FCC and ISED Test Report

Raymarine Belgium BVBA
Cyclone Pedestal, Model: Cyclone

In accordance with FCC 47 CFR Part 80, FCC 47 CFR Part 2, Industry Canada RSS-238 and ISED RSS-GEN (RADAR)

Prepared for: Raymarine Belgium BVBA
Luxemburgstraat
Meer
2321
Belgium

FCC ID: PJ5-953LPSSR IC: 4069B-953LPSSR

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Document 75950287-02 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matt Russell	RF Team Leader	Authorised Signatory	23 April 2021

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 80, FCC 47 CFR Part 2, Industry Canada RSS-238 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	23 April 2021	
Testing	Graeme Lawler	23 April 2021	

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 80: 2019, FCC 47 CFR Part 2: 2019, Industry Canada RSS-238: Issue 01 (07-2013) and ISED RSS-GEN: Issue 05 (04-2018) + A1 (03-2019) for the tests detailed in section 1.3.

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Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuv-sud.co.uk

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

Contents

1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	23 April 2021

Table 1

1.2 Introduction

Applicant	Raymarine Belgium BVBA
Manufacturer	Raymarine Belgium BVBA
Model Number(s)	Cyclone
Serial Number(s)	E70620 AD5NZBQ Storix ID 552061 Item 1
Hardware Version(s)	1010833-3
Software Version(s)	V0.56
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 80: 2019 FCC 47 CFR Part 2: 2019 Industry Canada RSS-238: Issue 01 (07-2013) ISED RSS-GEN: Issue 05 (04-2018) + A1 (03-2019)
Order Number Date	1310109535 22-October-2020
Date of Receipt of EUT	22-February-2021
Start of Test	23-February-2021
Finish of Test	18-March-2021
Name of Engineer(s)	Neil Rousell and Graeme Lawler
Related Document(s)	ANSI C63.26 (2015) ITU-R M.1177-4 (04-2011) ITU-R SM.1541-6 (08-2015)

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 80, FCC 47 CFR Part 9, FCC 47 CFR Part 2, Industry Canada RSS-238 and ISED RSS-GEN is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	FCC Part 80	FCC Part 2	RSS-238	RSS-GEN			
Configuration and Mode: DC Powered - Transmit							
2.1	-	2.1047	3.2(a)	-	Modulation Characteristics	Satisfactory	
2.2	80.205	2.1049	3.2(c)	6.7	Occupied Bandwidth	Pass	
2.3	80.209(b)	2.1055	4.1	6.11	Transmitter Frequency Stability	Pass	
2.4	80.211(f)	2.1051	4.3	6.13	Spurious Emissions at Antenna Terminals	Pass	
2.5	80.211(f)	2.1053	4.3	6.13	Radiated Spurious Emissions	Pass	
2.6	80.215	2.1046	4.2	6.12	RF Output Power	Pass	

Table 2

1.4 Application Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment including the technologies the product supports)*	Solid state non-IMO radar
Manufacturer:	FLIR Belgium Bvba
Model:	Cyclone
Part Number:	E70620 AD5NZBQ
Hardware Version:	Radar Pedestal 1010833-3 with the following deviations applied: D-21-1377 D-20-1186 D-20-1264 D-21-1335 D-21-1378 D-21-1383 D-21-1397 D-21-1407 3ft antenna 1011615-3 4ft antenna 1011614-3 6ft antenna 1010556-3
Software Version:	V0.56
FCC ID of the product under test – see guidance here	PJ5-953LPSSR
IC ID of the product under test – see guidance here	4069B-953LPSSR

Table 3

Intentional Radiators

Technology	Radar	-	-	-	-	-
Frequency Range (MHz to MHz)	9400+/- 20MHz	-	-	-	-	-
Conducted Declared Output Power (dBm)	46.2dBm					
Antenna Gain (dBi)	3ft 24.13 4ft 25.60 6ft 27.42	-	-	-	-	-
Supported Bandwidth(s) (MHz) (e.g 1 MHz, 20 MHz, 40 MHz)	32MHz Max					
Modulation Scheme(s) (e.g GFSK, QPSK etc)	Pulse modulation with non-linear FM chirp	-	-	-	-	-
ITU Emission Designator (see guidance here) (not mandatory for Part 15	66M8P0N and 40M1Q0N					

devices)						
Bottom Frequency (MHz)	9370	-	-	-	-	-
Middle Frequency (MHz)	9400					
Top Frequency (MHz)	9430	-	-	-	-	-

Table 4

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	9420MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	700Hz (longest PRF)
Class A Digital Device (Use in commercial, industrial or business environment) ☒ Class B Digital Device (Use in residential environment only) ☐	

Table 5

DC Power Source

Nominal voltage:	12/24	V
Extreme upper voltage:	31.2	V
Extreme lower voltage:	10.2	V
Max current:	20A	A

Table 6

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☐

Table 7

Temperature

Minimum temperature:	-25	°C
Maximum temperature:	+55	°C

Table 8

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector ☒ WR90 (WG16) / N-Type			State impedance	50	Ohm
Integral antenna ☒	Type:	Slotted Waveguide	Gain	24.13 / 25.60 / 27.42	dBi
External antenna ☐	Type:		Gain		dBi
For external antenna only: Standard Antenna Jack ☐ If yes, describe how user is prohibited from changing antenna (if not professional installed): Equipment is only ever professionally installed ☐ Non-standard Antenna Jack ☐					

Table 9

Ancillaries (if applicable)

Voltage Conditioner

Manufacturer:	FLIR Belgium Bvba	Part Number:	E52091
Model:	VCM100	Country of Origin:	Hungary

Table 10

3ft Antenna

Manufacturer:	FLIR Belgium Bvba	Part Number:	E70628
Model:	Cyclone 3ft Array	Country of Origin:	Hungary

Table 11

4ft Antenna

Manufacturer:	FLIR Belgium Bvba	Part Number:	E70629
Model:	Cyclone 4ft Array	Country of Origin:	Hungary

Table 12

6ft Antenna

Manufacturer:	FLIR Belgium Bvba	Part Number:	E70630
Model:	Cyclone 6ft Array	Country of Origin:	Hungary

Table 13

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

Name: Jamie Cox

Position held: Project Manager

Date: 22.02.2021

1.5 Product Information

1.5.1 Technical Description

Solid state non-IMO radar.

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: E70620, Serial Number: AD5NZBQ Storix ID 552061 Item 1			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 14

1.8 Test Location

TÜV SÜD conducted the following tests at our Fareham Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: DC Powered - Transmit		
Modulation Characteristics	Neil Rousell	UKAS
Occupied Bandwidth	Neil Rousell	UKAS
Transmitter Frequency Stability	Neil Rousell	UKAS
Spurious Emissions at Antenna Terminals	Neil Rousell	UKAS
Radiated Spurious Emissions	Graeme Lawler	UKAS
RF Output Power	Neil Rousell	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
Industry Canada RSS-238, Clause 3.2(a)

2.1.2 Equipment Under Test and Modification State

E70620, S/N: AD5NZBQ Storix ID 552061 Item 1- Modification State 0

2.1.3 Date of Test

01-March-2021

2.1.4 Test Method

The EUT was connected via a WR90 waveguide directional coupler and attenuator to a real time power sensor. The pulse width, rise time and its frequency (PRF) were measured.

The emission designator for the EUT was: 66M8P0N and 40M1Q0N.

2.1.5 Environmental Conditions

Ambient Temperature	26.5 °C
Relative Humidity	26.8 %

2.1.6 Test Results

DC Powered - Transmit

Radar Pulse Description	Radar Pulse Width (µs)	Repetition Rate (Hz)	Pulse Rise Time (µs)
9400 MHz, CW,46 ns	0.04419	4795.7	0.0195
9400 MHz, FM,192 ns	0.18798	4796.2	0.0254
9400 MHz, FM,750 ns	0.73576	4796.3	0.144
9400 MHz, FM,1020 ns	0.99211	4769.9	0.182
9400 MHz, FM,1235 ns	1.2041	4798.0	0.140
9400 MHz, FM,1675 ns	1.6336	4798.5	0.198
9400 MHz, FM,2300 ns	2.2872	4804.5	0.197
9400 MHz, FM,2710 ns	2.7159	4804.5	0.108
9400 MHz, FM,3900 ns	3.8973	4801.2	0.0925
9400 MHz, FM,17600 ns	17.580	3602.2	0.461
9400 MHz, FM,23600 ns	23.474	2400.7	0.573
9400 MHz, FM,35000 ns	35.070	1600.3	0.803
9400 MHz, FM,47000 ns	46.775	1200.4	1.04
9400 MHz, FM,79000 ns	78.745	819.91	1.47
9370 MHz, FM,750 ns	0.72915	4807.4	0.149
9370 MHz, FM,79000 ns	78.186	819.90	1.74
9430 MHz, FM,750 ns	0.81359	4807.4	0.091
9430 MHz, FM,79000 ns	79.468	819.91	1.13

Table 16 - Modulation Characteristics

Figure 1 - 9400 MHz, CW,46 ns

Figure 2 - 9400 MHz, FM,192 ns

Figure 3 - 9400 MHz, FM,750 ns

Figure 4 - 9400 MHz, FM,1020 ns

Figure 5 - 9400 MHz, FM,1235 ns

Figure 6 - 9400 MHz, FM,1675 ns

Figure 7 - 9400 MHz, FM,2300 ns

Figure 8 - 9400 MHz, FM,2710 ns

Figure 9 - 9400 MHz, FM,3900 ns

Figure 10 - 9400 MHz, FM,17600 ns

Figure 11 - 9400 MHz, FM,23600 ns

Figure 12 - 9400 MHz, FM,35000 ns

Figure 13 - 9400 MHz, FM,47000 ns

Figure 14 - 9400 MHz, FM,79000 ns

Figure 15 - 9370 GHz, FM,750 ns

Figure 16 - 9370 GHz, FM,79000 ns

Figure 17 - 9430 GHz, FM,750 ns

Figure 18 - 9430 GHz, FM,79000 ns

FCC 47 CFR Part 2, Limit Clause 2.1047

Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

ISED RSS-238 and RSS-GEN Limit Clause

None Specified

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Hygromer	Rotronic	A1	2138	12	01-Jul-2021
Multimeter	Fluke	79 Series II	3057	12	21-Aug-2021
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	29-Jan-2022
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	30-Dec-2021
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
Attenuator 20dB 100W	Weinschel	48-20-43-LIM	5133	12	03-Dec-2021
WR90 / WG16 Waveguide Directional Coupler	Quasar	QCC 16SB-UBR-UBR-N-F-30	5145	-	O/P Mon
WR90 / WG16 Waveguide Load	Quasar	QWL16SB-UBR-25W	5146	-	O/P Mon
USB Power Sensor	Boonton	RTP5318	5185	12	12-Jan-2022

Table 17

O/P Mon – Output Monitored using calibrated equipment

2.2 Occupied Bandwidth

2.2.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.205
FCC 47 CFR Part 2, Clause 2.1049
Industry Canada RSS-238, Clause 3.2(c)
ISED RSS-GEN, Clause 6.7

2.2.2 Equipment Under Test and Modification State

E70620, S/N: AD5NZBQ Storix ID 552061 Item 1- Modification State 0

2.2.3 Date of Test

08-March-2021 to 16-March-2021

2.2.4 Test Method

The measurements were made using a Spectrum Analyser with the RBW set to 1% to 5% of emission bandwidth and the VBW set to ≥ 3 times the RBW.

40 dB bandwidth

The detector was set to RMS and a long sweep time employed with the trace set to Max Hold. The peak of the fundamental was measured and markers at -40 dBc were positioned above and below the center frequency. The Marker Delta function result was recorded.

Occupied (99%) bandwidth

A Peak Detector and Max Hold trace were used.

2.2.5 Environmental Conditions

Ambient Temperature	22.5 - 25.1 °C
Relative Humidity	30.3 - 43.1 %

2.2.6 Test Results

DC Powered - Transmit

Test Frequency (MHz)	Radar Pulse Description	99% Occupied Bandwidth (MHz)	40 dB Bandwidth (MHz)
9400	CW, 46 ns	66.8	155.8
9400	FM, 192 ns	40.1	109.6
9400	FM, 750 ns	18.5	46.8
9400	FM, 1020 ns	14.9	43.4
9400	FM, 1235 ns	19.1	75.7
9400	FM, 1675 ns	17.4	68.7
9400	FM, 2300 ns	15.5	66.1
9400	FM, 2710 ns	15.7	66.9
9400	FM, 3900 ns	14.9	66.5
9400	FM, 17600 ns	4.2	56.3
9400	FM, 23600 ns	3.1	55.3
9400	FM, 35000 ns	2.1	54.2
9400	FM, 47000 ns	1.7	53.8
9400	FM, 79000 ns	1.2	80.0
9370	FM, 750 ns	17.1	54.0
9370	FM, 79000 ns	1.1	78.7
9430	FM, 750 ns	21.6	109.9
9430	FM, 79000 ns	1.3	79.2

Table 18 - Emission Bandwidth Results

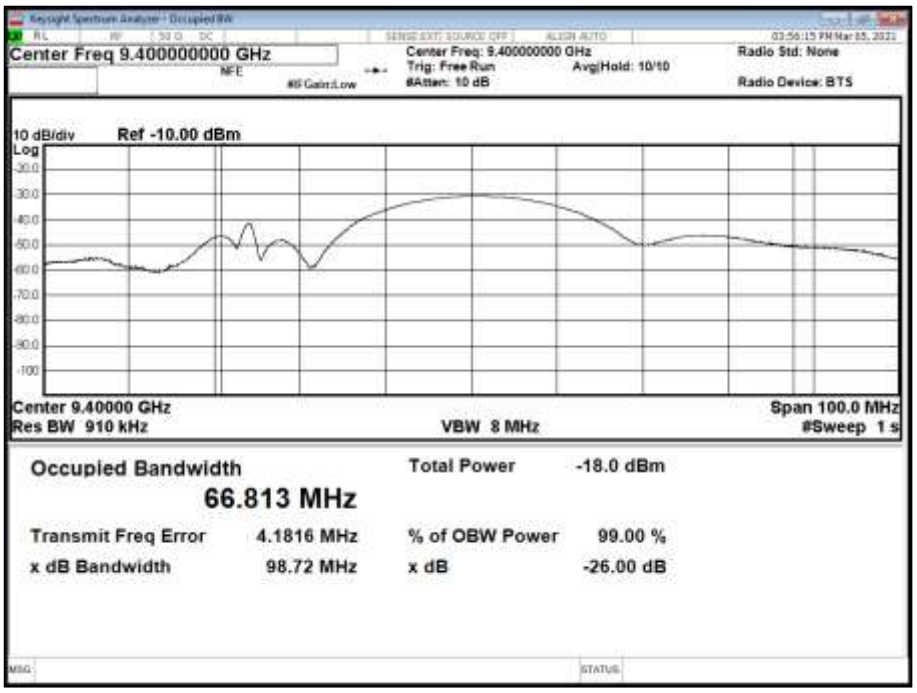

Figure 19 – 9400 MHz, CW, 46 ns, 99% Occupied Bandwidth

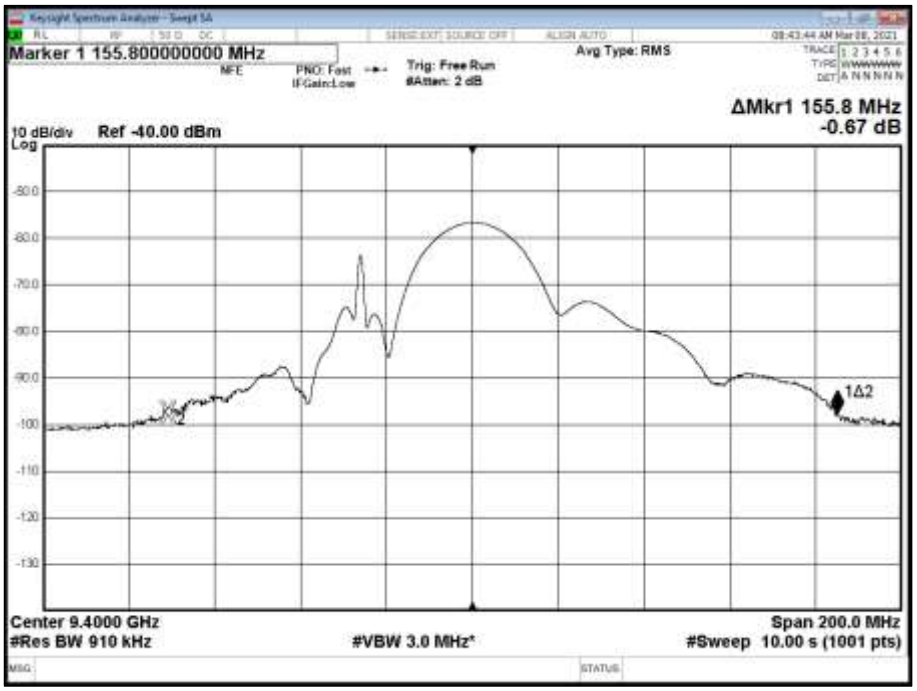

Figure 20 - 9400 MHz, CW, 46 ns, 40 dB Bandwidth

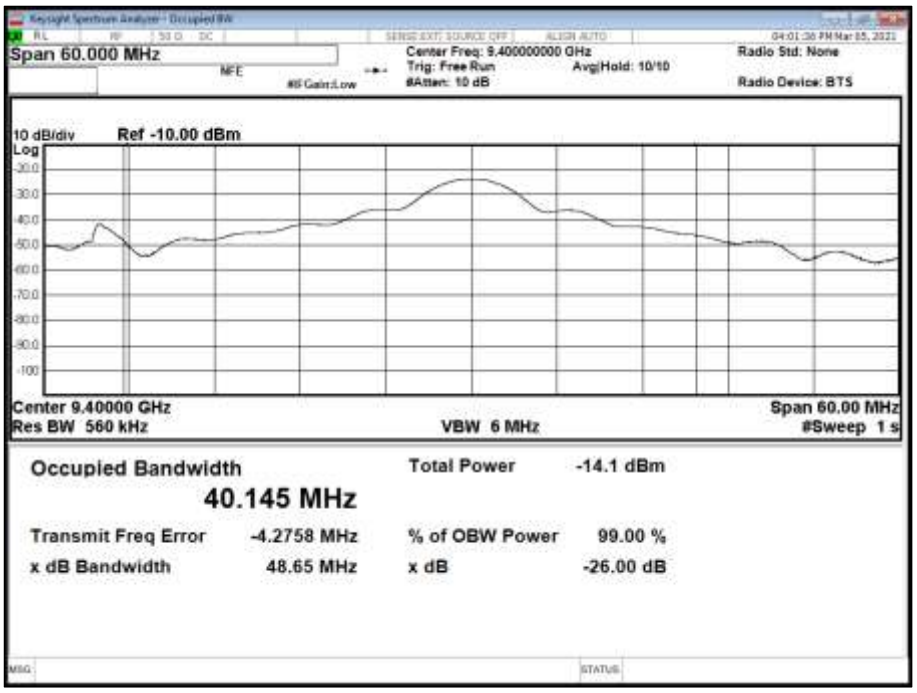

Figure 21 - 9400 MHz, FM, 192 ns, 99% Occupied Bandwidth

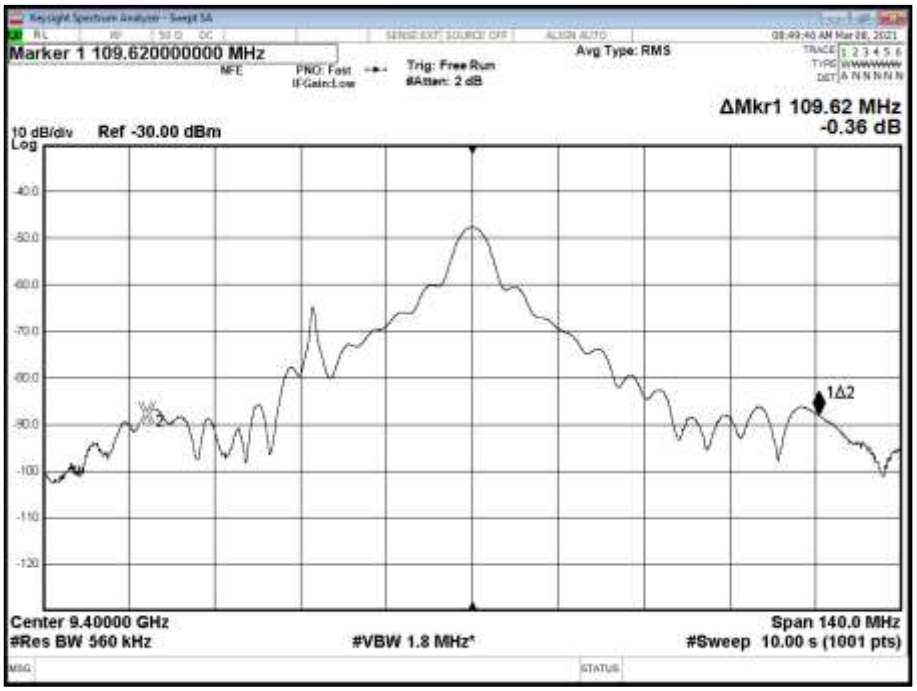

Figure 22 - 9400 MHz, FM, 192 ns, 40 dB Bandwidth

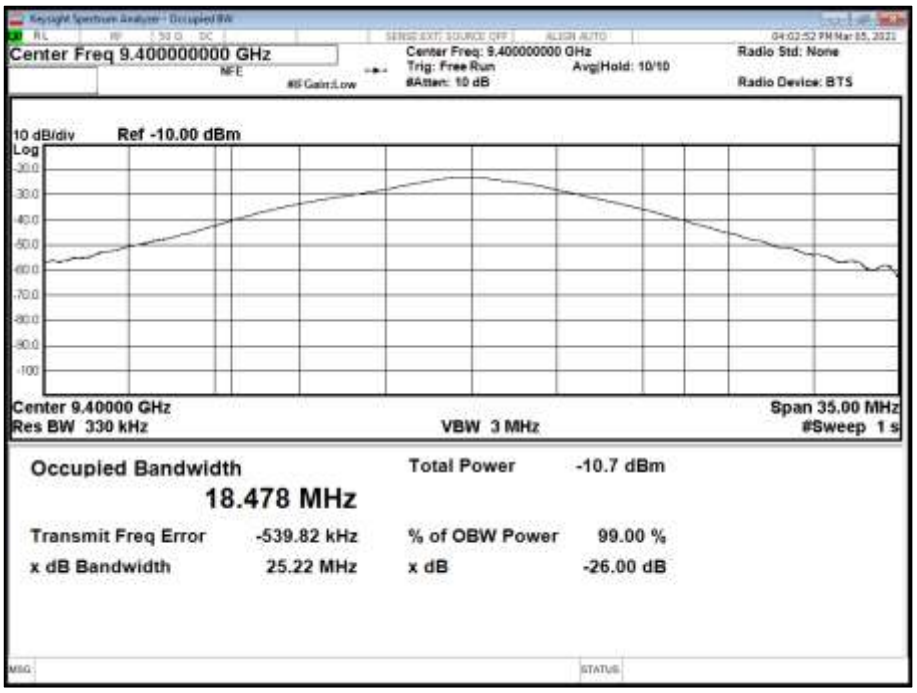

Figure 23 - 9400 MHz, FM, 750 ns, 99% Occupied Bandwidth

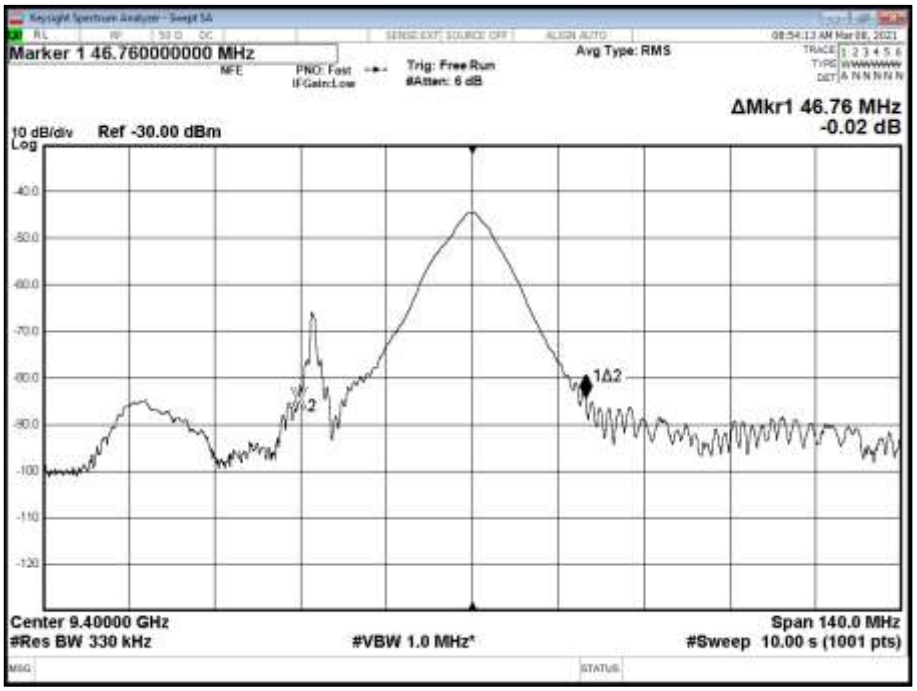

Figure 24 - 9400 MHz, FM, 750 ns, 40 dB Bandwidth

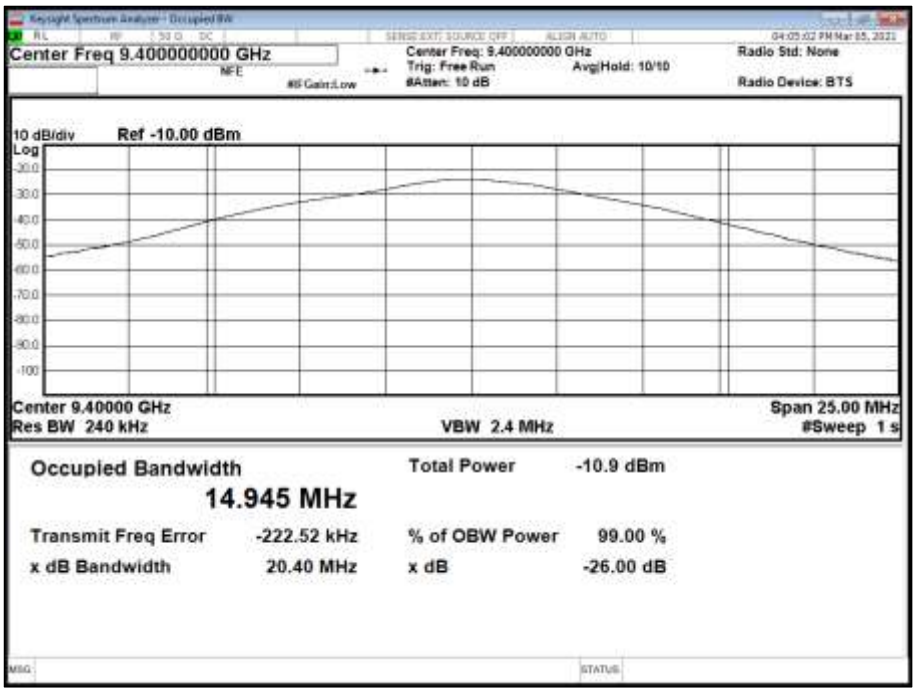

Figure 25 - 9400 MHz, FM, 1020 ns, 99% Occupied Bandwidth

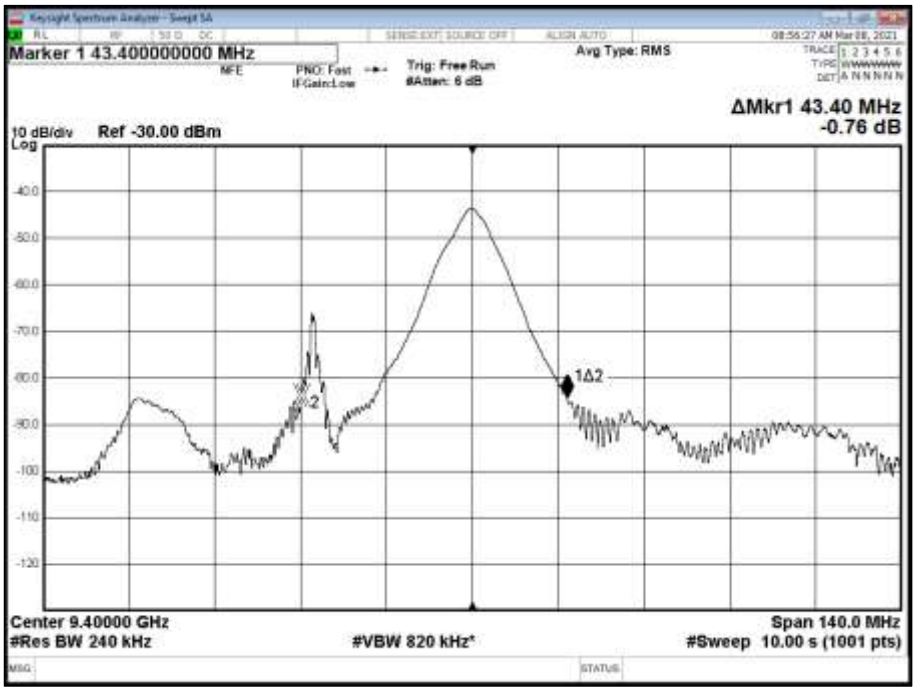

Figure 26 - 9400 MHz, FM, 1020 ns, 40 dB Bandwidth

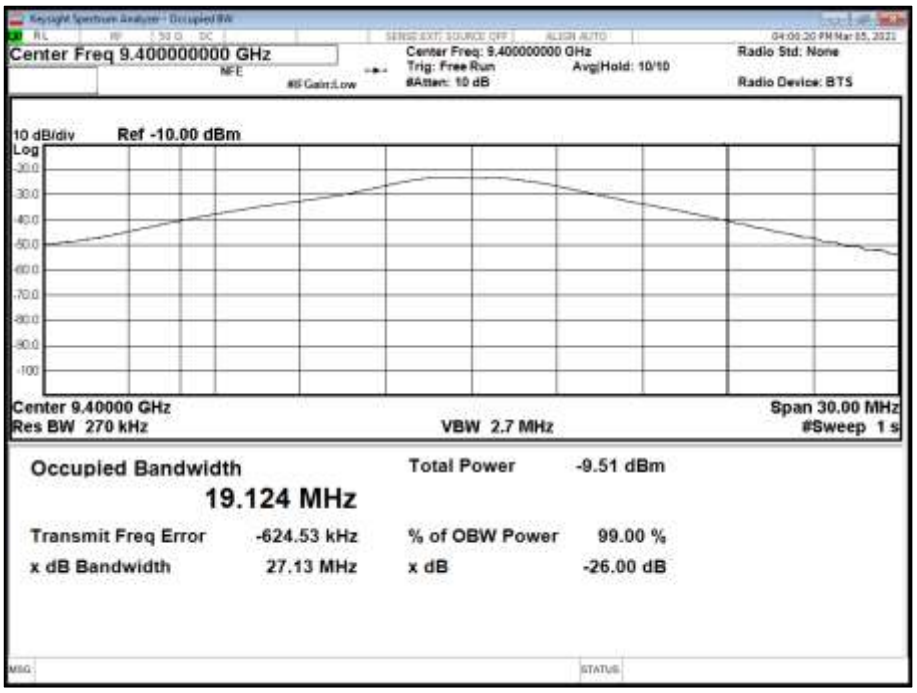

Figure 27 - 9400 MHz, FM, 1235 ns, 99% Occupied Bandwidth

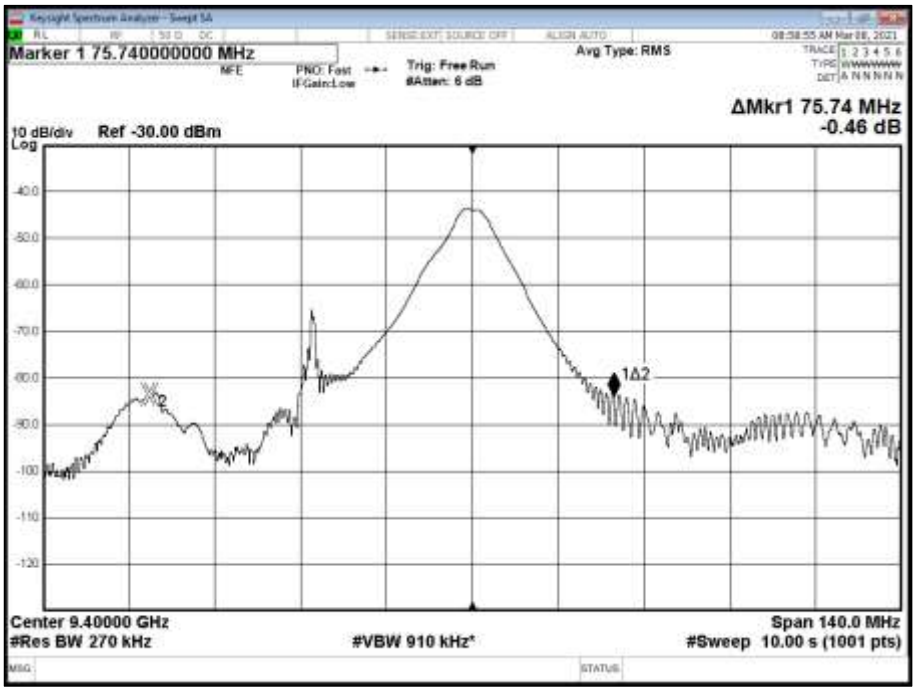

Figure 28 - 9400 MHz, FM, 1235 ns, 40 dB Bandwidth

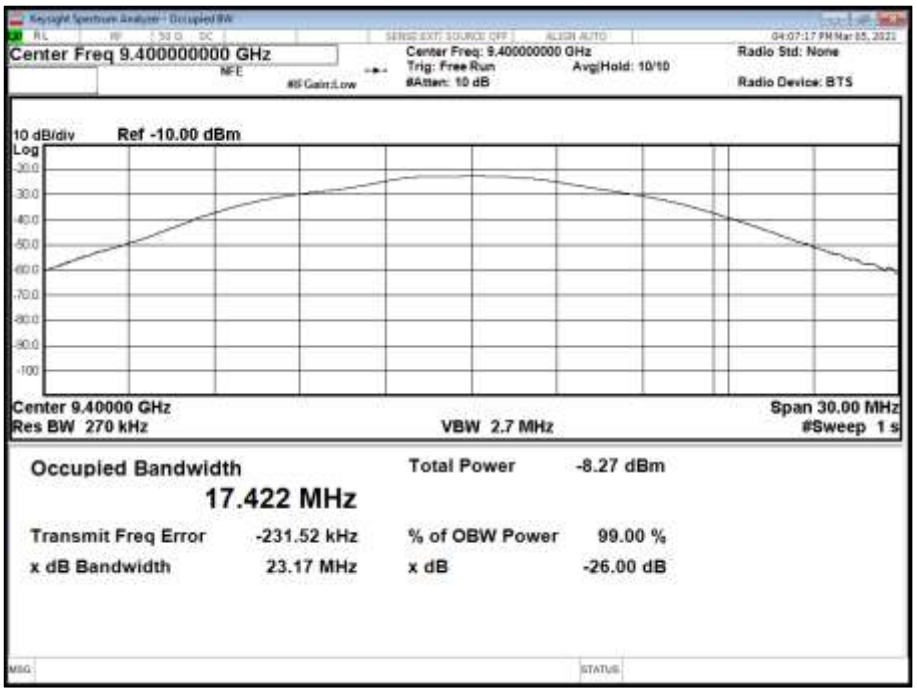

Figure 29 - 9400 MHz, FM, 1675 ns, 99% Occupied Bandwidth

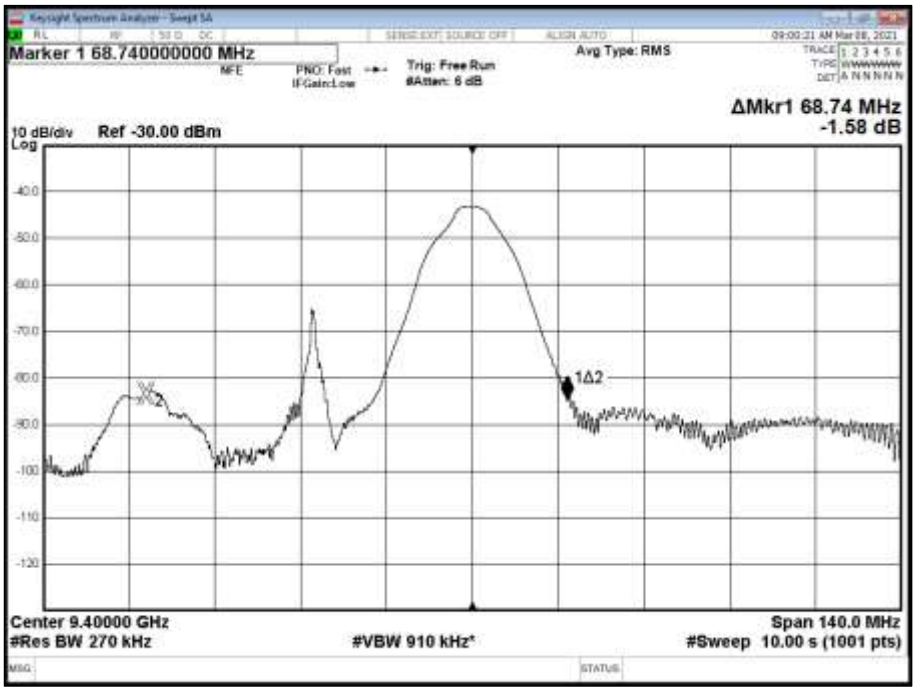

Figure 30 - 9400 MHz, FM, 1675 ns, 40 dB Bandwidth

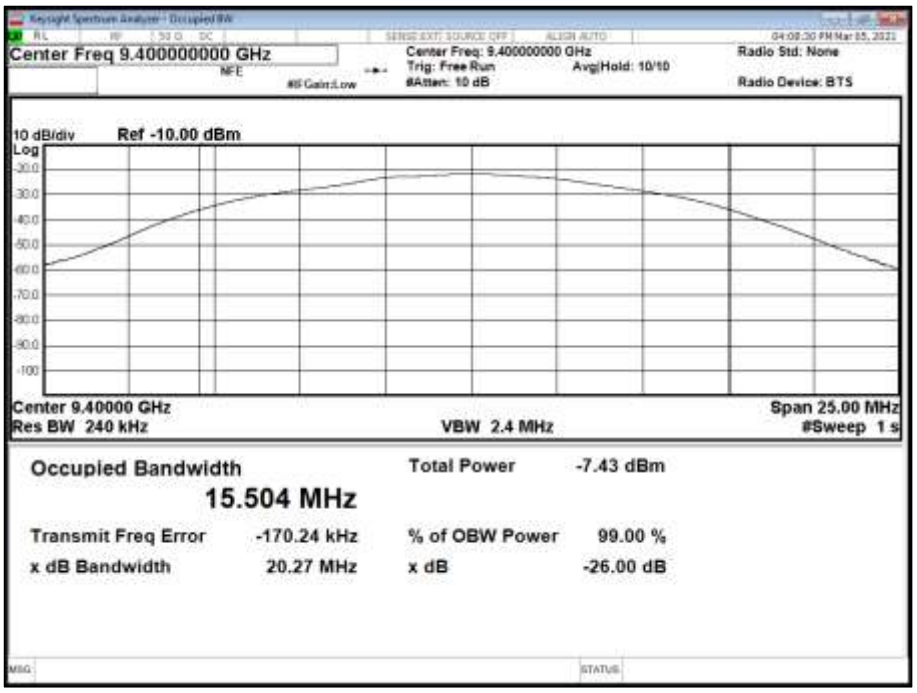

Figure 31 - 9400 MHz, FM, 2300 ns, 99% Occupied Bandwidth

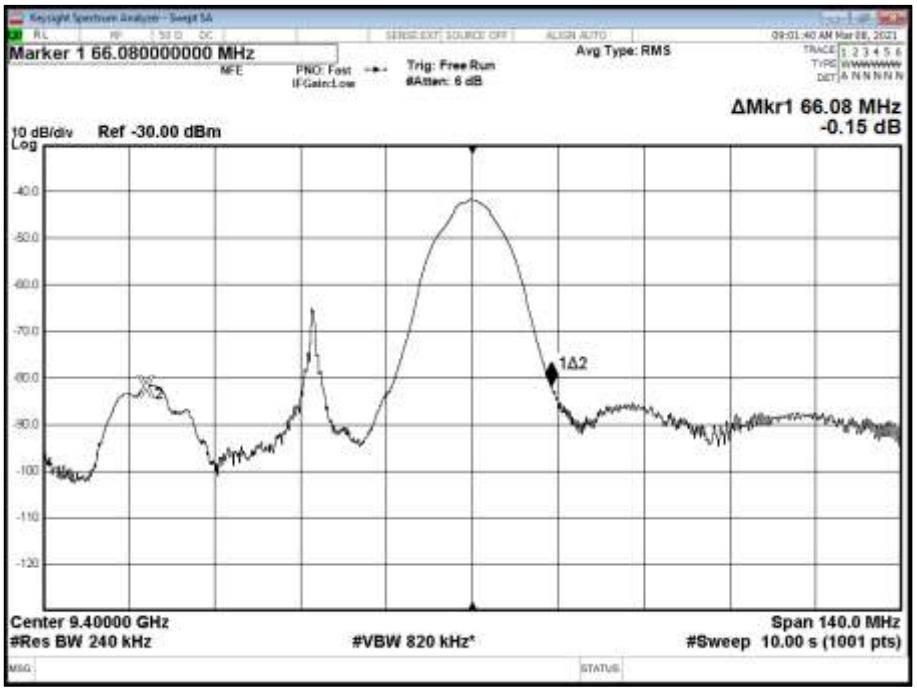

Figure 32 - 9400 MHz, FM, 2300 ns, 40 dB Bandwidth

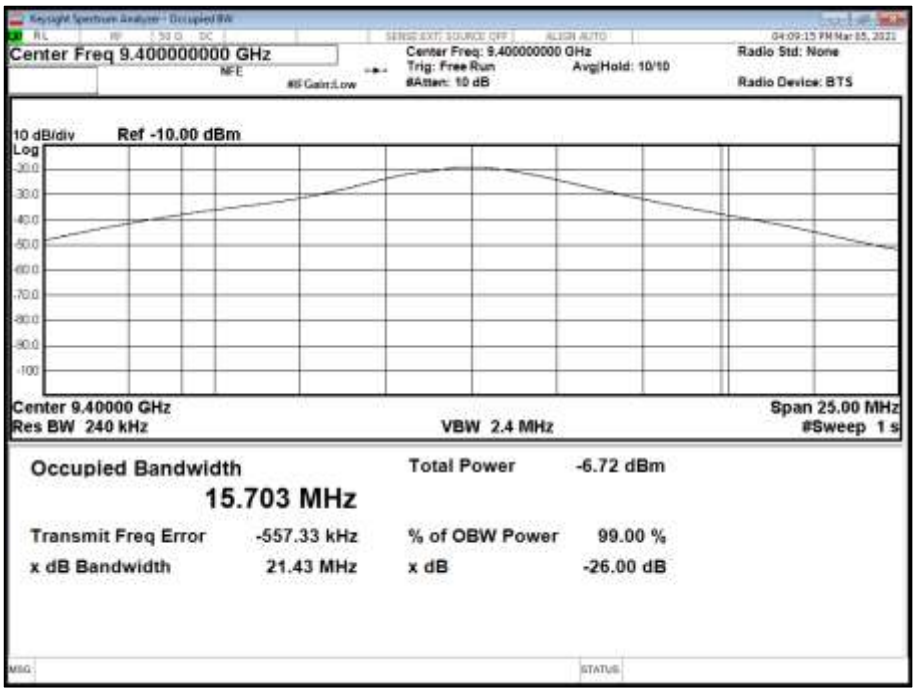

Figure 33 - 9400 MHz, FM, 2710 ns, 99% Occupied Bandwidth

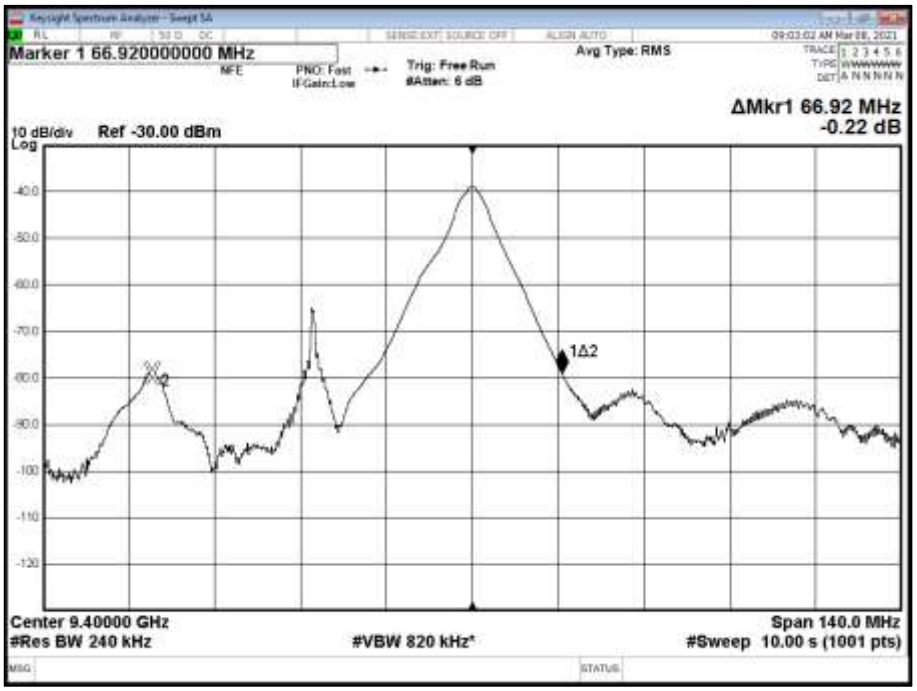

Figure 34 - 9400 MHz, FM, 2710 ns, 40 dB Bandwidth

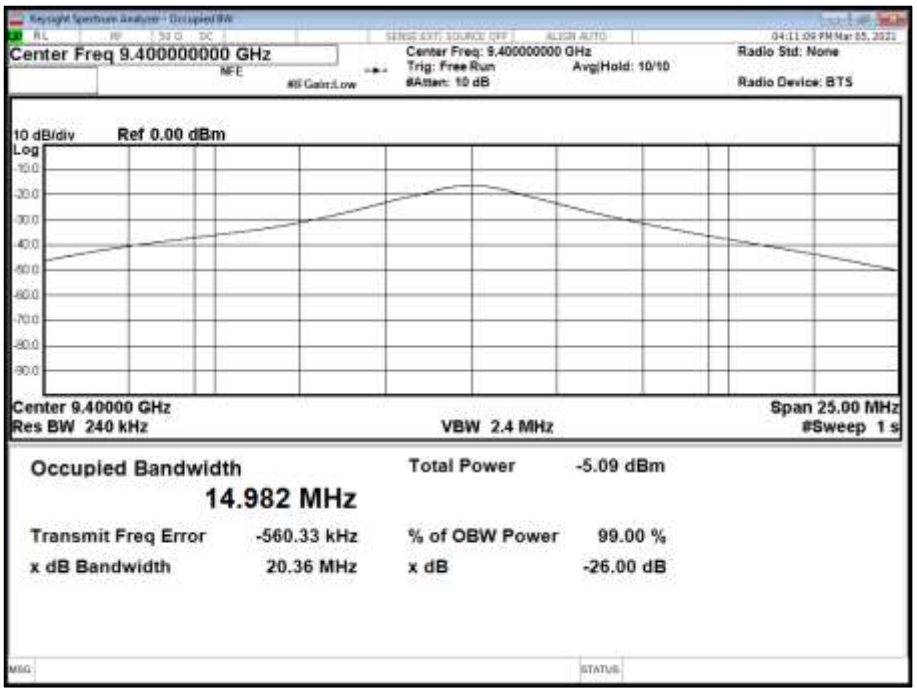

Figure 35 - 9400 MHz, FM, 3900 ns, 99% Occupied Bandwidth

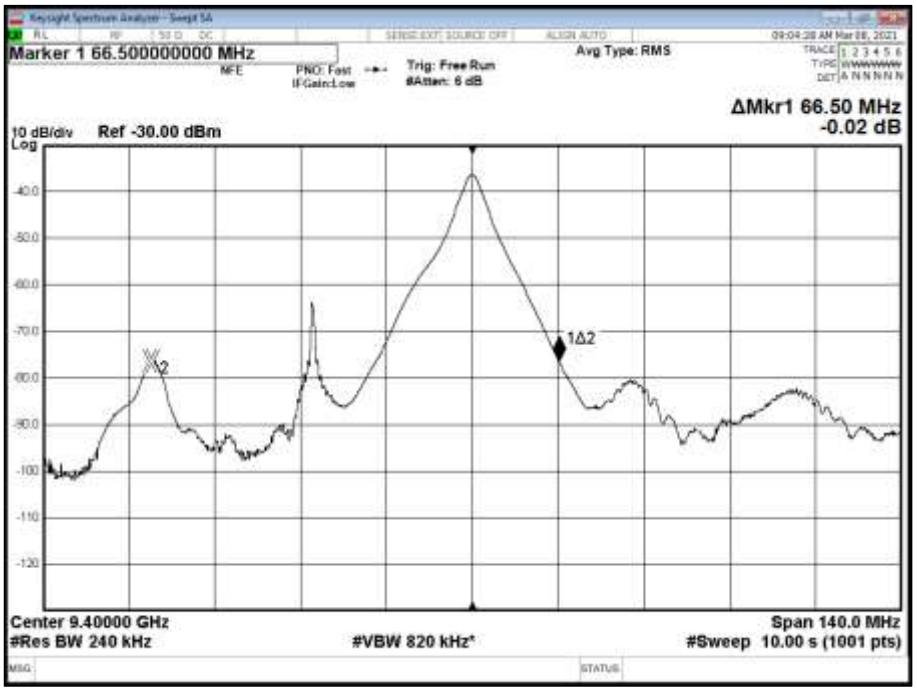

Figure 36 - 9400 MHz, FM, 3900 ns, 40 dB Bandwidth

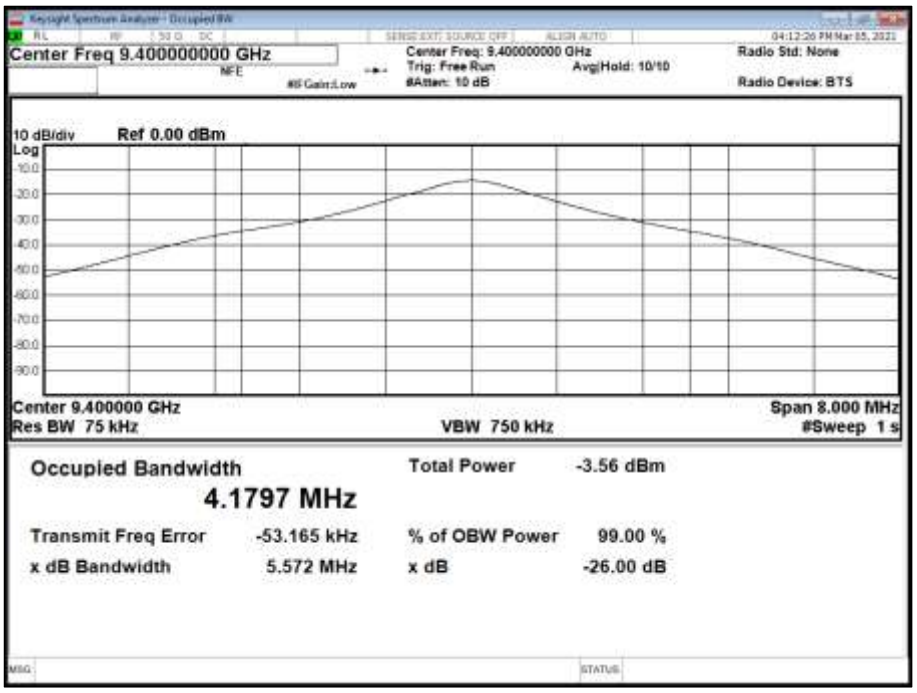

Figure 37 - 9400 MHz, FM, 17600 ns, 99% Occupied Bandwidth

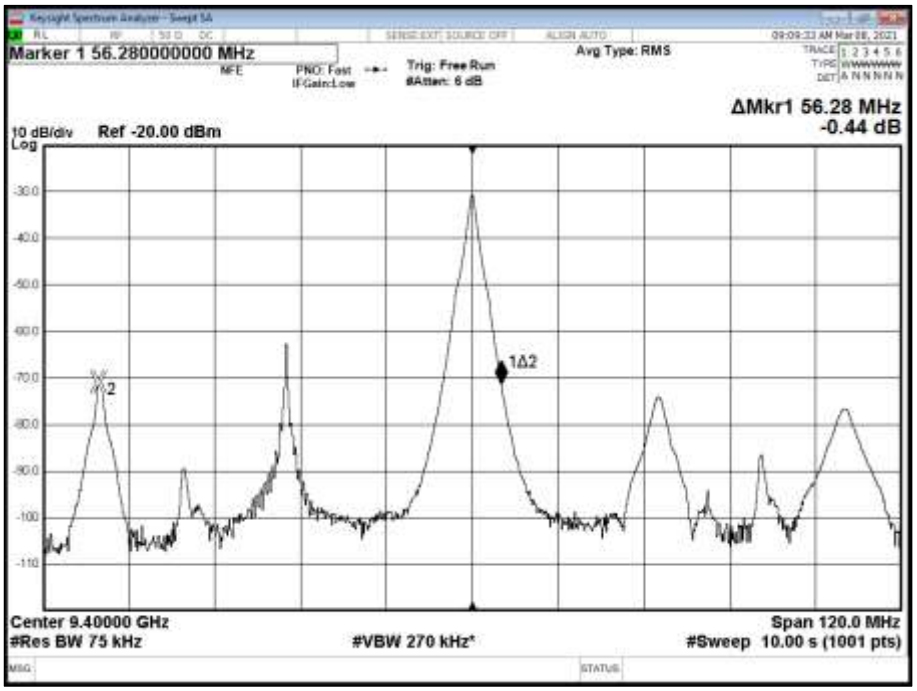

Figure 38 - 9400 MHz, FM, 17600 ns, 40 dB Bandwidth

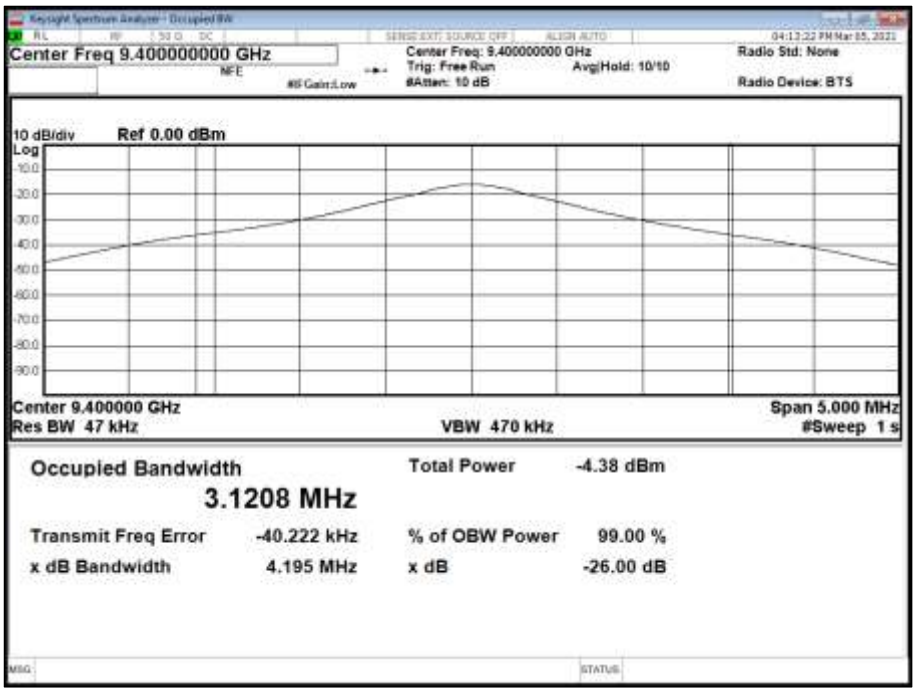

Figure 39 - 9400 MHz, FM, 23600 ns, 99% Occupied Bandwidth

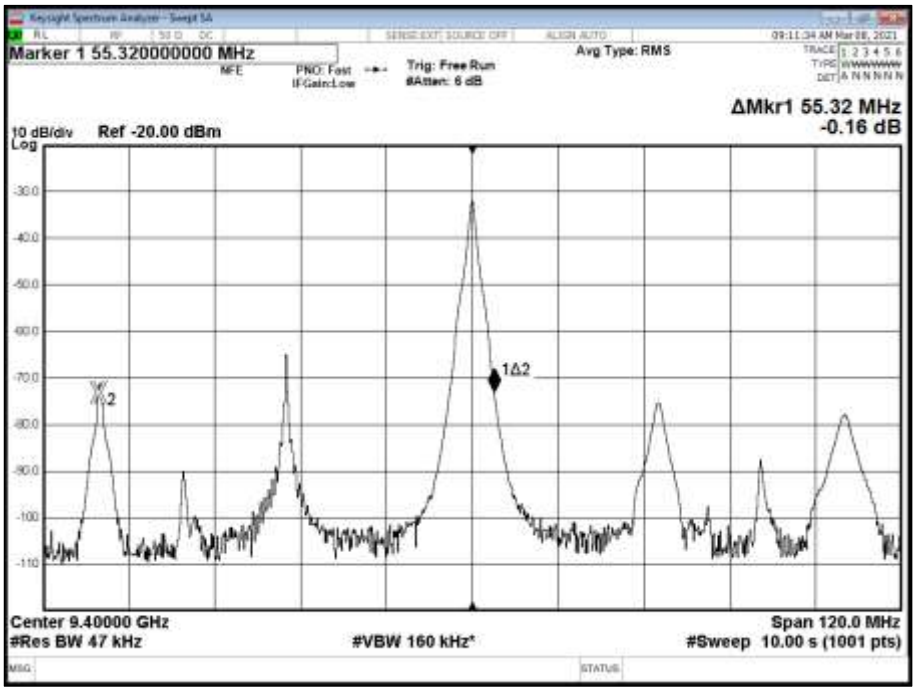

Figure 40 - 9400 MHz, FM, 23600 ns, 40 dB Bandwidth

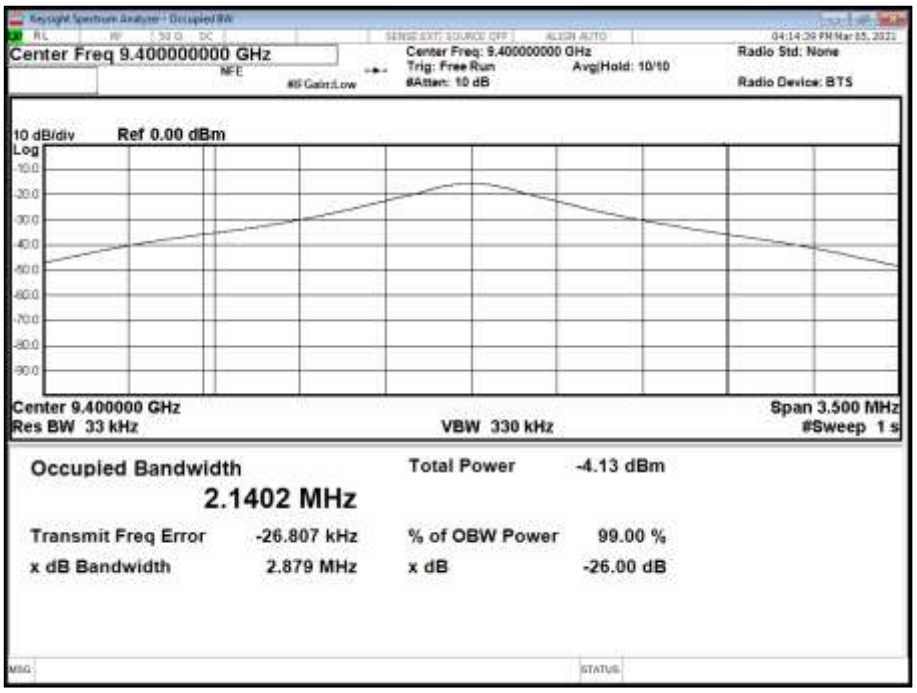

Figure 41 - 9400 MHz, FM, 35000 ns, 99% Occupied Bandwidth

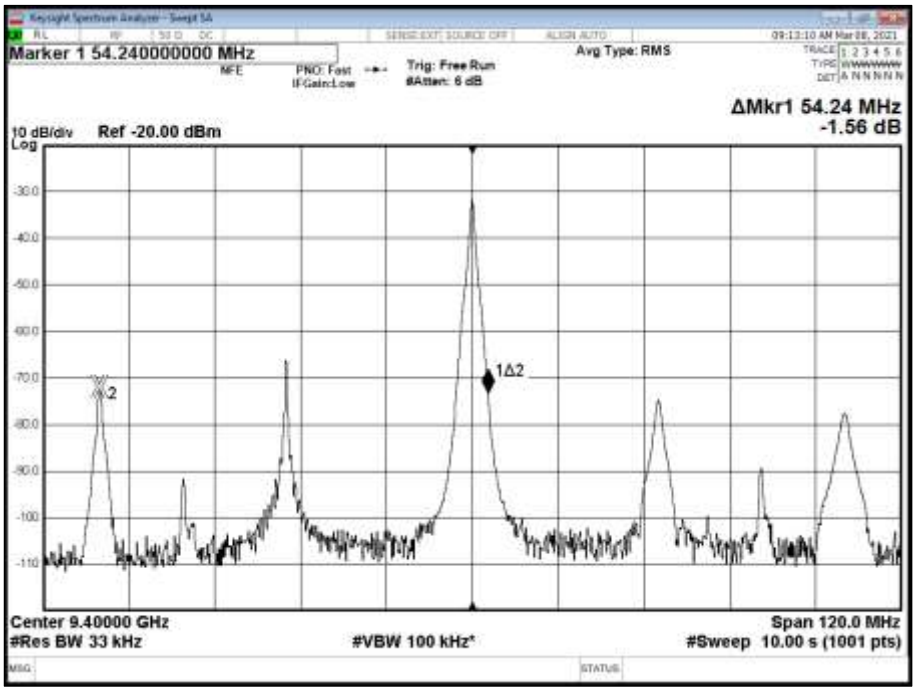

Figure 42 - 9400 MHz, FM, 35000 ns, 40 dB Bandwidth

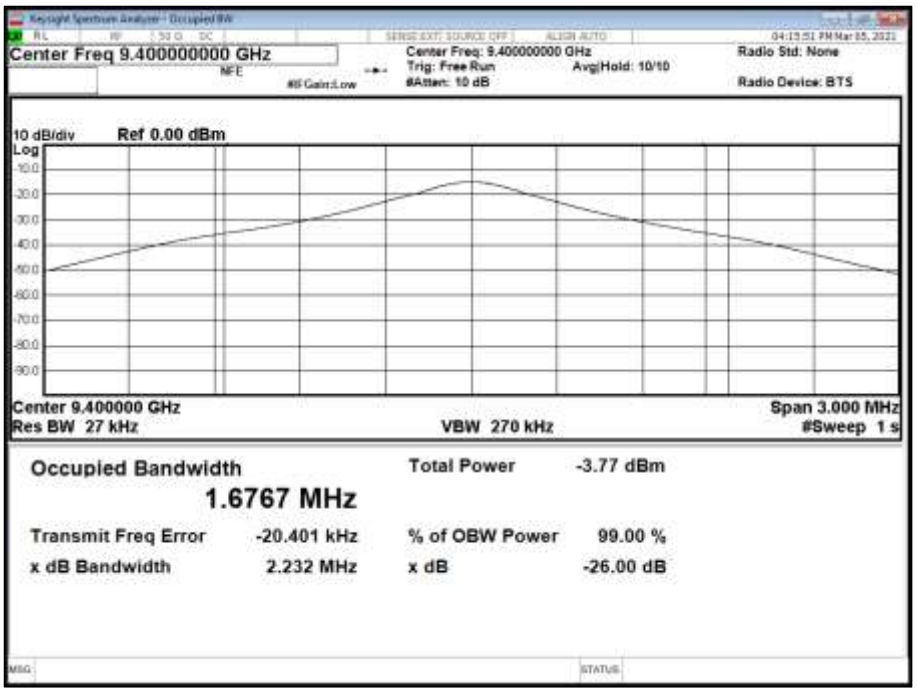

Figure 43 - 9400 MHz, FM, 47000 ns, 99% Occupied Bandwidth

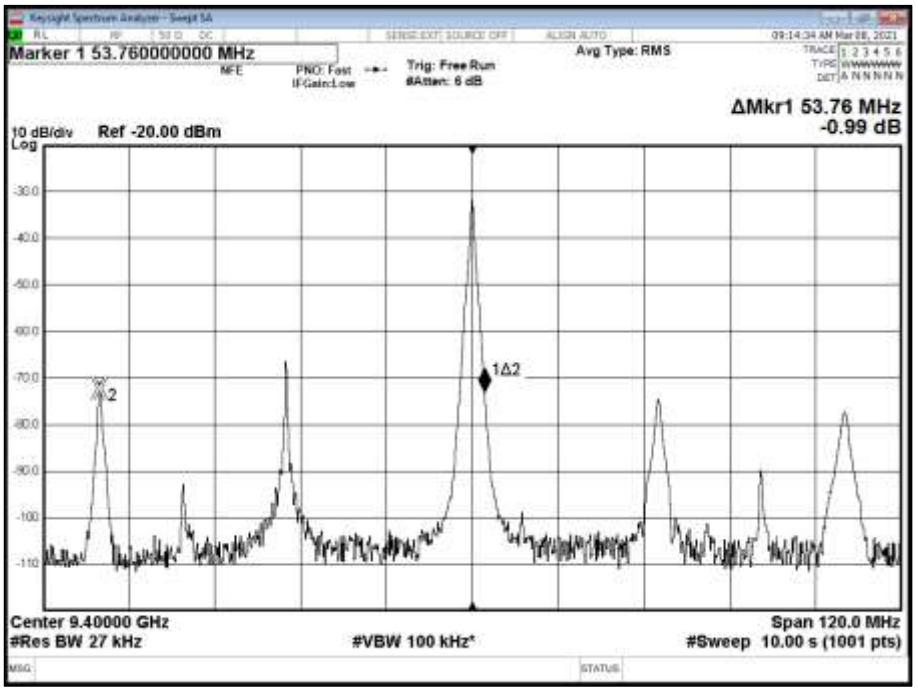

Figure 44 - 9400 MHz, FM, 47000 ns, 40 dB Bandwidth

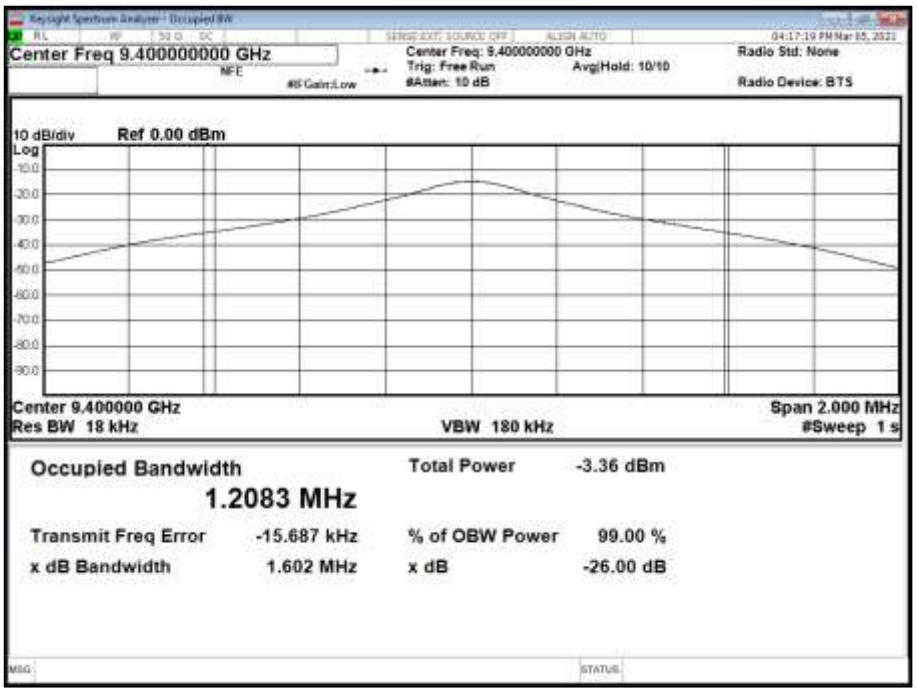

Figure 45 - 9400 MHz, FM, 79000 ns, 99% Occupied Bandwidth

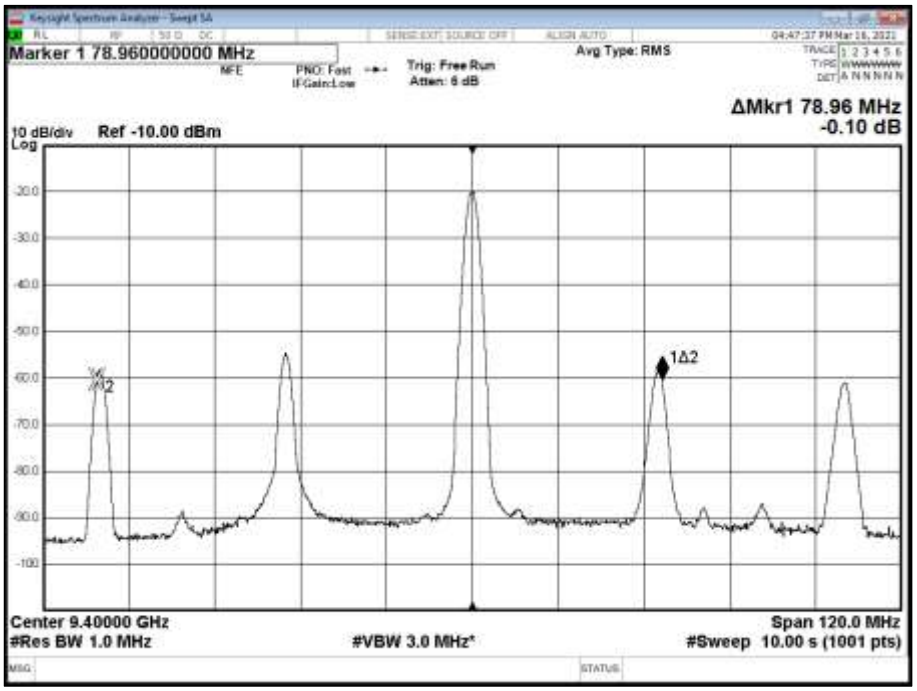

Figure 46 - 9400 MHz, FM, 79000 ns, 40 dB Bandwidth

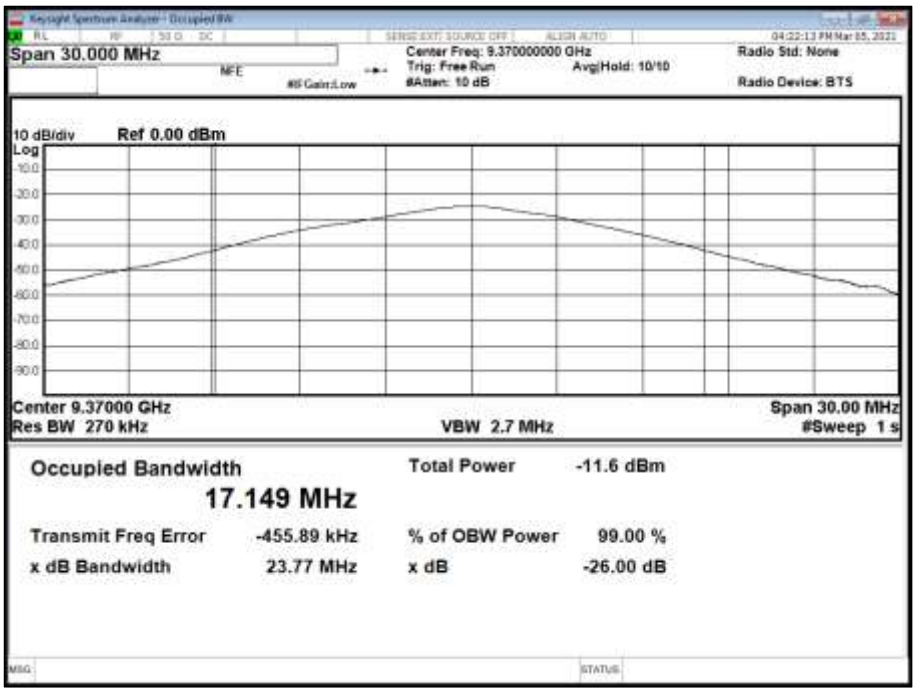

Figure 47 - 9370, FM, 750 ns, 99% Occupied Bandwidth

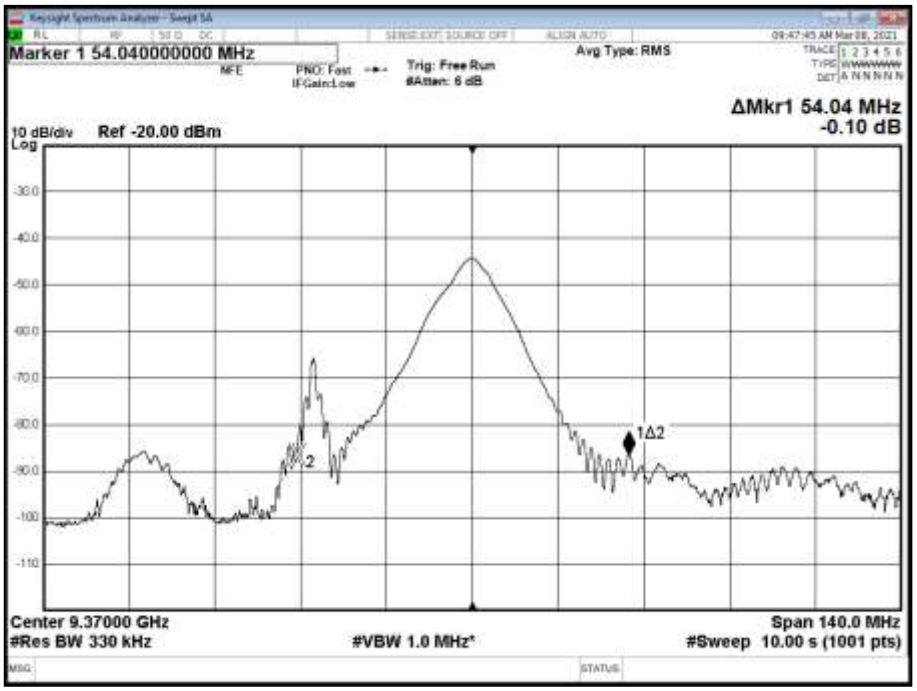

Figure 48 - 9370, FM, 750 ns, 40 dB Bandwidth

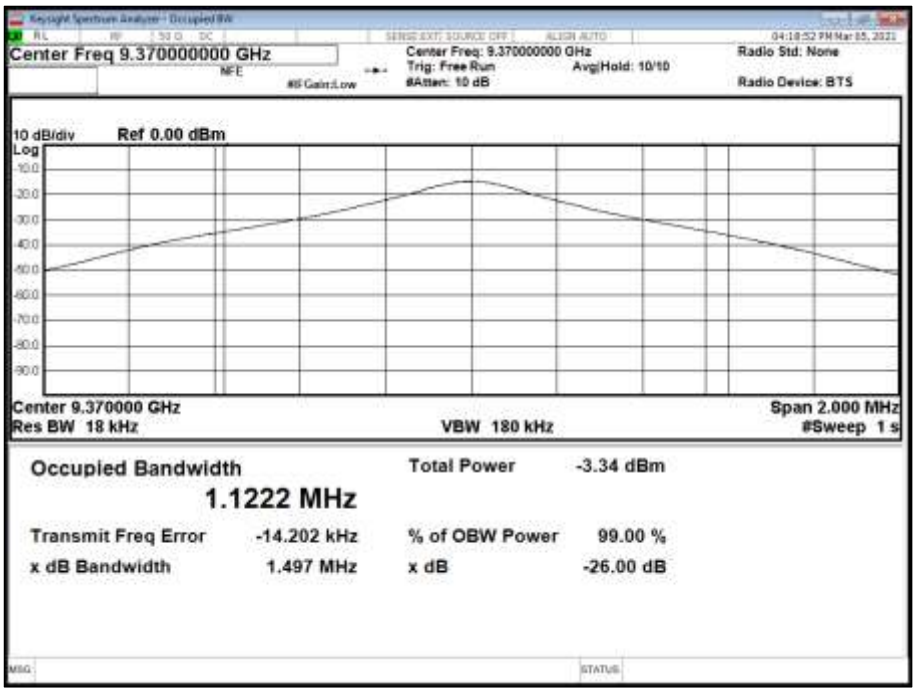

Figure 49 - 9370, FM, 79000 ns, 99% Occupied Bandwidth

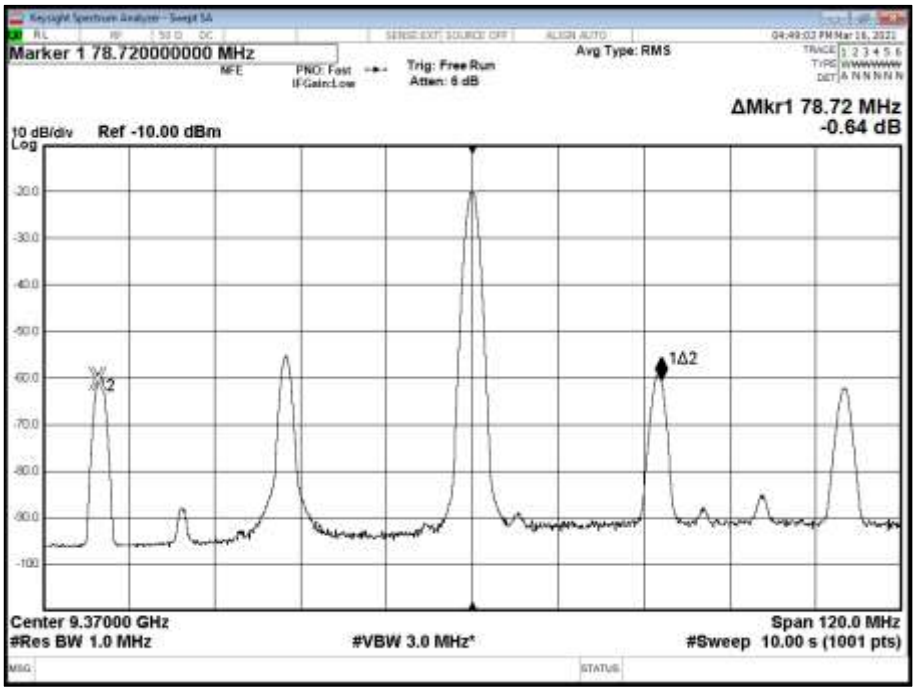

Figure 50 - 9370, FM, 79000 ns, 40 dB Bandwidth

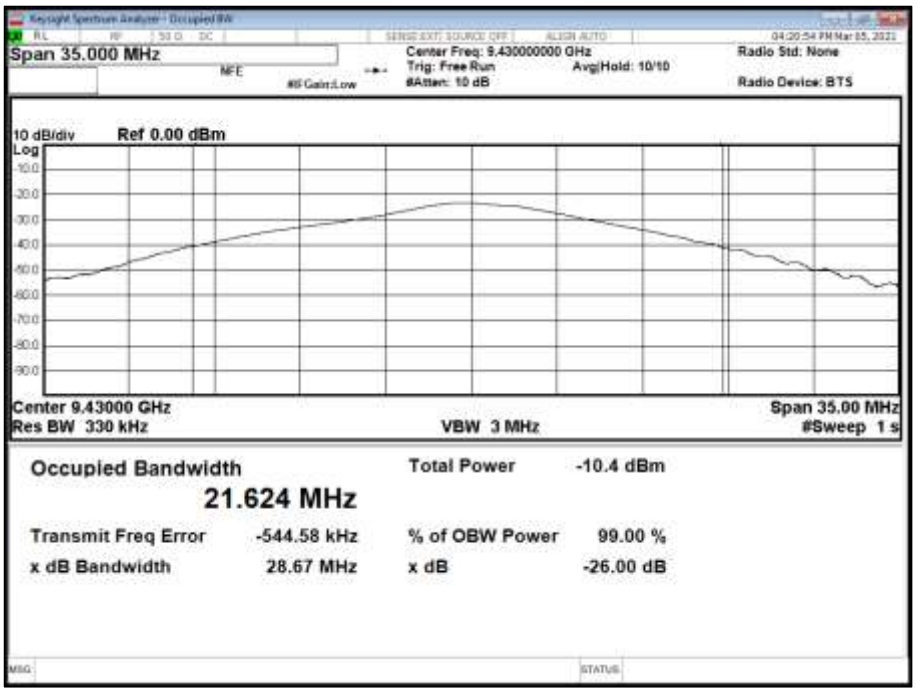

Figure 51 - 9430, FM, 750 ns, 99% Occupied Bandwidth

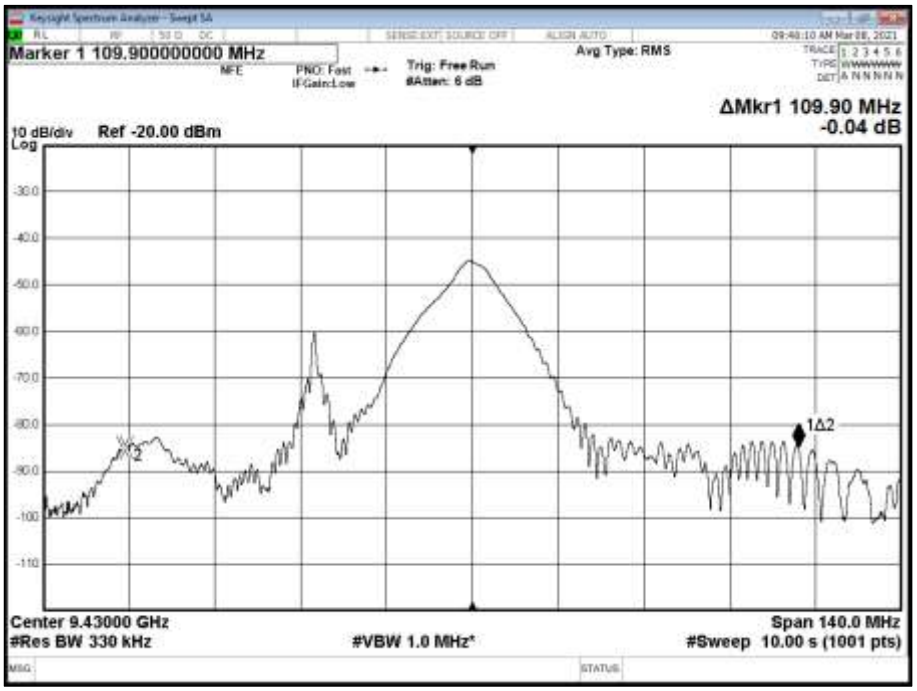

Figure 52 - 9430, FM, 750 ns, 40 dB Bandwidth

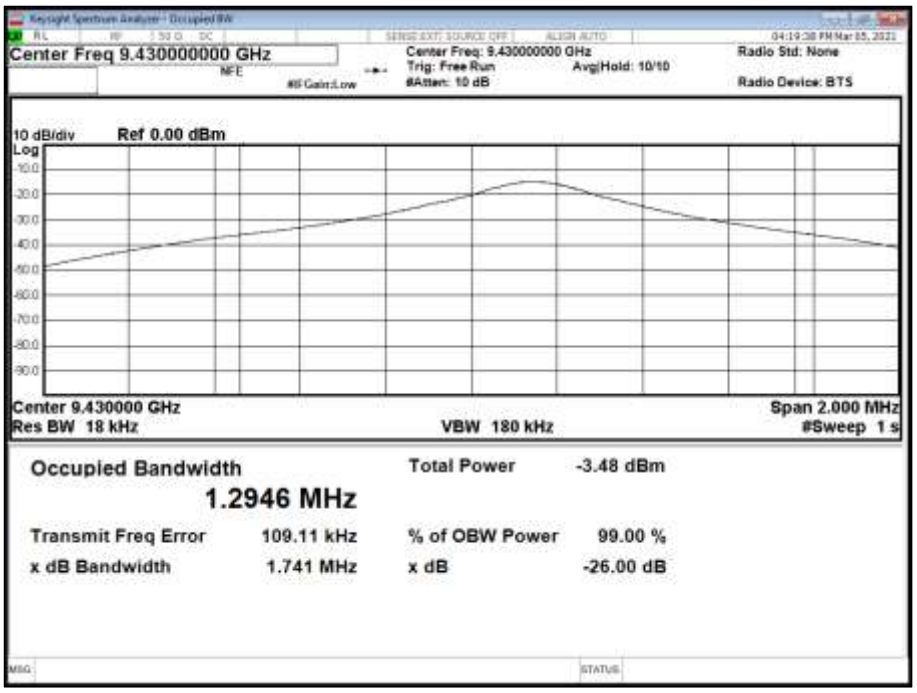

Figure 53 - 9430, FM, 79000 ns, 99% Occupied Bandwidth

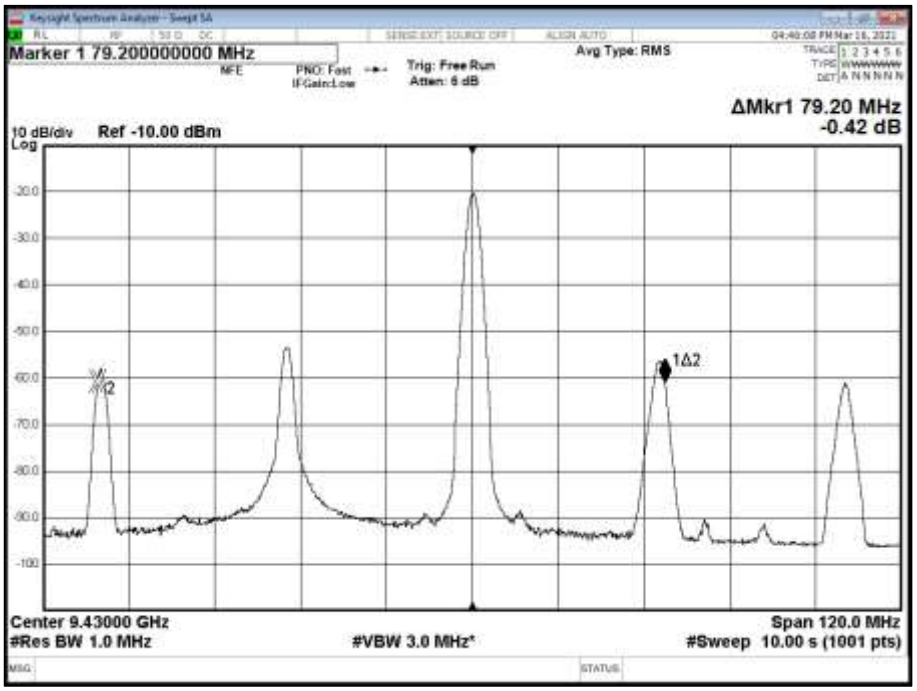

Figure 54 - 9430, FM, 79000 ns, 40 dB Bandwidth

FCC 47 CFR Part 80, Limit Clause 80.209(b)

When pulse modulation is used in land and ship radar stations operating in the bands above 2.4 GHz the frequency at which maximum emission occurs must be within the authorized bandwidth and must not be closer than 1.5/T MHz to the upper and lower limits of the authorized bandwidth where ‘‘T’’ is the pulse duration in microseconds.

Industry Canada RSS-238, Limit Clause

None Specified

2.2.7 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
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-2021
Hygromer	Rotronic	A1	2138	12	01-Jul-2021
Multimeter	Fluke	79 Series II	3057	12	21-Aug-2021
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	29-Jan-2022
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	30-Dec-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	17-May-2021
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Nov-2021
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
Attenuator 20dB 100W	Weinschel	48-20-43-LIM	5133	12	03-Dec-2021
WR90 / WG16 Waveguide Directional Coupler	Quasar	QCC 16SB-UBR-UBR-N-F-30	5145	-	O/P Mon
WR90 / WG16 Waveguide Load	Quasar	QWL16SB-UBR-25W	5146	-	O/P Mon

Table 19

O/P Mon – Output Monitored using calibrated equipment

2.3 Transmitter Frequency Stability

2.3.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.209(b)
FCC 47 CFR Part 2, Clause 2.1055
Industry Canada RSS-238, Clause 4.1
ISED RSS-GEN, Clause 6.11

2.3.2 Equipment Under Test and Modification State

E70620, S/N: AD5NZBQ Storix ID 552061 Item 1- Modification State 0

2.3.3 Date of Test

04-March-2021 to 05-March-2021

2.3.4 Test Method

This test was performed in accordance with ANSI C63.26 clause 5.6 and RSS-GEN clause 6.11. The EUT was placed in a Climatic Chamber and its Frequency Error measured using the Spectrum Analyser 99% Occupied Bandwidth function with a Peak detector and Max Hold, over the temperature range of -30°C to +50°C. In addition, measurements were made at ±15 % of the nominal voltage at 20°C.

2.3.5 Environmental Conditions

Ambient Temperature	22.5 - 23.8 °C
Relative Humidity	20.3 - 24.3 %

2.3.6 Test Results

DC Powered - Transmit

Voltage	Frequency Error (kHz)	Frequency Error (ppm)
24 V DC	2091	222
10.2 V DC	2211	235
31.2 V DC	2159	229

Table 20 - Frequency Stability Under Voltage Variations, 9400 MHz, CW, 46 ns

Voltage	Frequency Error (kHz)	Frequency Error (ppm)
24 V DC	-207	-22
10.2 V DC	-287	-30
31.2 V DC	-235	-25

Table 21 - Frequency Stability Under Voltage Variations, 9400 MHz, FM, 192 ns

Voltage	Frequency Error (kHz)	Frequency Error (ppm)
24 V DC	13	1
10.2 V DC	12	1
31.2 V DC	13	1

Table 22 - Frequency Stability Under Voltage Variations, 9400 MHz, FM, 79000 ns

Voltage	Frequency Error (kHz)	Frequency Error (ppm)
24 V DC	-354	-37
10.2 V DC	-369	-39
31.2 V DC	-367	-39

Table 23 - Frequency Stability Under Voltage Variations, 9370 MHz, FM, 750 ns

Voltage	Frequency Error (kHz)	Frequency Error (ppm)
24 V DC	18	2
10.2 V DC	17	1
31.2 V DC	17	1

Table 24 - Frequency Stability Under Voltage Variations, 9370 MHz, FM, 79000 ns

Voltage	Frequency Error (kHz)	Frequency Error (ppm)
24 V DC	-359	-38
10.2 V DC	--363	-38
31.2 V DC	-362	-38

Table 25 - Frequency Stability Under Voltage Variations, 9430 MHz, FM, 750 ns

Voltage	Frequency Error (kHz)	Frequency Error (ppm)
24 V DC	99	10
10.2 V DC	98	10
31.2 V DC	98	10

Table 26 - Frequency Stability Under Voltage Variations, 9430 MHz, FM, 79000 ns

All measurements in the tables above remained within the band of operation and were not closer than 1.5/T MHz to the upper and lower limits of the authorized bandwidth.

Temperature	Frequency Error (kHz)	Frequency Error (ppm)
-30.0 °C	1154	122
-20.0 °C	3359	357
-10.0 °C	3634	386
0.0 °C	-3844	-408
+10.0 °C	492	52
+20.0 °C	2091	222
+30.0 °C	4379	465
+40.0 °C	4420	470
+50.0 °C	2953	314

Table 27 - Frequency Stability Under Temperature Variations, 9400 MHz, CW, 46 ns

Temperature	Frequency Error (kHz)	Frequency Error (ppm)
-30.0 °C	-509	54
-20.0 °C	-431	45
-10.0 °C	-407	43
0.0 °C	-140	-15
+10.0 °C	-27	-3
+20.0 °C	-207	-22
+30.0 °C	-842	-89
+40.0 °C	-891	-94
+50.0 °C	-1065	-113

Table 28 - Frequency Stability Under Temperature Variations, 9400 MHz, FM, 192 ns

Temperature	Frequency Error (kHz)	Frequency Error (ppm)
-30.0 °C	148	15
-20.0 °C	125	13
-10.0 °C	111	11
0.0 °C	79	8
+10.0 °C	54	5
+20.0 °C	13	1
+30.0 °C	1	0.1
+40.0 °C	-13	-1
+50.0 °C	-12	-1

Table 29 - Frequency Stability Under Temperature Variations, 9400 MHz, FM, 79000 ns

Temperature	Frequency Error (kHz)	Frequency Error (ppm)
-30.0 °C	-489	-52
-20.0 °C	-211	-22
-10.0 °C	-201	-21
0.0 °C	-232	-24
+10.0 °C	-282	-30
+20.0 °C	-354	-37
+30.0 °C	-483	-51
+40.0 °C	-468	-50
+50.0 °C	-371	-39

Table 30 - Frequency Stability Under Temperature Variations, 9370 MHz, FM, 750 ns

Temperature	Frequency Error (kHz)	Frequency Error (ppm)
-30.0 °C	140	15
-20.0 °C	126	13
-10.0 °C	110	11
0.0 °C	80	8
+10.0 °C	55	5
+20.0 °C	18	2
+30.0 °C	1	0.1
+40.0 °C	-12	-1
+50.0 °C	-11	-1

Table 31 - Frequency Stability Under Temperature Variations, 9370 MHz, FM, 79000 ns

Temperature	Frequency Error (kHz)	Frequency Error (ppm)
-30.0 °C	-480	-50
-20.0 °C	-156	-16
-10.0 °C	-129	-13
0.0 °C	-9	-1
+10.0 °C	-192	-20
+20.0 °C	-359	-38
+30.0 °C	-616	-65
+40.0 °C	-539	-57
+50.0 °C	-459	-48

Table 32 - Frequency Stability Under Temperature Variations, 9430 MHz, FM, 750 ns

Temperature	Frequency Error (kHz)	Frequency Error (ppm)
-30.0 °C	295	31
-20.0 °C	221	23
-10.0 °C	201	21
0.0 °C	190	20
+10.0 °C	148	15
+20.0 °C	99	10
+30.0 °C	79	8
+40.0 °C	71	7
+50.0 °C	78	8

Table 33 - Frequency Stability Under Temperature Variations, 9430 MHz, FM, 79000 ns

All measurements in the tables above remained within the band of operation and were not closer than 1.5/T MHz to the upper and lower limits of the authorized bandwidth.

FCC 47 CFR Part 80, Limit clause 80.209(b)

When pulse modulation is used in land and ship radar stations operating in the bands above 2.4 GHz the frequency at which maximum emission occurs must be within the authorized bandwidth and must not be closer than 1.5/T MHz to the upper and lower limits of the authorized bandwidth where ‘‘T’’ is the pulse duration in microseconds. In the band 14.00–14.05 GHz the centre frequency must not vary more than 10 MHz from 14.025 GHz.

Industry Canada RSS-238, Limit Clause 4.1

The carrier frequency shall not depart from the reference frequency in excess of 800 ppm for equipment which operates in the band 2900-3100 MHz nor in excess of 1250 ppm for equipment which operates in the band 9225-9500 MHz.

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
True RMS Multimeter	Fluke	79 Series III	411	12	12-Oct-2021
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-2021
Thermocouple Thermometer	Fluke	51	3172	12	28-Jan-2022
Hygrometer	Rotronic	I-1000	3220	12	16-Oct-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	17-May-2021
PXA Signal Analyser	Keysight Technologies	N9030A	4653	12	26-Feb-2022
2 Channel PSU	Rohde & Schwarz	HMP2020	4735	-	TU
Climatic Chamber	Aralab	FitoTerm 300E45	4823	12	19-Mar-2021
Attenuator 30dB 100W	Weinschel	48-30-43-LIM	5135	12	23-Jul-2021
Power Supply	Rohde & Schwarz	HMP2020	S/N: 101828	-	O/P Mon
Coupler	Flann Microwave	16270-40-23	S/N: 154533	-	O/P Mon
Load	Hampton	MPT90-1A	S/N: 942117-002	-	O/P Mon

Table 34

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

2.4 Spurious Emissions at Antenna Terminals

2.4.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.211(f)
FCC 47 CFR Part 2, Clause 2.1051
Industry Canada RSS-238, Clause 4.3
ISED RSS-GEN, Clause 6.13

2.4.2 Equipment Under Test and Modification State

E70620, S/N: AD5NZBQ Storix ID 552061 Item 1- Modification State 0

2.4.3 Date of Test

16-March-2021 to 18-March-2021

2.4.4 Test Method

250 % Authorized Bandwidth

The EUT was connected to a Spectrum Analyser via a WR90 Waveguide Directional Coupler with additional attenuation. The mask reference level was set to the Peak value of the carrier. An RBW of 1 MHz and a VBW of 3 MHz was used for all tests. The mask was derived based on the measured or calculated 40 dB Bandwidth. An RMS detector was used for FCC measurements while a Peak detector was used for ISED measurements.

ISED Mask:

In accordance with ITU-R M.1177-4 Clause 4, the 40 dB Bandwidth was calculated for each pulse type. The calculations used are detailed in ITU-R SM.1541-6 Annex 8 Clause 3.1.

In accordance with RSS-238, the analyser RBW was set to 1 MHz and the VBW to 3 MHz. A Peak detector was configured with the trace set to Max Hold. The sweep points were set to > 2 * (Span / RBW). The trace was allowed to stabilize, and the result checked against the mask.

>250 % Authorized Bandwidth

The test equipment was configured as shown in the setup diagram. A search was made over the range 9 kHz to 40 GHz using a 1 MHz RBW and 3 MHz VBW filter. A peak detector was used in conjunction with a Max Hold trace. Any emissions that were noted over the test range were then measured with a reduced span. The peak emission value was measured and recorded, and the true Peak value calculated to account for the Pulse Desensitization of the Spectrum Analyser. The peak measurement result can be directly compared to the ISED limit requirements. To determine compliance against FCC limits, a Duty Cycle Correction Factor based on the Pulse Characteristics is applied to the Peak Level results to give the Average value.

Declared Carrier Power: 47 dBm
ISED Limit: -60 dBc
ISED Limit (dBm) = 47 - 60 = -13 dBm
FCC Limit = 47 - (43 + 10log(P)) = -13 dBm
where P = 50 W

The worst case value in each measurement range was reported.

2.4.5 Environmental Conditions

Ambient Temperature	21.4 - 23.6 °C
Relative Humidity	32.9 - 37.8 %

2.4.6 Test Results

DC Powered - Transmit

Results Within 250% of Authorised Bandwidth

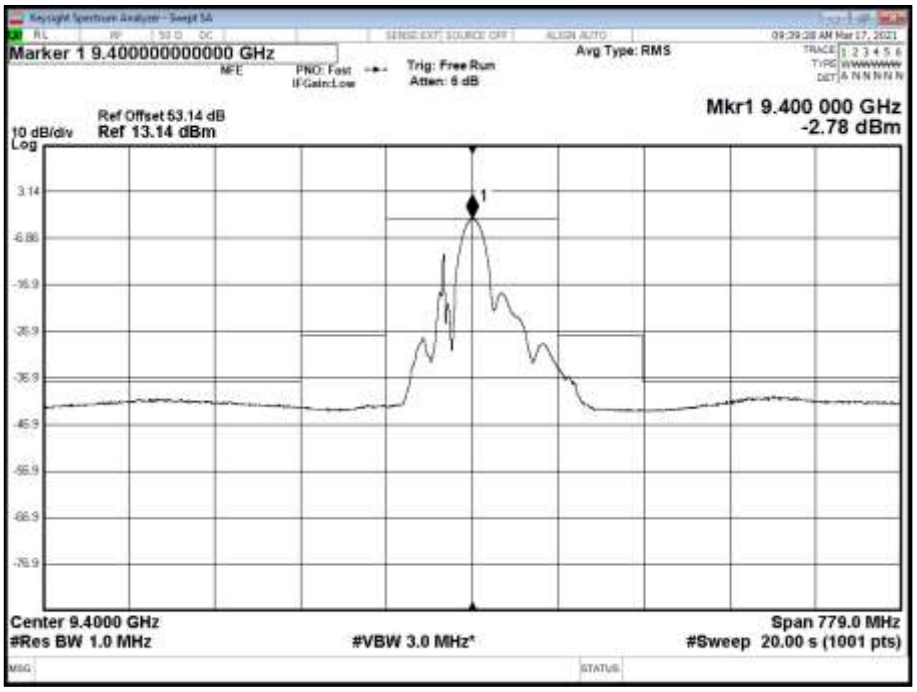

Figure 55 - 9400 MHz, CW, 46 ns (FCC Mask)

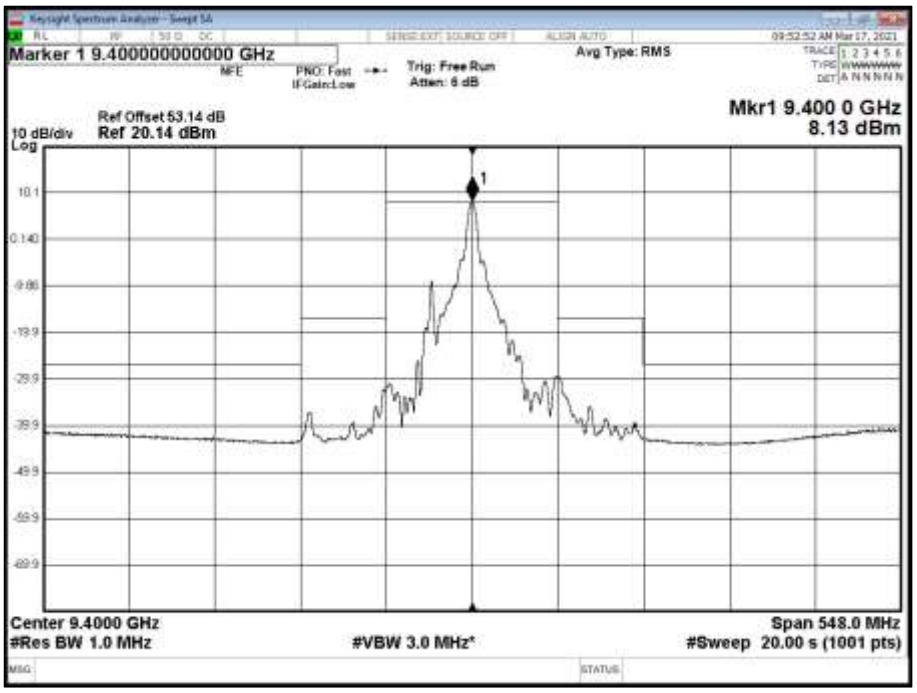

Figure 56 - 9400 MHz, FM, 192 ns (FCC Mask)

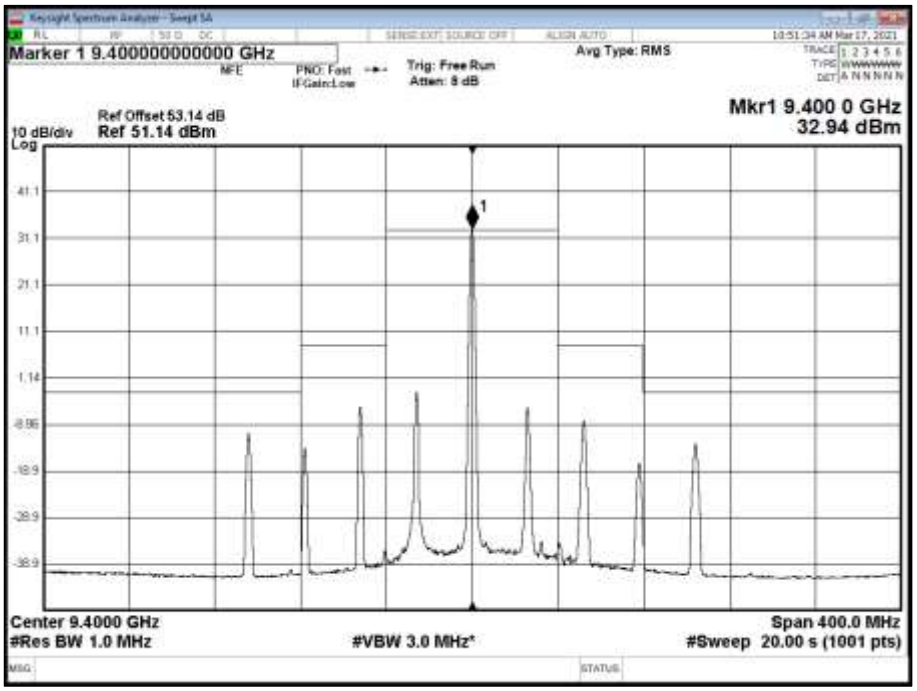

Figure 57 - 9400 MHz, FM, 79000 ns (FCC Mask)

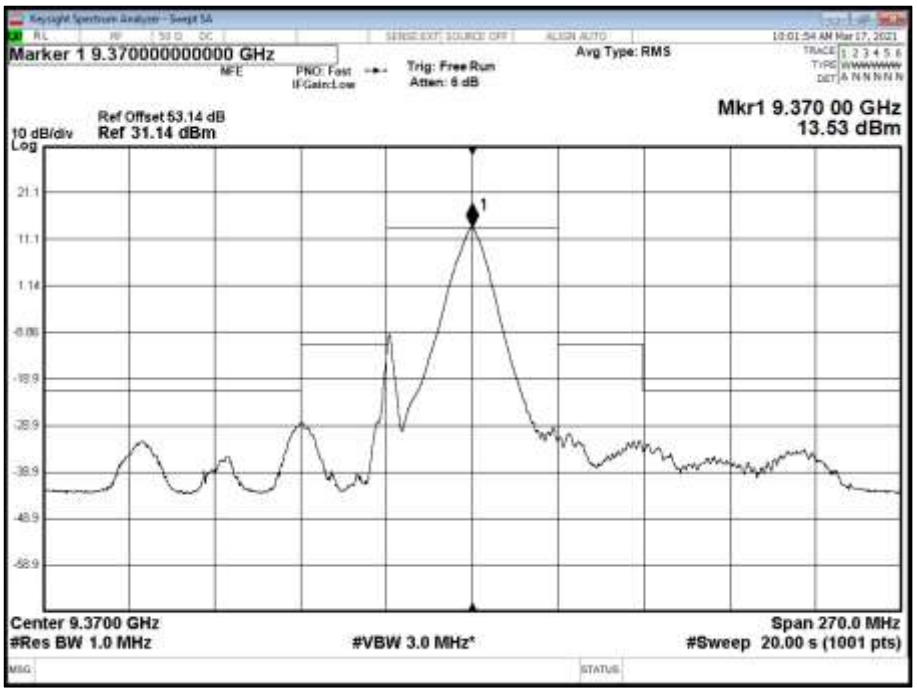

Figure 58 - 9370 MHz, FM, 750 ns (FCC Mask)

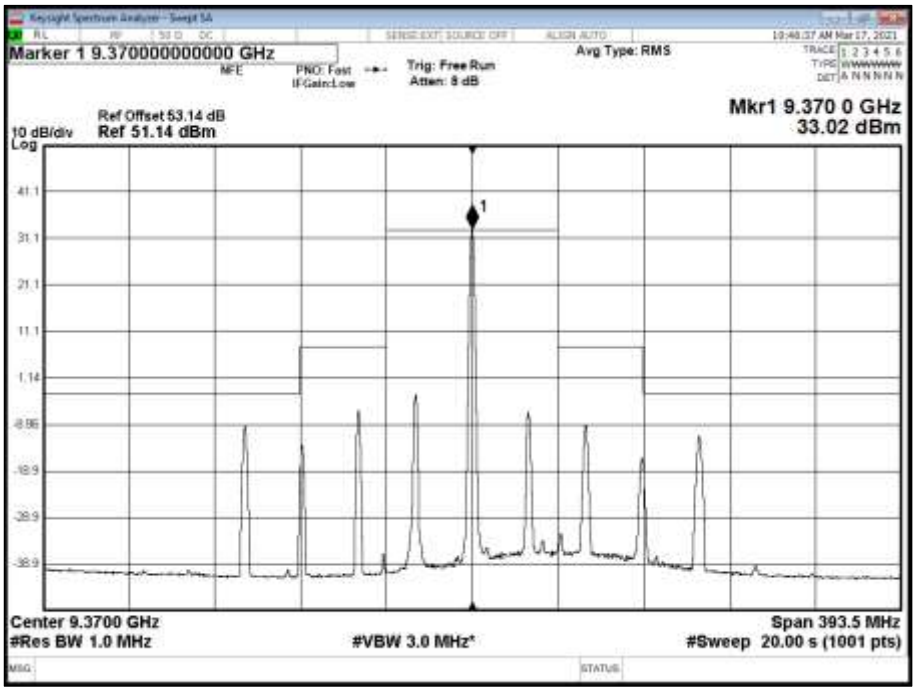

Figure 59 - 9370 MHz, FM, 79000 ns (FCC Mask)

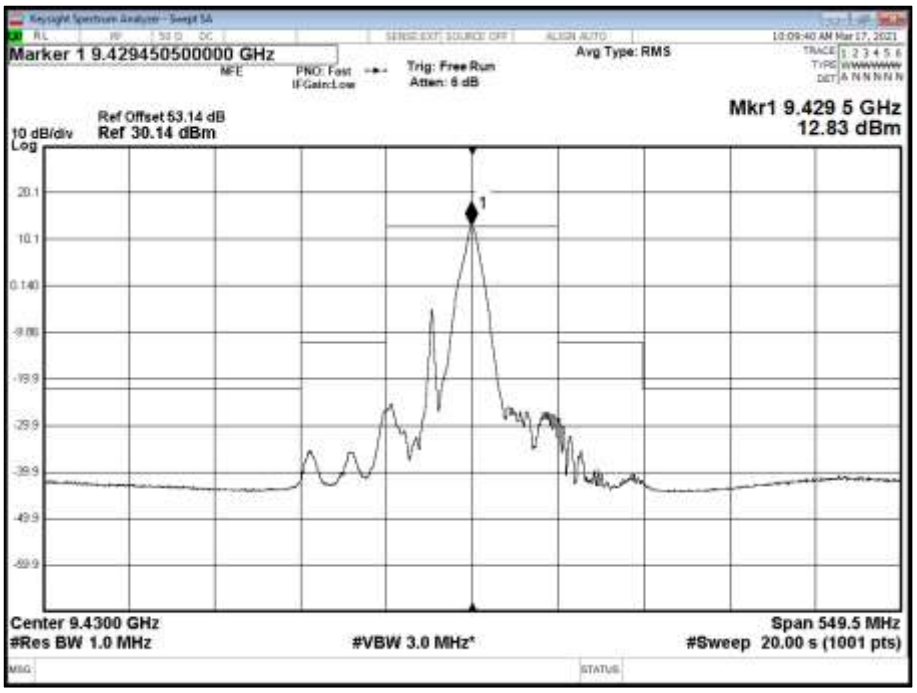

Figure 60 - 9430 MHz, FM, 750 ns (FCC Mask)

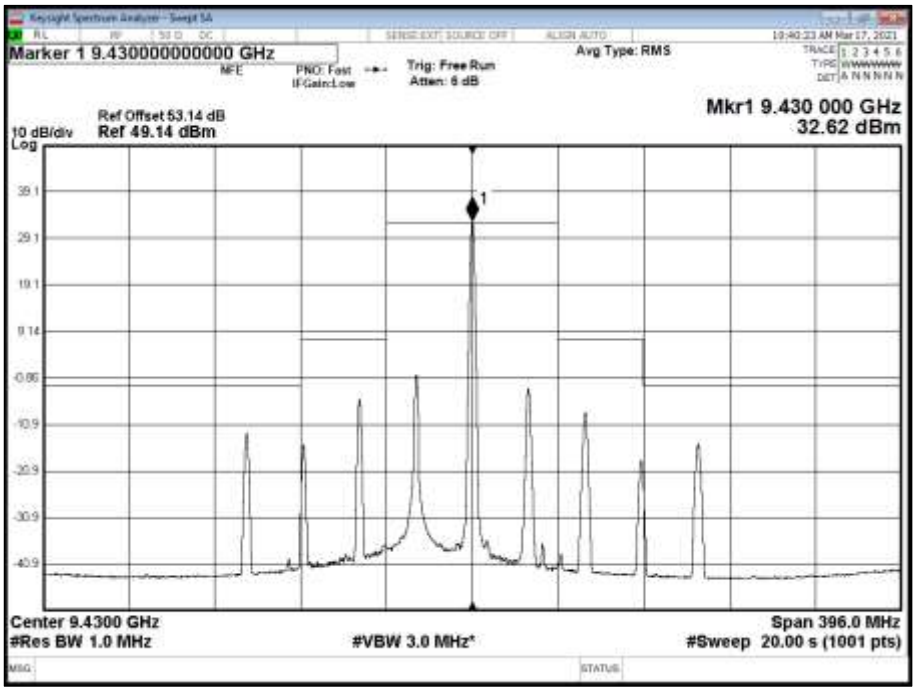

Figure 61 - 9430 MHz, FM, 79000 ns (FCC Mask)

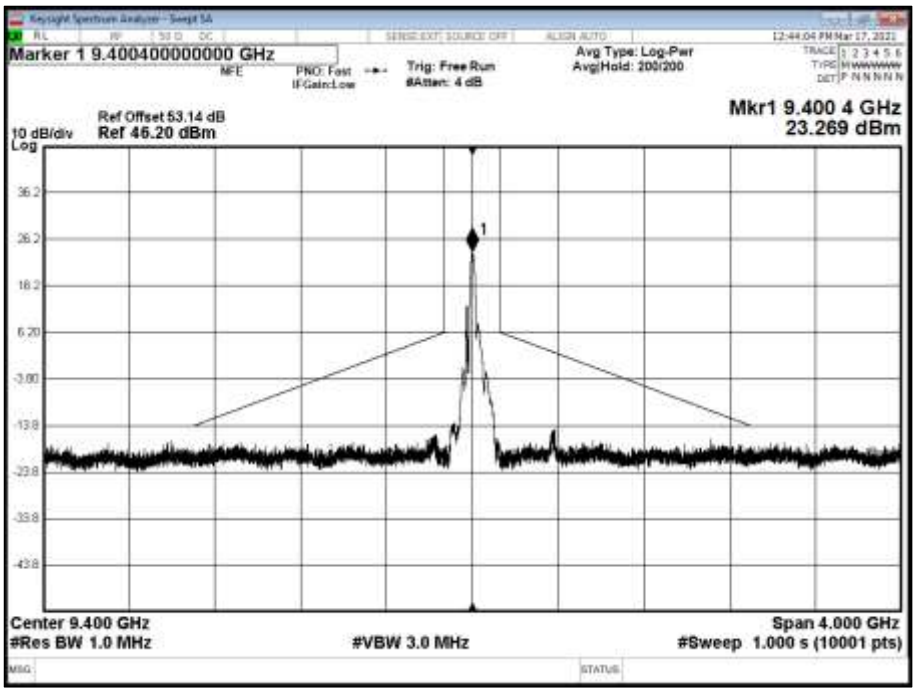

Figure 62 - 9400 MHz, CW, 46 ns (ISED Mask)

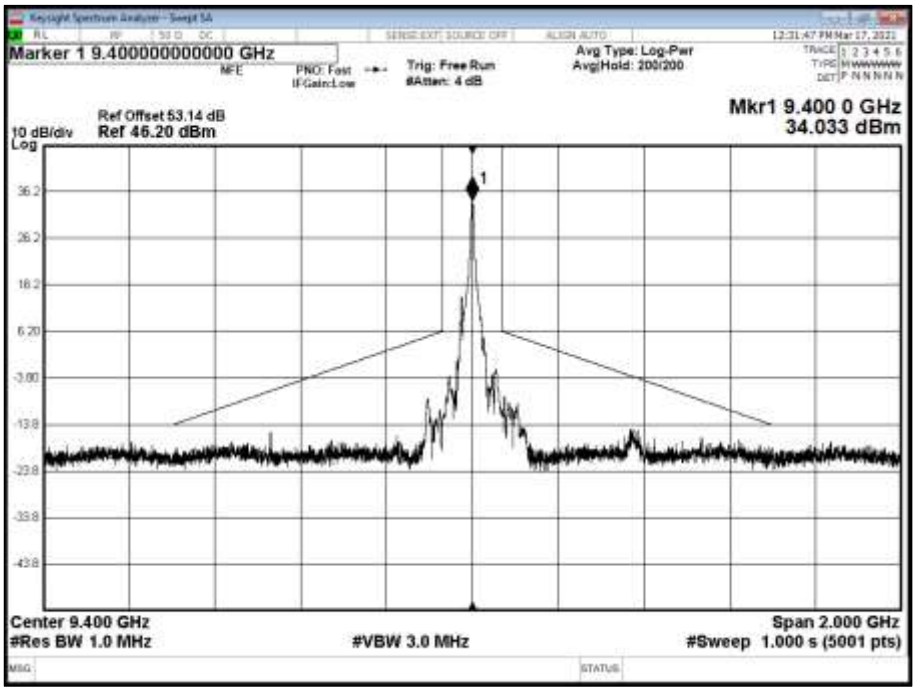

Figure 63 - 9400 MHz, FM, 192 ns (ISED Mask)

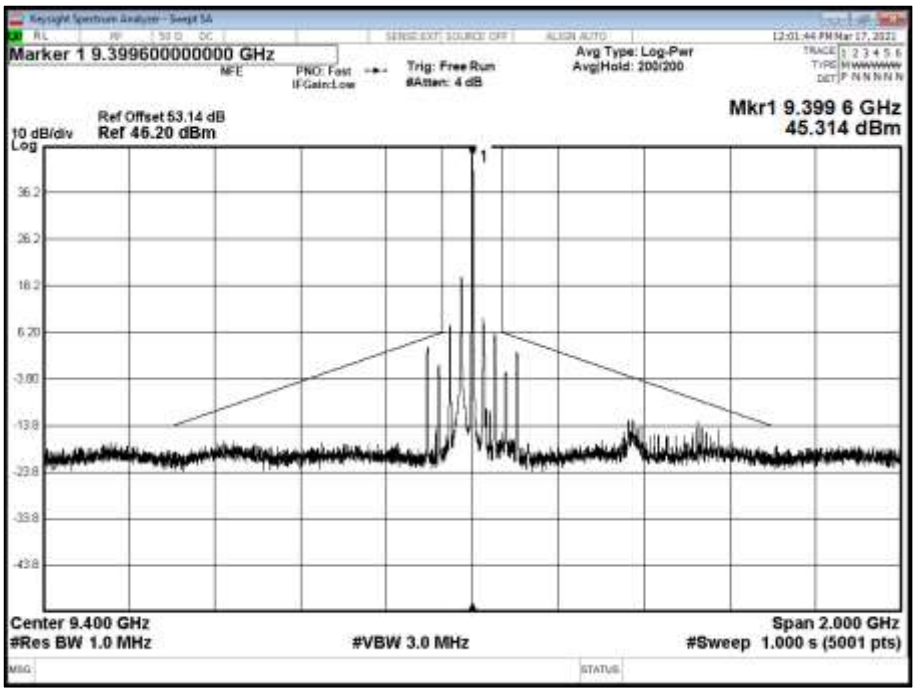

Figure 64 - 9400 MHz, FM, 79000 ns (ISED Mask)

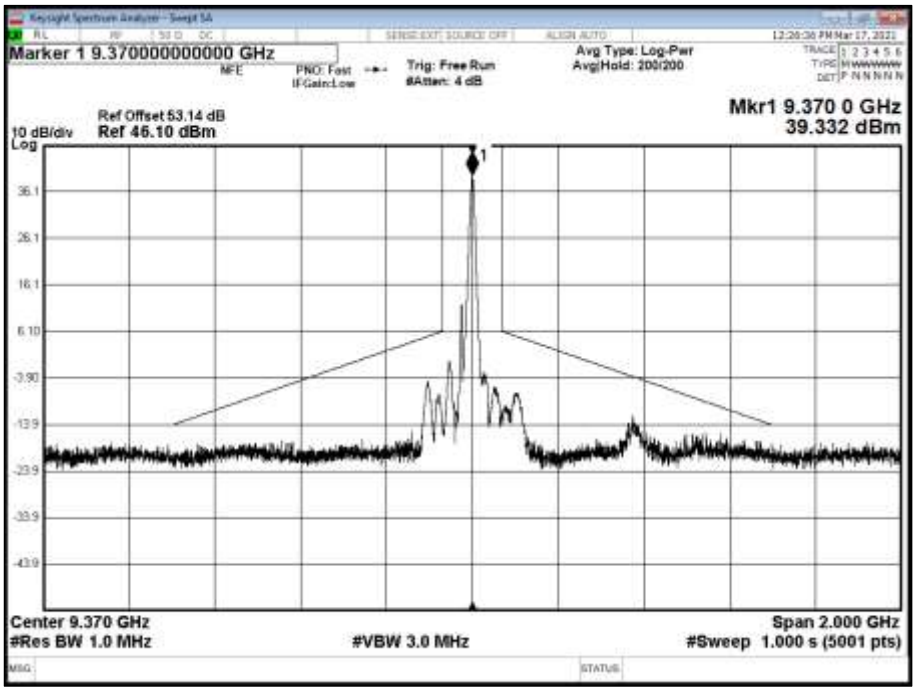

Figure 65 - 9370 MHz, FM, 750 ns (ISED Mask)

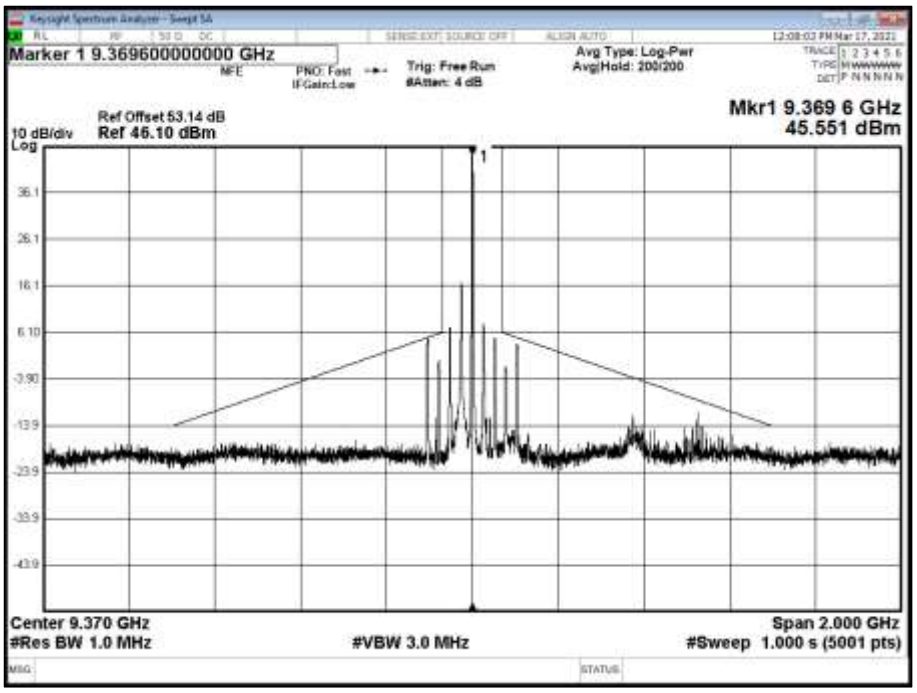

Figure 66 - 9370 MHz, FM, 79000 ns (ISED Mask)

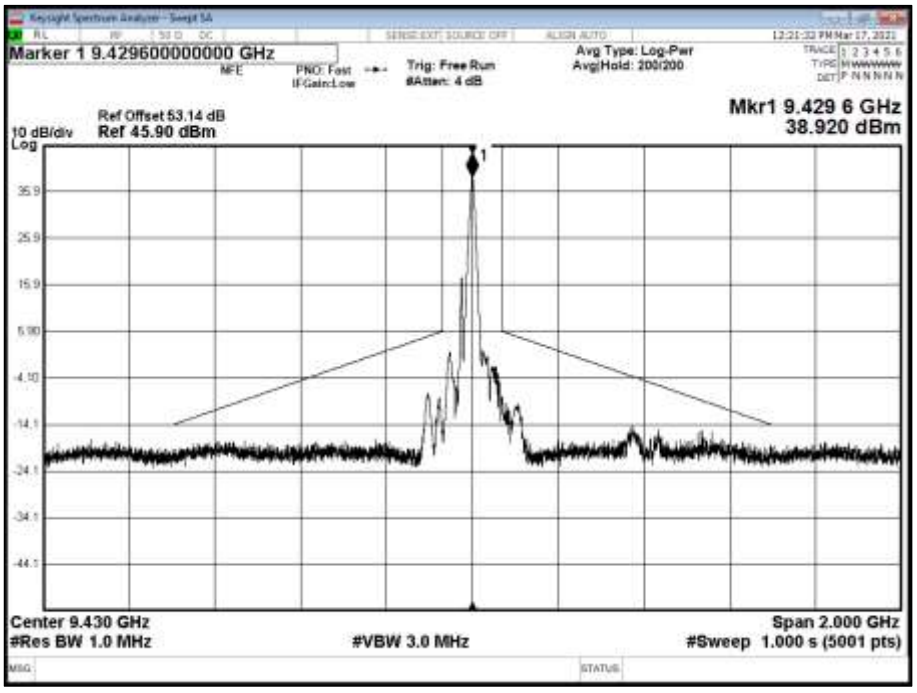

Figure 67 - 9430 MHz, FM, 750 ns (ISED Mask)

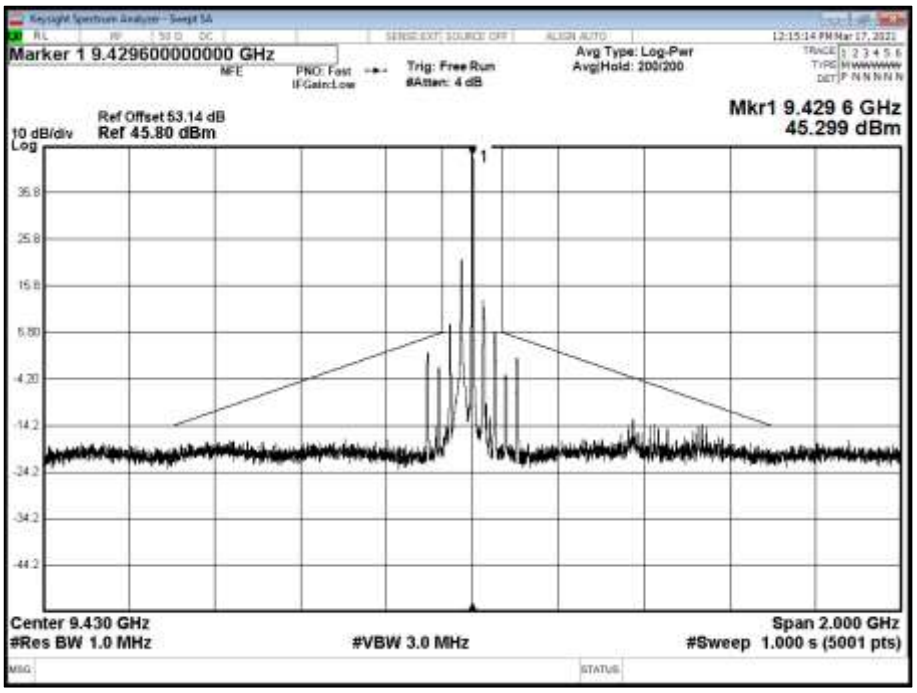

Figure 68 - 9430 MHz, FM, 79000 ns (ISED Mask)

Results >250% of Authorised Bandwidth

Pulse Type	Measured Frequency (MHz)	Peak Level (dBm)	Duty Cycle Correction Factor (dB)	Average Level (dBm)	FCC Limit (dBm)	ISED Limit (dBm)	Verdict
9430 MHz, FM, 79000 ns	14.14	-22.7	11.9	-34.6	-13.0	-13.0	Pass
9400 MHz, FM, 79000 ns	18.80	-33.0	11.9	-44.9	-13.0	-13.0	Pass
9370 MHz, FM, 79000 ns	28.11	-21.1	11.9	-33.0	-13.0	-13.0	Pass

Table 35 - Emission Results > 250% of Authorised Bandwidth

FCC 47 CFR Part 80, Clause 80.211(f)

On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB;

On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

Industry Canada RSS-238, Limit Clause 4.3

The unwanted emission and the transmitter power shall be measured using a peak detector.

The unwanted emission power in any 1 MHz bandwidth shall be attenuated below the transmitter peak power by at least 20 dB per decade from the edge of the 40 dB bandwidth and beyond.

The unwanted emissions power shall not need to be attenuated more than 60 dB below the transmitter peak power.

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
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-2021
Hygromer	Rotronic	A1	2138	12	01-Jul-2021
Multimeter	Fluke	79 Series II	3057	12	21-Aug-2021
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	29-Jan-2022
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	30-Dec-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	17-May-2021
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Nov-2021
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
Attenuator 20dB 100W	Weinschel	48-20-43-LIM	5133	12	03-Dec-2021
WR90 / WG16 to SMA Adaptor	Quasar	QWC18SB-UBR-SMA-F	5144	-	O/P Mon
WR90 / WG16 Waveguide Directional Coupler	Quasar	QCC 16SB-UBR-UBR-N-F-30	5145	-	O/P Mon
WR90 / WG16 Waveguide Load	Quasar	QWL16SB-UBR-25W	5146	-	O/P Mon
WR42 / WG20 to WR28 / WG22 Waveguide Taper	Quasar	QTT20SB-UBR-UBR-22	5147	-	O/P Mon
WR62 / WG18 to WR42 / WG20 Waveguide Taper	Quasar	QTT18SB-UBR-UBR-20	5148	-	O/P Mon
WR62 / WG18 to WR51 / WG19 Waveguide Taper	Quasar	QTT18SB-UBR-UBR-19	5149	-	O/P Mon
WR28 / WG22 to K Type Adaptor	Quasar	QWC22SB-UBR-K-F	5153	-	O/P Mon
WR42 / WG20 to K Type Adaptor	Quasar	QWC20SB-UBR-K-F	5154	-	O/P Mon
WR51 / WG19 to K Type Adaptor	Quasar	QWC19SB-UBR-SMAF	5155	-	O/P Mon
Semi-flex 18GHz-40GHz cable	Aralab	CSF6767C-C2S6500	5175	-	O/P Mon
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB 40	5605	12	08-Sep-2021

Table 36

O/P Mon – Output Monitored using calibrated equipment

2.5 Radiated Spurious Emissions

2.5.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.211(f)
FCC 47 CFR Part 2, Clause 2.1053
Industry Canada RSS-238, Clause 4.3
ISED RSS-GEN, Clause 6.13

2.5.2 Equipment Under Test and Modification State

E70620, S/N: AD5NZBQ Storix ID 552061 Item 1- Modification State 0

2.5.3 Date of Test

23-February-2021 to 27-February-2021

2.5.4 Test Method

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

2.5.5 Environmental Conditions

Ambient Temperature	22.4 - 23.1 °C
Relative Humidity	25.9 - 35.7 %

2.5.6 Test Results

DC Powered - Transmit

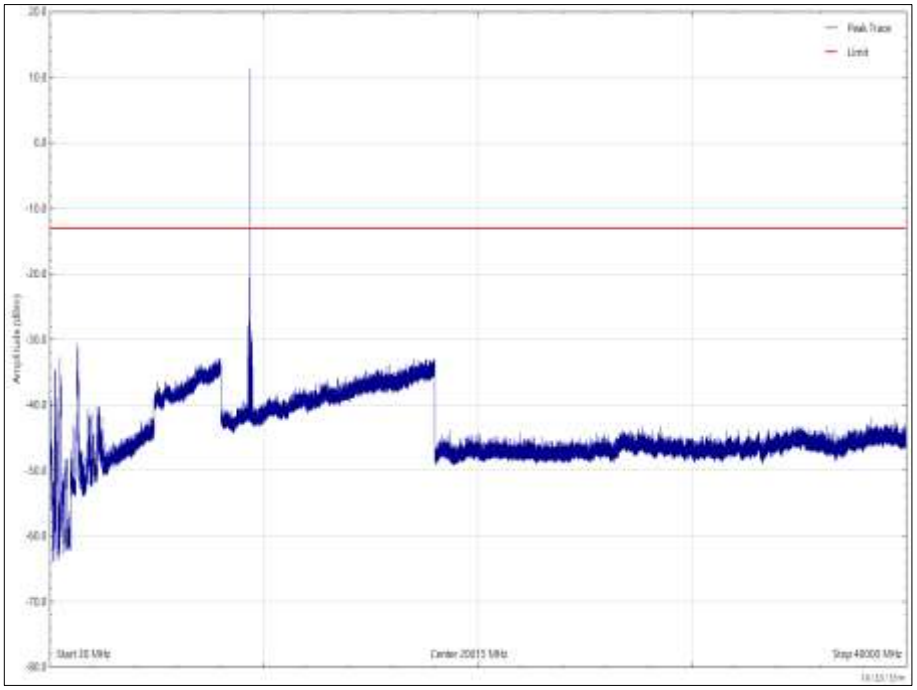

Figure 69 - 30 MHz to 40 GHz – 9370 MHz - Vertical

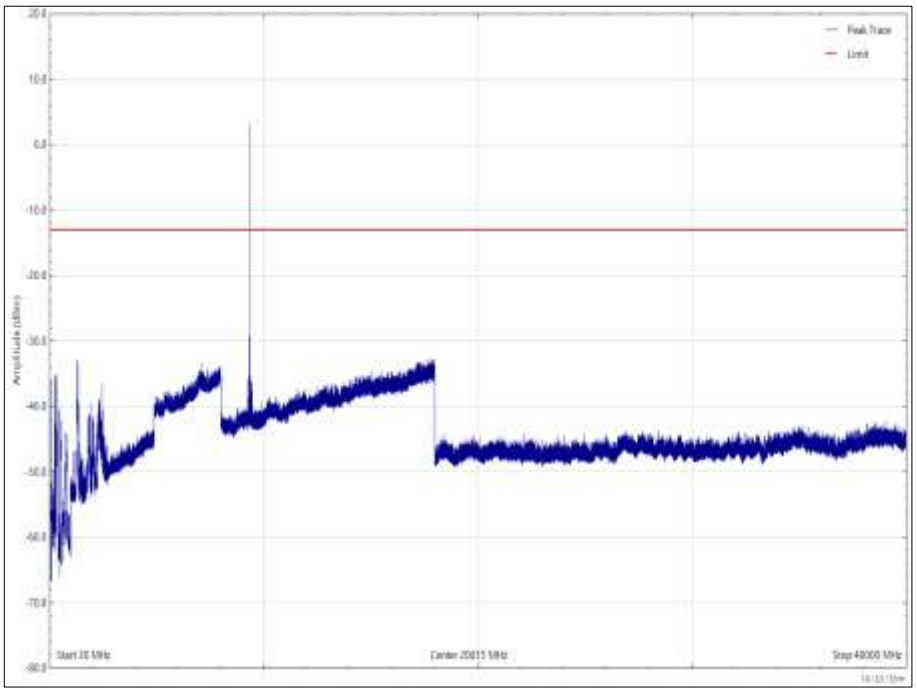

Figure 70 - 30 MHz to 40 GHz – 9370 MHz – Horizontal

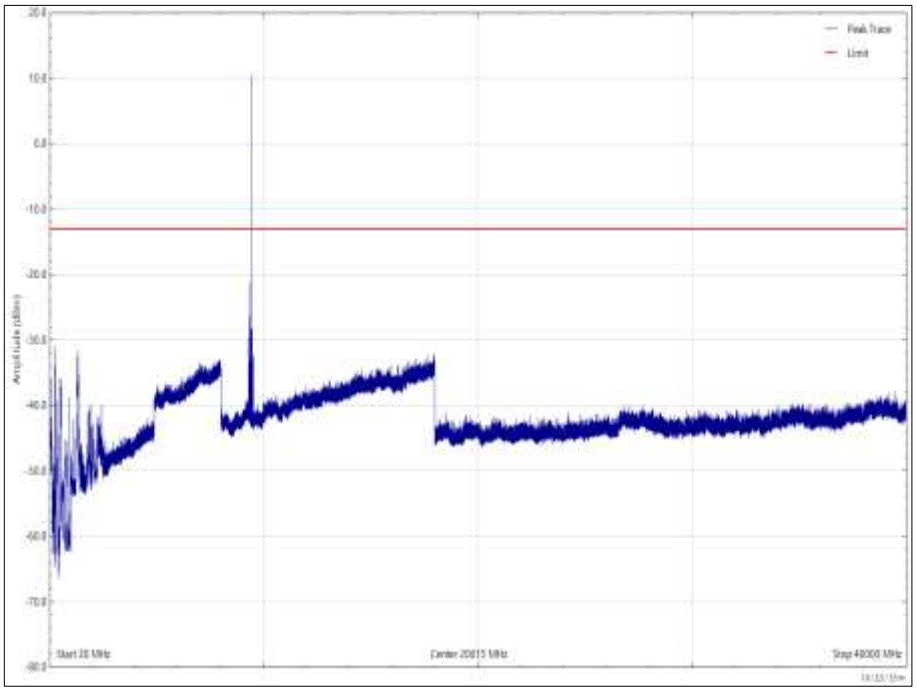

Figure 71 - 30 MHz to 40 GHz - 9400 MHz - Vertical

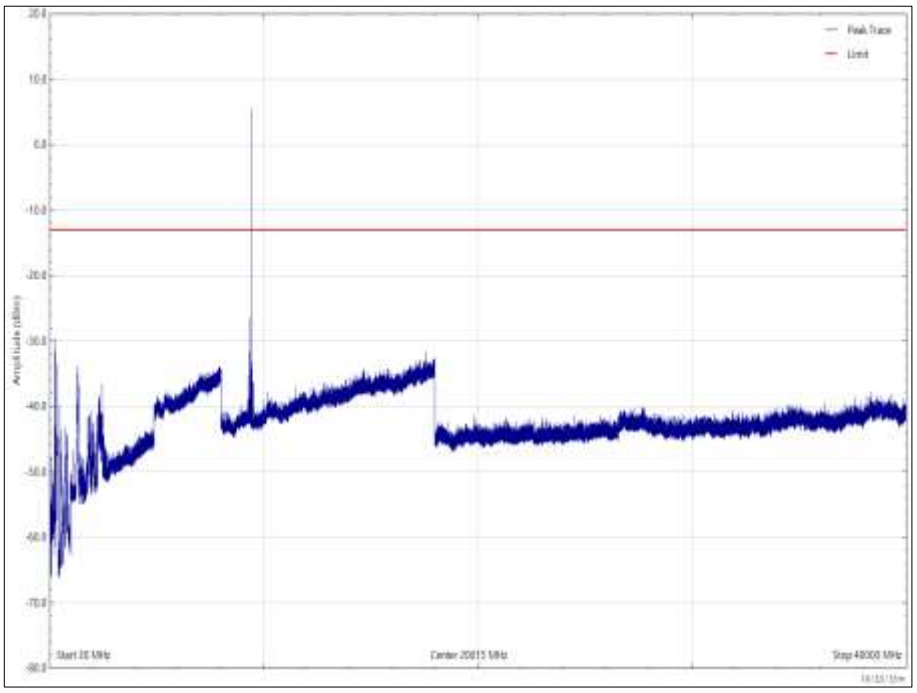

Figure 72 - 30 MHz to 40 GHz - 9400 MHz - Horizontal

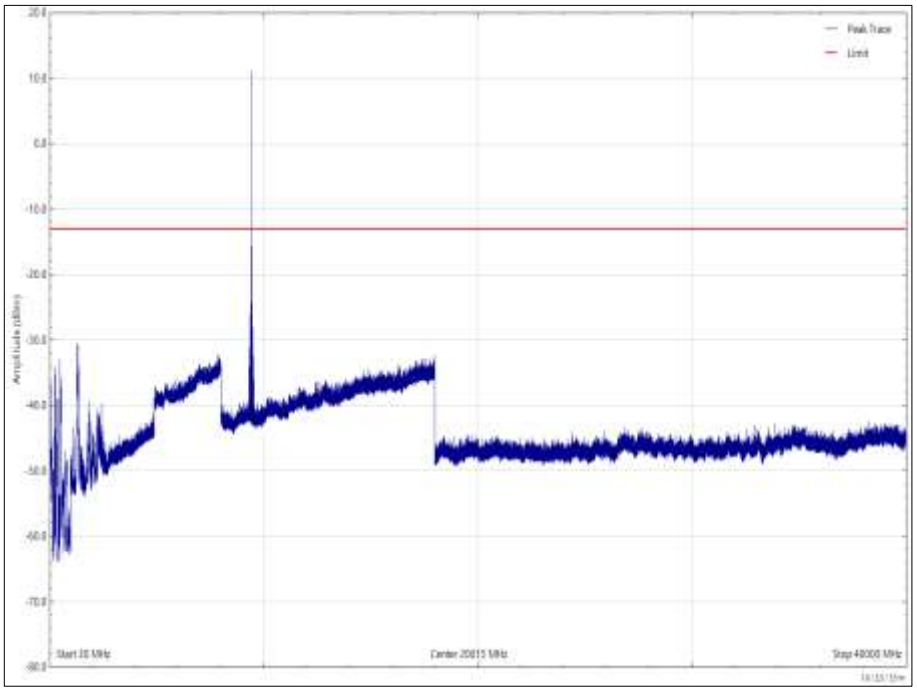

Figure 73 - 30 MHz to 40 GHz - 9430 MHz - Vertical

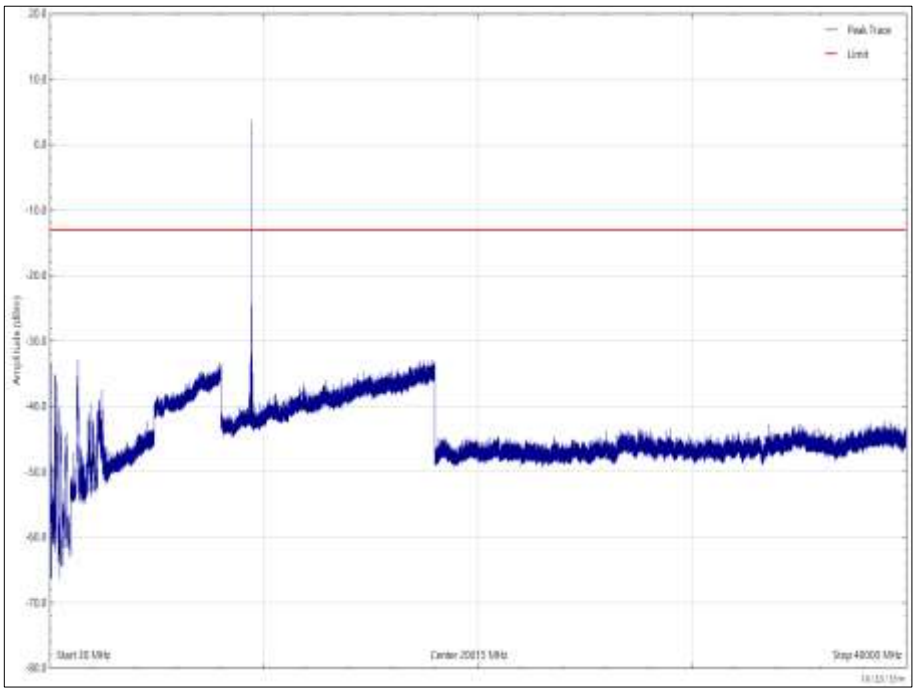

Figure 74 - 30 MHz to 40 GHz - 9430 MHz - Horizontal

FCC 47 CFR Part 80, Clause 80.211(f)

On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;

On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB;

On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

Industry Canada RSS-238, Limit Clause 4.3

The unwanted emission and the transmitter power shall be measured using a peak detector.

The unwanted emission power in any 1 MHz bandwidth shall be attenuated below the transmitter peak power by at least 20 dB per decade from the edge of the 40 dB bandwidth and beyond.

The unwanted emissions power shall not need to be attenuated more than 60 dB below the transmitter peak power.

2.5.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 12.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	27-Jul-2022
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	14-Oct-2022
18GHz - 40GHz Pre-Amplifier	Phase One	PSO4-0087	1534	12	18-Feb-2022
Comb Generator	Schaffner	RSG1000	3034	-	TU
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	12	16-Nov-2021
Multimeter	Fluke	175	4427	12	16-Mar-2021
EmX Emissions Software	TUV SUD	V2.1.1	5125	-	Software
Test Receiver	Rohde & Schwarz	ESW44	5379	12	15-Dec-2021
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5428	12	15-Oct-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	18-Mar-2021
1m K-Type Cable	Junkosha	MWX241-01000KMSKMS/A	5511	12	03-Apr-2021
8m N Type Cable	Junkosha	MWX221-08000NMSNMS/B	5519	12	24-Mar-2021
2 m K Type Cable	Junkosha	MWX241-02000KMSKMS/A	5523	12	03-Apr-2021
DRG Horn Antenna (7.5-18GHz)	Schwarzbeck	HWRD750	5610	12	22-Sep-2021
Broadband Horn Antenna (1-10 GHz)	Schwarzbeck	BBHA 9120 B	5611	12	22-Sep-2021
Turntable & Mast Controller	Maturo Gmbh	NCD/498/2799.01	5612	-	TU
Tilt Antenna Mast TAM 4.0-P	Maturo Gmbh	TAM 4.0-P	5613	-	TU
Turntable	Maturo Gmbh	Turntable 1.5 SI-2t	5614	-	TU
3m Semi Anechoic Chamber	MVG	EMC-3	5621	36	11-Aug-2023

Table 37

TU - Traceability Unscheduled

2.6 RF Output Power

2.6.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.215
FCC 47 CFR Part 2, Clause 2.1046
Industry Canada RSS-238, Clause 4.2
ISED RSS-GEN, Clause 6.12

2.6.2 Equipment Under Test and Modification State

E70620, S/N: AD5NZBQ Storix ID 552061 Item 1- Modification State 0

2.6.3 Date of Test

01-March-2021

2.6.4 Test Method

The path loss between the EUT and the Power Sensor was measured using a Network Analyser. The loss was entered as a correction into the Power Meter which was connected via attenuators and a WR90 30dB Waveguide Directional Coupler to the EUT. Peak power measurements were made, and the Average derived by applying a Duty Cycle correction factor to the results based on the measured pulse characteristics.

2.6.5 Environmental Conditions

Ambient Temperature	26.5 °C
Relative Humidity	26.8 %

2.6.6 Test Results

DC Powered - Transmit

Test Frequency (MHz)	Radar Pulse Description	Peak Power		Average Power	
		(dBm)	(W)	(dBm)	(W)
9400	CW, 46 ns	46.2	41.7	9.5	0.009
9400	FM, 192 ns	46.2	41.7	15.7	0.037
9400	FM, 750 ns	45.9	39.1	21.4	0.138
9400	FM, 1020 ns	46.1	40.3	22.8	0.192
9400	FM, 1235 ns	46.0	40.1	23.6	0.232
9400	FM, 1675 ns	45.9	38.6	24.8	0.303
9400	FM, 2300 ns	45.8	37.7	26.2	0.414
9400	FM, 2710 ns	45.8	38.2	27.0	0.499
9400	FM, 3900 ns	45.8	38.3	28.6	0.717
9400	FM, 17600 ns	46.0	39.4	34.0	2.496
9400	FM, 23600 ns	45.9	39.1	33.4	2.204
9400	FM, 35000 ns	46.0	39.6	33.5	2.225
9400	FM, 47000 ns	45.9	39.2	33.4	2.203
9400	FM, 79000 ns	46.0	39.5	34.1	2.553
9370	FM, 750 ns	46.1	40.7	21.5	0.143
9370	FM, 79000 ns	46.1	41.0	34.2	2.631
9430	FM, 750 ns	45.9	38.9	21.8	0.152
9430	FM, 79000 ns	45.6	38.5	34.0	2.507

Table 38 - RF Output Power

The maximum antenna gain was declared by the manufacturer as: 27.42 dBi.

FCC 47 CFR Part 80, Clause 80.215

The transmitter output power shall not exceed 60 kW and the antenna gain shall not exceed 35 dBi.

Industry Canada RSS-238, Limit Clause 4.2

The transmitter output power shall not exceed 60 kW and the antenna gain shall not exceed 35 dBi.

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
Hygromer	Rotronic	A1	2138	12	01-Jul-2021
Multimeter	Fluke	79 Series II	3057	12	21-Aug-2021
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	29-Jan-2022
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	30-Dec-2021
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
Attenuator 20dB 100W	Weinschel	48-20-43-LIM	5133	12	03-Dec-2021
WR90 / WG16 Waveguide Directional Coupler	Quasar	QCC 16SB-UBR-UBR-N-F-30	5145	-	O/P Mon
WR90 / WG16 Waveguide Load	Quasar	QWL16SB-UBR-25W	5146	-	O/P Mon
USB Power Sensor	Boonton	RTP5318	5185	12	12-Jan-2022

Table 39

O/P Mon – Output Monitored using calibrated equipment

3 Photographs

3.1 Test Setup Photographs

Figure 75 - Test Setup - 30 MHz to 1 GHz

Figure 76 - Test Setup - 1 GHz to 18 GHz

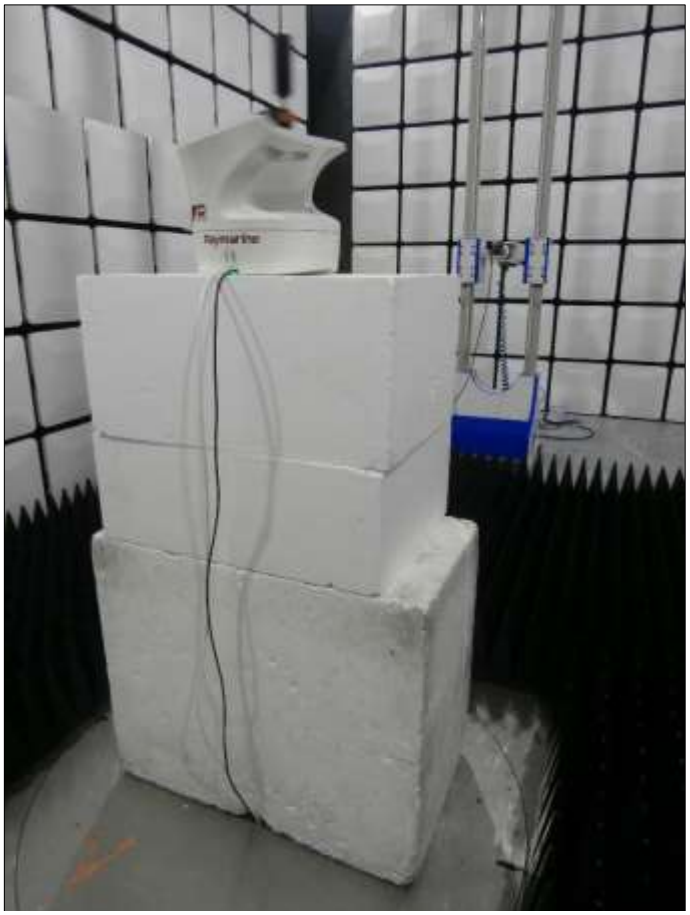

Figure 77 - Test Setup - 18 GHz to 40 GHz

Figure 78 - Conducted Test Setup

4 Test Equipment Information

4.1 Customer Support Equipment

Instrument	Manufacturer	Type No	Serial Number	Calibration Period (months)	Calibration Due
Multi-functional Display	Raymarine	E70401	685646	-	O/P Mon
Multi-functional Display	Raymarine	E70515	786700	-	O/P Mon
Power Supply Unit	Raymarine	VCM100	2668803	-	O/P Mon
Power Supply Unit	Raymarine	VCM100	1279649	-	O/P Mon
Power Supply Unit	Nevada	PS-30M	20190016	-	O/P Mon
Ethernet switch	Netgear	FS605 v2	FS62146CB241839	-	O/P Mon
Ethernet switch	Netgear	FS605 v2	FS62149CB297964	-	O/P Mon

Table 40

O/P Mon – Output Monitored Using Calibrated Equipment

5 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Modulation Characteristics	± 5%
Occupied Bandwidth	± 1857 kHz
Transmitter Frequency Stability	± 2610 kHz
Spurious Emissions at Antenna Terminals	± 3.45 dB
Radiated Spurious Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
RF Output Power	± 0.96 dB

Table 41

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

ANNEX A

CUSTOMER SUPPLIED INFORMATION

FLIR The World's Sixth Sense

Cyclone antennas

All figures quoted at 9.4GHz centre frequency.

Antenna Type: Slotted Waveguide.

Antenna size and model number	Gain dBi (directivity)	Gain dB*	Azimuth 3dB beam width	Elevation 3dB beam width	Azimuth squint angle	Azimuth sidelobes within ±10° (IMO limit -23dB)	Azimuth sidelobes outside ±10° (IMO limit -30dB)	Back lobe level	Antenna build standard
3ft E70628	25.7dBi	24.13dB	2.83°	28.4°	5.2°	-26dB	-25.9dB	-39.8dB	1011615-3
4ft E70629	27.7dBi	25.60dB	1.99°	26.8°	5.0°	-26.5dB	-33.2dB	-41.5dB	1011614-3
6ft E70630	29.5dBi	27.42dB	1.32°	26.3°	5.0°	-26.4dB	-30.3dB	-35.1dB	1010556-2

*Gain values include test fixture loss and elevation squint of -2°