

FCC and ISED Test Report

Manufacturer: TTP PLC
Model: Velaris Module



In accordance with FCC 47 CFR Part 25, FCC 47 CFR Part 2 and ISED RSS-170 and ISED RSS-GEN,
Technology: (Broadband Global Area Network)

Prepared for: TTP PLC
TTP Campus, Cambridge Road
Melbourn, SG8 6HQ

FCC ID: 2BO4Q-VMODULE200A IC: 33922-VMODULE200A

COMMERCIAL-IN-CONFIDENCE
Document 75962190-21 Issue 03

SIGNATURE			
NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Stephen Marshall	Senior Engineer	Authorised Signatory	31 July 2025

Signatures in this approval box have checked this document in line with the requirements of TUV SUD 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 25, FCC 47 CFR Part 2 and ISED RSS-170 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	Ahmad Javid	31 July 2025	
	Pier-Angelo Lorusso	31 July 2025	
	George Williams	31 July 2025	

FCC Accreditation ISED Accreditation
492497/UK2010 Octagon House, Fareham Test Laboratory 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 25: 2024, FCC 47 CFR Part 2: 2023, 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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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 May 2025
2	Update to application form	24 June 2025
3	Amendment of BGAN antenna gain from 2.5 dBi to 3.5 dBi	30 July 2025

Table 1

1.2 Introduction

Applicant	TTP PLC
Manufacturer	Gotonomi
Model Number(s)	Velaris Module
Serial Number(s)	SN681007 and SN681031
Hardware Version(s)	1
Software Version(s)	1.5.8931
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 25: 2024 FCC 47 CFR Part 2: 2023 ISED RSS-170: Issue 4 (09-2022) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number	PURORDTTP23503/PUROR
Date	06-August-2024
Date of Receipt of EUT	13-September-2024
Start of Test	26-September-2024
Finish of Test	29-April-2025
Name of Engineer(s)	Ahmad Javid, Pier-Angelo Lorusso, Matthew Russell and George Williams
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 25, FCC 47 CFR Part 2 and ISSED RSS-170 and ISSED RSS-GEN is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	Part 25	Part 2	RSS-170	RSS-GEN			
Configuration and Mode: Velaris Module - 1.6 GHz communications link							
2.1	25.202 (f)	2.1053	5.8	6.13	Radiated Spurious Emissions	Pass	ANSI C63.26 (2015)
2.2	-	2.1047 (d)	-	-	Modulation Characteristics	Declaration	
2.3	-	2.1049	-	6.7	Occupied Bandwidth	Pass	ANSI C63.26 (2015)
2.4	25.202 (d)	2.1055	5.3	6.11	Frequency Tolerance	Pass	ANSI C63.26 (2015)
2.5	25.202 (f)	2.1051	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	ANSI C63.26 (2015)
2.6	25.204	2.1046	5.5	6.12	Equivalent Isotropic Radiated Power	Pass	ANSI C63.26 (2015)
2.7	25.216	-	5.9 and 5.10	-	Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	Pass	ANSI C63.26 (2015)



1.4 Application Form

Equipment Description

Technical Description: <i>(Please provide a brief description of the intended use of the equipment including the technologies the product supports)</i>		Mobile earth station satellite communication data modem L-Band, up to 200kbps	
Manufacturer:		Gotonomi	
Model:		Velaris Module	
Part Number:		VM01	
Hardware Version:		1	
Software Version:		1.5.8931	
FCC ID of the product under test – see guidance here		2B04Q-VMODULE200A	
IC ID of the product under test – see guidance here		33922-VMODULE200A	
Device Category	Mobile <input type="checkbox"/>	Portable <input checked="" type="checkbox"/>	Fixed <input checked="" type="checkbox"/>
Equipment is fitted with an Audio Low Pass Filter		Yes <input type="checkbox"/>	No <input type="checkbox"/>

Table 2

Intentional Radiators

Technology	BGAN
Frequency Range (MHz to MHz)	1626.5 - 1660.5
Conducted Declared Output Power (dBm)	37.5
Antenna Gain (dBi)	3.5
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	200kHz
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	QPSK/QAM
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	200KX2D
Bottom Frequency (MHz)	1626.5
Middle Frequency (MHz)	1643.5
Top Frequency (MHz)	1660.5

Table 3



Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	1660.5
Lowest frequency generated or used in the device or on which the device operates or tunes	26MHz
Class A Digital Device (Use in commercial, industrial or business environment) <input checked="" type="checkbox"/>	
Class B Digital Device (Use in residential environment only) <input type="checkbox"/>	

Table 4

AC Power Source

AC supply frequency:	-	Hz
Voltage	-	V
Max current:	-	A
Single Phase <input type="checkbox"/> Three Phase <input type="checkbox"/>		

Table 5

DC Power Source

Nominal voltage:	24	V
Extreme upper voltage:	30	V
Extreme lower voltage:	18	V
Max current:	3	A

Table 6

Battery Power Source

Voltage:	-	V
End-point voltage:	-	V (Point at which the battery will terminate)
Alkaline <input type="checkbox"/> Leclanche <input type="checkbox"/> Lithium <input type="checkbox"/> Nickel Cadmium <input type="checkbox"/> Lead Acid* <input type="checkbox"/> *(Vehicle regulated)		
Other <input type="checkbox"/>	Please detail:	

Table 7

Charging

Can the EUT transmit whilst being charged	Yes <input type="checkbox"/> No <input type="checkbox"/>
---	--

Table 8

Temperature

Minimum temperature:	Ambient	°C
Maximum temperature:	85	°C

Table 9



Cable Loss

Adapter Cable Loss (Conducted sample)	0	dB
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Table 10

Antenna Characteristics

Antenna connector <input type="checkbox"/>			State impedance	50	Ohm
Temporary antenna connector <input type="checkbox"/>			State impedance		Ohm
Integral antenna <input type="checkbox"/>	Type:		Gain		dBi
External antenna <input checked="" type="checkbox"/>	Type:	200-A	Gain	3.5	dBi
<p>For external antenna only:</p> <p>Standard Antenna Jack <input checked="" type="checkbox"/> If yes, describe how user is prohibited from changing antenna (if not professional installed): By instruction</p> <p>Equipment is only ever professionally installed <input checked="" type="checkbox"/></p> <p>Non-standard Antenna Jack <input type="checkbox"/></p> <p>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.</p>					

Table 11

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

Table 12

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

Name: Roderick van den Bergh
Position held: Operations Manager
Date: 11/9/24



1.5 Product Information

1.5.1 Technical Description

Mobile earth station satellite communication data modem L-Band, up to 200kbps.

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: Velaris Module, Serial Number: SN681034			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: Velkaris Module, Serial Number: SN681007			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 13



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: Velaris Module - 1.6 GHz communications link		
Radiated Spurious Emissions	Ahmad Javid and Pier-Angelo Lorusso	UKAS
Modulation Characteristics	Matthew Russell	UKAS
Occupied Bandwidth	Matthew Russell	UKAS
Frequency Tolerance	George Williams	UKAS
Spurious Emissions at Antenna Terminals	Matthew Russell and Pier-Angelo Lorusso	UKAS
Equivalent Isotropic Radiated Power	Matthew Russell	UKAS
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	Matthew Russell	UKAS

Table 14

Office Address:

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



2 Test Details

2.1 Radiated Spurious Emissions

2.1.1 Specification Reference

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

2.1.2 Equipment Under Test and Modification State

Velaris Module, S/N: SN681007 - Modification State 0

2.1.3 Date of Test

26-September-2024 to 01-October-2024

2.1.4 Test Method

A preliminary profile of 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. Profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

The DUT was configured with the customer supplied antenna Chelton HOA2/1.6.

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:

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

$82.2 \text{ (dBuV/m)} + 20\log(3) - 104.8 = \text{EIRP (dBm)}$

$-13.0 = \text{EIRP (dBm)}$

2.1.5 Example Test Setup Diagram

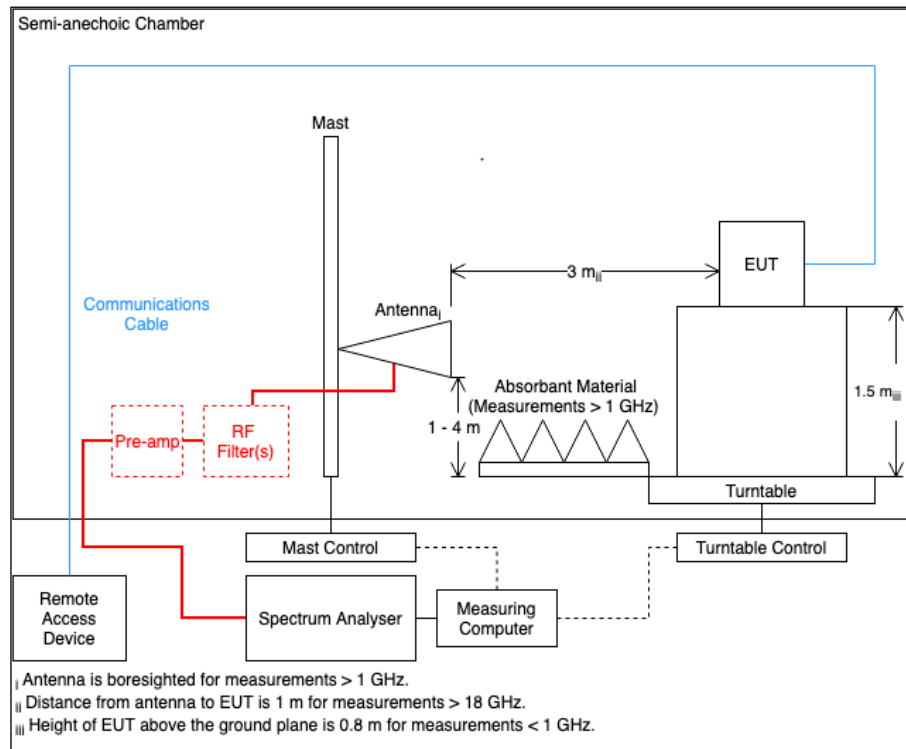


Figure 1

2.1.6 Environmental Conditions

Ambient Temperature	20.3 - 23.3 °C
Relative Humidity	50.6 - 54.4 %

2.1.7 Test Results

Velaris Module - 1.6 GHz communications link

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

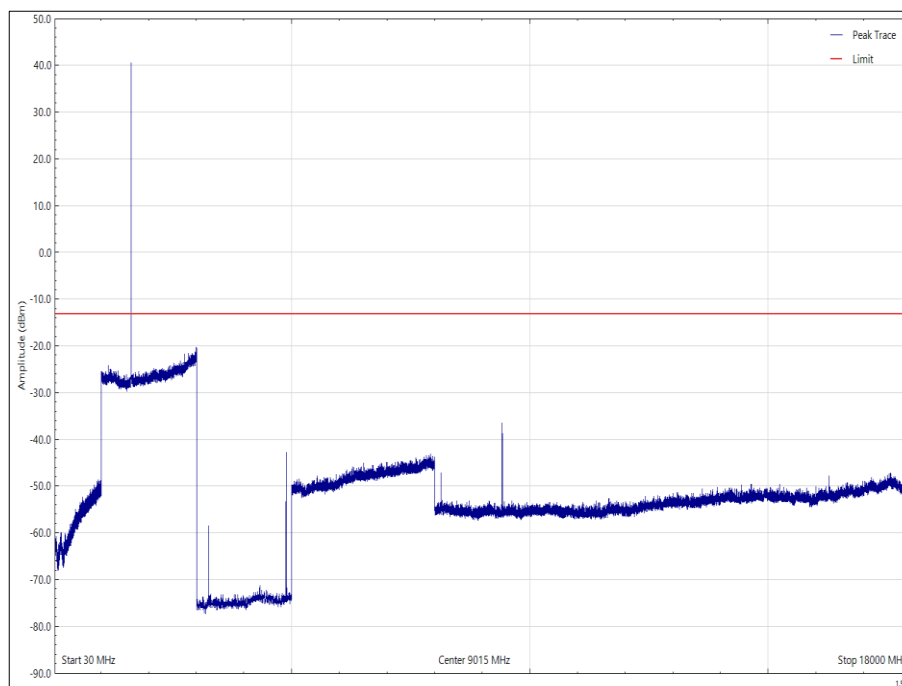


Figure 2 - 1626.712 MHz - 30 MHz to 18 GHz, Horizontal, X Orientation

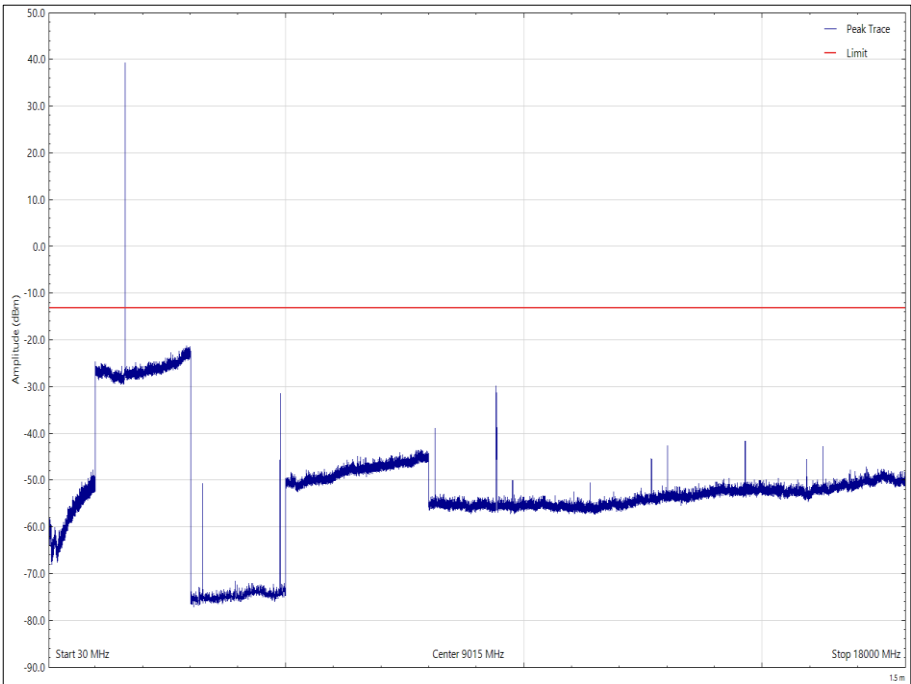


Figure 3 - 1626.712 MHz - 30 MHz to 18 GHz, Vertical, X Orientation

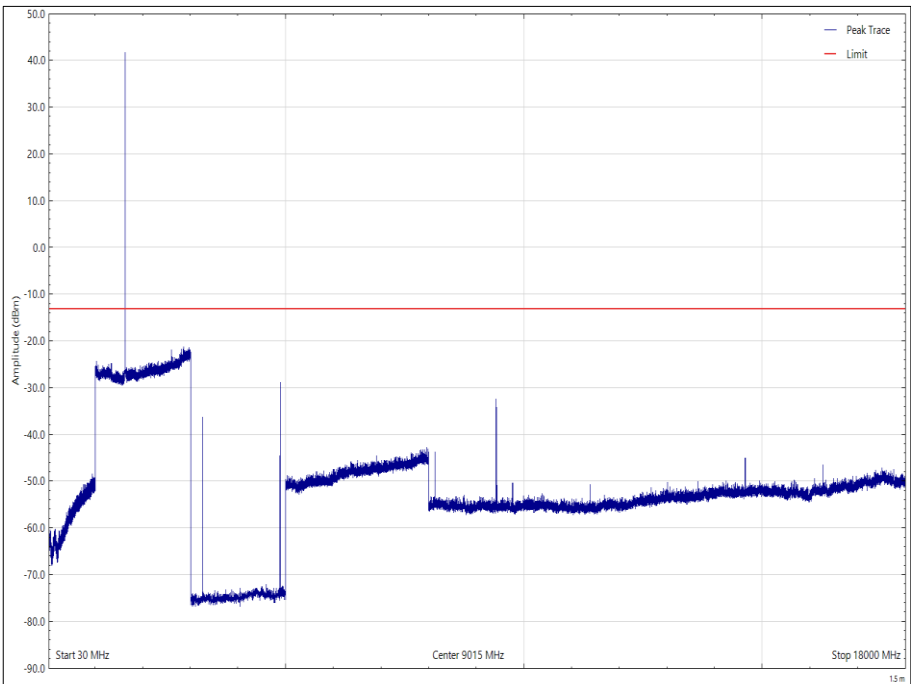


Figure 4 - 1626.712 MHz - 30 MHz to 18 GHz, Horizontal, Y Orientation

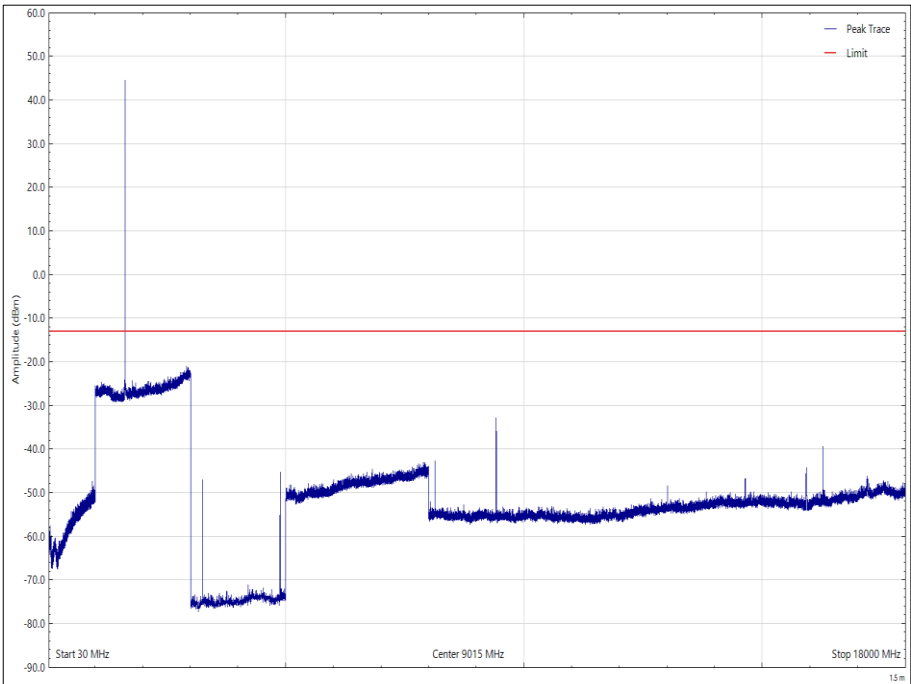


Figure 5 - 1626.712 MHz - 30 MHz to 18 GHz, Vertical, Y Orientation

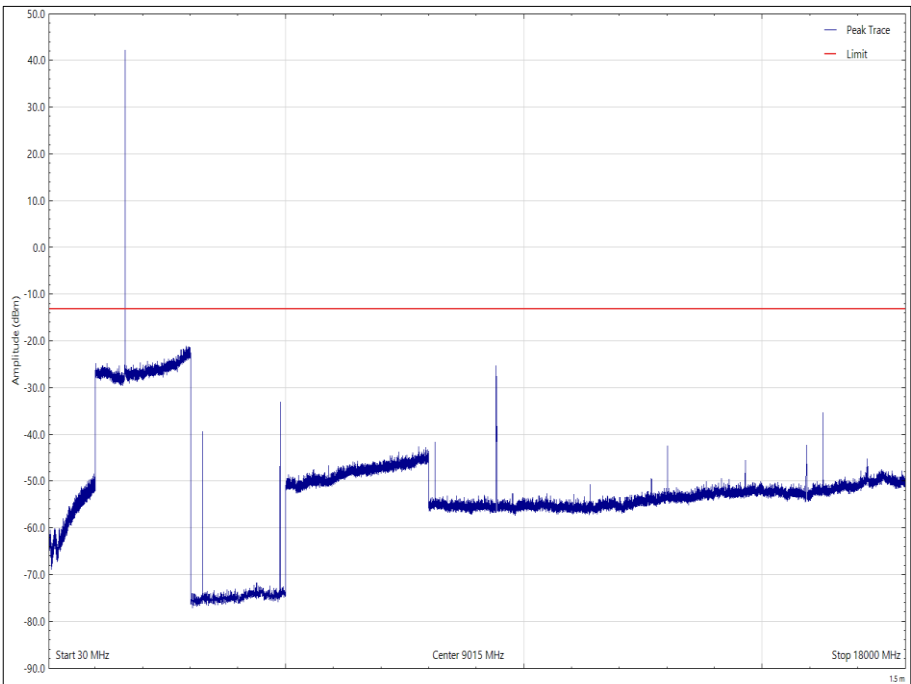


Figure 6 - 1626.712 MHz - 30 MHz to 18 GHz, Horizontal, Z Orientation

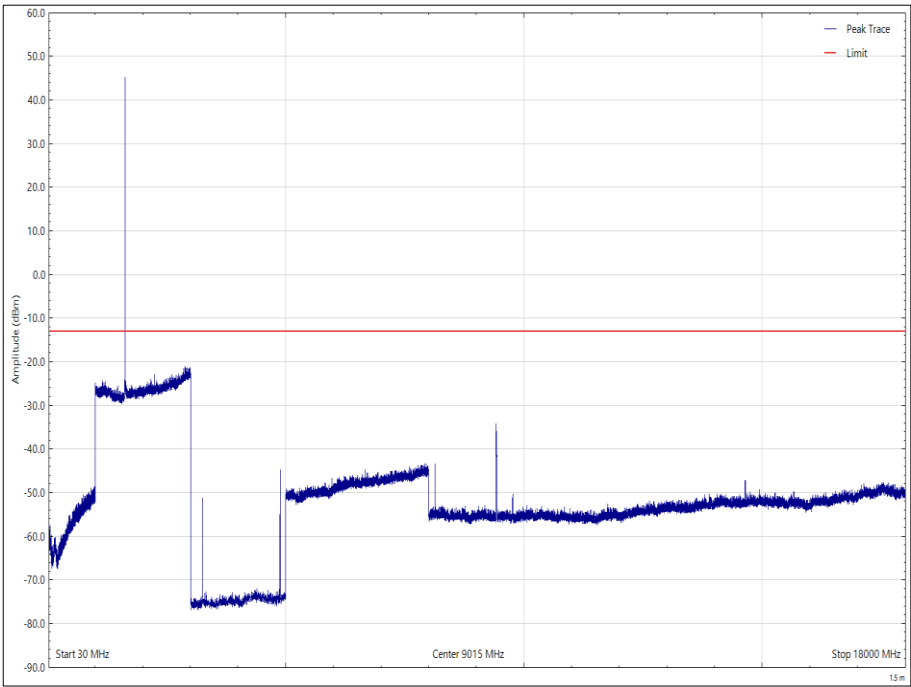


Figure 7 - 1626.712 MHz - 30 MHz to 18 GHz, Vertical, Z Orientation



Frequency (MHz)	Level (dBm)	Polarisation	Orientation
9424.875	X		

Table 15 - 1643.500 MHz, 30 MHz to 18GHz

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

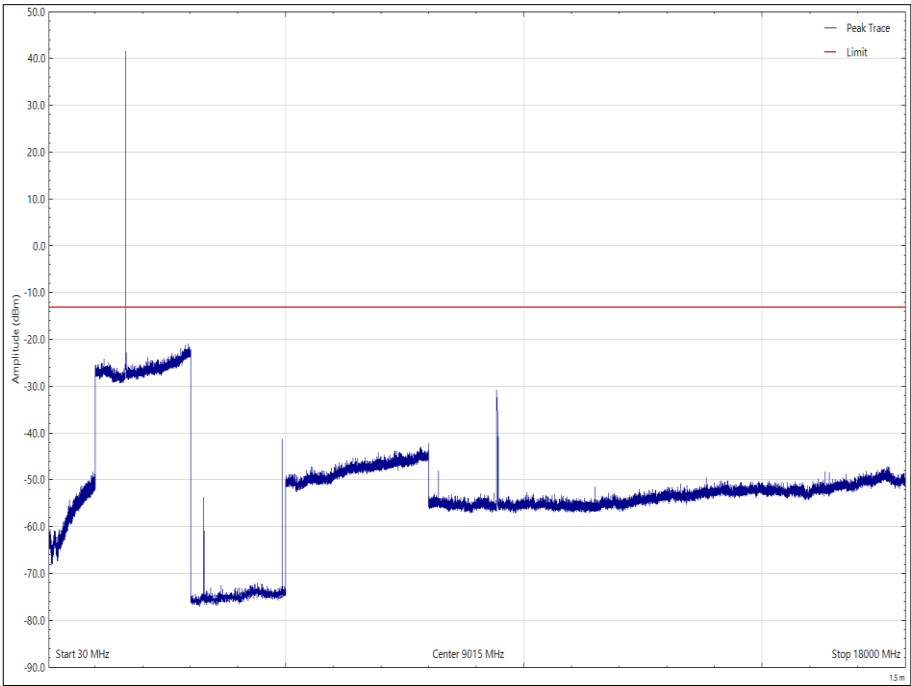


Figure 8 - 1643.500 MHz - 30 MHz to 18 GHz, Horizontal, X Orientation

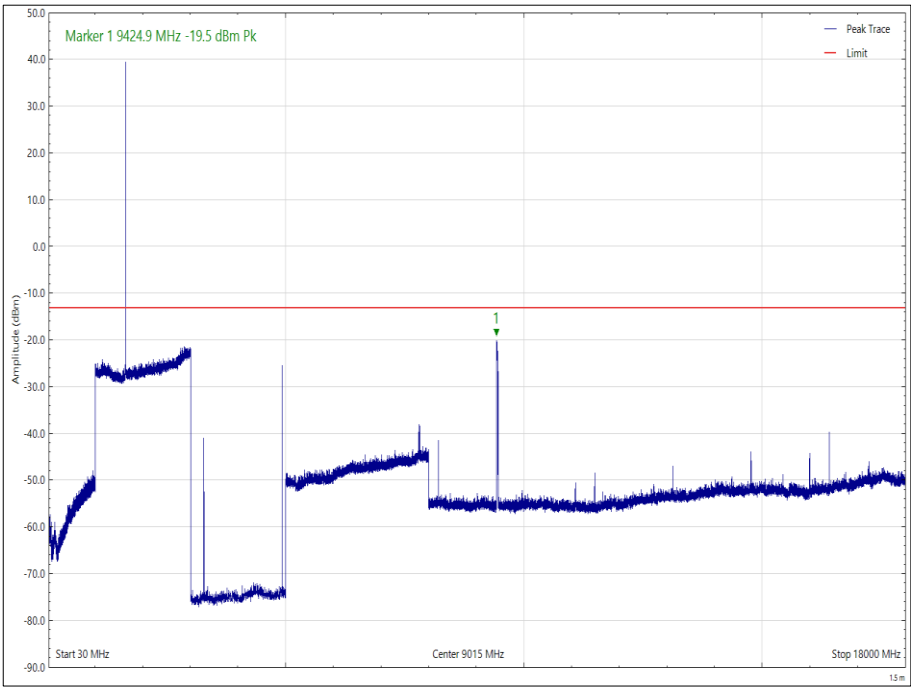


Figure 9 - 1643.500 MHz - 30 MHz to 18 GHz, Vertical, X Orientation

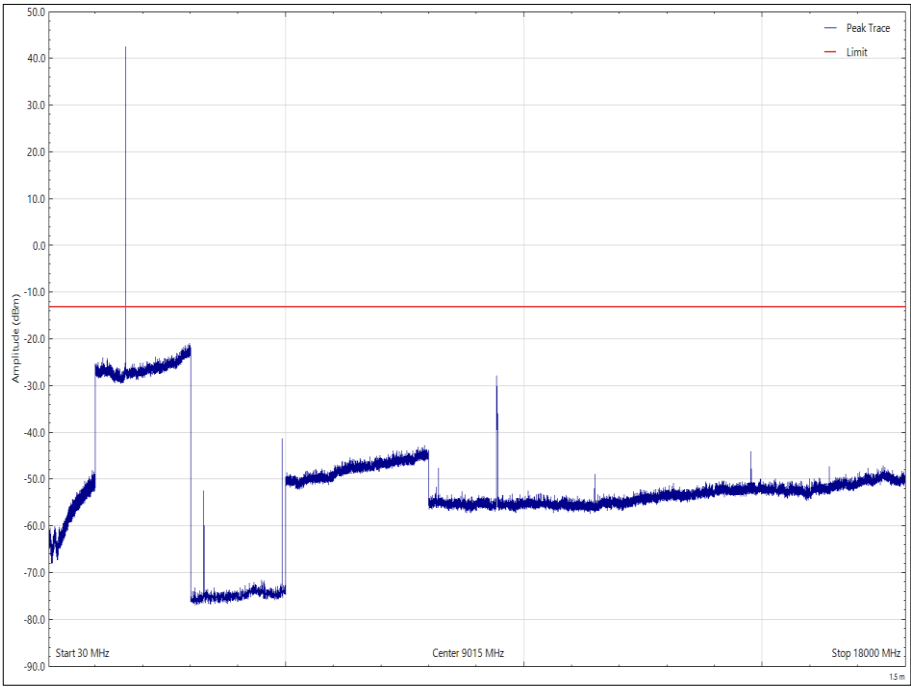


Figure 10 - 1643.500 MHz - 30 MHz to 18 GHz, Horizontal, Y Orientation

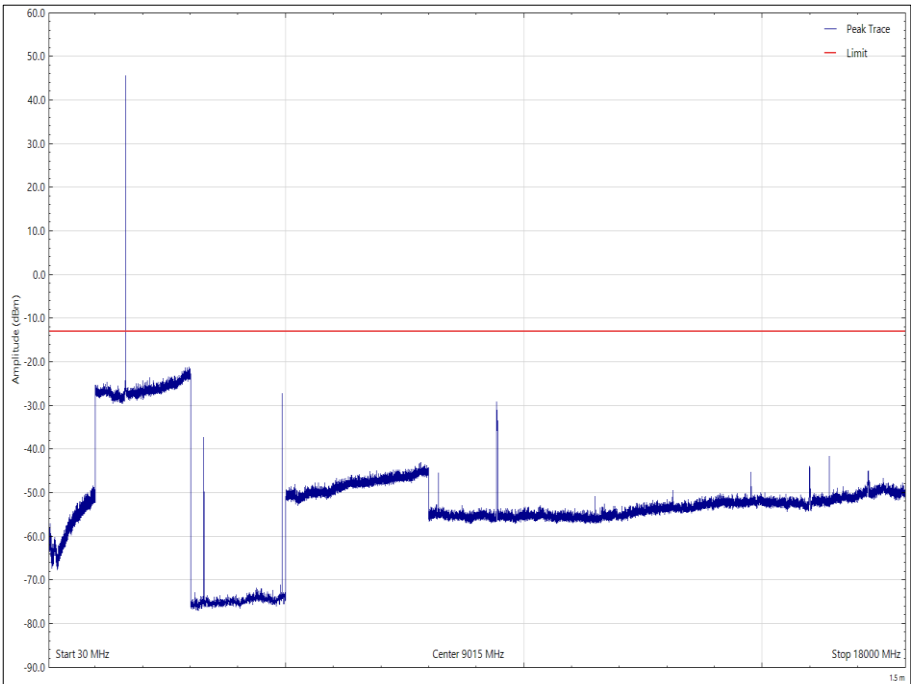


Figure 11 - 1643.500 MHz - 30 MHz to 18 GHz, Vertical, Y Orientation

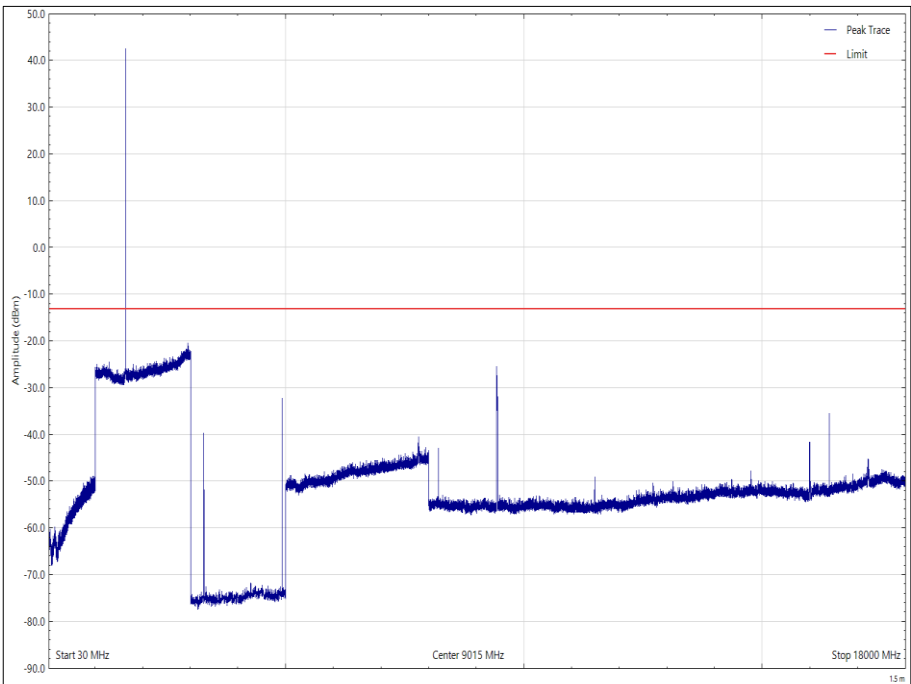


Figure 12 - 1643.500 MHz - 30 MHz to 18 GHz, Horizontal, Z Orientation

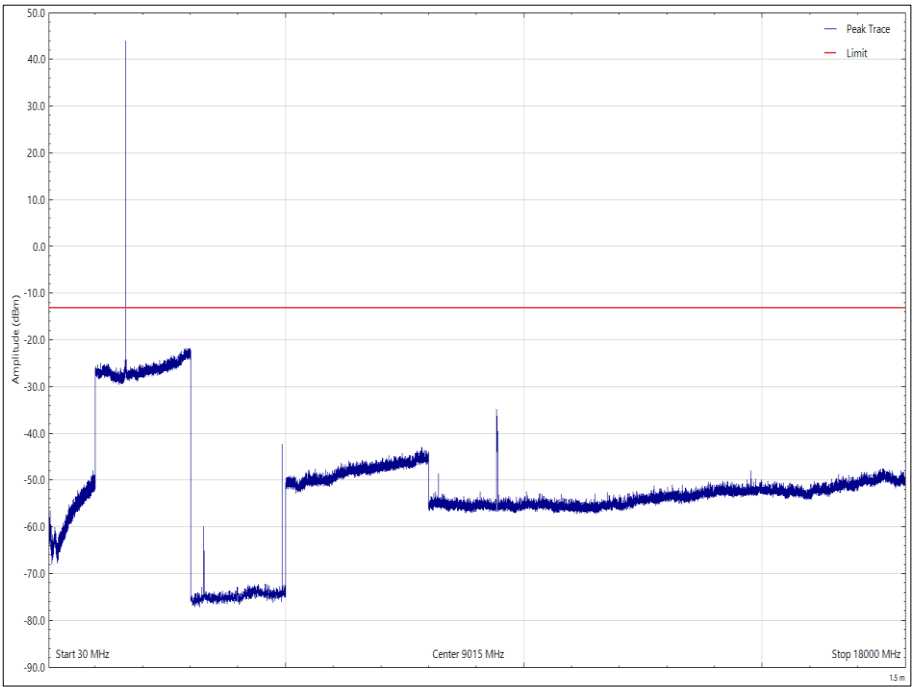


Figure 13 - 1643.500 MHz - 30 MHz to 18 GHz, Vertical, Z Orientation



Frequency (MHz)	Level (dBm)	Polarisation	Orientation
9425.915	X		

Table 16 - 1660.288 MHz, 30 MHz to 18GHz

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

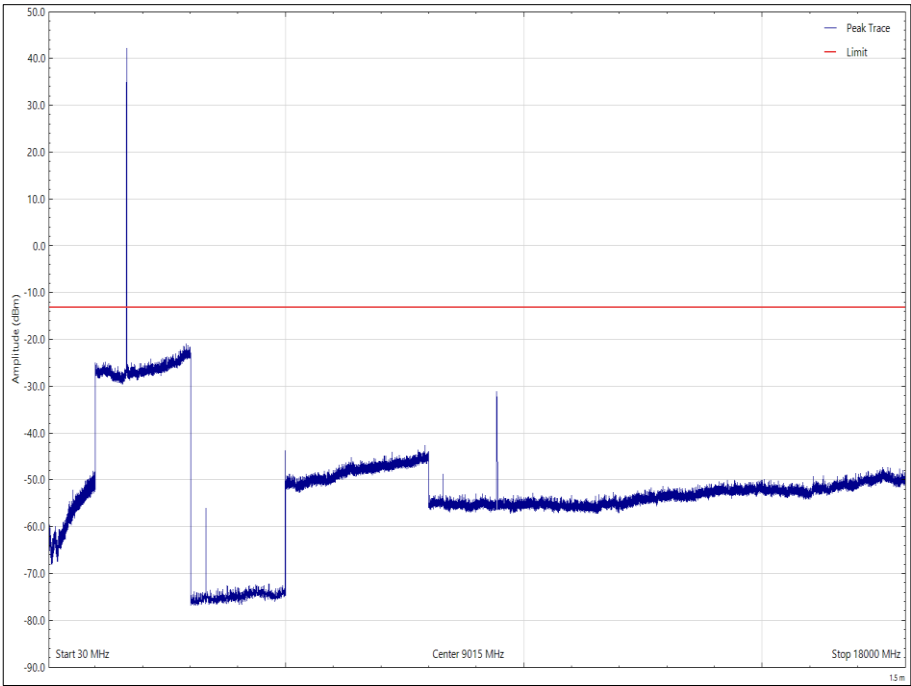


Figure 14 - 1660.288 MHz - 30 MHz to 18 GHz, Horizontal, X Orientation

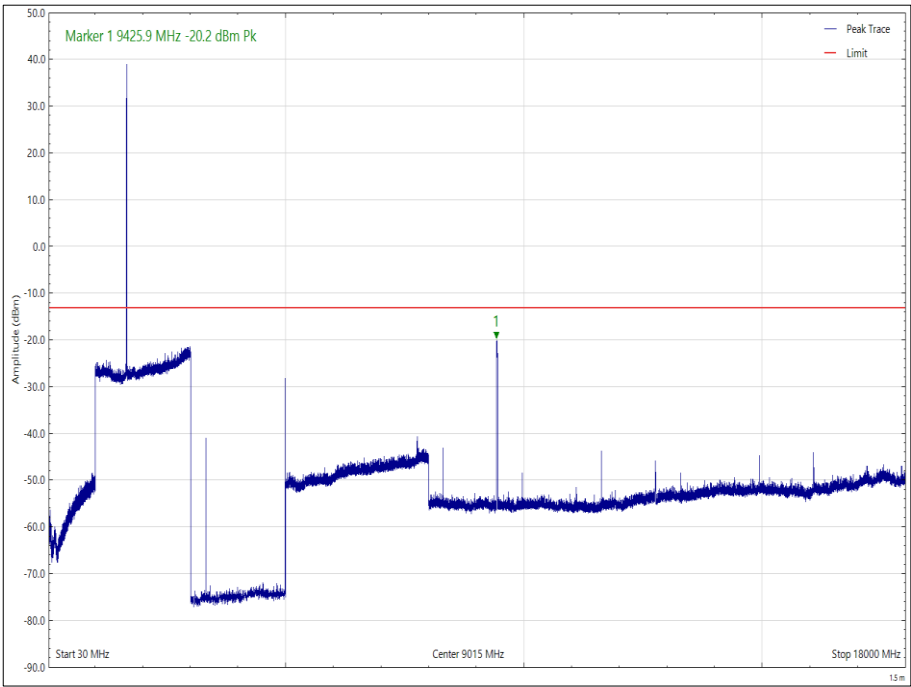


Figure 15 - 1660.288 MHz - 30 MHz to 18 GHz, Vertical, X Orientation

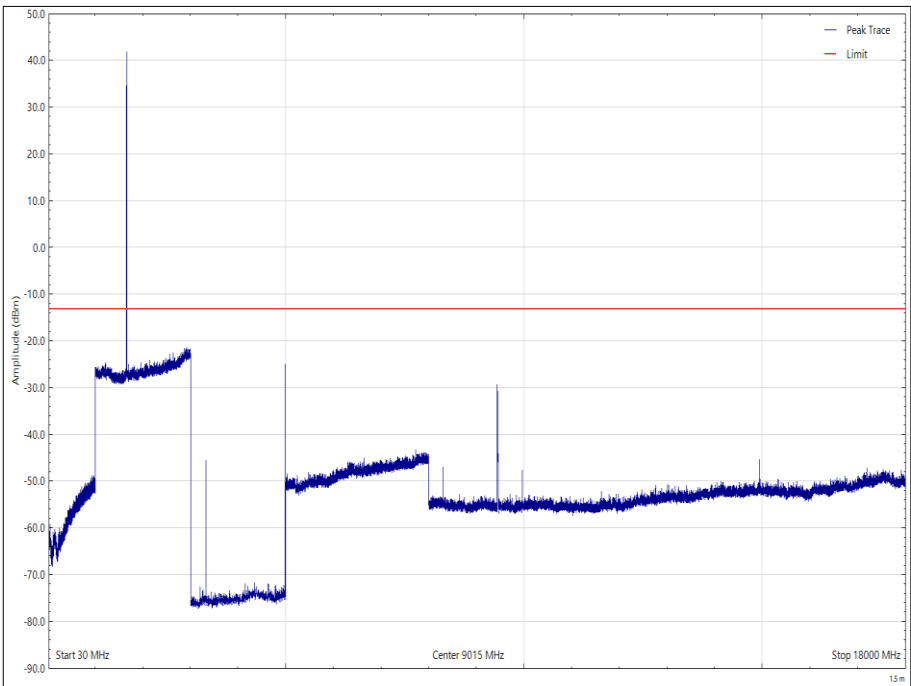


Figure 16 - 1660.288 MHz - 30 MHz to 18 GHz, Horizontal, Y Orientation

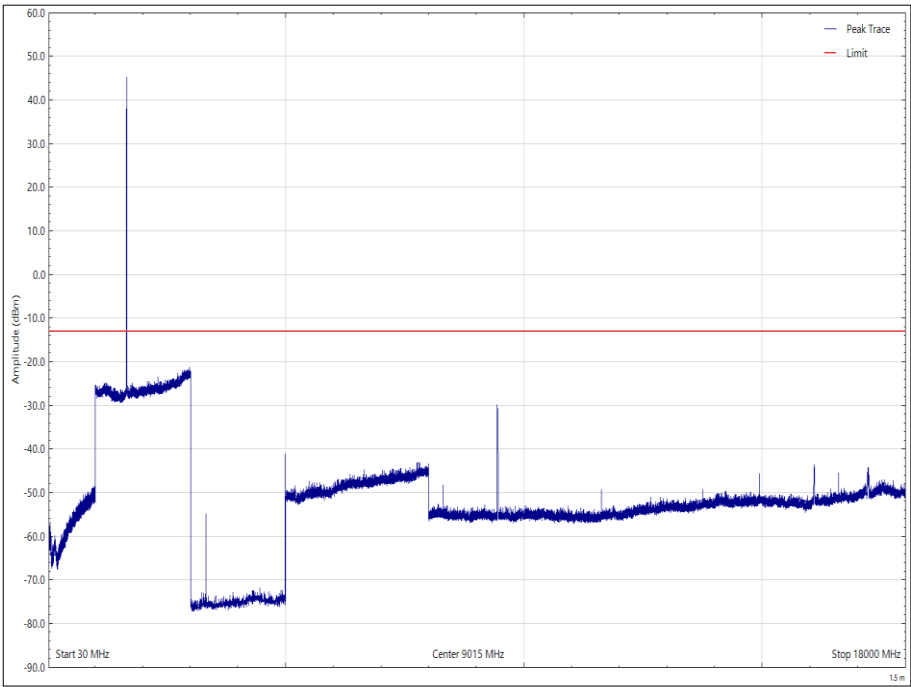


Figure 17 - 1660.288 MHz - 30 MHz to 18 GHz, Vertical, Y Orientation

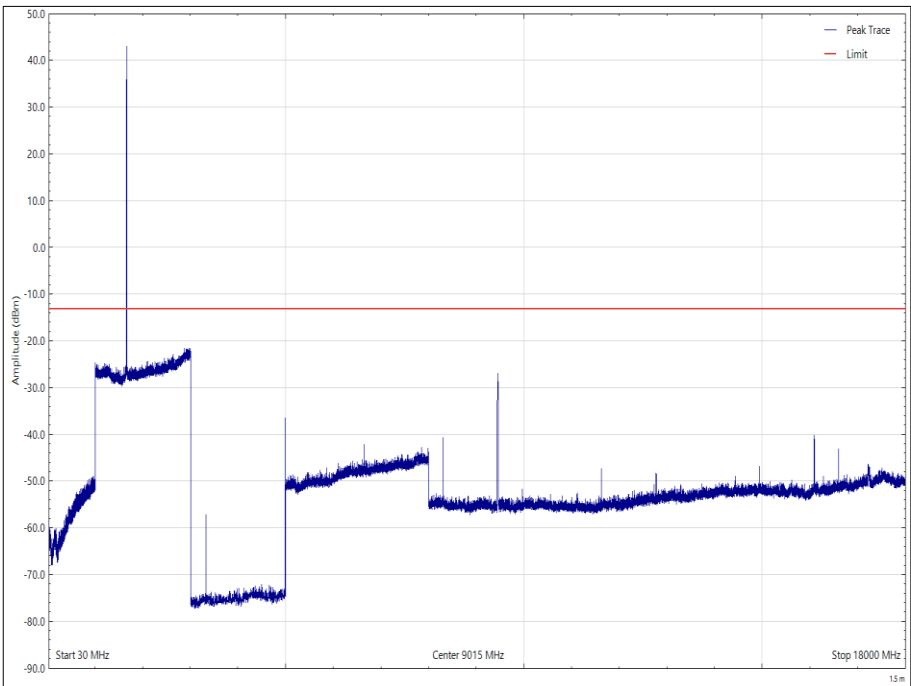


Figure 18 - 1660.288 MHz - 30 MHz to 18 GHz, Horizontal, Z Orientation

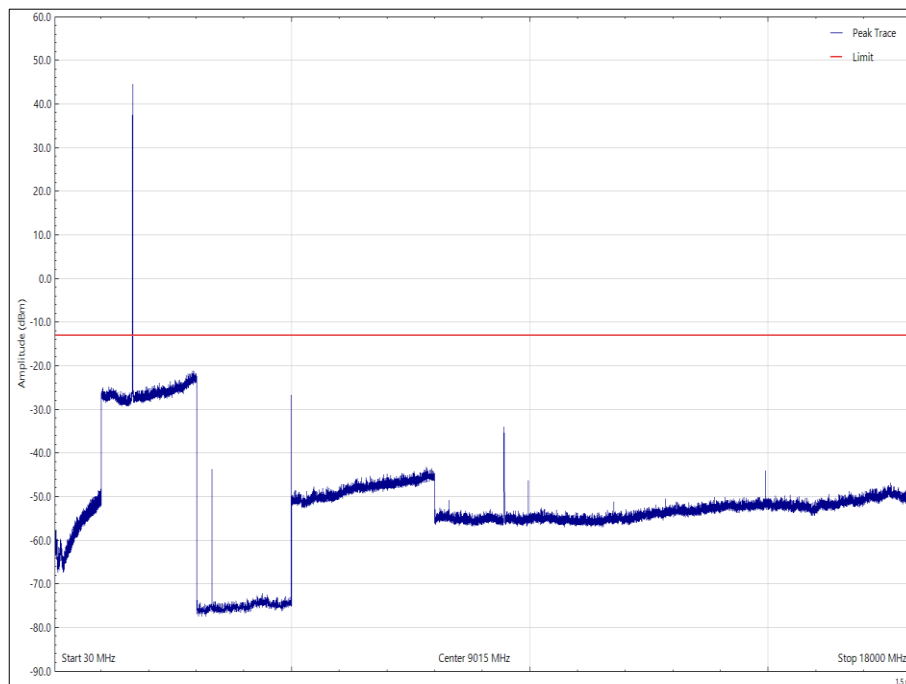


Figure 19 - 1660.288 MHz - 30 MHz to 18 GHz, Vertical, Z Orientation

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.



2.1.8 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
Dual Power Supply Unit	Hewlett Packard	6253A	292	-	O/P Mon
True RMS Multimeter	Fluke	179	4007	12	17-Nov-2024
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4519	12	01-Feb-2025
Test Receiver	Rohde & Schwarz	ESW44	5084	12	04-Nov-2024
Emissions Software	TUV SUD	EmX V3.5.1	5125	-	Software
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
Antenna (DRG, 1 GHz to 10.5 GHz)	Schwarzbeck	BBHA9120B	5215	12	14-Jul-2025
Antenna (DRG, 7.5 GHz to 18 GHz)	Schwarzbeck	HWRD750	5216	12	14-Jul-2025
3 GHz High pass filter	Wainwright	WHKX12-2580-3000-18000-80SS	5220	12	03-Apr-2025
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
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-02000AMSAMS/A	5518	12	18-Apr-2025
7 GHz High pass Filter	Wainwright	WHKX12-5850-6800-18000-80SS	5550	12	30-May-2025
Pre-Amplifier (8 GHz to 18 GHz)	Wright Technologies	APS06-0061	5595	12	26-Oct-2024
TRILOG Super Broadband Test Antenna	Schwarzbeck	VULB 9168	5942	24	24-May-2026
Cable (N to N 8m)	Junkosha	MWX221-08000NMSNMS/B	6330	6	17-Feb-2025
Spectrum Analyser	Anritsu	MT8821C	6542	12	28-Jun-2025

Table 17

TU - Traceability Unscheduled

O/P Mon – Output Monitored using calibrated 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

Velaris Module

2.2.3 Test Method

A declaration was made by the applicant.

2.2.4 Environmental Conditions

Ambient Temperature °C
Relative Humidity %

2.2.5 Test Results

Velaris Module - 1.6 GHz communications link

The following description was provided by the applicant:

The equipment under test can employ the following digital modulation schemes:

- QPSK
- p4-QPSK
- 16-QAM
- 32-QAM
- 64-QAM

Depending on the symbol rate used the channel bandwidth will vary as per the table below:

Symbol Rate	Nominal Channel Bandwidth (kHz)
16800	24
33000	48
67200	96
84000	102
151200	204
168000	204

Table 18

Measurements of occupied bandwidth are contained within this report.



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.

ISED RSS-170, Limit Clause 5.5

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



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

Velaris Module, S/N: SN681007 - Modification State 0

2.3.3 Date of Test

28-April-2025

2.3.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.4.4.

As the occupied bandwidth was shown to be the same across all modulation schemes, only plots for QPSK have been included in this report.

2.3.5 Environmental Conditions

Ambient Temperature	21.1 °C
Relative Humidity	45.1 %



2.3.6 Test Results

Velaris Module - 1.6 GHz communications link

Mode	Occupied Bandwidth (kHz)		
	Bottom Channel	Middle Channel	Top Channel
QPSK - 16800 kbps	18.832	18.648	18.677
QPSK - 33000 kbps	37.215	37.112	36.756
QPSK - 672000 kbps	75.015	74.814	74.407
QPSK - 84000 kbps	86.583	87.521	87.319
QPSK - 151200 kbps	167.93	167.70	168.07
QPSK - 168000 kbps	174.62	174.93	174.50
p4 QPSK - 16800 kbps	18.612	18.647	18.638
p4 QPSK - 33000 kbps	37.447	37.268	37.358
p4 QPSK - 672000 kbps	74.388	74.263	74.382
p4 QPSK - 84000 kbps	86.956	87.209	86.102
p4 QPSK - 151200 kbps	166.78	166.86	167.19
p4 QPSK - 168000 kbps	174.06	173.65	173.87
16-QAM - 16800 kbps	18.500	18.677	18.669
16-QAM - 33000 kbps	37.018	37.328	37.275
16-QAM - 672000 kbps	74.804	74.238	74.660
16-QAM - 84000 kbps	86.700	7487.182	87.339
16-QAM - 151200 kbps	168.76	168.19	167.59
16-QAM - 168000 kbps	173.90	175.01	173.98
32-QAM - 16800 kbps	18.530	18.579	18.562
32-QAM - 33000 kbps	37.509	37.328	37.531
32-QAM - 672000 kbps	75.723	74.206	74.543
32-QAM - 84000 kbps	87.228	87.326	87.118
32-QAM - 151200 kbps	167.11	166.15	167.39
32-QAM - 168000 kbps	173.88	176.82	174.70
64-QAM - 16800 kbps	18.768	18.614	18.469
64-QAM - 33000 kbps	37.800	37.166	37.372
64-QAM - 672000 kbps	75.037	74.101	73.960
64-QAM - 84000 kbps	87.297	86.824	87.470
64-QAM - 151200 kbps	168.00	166.95	167.160
64-QAM - 168000 kbps	174.83	174.35	175.020

Table 19 - Occupied Bandwidth

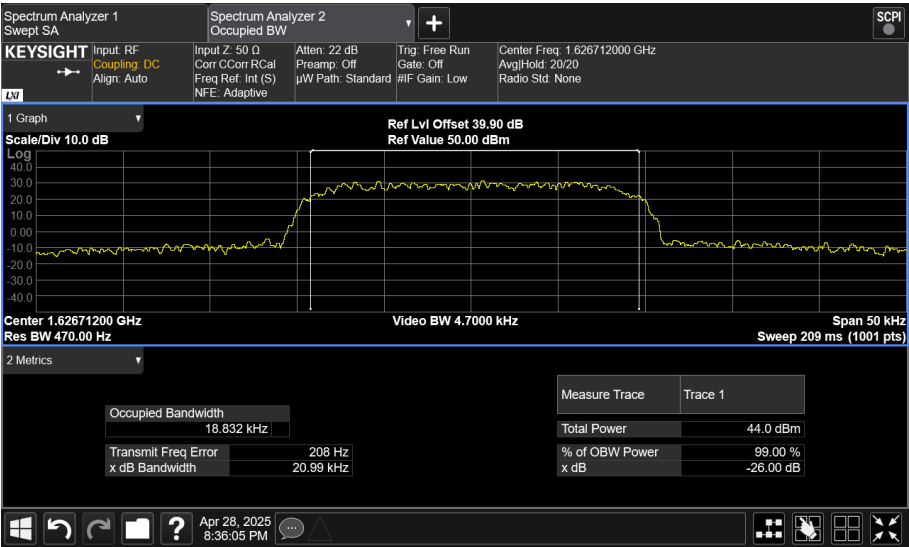


Figure 20 - Bottom Channel, QPSK - 16800 kbps

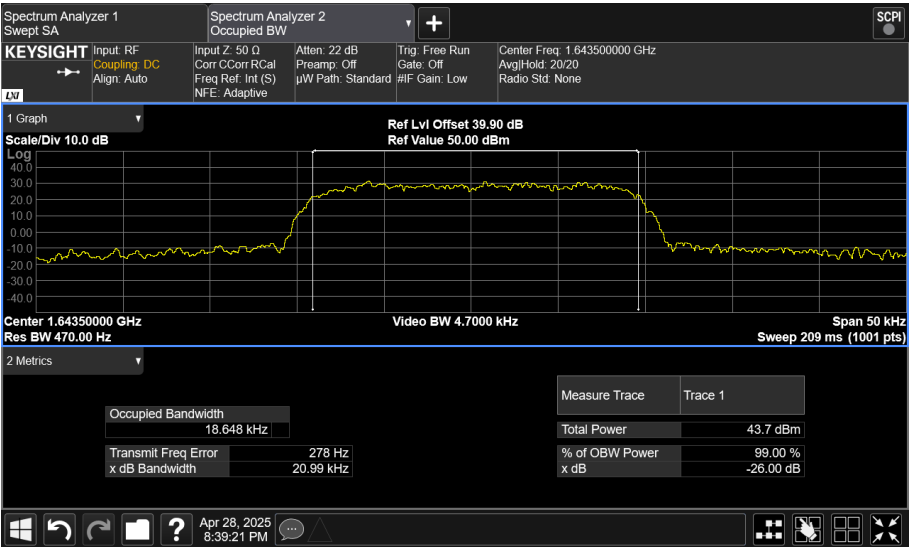


Figure 21- Middle Channel, QPSK – 16800 kbps

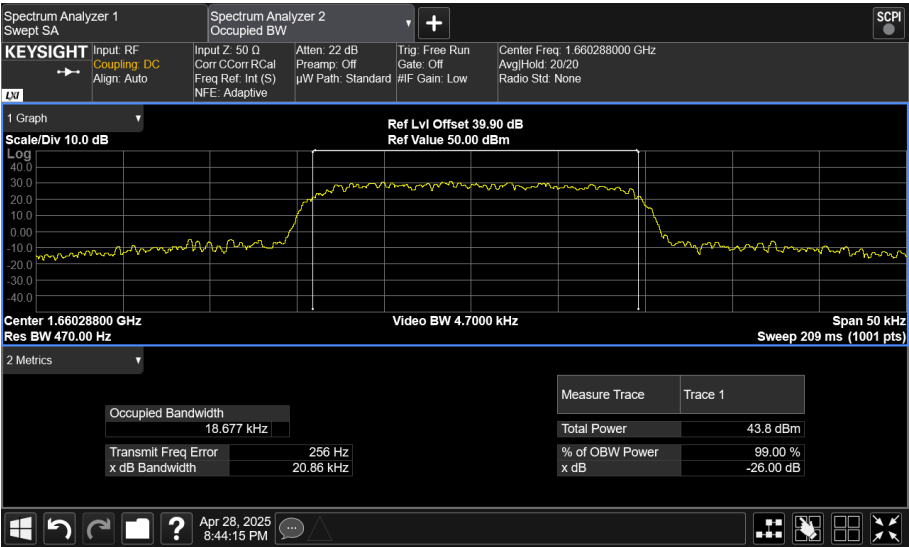


Figure 22 - Top Channel, QPSK - 16800 kbps

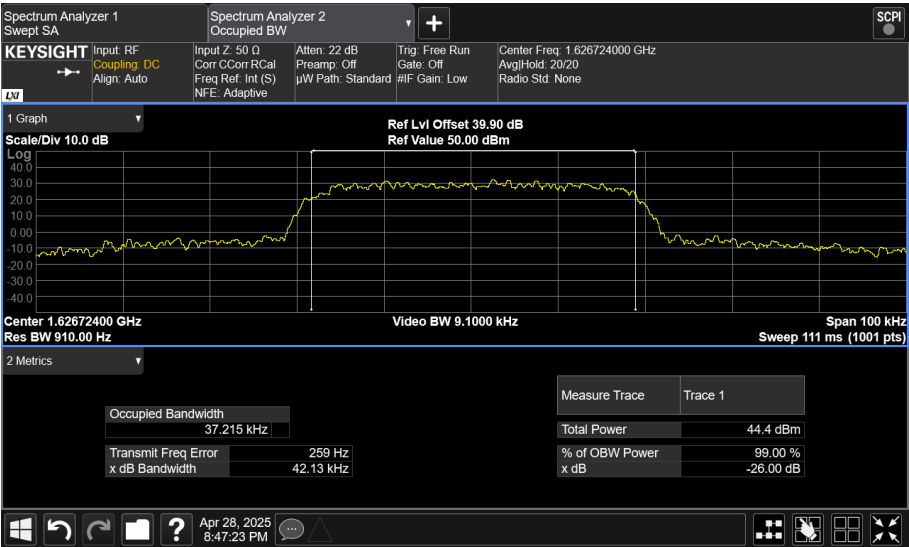


Figure 23 - Bottom Channel, QPSK - 33000 kbps

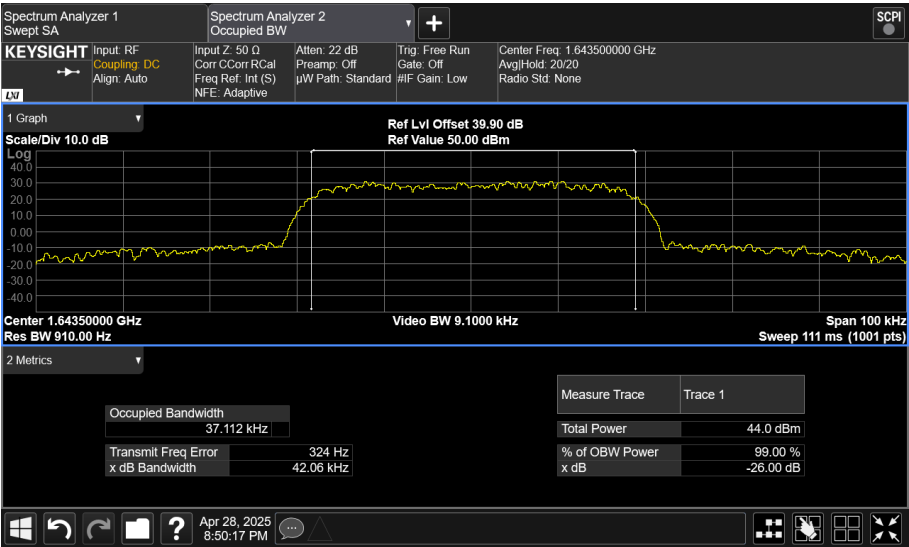


Figure 24 - Middle Channel, QPSK - 33000 kbps

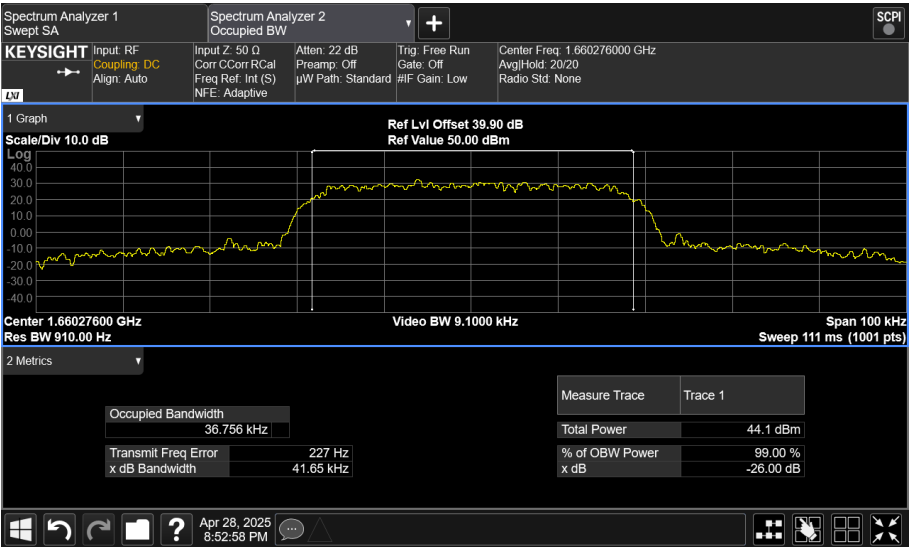


Figure 25 - Top Channel, QPSK - 33000 kbps

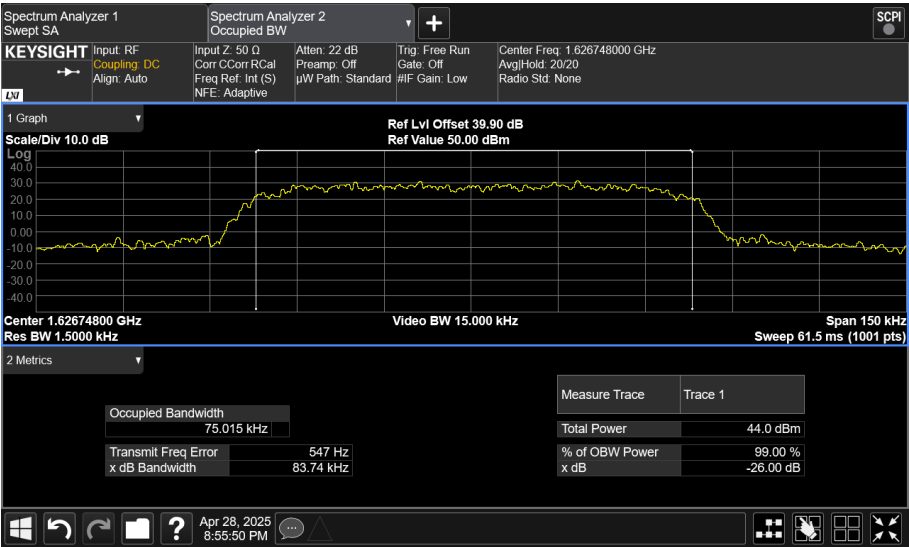


Figure 26 - Bottom Channel, QPSK - 672000 kbps

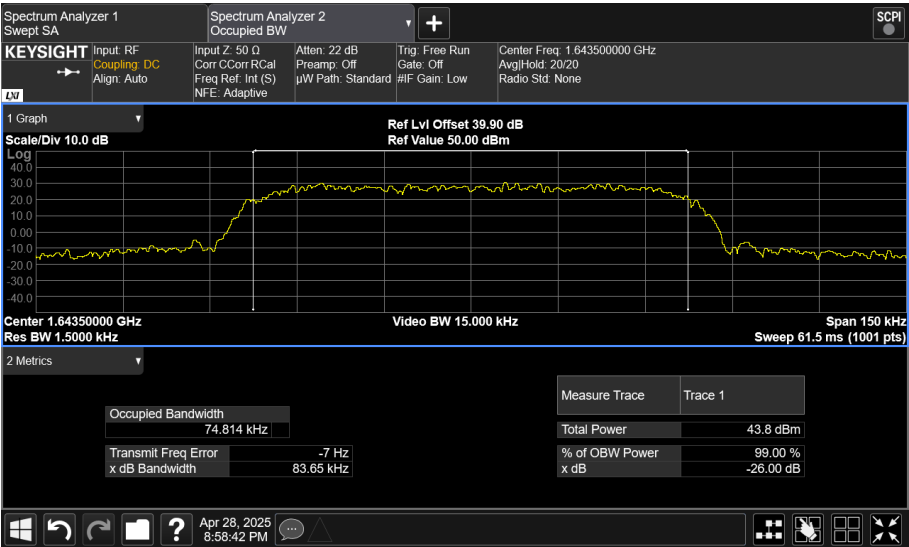


Figure 27 - Middle Channel, QPSK, 67000 kbps

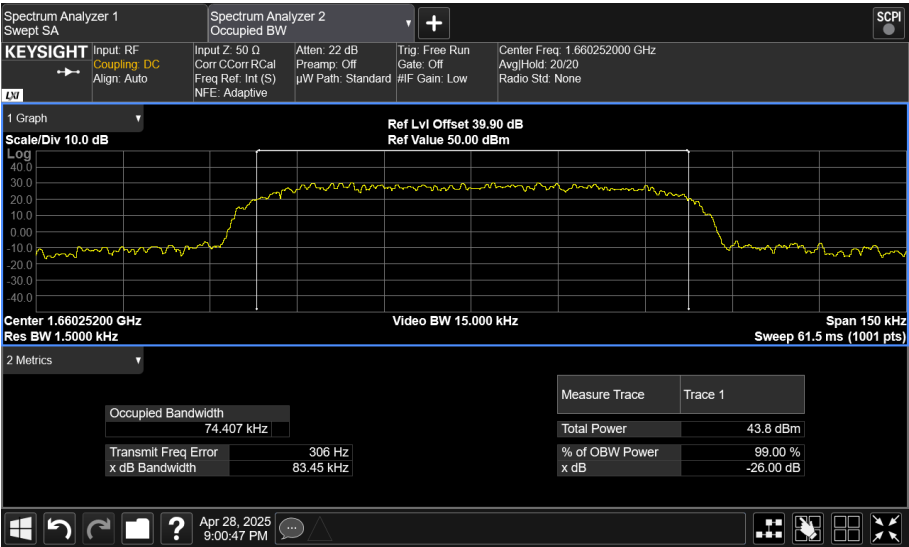


Figure 28 - Top Channel, QPSK - 672000 kbps

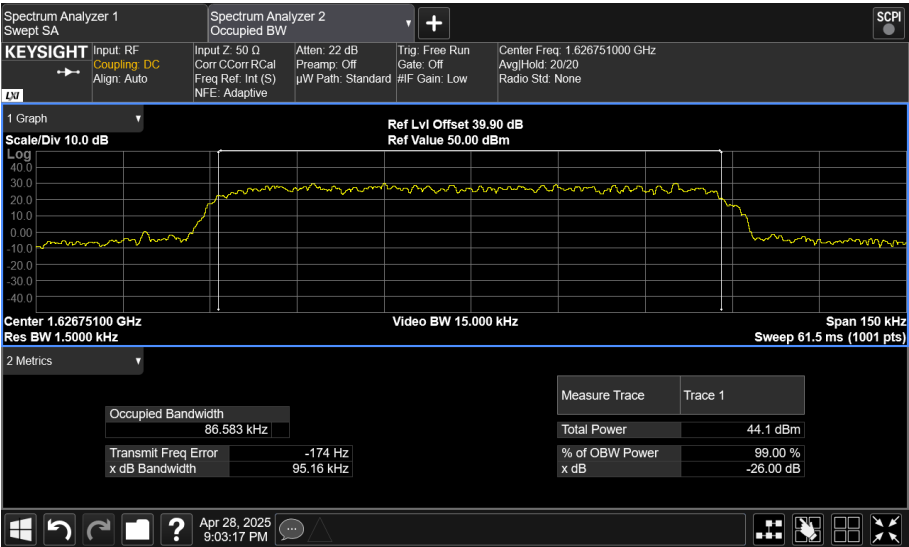


Figure 29 - Bottom Channel, QPSK - 84000 kbps

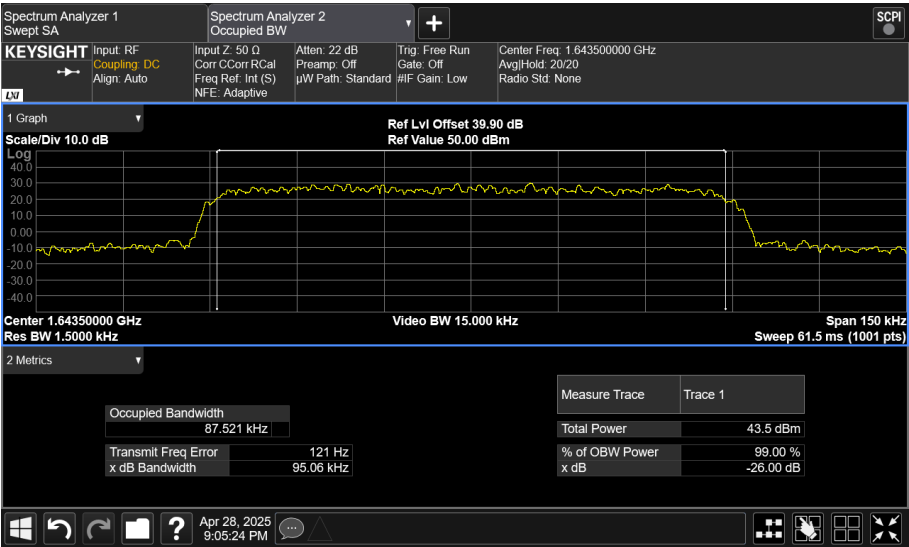


Figure 30 - Middle Channel, QPSK, 84000 kbps

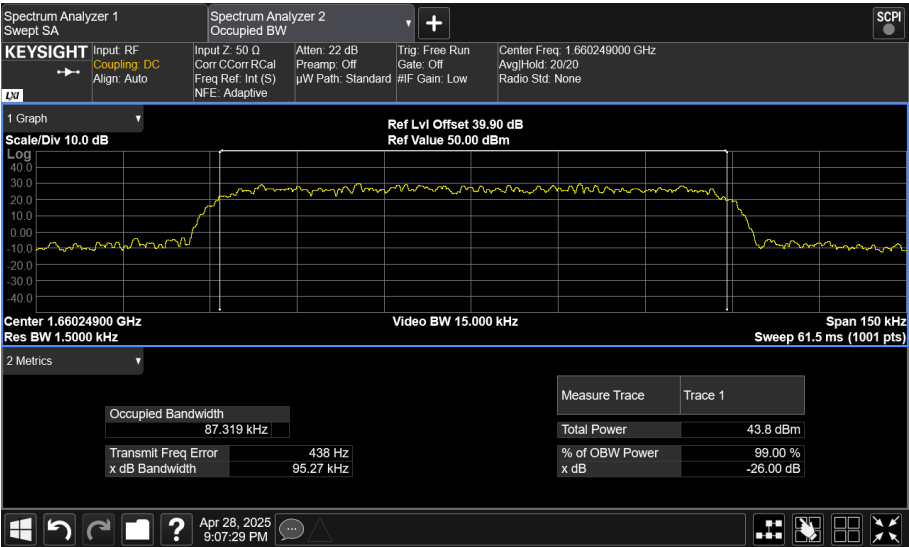


Figure 31 - Top Channel, QPSK - 84000 kbps

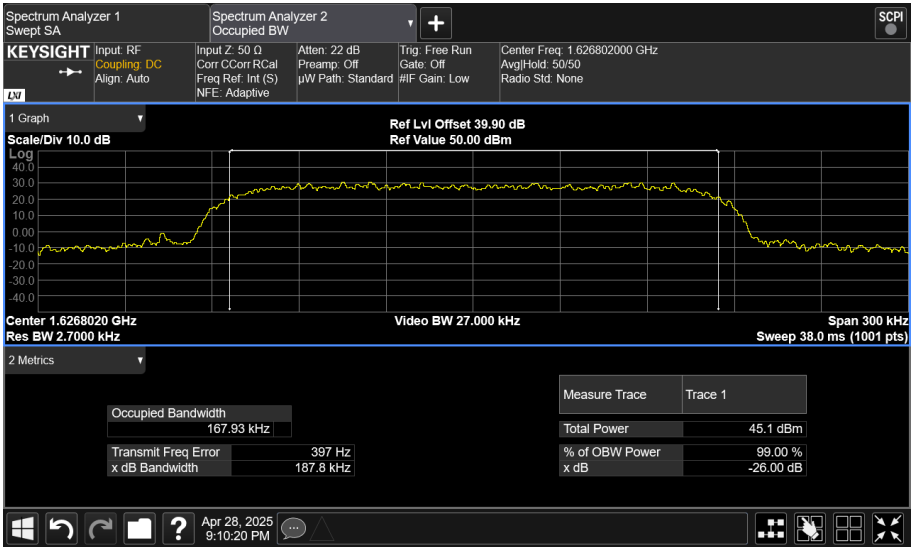


Figure 32 - Bottom Channel, QPSK - 151200 kbps

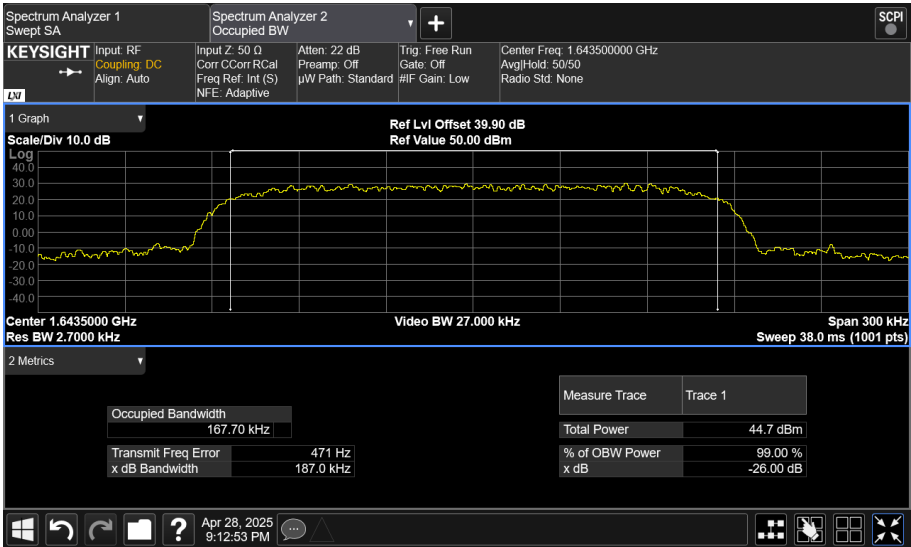


Figure 33 - Middle Channel, QPSK, 151200 kbps

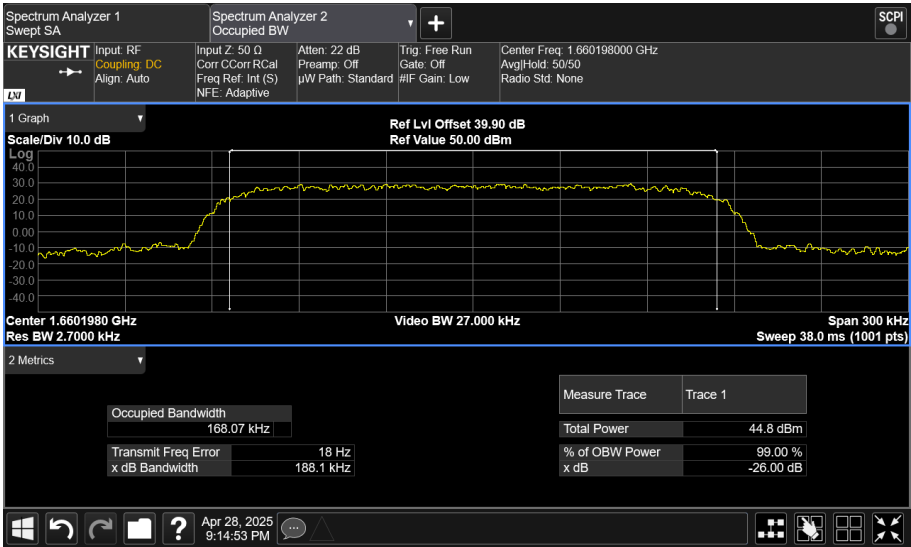


Figure 34 - Top Channel, QPSK - 151200 kbps

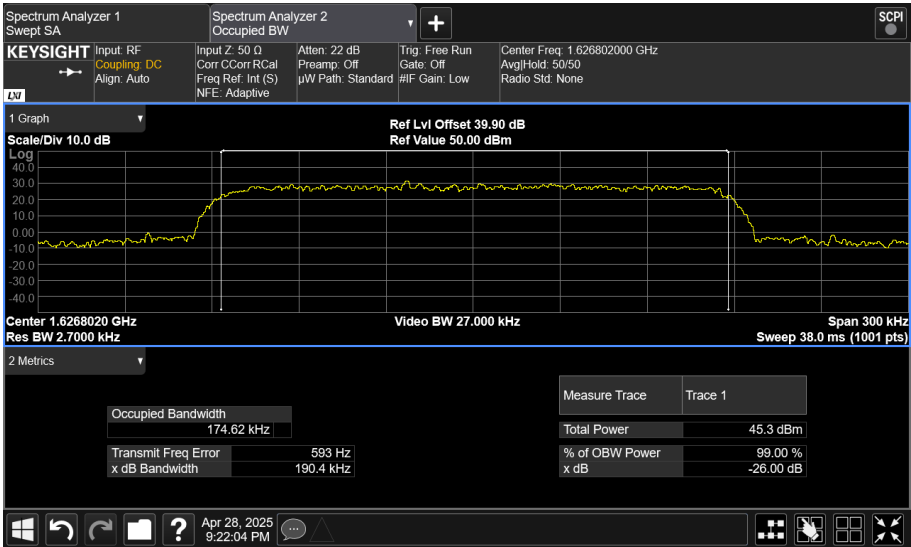


Figure 35 - Bottom Channel, QPSK - 168000 kbps

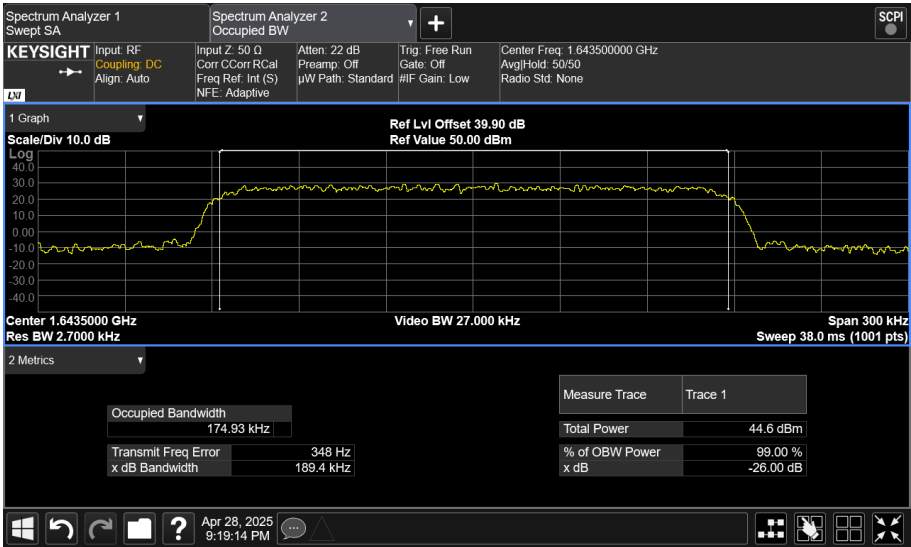


Figure 36 - Middle Channel, QPSK, 168000 kbps

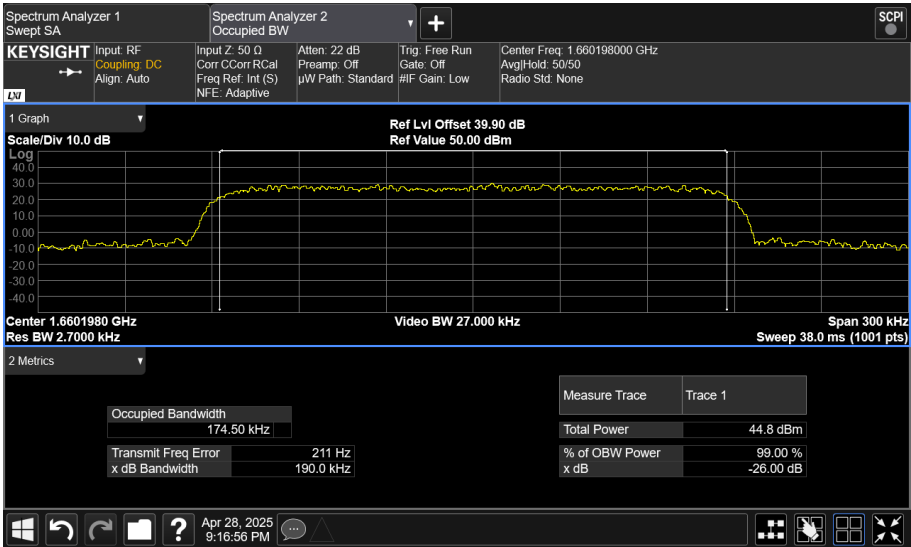


Figure 37 - Top Channel, QPSK - 168000 kbps

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
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	15-Apr-2026
True RMS Multimeter	Fluke	179	4006	12	21-Mar-2026
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Attenuator 5W 10dB DC-18GHz	Aaren	AT40A-4041-D18-10	5493	12	09-May-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	26-Nov-2025
MXA Signal Analyser	Keysight Technologies	N9020B	6876	24	31-Aug-2026
1m SMA Cable	Junkosha	MWX221-01000AMSAMS/B	6919	12	08-Dec-2025

Table 20



2.4 Frequency Tolerance

2.4.1 Specification Reference

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

2.4.2 Equipment Under Test and Modification State

Velaris Module, S/N: SN681007 - Modification State 0

2.4.3 Date of Test

23-April-2025

2.4.4 Test Method

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

The measurement was made with the carrier modulated using a spectrum analyser. The mid-point frequency was determined from the upper and lower edges of the 99% Occupied Bandwidth.

2.4.5 Environmental Conditions

Ambient Temperature	21.3 °C
Relative Humidity	47.2 %



2.4.6 Test Results

Velaris Module - 1.6 GHz communications link

Temperature (°C)	Voltage	Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)	Frequency Error (%)	Frequency Error (ppm)
-30	24.0 V DC	0.000026	0.261910	0.000027	0.271981	0.000022	0.222222
-20	24.0 V DC	0.000022	0.218258	0.000030	0.296319	0.000042	0.419756
-10	24.0 V DC	0.000024	0.237318	0.000018	0.183450	0.000020	0.200845
0	24.0 V DC	0.000002	0.018137	0.000004	0.044417	0.000002	0.022885
10	24.0 V DC	0.000008	0.075315	0.000017	0.169151	0.000014	0.143030
20	18.0 V DC	0.000023	0.225944	0.000030	0.299057	0.000013	0.132491
20	24.0 V DC	0.000028	0.279125	0.000019	0.194402	0.000020	0.199640
20	30.0 V DC	0.000033	0.329847	0.000024	0.235169	0.000021	0.209577
30	24.0 V DC	0.000020	0.329847	0.000018	0.177365	0.000003	0.032822
40	24.0 V DC	0.000015	0.202581	0.000013	0.134773	0.000011	0.106294
50	24.0 V DC	0.000033	0.328002	0.000026	0.256465	0.000013	0.131889

Table 21

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.



2.4.7 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
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	15-Apr-2026
Thermocouple Thermometer	Fluke	51	3173	12	31-May-2025
True RMS Multimeter	Fluke	179	4006	12	21-Mar-2026
GPSDR Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	18-Sep-2025
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Attenuator 5W 10dB DC-18GHz	Aaren	AT40A-4041-D18-10	5493	12	09-May-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	26-Nov-2025
MXA Signal Analyser	Keysight Technologies	N9020B	6876	24	31-Aug-2026
1m SMA Cable	Junkosha	MWX221-01000AMSAMS/B	6919	12	08-Dec-2025
1m N-type Cable	Junkosha	MWX221-01000NMSNMS/B	6929	12	08-Dec-2025

Table 22

O/P Mon – Output Monitored using calibrated equipment



2.5 Spurious Emissions at Antenna Terminals

2.5.1 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

2.5.2 Equipment Under Test and Modification State

Velaris Module, S/N: SN681034 - Modification State 0
Velaris Module, S/N: SN681007 - Modification State 0

2.5.3 Date of Test

17-October-2024 to 28-April-2025

2.5.4 Test Method

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

As the power and bandwidth was considered to be equivalent for all modulation scheme, this test was only performed on the lowest order modulation scheme, which was QPSK. Emission mask measurements were performed for each symbol rate as the nominal channel bandwidth was different.

For emission measurements beyond 250% of the authorised channel bandwidth measurements were limited to a symbol rate of 16800 kbps as this was shown to have the highest power spectral density in a 4 kHz bandwidth. Where an RBW greater than 4 kHz was used, this was considered worst case and used to speed up the measurement time.

2.5.5 Environmental Conditions

Ambient Temperature	21.1 - 22.1 °C
Relative Humidity	45.1 - 61.2 %



2.5.6 Test Results

Velaris Module - 1.6 GHz communications link

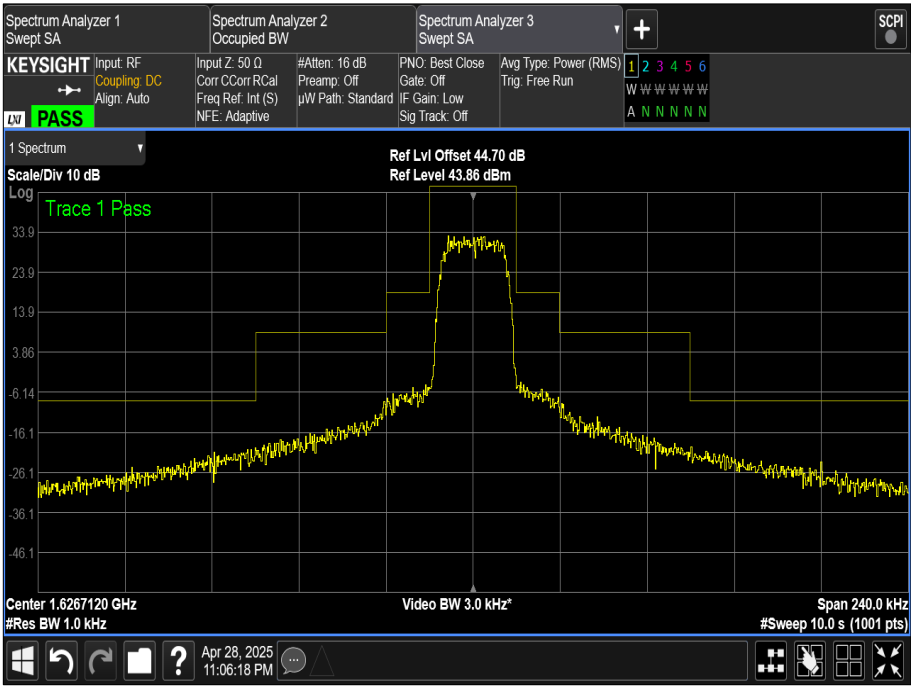


Figure 38 - 1626.712 MHz - Emission Mask - QPSK - 16800 kbps

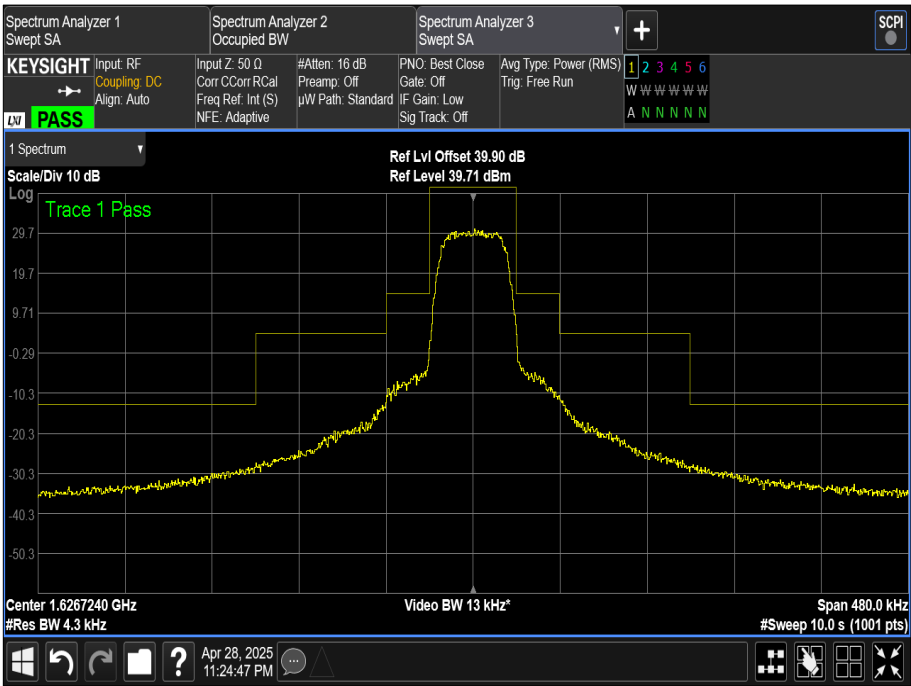


Figure 39 - 1626.712 MHz - Emission Mask - QPSK - 33000 kbps

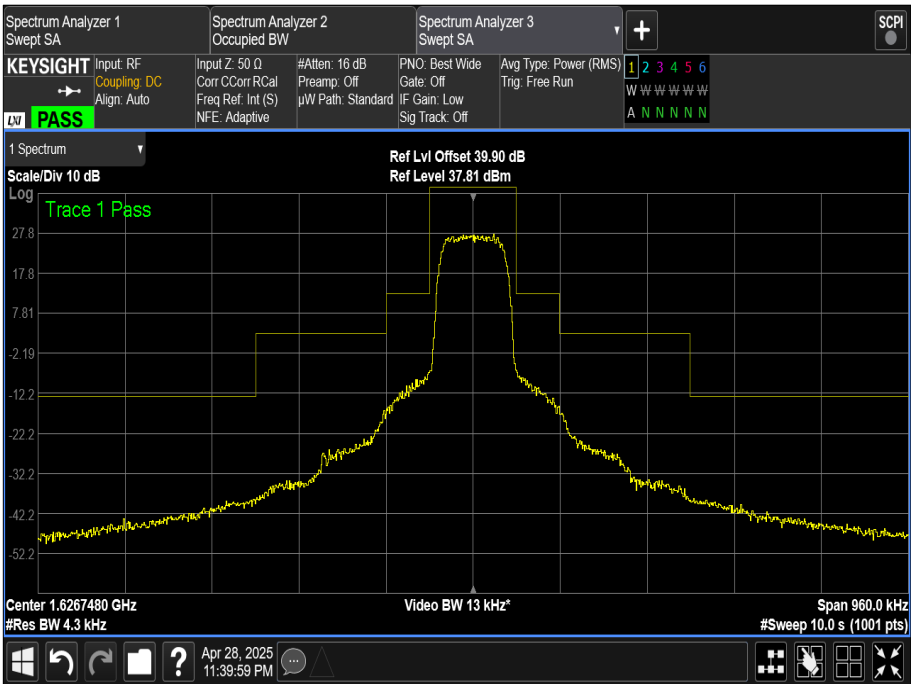


Figure 40 - 1626.712 MHz - Emission Mask - QPSK - 67200 kbps

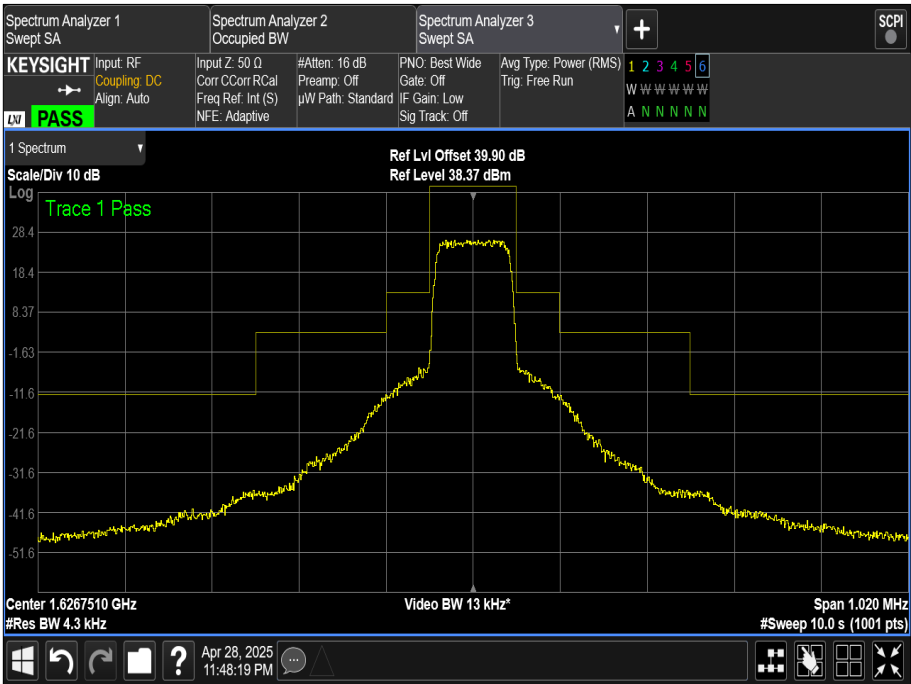


Figure 41 - 1626.712 MHz - Emission Mask - QPSK - 84000 kbps

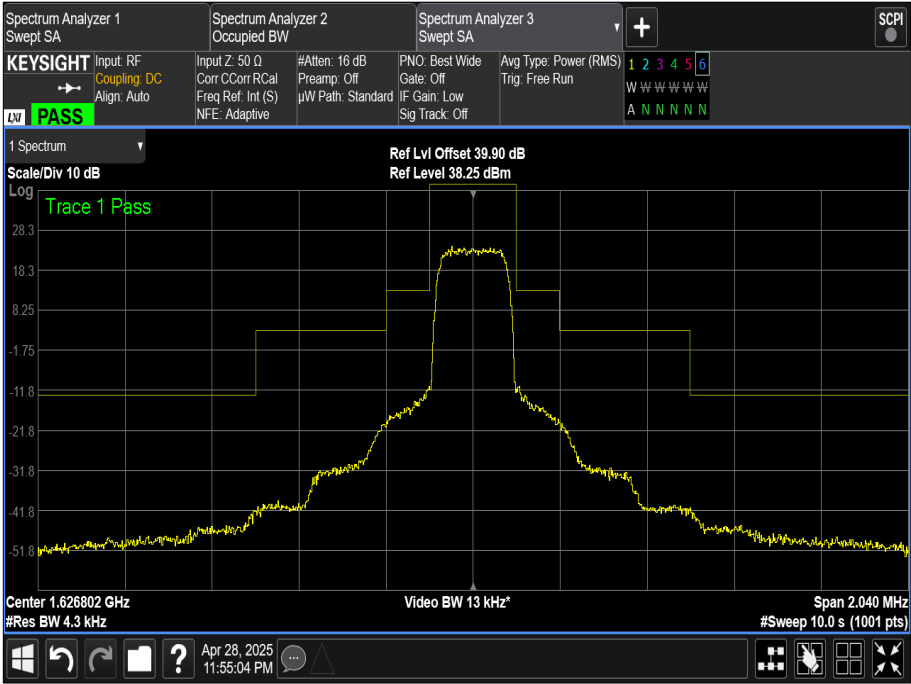


Figure 42 - 1626.712 MHz - Emission Mask - QPSK - 151200 kbps

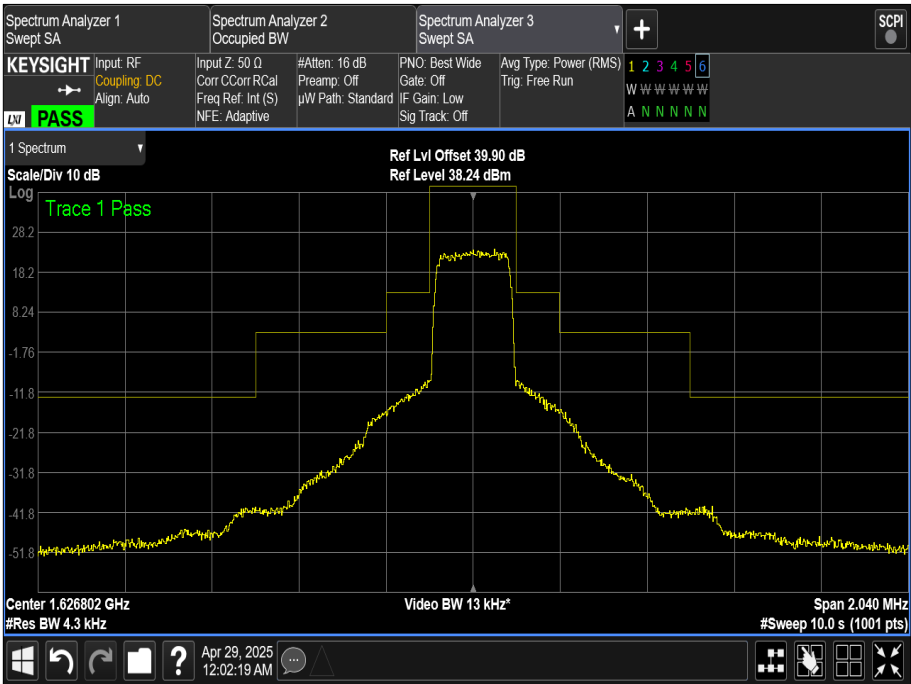


Figure 43 - 1626.712 MHz - Emission Mask - QPSK - 168000 kbps

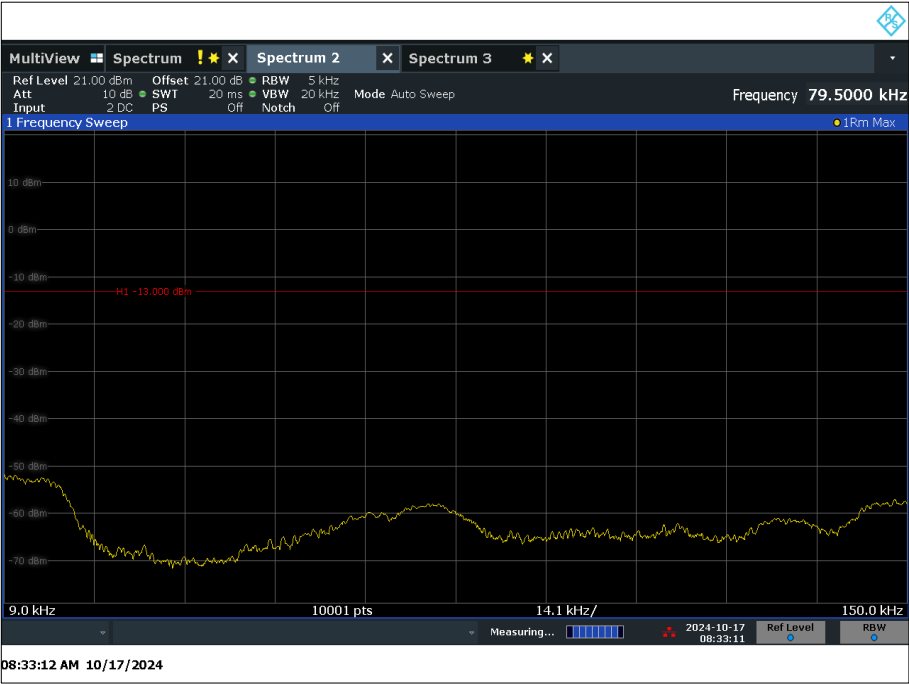


Figure 44 - 1626.712 MHz - 9 kHz to 150 kHz

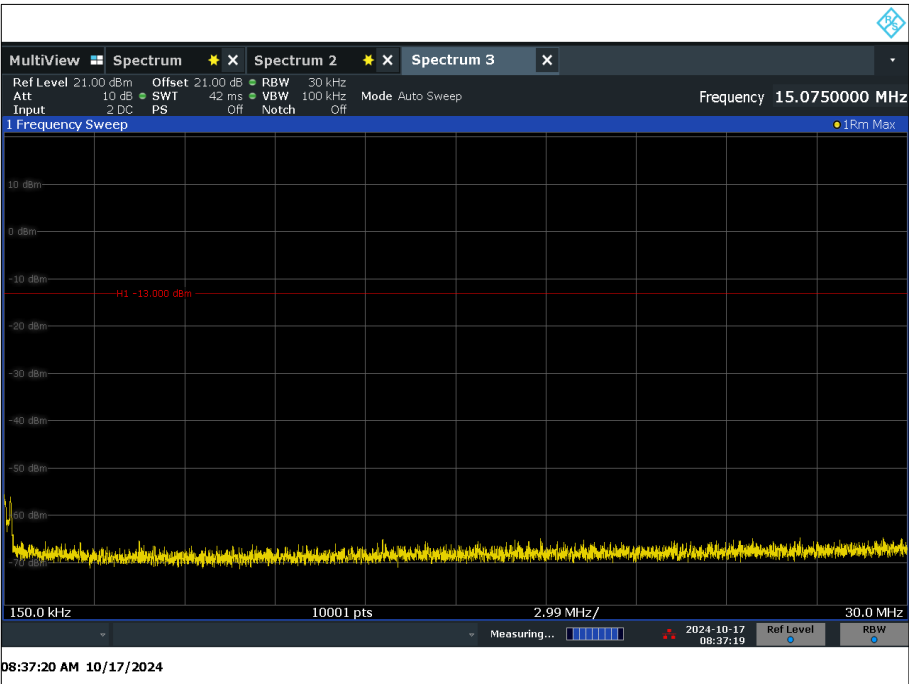


Figure 45 - 1626.712 MHz - 150 kHz to 30 MHz

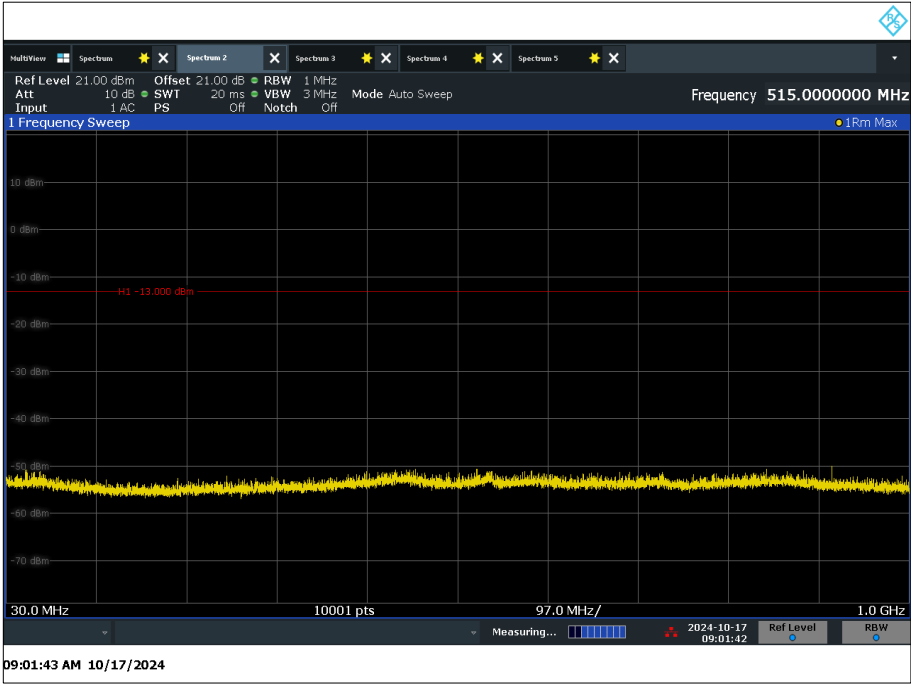


Figure 46 - 1626.712 MHz - 30 MHz to 1 GHz

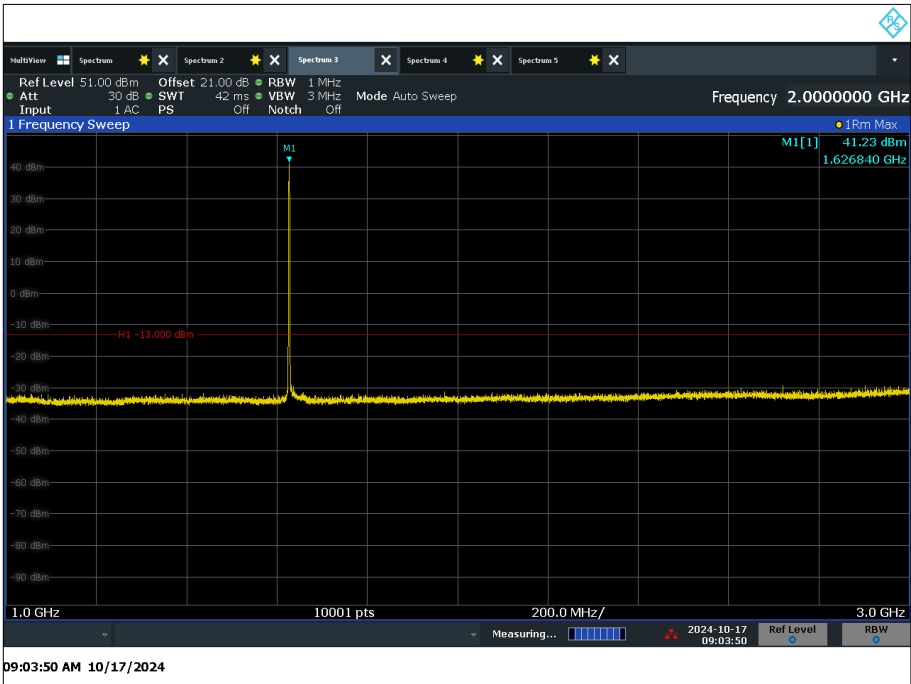


Figure 47 - 1626.712 MHz - 1 GHz to 3 GHz



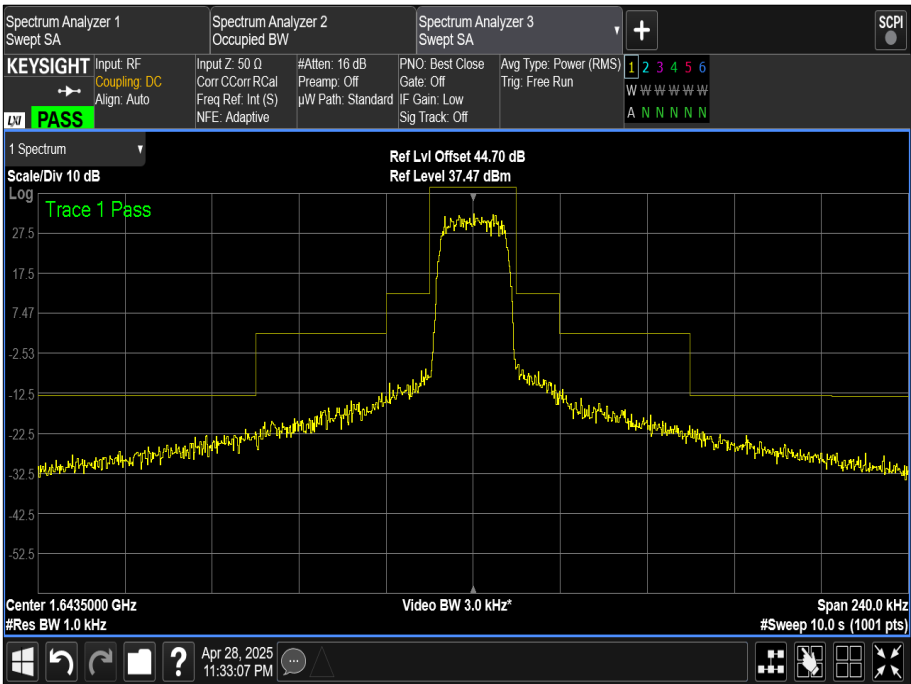


Figure 50 - 1643.500 MHz - Emission Mask - QPSK - 16800 kbps

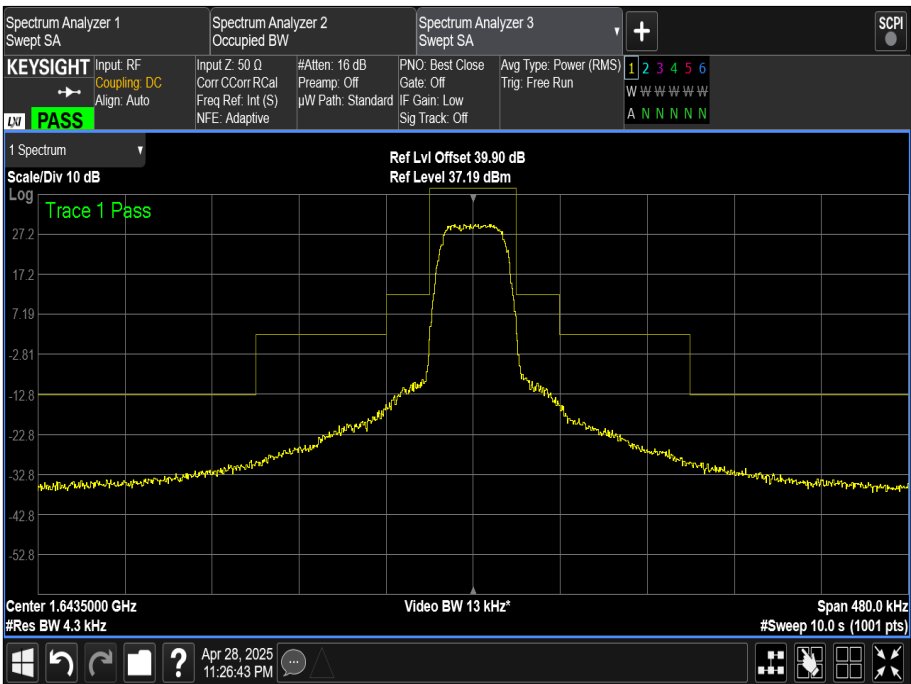


Figure 51 - 1643.500 MHz - Emission Mask - QPSK - 33000 kbps

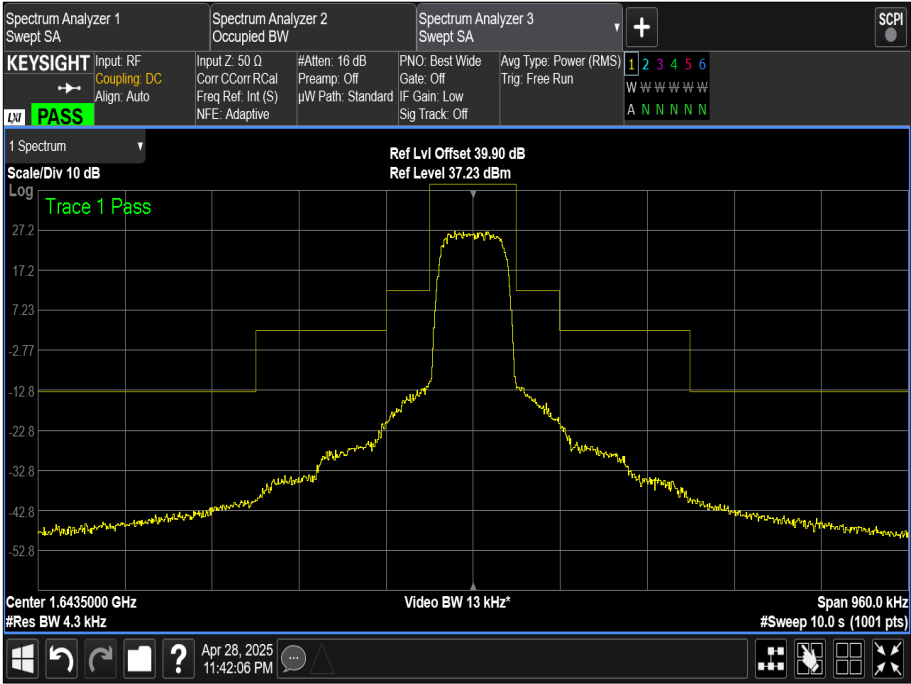


Figure 52 - 1643.500 MHz - Emission Mask - QPSK - 67200 kbps

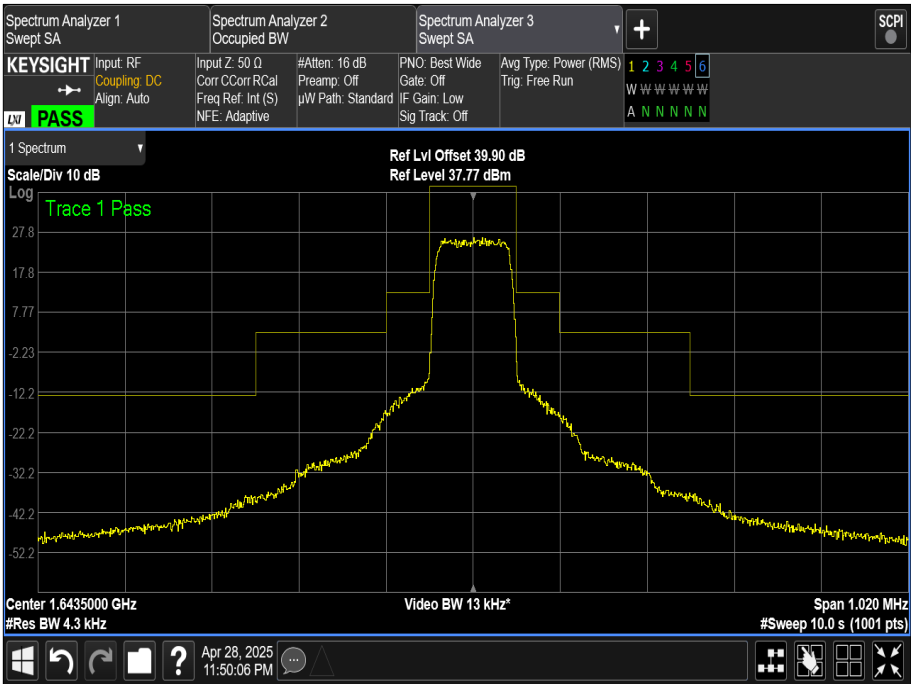


Figure 53 - 1643.500 MHz - Emission Mask - QPSK - 84000 kbps

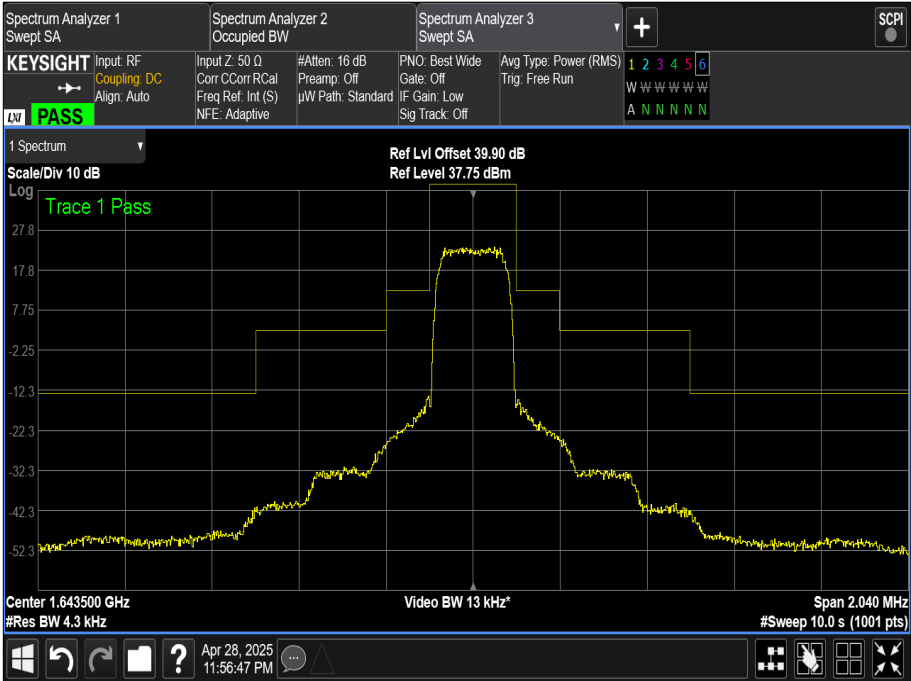


Figure 54 - 1643.500 MHz - Emission Mask - QPSK - 151200 kbps

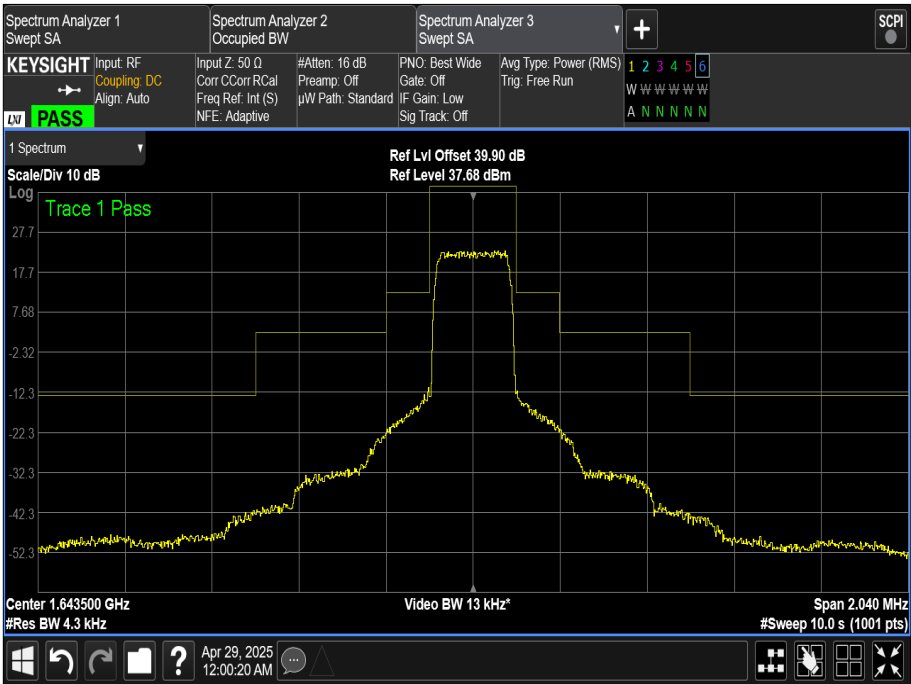


Figure 55 - 1643.500 MHz - Emission Mask - QPSK - 168000 kbps

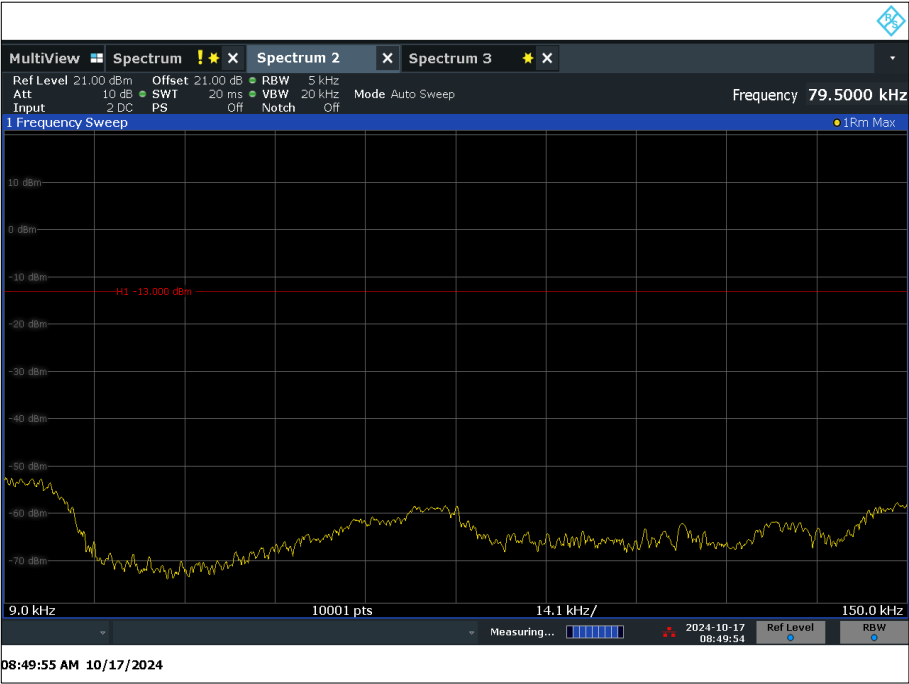


Figure 56 - 1643.500 MHz - 9 kHz to 150 kHz

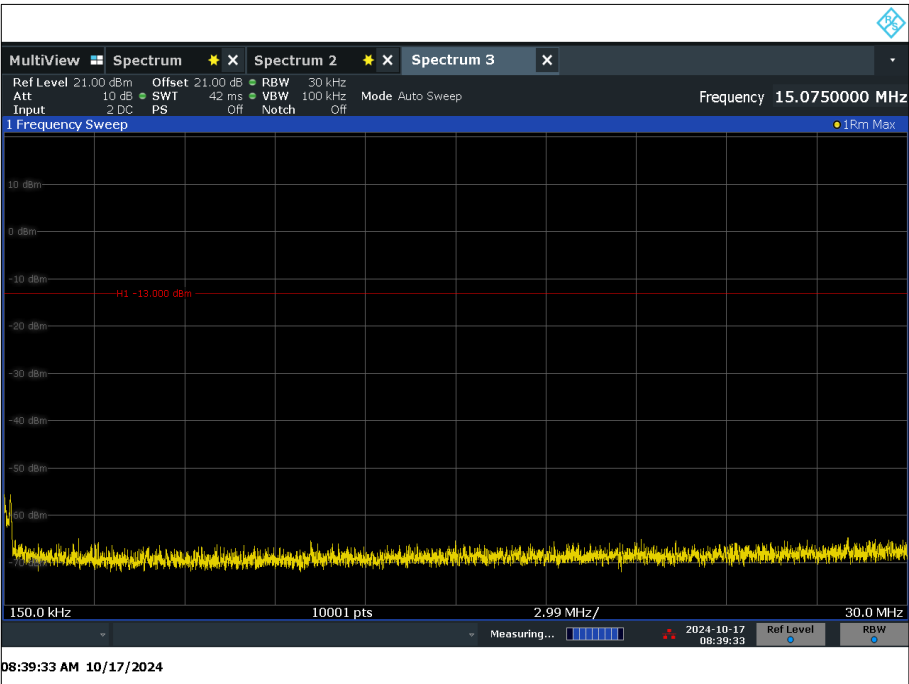


Figure 57 - 1643.500 MHz - 150 kHz to 30 MHz

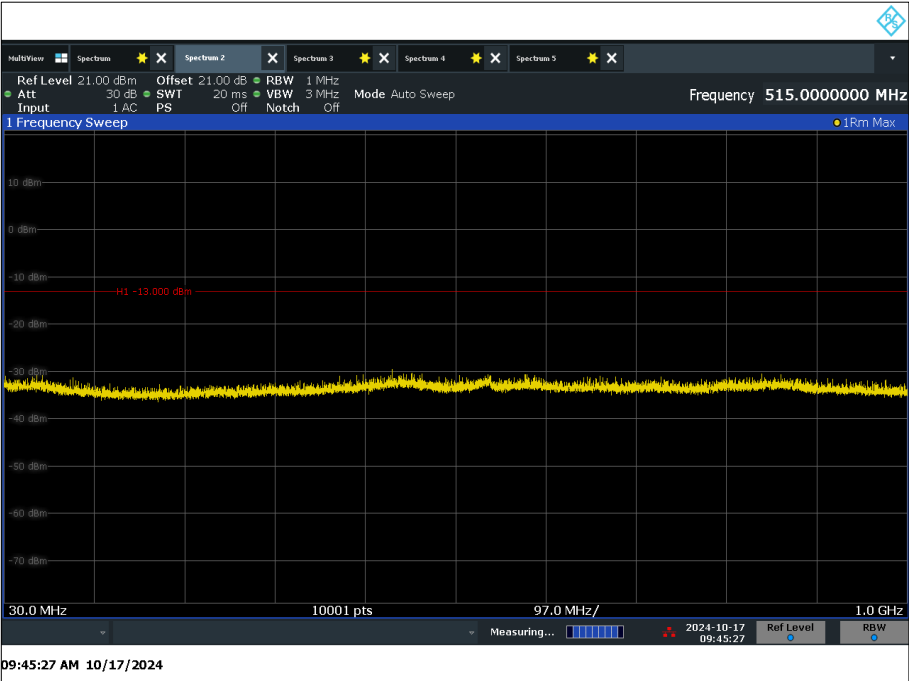


Figure 58 - 1643.500 MHz - 30 MHz to 1 GHz

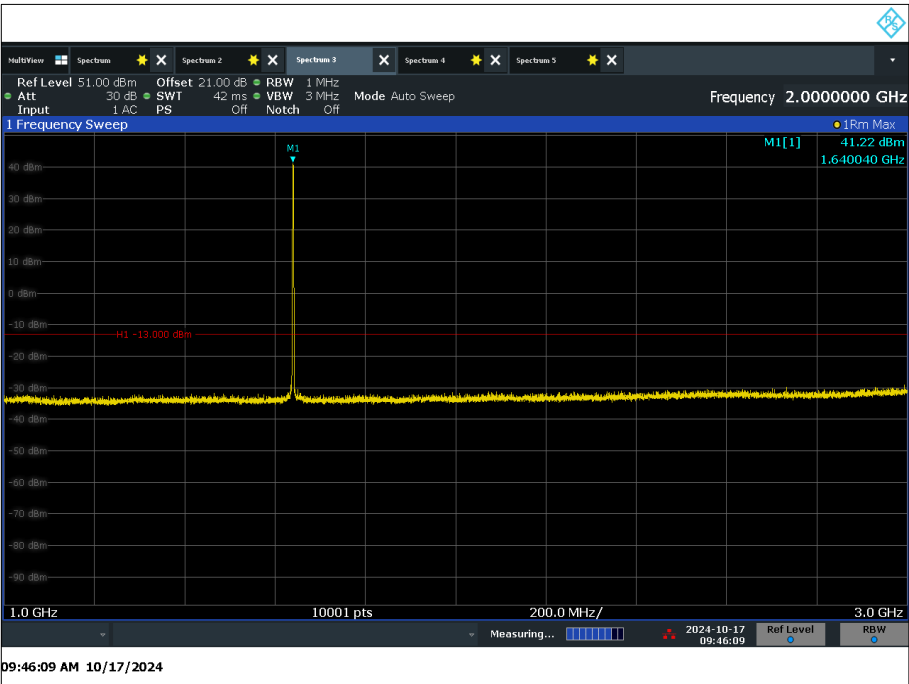


Figure 59 - 1643.500 MHz - 1 GHz to 3 GHz

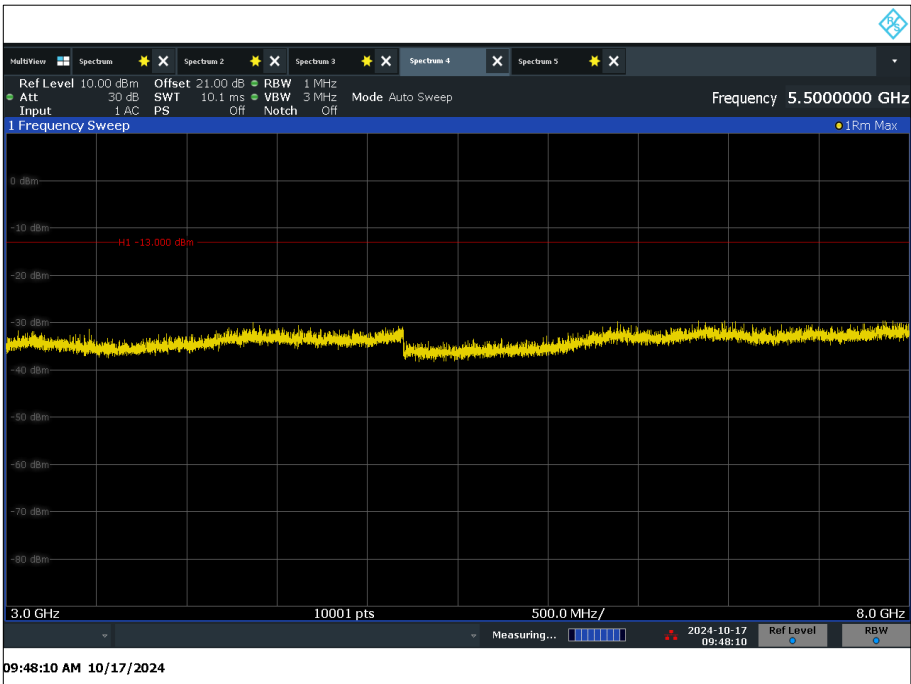


Figure 60 - 1643.500 MHz - 3 GHz to 8 GHz

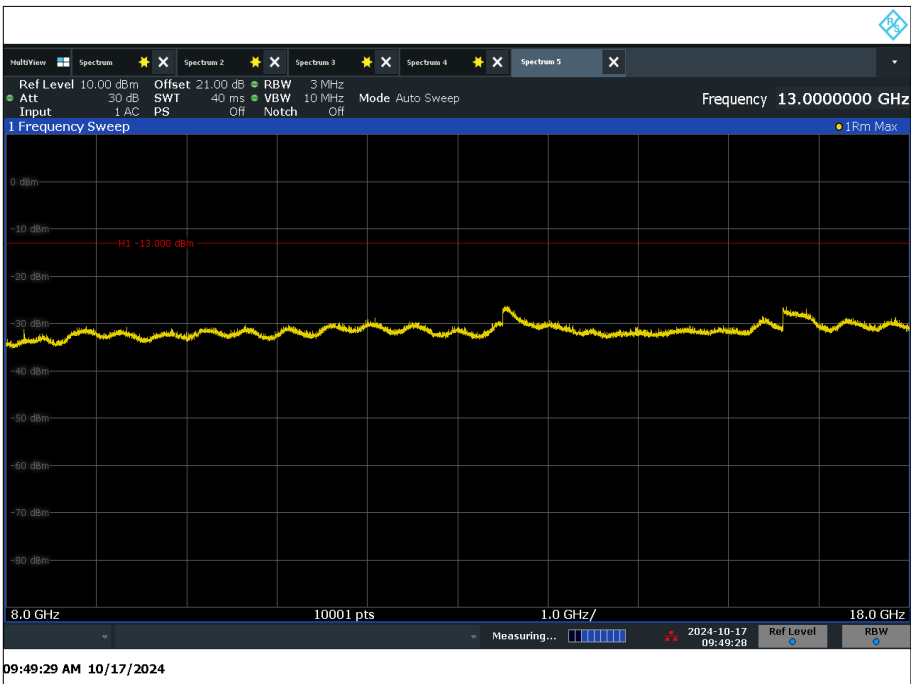


Figure 61 - 1643.500 MHz - 8 GHz to 18 GHz

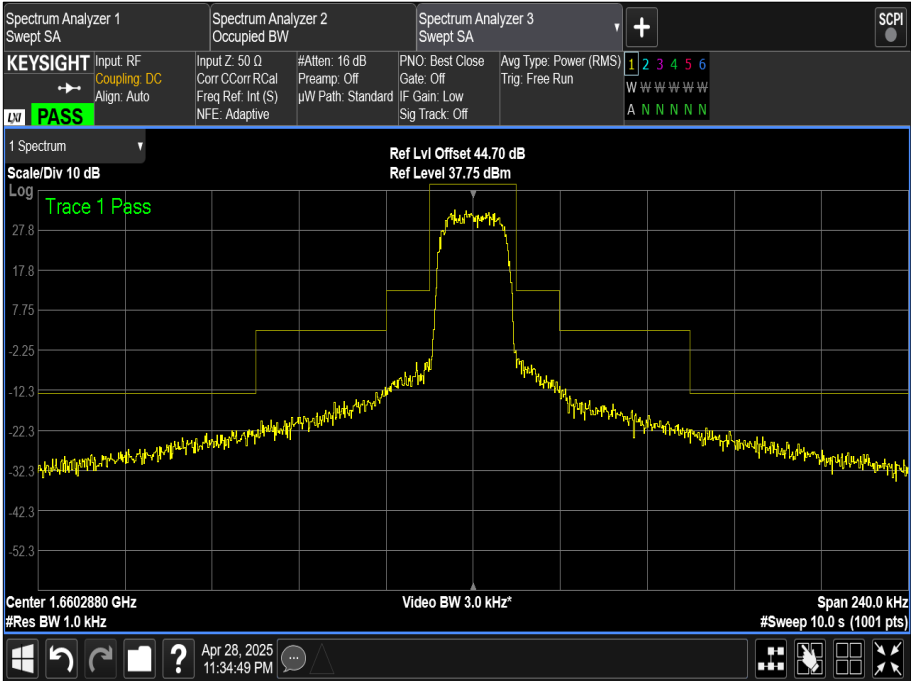


Figure 62 - 1660.288 MHz - Emission Mask - QPSK - 16800 kbps

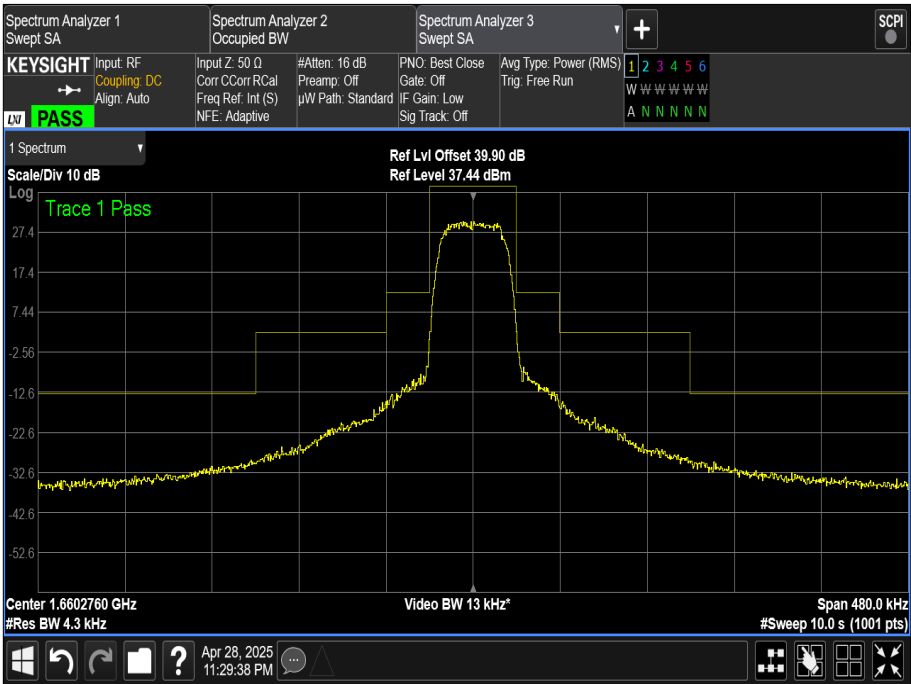


Figure 63 - 1660.288 MHz - Emission Mask - QPSK - 33000 kbps

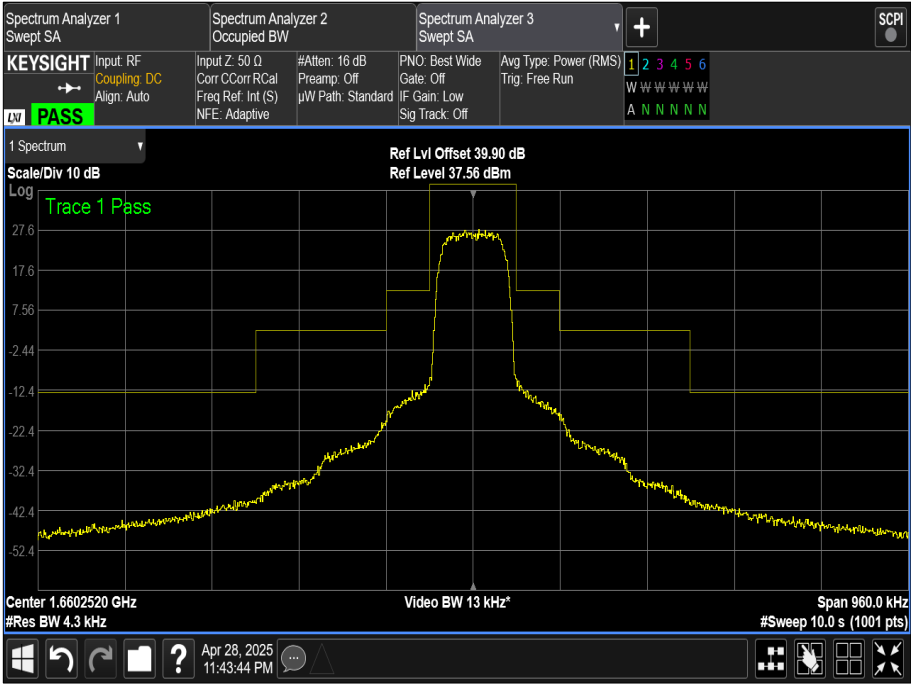


Figure 64 - 1660.288 MHz - Emission Mask - QPSK - 67200 kbps

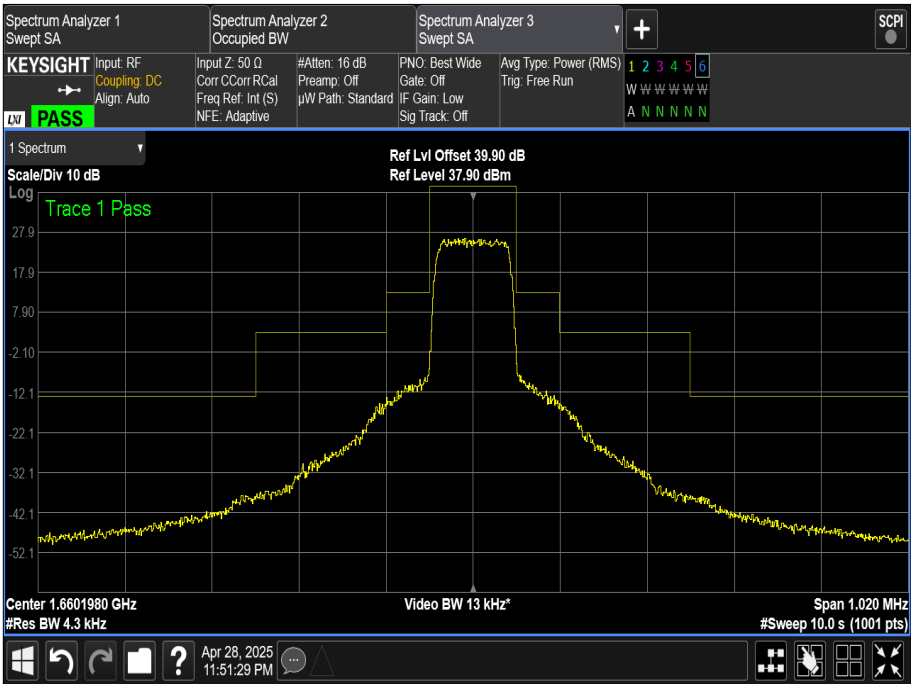


Figure 65 - 1660.288 MHz - Emission Mask - QPSK - 84000 kbps

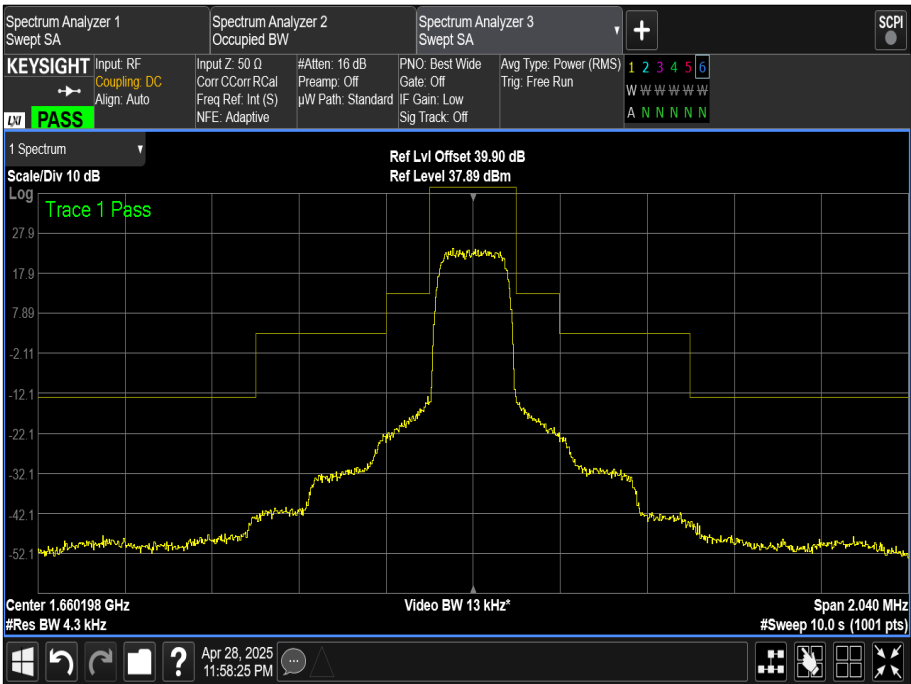


Figure 66 - 1660.288 MHz - Emission Mask - QPSK - 151200 kbps

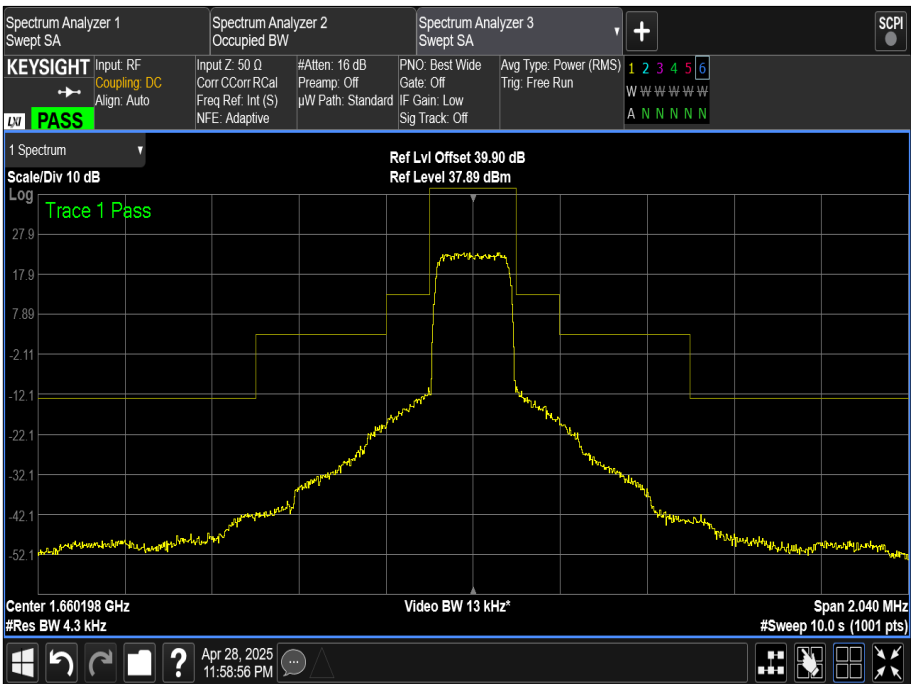


Figure 67 - 1660.288 MHz - Emission Mask - QPSK - 168000 kbps

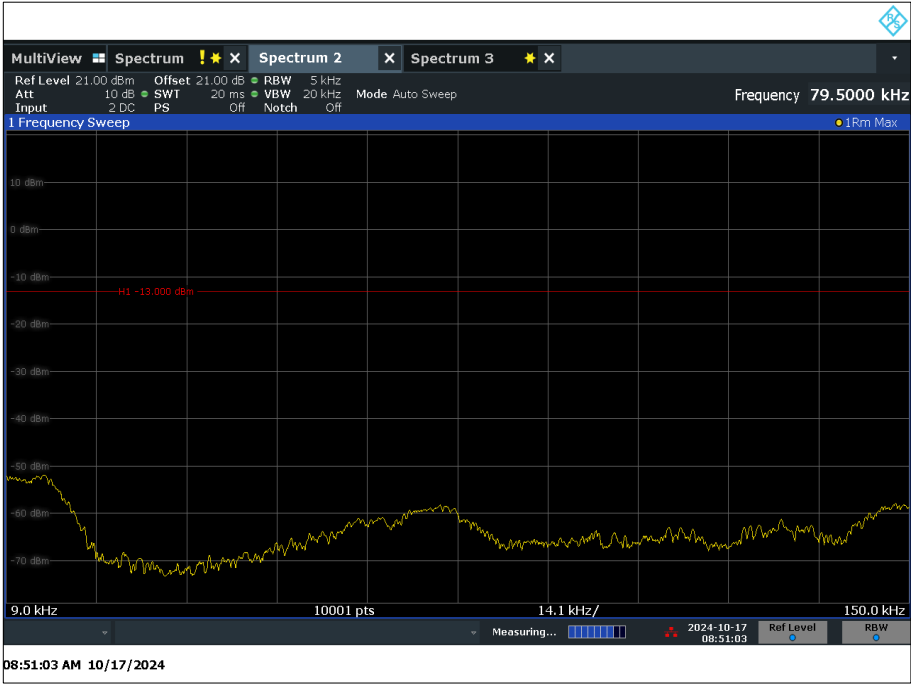


Figure 68 - 1660.288 MHz - 9 kHz to 150 kHz

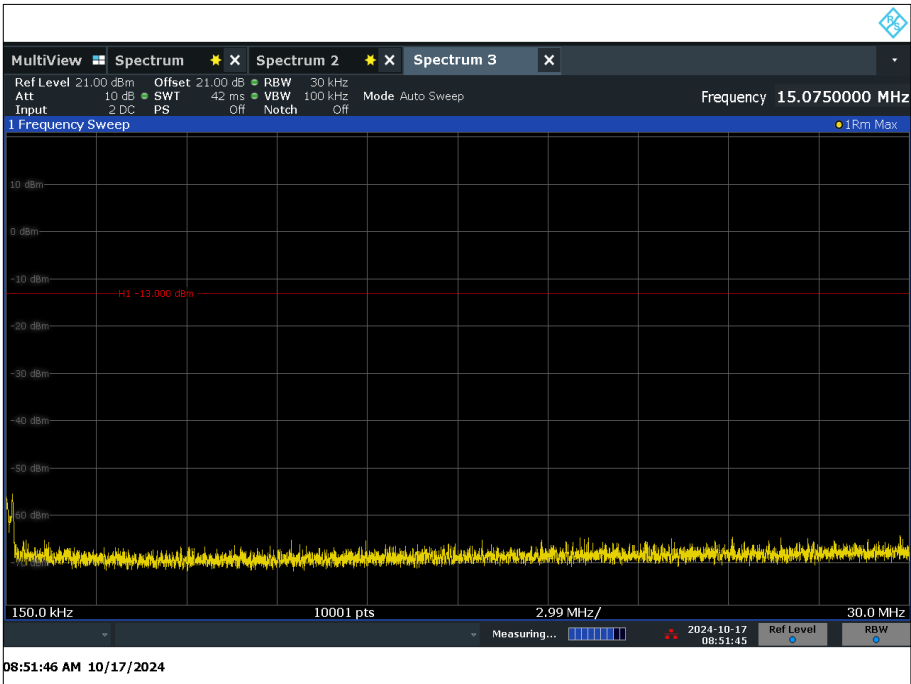


Figure 69 - 1660.288 MHz - 150 kHz to 30 MHz

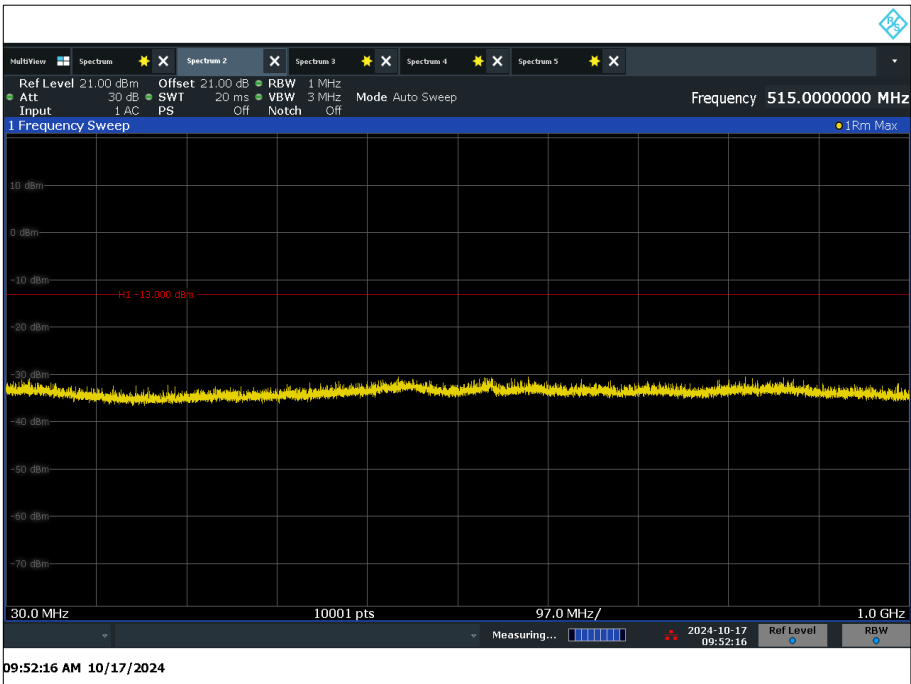


Figure 70 - 1660.288 MHz - 30 MHz to 1 GHz

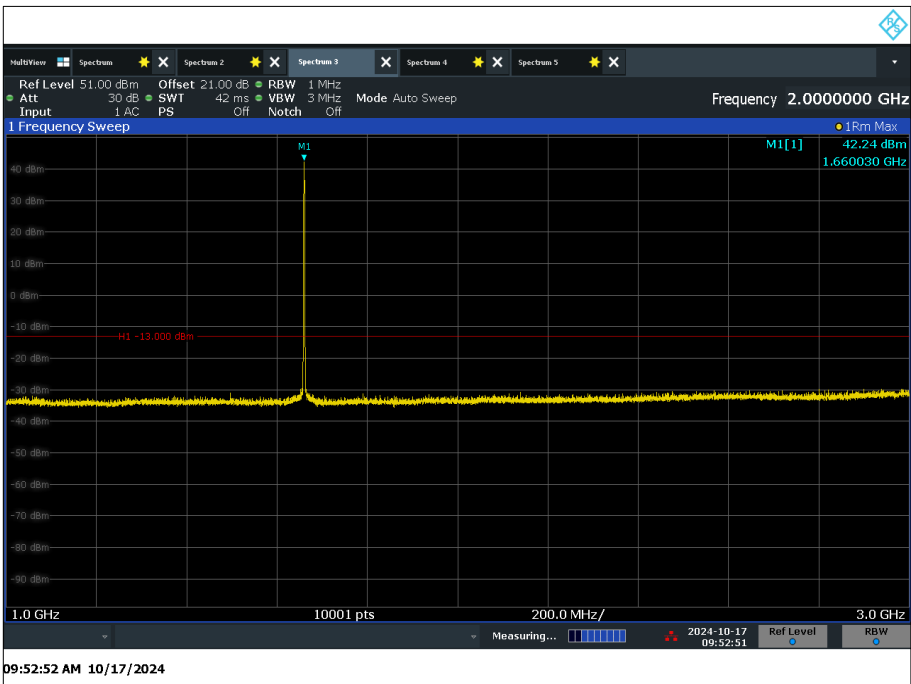


Figure 71 - 1660.288 MHz - 1 GHz to 3 GHz

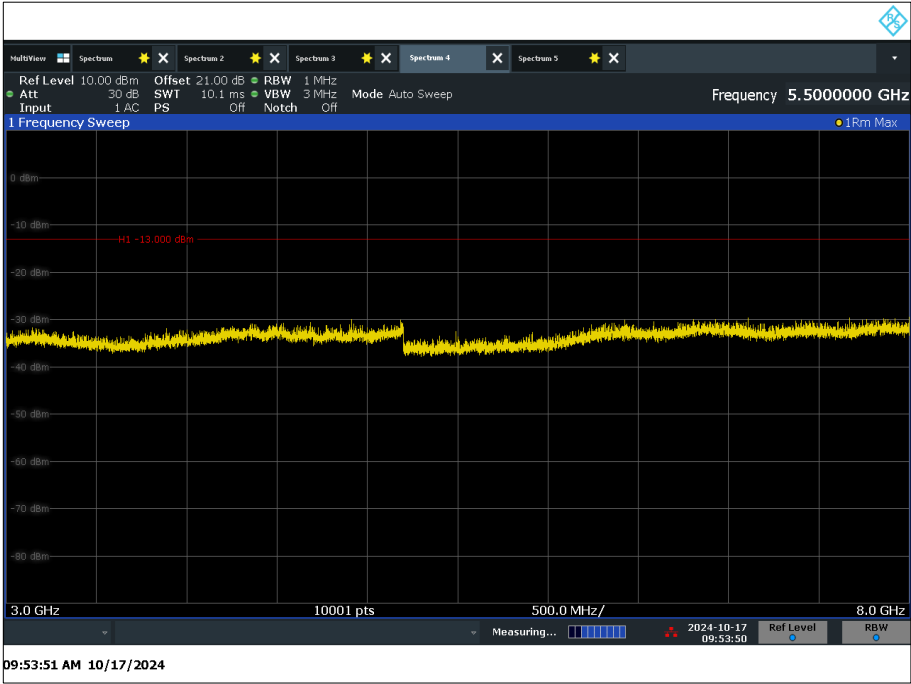


Figure 72 - 1660.288 MHz - 3 GHz to 8 GHz

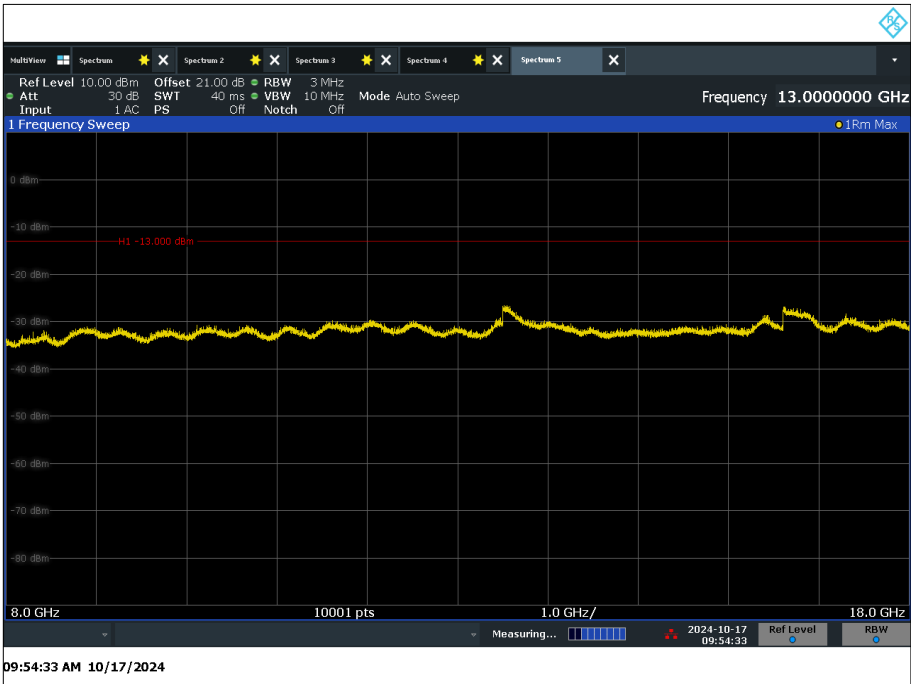


Figure 73 - 1660.288 MHz - 8 GHz to 18 GHz



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.



2.5.7 Test Location and Test Equipment Used

This test was carried out in RF Chamber 11 and RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Attenuator (20dB, 10W)	Weinschel	37-20-34	482	12	07-Feb-2025*
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	15-Apr-2026
True RMS Multimeter	Fluke	179	4006	12	21-Mar-2026
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Test Receiver	Rohde & Schwarz	ESW44	5084	12	04-Nov-2024*
Attenuator 5W 10dB DC-18GHz	Aaren	AT40A-4041-D18-10	5493	12	09-May-2025
Cable (SMA to SMA, 2 m)	Junkosha	MWX221-02000AMSAMS/A	5518	12	18-Apr-2025*
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	26-Nov-2025
MXA Signal Analyser	Keysight Technologies	N9020B	6876	24	31-Aug-2026
1m SMA Cable	Junkosha	MWX221-01000AMSAMS/B	6919	12	08-Dec-2025

Table 23

O/P Mon – Output Monitored using calibrated equipment

*This equipment was only used prior to the calibration expiry date listed.



2.6 Equivalent Isotropic Radiated Power

2.6.1 Specification Reference

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

2.6.2 Equipment Under Test and Modification State

Velaris Module, S/N: SN681007 - Modification State 0

2.6.3 Date of Test

28-April-2025

2.6.4 Test Method

Power Spectral Density measurements in a 4 kHz bandwidth were performed in accordance with ANSI C63.26, clause 5.2.3.5 (Peak-PSD).

Total EIRP measurements were performed in accordance with ANSI C63.26, clause 5.2.4.4 (average power with integration).

The antenna gain was added to the measured Conducted Output Power to determine the EIRP.

2.6.5 Environmental Conditions

Ambient Temperature	21.1 °C
Relative Humidity	45.1 %



2.6.6 Test Results

Velaris Module - 1.6 GHz communications link

Mode	EIRP (dBm/4kHz)		
	Bottom Channel	Middle Channel	Top Channel
QPSK - 16800 kbps	37.82	36.53	36.48
QPSK - 33000 kbps	35.72	33.36	33.80
QPSK - 67200 kbps	31.51	30.51	30.78
QPSK - 84000 kbps	28.87	29.98	29.96
QPSK - 151200 kbps	27.77	27.69	27.38
QPSK - 168000 kbps	27.52	26.97	27.14
p4 QPSK - 16800 kbps	37.04	36.52	36.65
p4 QPSK - 33000 kbps	35.81	33.08	33.31
p4 QPSK - 67200 kbps	30.70	30.20	29.80
p4 QPSK - 84000 kbps	30.63	30.11	30.08
p4 QPSK - 151200 kbps	27.69	27.53	27.56
p4 QPSK - 168000 kbps	27.40	26.83	27.36
16-QAM - 16800 kbps	37.00	36.48	36.89
16-QAM - 33000 kbps	34.09	33.56	33.65
16-QAM - 67200 kbps	29.34	30.33	30.95
16-QAM - 84000 kbps	30.65	30.15	30.10
16-QAM - 151200 kbps	28.10	27.54	27.29
16-QAM - 168000 kbps	27.27	27.10	27.11
32-QAM - 16800 kbps	37.09	36.95	37.02
32-QAM - 33000 kbps	34.60	33.42	34.13
32-QAM - 67200 kbps	30.97	30.53	30.89
32-QAM - 84000 kbps	30.44	29.62	30.29
32-QAM - 151200 kbps	28.03	27.49	27.94
32-QAM - 168000 kbps	27.38	27.47	27.36
64-QAM - 16800 kbps	36.87	36.46	36.96
64-QAM - 33000 kbps	33.84	33.58	33.63
64-QAM - 67200 kbps	30.80	30.09	30.63
64-QAM - 84000 kbps	30.65	29.76	30.16
64-QAM - 151200 kbps	28.30	26.26	27.70
64-QAM - 168000 kbps	27.45	27.00	27.36

Table 24 - EIRP/4 kHz Results Table



Mode	Bottom Channel		Middle Channel		Top Channel	
	EIRP (dBm)	Δ from rated power (dB)	EIRP (dBm)	Δ from rated power (dB)	EIRP (dBm)	Δ from rated power (dB)
QPSK - 16800 kbps	42.56	1.31	40.97	-0.28	41.25	0.00
QPSK - 33000 kbps	42.21	0.96	40.69	-0.56	40.94	-0.31
QPSK - 67200 kbps	41.31	0.06	40.73	-0.52	41.06	-0.19
QPSK - 84000 kbps	41.87	0.62	41.27	0.02	41.40	0.15
QPSK - 151200 kbps	41.75	0.50	41.25	0.00	41.39	0.14
QPSK - 168000 kbps	41.74	0.49	41.18	-0.07	41.39	0.14
p4 QPSK - 16800 kbps	41.60	0.35	41.06	-0.19	41.28	0.03
p4 QPSK - 33000 kbps	42.14	0.89	40.68	-0.57	40.88	-0.37
p4 QPSK - 67200 kbps	41.29	0.04	40.83	-0.42	41.04	-0.21
p4 QPSK - 84000 kbps	41.80	0.55	41.27	0.02	41.40	0.15
p4 QPSK - 151200 kbps	41.70	0.45	41.18	-0.07	41.39	0.14
p4 QPSK - 168000 kbps	41.74	0.49	41.22	-0.03	41.36	0.11
16-QAM - 16800 kbps	41.58	0.33	41.10	-0.15	41.35	0.10
16-QAM - 33000 kbps	41.32	0.07	40.68	-0.57	41.00	-0.25
16-QAM - 67200 kbps	41.28	0.03	40.88	-0.37	41.13	-0.12
16-QAM - 84000 kbps	41.79	0.54	41.22	-0.03	41.49	0.24
16-QAM - 151200 kbps	41.80	0.55	41.21	-0.04	41.42	0.17
16-QAM - 168000 kbps	41.71	0.46	41.18	-0.07	41.45	0.20
32-QAM - 16800 kbps	41.55	0.30	41.11	-0.14	41.33	0.08
32-QAM - 33000 kbps	41.31	0.06	40.73	-0.52	40.95	-0.30
32-QAM - 67200 kbps	41.26	0.01	40.85	-0.40	41.07	-0.18
32-QAM - 84000 kbps	41.82	0.57	41.19	-0.06	41.45	0.20
32-QAM - 151200 kbps	41.77	0.52	41.20	-0.05	41.49	0.24
32-QAM - 168000 kbps	41.73	0.48	41.17	-0.08	41.44	0.19
64-QAM - 16800 kbps	41.56	0.31	41.12	-0.13	41.35	0.10
64-QAM - 33000 kbps	41.17	-0.08	40.73	-0.52	40.97	-0.28
64-QAM - 67200 kbps	41.28	0.03	40.88	-0.37	41.15	-0.10
64-QAM - 84000 kbps	41.85	0.60	41.20	-0.05	41.46	0.21
64-QAM - 151200 kbps	41.76	0.51	41.22	-0.03	41.47	0.22
64-QAM - 168000 kbps	41.74	0.49	41.28	0.03	41.48	0.23

Table 25 - EIRP Results Table



FCC 47 CFR Part 25, Limit Clause 25.204

+40 dBW in any 4 kHz band for $\theta \leq 0^\circ$

+40 + 30 dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$

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 5.3

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.

2.6.7 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
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	15-Apr-2026
True RMS Multimeter	Fluke	179	4006	12	21-Mar-2026
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Attenuator 5W 10dB DC-18GHz	Aaren	AT40A-4041-D18-10	5493	12	09-May-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	26-Nov-2025
MXA Signal Analyser	Keysight Technologies	N9020B	6876	24	31-Aug-2026
1m SMA Cable	Junkosha	MWX221-01000AMSAMS/B	6919	12	08-Dec-2025

Table 26

O/P Mon – Output Monitored using calibrated 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: Clause 25.216
ISED RSS-170: Clause 5.9 and 5.10

2.7.2 Equipment Under Test and Modification State

Velaris Module, S/N: SN681007 - Modification State 0

2.7.3 Date of Test

29-April-2025

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 and 5.10.

2.7.5 Environmental Conditions

Ambient Temperature	21.1 °C
Relative Humidity	45.1 %



2.7.6 Test Results

Velaris Module - 1.6 GHz communications link

Frequency (MHz)	Level (dBW)
*	

Table 27 - 1626.712 MHz – Broadband Emission Results

*No emissions were detected within 6 dB of the limit.



Figure 74 - 1626.712 MHz – Broadband Emission Results



Frequency (MHz)	Level (dBW)
*	

Table 28 - 1626.712 MHz – Discrete Emission Results

*No emissions were detected within 6 dB of the limit.

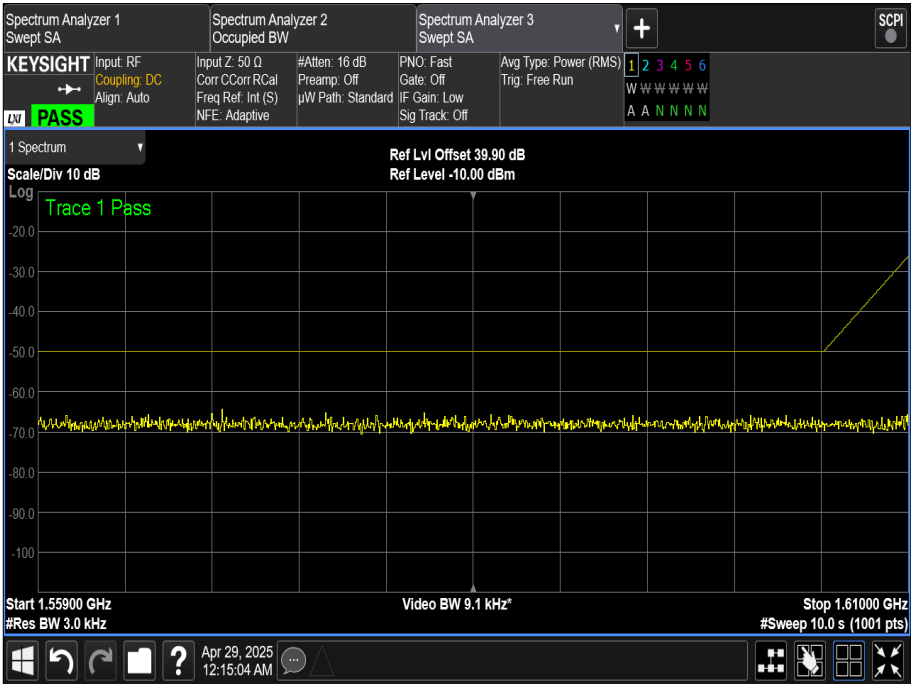


Figure 75 - 1626.712 MHz – Discrete Emission Results



Frequency (MHz)	Level (dBW)
*	

Table 29 - 1643.500 MHz – Broadband Emission Results

*No emissions were detected within 6 dB of the limit.



Figure 76 - 1643.500 MHz – Broadband Emission Results



Frequency (MHz)	Level (dBW)
*	

Table 30 - 1643.500 MHz – Discrete Emission Results

*No emissions were detected within 6 dB of the limit.

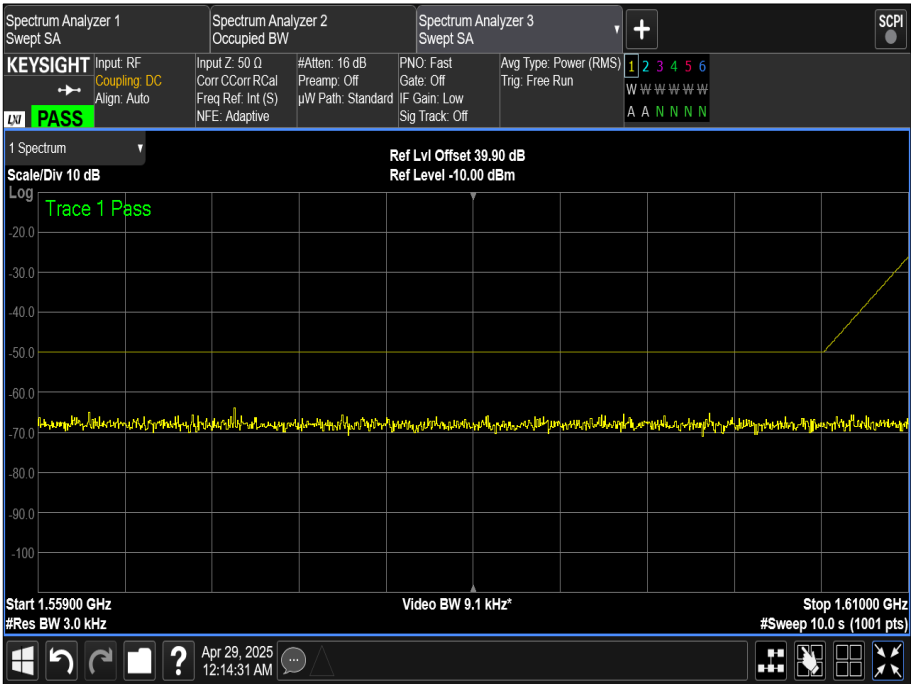


Figure 77 - 1643.500 MHz – Discrete Emission Results



Frequency (MHz)	Level (dBW)
*	

Table 31 - 1660.288 MHz – Broadband Emission Results

*No emissions were detected within 6 dB of the limit.



Figure 78 – 1660.288 MHz – Broadband Emission Results



Frequency (MHz)	Level (dBW)
*	

Table 32 - 1660.288 MHz – Discrete Emission Results

*No emissions were detected within 6 dB of the limit.

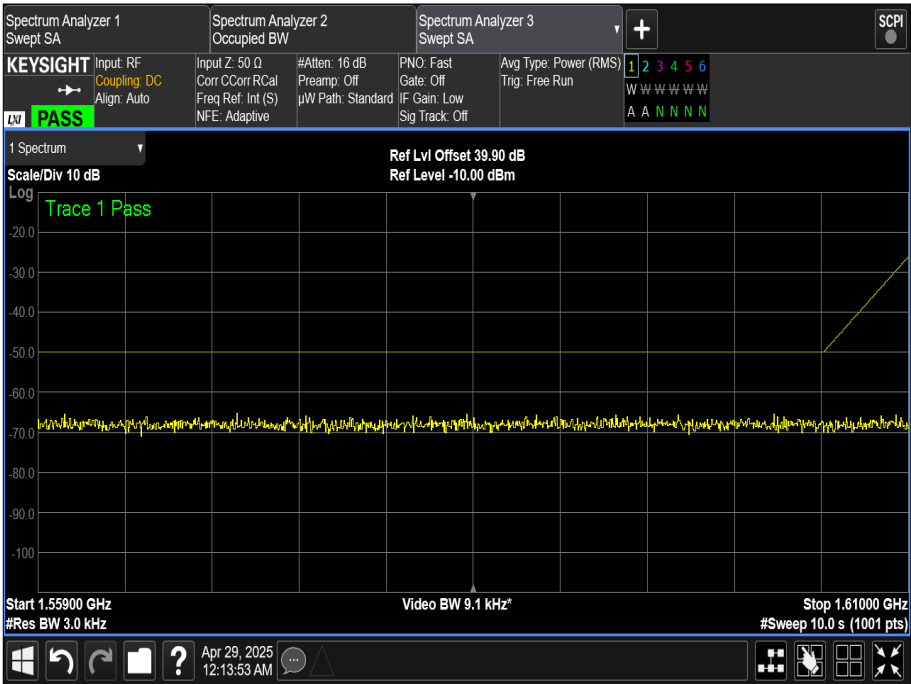


Figure 79 - 1660.288 MHz – Discrete Emission Results



Frequency (MHz)	Level (dBW)

Table 33 - Carrier-off state

*No emissions were detected within 6 dB of the limit.

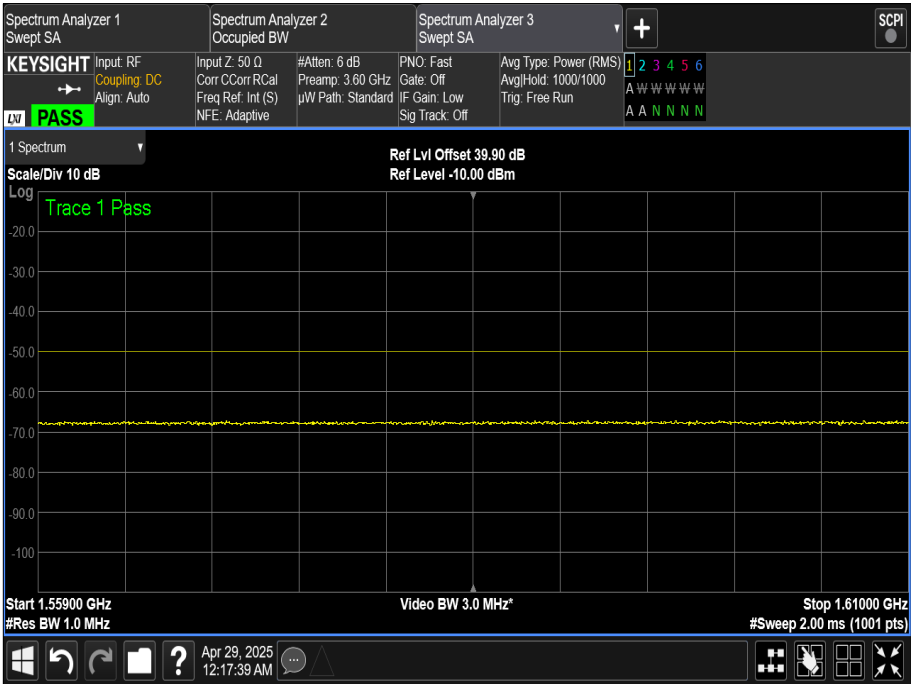


Figure 80 - Carrier-off state Emissions



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 two millisecond interval.

ISED, RSS-170, Limit Clause 5.9.2 and 5.10

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 1626.5-1660.5 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 -46 dBW/MHz at 1610 MHz, for broadband emissions

-80 dBW/kHz at 1605 MHz, linearly interpolated to -56 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
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	15-Apr-2026
True RMS Multimeter	Fluke	179	4006	12	21-Mar-2026
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Attenuator 5W 10dB DC-18GHz	Aaren	AT40A-4041-D18-10	5493	12	09-May-2025
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5604	12	26-Nov-2025
MXA Signal Analyser	Keysight Technologies	N9020B	6876	24	31-Aug-2026
1m SMA Cable	Junkosha	MWX221-01000AMSAMS/B	6919	12	08-Dec-2025

Table 34

O/P Mon – Output Monitored using calibrated equipment

3 Photographs

3.1 Test Setup Photographs

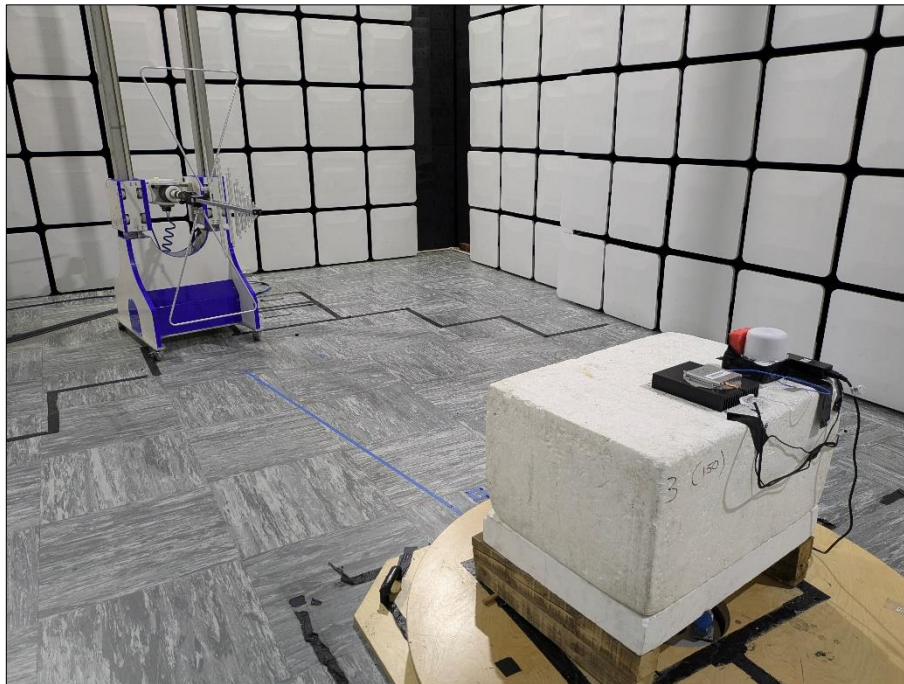


Figure 81 - Radiated Emissions, 30 MHz to 1 GHz

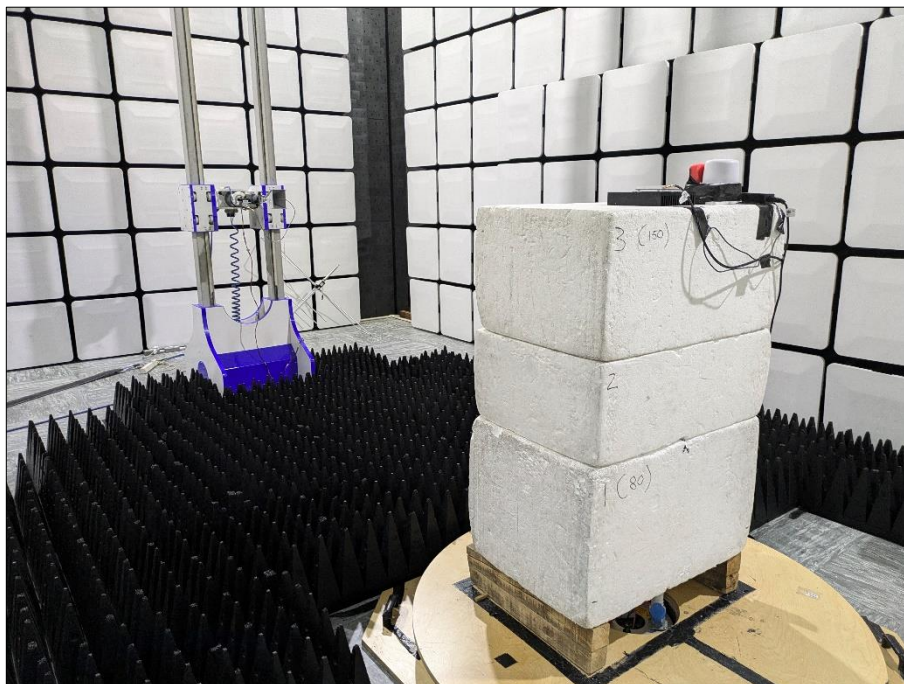


Figure 82 - Radiated Emissions, 1 GHz to 18 GHz



Figure 83 - Radiated Emissions, X-Plane

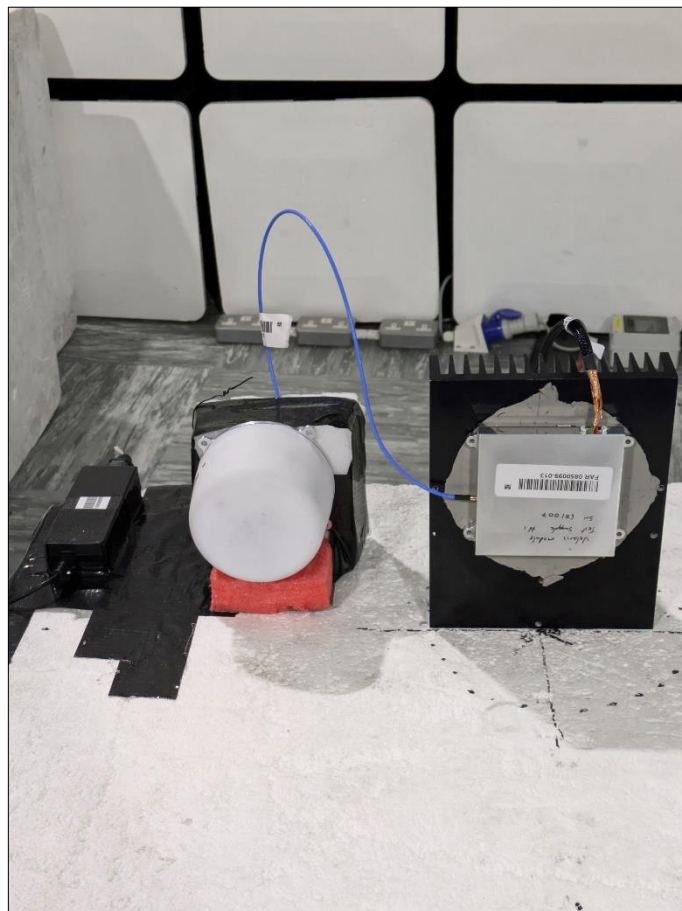


Figure 84 - Radiated Emissions, Y-Plane



Figure 85 - Radiated Emissions, Z-Plane



4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Radiated Spurious Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 18 GHz: ± 6.3 dB
Modulation Characteristics	-
Occupied Bandwidth	± 3.0 kHz
Frequency Tolerance	± 384.3 Hz
Spurious Emissions at Antenna Terminals	± 3.5 dB
Equivalent Isotropic Radiated Power	± 3.2 dB
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radio Navigation Satellite Service	± 3.5 dB

Table 35

Measurement Uncertainty Decision Rule

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.