Radio Test Report

Garmin International Inc

Garmin MES Module, Model: A04349

In accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 25, ISED RSS-170 and ISED RSS-GEN Mobile Earth Station (MES)

Add value.
Inspire trust.

Prepared for: Garmin International Inc
1200 E. 151st Street
Olathe, KS 66062
UNITED STATES

COMMERCIAL-IN-CONFIDENCE

Document 75957575-05 Issue 01

SIGNATURE			
NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Matthew Russell	Chief Engineer	Authorised Signatory	23 January 2024

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

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 2, 2021, FCC 47 CFR Part 25, 2021, ISED RSS-170, Issue 4 (09-2022) and ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021) for the tests detailed in section 1.3.

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Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TUV SUD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuvsud.com/en

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

Contents

1 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	23 January 2024

Table 1

1.2 Introduction

Applicant	Garmin International Inc
Manufacturer	Garmin Corporation
Model Number(s)	A04349
Serial Number(s)	1606803100025
Hardware Version(s)	Rev 10
Software Version(s)	SX-221028M-22215-I1-TM-SX-1360
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 2, 2021 FCC 47 CFR Part 25, 2021 ISED RSS-17: Issue 4 (09-2022) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number	359413 Rev 0
Date	17 Dec 2022
Date of Receipt of EUT	06-April-2023
Start of Test	16-May-2023
Finish of Test	21-June-2023
Name of Engineer(s)	Roscoe Harrison and Ahmad Javid
Related Document(s)	ANSI C63.26 (2015)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 25, ISED RSS-170 and ISED RSS-GEN is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	Part 2	Part 25	RSS-170	RSS-GEN			
Configuration and Mode: MES Transceiver - B1							
2.1	2.1046,	25.204	5.5	6.12	Equivalent Isotropic Radiated Power	Pass	ANSI C63.26 (2015)
2.2	2.1047 (d)	-	-	-	Modulation Characteristics	Declaration	ANSI C63.26 (2015)
2.3	2.1049	-	-	6.7	Occupied Bandwidth	Pass	ANSI C63.26 (2015)
2.4	2.1051	25.202(f)	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	ANSI C63.26 (2015)
2.5	2.1053	25.202(f)	5.8	6.13	Radiated Spurious Emissions	Pass	ANSI C63.26 (2015)
2.6	2.1055	25.202(d)	5.3	6.11	Frequency Tolerance	Pass	ANSI C63.26 (2015)
2.7	-	25.216	5.9	-	Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	Pass	ANSI C63.26 (2015)
Configuration and Mode: MES Transceiver - C1							
2.1	2.1046	25.204	5.5	6.12	Equivalent Isotropic Radiated Power	Pass	ANSI C63.26 (2015)
2.2	2.1047 (d)	-	-	-	Modulation Characteristics	Declaration	ANSI C63.26 (2015)
2.3	2.1049	-	-	6.7	Occupied Bandwidth	Pass	ANSI C63.26 (2015)
2.4	2.1051	25.202(f)	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	ANSI C63.26 (2015)
2.6	2.1055	25.202(d)	5.8	6.11	Frequency Tolerance	Pass	ANSI C63.26 (2015)
2.7	-	25.216	5.9	-	Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	Pass	ANSI C63.26 (2015)

Configuration and Mode: MES Transceiver - C2							
2.1	2.1046	25.204	5.5	6.12	Equivalent Isotropic Radiated Power	Pass	ANSI C63.26 (2015)
2.2	2.1047 (d)		-	-	Modulation Characteristics	Declaration	ANSI C63.26 (2015)
2.3	2.1049	-	-	6.7	Occupied Bandwidth	Pass	ANSI C63.26 (2015)
2.4	2.1051	25.202(f)	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	ANSI C63.26 (2015)
2.6	2.1055	25.202(d)	5.3	6.11	Frequency Tolerance	Pass	ANSI C63.26 (2015)
2.7	-	25.216	5.9	-	Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	Pass	ANSI C63.26 (2015)

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)*	Mobile Earth Station (MES) module based on second-generation technology.	
Manufacturer:	Garmin (Asia) Corporation	
Model:	M/N: A04349	
Part Number:	012-04349-00	
Hardware Version:	Rev 10	
Software Version:	SX-221028M-22215-I1-TM-SX-1360	
FCC ID of the product under test – see guidance here	IPH-04349	
IC ID of the product under test – see guidance here	1792A-04349	

Table 3

Intentional Radiators

Technology	Mobile Earth Station (MES) based on second-generation technology.	
Frequency Range (MHz to MHz)	1616-1626	
Conducted Declared Output Power (dBm)	34.2	B1 modulation
	32.0	C1 modulation
	32.0	C2 modulation
Antenna Gain (dBi)	6.0	
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	41.667 kHz, 83.333 kHz	
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	Differentially-Encoded QPSK (B1) (DE-QPSK).	QPSK (C1, C2)
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	41K7Q7W (B1, C1)	83K4Q7W (C2)
Bottom Frequency (MHz)	subband 1, access 1: 1616.020833 (B1, C1), 1616.041666 (C2)	
Middle Frequency (MHz)	subband 16, access 1: 1621.020833 (B1, C1), 1621.041666 (C2)	
Top Frequency (MHz)	subband 30, access 8: 1625.979167 (B1, C1), 1625.958333 (C2)	

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	3220-3253 MHz (Module I200 internal VCO)
Lowest frequency generated or used in the device or on which the device operates or tunes	3.6864MHz (Module Y500)
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:	5	V
Extreme upper voltage:	5.5	V
Extreme lower voltage:	4.5	V
Max current:	3	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 ☐ N/A ☒

Table 9

Temperature

Minimum temperature:	-30	°C
Maximum temperature:	+85	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)	0.34 between module and SMA-F connector of 012-04349-T1	dB

Table 11

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector ☒			State impedance	50	Ohm
Integral antenna ☐	Type:		Gain		dBi
External antenna ☒	Type:	Quad-helical	Gain	2.8 (typ.)	dBi
For external antenna only: Standard Antenna Jack ☒ If yes, describe how user is prohibited from changing antenna (if not professional installed): The provided Test Interface Board (TIB) is not the final product. Final product(s) will use an integrated antenna. Equipment is only ever professionally installed ☐ Non-standard Antenna Jack ☐ All part 15 applications will need to show how the antenna gain was derived either from a manufacturer data sheet or a measurement. Where the gain of the antenna is inherently accounted for as a result of the measurement, such as field strength measurements on a part 15.249 or 15.231 device, so the gain does not necessarily need to be verified. However, enough information regarding the construction of the antenna shall be provided. Such information maybe photographs, length of wire antenna etc.					

Table 12

Ancillaries (if applicable)

Manufacturer:	Garmin (Asia) Corporation	Part Number:	012-04349-T1
Model:	Test Interface Board (TIB)	Country of Origin:	Taiwan, R.O.C.

Table 13

Manufacturer:	Garmin Confidential	Part Number:	IRDM-5187-PCB-002C
Model:	USB Expansion Adapter Board	Country of Origin:	USA

Table 14

Manufacturer:	Maxtena, Inc.	Part Number:	M1621HCT-SMA
Model:	MES band antenna	Country of Origin:	USA

Table 15

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

Name: Daniel C. Irish
Position held: Lead Compliance Engineer
Date: 20 April 2023

1.5 Product Information

1.5.1 Technical Description

Mobile Earth Station (MES) module based on second-generation technology.

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: A04349, Serial Number: 1606803100025			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 16

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: MES Transceiver - B1		
Equivalent Isotropic Radiated Power	Roscoe Harrison	UKAS
Modulation Characteristics	Roscoe Harrison	UKAS
Occupied Bandwidth	Roscoe Harrison	UKAS
Spurious Emissions at Antenna Terminals	Roscoe Harrison	UKAS
Radiated Spurious Emissions	Ahmad Javid	UKAS
Frequency Tolerance	Roscoe Harrison	UKAS
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	Roscoe Harrison	UKAS
Configuration and Mode: MES Transceiver - C1		
Equivalent Isotropic Radiated Power	Roscoe Harrison	UKAS
Modulation Characteristics	Roscoe Harrison	UKAS
Occupied Bandwidth	Roscoe Harrison	UKAS
Spurious Emissions at Antenna Terminals	Roscoe Harrison	UKAS
Frequency Tolerance	Roscoe Harrison	UKAS
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	Roscoe Harrison	UKAS
Configuration and Mode: MES Transceiver - C2		
Equivalent Isotropic Radiated Power	Roscoe Harrison	UKAS
Modulation Characteristics	Roscoe Harrison	UKAS
Occupied Bandwidth	Roscoe Harrison	UKAS
Spurious Emissions at Antenna Terminals	Roscoe Harrison	UKAS
Frequency Tolerance	Roscoe Harrison	UKAS
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	Roscoe Harrison	UKAS

Table 17

Office Address:

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

2 Test Details

2.1 Equivalent Isotropic Radiated Power

2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046
FCC 47 CFR Part 25, Clause 25.204
ISED RSS-170, Clause 5.5
ISED RSS-GEN, Clause 6.12

2.1.2 Equipment Under Test and Modification State

A04349, S/N: 1606803100025 - Modification State 0

2.1.3 Date of Test

16-May-2023 to 10-July-2023

2.1.4 Test Method

Total EIRP measurements were performed in accordance with ANSI C63.26, clause 5.2.4.4 (average power with integration) using a gated trigger sweep. The Antenna Gain (6.0 dBi) was added to the measured Conducted Output Power to determine the EIRP.

The RBW was configured to 3 kHz RBW and the reference level offset increased to account for the correction factor required to show the result as 4 kHz bandwidth. The correction factor was obtained using the following formula:

10Log(4/3) = 1.25 dB

2.1.5 Environmental Conditions

Ambient Temperature	24.2 - 45.7 °C
Relative Humidity	21.5 - 37.3 %

2.1.6 Test Results

MES Transceiver - B1

EIRP (dBm/4kHz)		
1616.020833 MHz	1621.020833 MHz	1625.979167 MHz
32.05	32.76	32.51

Table 18 - EIRP/4 kHz Results Table

1616.020833 MHz		1621.020833 MHz		1625.979167 MHz	
EIRP (dBm)	Δ from rated power (dB)	EIRP (dBm)	Δ from rated power (dB)	EIRP (dBm)	Δ from rated power (dB)
40.71	0.51	40.63	0.43	40.70	0.50

Table 19 – EIRP Results Table

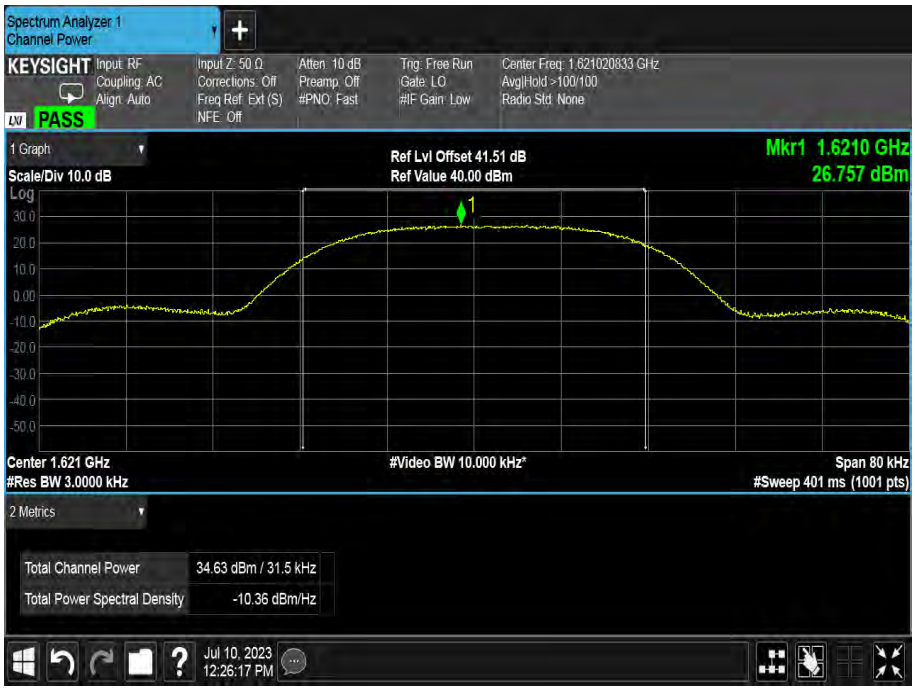

Figure 1 - 1621.0833 MHz

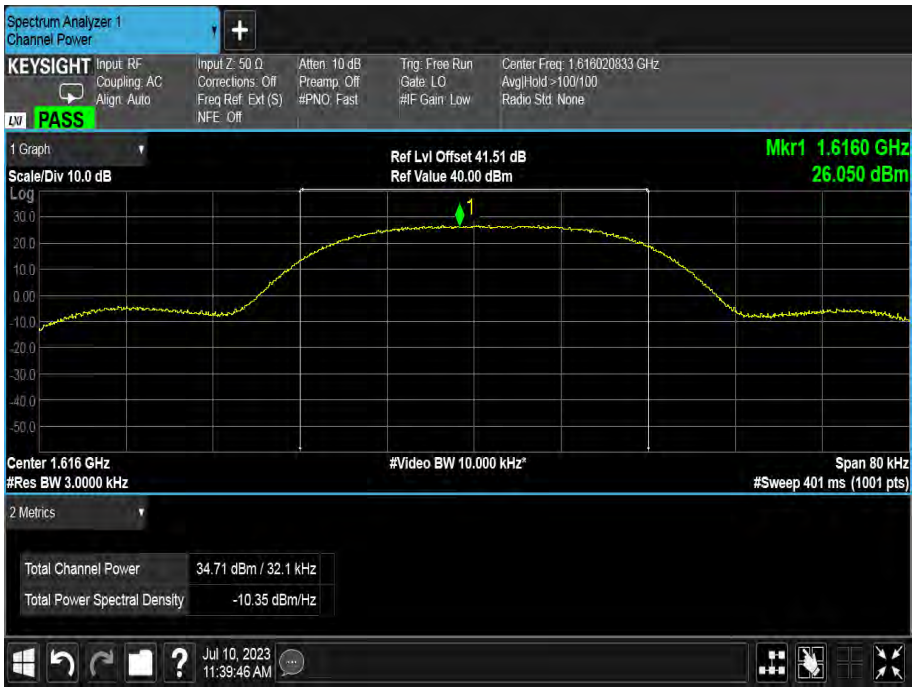

Figure 2, - 1616.020833 MHz

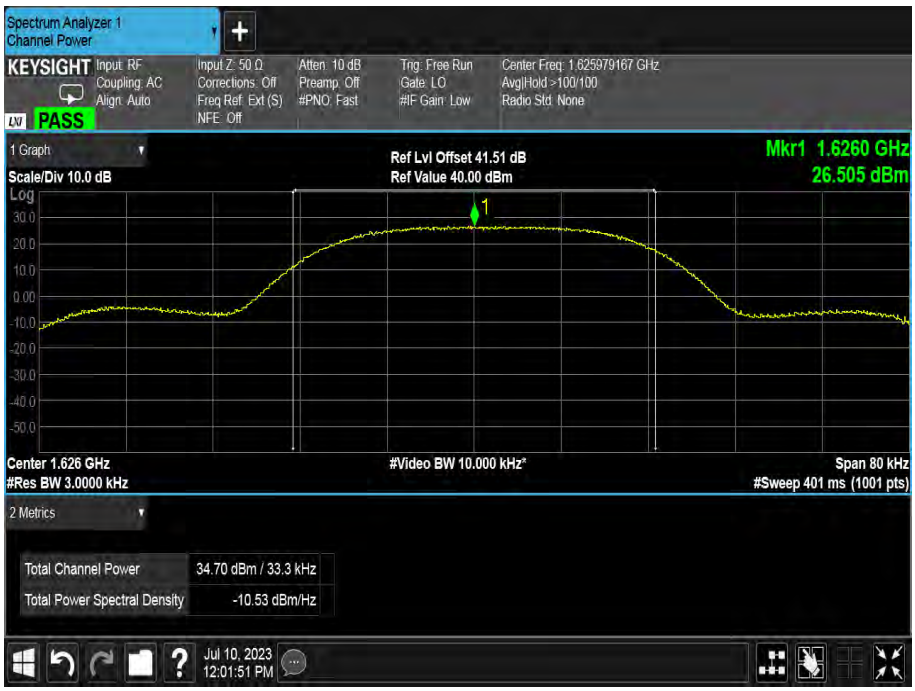

Figure 3, - 1625.979167 MHz

MES Transceiver – C1

EIRP (dBm/4kHz)		
1616.020833 MHz	1621.020833 MHz	1625.979167 MHz
29.56	29.24	29.48

Table 20 - EIRP/4kHz Results Table

1616.020833 MHz		1621.020833 MHz		1625.979167 MHz	
EIRP (dBm)	Δ from rated power (Db)	EIRP (dBm)	Δ from rated power (Db)	EIRP (dBm)	Δ from rated power (Db)
38.45	0.45	38.31	0.31	38.32	0.32

Table 21 - EIRP Results Table

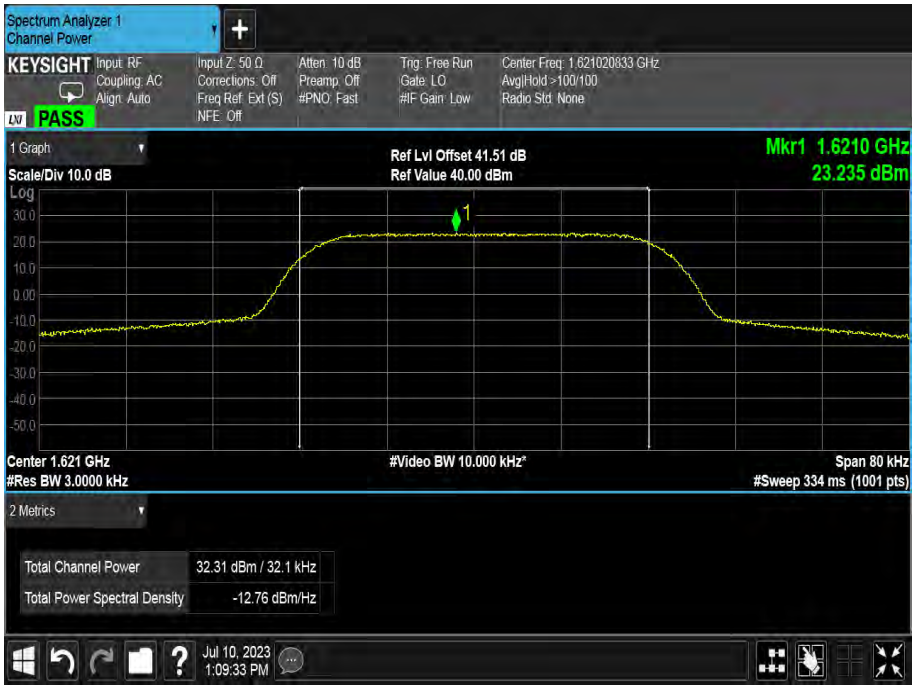

Figure 4, - 1621.020833 MHz

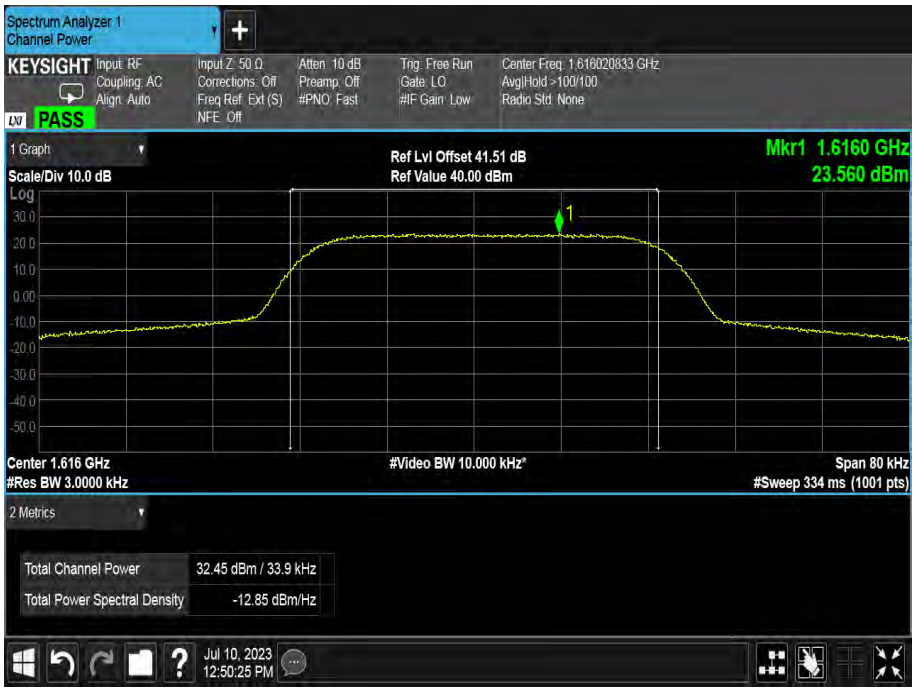

Figure 5, - 1616.020833 MHz

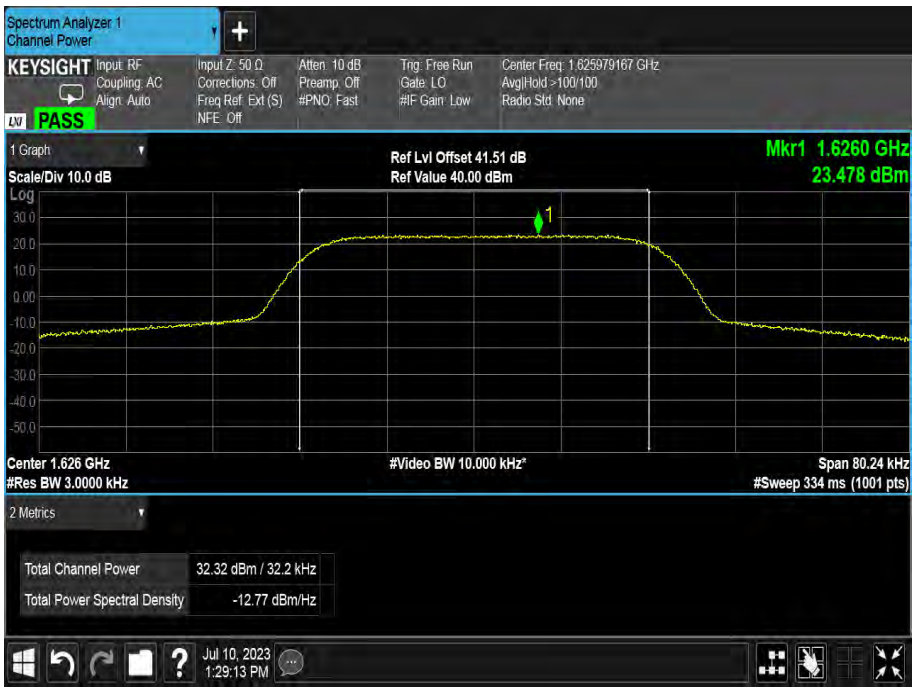

Figure 6, - 1625.979167 MHz

MES Transceiver - C2

EIRP (dBm/4kHz)		
1616.041666 MHz	1621.041666 MHz	1625.958333 MHz
26.72	26.73	26.72

Table 22 - EIRP/4kHz Results Table

1616.041666 MHz		1621.041666 MHz		1625.958333 MHz	
EIRP (dBm)	Δ from rated power (dB)	EIRP (dBm)	Δ from rated power (dB)	EIRP (dBm)	Δ from rated power (dB)
38.51	0.51	38.42	0.42	38.49	0.49

Table 23 - EIRP Results Table

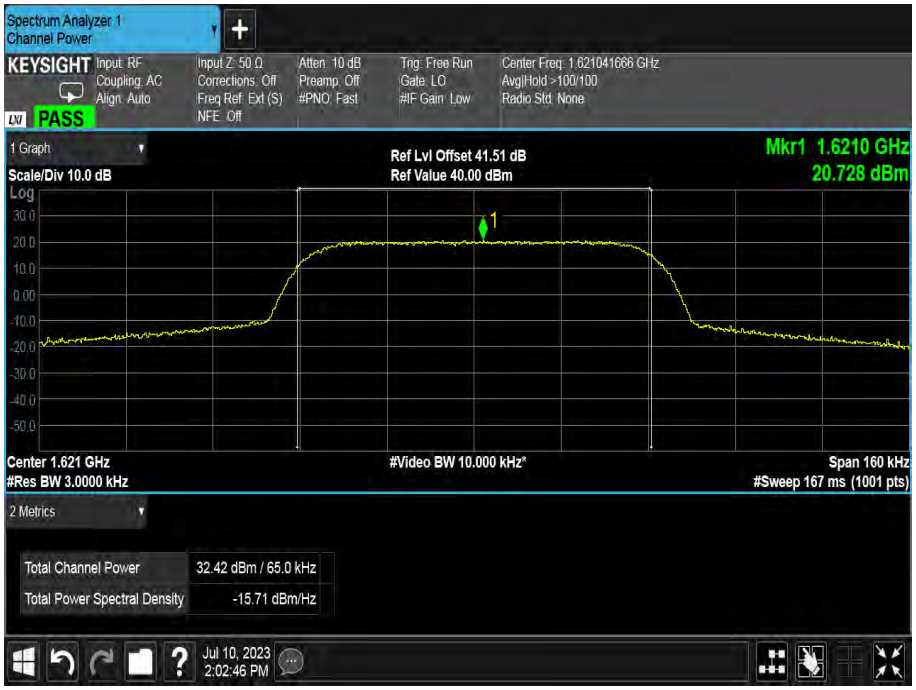

Figure 7 – 1621.041666 MHz

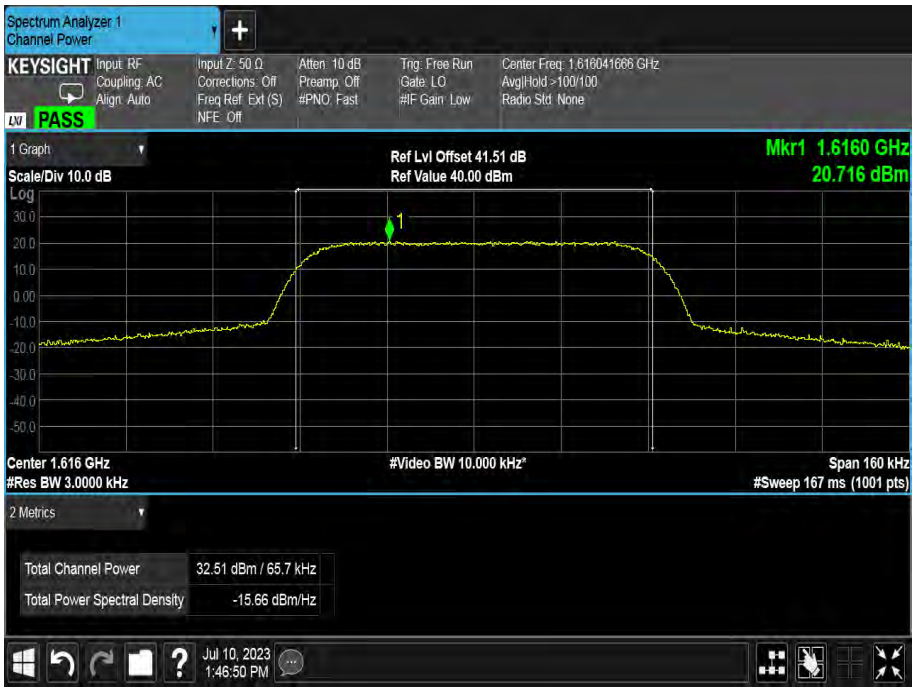

Figure 8, - 1616.041666 MHz

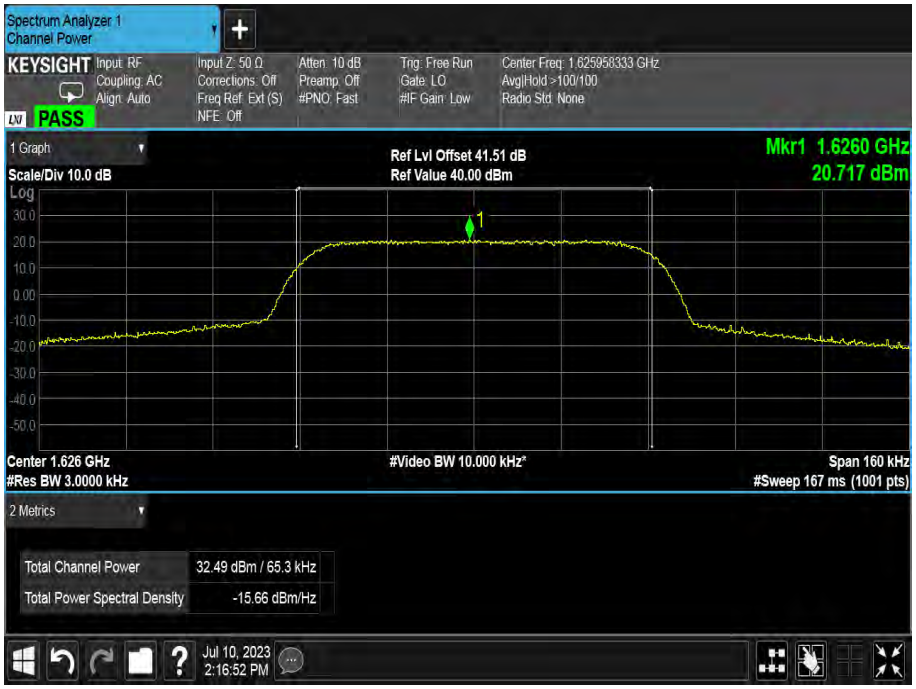

Figure 9, 1625.958333 MHz

FCC 47 CFR Part 25, Limit Clause 25.204

+40 dBW in any 4 kHz band for θ ≤ 0°
+40 + 3θ dBW in any 4 kHz band for 0° < θ ≤ 5°
For angles of elevation of the horizon greater than 5° there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.

ISED RSS-170, Limit Clause 5.5

The application for MES certification shall state the MES e.i.r.p. that is necessary for satisfactory communication. The maximum permissible e.i.r.p. will be the stated necessary e.i.r.p. plus a 2 dB margin. If a detachable antenna is used, the certification application shall state the recommended antenna type and manufacturer, the antenna gain and the maximum transmitter output power at the antenna terminal.

2.1.7 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
Power Supply Unit	Hewlett Packard	6282A	132	-	O/P Mon
HygroPalm	Rotronic	HygroPalm 0	3484	12	30-Aug-2023
Digital Multi-meter	Iso-tech	IDM93N	4435	12	04-Mar-2024
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	23-Oct-2023
EXA	Keysight Technologies	N9010B	4969	24	07-Feb-2024
Attenuator 40dB 100W	Weinschel	48-40-43-LIM	5134	12	10-Feb-2024
3.5mm Cable (1m)	Junkosha	MWX221/B	5838	12	24-Jul-2023

Table 24

O/P Mon – Output monitored using calibrated test equipment.

2.2 Modulation Characteristics

2.2.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1047 (d)

2.2.2 Equipment Under Test and Modification State

A04349, S/N: 1606803100025 - Modification State 0

2.2.3 Date of Test

16-May-2023

2.2.4 Test Method

A declaration was provided by the applicant.

2.2.5 Environmental Conditions

Ambient Temperature	23.3 - 24.0 °C
Relative Humidity	38.6 - 39.4 %

2.2.6 Test Results

MES Transceiver - B1

The following description was provided by the manufacturer:

Differentially Encoded QPSK (B1 Mode) (DE-QPSK).
ITU Emission Designator = 41K7Q7W where:

Q =Pulse, carrier also angle-modulated during pulse
7 = Two or more digital channels.

W = Multiple formats of data transmitted

41K7 = Maximum bandwidth, 41.7 kHz

MES Transceiver - C1

The following description was provided by the manufacturer:

Differentially Encoded QPSK (C1 Mode) (DE-QPSK).
ITU Emission Designator = 41K7Q7W where:

Q =Pulse, carrier also angle-modulated during pulse
7 = Two or more digital channels.

W = Multiple formats of data transmitted.

41K7 = Maximum bandwidth, 41.7 kHz

MES Transceiver - C2

The following description was provided by the manufacturer:

QPSK (C2 Mode) (DE-QPSK).
ITU Emission Designator = 83K4Q7W where:

Q =Pulse, carrier also angle-modulated during pulse
7 = Two or more digital channels.

W = Multiple formats of data transmitted

83K4 = Maximum bandwidth, 83.4 kHz

FCC 47 CFR Part 2, Limit Clause 2.1047 (d)

A curve or equivalent data which shows that the equipment will meet the modulation requirements of the rules under which the equipment is to be licensed.

2.3 Occupied Bandwidth

2.3.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1049
ISED RSS-GEN, Clause 6.7

2.3.2 Equipment Under Test and Modification State

A04349, S/N: 1606803100025 - Modification State 0

2.3.3 Date of Test

18-May-2023

2.3.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.4.4 using a conducted test setup.

2.3.5 Environmental Conditions

Ambient Temperature	26.4 °C
Relative Humidity	22.9 %

2.3.6 Test Results

MES Transceiver - B1

Occupied Bandwidth (kHz)		
1616.020833 MHz	1621.020833 MHz	1625.979167 MHz
32.063 kHz	31.545 kHz	33.317 kHz

Table 25 – Occupied Bandwidth Results

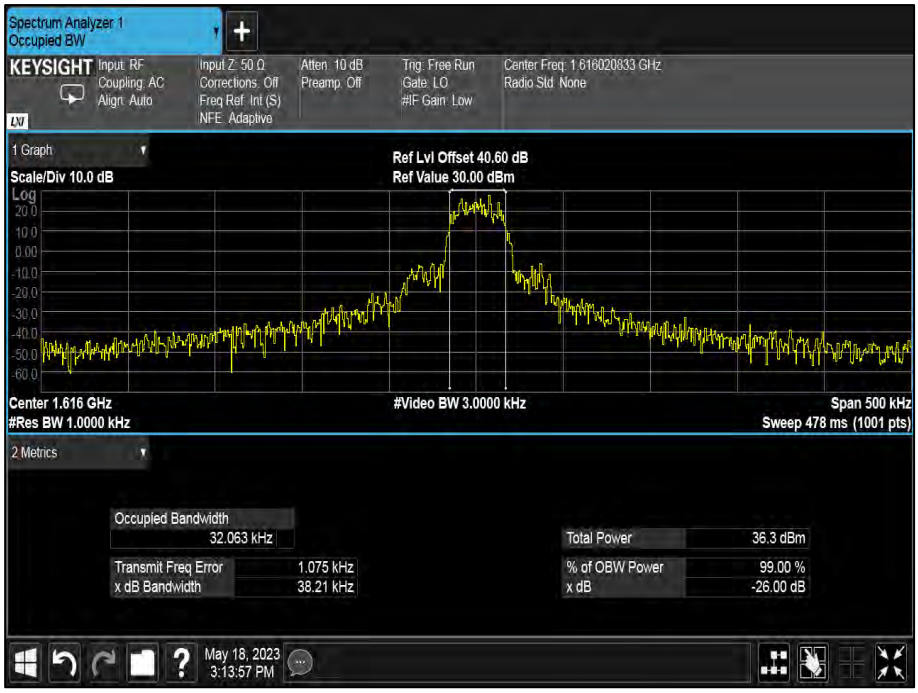

Figure 10 - 1616.020833 MHz

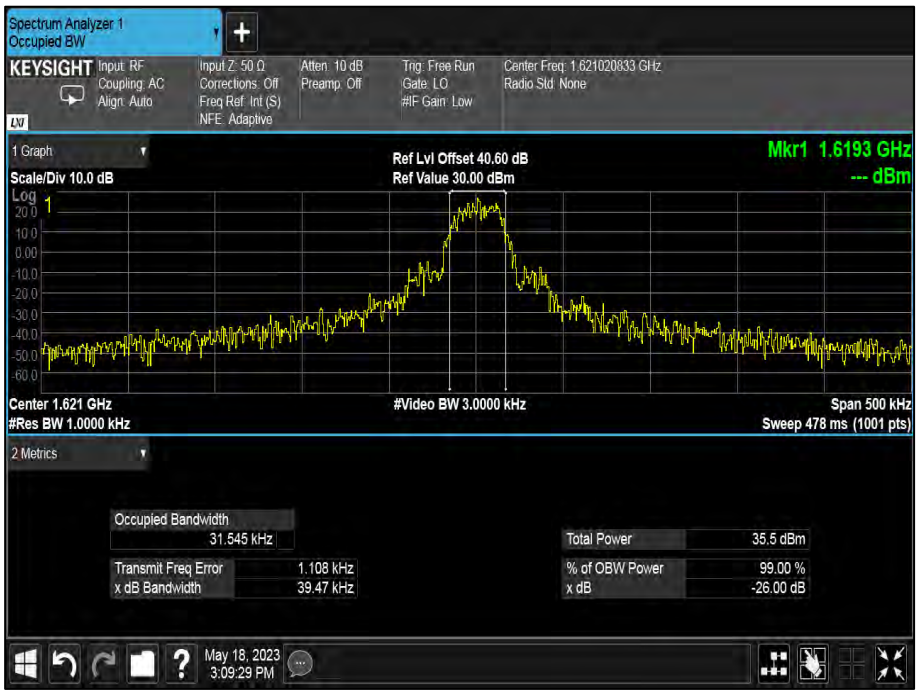

Figure 11- 1621.020833 MHz

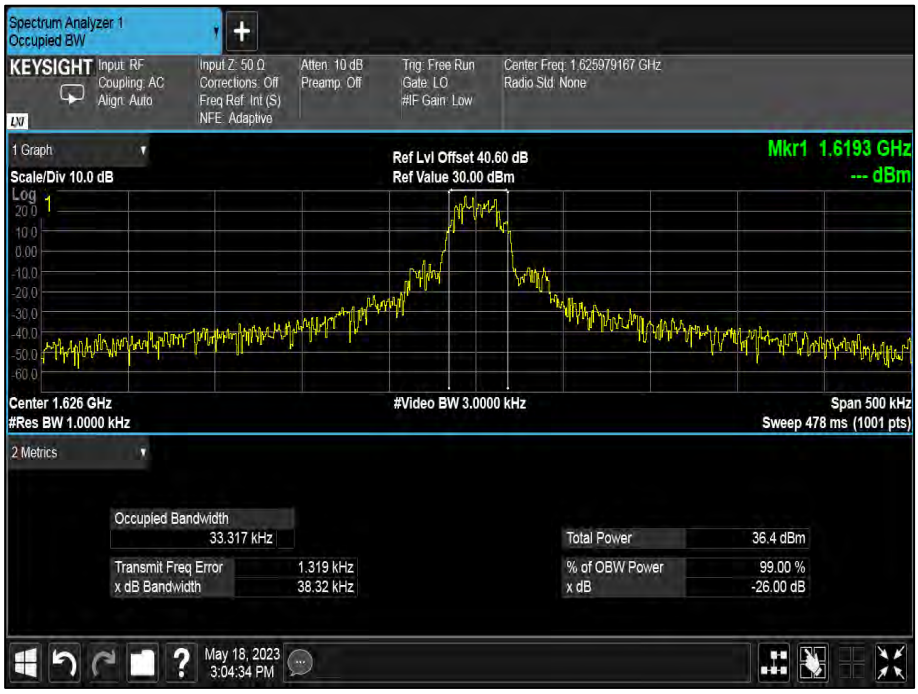

Figure 12- 1625.979167 MHz

MES Transceiver - C1

Occupied Bandwidth (kHz)		
1616.020833 MHz	1621.020833 MHz	1625.979167 MHz
33.871 kHz	32.149 kHz	32.246 kHz

Table 26 - Occupied Bandwidth Results

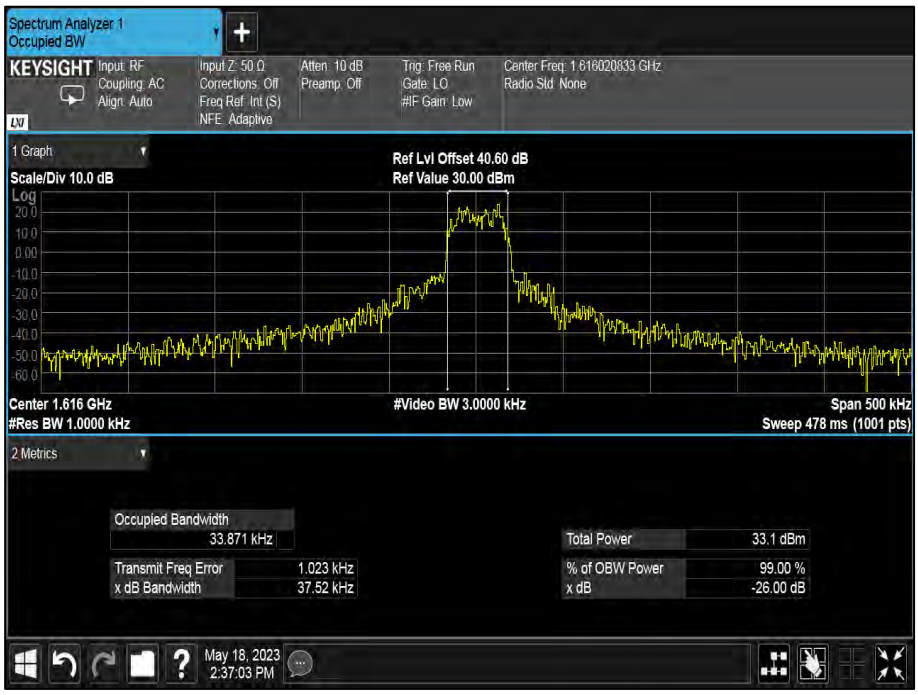

Figure 13 - 1616.020833 MHz

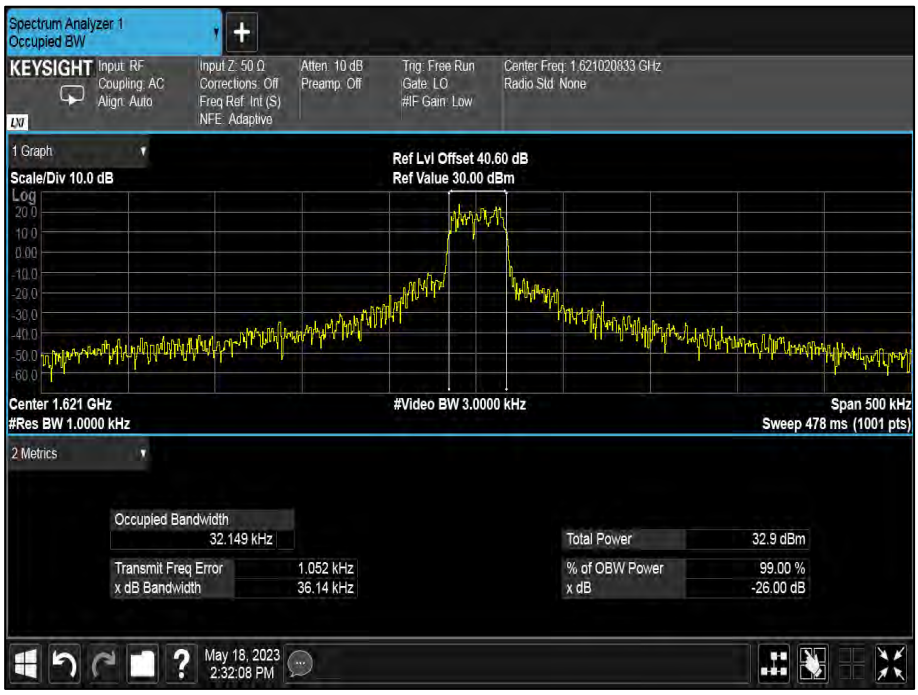

Figure 14- 1621.020833 MHz

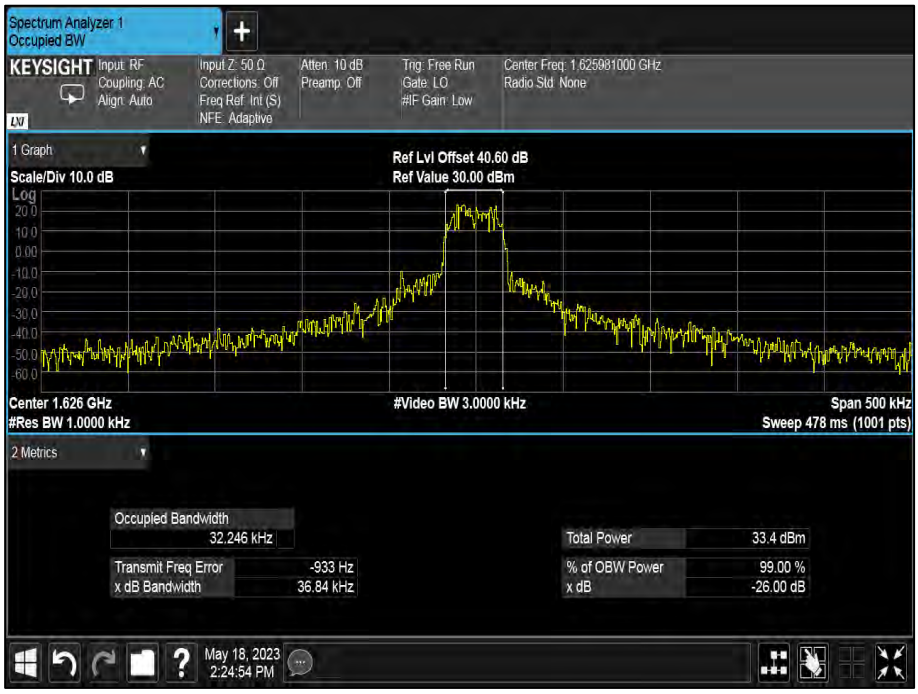

Figure 15- 1625.979167 MHz

MES Transceiver - C2

Occupied Bandwidth (kHz)		
1616.041666 MHz	1621.041666 MHz	1625.958333 MHz
65.685 kHz	65.009 kHz	65.251 kHz

Table 27 - Occupied Bandwidth Results

Figure 16 - 1616.041666 MHz

Figure 17- 1621.041666 MHz

Figure 18- 1625.958333 MHz

FCC 47 CFR Part 2, Limit Clause 2.1049

None specified.

ISED RSS-GEN, Limit Clause

None specified.

2.3.7 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
Power Supply Unit	Hewlett Packard	6282A	132	-	O/P Mon
HygroPalm	Rotronic	HygroPalm 0	3484	12	30-Aug-2023
Digital Multi-meter	Iso-tech	IDM93N	4435	12	04-Mar-2024
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	23-Oct-2023
EXA	Keysight Technologies	N9010B	4969	24	07-Feb-2024
Attenuator 40dB 100W	Weinschel	48-40-43-LIM	5134	12	10-Feb-2024
3.5mm Cable (1m)	Junkosha	MWX221/B	5838	12	24-Jul-2023

Table 28

O/P Mon – Output monitored using calibrated test equipment.

2.4 Spurious Emissions at Antenna Terminals

2.4.1 Specification Reference

FCC 47 CFR Part 25, Clause 25.202(f),
FCC 47 CFR Part 2, Clause 2.1051
ISED RSS-170, Clause 5.8
ISED RSS-GEN, Clause 6.13

2.4.2 Equipment Under Test and Modification State

A04349, S/N: 1606803100025 - Modification State 0

2.4.3 Date of Test

09-June-2023 to 20-June-2023

2.4.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.7.

RBW correction factor 10*LOG(4/3) = 1.25 dB was included in the reference level offset on the plots in the following section.

2.4.5 Environmental Conditions

Ambient Temperature	23.6 - 27.2 °C
Relative Humidity	40.4 - 50.2 %

2.4.6 Test Results

MES Transceiver - B1

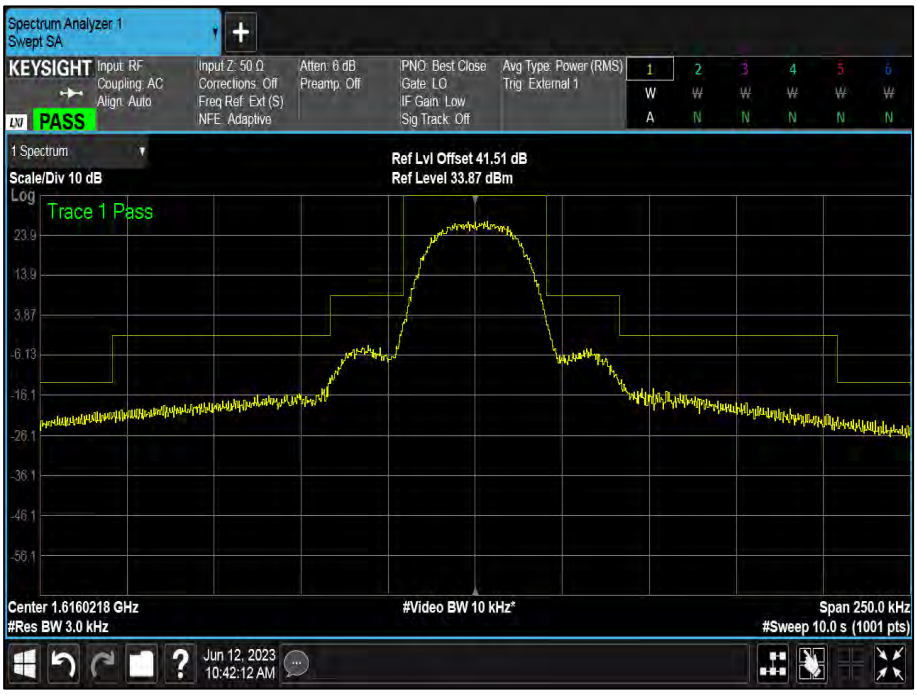

Figure 19- 1616.020833MHz - Emission Mask

Figure 20 - 1616.020833 MHz - 9 kHz to 150 kHz

Figure 21 - 1616.020833 MHz - 150 kHz to 30 MHz

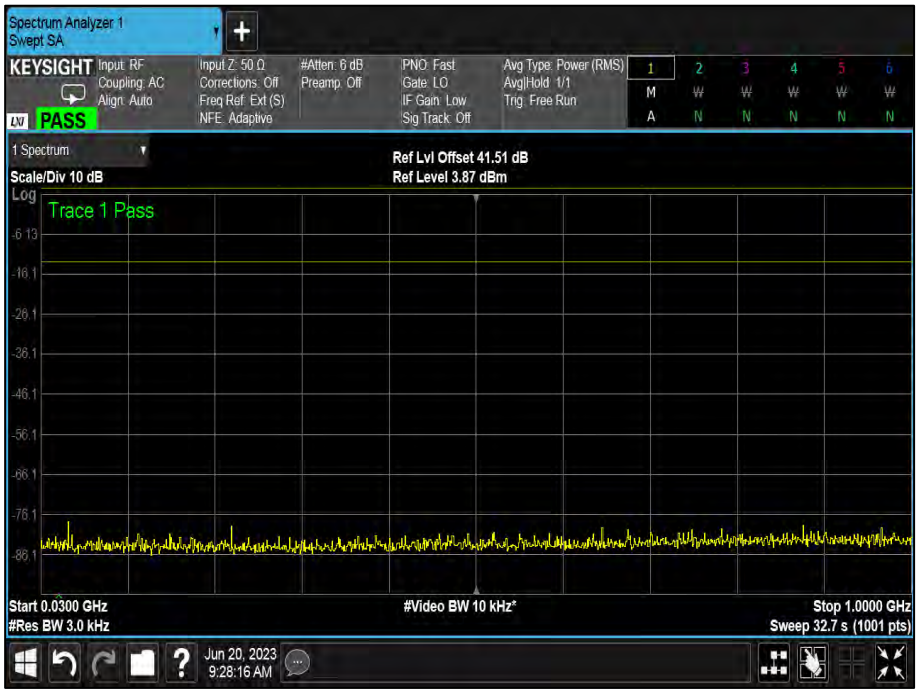

Figure 22- 1616.020833 MHz - 30 MHz to 1 GHz

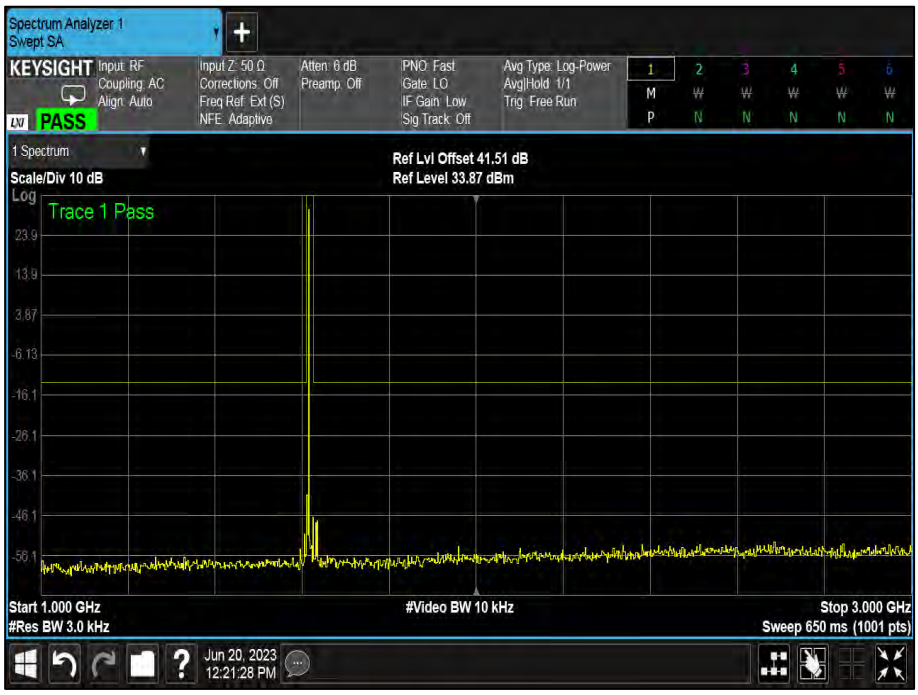

Figure 23- 1616.020833 MHz - 1 GHz to 3 GHz

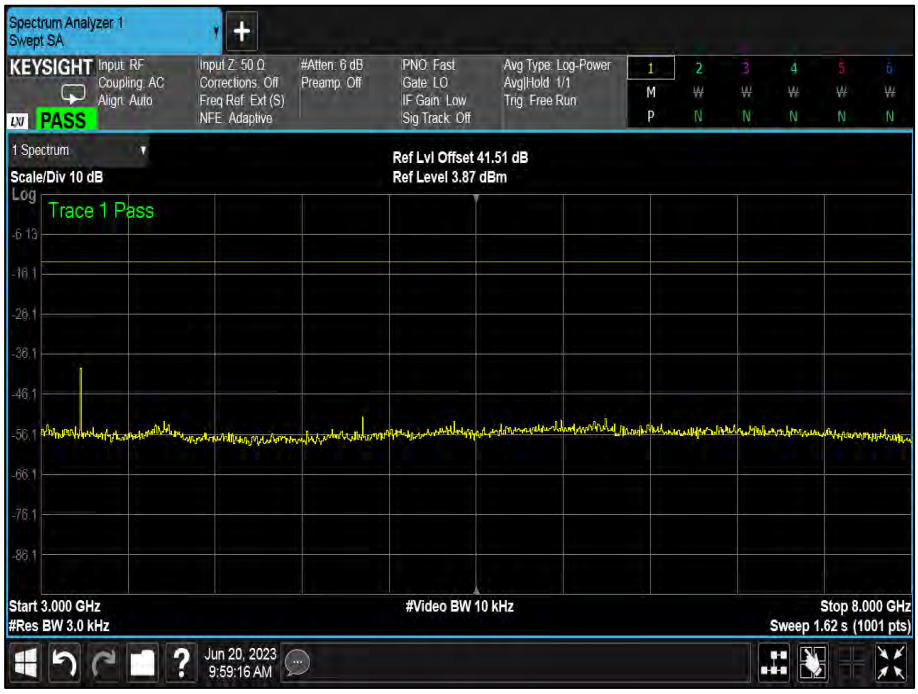

Figure 24- 1616.020833 MHz - 3 GHz to 8 GHz

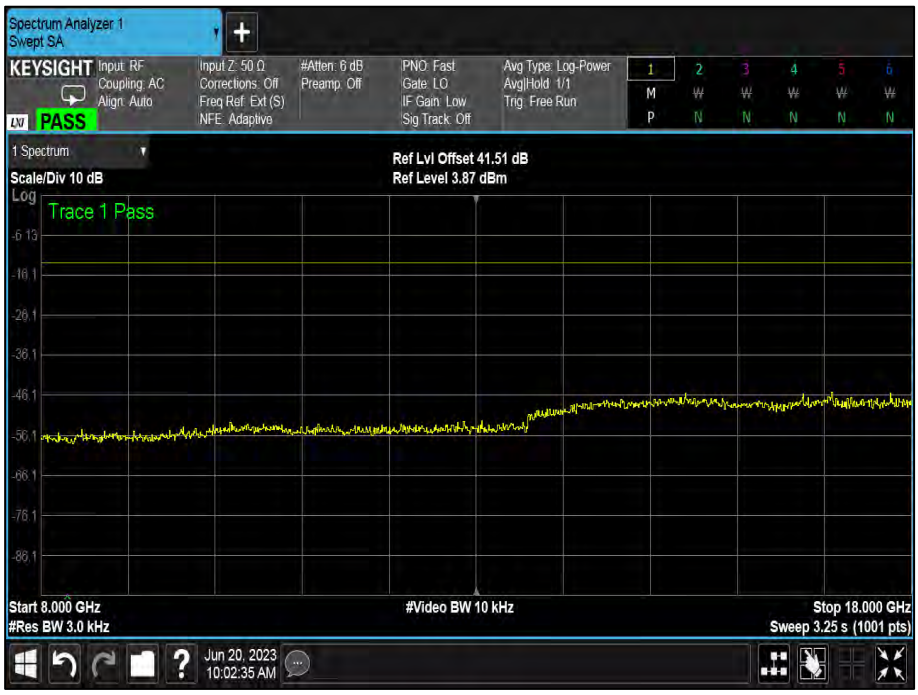

Figure 25- 1616.020833 MHz - 8 GHz to 18 GHz

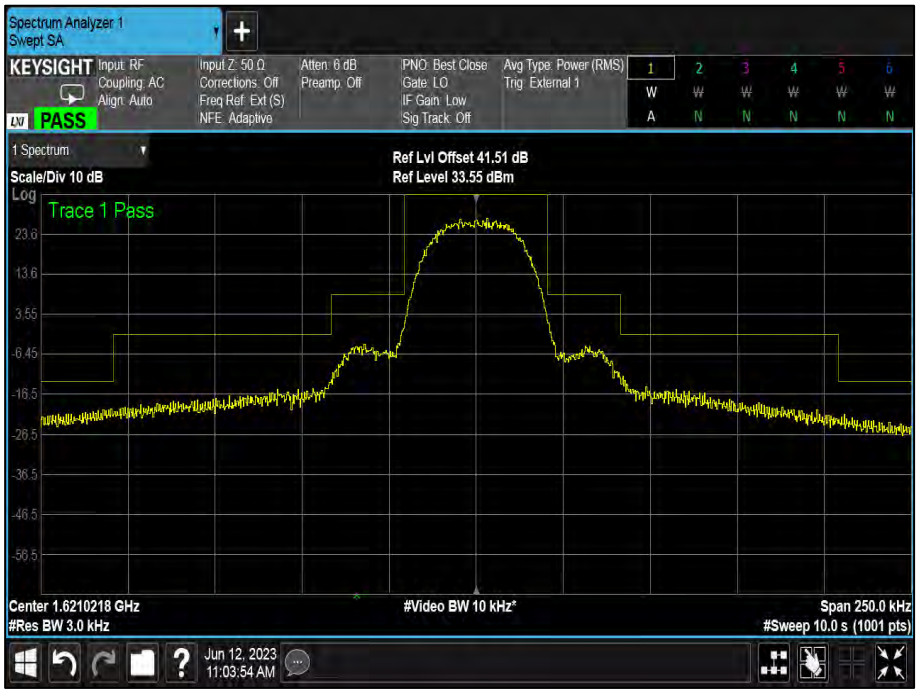

Figure 26- 1621.020833 MHz - Emission Mask

Figure 27- 1621.020833MHz - 9 kHz to 150 kHz

Figure 28- 1621.020833 MHz - 150 kHz to 30 MHz

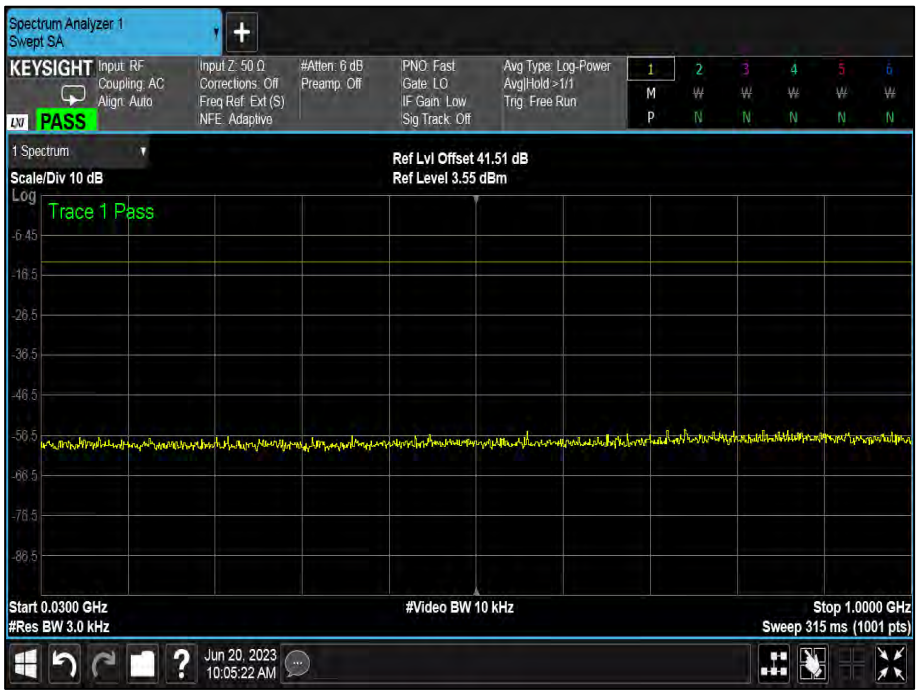

Figure 29 - 1621.020833 MHz - 30 MHz to 1 GHz

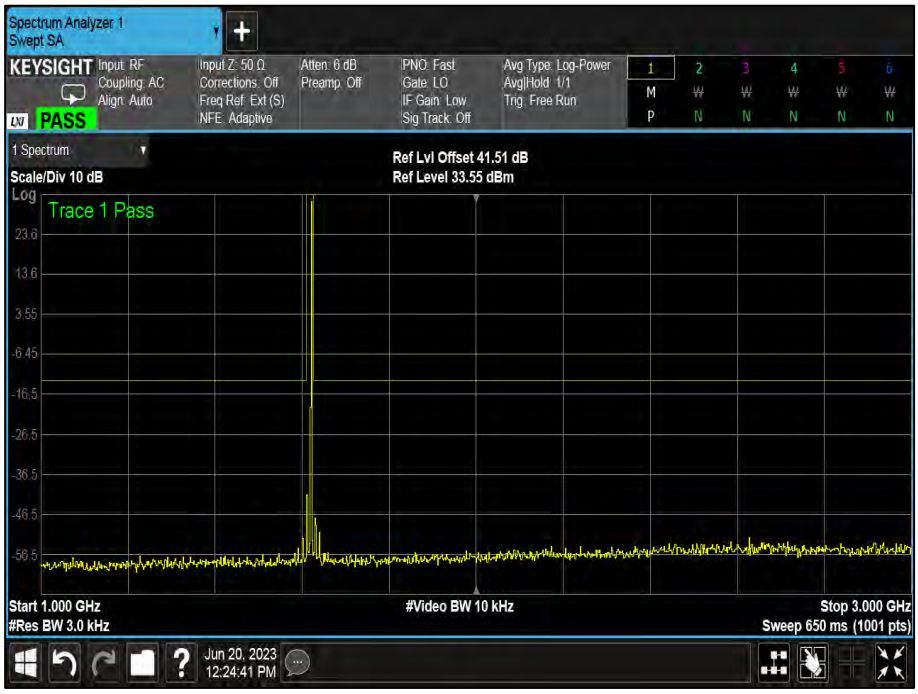

Figure 30- 1621.020833 MHz - 1 GHz to 3 GHz

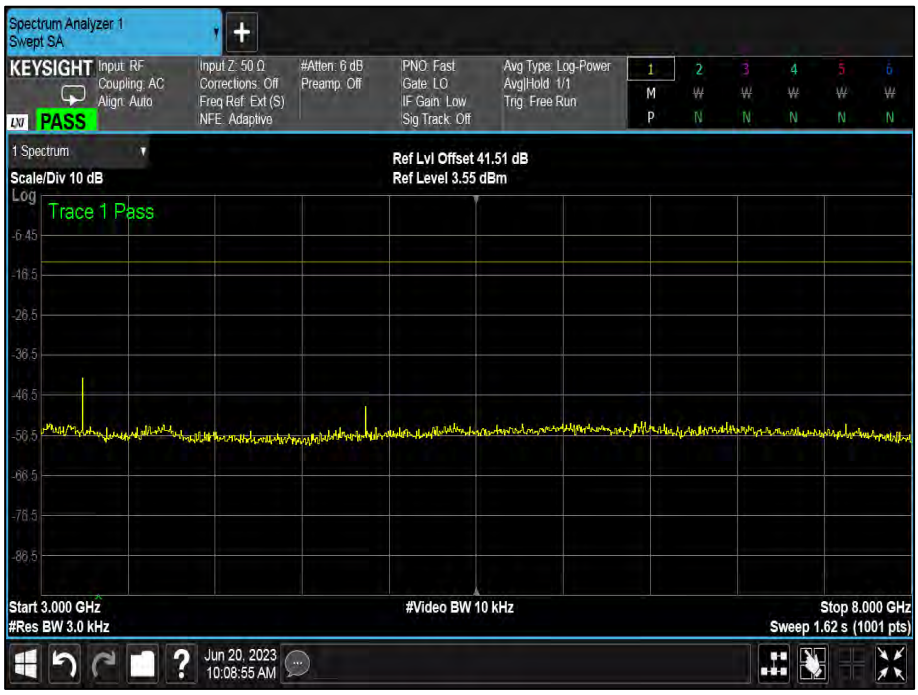

Figure 31- 1621.020833 MHz - 3 GHz to 8 GHz

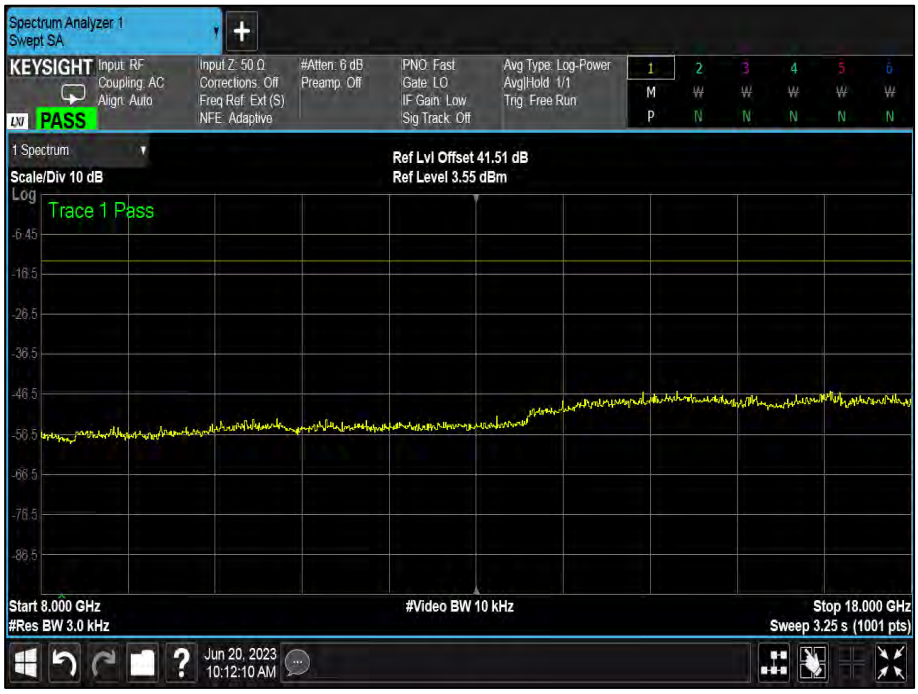

Figure 32- 1621.020833 MHz - 8 GHz to 18 GHz

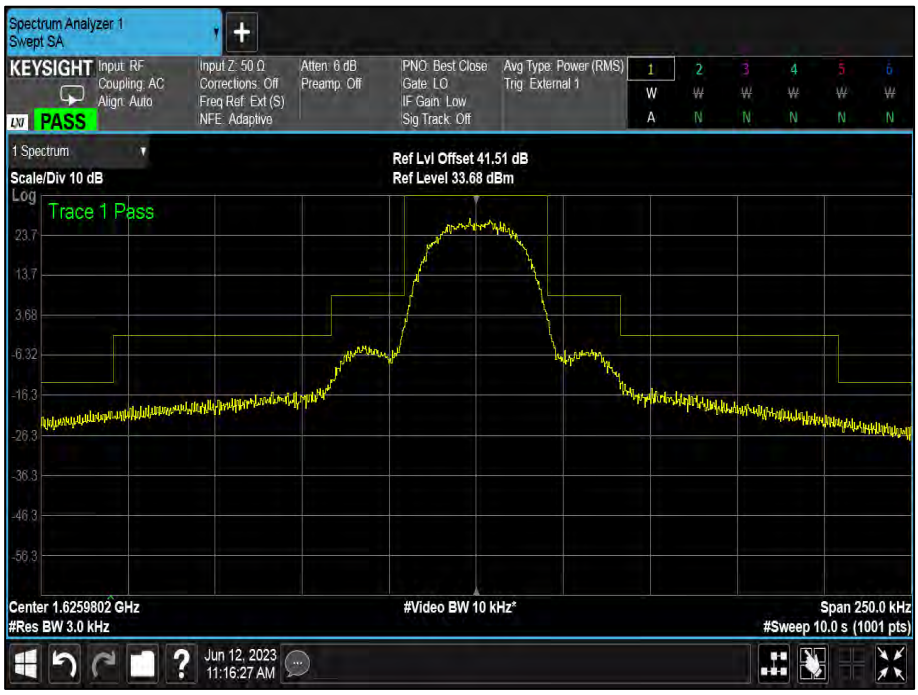

Figure 33 - 1625.979167 MHz - Emission Mask

Figure 34- 1625.979167 MHz - 9 kHz to 150 kHz

Figure 35 - 1625.979167 MHz - 150 kHz to 30 MHz

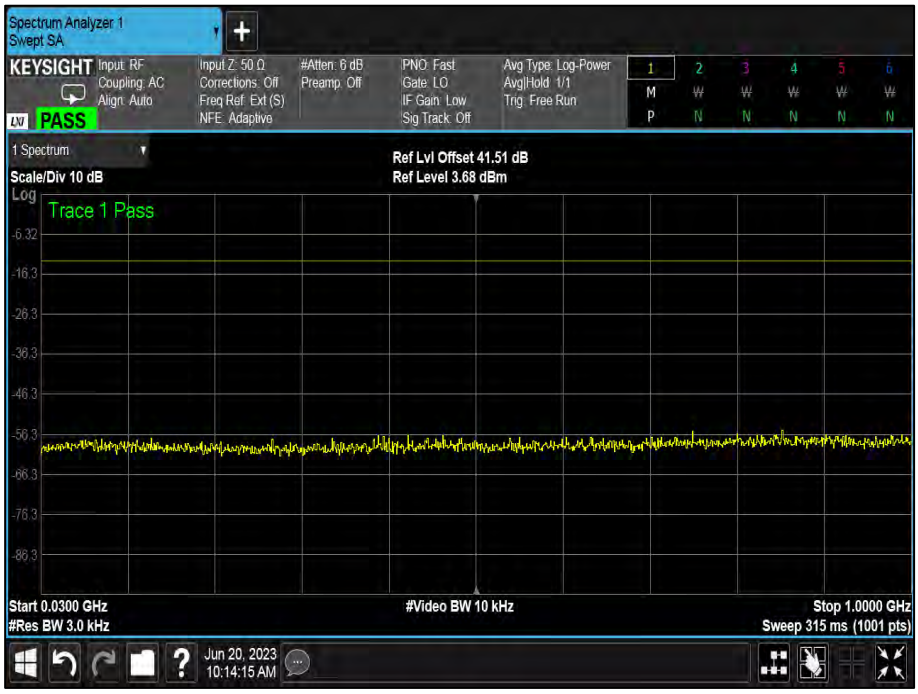

Figure 36- 1625.979167 MHz - 30 MHz to 1 GHz

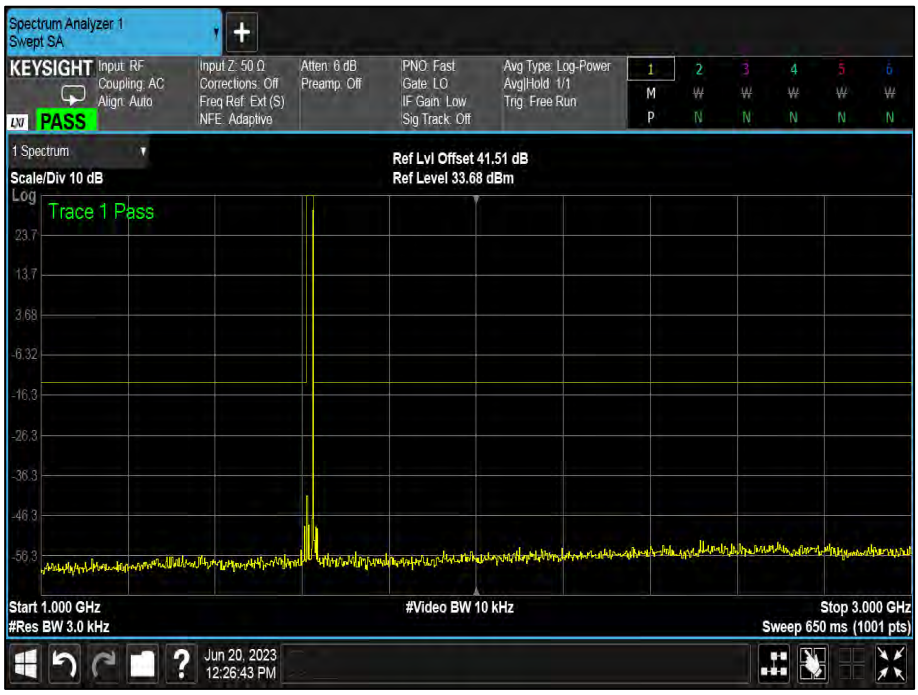

Figure 37 - 1625.979167 MHz - 1 GHz to 3 GHz

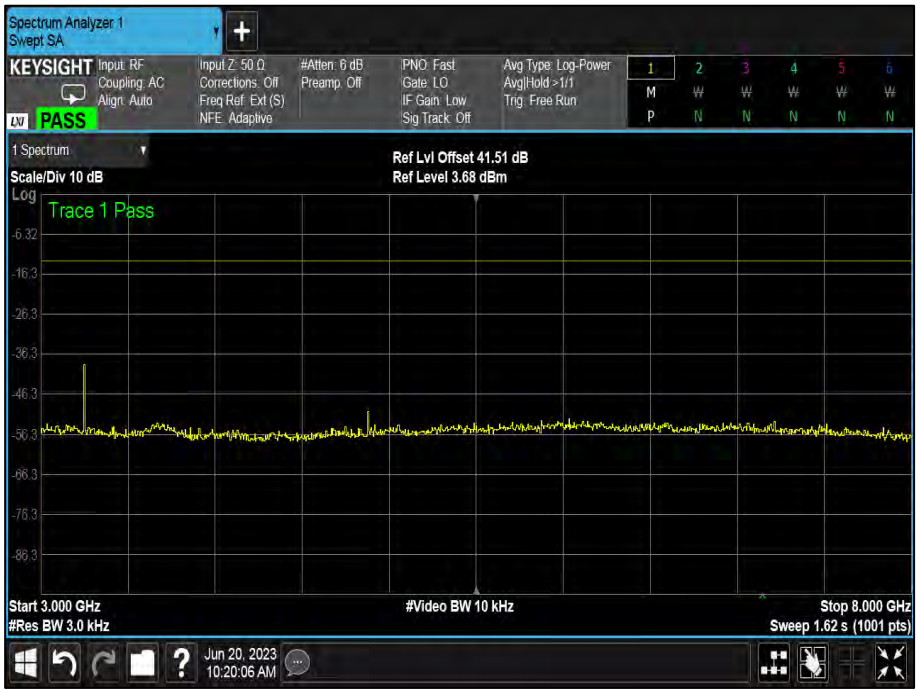

Figure 38 - 1625.979167 MHz - 3 GHz to 8 GHz

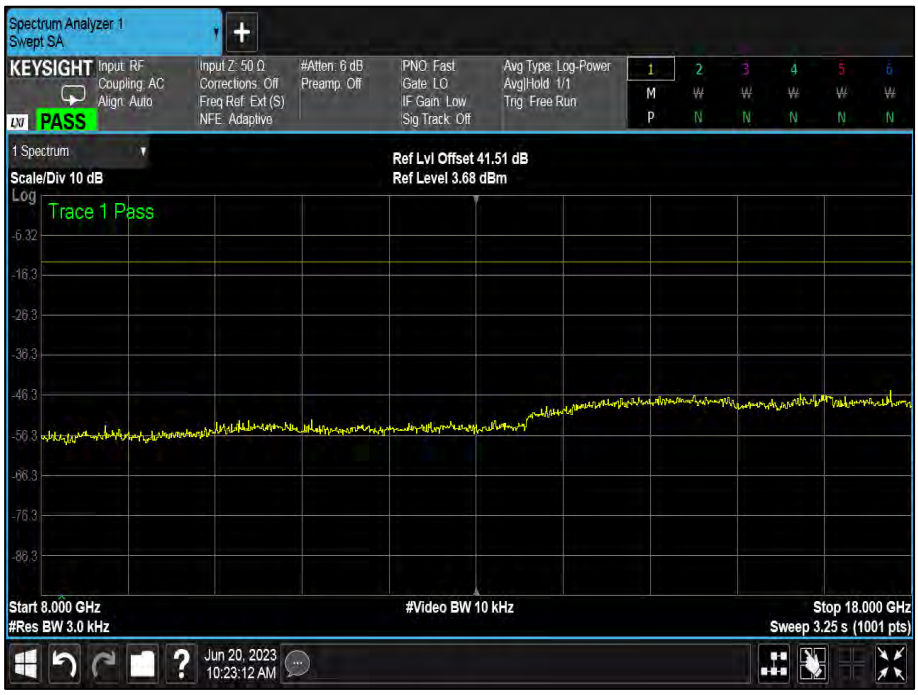

Figure 39- 1625.979167 MHz - 8 GHz to 18 GHz

MES Transceiver - C1

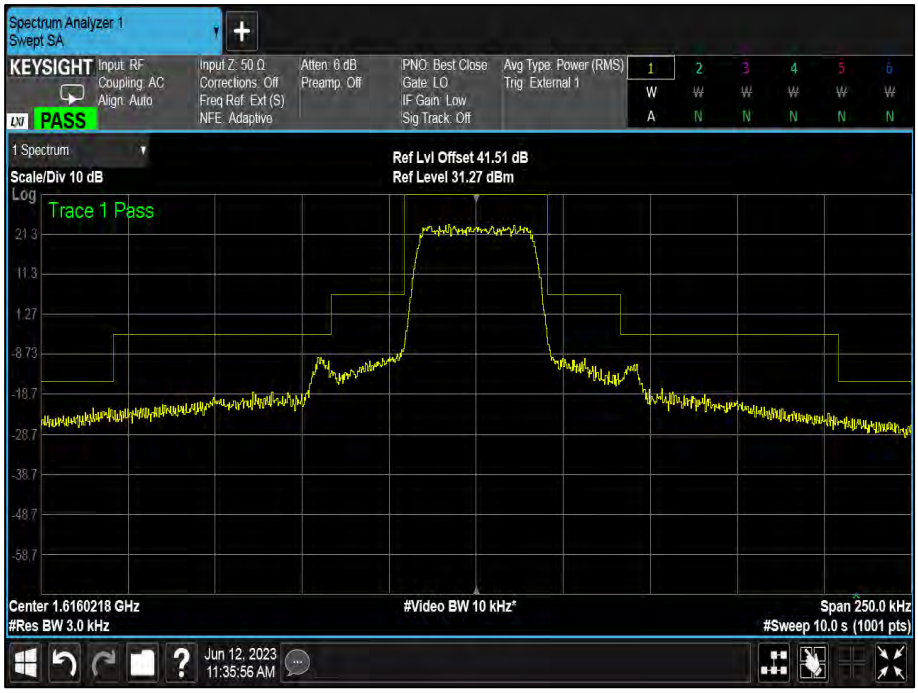

Figure 40- 1616.020833 MHz - Emission Mask

Figure 41- 1616.020833 MHz - 9 kHz to 150 kHz

Figure 42 - 1616.020833 MHz - 150 kHz to 30 MHz

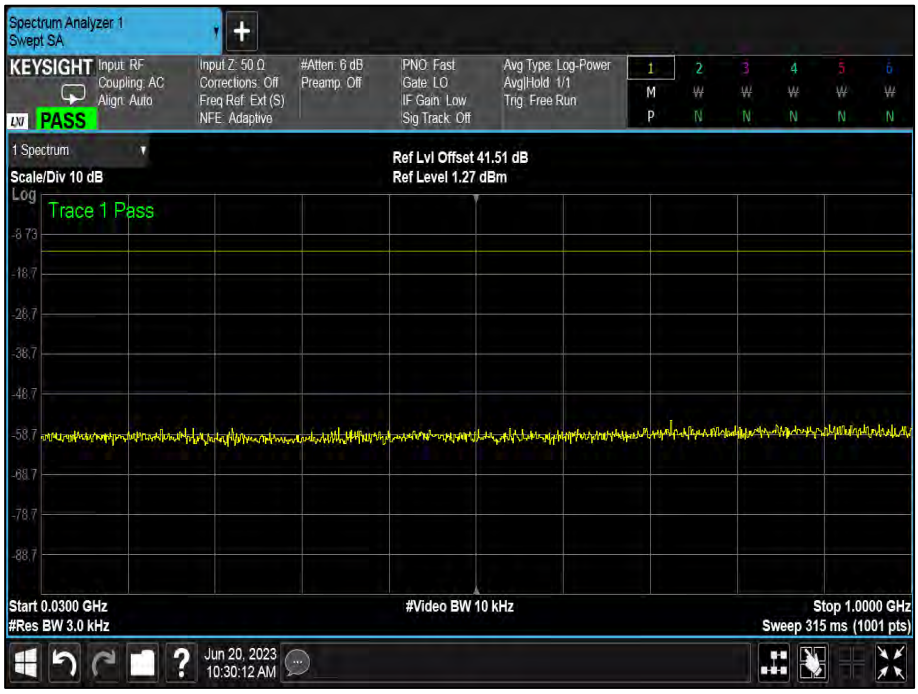

Figure 43- 1616.020833 MHz - 30 MHz to 1 GHz

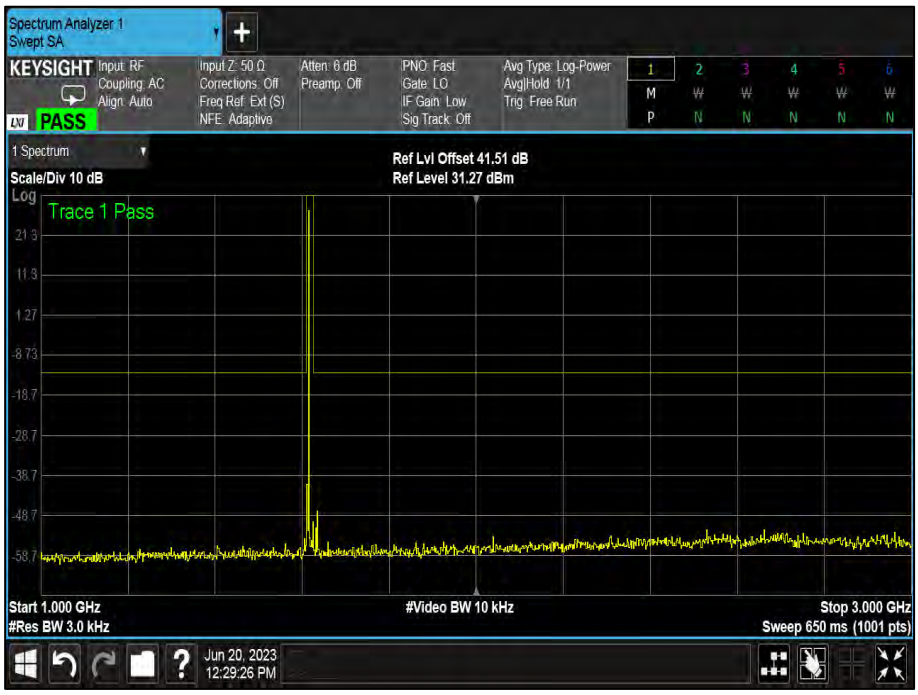

Figure 44- 1616.020833 MHz - 1 GHz to 3 GHz

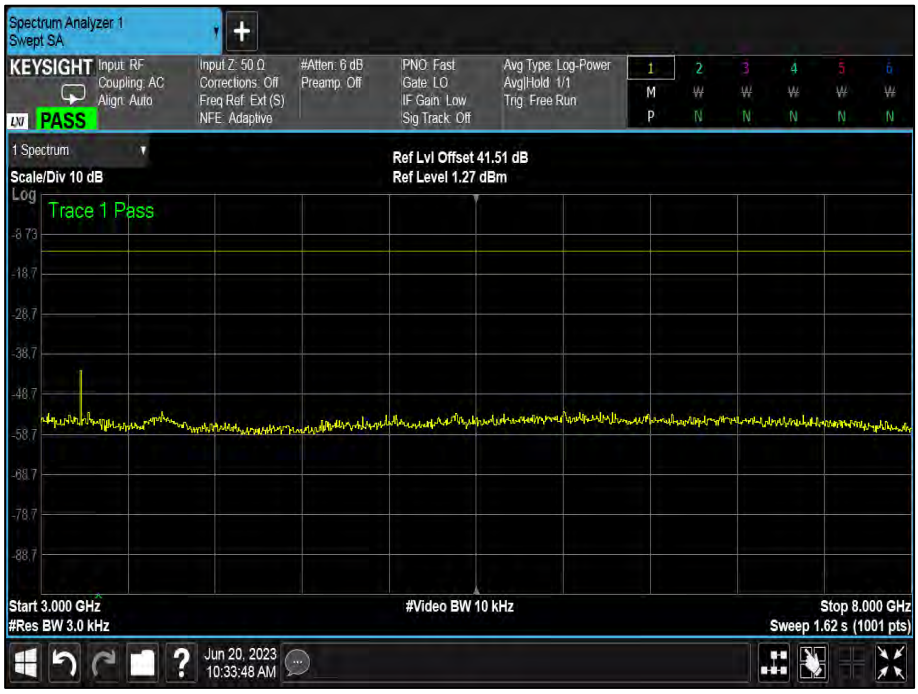

Figure 45- 1616.020833 MHz - 3 GHz to 8 GHz

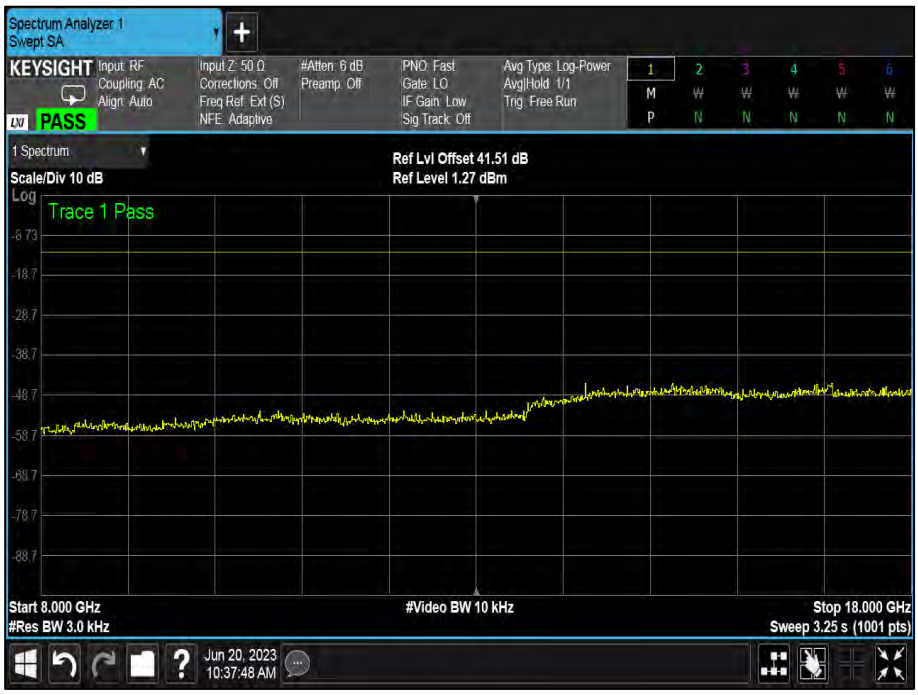

Figure 46- 1616.020833 MHz - 8 GHz to 18 GHz

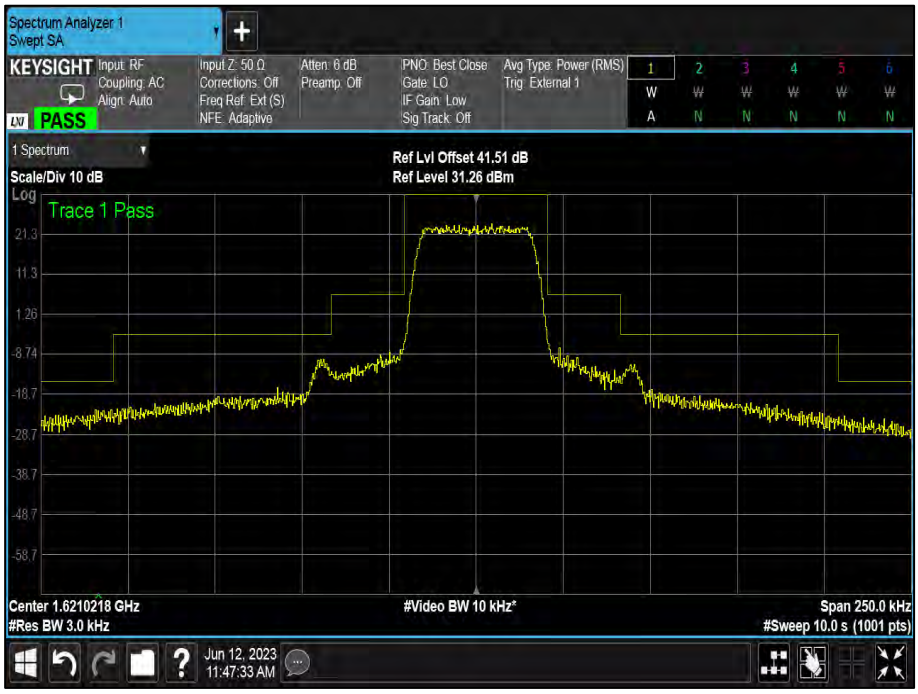

Figure 47 - 1621.020833 MHz - Emission Mask

Figure 48- 1621.020833 MHz - 9 kHz to 150 kHz

Figure 49- 1621.020833 MHz - 150 kHz to 30 MHz

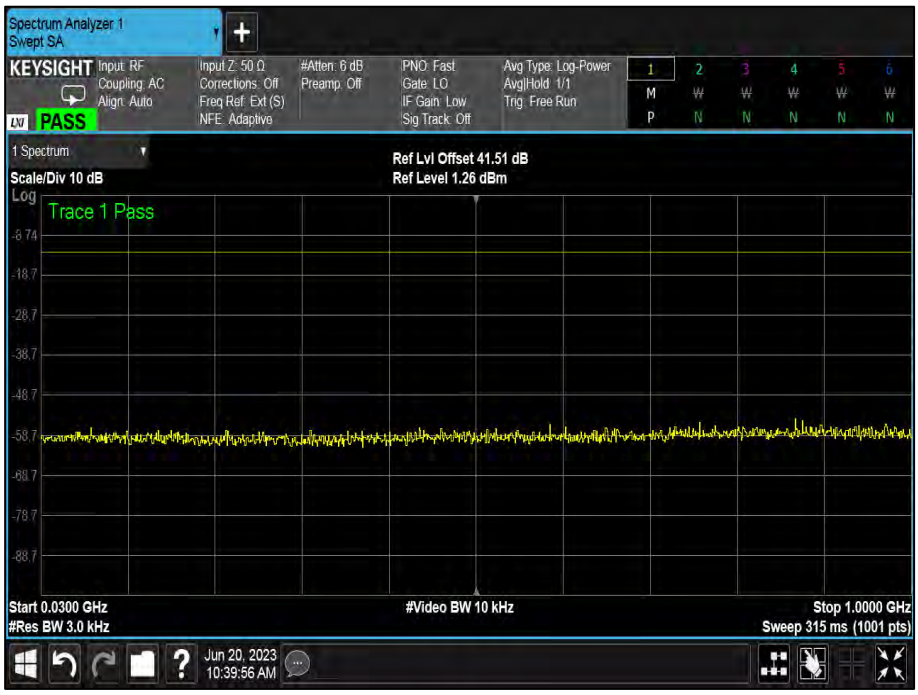

Figure 50 - 1621.020833 MHz - 30 MHz to 1 GHz

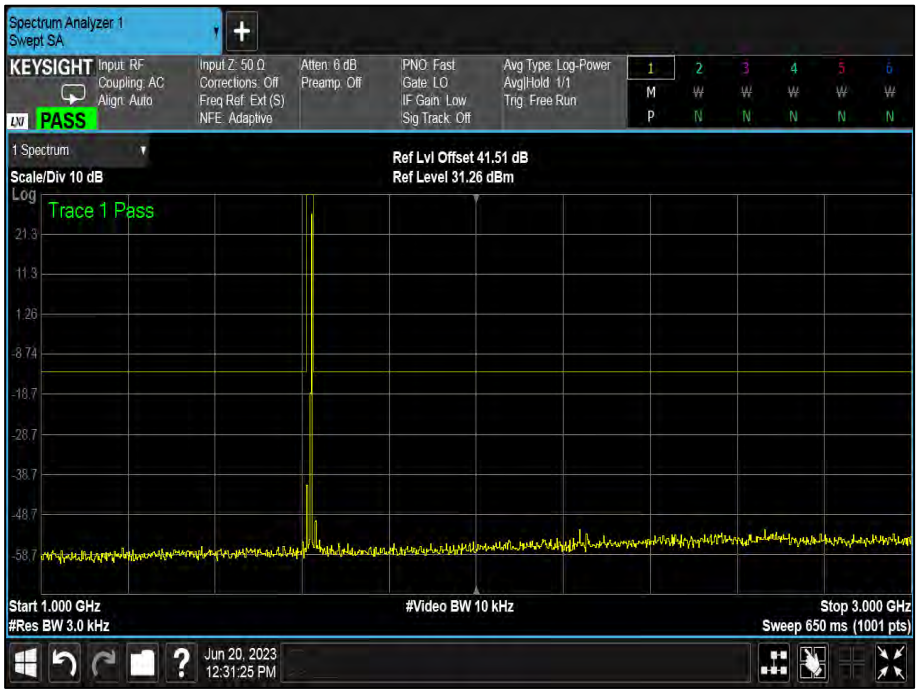

Figure 51- 1621.020833 MHz - 1 GHz to 3 GHz

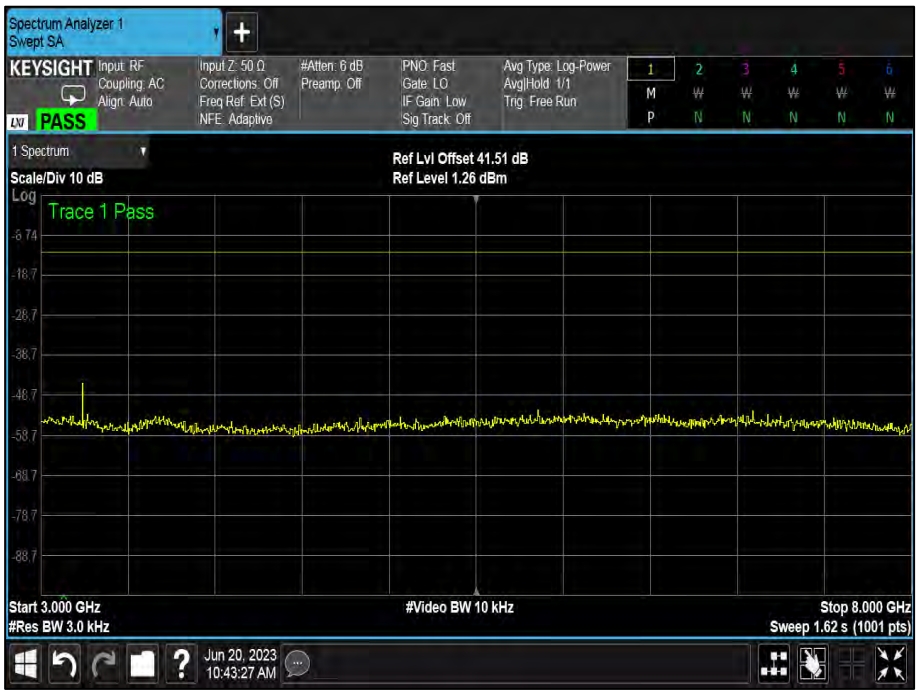

Figure 52 - 1621.020833 MHz - 3 GHz to 8 GHz

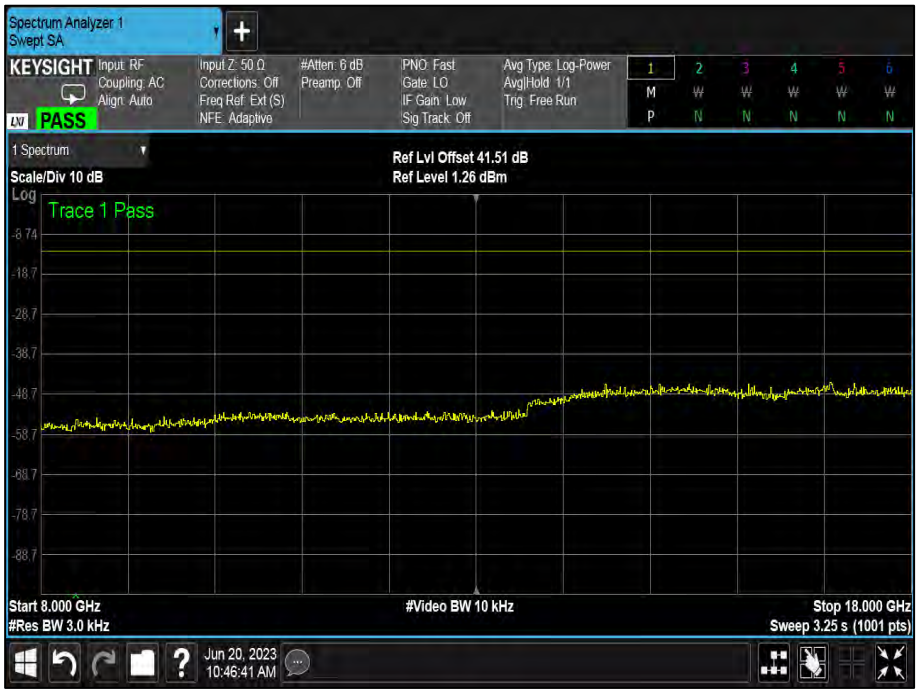

Figure 53 - 1621.020833 MHz - 8 GHz to 18 GHz

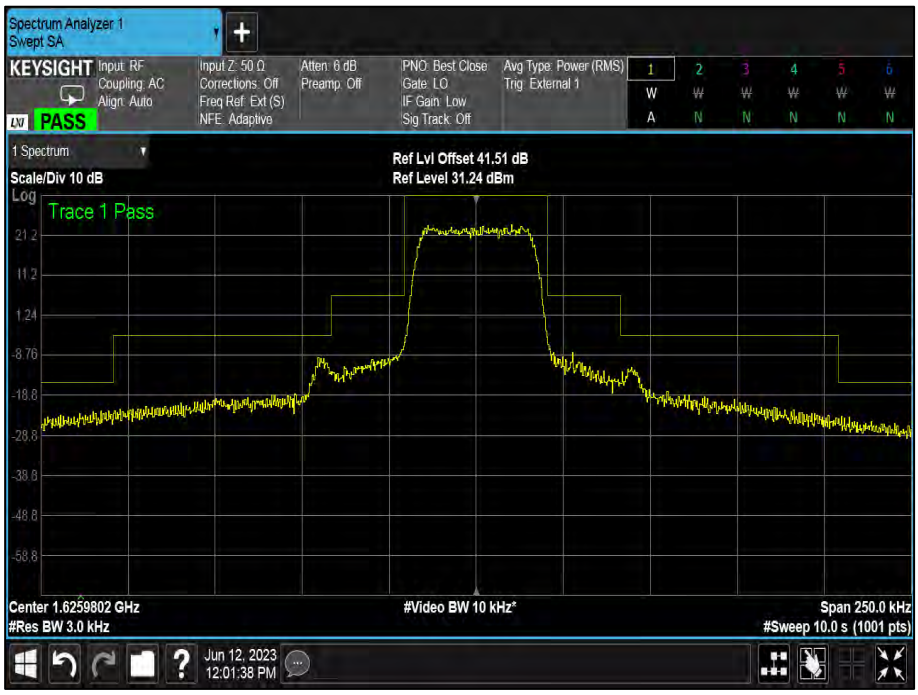

Figure 54- 1625.979167 MHz - Emission Mask

Figure 55- 1625.979167 MHz - 9 kHz to 150 kHz

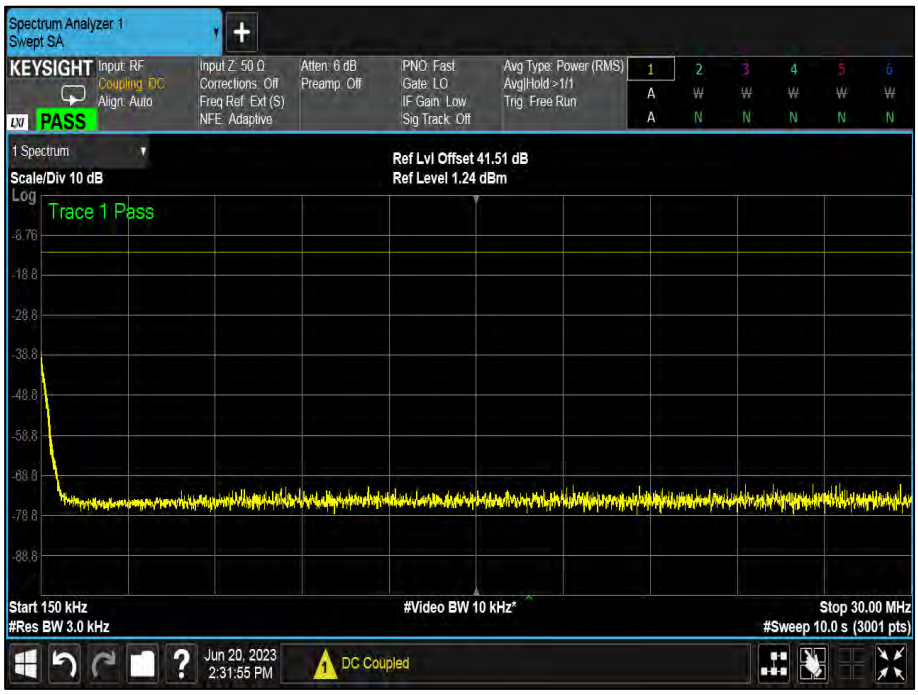

Figure 56- 1625.979167 MHz - 150 kHz to 30 MHz

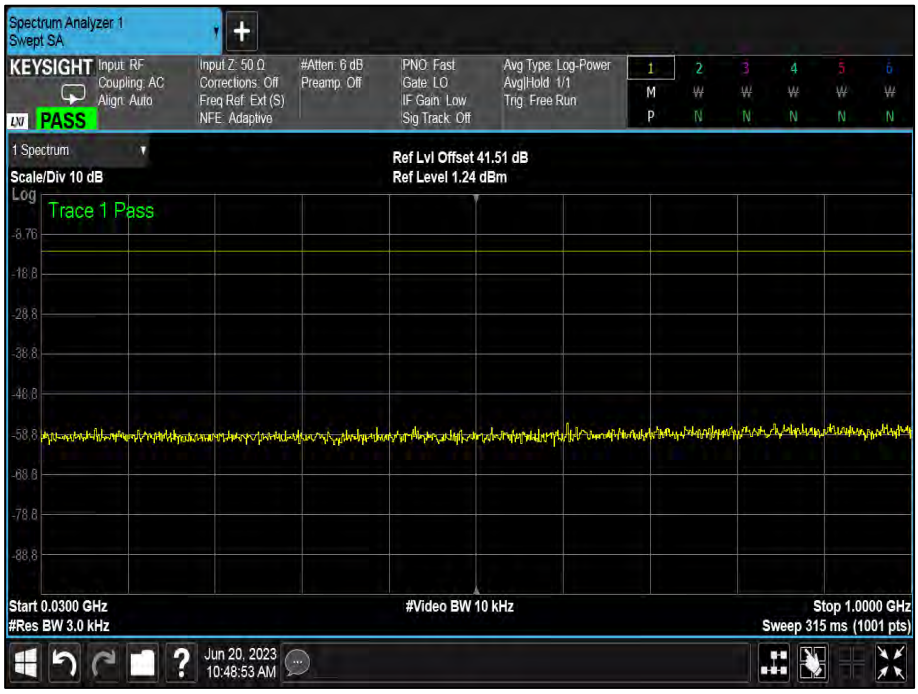

Figure 57 - 1625.979167 MHz - 30 MHz to 1 GHz

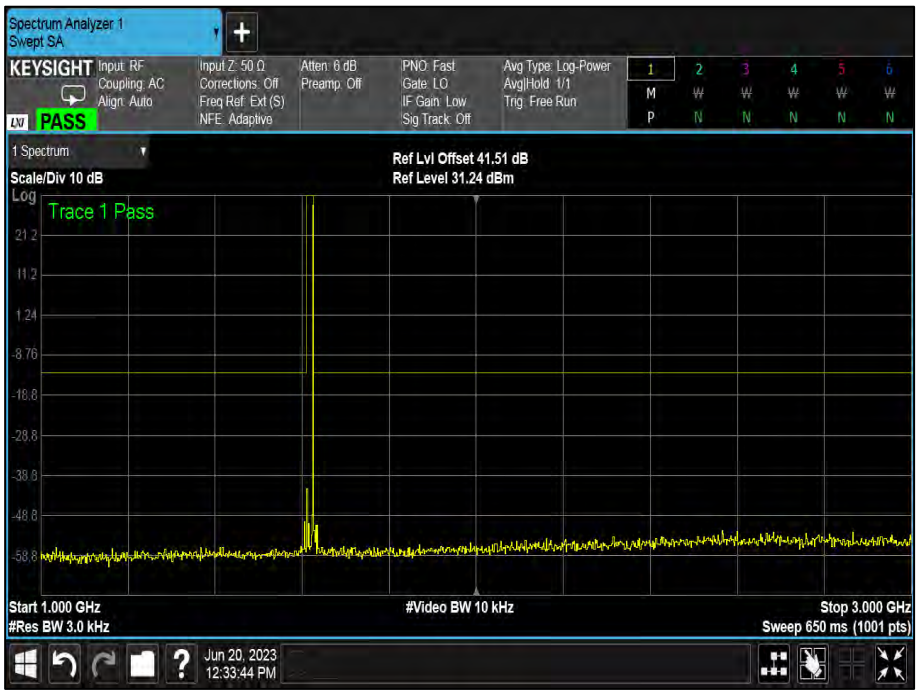

Figure 58- 1625.979167 MHz - 1 GHz to 3 GHz

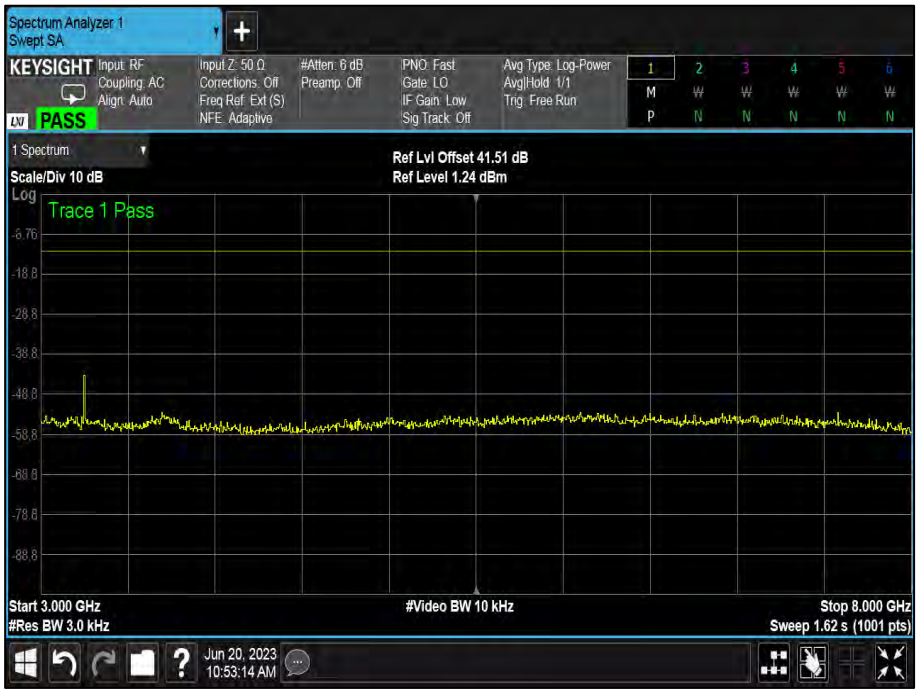

Figure 59 - 1625.979167 MHz - 3 GHz to 8 GHz

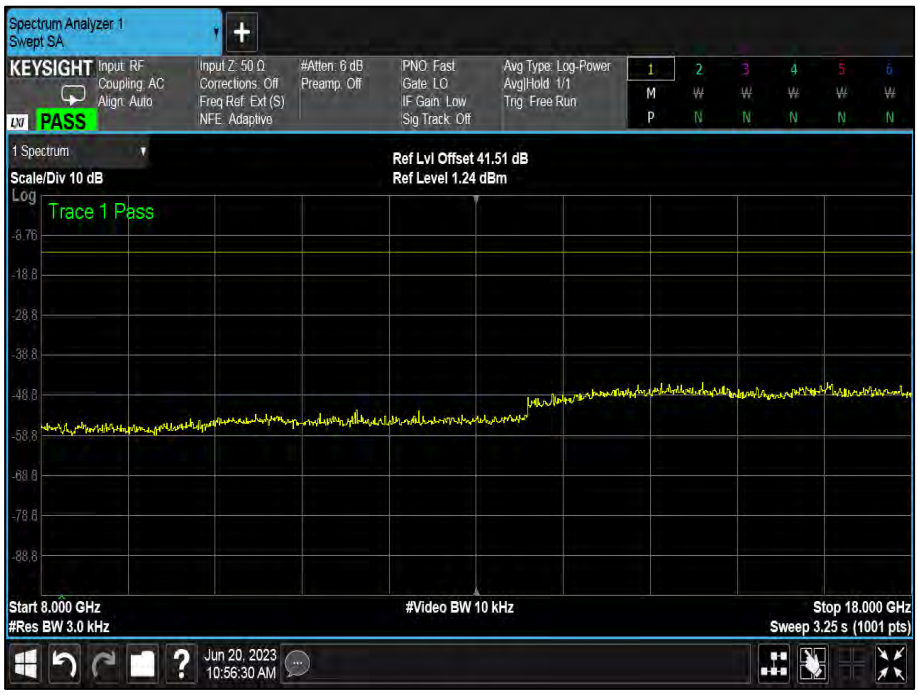

Figure 60 - 1625.979167 MHz - 8 GHz to 18 GHz

MES Transceiver - C2

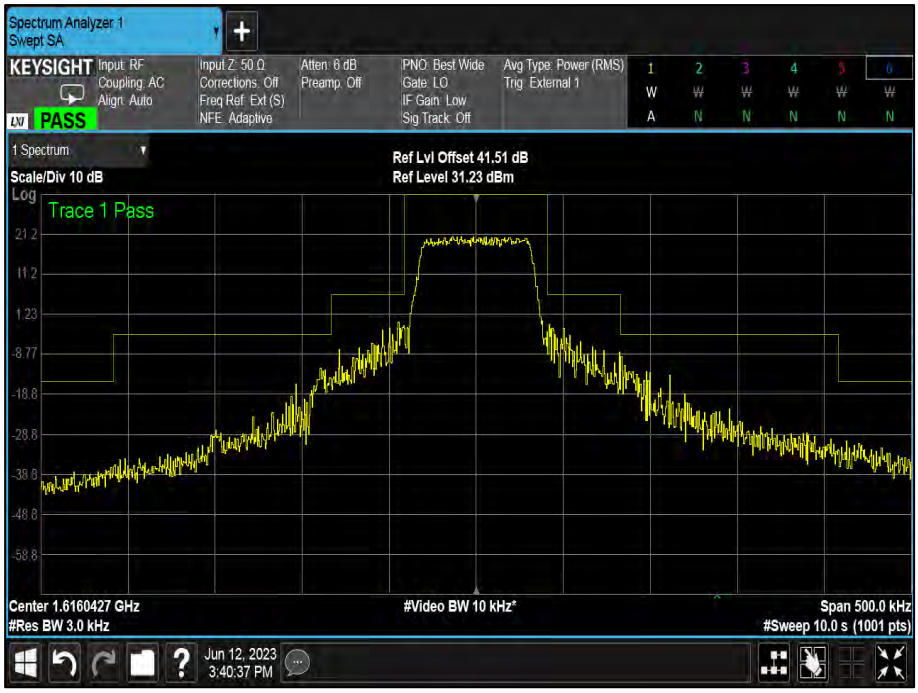

Figure 61- 1616.041666 MHz - Emission Mask

Figure 62- 1616.041666 MHz - 9 kHz to 150 kHz

Figure 63- 1616.041666 MHz - 150 kHz to 30 MHz

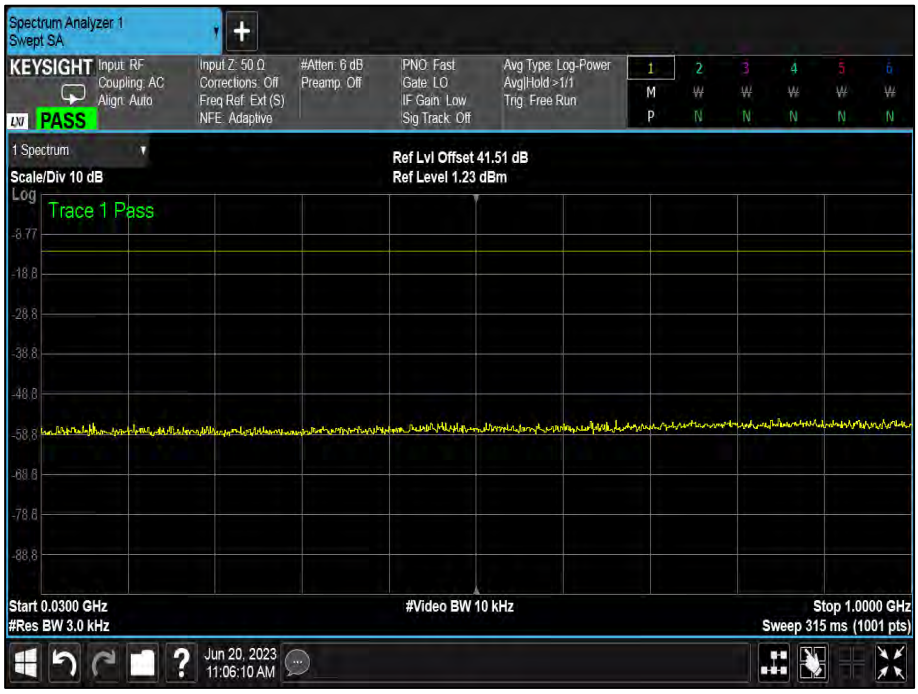

Figure 64 - 1616.041666 MHz - 30 MHz to 1 GHz

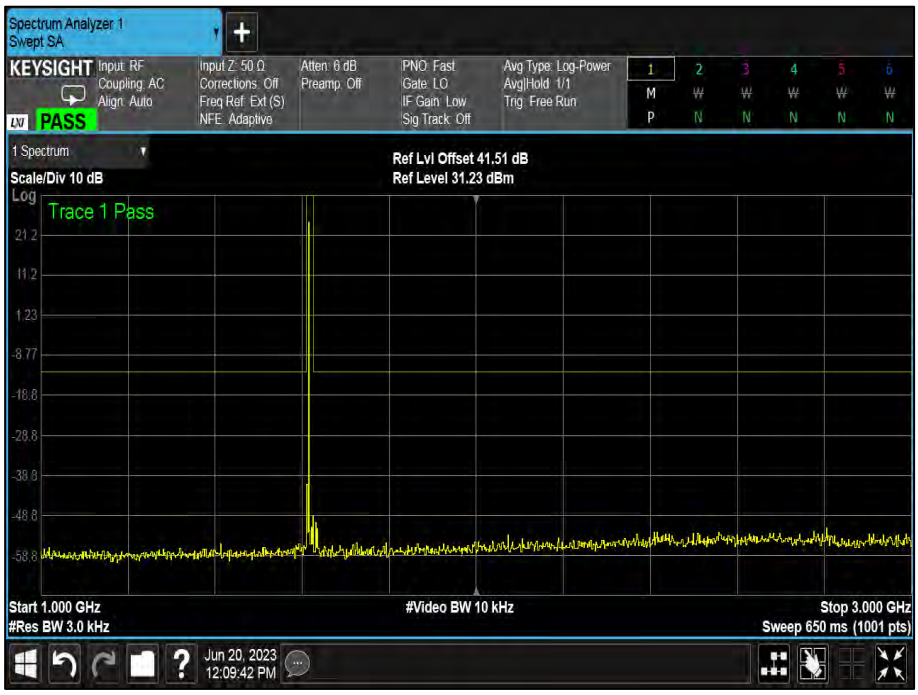

Figure 65 - 1616.041666 MHz - 1 GHz to 3 GHz

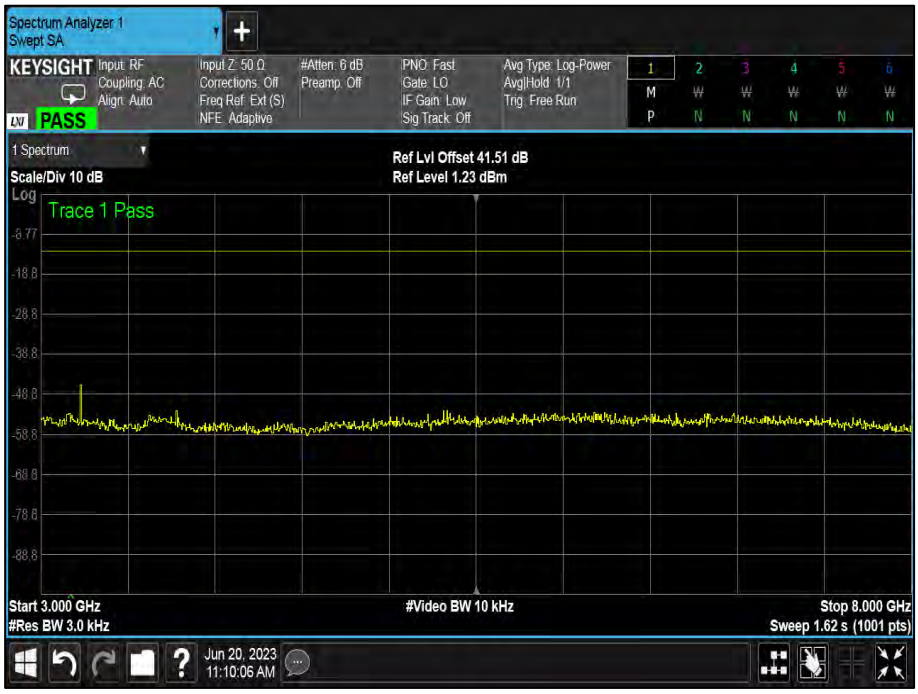

Figure 66- 1616.041666 MHz - 3 GHz to 8 GHz

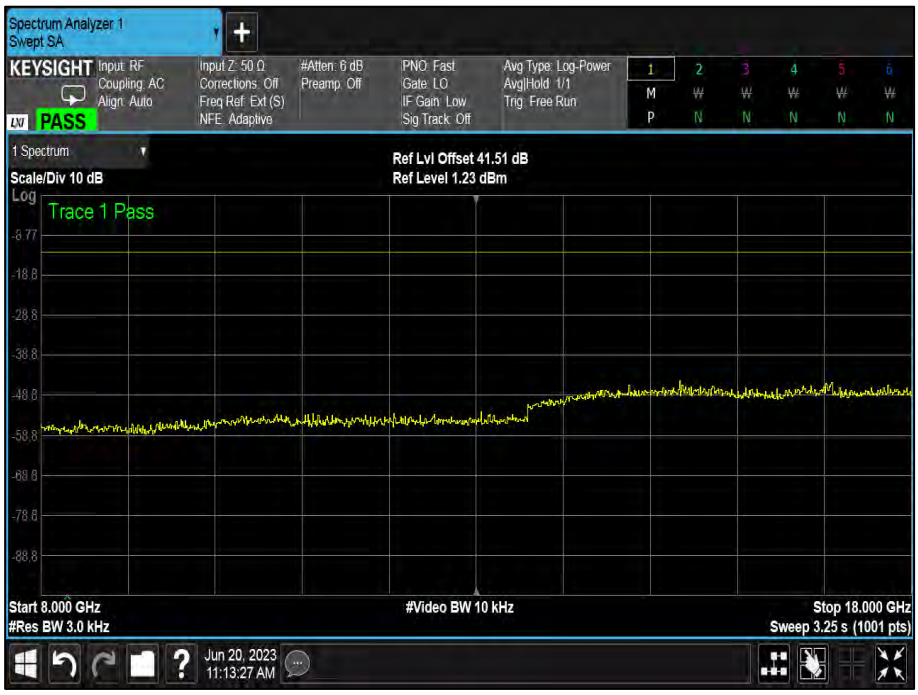

Figure 67 - 1616.041666 MHz - 8 GHz to 18 GHz

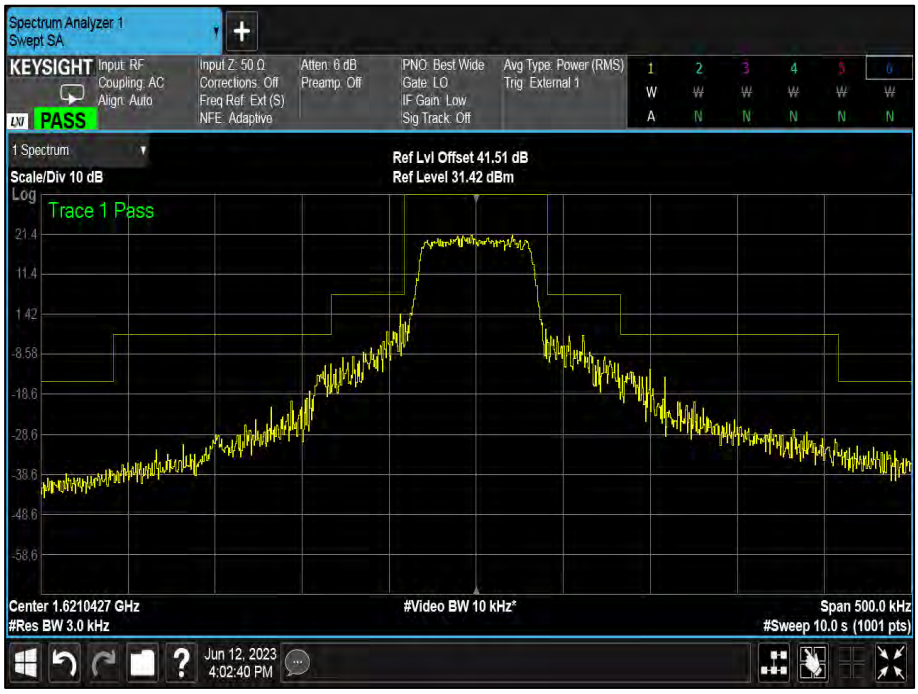

Figure 68 - 1621.041666 MHz - Emission Mask

Figure 69 - 1621.041666 MHz - 9 kHz to 150 kHz

Figure 70- 1621.041666 MHz - 150 kHz to 30 MHz

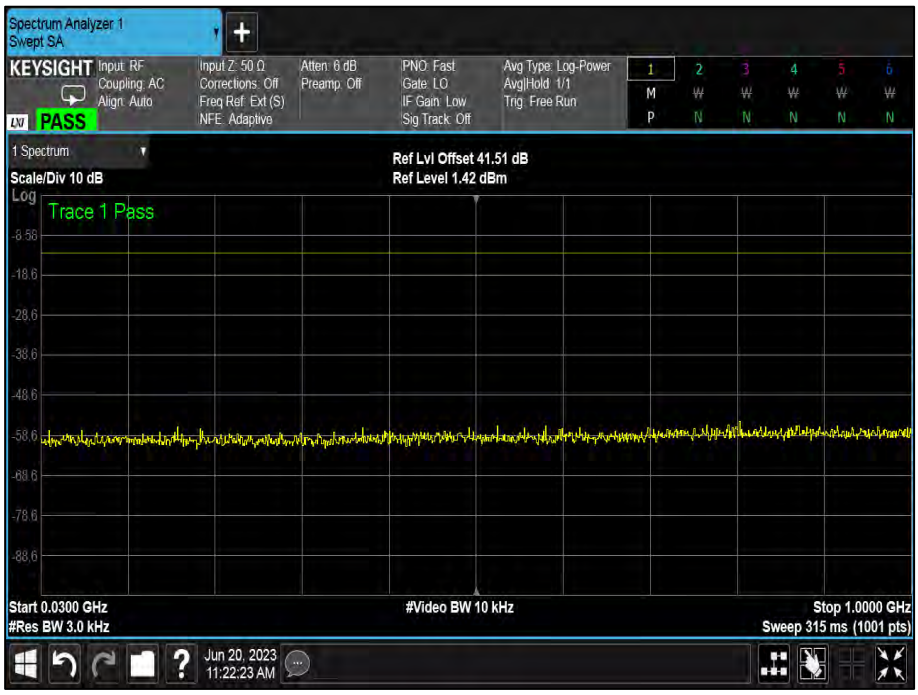

Figure 71 - 1621.041666 MHz - 30 MHz to 1 GHz

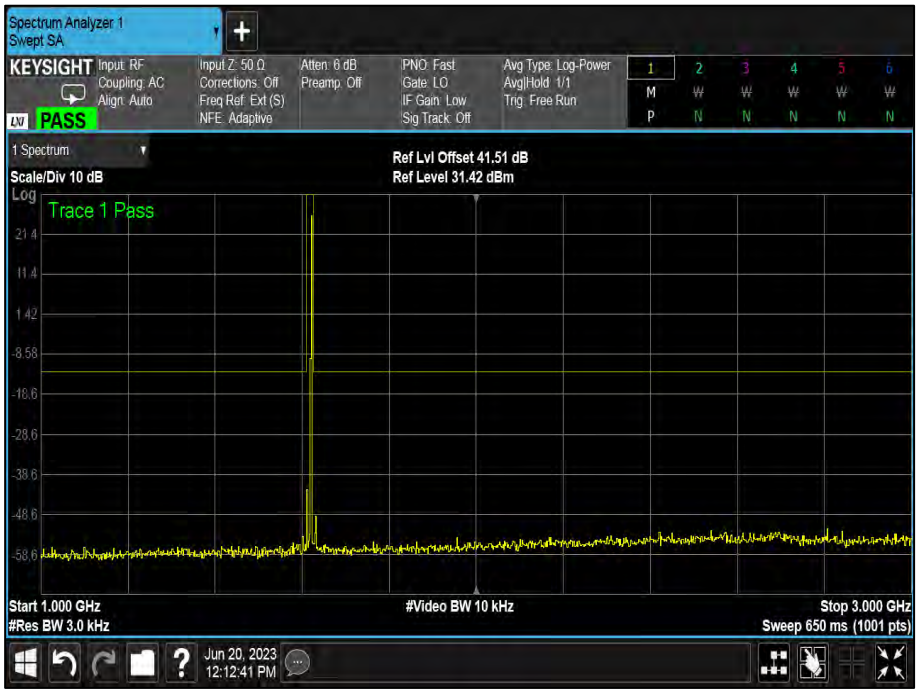

Figure 72- 1621.041666 MHz - 1 GHz to 3 GHz

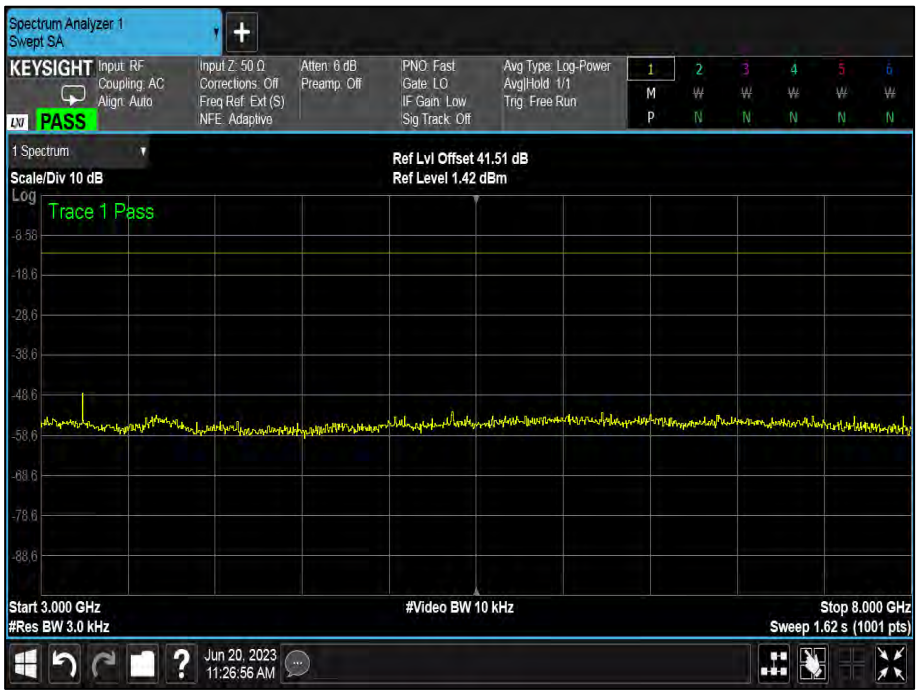

Figure 73 - 1621.041666 MHz - 3 GHz to 8 GHz

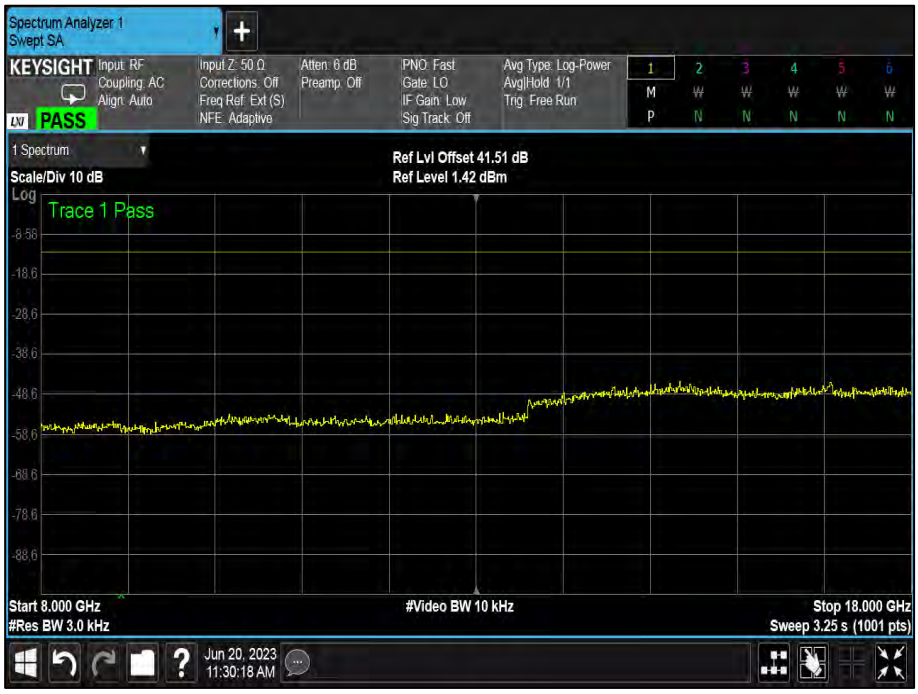

Figure 74- 1621.041666 MHz - 8 GHz to 18 GHz

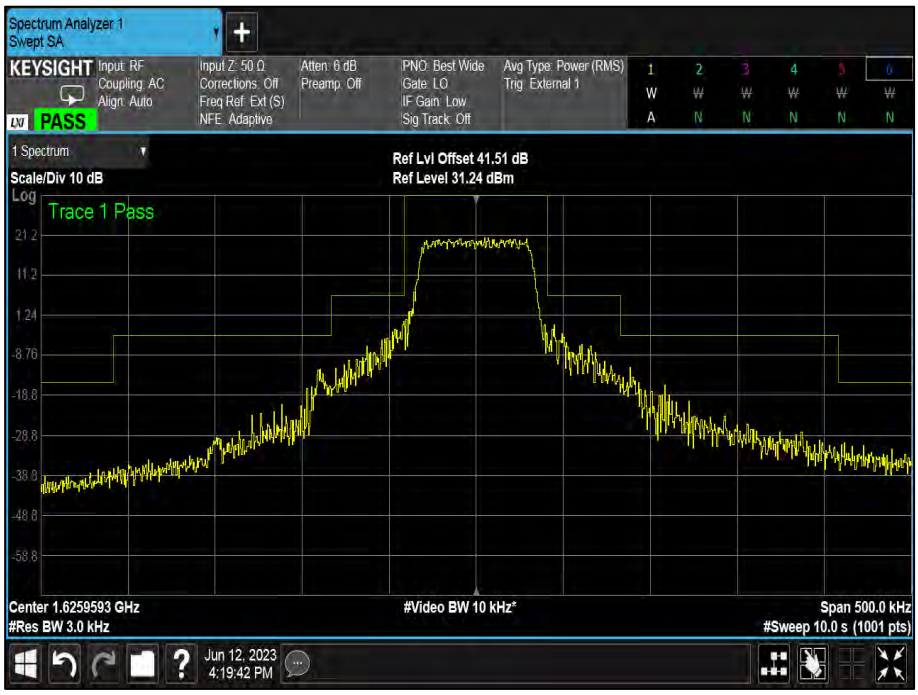

Figure 75 - 1625.958333 MHz - Emission Mask

Figure 76- 1625.95833 MHz - 9 kHz to 150 kHz

Figure 77- 1625.958333 MHz - 150 kHz to 30 MHz

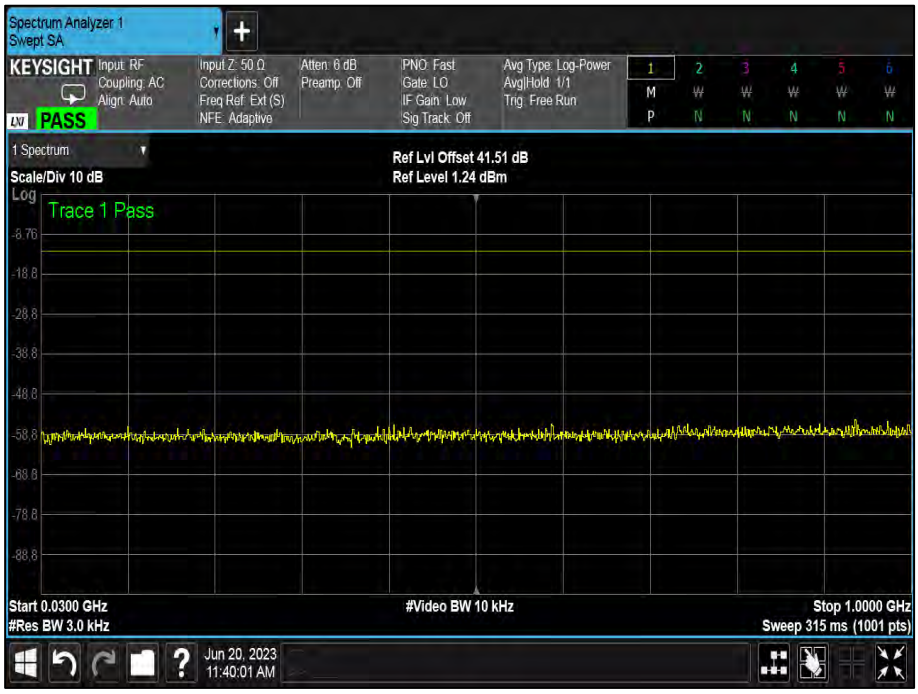

Figure 78- 1625.958333 MHz - 30 MHz to 1 GHz

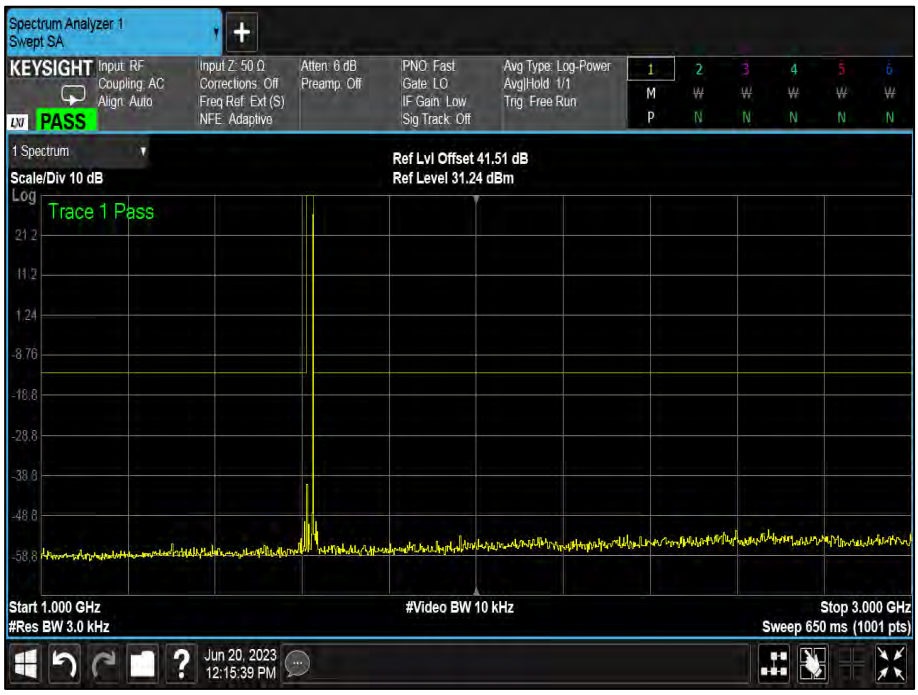

Figure 79- 1625.958333 MHz - 1 GHz to 3 GHz

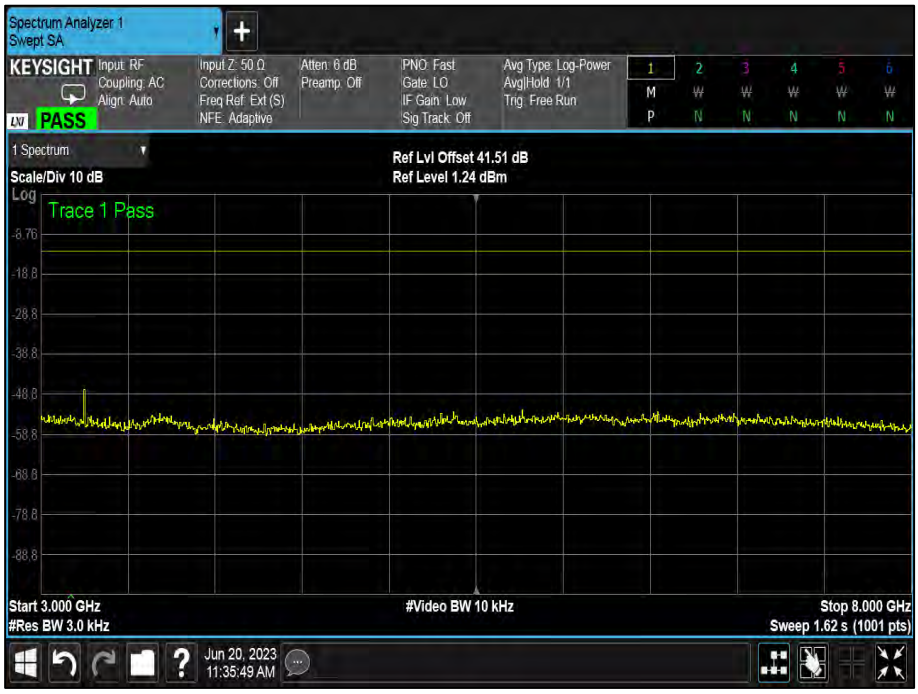

Figure 80- 1625.958333 MHz - 3 GHz to 8 GHz

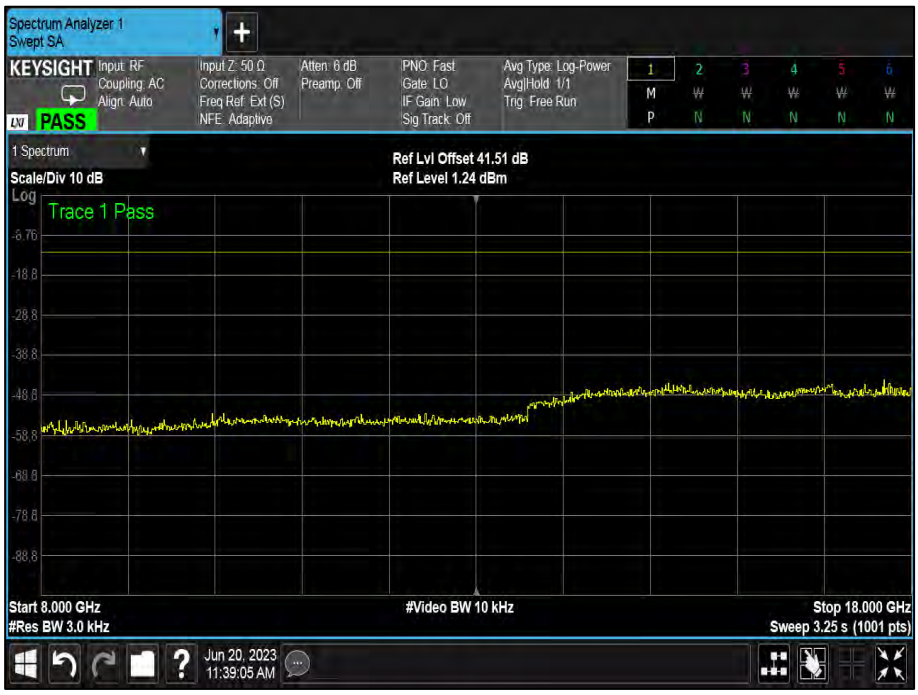

Figure 81- 1625.958333 MHz - 8 GHz to 18 GHz

FCC 47 CFR Part 2, Limit Clause 25.202(f)

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

- 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50 %, up to and including 100 % of the authorised bandwidth;
- 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100 %, up to and including 250 % of the authorised bandwidth;
- 43 + 10 Log p (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250 % of the authorised bandwidth.

ISED RSS-170, Limit Clause 5.8

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

- 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50 %, up to and including 100 % of the occupied bandwidth or necessary bandwidth, whichever is greater
- 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100 %, up to and including 250 % of the occupied bandwidth or necessary bandwidth, whichever is greater
- 43 + 10 Log p (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250 % of the occupied bandwidth or necessary bandwidth, whichever is greater.

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
Power Supply Unit	Hewlett Packard	6282A	132	-	O/P Mon
Oscilloscope	Tektronix	TDS460A	146		TU
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	13-Jul-2023
Digital Multi-meter	Iso-tech	IDM93N	4435	12	04-Mar-2024
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	23-Oct-2023
Hygrometer	Rotronic	HP21	4741	12	05-May-2024
EXA	Keysight Technologies	N9010B	4969	24	07-Feb-2024
Attenuator 40dB 100W	Weinschel	48-40-43-LIM	5134	12	10-Feb-2024
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5471	12	28-Apr-2024
3.5mm Cable (1m)	Junkosha	MWX221/B	5838	12	24-Jul-2023
Coaxial Fixed Attenuator DC-18GHz 5W 10dB	RF-Lambda	RFS5G18B10SMP	6179	12	17-Jul-2023

Table 29

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

2.5 Radiated Spurious Emissions

2.5.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1053
FCC 47 CFR Part 25, Clause 25.202(f),
ISED RSS-170, Clause 5.8
ISED RSS-GEN, Clause 6.13

2.5.2 Equipment Under Test and Modification State

A04349, S/N: 1606803100025 - Modification State 0

2.5.3 Date of Test

21-May-2023

2.5.4 Test Method

A preliminary profile of the Radiated Spurious Emissions was obtained up to the 10th harmonic by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber.

Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Testing was performed in accordance with ANSI C63.26, Clause 5.5.

Prescans and final measurements were performed using the direct field strength method.

Field strength measurements were performed and then converted to Equivalent Power Measurements in accordance with ANSI C63.26, Clause 5.2.7 equation c)

Example calculation:

E (dBuV/m) + 20log(d) - 104.8 = EIRP (dBm) where (d) is the measurement distance.

82.2 (dBuV/m) + 20log(3) – 104.8 = EIRP (dBm)

-13.0 = EIRP (dBm)

2.5.1 Example Test Setup Diagram

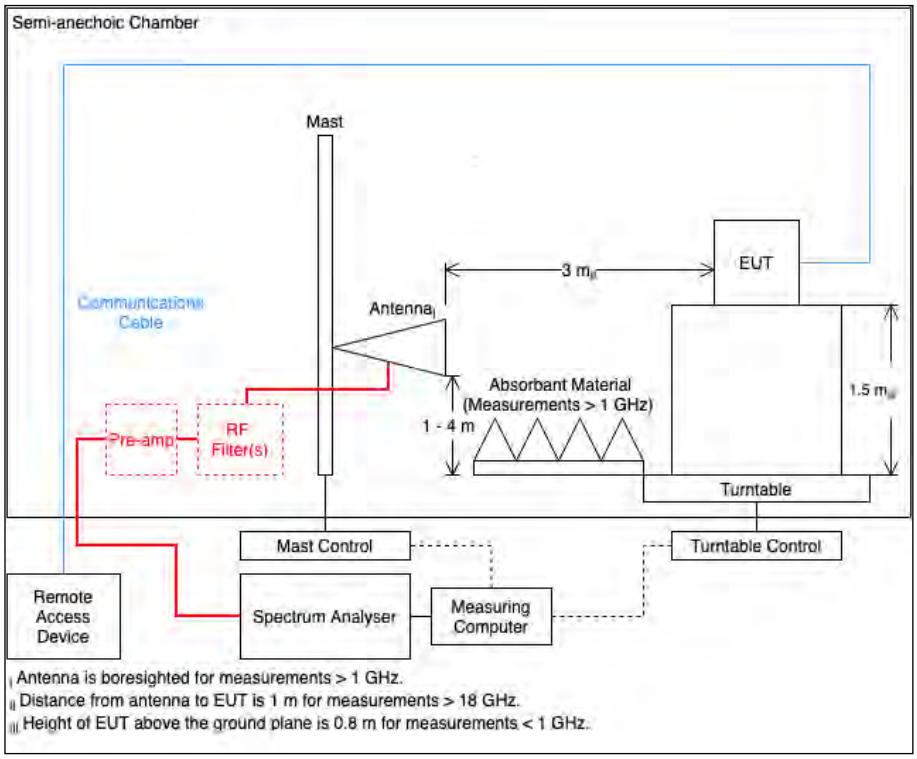

Figure 82 – Radiated Emissions Test Setup Diagram

2.5.2 Environmental Conditions

Ambient Temperature	20.5 °C
Relative Humidity	40.2 %

2.5.3 Test Results

MES Transceiver - B1

Frequency (MHz)	Level (dBm)	Polarisation	Orientation
*			

Table 30- 1616.020833 MHz, 30 MHz to 18 GHz

*No emissions were found within 10 dB of the limit.

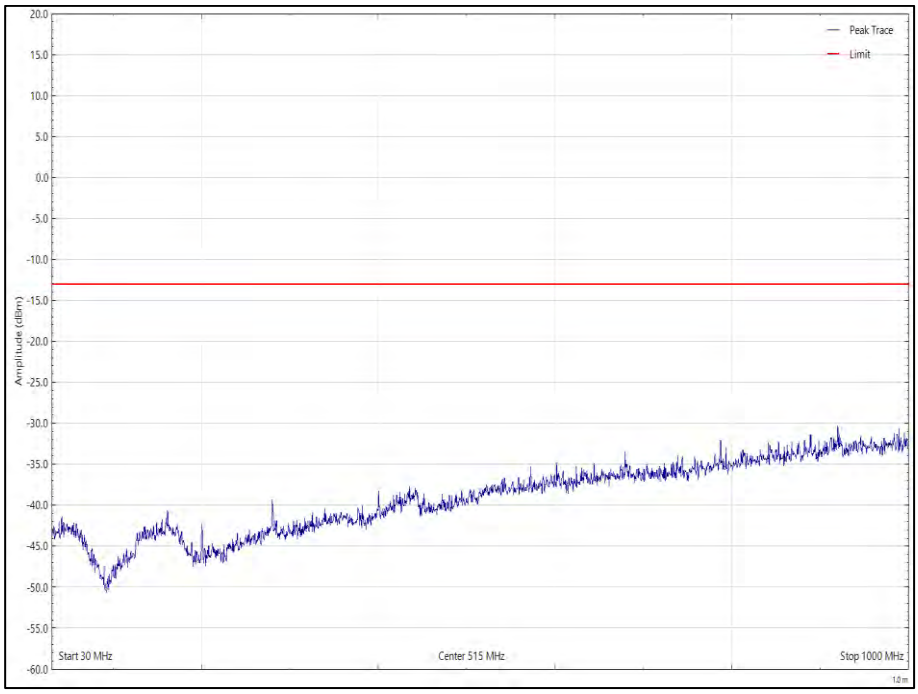

Figure 83 - 1616.020833 MHz - 30MHz to 1GHz, Horizontal, Orientation

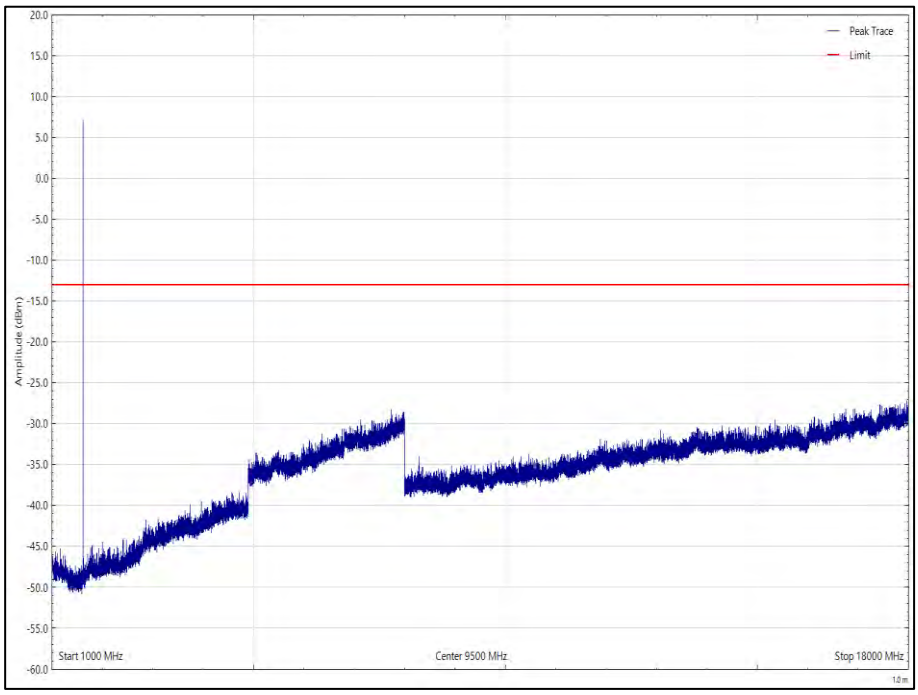

Figure 84 - 1616.020833 MHz - 1 GHz to 18 GHz, Horizontal, Orientation

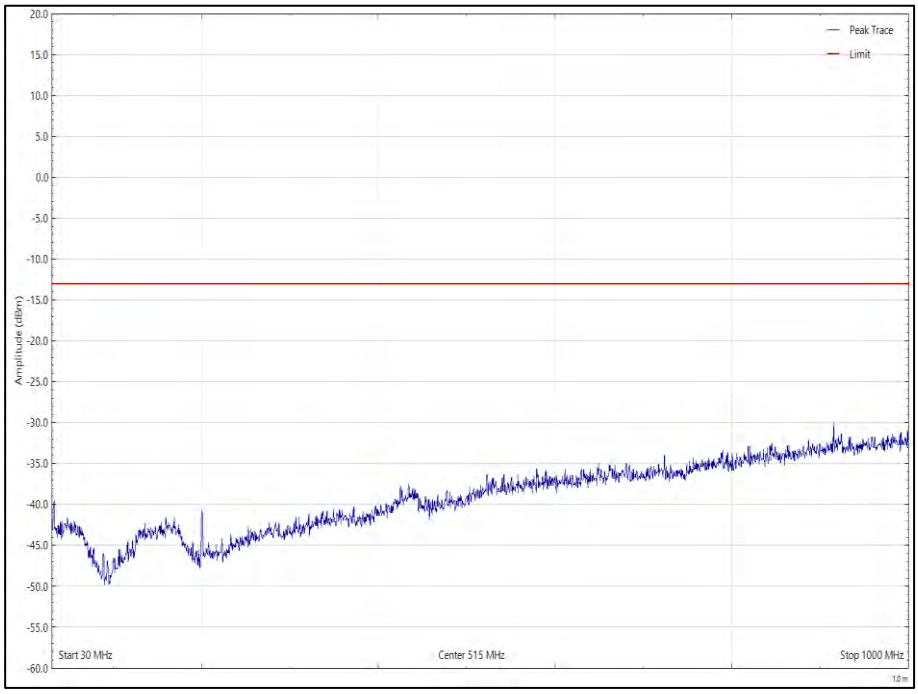

Figure 85 - 1616.020833 MHz - 30MHz to 1GHz, Vertical, Orientation

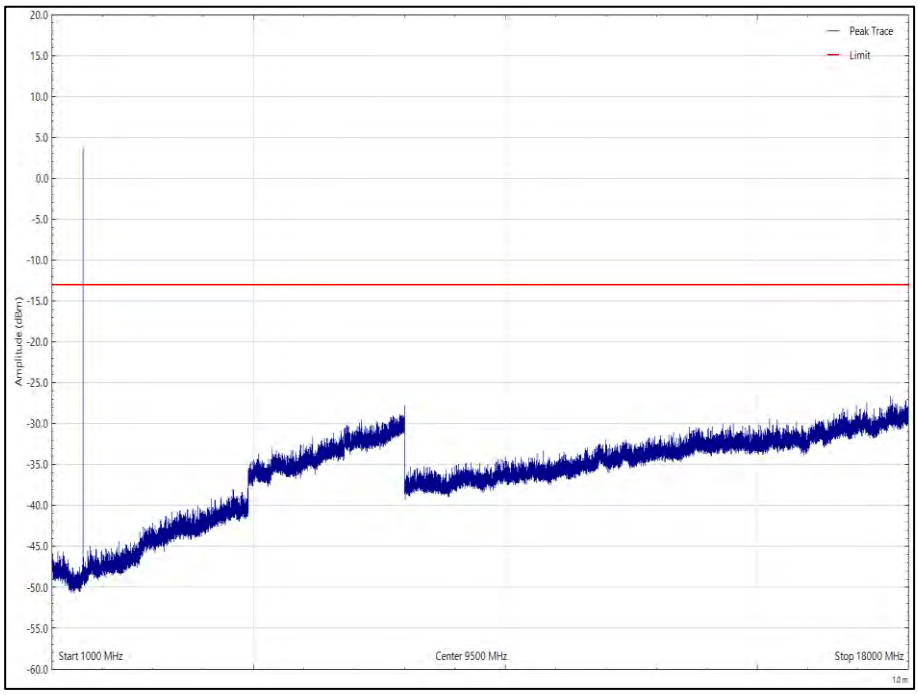

Figure 86- 1616.020833 MHz - 1 GHz to 18 GHz, Vertical, Orientation

Frequency (MHz)	Level (dBm)	Polarisation	Orientation
*			

Table 31- 1621.020833 MHz, 30 MHz to 18 GHz

*No emissions were found within 10 dB of the limit.

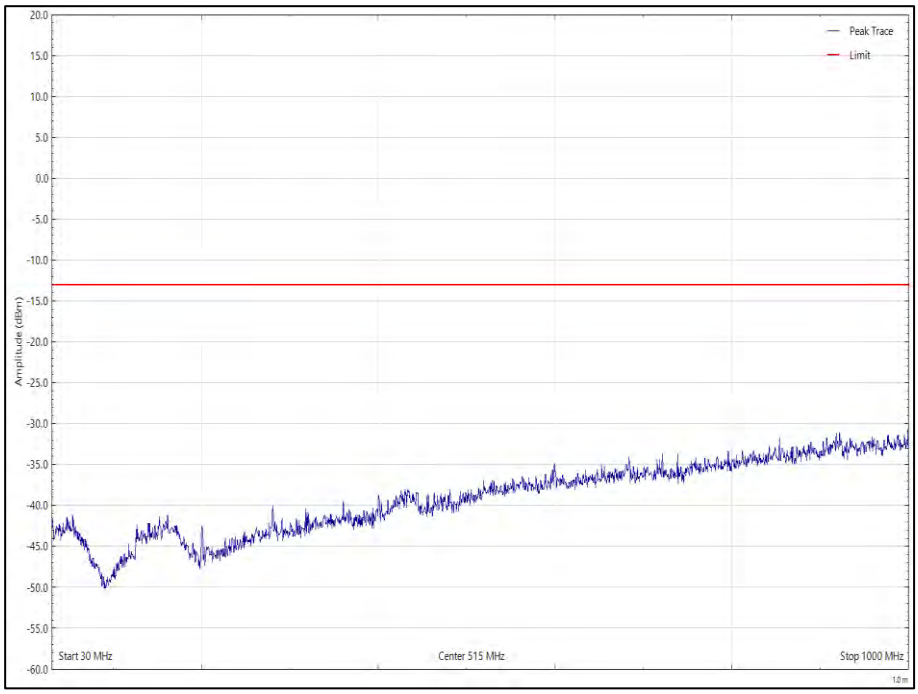

Figure 87 - 1621.020833 MHz - 30MHz to 1GHz, Horizontal, Orientation

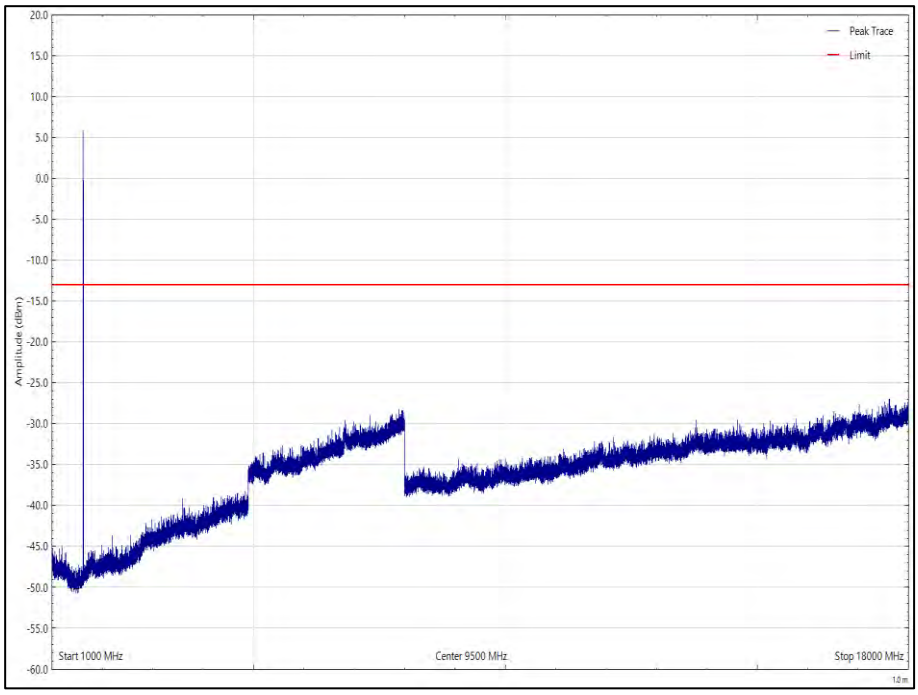

Figure 88- 1621.020833 MHz - 1 GHz to 18 GHz, Horizontal, Orientation

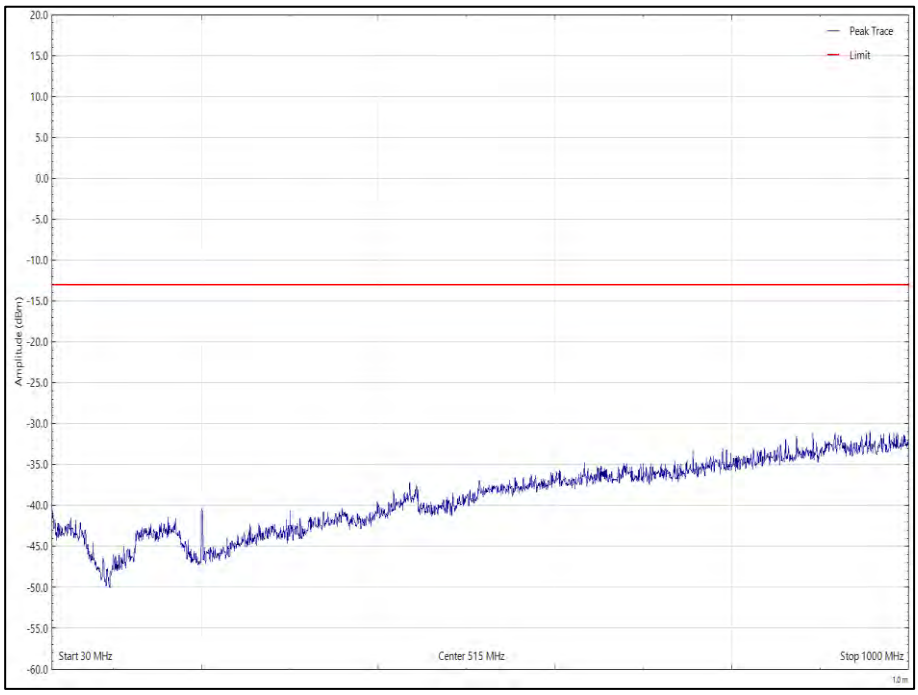

Figure 89 - 1621.020833 MHz - 30MHz to 1GHz, Vertical, Orientation

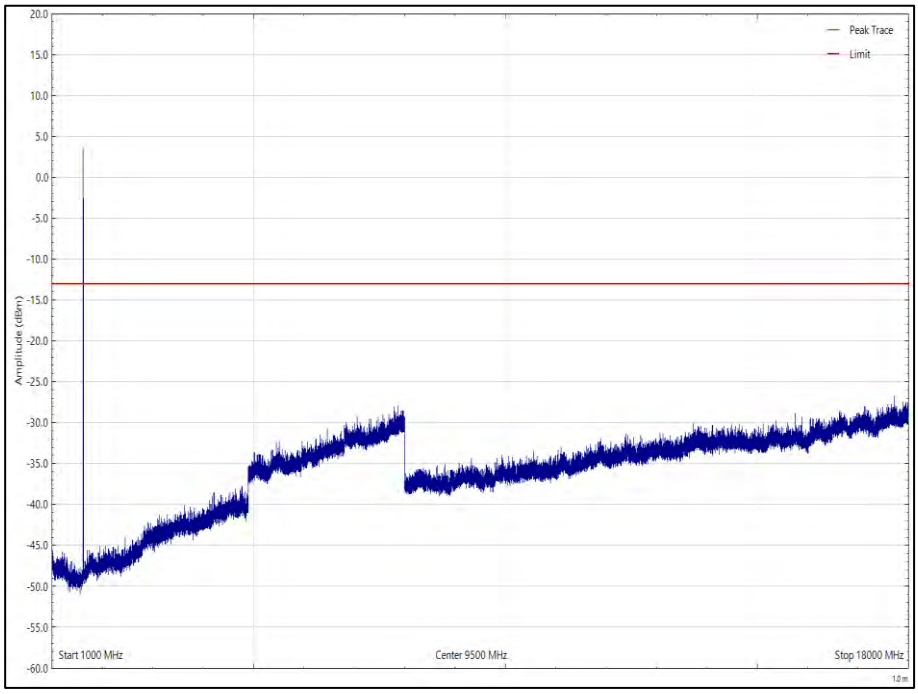

Figure 90 - 1621.020833 MHz - 1 GHz to 18 GHz, Vertical, Orientation

Frequency (MHz)	Level (dBm)	Polarisation	Orientation
*			

Table 32- 1625.979167 MHz, 30 MHz to 18 GHz

*No emissions were found within 10 dB of the limit.

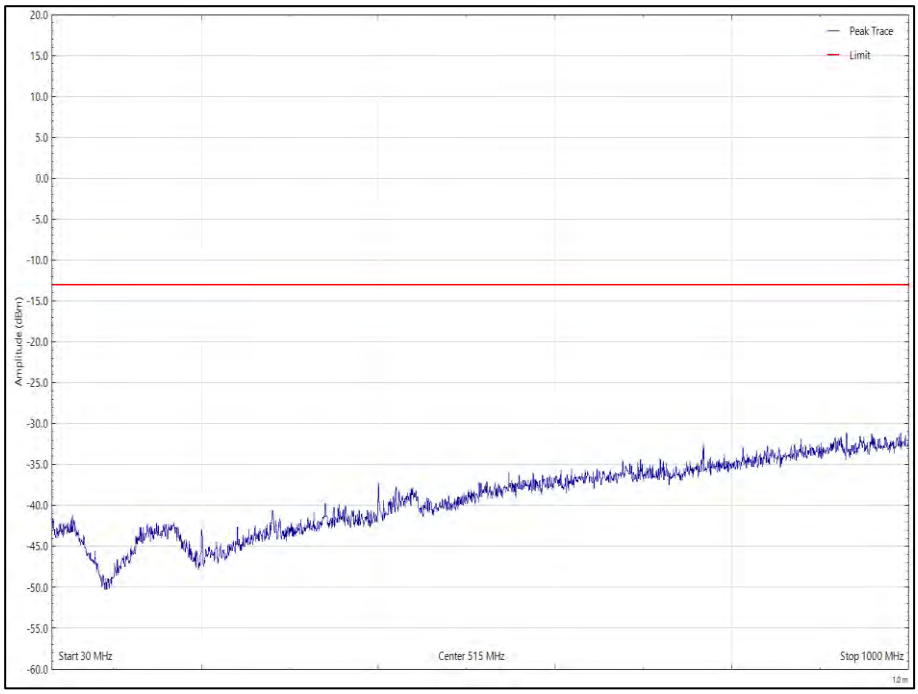

Figure 91- 1625.979167 MHz - 30MHz to 1GHz, Horizontal, Orientation

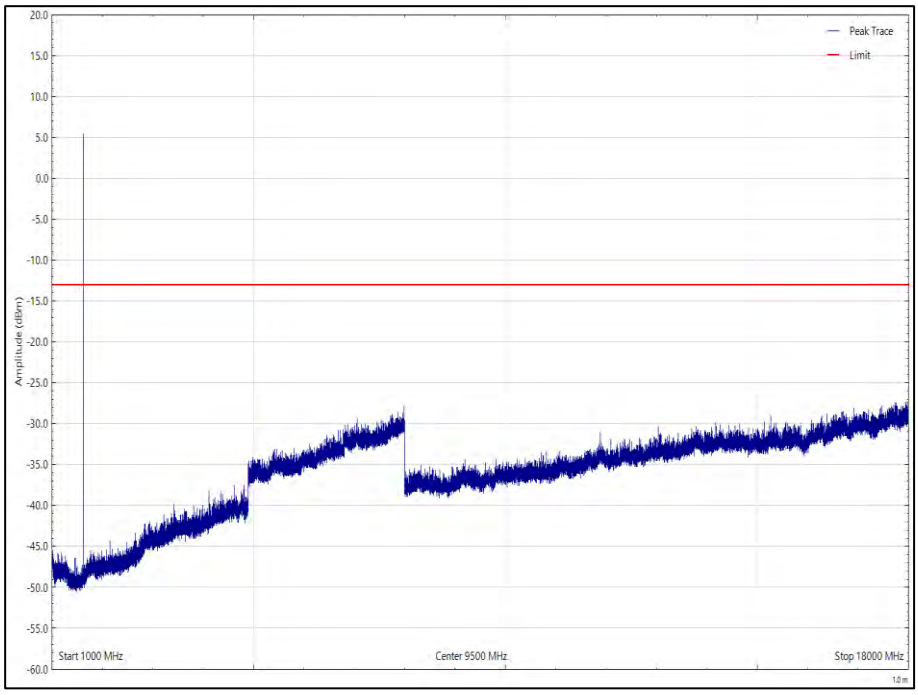

Figure 92- 1625.979167 MHz - 1 GHz to 18 GHz, Horizontal, Orientation

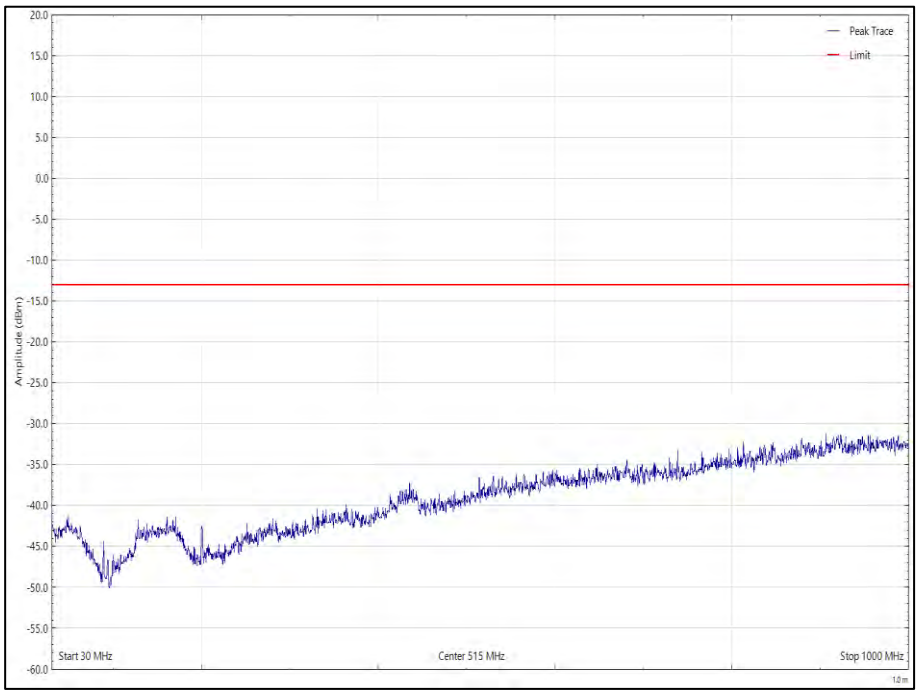

Figure 93 - 1625.979167 MHz - 30MHz to 1GHz, Vertical, Orientation

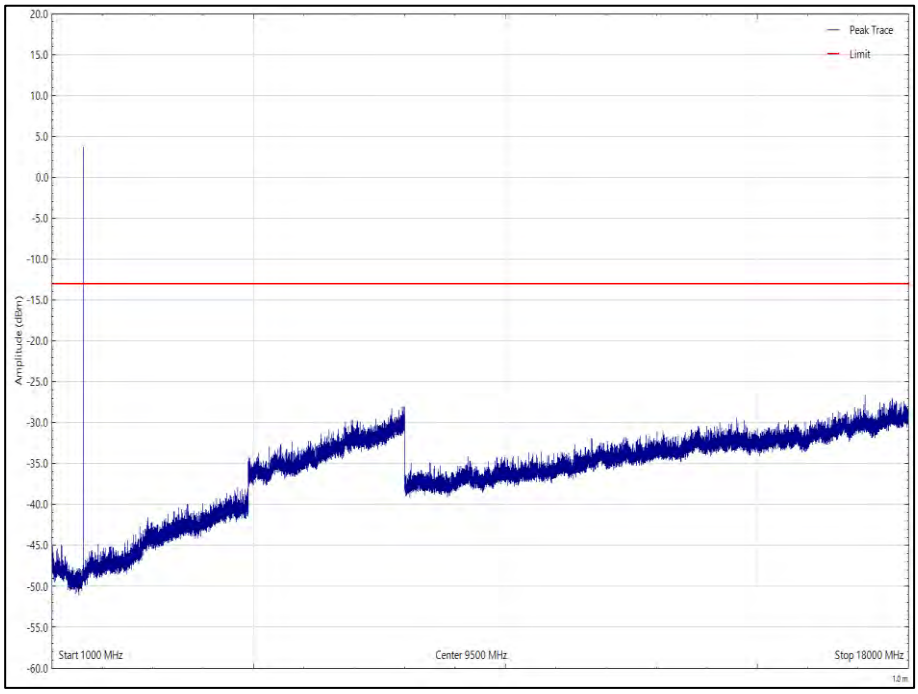

Figure 94 - 1625.979167 MHz - 1 GHz to 18 GHz, Vertical, Orientation

FCC 47 CFR Part 2, Limit Clause 25.202(f)

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the authorised bandwidth;

35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the authorised bandwidth;

43 + 10 Log p (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the authorised bandwidth.

ISED RSS-170, Limit Clause 5.8

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth or necessary bandwidth, whichever is greater;

35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth or necessary bandwidth, whichever is greater;

43 + 10 Log p (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth or necessary bandwidth, whichever is greater.

2.5.4 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
Dual Power Supply Unit	Hewlett Packard	6253A	292	-	O/P Mon
True RMS Multimeter	Fluke	179	4007	12	18-Nov-2023
Test Receiver	Rohde & Schwarz	ESW44	5084	12	12-Jul-2023
Emissions Software	TUV SUD	EmX V3.1.11	5125	-	Software
Screened Room (11)	Rainford	Rainford	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
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	5215	12	28-May-2023
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5216	12	29-May-2023
Thermo-Hygro-Barometer	PCE Instruments	OCE-THB-40	5470	12	20-Apr-2024
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-02000AMSAMS/A	5518	12	14-Apr-2024
Cable (N-Type to N-Type, 8 m)	Junkosha	MWX221-08000NMSNMS/B	5522	12	14-Apr-2024
Antenna (Tri-log, 30 MHz to 1 GHz)	Schwarzbeck	VULB 9168	5942	24	03-Feb-2024
Attenuator (4 dB)	Pasternack	PE7074-4	6202	24	16-Jul-2024

Table 33

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

2.6 Frequency Tolerance

2.6.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1055,
FCC 47 CFR Part 25, Clause 25.202(d),
ISED RSS-170, Clause 5.3
ISED RSS-GEN, Clause 6.11

2.6.2 Equipment Under Test and Modification State

A04349, S/N: 1606803100025 - Modification State 0

2.6.3 Date of Test

23-May-2023 to 26-May-2023

2.6.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.6.

The measurement was made with the DUT operating with a modulated carrier and the measurement made using a spectrum analyser. The mid-point frequency was determined from the upper and lower -10 dBc points.

2.6.5 Environmental Conditions

Ambient Temperature	21.8 - 23.8 °C
Relative Humidity	39.0 - 43.4 %

2.6.6 Test Results

MES Transceiver - B1

Temperature (˚C)	Voltage	1616.020833 MHz		1621.020833 MHz		1625.979167 MHz	
		Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)
-30	5 V	0.00000189	0.018873	0.00001280	0.128401	0.00000412	0.041205
-20	5 V	-0.00001593	-0.159342	-0.00000031	-0.003094	0.00002475	0.247543
-10	5 V	0.00001188	0.118810	0.00003004	0.300427	0.00002721	0.272143
0	5 V	0.00000879	0.087870	0.00003038	0.303820	0.00001205	0.120542
10	5 V	0.00002933	0.293313	0.00004374	0.437378	0.00002998	0.299819
20	4.5 V	0.00006770	0.676971	0.00005262	0.526211	0.00004308	0.430817
20	5 V	0.00007828	0.782786	0.00006749	0.674883	0.00007174	0.717413
20	5.5 V	0.00007101	0.710077	0.00007612	0.761248	0.00007159	0.715876
30	5 V	0.00006974	0.697392	0.00006447	0.644655	0.00006082	0.608248
40	5 V	0.00007945	0.794544	0.00006811	0.681052	0.00006980	0.698040
50	5 V	0.00008221	0.822080	0.00008911	0.891105	0.00009124	0.912373

Table 34

MES Transceiver - C1

Temperature (˚C)	Voltage	1616.020833 MHz		1621.020833 MHz		1625.979167 MHz	
		Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)
-30	5 V	-0.00000192	-0.019182	0.00000750	0.074952	0.00000557	0.055658
-20	5 V	-0.00000303	-0.030321	0.00000318	0.031770	-0.00000286	-0.028598
-10	5 V	0.00001092	0.109218	0.00001585	0.158542	0.00001104	0.110395
0	5 V	0.00002701	0.270107	0.00002619	0.261872	0.00001765	0.176509
10	5 V	0.00003685	0.368497	0.00004124	0.412394	0.00004201	0.420054
20	4.5 V	0.00006881	0.688109	0.00006150	0.615044	0.00005858	0.585800
20	5 V	0.00006324	0.632417	0.00006937	0.693698	0.00006928	0.692813
20	5.5 V	0.00007472	0.747205	0.00007045	0.704494	0.00006202	0.620241
30	5 V	0.00005919	0.591885	0.00006727	0.672724	0.00006384	0.638384
40	5 V	0.00007686	0.768554	0.00008732	0.873215	0.00008423	0.842261
50	5 V	0.00008227	0.822699	0.00008103	0.810291	0.00008118	0.811818

Table 35

MES Transceiver - C2

Temperature (˚C)	Voltage	1616.041666 MHz		1621.041666 MHz		1625.958333 MHz	
		Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)
-30	5 V	0.00001027	0.102720	0.00001132	0.113198	-0.00000895	-0.089485
-20	5 V	0.00000606	0.060642	0.00000281	0.028068	0.00000157	0.015683
-10	5 V	0.00000244	0.024442	0.00000867	0.086672	0.00001820	0.182046
0	5 V	0.00000424	0.042387	0.00002030	0.202955	0.00001731	0.173128
10	5 V	0.00004291	0.429134	0.00003220	0.322015	0.00002116	0.211567
20	4.5 V	0.00006182	0.618177	0.00006894	0.689371	0.00005298	0.529841
20	5 V	0.00007082	0.708211	0.00007733	0.773268	0.00006012	0.601183
20	5.5 V	0.00005312	0.531236	0.00007884	0.788381	0.00007648	0.764779
30	5 V	0.00005548	0.554750	0.00006801	0.680118	0.00006402	0.640237
40	5 V	0.00007741	0.774113	0.00008825	0.882457	0.00007276	0.727570
50	5 V	0.00008332	0.833208	0.00009395	0.939519	0.00008613	0.861338

Table 36

FCC 47 CFR Part 2, Limit Clause 25.202(d)

The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

ISED RSS-170, Limit Clause 5.3

For MES equipment, the carrier frequency shall not drift from the reference frequency by more than ±10 ppm.

2.6.7 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
Power Supply Unit	Hewlett Packard	6282A	132	-	O/P Mon
HygroPalm	Rotronic	HygroPalm 0	3484	12	30-Aug-2023
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	13-Jul-2023
Digital Multi-meter	Iso-tech	IDM93N	4435	12	04-Mar-2024
EXA	Keysight Technologies	N9010B	4969	24	07-Feb-2024
Attenuator 40dB 100W	Weinschel	48-40-43-LIM	5134	12	10-Feb-2024
2 Meter Cable	Teledyne	PR90-088-2MTR	5201	12	22-Aug-2023
3.5mm Cable (1m)	Junkosha	MWX221/B	5838	12	24-Jul-2023
Climatic Chamber	Weiss Technik	TempEvent T/180/40/3	5894	12	26-Jun-2023

Table 37

O/P Mon – Output monitored using calibrated test equipment.

2.7 Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service

2.7.1 Specification Reference

FCC 47 CFR Part 25, 25.216
ISED RSS-170, Clause 5.9

2.7.2 Equipment Under Test and Modification State

A04349, S/N: 1606803100025 - Modification State 0

2.7.3 Date of Test

14-June-2023 to 10-July-2023

2.7.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.7 within the requirements of FCC CFR 47 Part 25, Clause 25.216 and ISED RSS-170, clause 5.9.

2.7.5 Environmental Conditions

Ambient Temperature	22.2 - 23.4 °C
Relative Humidity	40.6 - 62.0 %

2.7.6 Test Results

MES Transceiver - B1

Frequency (MHz)	Level (dBW)
*	

Table 38- 1616.020833 MHz – Broadband Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

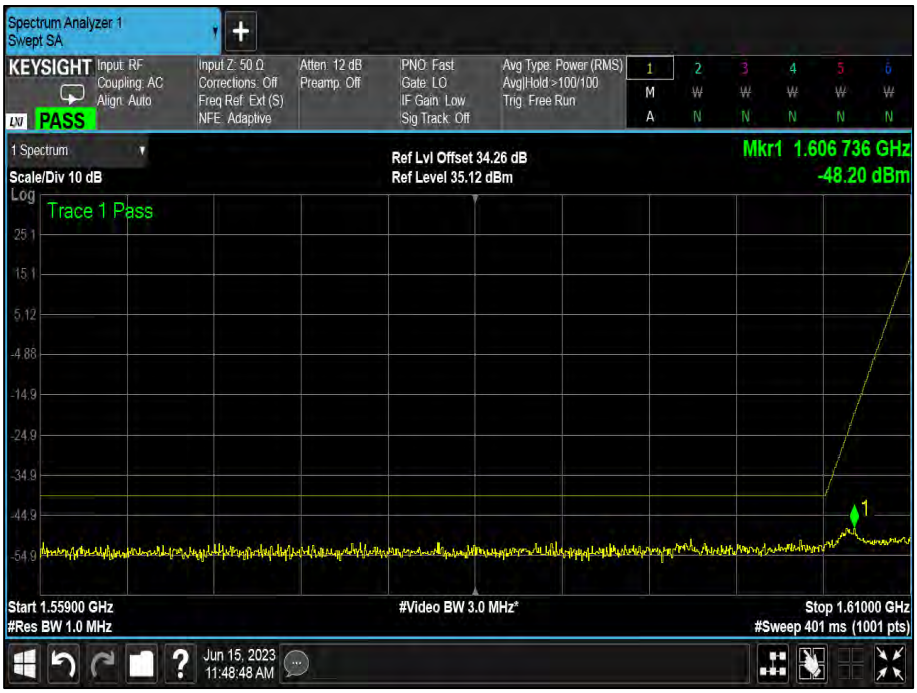

Figure 95- 1616.020833 MHz – Broadband Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 39- 1616.020833 MHz –Discrete Emission Results

*No emissions were detected within 9 dB of the limit based on a 0 dBi antenna gain.

Figure 96-1616.020833 MHz – Discrete Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 40- 1621.020833 MHz – Broadband Emission Results

*No emissions were detected within 9 dB of the limit based on a 0 dBi antenna gain

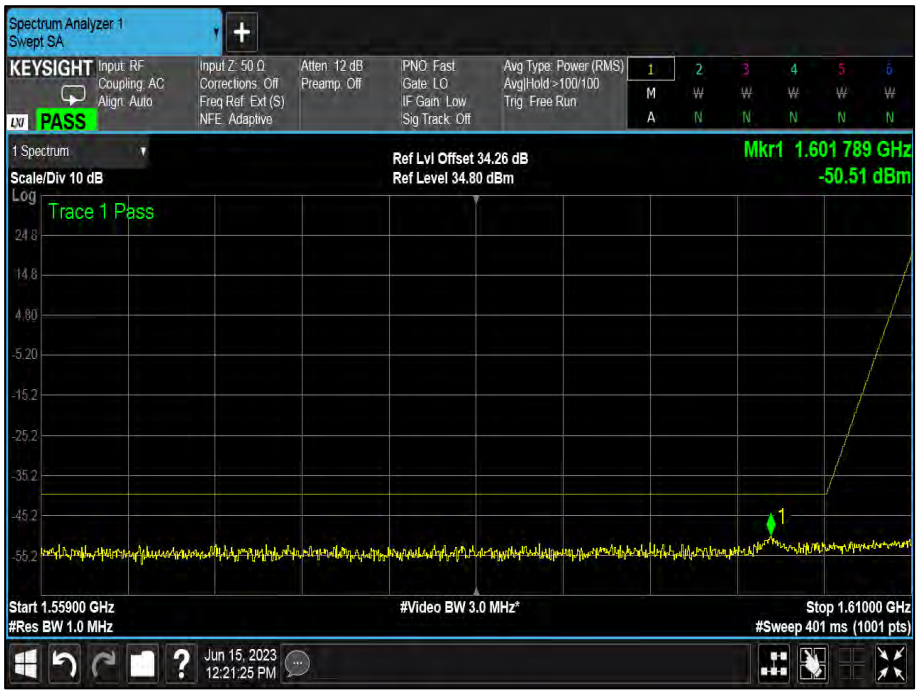

Figure 97 -1621.020833 MHz – Broadband Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 41- 1621.020833 MHz – Discrete Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

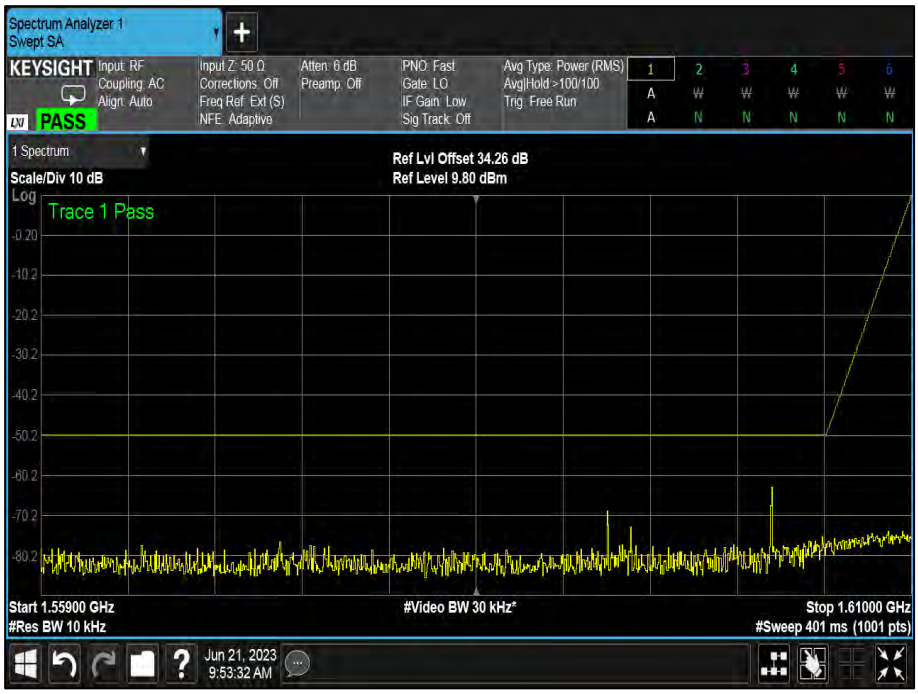

Figure 98-1621.020833 MHz – Discrete Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 42 - 1625.979167 MHz – Broadband Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

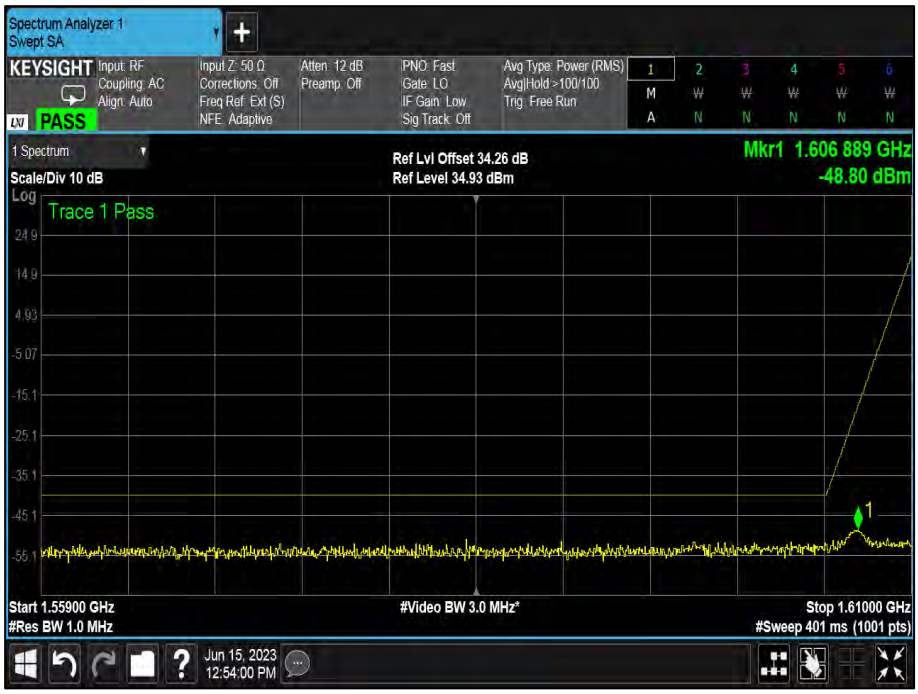

Figure 99-1625.979167 MHz – Broadband Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 43- 1625.979167 MHz – Discrete Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

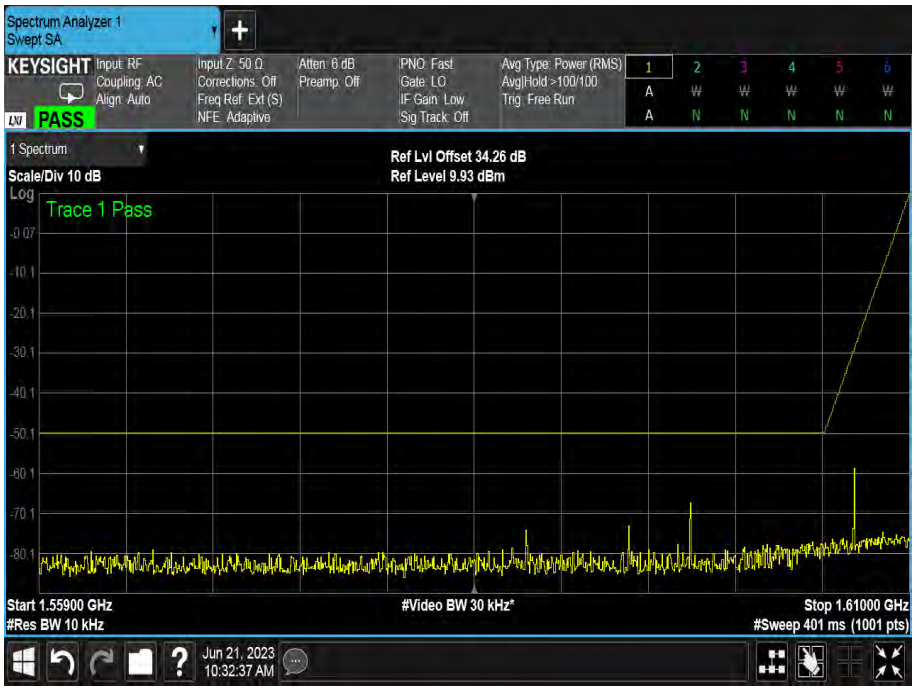

Figure 100 - 1625.979167 MHz – Discrete Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 44 – 1616.020833 MHz - Carrier-off state Emissions

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

Figure 101 – 1616.020833 MHz - Carrier-off state Emissions

Frequency (MHz)	Level (dBW)
*	

Table 45 - 1621.020833 MHz - Carrier-off state Emissions

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

Figure 102 – 1621.020833 MHz - Carrier-off state Emissions

Frequency (MHz)	Level (dBW)
*	

Table 46 – 1625.979167 MHz - Carrier-off state Emissions

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

Figure 103 – 1625.979167 MHz - Carrier-off state Emissions

MES Transceiver - C1

Frequency (MHz)	Level (dBW)
*	

Table 47 - 1616.020833 MHz – Broadband Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

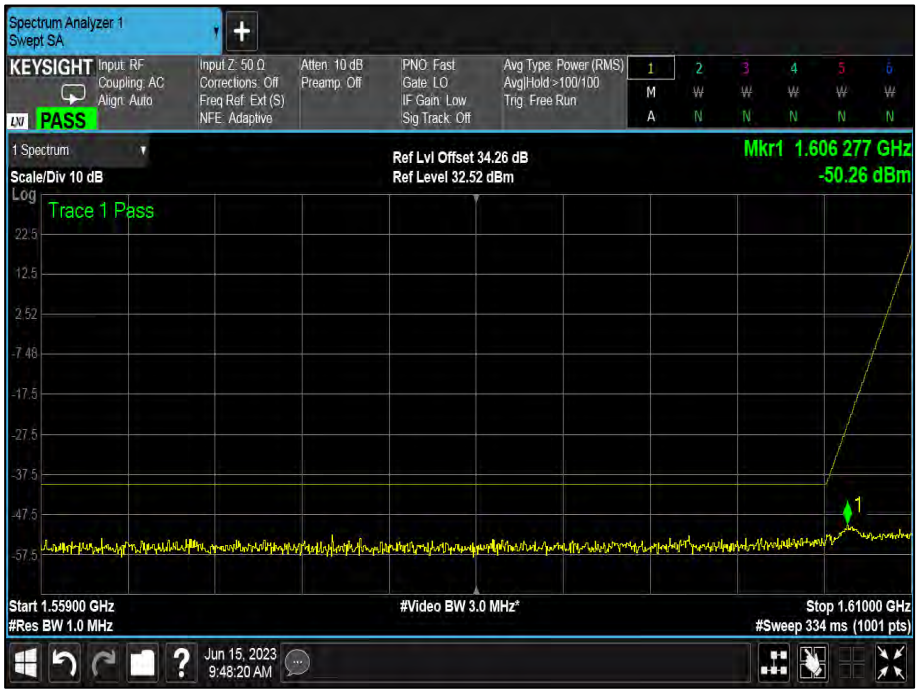

Figure 104- 1616.020833 MHz – Broadband Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 48 - 1616.020833 MHz –Discrete Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

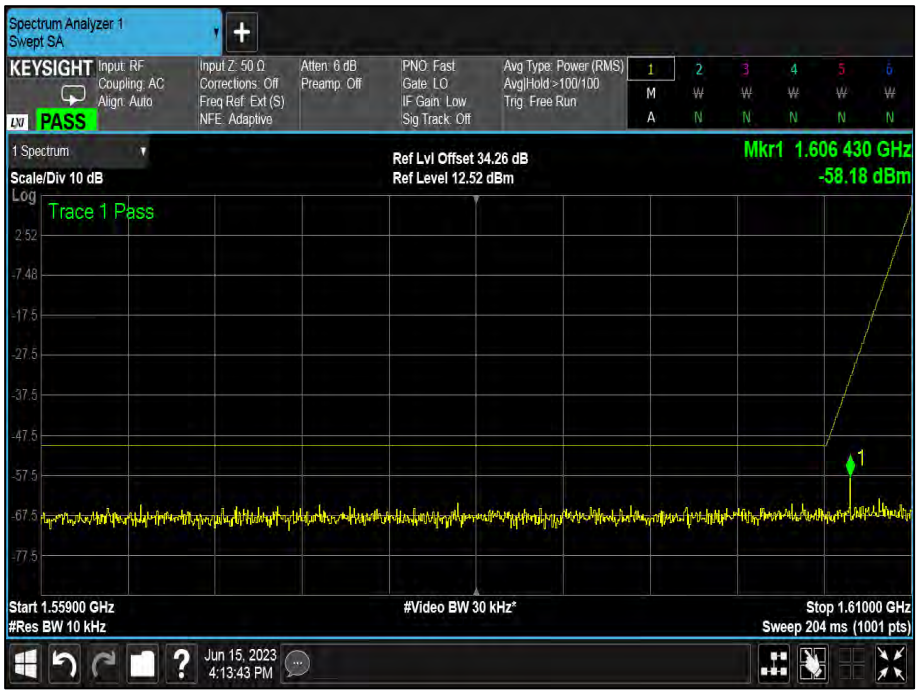

Figure 105 -1616.020833 MHz – Discrete Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 49- 1621.020833 MHz – Broadband Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

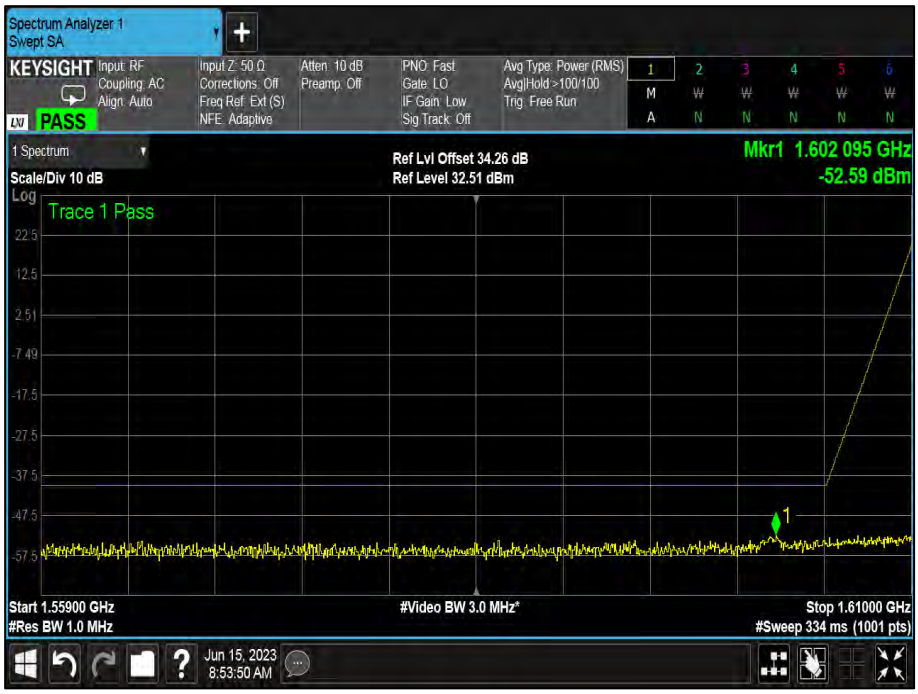

Figure 106-1621.020833 MHz – Broadband Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 50 - 1621.020833 MHz – Discrete Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

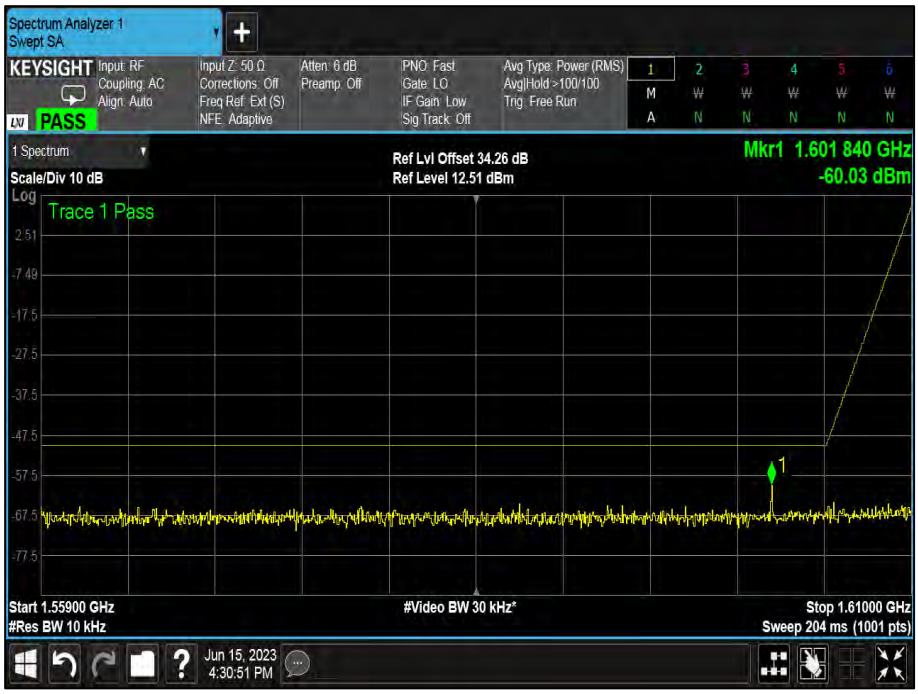

Figure 107 -1621.020833 MHz – Discrete Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 51- 1625.979167 MHz – Broadband Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

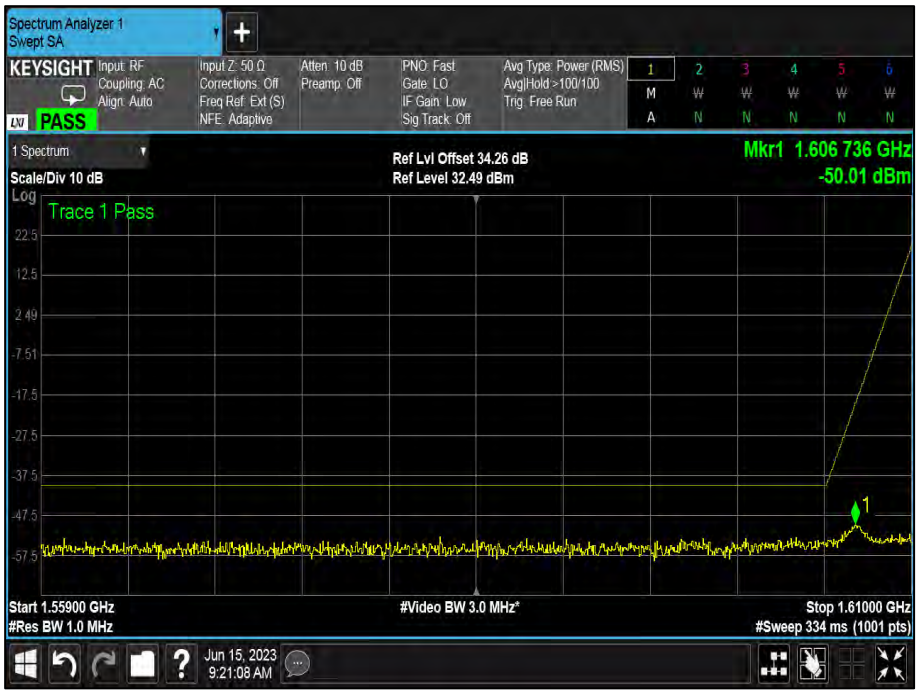

Figure 108 -1625.979167 MHz – Broadband Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 52 - 1625.979167 MHz – Discrete Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

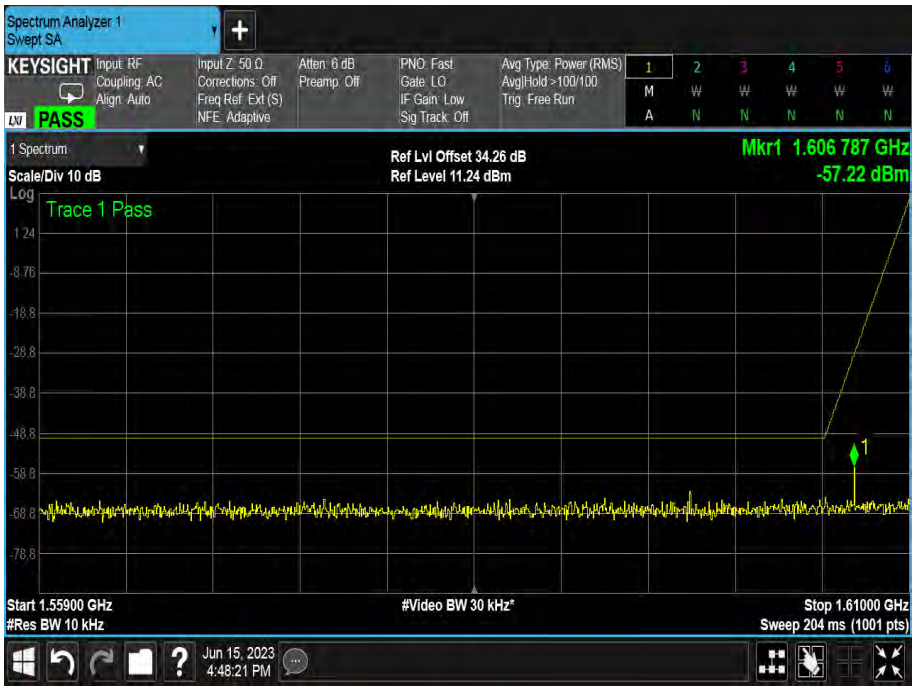

Figure 109 - 1625.979167 MHz – Discrete Emission Results

MES Transceiver - C2

Frequency (MHz)	Level (dBW)
*	

Table 53 - 1616.041666 MHz – Broadband Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

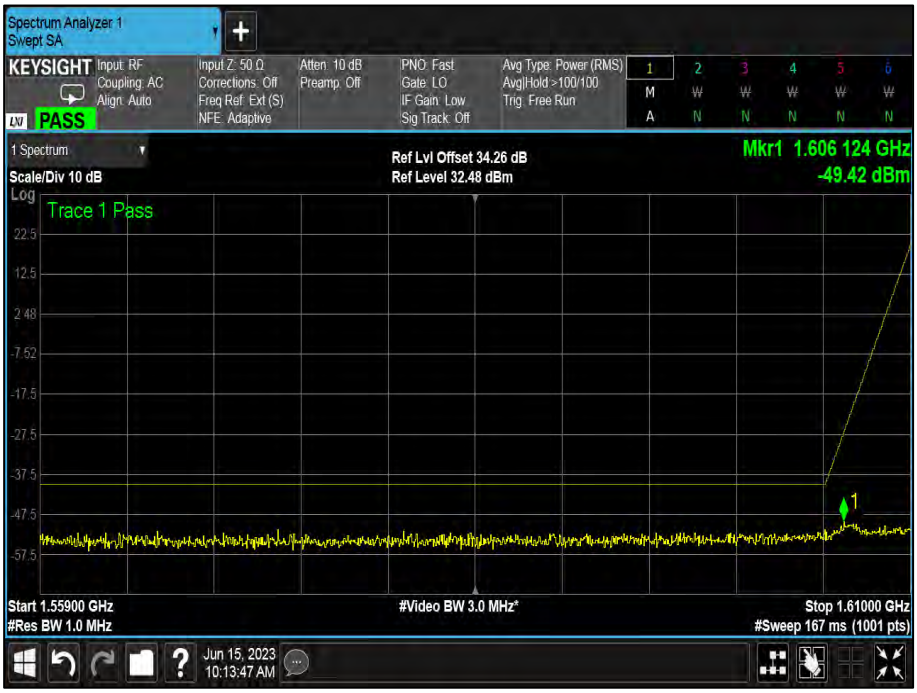

Figure 110 - 1616.041666 MHz – Broadband Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 54 - 1616.041666 MHz –Discrete Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

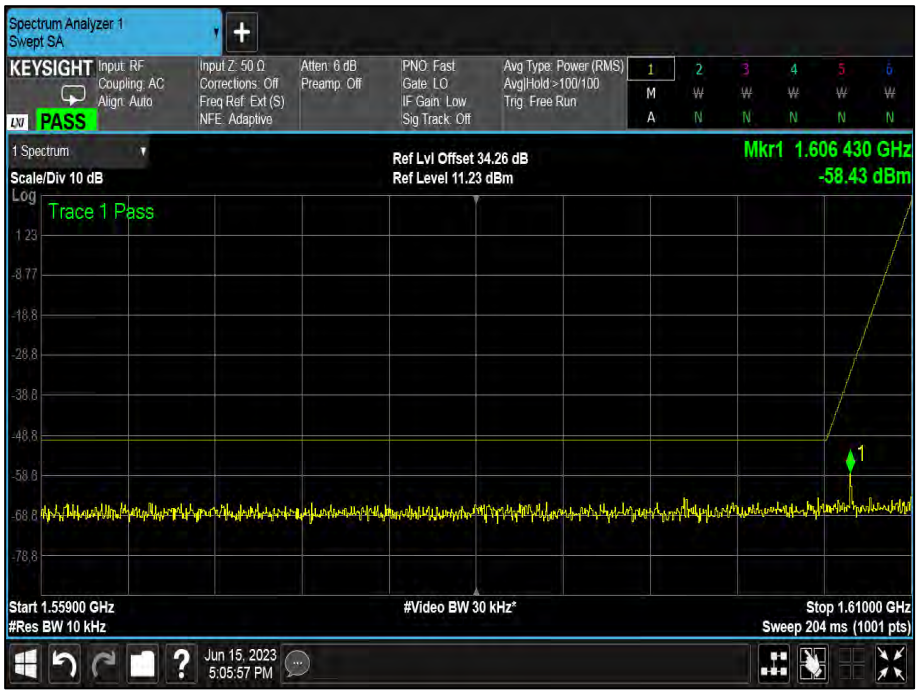

Figure 111 - 1616.041666 MHz – Discrete Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 55 - 1621.041666 MHz – Broadband Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

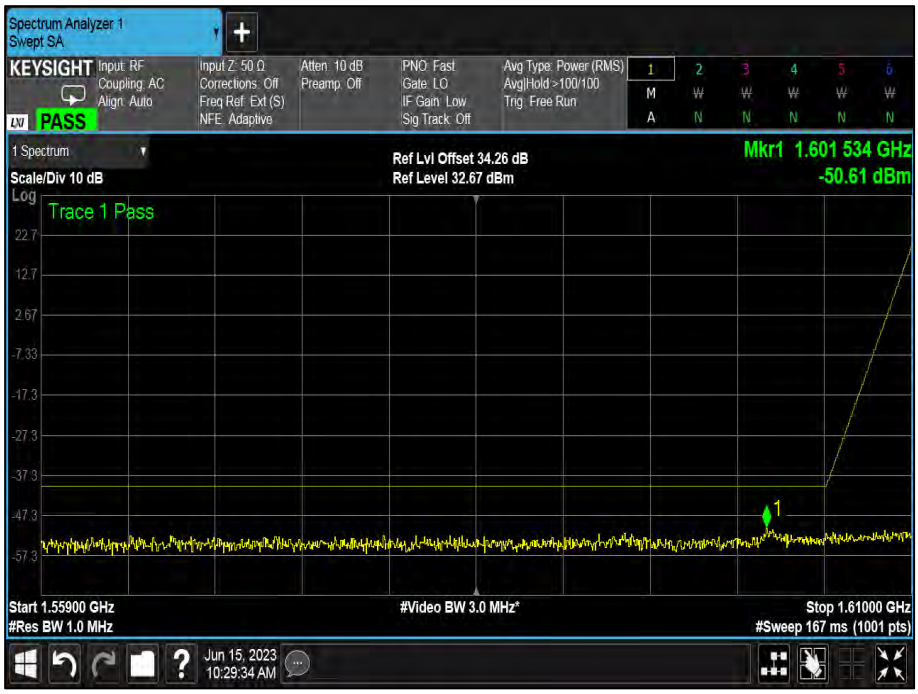

Figure 112 - 1621.041666 MHz – Broadband Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 56 - 1621.041666 MHz – Discrete Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

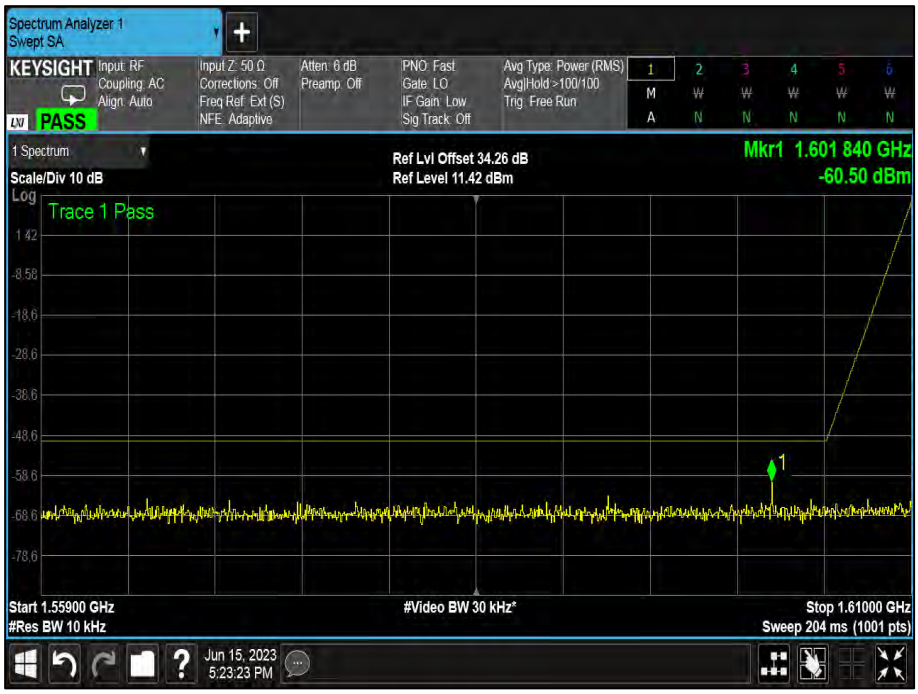

Figure 113-1621.041666 MHz – Discrete Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 57- 1625.958333 MHz – Broadband Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

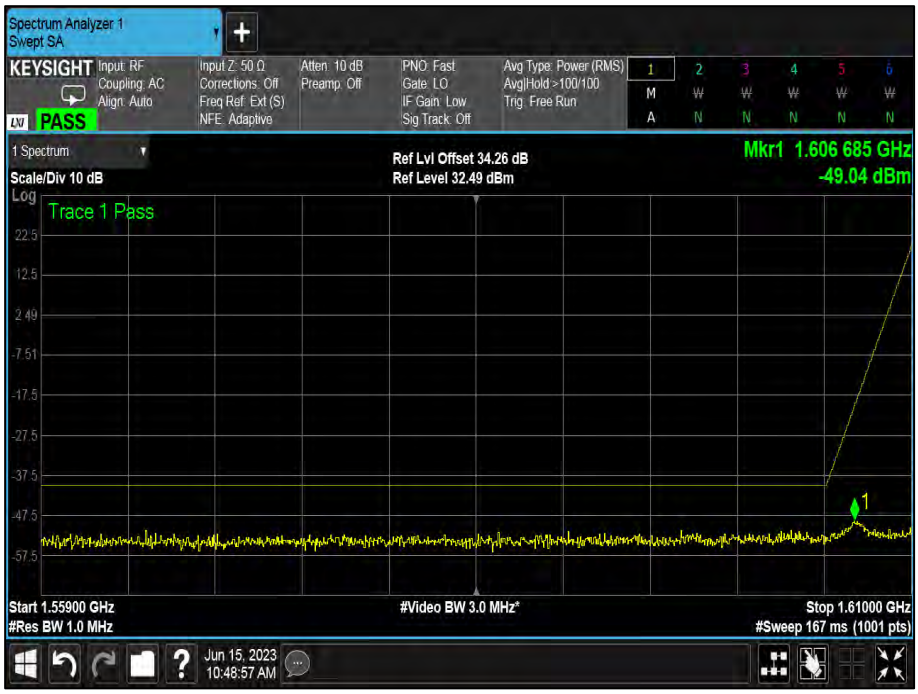

Figure 114-1625.958333 MHz – Broadband Emission Results

Frequency (MHz)	Level (dBW)
*	

Table 58 - 1625.958333 MHz – Discrete Emission Results

*No emissions were detected within 10 dB of the limit based on a 0 dBi antenna gain.

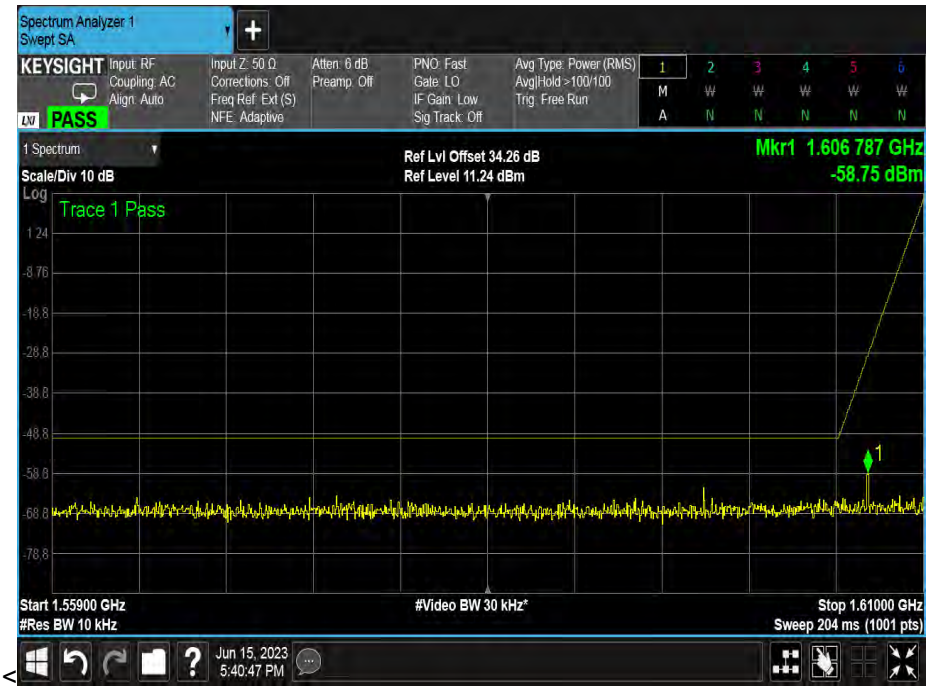

Figure 115 - 1625.958333 MHz – Discrete Emission Results

FCC 47 CFR Part 25, Limit Clause 25.216

25.216(c) The e.i.r.p. density of emissions from mobile earth stations placed in service after July 21, 2002 with assigned uplink frequencies between 1610 MHz and 1660.5 MHz shall not exceed -70 dBW/MHz, averaged over any 2 millisecond active transmission interval, in the band 1559–1605 MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed -80 dBW, averaged over any 2-millisecond active transmission interval, in the 1559–1605 MHz band.

25.216(g) Mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies in the 1610–1626.5 MHz band shall suppress the power density of emissions in the 1605–1610 MHz band-segment to an extent determined by linear interpolation from -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 MHz averaged over any 2-millisecond active transmission interval. The e.i.r.p of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed a level determined by linear interpolation from -80 dBW at 1605 MHz to -20 dBW at 1610 MHz, averaged over any 2-millisecond active transmission interval.

25.216(i) The e.i.r.p density of carrier-off state emissions from mobile earth stations manufactured more than six months after FEDERAL REGISTER publication of the rule changes adopted in FCC 03–283 with assigned uplink frequencies between 1 and 3 GHz shall not exceed -80 dBW/MHz in the 1559–1610 MHz band averaged over any 2-millisecond interval.

ISED, RSS-170, Limit Clause 5.9

MESs with transmitting frequencies in the bands 1610-1626.5 MHz and 1626.5-1660.5 MHz shall comply with the unwanted emission limits specified below:

Band 1610-1626.5 MHz:

For MESs with transmitting frequencies between 1610 MHz and 1626.5 MHz, the e.i.r.p. density of unwanted emissions shall not exceed the limits shown below, which are the same as those for the band 1605-1610 MHz, averaged over any 2 ms active transmission interval:

-70 dBW/MHz at 1605 MHz, linearly interpolated to -10 dBW/MHz at 1610 MHz, for broadband emissions
-80 dBW/kHz at 1605 MHz, linearly interpolated to -20 dBW/kHz at 1610 MHz, for discrete emissions

Carrier-off state emissions:

MESs with transmitting frequencies between 1 GHz and 3 GHz shall not exceed -80 dBW/MHz, which is the e.i.r.p. density of carrier-off state emissions in the band 1559-1610 MHz.

2.7.7 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
Power Supply Unit	Hewlett Packard	6282A	132	-	O/P Mon
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	13-Jul-2023
Digital Multi-meter	Iso-tech	IDM93N	4435	12	04-Mar-2024
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	23-Oct-2023
Hygrometer	Rotronic	HP21	4741	12	05-May-2024
EXA	Keysight Technologies	N9010B	4969	24	07-Feb-2024
Attenuator 40dB 100W	Weinschel	48-40-43-LIM	5134	12	10-Feb-2024
3.5mm Cable (1m)	Junkosha	MWX221/B	5838	12	24-Jul-2023

Table 59

O/P Mon – Output monitored using calibrated test equipment.

3 Test Equipment Information

3.1 Customer Support Equipment

Instrument	Manufacturer	Type No	Serial Number	Calibration Period (months)	Calibration Due
Signal Generator	R&S	SMBV100A	257373	36	22-Dec-2025

Table 60

4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Equivalent Isotropic Radiated Power	Conducted: ± 3.2 dB Radiated: ± 6.3 dB (1 GHz to 18 GHz)
Modulation Characteristics	-
Occupied Bandwidth	± 16.74 kHz
Spurious Emissions at Antenna Terminals	± 3.08 dB
Radiated Spurious Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 18 GHz: ± 6.3 dB
Frequency Tolerance	± 3.54 Hz
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	Conducted: ± 3.45 dB Radiated: ± 6.3 dB

Table 61

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.