Report on the FCC and IC Testing of:

PervasID
UHF RFID Distributed Antenna System, Model: Space/Portal Ranger 9200

In accordance with FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN

Prepared for: PervasID
St John's Inovation Centre, Cowley Road,
Cambridge, CB4 OWS, UNITED KINGDOM

FCC ID: 2AQQW9200 IC: 24482-9200

COMMERCIAL-IN-CONFIDENCE

Document Number: 75943122-02 | Issue: 01

Product Service

Choose certainty.
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SIGNATURE			
NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Simon Bennett	Chief Engineer	Authorised Signatory	05 November 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 15Cand Industry Canada RSS-247 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

SIGNATURE			
NAME	JOB TITLE	RESPONSIBLE FOR	ISSUE DATE
Graeme Lawler	Test Engineer	Testing	05 November 2018
Mehadi Choudhury	Test Engineer	Testing	05 November 2018
Matthew Russell	RF Team Leader	Testing	05 November 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: 2017, Industry Canada RSS-247: Issue 2 (2017-02) and Industry Canada RSS-GEN: Issue 4 (2014-11).

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ACCREDITATION

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Product Service

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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	05 November 2018

Table 1

1.2 Introduction

Applicant	PervasID
Manufacturer	PervasID
Model Number(s)	Space/Portal Ranger 9200
Serial Number(s)	0280420101-0007 and 0280420101-0001
Hardware Version(s)	5.2 FCC
Software Version(s)	2.6.8
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2017 Industry Canada RSS-247: Issue 2 (2017-02) Industry Canada RSS-GEN: Issue 4 (2014-11)
Order Number Date	PO-0028 15-June-2018
Date of Receipt of EUT	27-June-2018 and 01-August-2018
Start of Test	28-June-2018
Finish of Test	09-September-2018
Name of Engineer(s)	Graeme Lawler, Mehadi Choudhury and Matthew Russell
Related Document(s)	ANSI C63.10 (2013) KDB 662911 D01 v02r01

Product Service

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, 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: UHF RFiD						
2.1	15.207	-	8.8	AC Power Line Conducted Emissions	Pass	ANSI C63.10 (2013)
2.2	15.247 (d)	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.3	15.247 (d) and 15.205	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)
2.4	15.247 (b)	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.5	15.247 (d)	5.5	-	Spurious Conducted Emissions	Pass	ANSI C63.10 (2013)
2.6	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Average Time of Occupancy	Pass	ANSI C63.10 (2013)
2.7	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Channel Separation	Pass	ANSI C63.10 (2013)
2.8	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Number of Hopping Channels	Pass	ANSI C63.10 (2013)
2.9	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - 20 dB Bandwidth	Pass	ANSI C63.10 (2013)

Table 2

1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	Space/Portal Ranger 9200
Part Number	RFID_DAS_9200_R
Hardware Version	5.2 FCC
Software Version	2.6.8
FCC ID (if applicable)	2AQQW9200
Industry Canada ID (if applicable)	24482-9200
Technical Description (Please provide a brief description of the intended use of the equipment)	UHF RFID Distributed Antenna System - intended use detection and monitoring of UHF RFID tags

INTENTIONAL RADIATORS									
Technology	Frequency Band (MHz)	Conducted Declared Output Power (dBm)	Antenna Gain (dBi)	Supported Bandwidth (s) (MHz)	Modulation Scheme(s)	ITU Emission Designator	Test Channels (MHz)		
							Bottom	Middle	Top
UHF RFID	902-928MHz	34dBm	5-9dBic	0.5MHz	PR-ASK	500KD1D--	902.75	915.25	927.25

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	928 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	2 MHz
Class A Digital Device (Use in commercial, industrial or business environment) ☒ Class B Digital Device (Use in residential environment only) ☐	

Power Source			
AC	Single Phase	Three Phase	Nominal Voltage
	110 V		
External DC	Nominal Voltage		Maximum Current
	24		3A
Battery	Nominal Voltage		Battery Operating End Point Voltage
	-		-
Can EUT transmit whilst being charged?			Yes ☐ No ☒

Product Service

EXTREME CONDITIONS					
Maximum temperature	35	°C	Minimum temperature	0	°C

Ancillaries
Please list all ancillaries which will be used with the device.
Power supply Antennas Ethernet Hub Laptop

ANTENNA CHARACTERISTICS					
☒	Antenna connector		State impedance	50	Ohm
☐	Temporary antenna connector		State impedance		Ohm
☐	Integral antenna	Type			
☐	External antenna	Type			

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

Name: Sabesan Sithamparanathan

Position held: CEO Date: 25/06/2018

1.5 Product Information

1.5.1 Technical Description

UHF RFID Distributed Antenna System - intended use detection and monitoring of UHF RFID tags.

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: 0280420101-0007			
0	As supplied by the customer	Not Applicable	Not Applicable
1	The modification to the reader circuitry, in order to meet FCC requirements, is replacement of circuit component F1 from a B39871B3440U410 - 869MHz SAW filter, to the TA1628A - 918.6MHz SAW filter.	Customer	09 September 2018
Serial Number: 0280420101-0001			
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: UHF RFiD		
AC Power Line Conducted Emissions	Graeme Lawler	UKAS
Authorised Band Edges	Mehadi Choudhury	UKAS
Spurious Radiated Emissions	Graeme Lawler	UKAS
Spurious Conducted Emissions	Matthew Russell	UKAS
Maximum Conducted Output Power	Mehadi Choudhury	UKAS
Frequency Hopping Systems - Average Time of Occupancy	Mehadi Choudhury	UKAS
Frequency Hopping Systems - Channel Separation	Mehadi Choudhury	UKAS
Frequency Hopping Systems - Number of Hopping Channels	Mehadi Choudhury and Matthew Russell	UKAS
Frequency Hopping Systems - 20 dB Bandwidth	Mehadi Choudhury	UKAS

Table 4

Office Address:

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

2 Test Details

2.1 AC Power Line Conducted Emissions

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.207
Industry Canada RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

Space/Portal Ranger 9200, S/N: 0280420101-0001 - Modification State 0

2.1.3 Date of Test

01-August-2018

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.2.

2.1.5 Environmental Conditions

Ambient Temperature	20.1 °C
Relative Humidity	50.8 %

2.1.6 Test Results

UHF RFiD

Applied supply Voltage: 60 Hz
Applied supply frequency: 120 Vac

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.150	48.3	66.0	-17.7	24.4	56.0	-31.6
0.197	53.1	63.8	-10.7	41.8	53.8	-12.0
1.707	43.1	56.0	-12.9	38.3	46.0	-7.7
1.836	43.2	56.0	-12.8	38.4	46.0	-7.6
1.968	42.8	56.0	-13.2	37.8	46.0	-8.2
9.181	47.3	60.0	-12.7	42.2	50.0	-7.8

Table 5 - Neutral Line Emissions Results

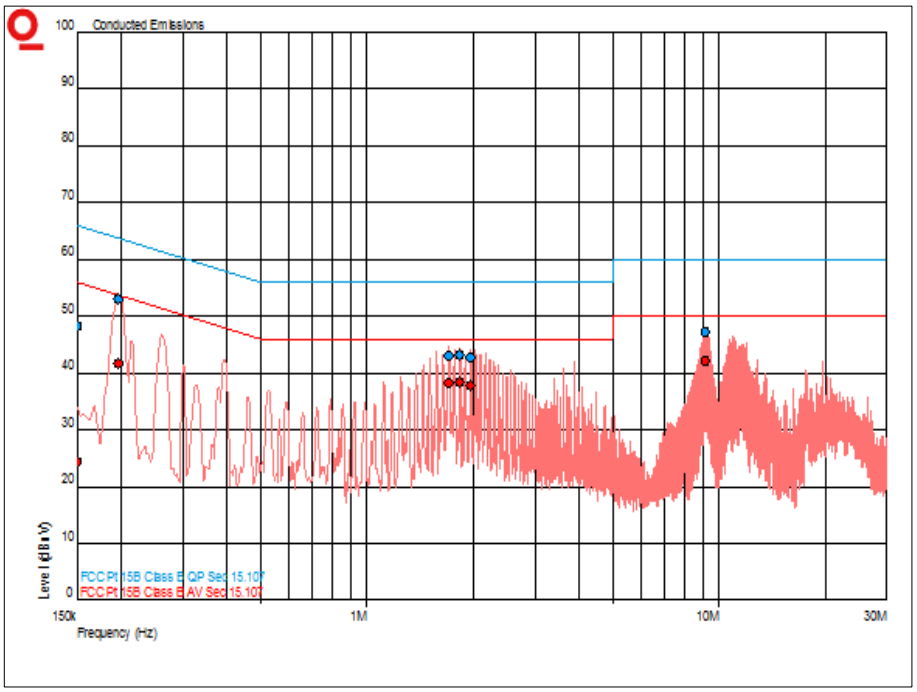

Figure 1 - Neutral Line - 150 kHz to 30 MHz

Frequency (MHz)	QP Level (dBuV)	QP Limit (dBuV)	QP Margin (dBuV)	AV Level (dBuV)	AV Limit (dBuV)	AV Margin (dBuV)
0.150	48.2	66.0	-17.8	24.3	56.0	-31.7
0.195	49.8	63.8	-14.1	39.8	53.8	-14.1
0.261	46.7	61.4	-14.7	36.6	51.4	-14.8
2.029	41.6	56.0	-14.4	35.5	46.0	-10.5
9.028	44.9	60.0	-15.1	39.4	50.0	-10.6
9.163	46.2	60.0	-13.8	39.3	50.0	-10.7

Table 6 - Live Line Emissions Results

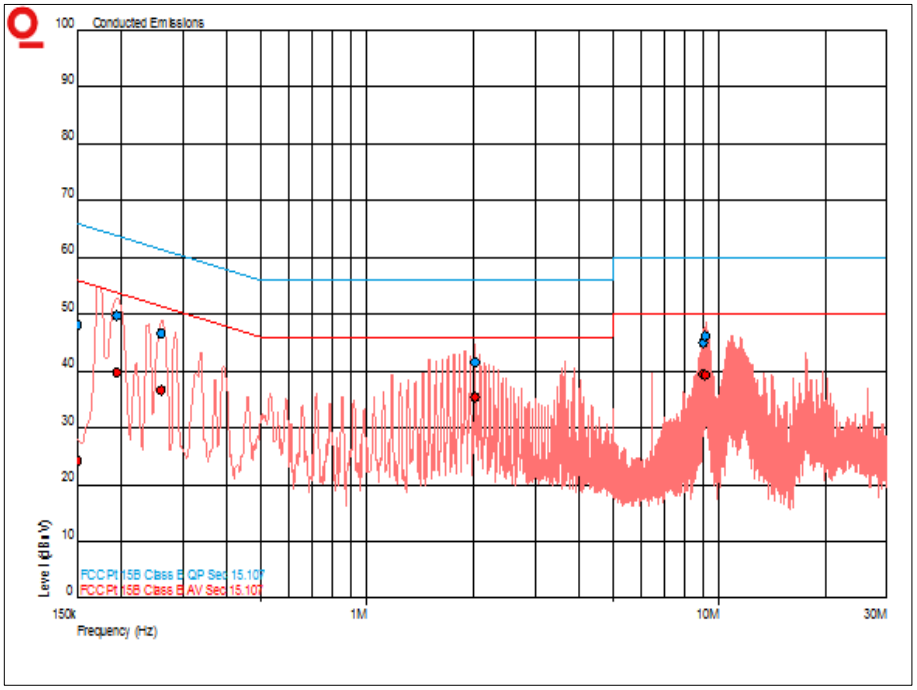

Figure 2 - Live Line - 150 kHz to 30 MHz

<u>FCC 47 CFR Part 15, Limit Clause 15.207 and Industry Canada RSS-GEN, Limit Clause 8.8</u>

Frequency of Emission (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

Table 7

*Decreases with the logarithm of the frequency.

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
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Single Phase LISN	Rohde & Schwarz	ESH3-Z5	1674	12	04-Apr-2019
Transient Limiter	Hewlett Packard	11947A	2377	12	23-Feb-2019
Multimeter	Iso-tech	IDM101	2419	12	23-Nov-2018
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
Cable (Rx, Nm-Nm, 7m)	Scott Cables	SLU18-NMNM-07.00M	4498	-	O/P Mon
Hygrometer	Rotronic	HP21	4989	12	26-Apr-2019

Table 8

O/P Mon – Output Monitored using calibrated equipment

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

Space/Portal Ranger 9200, S/N: 0280420101-0007 - Modification State 0

2.2.3 Date of Test

02-July-2018

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 23.8 °C
Relative Humidity 27.6 %

2.2.6 Test Results

UHF RFiD

Mode	Frequency (MHz)	Measured Frequency (MHz)	Level (dBc)
Static	902.75	902.00	63.39
Hopping	902.75	902.00	64.49
Static	927.25	928.00	62.20
Hopping	927.25	928.00	69.50

Table 9

Product Service

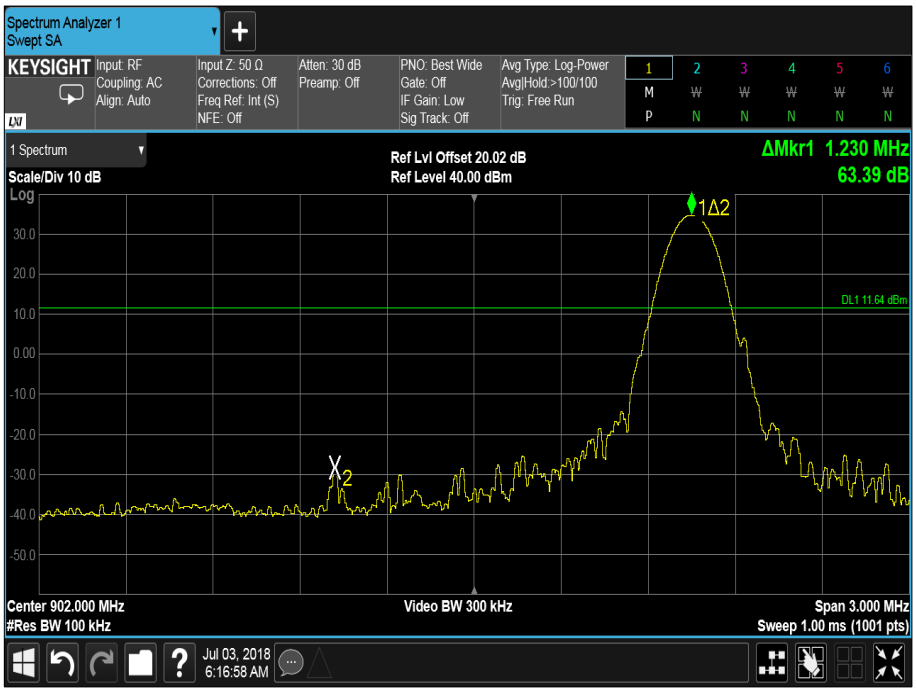

Figure 3 - Static 902.75 MHz - Measured Frequency 902.00 MHz

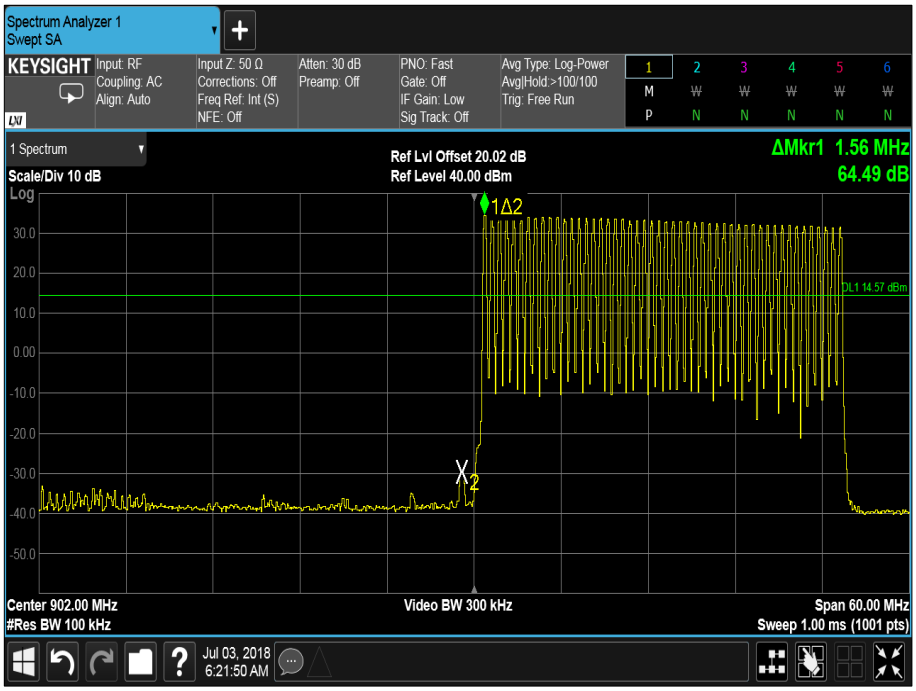

Figure 4 - Hopping 902.75 MHz - Measured Frequency 902.00 MHz

Product Service

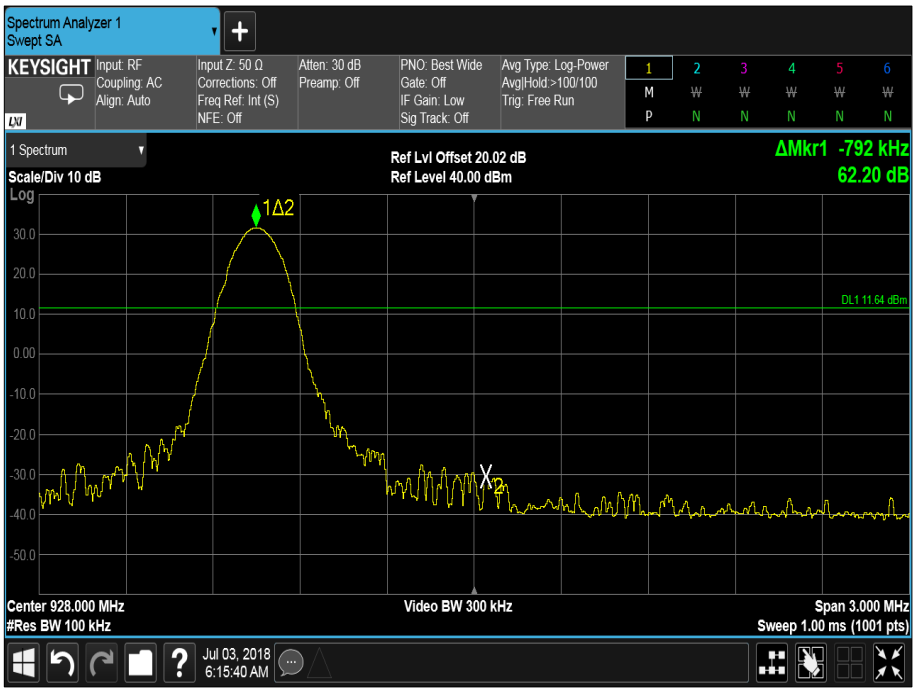

Figure 5 - Static 927.25 MHz - Measured Frequency 928.00 MHz

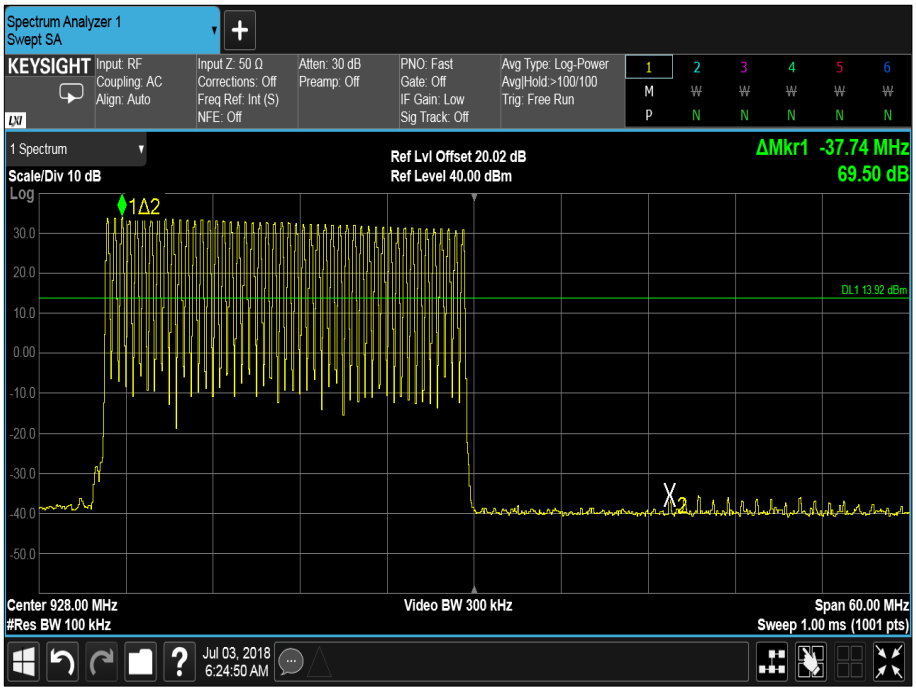

Figure 6 - Hopping 927.25 MHz - Measured Frequency 928.00 MHz

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 RF Laboratory 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Mains Voltage Monitor	TUV SUD Product Service	RAB-001	1378	12	17-Apr-2019
Programmable Power Supply	California Inst	LO8036	1898	-	O/P Mon
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	20-Oct-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	09-Feb-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	20-Oct-2018
Attenuator (10dB, 100W)	Weinschel	48-10-43	4868	12	01-Nov-2018
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018
Cable (18GHz	Rosenberger	LU7-036-1000	5030	-	O/P Mon
Cable (18GHz	Rosenberger	LU7-036-1000	5034	-	O/P Mon

Table 10

O/P Mon – Output Monitored using calibrated equipment

2.3 Spurious Radiated Emissions

2.3.1 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

2.3.2 Equipment Under Test and Modification State

Space/Portal Ranger 9200, S/N: 0280420101-0001 - Modification State 0 (1 GHz to 10 GHz)
Space/Portal Ranger 9200, S/N: 0280420101-0007- Modification State 1 (30 MHz to 1 GHz)

2.3.3 Date of Test

30-July-2018 to 09-September-2018

2.3.4 Test Method

This test was performed in accordance with ANSI C63.10-2013 clause 6.3, 6.5 and 6.6.
For frequencies > 1 GHz, plots for average measurements were taken in accordance with ANSI C63.10 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 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, (74/54 dBuV/m) 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).

2.3.5 Environmental Conditions

Ambient Temperature	21.5 -22.0 °C
Relative Humidity	24.0 - 68.7 %

2.3.6 Test Results

UHF RFiD

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
81.274	25.2	40.0	-14.8	316	1.00	Vertical
162.620	30.8	43.5	-12.7	34	1.00	Vertical
185.860	29.7	43.5	-3.8	118	1.00	Horizontal

Table 11 - 902.75 MHz - 30 MHz to 300 MHz
EUT Orientation: X

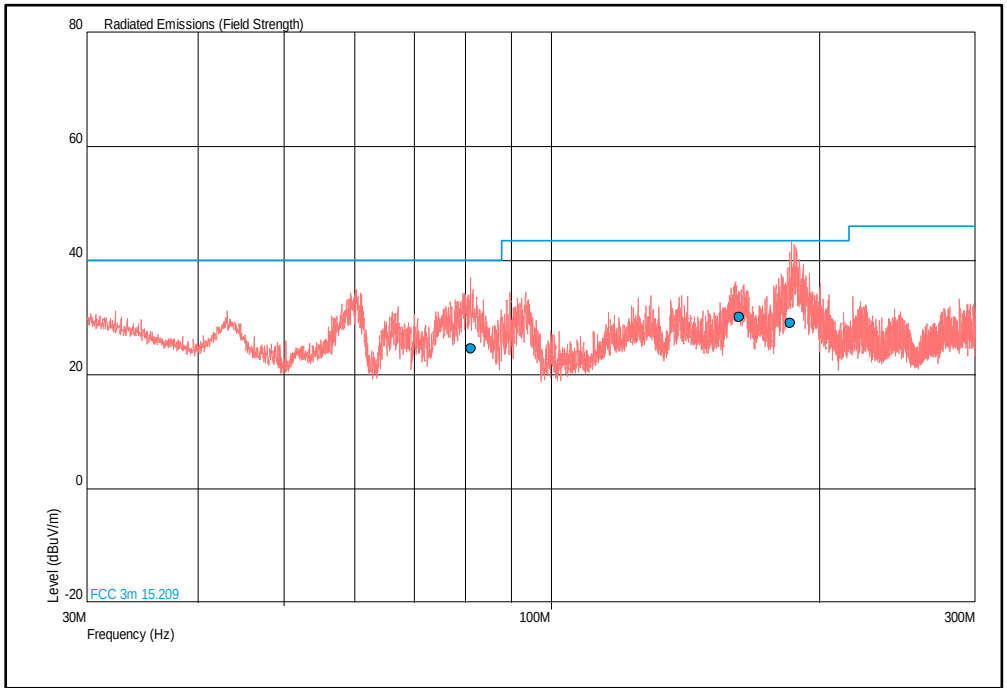

Figure 7 - 902.75 MHz - 30 MHz to 300 MHz
Polarity: Combined, EUT Orientation: X

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
333.854	32.2	46.0	-13.8	320	1.00	Horizontal
400.000	31.6	46.0	-14.4	225	1.00	Horizontal
614.000	36.3	46.0	-9.7	237	1.00	Horizontal
960.000	38.8	46.0	-7.2	4	2.98	Vertical

Table 12 - 902.75 MHz - 300 MHz to 1 GHz
EUT Orientation: X

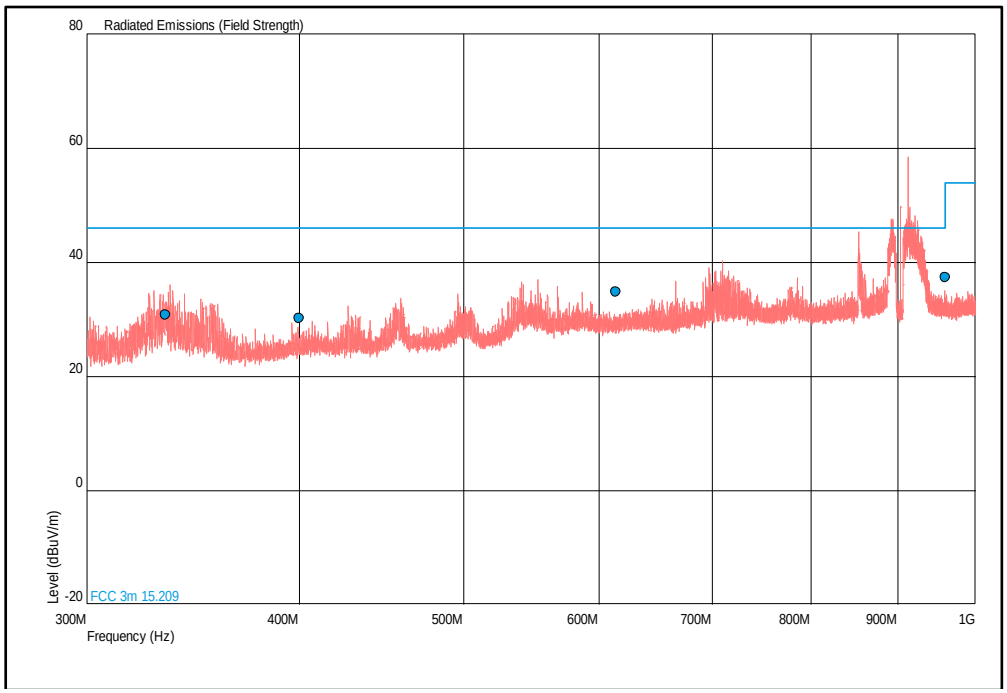

Figure 8 - 902.75 MHz - 300 MHz to 1 GHz
Polarity: Combined, EUT Orientation: X

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
80.825	28.4	40.0	-11.6	277	1.00	Vertical
164.402	29.8	43.5	-13.7	179	1.00	Vertical
190.170	26.9	43.5	-16.6	246	1.00	Vertical
80.825	28.4	40.0	-11.6	277	1.00	Vertical

Table 13 - 902.75 MHz - 30 MHz to 300 MHz
EUT Orientation: Y

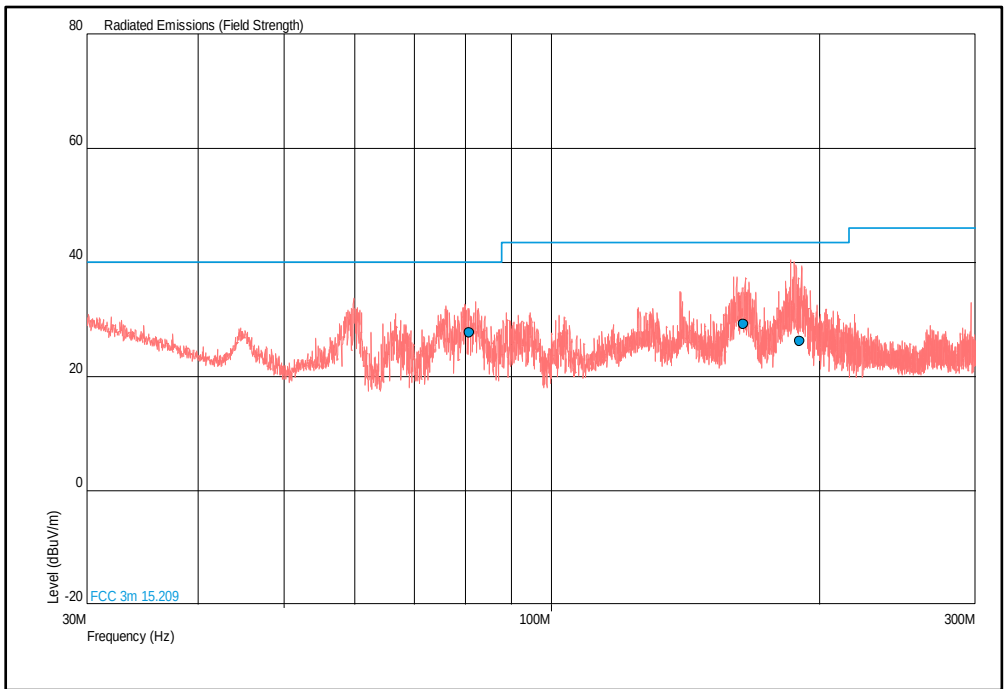

Figure 9 - 902.75 MHz - 30 MHz to 300 MHz
Polarity: Combined, EUT Orientation: Y

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
333.583	33.4	46.0	-12.6	331	1.00	Horizontal
400.000	31.7	46.0	-14.3	206	1.00	Horizontal
610.983	36.2	46.0	-9.8	240	3.55	Vertical
960.000	39.6	46.0	-6.4	337	1.00	Vertical

Table 14 - 902.75 MHz - 300 MHz to 1 GHz
EUT Orientation: Y

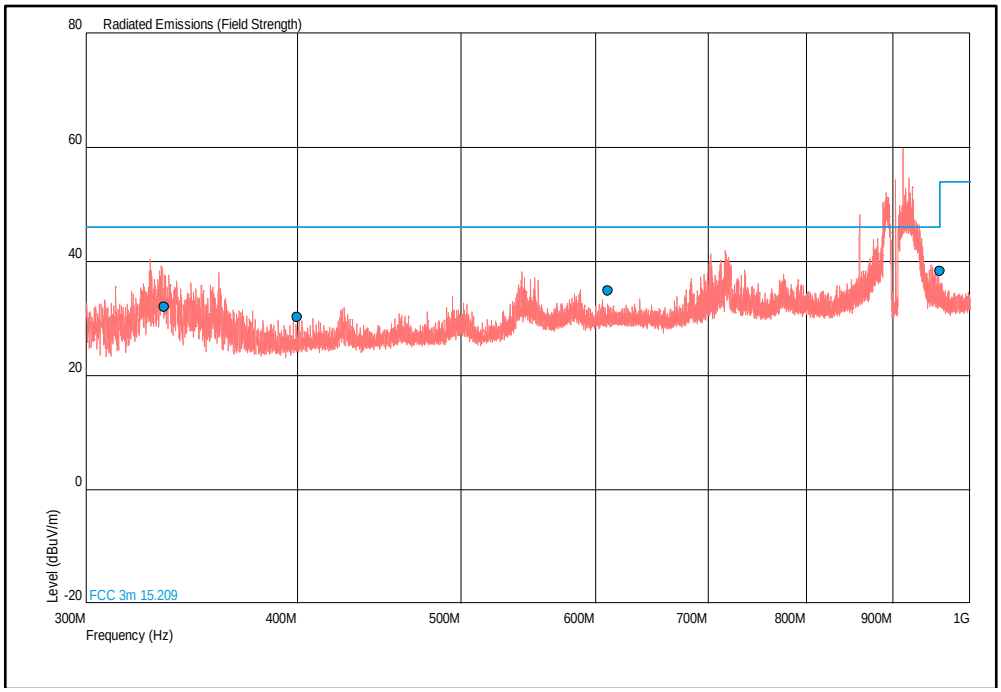

Figure 10 - 902.75 MHz - 300 MHz to 1 GHz
Polarity: Combined, EUT Orientation: Y

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

Table 15 - 902.75 MHz - 1 GHz to 10 GHz
EUT Orientation: X

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

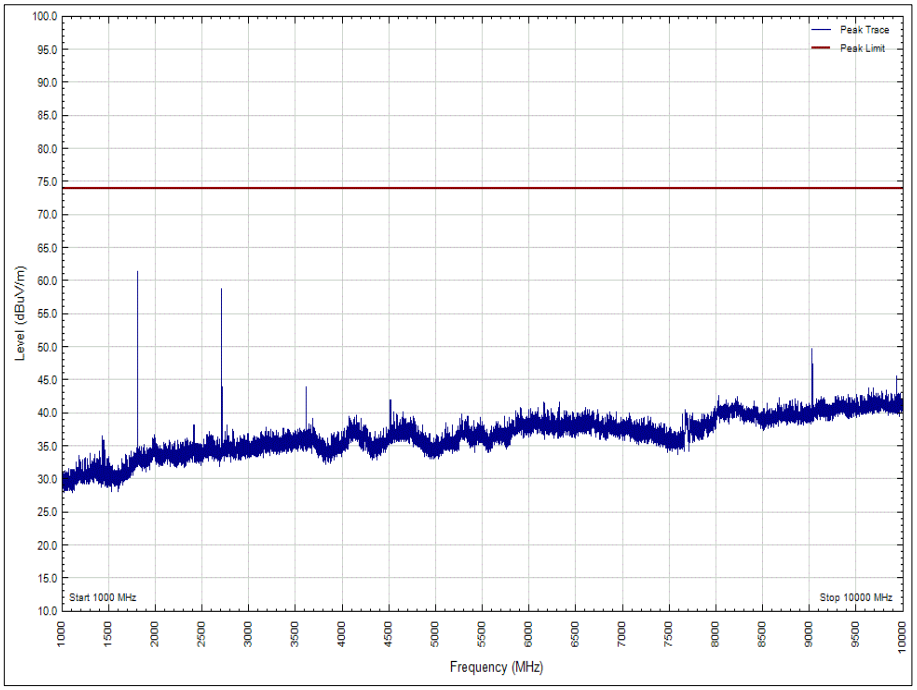

Figure 11 - 902.75 MHz - 1 GHz to 10 GHz,
Polarity: Vertical, EUT Orientation: X, Peak

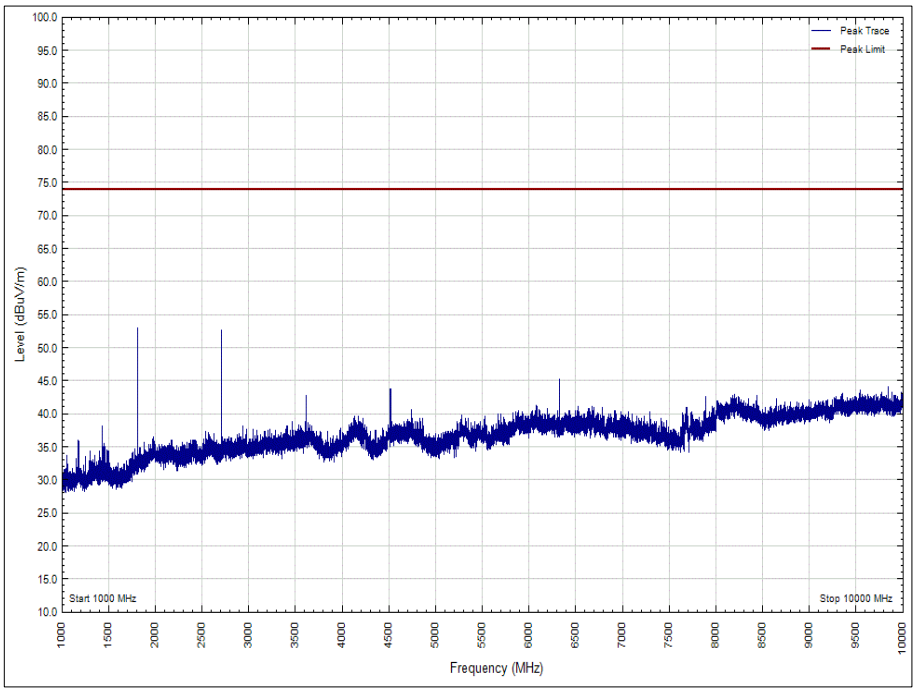

Figure 12 - 902.75 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: X, Peak

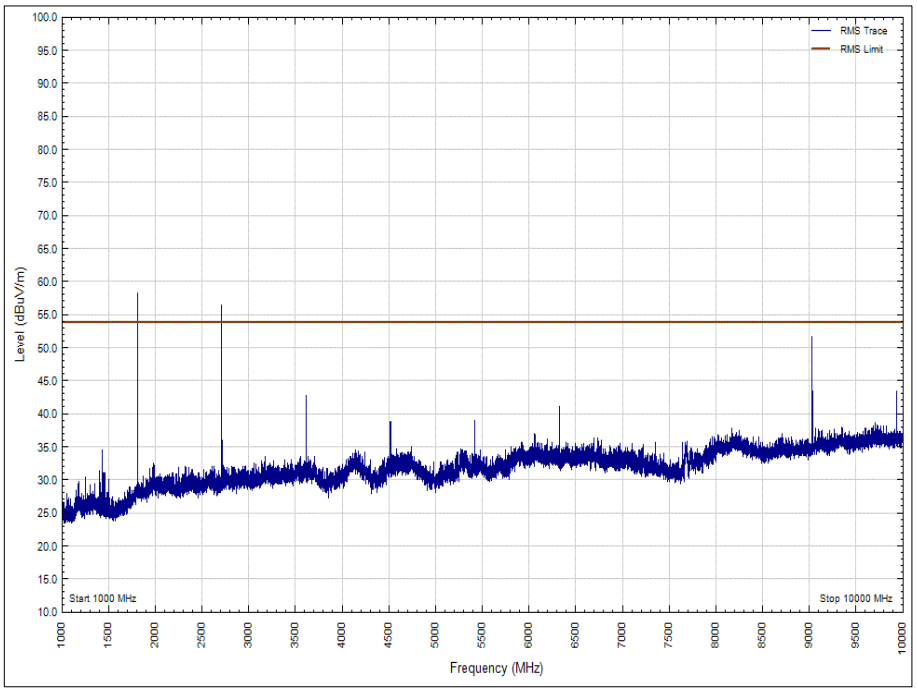

Figure 13 - 902.75 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: X, Average

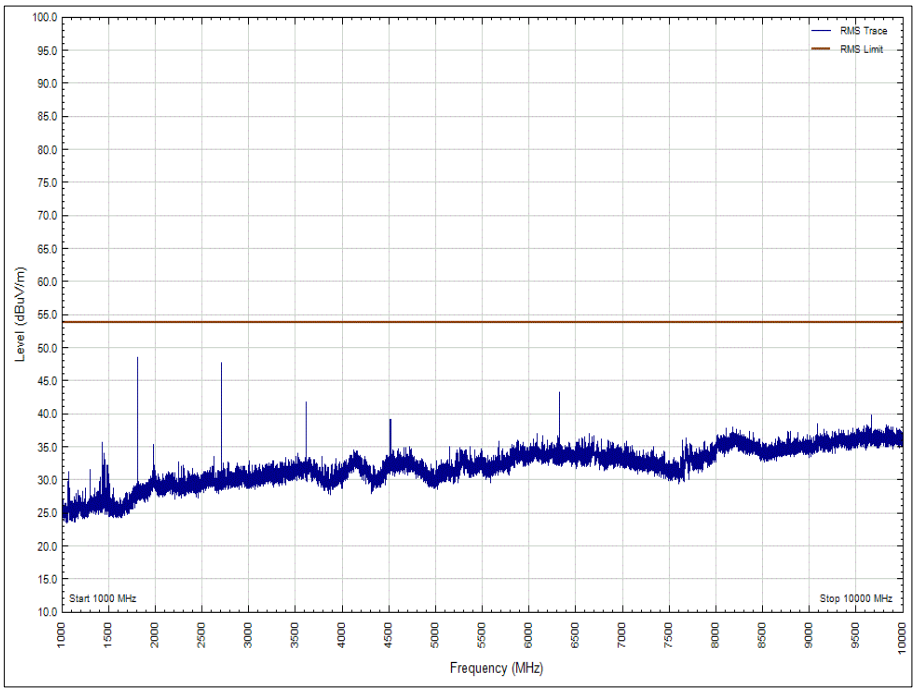

Figure 14 - 902.75 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: X, Average

Frequency (GHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.708193	-	50.23	-	54.0	-	3.77

Table 16 - 902.75 MHz - 1 GHz to 10 GHz
EUT Orientation: Y

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

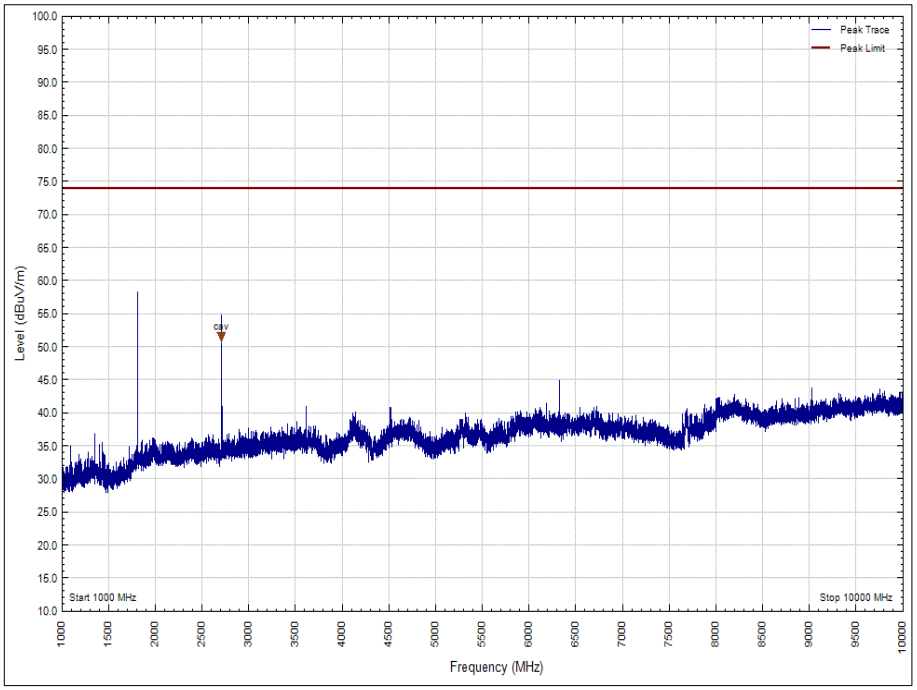

Figure 15 - 902.75 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: Y, Peak

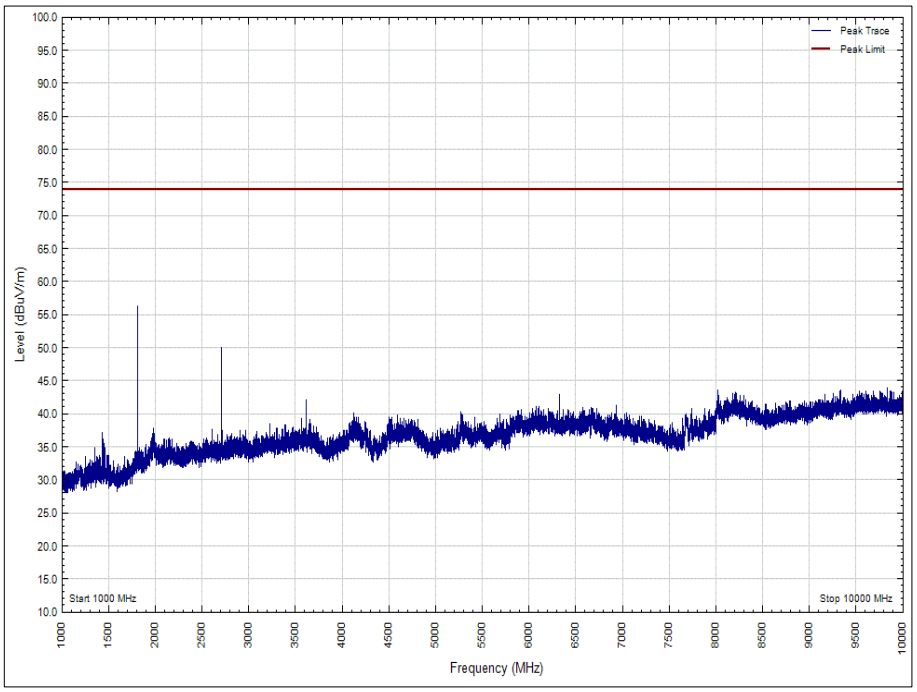

Figure 16 - 902.75 MHz - 1 GHz to 10 GHz - Orientation Polarity: Horizontal, EUT Orientation: Y, Peak

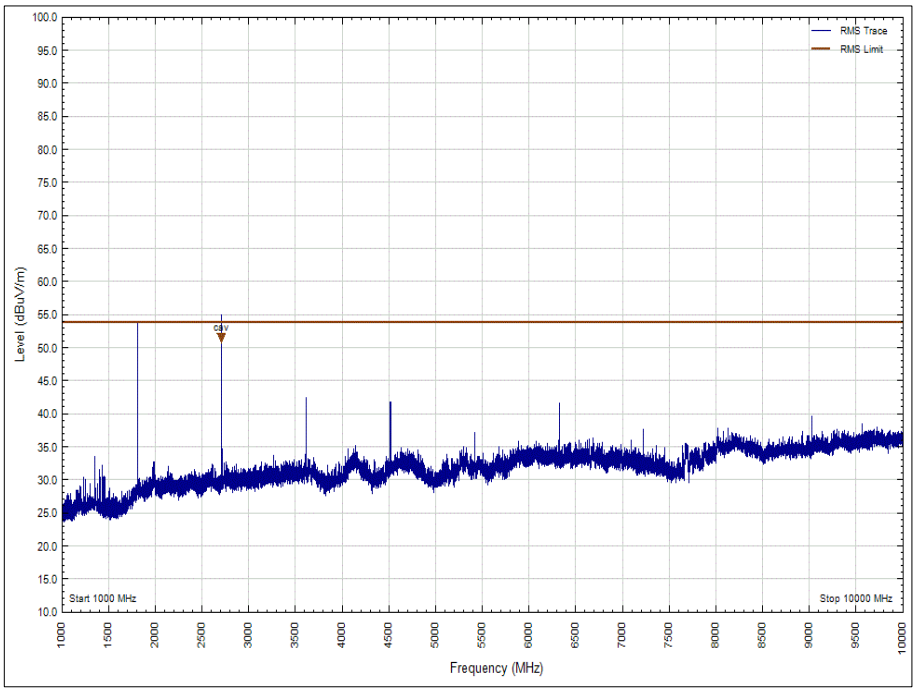

Figure 17 - 902.75 MHz - 1 GHz to 10 GHz Polarity: Vertical, EUT Orientation: Y, Average

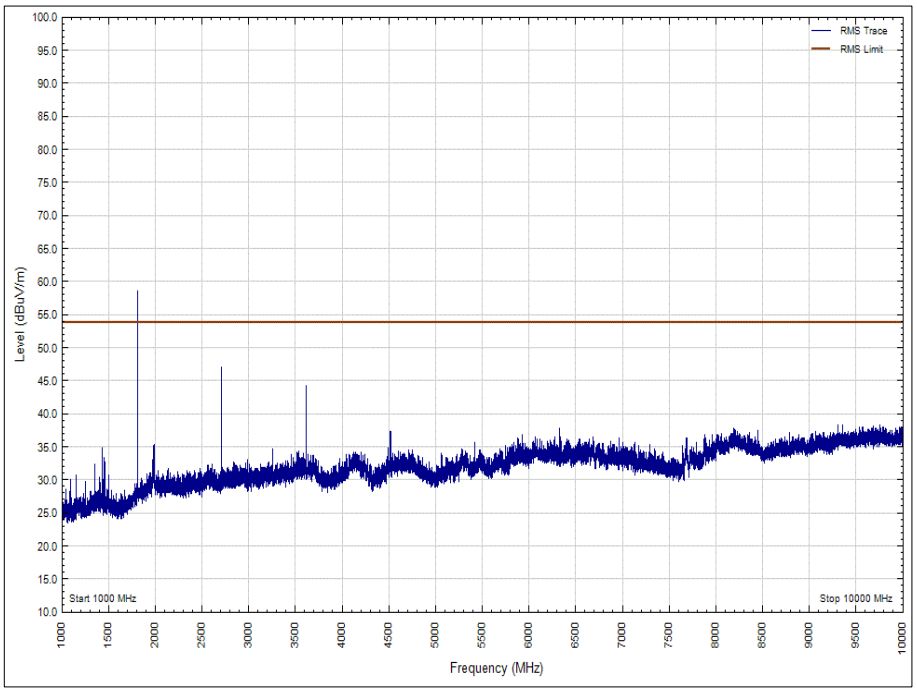

Figure 18 - 902.75 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: Y, Average

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
163.058	32.0	43.5	-11.5	323	1.77	Vertical
170.269	31.5	43.5	-12.0	243	1.00	Vertical
179.660	42.5	43.5	-1.0	15	1.75	Horizontal
283.053	33.6	46.0	-12.4	48	1.00	Horizontal

Table 17 - 915.25 MHz - 30 MHz to 300 MHz
EUT Orientation: X

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

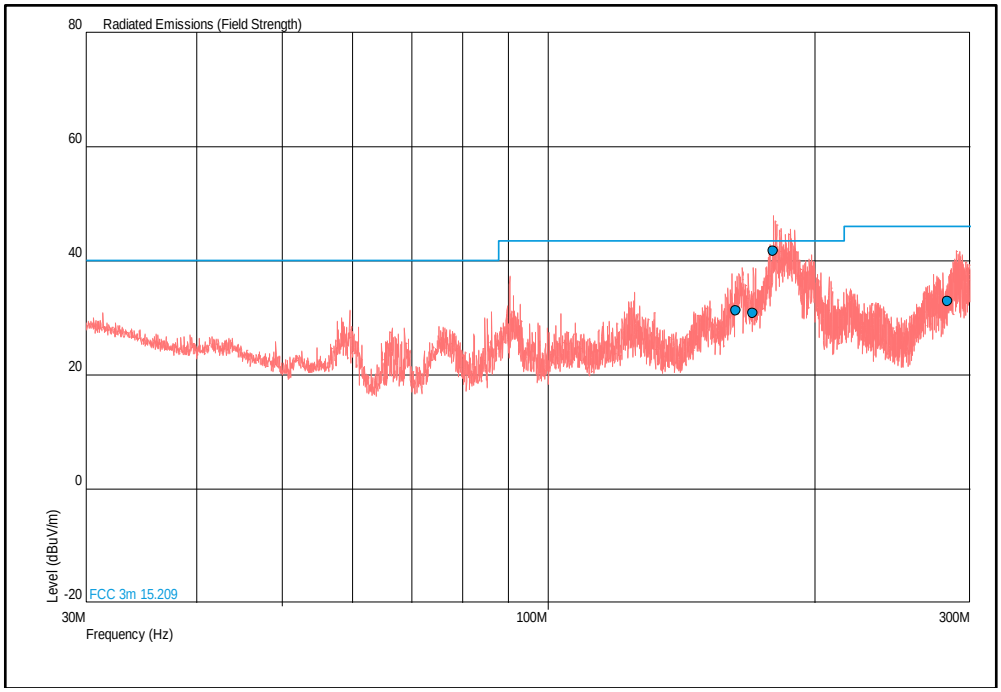

Figure 19 - 915.25 MHz - 30 MHz to 300 MHz
Polarity: Combined, EUT Orientation: X

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
332.521	36.9	46.0	-9.1	103	1.00	Horizontal
400.000	31.5	46.0	-14.5	176	1.00	Horizontal
608.000	36.2	46.0	-9.8	48	1.00	Horizontal
960.000	38.9	46.0	-7.1	359	1.00	Vertical

Table 18 - 915.25 MHz - 300 MHz to 1 GHz
EUT Orientation: X

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

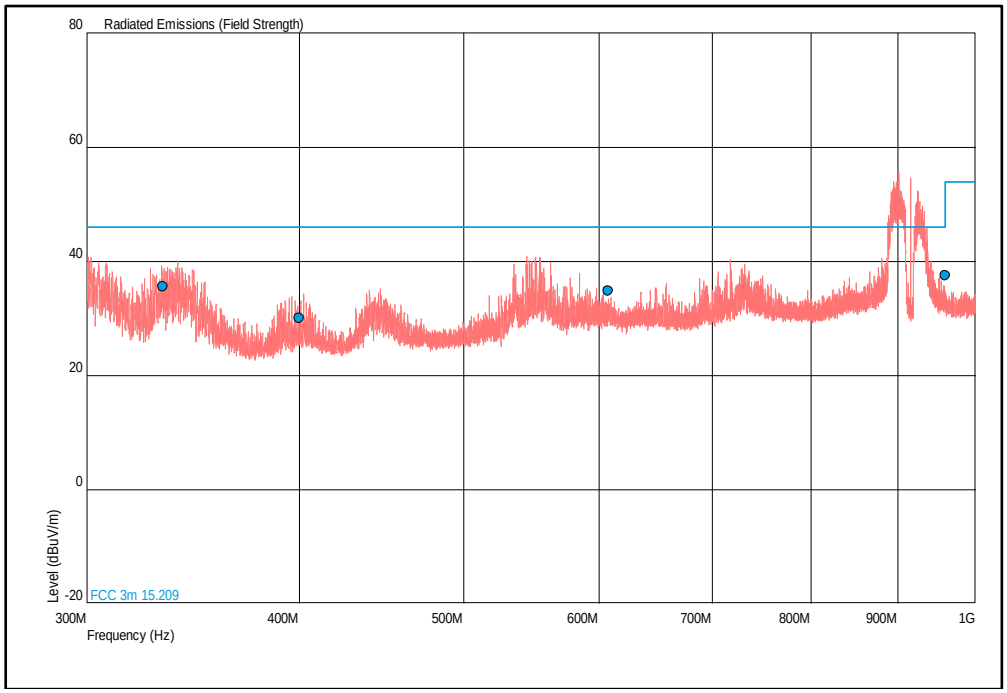

Figure 20 - 915.25 MHz - 300 MHz to 1 GHz
Polarity: Combined, EUT Orientation: X

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
164.476	35.4	43.5	-8.1	6	1.00	Vertical
171.795	35.5	43.5	-8.0	307	1.00	Vertical
188.333	42.4	43.5	-1.1	87	2.21	Horizontal
282.404	35.8	46.0	-10.2	310	1.00	Horizontal

Table 19 - 915.25 MHz - 30 MHz to 300 MHz
EUT Orientation: Y

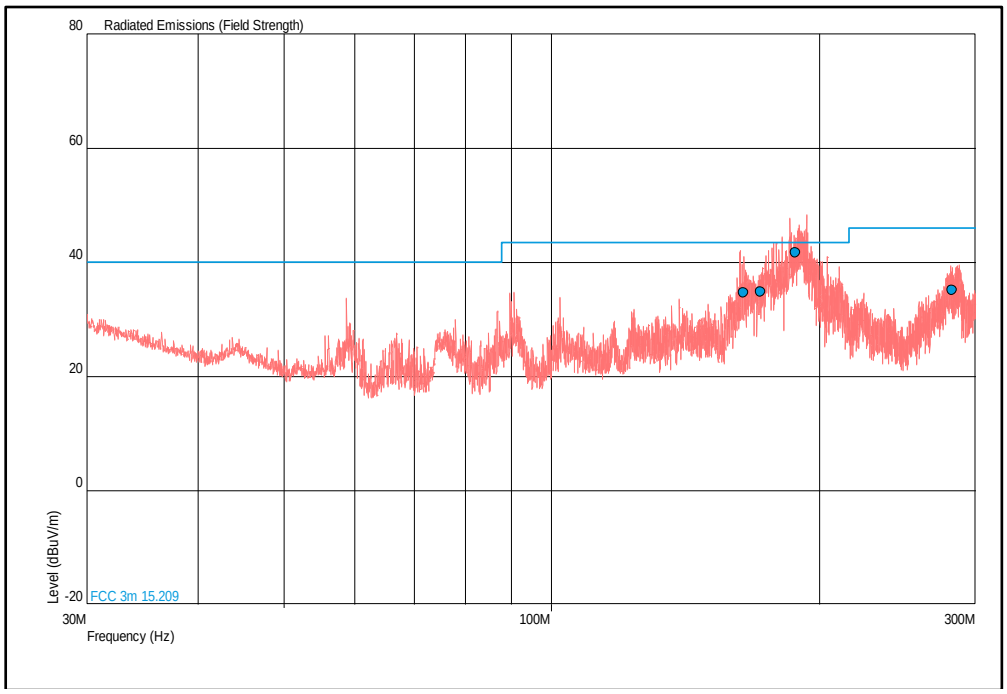

Figure 21 - 915.25 MHz - 30 MHz to 300 MHz
Polarity: Combined, EUT Orientation: Y

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
335.000	39.0	46.0	-7.0	73	1.09	Horizontal
400.000	32.0	46.0	-14.0	103	1.00	Horizontal
614.000	36.8	46.0	-9.2	120	1.00	Vertical
960.000	38.9	46.0	-7.1	164	1.00	Vertical

Table 20 - 915.25 MHz - 300 MHz to 1 GHz
EUT Orientation: Y

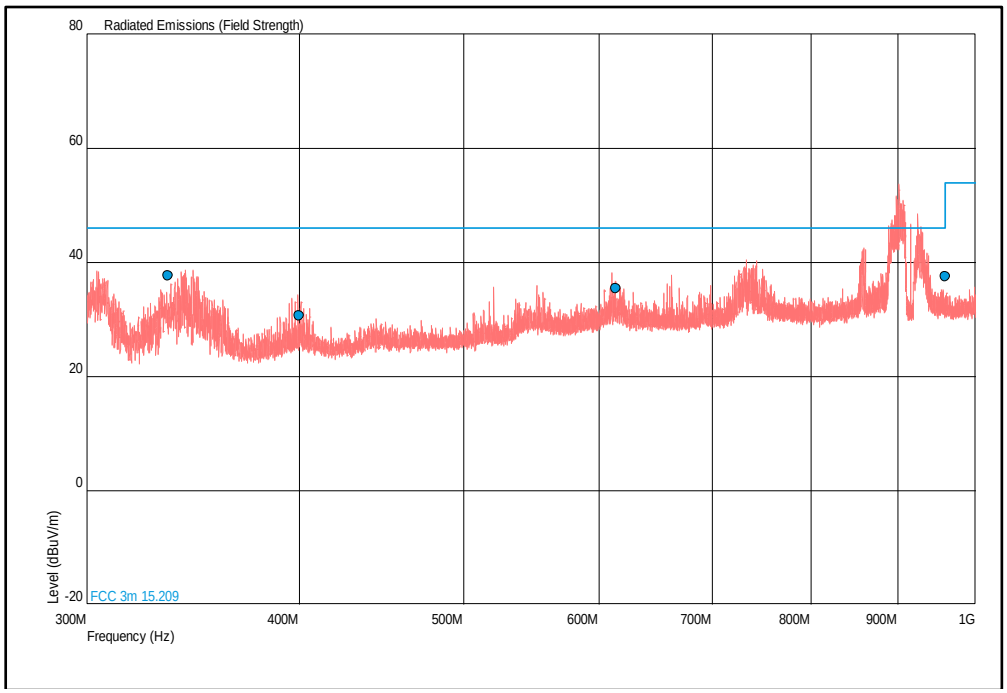

Figure 22 - 915.25 MHz - 300 MHz to 1 GHz
Polarity: Combined, EUT Orientation: Y

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

Table 21 - 915.25 MHz - 1 GHz to 10 GHz
EUT Orientation: X

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

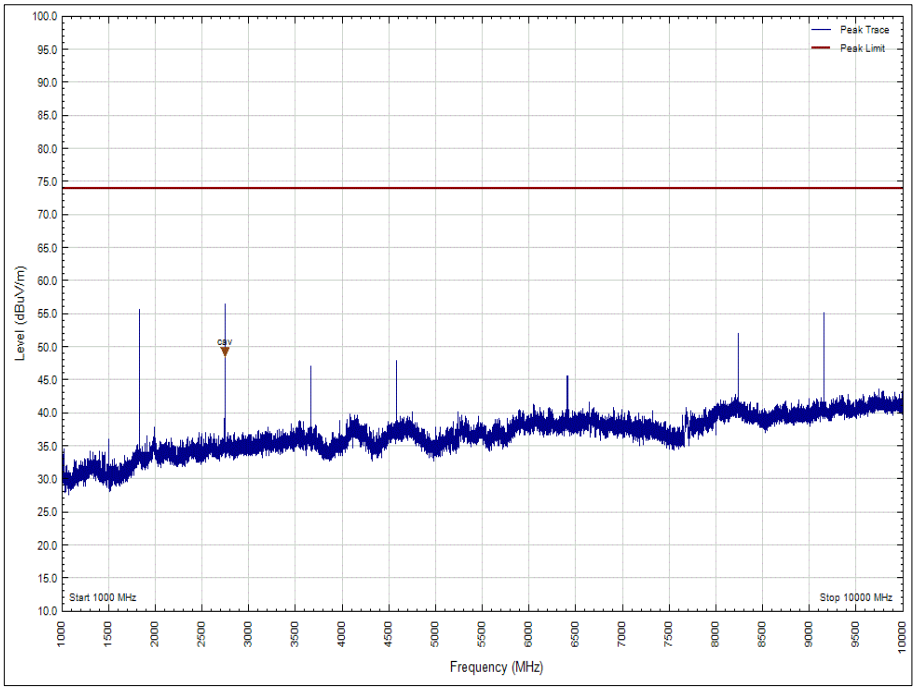

Figure 23 - 915.25 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: X, Peak

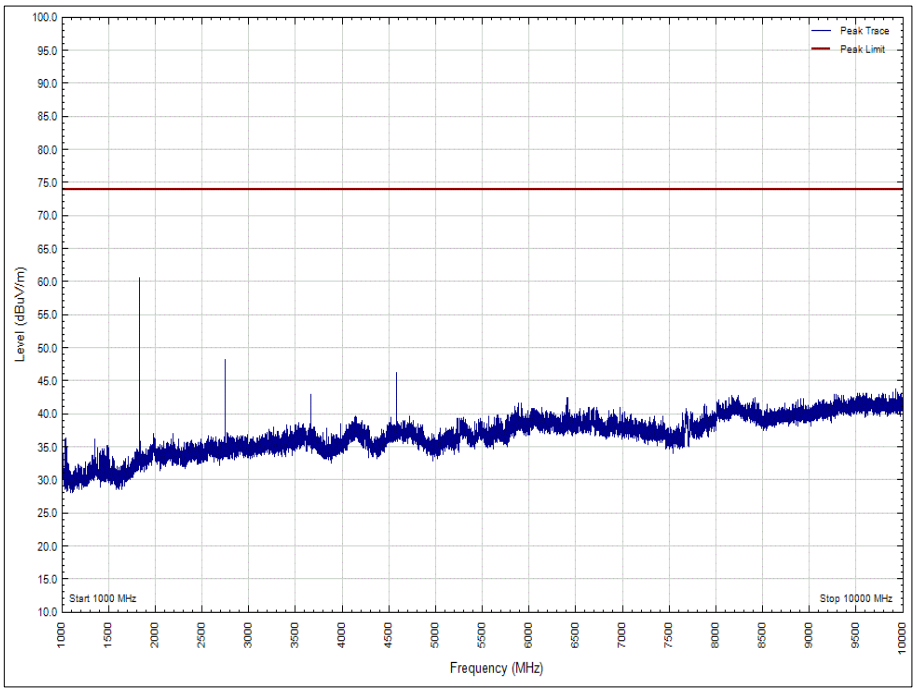

Figure 24 - 915.25 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: X Peak

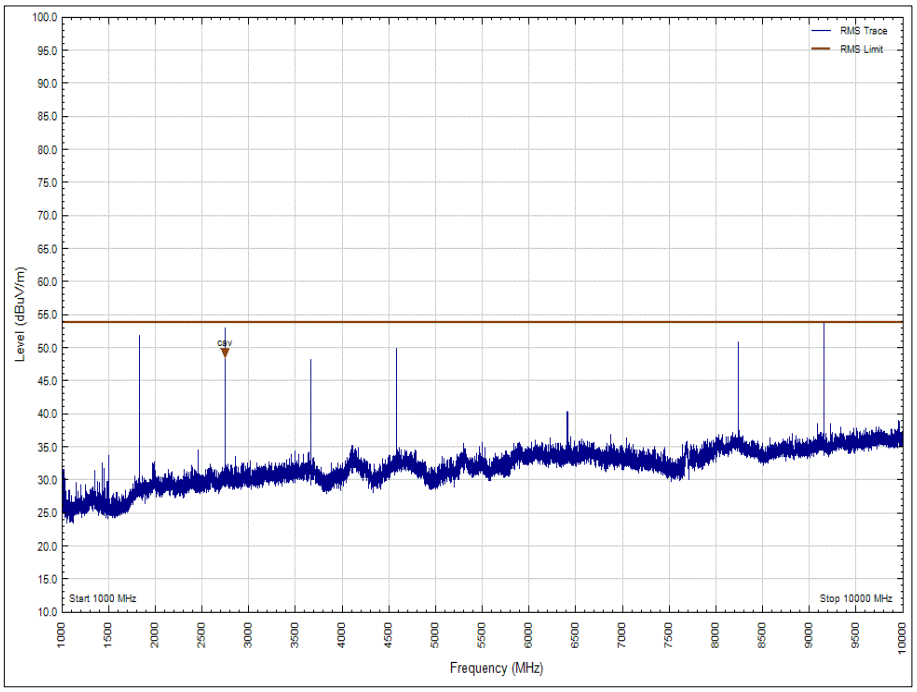

Figure 25 - 915.25 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: X, Average

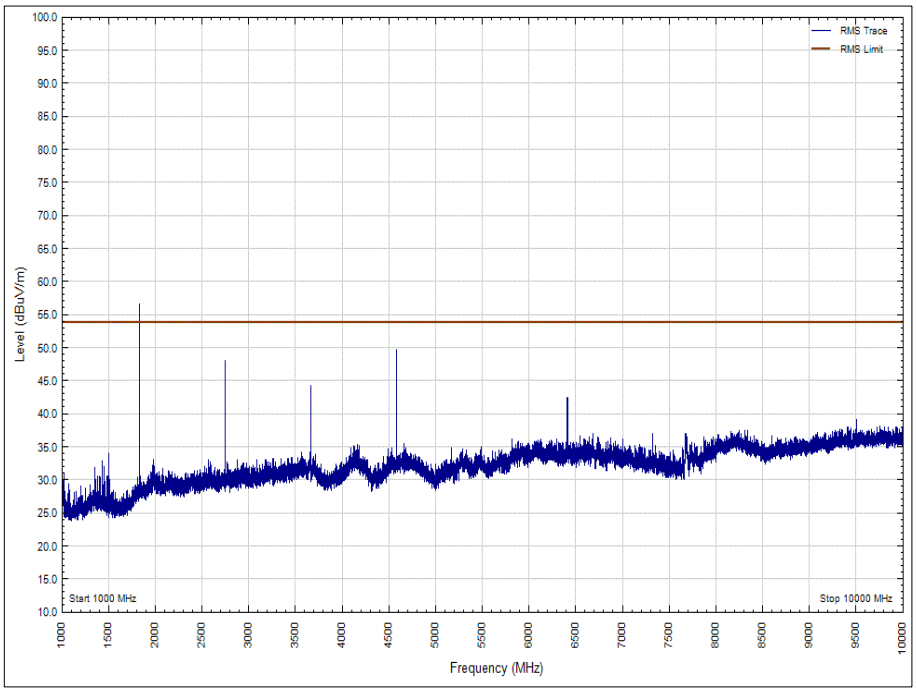

Figure 26 - 915.25 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: X, Average

Frequency (GHz)	Result (dBµV/m)		Limit (dBµV/m)		Margin (dBµV/m)	
	Peak	Average	Peak	Average	Peak	Average
2.745745	-	48.05	-	54.00	-	5.95

Table 22 - 915.25 MHz - 1 GHz to 10 GHz
EUT Orientation: Y

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

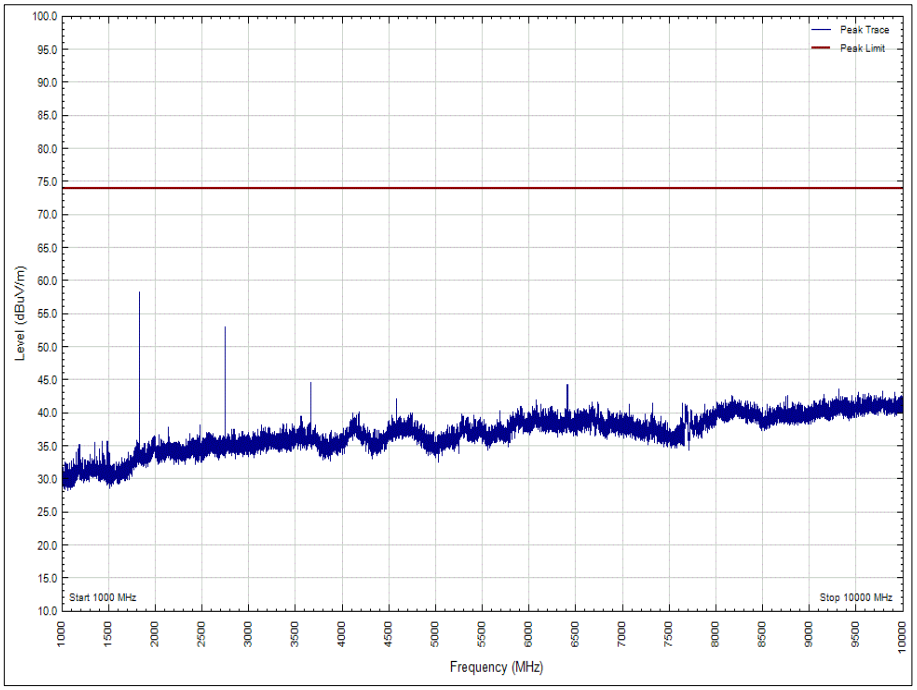

Figure 27 - 915.25 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: Y, Peak

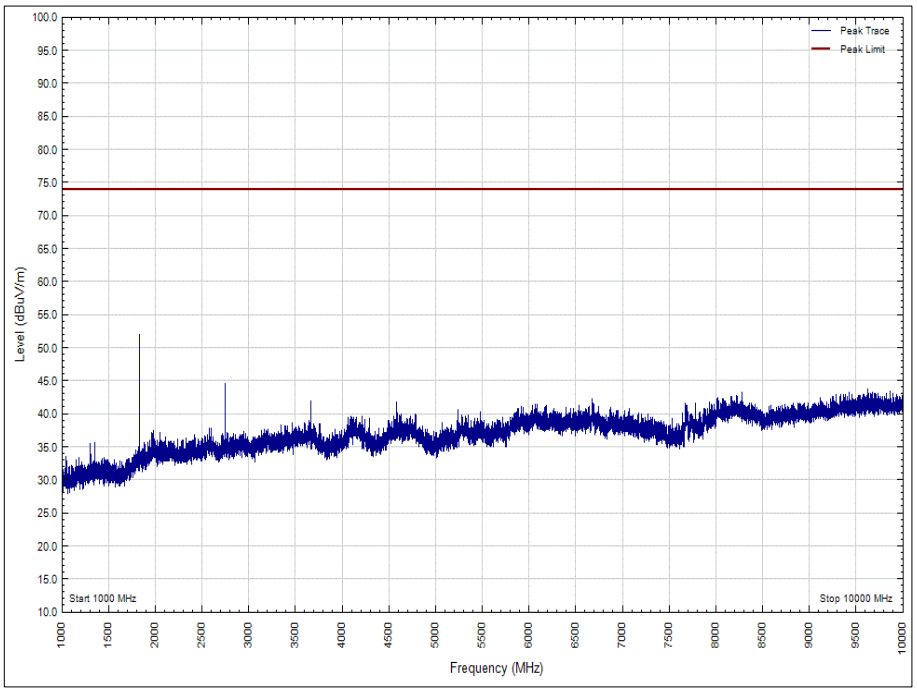

Figure 28 - 915.25 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: Y, Peak

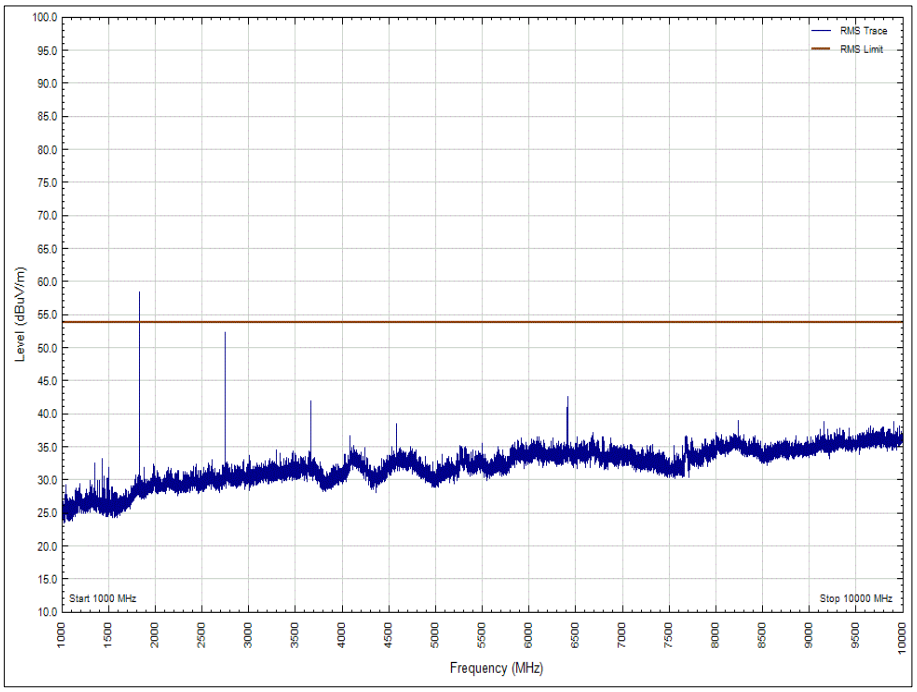

Figure 29 - 915.25 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: Y, Average

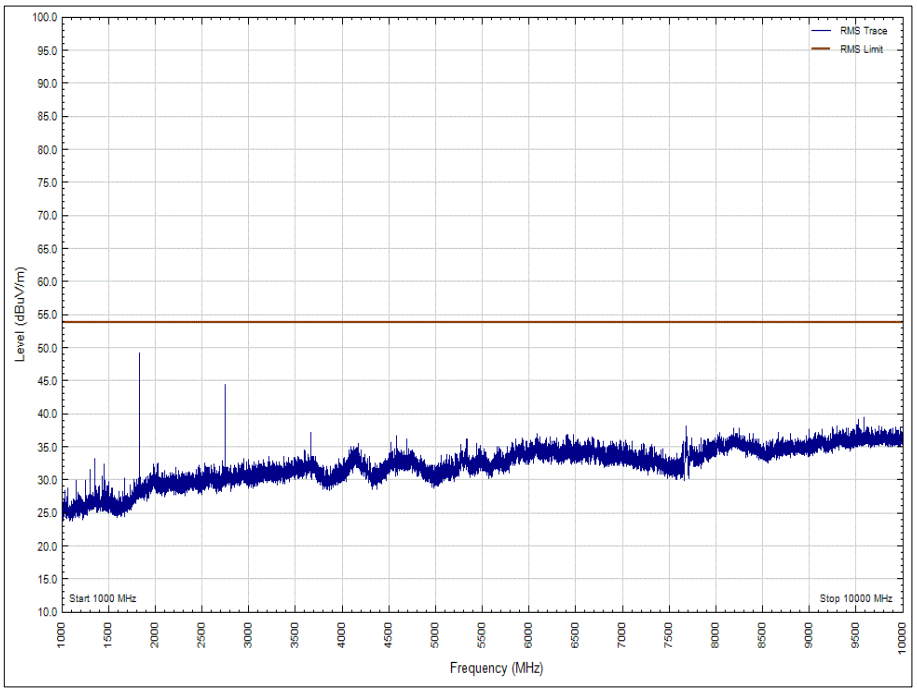

Figure 30 - 915.25 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: Y, Average

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
120.480	29.3	43.5	-14.2	246	2.95	Horizontal
150.000	32.0	43.5	-11.5	349	1.00	Vertical
173.200	27.2	43.5	-16.3	77	1.00	Vertical

Table 23 - 927.25 MHz - 30 MHz to 300 MHz
EUT Orientation: X

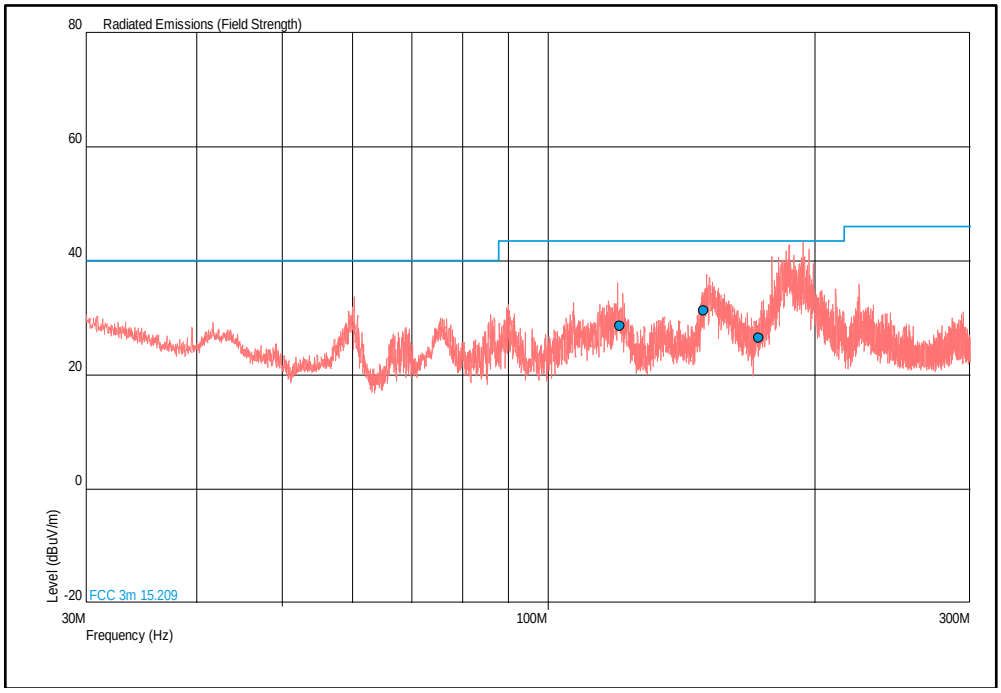

Figure 31 - 927.25 MHz - 30 MHz to 300 MHz
Polarity: Combined, EUT Orientation: X

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
322.000	30.8	46.0	-15.2	72	1.00	Horizontal
335.000	33.7	46.0	-12.3	334	1.00	Horizontal
400.000	31.6	46.0	-14.4	357	1.00	Vertical
614.000	36.5	46.0	-9.5	75	1.00	Vertical
960.000	37.6	46.0	-8.4	284	1.00	Vertical

Table 24 - 927.25 MHz - 300 MHz to 1 GHz
EUT Orientation: X

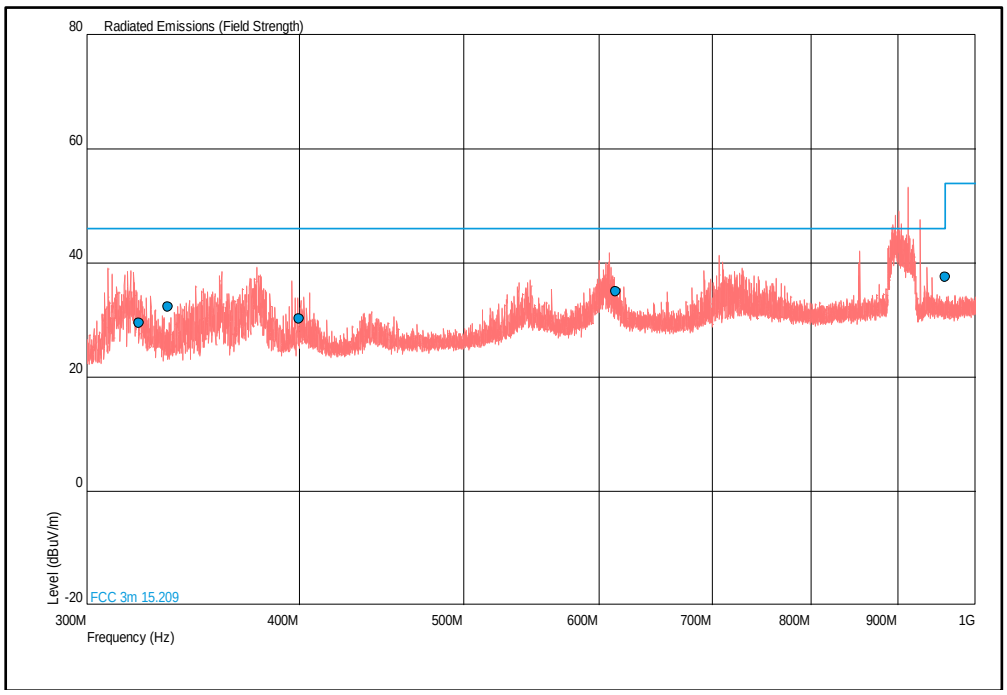

Figure 32 - 927.25 MHz - 300 MHz to 1 GHz
Polarity: Combined, EUT Orientation: X

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
136.262	27.6	43.5	-15.9	358	1.00	Vertical
173.200	30.1	43.5	-13.4	29	1.74	Vertical
188.448	38.8	43.5	-4.7	147	1.00	Vertical

Table 25 - 972.25 MHz - 30 MHz to 300 MHz
EUT Orientation: Y

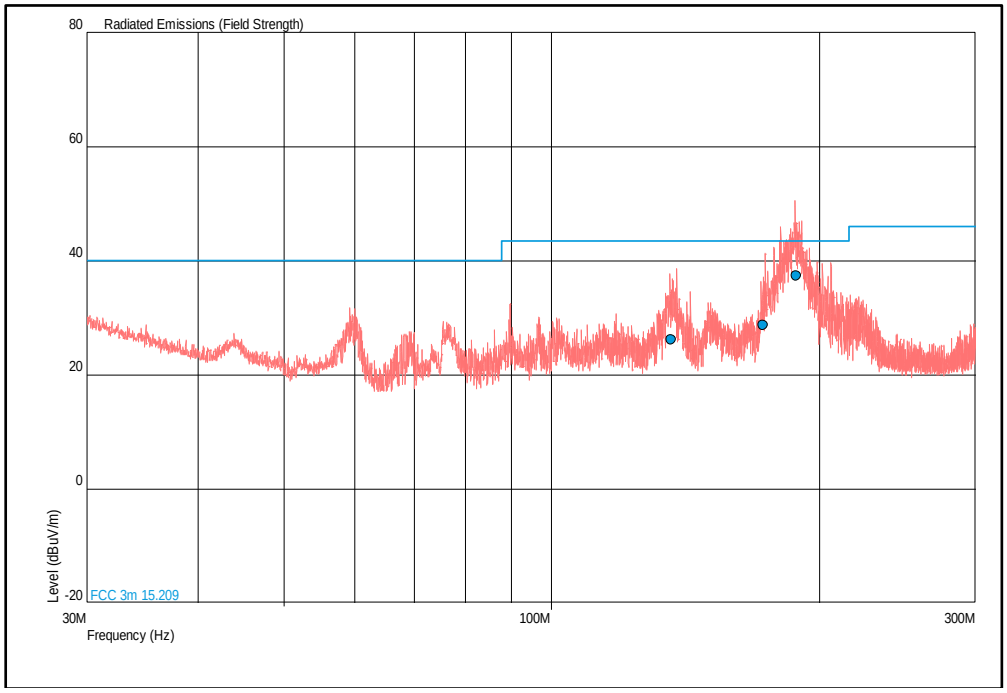

Figure 33 - 927.25 MHz - 30 MHz to 300 MHz
Polarity: Combined, EUT Orientation: Y

Frequency (MHz)	QP Level (dBuV/m)	QP Limit (dBuV/m)	QP Margin (dBuV/m)	Angle (°)	Height (cm)	Polarisation
322.208	29.3	46.0	-16.7	358	3.09	Vertical
400.000	31.5	46.0	-14.5	271	2.08	Vertical
614.000	37.0	46.0	-9.0	237	1.00	Horizontal
960.000	39.1	46.0	-6.9	357	1.00	Horizontal

Table 26 - 927.25 MHz - 300 MHz to 1 GHz
EUT Orientation: Y

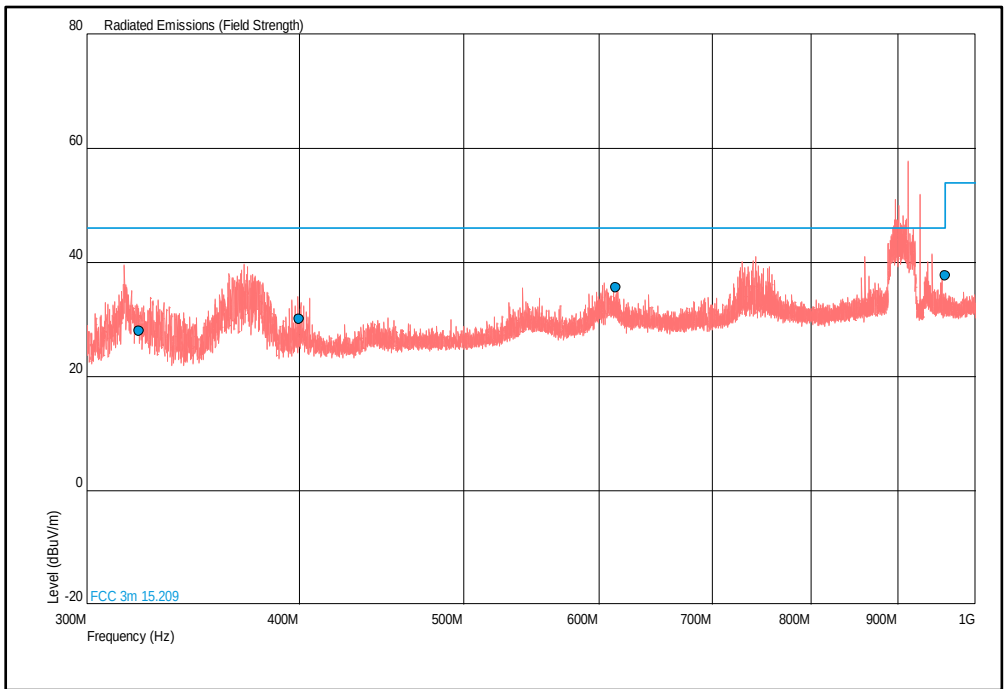

Figure 34 - 927.25 MHz - 300 MHz to 1 GHz
Polarity: Combined, EUT Orientation: Y

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

Table 27 - 927.25 MHz - 1 GHz to 10 GHz
EUT Orientation: X

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

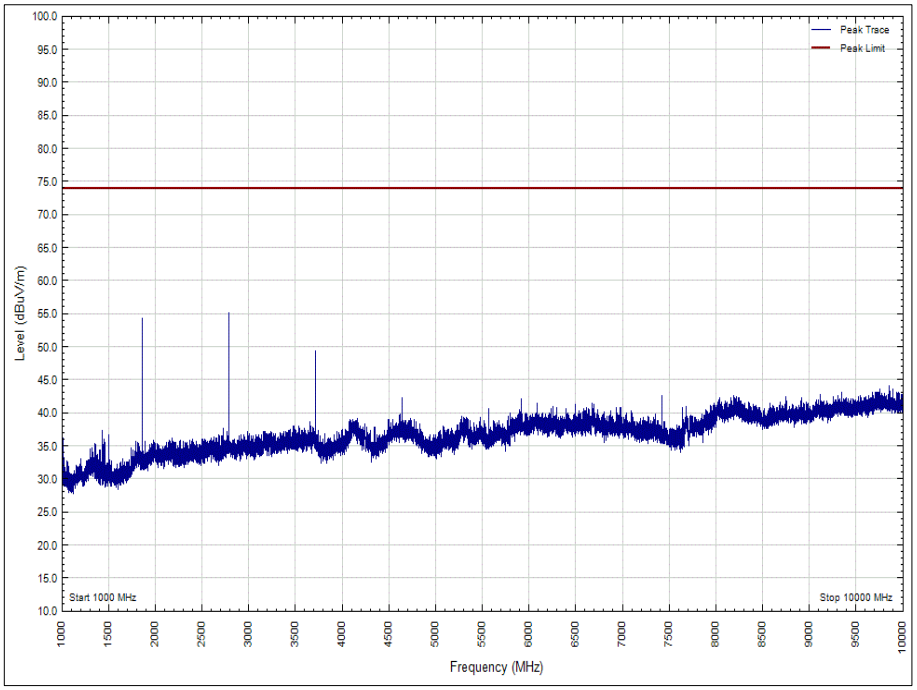

Figure 35 - 927.25 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: X, Peak

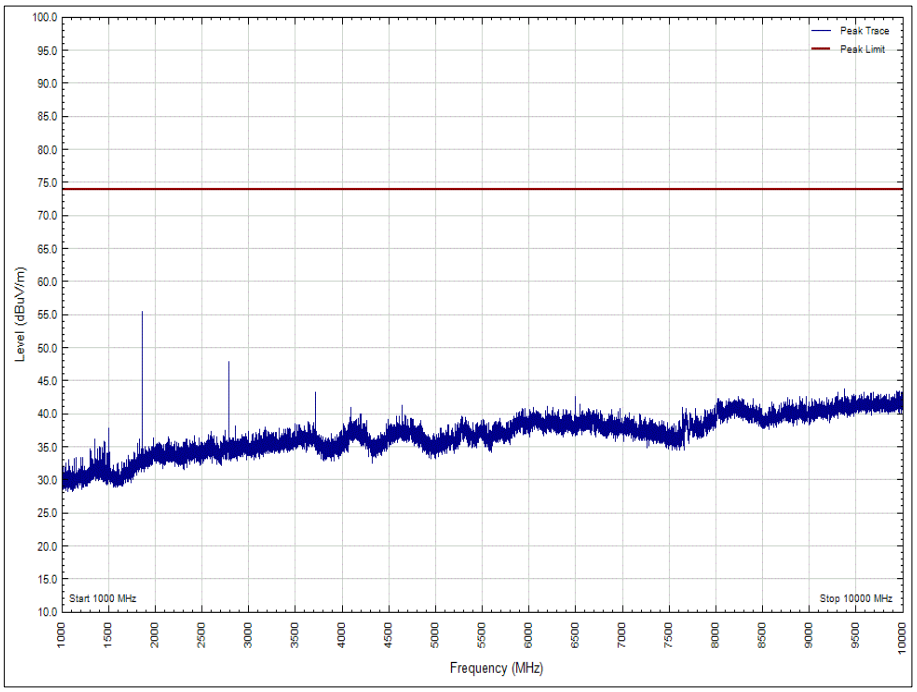

Figure 36 - 927.25 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: X, Peak

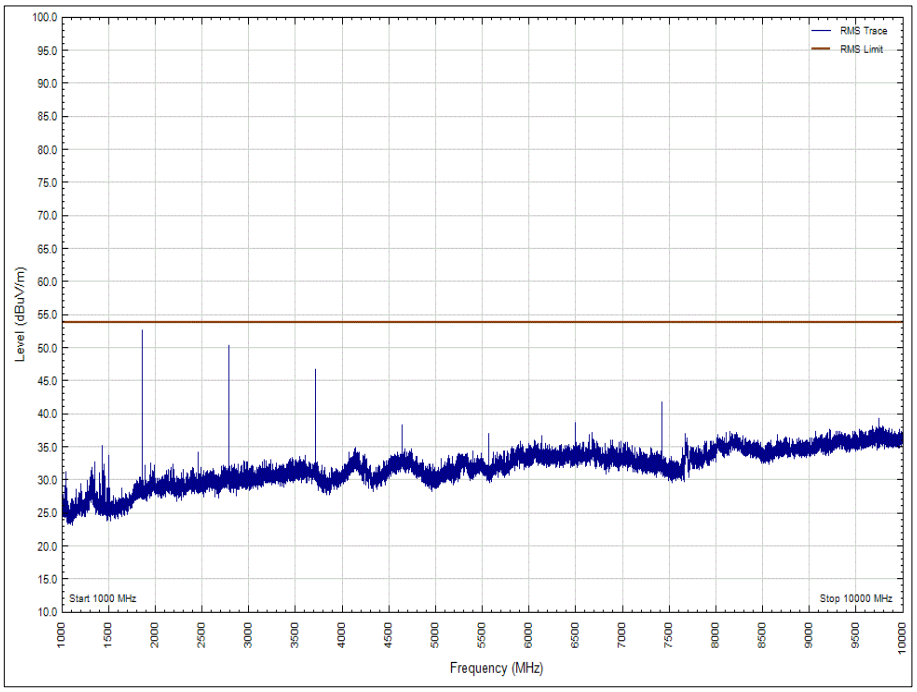

Figure 37 - 927.25 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: X, Average

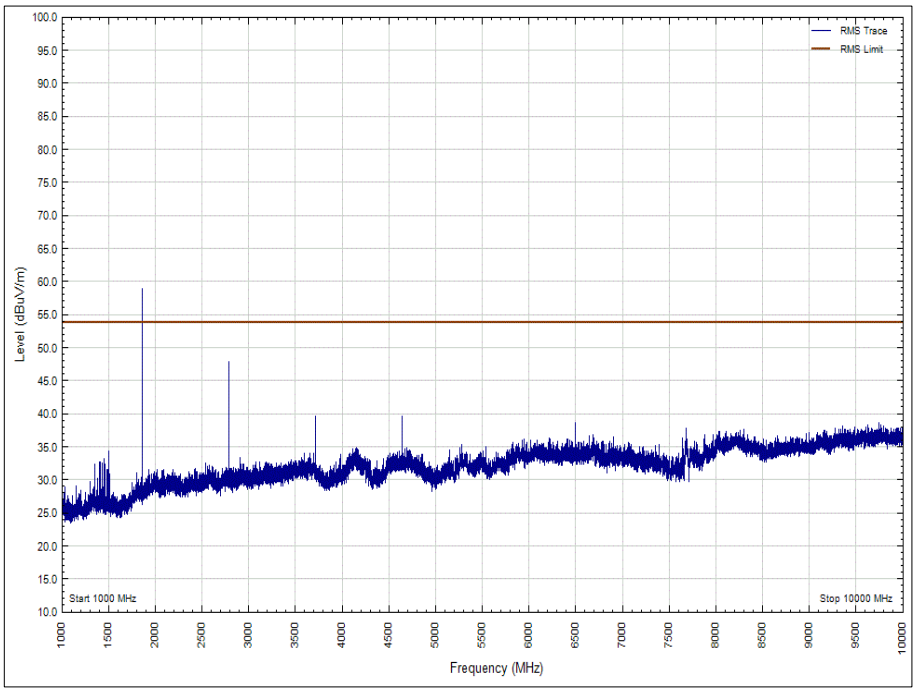

Figure 38 - 927.25 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: X, Average

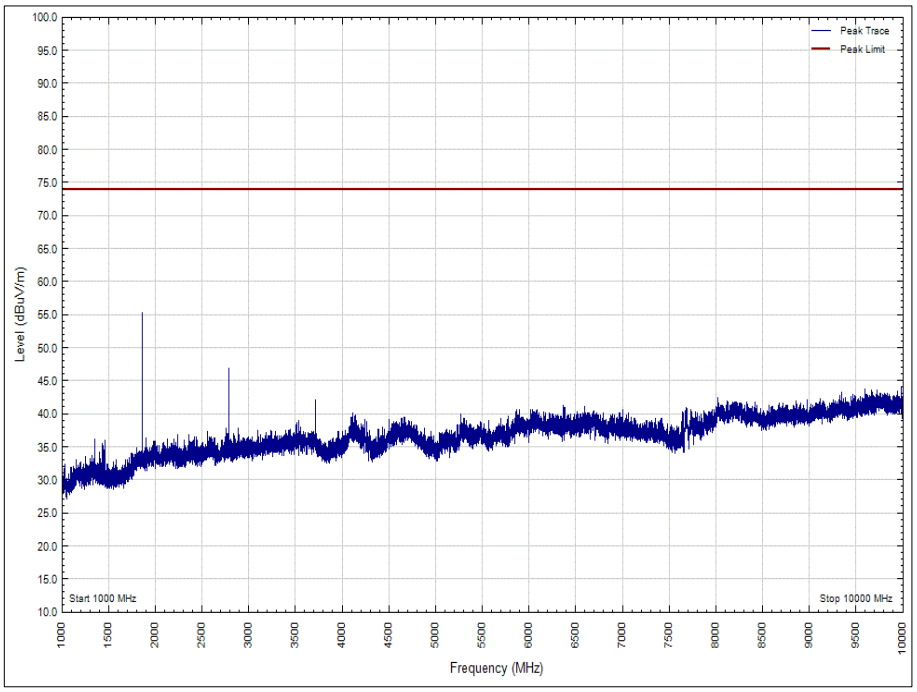

Figure 39 - 927.25 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: Y, Peak

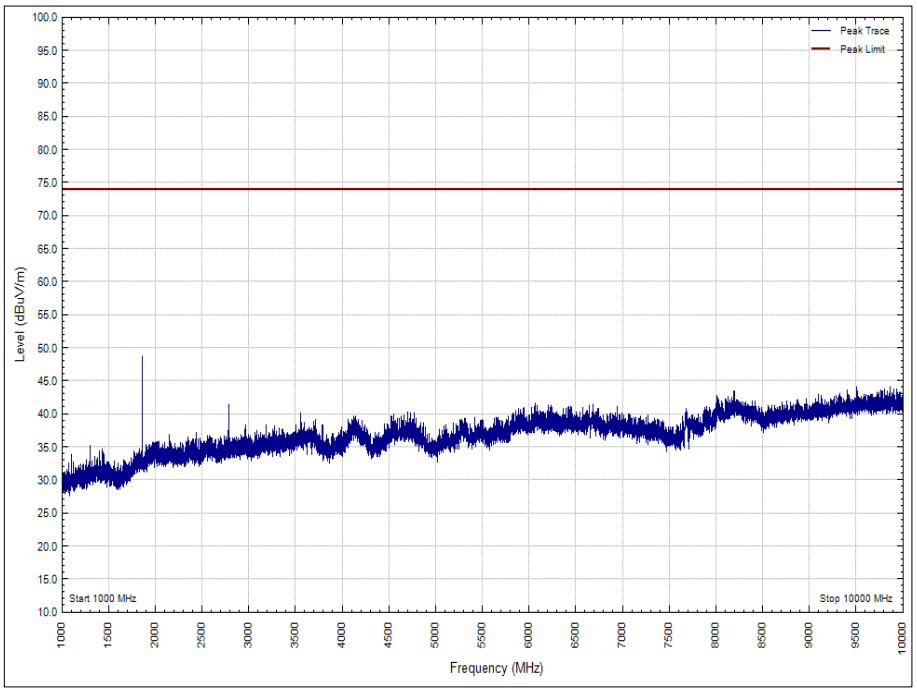

Figure 40 - 927.25 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: Y, Peak

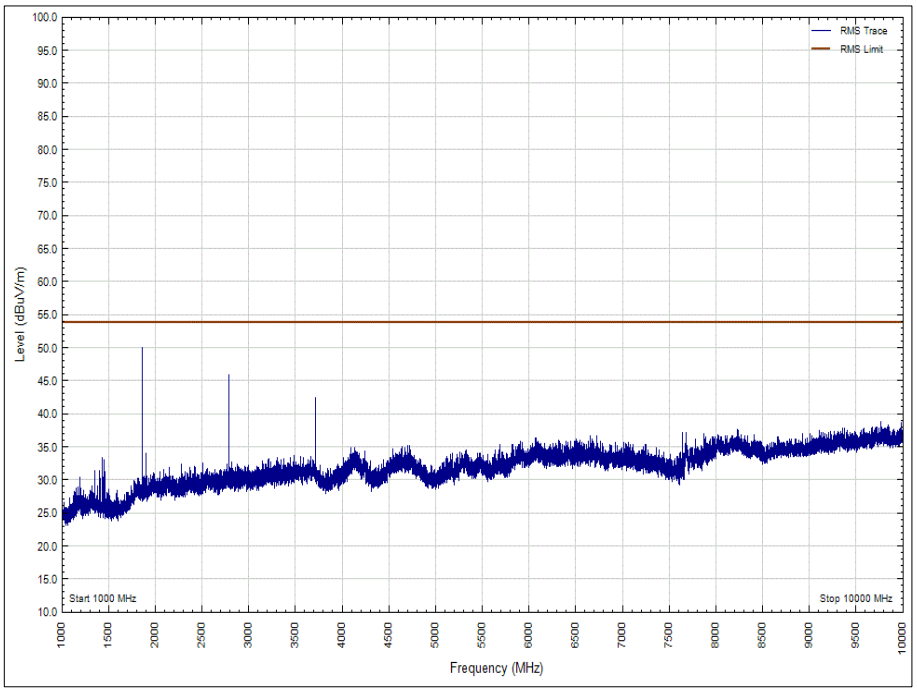

Figure 41 - 927.25 MHz - 1 GHz to 10 GHz
Polarity: Vertical, EUT Orientation: Y, Average

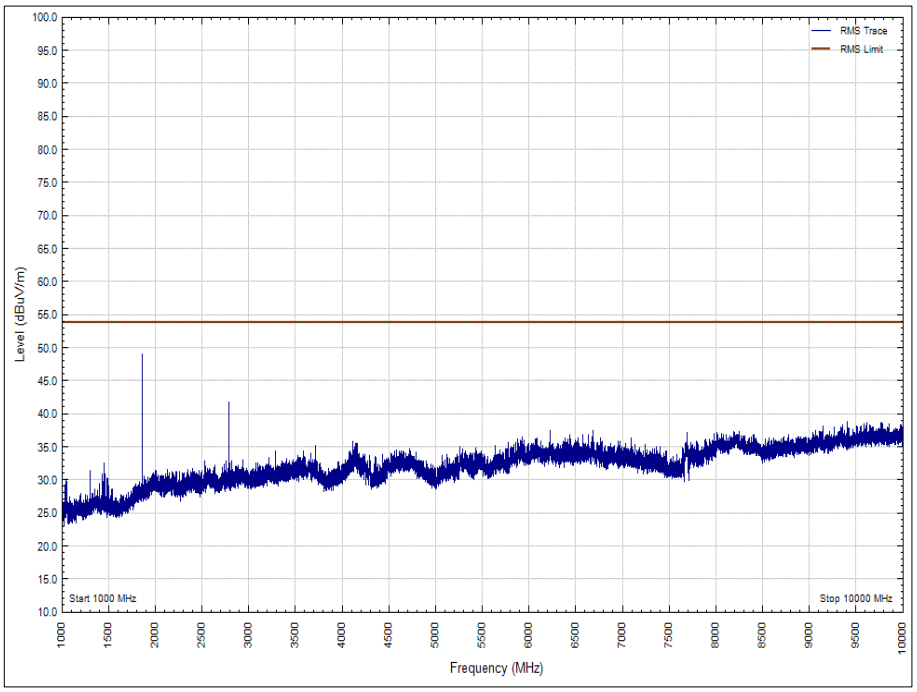

Figure 42 - 927.25 MHz - 1 GHz to 10 GHz
Polarity: Horizontal, EUT Orientation: Y, Average

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.

2.3.7 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
Turntable Controller	Heinrich Diesel	HD 050	280	-	TU
Antenna with permanent attenuator (Bilog)	Schaffner	CBL6143	287	24	15-May-2020
Filter (Tuneable Bandreject)	K&L Microwave	5TNF-500/1000-N/N	439	-	TU
Pre-Amplifier	Phase One	PS04-0086	1533	12	12-Jan-2019
Screened Room (5)	Rainford	Rainford	1545	36	23-Jan-2021
Screened Room (7)	Siemens	S M	1547	36	21-Jan-2021
Signal Generator	Rohde & Schwarz	SML01	1593	12	9-Mar-2019
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Low Pass Filter	Mini-Circuits	NLP-300	1636	12	25-Oct-2018
Multimeter	Iso-tech	IDM101	2419	12	23-Nov-2018
Antenna (Bilog)	Chase	CBL6143	2904	24	08-Aug-2019
Comb Generator	Schaffner	RSG1000	3034	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	22-Nov-2018
Cable (2m, N type)	Teledyne	239-0195-2000	3567	12	31-Jan-2019
Mast Controller	Maturo Gmbh	NCD	3917	-	TU
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	18-Oct-2018
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	31-Aug-2018
Cable (Rx, SMAm-SMAm 0.5m)	Scott Cables	SLSLL18-SMSM-00.50M	4528	6	15-Aug-2018
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	01-Mar-2019
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
9m N type RF cable	Rosenberger	2303-0 9.0m PNm PNm	4827	6	04-Jan-2019
4dB Attenuator	Pasternack	PE7047-4	4935	12	28-Nov-2018
N to N cable, 4m	Rhophase	2303-002-TUVS	4849	12	18-Dec-2018
N to N cable, 4m	Rhophase	2303-002-TUVS	4850	12	18-Dec-2018

Table 28

TU - Traceability Unscheduled

2.4 Maximum Conducted Output Power

2.4.1 Specification Reference

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

2.4.2 Equipment Under Test and Modification State

Space/Portal Ranger 9200, S/N: 0280420101-0001 - Modification State 0

2.4.3 Date of Test

13-August-2018

2.4.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 7.8.5 using a peak power meter.

The conducted power measurements were made at the maximum power setting (340) based on the minimum cable length of 11.5m that is to be used at this power setting for cable type 'LMR195'. When installed the power setting used in device is configured to consider the loss between the conducted antenna port and the antenna and the gain of the transmitting antenna.

The EIRP was calculated by adding the antenna gain of 6.49 dB which was the highest declared antenna gain for antenna type 'Laird S9028PCR'. The eight beams are fed in to two 4-element array ceiling tile antennas of which the transmitted beams are non-overlapping, therefore the power from each individual antenna ports were not summed and each beam is allowed to transmit a maximum of 4 W EIRP.

2.4.5 Environmental Conditions

Ambient Temperature	23.1 °C
Relative Humidity	32.6 %

2.4.6 Test Results

UHF RFiD

Testing was performed on the Data Rate with the highest conducted output power. This Data Rate was.

Antenna Port	Output Power (dBm)		
	902.75 MHz	915.25 MHz	927.25 MHz
1	28.32	26.85	25.35
2	28.35	25.91	24.88
3	28.74	27.06	25.62
4	29.22	27.33	25.72
5	28.00	25.72	23.97
6	28.37	26.06	24.12
7	28.99	27.19	24.93
8	29.18	26.75	25.54

Table 29 - Conducted Power

Antenna Port	EIRP (dBm)		
	902.75 MHz	915.25 MHz	927.25 MHz
1	34.81	33.34	31.84
2	34.84	32.40	31.37
3	35.23	33.55	32.11
4	35.71	33.82	32.21
5	34.49	32.21	30.46
6	34.86	32.55	30.61
7	35.48	33.68	31.42
8	35.67	33.24	32.03

Table 30 - EIRP

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(3)(4)

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

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

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

For FHSs operating in the band 902-928 MHz, the maximum peak conducted output power shall not exceed 1.0 W, and the e.i.r.p. shall not exceed 4 W if the hopset uses 50 or more hopping channels; the maximum peak conducted output power shall not exceed 0.25 W and the e.i.r.p. shall not exceed 1 W if the hopset uses less than 50 hopping channels.

2.4.7 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
Mains Voltage Monitor	TUV SUD Product Service	RAB-001	1378	12	17-Apr-2019
Programmable Power Supply	California Inst	LO8036	1898	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Attenuator (30dB, 150W)	Narda	769-30	3369	12	17-Jul-2019
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
P-Series Power Meter	Agilent Technologies	N1911A	3980	12	28-Sep-2018
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	28-Sep-2018
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
1 metre N-Type Cable	Florida Labs	NMS-235SP-39.4-NMS	4509	12	14-Jun-2018

Table 31

2.5 Spurious Conducted Emissions

2.5.1 Specification Reference

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

2.5.2 Equipment Under Test and Modification State

Space/Portal Ranger 9200, S/N: 0280420101-0001 - Modification State 0
Space/Portal Ranger 9200, S/N: 0280420101-0007 - Modification State 0

2.5.3 Date of Test

03-July-2018 to 14-August-2018

2.5.4 Test Method

This test was performed in accordance with ANSI C63.10, clause 6.7 and 7.8.8.

Radiated Spurious Emissions were performed with the antenna in the frequency range 30 MHz to 1 GHz, therefore restricted band measurements were not considered for conducted measurements below 1 GHz.

Measurements above 1 GHz have been performed using the most stringent limit for restricted band which equate to -21.2/-41.2 dBm EIRP Peak/Avg based on 54/74 dBµV/m requirements.

2.5.5 Environmental Conditions

Ambient Temperature	21.8 - 23.5 °C
Relative Humidity	41.5 - 64.6 %

2.5.6 Test Results

UHF RFiD

Frequency (MHz)	QP Level (dBm)	QP Limit (dBm)	Margin (dB)
*			

Table 32 – Conducted Spurious Emission Measurement Results, Bottom Channel

No emissions within 6 dB of the limit were found.

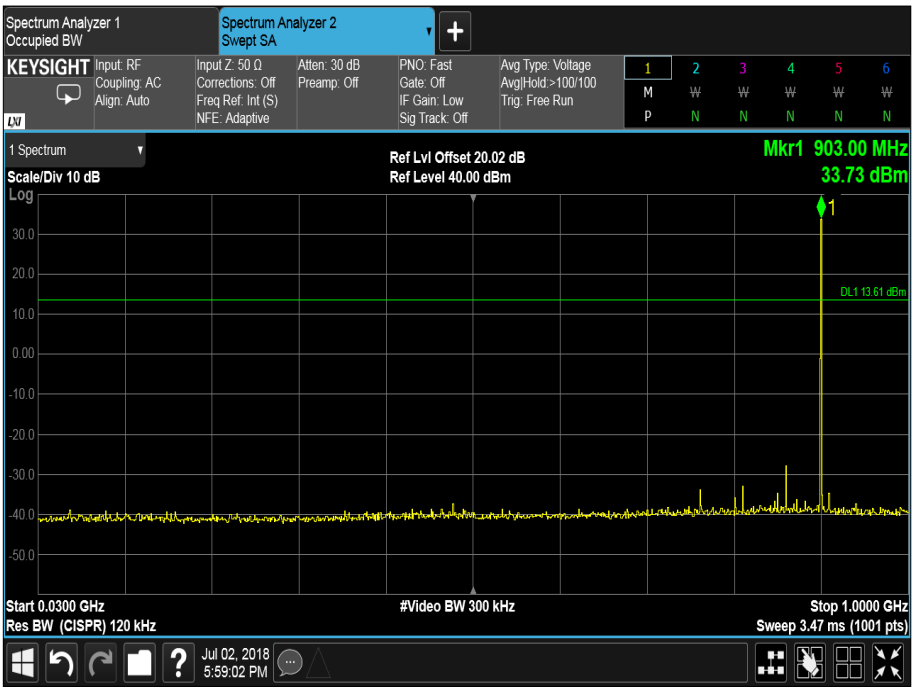

Figure 43 - Bottom Channel - 30 MHz to 1 GHz (15.247 Limit)

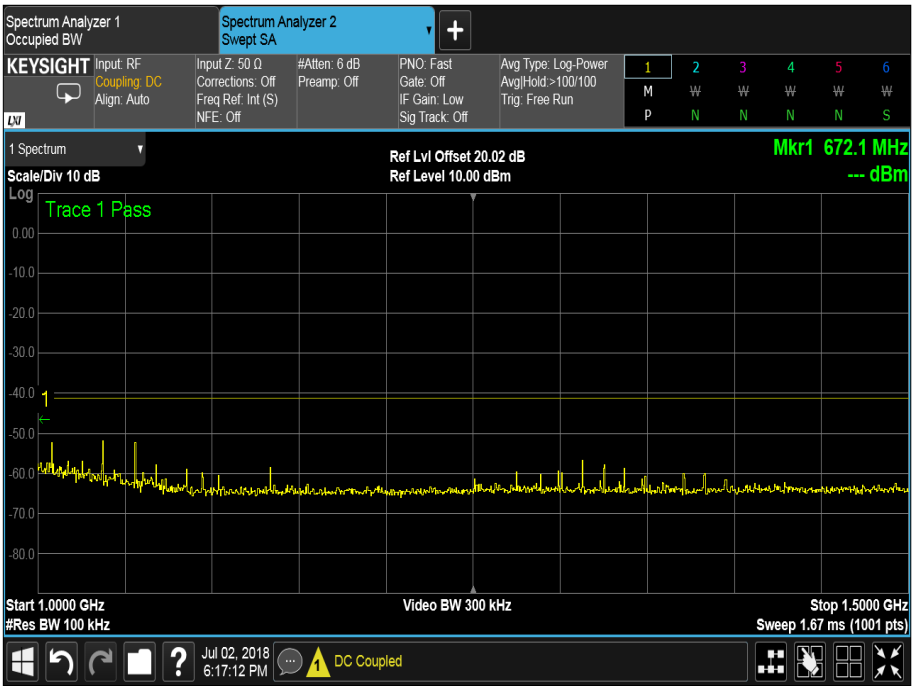

Figure 44 - Bottom Channel - 1 GHz to 1.5 GHz – Peak

NOTE: The peak trace passes the average limit, therefore an average measurement was not taken.

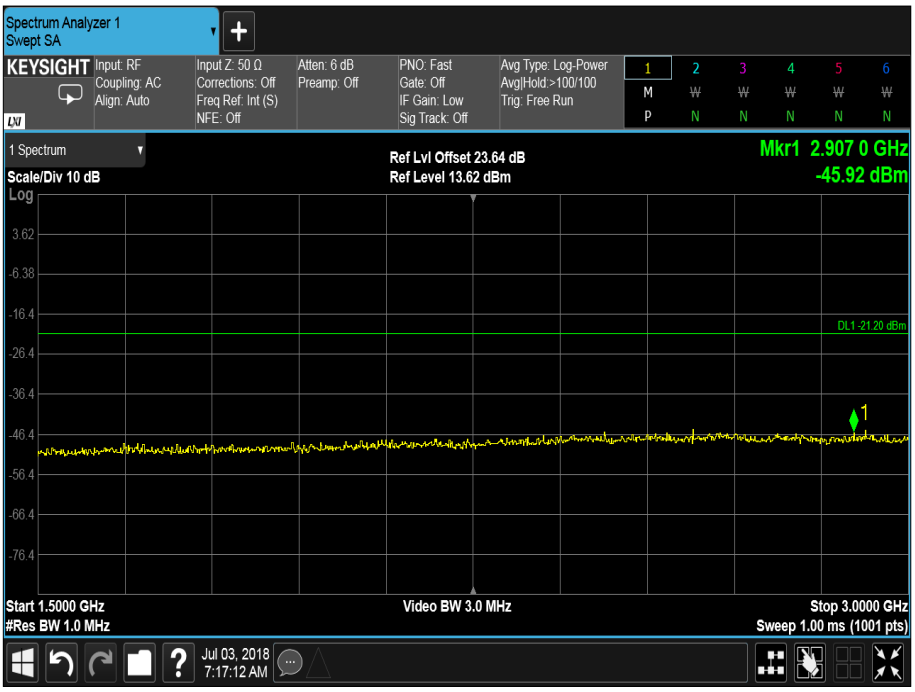

Figure 45 - Bottom Channel - 1.5 GHz to 3 GHz – Peak

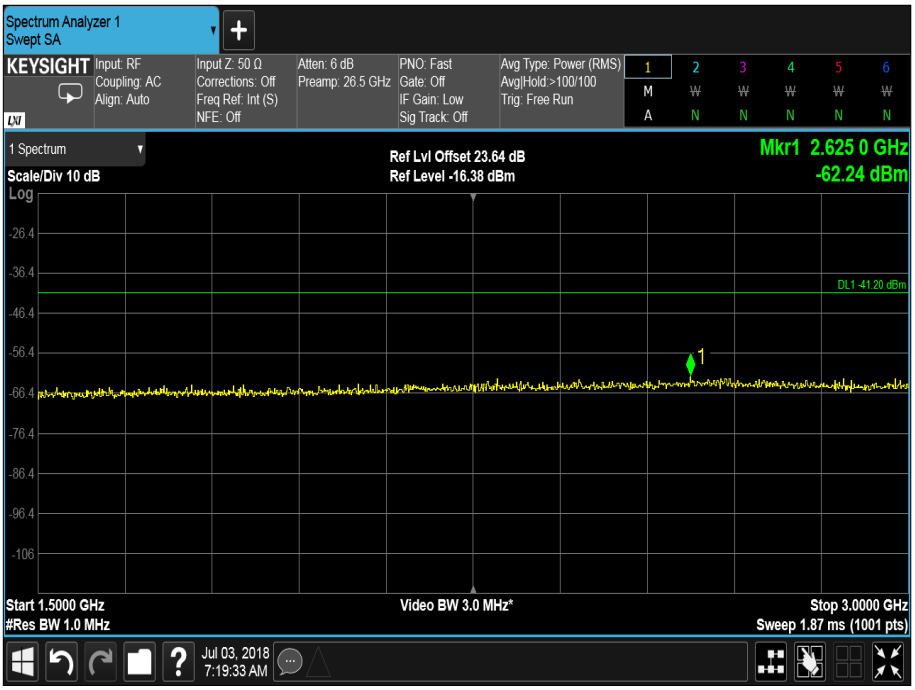

Figure 46 - Bottom Channel - 1.5 GHz to 3 GHz - Average

Product Service

Figure 47 - Bottom Channel - 3 GHz to 10 GHz - Peak

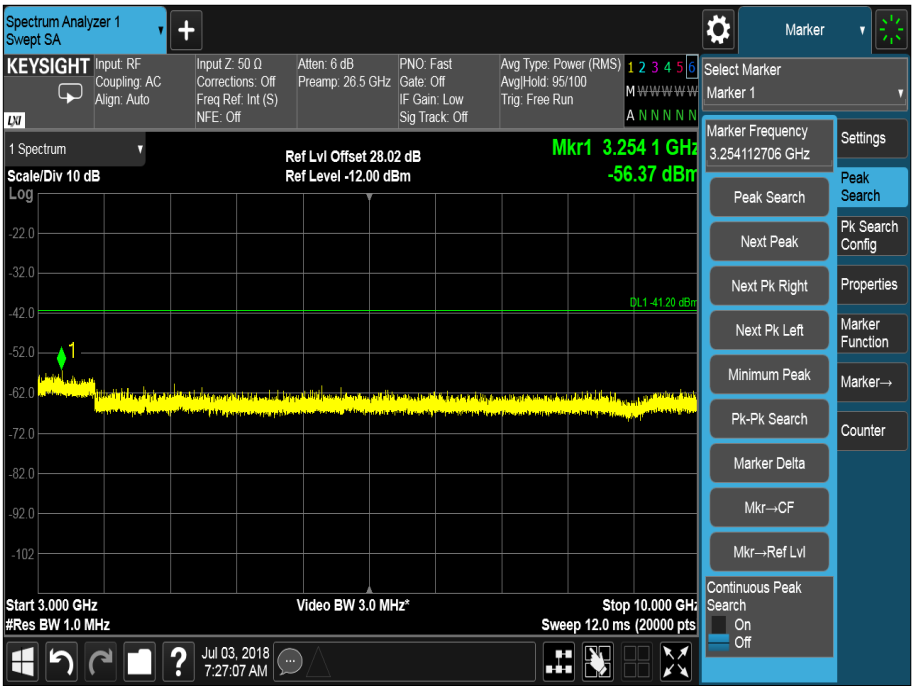

Figure 48 - Bottom Channel - 3 GHz to 10 GHz - Average

Frequency (MHz)	QP Level (dBm)	QP Limit (dBm)	Margin (dB)
*			

Table 33 – Conducted Spurious Emission Measurement Results, Middle Channel

No emissions within 6 dB of the limit were found.

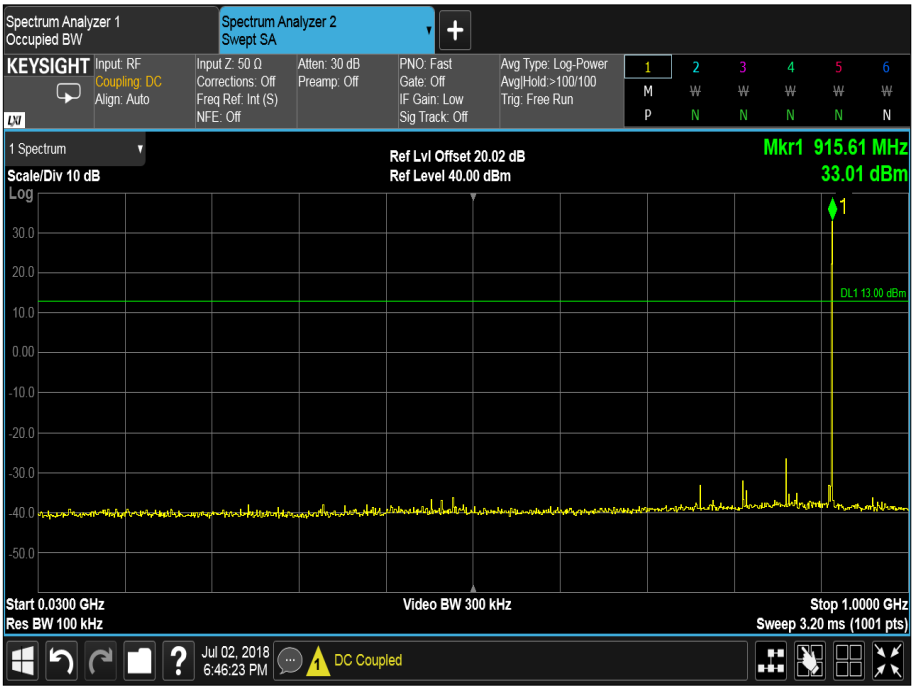

Figure 49 - Middle Channel - 30 MHz to 1 GHz (15.247 Limit)

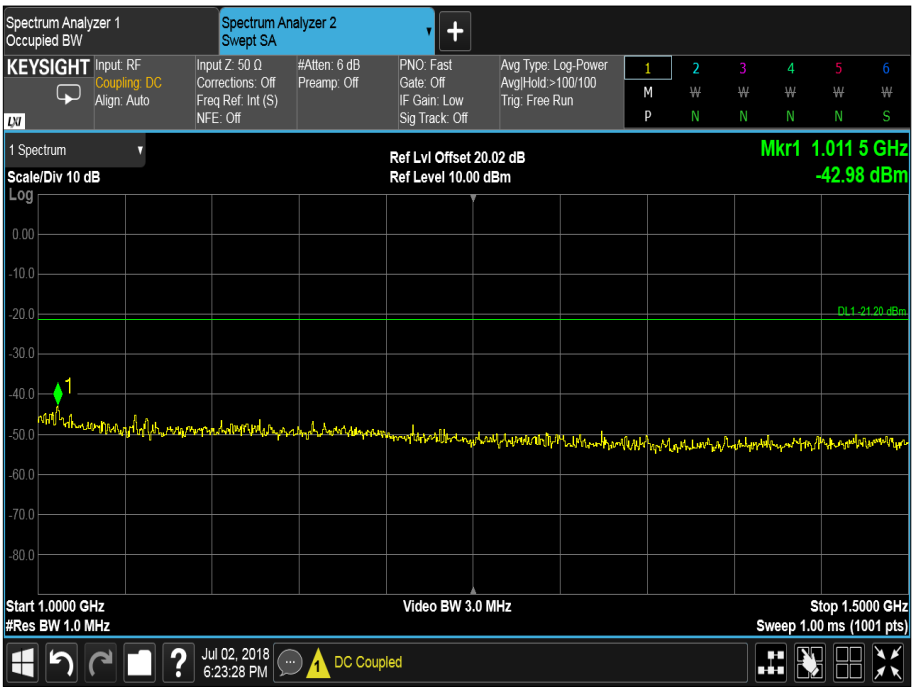

Figure 50 - Middle Channel - 1 GHz to 1.5 GHz - Peak

Figure 51 - Middle Channel - 1 GHz to 1.5 GHz - Average

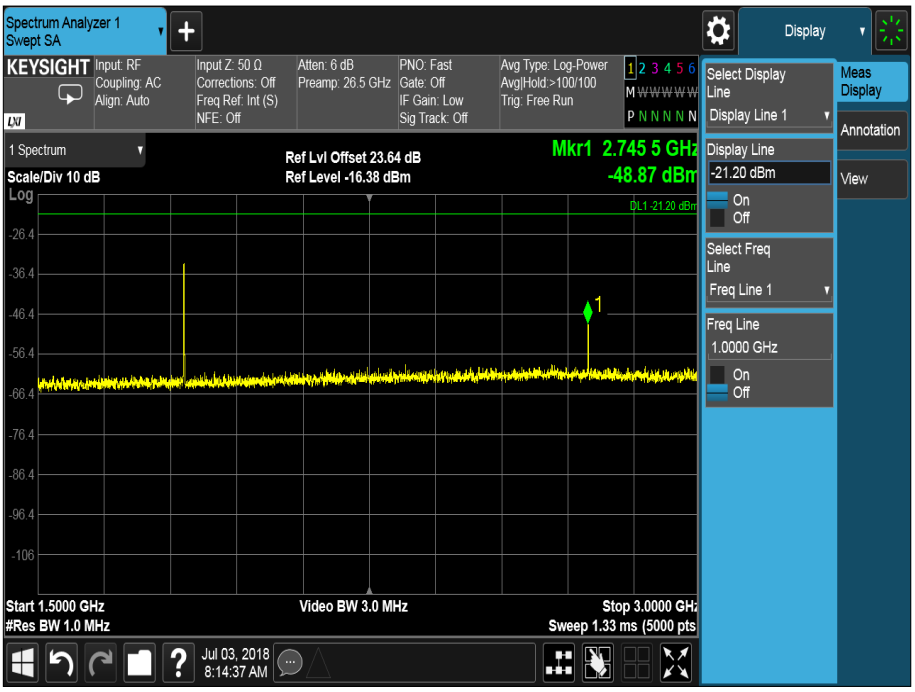

Figure 52 - Middle Channel - 1.5 GHz to 3 GHz - Peak

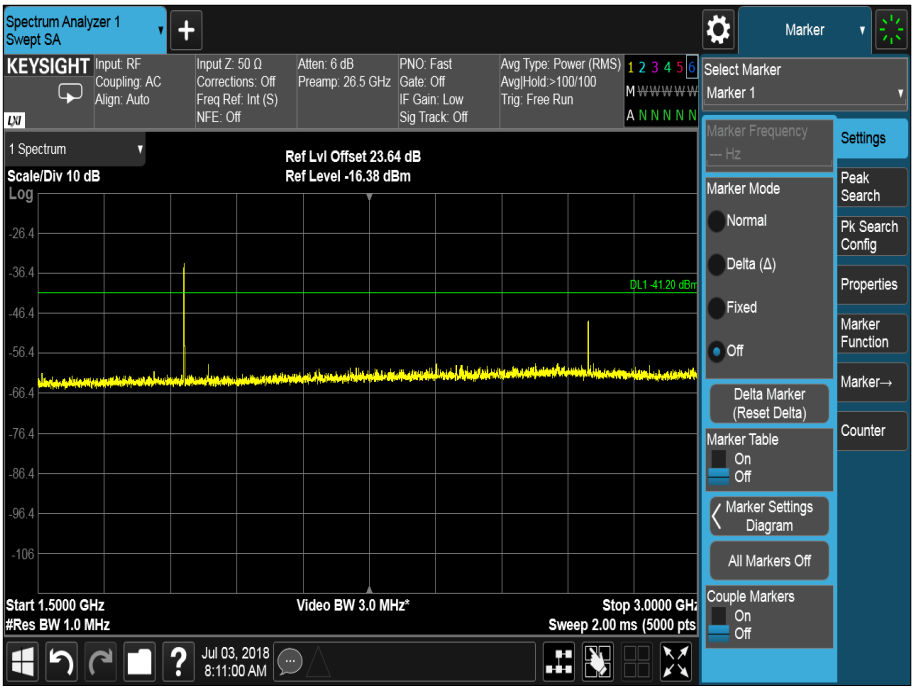

Figure 53 - Middle Channel - 1.5 GHz to 3 GHz – Average

NOTE; The emission observed at 1830 MHz does not fall within the restricted band of operation and is therefore not subject to the limit of 125.209. The limit in 15.247(d) applies of which there is > 20 dB margin.

Product Service

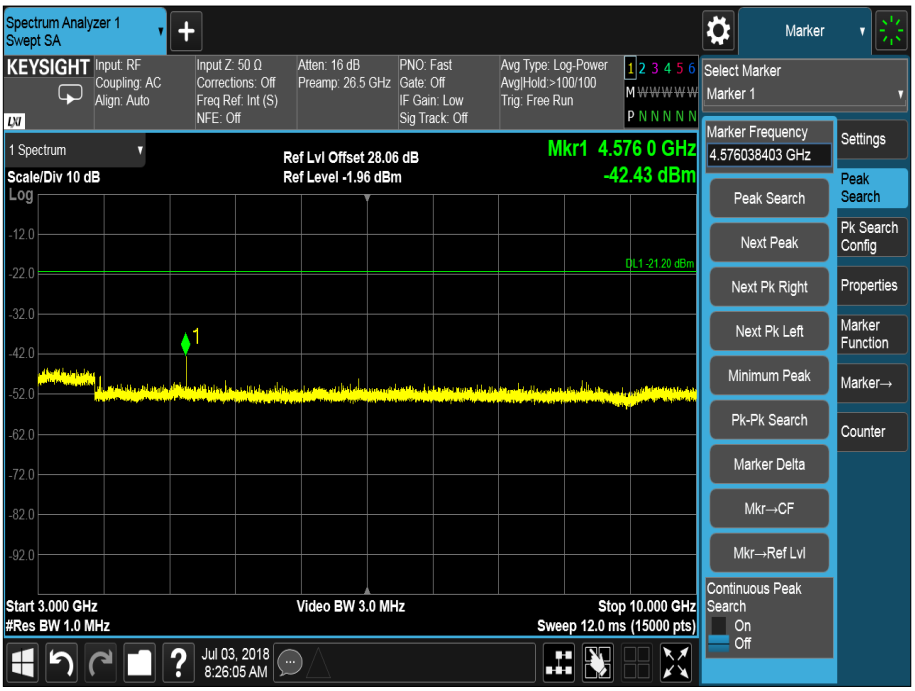

Figure 54 - Middle Channel - 3 GHz to 10 GHz - Peak

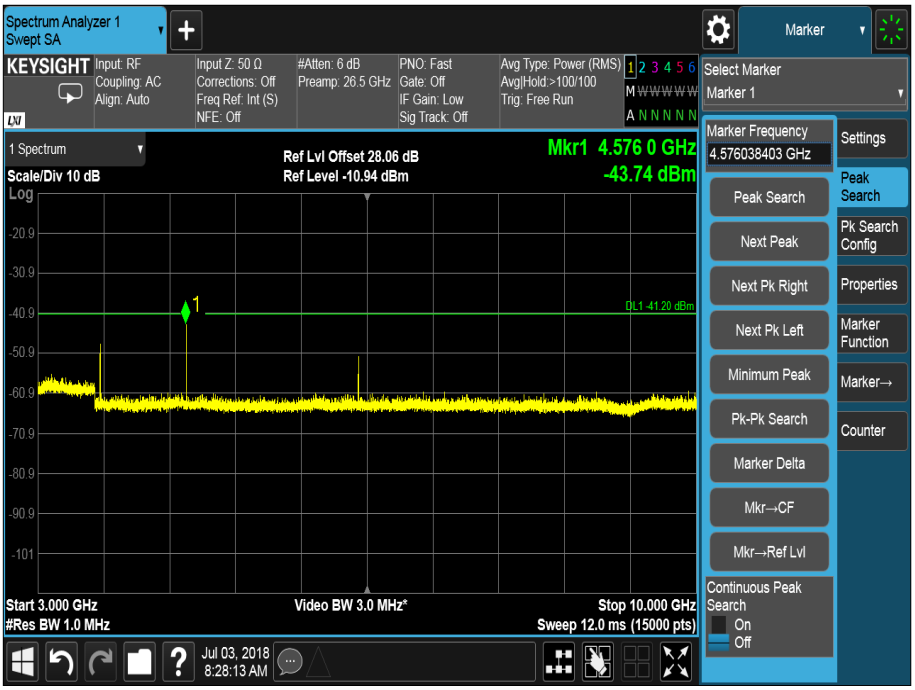

Figure 55 - Middle Channel - 3 GHz to 10 GHz - Average

Frequency (MHz)	QP Level (dBm)	QP Limit (dBm)	Margin (dB)
*			

Table 34 – Conducted Spurious Emission Measurement Results, Top Channel

No emissions within 6 dB of the limit were found.

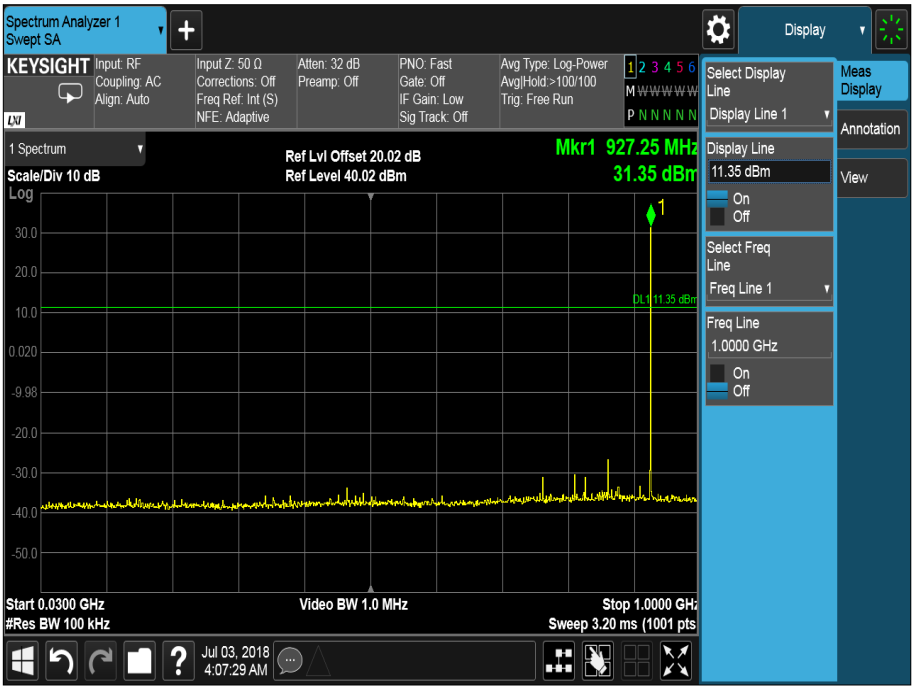

Figure 56 - Top Channel - 30 MHz to 1 GHz (15.247 Limit)

Product Service

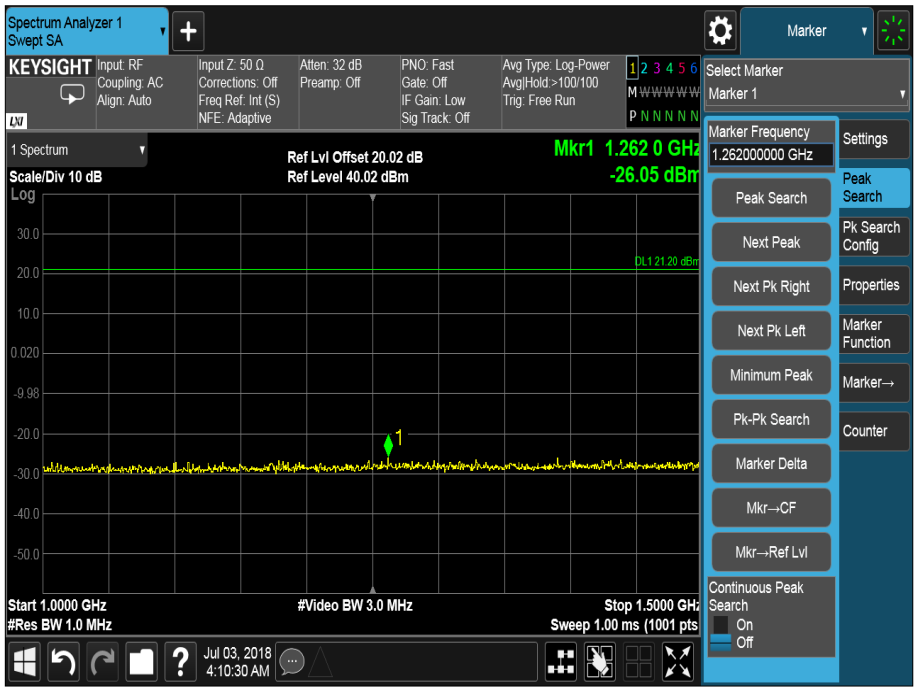

Figure 57 - Top Channel - 1 GHz to 1.5 GHz - Peak

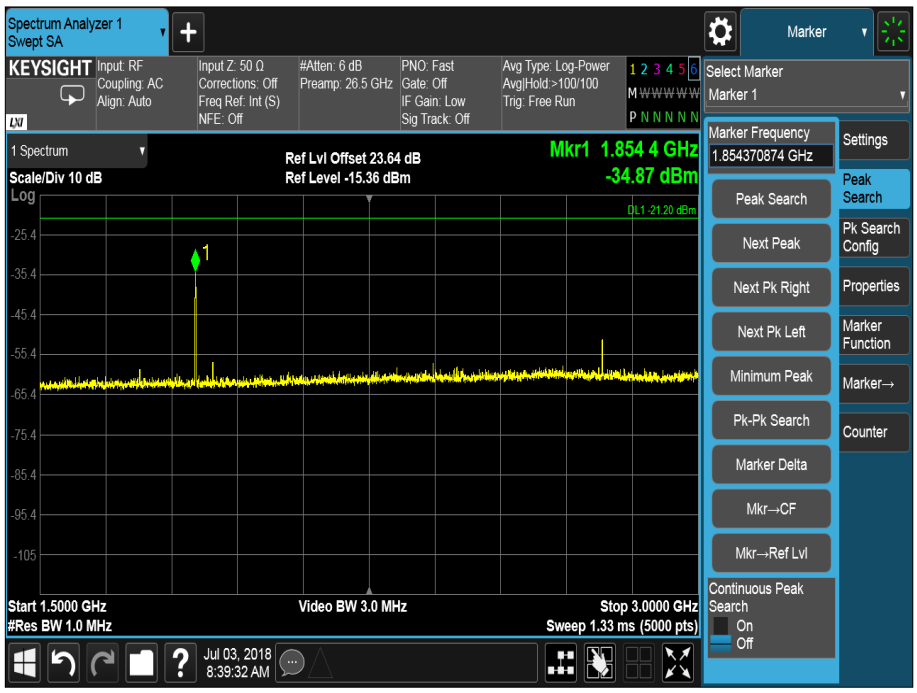

Figure 58 - Top Channel - 1.5 GHz to 3 GHz - Peak

Product Service

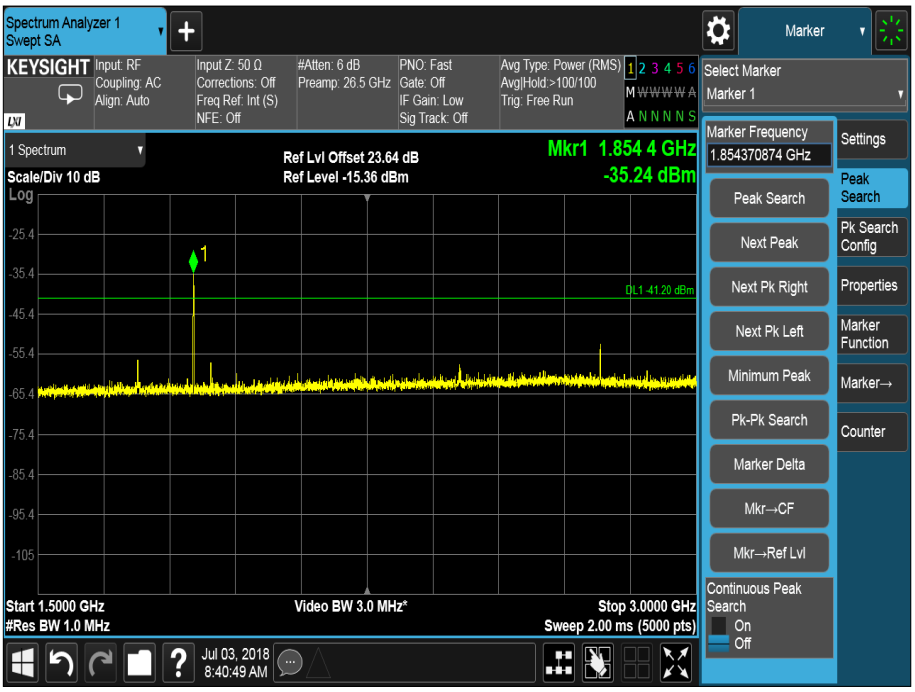

Figure 59 - Top Channel - 1.5 GHz to 3 GHz - Average

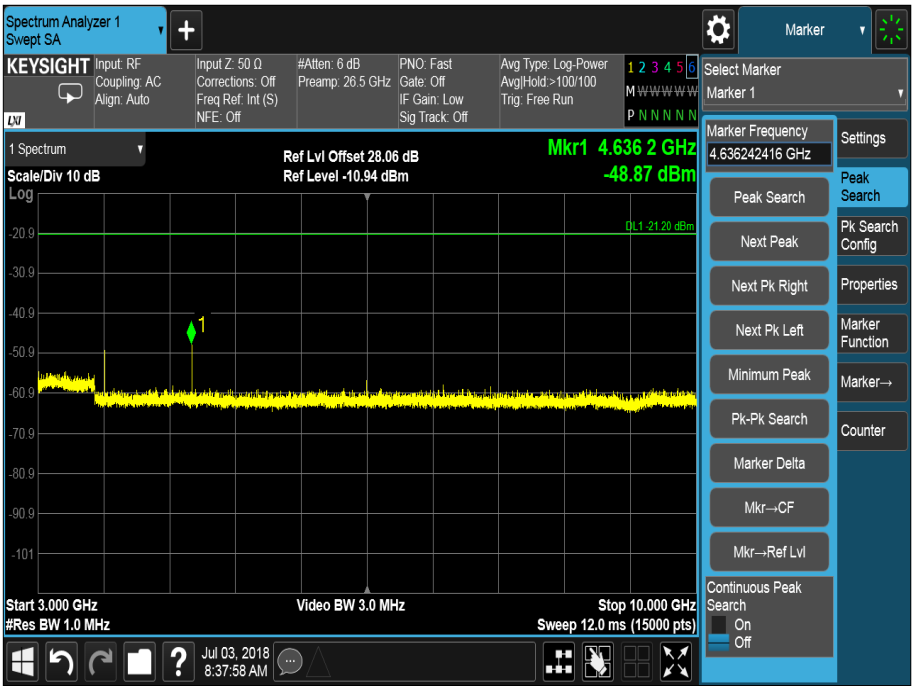

Figure 60 - Top Channel - 3 GHz to 10 GHz - Peak

Product Service

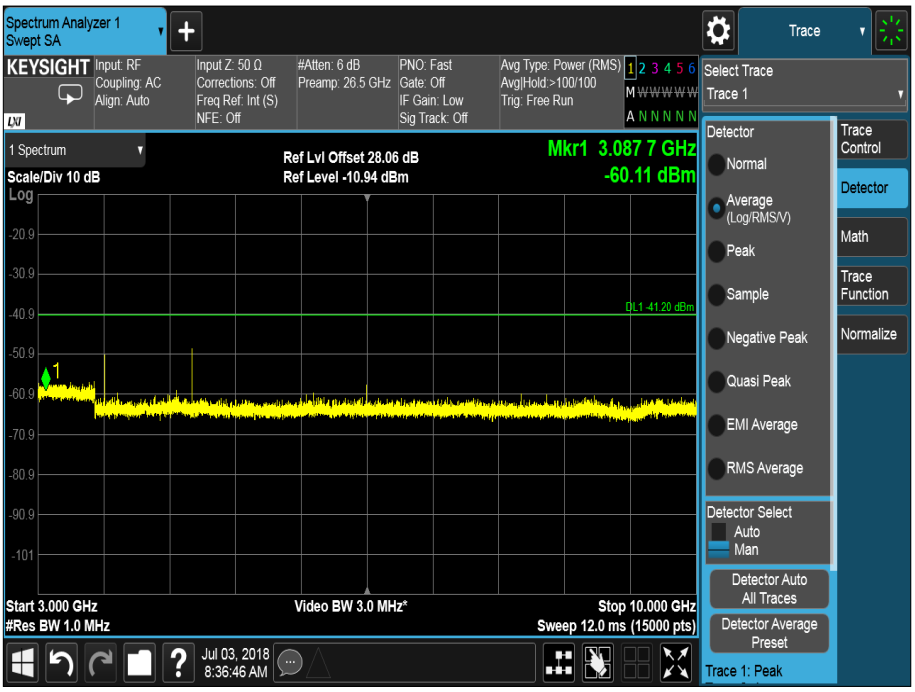

Figure 61 - Top Channel - 3 GHz to 10 GHz - Average

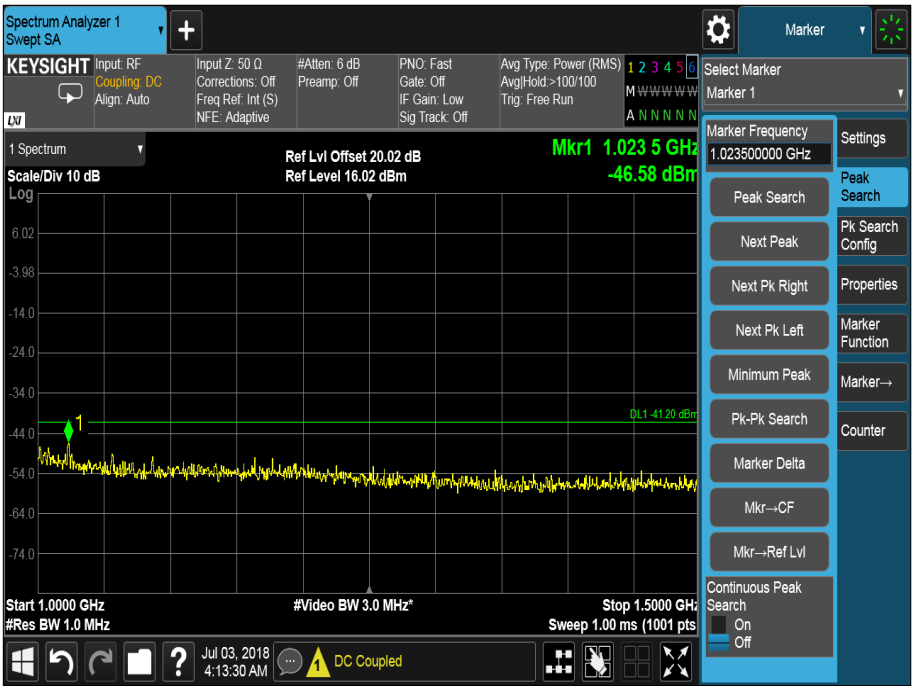

Figure 62 - Top Channel - 1 GHz to 1.5 GHz - Average

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(d), 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.

2.5.7 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
Mains Voltage Monitor	TUV SUD Product Service	RAB-001	1378	12	17-Apr-2019
Programmable Power Supply	California Inst	LO8036	1898	-	O/P Mon
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	20-Oct-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	09-Feb-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	20-Oct-2018
Attenuator (10dB, 100W)	Weinschel	48-10-43	4868	12	01-Nov-2018
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018
Cable (18GHz)	Rosenberger	LU7-036-1000	5030	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5034	-	O/P Mon

Table 35

O/P Mon – Output Monitored using calibrated equipment

2.6 Frequency Hopping Systems - Average Time of Occupancy

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
Industry Canada RSS-247, Clause 5.1

2.6.2 Equipment Under Test and Modification State

Space/Portal Ranger 9200, S/N: 0280420101-0007 - Modification State 0

2.6.3 Date of Test

29-June-2018

2.6.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.4.

2.6.5 Environmental Conditions

Ambient Temperature	22.6 °C
Relative Humidity	39.2 %

2.6.6 Test Results

UHF RFiD

Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
12.14	15	182.10

Table 36

Figure 63 - Dwell Time

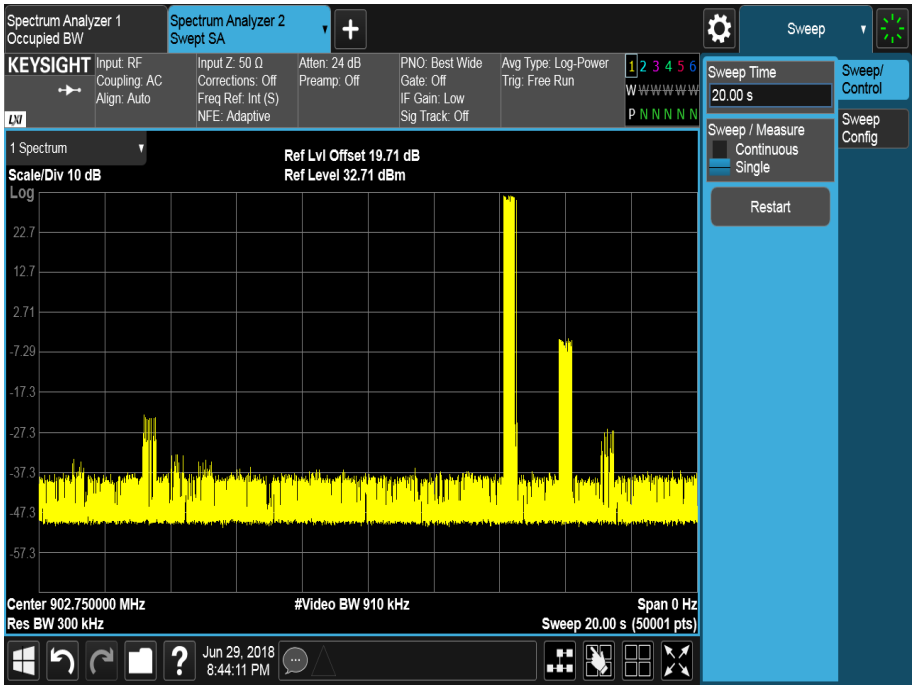

Figure 64 - Total Average Time of Occupancy

Remarks

Each sequence of bursts is made up of 15 transmissions of approximately 12.14 ms in duration. In any 20 second period no more than one burst sequence occurs therefore the maximum occupation time within 20 s is no more than 182.2 ms.

FCC 47 CFR Part 15, Limit Clause (a)(1)(i)

For frequency hopping systems operating in the 902–928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Industry Canada RSS-247, Limit Clause 5.1 (c)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period.

2.6.7 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
Mains Voltage Monitor	TUV SUD Product Service	RAB-001	1378	12	17-Apr-2019
Programmable Power Supply	California Inst	LO8036	1898	-	O/P Mon
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	20-Oct-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	09-Feb-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	20-Oct-2018
Attenuator (10dB, 100W)	Weinschel	48-10-43	4868	12	01-Nov-2018
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018
Cable (18GHz)	Rosenberger	LU7-036-1000	5030	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5034	-	O/P Mon

Table 37

O/P Mon – Output Monitored Using Calibrated Equipment

Product Service

2.7 Frequency Hopping Systems - Channel Separation

2.7.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
Industry Canada RSS-247, Clause 5.1

2.7.2 Equipment Under Test and Modification State

Space/Portal Ranger 9200, S/N: 0280420101-0007 - Modification State 0

2.7.3 Date of Test

29-June-2018

2.7.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.2.

2.7.5 Environmental Conditions

Ambient Temperature	22.6 °C
Relative Humidity	39.2 %

2.7.6 Test Results

UHF RFiD

Channel Separation (MHz)
0.5

Table 38

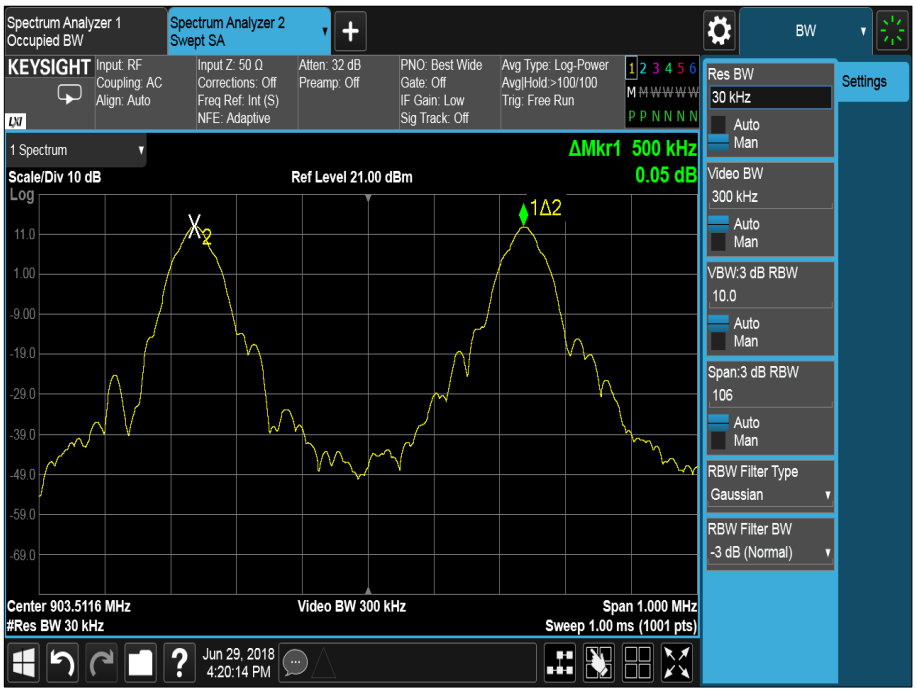

Figure 65

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Industry Canada RSS-247, Limit Clause 5.1 (c)

For FHSs in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 20-second period. If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

2.7.7 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
Mains Voltage Monitor	TUV SUD Product Service	RAB-001	1378	12	17-Apr-2019
Programmable Power Supply	California Inst	LO8036	1898	-	O/P Mon
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	20-Oct-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	09-Feb-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	20-Oct-2018
Attenuator (10dB, 100W)	Weinschel	48-10-43	4868	12	01-Nov-2018
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018
Cable (18GHz)	Rosenberger	LU7-036-1000	5030	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5034	-	O/P Mon

Table 39

O/P Mon – Output Monitored using calibrated equipment

2.8 Frequency Hopping Systems - Number of Hopping Channels

2.8.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
Industry Canada RSS-247, Clause 5.1

2.8.2 Equipment Under Test and Modification State

Space/Portal Ranger 9200, S/N: 0280420101-0001 - Modification State 0

2.8.3 Date of Test

14-August-2018

2.8.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.3.

2.8.5 Environmental Conditions

Ambient Temperature	21.8 °C
Relative Humidity	64.6 %

2.8.6 Test Results

<u>UHF RFiD</u>

Number of Hopping Channels: 50

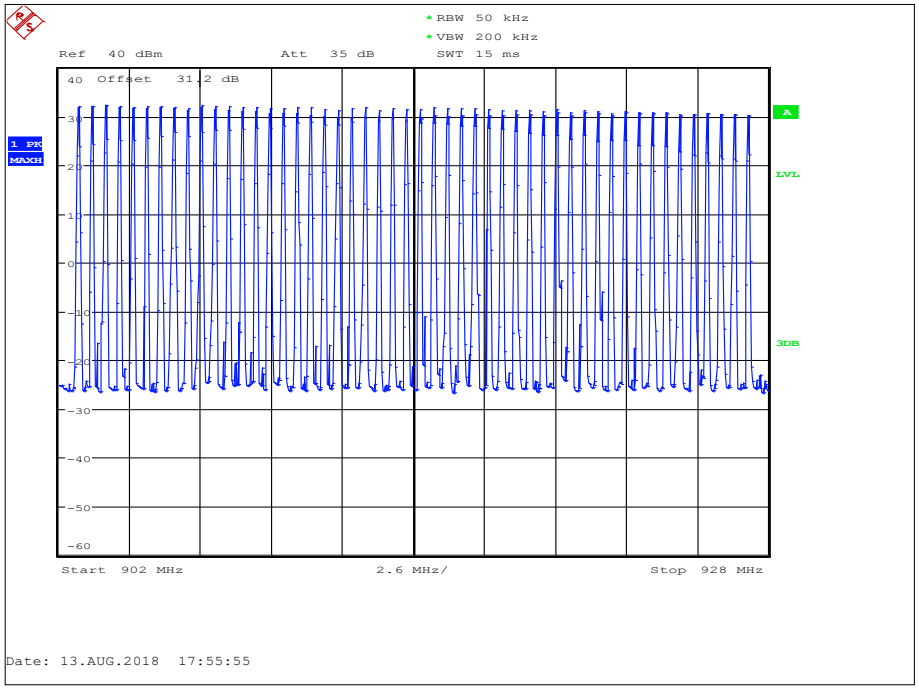

Figure 66 - Measurement Frequency Range: 902 MHz to 928 MHz

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(i) and Industry Canada RSS-247, Limit Clause 5.1 (3)

If the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies.

If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies.

2.8.7 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
Mains Voltage Monitor	TUV SUD Product Service	RAB-001	1378	12	17-Apr-2019
Programmable Power Supply	California Inst	LO8036	1898	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Attenuator (30dB, 150W)	Narda	769-30	3369	12	17-Jul-2019
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	14-Mar-2019
Cable (18GHz)	Rosenberger	LU7-036-1000	5030	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5034	-	O/P Mon

Table 40

O/P Mon – Output Monitored using calibrated equipment

2.9 Frequency Hopping Systems - 20 dB Bandwidth

2.9.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
Industry Canada RSS-247, Clause 5.1

2.9.2 Equipment Under Test and Modification State

Space/Portal Ranger 9200, S/N: 0280420101-0007 - Modification State 0

2.9.3 Date of Test

28-June-2018

2.9.4 Test Method

The EUT was connected to a spectrum analyser via a cable and attenuator. The automatic 'X' dB bandwidth functionality of the spectrum analyser was used, where 'X' was set to 20 dB.

The RBW was approximately set to 5% of the span using a peak detector and max-hold trace. Once the trace was sufficiently built up the result was recorded, and the screen image captured as shown below.

2.9.5 Environmental Conditions

Ambient Temperature	23.8 °C
Relative Humidity	45.6 %

2.9.6 Test Results

UHF RFiD

20 dB Bandwidth (kHz)		
902.75 MHz	915.25 MHz	927.25 MHz
50.48	51.64	68.76

Table 41

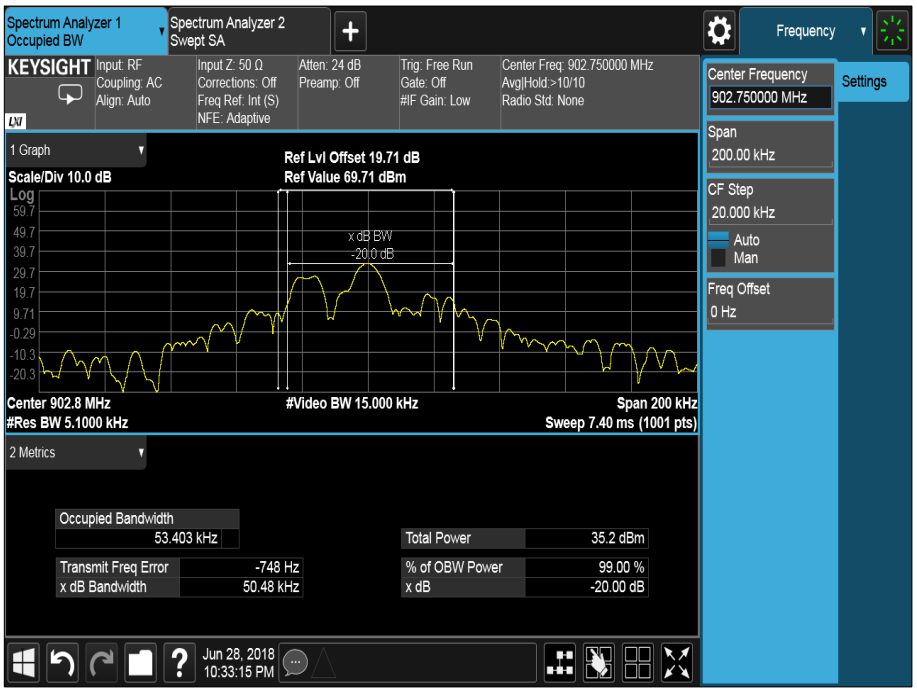

Figure 67 - 902.75 MHz

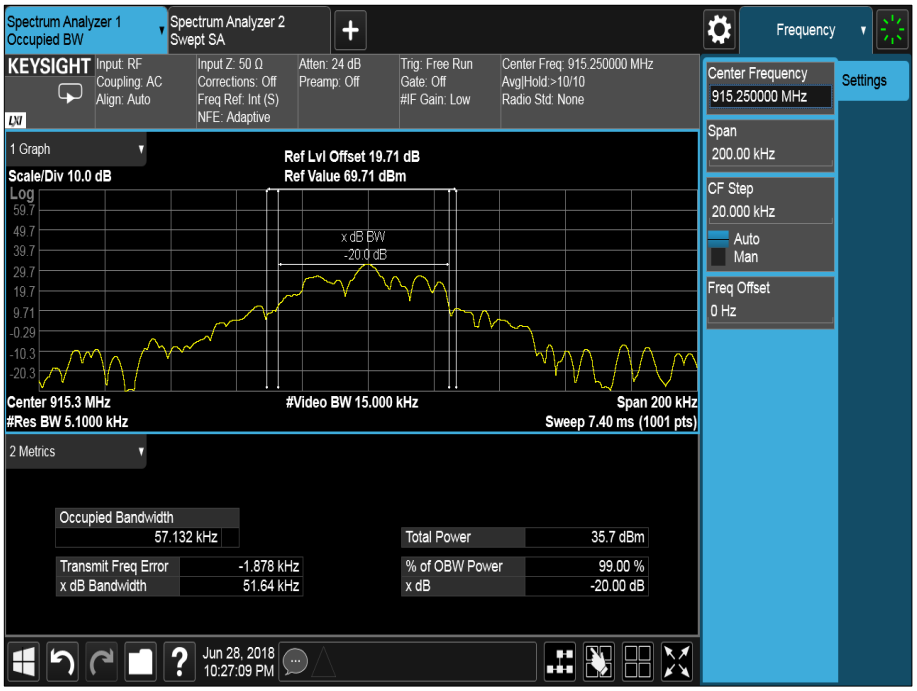

Figure 68 - 915.25 MHz

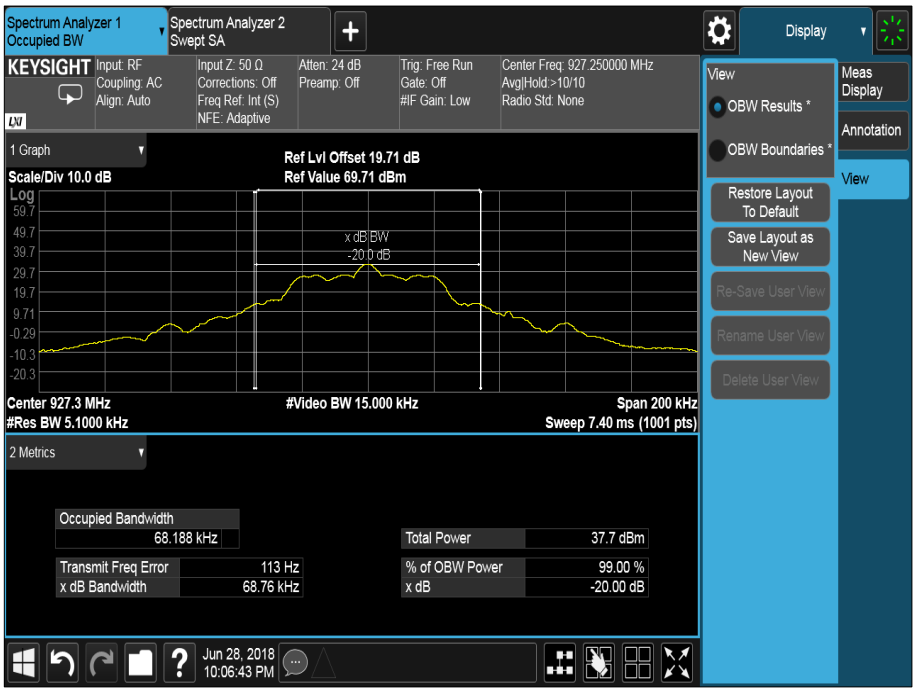

Figure 69 - 927.25 MHz

<u>FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(i) and Industry Canada RSS-247, Limit Clause 5.1 (c)</u>

The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

2.9.7 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
Mains Voltage Monitor	TUV SUD Product Service	RAB-001	1378	12	17-Apr-2019
Programmable Power Supply	California Inst	LO8036	1898	-	O/P Mon
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	20-Oct-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
'3.5mm' - '3.5mm' RF Cable (2m)	Rhophase	3PS-1803-2000-3PS	3702	12	09-Feb-2019
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	20-Oct-2018
Attenuator (10dB, 100W)	Weinschel	48-10-43	4868	12	01-Nov-2018
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018
Cable (18GHz)	Rosenberger	LU7-036-1000	5030	-	O/P Mon
Cable (18GHz)	Rosenberger	LU7-036-1000	5034	-	O/P Mon

Table 42

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
AC Power Line Conducted Emissions	150 kHz to 30 MHz, LISN, ±3.7 dB
Authorised 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: ± 5.2 dB 1 GHz to 40 GHz: ± 6.3 dB
Maximum Conducted Output Power	± 3.2 dB
Spurious Conducted Emissions	± 3.08 dB
Frequency Hopping Systems - Average Time of Occupancy	-
Frequency Hopping Systems - Channel Separation	± 17.972 kHz
Frequency Hopping Systems - Number of Hopping Channels	-
Frequency Hopping Systems - 20 dB Bandwidth	± 17.972 kHz

Table 43