

FCC and ISED Test Report

Kineis SAS
Model: KIM1

In accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 25, ISED RSS-170 and ISED RSS-GEN (UHF)

Prepared for: Kineis SAS
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Add value.
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FCC ID: 2A96E-KIM1-HW1-5 IC: 30247-KIM1HW15

COMMERCIAL-IN-CONFIDENCE

Document 75957047-01 Issue 01

SIGNATURE

NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Matthew Russell	Chief Engineer (RF)	Authorised Signatory	06 April 2023

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

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 2, FCC 47 CFR Part 25, 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	Neil Rousell	06 April 2023	
Testing	Pier-Angelo Lorusso	06 April 2023	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISED Accreditation
12669A Octagon House, Fareham Test Laboratory

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 3 (07-2015) 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	06-April-2023

Table 1

1.2 Introduction

Applicant	Kineis SAS
Manufacturer	Kineis SAS
Model Number(s)	KIM1
Serial Number(s)	26CDBAD, Not Serialised (Storix ID 705300-05) and Not Serialised (Storix ID 705300-07)
Hardware Version(s)	1.5
Software Version(s)	3.0
Number of Samples Tested	3
Test Specification/Issue/Date	FCC 47 CFR Part 2: 2021 FCC 47 CFR Part 25: 2021 ISED RSS-170: Issue 3 (07-2015) ISED RSS-GEN: Issue 5 (04-2018) + A2 (02-2021)
Order Number	PO-22-00438
Date	15-November-2022
Date of Receipt of EUT	20-January-2023
Start of Test	25-January-2023
Finish of Test	06-March-2023
Name of Engineer(s)	Neil Rousell and Pier-Angelo Lorusso
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: 400 MHz transmitter							
2.1	2.1047 (d)	-	-	-	Modulation Characteristics	Declaration	
2.3	2.1049	-	-	6.7	Occupied Bandwidth	Satisfactory	
2.4	2.1055	25.202(d)	5.2	6.11	Frequency Tolerance	Pass	
2.5	2.1051	25.202(f)	5.4.3.1	6.13	Spurious Emissions at Antenna Terminals	Pass	
Configuration and Mode: 400 MHz transmitter - coil antenna (case 0dBi)							
2.2	2.1053	25.202(f)	5.4.3.1	6.13	Radiated Spurious Emissions	Pass	
2.6	2.1046	25.204	5.3	6.12	Equivalent Isotropic Radiated Power	Pass	
Configuration and Mode: 400 MHz transmitter - dipole stick antenna (case +4dBi)							
2.2	2.1053	25.202(f)	5.4.3.1	6.13	Radiated Spurious Emissions	Pass	
2.6	2.1046	25.204	5.3	6.12	Equivalent Isotropic Radiated Power	Pass	

Table 2



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>	This is a telecommunication module, dedicated to Kinéis protocol. Uplink only (ground to satellites).	
Manufacturer:	Kinéis	
Model:	KIM1	
Part Number:	KIM152211xxxxx	
Hardware Version:	1.5	
Software Version:	3.0	
FCC ID of the product under test – see guidance here		
IC ID of the product under test – see guidance here		

Table 3

Intentional Radiators

Technology	Kinéis					
Frequency Range (MHz to MHz)	399.9-400.05MHz 401-403MHz					
Conducted Declared Output Power (dBm)	30dBm					
Antenna Gain (dBi)	2 ; 0 ; -3 dBi					
Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)	4 kHz					
Modulation Scheme(s) (e.g. GFSK, QPSK etc)	BPSK					
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	1K60G7D 0K80G7D					
Bottom Frequency (MHz)	399.91 MHz					
Middle Frequency (MHz)						
Top Frequency (MHz)	402.99 MHz					

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	402.99MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	16.369MHz
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 5



AC Power Source

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

Table 6

DC Power Source

Nominal voltage:	5	V
Extreme upper voltage:	5.5	V
Extreme lower voltage:	4.5	V
Max current:	0.55	A

Table 7

Battery Power Source

Voltage:	NA	V
End-point voltage:	NA	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 8

Charging

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

Table 9

Temperature

Minimum temperature:	-40	°C
Maximum temperature:	+85	°C

Table 10

Cable Loss

Adapter Cable Loss (Conducted sample)	NA	dB
---------------------------------------	----	----

Table 11



Antenna Characteristics

Antenna connector <input type="checkbox"/>			State impedance		Ohm
Temporary antenna connector <input checked="" type="checkbox"/>			State impedance	50	Ohm
Integral antenna <input type="checkbox"/>	Type:		Gain		dBi
External antenna <input checked="" type="checkbox"/>	Type:	Whip dipole PCB Coil	Gain	4 0	dBi
<p>For external antenna only: Standard Antenna Jack <input checked="" type="checkbox"/> If yes, describe how user is prohibited from changing antenna (if not professional installed): Equipment is only ever professionally installed <input checked="" type="checkbox"/> Non-standard Antenna Jack <input type="checkbox"/> 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 12

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

Table 13

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

Name: Vincent Gamonal
 Position held: Test & validation engineer
 Date: 22 November 2022



1.5 Product Information

1.5.1 Technical Description

This is a telecommunication module, dedicated to Kinéis protocol. Uplink only (ground to satellites).

1.6 Deviations from the Standard

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

1.7 Test environment

The EUT supported BPSK modulation at bit rates 400bps (LDA2), 300bps (LDK) and 200bps (VLDA4). All testing was performed using LDA2, which was found to produce the largest occupied bandwidth.

1.8 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: KIM1, Serial Number: 26CDBAD			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: KIM1, Serial Number: Not Serialised (Storix ID 705300-05)			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: KIM1, Serial Number: Not Serialised (Storix ID 705300-07)			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 14



1.9 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: 400 MHz transmitter		
Modulation Characteristics	Neil Rousell	UKAS
Occupied Bandwidth	Neil Rousell	UKAS
Frequency Tolerance	Neil Rousell	UKAS
Spurious Emissions at Antenna Terminals	Neil Rousell	UKAS
Configuration and Mode: 400 MHz transmitter - coil antenna (case 0dBi)		
Radiated Spurious Emissions	Pier-Angelo Lorusso	UKAS
Equivalent Isotropic Radiated Power	Pier-Angelo Lorusso	UKAS
Configuration and Mode: 400 MHz transmitter - dipole stick antenna (case +4dBi)		
Radiated Spurious Emissions	Pier-Angelo Lorusso	UKAS
Equivalent Isotropic Radiated Power	Pier-Angelo Lorusso	UKAS

Table 15

Office Address:

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



2 Test Details

2.1 Modulation Characteristics

2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1047 (d)

2.1.2 Equipment Under Test and Modification State

KIM1, S/N: 26CDBAD - Modification State 0

2.1.3 Date of Test

25-January-2023

2.1.4 Test Method

Customer provided description of supported modulation.

2.1.5 Test Results

400 MHz transmitter

The following description was provided by the manufacturer:

Three modulations are of type BPSK between +/-1.1 radians.

The bit rates are respectively, 400bps for LDA2, 300bps for LDK and 200bps for VLDA4.

The payload is limited to 31bytes for both LDA2 and LDK while shorter are available. The payload of VLDA4 is limited to 56bits.

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.



2.2 Radiated Spurious Emissions

2.2.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1053
FCC 47 CFR Part 25, Clause 25.202(f)
ISED RSS-170, Clause 5.4.3.1
ISED RSS-GEN, Clause 6.13

2.2.2 Equipment Under Test and Modification State

KIM1, S/N: Not Serialised (Storix ID 705300-05) - Modification State 0
KIM1, S/N: 26CDBAD - Modification State 0

2.2.3 Date of Test

04-February-2023 to 06-March-2023

2.2.4 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.

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.

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

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

2.2.5 Example Test Setup Diagram

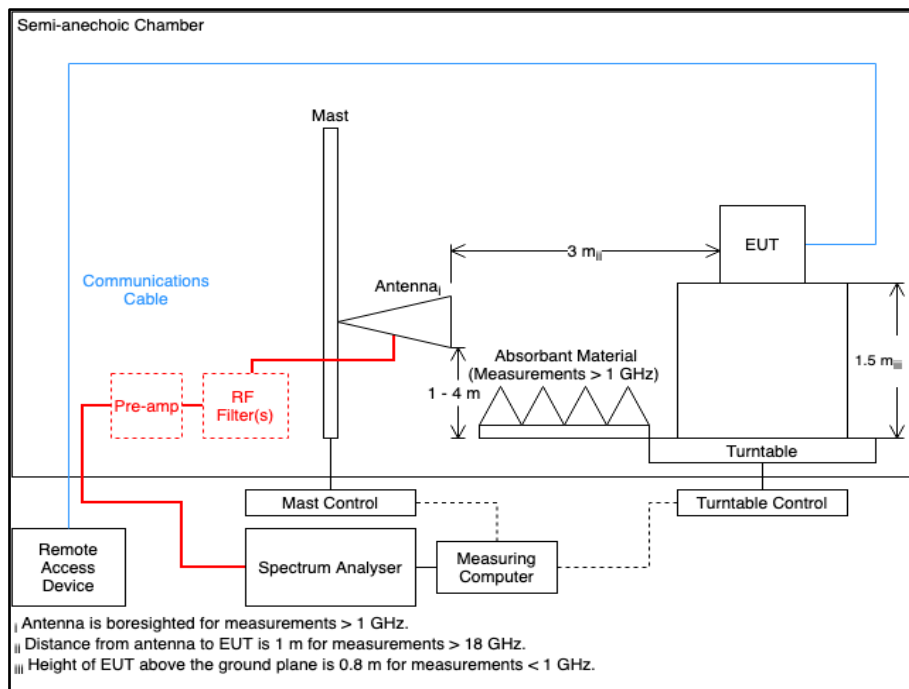


Figure 1

2.2.6 Environmental Conditions

Ambient Temperature 17.5 - 22.1 °C
Relative Humidity 26.1 - 43.2 %



2.2.7 Test Results

400 MHz transmitter - coil antenna (case 0dBi)

Frequency (MHz)	Level (dBm)	Polarisation	Orientation
*			

Table 16 - 399.91 MHz, 30 MHz to 5 GHz

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

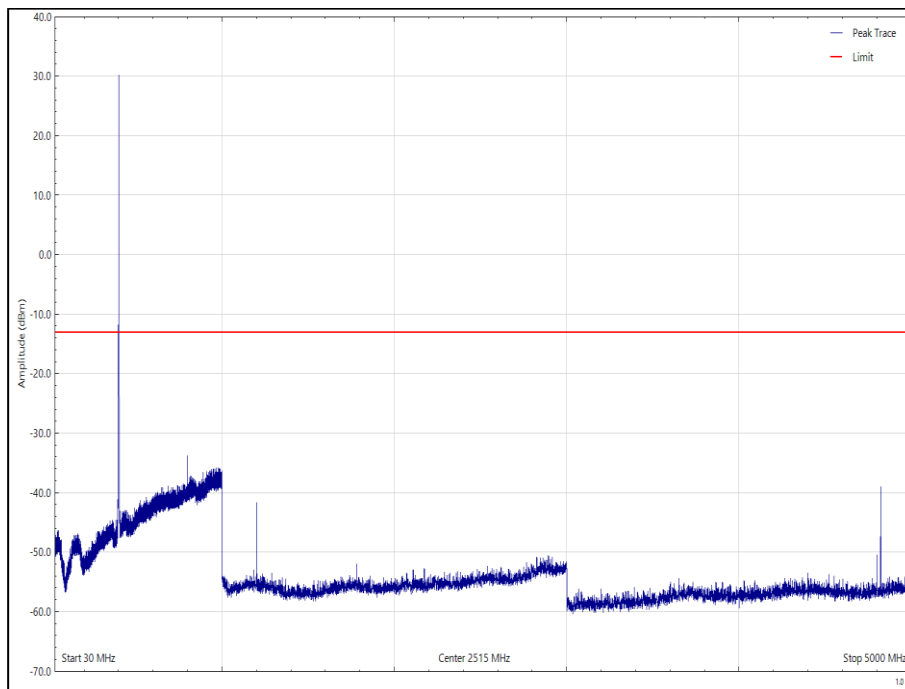


Figure 2 - 399.91 MHz - 30 MHz to 5 GHz, Horizontal, X Orientation

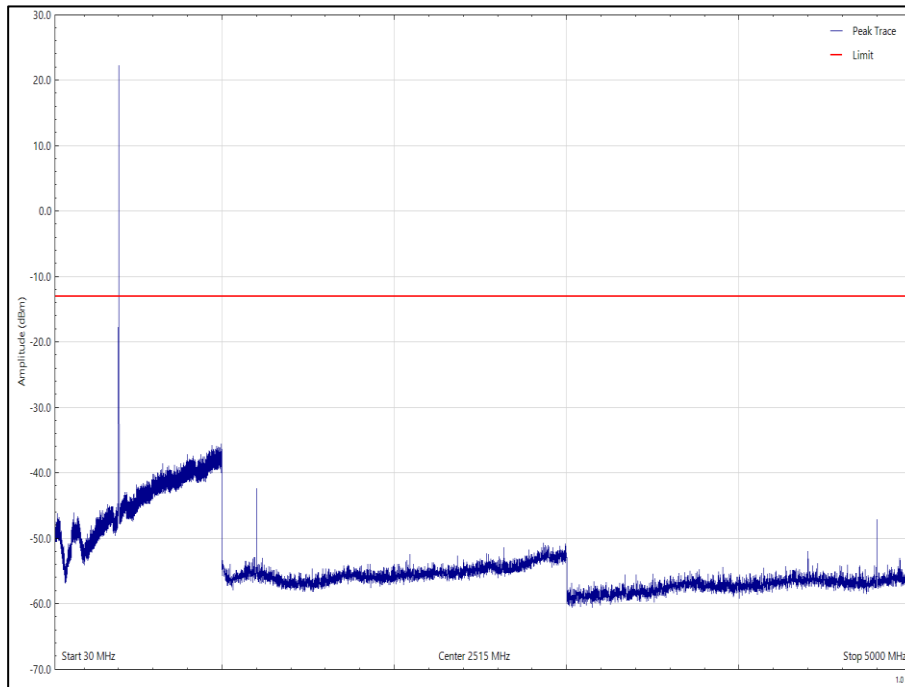


Figure 3 - 399.91 MHz - 30 MHz to 5 GHz, Vertical, X Orientation

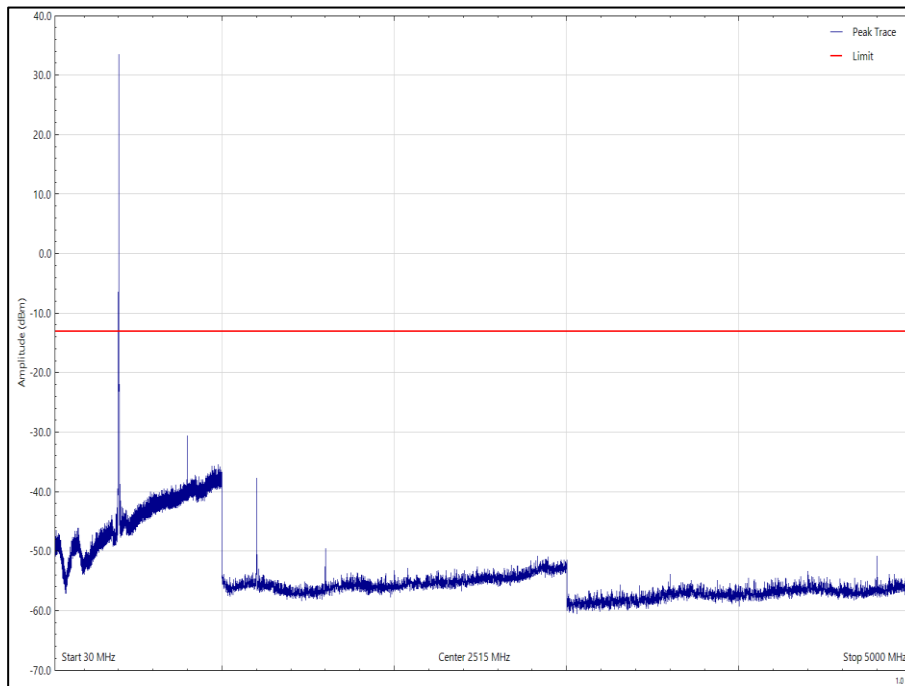


Figure 4 - 399.91 MHz - 30 MHz to 5 GHz, Horizontal, Y Orientation

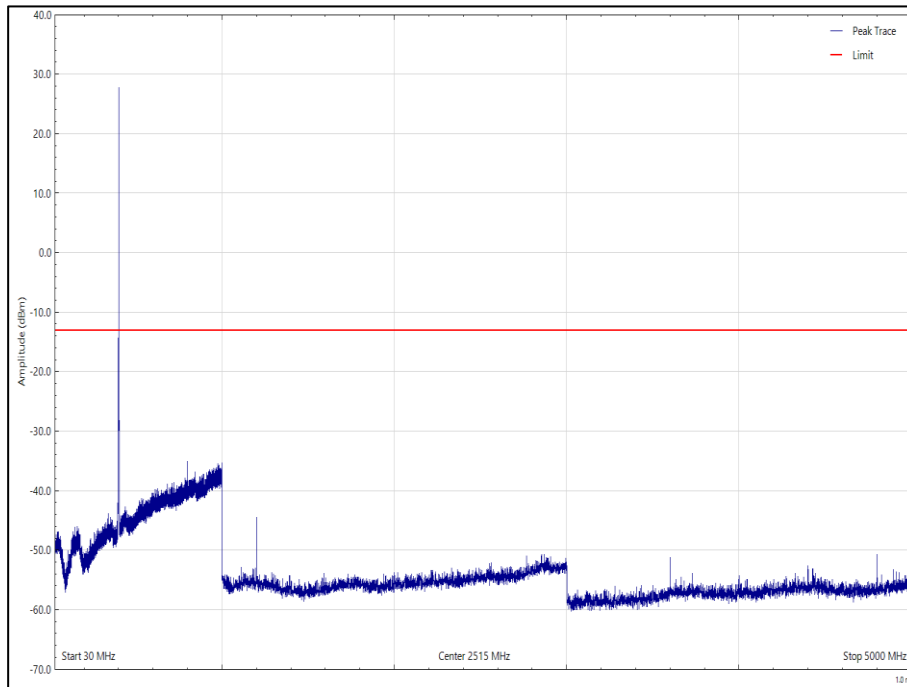


Figure 5 - 399.91 MHz - 30 MHz to 5 GHz, Vertical, Y Orientation

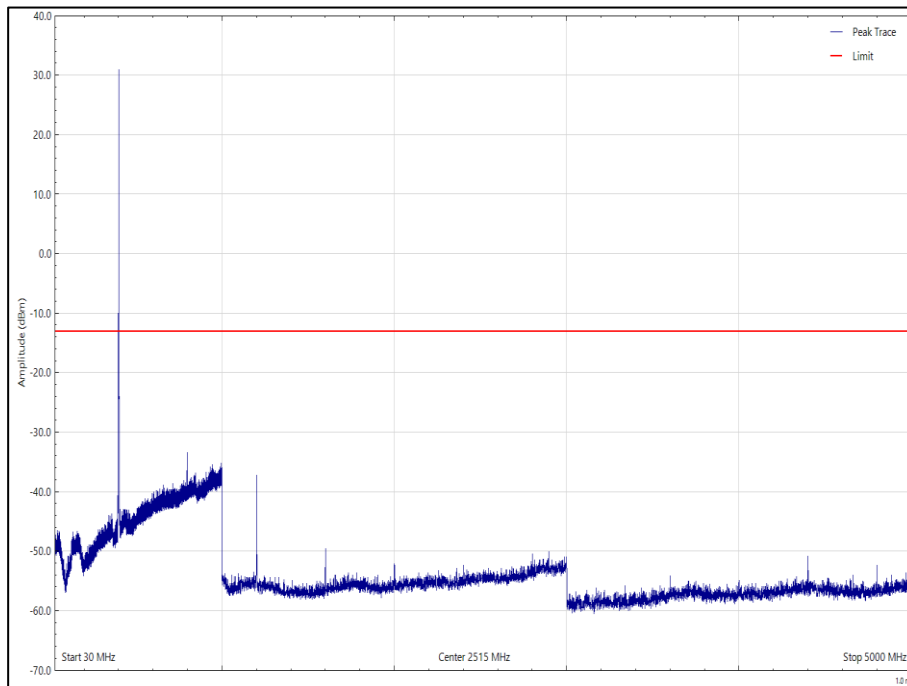


Figure 6 - 399.91 MHz - 30 MHz to 5 GHz, Horizontal, Z Orientation

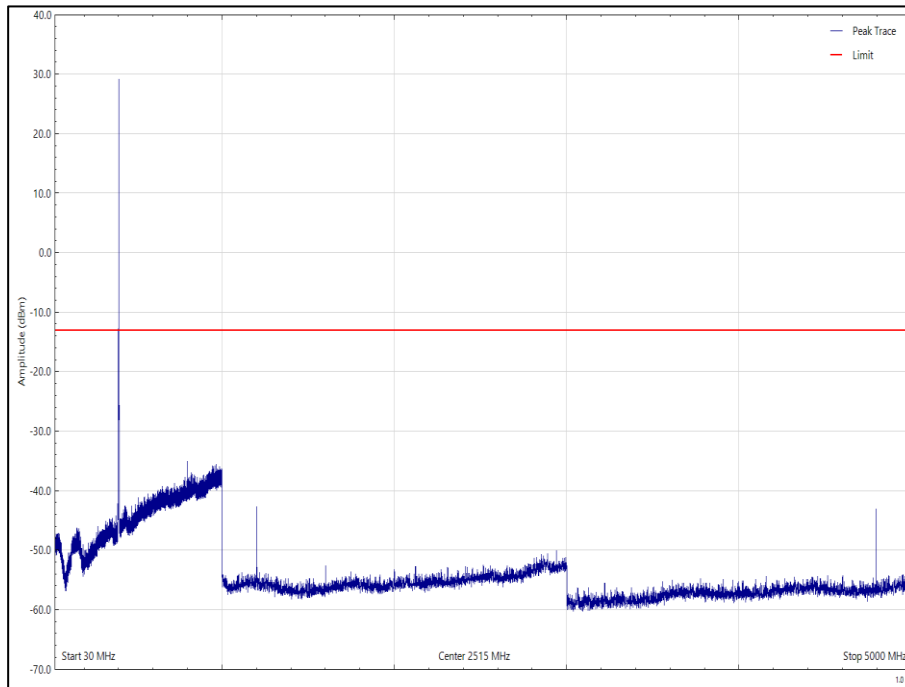


Figure 7 - 399.91 MHz - 30 MHz to 5 GHz, Vertical, Z Orientation



Frequency (MHz)	Level (dBm)	Polarisation	Orientation
*			

Table 17 - 402.99 MHz, 30 MHz to 5 GHz

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

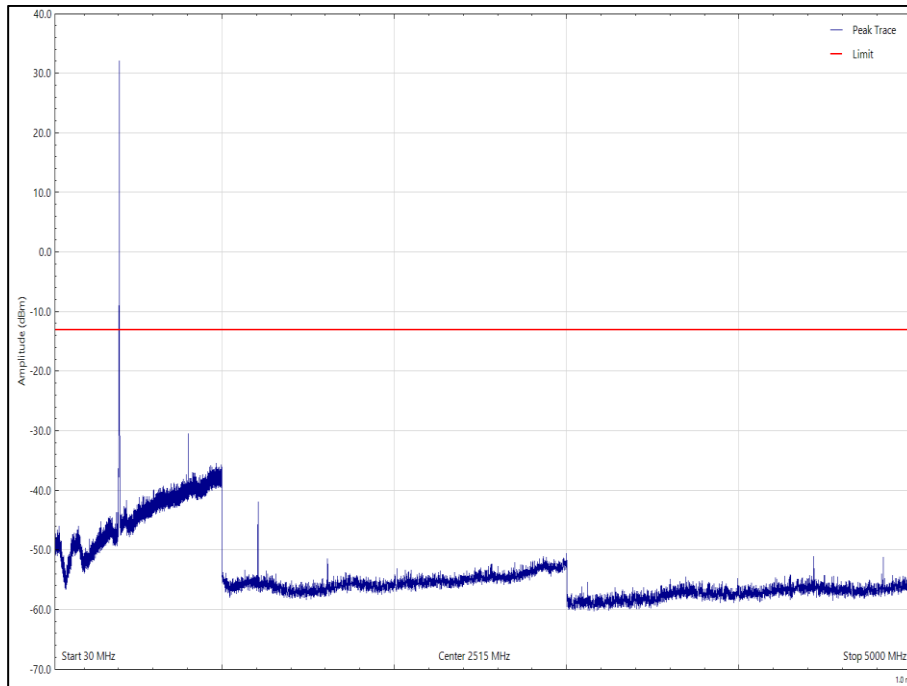


Figure 8 - 402.99 MHz - 30 MHz to 5 GHz, Horizontal, X Orientation

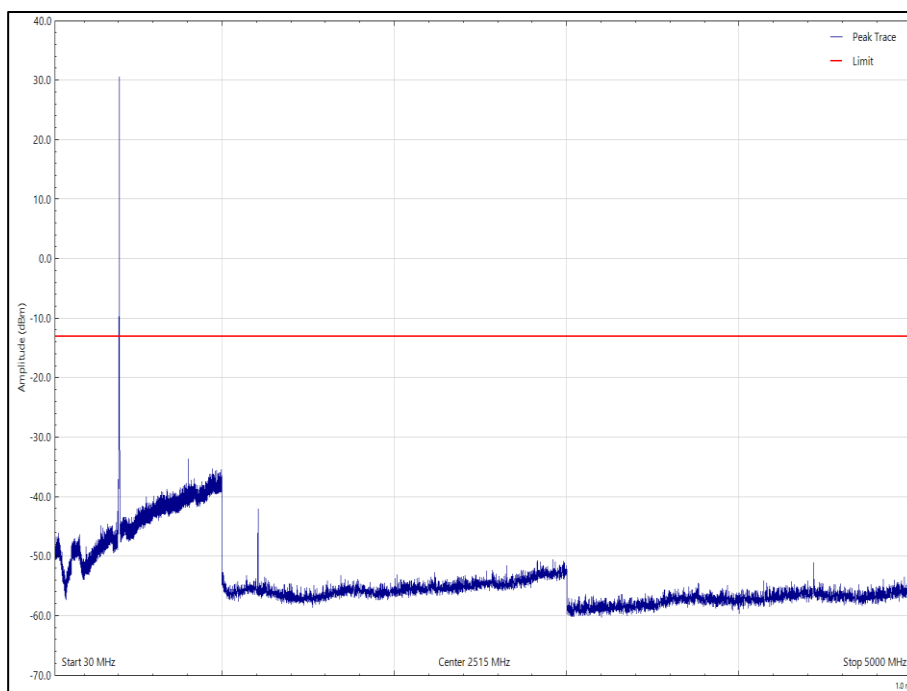


Figure 9 - 402.99 MHz - 30 MHz to 5 GHz, Vertical, X Orientation

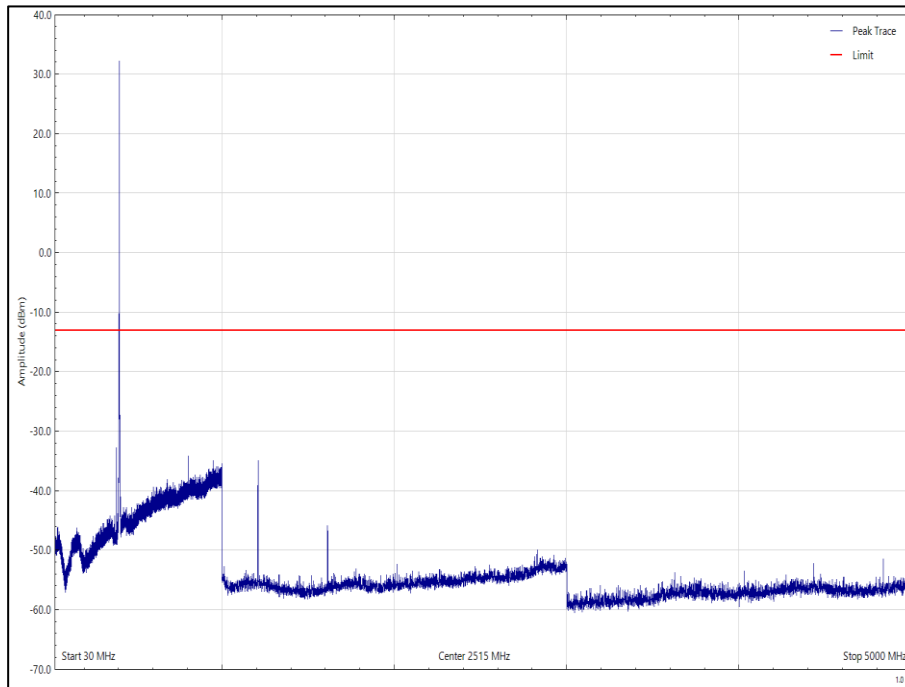


Figure 10 - 402.99 MHz - 30 MHz to 5 GHz, Horizontal, Y Orientation

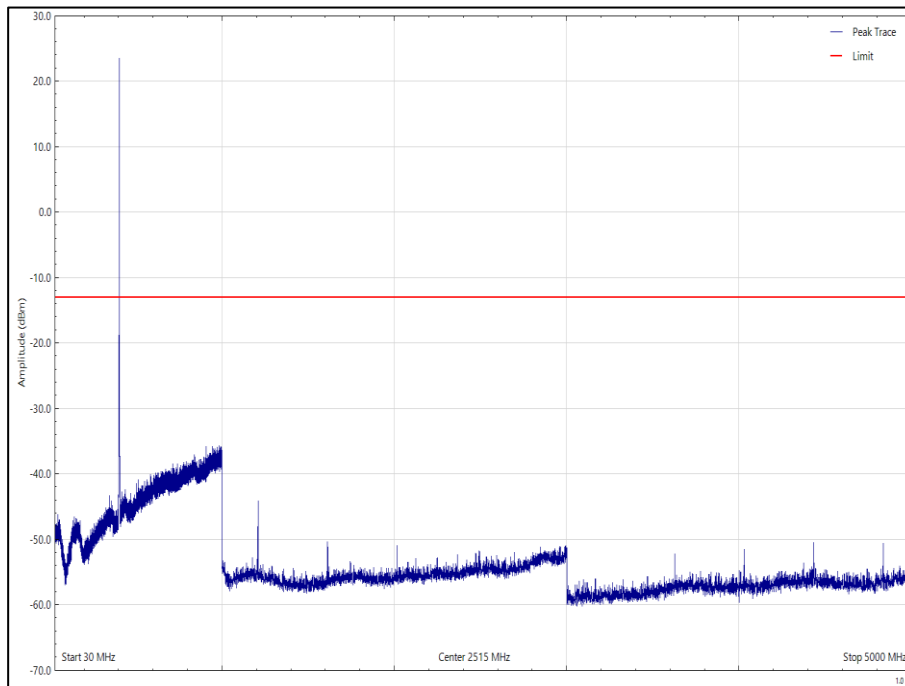


Figure 11 - 402.99 MHz - 30 MHz to 5 GHz, Vertical, Y Orientation

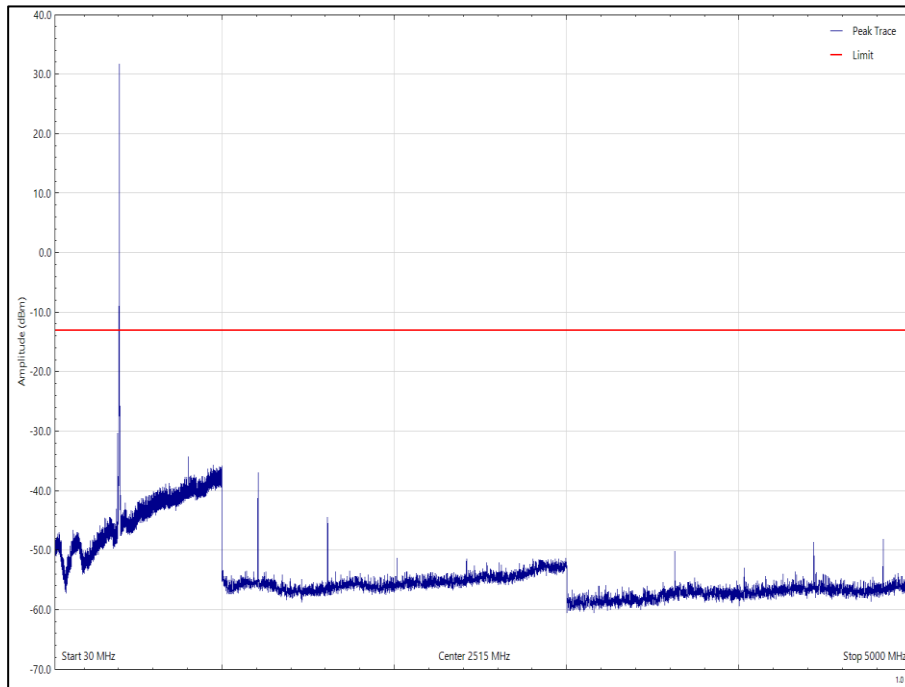


Figure 12 - 402.99 MHz - 30 MHz to 5 GHz, Horizontal, Z Orientation

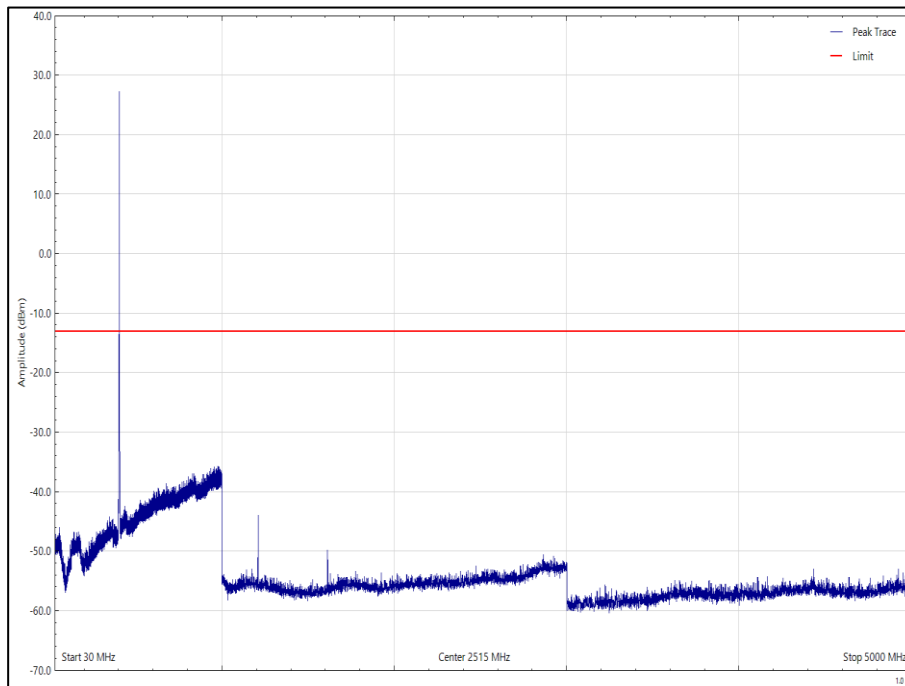


Figure 13 - 402.99 MHz - 30 MHz to 5 GHz, Vertical, Z Orientation



400 MHz transmitter - dipole stick antenna (case +4dBi)

Frequency (MHz)	Level (dBm)	Polarisation	Orientation
*			

Table 18 - 399.91 MHz, 30 MHz to 5000

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

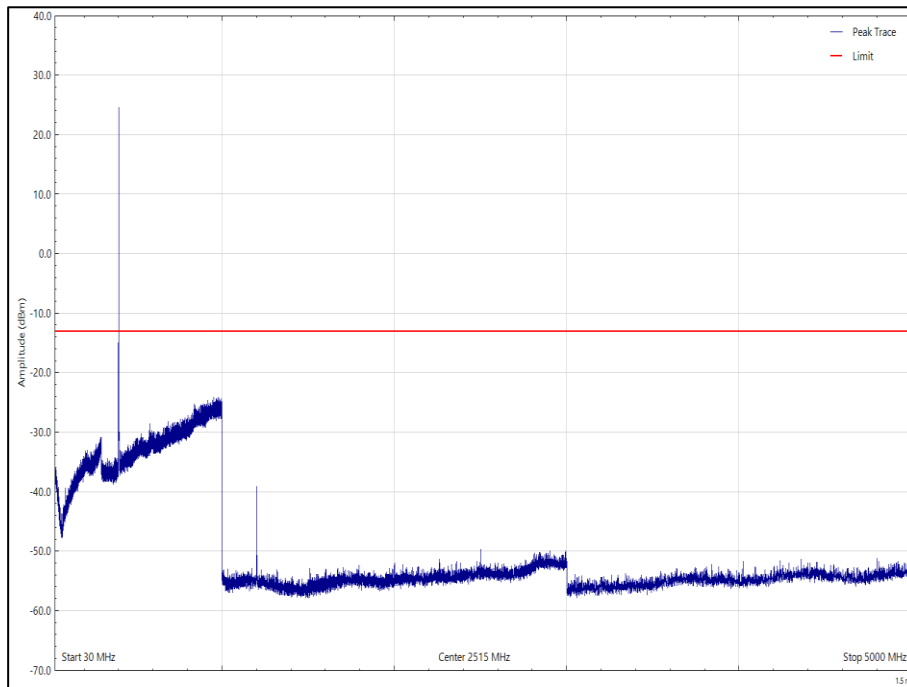


Figure 14 - 399.91 MHz - 30 MHz to 5 GHz, Horizontal, X Orientation

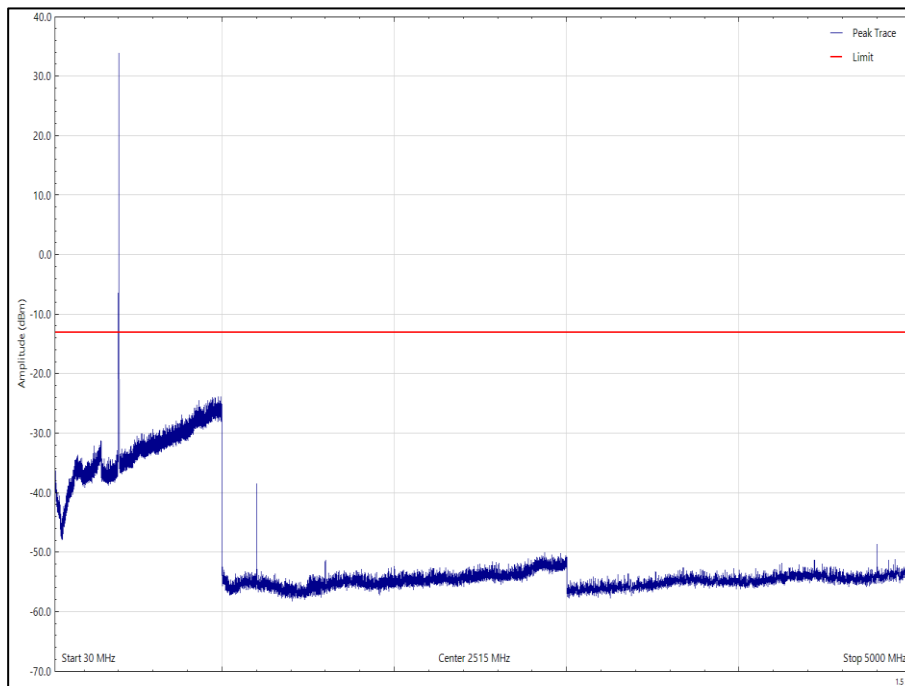


Figure 15 - 399.91 MHz - 30 MHz to 5 GHz, Vertical, X Orientation

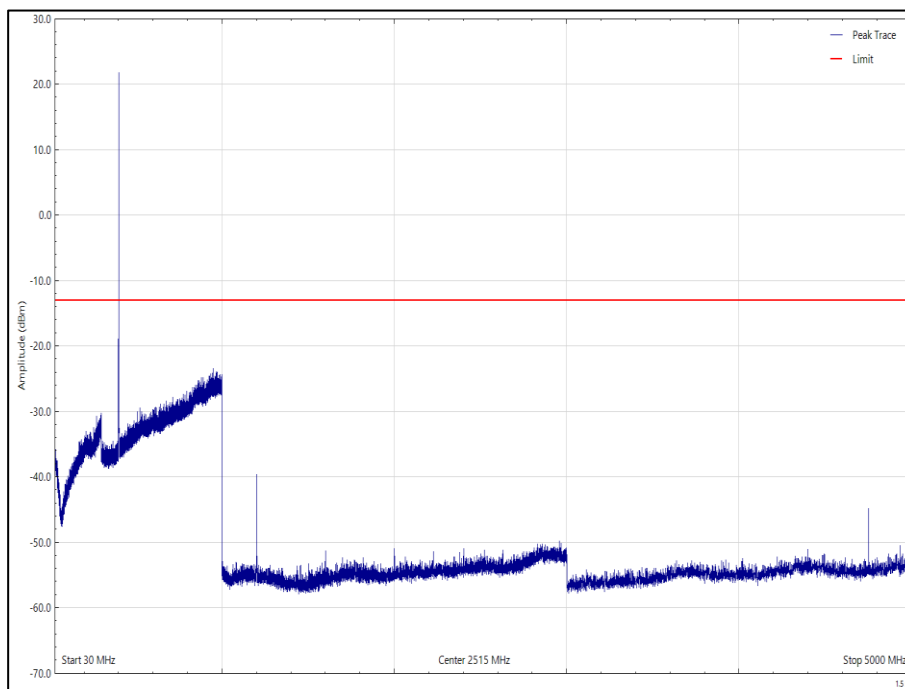


Figure 16 - 399.91 MHz - 30 MHz to 5 GHz, Horizontal, Y Orientation

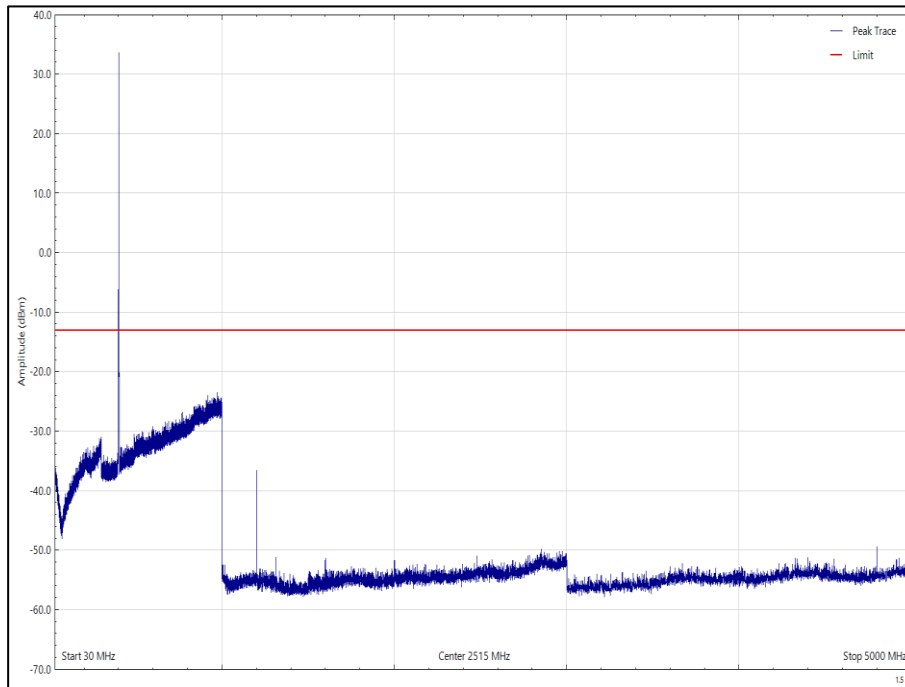


Figure 17 - 399.91 MHz - 30 MHz to 5 GHz, Vertical, Y Orientation

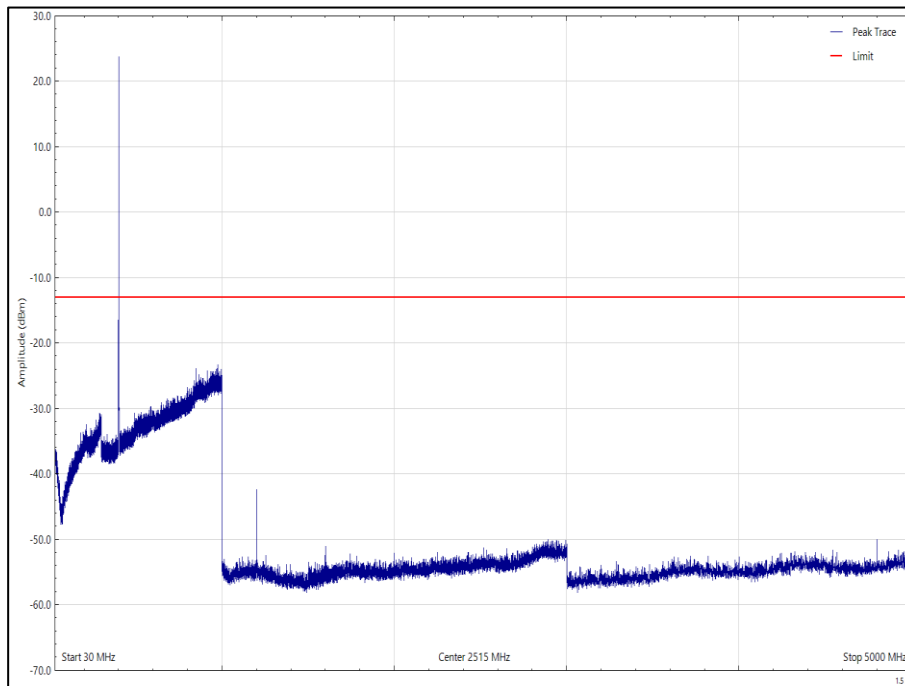


Figure 18 - 399.91 MHz - 30 MHz to 5 GHz, Horizontal, Z Orientation

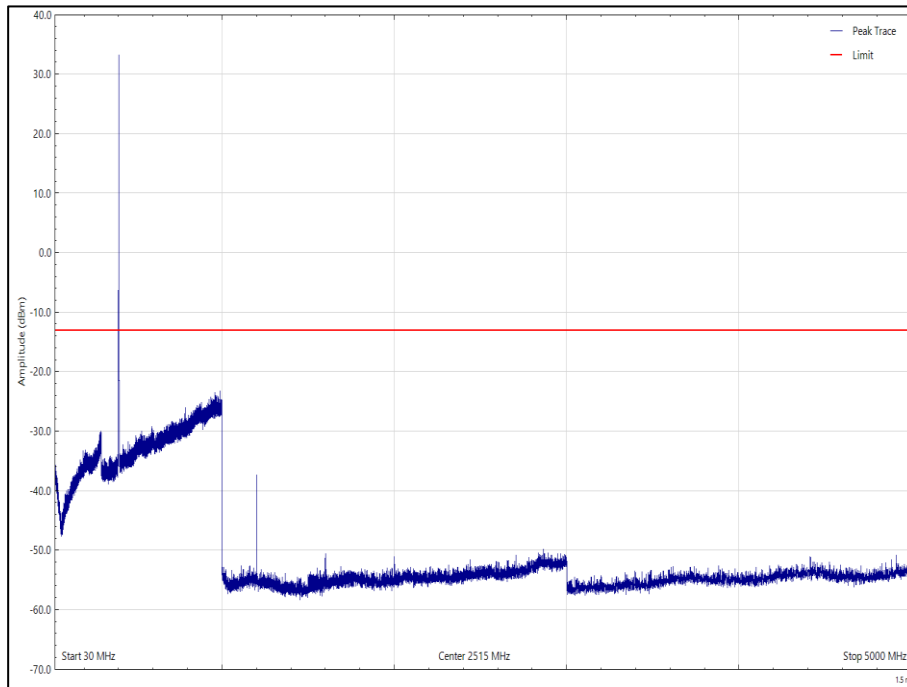


Figure 19 - 399.91 MHz - 30 MHz to 5 GHz, Vertical, Z Orientation



Frequency (MHz)	Level (dBm)	Polarisation	Orientation
*			

Table 19 - 402.99 MHz, 30 MHz to 5 GHz

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

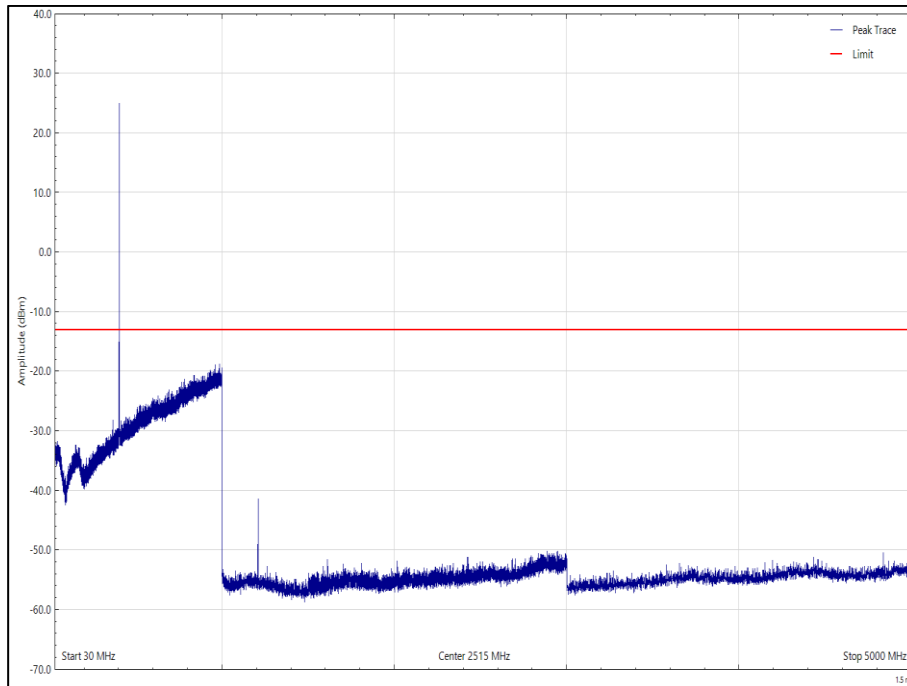


Figure 20 - 402.99 MHz - 30 MHz to 5 GHz, Horizontal, X Orientation

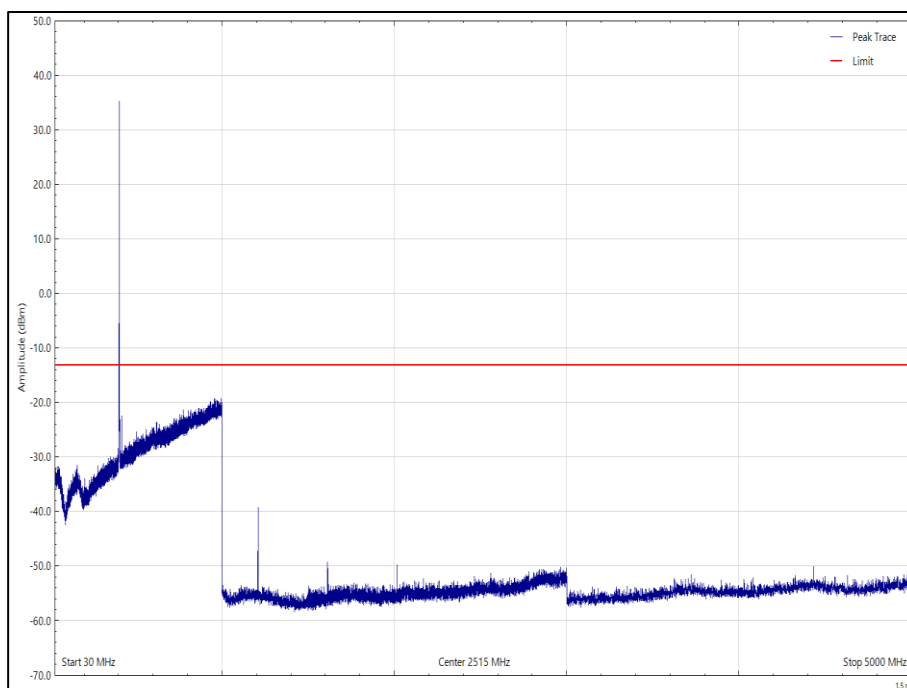


Figure 21 - 402.99 MHz - 30 MHz to 5 GHz, Vertical, X Orientation

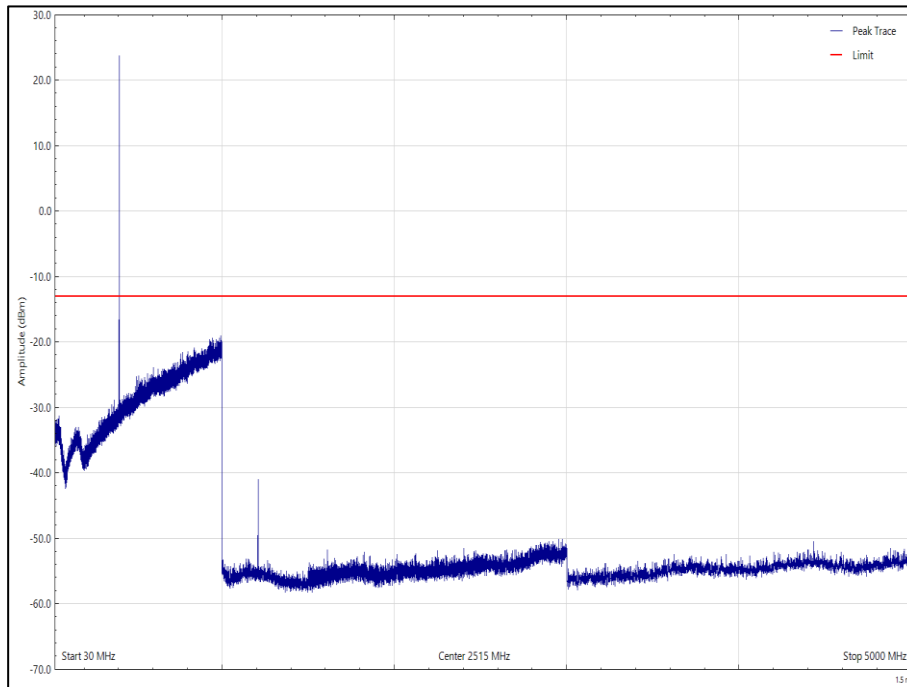


Figure 22 - 402.99 MHz - 30 MHz to 5 GHz, Horizontal, Y Orientation

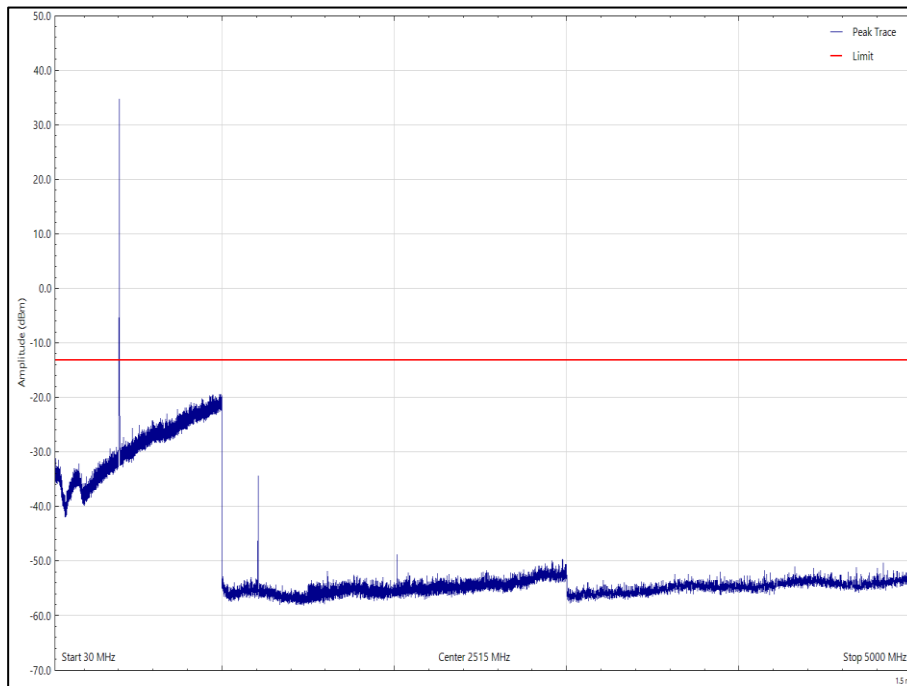


Figure 23 - 402.99 MHz - 30 MHz to 5 GHz, Vertical, Y Orientation

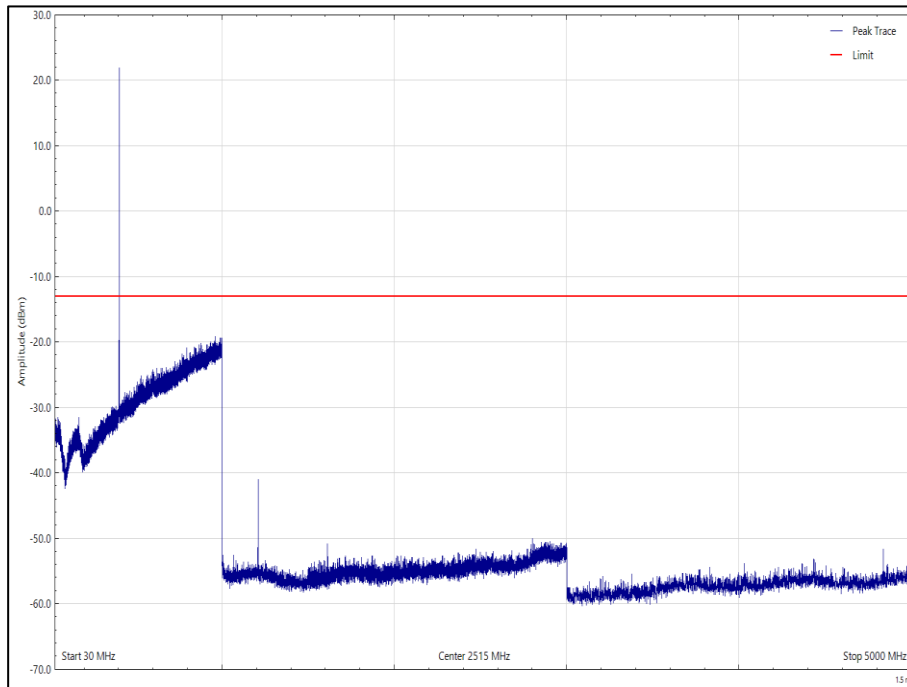


Figure 24 - 402.99 MHz - 30 MHz to 5 GHz, Horizontal, Z Orientation

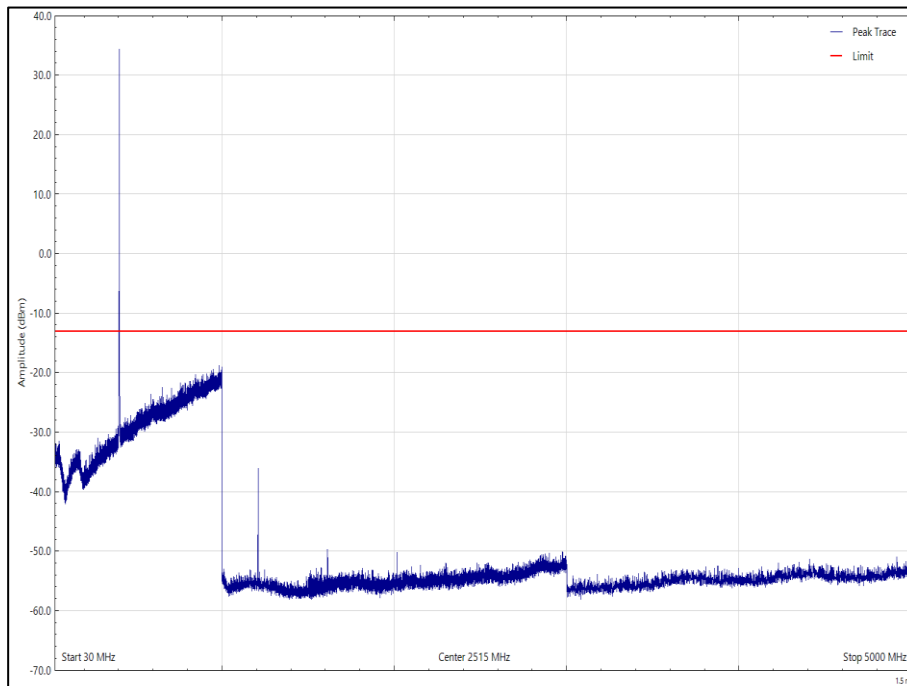


Figure 25 - 402.99 MHz - 30 MHz to 5 GHz, Vertical, Z Orientation



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.

Industry Canada RSS-170, Limit Clause 5.4.3.1

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.



2.2.8 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
Filter (Hi Pass)	Mini-Circuits	NHP-600	2834	12	19-Jan-2024
True RMS Multimeter	Fluke	179	4006	12	29-Mar-2023
High Pass filter	Wainwright	WHKX12-1290-1500-18000-80SS	4962	12	19-May-2023
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	17-May-2023
Emissions Software	TUV SUD	EmX V3.1.10	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 1-10.5GHz)	Schwarzbeck	BBHA9120B	5215	12	28-May-2023
Thermo-Hygro-Barometer	PCE Instruments	OCE-THB-40	5470	12	07-Apr-2023
Cable (K-Type to K-Type, 1 m)	Junkosha	MWX241-01000KMSKMS/A	5512	12	14-Apr-2023
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5518	12	12-Apr-2023
8m N Type Cable	Junkosha	MWX221-08000NMSNMS/B	5522	12	24-Mar-2023
TRILOG Super Broadband Test Antenna	Schwarzbeck	VULB 9168	5942	24	03-Feb-2024
Attenuator 4dB	Pasternack	PE7074-4	6202	24	16-Jul-2024

Table 20

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



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

KIM1, S/N: 26CDBAD - Modification State 0

2.3.3 Date of Test

25-January-2023

2.3.4 Test Method

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

2.3.5 Environmental Conditions

Ambient Temperature	20.5 °C
Relative Humidity	35.1 %



2.3.6 Test Results

400 MHz transmitter

Occupied Bandwidth (kHz)	
399.91 MHz	402.99 MHz
4.079	4.059

Table 21

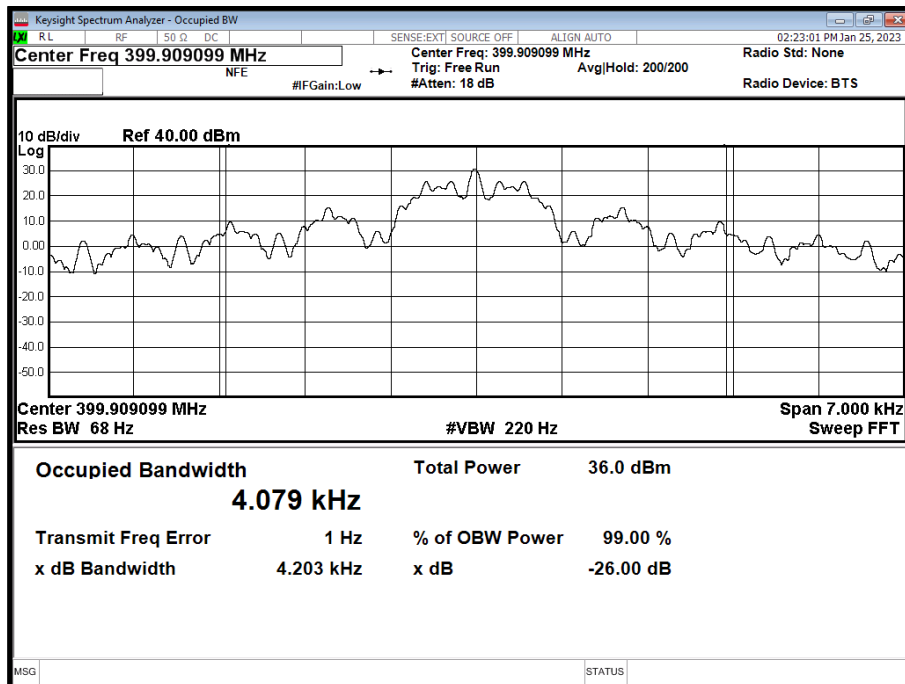


Figure 26 - 399.91 MHz

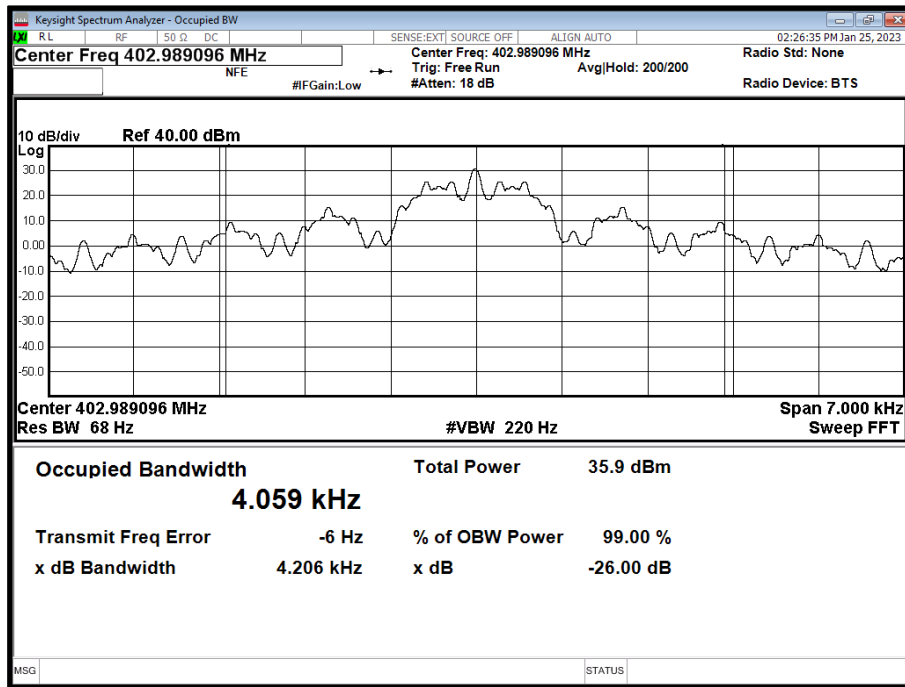


Figure 27 - 402.99 MHz

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
Multimeter	Iso-tech	IDM101	2417	12	28-Nov-2023
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	13-Jul-2023
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	08-Mar-2023
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	25-Apr-2023
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	5502	12	21-Apr-2023

Table 22

O/P Mon – Output Monitored using calibrated equipment



2.4 Frequency Tolerance

2.4.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1055
FCC 47 CFR Part 25, Clause 25.202(d),
ISED RSS-170, Clause 5.2
ISED RSS-GEN, Clause 6.11

2.4.2 Equipment Under Test and Modification State

KIM1, S/N: 26CDBAD - Modification State 0

2.4.3 Date of Test

25-January-2023 to 26-January-2023

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 -10 dBc points.

2.4.5 Environmental Conditions

Ambient Temperature	20.5 °C
Relative Humidity	35.1 %



2.4.6 Test Results

400 MHz transmitter

Temperature (°C)	Voltage (DC)	399.91 MHz		402.99 MHz	
		Frequency Error (Drift)		Frequency Error (Drift)	
		%	ppm	%	ppm
-30	5.0	0.000023	0.23	0.000015	0.15
-20	5.0	-0.000006	-0.06	-0.000006	-0.06
-10	5.0	-0.000014	-0.14	-0.000015	-0.15
0	5.0	-0.000011	-0.11	-0.000015	-0.15
10	5.0	0.000001	0.01	0.000000	0.00
20	4.5	0.000001	0.01	0.000000	0.00
20	5.0	-	-	-	-
20	5.5	0.000002	-0.02	0.000000	0.00
30	5.0	-0.000005	-0.05	-0.000007	-0.07
40	5.0	-0.000012	-0.12	-0.000013	-0.13
50	5.0	-0.000013	-0.13	-0.000014	-0.14

Table 23

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.

Industry Canada RSS-170, Limit Clause 5.2

For mobile earth station equipment, the carrier frequency shall not depart 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
Multimeter	Iso-tech	IDM101	2417	12	28-Nov-2023
Thermocouple Thermometer	Fluke	51	3172	12	27-Jan-2023
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	13-Jul-2023
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	08-Mar-2023
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	25-Apr-2023
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	5502	12	21-Apr-2023

Table 24

O/P Mon – Output Monitored using calibrated equipment



2.5 Spurious Emissions at Antenna Terminals

2.5.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1051
FCC 47 CFR Part 25, Clause 25.202(f)
ISED RSS-170, Clause 5.4.3.1
ISED RSS-GEN, Clause 6.13

2.5.2 Equipment Under Test and Modification State

KIM1, S/N: 26CDBAD - Modification State 0

2.5.3 Date of Test

26-January-2023 to 27-January-2023

2.5.4 Test Method

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

Emission mask was measured using approx 3% OBW referenced to average power measured with a 4 kHz RBW.

Where an RBW > 4 kHz was used, this was considered worst case.

2.5.5 Environmental Conditions

Ambient Temperature	20.7 - 22.0 °C
Relative Humidity	33.4 - 36.0 %



2.5.6 Test Results

400 MHz transmitter

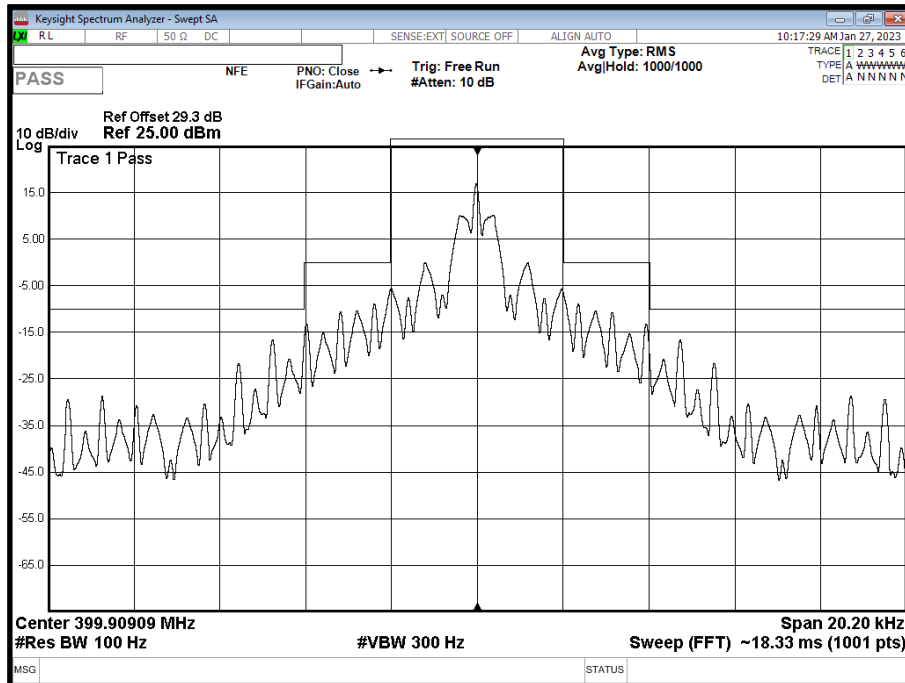


Figure 28 - 399.91 MHz - Emission Mask

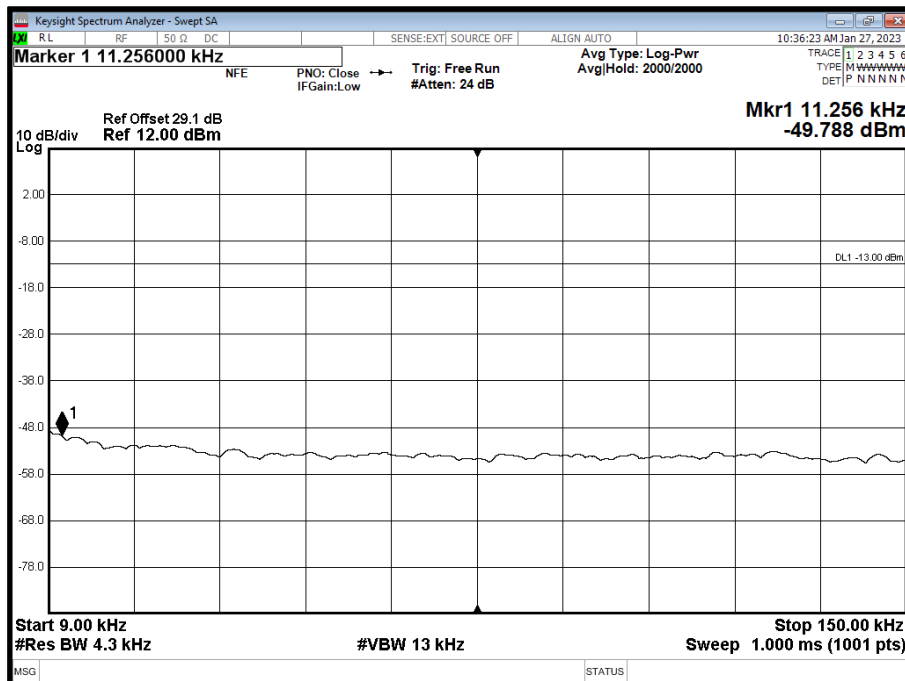


Figure 29 - 399.91 MHz - 9 kHz to 150 kHz

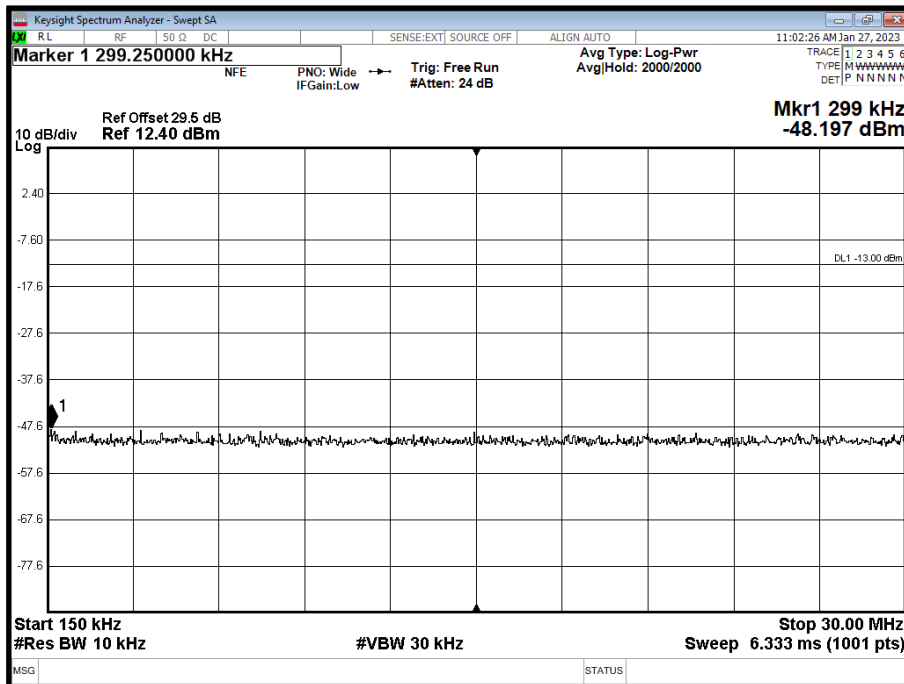


Figure 30 - 399.91 MHz - 150 kHz to 30 MHz

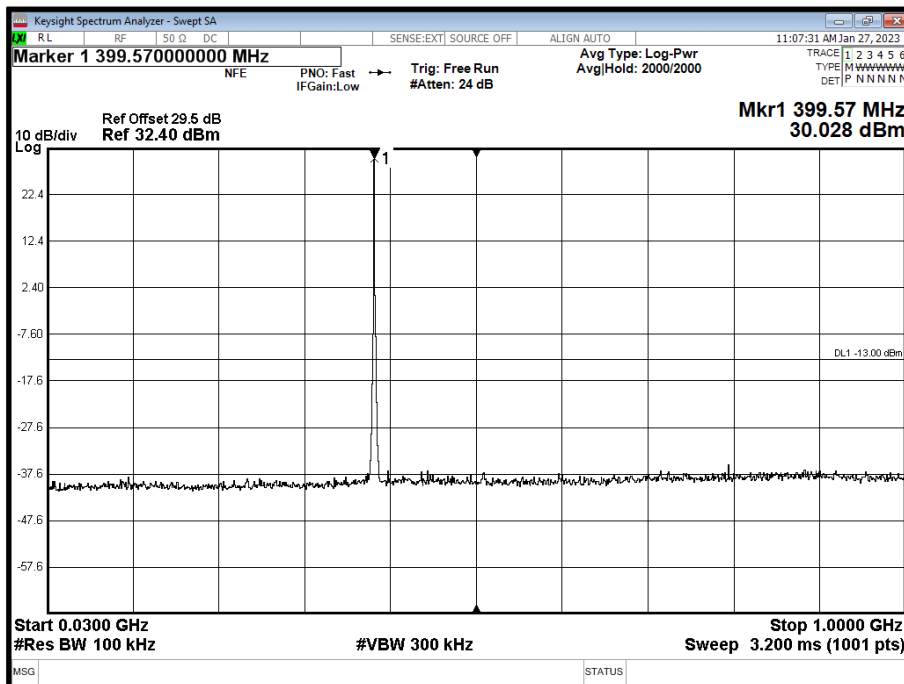


Figure 31 - 399.91 MHz - 30 MHz to 1 GHz

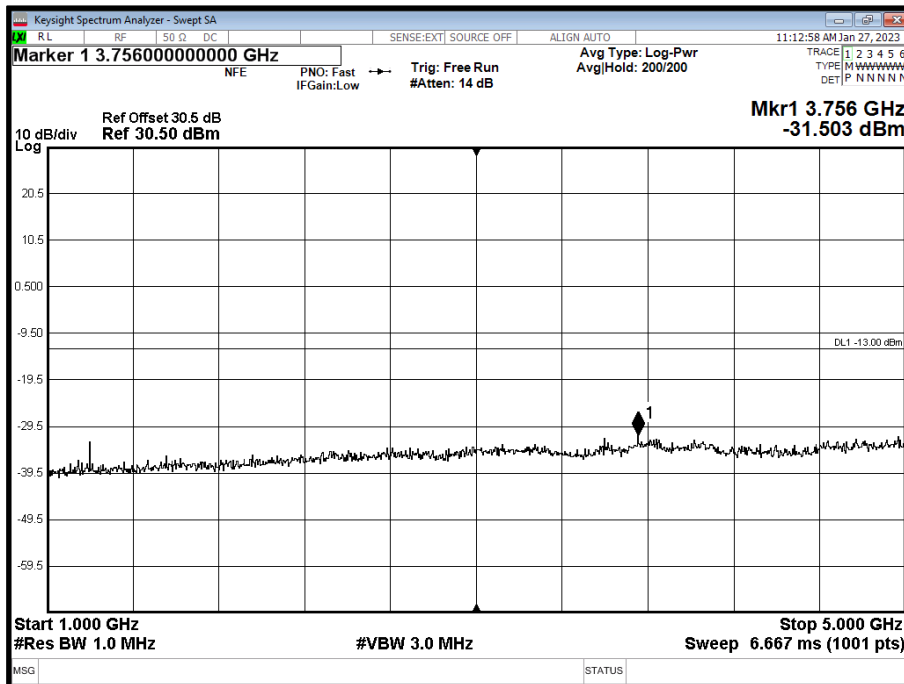


Figure 32 - 399.91 MHz - 1 GHz to 5 GHz

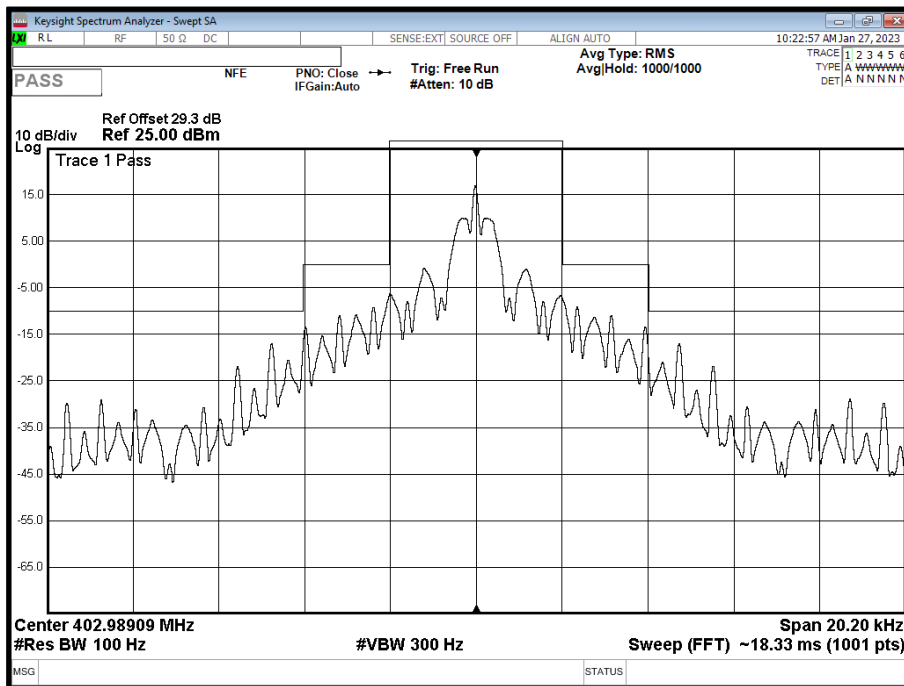


Figure 33 - 402.99 MHz - Emission Mask

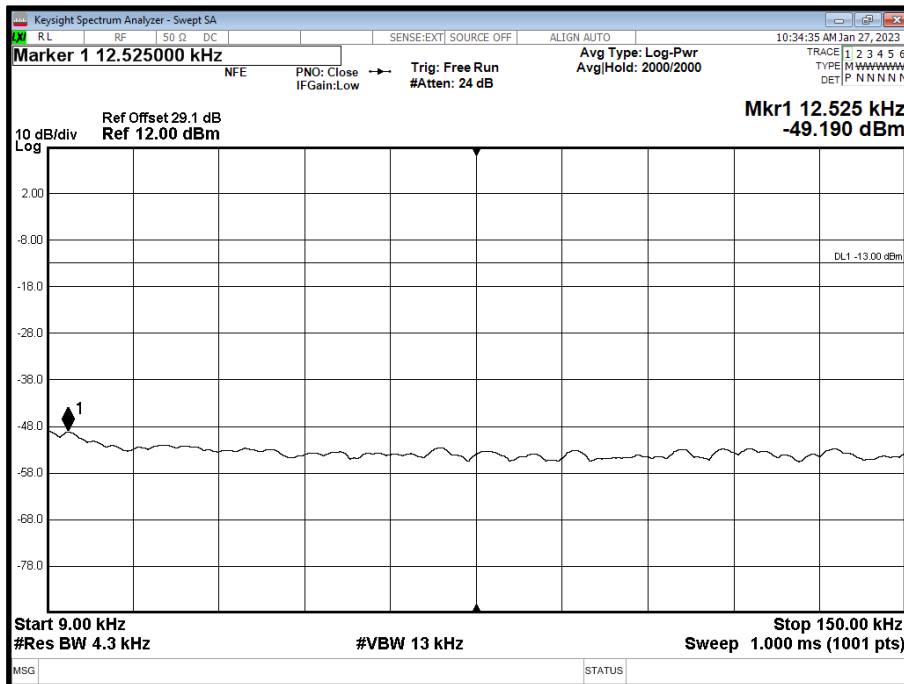


Figure 34 - 402.99 MHz - 9 kHz to 150 kHz

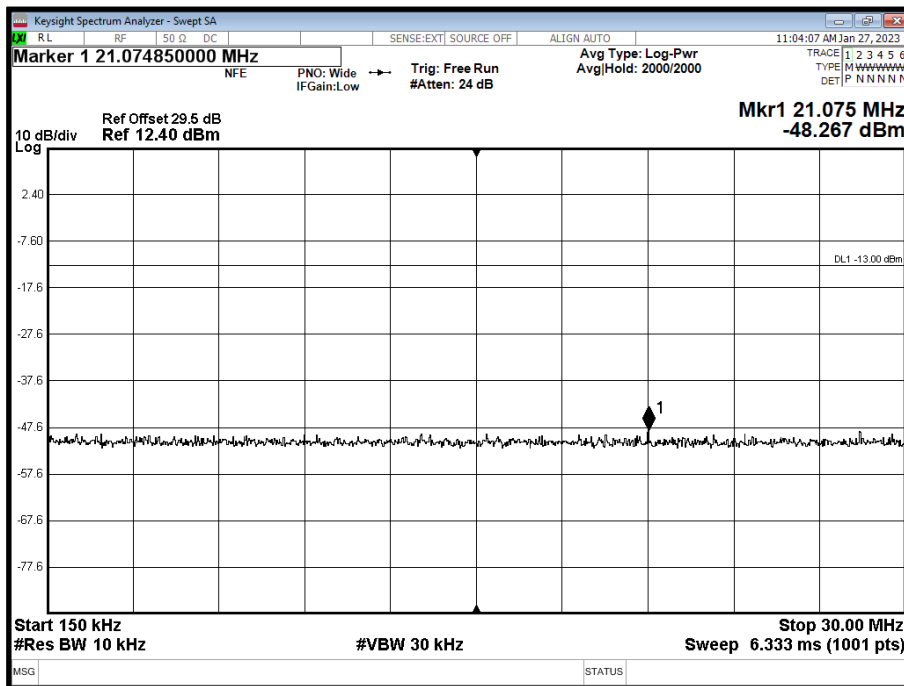


Figure 35 - 402.99 MHz - 150 kHz to 30 MHz

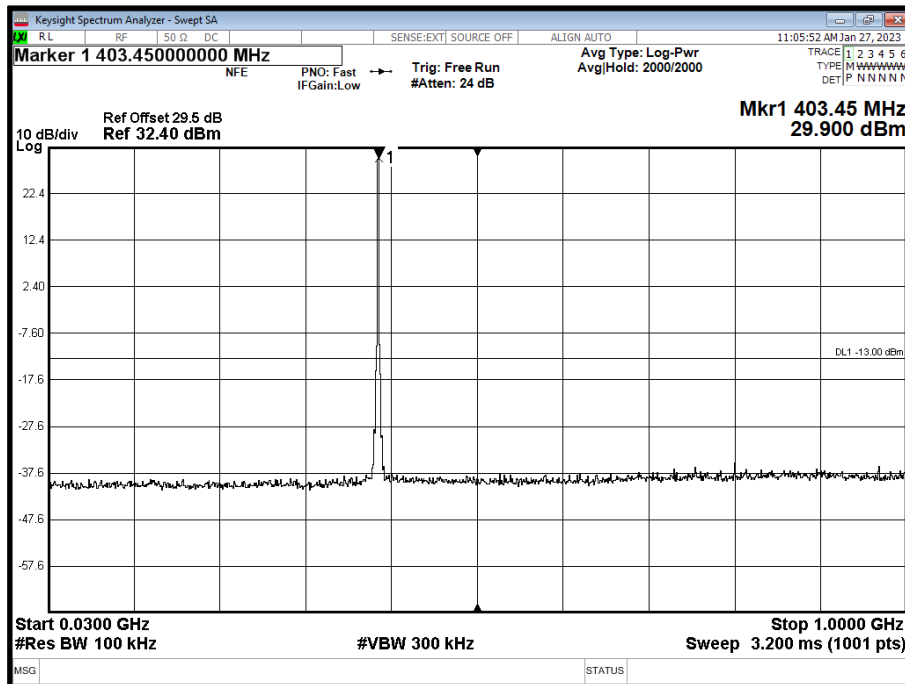


Figure 36 - 402.99 MHz - 30 MHz to 1 GHz

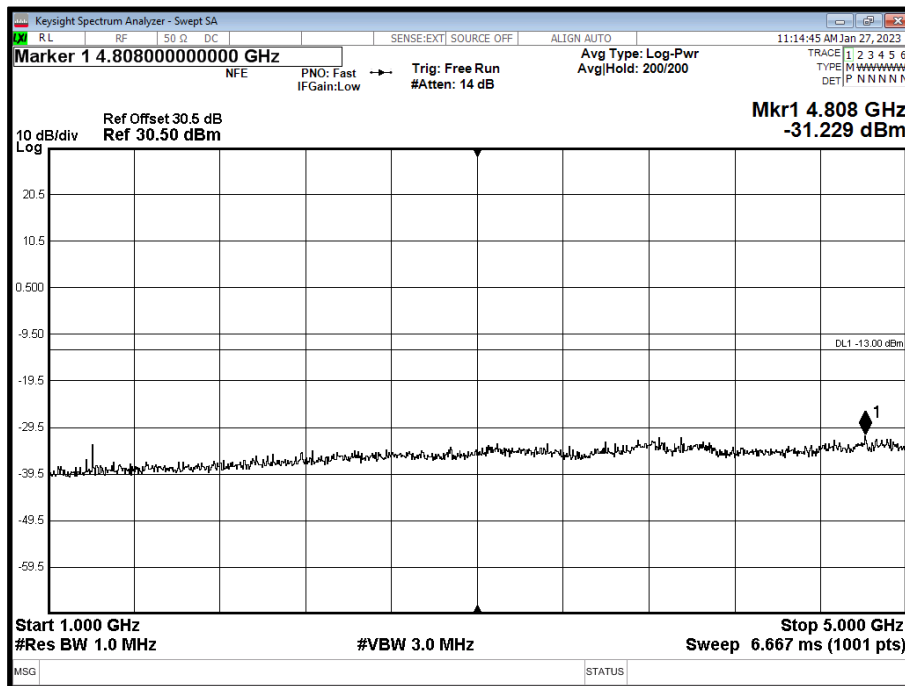


Figure 37 - 402.99 MHz - 1 GHz to 5 GHz



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.

Industry Canada RSS-170, Limit Clause 5.4.3.1

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 Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Dual Power Supply Unit	Hewlett Packard	6253A	271	-	O/P Mon
Multimeter	Iso-tech	IDM101	2417	12	28-Nov-2023
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	24-Feb-2023
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Feb-2023
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	13-Jul-2023
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	08-Mar-2023
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	25-Apr-2023
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	5502	12	21-Apr-2023

Table 25

O/P Mon – Output Monitored using calibrated equipment



2.6 Equivalent Isotropic Radiated Power

2.6.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1046
FCC 47 CFR Part 25, Clause 25.204
ISED RSS-170, Clause 5.3
ISED RSS-GEN, Clause 6.12

2.6.2 Equipment Under Test and Modification State

KIM1, S/N: Not Serialised (Storix ID 705300-07) - Modification State 0
KIM1, S/N: Not Serialised (Storix ID 705300-05) - Modification State 0
KIM1, S/N: 26CDBAD - Modification State 0

2.6.3 Date of Test

07-February-2023

2.6.4 Test Method

The EUT was placed on a remotely controlled turntable within a semi-anechoic chamber. Measurements of the fundamental was obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations.

Testing was performed in accordance with ANSI C63.26, Clause 5.2.3.3 and 5.2.7.

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:

$EIRP (dBm) = E (dB\mu V/m) + 20\log(D) - 104.8$; where D is the measurement distance (in the far field region) in m.

The measurement distance was 3m.

2.6.5 Environmental Conditions

Ambient Temperature	18.4 - 19.9 °C
Relative Humidity	25.0 - 37.1 %



2.6.6 Test Results

400 MHz transmitter - coil antenna (case 0dBi)

EIRP (dBm/4kHz)	
399.91 MHz	402.99 MHz
32.00	31.36

Table 26 - EIRP/4 kHz Results Table

399.91 MHz		402.99 MHz	
EIRP (dBm)	Δ from rated power (dB)	EIRP (dBm)	Δ from rated power (dB)
32.00	2.00	31.36	1.36

Table 27 - EIRP Results Table

400 MHz transmitter - dipole stick antenna (case +4dBi)

EIRP (dBm/4kHz)	
399.91 MHz	402.99 MHz
34.59	33.53

Table 28 - EIRP/4 kHz Results Table

399.91 MHz		402.99 MHz	
EIRP (dBm)	Δ from rated power (dB)	EIRP (dBm)	Δ from rated power (dB)
34.59	0.59	33.53	-0.47

Table 29 - 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 + 3 θ 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.

Industry Canada 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 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	4006	12	29-Mar-2023
EMI Test Receiver	Rohde & Schwarz	ESW44	5084	12	17-May-2023
Emissions Software	TUV SUD	EmX V3.1.10	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
Thermo-Hygro-Barometer	PCE Instruments	OCE-THB-40	5470	12	07-Apr-2023
2m SMA Cable	Junkosha	MWX221-02000AMSAMS/A	5518	12	12-Apr-2023
8m N Type Cable	Junkosha	MWX221-08000NMSNMS/B	5522	12	24-Mar-2023
TRILOG Super Broadband Test Antenna	Schwarzbeck	VULB 9168	5942	24	03-Feb-2024
Attenuator 4dB	Pasternack	PE7074-4	6202	24	16-Jul-2024

Table 30

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

3 Photographs

3.1 Test Setup Photographs

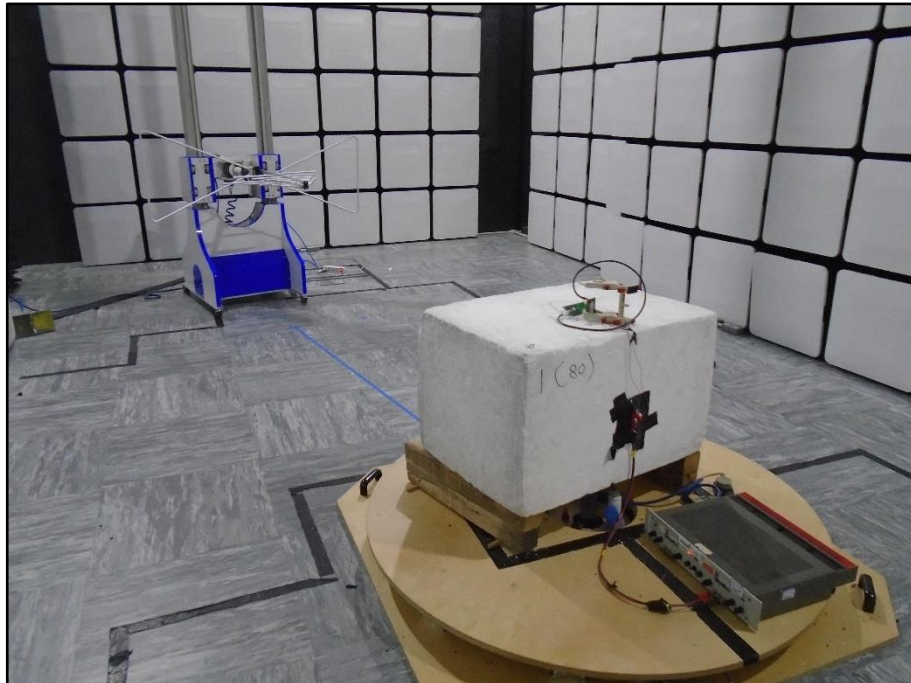


Figure 38 - 30 MHz to 1 GHz, Coil Antenna

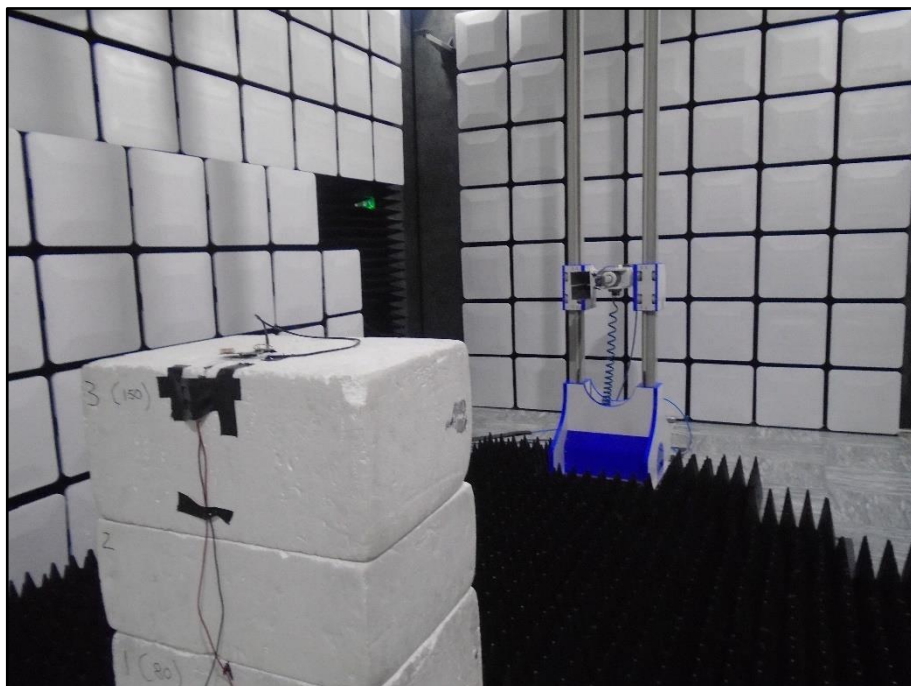


Figure 39 - 1 GHz to 5 GHz, Coil Antenna

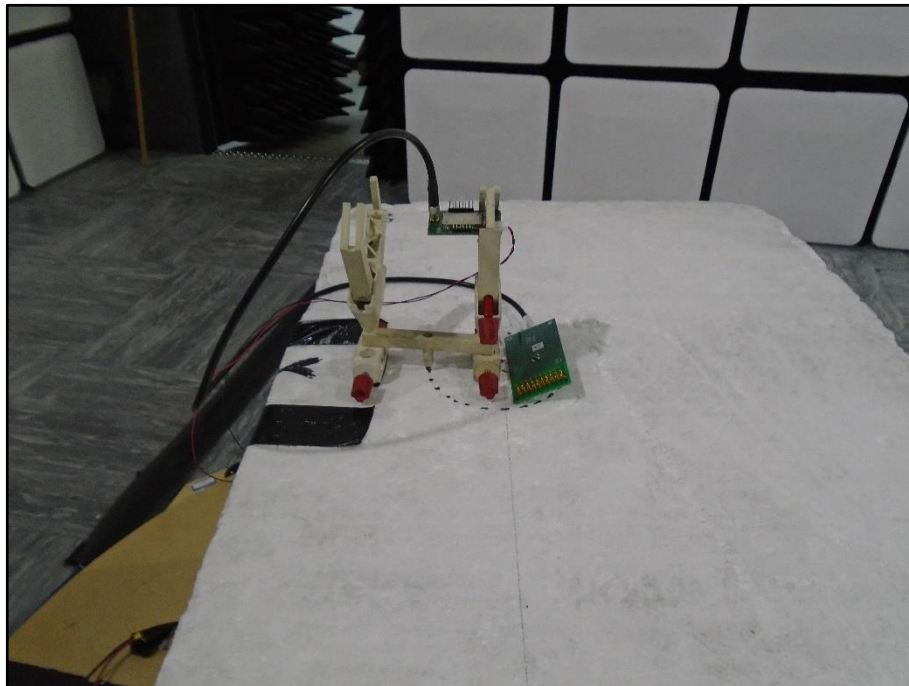


Figure 40 - Coil Antenna, Orientation X

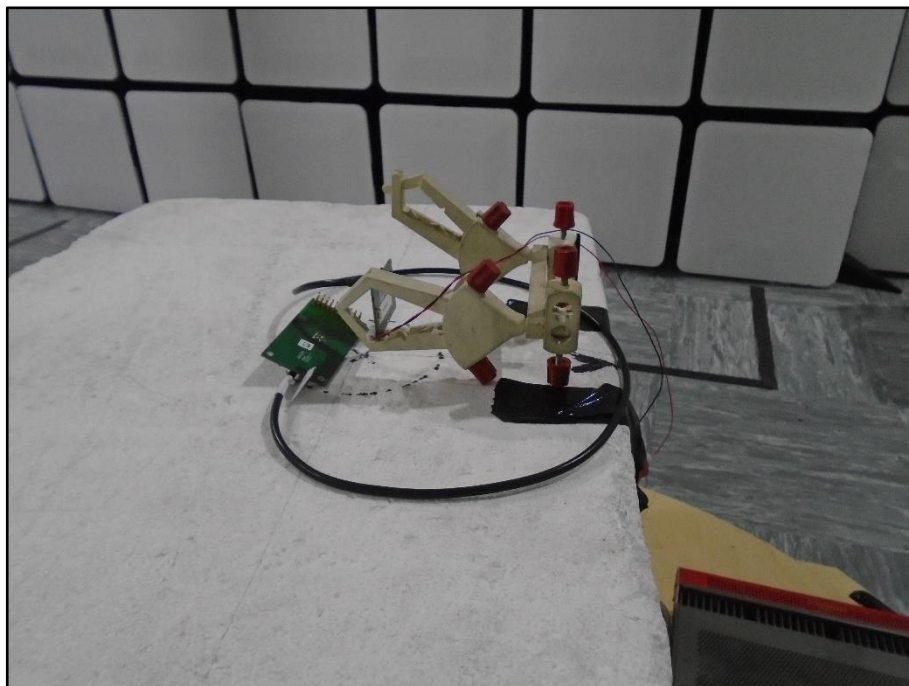


Figure 41 - Coil Antenna, Orientation Y

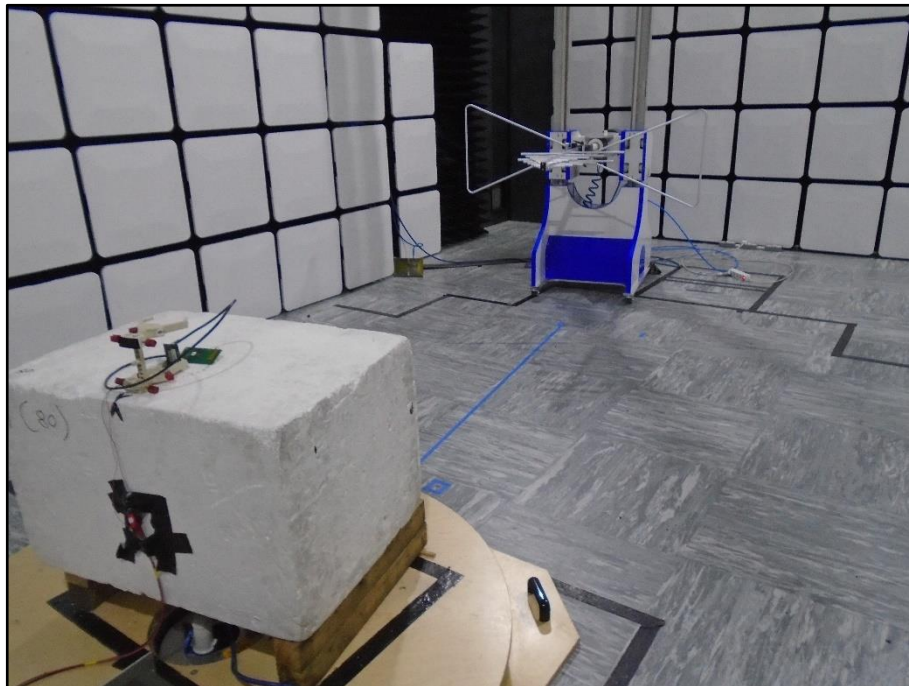


Figure 42 - Coil Antenna, Orientation Z



Figure 43 - 30 MHz to 1 GHz, Dipole Stick Antenna

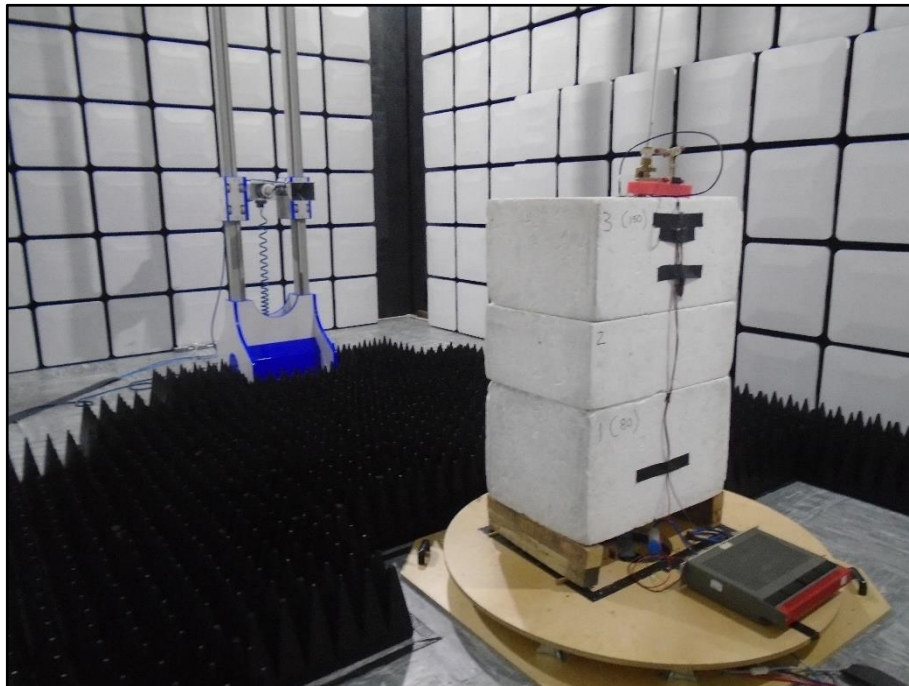


Figure 44 - 1 GHz to 5 GHz, Dipole Stick Antenna

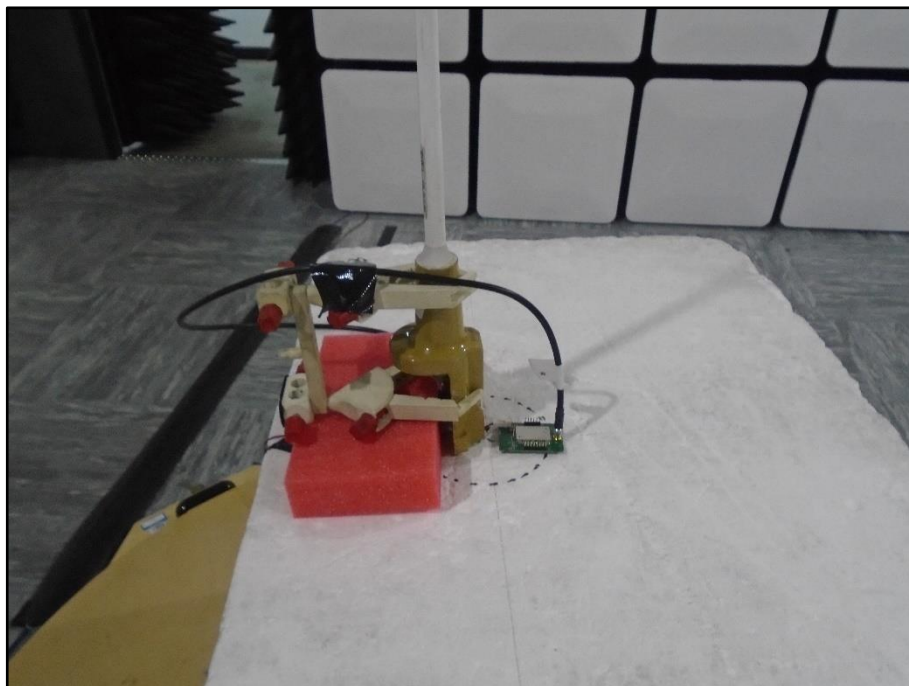


Figure 45 - Dipole Stick Antenna, Orientation X



Figure 46 - Dipole Stick Antenna, Orientation Y

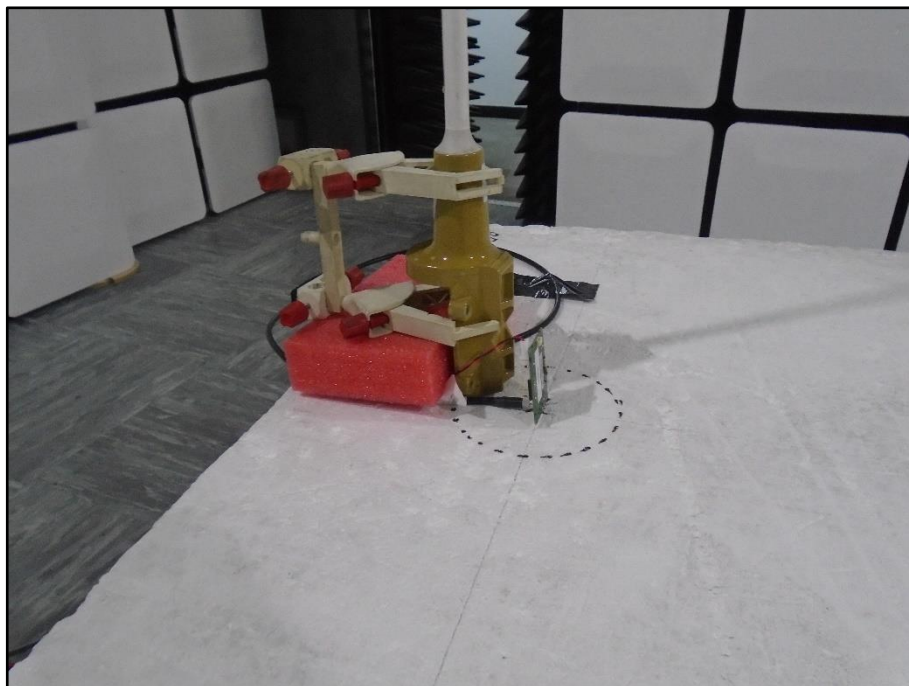


Figure 47 - Dipole Stick Antenna, Orientation Z



4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Modulation Characteristics	-
Occupied Bandwidth	± 16.74 kHz
Frequency Tolerance	± 3.54 Hz
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
Equivalent Isotropic Radiated Power	Conducted: ± 3.2 dB Radiated: ± 6.3 dB (1 GHz to 18 GHz)

Table 31

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.