FCC and ISED Test Report

Jotron AS
EPIRB, Model: Tron 60AIS

In accordance with FCC 47 CFR Part 80, FCC 47 CFR Part 2, ISED RSS-287 and ISED RSS-GEN (121.5 MHz Homer)

Add value.
Inspire trust.

Prepared for: Jotron AS
Ringdalskogen 8,
3270 Larvik,
Norway

FCC ID: VRV60AIS IC: 2131A-60AIS

COMMERCIAL-IN-CONFIDENCE

Document 75950996-05 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matthew Russell	RF Team Leader	Authorised Signatory	12 January 2022

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 and ISED RSS-287 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	12 January 2022	
Testing	Graeme Lawler	12 January 2022	

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, ISED RSS-287: Issue 2 (2014-03) and ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02) 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	12 January 2022

Table 1

1.2 Introduction

Applicant	Jotron AS
Manufacturer	Jotron AS
Model Number(s)	Tron 60AIS
Serial Number(s)	00016 and 00008
Hardware Version(s)	Rev: 2021
Software Version(s)	Rev 1.2
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 80: 2019 FCC 47 CFR Part 2: 2019 ISED RSS-287: Issue 2 (2014-03) ISED RSS-GEN: Issue 5 (2018-04) + A2 (2021-02)
Order Number Date	P42647 15-January-2021
Date of Receipt of EUT	23-February-2021
Start of Test	30-April-2021
Finish of Test	09-June-2021
Name of Engineer(s)	Neil Rousell and Graeme Lawler
Related Document(s)	ANSI C63.26: 2015 RTCM 11000.4 with Amd1 (July 17, 2016)

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 2, ISED RSS-287 and ISED RSS-GEN is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	Part 80	Part 2	RSS-287	RSS-GEN			
Configuration and Mode: Battery Powered - 121.5 MHz Homer							
2.1	80.205	2.1049	-	6.7	Bandwidths	Pass	
2.2	80.209	2.1055	7.4.2	6.11	Transmitter Frequency Tolerances	Pass	
2.3	80.211	2.1051	7.9	6.13	Spurious Emissions at Antenna Terminals	Pass	
2.4	80.211	2.1053	7.9	6.13	Radiated Spurious Emissions	Pass	
2.5	80.1061	2.1047	7.4.1	-	Modulation Characteristics	Pass	
2.6	80.215	2.1046	7.4.3	6.12.	Transmitter Power	Pass	
2.7	80.1061	-	7.4.5	-	Spectrum Characteristics	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)*	COSPAS-SARSAT 406 MHz Satellite Emergency Position-Indication Radio Beacon
Manufacturer:	Jotron AS
Model:	Tron 60AIS
Part Number:	103161
Hardware Version:	Rev: 2021
Software Version:	Rev 1.2
FCC ID of the product under test – see guidance here	VRV60AIS
IC ID of the product under test – see guidance here	2131A-60AIS

Intentional Radiators

Technology	EPIRB					
Frequency Range (MHz to MHz)	406.031 MHz, 161.975 - 162.025 MHz, 121.5 MHz					
Conducted Declared Output Power (dBm)	35.5 dBm (406 MHz) 31.4 dBm (162 MHz) 19.2 dBm (121.5 MHz)					
Antenna Gain (dBi)	-					
Supported Bandwidth(s) (MHz) (e.g 1 MHz, 20 MHz, 40 MHz)	25 KHz (406 MHz) 25 KHz (162 MHz) 25 KHz (121.5 MHz)					
Modulation Scheme(s) (e.g GFSK, QPSK etc)	Phase modulation 1.1 rad (406 MHz) GMSK/FM (162 MHz) AM Homing (121.5 MHz)					
ITU Emission Designator (see guidance here) (not mandatory for Part 15 devices)	16K0G1D (406.031 MHz) 16K0GXW (162 MHz) 3K20A3X (121.5 MHz)					
Bottom Frequency (MHz)	121.5 MHz					
Middle Frequency (MHz)	-					
Top Frequency (MHz)	406.031 MHz					

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	406.031 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	121.5 MHz
Class A Digital Device (Use in commercial, industrial or business environment) ☒ Class B Digital Device (Use in residential environment only) ☐	

AC Power Source

AC supply frequency:	-	Hz

Voltage	-	V
Max current:	-	A
Single Phase ☐ Three Phase ☐		

DC Power Source

Nominal voltage:	-	V
Extreme upper voltage:	-	V
Extreme lower voltage:	-	V
Max current:	-	A

Battery Power Source

Voltage:	12	V
End-point voltage:	10	V *(Point at which the battery will terminate)*
Alkaline ☐ Leclanche ☐ Lithium ☒ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)*		
Other ☐ Please detail:		

Charging

Can the EUT transmit whilst being charged	Yes ☐ No ☒

Temperature

Minimum temperature:	-20	°C
Maximum temperature:	+55	°C

Cable Loss

Adapter Cable Loss (Conducted sample)	-	dB

Antenna Characteristics

Antenna connector ☐			State impedance		Ohm
Temporary antenna connector ☐			State impedance		Ohm
Integral antenna ☒	Type:		Gain		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 ☐

Ancillaries (if applicable)

Manufacturer:		Part Number:	

Model:		Country of Origin:	

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

Name: Frank Løke
Position held: Certification Manager Jotron AS
Date: 2021-11-18

1.5 Product Information

1.5.1 Technical Description

The Equipment under test (EUT) was a Jotron AS Tron 60AIS EPIRB with Float Free capsule

The primary function of the EUT is an Emergency Position Indication Radio Beacon (EPIRB) within capsule.

Additionally, the EUT has functionality for Automatic Identification System (AIS), GNSS Rx (GPS/Galileo/Glonass), Transmitting 406 MHz, 121.5 MHz Homer and RLS.

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: Tron 60 AIS, Serial Number:00008 and 00016			
0	As supplied by the customer	Not Applicable	Not Applicable
1	GNSS LED changed to blink before or after 406MHz to reduce noise on modulation	Manufacturer at TUV SUD site	31-March 2021
2	Addition of a LDO (Low Dropout Regulator) to the TCXO, to reduce the noise coming from the power supply. A resistor of 0 ohm (added to the design for current measurement) was replaced by the three-legged regulator.	Manufacturer	27-April 2021
3	SW update to reduce image AIS frequencies. Parameter in the synthesizer was adjusted to reduce the signal level from the clock.	Manufacturer	21-May 2021

Table 3

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: Battery Powered - 121.5 MHz Homer		
Bandwidths	Neil Rousell	UKAS
Transmitter Frequency Tolerances	Neil Rousell	UKAS
Spurious Emissions at Antenna Terminals	Neil Rousell	UKAS
Radiated Spurious Emissions	Graeme Lawler	UKAS
Modulation Characteristics	Neil Rousell	UKAS
Transmitter Power	Neil Rousell	UKAS
Spectrum Characteristics	Neil Rousell	UKAS

Table 4

Office Address:

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

2 Test Details

2.1 Bandwidths

2.1.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.205
FCC 47 CFR Part 2, Clause 2.1049
ISED RSS-GEN, Clause 6.7

2.1.2 Equipment Under Test and Modification State

Tron 60AIS, S/N: 00016 - Modification State 2

2.1.3 Date of Test

04-May-2021

2.1.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.4.3.

The EUT was transmitting at maximum power, with normal modulation as described in FCC CFR 47 Part 2, clause 2.1049. The EUT was connected to a spectrum analyser via a cable and attenuator, the RBW of the spectrum analyser was set to at least 1% of the emission bandwidth and a video bandwidth of 3 times RBW, the occupied bandwidth measurement function of the analyser was used and the 99% bandwidth recorded

The plots on the following pages show the resultant display from the Spectrum Analyser.

2.1.5 Environmental Conditions

Ambient Temperature	24.8 °C
Relative Humidity	31.5 %

2.1.6 Test Results

Battery Powered - 121.5 MHz Homer

Occupied Bandwidth (kHz)
20.6

Table 5 - Occupied Bandwidth Result

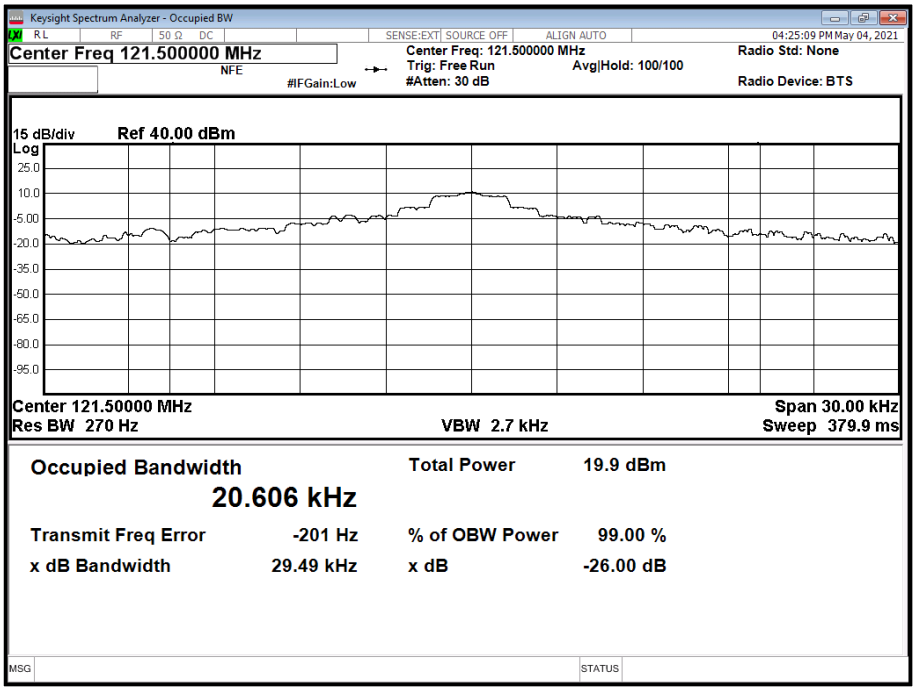

Figure 1 - Occupied Bandwidth

FCC 47 CFR Part 80, Limit Clause 80.205

< 25 kHz

Industry Canada 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
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-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
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	16-Nov-2021
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Nov-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	06-Apr-2022
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	5504	12	14-Apr-2022
Attenuator 2W 10dB DC-10GHz	Telegartner	J01156A0031	5577	-	O/P Mon

Table 6

O/P Mon – Output Monitored using calibrated equipment

2.2 Transmitter Frequency Tolerances

2.2.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.209
FCC 47 CFR Part 2, Clause 2.1055
ISED RSS-287, Clause 7.4.2
ISED RSS-GEN, Clause 6.11

2.2.2 Equipment Under Test and Modification State

Tron 60AIS, S/N: 00016 - Modification State 2

2.2.3 Date of Test

07-May-2021

2.2.4 Test Method

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

The EUT was connected to a spectrum analyser via a cable and attenuator. The external frequency reference of the spectrum analyser was locked to a 10 MHz rubidium frequency standard reference. The 99% OBW function of the spectrum analyser was used to record the carrier frequency error. The temperature was varied from -30.0 °C to +55.0 ° in 10.0 ° steps. At 20.0 °C the voltage was also reduced to the manufacturer declared battery endpoint voltage and the carrier frequency measured.

2.2.5 Environmental Conditions

Ambient Temperature	24.9 °C
Relative Humidity	19.6 %

2.2.7 Test Results

Battery Powered - 121.5 MHz Homer

Voltage	Frequency Error (ppm)
10.0 V DC	-0.86
12.0 V DC	-2.80

Table 7 - Frequency Stability Under Voltage Variations

Temperature	Frequency Error (ppm)
+55.0 °C	-4.20
+50.0 °C	-1.74
+40.0 °C	-2.56
+30.0 °C	-1.08
+20.0 °C	-2.80
+10.0 °C	-2.09
0 °C	-0.53
-10.0 °C	-1.06
-20.0 °C	-2.87
-30.0 °C	0.44

Table 8 - Frequency Stability Under Temperature Variations

FCC 47 CFR Part 80, Limit Clause 80.209

± 50 ppm.

ISED RSS-287, Limit Clause 7.4.2

The carrier frequency shall not depart by more than 0.005% (±50 ppm) from that measured at 20˚C and the rated supply voltage. If the 121.5 MHz and 243 MHz frequencies are derived from the same oscillator circuitry, it is not necessary to repeat the frequency stability test for the other frequency.

2.2.8 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 3.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-2021
Hygrometer	Rotronic	I-1000	2891	12	16-Oct-2021
Multimeter	Fluke	79 Series II	3057	12	21-Aug-2021
Thermocouple Data Logger	Pico Technology Ltd	TC-08	3783	12	22-Jun-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	17-May-2021
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	16-Nov-2021
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Nov-2021
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
Thermo-Hygro-Barometer	PCE Instruments	OCE-THB-40	5470	12	31-Mar-2022
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	5504	12	14-Apr-2022
Attenuator 2W 10dB DC-10GHz	Telegartner	J01156A0031	5577	-	O/P Mon
Environmental Chamber	ACS	DY110TC	5589	-	O/P Mon

Table 9

O/P Mon – Output Monitored using calibrated equipment

2.3 Spurious Emissions at Antenna Terminals

2.3.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.211
FCC 47 CFR Part 2, Clause 2.1051
ISED RSS-287, Clause 7.9
ISED RSS-GEN, Clause 6.13.

2.3.2 Equipment Under Test and Modification State

Tron 60AIS, S/N: 00016 - Modification State 2

2.3.3 Date of Test

04-May-2021

2.3.4 Test Method

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

For emissions where the frequency is removed less than 250% of the authorized bandwidth measurements were performed as follows:

The EUT was connected to a spectrum analyser via a cable and attenuator. The path loss between the EUT and analyser was calibrated using a network analyser and entered in to the spectrum analyser as a reference level offset. The RBW was configured to 300 Hz using an average detector with max hold.

For emissions where the frequency is removed more than 250% of the authorized bandwidth measurements were performed as follows:

A network analyser was used to measure the path loss and the worst case was entered as a reference level offset into the spectrum analyser. The EUT was connected to a spectrum analyser via a cable and attenuator. The analyser was configured with an RBW of 100 kHz below 1 GHz and 1 MHz for frequencies greater than 1 GHz with the trace set to max hold using a peak detector.

2.3.5 Environmental Conditions

Ambient Temperature	25.0 °C
Relative Humidity	31.5 %

2.3.6 Test Results

Battery Powered - 121.5 MHz Homer

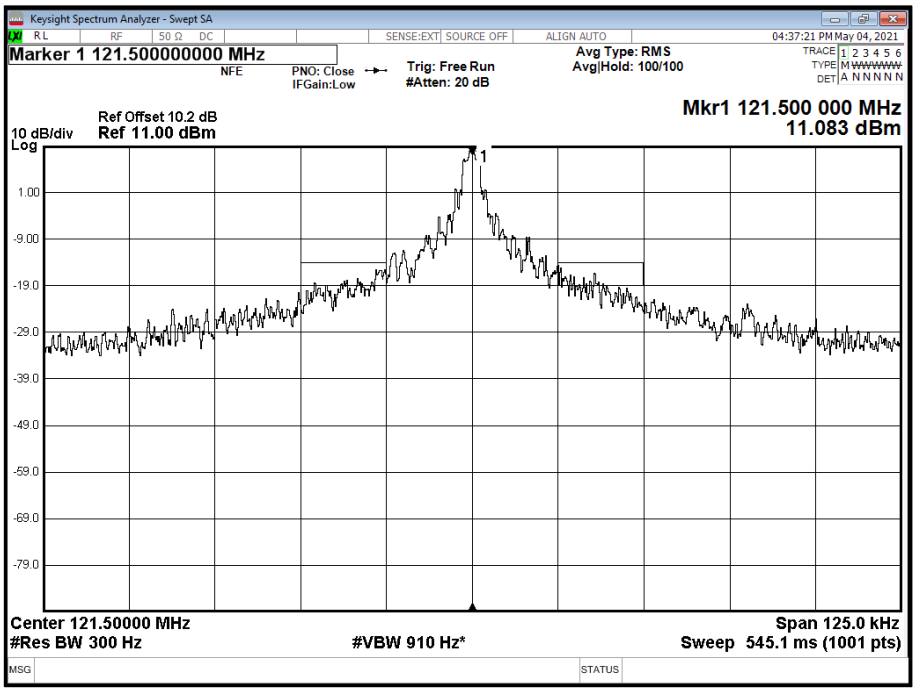

Figure 2 - Transmitter Spectrum Mask

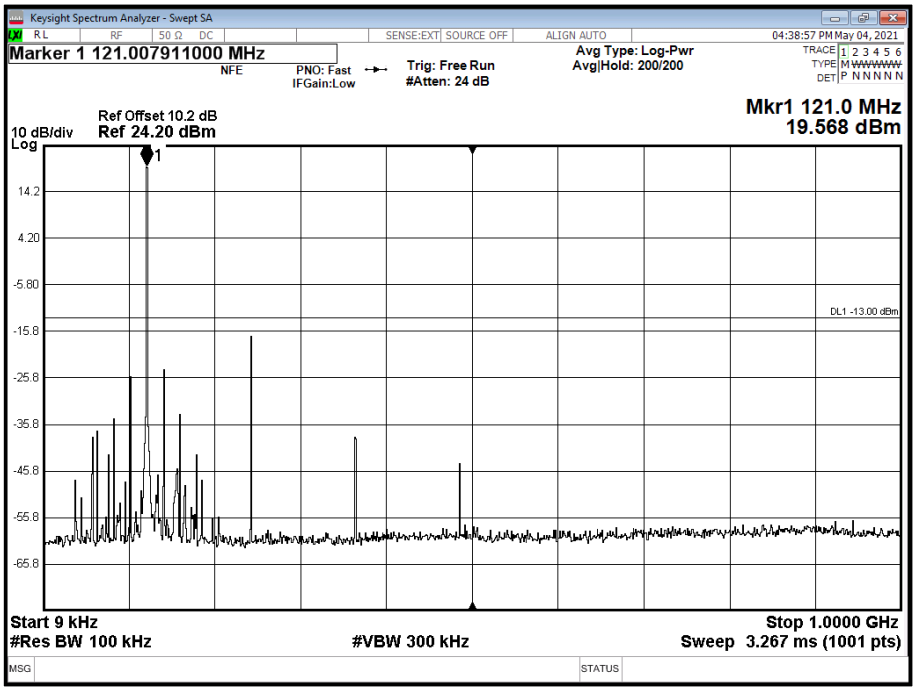

Figure 3 - 9 kHz to 1 GHz

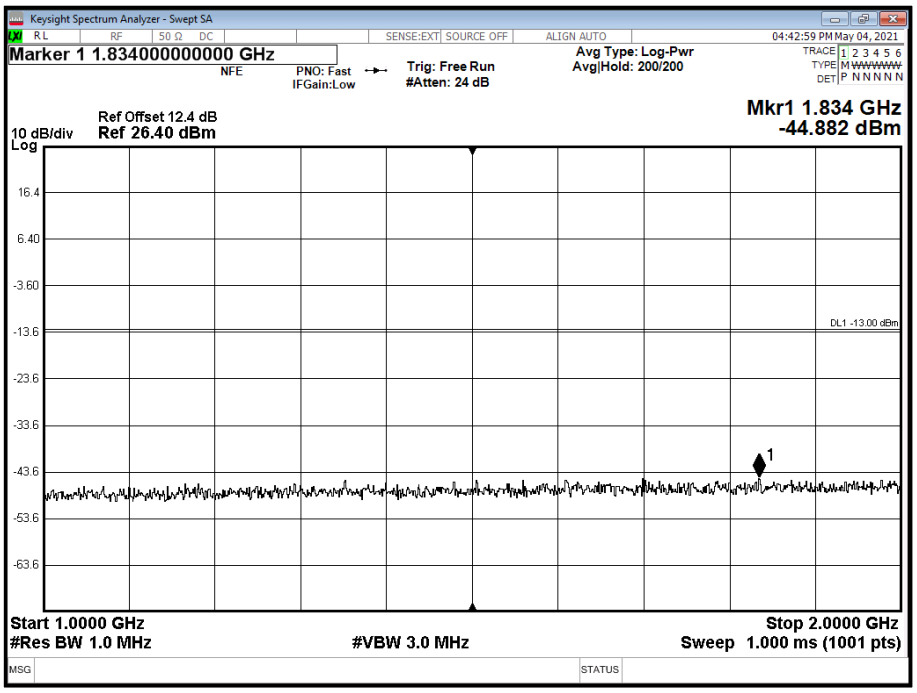

Figure 4 - 1 GHz to 2 GHz

FCC 47 CFR Part 80, Limit Clause 80.211(e)

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: At least 30 dB

ISED RSS-287, Limit Clause 7.4.4

The average power of unwanted emissions in a 300 Hz resolution bandwidth shall be attenuated below the level of the average transmitter power P (dBW) by:

(a) at least 25 dB on any frequency removed from the centre of the authorized bandwidth by more than 50%, up to and including 100% of the authorized bandwidth; and

(b) at least 30 dB on any frequency removed from the centre of the authorized bandwidth by more than 100%

where the authorized bandwidth is set at 25 kHz with the transmit frequency at the centre of the bandwidth.

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
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-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
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	16-Nov-2021
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Nov-2021
Cable (18 GHz)	Rosenberger	LU7-071-1000	5099	12	12-Oct-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	06-Apr-2022
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	5504	12	14-Apr-2022
300 MHz High Pass Filter	Mini-Circuits	NHP-300	5532	12	25-Mar-2022
Attenuator 2W 10dB DC-10GHz	Telegartner	J01156A0031	5577	-	O/P Mon

Table 10

O/P Mon – Output Monitored using calibrated equipment

2.4 Radiated Spurious Emissions

2.4.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.211
FCC 47 CFR Part 2, Clause 2.1053
ISED RSS-287, Clause 7.9
ISED RSS-GEN, Clause 6.13

2.4.2 Equipment Under Test and Modification State

Tron 60AIS, S/N: 00008 - Modification State 3

2.4.3 Date of Test

09-June-2021

2.4.4 Test Method

Testing was performed in accordance with ANSI C63.26 clause 5.5.4.

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

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

Using the information from the preliminary profiling of the EUT, the list of emissions was then confirmed or updated under Alternative Open Site conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

The EUT was set to transmit on maximum power with the 121.5 MHz homing channel operating.

2.4.5 Environmental Conditions

Ambient Temperature	21.0 °C
Relative Humidity	59.3 %

2.4.6 Test Results

Battery Powered - 121.5 MHz Homer

Frequency (MHz)	Level (dBm)
99.443	-16.00
110.672	-21.82
124.950	-15.50
170.215	-16.04

Table 11 - Emissions Results

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

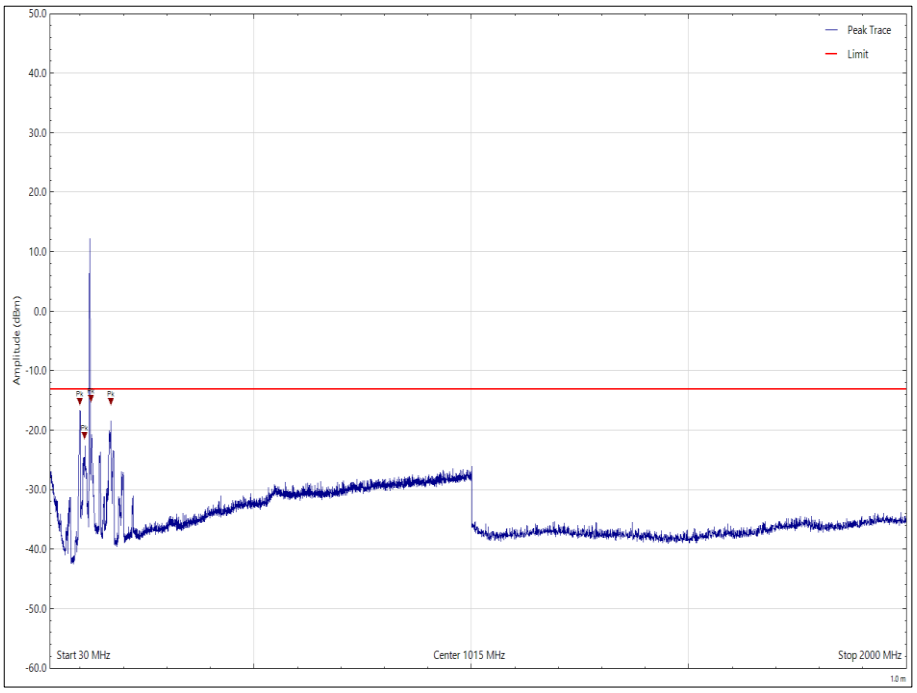

Figure 5 - 30 MHz to 2 GHz - Vertical Polarisation

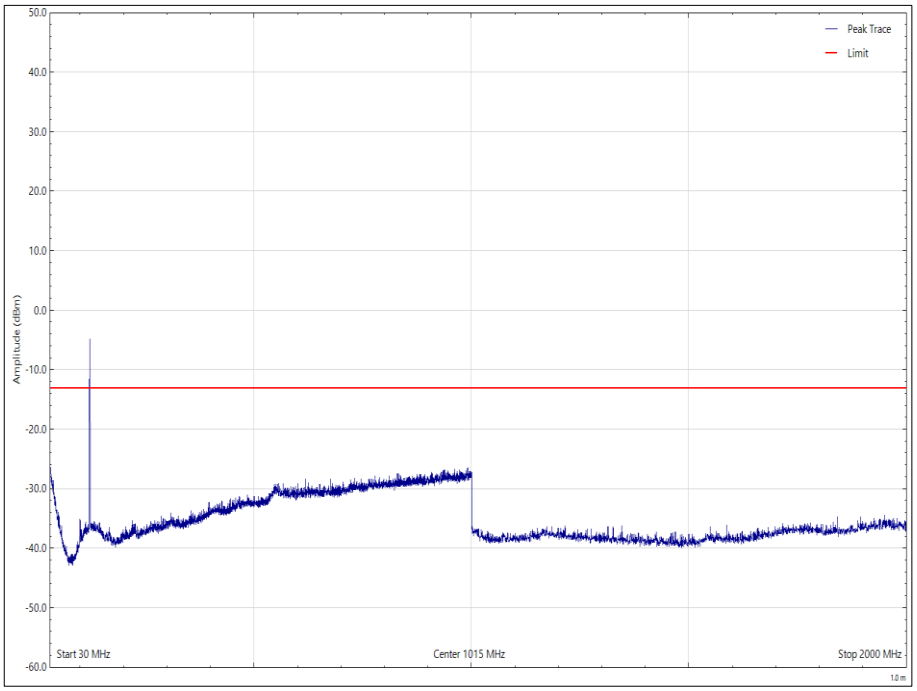

Figure 6 - 30 MHz to 2 GHz - Horizontal Polarisation

FCC 47 CFR Part 80, Limit Clause 80.211(e)

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: At least 30 dB

ISED RSS-287, Limit Clause 7.4.4

The average power of unwanted emissions in a 300 Hz resolution bandwidth shall be attenuated below the level of the average transmitter power P (dBW) by:

(a) at least 25 dB on any frequency removed from the centre of the authorized bandwidth by more than 50%, up to and including 100% of the authorized bandwidth; and

(b) at least 30 dB on any frequency removed from the centre of the authorized bandwidth by more than 100%

where the authorized bandwidth is set at 25 kHz with the transmit frequency at the centre of the bandwidth.

2.4.7 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 with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	14-Oct-2022
Comb Generator	Schaffner	RSG1000	3034	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	18-Mar-2022
EmX Emissions Software	TUV SUD	V2.1.10	5125	-	Software
3.5 mm 2m Cable	Junkosha	MWX221-02000DMS	5428	12	15-Oct-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5481	12	31-Mar-2022
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
Cable Assembly - 18GHz 8m	Junkosha	MWX221-08000NMSNMS/B	5732	6	05-Aug-2021

Table 12

TU - Traceability Unscheduled

2.5 Modulation Characteristics

2.5.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.1061
FCC 47 CFR Part 2, Clause 2.1047
ISED RSS-287, Clause 7.4.1

2.5.2 Equipment Under Test and Modification State

Tron 60AIS, S/N: 00016 - Modification State 2

2.5.3 Date of Test

11-May-2021

2.5.4 Test Method

This test EUT antenna was connected either directly to the oscilloscope via a cable and attenuator or was connected to the spectrum analyser and then the demodulated output of the spectrum analyser was connected to the oscilloscope.

The markers on the oscilloscope was used to measure the parameters specified in the table below.

2.5.5 Environmental Conditions

Ambient Temperature 23.2 °C
Relative Humidity 40.6 %

2.5.6 Test Results

Battery Powered - 121.5 MHz Homer

Requirement	Result	Unit
	Ambient	
Audio sweep frequency (low)	370	Hz
Audio sweep frequency (high)	1208	Hz
Audio sweep frequency range	838	Hz
Audio sweep frequency direction	High to Low	-
Audio sweep repetition rate	2.47	Hz
Modulation factor	0.91	-
Modulation duty cycle (low)	34.2	%
Modulation duty cycle (mid)	33.9	%
Modulation duty cycle (high)	36.1	%
Continuous transmission (during burst)	Yes	-
Morse letter	N/A	-

Table 13 - Modulation Characteristics

FCC 47 CFR Part 80, Limit Clause 80.1061(b)

The 406.0-406.1 EPIRB must contain as an integral part a “homing” beacon operating only on 121.500 MHz that meets all the requirements described in the RTCM Recommended Standards document described in paragraph (a) of this section. The 121.500 MHz “homing” beacon must have a continuous duty cycle that may be interrupted during the transmission of the 406.0-406.1 MHz signal only.

ISED RSS-287, Limit Clause 7.4.1

Requirement	Limit
The carrier is not interrupted (except for two seconds encompassing the transmission of the 406 MHz pulse plus the additional time required for the Morse “P” transmission).	True
Lower Audio Frequency	> 300 Hz
Upper Audio Frequency	< 1600 Hz
Audio Frequency Range	> 700 Hz
Sweep Repetition Rate	Between 2 Hz and 4 Hz
Modulation Duty Cycle	Between 33% and 55%
Modulation Factor	Between 85% and 100%
Morse Letter P: Dot Length Dash Length Gap Length Modulating Frequency	 115 ms ± 5% 345 ms ± 5% 115 ms ± 5% 1000 Hz ± 50 Hz

Table 14 - Modulation Characteristic Limits

2.5.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-2021
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	29-Jan-2022
Oscilloscope	Agilent Technologies	DSO9104A	4142	12	14-Sep-2021
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	30-Dec-2021
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	17-May-2021
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	16-Nov-2021
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Nov-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	06-Apr-2022
Attenuator 2W 10dB DC-10GHz	Telegartner	J01156A0031	5577	-	O/P Mon

Table 15

O/P Mon – Output Monitored using calibrated equipment

2.6 Transmitter Power

2.6.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.215
FCC 47 CFR Part 2, Clause 2.1046
ISED RSS-287, Clause 7.4.3
ISED RSS-GEN, Clause 6.12

2.6.2 Equipment Under Test and Modification State

Tron 60AIS, S/N: 00016 - Modification State 2

2.6.3 Date of Test

04-May-2021

2.6.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.2.3.3.

2.6.5 Environmental Conditions

Ambient Temperature	24.7 °C
Relative Humidity	32.6 %

2.6.6 Test Results

Battery Powered - 121.5 MHz Homer

121.5 MHz	
Result (dBm)	Result (W)
14.931	0.031

Table 16 - Transmitter Power Results

FCC 47 CFR Part 80, Limit Clause 80.215

>25 mW

ISED-RSS 287, Limit Clause 7.4.3

The average output power of EPIRBs and PLBs shall not be less than 50 mW when the transmitter is used as a primary beacon and not less than 25 mW when used as a homing transmitter. The output power of MSLDs shall be less than 25 mW.

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
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-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
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	16-Nov-2021
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Nov-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	06-Apr-2022
Attenuator 5W 30dB DC-18GHz	Aaren	AT40A-4041-D18-30	5504	12	14-Apr-2022
Attenuator 2W 10dB DC-10GHz	Telegartner	J01156A0031	5577	-	O/P Mon

Table 17

O/P Mon – Output Monitored using calibrated equipment

2.7 Spectrum Characteristics

2.7.1 Specification Reference

FCC 47 CFR Part 80, Clause 80.1061
ISED RSS-287, Clause 7.4.5

2.7.2 Equipment Under Test and Modification State

Tron 60AIS, S/N: 00016 - Modification State 2

2.7.3 Date of Test

30-April-2021

2.7.4 Test Method

This test was performed in accordance with RSS-287, clause 6.5

2.7.5 Environmental Conditions

Ambient Temperature	24.7 °C
Relative Humidity	32.6 %

2.7.6 Test Results

Battery Powered - 121.5 MHz Homer

Parameter	Result
Total (Wideband) Power (dBm)	14.931
Power within the resolution bandwidth (dBm)	10.215
Difference (dB)	4.716

Table 18 - Spectrum Characteristics

FCC 47 CFR Part 80, Limit Clause 80.1061

At least 30 percent of the total power emitted during any transmission cycle must be contained within plus or minus 30 Hz of the carrier frequency.

Industry Canada RSS-287 Limit Clause 7.4.5

The total power in the resolution bandwidth shall not drop by more than 5 dB below the transmitter mean output power that is measured by a wideband meter, indicating that at least 30% of the power resides within the band fc ±30 Hz (at 121.5 MHz) and within the band fc ±60 Hz (at 243 MHz).

2.7.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	17-May-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
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	16-Nov-2021
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	06-Nov-2021
Thermo-Hygro-Barometer	PCE Instruments	PCE-THB-40	5475	12	06-Apr-2022
Attenuator 2W 10dB DC-10GHz	Telegartner	J01156A0031	5577	-	O/P Mon

Table 19

O/P Mon – Output Monitored using calibrated equipment

3 Photographs

3.1 Test Setup Photographs

Figure 7 - Test Setup - 30 MHz to 1 GHz

Figure 8 - Test Setup - 1 GHz to 2 GHz

4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Bandwidths	± 58.05 Hz
Transmitter Frequency Tolerances	± 11 Hz
Spurious Emissions at Antenna Terminals	± 3.45 dB
Radiated Spurious Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 18 GHz: ± 6.3 dB
Modulation Characteristics	Minimum Audio Frequency: ± 22.4 Hz Maximum Audio Frequency: ± 121.56 Hz Audio Frequency Range: ± 123.6 Hz Sweep Repetition Rate: ± 5 % Modulation Factor: ± 5% Modulation Duty Cycle: ± 5% 30% Occupied Bandwidth: ± 5%
Transmitter Power	± 3.2 dB
Spectrum Characteristics	± 1.8 dB

Table 20

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.