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)

Raymarine Belgium BVBA Prepared for: Luxemburgstraat Meer 2321 Belgium

Add value. Inspire trust.

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

COMMERCIAL-IN-CONFIDENCE

Document 75950287-02 Issue 01



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	John
Testing	Graeme Lawler	23 April 2021	GMawler -
FCC Accreditation 90987 Octagon House, Fa	reham Test Laboratory	ISED Accreditation 12669A Octagon House, Fareham Test	Laboratory

90987 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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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.

Contion		Specificati	on Clause		Toot Description	Booult Commonte/Page Stands	
Section	FCC Part 80	FCC Part 2	RSS-238	RSS-GEN	Test Description	Result	Comments/Base Standard
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:	E70620 AD5NZBQ Radar Pedestal 1010833-3 with the following deviations applied: D-21-1377 D-20-1186 D-20-1264 D-21-1335 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 (<u>see guidance here)</u> (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	А

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					istalled):

Table 9



Ancillaries (if applicable)

Voltage Conditioner

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

Table 10

<u>3ft Antenna</u>

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 Temperature26.5 °CRelative Humidity26.8 %



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 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



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Frind Provide Locare - KTAUTACHART F			*)#
Car Bin Barns Barns Co	er 🕴 🙀 barta (Franc Ban Barra) / war. 1		
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@ Lines Barrent	Terret		- i
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	nd i Rossin i Tibu Kati pajus Sant Mala Dan da i Tibu Kati I		

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 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 \geq 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



Center Freq 9.400000000	GHz	Selice exit source on () A Center Freg: 9.4000000	LISH AUTO	02:56:15 PH Mar 85, 2021 Radio Std: Nore
	FE ## GaintLow	#Atten: 10 dB	Avg/Hold: 10/10	Radio Device: BTS
10 dB/div Ref -10.00 dB/	n	A	1	
100				
30.0	-			
40.0	~ /			
60.0	VNV-			
600	ľ.			
20.0				
-90.0				
-100				
Center 9.40000 GHz Res BW 910 kHz		VBW 8 MHz	1	Span 100.0 MHz #Sweep 1 s
Occupied Bandwidt	h	Total Power	-18.0 dBm	
66	6.813 MHz			
Transmit Freq Error	4.1816 MHz	% of OBW Powe	r 99.00 %	
x dB Bandwidth	98.72 MHz	x dB	-26.00 dB	
MEG			STATUS.	

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



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



FE #6 Ganiow	Trig: Free Run #Amen: 10 dB	AvgiHold: 10/10	Radio Device: 815
n			
	the second se	-	
			\sim
	VBW 6 MHz		Span 60.00 MHz #Sweep 1 s
h	Total Power	-14.1 dBm	
).145 MHz			
-4.2758 MHz	% of OBW Power	99.00 %	
48.65 MHz	x dB	-26.00 dB	
		STATUS	
1	h - 145 MHz -4.2758 MHz 48.65 MHz	VBW 6 MHz h Total Power .145 MHz -4.2758 MHz % of OBW Power 48.65 MHz x dB	VBW 6 MHz h Total Power -14.1 dBm .145 MHz -4.2758 MHz % of OBW Power 99.00 % 48.65 MHz x dB -26.00 dB

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



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



Center Fr	eq 9.400000000	GHz	Select Xrf Source of ALL Center Freq: 9,400000000 Trin: Freq: 9,400000000	GHz GHz	64-62-52 7M Har 85, 2621 Radio Std: Nore
		FE #FGaintLow	sAmen: 10 dB	Arginala, tarta	Radio Device: BTS
10 dB/div	Ref -10.00 dB	m			
Log					
200					
40.0					
40.0					
100		-			
.70.0					
-0.08					
-80.0					
-100					
Center 9.4 Res BW 3	10000 GHz 130 kHz	h. ti i	VBW 3 MHz	, a	Span 35.00 MHz #Sweep 1 s
Occup	oied Bandwidt	h	Total Power	-10.7 dBm	
11702090	18	8.478 MHz			
Transn	nit Freq Error	-539.82 kHz	% of OBW Power	99.00 %	
x dB Bi	andwidth	25.22 MHz	x dB	-26.00 dB	
wsg.				STATUS	

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



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



Center Fr	eq 9.400000000	GHz	Saling axe source ore acc Center Freq: 9,40000000	GH AUTO	04:03:02 PM Mar 85, 2021 Radio Std: Nore
	N	E #E GaintLow	Atten: 10 dB	Avg/Hold: 10/10	Radio Device: BTS
10 dB/div	Ref -10.00 dBr	n	A 02 13		1000 D
Log					
30.0					
40.0					-
50.0					
10.0	· · · · ·				
.70.0					
-0.06					
-90.0					
-100					
Center 9.4 Res BW 2	10000 GHz 240 kHz	, (),,	VBW 2.4 MHz		Span 25.00 MHz #Sweep 1 s
Occur	ied Bandwidt	h	Total Power	-10.9 dBm	
10403030	14	.945 MHz			
Transn	nit Freq Error	-222.52 kHz	% of OBW Power	99.00 %	
x dB B	andwidth	20.40 MHz	x dB	-26.00 dB	
100				-	
Million .				al Milde	

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



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



Center F	reg 9 400000000	GH2	Center Freq: 9.4000000	ISH AUTO	04:00:20 FM Mar 85, 2021 Radio Std: Norie
	N	FE #F GaintLow	. Trig: Free Run #Atten: 10 dB	Avg/Hold: 10/10	Radio Device: BTS
10 dB/div	Ref -10.00 dBr	n	0. 0P. 1		
Log					
30.0					
40.0					-
-50.0					
40.0					
.70.0					
-80.0					-
-80.0					
-100					
Center 9. Res BW	40000 GHz 270 kHz	.0	VBW 2.7 MHz		Span 30.00 MHz #Sweep 1 s
Occu	pied Bandwidt	h	Total Power	-9.51 dBm	
1010039070	19	.124 MHz			
Transi	nit Freq Error	-624.53 kHz	% of OBW Power	99.00 %	
x dB B	andwidth	27.13 MHz	x dB	-26.00 dB	
100				(man a)	
Maria -				PT M T M P	

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



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



Center Fre	ner Andere Douplet M	GH2	Selves EXT Source OFF 1 AU Center Freq: 5.40000000	ISH AUTO	04:07:17 PM Mar 85, 2021 Radio Std: Norve
o critici i riti	N	FE ## GaintLow	Atten: 10 dB	Avg(Hold: 10/10	Radio Device: BTS
10 dB/div	Ref -10.00 dBr	n	A AP		
Log					
30.0	-				
40.0					
-50.0					
-000					
20.0					
-90.0					
-100					
Center 9.4 Res BW 2	0000 GHz 70 kHz	- 1 <u>1</u>	VBW 2.7 MHz		Span 30.00 MHz #Sweep 1 s
Occup	ied Bandwidt	h	Total Power	-8.27 dBm	
	17	.422 MHz			
Transm	it Freq Error	-231.52 kHz	% of OBW Power	99.00 %	
x dB Ba	indwidth	23.17 MHz	x dB	-26.00 dB	
MEG				STATUS	

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



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



Center F	reg 9.400000000	GHz	Select corr source on a Center Freq: 9,40000000	308 AUTO	04:00:00 PM Mar 85, 2021 Radio Std: Norie
	N	FE #F Gaint Low	Atten: 10 dB	Avg/Hold: 10/10	Radio Device: BTS
10 dB/div	Ref -10.00 dBi	n .	0 0 ¹	2. 77	
-30.0					
-30.0					
40.0					
-50.0					
100					
.70.0					
300					
-100					
Center 9	40000 GHz				Span 25.00 MHz
Res BW	240 kHz		VBW 2.4 MHz	2	#Sweep 1 s
Occu	pied Bandwidt	h	Total Power	-7.43 dBm	
10703000	15	5.504 MHz			
Transi	mit Freq Error	-170.24 kHz	% of OBW Power	99.00 %	
x dB B	landwidth	20.27 MHz	x dB	-26.00 dB	
100				(manual)	
Month'				ALM DOB	

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



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



Center Fre	a 9.40000000	GHz	Sales and sound on T Center Freq: 9,4000000	ALISH AUTO	64-09-15 7H Mar 15, 2521 Radio Std: None
	N	FE #E GaintLow	#Atten: 10 dB	Avg Hold: 10/10	Radio Device: BTS
10 dB/div	Ref -10.00 dBi	n	16 M.	19 75	SW2 0 2
Log					
20.0				-	
42.0					
40.0					
0.0					
70.0					
-006					
-90.0				+	
100					
Center 9.40 Res BW 24	0000 GHz 40 kHz		VBW 2.4 MH	z	Span 25.00 MHz #Sweep 1 s
Occup	ied Bandwidt	h	Total Power	-6.72 dBm	
	15	5.703 MHz			
Transm	it Freq Error	-557.33 kHz	% of OBW Powe	er 99.00 %	
x dB Ba	ndwidth	21.43 MHz	x dB	-26.00 dB	
MEG.				STATUS	

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



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



Center Fr	reg 9.400000000	GHz	Sales axt; source of r au Center Freq: 9,4000000	JIRI AUTO D GHa	04:11:05 PM Mar 85, 2521 Radio Std: None
	N	FE #E Gaint:Low	SAtten: 10 dB	Avg(Hold: 10/10	Radio Device: BTS
10 dB/div	Ref 0.00 dBm		A A.	1 22 24	
Log					
-20.0					
00.0			2 3		
40.0					
-50.0					
-80:0					
-70.0					
-80.0					
Center 9.4 Res BW 2	40000 GHz 240 kHz	111	VBW 2.4 MHz		Span 25.00 MHz #Sweep 1 s
Occup	pied Bandwidt	h	Total Power	-5.09 dBm	
	14	.982 MHz			
Transn	nit Freq Error	-560.33 kHz	% of OBW Power	99.00 %	
x dB B	andwidth	20.36 MHz	x dB	-26.00 dB	
MBG				STATUS.	

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



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



Center Frei	a 9.400000000	GHz	Suites and Source on J	LIGH AUTO	04:12:20 PM Mar 85, 2021 Radio Std: None
	N	FE #E Gaint Low	Atten: 10 dB	Avg/Hold: 10/10	Radio Device: BTS
10 dB/div	Ref 0.00 dBm		a ar		
Log			l i i		
-20.0					
-30.0					
40.0					
50.0					
-86.0					
-30.0					
90.0					
Center 9.40 Res BW 75	0000 GHz kHz	<u>.</u>	VBW 750 kHz	z	Span 8.000 MHz #Sweep 1 s
Occupie	ed Bandwidt	h	Total Power	-3.56 dBm	
1740/2010/04	4.	1797 MHz			
Transmit	t Freq Error	-53.165 kHz	% of OBW Powe	r 99.00 %	
x dB Bar	ndwidth	5.572 MHz	x dB	-26.00 dB	
wiid-				STATUS	

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



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



Center Fre	a 9.40000000	GHz	Spies and source or T	LISH ALTO	04:12:22 PM Mar 85, 2521 Radio Std: Norve
	N	FE #IF GaintLow	Atten: 10 dB	Avg Hold: 10/10	Radio Device: BTS
10 dB/div	Ref 0.00 dBm				
Log					
20.0					
30.0					
40.0					
80.0					
-9610					
300					
90.0					
Center 9.4 Res BW 4	00000 GHz 7 kHz		VBW 470 kHz		Span 5.000 MHz #Sweep 1 s
Occup	ied Bandwidt	h	Total Power	-4.38 dBm	
	3.	1208 MHz			
Transm	it Freq Error	-40.222 kHz	% of OBW Powe	r 99.00 %	
x dB Ba	ndwidth	4.195 MHz	x dB	-26.00 dB	
vsa.				STATUS	

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



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



Center Fre	9.400000000	GHz	Silestant Source of A	JISH AUTO	04:14:29 7M Mar 85, 2021 Radio Std: Nore
		FE #IF Gaint Low	#Atten: 10 dB	Avg/Hold: 10/10	Radio Device: BTS
10 dB/div	Ref 0.00 dBm		A A.	1	
Log					
20.0					
-00.0					
40.0					
40.0	2				
-80:0					-
70.0					-
-80.0					
-90.0					
Center 9.40 Res BW 33	00000 GHz 3 kHz	10	VBW 330 kHz		Span 3.500 MHz #Sweep 1 s
Occupi	ied Bandwidt	h	Total Power	-4.13 dBm	
1.1018-07.29	2.	1402 MHz			
Transmi	it Freq Error	-26.807 kHz	% of OBW Power	99.00 %	
x dB Ba	ndwidth	2.879 MHz	x dB	-26.00 dB	
Mara				BTAT/08	

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



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



Center Freq 9.4000000	00 GHz	Selies exit source of 1 /	LISH ACTO	04:13:51 PH Mar 85, 2021 Radio Std: Nore
	NFE #E GaintLow	Atten: 10 dB	Radio Device: BTS	
10 dB/div Ref 0.00 dB	m			
Log				
30.0				
30.0				
40.0				
40.0				
40.0				
100				
90.0				
Center 9 400000 CHr	II			Soon 2 000 MHz
Res BW 27 kHz		VBW 270 kHz		#Sweep 1 s
Occupied Bandwi	dth	Total Power	-3.77 dBm	
	.6767 MHz			
Transmit Freq Error	-20.401 kHz	% of OBW Powe	r 99.00 %	
x dB Bandwidth	2.232 MHz	x dB	-26.00 dB	
			107470-00	
Millia			R19100	

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



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



Center Fr	eq 9.400000000	GHz	Siles sxf: source cirr [A Center Freq: 9,40000000	LISH AUTO	04:17:19 FM Mar 15, 2521 Radio Std: None
MFE ##GaintLow			SAtten: 10 dB	Radio Device: BTS	
10 dB/div	Ref 0.00 dBm				
Log					
20.0					
30.0					
40.0					
-50.0					
-80:0					-
-70.0					
-80.0					
-90.0					
Center 9.4 Res BW 1	100000 GHz 18 kHz	.07	VBW 180 kHz		Span 2.000 MHz ≢Sweep 1 s
Occup	pied Bandwidt	h	Total Power	-3.36 dBm	
	1.	2083 MHz			
Transn	nit Freq Error	-15.687 kHz	% of OBW Powe	r 99.00 %	
x dB B	andwidth	1.602 MHz	x dB	-26.00 dB	
MBG				STATUS	

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



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


Reysayld Specta	IF 310 DC		select exit source of F Act	SH AUTO	04:22:13 PM Mar 85, 2021
Span 30.00	00 MHz N	FE #F GaintLow	Center Freq: 9.370000000 Trig: Free Run #Atten: 10 dB	GHz Avg[Hold: 10/10	Radio Std: None Radio Device: BTS
10 dB/div	Ref 0.00 dBm		A AP P		
Log					
-20.0	_				
-30.0				~	
40.0	-				
-50.0					
70.0					
-80.0					
000	-				
Center 9.37 Res BW 27	000 GHz 0 kHz	10	VBW 2.7 MHz		Span 30.00 MHz #Sweep 1 s
Occupi	ed Bandwidt	h	Total Power	-11.6 dBm	
10100055	17	.149 MHz			
Transmi	t Freq Error	-455.89 kHz	% of OBW Power	99.00 %	
x dB Bai	ndwidth	23.77 MHz	x dB	-26.00 dB	
MBG				STATUS	

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



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



Center Freq 9.37000000) GHz	Silicit coll source on the Center Freq: 9.37000000	JISH AUTO	04:10:52 7H Mar 85, 2021 Radio Std: Nore
	#E #E Gain:Low	Atten: 10 dB	Avg/Hold: 10/10	Radio Device: BTS
10 dB/div Ref 0.00 dBm				
Log				
30.0				
00.0				
40.0				
40.0				
40.0				
70.0				
-80.0				
90.0				
Center 9.370000 GHz Res BW 18 kHz	- 190 - A	VBW 180 kHz		Span 2.000 MHz #Sweep 1 s
Occupied Bandwidt	th	Total Power	-3.34 dBm	
1.	1222 MHz			
Transmit Freq Error	-14.202 kHz	% of OBW Power	99.00 %	
x dB Bandwidth	1.497 MHz	x dB	-26.00 dB	
MEG			STATUS	

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



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



Keysagit Spent	New Andrew Dotupied W		SERVER EXIT ROUNCE OFF [ISH ALTIO	04:20:54 PM Nat 85, 2521
Span 35.0	00 MHz	FE #E GaintLow	Trig: Free Run #Atten: 10 dB	Avg[Hold: 10/10	Radio Oevice: 875
10 dB/div	Ref 0.00 dBm		05 05		100
-10.0					
-20.0					-
-00.0					
40.0					
40.0					- m
20.0					
-80.0					
90.0					-
Center 9.43 Res BW 33	3000 GHz 30 kHz	10.	VBW 3 MHz		Span 35.00 MHz #Sweep 1 s
Occup	ied Bandwidt	h	Total Power	-10.4 dBm	
	21	.624 MHz			
Transm	it Freq Error	-544.58 kHz	% of OBW Power	99.00 %	
x dB Ba	indwidth	28.67 MHz	x dB	-26.00 dB	
uno.				Innel	
With A				11/11/10	

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



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



Center Fred	1 Andrew Douplet FA	GH2	Sense sort source one [Center Fred: 9.4300000	ALISH AUTO	04:19:30 FMMar 85, 2021 Radio Std; Norve
Center Prec	1 5.450000000 N	FE #E GaintLow	Atten: 10 dB	Avg Hold: 10/10	Radio Device: BTS
10 dB(div	Ref 0.00 dBm				
Log	Rei 0.00 dum	1		1 1	1 11
200			-		
30.0					
40.0					
-50.0					
-60.0	+ +				
70.0	-				
-30.0	-				
-90.0				1 1	
Center 9.430 Res BW 18	0000 GHz kHz		VBW 180 kH	z	Span 2.000 MHz ≢Sweep 1 s
Occupie	ed Bandwidt	h	Total Power	-3.48 dBm	
1010200000	1.:	2946 MHz			
Transmit	Freq Error	109.11 kHz	% of OBW Powe	өг 99.00 %	
x dB Ban	dwidth	1.741 MHz	x dB	-26.00 dB	
MIG				STATUS	

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

Instrument	Manufacturer	Туре 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

This test was carried out in RF Laboratory 2.

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 \pm 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	Туре 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 + $10\log(P)$) = -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

Keysight Spectrum Analyzer - Swept SA	11 11.000493004		lail#
Marker 1 9 40000000000 0	SERSE EXT 30	Avg Typ	e: RMS TRACE 1 2 3 4 1
MERCENT 1 S.40000000000000	PNO: Fast Trig: Fre	ee Rum	DET & N N N
	Il-GaincLow Section: G	100	Mk-1 9 400 000 CH
Ref Offset 53.14 dB			-2.78 dBi
Log			1 1 1
3.14		▲ ¹	
		X I	
6.05	10	///	
.95.9			
1.000	A.	N	
2.9			
	N	N	
35.9		- N-	
45.9			
46.9			
26.9			
76.9			
Center 9 4000 GHz		*	Spap 779.0 Mb
#Res BW 1.0 MHz	#VBW 3.0 MH	fz*	#Sweep 20.00 s (1001 pt
wsg.		STATUS	

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



Marker 1	9.400000000	DOO GHZ	PNO: Fast -+	Siles cor so. . Trig: Free Atten: 6 c	Run 18	Avg Type: Ri	MS	09:52:5	2 AM Mar 17, 2001 ALCE 1 2 3 4 5 6 DITING DIVISION NON N
t0 dB/div	Ref Offset 53.14 Ref 20.14 dBr	dB n	1002.05 G			() 		Mkr1 9.4	00 0 GHz 8.13 dBm
10.1		-	-		<u>•</u> '	-			-
0.140		-							
0.05		-			R				
+13.9				1	N,				
79.9			n . N	min	W	Mr.			
499			hur			and	20180		
.69	_	-	-		_			-	
49.9					·			·	
Center 9. #Res BW	4000 GHz		#VE	W 3.0 MHz			#Swi	Span	548.0 MHz
MIG					•	STATUS			

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



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









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



Marker 1 9.4294	50500000 GHz		siles avi so. Trig: Free	Ran Diff	Avg Type: RI	ws	10:09:40 AM Har 17, 2021 TRACE 1 2 3 4 5 1 TIRE WWWWWW
Ref Offi 10 dB/div Ref 30	set 53.14 dB 0.14 dBm	IFGainLow	Atten: 6	48	0	Mk	19.429 5 GHz 12.83 dBm
28.1			0	[.—			_
10.1	-	-		Å.			
3.1.40		-		1			
9.00				1			-
19.9		-	. 11	1	-		-
29.9		h /	W	Nu	Ma		
199		100			11 anna		
89.9							
Center 9 4300 GH	47						Span 549.5 MH
Res BW 1.0 MH	z	#VB	W 3.0 MH	z*	STATUS	#Sweep	20.00 s (1001 pts





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









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









Figure 65 - 9370 MHz, FM, 750 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 10log₁₀ (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	Туре 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 10log₁₀ (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		ти
Tilt Antenna Mast TAM 4.0-P	Maturo Gmbh	TAM 4.0-P	5613		ти
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 Temperature26.5 °CRelative Humidity26.8 %



2.6.6 Test Results

DC Powered - Transmit

Test Frequency	Radar Pulse	Peak	Power	Average Power	
(MHZ)	Description	(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	Туре 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




The World's Gall Seven

Cyclone antennas

All figures quoted at 9.4GHz centre frequency.

Antenna Type: Slotted Waveguide.

Antenna siae and model number	Gais dBi (directivity)	Gain dB"	Azimuth 3d8 beam wiath	Elevation 3dB beam width	Azimuth squint angle	Azimuth sidelobes within ±10" (IMD Tmit - 2300)	Adimuth sidektbes outside ±30* (BAC) (bits) 30(#)	Back lobe level	Antenna build standard
3ft E70628	25.7dB	24.13d8	2.83*	28.4*	5.2*	-26dB	-25.9dB	-39.8dB	1011615-3
4ft E70629	27.7dB	25.60dB	1.99*	26.8*	5.0*	-26.5dB	-33.2dB	-41.5dB	1011614-3
6ft £70630	29.5dB	27.42d8	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"