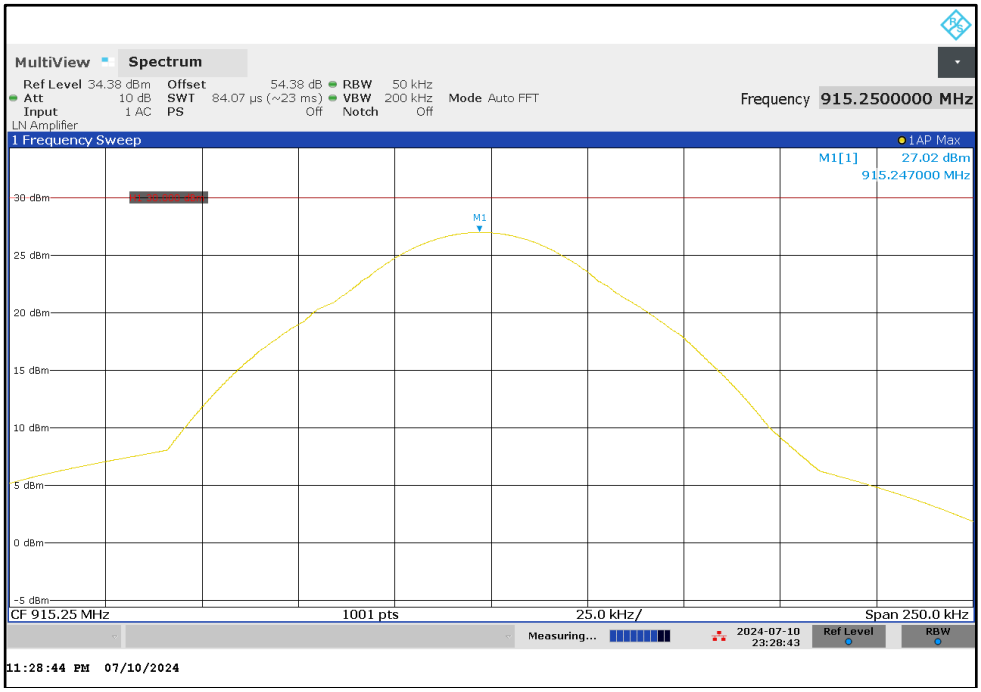

Figure 43 - Conducted Output Power, 915.25 MHz, Port 1A

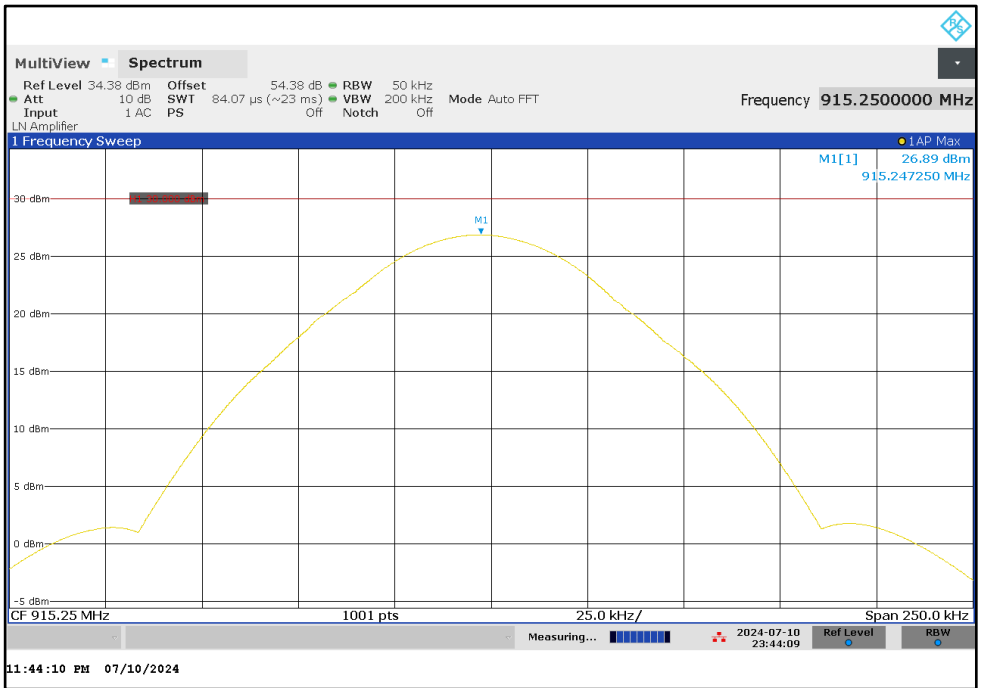

Figure 44 - Conducted Output Power, 915.25 MHz, Port 2A

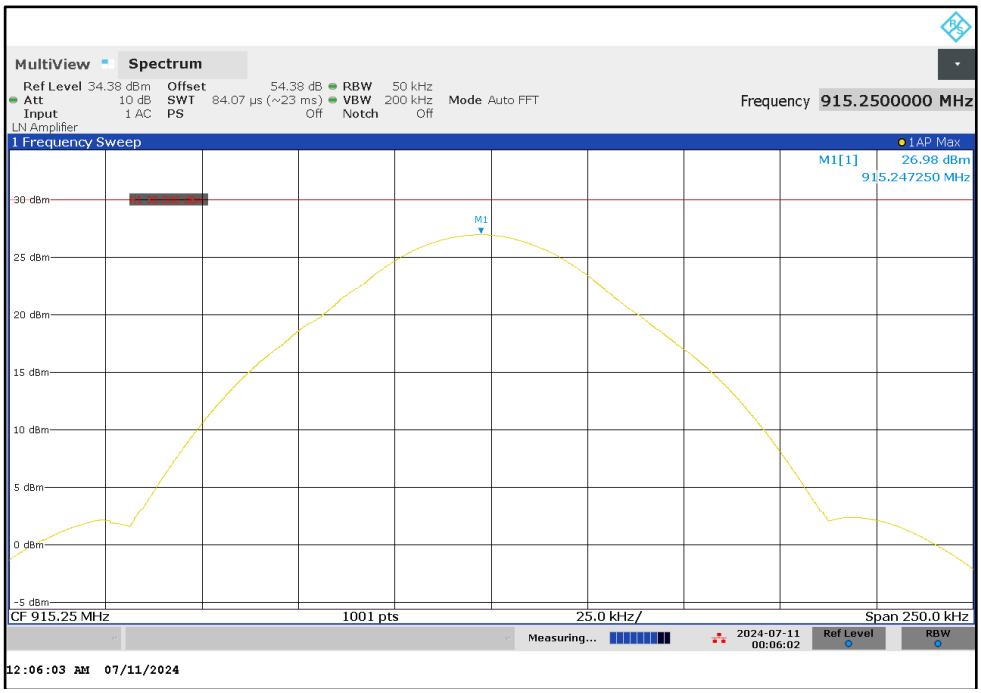

Figure 45 - Conducted Output Power, 915.25 MHz, Port 3A

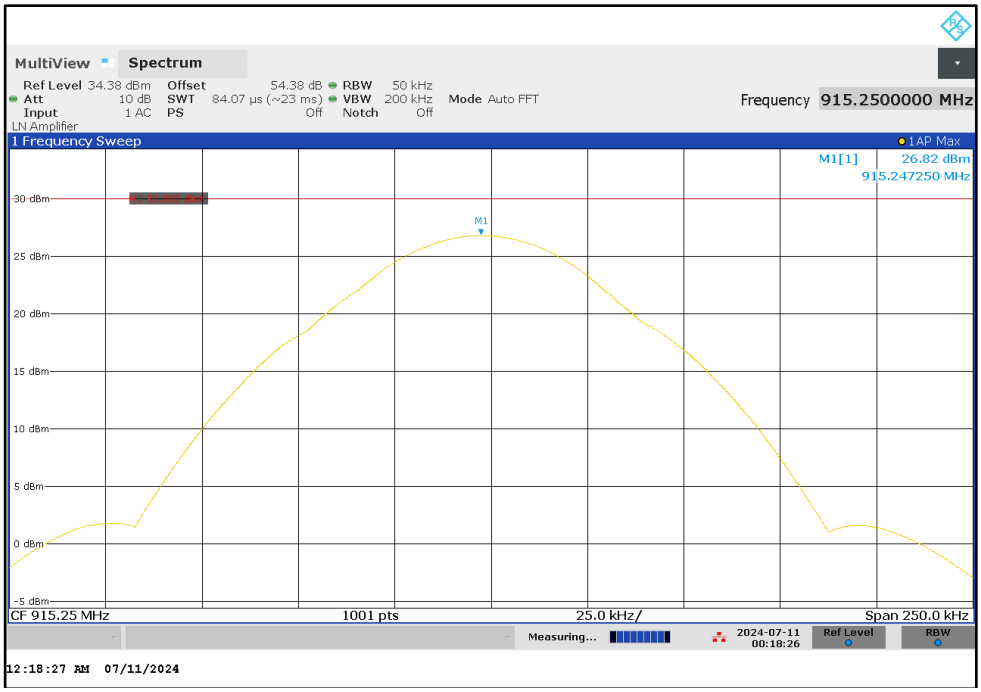

Figure 46 - Conducted Output Power, 915.25 MHz, Port 4A

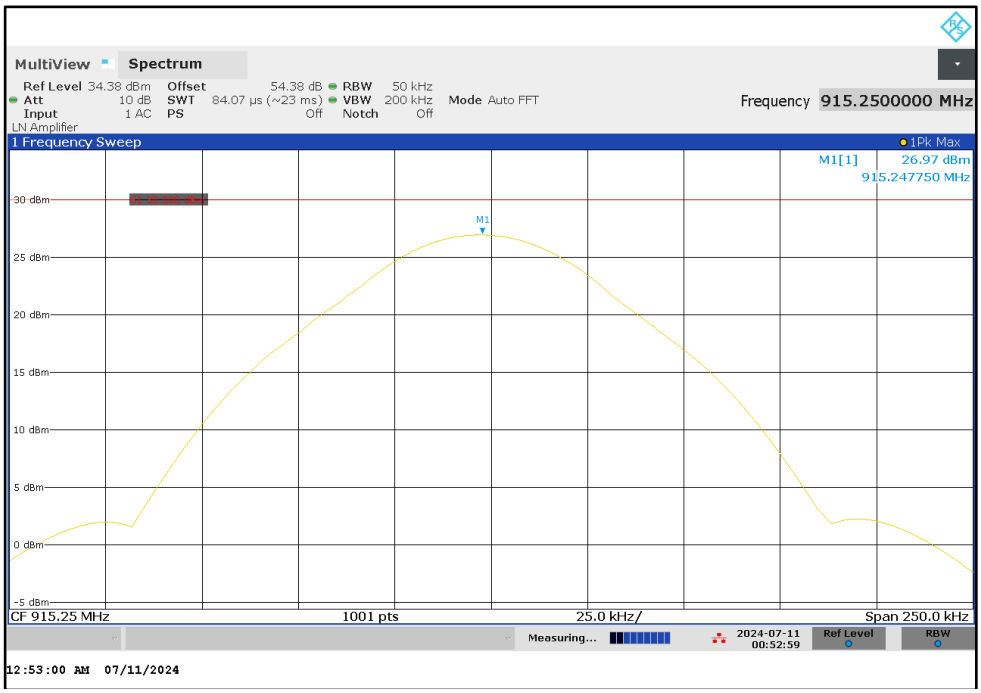

Figure 47 - Conducted Output Power, 915.25 MHz, Port 5A

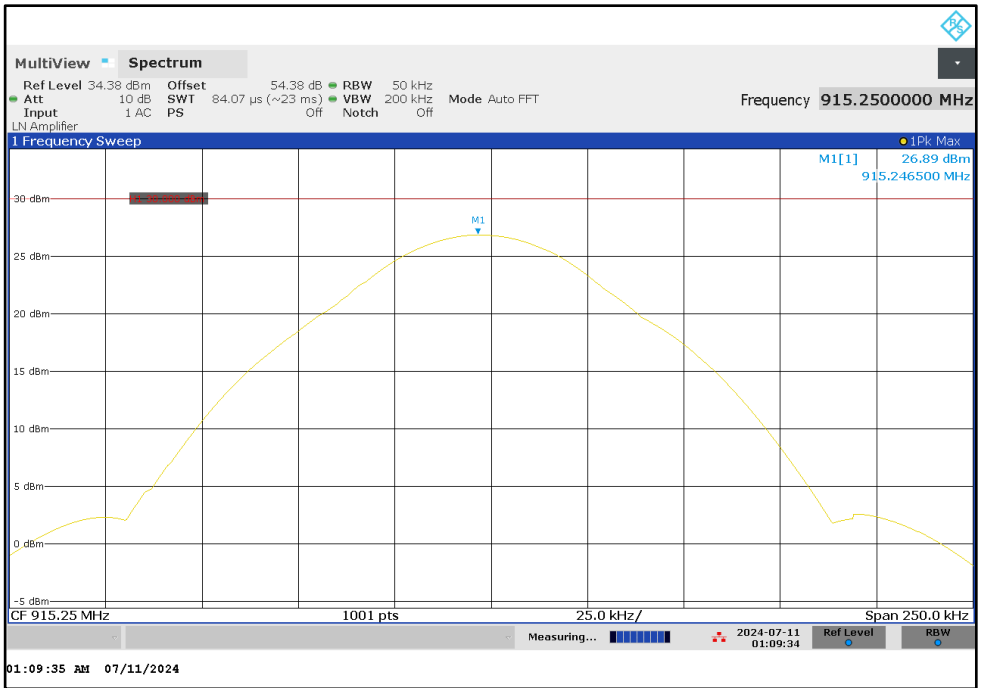

Figure 48 - Conducted Output Power, 915.25 MHz, Port 6A

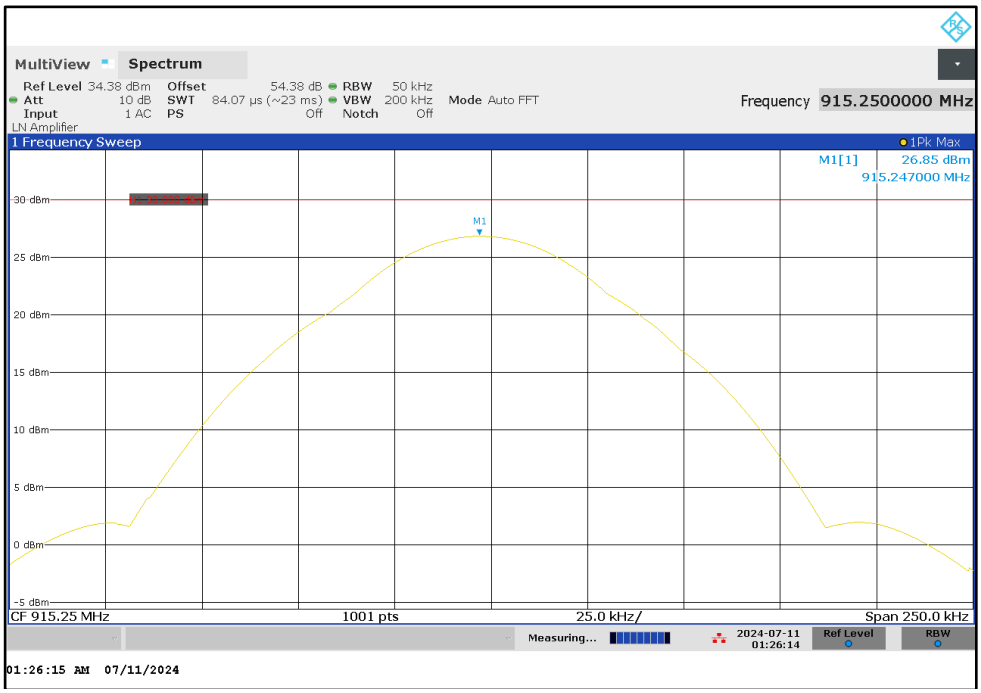

Figure 49 - Conducted Output Power, 915.25 MHz, Port 7A

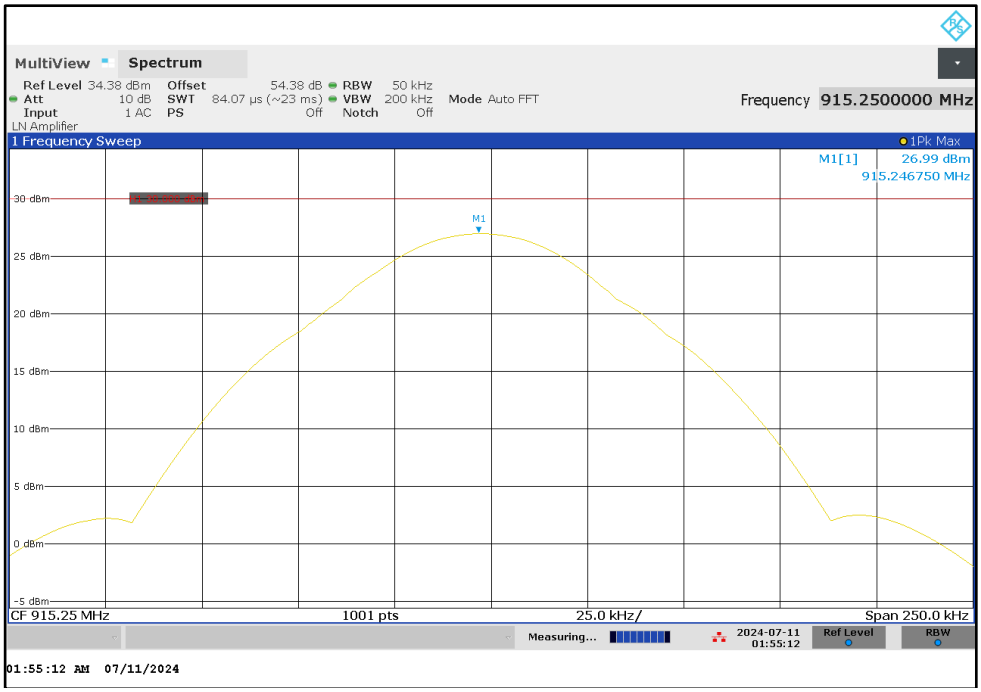

Figure 50 - Conducted Output Power, 915.25 MHz, Port 8A

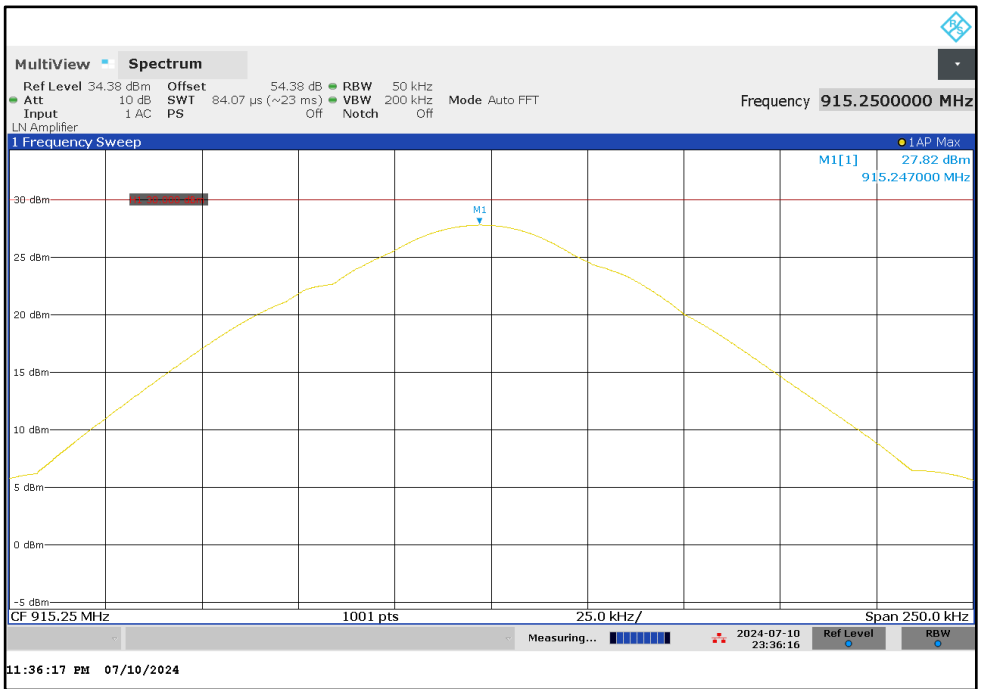

Figure 51 - Conducted Output Power, 915.25 MHz, Port 1B

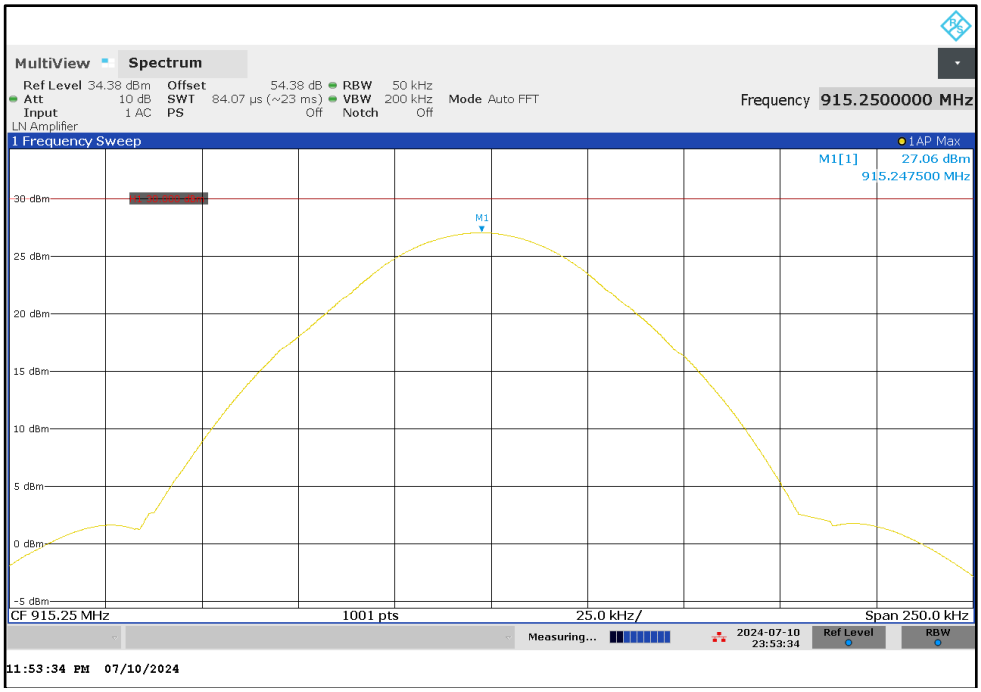

Figure 52 - Conducted Output Power, 915.25 MHz, Port 2B

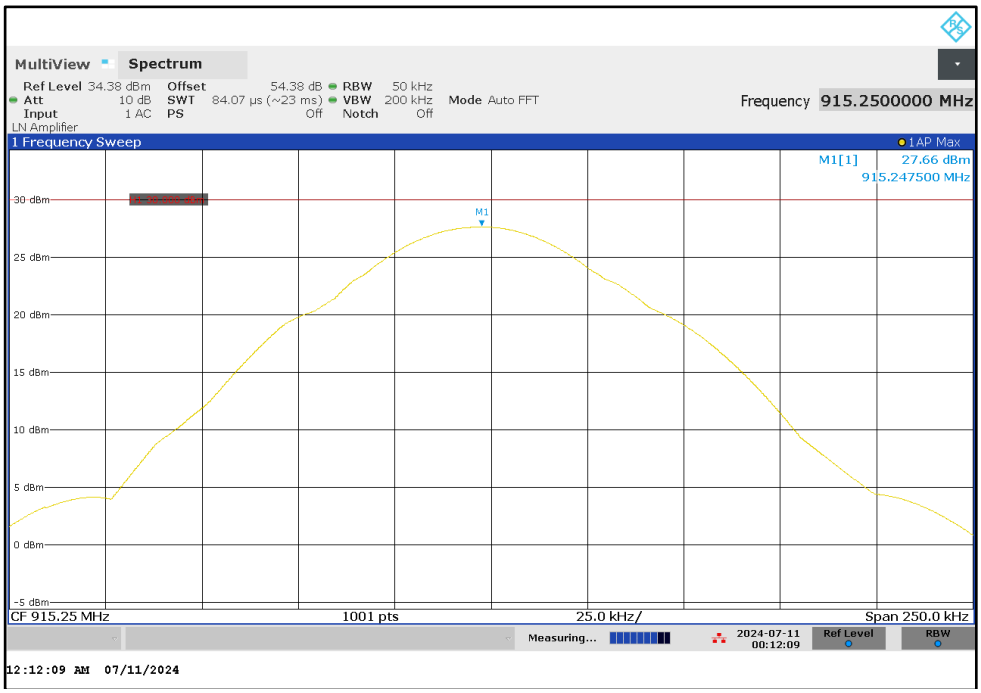

Figure 53 - Conducted Output Power, 915.25 MHz, Port 3B

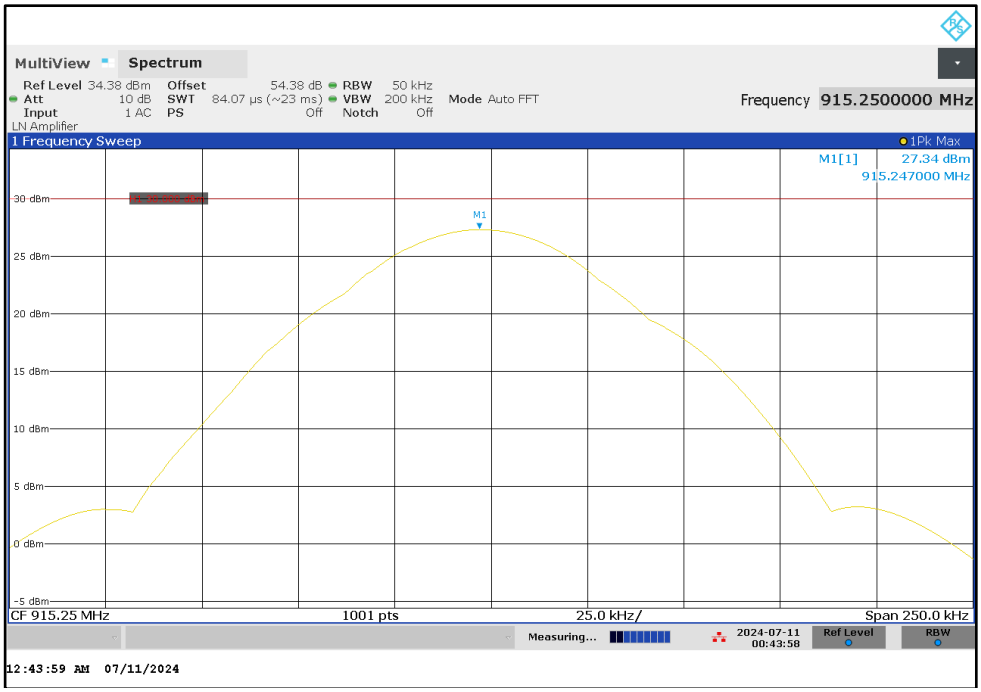

Figure 54 - Conducted Output Power, 915.25 MHz, Port 4B

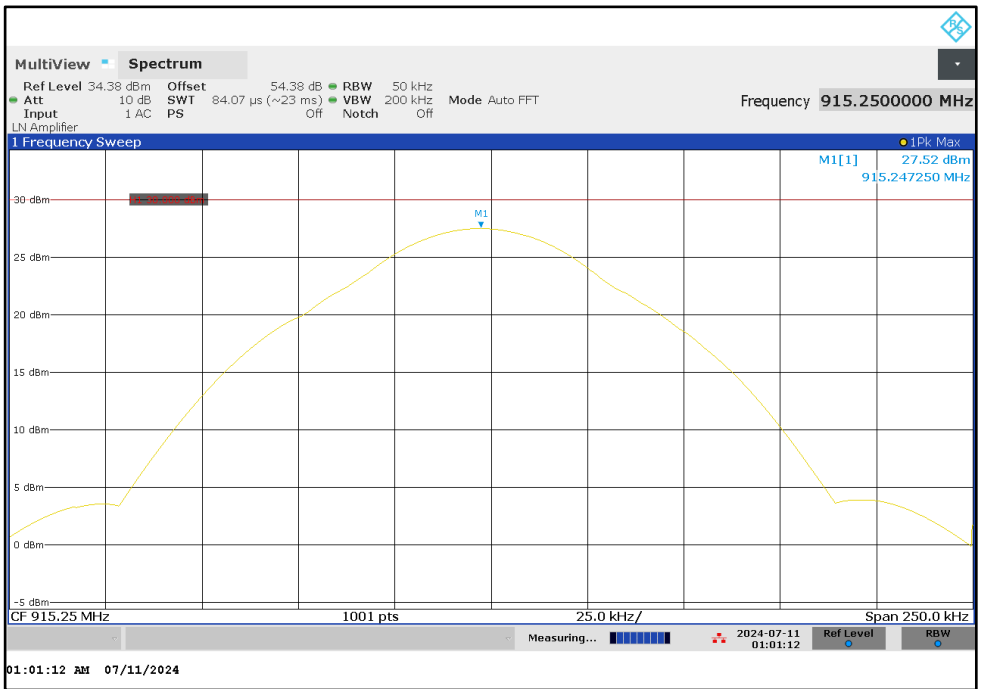

Figure 55 - Conducted Output Power, 915.25 MHz, Port 5B

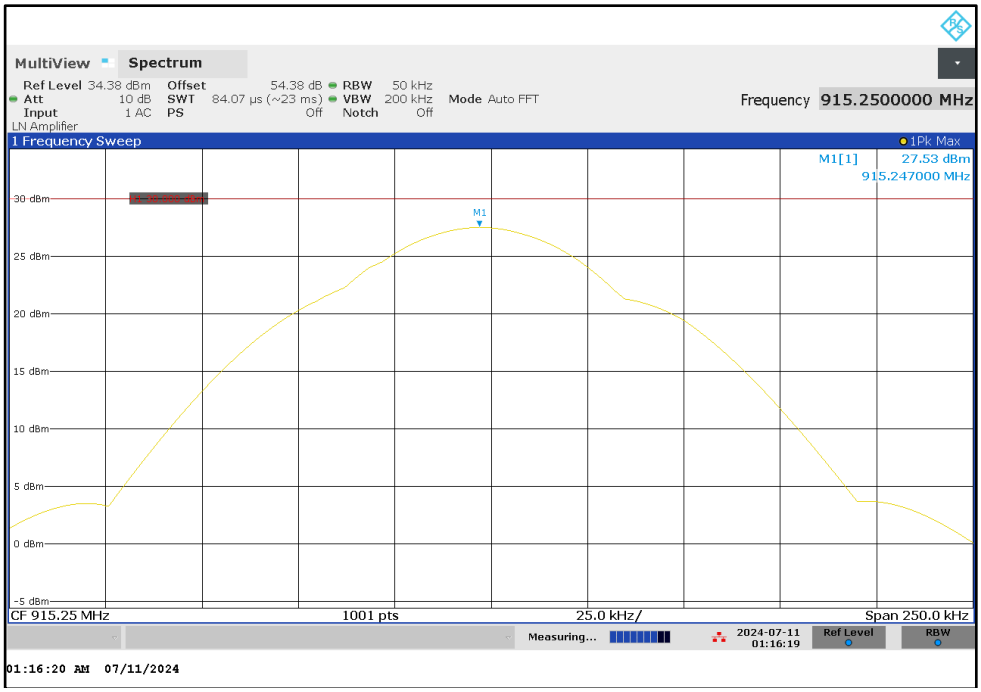

Figure 56 - Conducted Output Power, 915.25 MHz, Port 6B

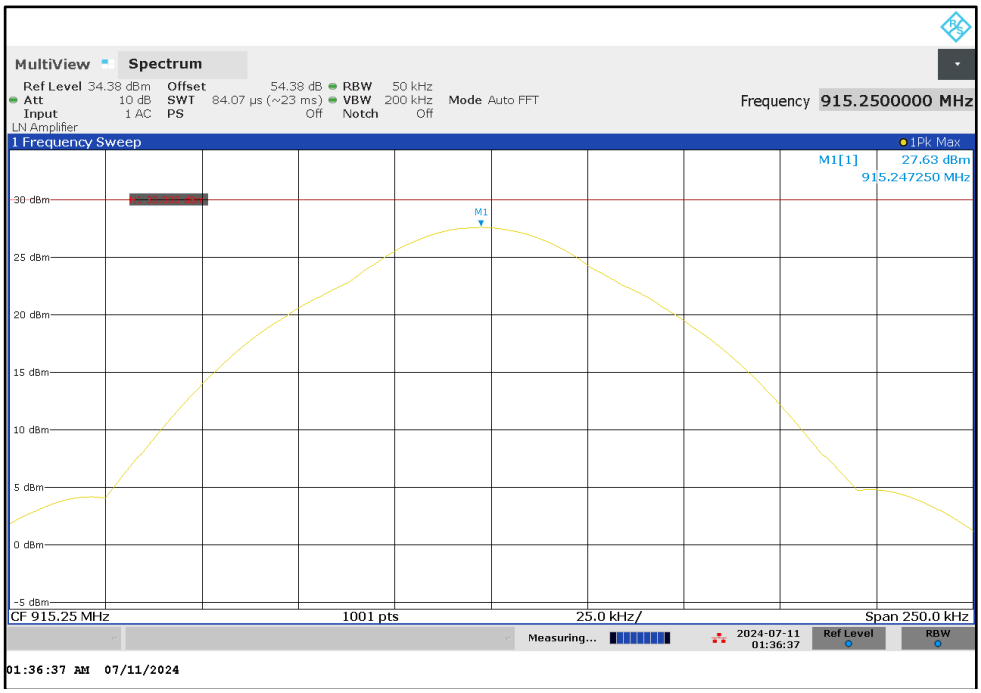

Figure 57 - Conducted Output Power, 915.25 MHz, Port 7B

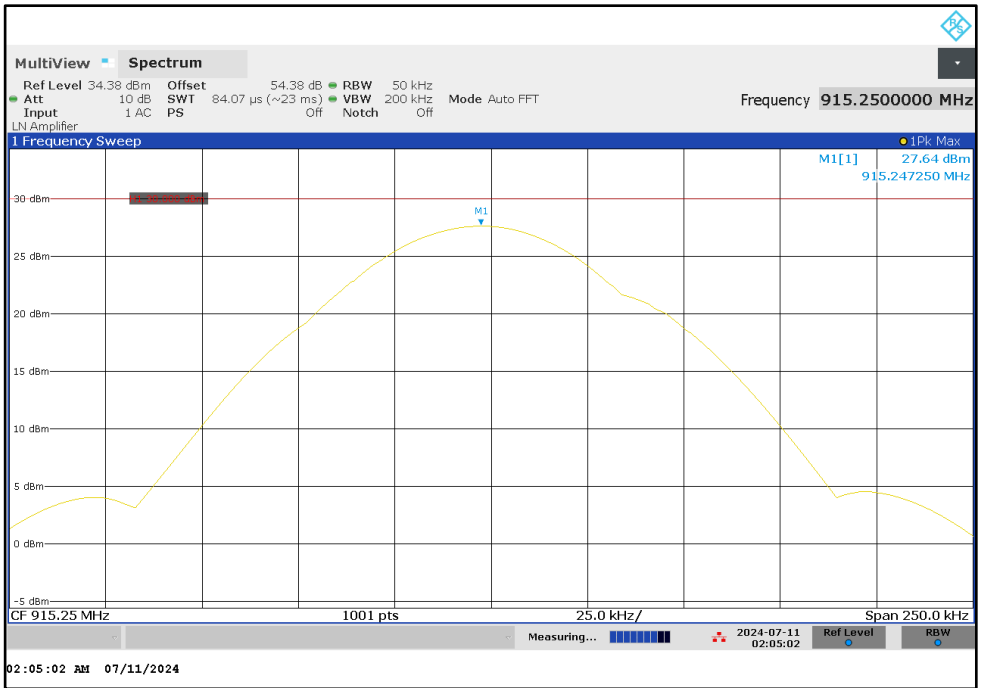

Figure 58 - Conducted Output Power, 915.25 MHz, Port 8B

Frequency (MHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Maximum Antenna Gain (dBi)*	Verdict	Detector	EUT Port
927.25	26.57	30	-3.43	9.43	Pass	PEAK	1A
927.25	26.76	30	-3.24	9.24	Pass	PEAK	2A
927.25	26.84	30	-3.16	9.16	Pass	PEAK	3A
927.25	26.54	30	-3.46	9.46	Pass	PEAK	4A
927.25	26.74	30	-3.26	9.26	Pass	PEAK	5A
927.25	26.58	30	-3.42	9.42	Pass	PEAK	6A
927.25	26.59	30	-3.41	9.41	Pass	PEAK	7A
927.25	26.74	30	-3.26	9.26	Pass	PEAK	8A
927.25	26.73	30	-3.27	9.27	Pass	PEAK	1B
927.25	26.94	30	-3.06	9.06	Pass	PEAK	2B
927.25	27.02	30	-2.98	8.98	Pass	PEAK	3B
927.25	26.71	30	-3.29	9.29	Pass	PEAK	4B
927.25	26.91	30	-3.09	9.09	Pass	PEAK	5B
927.25	26.71	30	-3.29	9.29	Pass	PEAK	6B
927.25	26.85	30	-3.15	9.15	Pass	PEAK	7B
927.25	26.92	30	-3.08	9.08	Pass	PEAK	8B

Table 31 - Conducted Output Power Results, 927.25 MHz

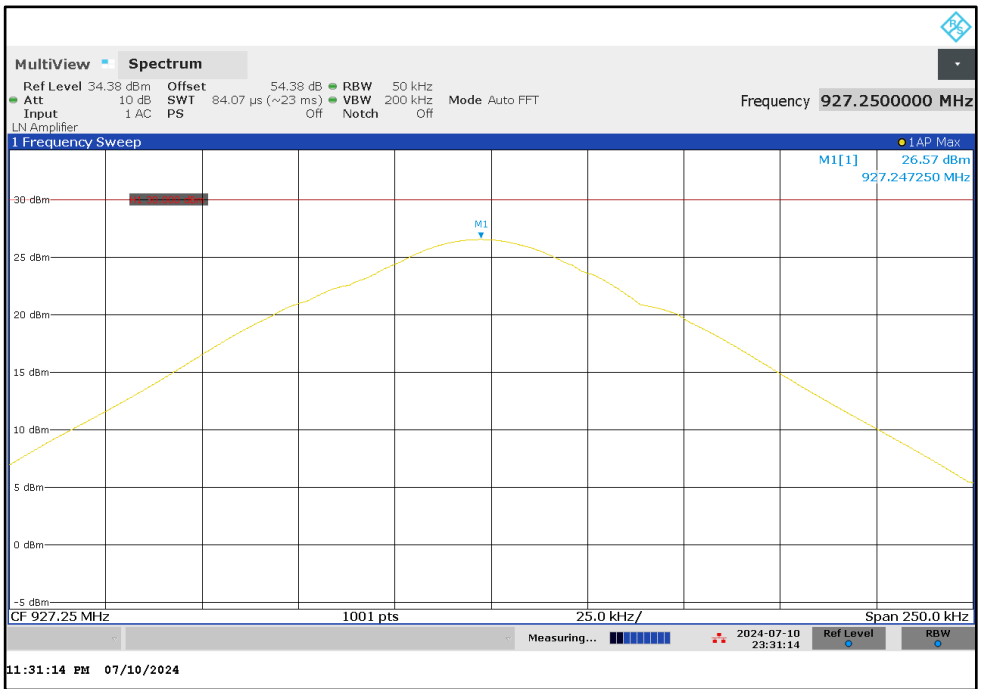

Figure 59 - Conducted Output Power, 927.25 MHz, Port 1A

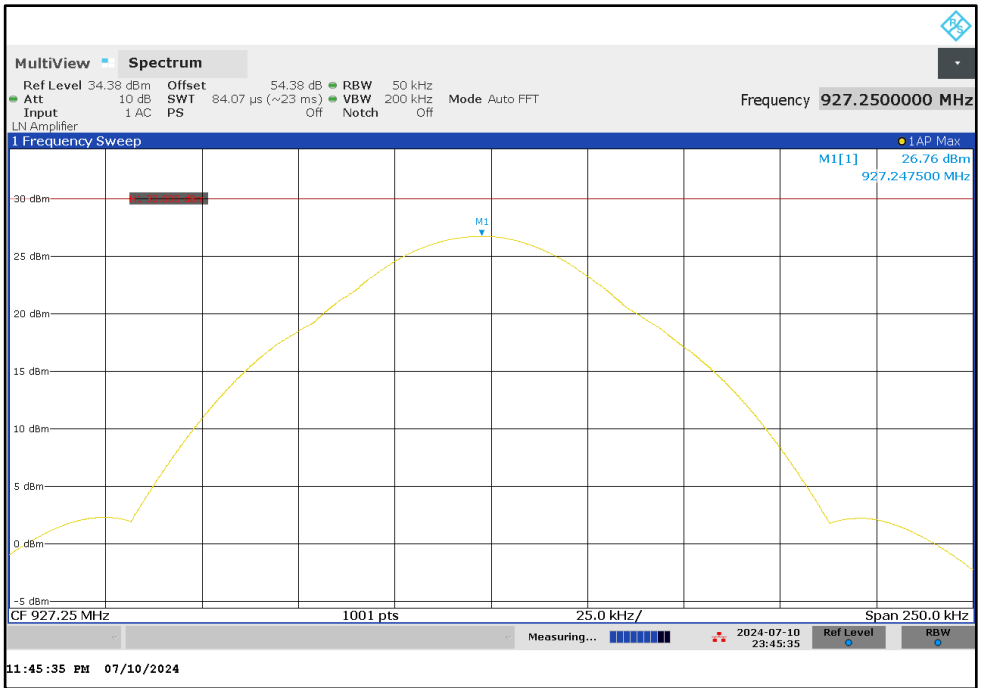

Figure 60 - Conducted Output Power, 927.25 MHz, Port 2A

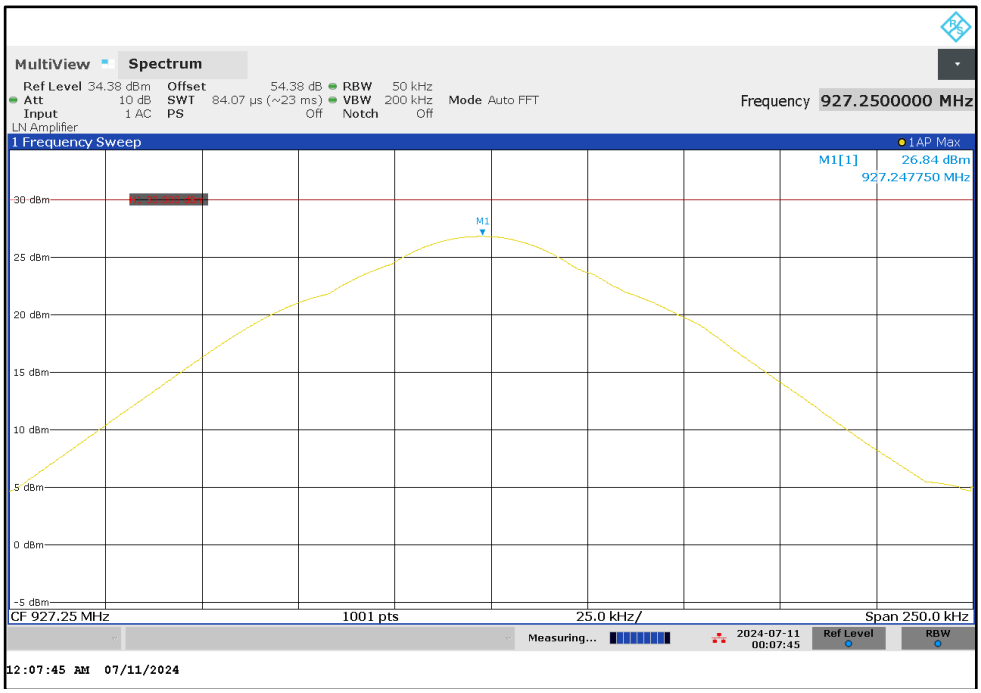

Figure 61 - Conducted Output Power, 927.25 MHz, Port 3A

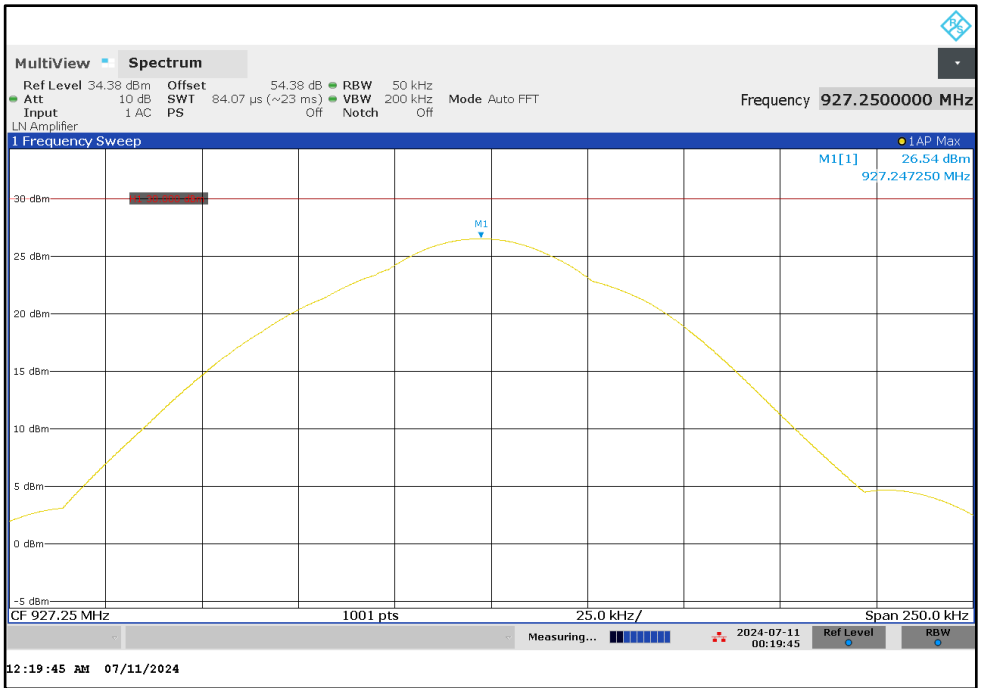

Figure 62 - Conducted Output Power, 927.25 MHz, Port 4A

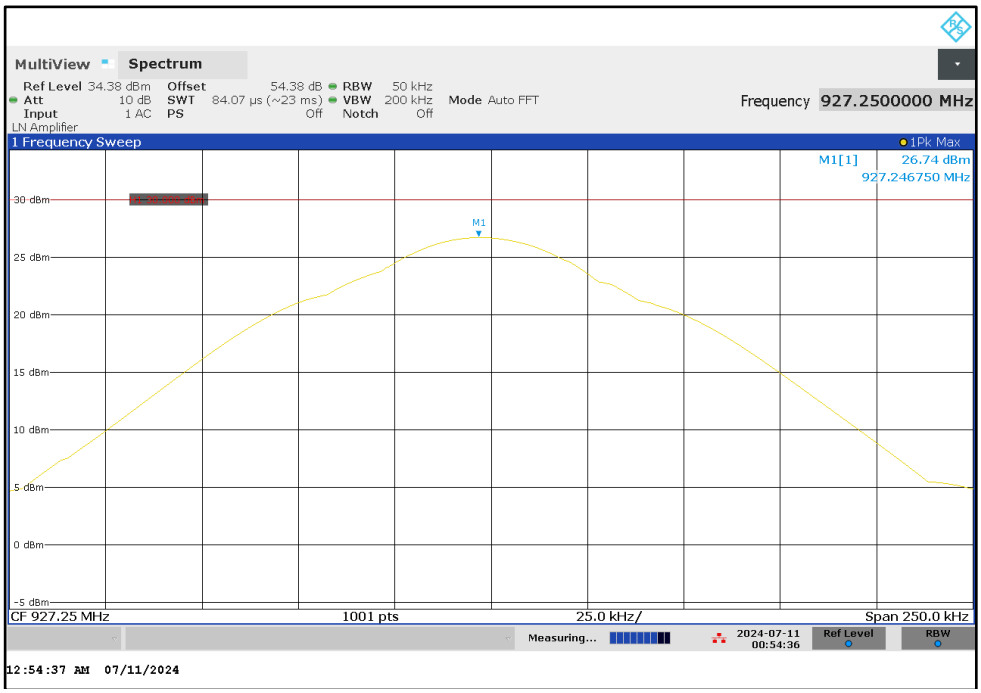

Figure 63 - Conducted Output Power, 927.25 MHz, Port 5A

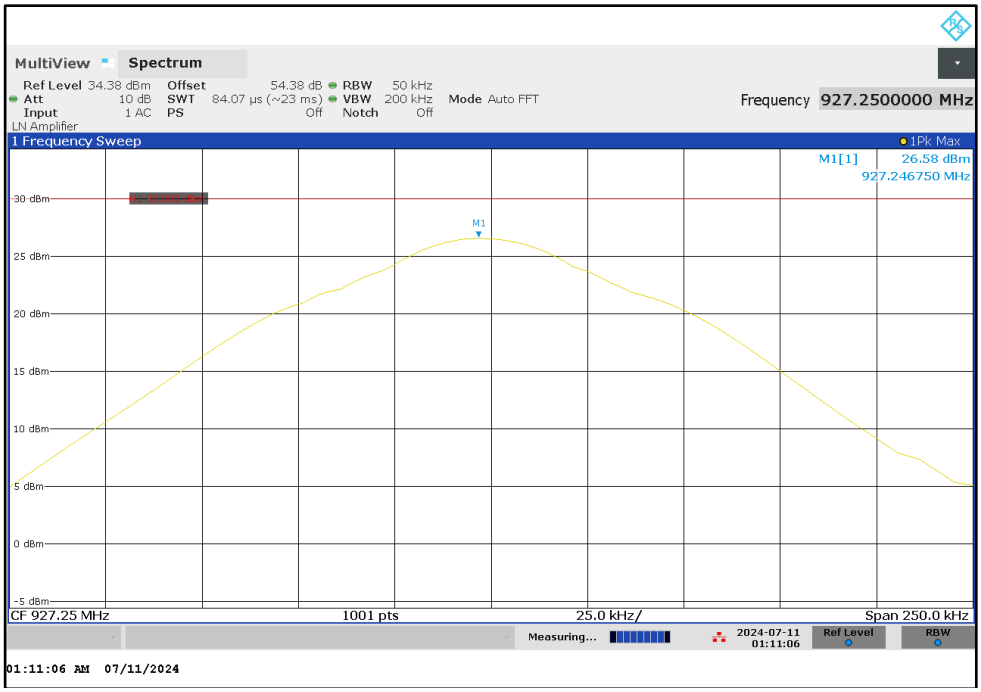

Figure 64 - Conducted Output Power, 927.25 MHz, Port 6A

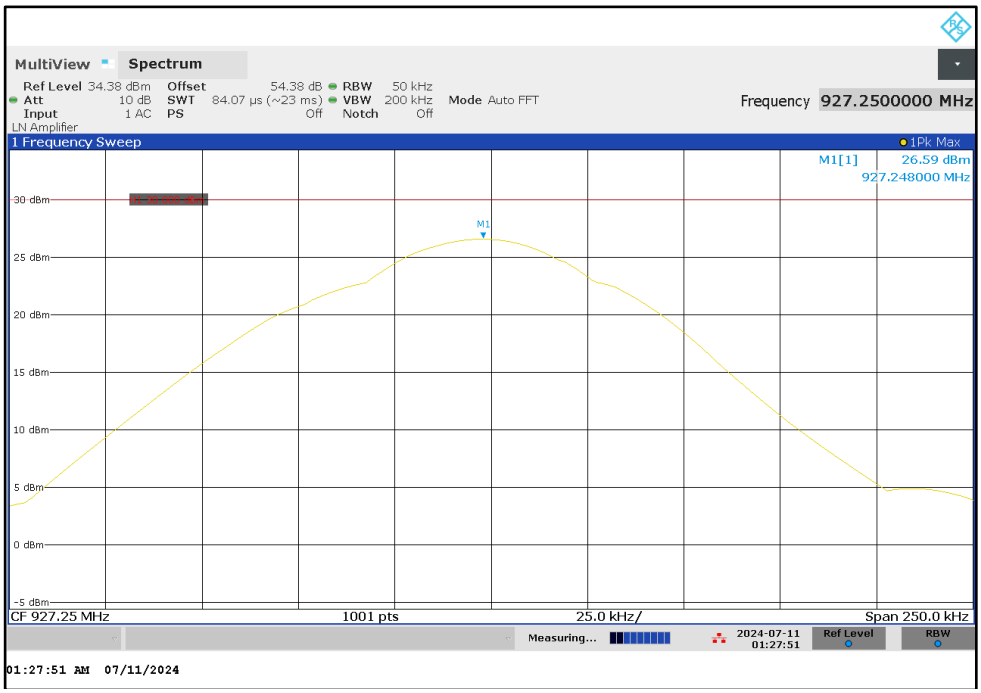

Figure 65 - Conducted Output Power, 927.25 MHz, Port 7A

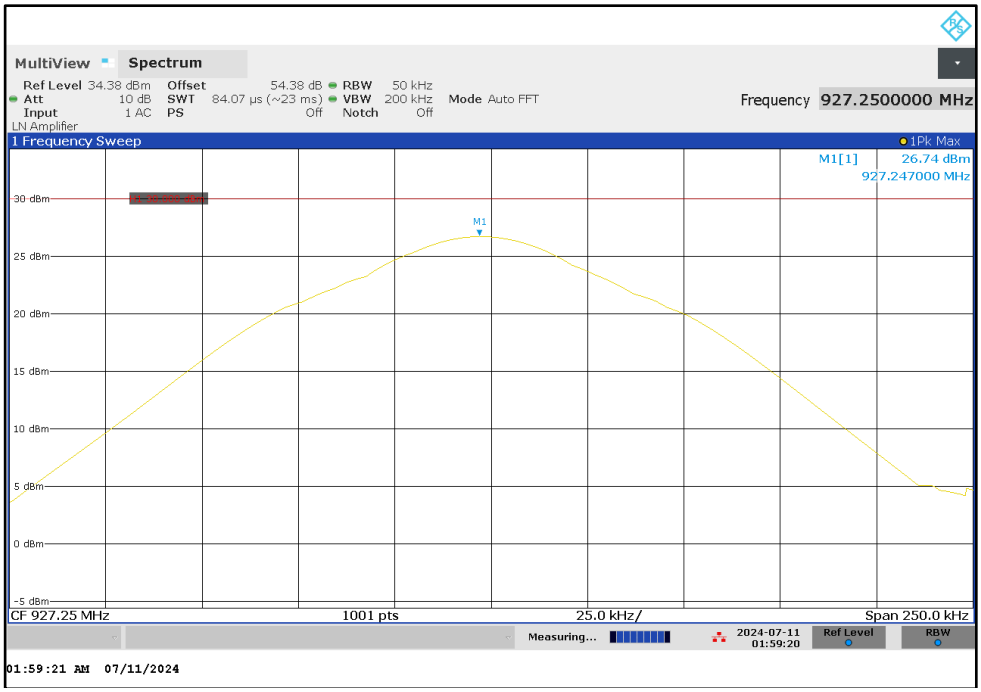

Figure 66 - Conducted Output Power, 927.25 MHz, Port 8A

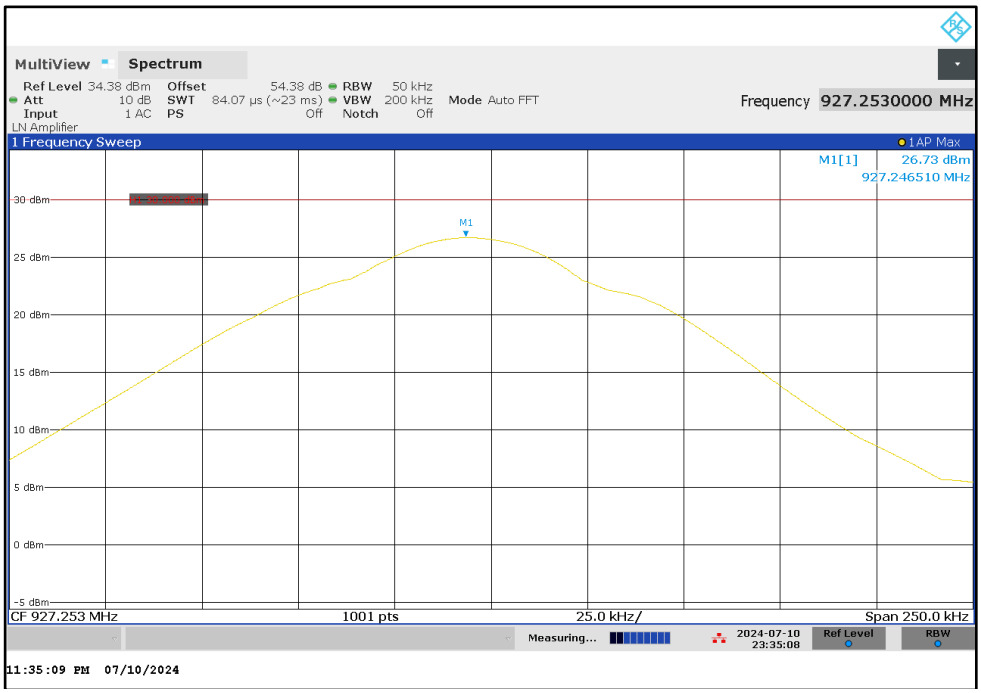

Figure 67 - Conducted Output Power, 927.25 MHz, Port 1B

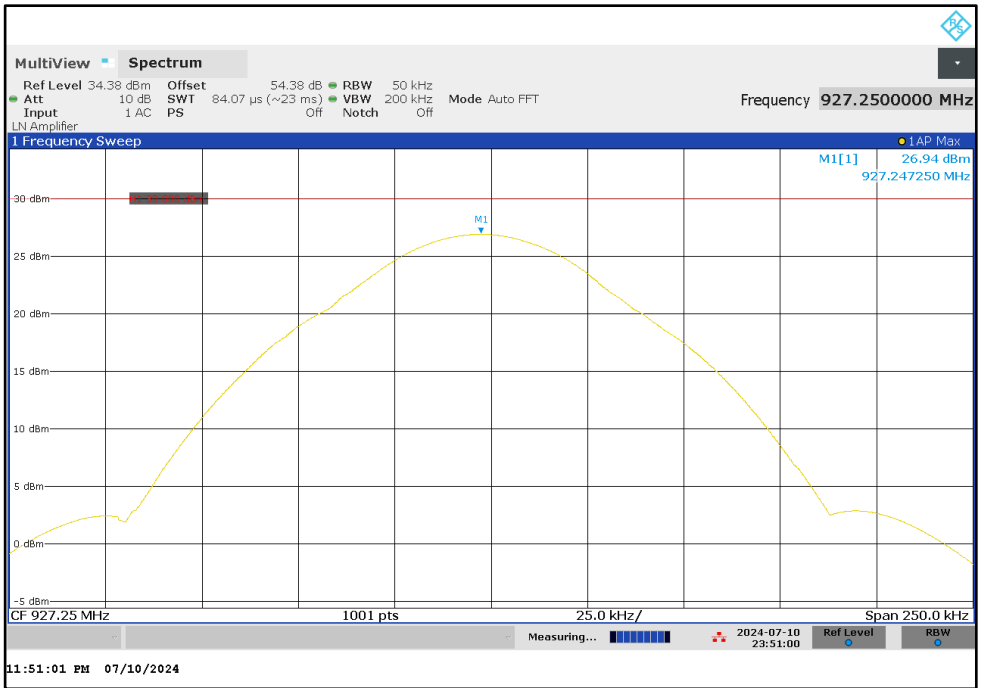

Figure 68 - Conducted Output Power, 927.25 MHz, Port 2B

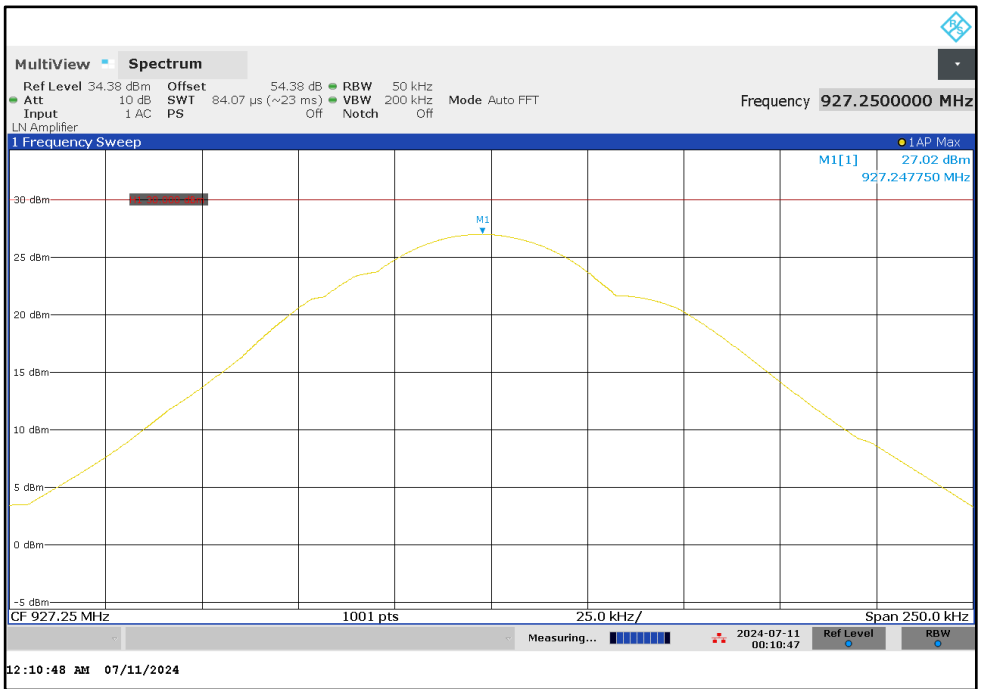

Figure 69 - Conducted Output Power, 927.25 MHz, Port 3B

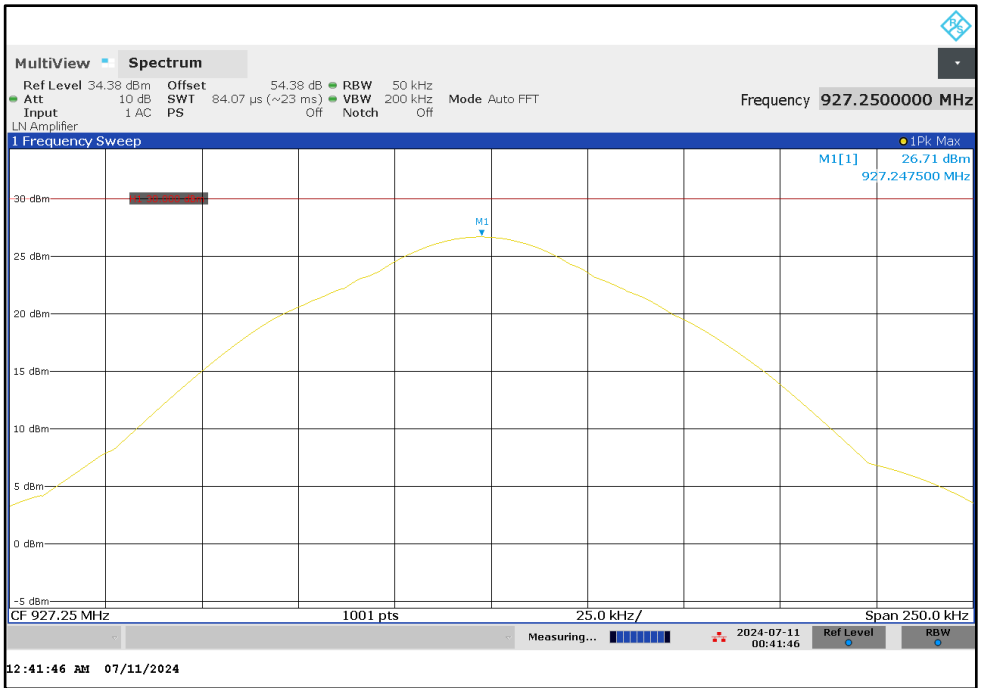

Figure 70 - Conducted Output Power, 927.25 MHz, Port 4B

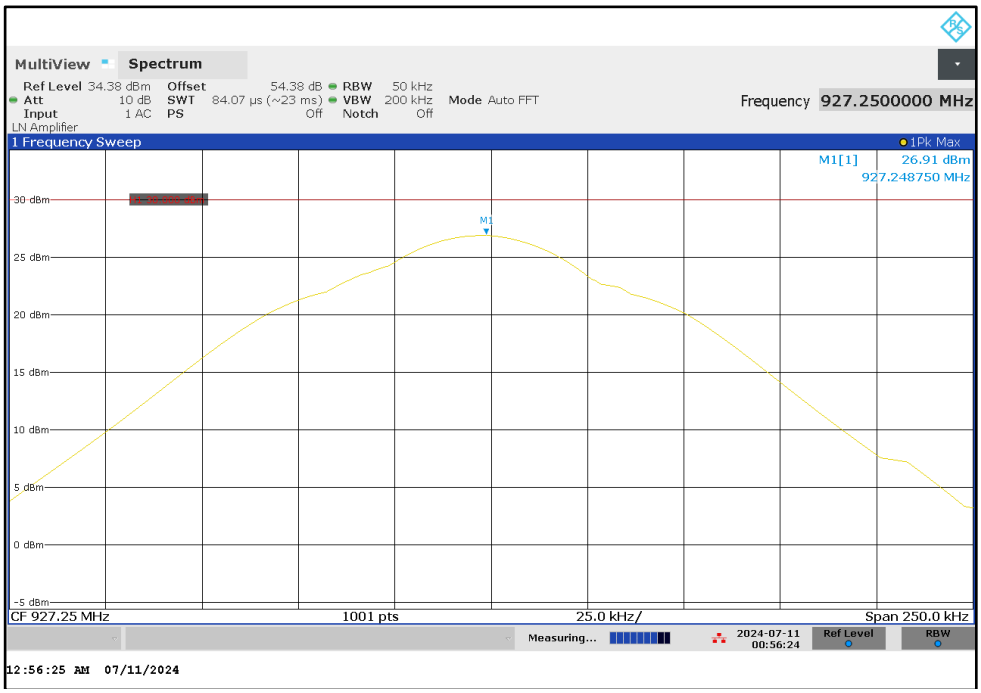

Figure 71 - Conducted Output Power, 927.25 MHz, Port 5B

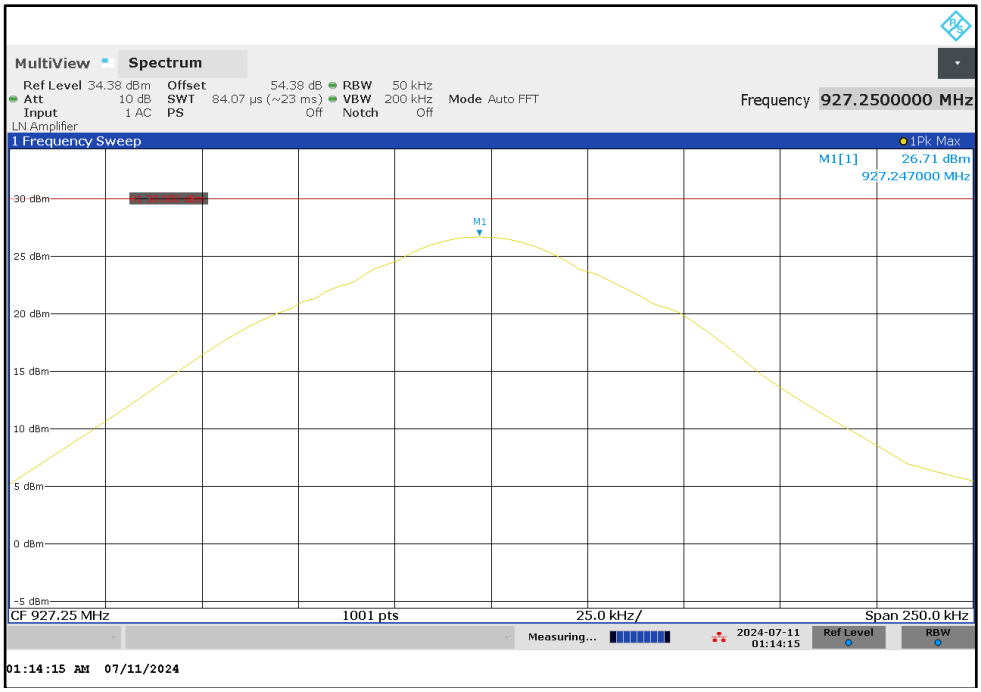

Figure 72 - Conducted Output Power, 927.25 MHz, Port 6B

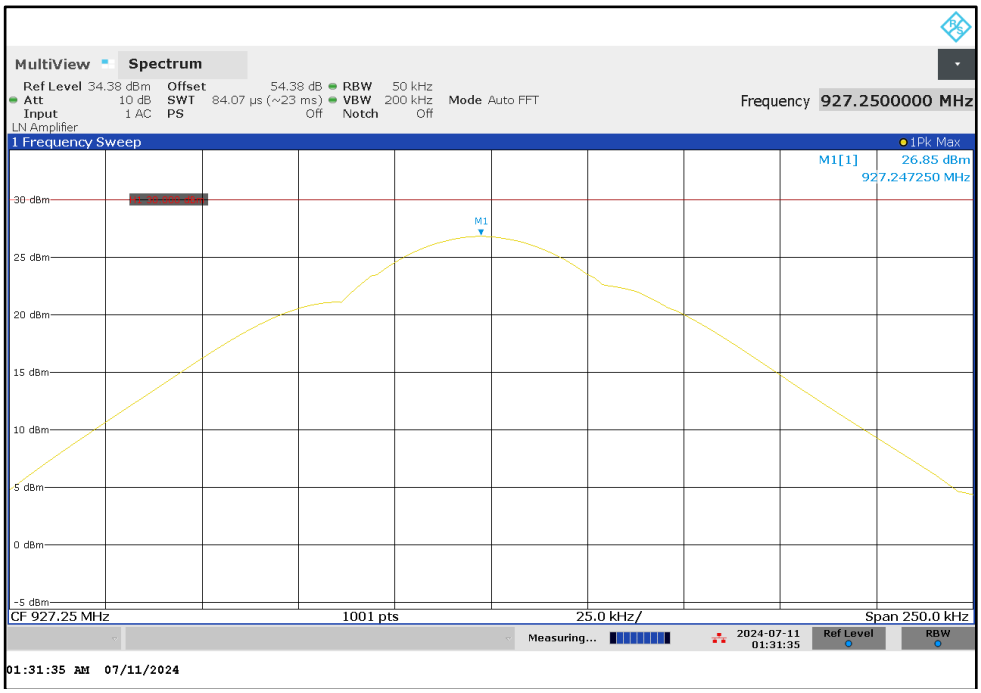

Figure 73 - Conducted Output Power, 927.25 MHz, Port 7B

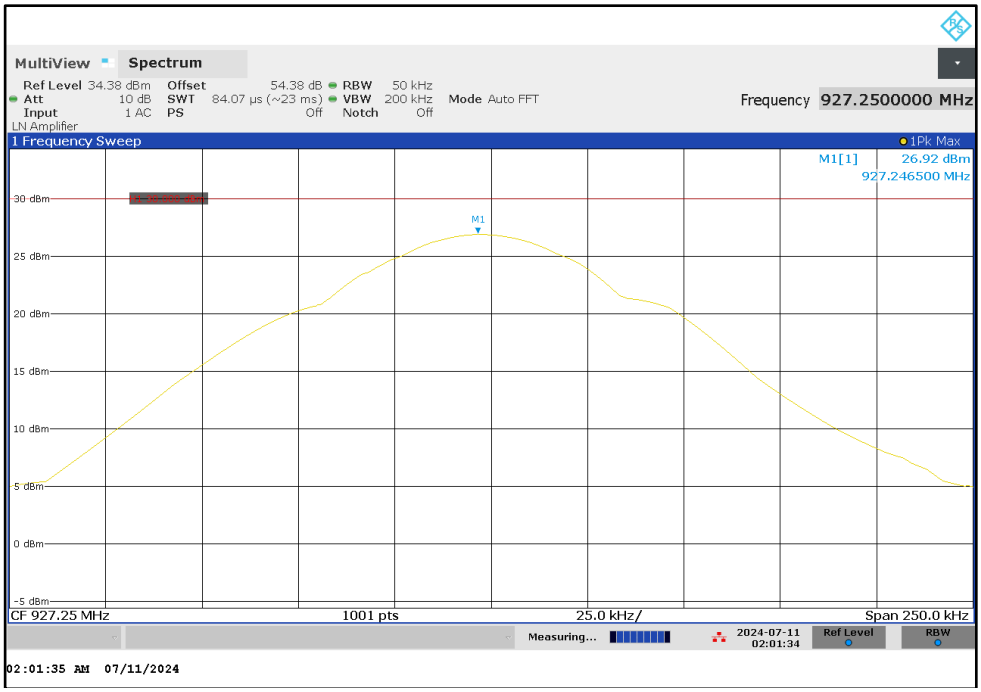

Figure 74 - Conducted Output Power, 927.25 MHz, Port 8B

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(1)

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

ISED RSS-247, Limit Clause 5.4 (b)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channel; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channel. The e.i.r.p. shall not exceed 4 W except as provided in section 5.4(e) of the specification.

Frequency (MHz)	Maximum Output Power	
	dBm	mW
<0>	<2>	<3>

Table 32

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(2)

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.

ISED RSS-247, Limit Clause 5.4 (a)

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 hopset 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 hopset uses less than 50 hopping channels.

*The value shown is the maximum antenna gain for which the device is still compliant with both the Conducted Output Power and EIRP limits.

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

ISED RSS-247, Limit Clause 5.4 (d)

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

2.7.7 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
True RMS Multimeter	Fluke	179	4006	12	22-Mar-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	13-May-2025
Attenuator 5W 20dB DC-18GHz	Aaren	AT40A-4041-D18-20	5500	6	26-Nov-2024
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	23-May-2025
Coaxial Fixed Attenuator DC-18GHz 5W 10dB	RF-Lambda	RFS5G18B10SMP	6181	12	16-Aug-2024
EMC Test Receiver	Rohde & Schwarz	ESW44	6334	12	31-May-2025
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	6561	12	18-Jun-2025

Table 33

3 Photographs

3.1 Test Setup Photographs

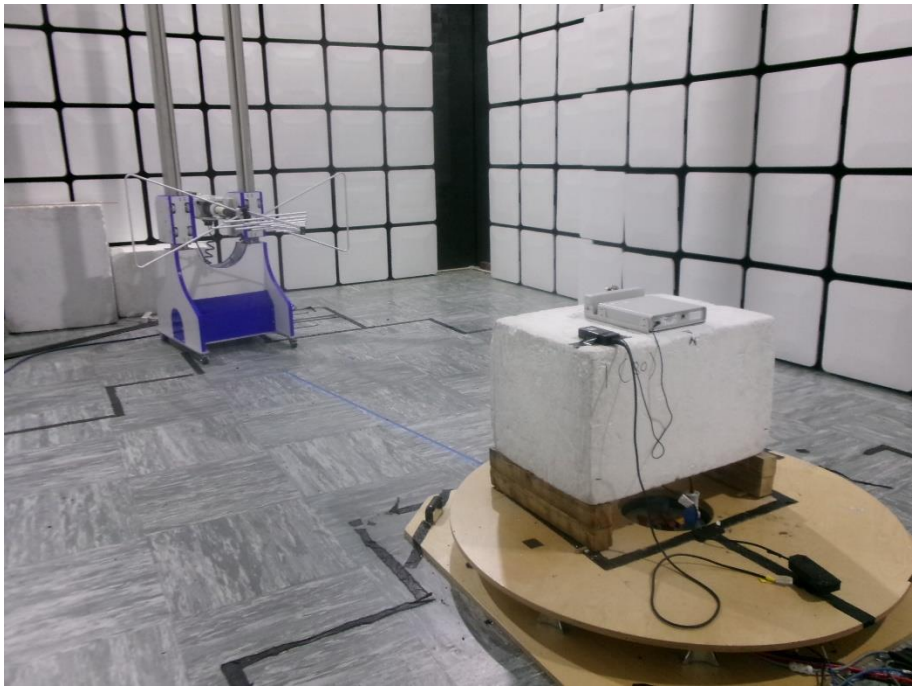

Figure 75 - Radiated Emissions Test Setup, 30 MHz to 1 GHz

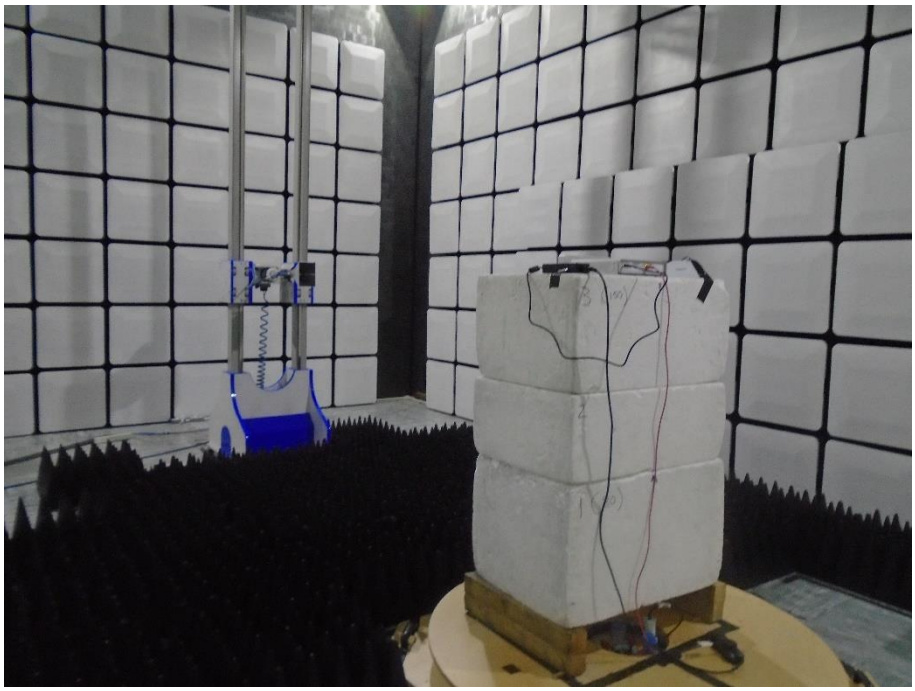

Figure 76 - Radiated Emissions Test Setup,1 GHz to 10 GHz

4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

Test Name	Measurement Uncertainty
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Authorised Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Frequency Hopping Systems - Average Time of Occupancy	-
Frequency Hopping Systems - Channel Separation	5.222 kHz
Frequency Hopping Systems - Number of Hopping Channels	-
Frequency Hopping Systems - 20 dB Bandwidth	1.657 kHz
Maximum Conducted Output Power	± 1.38 dB

Table 34

Measurement Uncertainty Decision Rule – Accuracy Method

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2021, Clause 4.4.3 (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.