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# Report On

FCC and Industry Canada Testing of the Quake Global Inc QLOCATE In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and Industry Canada RSS-GEN

COMMERCIAL-IN-CONFIDENCE

FCC ID: PB5QLOCATE IC: 4650A-QLOCATE

Document 75928153 Report 05 Issue 1

November 2014



**Product Service** 

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North, Fareham, Hampshire, United Kingdom, PO15 5RL Tel: +44 (0) 1489 558100. Website: <u>www.tuv-sud.co.uk</u>

COMMERCIAL-IN-CONFIDENCE

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PREPARED FOR

Quake Global Inc 4933 Paramount Drive 92123 USA

PREPARED BY

Natalie Bennett Senior Administrator, Project Support

APPROVED BY

He.

Ryan Henley Authorised Signatory

DATED

21 November 2014

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 CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

M Russell

G Lawler



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**SECTION 1** 

## **REPORT SUMMARY**

FCC and Industry Canada Testing of the Quake Global Inc QLOCATE In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and Industry Canada RSS-GEN



#### 1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC and Industry Canada Testing of the Quake Global Inc QLOCATE to the requirements of FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and Industry Canada RSS-GEN.

Objective	To perform FCC and Industry Canada Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Quake Global Inc
Model Number(s)	QLOCATE 1158-5000
Serial Number(s)	142105180
Number of Samples Tested	1
Non Tested Variant	1158-5001 (Non GPS)
Test Specification/Issue/Date	FCC CFR 47 Part 2 (2013) FCC CFR 47 Part 25 (2013) Industry Canada RSS-170 (2011) Industry Canada RSS-GEN (2010)
Incoming Release Date	Application Form 05 October 2014
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	PO7195 1 October 2014
Start of Test	9 October 2014
Finish of Test	13 October 2014
Name of Engineer(s)	M Russell G Lawler
Related Document(s)	ANSI C63.4: 2009



## 1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and Industry Canada RSS-GEN is shown below.

	Spec Clause						
Section	Pt 2	Pt 25	RSS- 170	RSS- GEN	Test Description	Result	Comments/Base Standard
Transmit							
2.1	2.1055	25.202(d)	5.2	-	Frequency Tolerance	Pass	
2.2	2.1053	25.202(f)	5.4.3.1	-	Emission Limitations	Pass	
2.3	-	25.204	5.3	-	Power Limits	Pass	
2.4	-	25.216	5.4.3	-	Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	Pass	
2.5	2.1047(d)	-	-	-	Modulation Characteristics	Pass	
2.6	2.1049	-	-	4.6.1	Occupied Bandwidth	Pass	



#### 1.3 APPLICATION FORM

APPLICANT'S DETAILS										
COMPANY NAME :QUAKE GLOBALADDRESS :4933 Paramount Dr. S	San Diego, CA, 92123									
NAME FOR CONTACT PURPOSES : Enrique Valdez										
TELEPHONE NO: (858) 277-7290 EXT 253	FAX NO: (858) 277-7259 E-MAIL: evaldez @quakeglobal.com									
EQUIPMEN										
Model name/number QLOCATE	Identification/Part number 1158-1000 Software Version TA13001									
Manufacturer QUAKE GLOBAL.	Country of Origin United States of America									
FCC ID PB5QLOCATE	Industry Canada ID 4650A-QLOCATE									
recinical description (a brief description of the intended use a	nd operation)									
Supply Voltage:										
[ ] AC mains State AC voltage	V and AC frequencyHz									
[ ] DC (external) State DC voltage	V and Battery type									
Frequency characteristics: Transmitter Frequency range 1616 MHz to 1626.5 MHz	Channel spacing 41.667 kHz									
Receiver Frequency range 1616 MHz to 1626.5 MHz	Channel spacing 41.667 kHz									
(if different)	(if channelized)									
Designated test frequencies: Bottom: 1616 MHz Middle: 1621 0004 MH:	z Top: 1626 500084 MHz									
Intermediate Frequencies :	2 10p 1020.00004 White									
Highest Internally Generated Frequency : 1626	6.500084 MHz									
Power characteristics:										
Maximum transmitter power1.6 W	Minimum transmitter power									
[ X ] Continuous transmission										
Intermittent transmission	ntinuous transmit test mode? Y/N									
Antenna characteristics:										
[ X ] Antenna connector	State impedance50 ohm									
[ ] Integral antenna Type	State gain dBi									
[ ] External Antenna Type	State gain3 dBi									
Modulation characteristics:										
[ ] Amplitude	[X] Other									
[ ] Frequency	Details:TDMA FDMA									
Can the transmitter operate un-modulated?	(GMSK, QSPK etc) Y/N									
ITU Class of emission:										
Detter (Device Currel)										
Dattery/Power Supply Model name/number	Identification/Part number									
Manufacturer	Country of Origin									
Appillation (if applicable)										
Anchiaries (ir applicable) Model name/number	Identification/Part number									
Manufacturer	Country of Origin									
	-									
Extreme conditions: Maximum temperature 85 °C	Minimum temperature -40 °C									
Maximum supply voltage	Minimum supply voltage4.5 V									

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I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Darin Calm

Signature :

Name : Darrin Calin

Position held : Vice President of Operations

Date : October 5, 2014



#### 1.4 **PRODUCT INFORMATION**

#### 1.4.1 Technical Description

The Equipment Under Test (EUT) was a Quake Global Inc QLOCATE. A full technical description can be found in the manufacturer's documentation.

#### 1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 5.0 V DC supply.

FCC Measurement Facility Registration Number 90987 Octagon House, Fareham Test Laboratory

Industry Canada Company Address Code IC2932B-1 Octagon House, Fareham Test Laboratory

#### 1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard were made during testing.

#### 1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.



**SECTION 2** 

## **TEST DETAILS**

FCC and Industry Canada Testing of the Quake Global Inc QLOCATE In accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 25, Industry Canada RSS-170 and Industry Canada RSS-GEN



#### 2.1 FREQUENCY TOLERANCE

#### 2.1.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1055 FCC CFR 47 Part 25, Clause 25.202(d) Industry Canada RSS-170, Clause 5.2

#### 2.1.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

#### 2.1.3 Date of Test

13 October 2014

#### 2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

#### 2.1.5 Test Procedure

This test was performed in accordance with the requirements of FCC CFR 47 Part 2.1055 (a) and (d). The result was compared against the limit specified in 25.202(d).

The EUT was connected to a spectrum analyser via an attenuator which was configured to transmit modulated on the centre channel. Using an RBW of 3 kHz the upper and lower points containing the 20 dB bandwidth were found and the mid-point was determined as the frequency error.

The measurement was performed over the temperature range of +50 to -30 in 10degree steps. Additionally at +20degrees, measurements were performed at 85% and 115% of the primary supply voltage.

#### 2.1.6 Environmental Conditions

Ambient Temperature	23.9°C
Relative Humidity	47.4%



#### 2.1.7 Test Results

5.0 V DC Supply

#### **Under Temperature Variations**

#### 1621.020833 MHz

	Frequency Error				
	%	ppm			
-30	-0.00016	-1.587			
-20	-0.00014	-1.399			
-10	-0.00010	-1.035			
0	-0.00013	-1.303			
+10	-0.00009	-0.949			
+20	-0.00009	-0.918			
+30	-0.00010	-1.026			
+40	-0.00009	-0.881			
+50	-0.00007	-0.699			

#### **Under Voltage Variations**

#### 1621.020833 MHz

	Frequency Error				
DC Vollage	%	ppm			
4.25	-0.00010	-1.014			
5.0	-0.0009	-0.918			
5.75	-0.0009	-0.912			

#### Limit Clause FCC CFR 47, 25.202(d)

Frequency tolerance, Earth stations. The carrier frequency of each earth station transmitter authorized in these services shall be maintained within 0.001 percent of the reference frequency.

#### Limit Clause RSS-170, 5.2

For mobile earth station equipment, the carrier frequency shall not depart from the reference frequency by more than  $\pm 10$  ppm.



#### 2.2 EMISSION LIMITATIONS

#### 2.2.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1053, FCC CFR 47 Part 25, Clause 25.202(f) and Industry Canada RSS-170, Clause 5.4.3.1

#### 2.2.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

#### 2.2.3 Date of Test

10 October 2014, 12 October 2014 & 13 October 2014

#### 2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

#### 2.2.5 Test Procedure

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 25.202(f), FCC CFR 47 Part 2.1051 and 2.1053.

For emissions removed less than 250% of the authorized bandwidth from the assigned frequency, measurements were performed conducted as follows:

The EUT was connected to a spectrum analyser via a cable and attenuator. The EUT was transmitting at maximum power, for bottom, middle and top channels. The EUT was modulated as stated in the manufactures application form. The sum of the path loss, a 4 kHz correction factor of 1.71 dB, as the RBW was set as 2.7 kHz on the spectrum analyser, plus the antenna gain as declared by the manufacturer was entered as a reference level offset in to the spectrum analyser. The gated trigger of the analyser was used so that average measurements were taken over the active part of the burst using an RMS detector. The reference level for the mask was set to the mean output power measured in a 4kHz bandwidth. The mask as specified in clause 25.202(f) was then applied.

For emissions removed more than 250% of the authorized bandwidth from the assigned frequency, measurements were performed both conducted and radiated as follows:

Conducted: A network analyser was used to measure the path loss. The sum of the path loss and the antenna gain as declared by the manufacturer was entered as a reference level offset in to the spectrum analyser. From 9 kHz to 3 GHz, the EUT was connected to a spectrum analyser via an attenuator and cable. Between 3 GHz and 18 GHz a 3 GHz high pass filter was used. The EUT was configured to maximum power on bottom, middle or top channel with modulation as described in the manufactures application form. The spectrum analyser was configured with an RBW and VBW of 1 MHz and 3 MHz respectfully with the trace set to max hold using an RMS detector.



Product Service

Radiated; A preliminary profile of the Spurious Radiated Emissions was obtained up to a minimum of the 10th harmonic of the highest internally generated frequency by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

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

The EUT was set to transmit on maximum power in turn on bottom, middle and top channels.

For any emissions found the EUT was then removed from the chamber and replaced with a substitution antenna. Using a signal generator the level was adjusted to achieve the same value on the measuring instrument as previously recorded with the EUT. The final result was determined by a calculation using the signal generator level, antenna gain and cable loss.

The measurements were performed at a 3m distance unless otherwise stated.

#### 2.2.6 Environmental Conditions

Ambient Temperature	18.8 - 25.5°C
Relative Humidity	42.9 - 44.0%



#### 2.2.7 Test Results

5.0 V DC Supply

**Conducted** 

1616.020833 MHz

Mask



## COMMERCIAL-IN-CONFIDENCE



#### 9 kHz to 3 GHz

Agilent Spect	trum Analyzer - Swept SA								
Marker 1	RF 50 Ω DC 1.61700414900	0 GHz	SENSE	E:EXT	Avg Type	ALIGN AUTO RMS	11:45:40 AM	10ct 10, 2014 E 1 2 3 4 5 6	Peak Search
10 dB/div	Ref Offset 34.93 dE Ref 40.00 dBm	PNO: Fast IFGain:Low	#Atten: 16 d	dB	Avginoid	:>100/100 Mk	(r1 1.61) 29.4	7 0 GHz 06 dBm	Next Peak
30.0				<b>∮</b> <sup>1</sup>					Next Pk Right
20.0									Next Pk Left
-10.0								-13.00 dBm	Marker Delta
-20.0									Mkr→CF
-40.0	an tan an a	ayayaadadhadaa ayahadaa yahada		يور المراجع الور المراجع	an a		a na managa ang kana na mang kan Na mang kana na mang	to a frankligter	Mkr→RefLvl
Start 9 kH							Stop 3	.000 GHz	More 1 of 2
#Res BW	1.0 MHZ	#VBW	3.0 WHZ*		#	Sweep 2	0.00 ms (	1001 pts)	
						014103			

#### 3 GHz to 12 GHz

💵 Agile	ent Spectr	um Analyze	r - Swept	SA									
L <mark>XI</mark>		RF	50 Ω	DC		SEN	ISE:EXT		ALIGN AUTO	11:52:40 A	M Oct 10, 2014		Diaplay
Disp	lay Li	ne -13	6.00 d	Bm			-	Avg Type	RMS	TRAC	E 1 2 3 4 5 6		Display
					PNO: Fast 🖵	Trig: Free	Run	Avg Hold	:>100/100	D			
_	_				IFGain:Low	#Atten: 6	ab						Annotation
		Ref Off	eat 36 7	dB						Mkr1 3.2	234 GHz		Annotation
10 dF	Udiv	Ref 10	0.00 di	Bm						-35.2	52 dBm		
Log	7611												
0.00													Title►
0.00													
-10.0					_						12.00 (8)		
											-13.00 dBm		Graticule
												On	Off
-20.0												_	
-30.0	1				_								Display Line
	•												-13.00 dBm
												On	Off
-40.0		<u>^</u>		<b>b</b> . <b>b</b>	4				and all all a	a a shere	monument		
	لريعاس	*	al and	ww	A war	and the second second	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~					
-50.0													
-60.0													
													System
-70.0													Display▶
													Settings
-80.0													
Start	1 3.000	GHz								Stop 12	.000 GHz		
#Res	BW 1	.0 MH:	z		#VBW	3.0 MHz <sup>3</sup>	*	#	Sweep	20.00 ms (	1001 pts)		
MSG									STAT	us.			
100									STAT				



## 12 GHz to 18 GHz

Agilent Spe	ctrum Analyzer - Swept SA							
	RF 50 Ω DC		SENSE:	EXT	ALIGN AUTO	11:56:55 AM	Oct 10, 2014	Peak Search
arker 1	17.514000000	DOU GHZ	Trig: Free Ru	ın Avg	Type: RMS  Hold:>100/100	TYPE	1 2 3 4 5 6 MWWWWW	
		IFGain:Low	#Atten: 6 dB			DET	ANNNN	
	Ref Offcet 37.7 dB				N	lkr1 17.5 <sup>.</sup>	14 GHz	NextPeak
dB/div	Ref 11.00 dBm					-37.40	)2 dBm	
g								
								Next Pk Right
10								Heat I have a set of the
							-13.00 dBm	
								Next Pk Left
3.0								
							-	
							♦ 1	MarkerDetta
1.0 Managerton	لحمور بالعرار بالمعاللة بالمعاصر عراص	-	and the second states and	and the second	متحدمه فيسبو مروجه ومعطوه محمد	- Microsoft and	dogermoni	
.0								Mkr→CF
.0								
.0								Mkr→RefLvl
.0								
								More
						Oton 40		1 of 2
art 12. Pes Biái		#\/B\M	3.0 MH7*		Sween	500p 18. 10.00 ms (1	000 GHZ	
		# V D V V	0.0 11112		oweep		loo i proj	
G					STATU	15		



#### 1621.020833 MHz

#### Mask



#### 9 kHz to 3 GHz

Agilent Spectrum Analyzer - Sw	ept SA				
Marker 1 1.620004	Ω DC 140000 GHz	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold:>100/100	11:44:32 AM Oct 10, 2014 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
Ref Offset 3	IFGain:Low dBm	#Atten: 16 dB	M	r1 1.620 0 GHz 29.075 dBm	NextPeak
30.0		∳ <sup>1</sup>			Next Pk Right
20.0					Next Pk Left
-10.0				-13.00 dBm	Marker Delta
-20.0					Mkr→CF
-40.0 Managene Managene -	understanderstanderstanderstanderstanderstanderstanderstanderstanderstanderstanderstanderstanderstanderstanders		and and a second se		Mkr→RefLvl
Start 9 kHz	#\/D\		#Swoon 2	Stop 3.000 GHz	More 1 of 2
WRGS DW-1.0 WINZ	#VDV	1510 WI12	#Sweep 2		1
mog			STATUS		



#### 3 GHz to 12 GHz

Agilent Spec	trum Analyzer - Swept SA							
<mark>W</mark> Marker 1	RF 50 Ω DC	) GHz	SENSE:EX		ALIGN AUTO	02:52:02 PI TRAC	1 Oct 10, 2014	Peak Search
marker	5.0100000000000	PNO: Fast	Trig: Free Run	Avg Hold:	:>100/100	TYP		
		IFGain:Low	#Atten: 6 db			Miked 2.0	10 CH-	NextPeak
	Ref Offset 36.7 dB					-40.5	35 dBm	
	Rel 10.00 dBm					40.0		
0.00								Next PK Right
-10.0							-13.00 dBm	
								Next Pk Left
-20.0								
-30.0								Marker Delta
10.0	<b>≜</b> <sup>1</sup>							
-40.0	man	mm	mon	برميه بروي والمريد المريد المريد	maria	and the	man	
50.0								
-50.0								Mkr→CF
-60.0								
-70.0								Mkr→RefLvl
-80.0								
								More
Start 2.00						Stop 12		1 of 2
#Res BW	1.0 MHz	#VBW 3	3.0 MHz*	#	Sweep 2	20.00 ms (	1001 pts)	
MSG					STATU	s		
					SIAIO			

#### 12 GHz to 18 GHz





#### 1625.969667 MHz

#### Mask



#### 9 kHz to 3 GHz

BB. Agilent Spectrum Analyzer - Swept SA				— • • <del>• • •</del>
Marker 1 1.626004122000		ALIGN AUTO Avg Type: RMS Avg/Hold:>100/100	11:42:32 AM Oct 10, 2014 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
Ref Offset 34.93 dB 10 dB/div Ref 40.00 dBm	IFGain:Low #Atten: 16 dB	M	cr1 1.626 0 GHz 29.761 dBm	Next Peak
30.0	<b>↓</b> 1			Next Pk Right
20.0				Next Pk Left
-10.0			-13.00 dBm	Marker Delta
-20.0				Mkr→CF
-40.0	a designed and the second s	and a second second and a second s	AND THE CONTRACT OF THE CONTRACT.	Mkr→RefLvl
Start 9 kHz #Res BW 1.0 MHz	#VBW 3.0 MHz*	#Sweep 2	Stop 3.000 GHz 20.00 ms (1001 pts)	More 1 of 2
MSG		STATU	S	



#### 3 GHz to 12 GHz

Agrient Spectrun	Analyzer - Swept SA							
Marker 1 1	0.91100000000	0 GHz	SENSE	EXT	g Type: RMS	TO 03:01:58 P	M Oct 10, 2014 CE 1 2 3 4 5 6	Peak Search
10 dB/div	Ref Offset 36.7 dB Ref 10.00 dBm	PNO: Fast IFGain:Low	Trig: Free R #Atten: 6 dB	un Avı 3	j Hold:>100/10	Mkr1 10.9 -40.3	90 dBm	Next Peak
0.00								Next Pk Right
-10.0							-13.00 dBm	Next Pk Left
-30.0	h	~~~~	and a second	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		 	Marker Delta
-50.0								Mkr→CF
-70.0								Mkr→RefLvl
Start 3.000 ( #Res BW 1.)	GHz 0 MHz	#VBW	3.0 MHz*		#Sweep	Stop 12	.000 GHz (1001 pts)	More 1 of 2
MSG					ST	ATUS		

#### 12 GHz to 18 GHz





#### Radiated

1616.020833 MHz

#### 30 MHz to 1 GHz



Date: 12.0CT.2014 08:42:53

#### 1 GHz to 40 GHz

Frequency (MHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBm)
3232.049	Vertical	100	185	-17.82
4848.065	Vertical	100	141	-28.21
9693.130	Vertical	100	28	-36.45



#### 1 GHz to 3 GHz



Date: 12.0CT.2014 10:28:58





Date: 12.0CT.2014 11:44:27



#### 8 GHz to 18 GHz



Date: 13.0CT.2014 18:39:25



#### 1621.020833 MHz

#### 30 MHz to 1 GHz



Date: 12.0CT.2014 08:48:15

## 1 GHz to 40 GHz

Frequency (MHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBm)
3242.043	Vertical	100	183	-17.55
4863.064	Vertical	100	270	-30.86
9726.130	Vertical	100	344	-36.59



#### 1 GHz to 3 GHz



Date: 12.0CT.2014 10:33:11





Date: 12.0CT.2014 11:19:04



#### 8 GHz to 18 GHz



Date: 13.0CT.2014 18:56:59



#### 1625.969667 MHz

#### 30 MHz to 1 GHz



Date: 12.0CT.2014 08:52:05

#### 1 GHz to 40 GHz

Frequency (MHz)	Antenna Polarisation	Antenna Height (cm)	EUT Arc (degrees)	Final Peak (dBm)
3251.960	Vertical	106	171	-18.63
4877.939	Vertical	100	271	-27.61
9755.880	Vertical	100	343	-37.55



#### 1 GHz to 3 GHz



Date: 12.0CT.2014 10:36:55





Date: 12.0CT.2014 11:34:54



#### Marker 1 [T1 ] -51.37 dBm 9.746794872 GHz \* RBW 1 MHz \* VBW SWT 1 MHz 60 ms Ref -30 dBm \* Att 0 dB 1 PK hul A MANA MANA monumen 80 -90 -100 -130 Start 8 GHz 1 GHz/ Stop 18 GHz

#### 8 GHz to 18 GHz

Date: 13.0CT.2014 19:26:18

#### Limit Clause FCC CFR 47, 25.202(f) and RSS-170, 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;
- 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;
- 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 occupied bandwidth.



#### 2.3 POWER LIMITS

#### 2.3.1 Specification Reference

FCC CFR 47 Part 25, Clause 25.204 Industry Canada RSS-170, Clause 5.3

#### 2.3.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

#### 2.3.3 Date of Test

9 October 2014 & 10 October 2014

#### 2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

#### 2.3.5 Test Procedure

For conducted power, the EUT was connected to a spectrum analyser via a cable and 30dB attenuator. An RBW of 3 kHz and VBW of 10 kHz was used and the correction factor was calculated as 10Log(4/3) = 1.25 dB so that the final result was relative to any 4 kHz band as per the requirement in 25.204(a). A reference level offset equal to the sum of the path loss, antenna gain as declared by the manufacturer and the above correction factor was entered on the spectrum analyser. The transmit power was measured over the active part of the burst using an RMS detector, the spectrum analyser was set to max hold and the peak result recorded.

For radiated power, the EUT was transmitted at maximum power via a cable to the Spectrum Analyser. The Analyser settings were adjusted to display the resultant trace on screen and a resolution bandwidth and video bandwidth of 1 MHz were used to perform the measurement. The level on the spectrum analyser was maximised by rotating the EUT through 360° and a height search of the measuring antenna. A substitution was then performed using a suitable calibrated antenna and signal generator.

This level was maximised by adjusting the height of the measuring antenna once more. The level from the signal generator was then adjusted to achieve the same raw result as with the EUT. This level was then corrected to account for cable loss and antenna factor.

A calculation was then performed to obtain the final figure.

#### 2.3.6 Environmental Conditions

Ambient Temperature	25.7°C
Relative Humidity	40.1%



#### 2.3.7 Test Results

5.0 V DC Supply

**Conducted** 

EIRP (dBW)						
1616.020833 MHz 1621.020833 MHz 1625.969667 MHz						
-1.32	-1.44	-1.54				

#### Limit Clause FCC CFR 47, 25.204

+40 dBW in any 4 kHz band for  $\theta \le 0^{\circ}$ +40 + 30 dBW in any 4 kHz band for  $0^{\circ} < \theta \le 5^{\circ}$ 

#### Limit Clause RSS-170, 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.



#### 2.4 LIMITS ON EMISSIONS FROM MOBILE EARTH STATIONS FOR PROTECTION OF AERONAUTICAL RADIONAVIGATION-SATELLITE SERVICE

#### 2.4.1 Specification Reference

FCC CFR 47 Part 25, Clause 25.216 Industry Canada RSS-170, Clause 5.4.3

#### 2.4.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

#### 2.4.3 Date of Test

9 October 2014 & 10 October 2014

#### 2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

#### 2.4.5 Test Procedure

This test was performed in accordance with the test method requirements as stated in FCC CFR 47 Part 25.216 (c), (f), (i) & (j).

The EUT was set to transmit at maximum power using modulation as described in the manufacturers application form. The EUT was connected to a spectrum analyser via a cable and attenuator. The path loss was measured using a vector network analyser and the sum of the path loss and antenna gain as declared by the manufacturer was entered as a reference level offset in the analyser. The gated trigger of the analyser was used so that average measurements were taken over a 2 ms period of the active burst. The spectrum analyser was adjusted to show the frequency range of interest on screen with an RBW & VBW of 1 MHz and 3 MHz respectfully. The analyser was set with an RMS detector and average trace.

Any spur within 10 dB of -70 dBW/MHz was investigated further to determine the bandwidth of the emission. Each spur was individually investigated and the RBW of the analyser was reduced to allow an approximation of the emission bandwidth of the spur. It was confirmed that all discrete emissions have a power density less than -80 dBW.

For emissions in the carrier off state, the EUT was configured in a state of continuous nontransmission. The EUT was connected to a spectrum analyser via a cable and attenuator. The path loss was measured using a vector network analyser and entered as a reference level offset in the analyser. The spectrum analyser was adjusted to show the frequency range of interest on screen with an RBW & VBW of 1 MHz and 3 MHz respectfully. The analyser was set with an RMS detector and average trace.

#### 2.4.6 Environmental Conditions

Ambient Temperature23.1 - 25.7°CRelative Humidity40.1 - 45.6%



#### 2.4.7 Test Results

5.0 V DC Supply

EIRP Density – Broadband Emissions (dBW/MHz)						
1616.020833 MHz 1621.020833 MHz 1625.969667 MHz						
-81.533	-85.250	-87.198				

## 1616.020833 MHz

Agilent Spec	trum Analyzer - Swept SA					- 0 <u>- X</u>
Marker 1	RF 50 Ω De 1.6007358000 Gate: LO	C 000 GHz PNO: Fast ↔→→ IEGain:Low	Trig: External1 #Atten: 6 dB	Avg Type: RMS Avg Hold: 100/100	12:20:02 PM Oct 10, 2014 TRACE 1 2 3 4 5 6 TYPE A	Peak Search
10 dB/div	Ref Offset 23.82 Ref -20.00 dB	dB m		Mkr1 1	.600 735 8 GHz -51.533 dBm	Next Peak
Log						
-30.0						Next Pk Right
-40.0					-40.00 dBm	
60.0					<mark>↓</mark> 1	Next Pk Left
-60.0				Ships in the second second	and the second sec	
70.0						MarkerDelta
-70.0						
-80.0						Mkr.CE
						WIKI
-90.0						
-100						Mkr→RefLvi
						initia interiziti
-110						
						More
Start 1.55	900 GHz				Stop 1.60500 GHz	1 of 2
#Res BW	1.0 MHz	#VBW	3.0 MHz*	#Sweep 20	0.00 ms (10001 pts)	
MSG				STATUS	S	
		_				
M Agilent Spec	trum Analyzer - Swept SA RF 50 Ω D	c	SENSE:EXT	ALIGN AUTO	12:35:27 PM Oct 10, 2014	- 0 - X
Marker 1	trum Analyzer - Swept SA RF 50 Ω D0 <b>1.6050950000</b> Gate: LO	C DOO GHz PNO: Wide ↔ IFGain:Low	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE 1 2 3 4 5 TYPE A	Peak Search
Agilent Spec	trum Analyzer - Swept SA RF 50 Ω DO 1.6050950000 Gate: L0 Ref Offset 23.82 Ref 20.00 dBn	c DOO GHz PNO: Wide ↔ IFGain:Low dB	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100 Mkr1	12:35:27 PM Oct 10, 2014 TRACE 12 3 4 5 0 TYPE A DET ANNNNN 1.605 095 GHz -54.184 dBm	Peak Search Next Peak
Agilent Spec	trum Analyzer - Swept SA RF 50 Ω Dr 1.6050950000 Gate: LO Ref Offset 23.82 c Ref 20.00 dBn e 1 Pass	c DOO GHz PNO: Wide →→ IFGain:Low dB m	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100 MKr1	12:35:27 PM Oct 10, 2014 TRACE 10, 2014 TYPE 10, 2014 TYPE 10, 2014 TYPE 10, 2014 DET NNNNN 1.605 095 GHz -54, 184 dBm	Peak Search Next Peak
Agilent Spec Marker 1 PASS	trum Analyzer - Swept SA RF   50 Q DJ 1.605509550000 Gate: L0 Ref Offset 23.82 / Ref 20.00 dBm e 1 Pass	C PNO: Wide ↔ IFGain:Low dB	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100 Mkr1	12:35:27 PM Oct 10, 2014 TRACE 11 23 4 5 C TYPE 12:00 C TYPE 12:00 C TYPE 12:00 C TYPE 12:00 C TYPE 12:00 C TRACE 10, 2014	Peak Search Next Peak
Agilent Spec XI Marker 1 PASS	trum Analyzer - Swept SA RF 50 2 DU 1.6050950000 Gate: LO Ref Offset 23.82 o Ref 20.00 dBm e 1 Pass	C PNC: Wide →→ IFGain:Low dB	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE 11 23 4 5 0 TYPE A WINN N 0 ET A NNN N 1.605 095 GHz -54.184 dBm	Peak Search Next Peak
Marker 1 PASS 10 dB/div Log Trac	trum Analyzer - Swept SA RF 50 2 DU 1.605509550000 Gate: LO Ref Offset 23.82 0 Ref 20.00 dBm	C PNC: Wide IFGain:Low dB m	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100 Mkr1	12:35:27 PM Oct 10, 2014 TRACE []] 23 45 0 TYPE ANNINN DET ANNINN 1.605 095 GHz -54.184 dBm	Peak Search Next Peak Next Pk Right
Marker 1 PASS 10 dB/div Log 10.0	trum Analyzer - Sweet SA RF 50 0 00 Gate: LO Ref Offset 23.82 0 Ref 20.00 dBn e 1 Pass	C PNC: Wide IFGain:Low dB m	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg[Hold: 100/100	12:35:27 PMOct 10, 2014 TRACE [] 23 4 5 0 TYPE [] 23 4 5 0 TYPE ANNINN 1.605 095 GHz -54.184 dBm	Peak Search Next Peak Next Pk Right Next Pk Left
in Agilent Spec Marker 1 PASS 10 dB/div Log Trac 1000	trum Analyzer - Sweet SA RF 50 0 00 Gate: LO Ref Offset 23.82 0 Ref 20.00 dBn e 1 Pass	C D00 GHZ PNC: Wide →→ IFGain:Low dB m	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg[Hold: 100/100	12:35:27 PMOct 10, 2014 TRACE [] 2 3 4 5 0 TYPE ANNINN DET ANNINN 1.605 095 GHz -54.184 dBm	Peak Search Next Peak Next Pk Right Next Pk Left
III. Agilent Species Marker 1 PASS 10 dB/div 10 0 10 0 -10 0 -20 0	trum Analyzer - Sweet SA RF   50 Q DU 1.6050950000 Gate: LO Ref Offset 23.82 ( Ref 20.00 dBn e 1 Pass	C D00 GHZ PNC: Wide →→ IFGain:Low dB m	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PMOct 10, 2014 TRACE [] 2 3 4 5 0 TYPE ANNINN DET ANNINN 1.605 095 GHz -54.184 dBm	Peak Search Next Peak Next Pk Right Next Pk Left
III. Agilent Spece Marker 1 PASS 10 dB/div 10 0 10 0 -10 0 -20 0	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: LO Ref Offset 23.82 ( Ref 20.00 dBn e 1 Pass	C 000 GHz PNC: Wide →→ IFGain:Low dB n	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PMOct 10, 2014 TRACE [] 2:3 4.5 0 TYPE A MINNIN 1.605 095 GHz -54.184 dBm	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta
III. Agulent Species Marker 1 PASS 10 dB/div Log Trac 10 0 -10 0 -20 0 -30 0	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: L0 Ref Offset 23.82 ( Ref 20.00 dBn e 1 Pass	C 000 GHz PNC: Wide →→ IFGain:Low dB n	SENSE:EXT Trig: External1 #Atten: 10 dB	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PMOct 10, 2014 TRACE [] 2:3 4.5 0 TYPE A MINNIN 1.605 095 GHz -54.184 dBm	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta
III. Agulent Species III. Agulent Species	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: L0 Ref Offset 23.82 ( Ref 20.00 dBn e 1 Pass	C D00 GHz PNC: Wide →→ IFGain:Low dB n	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE [] 2:3 4.5 0 TYPE [] 2:3 4.5 0 TYPE AMININ N 1.605 095 GHz -54.184 dBm	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta
III. Agulent Species Marker 1 PASS 10 dB/div Log Trac 10 0 .10 0 .20 0 .30 0 .40 0	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: L0 Ref Offset 23.82 ( Ref 20.00 dBn e 1 Pass	C 000 GHZ PNC: Wide →→ IFGain:Low dB n	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE [] 2:3 4.5 0 TYPE [] 2:3 4.5 0 TYPE AMNIN N 1.605 095 GHz -54.184 dBm	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF
III. Agulent Specer Marker 1 PASS 10 dB/div Log Trac 10 0 .0000 .000 .000	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: L0 Ref Offset 23.82 - Ref 20.00 dBn e 1 Pass	C D00 GHZ PNC: Wide →→ IFGain:Low dB n	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE [] 2:3 4.5 0 TYPE	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF
III. Agulent Spece III. A	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: L0 Ref 20.00 dBn e 1 Pass	C 000 CHZ PRO: Wide →→ IFGain:Low dB n	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE 12:24:54 TYPE 2:24:54 TYPE 2:24:54 TYPE 2:25:27 PM Oct 10, 2014 TYPE 2:25:27 PM Oct 10, 20	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF
In. Agulent Spece           Marker 1           PASS           10 dB/div           10 0           .000           .100           .200           .300           .400           .500	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: L0 Ref 20.00 dBm e 1 Pass	C 000 CHZ PRO: Wide →→ IFGain:Low dB n	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE 12:24:54 TYPE 2:24:54 TYPE 2:24:54 TYPE 2:25:27 PM Oct 10, 2014 TYPE 12:35:27 PM Oct 10:	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF
In. Agulent Spece           Marker 1           PASS           IO dB/div           Trac           100           0.00           -100           -200           -3000           -400           -5000           -700	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: L0 Ref 20.00 dBn e 1 Pass	C 000 CHZ PNC: Wide →→ IFGain:Low dB n	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE 12:24:54 TYPE 2:24:54 TYPE 2:24:54 TYPE 2:25:27 PM Oct 10, 2014 TYPE 2:25:27 PM Oct 10, 20	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF
In. Agulent Spece           Marker 1           PASS           IO dB/div           Trac           100           0.00           -100           -200           -3000           -400           -500           -700	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: L0 Ref 20.00 dBn e 1 Pass	C 000 CHZ PRO: Wide →→ IFGain:Low dB n	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE 12:24:54 TYPE 2:24:54 TYPE 2:24:54 TYPE 2:25:27 PM Oct 10, 2014 TYPE 2:25:27 PM Oct 10, 20	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF Mkr→Ref Lvl More
III. Agulent Spece           00         Marker 1           PASS         10 dB/div           10 dB/div         Trac           10 0	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: LO Ref 20.00 dBn e 1 Pass	C 000 CHZ PNC: Wide →→ IFGain:Low dB n	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100	12:35:27 PM Oct 10, 2014 TRACE 12:24 5 10 TYPE 12:34 5 10 TYPE 12:35:27 PM Oct 10, 2014 TYPE 12:35:27 PM Oct 10, 2014 T	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF Mkr→Ref Lvl More 1 of 2
In. Agulent Spece           Marker 1           PASS           IO dB/div           IO dB/div           Trac           100           .000           .100           .200           .3000           .400           .400           .700           Start 1.60           #Res BW	trum Analyzer - Sweet SA RF   50 Q D0 1.6050950000 Gate: LO Ref 20.00 dBn e 1 Pass   1 Pass   1 Pass   2 Pass 	C 000 CHZ PRO: Wide →→ IFGain:Low dB n dB n dB m	SENSE:EXT	ALIGN AUTO Avg Type: RMS Avg Hold: 100/100 Mkr1	12:35:27 PM Oct 10, 2014 TRACE 12:24 5 1 TYPE 12:34 5 1 TYPE 14:10000 16:05 095 GHz -54.184 dBm	Peak Search Next Peak Next Pk Right Next Pk Left Marker Delta Mkr→CF Mkr→Ref Lvl More 1 of 2

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#### 1621.020833 MHz

Agilent Spe	trum Analyzer - Swep	it SA						
<mark>W</mark> Marker 1	RF 50 Ω		SEN	ISE:EXT	ALIGN AUT	0 12:23:02 P	MOct 10, 2014	Peak Search
Marker	Gate: LO	PNO: F	ast Trig: Exte	ernal1 Avg	Hold: 100/100	TY		
		IFGain:	Low #Atten: 6	ab	Mice4	4 604 44		Next Peak
10 dB/diu	Ref Offset 23.	.82 dB			WIKI I	-55.2	50 dBm	
	Rei -20.00							
								Nevt Pk Pight
-30.0								NEXTERNIQUE
							-40.00 dBm	
-40.0								
-50.0								Next Pk Left
00.0								
-60.0	ter tertitik	( en angelen der bei	ale in the second second			, the state of the second s	n here and	
	a contractores	and a second						Marker Delta
-70.0								
-80.0								Mkr→CF
-90.0								
-100								Mkr→RefLvl
-110								
								More
Start 1.5	5900 GHz					Stop 1.6	1500 GHz	1 of 2
#Res BW	1.0 MHz		#VBW 3.0 MHz	*	#Sweep	20.00 ms (1	0001 pts)	
MSG					STA	TUS		

Agilent Spectr	rum Analyzer - Swept SA	100				×-
Marker 1	RF 50 Ω DC Δ -1.135000000	MHz	SENSE:EXT	ALIGN AUTO Avg Type: RMS	12:34:29 PM Oct 10, 2014 TRACE 1 2 3 4 5 6	Peak Search
PASS	Gate: LO	PNO: Wide +++ IFGain:Low	Trig: External1 #Atten: 10 dB	Avg Hold: 100/100	DET A NNNNN	NextBask
10 dB/div	Ref Offset 23.82 dB Ref 20.00 dBm			Δι	Mkr1 -1.135 MHz 21.529 dB	NextPeak
10.0	e 1 Pass					Next Pk Right
0.00						Next Pk Left
-20.0						Marker Delta
-40.0	1Δ2					Mkr→CF
-60.0		~~~~~		varment		Mkr→RefLvl
-70.0		X	2			More 1 of 2
Start 1.60 #Res BW	5000 GHz 1.0 MHz	#VBW	3.0 MHz*	Sweep	Stop 1.610000 GHz 2.533 ms (1001 pts)	
MSG				STAT	us	



#### 1625.969667 MHz

Agilent Spe	ctrum Analyzer - Swe	pt SA								
<mark>W</mark> arkor (	RF 50 Ω		CH-	SEN	SE:EXT		ALIGN AU	TO 12:24:38 P TRA	MOct 10, 2014	Peak Search
Marker	Gate: LO	00000	PNO: Fast ++	Trig: Exte	rnal1	Avg Hold	100/100	) TY		
	-		IFGain:Low	#Atten: 6	dB		_	U		Nevt Peak
	Ref Offset 23	3.82 dB					Mkr	1.586 41	14 GHz	NEXTFEAK
10 dB/div	Ref -20.00	dBm						-57.1	98 aBM	
-30.0										Next Pk Right
-40.0									-40.00 dBm	
										Novt Dk Loft
-50.0										NEXI FK LEIL
						1				
-60.0	elui-sidesteau elle		an a		pharent of Mark	appendenter og de	( <b>Pite</b> l)	in the state of the second second second		
	a la la facta de la caracteria de la carac	1.61.0	TALL AND A DECEMPENDED	i inte di di di						Marker Delta
-70.0										
-80.0										Mkr CE
										IVIKI→CF
-90.0										
-100										Mkr→RefLvl
-110										
										More
	5000 CH-							Oton 4-6		1 of 2
#Res BiA	5900 GHZ		#\/B14	3 0 MH7		#5	ween	20.00 ms (1	0000 GHZ	
white's DW	1.0 10112		# V D V	0.010112		<i>w</i>	weep	20100 1113 (1	oco i pis)	
MSG							STA	AIUS		

Agilen	t Spectru	m Analyzer - Sw	ept SA	1.55						- 0 <mark>- ×</mark> -	
Marke	er 1 1	RF 50	Ω DC	GHz	SENSE	Avg 1	ALIGN AUTO	12:36:24 PI TRAC	MOct 10, 2014	Peak Search	
PASS	5	Gate: LO		PNO: Wide ++ IFGain:Low	#Atten: 10 c	iB Avgir	1010. 100/100	DE	ANNNN		
10 dB/	div	Ref Offset 2 Ref 20.00	3.82 dB dBm				Mkr1	1.609 1 -54.7	20 GHz 63 dBm	NextPeak	
10.0	Trace	1 Pass								Next Pk Right	
0.00										Next Pk Left	
-20.0 -										Marker Delta	
-40.0	/									Mkr→CF	
-60.0	ven	······	m	m		han an a	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	-	••••••	Mkr→RefLvl	
-70.0	1.605	000 GHz						Stop 1.610	0000 GHz	More 1 of 2	
#Res	BW 1	U WHZ		#VBM	7 3.0 MHz*		Sweep 2	2.533 ms (	1001 pts)		
mag							STATU	3			



EIRP Density – Discrete Emissions (dBW/MHz)							
1616.020833 MHz 1621.020833 MHz 1625.969667 MHz							
-84.646	-93.953	No discrete emissions found					

#### <u>1616.020833 MHz</u>

OP         RF         S0.0         DC         SENSE:EXT         ALLIAN AUTO         04:43:33 PM oft 00, 2014         Marker           Marker 1 1.600721354000 GHz PNO: Close         Trig: Free Run IFGain:Auto         Avg Type: RMS Avg Hold:>100/100         Trace [] 2 3:4 3:0 Tree
Marker 1 1.600721354000 GHz PNO: Close IFGain:Auto Ref Offset 23.82 dB 10 dB/div Ref -20.00 dBm -30 0 -30 0 -30 0 Marker 1 1.600 721 354 GHz -54.646 dBm -54.646 dBm Nor
Ref Offset 23.82 dB         Mkr1 1.600 721 354 GHz         Select Man           10 dB/div         Ref -20.00 dBm         -54.646 dBm         Nor
-40.0
-60 0 Fix
Properti
-110 N
Center 1.600721360 GHz Span 2.000 kHz Span 2.000 kHz #VBW 3.0 MHz Sweep (FFT) ~19.87 ms (1001 pts)
MSG STATUS



#### 1621.020833 MHz

Agilent Spec	trum Analyzer - Swept SA								
	RF 50 Ω DC		SENSE	:EXT		ALIGN AUTO	12:30:01 PM	10ct 10, 2014	Peak Search
Marker	1.605721410500	PNO: Close	Trig: Extern	nal1	Avg Hold:	>100/100	TYP		
		IFGain:Auto	#Atten: 6 df	3			DE		Nevt Peak
	Ref Offset 23.82 dB				M	kr1 1.60	05 721 4 -63 9	11 GHz	NextFeak
	Rei -20.00 uBill								
									Next Dk Dight
-30.0									Next PK Right
-40.0									
50.0								-50.00 dBm	Next Pk Left
-50.0									
-60.0			1	1					
				_					Marker Delta
-70.0									
-80.0									Mkr→CF
-90.0									
									Mirr Doff vi
-100									wiki → Rei Lvi
-110									
									More
									1 of 2
Center 1. #Pec BM	605721409 GHz	#VBM	3.0 MHz		Sween	(EET) ~1	Span 2 0 87 ms (	1001 ptc)	
WINCES DW	100 112	#VBVV	5.0 WITZ		oweep		5.07-III5 (	roor pis)	
Dow						STATUS			





Limit Clause FCC CFR 47, 25.216 and IC RSS-170, 5.4.3

The e.i.r.p density of emissions from mobile earth stations with assigned uplink frequencies between 1610 MHz and 1660.5 MHz shall not exceed -70 dBW/MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed -80 dBW.

Mobile earth stations placed in service after July 21, 2002 with assigned uplink frequencies in the 1610-1660.5 MHz band shall suppress the power density of emissions in the 1605-1610 MHz band to an extent determined by linear interpolation from -70 dBW/MHz at 1605 MHz to -10 dBW/MHz at 1610 MHz.

The e.i.r.p. density of carrier-off state emissions from mobile earth stations with assigned uplink frequencies between 1 and 3 GHz shall not exceed -80 dBW/MHz in the 1559-1610 MHz band averaged over any two milli-second interval.



#### 2.5 MODULATION CHARACTERISTICS

2.5.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1047(d)

2.5.2 Equipment Under Test and Modification State QLOCATE S/N: 142105180 - Modification State 0

#### 2.5.3 Date of Test

9 October 2014

#### 2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

#### 2.5.5 Test Procedure

The description below of the modulation used was declared by the manufacturer.

To support this description, plots of the transmitted burst in the time and frequency domains have been provided.

#### 2.5.6 Environmental Conditions

Ambient Temperature25.7°CRelative Humidity40.1%



#### 2.5.7 Test Results

#### 1621.020833 MHz







Traffic, broadcast, and ring alert channels use differentially encoded quaternary phase shift keyed (DE-QPSK) modulation with 40% square root raised cosine pulse shaping. The burst transmission rate is 25ksps or 50 kbps. The phase of the QPSK symbol states relative to the carrier phase is (Symbol State/Phase in deg): 00/0, 01/-90, 10/+90, 11/180.

The acquisition channel uses differentially encoded binary phase shift keyed (DE-BPSK) with 40% square root raised cosine pulse shaping. The burst rate on these channels is 25 kbps.

The sync channel uses 25 kbps DE-BPSK on the uplink and 50 kbps DE-QPSK on the downlink. Both with 40% square root raised cosine pulse shaping.



#### 2.6 OCCUPIED BANDWIDTH

#### 2.6.1 Specification Reference

FCC CFR 47 Part 2, Clause 2.1049 Industry Canada RSS-GEN, Clause 4.6.1

#### 2.6.2 Equipment Under Test and Modification State

QLOCATE S/N: 142105180 - Modification State 0

#### 2.6.3 Date of Test

9 October 2014

#### 2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

#### 2.6.5 Test Procedure

The test was applied in accordance with the test method requirements of Part 2.1051 and KDB 971168.

The EUT was connected to a spectrum analyser via a cable and attenuator. The EUT was configured to transmit on bottom, middle and top channels at maximum power. The spectrum analyser was configured to measure only over the active part of the burst. The settings of the analyser were configured with an RBW of 1.8 kHz and VBW of 18 kHz using an RMS detector and average trace. The Occupied bandwidth measurement function of the analyser was then utilized to make the measurement and the 99% occupied bandwidth was recorded.

#### 2.6.6 Environmental Conditions

Ambient Temperature	25.7°C
Relative Humidity	40.1%



#### 2.6.7 Test Results

5.0 V DC

Frequency	Occupied Bandwidth (kHz)
1616.020833 MHz	32.419
1621.020833 MHz	32.488
1625.969667 MHz	31.993

#### 1616.020833 MHz





#### 1621.020833 MHz



#### 1625.969667 MHz



#### Limit Clause FCC CFR 47 Part 25.202(b)

(b) Other frequencies and associated bandwidths of emission may be assigned on a case-bycase basis to space systems under this part in conformance with § 2.106 of this chapter and the Commission's rules and policies.



**SECTION 3** 

## **TEST EQUIPMENT USED**



#### 3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Туре No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 - Frequency Tolera	ince	<u>.</u>		· · ·	<u>.</u>
Climatic Chamber	Votsch	VT4002	161	-	O/P Mon
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Digital Thermometer	Digitron	T208	2831	12	31-Jul-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
Frequency Standard	Spectracom	Secure Sync 1200- 0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Section 2.2 - Emission Limitati	ons				
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	2-May-2015
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	235	12	8-Nov-2014
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Signal Generator (10MHz to 40GHz)	Rohde & Schwarz	SMR40	1002	12	19-Sep-2015
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Pre-Amplifier	Phase One	PS04-0086	1533	12	19-Dec-2014
Screened Room (5)	Rainford	Rainford	1545	24	10-Jan-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Amplifier (1kW)	EMV	1000W1000M7	1633	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	12-Dec-2014
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar Instruments	TG 315	3240	-	TU
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Oct-2014
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
'3.5mm' - '3.5mm' RF Cable (1m)	Rhophase	3PS-1803-1000- 3PS	3697	12	28-Feb-2015
9m RF Cable (N Type)	Rhophase	NPS-2303-9000- NPS	3791	-	TU
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	1-Oct-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Frequency Standard	Spectracom	Secure Sync 1200- 0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Suspended Subtrate Highpass Filter	Advance Power Components	11SH10- 3000/X18000-O/O	4411	12	21-Mar-2015

#### COMMERCIAL-IN-CONFIDENCE



#### **Product Service**

-		1 =			
Instrument	Manufacturer	Type No.	TE No.	Calibration	Calibration Due
				Period	
				(months)	
Section 2.3 - Power Limits					
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar Instruments	TG 315	3240	-	TU
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Frequency Standard	Spectracom	Secure Sync 1200- 0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Section 2.4- Limits on Emis	sions from Mobile Earth S	tations for Protection	of Aerona	utical Radiona	vigation-Satellite
Service					•
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	18-Jan-2015
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar Instruments	TG 315	3240	-	TU
Attenuator (20dB, 150W)	Narda	769-20	3367	12	28-May-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Frequency Standard	Spectracom	Secure Sync 1200- 0408-0601	4393	6	18-Jan-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Section 2.5 - Modulation Ch	aracteristics		•		
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	D302T	609	-	O/P Mon
Hvgrometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar Instruments	TG 315	3240	-	TU
Attenuator (30dB, 150W)	Narda	769-30	3369	12	28-May-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
Section 2.6 - Occupied Ban	dwidth			- <b>-</b>	
Multimeter	White Gold	WG022	190	12	28-Oct-2014
Power Supply Unit	Farnell	D302T	609	1-	O/P Mon
Hvarometer	Rotronic	I-1000	3220	12	24-Jul-2015
Function Generator	Thurlby Thandar	TG 315	3240	-	TU
Attenuator (30dB 150W)	Narda	769-30	3369	12	28-May-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	27-Feb-2015
				· · · -	

TU – Traceability Unscheduled O/P MON – Output Monitored with Calibrated Equipment



## 3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU		
Power Limits	Conducted: ± 0.70 dB Radiated: ± 6.3 dB		
Modulation Characteristics	-		
Limits on Emissions from Mobile Earth Stations for Protection of Aeronautical Radionavigation-Satellite Service	± 3.08 dB		
Frequency Tolerance	± 3.54 Hz		
Emission Limitations	Conducted: ± 3.08 dB Radiated: 30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 17 GHz: ± 6.3 dB		
Occupied Bandwidth	± 16.74 kHz		



**SECTION 4** 

## ACCREDITATION, DISCLAIMERS AND COPYRIGHT



## 4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).

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