# Report on the FCC and IC Testing of the SATcase Limited, Model: SC01 In accordance with FCC 47 CFR Part 25, FCC 47 CFR Part 2, Industry Canada RSS-170 and Industry Canada RSS-GEN

Product Service

Choose certainty.
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Prepared for: SATcase
Baird Lane
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York
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United Kingdom

FCC ID: 2AM7Y-SC01
IC: 23028-SC01

## COMMERCIAL-IN-CONFIDENCE

Date: January 2018
Document Number: 75938844-06 | Issue: 01

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|---|---|---|---|
| Project Management | Steven White | 19 January 2018 | |
| Authorised Signatory | Simon Bennett | 19 January 2018 | |

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service 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 25, FCC 47 CFR Part 2, Industry Canada RSS-170 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

| RESPONSIBLE FOR | NAME | DATE | SIGNATURE |
|---|---|---|---|
| Testing | Graeme Lawler | 19 January 2018 | |
| Testing | Matthew Russell | 19 January 2018 | |

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

Industry Canada Accreditation
IC2932B-1 Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with FCC 47 CFR Part 25: 2016, FCC 47 CFR Part 2: 2016, Industry Canada RSS-170: Issue 3, 2015 and Industry Canada RSS-GEN: Issue 4 and 2014 for the tests detailed in section 1.3.



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Product Service

# Contents

# 1 Report Summary

## 1.1 Report Modification Record

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

| Issue | Description of Change | Date of Issue |
|---|---|---|
| 1 | First Issue | 19 January 2018 |

**Table 1**

## 1.2 Introduction

| | |
|---|---|
| Applicant | SATcase Limited |
| Manufacturer | SATcase Limited |
| Model Number(s) | SC01 |
| Serial Number(s) | 300125060276200 and 300125060276260 |
| Hardware Version(s) | V1.1 |
| Software Version(s) | V0.0.190 |
| Number of Samples Tested | 2 |
| Test Specification/Issue/Date | FCC 47 CFR Part 25: 2016, FCC 47 CFR Part 2: 2016, Industry Canada RSS-170: Issue 3, 2015 and Industry Canada RSS-GEN: Issue 4 and 2014 |
| Order Number<br>Date | 5612<br>20-April-2017 |
| Date of Receipt of EUT | 25-October-2017 and 02-November-2017 |
| Start of Test | 14-November-2017 |
| Finish of Test | 04-January-2018 |
| Name of Engineer(s) | Matthew Russell and Graeme Lawler |
| 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 25, FCC 47 CFR Part 2, Industry Canada RSS-170 and Industry Canada RSS-GEN is shown below.

| Section | Specification Clause | | | | Test Description | Result | Comments/Base Standard |
|---|---|---|---|---|---|---|---|
| | Part 25 | Part 2 | RSS-170 | RSS-GEN | | | |
| Configuration and Mode: Satellite PCS Transceiver | | | | | | | |
| 2.1 | 25.202(f) | 2.1053 | 5.4.3.1 | 6.13 | Radiated Spurious Emissions | Pass | ANSI C63.26 (2015) |
| 2.2 | 25.204 | 2.1046 | 5.3 | 6.12 | Equivalent Isotropic Radiated Power | Pass | ANSI C63.26 (2015) |

**Table 2**

## 1.4 Application Form

| EQUIPMENT DESCRIPTION | |
|---|---|
| Model Name/Number | SATcase |
| Part Number | SC01 |
| Hardware Version | V1.1 |
| Software Version | V0.0.190 |
| Technical Description (Please provide a brief description of the intended use of the equipment) | A satellite phone that integrates smartphone technology to make calls, send text messages and SOS requests. This device is Mil810 and IP68. |

| POWER SOURCE | | | | | |
|---|---|---|---|---|---|
| ☐ | AC mains | | State voltage 5 | | |
| AC supply frequency | | (Hz) | | | |
| | VAC | | | | |
| | Max Current | | | | |
| | Hz | | | | |
| ☐ | Single phase | | ☐ | Three phase | |
| And / Or | | | | | |
| ☒ | External DC supply | | | | |
| | Nominal voltage | | 5 V | Max Current 1 | A |
| | Extreme upper voltage | | 5.5 V | | |
| | Extreme lower voltage | | 4.5 V | | |
| Battery | | | | | |
| ☐ | Nickel Cadmium | | ☐ | Lead acid (Vehicle regulated) | |
| ☐ | Alkaline | | ☐ | Leclanche | |
| ☒ | Lithium | | ☐ | Other Details : | |
| 3.7 | Volts nominal. | | | | |
| End point voltage as quoted by equipment manufacturer | | | 4.2 | V | |

| FREQUENCY INFORMATION | | | | | |
|---|---|---|---|---|---|
| Frequency Range | 1616 to1626.5 | MHz | | | |
| Channel Spacing (where applicable) | 41.667kHz | | | | |
| Test Frequencies* | Bottom | 1616.020833 | MHz | Channel Number (if applicable) | 1 |
| | Middle | 1621.020833 | MHz | Channel Number (if applicable) | 121 |
| | Top | 1625.479167 | MHz | Channel Number (if applicable) | 240 |
| If alternate test modes are available resulting in different test frequencies please specify which mode is applicable: | | | | | |

| POWER CHARACTERISTICS | | | | |
|---|---|---|---|---|
| Maximum TX power | 7 | W | | |
| Minimum TX power | | W (if variable) | | |
| Is transmitter intended for : | | | | |
| Continuous duty | | | ☐ Yes | ☐ No |
| Intermittent duty | | | ☒ Yes | ☐ No |
| If intermittent state DUTY CYCLE | | | | |
| Transmitter ON | 8.3ms seconds | | | |
| Transmitter OFF | 73.4ms seconds | | | |

| ANTENNA CHARACTERISTICS | | | | |
|---|---|---|---|---|
| ☒ | Antenna connector | State impedance | 50 | Ohm |
| ☐ | Temporary antenna connector | State impedance | | Ohm |
| ☐ | Integral antenna | State impedance | 2.8 | dBi |

| MODULATION CHARACTERISTICS | | | |
|---|---|---|---|
| ☐ | Amplitude | ☐ | Frequency |
| ☒ | Phase | ☐ | Other (please provide details): |
| Can the transmitter operate un-modulated? | | ☐ Yes | ☒ No |

| CLASS OF EMISSION USED | | |
|---|---|---|
| ITU designation or Class of Emission: | | |
| | 1 | 41K7V7W |
| | (if applicable) 2 | V7D |
| | (if applicable) 3 | V7W |
| If more than three classes of emission, list separately: | | |

| EXTREME CONDITIONS | | | | | |
|---|---|---|---|---|---|
| Extreme test voltages (Max) | 5.5 | V | Extreme test voltages (Mix) | 4.5 | V |
| Nominal DC Voltage | 5 | V | DC Maximum Current | 1 | A |
| Maximum temperature | 65 | °C | Minimum temperature | -30 | °C |

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

Name: Darren Brook Position held: Project Manager
Date: 11 Oct 2017

## 1.5 Product Information

### 1.5.1 Technical Description

A satellite phone that integrates smartphone technology to make calls, send text messages and SOS requests. This device is Mil810 and IP68

## 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 |
|---|---|---|---|
| Serial Number: 300125060276200 | | | |
| 0 | As supplied by the customer | Not Applicable | Not Applicable |
| Serial Number: 300125060276260 | | | |
| 0 | As supplied by the customer | Not Applicable | Not Applicable |

**Table 3**

## 1.8 Test Location

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

| Test Name | Name of Engineer(s) | Accreditation |
|---|---|---|
| Configuration and Mode: Satellite PCS Transceiver | | |
| Radiated Spurious Emissions | Graeme Lawler | UKAS |
| Equivalent Isotropic Radiated Power | Matthew Russell | UKAS |

**Table 4**

Office Address:

Octagon House
Concorde Way
Segensworth North
Fareham
Hampshire
PO15 5RL
United Kingdom

# 2 Test Details

## 2.1 Radiated Spurious Emissions

### 2.1.1 Specification Reference

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

### 2.1.2 Equipment Under Test and Modification State

SC01, S/N: 300125060276260 - Modification State 0

### 2.1.3 Date of Test

14-November-2017

### 2.1.4 Test Method

Testing was performed in accordance with ANSI C63.26-2015 clause 5.5.

Prescans were performed using the direct field strength method. Any emissions found within 10 dB of the specification limit were formally measured using the substitution method.

RBW used was 1MHz which gives a worst case result.

The limit line on the prescan plots was calculated from equation c) in clause 5.2.7

### 2.1.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 22.0 °C |
| Relative Humidity | 34.0 % |

### 2.1.6 Test Results

Satellite PCS Transceiver

| Frequency (MHz) | Result (dBm) |
|---|---|
| * | |

**Table 5 - 1616.021 MHz - 1 GHz to 18 GHz**

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

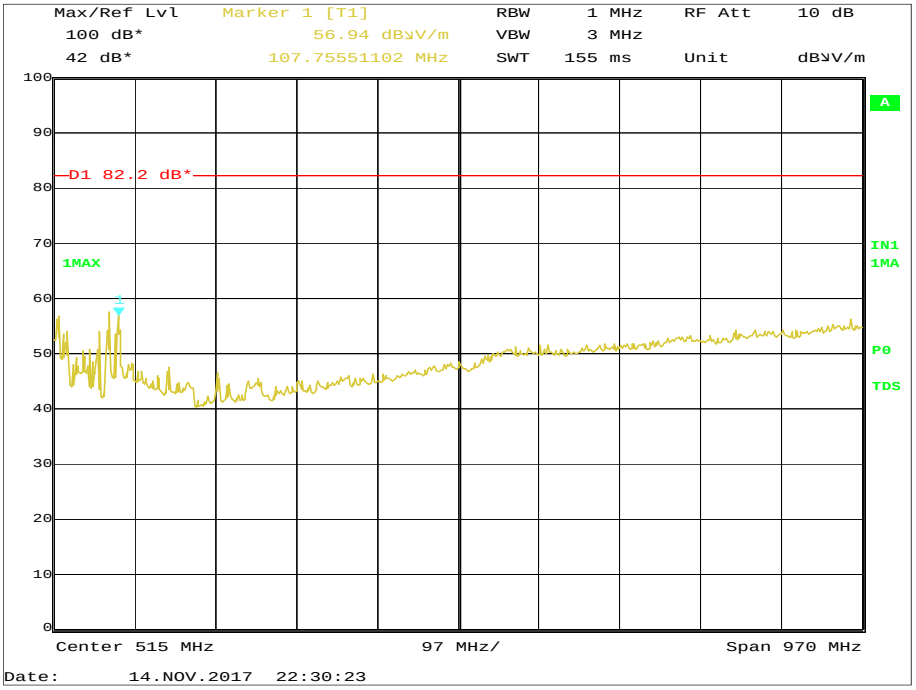


**Figure 1 - 1616.021 MHz - 30 MHz to 1 GHz**

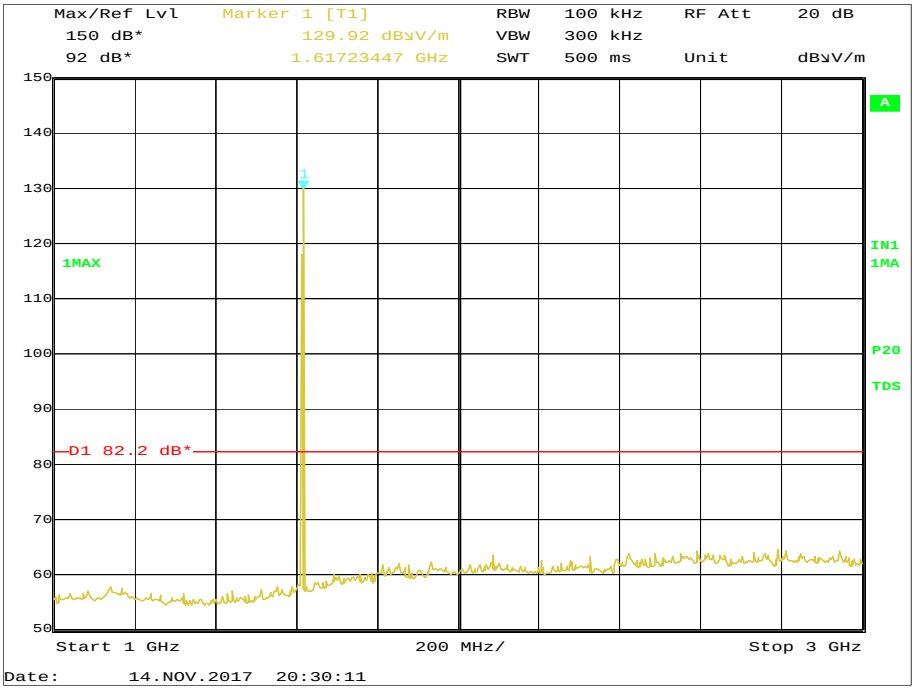


**Figure 2 - 1616.021 MHz - 1 GHz to 3 GHz**

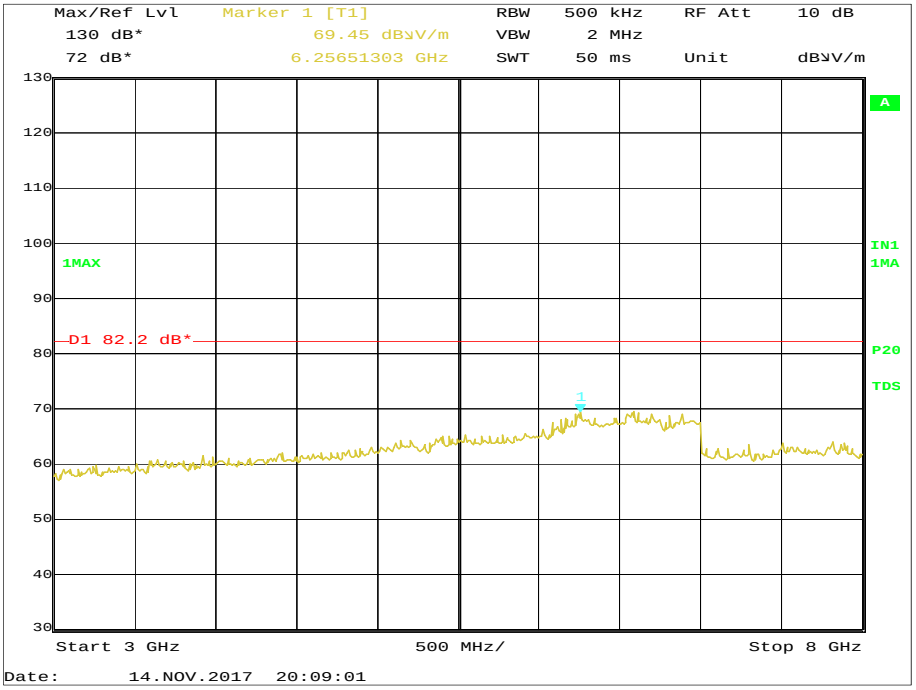


**Figure 3 - 1616.021 MHz - 3 GHz to 8 GHz**

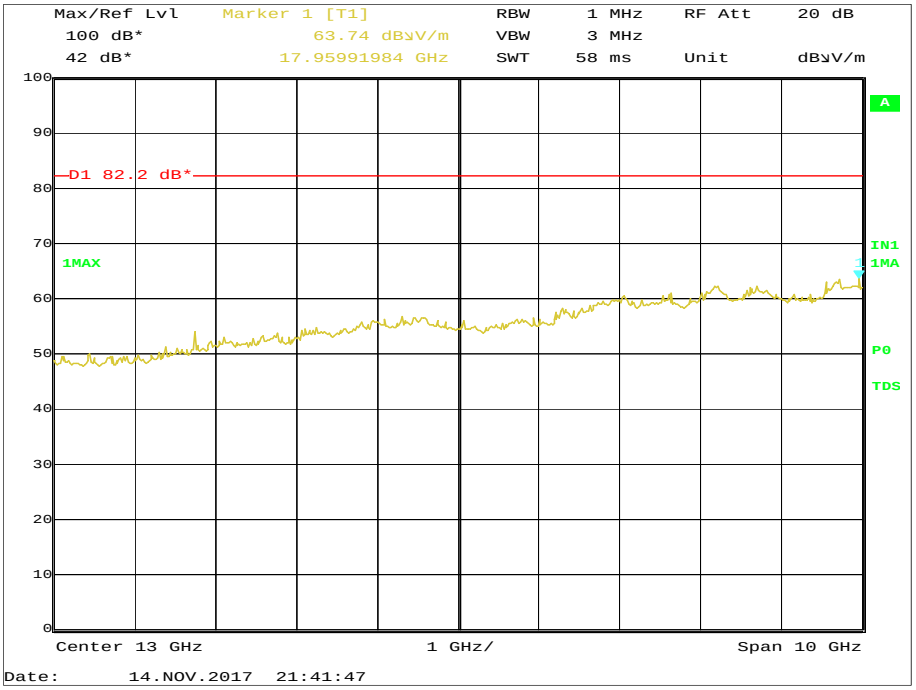


**Figure 4 - 1616.021 MHz - 8 GHz to 18 GHz**

| Frequency (MHz) | Result (dBm) |
|---|---|
| * | |

**Table 6 - 1621.021 MHz - 1 GHz to 18 GHz**

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

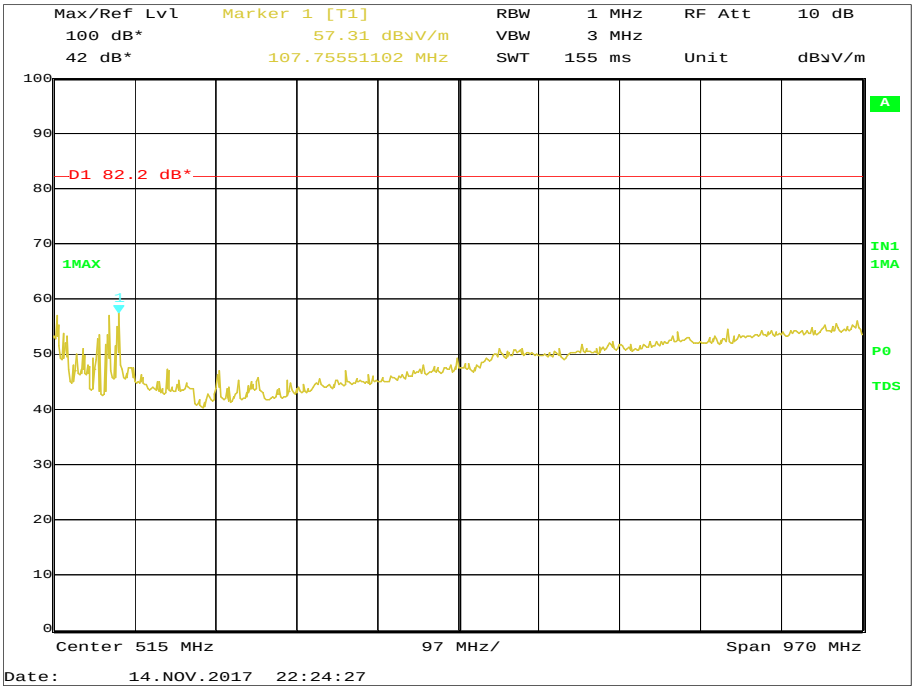


**Figure 5 – 1621.021 MHz - 30 MHz to 1 GHz**

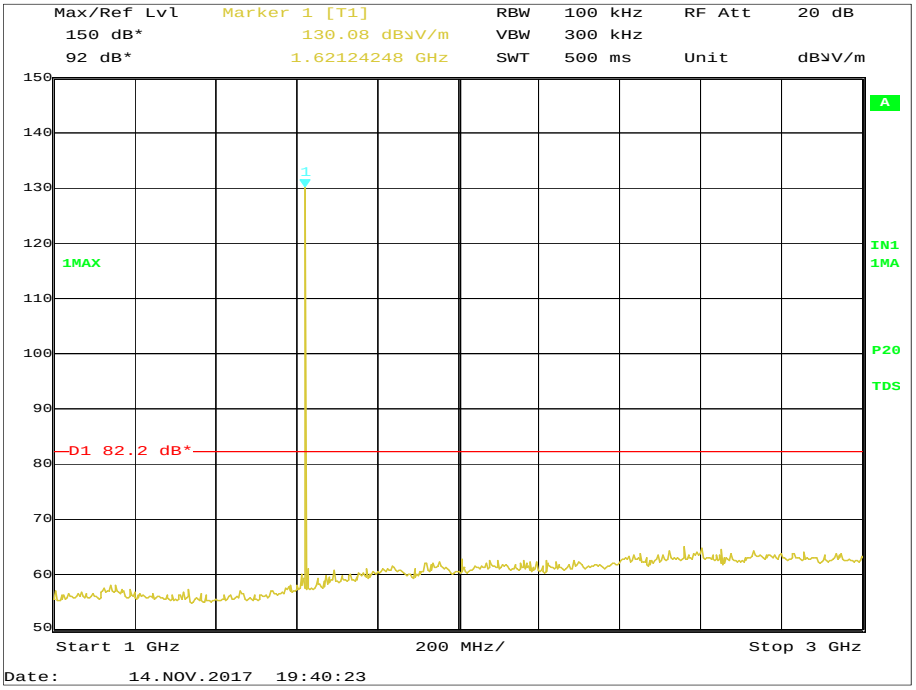


**Figure 6 - 1621.021 MHz - 1 GHz to 3 GHz**

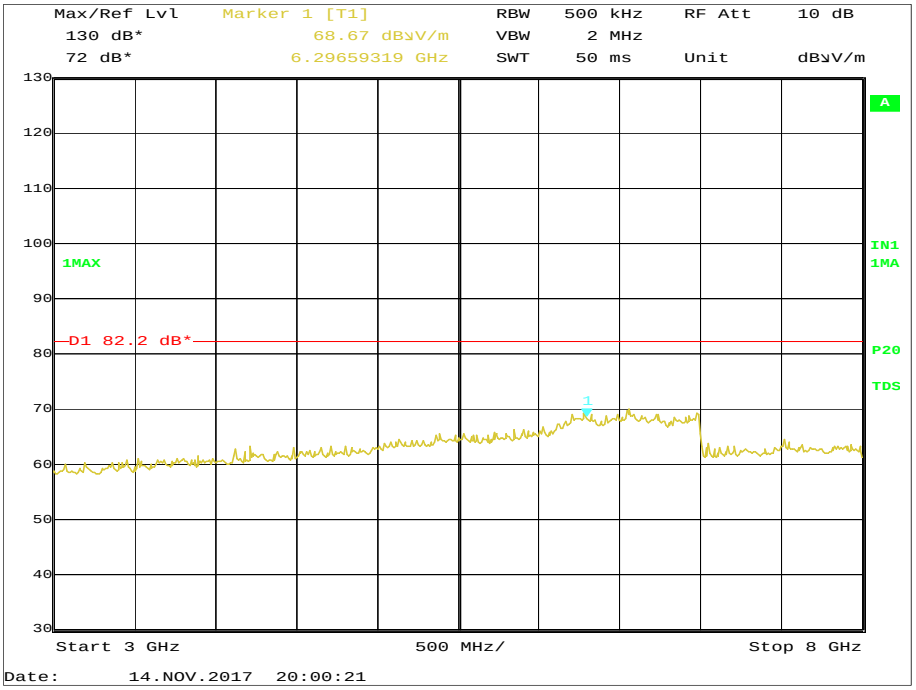


**Figure 7 - 1621.021 MHz - 3 GHz to 8 GHz**

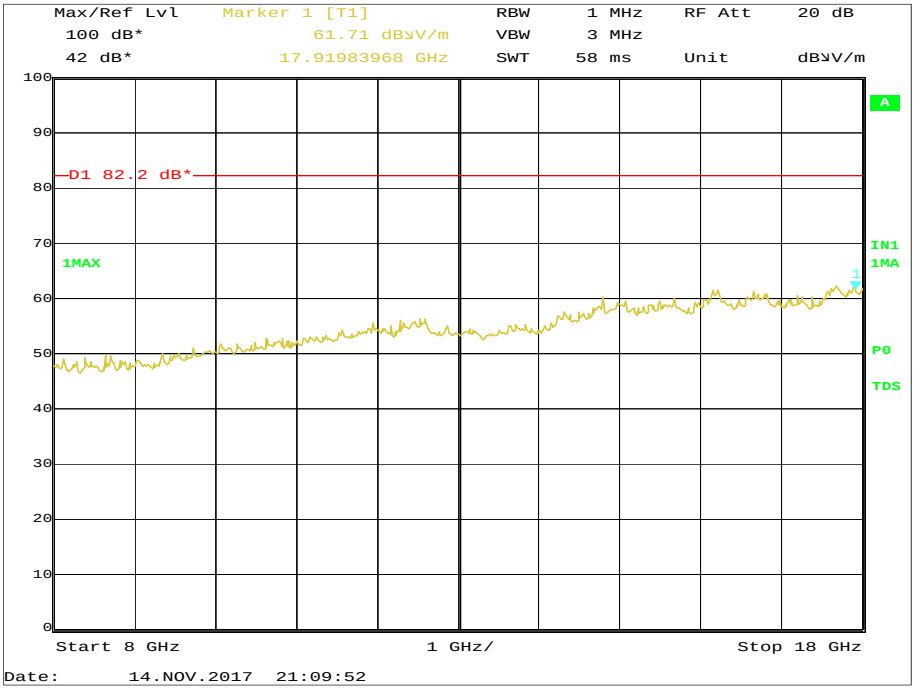


**Figure 8 - 1621.021 MHz - 8 GHz to 18 GHz**

| Frequency (MHz) | Result (dBm) |
|---|---|
| * | |

**Table 7 - 1625.479 MHz - 1 GHz to 18 GHz**

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

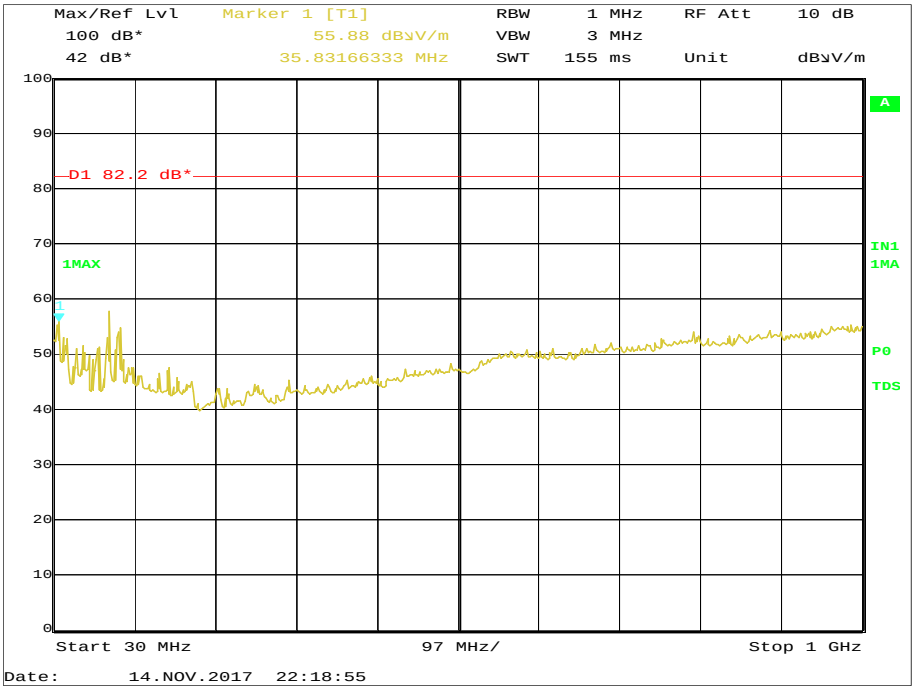


**Figure 9 – 1625.479 MHz - 30 MHz to 1 GHz**

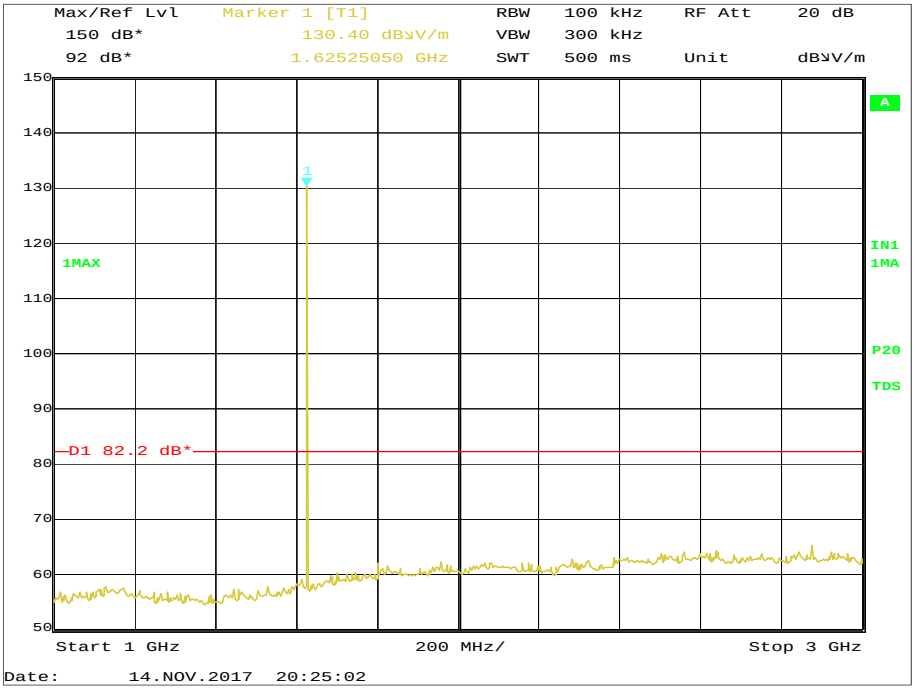


**Figure 10 - 1625.479 MHz - 1 GHz to 3 GHz**

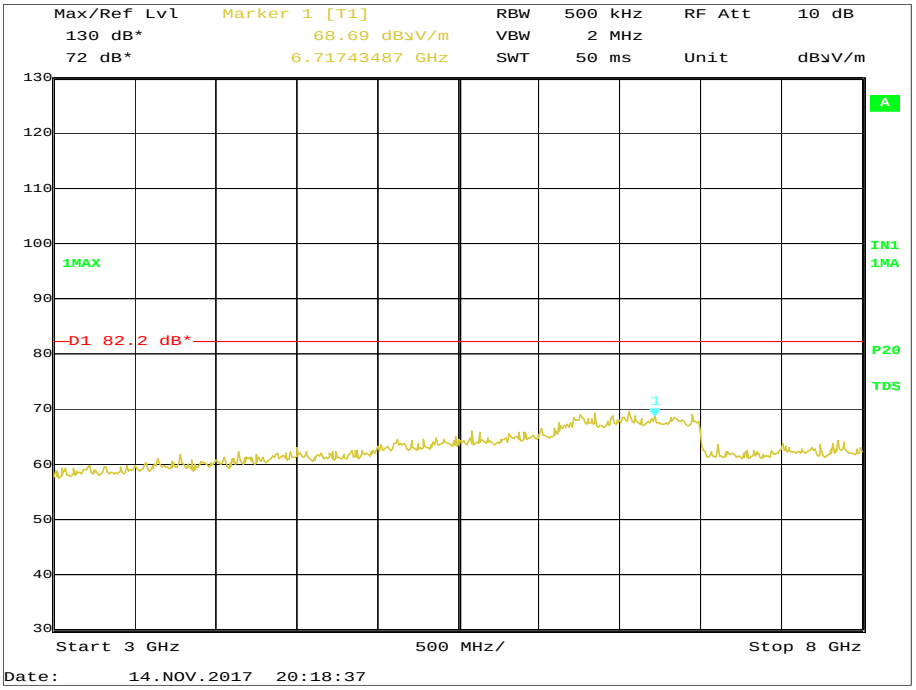


**Figure 11 - 1625.479 MHz - 3 GHz to 8 GHz**

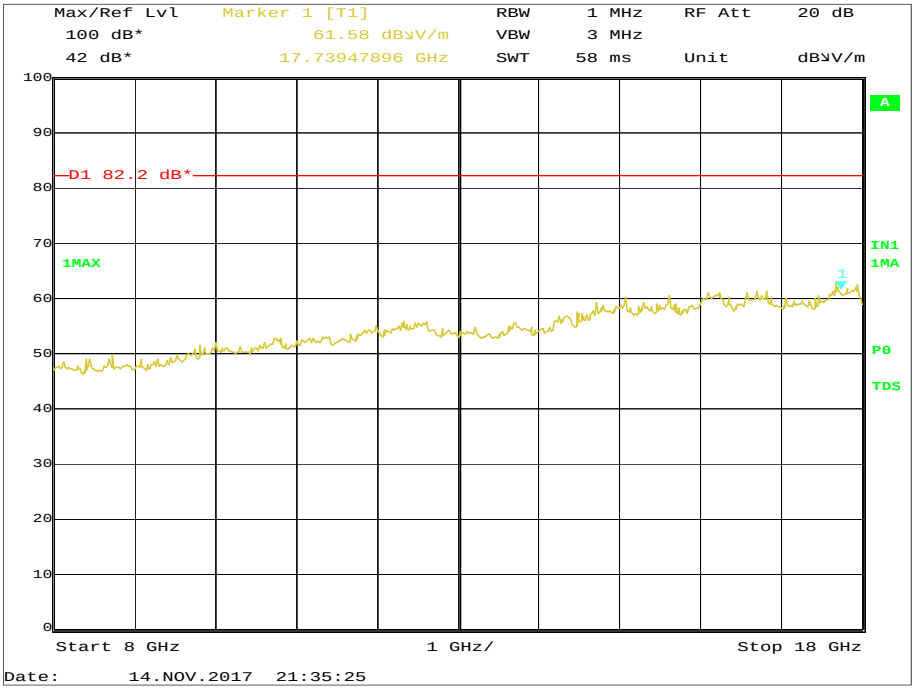


**Figure 12 - 1625.479 MHz - 8 GHz to 18 GHz**

FCC 47 CFR Part 2, Limit Clause 25.202(f)

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the authorised bandwidth;
2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the authorised bandwidth;
3) 43 + 10 Log p (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the authorised bandwidth.

Industry Canada RSS-170, Limit Clause 5.4.3.1

The average power of unwanted emissions shall be attenuated below the average output power, P(dBW), of the transmitter, as specified below:

1) 25 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 50%, up to and including 100% of the occupied bandwidth or necessary bandwidth, whichever is greater;
2) 35 dB in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 100%, up to and including 250% of the occupied bandwidth or necessary bandwidth, whichever is greater;

43 + 10 Log p (watts) in any 4 kHz band, the centre frequency of which is offset from the channel frequency by more than 250% of the occupied bandwidth or necessary bandwidth, whichever is greater.

### 2.1.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Test Receiver | Rohde & Schwarz | ESIB26 | 242 | 12 | 19-Jun-2018 |
| Antenna (Bilog) | Schaffner | CBL6143 | 287 | 24 | 18-Apr-2018 |
| Signal Generator (10MHz to 40GHz) | Rohde & Schwarz | SMR40 | 1002 | 12 | 20-Oct-2018 |
| Pre-Amplifier | Phase One | PS04-0086 | 1533 | 12 | 31-Jul-2018 |
| Screened Room (5) | Rainford | Rainford | 1545 | 36 | 20-Dec-2017 |
| Turntable Controller | Inn-Co GmbH | CO 1000 | 1606 | - | TU |
| Hygrometer | Rotronic | HYGROPALM 1 | 2338 | 12 | 24-Oct-2018 |
| Multimeter | Iso-tech | IDM101 | 2417 | 12 | 02-Oct-2018 |
| Cable (N-N, 8m) | Rhophase | NPS-2302-8000-NPS | 3248 | 12 | 02-May-2018 |
| Tilt Antenna Mast | maturo Gmbh | TAM 4.0-P | 3916 | - | TU |
| Mast Controller | maturo Gmbh | NCD | 3917 | - | TU |
| Suspended Substrate Highpass Filter | Advance Power Components | 11SH10-3000/X18000-O/O | 4411 | 12 | 22-May-2018 |
| Cable (Yellow, Rx, Km-Km 2m) | Scott Cables | KPS-1501-2000-KPS | 4527 | 6 | 04-Dec-2017 |
| Double Ridged Waveguide Horn Antenna | ETS-Lindgren | 3117 | 4722 | 12 | 17-Feb-2018 |

**Table 8**

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

## 2.2 Equivalent Isotropic Radiated Power

### 2.2.1 Specification Reference

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

### 2.2.2 Equipment Under Test and Modification State

SC01, S/N: 300125060276200 - Modification State 0

### 2.2.3 Date of Test

04-January-2018

### 2.2.4 Test Method

For compliance with the FCC requirements, where the limit is specified in terms of a 4 kHz reference bandwidth, ANCI C63.26 clause 5.2.4.4.1 and 5.2.4.5. Sweep triggering was utilized to perform measurements only during the active part of the burst.

The reference bandwidth was set to 3.9 kHz and a correction factor of 10*log(4/3.9) = 0.11 dB.

The final result (EIRP) was determined from the spectrum analyser result + reference bandwidth correction factor + antenna gain (2.8 dBi).

For compliance with Industry Canada RSS-170 requirements, this test was performed in accordance with ANSI C63.26, clause 5.2.4.3.1. Sweep triggering was utilized to perform measurements only during the active part of the burst.

The EUT was powered using a fully charged battery for this test.

### 2.2.5 Environmental Conditions

| | |
|---|---|
| Ambient Temperature | 23.2 °C |
| Relative Humidity | 44.5 % |

### 2.2.6 Test Results

Satellite PCS Transceiver

Maximum Rated EIRP: 7 W (38.5 dBm)

| EIRP (dBm/4kHz) | | |
|---|---|---|
| 1616.021 MHz | 1621.021 MHz | 1625.479 MHz |
| 30.38 | 30.35 | 30.59 |

**Table 9 – EIRP/4 kHz Results Table**

| 1616.021 MHz | | 1621.021 MHz | | 1625.479 MHz | |
|---|---|---|---|---|---|
| EIRP (dBm) | Δ from rated power (dB) | EIRP (dBm) | Δ from rated power (dB) | EIRP (dBm) | Δ from rated power (dB) |
| 35.44 | -3.06 | 35.33 | -3.17 | 35.20 | -3.30 |

**Table 10 - EIRP Results Table**

FCC 47 CFR Part 25, Limit Clause 25.204

+40 dBW in any 4 kHz band for $\theta \leq 0°$
+40 + 3θ dBW in any 4 kHz band for $0° < \theta \leq 5°$
For angles of elevation of the horizon greater than 5° there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.

Industry Canada RSS-170, Limit Clause 5.3

The application for MES certification shall state the MES e.i.r.p. that is necessary for satisfactory communication. The maximum permissible e.i.r.p. will be the stated necessary e.i.r.p. plus a 2 dB margin. If a detachable antenna is used, the certification application shall state the recommended antenna type and manufacturer, the antenna gain and the maximum transmitter output power at the antenna terminal.

### 2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 1.

| Instrument | Manufacturer | Type No | TE No | Calibration Period (months) | Calibration Due |
|---|---|---|---|---|---|
| Rubidium Standard | Rohde & Schwarz | XSRM | 1316 | 6 | 12-Mar-2018 |
| Attenuator (30dB/50W) | Aeroflex / Weinschel | 47-30-34 | 3164 | 12 | 11-Jul-2018 |
| Hygrometer | Rotronic | I-1000 | 3220 | 12 | 30-Aug-2018 |
| Frequency Standard | Spectracom | Secure Sync 1200-0408-0601 | 4393 | 6 | 12-Mar-2018 |
| 2 metre SMA Cable | Florida Labs | SMS-235SP-78.8-SMS | 4517 | 12 | 19-Sep-2018 |
| 1 metre K-Type Cable | Florida Labs | KMS-180SP-39.4-KMS | 4519 | 12 | 20-Dec-2018 |
| PXA Signal Analyser | Keysight Technologies | N9030A | 4653 | 12 | 12-Jan-2018 |
| Vector Signal Generator | Rohde & Schwarz | SMBV100A | 4886 | 12 | 11-May-2018 |

**Table 11**

O/P Mon – Output Monitored using calibrated equipment

# 3 Measurement Uncertainty

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

| Test Name | Measurement Uncertainty |
|---|---|
| Radiated Spurious Emissions | 30 MHz to 1 GHz: ± 5.1 dB<br>1 GHz to 18 GHz: ± 6.3 dB |
| Equivalent Isotropic Radiated Power | Conducted: ± 0.7 dB<br>Radiated: ± 6.3 dB (1 GHz to 18 GHz) |

**Table 12**