

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

Prepared for: SATcase
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FCC ID: 2AM7Y-SC01
IC: 23028-SC01



Product Service

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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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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	5612
Date	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)



Product Service

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	
<input type="checkbox"/> AC mains	State voltage 5
AC supply frequency (Hz)	
VAC	
Max Current	
Hz	
<input type="checkbox"/> Single phase	<input type="checkbox"/> Three phase
And / Or	
<input checked="" type="checkbox"/> External DC supply	
Nominal voltage	5 V Max Current 1 A
Extreme upper voltage	5.5 V
Extreme lower voltage	4.5 V
Battery	
<input type="checkbox"/> Nickel Cadmium	<input type="checkbox"/> Lead acid (Vehicle regulated)
<input type="checkbox"/> Alkaline	<input type="checkbox"/> Leclanche
<input checked="" type="checkbox"/> Lithium	<input type="checkbox"/> 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	1616.02 0833	MHz	Channel Number (if applicable)	1
	Middle	1621.02 0833	MHz	Channel Number (if applicable)	121
	Top	1625.47 9167	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		<input type="checkbox"/> Yes	<input type="checkbox"/> No
Intermittent duty		<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
If intermittent state DUTY CYCLE			
Transmitter ON	8.3ms	seconds	
Transmitter OFF	73.4ms	seconds	

ANTENNA CHARACTERISTICS			
<input checked="" type="checkbox"/> Antenna connector	State impedance	50	Ohm
<input type="checkbox"/> Temporary antenna connector	State impedance		Ohm
<input type="checkbox"/> Integral antenna	State impedance	2.8	dBi

MODULATION CHARACTERISTICS			
<input type="checkbox"/> Amplitude	<input type="checkbox"/> Frequency		
<input checked="" type="checkbox"/> Phase	<input type="checkbox"/> Other (please provide details):		
Can the transmitter operate un-modulated?		<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> 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
 Date: 11 Oct 2017

Position held: Project Manager

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.

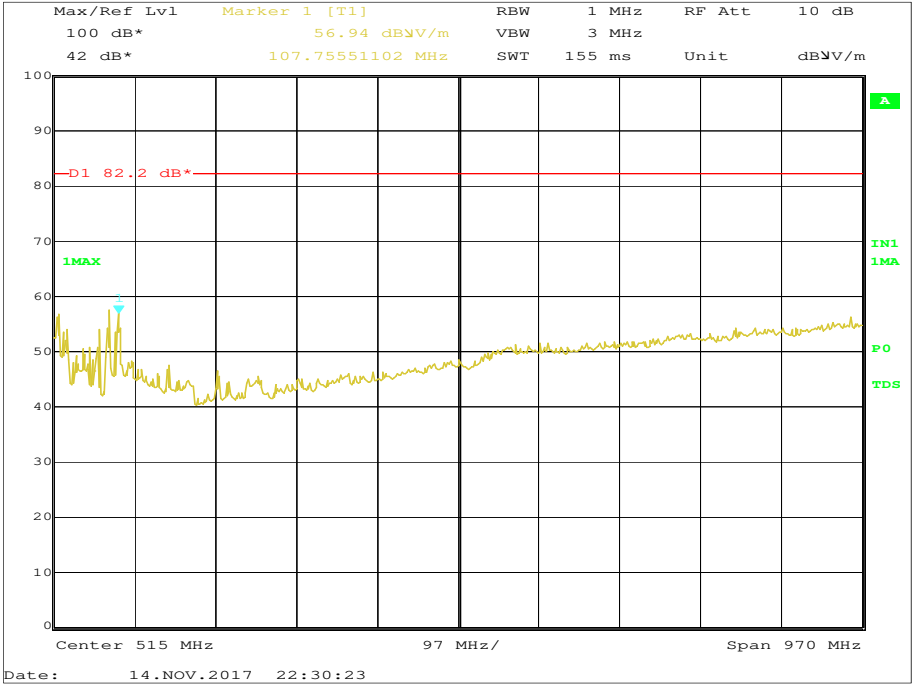


Figure 1 - 1616.021 MHz - 30 MHz to 1 GHz

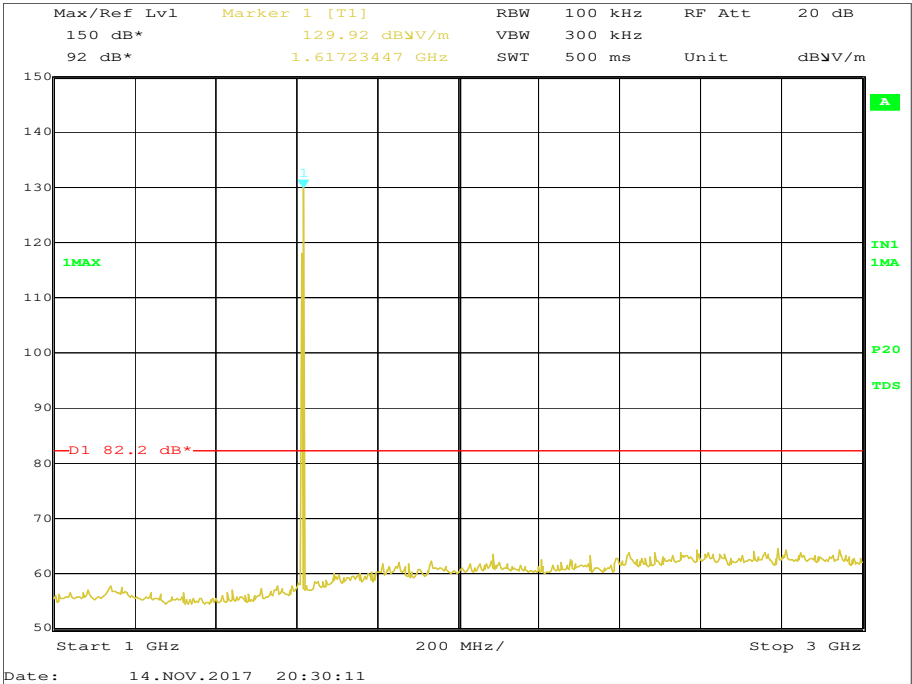


Figure 2 - 1616.021 MHz - 1 GHz to 3 GHz

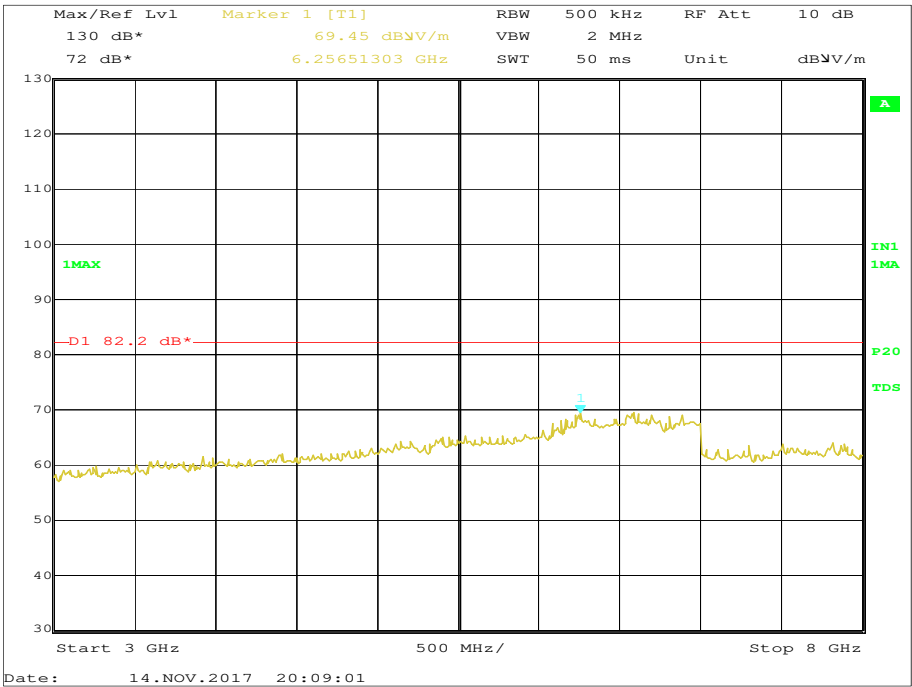


Figure 3 - 1616.021 MHz - 3 GHz to 8 GHz

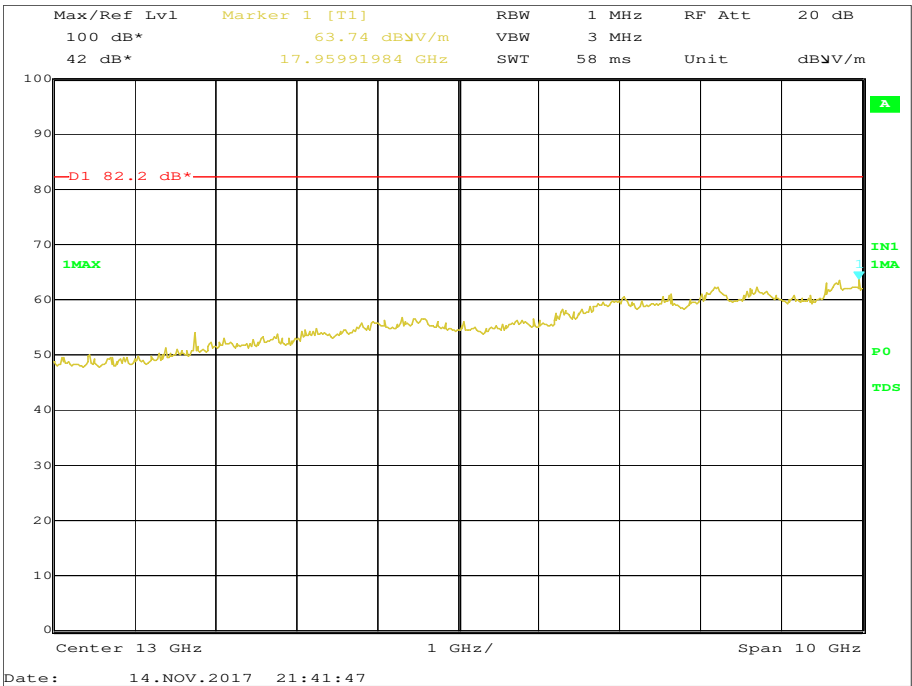


Figure 4 - 1616.021 MHz - 8 GHz to 18 GHz

Frequency (MHz)	Result (dBm)
*	

Table 6 - 1621.021 MHz - 1 GHz to 18 GHz

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

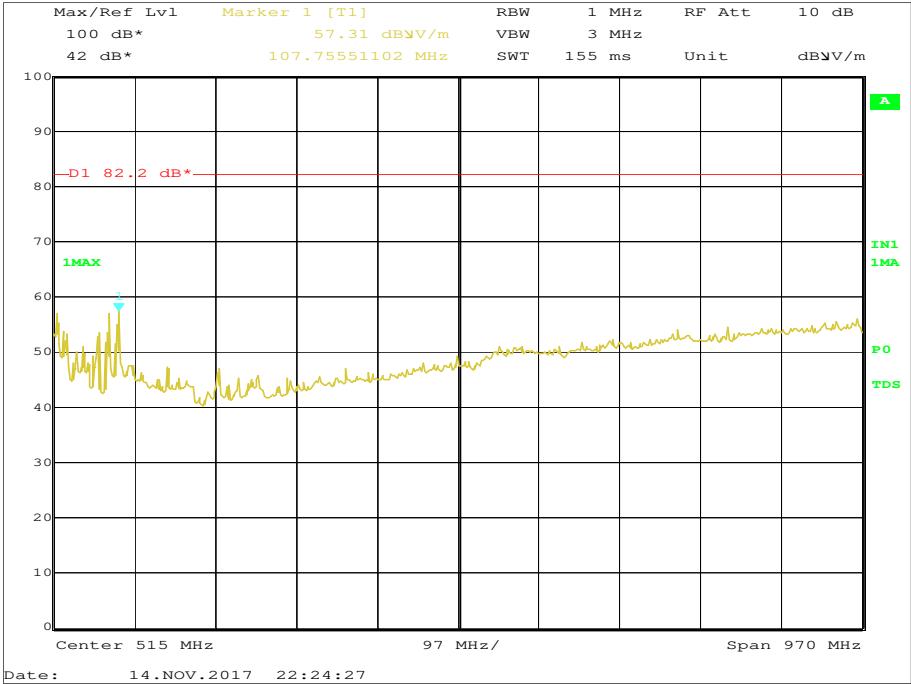


Figure 5 – 1621.021 MHz - 30 MHz to 1 GHz

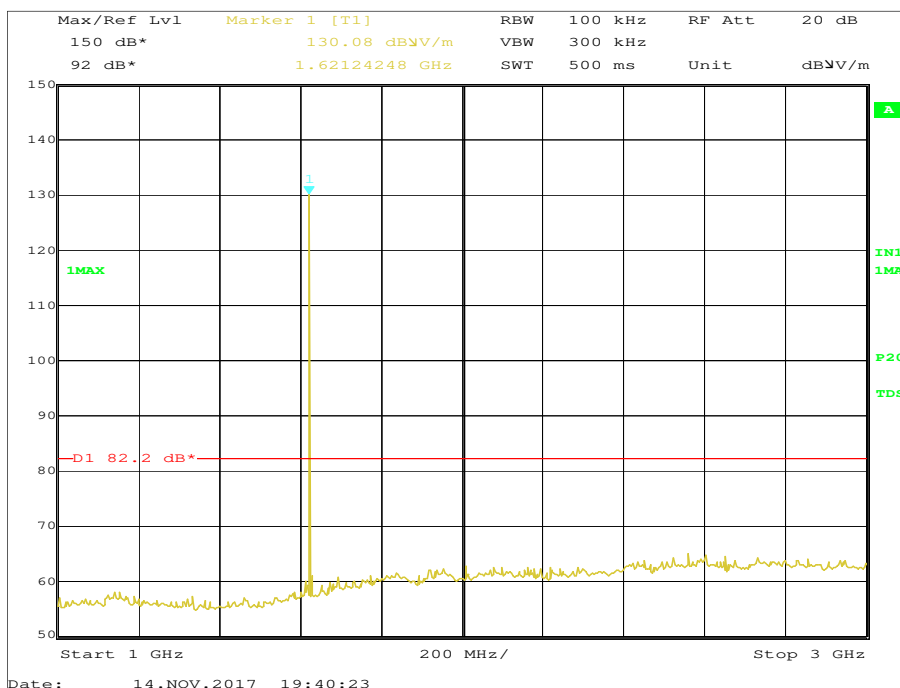


Figure 6 - 1621.021 MHz - 1 GHz to 3 GHz

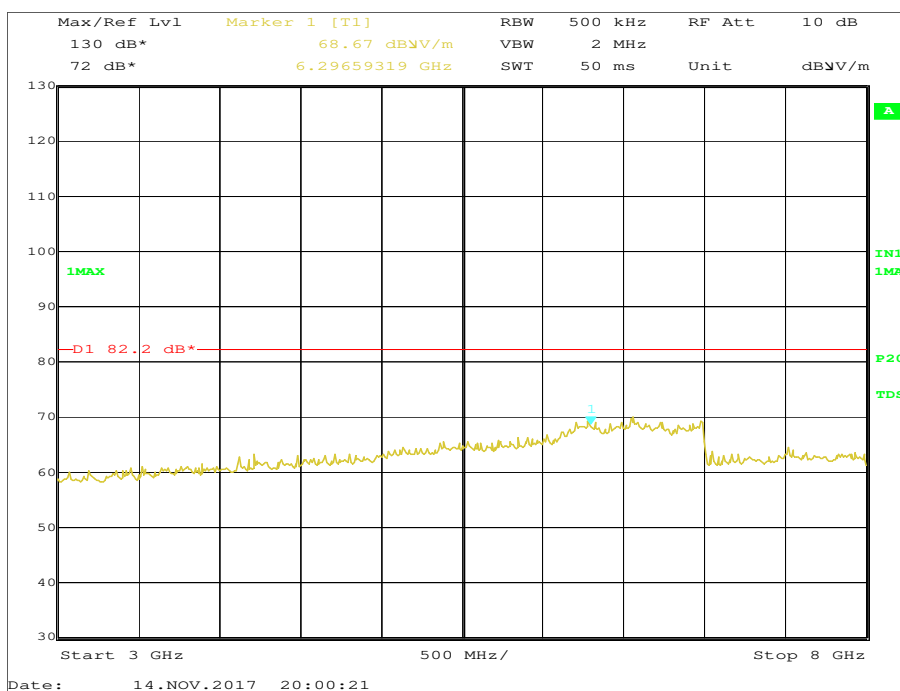


Figure 7 - 1621.021 MHz - 3 GHz to 8 GHz



Product Service

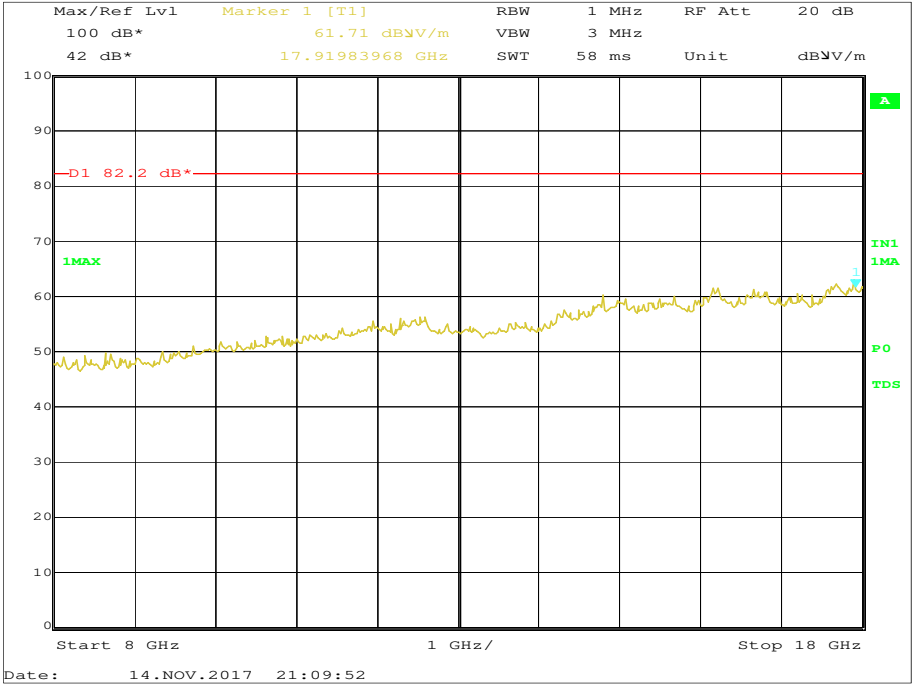


Figure 8 - 1621.021 MHz - 8 GHz to 18 GHz

Frequency (MHz)	Result (dBm)
*	

Table 7 - 1625.479 MHz - 1 GHz to 18 GHz

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

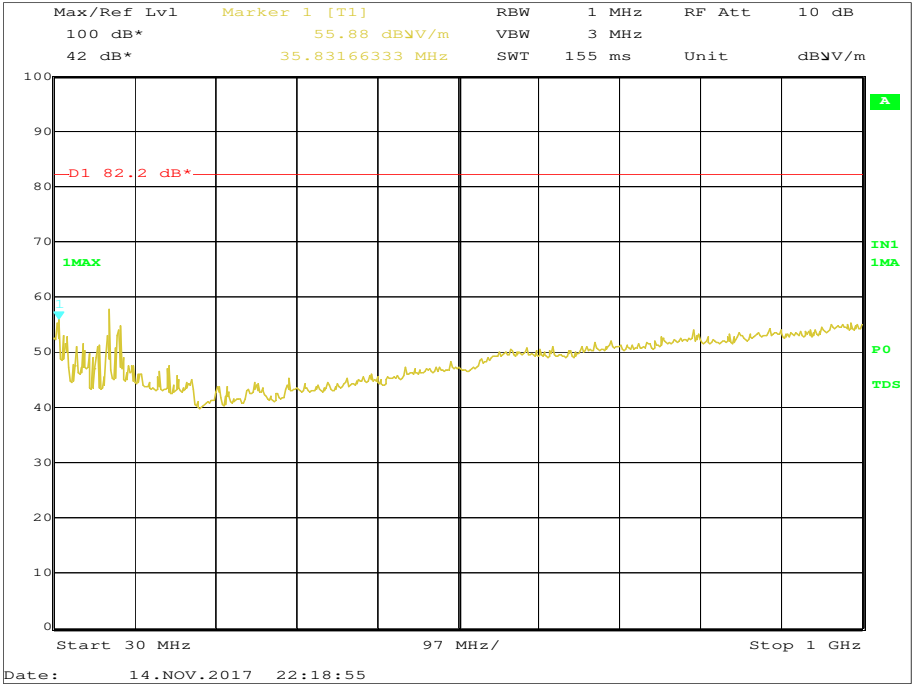


Figure 9 – 1625.479 MHz - 30 MHz to 1 GHz

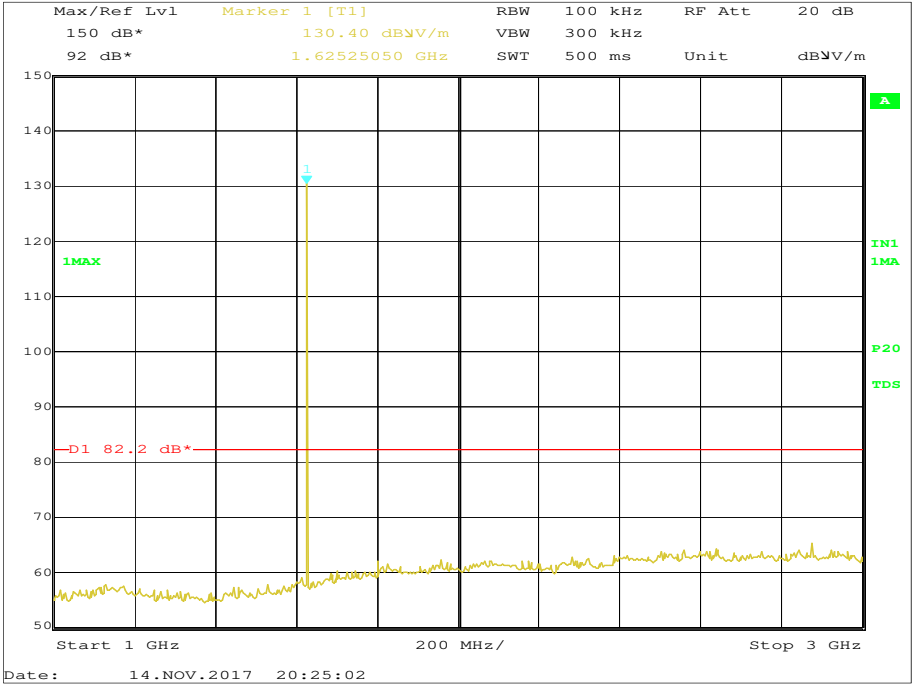


Figure 10 - 1625.479 MHz - 1 GHz to 3 GHz

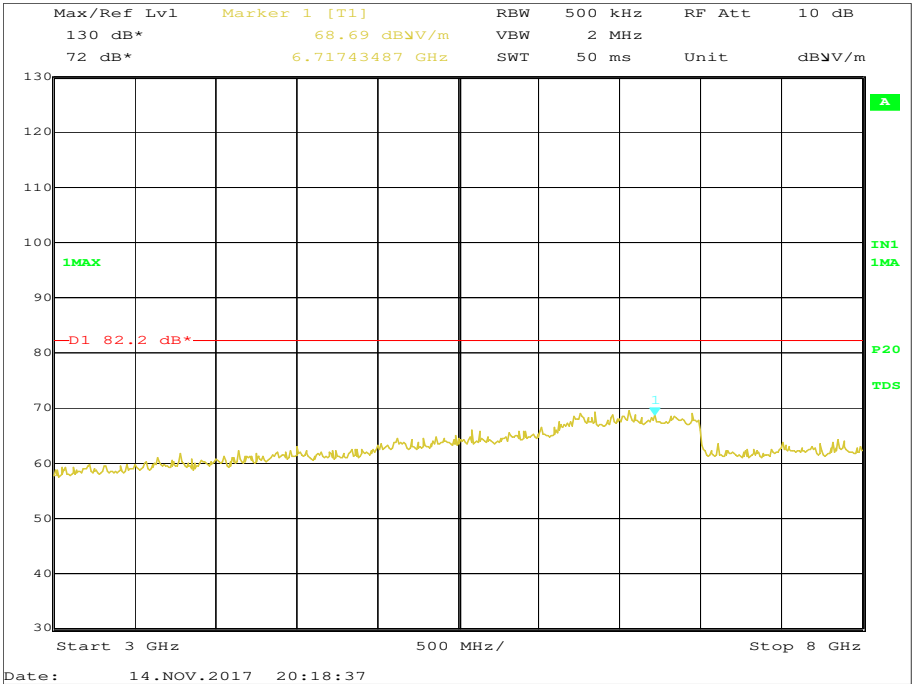


Figure 11 - 1625.479 MHz - 3 GHz to 8 GHz

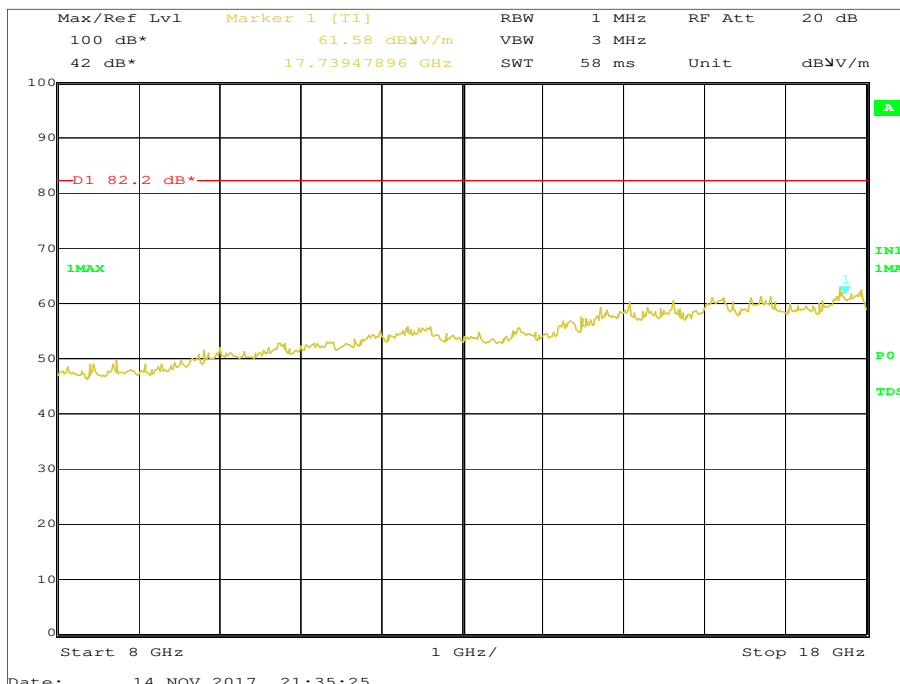


Figure 12 - 1625.479 MHz - 8 GHz to 18 GHz

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, ANSI 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 $10 \cdot \log(4/3.9) = 0.11$ 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 $\theta \leq 0^\circ$

+40 + 3 θ dBW in any 4 kHz band for $0^\circ < \theta \leq 5^\circ$

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 1 GHz to 18 GHz: ± 6.3 dB
Equivalent Isotropic Radiated Power	Conducted: ± 0.7 dB Radiated: ± 6.3 dB (1 GHz to 18 GHz)

Table 12