FCC and ISED Test Report

DETNET SOUTH AFRICA (PTY) LTD
DGPS Commander, Model: CE4

In accordance with FCC 47 CFR Part 15C and ISED RSS-247 and ISED RSS-GEN

Add value.
Inspire trust.

Prepared for: Detnet South Africa (Pty) Ltd
Block 1B, Founders Hill Office Park
Centenary Road
Modderfontein P O Box 10
1645
South Africa

FCC ID: 2ARNH- 18462290 IC: 24476- 18462290

COMMERCIAL-IN-CONFIDENCE

Document 75949717-02 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matthew Russell	RF Team Leader	Authorised Signatory	5 July 2021

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD document control rules.

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C and ISED RSS-247 and ISED RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Callum Smith	**5 July 2021**	

FCC Accreditation
217472 Bearley Test Laboratory

Industry Canada Accreditation
2932E Bearley Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 15C: 2019, ISED RSS-247 Issue 2 (02-2017) and ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) for the tests detailed in section 1.3.

DISCLAIMER AND COPYRIGHT

This non-binding report has been prepared by TÜV SÜD with all reasonable skill and care. The document is confidential to the potential Client and TÜV SÜD. No part of this document may be reproduced without the prior written approval of TÜV SÜD. © 2021 TÜV SÜD. This report relates only to the actual item/items tested.

ACCREDITATION

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).

TÜV SÜD
is a trading name of TUV SUD Ltd
Registered in Scotland at East Kilbride,
Glasgow G75 0QF, United Kingdom
Registered number: SC215164

TUV SUD Ltd is a
TÜV SÜD Group Company

Phone: +44 (0) 1489 558100
Fax: +44 (0) 1489 558101
www.tuv-sud.co.uk

TÜV SÜD
Octagon House
Concorde Way
Fareham
Hampshire PO15 5RL
United Kingdom

Contents

1 Report Summary 2

1.1 Report Modification Record 2
1.2 Introduction 2
1.3 Brief Summary of Results 3
1.4 Application Form 4
1.5 Product Information 5
1.6 Deviations from the Standard 5
1.7 EUT Modification Record 5
1.8 Test Location 5

2 Test Details 6

2.1 Maximum Conducted Output Power 6
2.2 Frequency Hopping Systems - Average Time of Occupancy 9
2.3 Frequency Hopping Systems - Channel Separation 11
2.4 Frequency Hopping Systems - Number of Hopping Channels 14
2.5 Frequency Hopping Systems - 20 dB Bandwidth 16
2.6 Authorised Band Edges 19
2.7 Spurious Radiated Emissions 23

3 Photographs 40

3.1 Test Setup Photographs 40

4 Measurement Uncertainty 41

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	5 July 2021

Table 1

1.2 Introduction

Applicant	DETNET SOUTH AFRICA (PTY) LTD
Manufacturer	DETNET SOUTH AFRICA (PTY) LTD
Model Number(s)	CE4
Serial Number(s)	18400000C - (Conducted Tests) 153000220 - (Radiated Tests)
Hardware Version(s)	V6
Software Version(s)	45232
Number of Samples Tested	1
Test Specification/Issue/Date	FCC 47 CFR Part 15C: 2019 ISED RSS-247: Issue 2 (02-2017) ISED RSS-GEN: Issue 5 (04-2018) + A1 (03-2019)
Order Number Date	4500432723 05-August-2020
Date of Receipt of EUT	25-January-2021
Start of Test	18-January-2021
Finish of Test	24-May-2021
Name of Engineer(s)	Callum Smith and Lewis Hoe
Related Document(s)	ANSI C63.10 (2013)

1.3 Brief Summary of Results

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

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	FCC Part 15C	RSS-247	RSS-GEN			
Configuration and Mode: Tagger - Battery powered - 915 MHz transmitter						
2.1	15.247 (b),	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.10 (2013)
2.2	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Average Time of Occupancy	Pass	ANSI C63.10 (2013)
2.3	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Channel Separation	Pass	ANSI C63.10 (2013)
2.4	15.247 (a)(1)	5.1	-	Frequency Hopping Systems - Number of Hopping Channels	Pass	ANSI C63.10 (2013)
2.5	15.247 (a)(1),	5.1	6.7	Frequency Hopping Systems - 20 dB Bandwidth	Pass	ANSI C63.10 (2013)
2.6	15.247 (d),	5.5	-	Authorised Band Edges	Pass	ANSI C63.10 (2013)
2.7	15.247 (d) and 15.205,	5.5	6.13	Spurious Radiated Emissions	Pass	ANSI C63.10 (2013)

Table 2

1.4 Application Form

Technical Description: *(Please provide a brief description of the intended use of the equipment including the technologies the product supports)*	Blasting control of electronic detonators
Manufacturer:	DetNet South Africa Pty (Ltd)
Model:	DGPS CE4 Commander
Part Number:	18400000C
Hardware Version:	V6
Software Version:	45232
FCC ID of the product under test – see guidance here	2ARNH-18462290
IC ID of the product under test – see guidance here	24476-18462290

Table 3

Intentional Radiators

Technology	RF	WiFi	NFC
Frequency Range (MHz to MHz)	902-928	2412-2457	13.553-13.567
Conducted Declared Output Power (dBm)	27	18	6
Antenna Gain (dBi)	0	2.1	2.1
Supported Bandwidth(s) (MHz) (e.g 1 MHz, 20 MHz, 40 MHz)	50	22	0.014
Modulation Scheme(s) (e.g GFSK, QPSK etc)	GFSK	BPSK, QPSK, 16QAM, 64QAM	Point to point Communication
ITU Emission Designator (see guidance here)	900MF1D	2G4G1D	13M5D1D
Bottom Frequency (MHz)	902.26	2412	-
Middle Frequency (MHz)	914.74	2437	13.56
Top Frequency (MHz)	927.74	2457	-

Table 4

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

Name: Suzette Menezes
Position held: Approvals Manager
Date: 2020-08-14

1.5 Product Information

1.5.1 Technical Description

The Equipment under test (EUT) was a DetNet South Africa Pty (Ltd), DGPS CE4 Commander.

The primary function of the EUT is to be used as a Blasting control for electronic detonators.

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
Model: CE4, Serial Number: 18400000C			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 5

1.8 Test Location

TÜV SÜD conducted the following tests at our Bearley Test Laboratory.

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: Commander - Battery powered - 915 MHz transmitter		
Maximum Conducted Output Power	Callum Smith	UKAS
Emission Bandwidth	Callum Smith	UKAS
Frequency Hopping Systems - Average Time of Occupancy	Callum Smith	UKAS
Frequency Hopping Systems - Channel Separation	Callum Smith	UKAS
Frequency Hopping Systems - Number of Hopping Channels	Callum Smith	UKAS
Frequency Hopping Systems - 20 dB Bandwidth	Callum Smith	UKAS
Authorised Band Edges	Callum Smith	UKAS
Spurious Radiated Emissions	Lewis Hoe and Callum Smith	UKAS

Table 6

Office Address:

Snitterfield Road
Bearley
Stratford-upon-Avon
Warwickshire
CV37 0EX
United Kingdom

2 Test Details

2.1 Maximum Conducted Output Power

2.1.1 Specification Reference

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

2.1.2 Equipment Under Test and Modification State

CE4, S/N: 18400000C - Modification State 0

2.1.3 Date of Test

19-January-2021

2.1.4 Test Method

The test was performed in accordance with ANSI C63.10, Clause 7.8.5

2.1.5 Environmental Conditions

Ambient Temperature	18.4 °C
Relative Humidity	32.1 %

2.1.6 Test Results

Commander - Battery powered - 915 MHz transmitter

Frequency (MHz)	Modulation Scheme	Maximum Output Power	
		dBm	mW
902.26	GFSK	21.733	149.039
914.74	GFSK	22.652	184.162
927.74	GFSK	23.889	244.850

Table 7 - Maximum Conducted Output Power Results

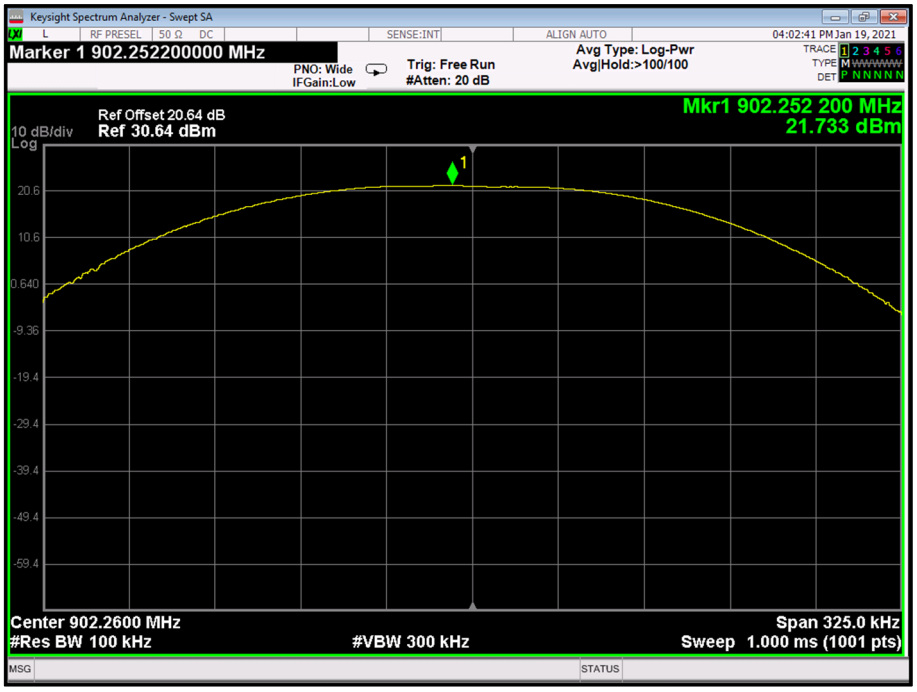

Figure 1 - 902.26 MHz - Maximum Output Power

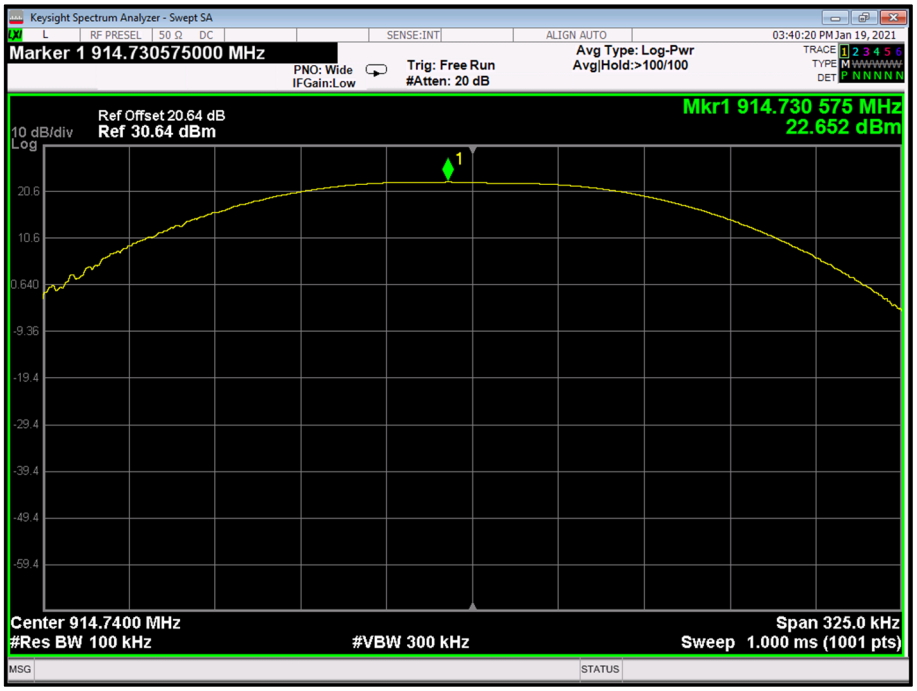

Figure 2 - 914.74 MHz - Maximum Output Power

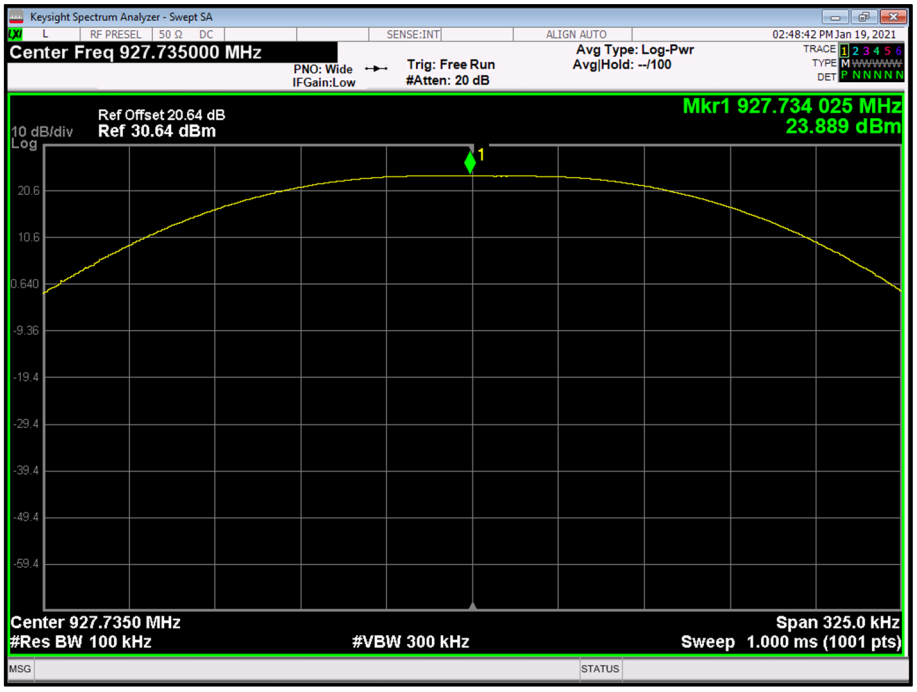

Figure 3 - 927.74 MHz - Maximum Output Power

FCC 47 CFR Part 15, Limit Clause 15.247 (b)(2)

For frequency hopping systems operating in the 902–928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels.

ISEDC 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.

2.1.7 Test Location and Test Equipment Used

This test was carried out in Bearley EMC Chamber 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Attenuator (20dB, 25W)	Spinner	BN745384	1705	12	30-Nov-2021
Cable (18GHz N Type 3m)	Rosenberger	LU7-036-3000	5163	12	10-Dec-2021
Hygromer	Rotronic	A2	1698	12	18-Nov-2021
EMI Receiver	Keysight Technologies	N9038A MXE	4974	12	11-Feb-2021

Table 8

2.2 Frequency Hopping Systems - Average Time of Occupancy

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

CE4, S/N: 18400000C - Modification State 0

2.2.3 Date of Test

19-January-2021

2.2.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 7.8.4.Hwever the measurements where made using a normal detector.

2.2.5 Environmental Conditions

Ambient Temperature	15.4 °C
Relative Humidity	43.1 %

2.2.6 Test Results

Commander - Battery powered - 915 MHz transmitter

Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
0.203	17	3.451

Table 9

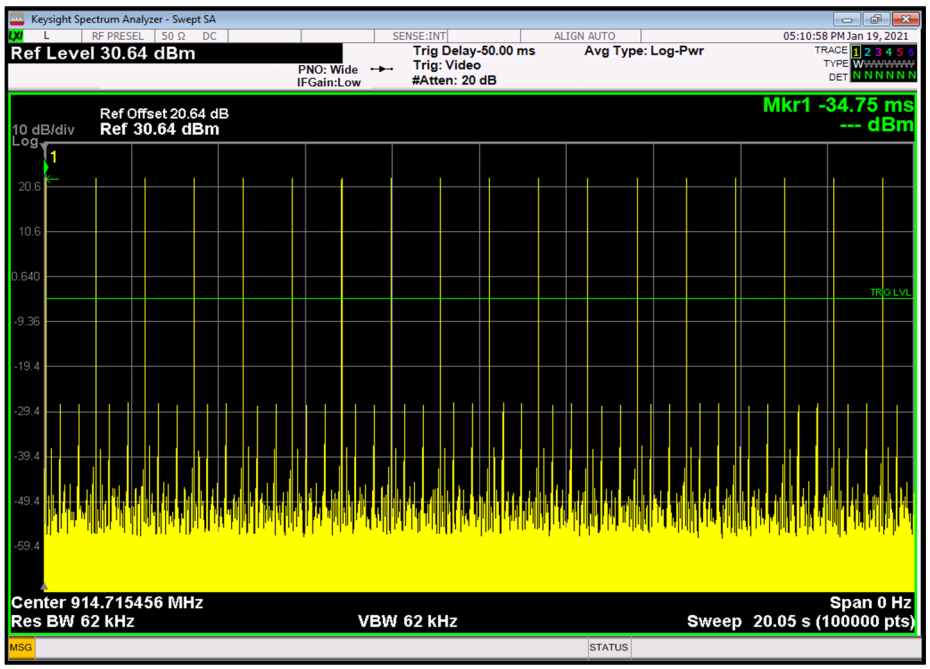

Figure 4 - Dwell Time

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.

2.2.7 Test Location and Test Equipment Used

This test was carried out in Bearley EMC Chamber 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Attenuator (20dB, 25W)	Spinner	BN745384	1705	12	30-Nov-2021
Cable (18GHz N Type 3m)	Rosenberger	LU7-036-3000	5163	12	10-Dec-2021
Hygromer	Rotronic	A2	1698	12	18-Nov-2021
EMI Receiver	Keysight Technologies	N9038A MXE	4974	12	11-Feb-2021

Table 10

2.3 Frequency Hopping Systems - Channel Separation

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test and Modification State

CE4, S/N: 18400000C - Modification State 0

2.3.3 Date of Test

19-January-2021

2.3.4 Test Method

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

2.3.5 Environmental Conditions

Ambient Temperature	20.4 °C
Relative Humidity	36.4 %

2.3.6 Test Results

Commander - Battery powered - 915 MHz transmitter

Channel Separation (MHz)
0.509

Table 11

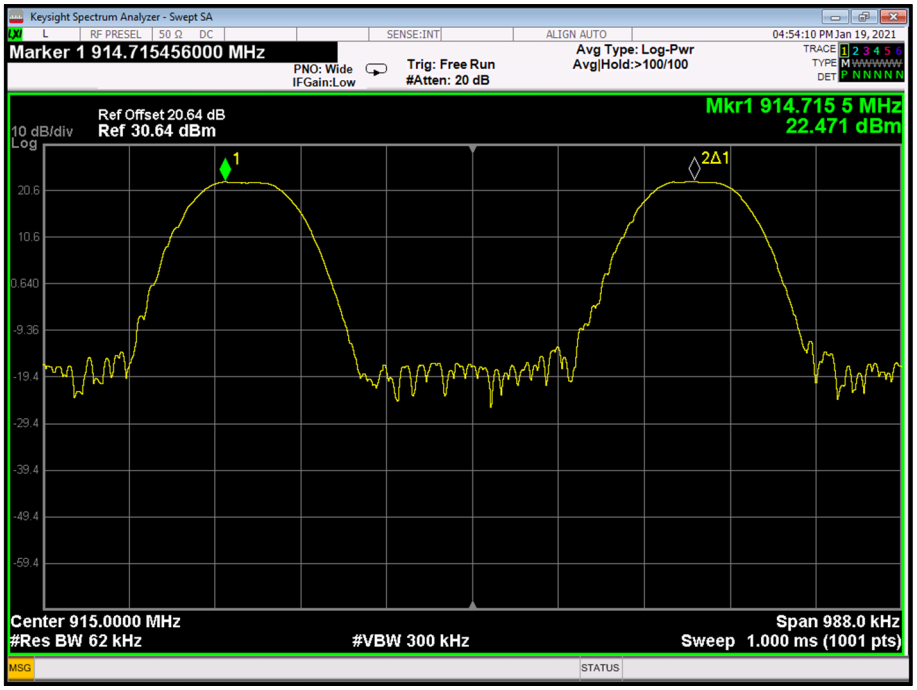

Figure 5

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.

2.3.7 Test Location and Test Equipment Used

This test was carried out in Bearley EMC Chamber 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Attenuator (20dB, 25W)	Spinner	BN745384	1705	12	30-Nov-2021
Cable (18GHz N Type 3m)	Rosenberger	LU7-036-3000	5163	12	10-Dec-2021
Hygromer	Rotronic	A2	1698	12	18-Nov-2021
EMI Receiver	Keysight Technologies	N9038A MXE	4974	12	11-Feb-2021

Table 12

2.4 Frequency Hopping Systems - Number of Hopping Channels

2.4.1 Specification Reference

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

2.4.2 Equipment Under Test and Modification State

CE4, S/N: 18400000C - Modification State 0

2.4.3 Date of Test

19-January-2021

2.4.4 Test Method

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

2.4.5 Environmental Conditions

Ambient Temperature	15.5 °C
Relative Humidity	42.1 %

2.4.6 Test Results

<u>Commander - Battery powered - 915 MHz transmitter</u>

Number of Hopping Channels: 50

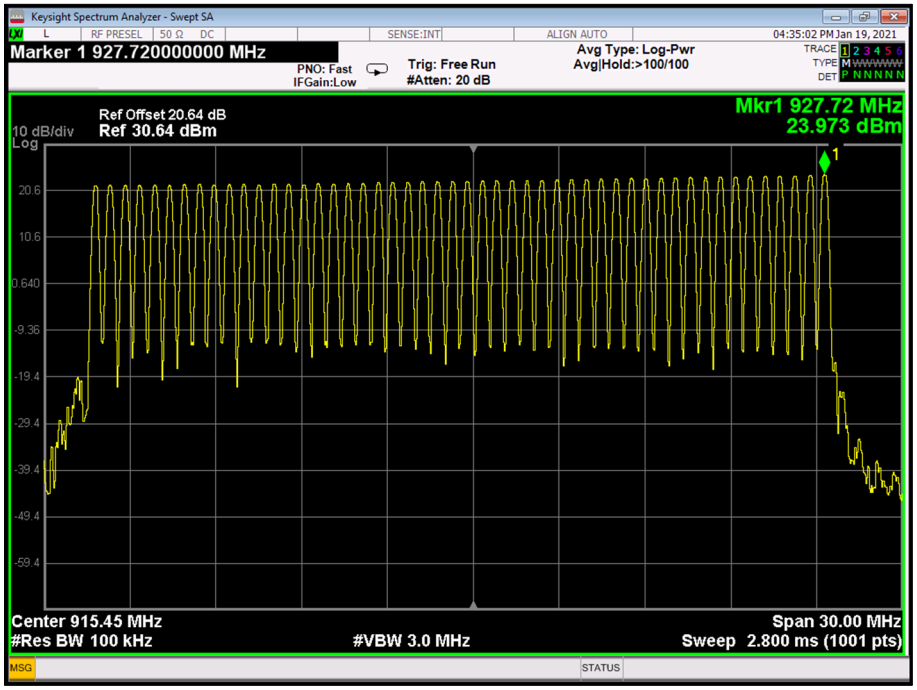

Figure 6 - Measurement Frequency Range: 902.26 MHz - 927.74 MHz

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

≥ 15 channels

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

FHSs operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

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.

2.4.7 Test Location and Test Equipment Used

This test was carried out in Bearley EMC Chamber 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Attenuator (20dB, 25W)	Spinner	BN745384	1705	12	30-Nov-2021
Cable (18GHz N Type 3m)	Rosenberger	LU7-036-3000	5163	12	10-Dec-2021
Hygromer	Rotronic	A2	1698	12	18-Nov-2021
EMI Receiver	Keysight Technologies	N9038A MXE	4974	12	11-Feb-2021

Table 13

2.5 Frequency Hopping Systems - 20 dB Bandwidth

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
ISED RSS-247, Clause 5.1
ISED RSS-GEN, Clause 6.7

2.5.2 Equipment Under Test and Modification State

CE4, S/N: 18400000C - Modification State 0

2.5.3 Date of Test

19-January-2021

2.5.4 Test Method

The test was performed in accordance with ANSI C63.10, clause 6.9.2

2.5.5 Environmental Conditions

Ambient Temperature	18.4 °C
Relative Humidity	49.8 %

2.5.6 Test Results

Commander - Battery powered - 915 MHz transmitter

Frequency (MHz)	20 dB Bandwidth (kHz)
	GFSK
902.26	65.2
914.74	74.0
927.74	64.6

Table 14

Figure 7 - 902.26 MHz – Emission Bandwidth

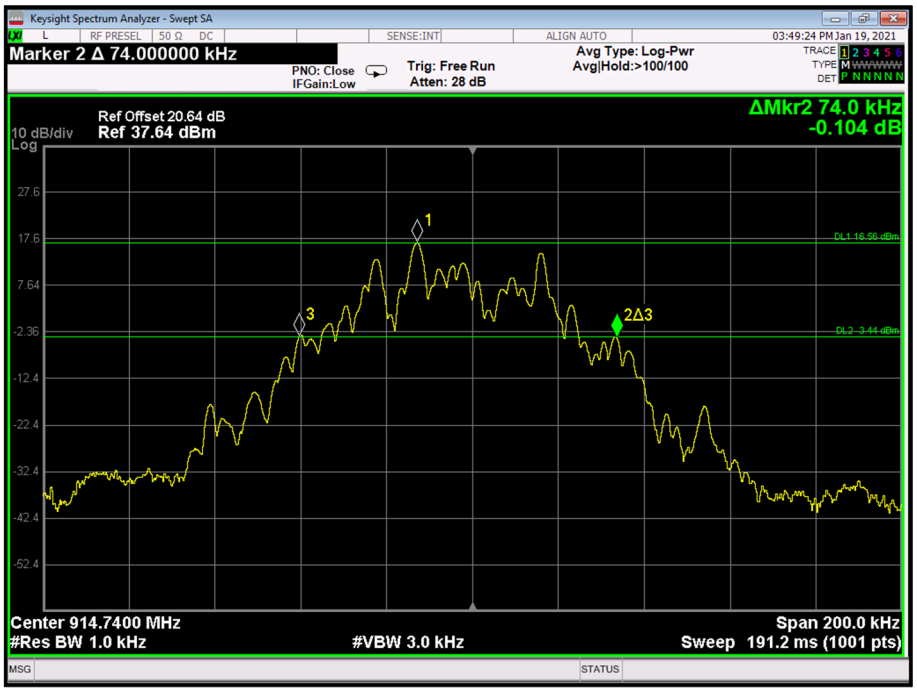

Figure 8 - 914.74 MHz – Emission Bandwidth

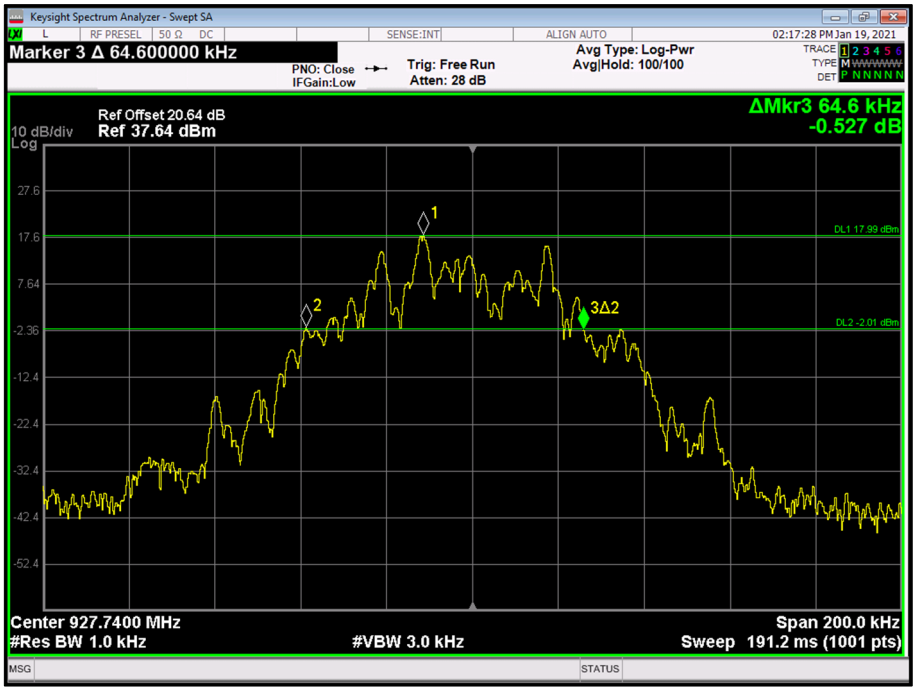

Figure 9 - 927.74 MHz – Emission Bandwidth

Testing was performed on the modulation/packet type with the highest conducted output power. This modulation/packet type was GFSK.

<u>FCC 47 CFR Part 15 and RSS-247 Limit Clause</u>

None specified.

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

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

2.5.1 Test Location and Test Equipment Used

This test was carried out in Bearley EMC Chamber 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Expires
Attenuator (20dB, 25W)	Spinner	BN745384	1705	12	30-Nov-2021
Cable (18GHz N Type 3m)	Rosenberger	LU7-036-3000	5163	12	10-Dec-2021
Hygromer	Rotronic	A2	1698	12	18-Nov-2021
EMI Receiver	Keysight Technologies	N9038A MXE	4974	12	11-Feb-2021

Table 15

2.6 Authorised Band Edges

2.6.1 Specification Reference

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

2.6.2 Equipment Under Test and Modification State

CE4, S/N: 153000220 - Modification State 0

2.6.3 Date of Test

21-May-2021

2.6.4 Test Method

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

2.6.5 Environmental Conditions

Ambient Temperature	14.9 - 15.3 °C
Relative Humidity	46.3 -47.8 %

2.6.6 Test Results

Commander - Battery powered - 915 MHz transmitter

Mode	Frequency (MHz)	Band Edge Frequency (MHz)	Level (dBc)
Static	901.626	902	-41.99
Static	928.038	928	-38.31
Hopping	880.920	902	-46.12
Hopping	928.038	928	-40.73

Table 16 - Authorised Band Edge Results

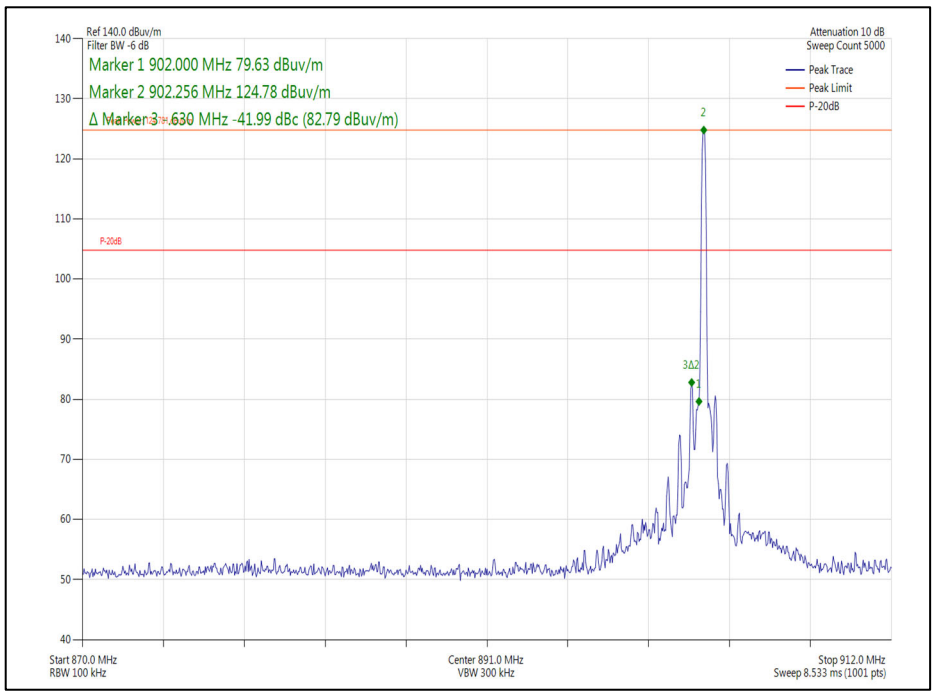

Figure 10 – Static - 902.26 MHz - Measured Frequency 901.63 MHz

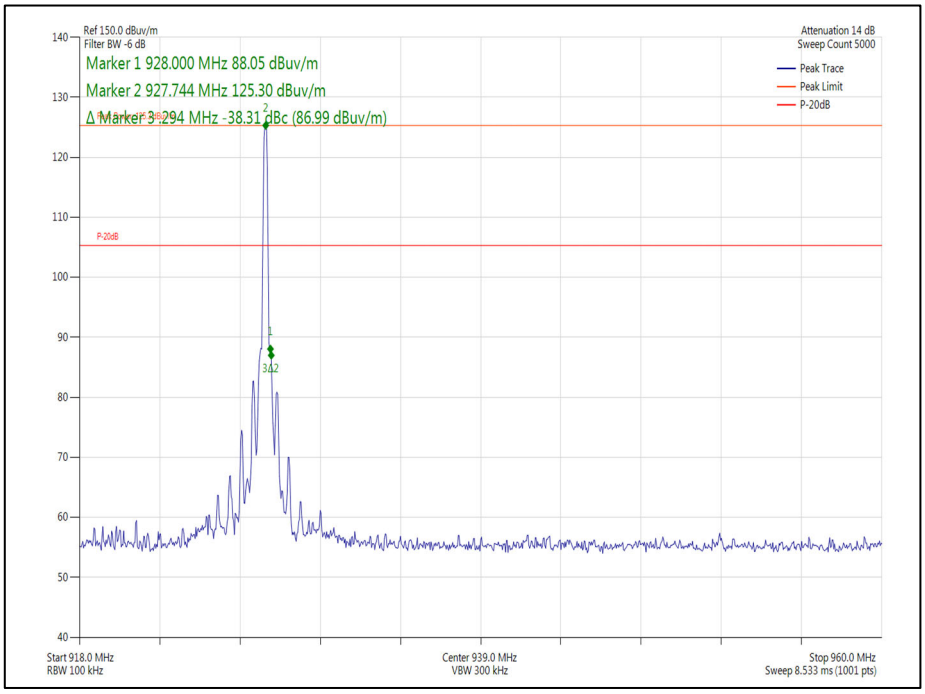

Figure 11 - Static 927.74 MHz - Measured Frequency 928.03 MHz