

# FCC and ISED Test Report

Jotron AS  
Tron SA20 PLB

In accordance with FCC 47 CFR Part 2, FCC 47  
CFR Part 95, ISED RSS-287, ISED RSS-GEN and  
RTCM 11010.4  
(121.5 MHz Homer Frequency)

Prepared for: Jotron AS  
Ringdalskogen 8  
3270 Larvik  
Norway



Add value.  
Inspire trust.

FCC ID: VRVTRONSA20

IC: 2131A-TRONSA20

## COMMERCIAL-IN-CONFIDENCE

Document 75956621-03 Issue 01

### SIGNATURE

| NAME            | JOB TITLE           | RESPONSIBLE FOR      | ISSUE DATE        |
|-----------------|---------------------|----------------------|-------------------|
| Matthew Russell | Chief Engineer (RF) | Authorised Signatory | 27 September 2023 |

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

### ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 2, FCC 47 CFR Part 95, ISED RSS-287, ISED RSS-GEN and RTCM 11010.4. The sample tested was found to comply with the requirements defined in the applied rules.

| RESPONSIBLE FOR | NAME         | DATE              | SIGNATURE |
|-----------------|--------------|-------------------|-----------|
| Testing         | Neil Rousell | 27 September 2023 |           |
| Testing         | Paul Adams   | 27 September 2023 |           |
| Testing         | Ahmad Javid  | 27 September 2023 |           |

FCC Accreditation  
90987 Octagon House, Fareham Test Laboratory

ISED Accreditation  
12669A Octagon House, Fareham Test Laboratory

### EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 2: 2021, FCC 47 CFR Part 95: 2021, ISED RSS-287: Issue 2 (03-2014) + A1 (06-2021), ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) + A2 (02-2021) and RTCM 11010.4: (06-2022) 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           | 27 September 2023 |

**Table 1**

## 1.2 Introduction

|                               |                                                                                                                                                                                                      |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Applicant                     | Jotron AS                                                                                                                                                                                            |
| Manufacturer                  | Jotron AS                                                                                                                                                                                            |
| Model Number(s)               | Tron SA20 PLB                                                                                                                                                                                        |
| Serial Number(s)              | 151 and 107                                                                                                                                                                                          |
| Hardware Version(s)           | 2137                                                                                                                                                                                                 |
| Software Version(s)           | 1.3                                                                                                                                                                                                  |
| Number of Samples Tested      | 2                                                                                                                                                                                                    |
| Test Specification/Issue/Date | FCC 47 CFR Part 2: 2021<br>FCC 47 CFR Part 95: 2021<br>ISED RSS-287: Issue 2 (03-2014) +A1 (06-2021)<br>ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) +<br>A2 (2022-05).<br>RTCM 11010.4: (06-2022) |
| Order Number                  | P55347                                                                                                                                                                                               |
| Date                          | 16-September-2022                                                                                                                                                                                    |
| Date of Receipt of EUT        | 08-December-2022                                                                                                                                                                                     |
| Start of Test                 | 12-January-2023                                                                                                                                                                                      |
| Finish of Test                | 20-June-2023                                                                                                                                                                                         |
| Name of Engineer(s)           | Neil Rousell<br>Paul Adams<br>Ahmad Javid                                                                                                                                                            |
| Related Document(s)           | ANSI C63.26: 2015                                                                                                                                                                                    |



### 1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 2, FCC 47 CFR Part 95, ISSED RSS-287, ISSED RSS-GEN and RTCM 11010.4 is shown below.

| Section                                                   | Specification Clause |           |         |         |              | Test Description                                   | Result | Comments/Base Standard |
|-----------------------------------------------------------|----------------------|-----------|---------|---------|--------------|----------------------------------------------------|--------|------------------------|
|                                                           | Part 2               | Part 95   | RSS-287 | RSS-GEN | RTCM 11010.4 |                                                    |        |                        |
| Configuration and Mode: Battery Powered - 121.5 MHz Homer |                      |           |         |         |              |                                                    |        |                        |
| 2.1                                                       | 2.1055               | Subpart K | 7.4.2   | 6.11    | A.16.1       | Transmitter Frequency and Output Power Stabilities | Pass   |                        |
| 2.2                                                       | 2.1047               | Subpart K | 7.4.1   | -       | A.16.2       | Modulation Characteristics                         | Pass   |                        |
| 2.3                                                       | -                    | Subpart K | 7.4.5   | -       | A.16.2(e)    | Spectrum Characteristics                           | Pass   |                        |
| 2.4                                                       | 2.1046               | Subpart K | 7.4.3   | 6.12    | A.16.3       | Peak Equivalent Isotropic Radiated Power           | Pass   |                        |
| 2.5                                                       | 2.1051               | Subpart K | 7.4.4   | 6.13    | 4.2.4        | Spurious Emissions at Antenna Terminals            | Pass   |                        |
| 2.6                                                       | 2.1049               | -         | -       | 6.7     | -            | Occupied Bandwidth                                 | Pass   |                        |
| 2.7                                                       | 21053                | -         | 7.4.4   | 6.13    | -            | Radiated Spurious Emissions                        | Pass   |                        |

**Table 2**



## 1.4 Application Form

### Equipment Description

|                                                                                                                                                            |                                           |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--|
| Technical Description:<br><i>(Please provide a brief description of the intended use of the equipment including the technologies the product supports)</i> | RLS capable Personal Locator Beacon (PLB) |  |
| Manufacturer:                                                                                                                                              | Jotron AS                                 |  |
| Model:                                                                                                                                                     | Tron SA20 PLB                             |  |
| Part Number:                                                                                                                                               | 103675                                    |  |
| Hardware Version:                                                                                                                                          | 2137                                      |  |
| Software Version:                                                                                                                                          | 1.3                                       |  |
| FCC ID of the product under test- <a href="#">see guidance here</a>                                                                                        | VRVTRONSA20                               |  |
| IC ID of the product under test- <a href="#">see guidance here</a>                                                                                         | 2131A-TRONSA20                            |  |

**Table 3**

### Intentional Radiators

| Technology                                                    | Homer 121 | PLB 406          |
|---------------------------------------------------------------|-----------|------------------|
| Frequency Range (MHz to MHz)                                  | 121.5 MHz | 406.031 MHz      |
| Conducted Declared Output Power(dBm)                          | 20.6      | 36.6             |
| Antenna Gain (dBi)                                            | -         | -                |
| Supported Bandwidth(s) (MHz) (e.g. 1 MHz, 20 MHz, 40 MHz)     | 25 kHz    | 25 kHz           |
| Modulation Scheme(s) (e.g. GFSK, QPSK etc)                    | AM        | Phase modulation |
| ITU Emission Designator ( <a href="#">see guidance here</a> ) | 3K20A3X   | 16K0G1D          |
| (not mandatory for Part 15 devices)                           |           |                  |
| Bottom Frequency (MHz)                                        | -         | -                |
| Middle Frequency (MHz)                                        | 121.5 MHz | 406.031 MHz      |
| Top Frequency (MHz)                                           | -         | -                |

**Table 4**



### Un-intentional Radiators

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

**Table 5**

### AC Power Source

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

**Table 6**

### DC Power Source

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

**Table 7**

### Battery Power Source

|                                                                                                                                                                                                                  |                                                   |                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------|
| Voltage:                                                                                                                                                                                                         | 6.0                                               | V                                                    |
| End-point voltage:                                                                                                                                                                                               | <i>equivalent to discharge of 24 hours of use</i> | <i>V (Point at which the battery will terminate)</i> |
| Alkaline <input type="checkbox"/> Leclanche <input type="checkbox"/> Lithium <input checked="" type="checkbox"/> Nickel Cadmium <input type="checkbox"/> Lead Acid <input type="checkbox"/> *(Vehicle regulated) |                                                   |                                                      |
| Other <input type="checkbox"/> Please detail: I                                                                                                                                                                  |                                                   |                                                      |

**Table 8**

### Charging

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

**Table 9**



### Temperature

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

**Table 10**

### Cable Loss

|                                          |   |    |
|------------------------------------------|---|----|
| Adapter Cable Loss<br>(Conducted sample) | - | dB |
|------------------------------------------|---|----|

**Table 11**

### Antenna Characteristics

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |       |  |                 |    |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--|-----------------|----|-----|
| Antenna connector <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |       |  | State impedance |    | Ohm |
| Temporary antenna connector <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |       |  | State impedance | 50 | Ohm |
| Integral antenna <input checked="" type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Type: |  | Gain            | -5 | dBi |
| External antenna <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Type: |  | Gain            |    | dBi |
| <p>For external antenna only:</p> <p>Standard Antenna Jack <input type="checkbox"/> If yes, describe how user is prohibited from changing antenna (if not professional installed):<br/>Equipment is only ever professionally installed <input type="checkbox"/></p> <p>Non-standard Antenna Jack D</p> <p>All part 15 applications will need to show how the antenna gain was derived either from a manufacturer data sheet or a measurement. Where the gain of the antenna is inherently accounted for as a result of the measurement, such as field strength measurements on a part 15.249 or 15.231 device, so the gain does not necessarily need to be verified. However, enough information regarding the construction of the antenna shall be provided. Such information may be photographs, length of wire antenna etc.</p> |       |  |                 |    |     |

**Table 12**

### Ancillaries (If applicable)

|               |  |                    |  |
|---------------|--|--------------------|--|
| Manufacturer: |  | Part Number:       |  |
| Model:        |  | Country of Origin: |  |

**Table 13**

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

Name: Frank Løke  
Position held: Certification Manager  
Date: 11 April 2023



## 1.5 Product Information

### 1.5.1 Technical Description

The Equipment under test (EUT) was a Jotron AS Tron SA20 PLB.

The primary function of the EUT (Personal Location Beacon (PLB)) is transmitting 406 MHz and additionally, the EUT has functionality for GNSS Rx (GPS/Galileo/GLONASS), 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 SA20 PLB, Serial Number: 151 |                                                 |                        |                          |
| 0                                        | As supplied by the customer                     | Not Applicable         | Not Applicable           |
| Model: Tron SA20 PLB, Serial Number: 107 |                                                 |                        |                          |
| 0                                        | As supplied by the customer                     | Not Applicable         | Not Applicable           |

**Table 14**



## 1.8 Test Location

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

| Test Name                                                 | Name of Engineer(s) | Accreditation |
|-----------------------------------------------------------|---------------------|---------------|
| Configuration and Mode: Battery Powered - 121.5 MHz Homer |                     |               |
| Transmitter Frequency and Output Power Stabilities        | Neil Rousell        | UKAS          |
| Modulation Characteristics                                | Neil Rousell        | UKAS          |
| Spectrum Characteristics                                  | Neil Rousell        | UKAS          |
| Peak Equivalent Isotropic Radiated Power                  | Paul Adams          | UKAS          |
| Spurious Emissions at Antenna Terminals                   | Neil Rousell        | UKAS          |
| Occupied Bandwidth                                        | Neil Rousell        | UKAS          |
| Radiated Spurious Emissions                               | Ahmad Javid         | UKAS          |

**Table 15**

Office Address:

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



## 2 Test Details

### 2.1 Transmitter Frequency and Output Power Stabilities

#### 2.1.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1055  
FCC 47 CFR Part 95, Subpart K  
ISED RSS-287, Clause 7.4.2  
ISED RSS-GEN, Clause 6.11  
RTCM 11010.4, Clause A.16.1

#### 2.1.2 Equipment Under Test and Modification State

Tron SA20 PLB, S/N: 151 - Modification State 0

#### 2.1.3 Date of Test

09-February-2023 to 10-February-2023

#### 2.1.4 Test Method

This test was performed in accordance with ANSI C63.26 clause 5.6 and RSS-287 clause 6.1.

Testing was performed after the battery was discharged for a minimum of 24 hours of 'normal operation' which is the operating lifetime of the EUT as declared by the manufacturer.

#### 2.1.5 Environmental Conditions

|                     |                |
|---------------------|----------------|
| Ambient Temperature | 19.6 - 20.5 °C |
| Relative Humidity   | 37.1 - 38.0 %  |



## 2.1.6 Test Results

### Battery Powered - 121.5 MHz Homer

| Temperature | Measured Frequency (MHz) | Frequency Error (ppm) | Carrier Power (dBm) |
|-------------|--------------------------|-----------------------|---------------------|
| +55.0 °C    | 121.500522               | 4.30                  | 20.655              |
| +50.0 °C    | 121.500272               | 2.24                  | 20.721              |
| +40.0 °C    | 121.500900               | 7.41                  | 20.682              |
| +30.0 °C    | 121.500482               | 3.97                  | 20.737              |
| +20.0 °C    | 121.500284               | 2.34                  | 20.720              |
| +10.0 °C    | 121.500450               | 3.70                  | 20.694              |
| 0 °C        | 121.500305               | 2.51                  | 20.709              |
| -10.0 °C    | 121.500412               | 3.39                  | 20.672              |
| -20.0 °C    | 121.500438               | 3.60                  | 20.683              |

**Table 16 - Frequency Stability Under Temperature Variations**

### RTCM 11010.4, Limit Clause A.16.1

The carrier frequency, measured at the minimum and maximum operating temperatures, shall be 121.5 MHz  $\pm$  50 parts/million.

### ISED RSS-287, Limit Clause 7.4.2

The carrier frequency shall not depart by more than 0.005% ( $\pm$ 50 ppm) from that measured at 20°C and the rated supply voltage.



### 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 |
|-----------------------------|-----------------------|-----------------------------|-------|-----------------------------|---------------------|
| Climatic Chamber            | Votsch                | VT4002                      | 161   | -                           | O/P Mon             |
| Network Analyser            | Rohde & Schwarz       | ZVA 40                      | 3548  | 12                          | 24-Feb-2023         |
| Meter & T/C                 | R.S Components        | Meter 615-8206 & Type K T/C | 3612  | 12                          | 14-Sep-2023         |
| Calibration Unit            | Rohde & Schwarz       | ZV-Z54                      | 4368  | 12                          | 24-Feb-2023         |
| Frequency Standard          | Spectracom            | SecureSync 1200-0408-0601   | 4393  | 6                           | 13-Jul-2023         |
| PXA Signal Analyser         | Keysight Technologies | N9030A                      | 4654  | 12                          | 16-Jan-2024         |
| Thermo-Hygro-Barometer      | PCE Instruments       | PCE-THB-40                  | 5475  | 12                          | 25-Apr-2023         |
| Attenuator 5W 30dB DC-18GHz | Aaren                 | AT40A-4041-D18-30           | 5502  | 12                          | 21-Apr-2023         |

**Table 17**

O/P Mon – Output Monitored using calibrated equipment



## **2.2 Modulation Characteristics**

### **2.2.1 Specification Reference**

FCC 47 CFR Part 2, Clause 2.1047  
FCC 47 CFR Part 95, Subpart K  
ISED RSS-287, Clause 7.4.1  
RTCM 11010.4, Clause A.16.2

### **2.2.2 Equipment Under Test and Modification State**

Tron SA20 PLB, S/N: 151 - Modification State 0

### **2.2.3 Date of Test**

12-January-2023 to 17-January-2023

### **2.2.4 Test Method**

This test was performed in accordance with RTCM 11010.4, Clause A.16.2 and RSS-287 Clause 6.4.

### **2.2.5 Environmental Conditions**

|                     |                |
|---------------------|----------------|
| Ambient Temperature | 21.2 - 21.7 °C |
| Relative Humidity   | 29.6 - 49.1 %  |



## 2.2.6 Test Results

### Battery Powered - 121.5 MHz Homer

| Requirement                                                                                                                                                                  | Result      |             |             | Unit |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-------------|-------------|------|
|                                                                                                                                                                              | -20 °C      | +21.7°      | +55 °C      |      |
| 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        | True        | True        | -    |
| Lower Audio Frequency                                                                                                                                                        | 381         | 381         | 381         | Hz   |
| Upper Audio Frequency                                                                                                                                                        | 1165        | 1165        | 1165        | Hz   |
| Audio Frequency Direction                                                                                                                                                    | High to Low | High to Low | High to Low | -    |
| Range of Audio Frequency                                                                                                                                                     | 784         | 784         | 784         | Hz   |
| Sweep Repetition Rate                                                                                                                                                        | 2.7         | 2.7         | 2.7         | Hz   |
| Modulation Duty Cycle (near start)                                                                                                                                           | 36.8        | 36.8        | 36.8        | %    |
| Modulation Duty Cycle (near midpoint)                                                                                                                                        | 34.9        | 34.9        | 34.9        | %    |
| Modulation Duty Cycle (near end)                                                                                                                                             | 35.5        | 35.5        | 35.5        | %    |
| Modulation Factor                                                                                                                                                            | 0.87        | 0.87        | 0.87        | %    |
| Morse Code P - Dot Length                                                                                                                                                    | 113.9       | 113.9       | 113.9       | ms   |
| Morse Code P - Dash Length                                                                                                                                                   | 345.4       | 345.4       | 345.4       | ms   |
| Morse Code P - Gap Length                                                                                                                                                    | 115.4       | 115.4       | 115.4       | ms   |
| Morse Code P - Modulating Frequency                                                                                                                                          | 983         | 983         | 983         | Hz   |

**Table 18 - Modulation Characteristics**

Remark:

Morse P length was 1951ms due to 3 x additional 115ms units.  
Voice was not supported.



RTCM 11010.4, Limit Clause A.16.2 and 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:<br>Dot Length<br>Dash Length<br>Gap Length<br>Modulating Frequency                                                                                           | 115 ms $\pm$ 5%<br>345 ms $\pm$ 5%<br>115 ms $\pm$ 5%<br>1000 Hz $\pm$ 50 Hz |

**Table 19 - Modulation Characteristic Limits**

**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 |
|-----------------------------|-----------------------|---------------------------|-------|-----------------------------|---------------------|
| Climatic Chamber            | Votsch                | VT4002                    | 161   | -                           | O/P Mon             |
| Thermocouple Thermometer    | Fluke                 | 51                        | 3172  | 12                          | 27-Jan-2023         |
| Oscilloscope                | Agilent Technologies  | DSO9104A                  | 4142  | 12                          | 06-Oct-2023         |
| Frequency Standard          | Spectracom            | SecureSync 1200-0408-0601 | 4393  | 6                           | 13-Jul-2023         |
| 1 metre SMA Cable           | Florida Labs          | SMS-235SP-39.4-SMS        | 4512  | 12                          | 23-Oct-2023         |
| PXA Signal Analyser         | Keysight Technologies | N9030A                    | 4653  | 12                          | 08-Mar-2023         |
| Thermo-Hygro-Barometer      | PCE Instruments       | PCE-THB-40                | 5475  | 12                          | 25-Apr-2023         |
| Attenuator 5W 20dB DC-18GHz | Aaren                 | AT40A-4041-D18-20         | 5498  | 12                          | 16-May-2023         |
| Digital Timer               | Radio Spares          | RS Pro                    | 5603  | 12                          | 25-Aug-2023         |

**Table 20**

O/P Mon – Output Monitored using calibrated equipment



## **2.3 Spectrum Characteristics**

### **2.3.1 Specification Reference**

FCC 47 CFR Part 95: Subpart K  
ISED RSS-287, Clause 7.4.5  
RTCM 11010.4, Clause A.16.2(e)

### **2.3.2 Equipment Under Test and Modification State**

Tron SA20 PLB, S/N: 151 - Modification State 0

### **2.3.3 Date of Test**

10-February-2023

### **2.3.4 Test Method**

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

### **2.3.5 Environmental Conditions**

|                     |         |
|---------------------|---------|
| Ambient Temperature | 20.6 °C |
| Relative Humidity   | 36.7 %  |



### 2.3.6 Test Results

#### Battery Powered - 121.5 MHz Homer

| Parameter                                   | Result |
|---------------------------------------------|--------|
| Total (Wideband) Power (dBm)                | 15.845 |
| Power within the resolution bandwidth (dBm) | 11.355 |
| Difference (dB)                             | 4.5    |

**Table 21 - Spectrum Characteristics**

#### RTCM 1010.4, Limit Clause A.16.2(e)

Measurements must be made to show that at least 30% of the total power emitted during any transmission cycle with or without modulation shall be contained within  $\pm 30$  Hz of the carrier frequency. Additionally, if the emission is interrupted by the transmission of the 406 MHz burst, the carrier frequency must not shift more than  $\pm 30$  Hz.

#### ISED 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  $f_c \pm 30$  Hz (at 121.5 MHz) and within the band  $f_c \pm 60$  Hz (at 243 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 |
|-----------------------------|-----------------------|---------------------------|-------|-----------------------------|---------------------|
| Network Analyser            | Rohde & Schwarz       | ZVA 40                    | 3548  | 12                          | 24-Feb-2023         |
| Calibration Unit            | Rohde & Schwarz       | ZV-Z54                    | 4368  | 12                          | 24-Feb-2023         |
| Frequency Standard          | Spectracom            | SecureSync 1200-0408-0601 | 4393  | 6                           | 13-Jul-2023         |
| PXA Signal Analyser         | Keysight Technologies | N9030A                    | 4654  | 12                          | 16-Jan-2024         |
| Thermo-Hygro-Barometer      | PCE Instruments       | PCE-THB-40                | 5475  | 12                          | 25-Apr-2023         |
| Attenuator 5W 30dB DC-18GHz | Aaren                 | AT40A-4041-D18-30         | 5502  | 12                          | 21-Apr-2023         |

**Table 22**



## **2.4 Peak Equivalent Isotropic Radiated Power**

### **2.4.1 Specification Reference**

RTCM 11010.4, Clause A.16.3  
RTCM 11010.4, Clause A.16.4

### **2.4.2 Equipment Under Test and Modification State**

Tron SA20, S/N: 157 - Modification State 0

### **2.4.3 Date of Test**

20 June 2023

### **2.4.4 Test Method**

This test was performed in accordance with RTCM 11010.4, Clause A.16.3 and A.16.4.

### **2.4.5 Environmental Conditions**

Ambient Temperature      26.2 °C  
Relative Humidity          38.1 %

### **2.4.6 Test Results**

Battery Powered - 121.5 MHz Homer

| Azimuth (°)            | Elevation resulting in maximum EIRP (20°) |
|------------------------|-------------------------------------------|
|                        | PEIRP (mW)                                |
| 0                      | 44.75                                     |
| 30                     | 40.81                                     |
| 60                     | 42.74                                     |
| 90                     | 43.73                                     |
| 120                    | 46.86                                     |
| 150                    | 49.07                                     |
| 180                    | 50.21                                     |
| 210                    | 52.58                                     |
| 240                    | 55.06                                     |
| 270                    | 51.38                                     |
| 300                    | 49.07                                     |
| 330                    | 49.07                                     |
| Maximum Recorded Value | 55.06                                     |
| Mean Value             | 49.07                                     |

**Table 23 – On Ground Plane (A16.3)**



| Azimuth (°)            | Elevation resulting in maximum EIRP (5°) |
|------------------------|------------------------------------------|
|                        | PEIRP (mW)                               |
| 0                      | 2.42                                     |
| 90                     | 2.54                                     |
| 180                    | 2.39                                     |
| 270                    | 2.48                                     |
| Maximum Recorded Value | 2.54                                     |
| Mean Value             | 2.45                                     |

**Table 24 – Off Ground Plane (A16.4)**

RTCM 11010.4 Limit Clause A.16.3

The median value of PEIRP shall be between 25 and 100 mW. The ratio of the maximum to minimum of the 11 highest values of PEIRP shall not exceed 4 to 1 (6 dB)

RTCM 11010.4 Limit Clause A16.4

The minimum value of PEIRP measured at each of the 4 azimuth angle increments shall be at least 2 mW.

**2.4.7 Test Location and Test Equipment Used**

This test was carried out in Open Area Facility.

| Instrument                           | Manufacturer    | Type No                     | TE No | Calibration Period (months) | Calibration Expires |
|--------------------------------------|-----------------|-----------------------------|-------|-----------------------------|---------------------|
| Spectrum Analyser                    | Hewlett Packard | 8542E                       | 18    | -                           | TU                  |
| Antenna, (Tuned Dipole Set)          | Roberts Antenna | A-100                       | 568   | 24                          | 24-May-2025         |
| Power Meter                          | Rohde & Schwarz | NRP                         | 3491  | 12                          | 13-Jan-2024         |
| Wideband Power Sensor, 50 MHz-18 GHz | Rohde & Schwarz | NRP-Z81                     | 3492  | 12                          | 13-Jan-2024         |
| Inclinometer, Digital                | Radio Spares    | 01-900-020003 (RS 667-3916) | 4125  | 12                          | 14-Mar-2024         |
| Analyser (Spectrum)                  | Rohde & Schwarz | FPL1003                     | 5349  | 12                          | 02-Jan-2024         |
| Dreloscop Strobe                     | Unknown         | 3009                        | 5387  | -                           | TU                  |
| Humidity & Temperature meter         | Rotronic        | HP31 HygroPalm              | 6247  | 12                          | 21-Sep-2023         |

**Table 25**

TU – Traceability Unscheduled



## **2.5 Spurious Emissions at Antenna Terminals**

### **2.5.1 Specification Reference**

FCC 47 CFR Part 2, Clause 2.1051  
FCC 47 CFR Part 95, Subpart K  
ISED RSS-287, Clause 7.4.4  
ISED RSS-GEN, Clause 6.13  
RTCM 11010.4, Clause 4.2.4

### **2.5.2 Equipment Under Test and Modification State**

Tron SA20 PLB, S/N: 151 - Modification State 0

### **2.5.3 Date of Test**

17-January-2023 to 18-January-2023

### **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 | 21.2 - 21.4 °C |
| Relative Humidity   | 29.6 - 32.3 %  |



## 2.5.6 Test Results

### Battery Powered - 121.5 MHz Homer

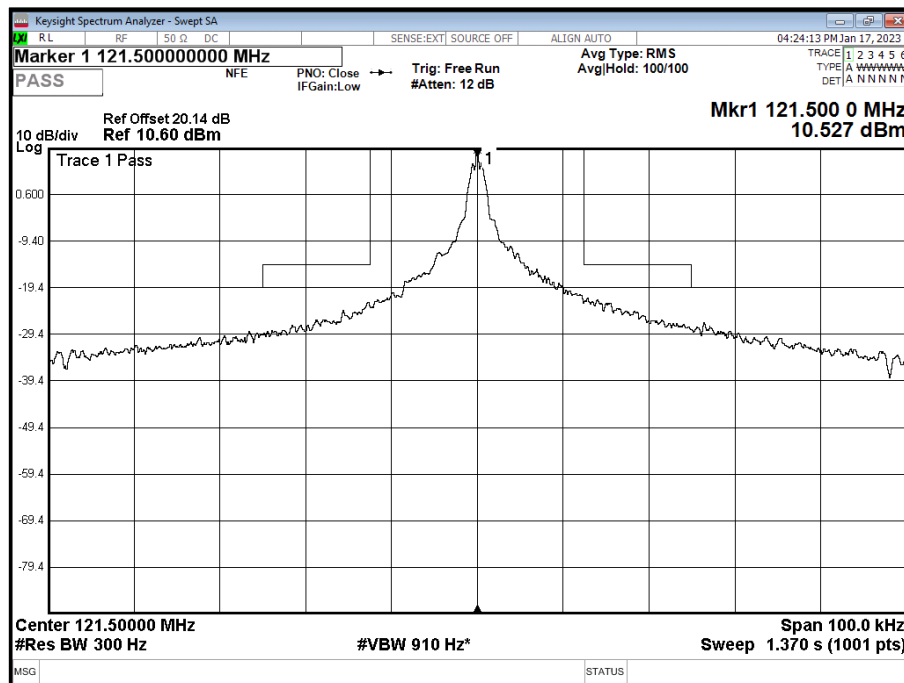


Figure 1 - Transmitter Mask (RSS-287 Clause 7.4.4)

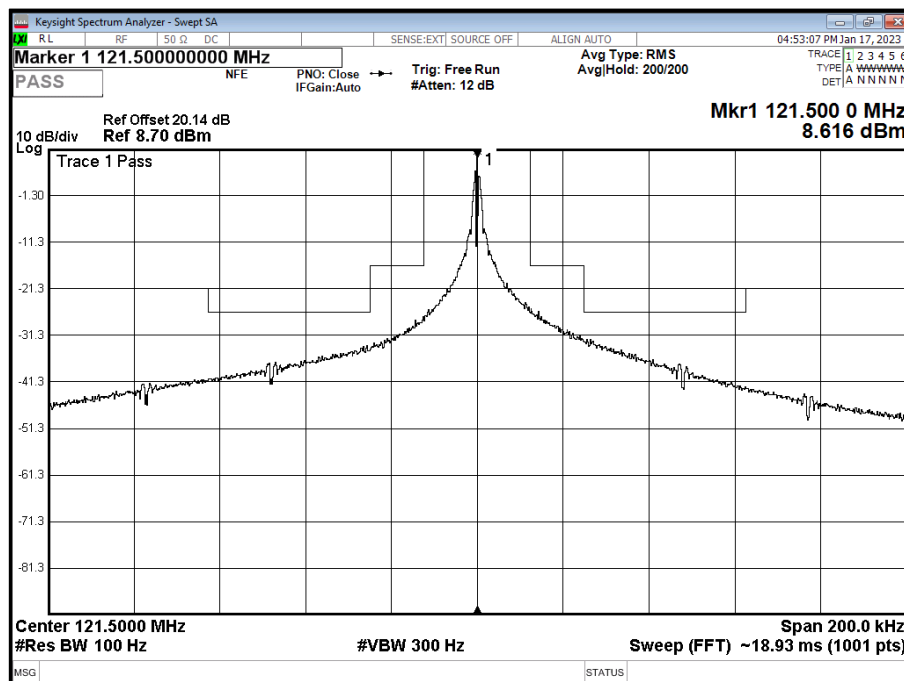


Figure 2 - Transmitter Mask (RTCM 1010.2 Clause 4.2.3)

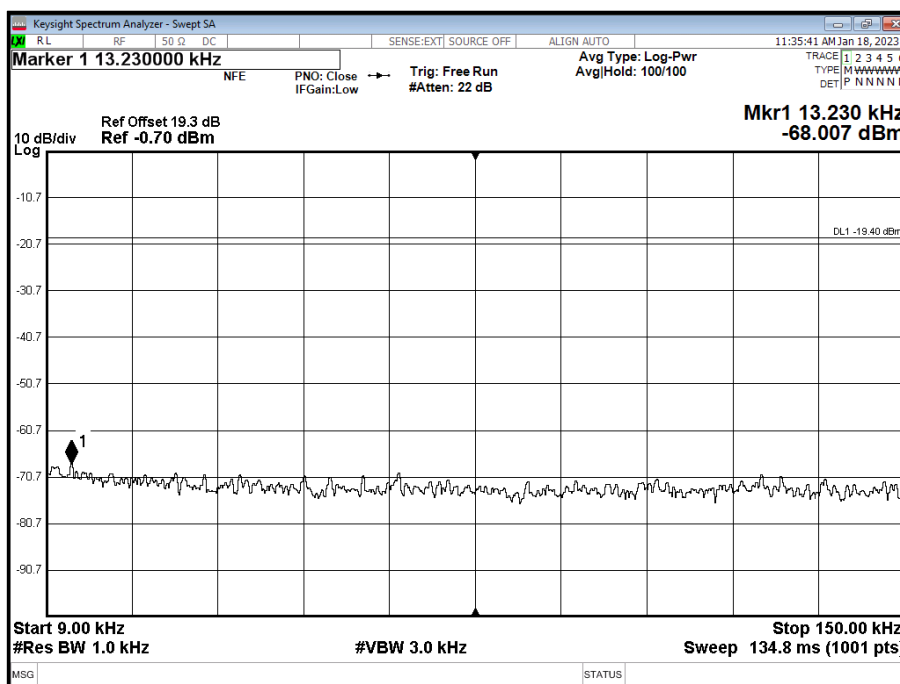


Figure 3 - 9 kHz to 150 kHz

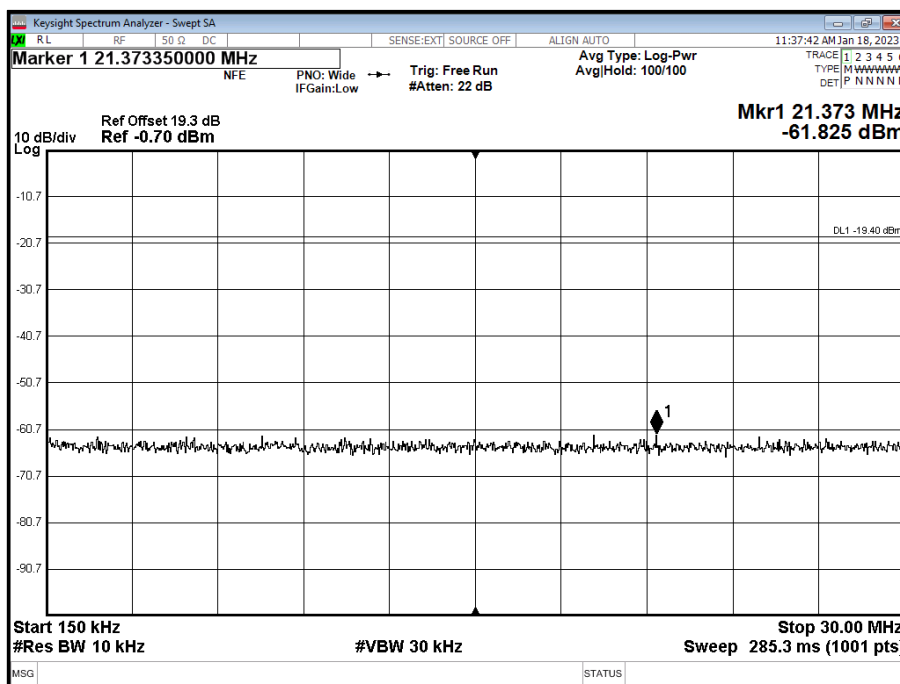


Figure 4 - 150 kHz to 30 MHz

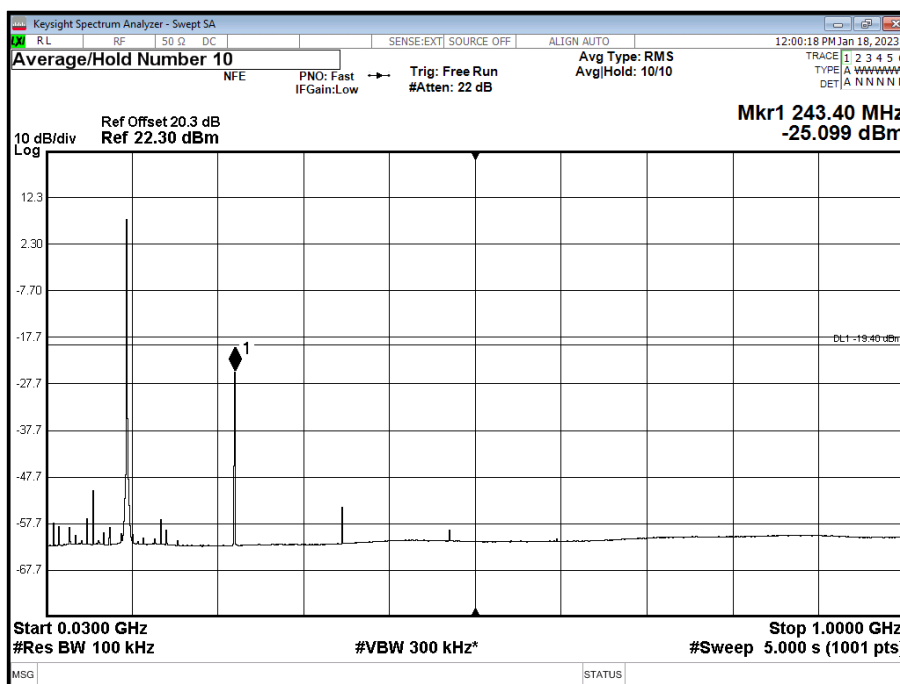


Figure 5 - 30 MHz to 1 GHz

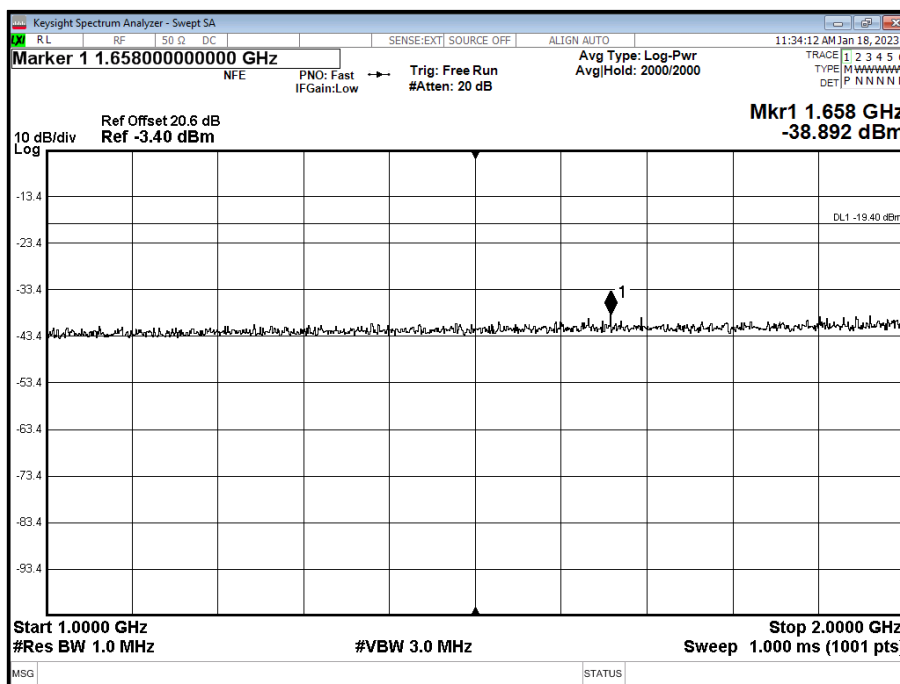
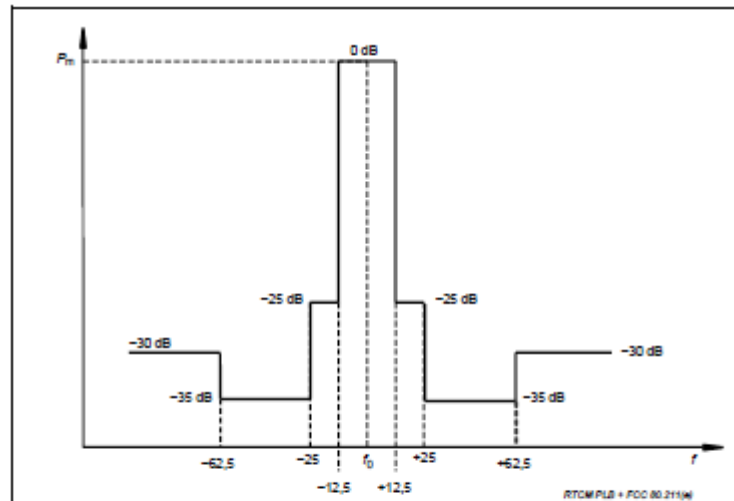


Figure 6 - 1 GHz to 2 GHz

#### RTCM 11010.4, Limit Clause 4.2.4, 121.5 MHz emission limitations

The transmitter power output spectrum shall remain within the limits of the emission mask shown in Figure 4.



Relative frequency to 121,5 MHz homing device in kHz  
 $P_m$  = mean power  
 $P_m$  =  $D(\text{PERP})$  power output of 121,5 MHz homing device  
 $D$  = modulation duty cycle  
 PERP = peak effective radiated power  
 Measurement Resolution Bandwidth 100 Hz

#### 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.



## 2.5.7 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 |
|-----------------------------|-----------------------|---------------------------|-------|-----------------------------|---------------------|
| Frequency Standard          | Spectracom            | SecureSync 1200-0408-0601 | 4393  | 6                           | 13-Jul-2023         |
| 1 metre SMA Cable           | Florida Labs          | SMS-235SP-39.4-SMS        | 4512  | 12                          | 23-Oct-2023         |
| Network Analyser            | Rohde & Schwarz       | ZVA 40                    | 3548  | 12                          | 24-Feb-2023         |
| Calibration Unit            | Rohde & Schwarz       | ZV-Z54                    | 4368  | 12                          | 24-Feb-2023         |
| PXA Signal Analyser         | Keysight Technologies | N9030A                    | 4653  | 12                          | 08-Mar-2023         |
| Thermo-Hygro-Barometer      | PCE Instruments       | PCE-THB-40                | 5475  | 12                          | 25-Apr-2023         |
| Attenuator 5W 20dB DC-18GHz | Aaren                 | AT40A-4041-D18-20         | 5498  | 12                          | 16-May-2023         |

**Table 26**



## **2.6 Occupied Bandwidth**

### **2.6.1 Specification Reference**

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

### **2.6.2 Equipment Under Test and Modification State**

Tron SA20 PLB, S/N: 151 - Modification State 0

### **2.6.3 Date of Test**

18-January-2023

### **2.6.4 Test Method**

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

### **2.6.5 Environmental Conditions**

|                     |         |
|---------------------|---------|
| Ambient Temperature | 20.8 °C |
| Relative Humidity   | 33.3 %  |



2.6.6 Test Results

Battery Powered - 121.5 MHz Homer

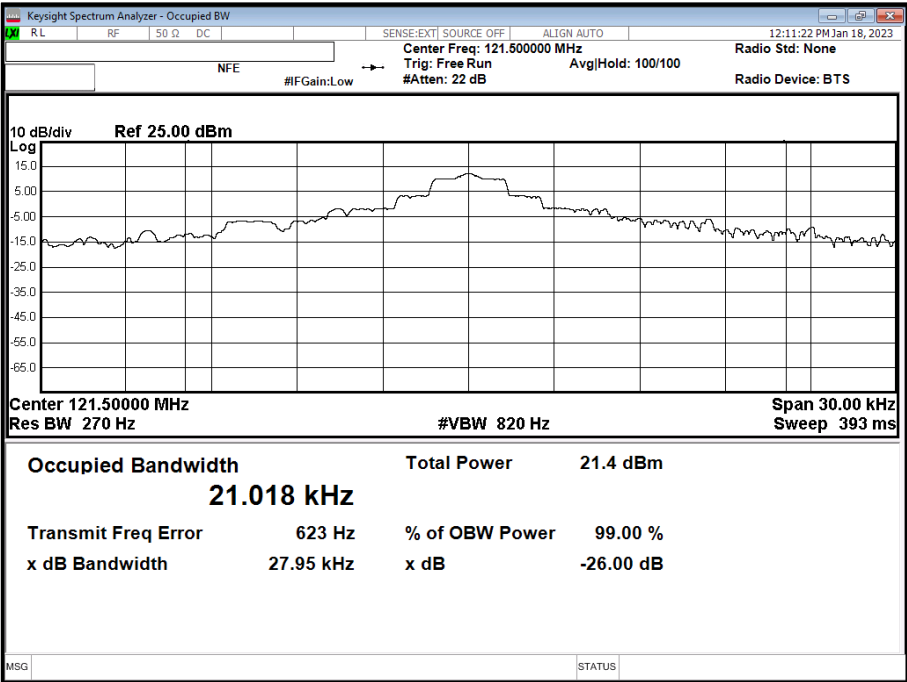


Figure 7 - 99% Occupied Bandwidth

FCC Part 2 and ISSED RSS-GEN Limit Clause

None Specified

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 |
|-----------------------------|-----------------------|---------------------------|-------|-----------------------------|---------------------|
| Frequency Standard          | Spectracom            | SecureSync 1200-0408-0601 | 4393  | 6                           | 13-Jul-2023         |
| 1 metre SMA Cable           | Florida Labs          | SMS-235SP-39.4-SMS        | 4512  | 12                          | 23-Oct-2023         |
| PXA Signal Analyser         | Keysight Technologies | N9030A                    | 4653  | 12                          | 08-Mar-2023         |
| Thermo-Hygro-Barometer      | PCE Instruments       | PCE-THB-40                | 5475  | 12                          | 25-Apr-2023         |
| Attenuator 5W 20dB DC-18GHz | Aaren                 | AT40A-4041-D18-20         | 5498  | 12                          | 16-May-2023         |

Table 27

## 2.7 Radiated Spurious Emissions

### 2.7.1 Specification Reference

FCC 47 CFR Part 2, Clause 2.1053  
ISED RSS-287, Clause 7.4.4  
ISED RSS-GEN, Clause 6.13

### 2.7.2 Equipment Under Test and Modification State

Tron SA20 PLB, S/N: 107 - Modification State 0

### 2.7.3 Date of Test

28-January-2023 to 29-January-2023

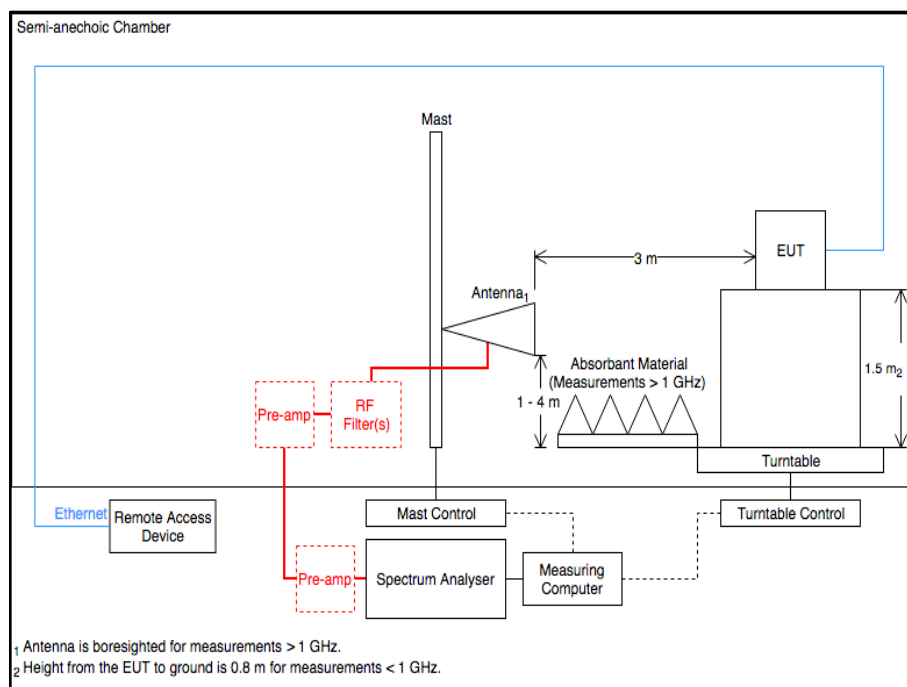
#### 2.7.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.5.

Measurements were made at a distance of 3m. Field strength values were converted to EIRP using the formula in ANSI C63.26 clause 5.2.7 – equation d) as follows:

$$\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20 \cdot \text{LOG}(D) - 104.8 \text{ where } D = 3 \text{ meters.}$$

### 2.7.5 Test Setup Diagram



**Figure 8**

### 2.7.6 Environmental Conditions

|                     |         |
|---------------------|---------|
| Ambient Temperature | 20.2 °C |
| Relative Humidity   | 38.4 %  |



2.7.7 Test Results

Battery Powered - 121.5 MHz Homer

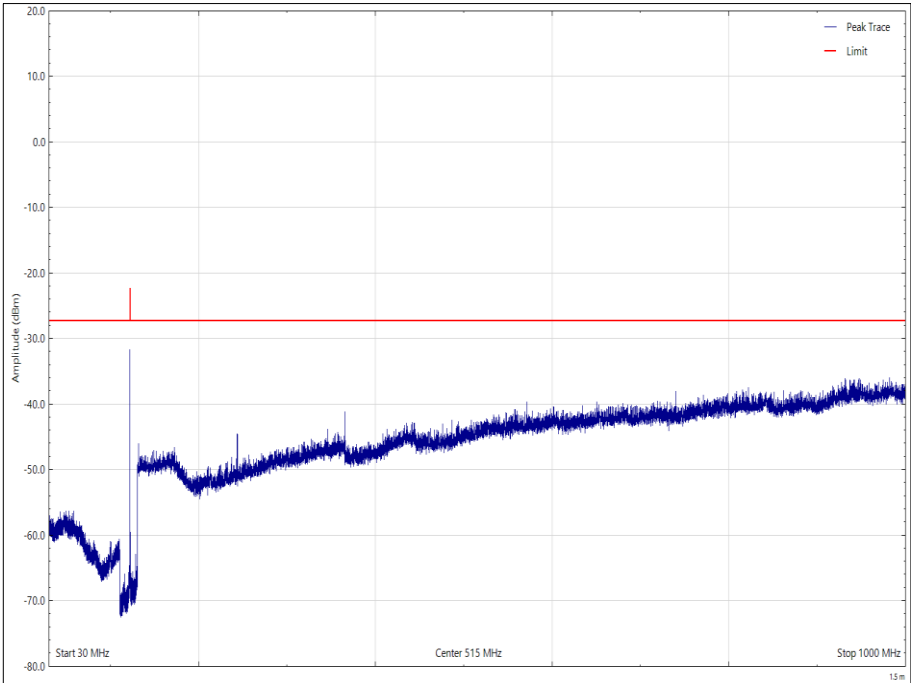


Figure 8 - EUT Orientation X: 30 MHz to 1 GHz: Horizontal

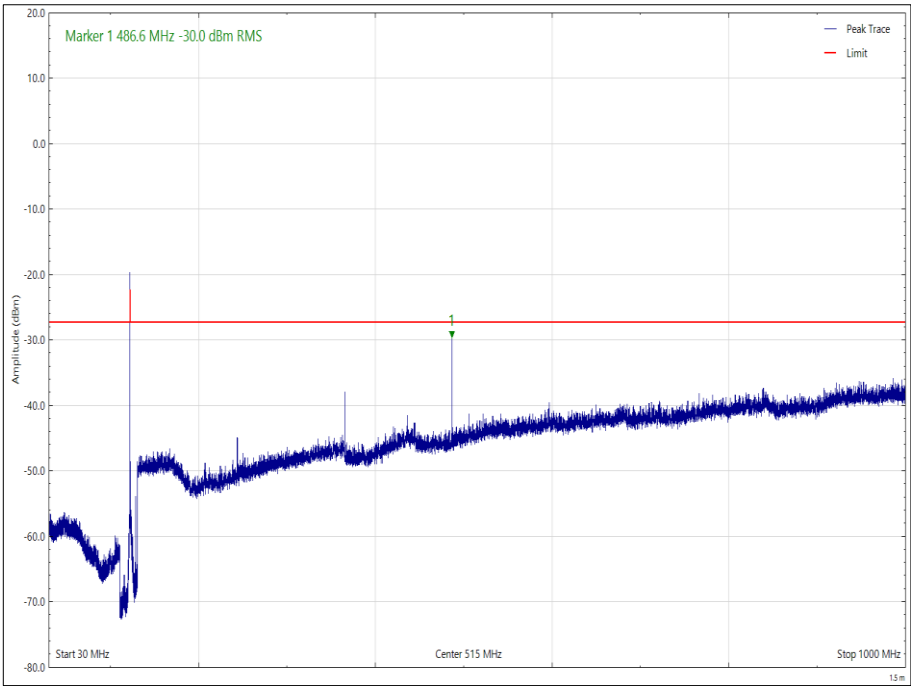


Figure 9 - EUT Orientation X: 30 MHz to 1 GHz: Vertical

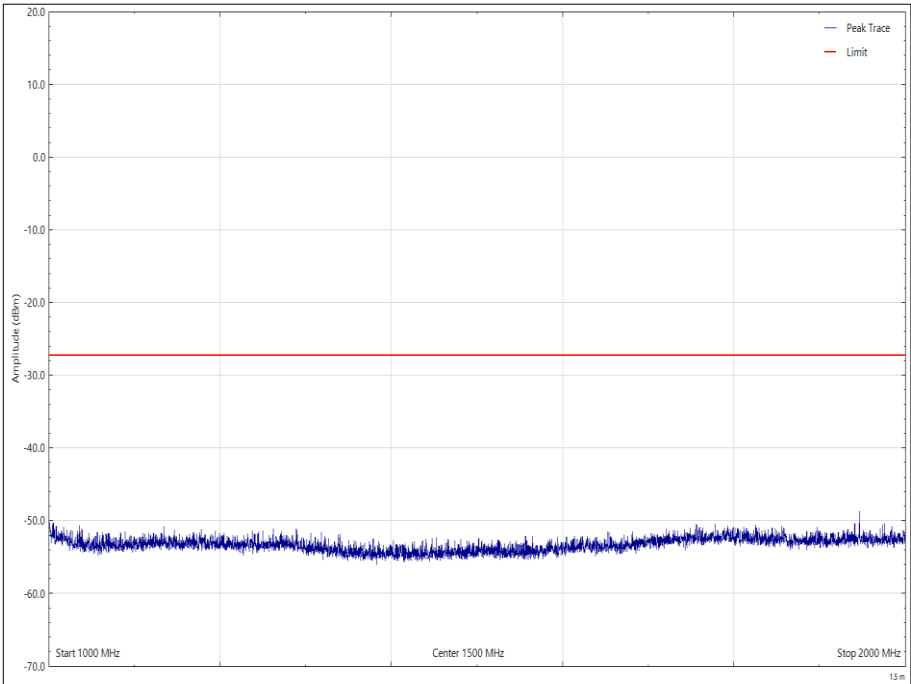


Figure 10 - EUT Orientation X: 1 GHz to 2 GHz: Horizontal

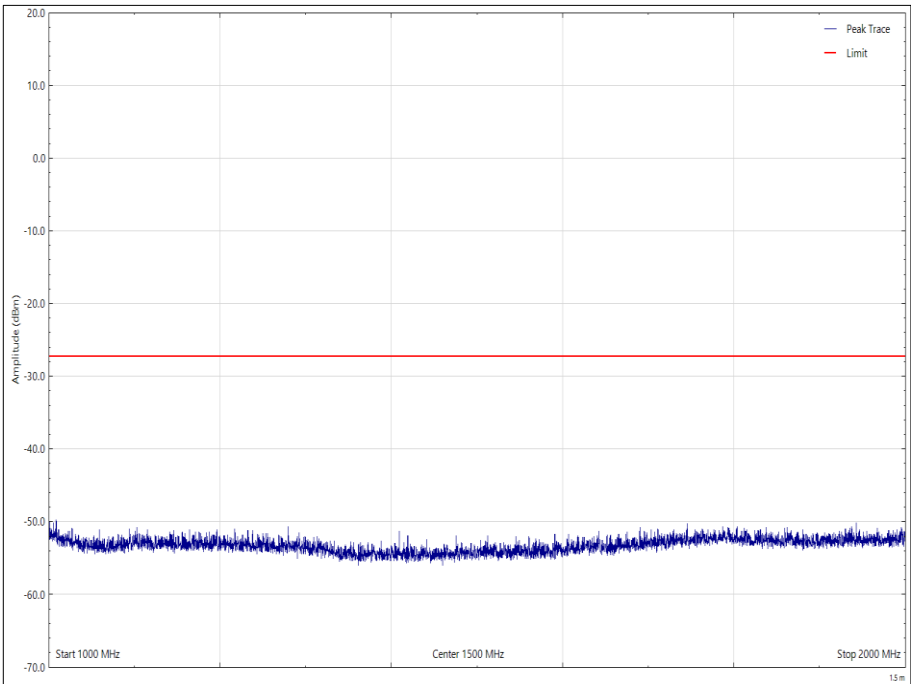


Figure 11 - EUT Orientation X: 1 GHz to 2 GHz: Vertical

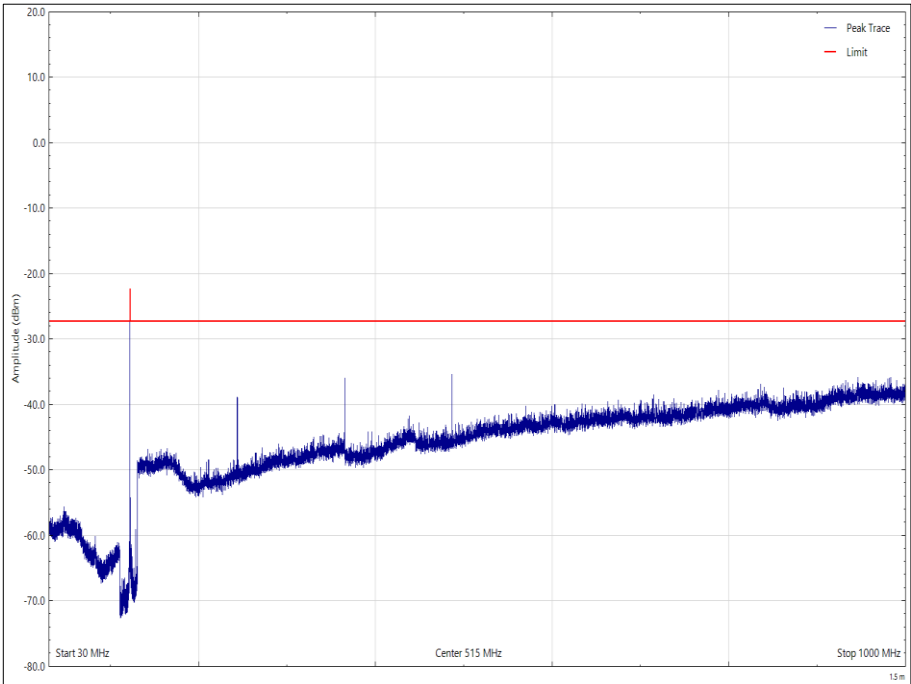


Figure 12 - EUT Orientation Y: 30 MHz to 1 GHz: Horizontal

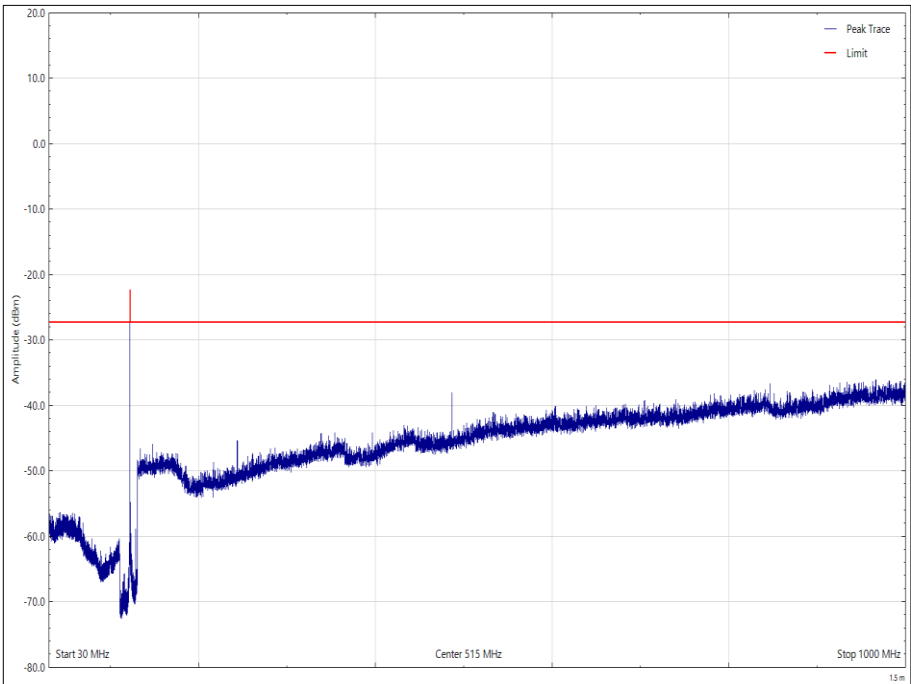


Figure 13 - EUT Orientation Y: 30 MHz to 1 GHz: Vertical

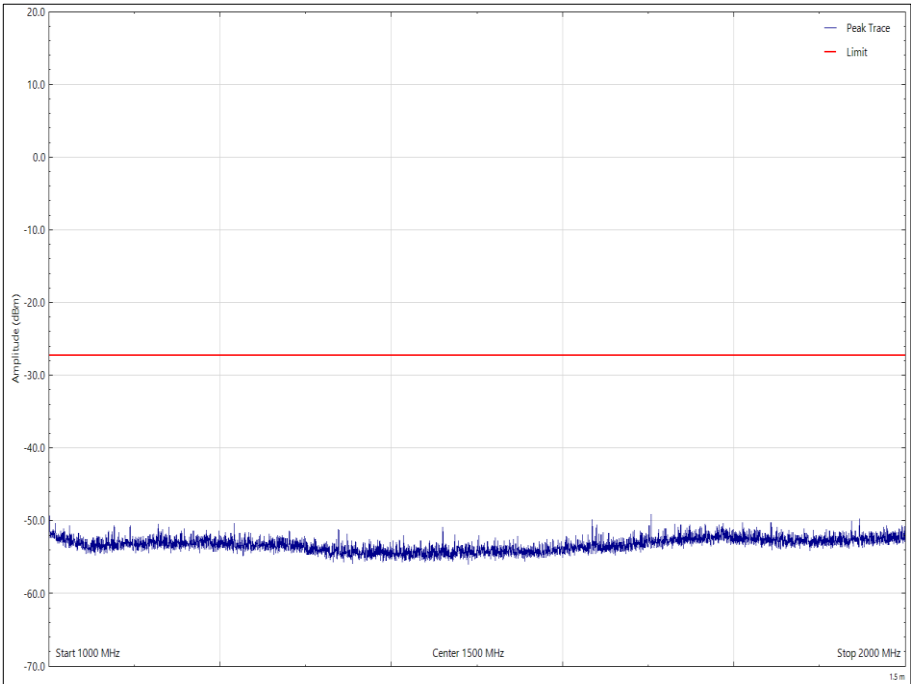


Figure 14 - EUT Orientation Y: 1 GHz to 2 GHz: Horizontal

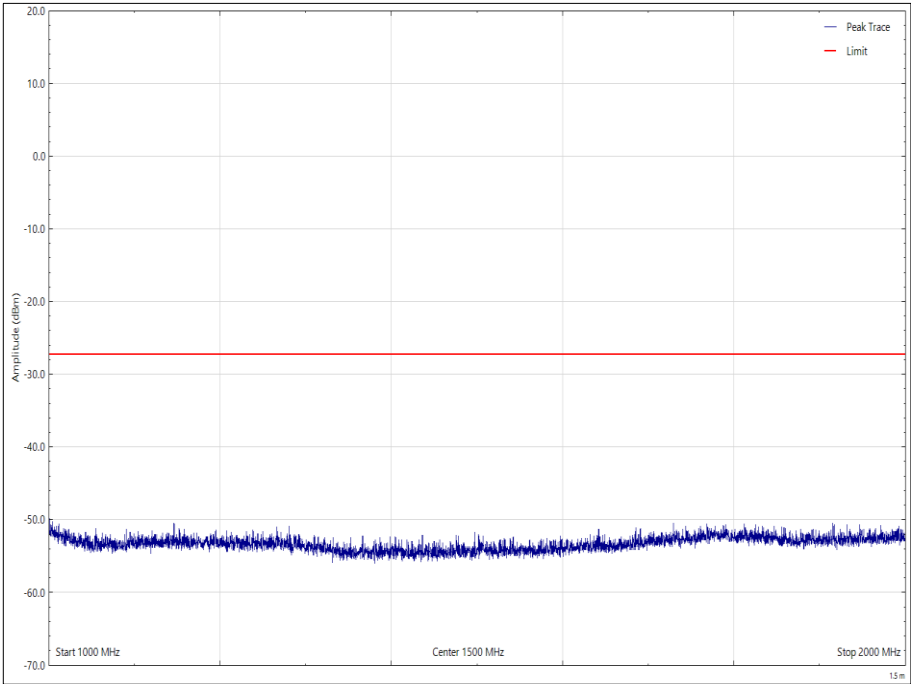


Figure 15 - EUT Orientation Y: 1 GHz to 2 GHz: Vertical

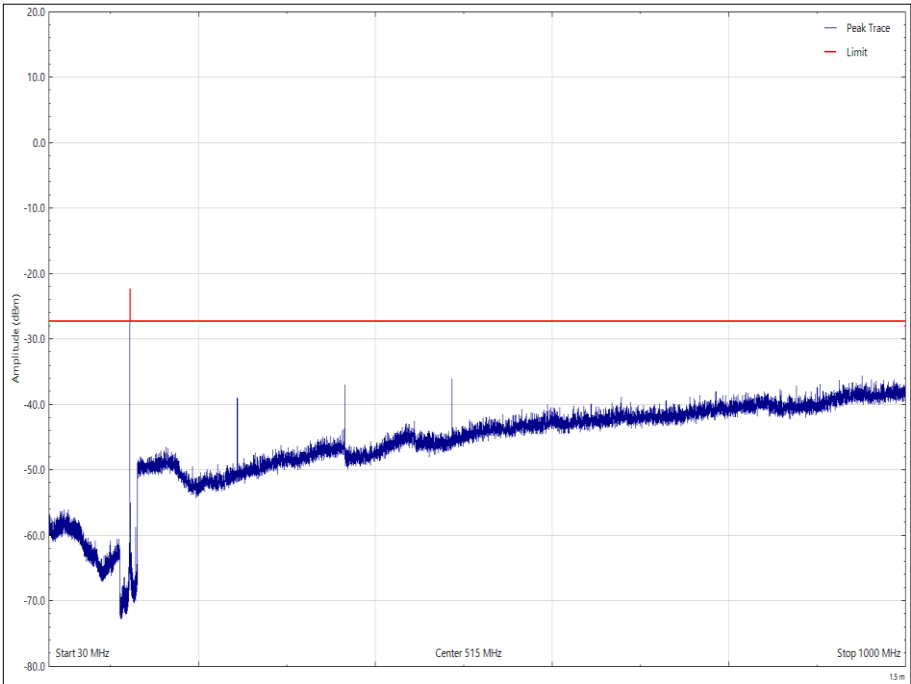


Figure 16 - EUT Orientation Z: 30 MHz to 1 GHz: Horizontal

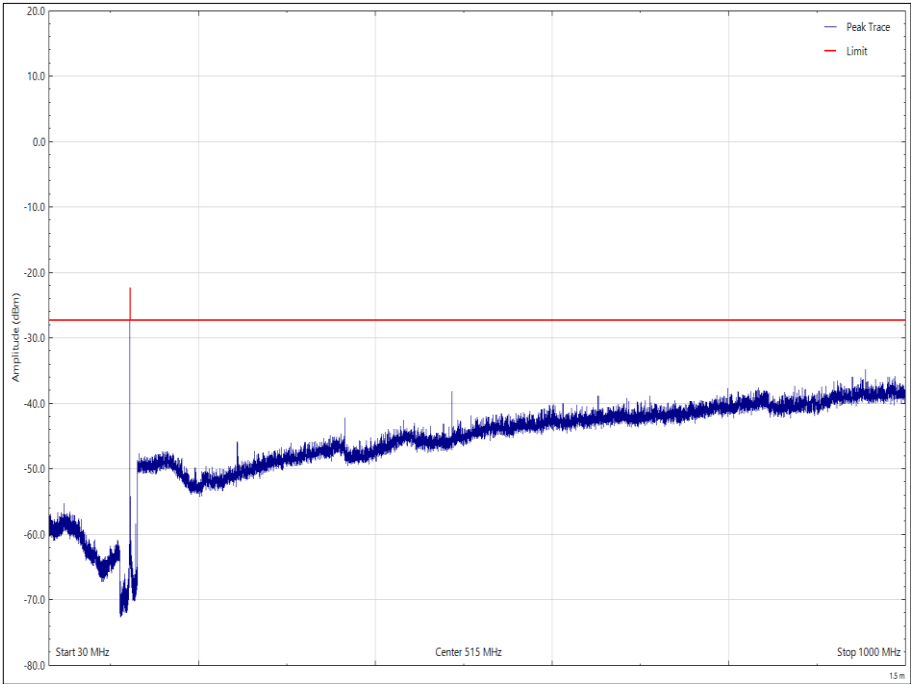


Figure 17 - EUT Orientation Z: 30 MHz to 1 GHz: Vertical

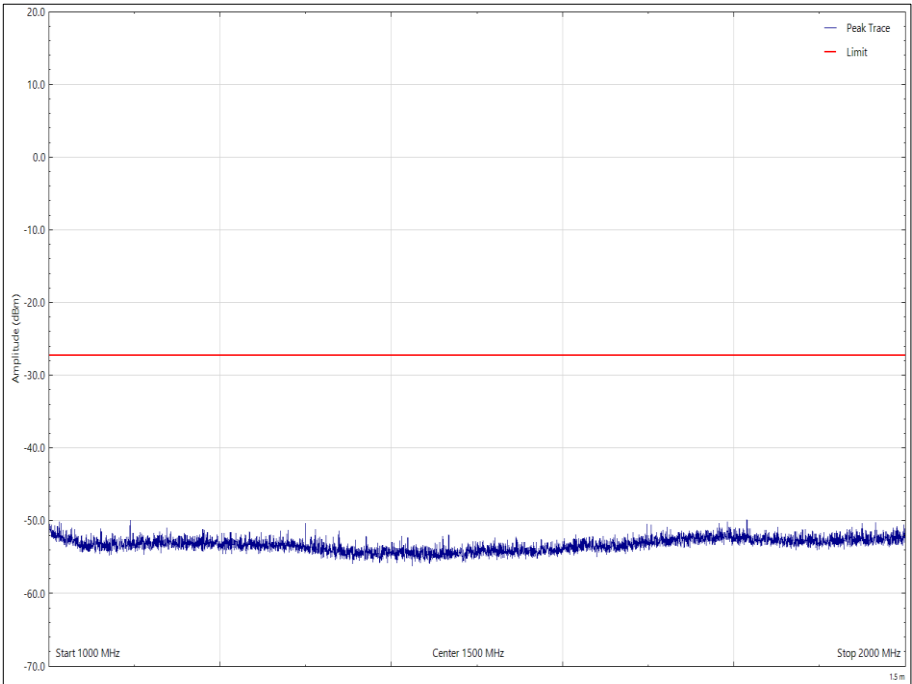


Figure 18 - EUT Orientation Z: 1 GHz to 2 GHz: Horizontal

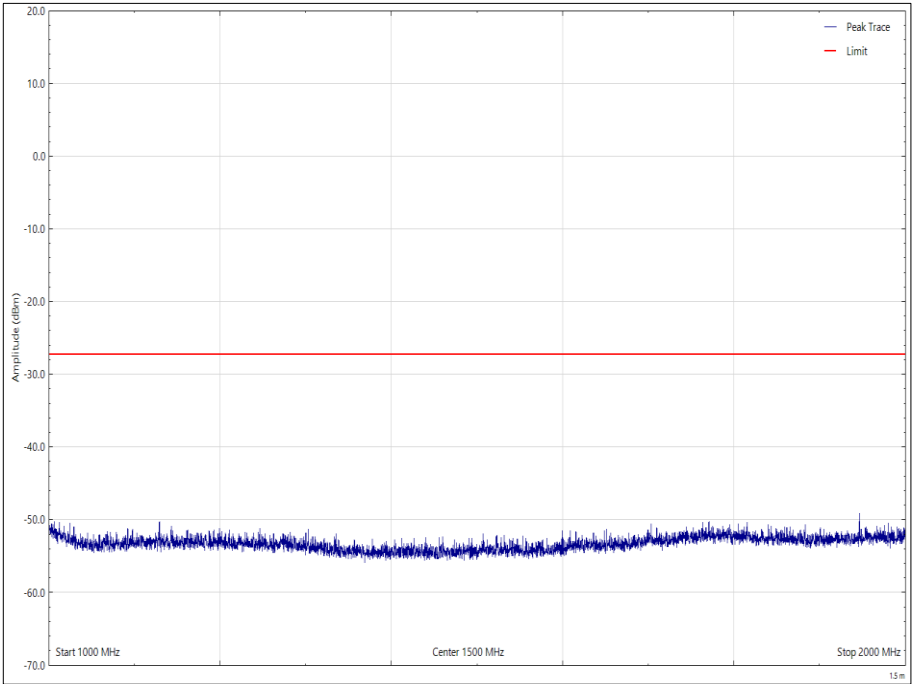


Figure 19 - EUT Orientation Z: 1 GHz to 2 GHz: Vertical



#### 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.

#### **2.7.8 Test Location and Test Equipment Used**

This test was carried out in RF Chamber 11.

| Instrument                          | Manufacturer    | Type No              | TE No | Calibration Period (months) | Calibration Expires |
|-------------------------------------|-----------------|----------------------|-------|-----------------------------|---------------------|
| EMI Test Receiver                   | Rohde & Schwarz | ESW44                | 5084  | 12                          | 17-May-2023         |
| Emissions Software                  | TUV SUD         | EmX V3.1.10          | 5125  | -                           | Software            |
| Screened Room (11)                  | Rainford        | Rainford             | 5136  | 36                          | 24-Nov-2024         |
| Mast                                | Maturo          | TAM 4.0-P            | 5158  | -                           | TU                  |
| Mast and Turntable Controller       | Maturo          | Maturo NCD           | 5159  | -                           | TU                  |
| Turntable                           | Maturo          | TT 15WF              | 5160  | -                           | TU                  |
| Antenna                             | Schwarzbeck     | BBHA9120B            | 5215  | 12                          | 28-May-2023         |
| Thermo-Hygro-Barometer              | PCE Instruments | OCE-THB-40           | 5470  | 12                          | 07-Apr-2023         |
| Cable (SMA to SMA, 2 m)             | Junkosha        | MWX221-02000AMSAMS/A | 5517  | 12                          | 12-Apr-2023         |
| 8m N Type Cable                     | Junkosha        | MWX221-08000NMSNMS/B | 5522  | 12                          | 24-Mar-2023         |
| TRILOG Super Broadband Test Antenna | Schwarzbeck     | VULB 9168            | 5942  | 24                          | 03-Feb-2024         |
| Attenuator 4dB                      | Pasternack      | PE7074-4             | 6202  | 24                          | 16-Jul-2024         |

**Table 28**

TU - Traceability Unscheduled

### 3 Photographs

#### 3.1 Test Setup Photographs

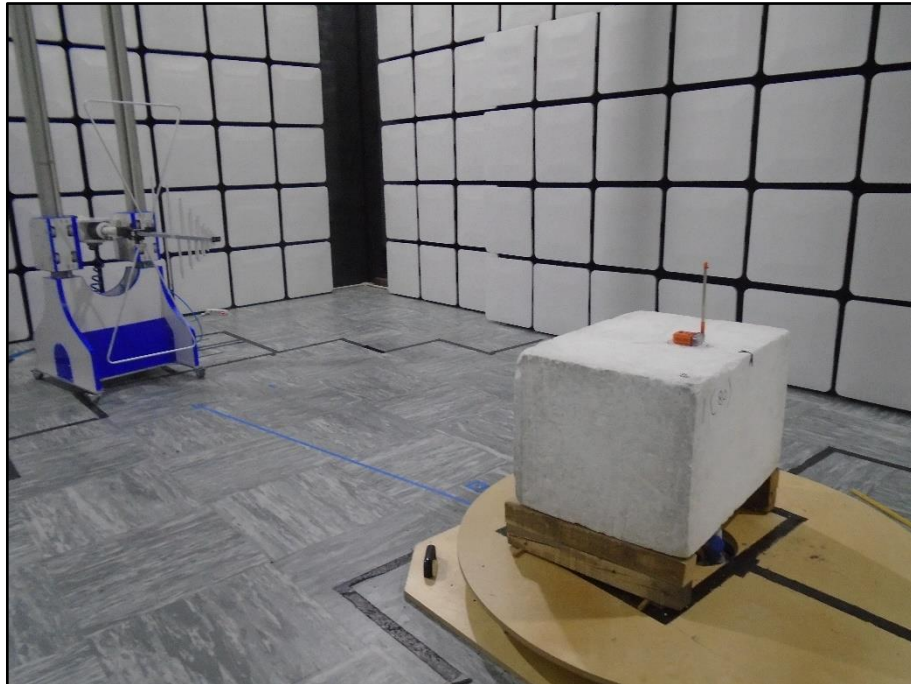


Figure 20 – Test Setup Photo, 30 GHz to 1 GHz

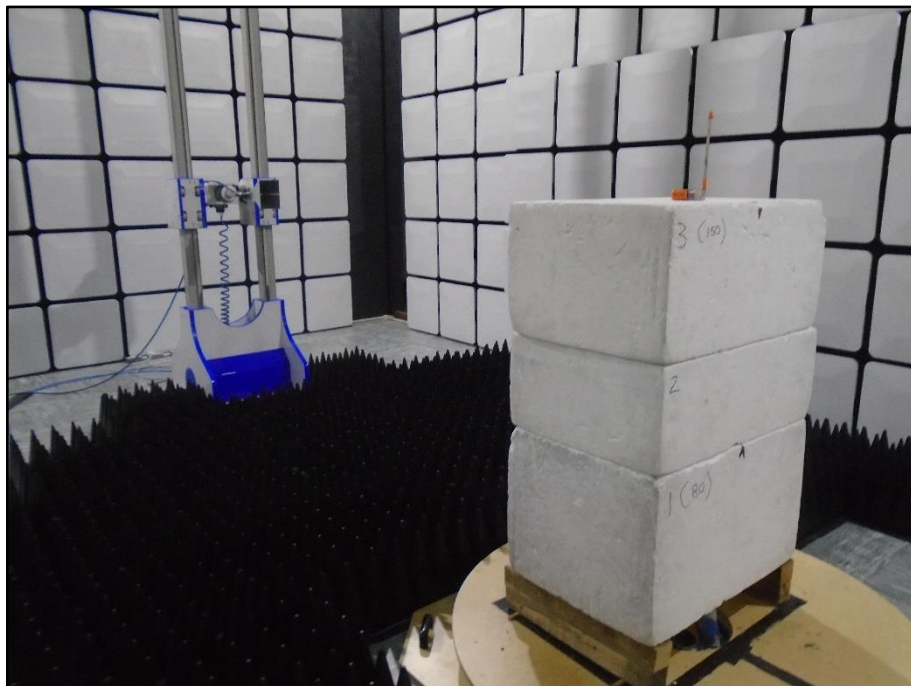


Figure 21 – Test Setup Photo, 1 GHz to 2 GHz

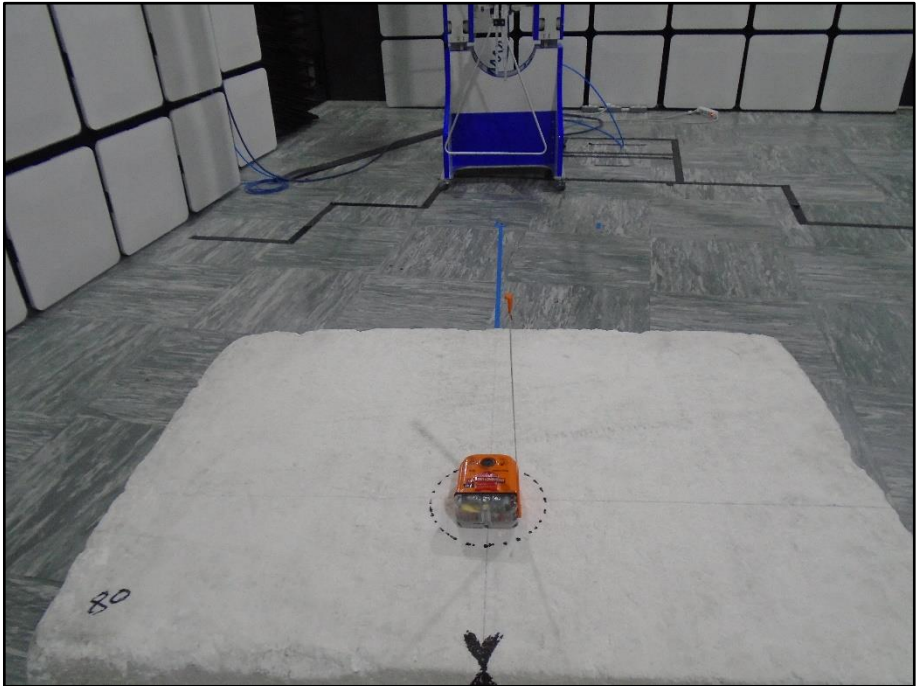


Figure 22 – Test Setup Photo, Orientation X

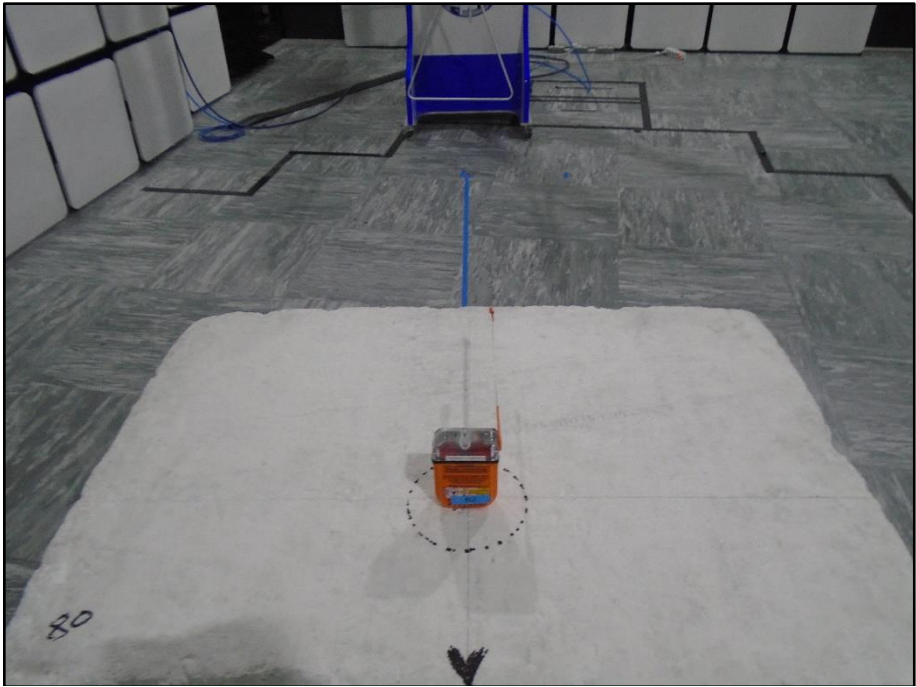


Figure 23 - Test Setup Photo, Orientation Y

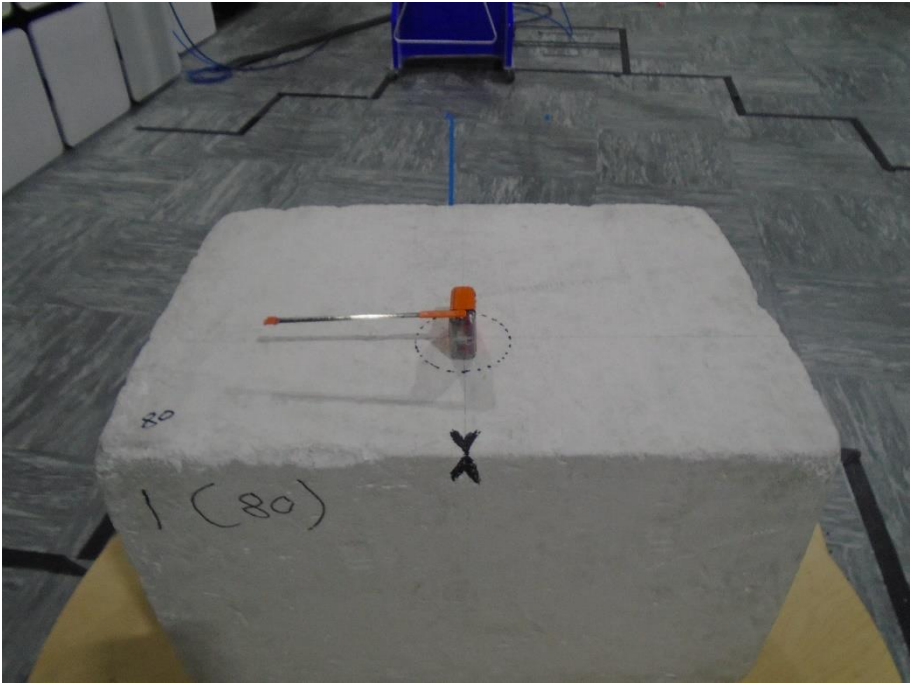


Figure 24 - Test Setup Photo, Orientation Z



## 4 Measurement Uncertainty

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

| Test Name                                          | Measurement Uncertainty                                                                                                                                                                                                                                                  |
|----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transmitter Frequency and Output Power Stabilities | $\pm 11$ Hz                                                                                                                                                                                                                                                              |
| Modulation Characteristics                         | Minimum Audio Frequency: $\pm 22.4$ Hz<br>Maximum Audio Frequency: $\pm 121.56$ Hz<br>Audio Frequency Range: $\pm 123.6$ Hz<br>Sweep Repetition Rate: $\pm 5$ %<br>Modulation Factor: $\pm 5\%$<br>Modulation Duty Cycle: $\pm 5\%$<br>30% Occupied Bandwidth: $\pm 5\%$ |
| Spectrum Characteristics                           | $\pm 1.8$ dB                                                                                                                                                                                                                                                             |
| Peak Equivalent Isotropic Radiated Power           | $\pm 5.2$ dB                                                                                                                                                                                                                                                             |
| Spurious Emissions at Antenna Terminals            | $\pm 3.45$ dB                                                                                                                                                                                                                                                            |
| Occupied Bandwidth                                 | $\pm 300.3$ Hz                                                                                                                                                                                                                                                           |
| Radiated Spurious Emissions                        | $\pm 3.45$ dB                                                                                                                                                                                                                                                            |

**Table 29**

### Measurement Uncertainty Decision Rule – Accuracy Method

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115:2021, Clause 4.4.3 (Procedure 2). The measurement results are directly compared with the test limit to determine conformance with the requirements of the standard.

Risk: The uncertainty of measurement about the measured result is negligible with regard to the final pass/fail decision. The measurement result can be directly compared with the test limit to determine conformance with the requirement (compare IEC Guide 115). The level of risk to falsely accept and falsely reject items is further described in ILAC-G8.