Report on the FCC and IC Testing of the SATcase Limited SATcase. Model: SC01 In accordance with FCC 47 CFR Part 15C and Industry Canada RSS-247 and Industry Canada RSS-GEN

Prepared for: SATcase
Baird Lane
Heslington
York
YO10 5GA
United Kingdom

Product Service

Choose certainty.
Add value.

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

COMMERCIAL-IN-CONFIDENCE

Date: January 2018
Document Number: 75938844-07 | Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Steven White	17 January 2018	
Authorised Signatory	Nic Forsyth	17 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 15C and Industry Canada RSS-247 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	17 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 15C: 2016, Industry Canada RSS-247: Issue 2 (2017-02) and Industry Canada RSS-GEN: Issue 4 (2014-11) for the tests detailed in section 1.3.

TÜV SÜD Product Service
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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	17 January 2018

Table 1

1.2 Introduction

Applicant	SATcase Limited
Manufacturer	SATcase Limited
Model Number(s)	SC01
Serial Number(s)	300125060276260
Hardware Version(s)	V1.1
Software Version(s)	V0.0.190
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2016 Industry Canada RSS-247: Issue 2 (2017-02 Industry Canada RSS-GEN: Issue 4 (2014-11)
Order Number Date	5612 20-April-2017
Date of Receipt of EUT	02-November-2017
Start of Test	18-December-2017
Finish of Test	18-December-2017
Name of Engineer(s)	Graeme Lawler
Related Document(s)	ANSI C63.10 (2013) KDB 662911 D01 v02r02

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1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C and Industry Canada RSS-247 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: Bluetooth Transceiver						
2.1	15.247 (b)(3)	5.4	-	Maximum Conducted Output Power	Pass	ANSI C63.10 KDB 662911 D01 v02r02
2.2	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10
2.3	15.205	-	8.10	Restricted Band Edges	Pass	ANSI C63.10
2.3	15.247 (a)(2)	5.2	6.6	Emission Bandwidth	Pass	ANSI C63.10
2.4	15.247 (d) and 15.205	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10

Table 2

1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	SATcase
Part Number	SC01
Hardware Version	V1.1
Software Version	V0.0.190
FCC ID (if applicable)	2AM7Y-SC01
Industry Canada ID (if applicable)	23028-SC01
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..

Types of Modulations used by the Equipment	
☐	FHSS
☒	Other forms of modulation
In case of FHSS Modulation	
In case of non-Adaptive Frequency Hopping equipment:	
	Number of Hopping Frequencies:
In case of Adaptive Frequency Hopping Equipment:	
	Maximum number of Hopping Frequencies:
	Minimum number of Hopping Frequencies:
Dwell Time:	
Adaptive / non-adaptive equipment:	
☐	non-adaptive Equipment
☒	adaptive Equipment without the possibility to switch to a non-adaptive mode
☐	adaptive Equipment which can also operate in a non-adaptive mode
In case of adaptive equipment:	
The maximum Channel Occupancy Time implemented by the equipment: 0.625 ms	
☐	The equipment has implemented an LBT based DAA mechanism
In case of equipment using modulation different from FHSS:	
☒	The equipment is Frame Based equipment
☐	The equipment is Load Based equipment
☐	The equipment can switch dynamically between Frame Based and Load Based equipment
The CCA time implemented by the equipment: µs	
☒	The equipment has implemented an non-LBT based DAA mechanism
☐	The equipment can operate in more than one adaptive mode

In case of non-adaptive Equipment:		
The maximum RF Output Power (e.i.r.p.): 2.5 dBm		
The maximum (corresponding) Duty Cycle: 65 %		
Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):		
The worst case operational mode for each of the following tests:		
RF Output Power: 3dBm		
Power Spectral Density:		
Duty cycle, Tx-Sequence, Tx-gap: 65.12%		
Accumulated Transmit Time, Frequency Occupation & Hopping Sequence (only for FHSS equipment):		
Hopping Frequency Separation (only for FHSS equipment):		
Medium Utilisation: 100%		
Adaptivity & Receiver Blocking:		
Nominal Channel Bandwidth: 500kHz at 6dB		
Transmitter unwanted emissions in the OOB domain:		
Transmitter unwanted emissions in the spurious domain:		
Receiver spurious emissions:		
The different transmit operating modes (tick all that apply):		
☒	Operating mode 1: Single Antenna Equipment	
	☒	Equipment with only 1 antenna
	☐	Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
	☐	Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)
☐	Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming	
	☐	Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
NOTE: Add more lines if more channel bandwidths are supported.		
☐	Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming	
	☐	Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
NOTE: Add more lines if more channel bandwidths are supported.		

In case of Smart Antenna Systems:
The number of Receive chains:
The number of Transmit chains:
☐ symmetrical power distribution
☐ asymmetrical power distribution
In case of beam forming, the maximum (additional) beam forming gain: dB
NOTE: The additional beam forming gain does not include the basic gain of a single antenna.
Operating Frequency Range(s) of the equipment:
Operating Frequency Range 1: 2402 MHz to 2480 MHz
Operating Frequency Range 2: MHz to MHz
Operating Frequency Range 3: MHz to MHz
NOTE: Add more lines if more Frequency Ranges are supported.
Nominal Channel Bandwidth(s):
Nominal Channel Bandwidth1: 1 MHz
Nominal Channel Bandwidth2: MHz
Nominal Channel Bandwidth3: MHz
Nominal Channel Bandwidth4: MHz
Nominal Channel Bandwidth5: MHz
NOTE: Add more lines if more channel bandwidths are supported.
Type of Equipment (stand-alone, combined, plug-in radio device, etc.):
☒ Stand-alone
☐ Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
☐ Plug-in radio device (Equipment intended for a variety of host systems)
☐ Other
The normal and extreme operating conditions that apply to the equipment:
Normal operating conditions (if applicable):
Operating temperature: -40 to +85 °C
Other (please specify if applicable):
Extreme operating conditions:
Operating temperature range: Minimum °C to Maximum °C
Other (please specify if applicable): Minimum °C to Maximum °C
Details provided are for the:
☒ stand-alone equipment
☐ combined (or host) equipment
☐ test jig

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The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:			
Antenna Type:			
☒ Integral Antenna (information to be provided in case of conducted measurements)			
Antenna Gain: -0.5 dBi			
If applicable, additional beamforming gain (excluding basic antenna gain): dB			
☐ Temporary RF connector provided			
☐ No temporary RF connector provided			
☐ Dedicated Antennas (equipment with antenna connector)			
☐ Single power level with corresponding antenna(s)			
☐ Multiple power settings and corresponding antenna(s)			
Number of different Power Levels: 1			
Power Level 1: 2.5 dBm			
Power Level 2: dBm			
Power Level 3: dBm			
NOTE 1: Add more lines in case the equipment has more power levels.			
NOTE 2: These power levels are conducted power levels (at antenna connector).			
For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable			
Power Level 1: 3 dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1	-0.5dBi		Johanson 2450AT18B100
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 2: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 3: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	**Gain (dBi)**	**e.i.r.p (dBm)**	**Part number or model number**
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			

The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:	
Details provided are for the:	
☒ stand-alone equipment	
☐ combined (or host) equipment	
☐ test jig	
Supply Voltage ☐ AC mains State AC voltage 5 V	
☒ DC State DC voltage 5 V	
In case of DC, indicate the type of power source	
☐ Internal Power Supply	
☒ External Power Supply or AC/DC adapter	
☒ Battery	
☐ Other:	
Describe the test modes available which can facilitate testing:	
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3] IEEE 802.15.4™ [i.4], proprietary, etc.):	
Bluetooth	
If applicable, the statistical analysis referred in clause 5.4.1 q)	
To be provided as separate attachment	
If applicable, the statistical analysis referred in clause 5.4.1 r)	
To be provided as separate attachment	
Geo-location capability supported by the equipment:	
☒ Yes	
☐ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.	
☐ No	
Describe the minimum performance criteria that apply to the equipment (see clause 4.3.1.12.3 or 4.3.2.11.3)	
Combination for testing (see clause 5.3.2.3 of EN 300 328 V21.1)	
From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 5.4.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment. Unless otherwise specified in ETSI EN 300 328, this power setting is to be used for testing against the requirements of ETSI EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also ETS EN 300 328, clause 5.3.2.3	
Highest overall e.i.r.p. value: -2.5 dBm	
Corresponding Antenna assembly gain: -0.5 dBi	Antenna Assembly #:
Corresponding conducted power setting: 3 dBm (also the power level to be used for testing)	Listed as Power Setting #:
Additional information provided by the applicant	
Modulation	
ITU Class(es) of emission:	
Can the transmitter operate unmodulated? ☐ Yes ☒ No	

Duty Cycle	
The transmitter is intended for:	
☐	Continuous duty
☐	Intermittent duty
☒	Continuous operation possible for testing purposes
About the UUT	
☐	The equipment submitted are representative production models
☐	If not, the equipment submitted are pre-production models?
☒	If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested
☐	If not, supply full details
☐	The equipment submitted is CE marked
Additional items and/or supporting equipment provided	
☒	Spare batteries (e.g. for portable equipment)
☐	Battery charging device
☒	External Power Supply or AC/DC adapter
☐	Test Jig or interface box
☐	RF test fixture (for equipment with integrated antennas)
☐	Host System
	Manufacturer
	Model
	Model Name
☐	Combined equipment
	Manufacturer
	Model
	Model Name
☒	User Manual
☒	Technical documentation (Handbook and circuit diagrams)

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: 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: Bluetooth Transceiver		
Maximum Conducted Output Power	Graeme Lawler	UKAS
Authorised Band Edges	Graeme Lawler	UKAS
Restricted Band Edges	Graeme Lawler	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS

Table 4

Office Address:

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

2 Test Details

2.1 Maximum Conducted Output Power

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)(3)
Industry Canada RSS-247, Clause 5.4
Industry Canada RSS-GEN, Clause 6.12

2.1.2 Equipment Under Test and Modification State

SC01, S/N: 300125060276260 - Modification State 0

2.1.3 Date of Test

18-December-2017

2.1.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 11.9.1.1.

2.1.5 Environmental Conditions

Ambient Temperature	19.5 °C
Relative Humidity	31.0 %

2.1.6 Test Results

Bluetooth Transceiver

Frequency (MHz)	Output Power	
	dBm	mW
2402	-24.57	0.0035
2440	-25.00	0.0032
2478	-25.07	0.0031

Table 5

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(3)

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

Industry Canada RSS-247, Limit Clause 5.4 (d)

For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1 W. The e.i.r.p. shall not exceed 4 W, except as provided in section 5.4(e) of the specification.

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
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	1002	12	20-Oct-2018
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Digital Multimeter	Iso-tech	IDM-101	2895	12	20-Jul-2018
Antenna (DRG Horn)	ETS-Lindgren	3115	3125	12	21-Jul-2018
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	12	02-May-2018
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	04-May-2018
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	22-May-2018
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	17-Feb-2018

Table 6

TU - Traceability Unscheduled

2.2 Authorised Band Edges

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d)
Industry Canada RSS-247, Clause 5.5

2.2.2 Equipment Under Test and Modification State

SC01, S/N: 300125060276260 - Modification State 0

2.2.3 Date of Test

18-December-2017

2.2.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.10.4.

2.2.5 Environmental Conditions

Ambient Temperature	19.5 °C
Relative Humidity	31.0 %

2.2.6 Test Results

Bluetooth Transceiver

Packet Type	Frequency (MHz)	Measured Frequency (MHz)	Level (dBc)
DH1	2402	2400	-20.60
DH1	2478	2483.5	-20.78

Table 7

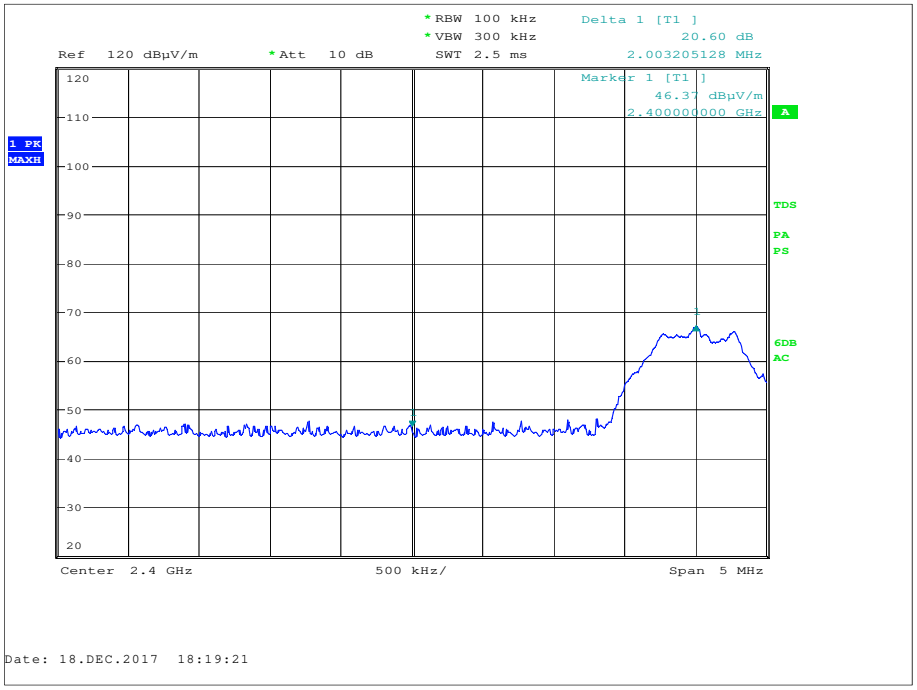

Figure 1 - DH1 – 2402 MHz - Measured Frequency 2400 MHz

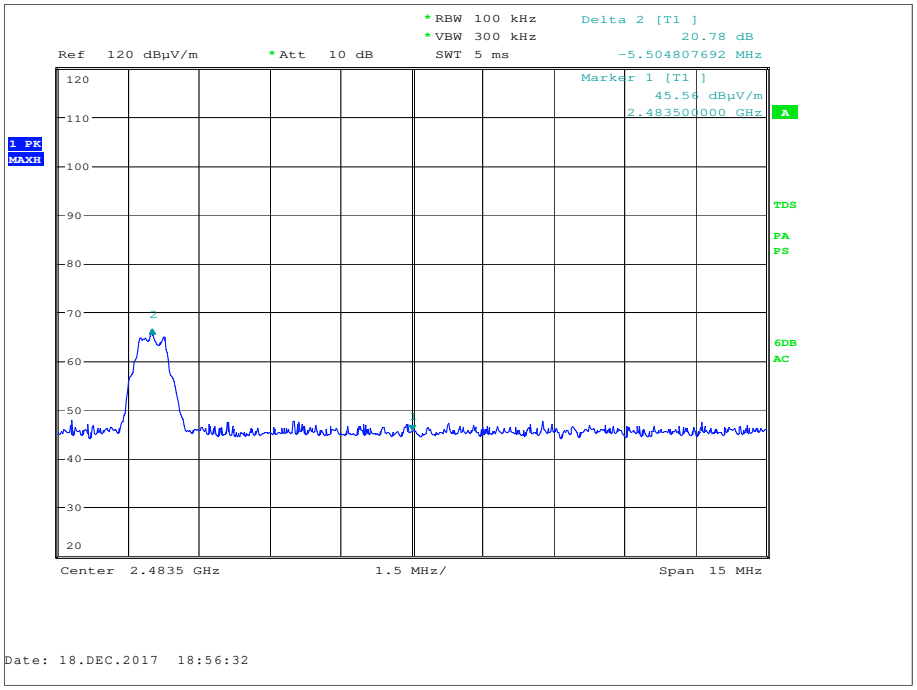

Figure 2 - DH1 – 2478 MHz - Measured Frequency 2483.5 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.2.7 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
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Digital Multimeter	Iso-tech	IDM-101	2895	12	20-Jul-2018
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	12	02-May-2018
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	12-Nov-2017
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	04-May-2018
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	22-May-2018
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	17-Feb-2018

Table 8

TU - Traceability Unscheduled

2.3 Restricted Band Edges

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205
Industry Canada RSS-GEN, Clause 8.10

2.3.2 Equipment Under Test and Modification State

SC01, S/N: 300125060276260 - Modification State 0

2.3.3 Date of Test

18-December-2017

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.10.5.

Plots for average measurements were taken in accordance with ANSI C63.10 clause 4.1.4.2.3. These are shown for information purposes and were used to determine the worst case measurement point. Final average measurements were then taken in accordance with ANSI C63.10 clause 4.1.4.2.2. to obtain the measurement result recorded in the test results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

2.3.5 Environmental Conditions

Ambient Temperature	19.5 °C
Relative Humidity	31.0 %

2.3.6 Test Results

Bluetooth Transceiver

Packet Type	Frequency (MHz)	Measured Frequency (MHz)	Peak Level (dBµV/m)	Average Level (dBµV/m)
DH1	2402	2390	57.06	45.15
DH1	2478	2483.5	57.06	45.41

Table 9

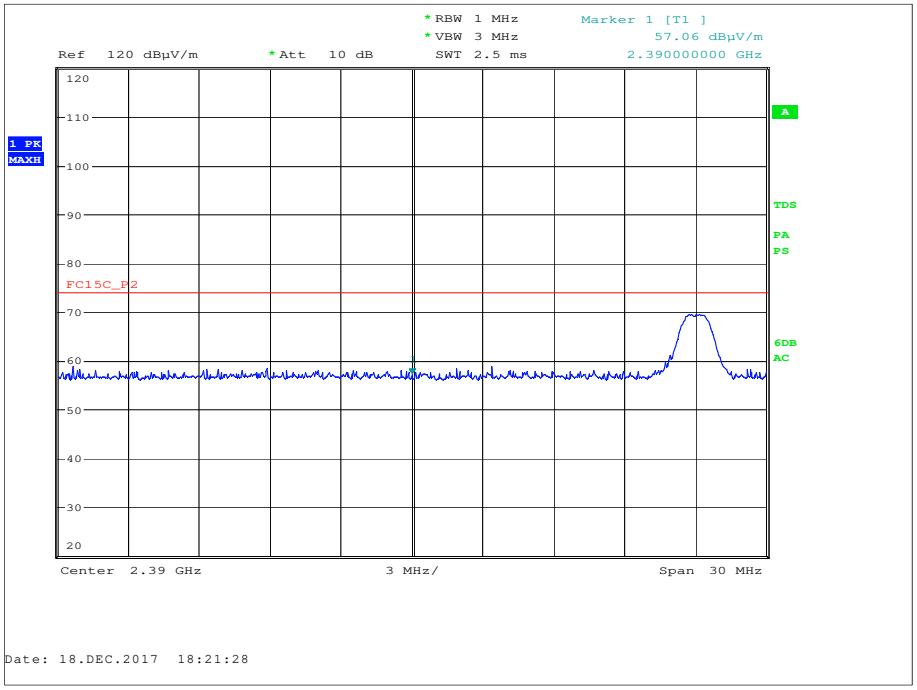

Figure 3 - DH1 – 2402 MHz - Measured Frequency 2390 MHz - Peak

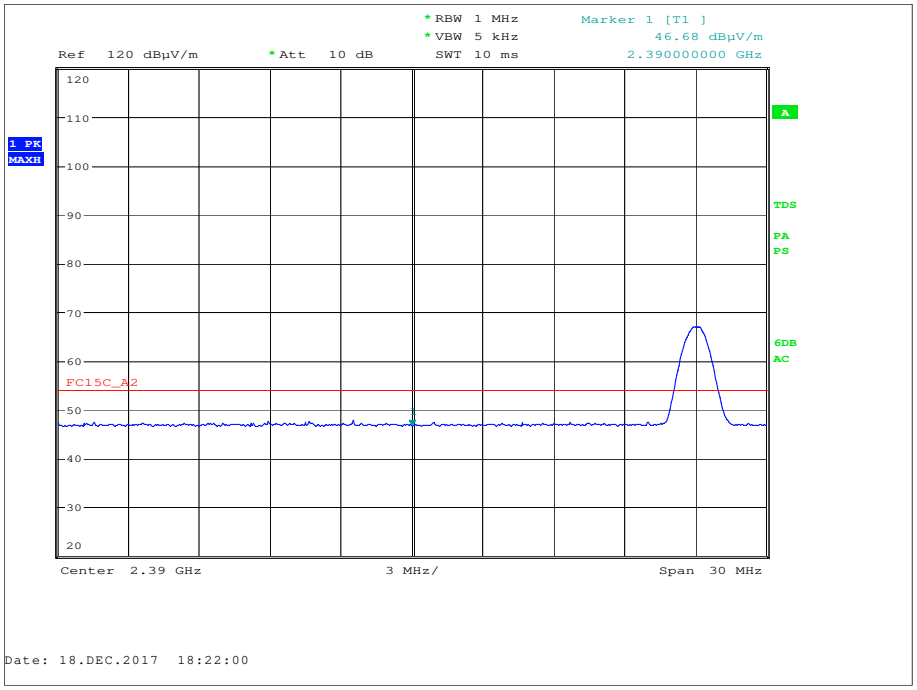

Figure 4 - DH1 - 2402 MHz - Measured Frequency 2390 MHz - Average

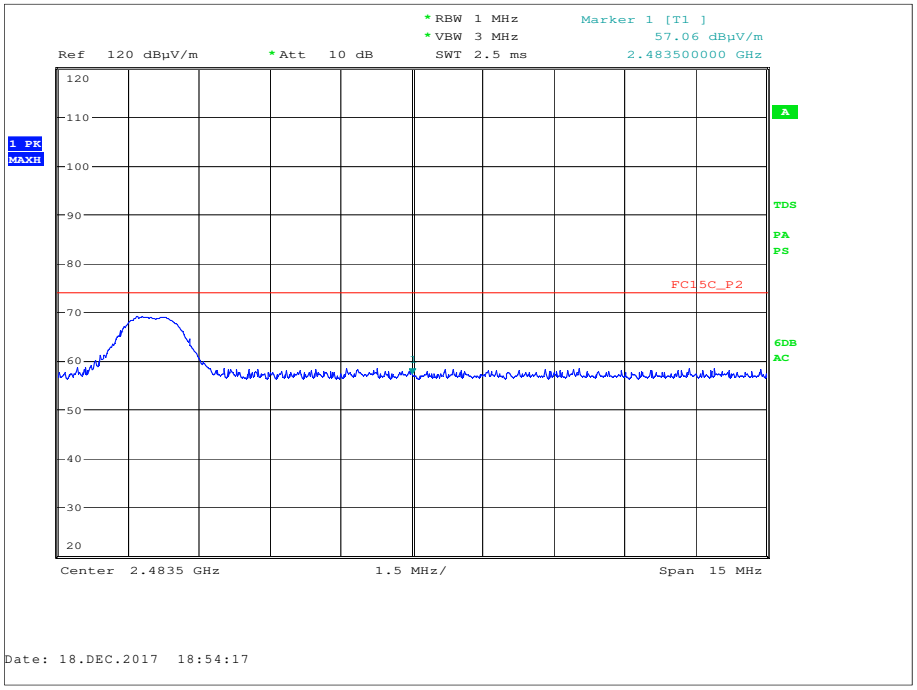

Figure 5 - DH1 – 2478 MHz - Measured Frequency 2483.5 MHz - Peak

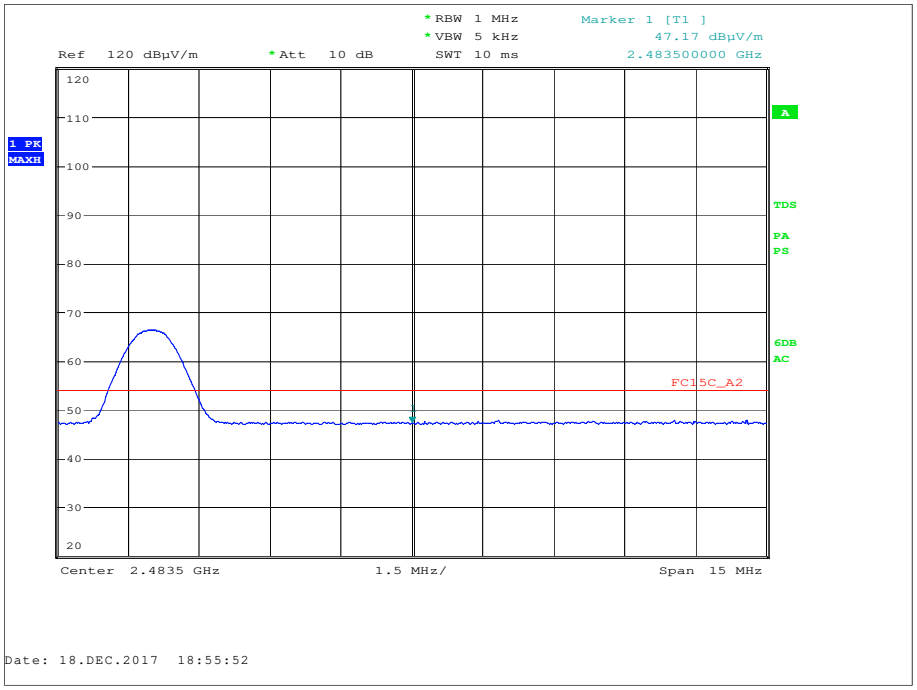

Figure 6 - DH1 - 2478 MHz – Measured Frequency 2483.5 MHz - Average

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength (μV/m at 3 m)
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

Table 10

Industry Canada RSS-GEN, Limit Clause 8.9

Frequency (MHz)	Field Strength (μV/m at 3 metres)
30-88	100
88-216	150
216-960	200
Above 960*	500

Table 11

*Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of 1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

2.3.7 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
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Digital Multimeter	Iso-tech	IDM-101	2895	12	20-Jul-2018
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	12	02-May-2018
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	04-May-2018
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	22-May-2018
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	17-Feb-2018

Table 12

TU - Traceability Unscheduled

2.4 Spurious Radiated Emissions

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205
Industry Canada RSS-247, Clause 5.5
Industry Canada RSS-GEN, Clause 6.13

2.4.2 Equipment Under Test and Modification State

SC01, S/N: 300125060276260 - Modification State 0

2.4.3 Date of Test

18-December-2017

2.4.4 Test Method

Testing was performed in accordance with ANSI C63.10-2013 clause 6.3, 6.5 and 6.6.

Plots for average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.3 to characterize the EUT. Where emissions were detected, final average measurements were taken in accordance with ANSI C63.10-2013 clause 4.1.4.2.2.

The plots shown are the characterization of the EUT. The limits on the plots represent the most stringent case for restricted bands, (54/74 dBuV/m @ 3m and 64/84 dBuV/m @ 1m) when compared to 20 dBc outside restricted bands. The limits shown have been used as a threshold to determine where further measurements are necessary. Where results are within 10 dB of the limits shown on the plots, further investigation was carried out and reported in results tables.

The following conversion can be applied to convert from dBµV/m to µV/m:
10^(Field Strength in dBµV/m/20).

2.4.5 Environmental Conditions

Ambient Temperature	19.5 °C
Relative Humidity	31.0 %

2.4.6 Test Results

Bluetooth Transceiver

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
30.791	30.2	40.0	-9.8	0	1.00	Vertical
31.779	29.9	40.0	-10.1	0	1.00	Vertical
33.186	29.3	40.0	-10.7	0	1.00	Vertical
824.675	32.8	46.0	-13.2	0	1.00	Vertical
859.289	33.2	46.0	-12.8	0	1.00	Vertical
912.398	33.6	46.0	-12.4	0	1.00	Vertical

Table 13 - 2402 MHz - 30 MHz to 1 GHz Emissions Results

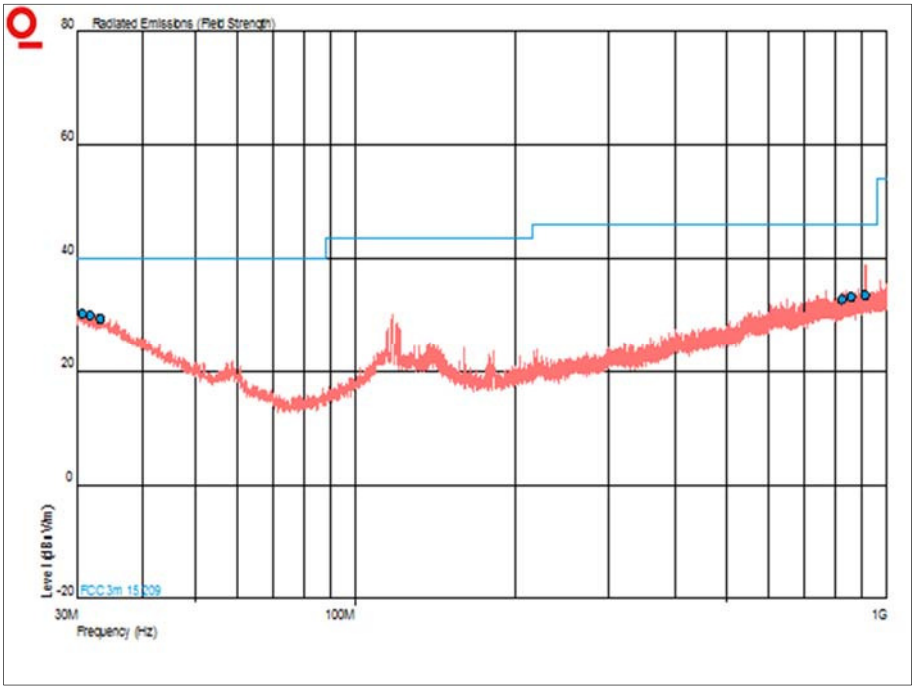

Figure 7 - 2402 MHz - 30MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 14 - 2402 MHz - 1 GHz to 25 GHz Emissions Results

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

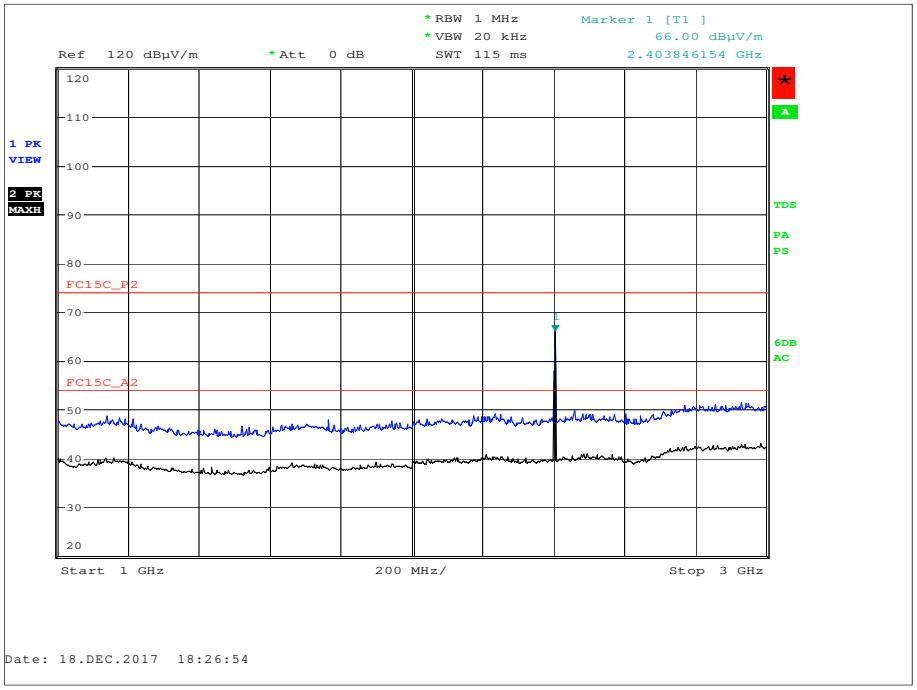

Figure 8 – 2402 MHz - 1 GHz to 3 GHz - Horizontal and Vertical

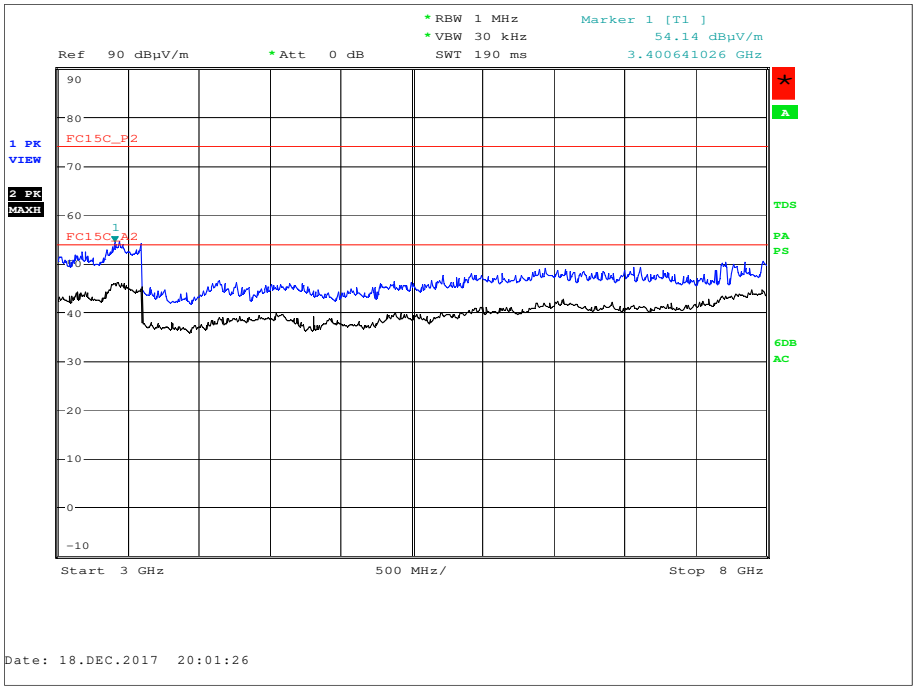

Figure 9 - 2402 MHz - 3 GHz to 8 GHz - Horizontal and Vertical

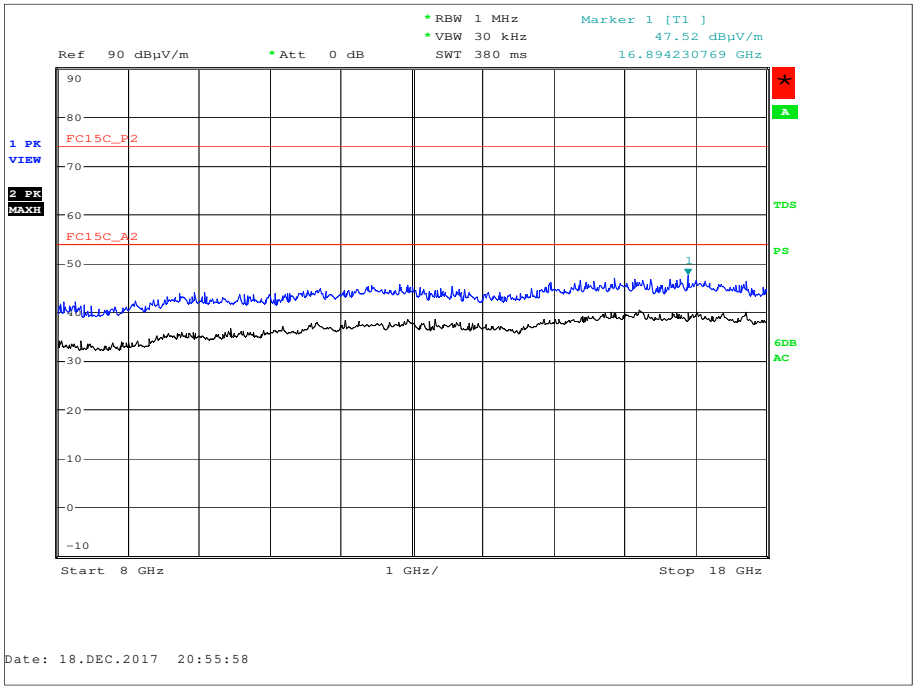

Figure 10 - 2402 MHz - 8 GHz to 18 GHz - Horizontal and Vertical

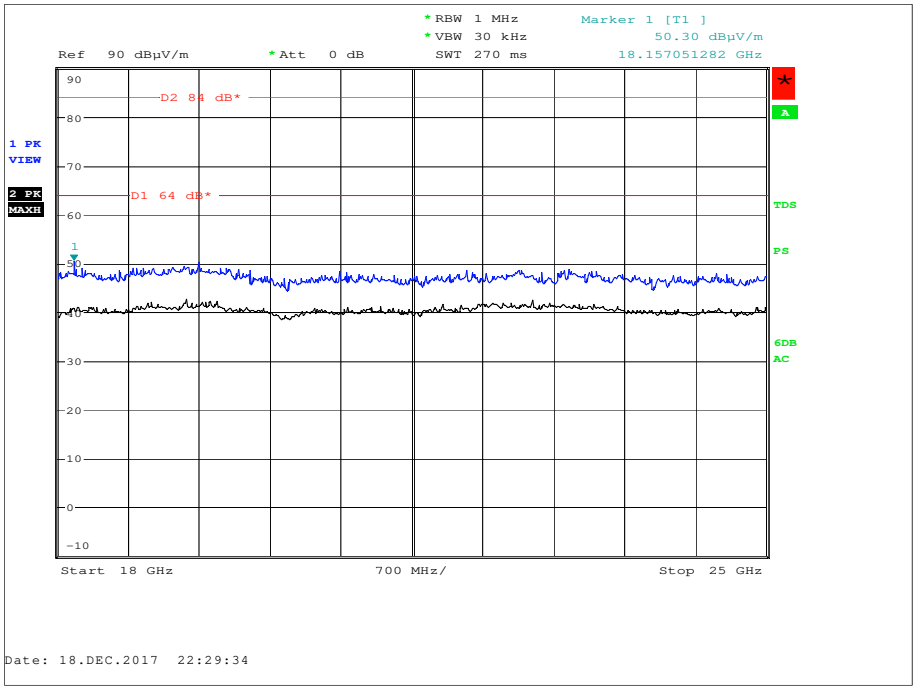

Figure 11 - 2402 MHz - 18 GHz to 25 GHz - Horizontal and Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
30.352	30.5	40.0	-9.5	0	1.00	Horizontal
31.746	29.9	40.0	-10.1	0	1.00	Vertical
32.990	29.2	40.0	-10.8	0	1.00	Horizontal
897.527	33.5	46.0	-12.5	0	1.00	Horizontal
943.948	33.9	46.0	-12.1	0	1.00	Horizontal
960.000	34.1	46.0	-11.9	0	1.00	Horizontal

Table 15 – 2442 MHz - 30 MHz to 1 GHz Emissions Results

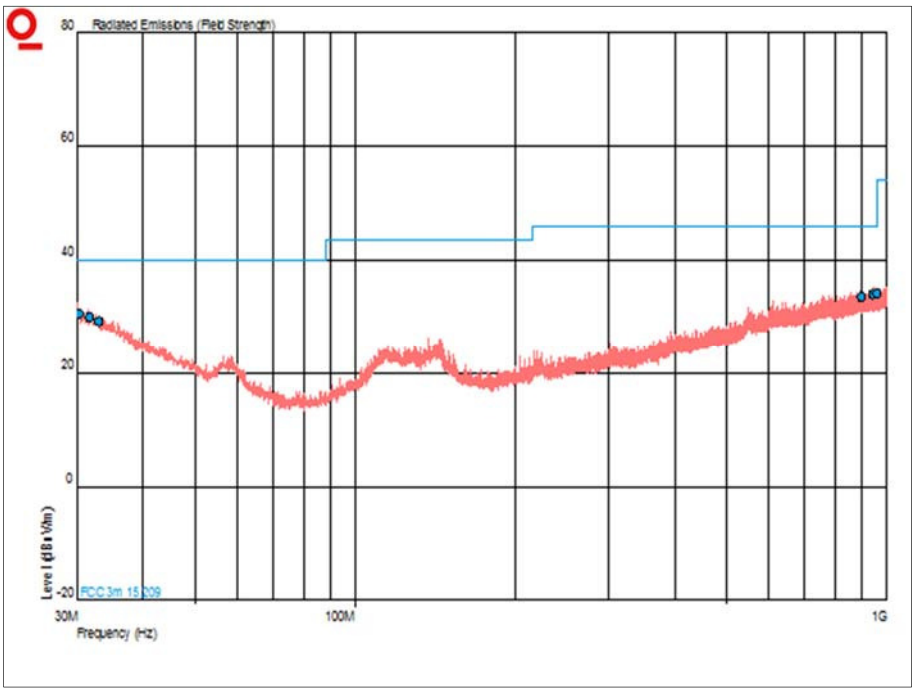

Figure 12 - 2442 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 16 - 2442 MHz - 1 GHz to 25 GHz Emissions Results

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

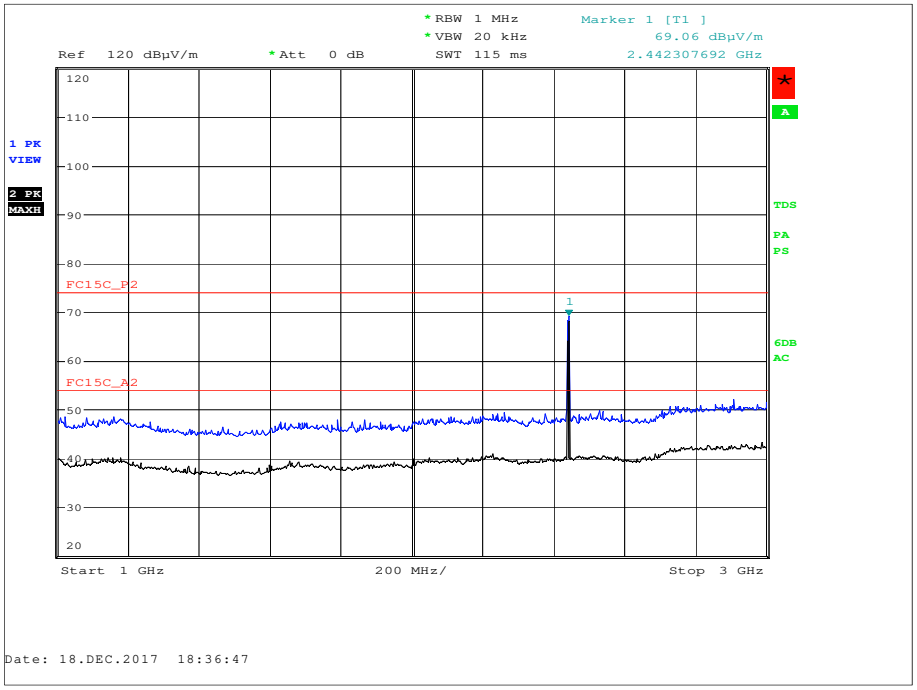

Figure 13 - 2442 MHz - 1 GHz to 3 GHz - Horizontal and Vertical

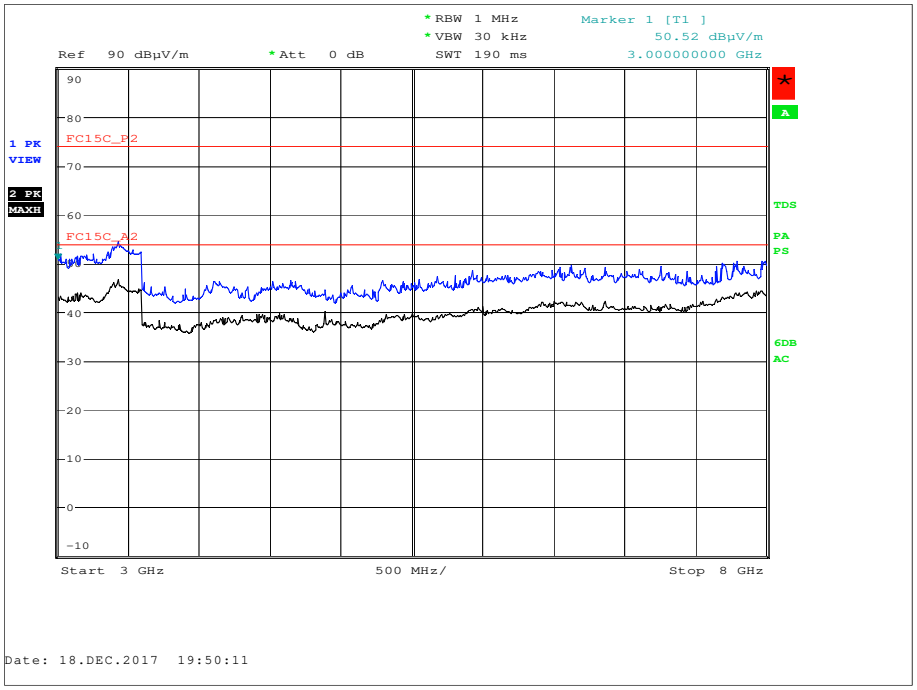

Figure 14 - 2442 MHz - 3 GHz to 8 GHz - Horizontal and Vertical

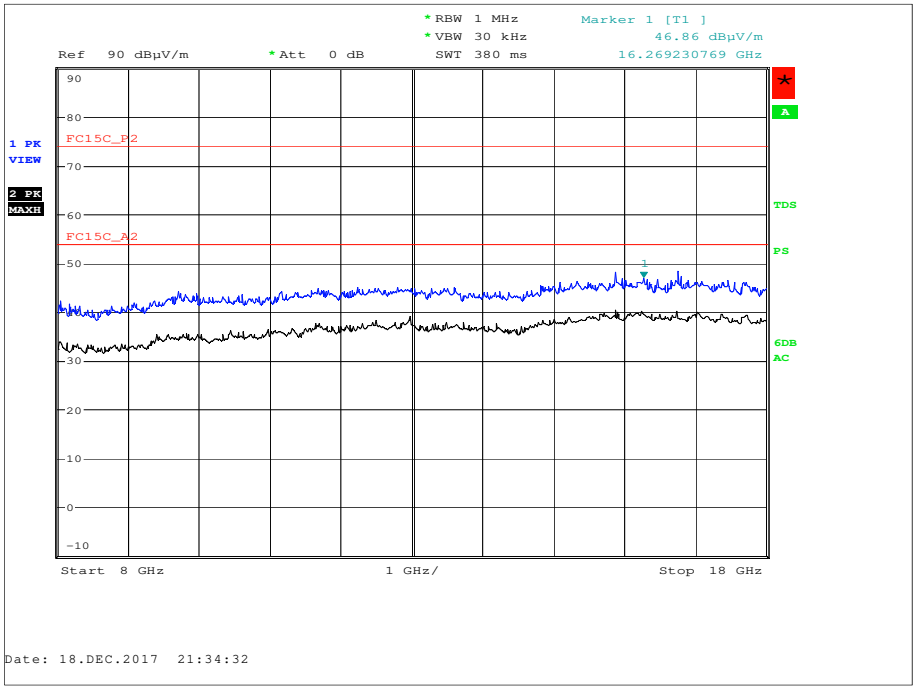

Figure 15 - 2442 MHz - 8 GHz to 18 GHz - Horizontal and Vertical

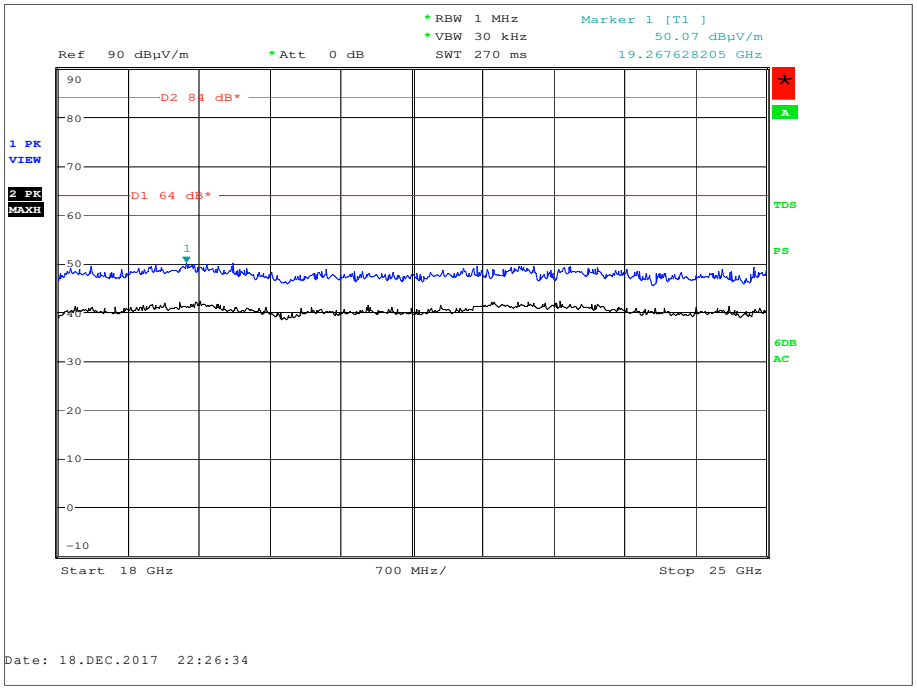

Figure 16 - 2442 MHz - 18 GHz to 25 GHz - Horizontal and Vertical

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle(Deg)	Height(m)	Polarity
30.812	30.2	40.0	-9.8	0	1.00	Vertical
33.197	29.4	40.0	-10.6	0	1.00	Vertical
34.352	28.8	40.0	-11.2	0	1.00	Vertical
835.787	32.9	46.0	-13.1	0	1.00	Vertical
882.160	33.5	46.0	-12.5	0	1.00	Vertical
960.000	34.0	46.0	-12.0	0	1.00	Vertical

Table 17 - 2778 MHz - 30 MHz to 1 GHz Emissions Results

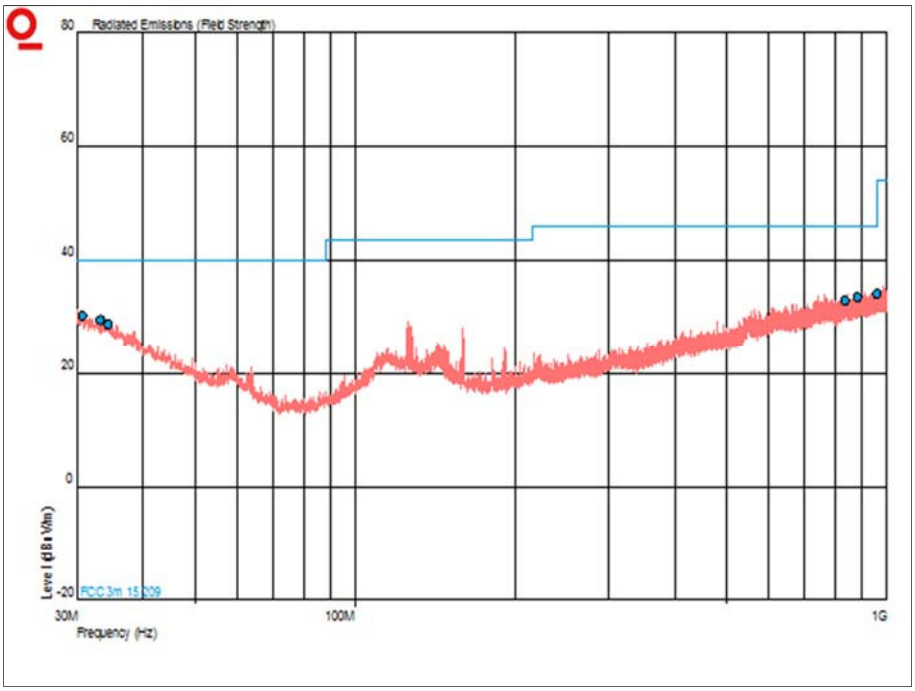

Figure 17 - 2778 MHz - 30 MHz to 1 GHz - Horizontal and Vertical

Frequency (MHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
*						

Table 18 - 2778 MHz - 1 GHz to 25 GHz Emissions Results

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

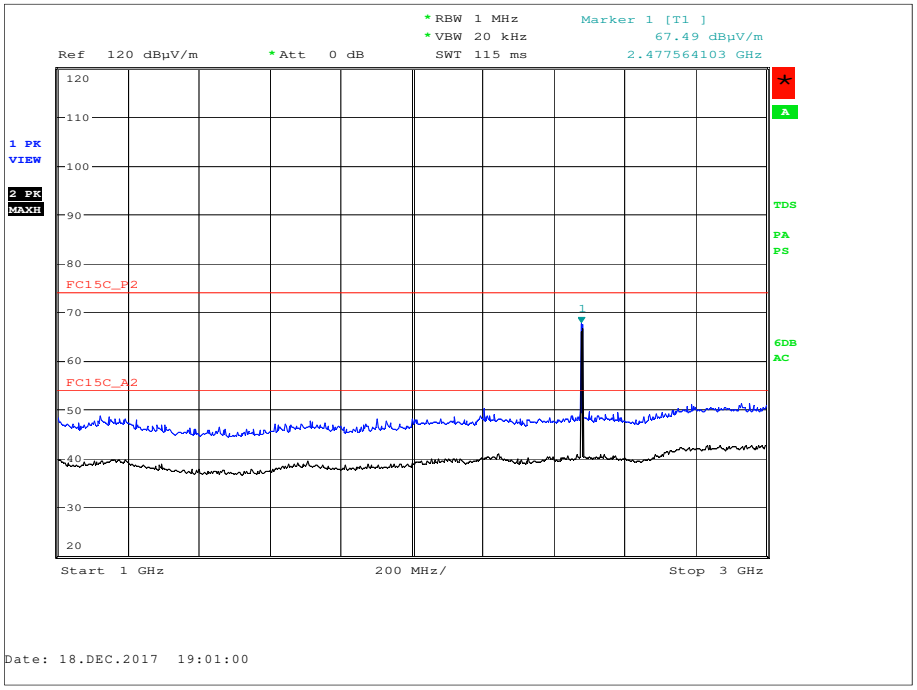

Figure 18 - 2778 MHz - 1 GHz to 3 GHz - Horizontal and Vertical

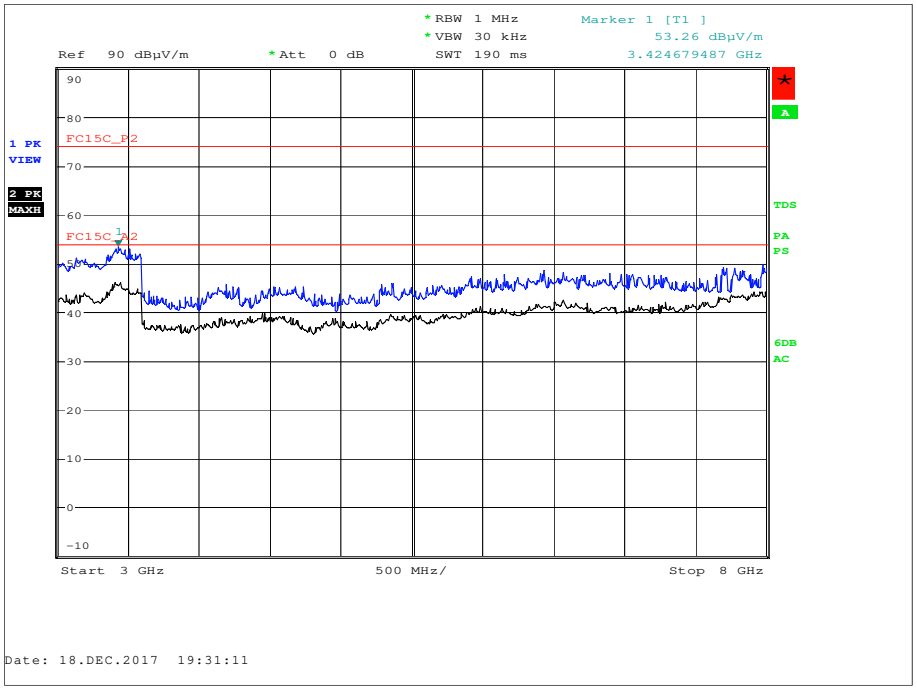

Figure 19 - 2778 MHz - 3 GHz to 8 GHz - Horizontal and Vertical

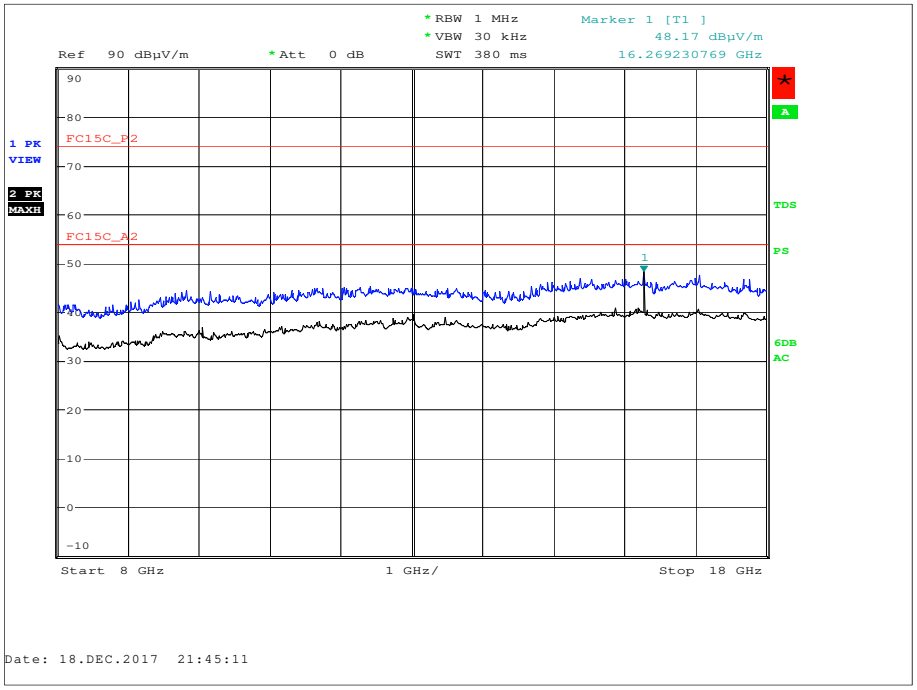

Figure 20 - 2778 MHz - 8 GHz to 18 GHz - Horizontal and Vertical

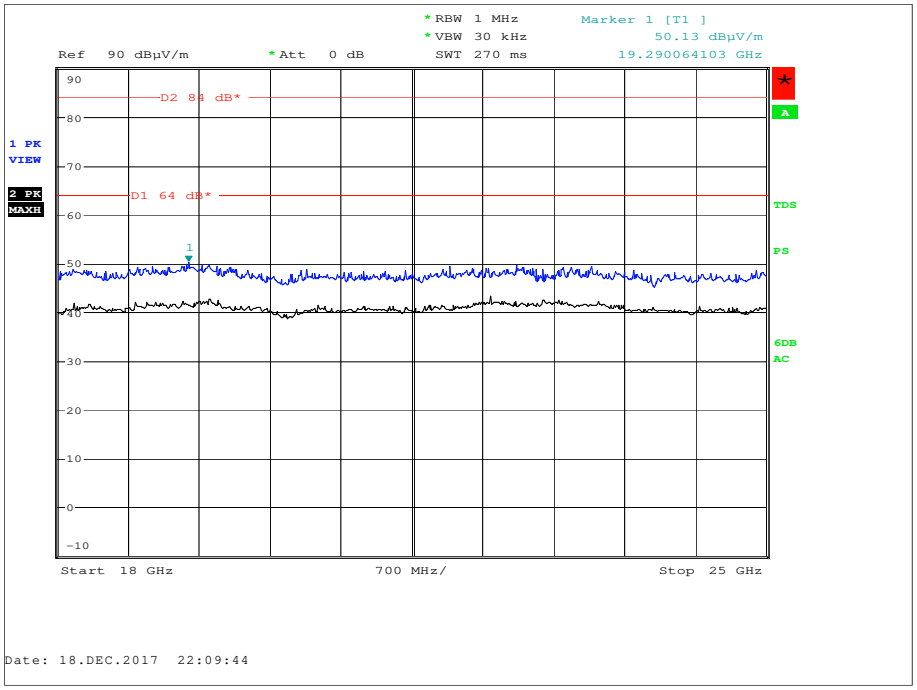

Figure 21 - 2778 MHz - 18 GHz to 25 GHz - Horizontal and Vertical

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

Industry Canada RSS-247, Limit Clause 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

2.4.7 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
Antenna (Bilog)	Schaffner	CBL6143	287	24	18-Apr-2018
Pre-Amplifier	Phase One	PS04-0086	1533	12	31-Jul-2018
18GHz - 40GHz Pre-Amplifier	Phase One	PSO4-0087	1534	12	23-Jan-2018
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Digital Multimeter	Iso-tech	IDM-101	2895	12	20-Jul-2018
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	12	02-May-2018
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	12	23-Jan-2018
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	04-May-2018
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4412	12	03-Apr-2018
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	22-May-2018
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	17-Feb-2018
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	17-Feb-2018

Table 19

TU - Traceability Unscheduled

3 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Maximum Conducted Output Power	± 0.96 dB
Authorised Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Restricted Band Edges	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB

Table 20