FCC and ISEDC Test Report

Sepura Ltd
Portable TETRA handset, Model: SC2028

In accordance with FCC 47 CFR Part 90, FCC 47 CFR Part 2 and Industry Canada RSS-119 and ISEDC RSS-GEN

Add value.
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Prepared for: Sepura Ltd
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Cambridge, CB25 9TL
United Kingdom

FCC ID: XX6SC2028 IC: 8739A-SC2028

COMMERCIAL-IN-CONFIDENCE

Document 75947270-05 Issue 01

SIGNATURE			
NAME	**JOB TITLE**	**RESPONSIBLE FOR**	**ISSUE DATE**
Matthew Russell	RF Team Leader	Authorised Signatory	06 January 2020

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 90, FCC 47 CFR Part 2, Industry Canada RSS-119 and ISEDC RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Francis Kane	06 January 2020	
Testing	Graeme Lawler	06 January 2020	

FCC Accreditation
90987 Octagon House, Fareham Test Laboratory

ISEDC Accreditation
12669A Octagon House, Fareham Test Laboratory

EXECUTIVE SUMMARY

A sample of this product was tested and found to be compliant with FCC 47 CFR Part 90: 2018, FCC 47 CFR Part 2: 2018, Industry Canada RSS-119: Issue 12 (05-2015) and ISEDC RSS-GEN: Issue 5 (04-2018) + A1 (03-2019) for the tests detailed in section 1.3.

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Contents

1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	06 January 2020

Table 1

1.2 Introduction

Applicant	Sepura Ltd
Manufacturer	Sepura Ltd
Model Number(s)	SC2028
Serial Number(s)	1PR001947GKE03R and 1PR001925GK63ZJ
Hardware Version(s)	Pre-Production
Software Version(s)	2001 730 07367
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 90: 2018 FCC 47 CFR Part 2: 2018 Industry Canada RSS-119: Issue 12 (05-2015) ISEDC RSS-GEN: Issue 5 (04-2018) + A1 (03-2019)
Order Number Date	PLC-PO014257-2 11-October-2019
Date of Receipt of EUT	06-December-2019
Start of Test	09-December-2019
Finish of Test	18-December-2019
Name of Engineer(s)	Francis Kane and Graeme Lawler
Related Document(s)	ANSI C63.26: 2015

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 90, FCC 47 CFR Part 2, Industry Canada RSS-119 and ISEDC RSS-GEN is shown below.

Section	Specification Clause				Test Description	Result	Comments/Base Standard
	Part 90	Part 2	RSS-119	RSS-GEN			
Configuration and Mode: TETRA 809 MHz to 824 MHz - Transmit High capacity battery							
2.1	90.205	2.1046	5.4	6.12	Maximum Conducted Output Power	Pass	
2.2	90.209	2.1049	5.5	6.7	Bandwidth Limitations	Pass	
2.3	90.210	2.1051	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	
2.4	90.210	2.1055	5.3	6.11	Frequency Stability	Pass	
2.5	90.221	-	-	-	Adjacent Channel Power	Pass	
2.6	90.207	2.1047	5.2	-	Types of Emissions	Pass	
2.7	90.210	2.1051	5.8	6.13	Radiated Spurious Emissions	Pass	
Configuration and Mode: TETRA 851 MHz to 869 MHz - Transmit High capacity battery							
2.1	90.205	2.1046	5.4	6.12	Maximum Conducted Output Power	Pass	
2.2	90.209	2.1049	5.5	6.7	Bandwidth Limitations	Pass	
2.3	90.210	2.1051	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	
2.4	90.210	2.1055	5.3	6.11	Frequency Stability	Pass	
2.5	90.221	-	-	-	Adjacent Channel Power	Pass	
2.6	90.207	2.1047	5.2	-	Types of Emissions	Pass	
2.7	90.210	2.1051	5.8	6.13	Radiated Spurious Emissions	Pass	

Table 2

1.4 Application Form

Equipment Description

Technical Description: *(Please provide a brief description of the intended use of the equipment)*	The SC20 hand-portable terminal is a TETRA enabled radio with Bluetooth and Wi-Fi capability
Manufacturer:	Sepura Limited
Model:	SC2028
Part Number:	N/A
Hardware Version:	Pre-Production
Software Version:	2001 730 07367
FCC ID (if applicable)	XX6SC2028
IC ID (if applicable)	8739A-SC2028

Intentional Radiators

Technology	TETRA	TETRA	BT Classic/EDR	BLE	WLAN
Frequency Band (MHz)	806-824	851-869	2402-2480	2402-2480	2412-2462
Conducted Declared Output Power (dBm)	34	34	7.382	7.382	16.5
Antenna Gain (dBi)	> 0	> 0	2.5	2.5	2.5
Supported Bandwidth(s) (MHz)	25 kHz	25 kHz	1	2	16.5 22 16.5
Modulation Scheme(s)	π/4 DQPSK	π/4 DQPSK	8PSK, DQPSK, GFSK	8PSK, DQPSK, GFSK	802.11g, 802.11b 802.11n
ITU Emission Designator	22K0DXW	22K0DXW	1M00F1D	2M00F1D	16M5D1D 22M0G1D 16M5D1D
Bottom Frequency (MHz)	806	851	2402	2402	2412
Middle Frequency (MHz)	815	860	2441	2441	2437
Top Frequency (MHz)	824	869	2480	2480	2462

Un-intentional Radiators

Highest frequency generated or used in the device or on which the device operates or tunes	2480 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	32.768 kHz
Class A Digital Device (Use in commercial, industrial or business environment) ☒ Class B Digital Device (Use in residential environment only) ☐	

AC Power Source

AC supply frequency:		Hz
Voltage		V
Max current:		A
Single Phase ☐ Three Phase ☐		

DC Power Source

Nominal voltage:	7.4	V
Extreme upper voltage:	7.4	V
Extreme lower voltage:	6.2	V
Max current:	2	A

Battery Power Source

Voltage:	7.4	V
End-point voltage:	6.2	V *(Point at which the battery will terminate)*
Alkaline ☐ Leclanche ☒ Lithium ☐ Nickel Cadmium ☐ Lead Acid* ☐ **(Vehicle regulated)*		
Other ☐ Please detail:		

Charging

Can the EUT transmit whilst being charged	Yes ☒ No ☐

Temperature

Minimum temperature:	-30	°C
Maximum temperature:	+65	°C

Antenna Characteristics

Antenna connector ☒ TETRA			State impedance	50	Ohm
Temporary antenna connector ☐			State impedance		Ohm
Integral antenna ☒	Type:	PCB	State impedance	50	Ohm
External antenna ☐	Type:		State impedance		dBI

Ancillaries (if applicable)

Manufacturer:		Part Number:	
Model:		Country of Origin:	

The SC2028 may be used with standard SC20 accessories, batteries, chargers, belt clips, holsters, remote speaker and microphones, earpieces etc

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

Name: Chris Beecham
Position held: Conformance Engineer
Date: 21 October 2019

1.5 Product Information

1.5.1 Technical Description

The SC20 hand-portable terminal is a TETRA enabled radio with Bluetooth and Wi-Fi capability.

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: SC2028: Serial Number: 1PR001925GK63ZJ			
0	As supplied by the customer	Not Applicable	Not Applicable
Model: SC2028: Serial Number: 1PR001947GKE03R			
0	As supplied by the customer	Not Applicable	Not Applicable

Table 3

1.8 Test Location

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

Test Name	Name of Engineer(s)	Accreditation
Configuration and Mode: TETRA 809 MHz to 824 MHz - Transmit High capacity battery		
Maximum Conducted Output Power	Francis Kane	UKAS
Bandwidth Limitations	Francis Kane	UKAS
Spurious Emissions at Antenna Terminals	Francis Kane	UKAS
Frequency Stability	Francis Kane	UKAS
Adjacent Channel Power	Francis Kane	UKAS
Types of Emissions	Francis Kane	UKAS
Radiated Spurious Emissions	Graeme Lawler	UKAS
Configuration and Mode: TETRA 851 MHz to 869 MHz - Transmit High capacity battery		
Maximum Conducted Output Power	Francis Kane	UKAS
Bandwidth Limitations	Francis Kane	UKAS
Spurious Emissions at Antenna Terminals	Francis Kane	UKAS
Frequency Stability	Francis Kane	UKAS
Adjacent Channel Power	Francis Kane	UKAS
Types of Emissions	Francis Kane	UKAS
Radiated Spurious Emissions	Graeme Lawler	UKAS

Table 4

Office Address:

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

2 Test Details

2.1 Maximum Conducted Output Power

2.1.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.205
FCC 47 CFR Part 2, Clause 2.1046
Industry Canada RSS-119, Clause 5.4
ISEDC RSS-GEN, Clause 6.12

2.1.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001947GKE03R - Modification State 0

2.1.3 Date of Test

09-December-2019

2.1.4 Test Method

The test was applied in accordance with ANSI C63.26, Clause 5.2.4.3.1.

2.1.5 Environmental Conditions

Ambient Temperature	22.8 - 23.7 °C
Relative Humidity	40.1 - 42.8 %

2.1.6 Test Results

TETRA 809 MHz to 824 MHz - Transmit High capacity battery

806.025 MHz		815.000 MHz		823.975 MHz	
Result (dBm)	Result (W)	Result (dBm)	Result (W)	Result (dBm)	Result (W)
34.51	2.825	34.42	2.767	34.58	2.767

Table 5 – ERP

TETRA 851 MHz to 869 MHz - Transmit High capacity battery

851.025 MHz		860.000 MHz		868.975 MHz	
Result (dBm)	Result (W)	Result (dBm)	Result (W)	Result (dBm)	Result (W)
34.63	2.904	34.41	2.761	34.23	2.649

Table 6 – ERP

FCC 47 CFR Part 90, Limit Clause 90.205

Frequency (MHz)	Limit
806 to 824, 851 to 869, 869 to 901 and 935 to 940	Refer to 90.635 of the specification

Table 7 - FCC Limits for Maximum ERP

Industry Canada RSS-119, Limit Clause 5.4

The output power shall be within ±1 dB of the manufacturer's rated power listed in the equipment specifications.

Frequency (MHz)	Transmitter Output Power (W)	
	Base/Fixed Equipment	Mobile Equipment
806 to 821, 851 to 866, 821 to 824 and 866 to 869	110	30

Table 8 - Industry Canada Limits for Transmitter Output Power

2.1.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Fluke	75 Mk3	455	12	11-Oct-2020
Hygromer	Rotronic	A1	2138	12	05-Mar-2020
Attenuator (20 dB, 150 W)	Narda	769-20	3367	12	17-Jul-2020
Attenuator (10dB, 150W)	Narda	769-10	3368	12	17-Jul-2020
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	12-Nov-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
EXA	Keysight Technologies	N9010B	4968	24	21-Dec-2019
Network Analyser	Keysight Technologies	E5063A	5018	12	20-May-2020
Electronic Calibration Module	Keysight Technologies	85093C	5188	12	21-May-2020

Table 9

O/P Mon – Output Monitored using Calibrated Equipment

2.2 Bandwidth Limitations

2.2.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.209
FCC 47 CFR Part 2, Clause 2.1049
Industry Canada RSS-119, Clause 5.5
ISEDC RSS-GEN, Clause 6.7

2.2.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001947GKE03R - Modification State 0

2.2.3 Date of Test

09-December-2019

2.2.4 Test Method

The test was performed in accordance with ANSI C63.26, clause 5.4.4.

2.2.5 Environmental Conditions

Ambient Temperature	22.5 - 22.7 °C
Relative Humidity	42.6 - 42.9 %

2.2.6 Test Results

TETRA 809 MHz to 824 MHz - Transmit High capacity battery

806.025 MHz	815.000 MHz	823.975 MHz
Result (kHz)	Result (kHz)	Result (kHz)
21.221	21.204	21.256

Table 10 - Occupied Bandwidth Results

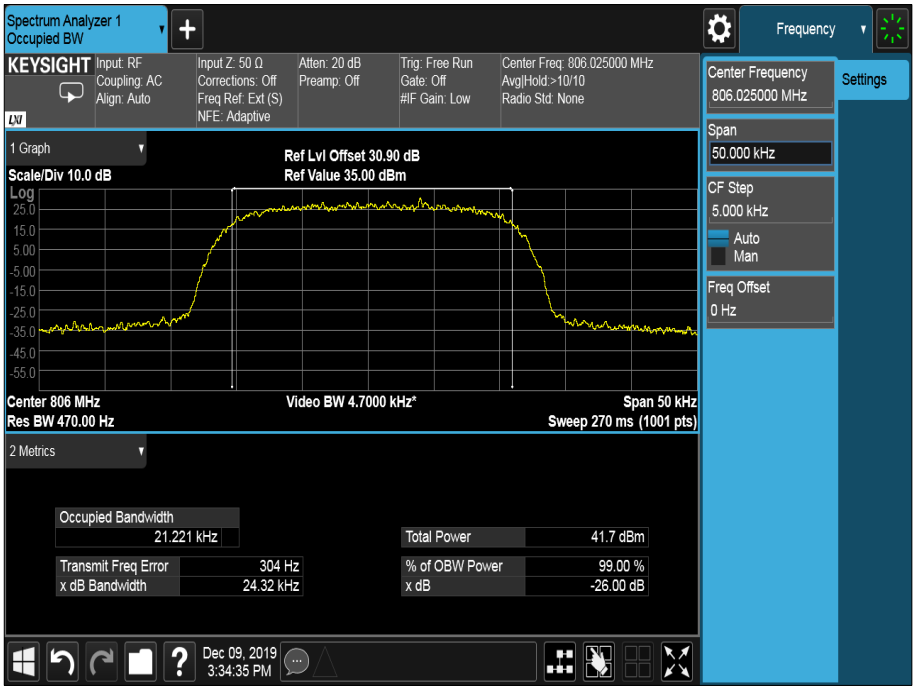

Figure 1 - 806.025 MHz Occupied Bandwidth

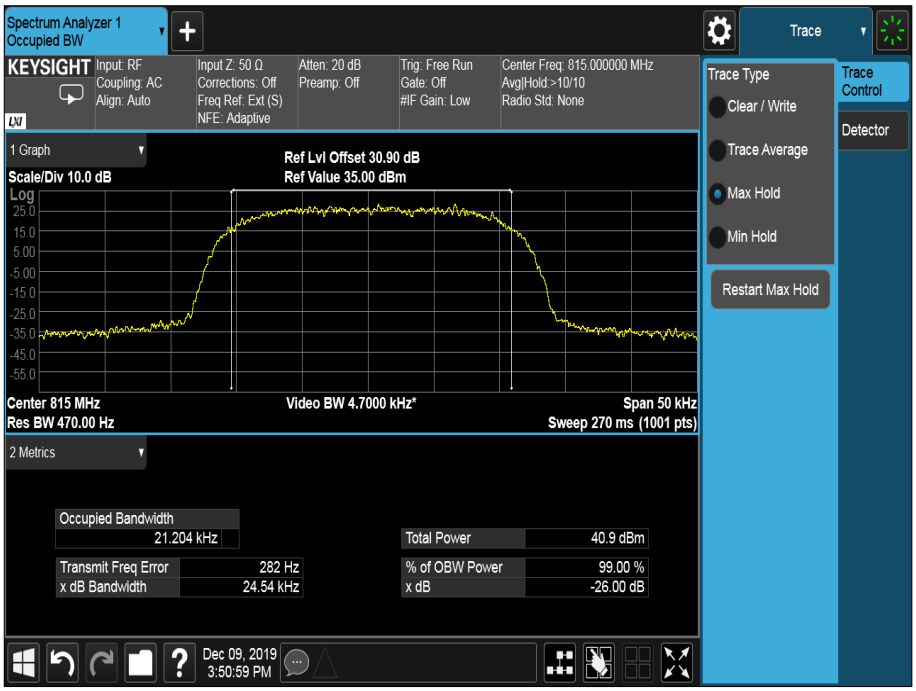

Figure 2 - 815.000 MHz Occupied Bandwidth

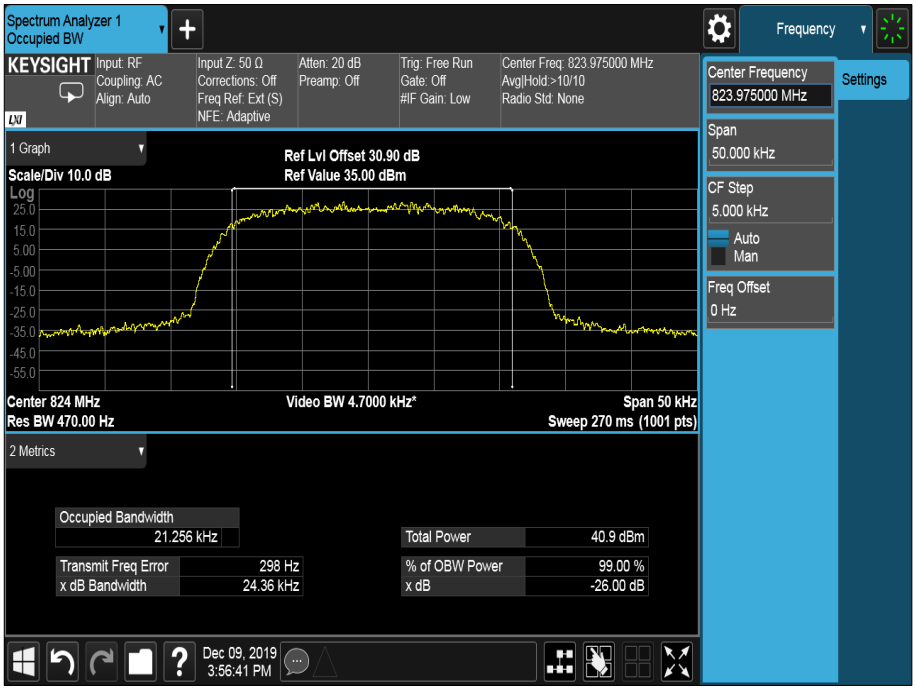

Figure 3 - 823.975 MHz Occupied Bandwidth

TETRA 851 MHz to 869 MHz - Transmit High capacity battery

851.025 MHz	860.000 MHz	868.975 MHz
Result (kHz)	Result (kHz)	Result (kHz)
21.407	21.410	21.114

Table 11 - Occupied Bandwidth Results

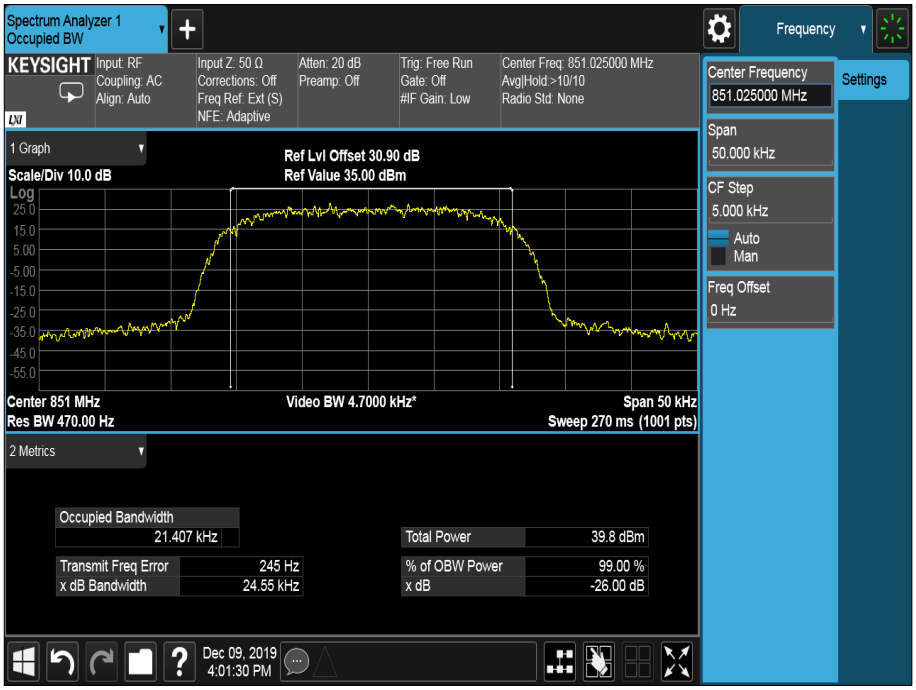

Figure 4 - 851.025 MHz Occupied Bandwidth

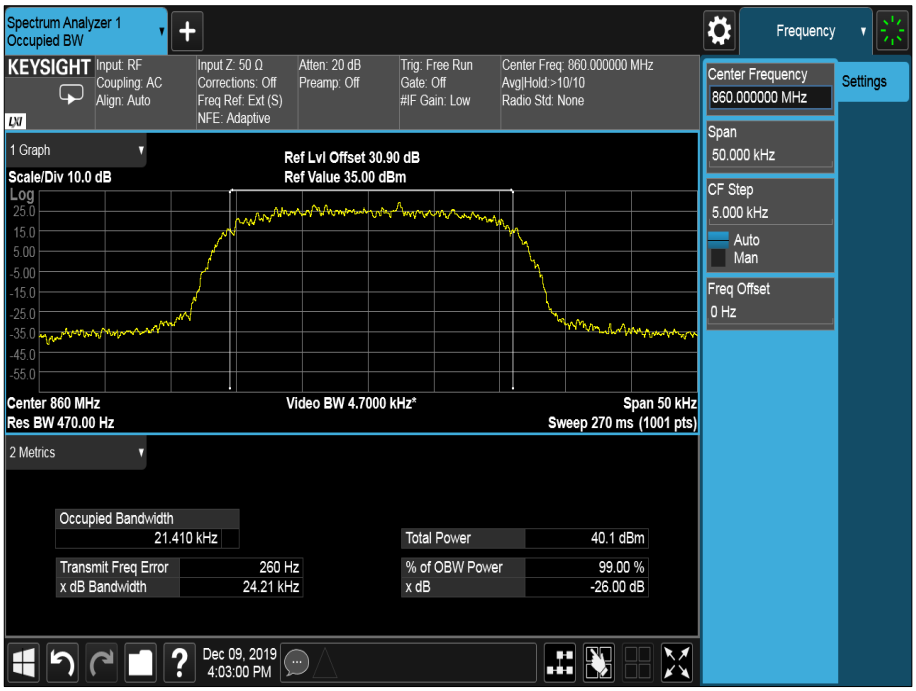

Figure 5 - 860.000 MHz Occupied Bandwidth

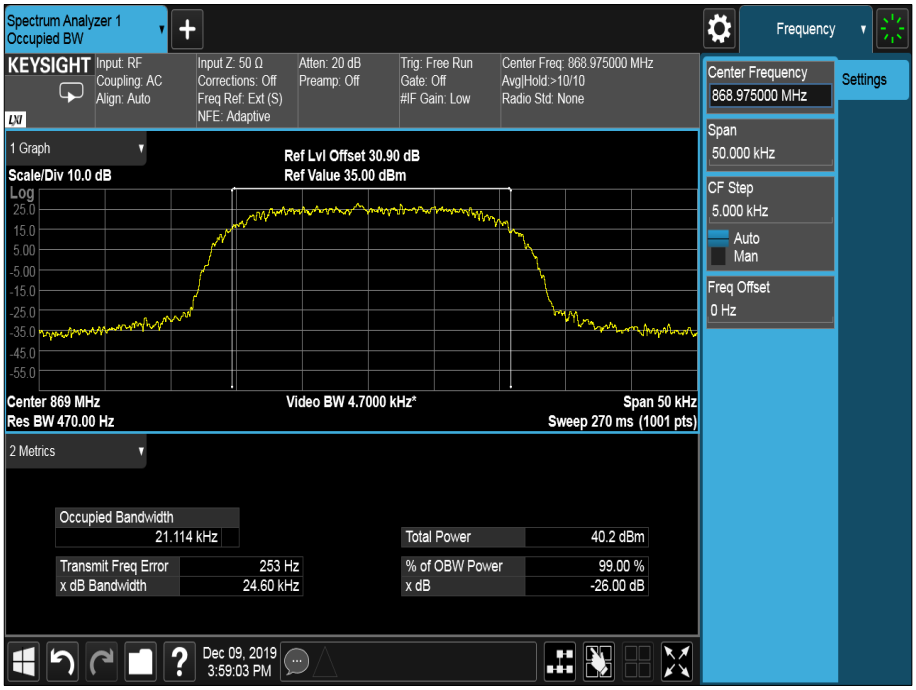

Figure 6 - 868.975 MHz Occupied Bandwidth

FCC 47 CFR Part 90, Limit Clause 90.209

Operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the Adjacent Channel Power limits of FCC 47 CFR Part 90.221.

Industry Canada RSS-119, Limit Clause 5.5

The maximum permissible occupied bandwidth shall not exceed the authorized bandwidth specified in table 3 of the test specification for the equipment's frequency band as specified below.

< 22 kHz

2.2.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Fluke	75 Mk3	455	12	11-Oct-2020
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	16-Apr-2020
Hygromer	Rotronic	A1	2138	12	05-Mar-2020
Attenuator (20 dB, 150 W)	Narda	769-20	3367	12	17-Jul-2020
Attenuator (10dB, 150W)	Narda	769-10	3368	12	17-Jul-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	12-Nov-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
EXA	Keysight Technologies	N9010B	4968	24	21-Dec-2019

Table 12

O/P Mon – Output Monitored using calibrated equipment

2.3 Spurious Emissions at Antenna Terminals

2.3.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.210
FCC 47 CFR Part 2, Clause 2.1051
Industry Canada RSS-119, Clause 5.8
ISEDC RSS-GEN, Clause 6.13

2.3.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001947GKE03R - Modification State 0

2.3.3 Date of Test

10-December-2019 to 11-December-2019

2.3.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.7.

For emissions where the frequency is removed less than 250 % of the authorised bandwidth measurements were performed conducted as follows:

The EUT was connected to a spectrum analyser via a cable and attenuator. The path loss between the EUT and analyser was calibrated using a network analyser and entered in to the spectrum analyser as a reference level offset. The reference level for the mask was established with an RBW approximately 2 or 3 times the emission bandwidth. The RBW was then reduced to at least 1% of the emission bandwidth, with a VBW of 3 times RBW.

For emissions where the frequency is removed more than 250 % of the authorised bandwidth measurements were performed conducted as follows:

The EUT was connected to a spectrum analyser via a cable and attenuator. The path loss between the EUT and analyser was calibrated using a network analyser and entered in to the spectrum analyser as a reference level offset. The analyser was configured with a peak detector and max hold trace. For measurements above 1800 MHz, a high pass filter was used. Measurements were also performed radiated as recorded in section 2.7 of this report.

2.3.5 Environmental Conditions

Ambient Temperature	22.1 - 22.7 °C
Relative Humidity	32.5 - 35.8 %

2.3.6 Test Results

TETRA 809 MHz to 824 MHz - Transmit High capacity battery

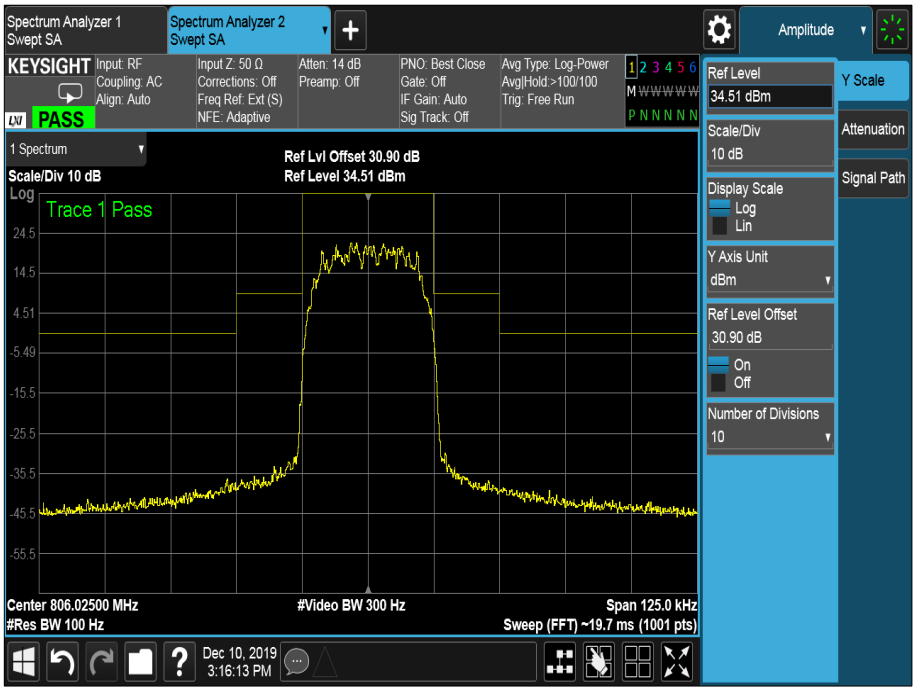

Figure 7 - 806.025 MHz, Transmitter Mask

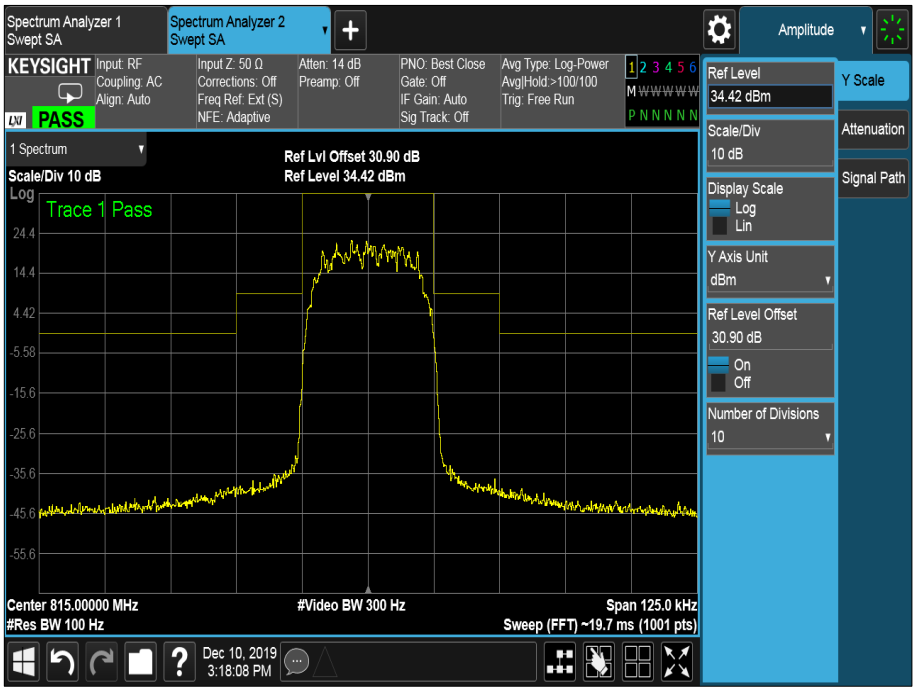

Figure 8 - 815.000 MHz, Transmitter Mask

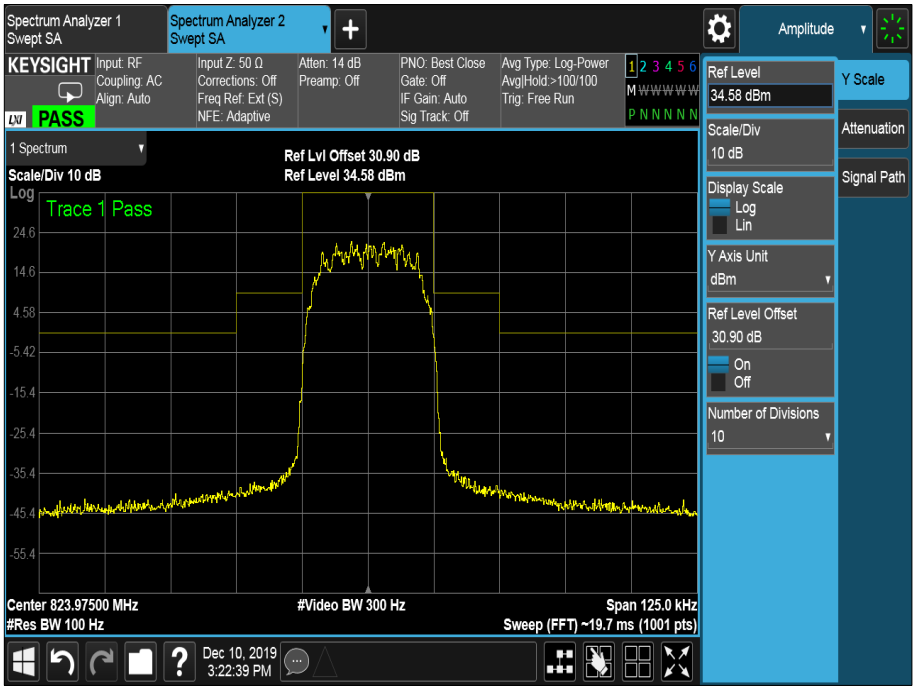

Figure 9 - 823.975 MHz, Transmitter Mask

Figure 10 - 806.025 MHz, 9 kHz to 150 kHz

Figure 11 - 815.000 MHz, 9 kHz to 150 kHz

Figure 12 - 823.975 MHz - 9 kHz to 150 kHz

Figure 13 - 806.025 MHz, 150 kHz to 1 MHz

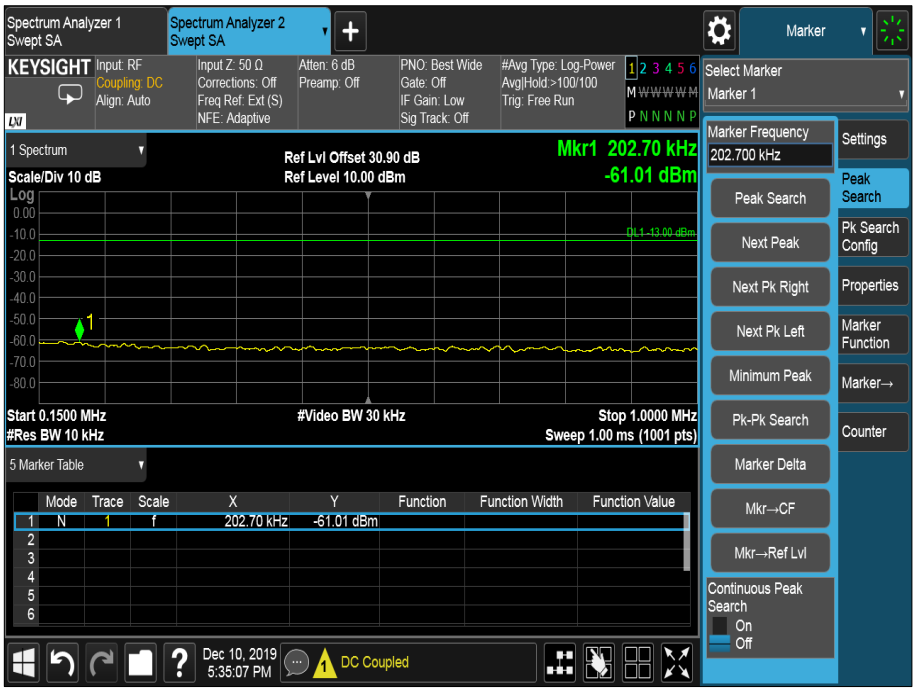

Figure 14 - 815.000 MHz, 150 kHz to 1 MHz

Figure 15 - 823.975 MHz - 150 kHz to 1 MHz

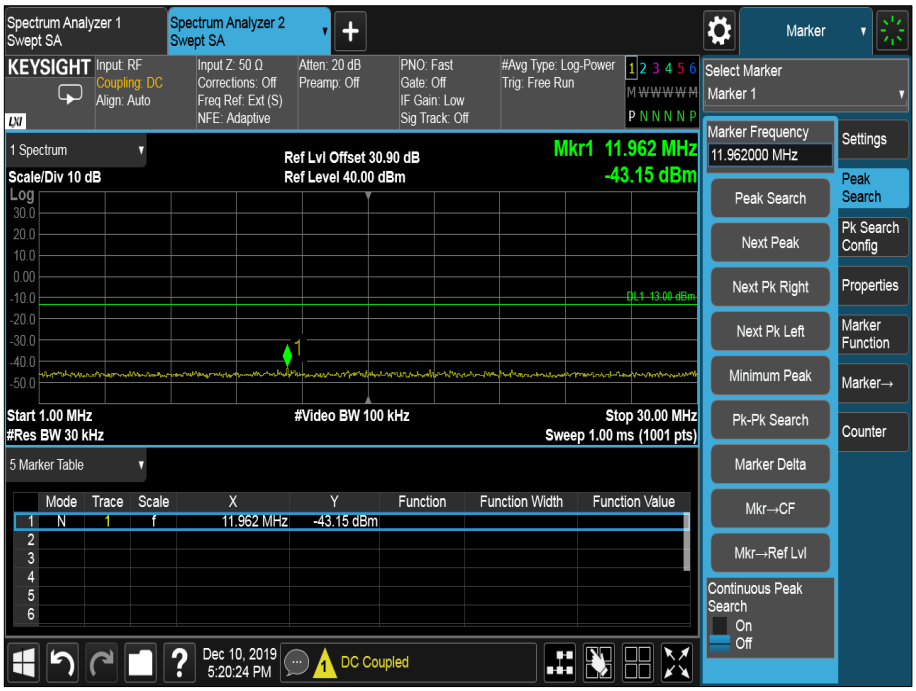

Figure 16 - 806.025 MHz, 1 MHz to 30 MHz

Figure 17 - 815.000 MHz, 1 MHz to 30 MHz

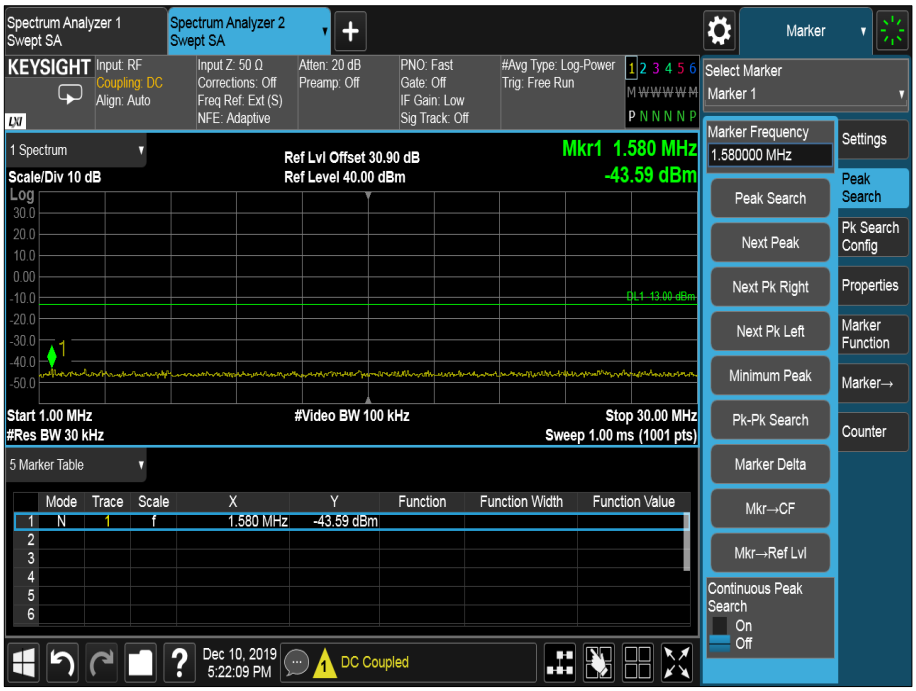

Figure 18 - 823.975 MHz - 1 MHz to 30 MHz

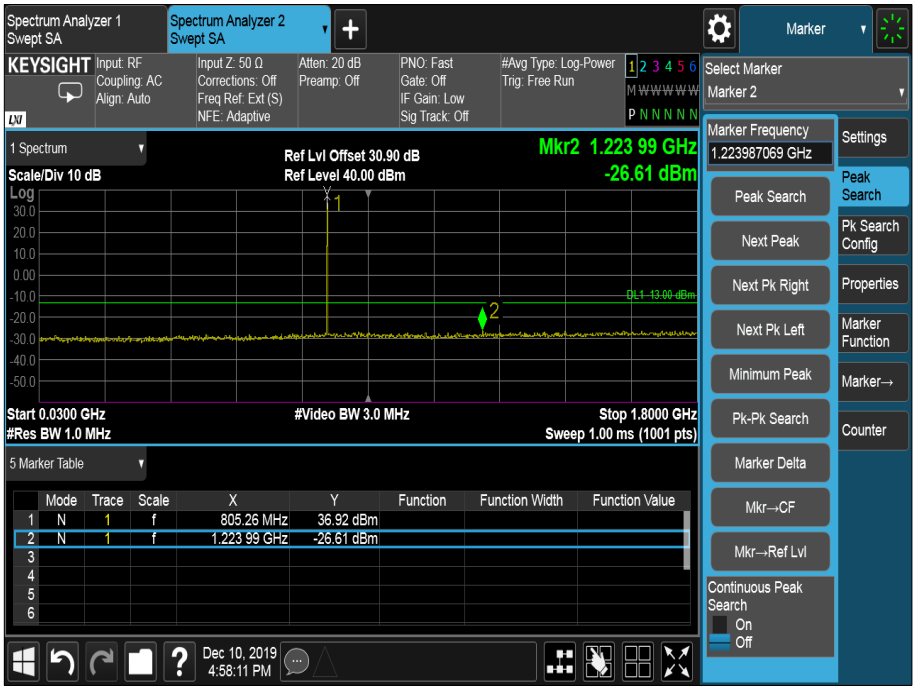

Figure 19 - 806.025 MHz, 30 MHz to 1.8 GHz

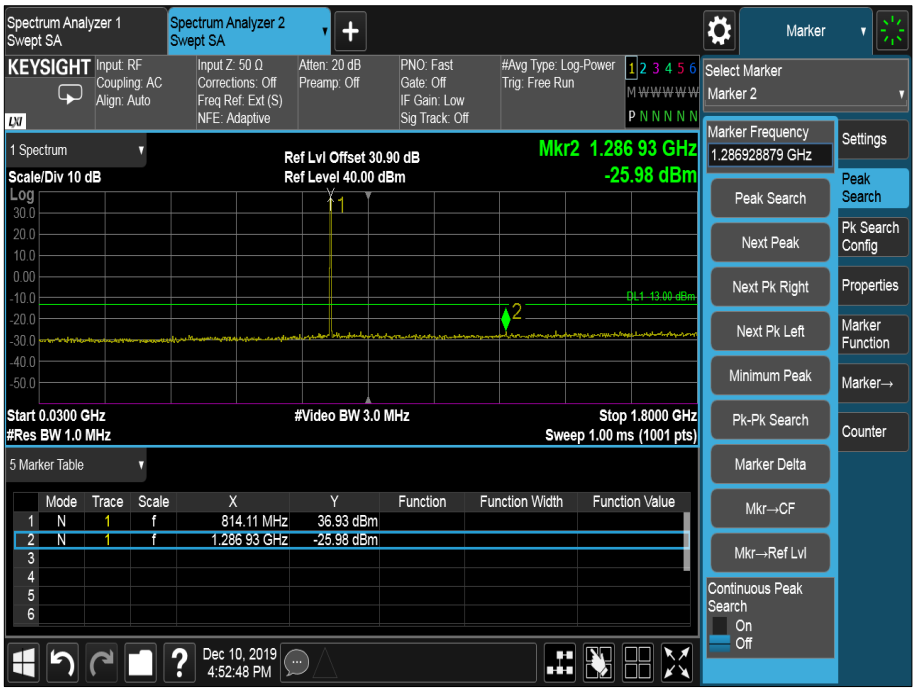

Figure 20 - 815.000 MHz, 30 MHz to 1.8 GHz

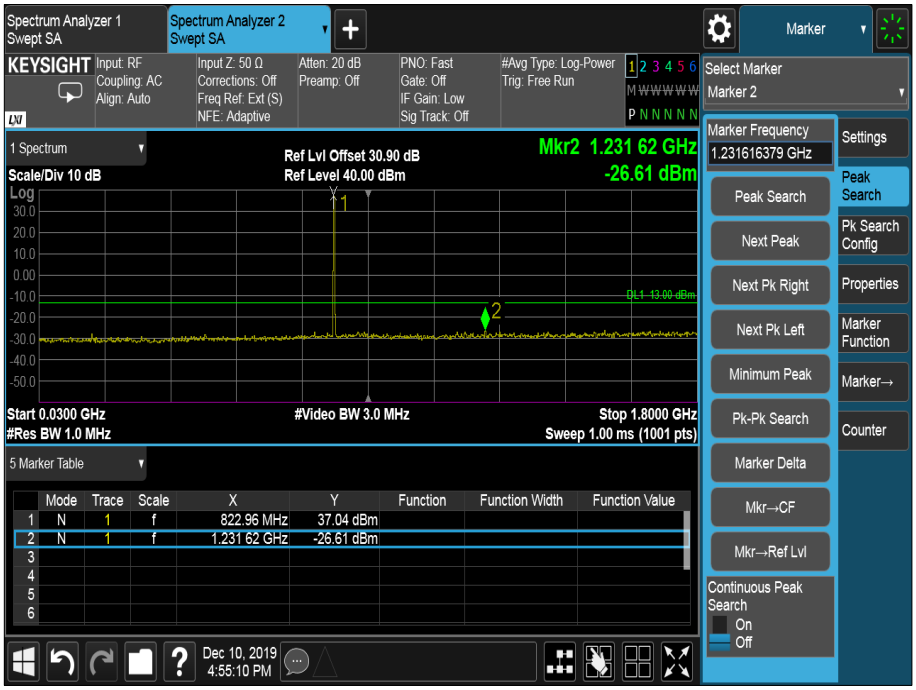

Figure 21 - 823.975 MHz - 30 MHz to 1.8 GHz

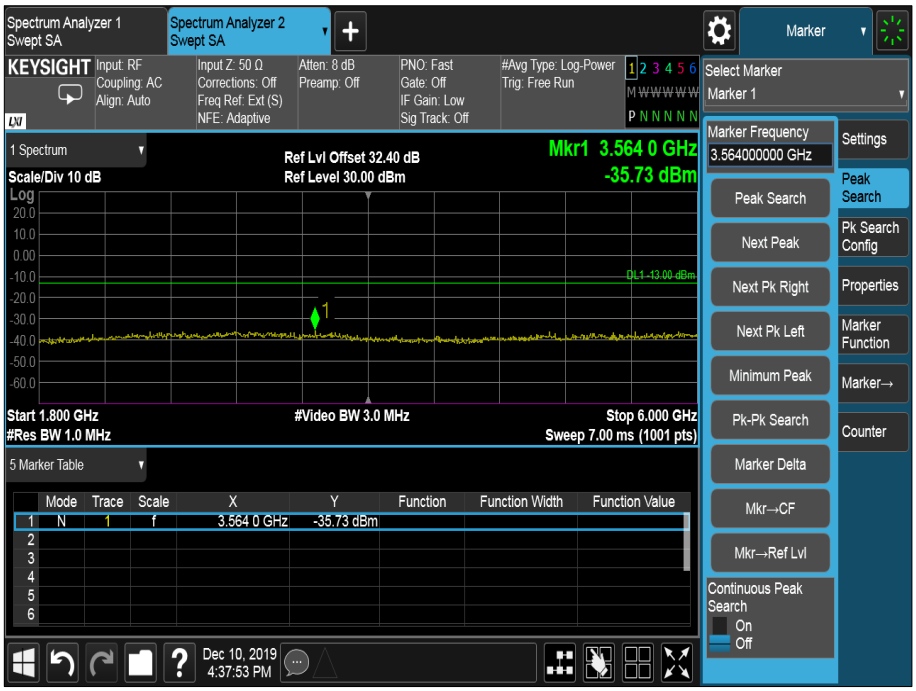

Figure 22 - 806.025 MHz, 1.8 GHz to 6 GHz

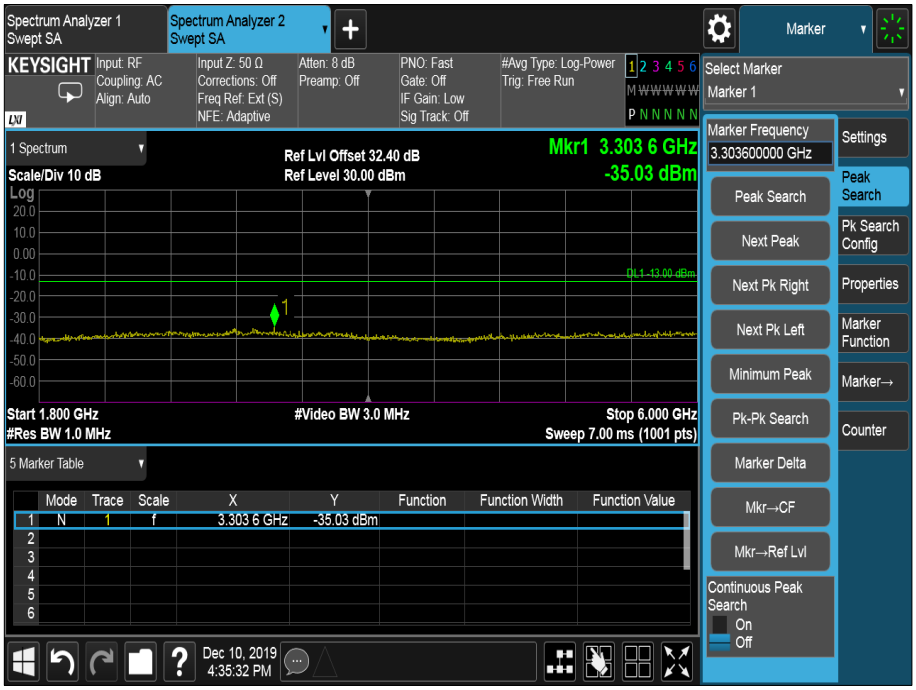

Figure 23 - 815.000 MHz, 1.8 GHz to 6 GHz

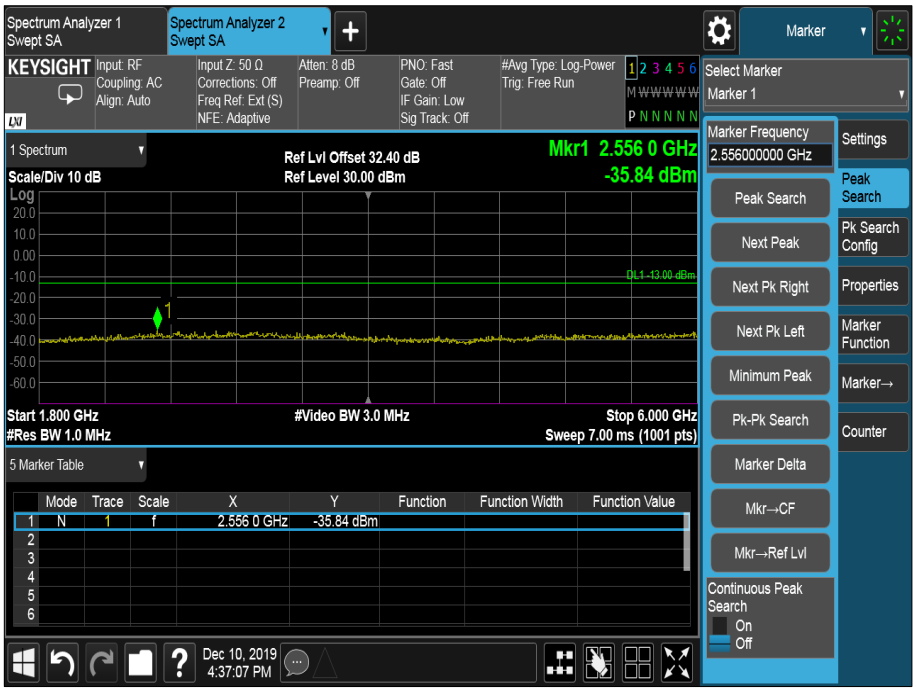

Figure 24 - 823.975 MHz - 1.8 GHz to 6 GHz

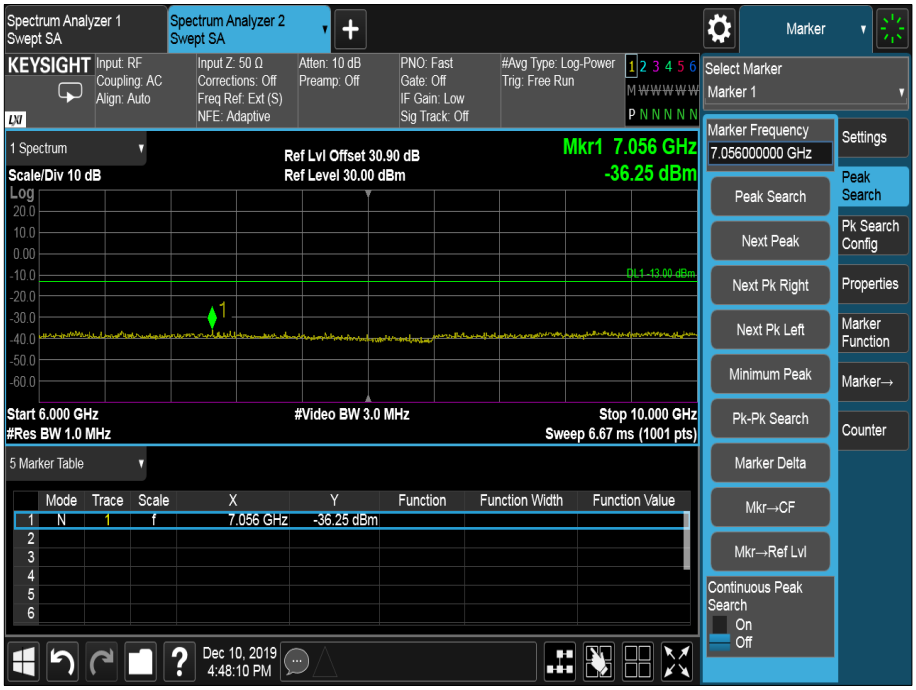

Figure 25 - 806.025 MHz, 6 GHz to 10 GHz

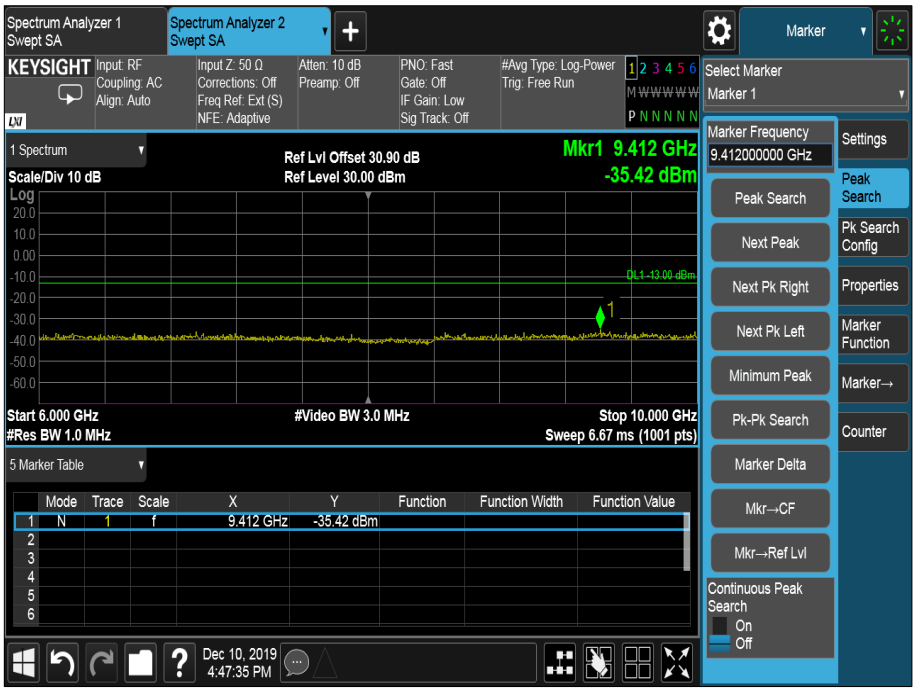

Figure 26 - 815.000 MHz, 6 GHz to 10 GHz

Figure 27 - 823.975 MHz - 6 GHz to 10 GHz

TETRA 851 MHz to 869 MHz - Transmit High capacity battery

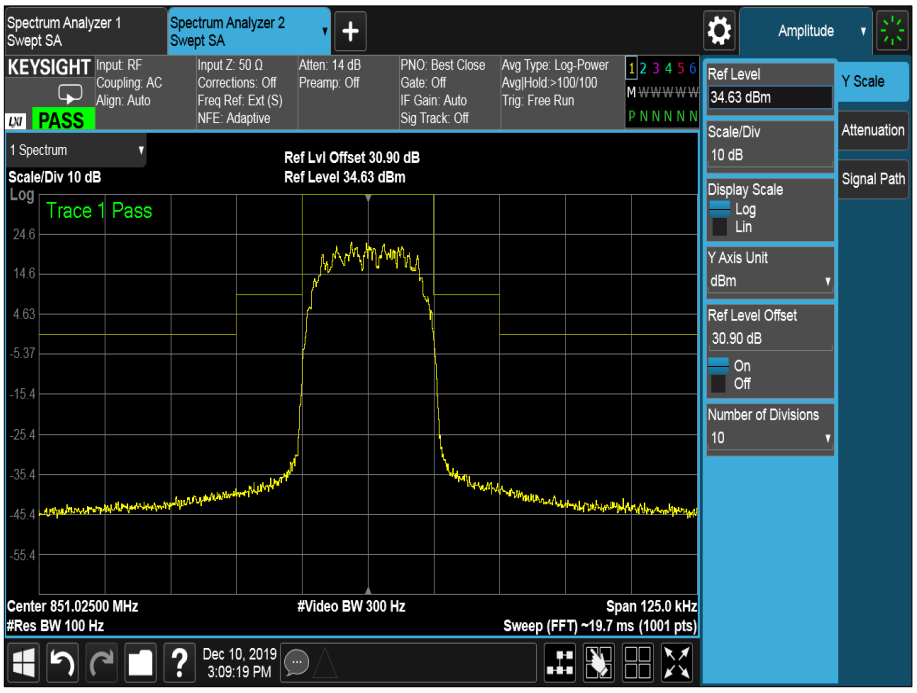

Figure 28 - 851.025 MHz, Transmitter Mask

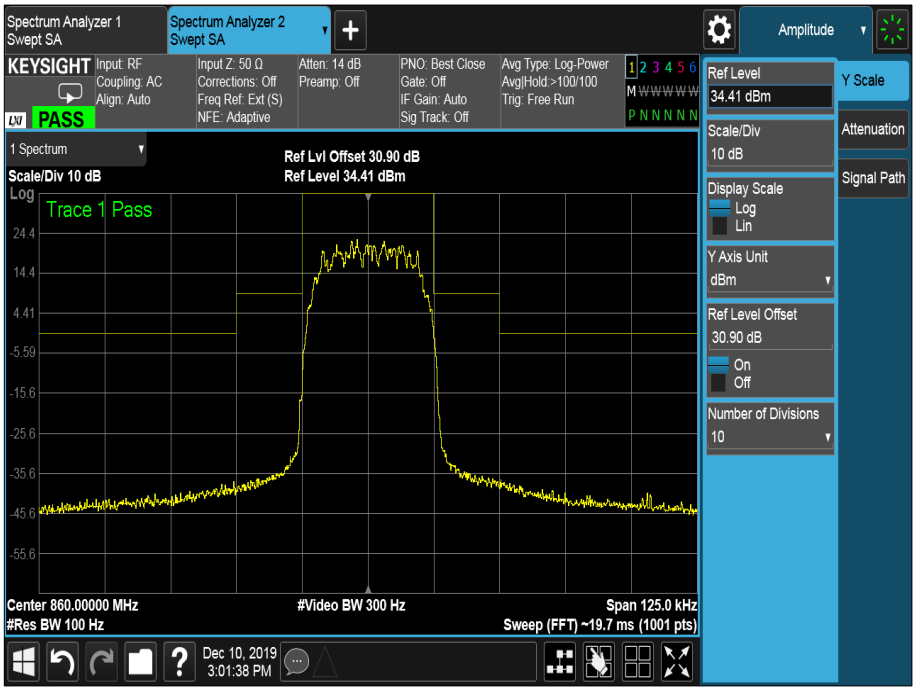

Figure 29 - 860.000 MHz, Transmitter Mask

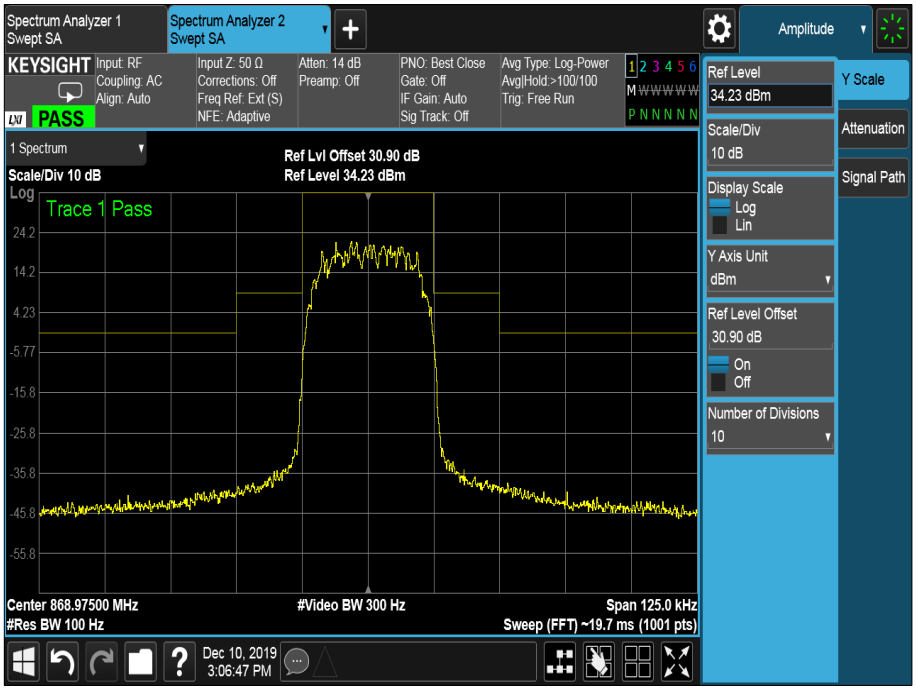

Figure 30 - 868.975 MHz, Transmitter Mask

Figure 31 - 851.025 MHz, 9 kHz to 150 kHz

Figure 32 - 860.000 MHz, 9 kHz to 150 kHz

Figure 33 - 868.975 MHz - 9 kHz to 150 kHz

Figure 34 - 851.025 MHz, 150 kHz to 1 MHz

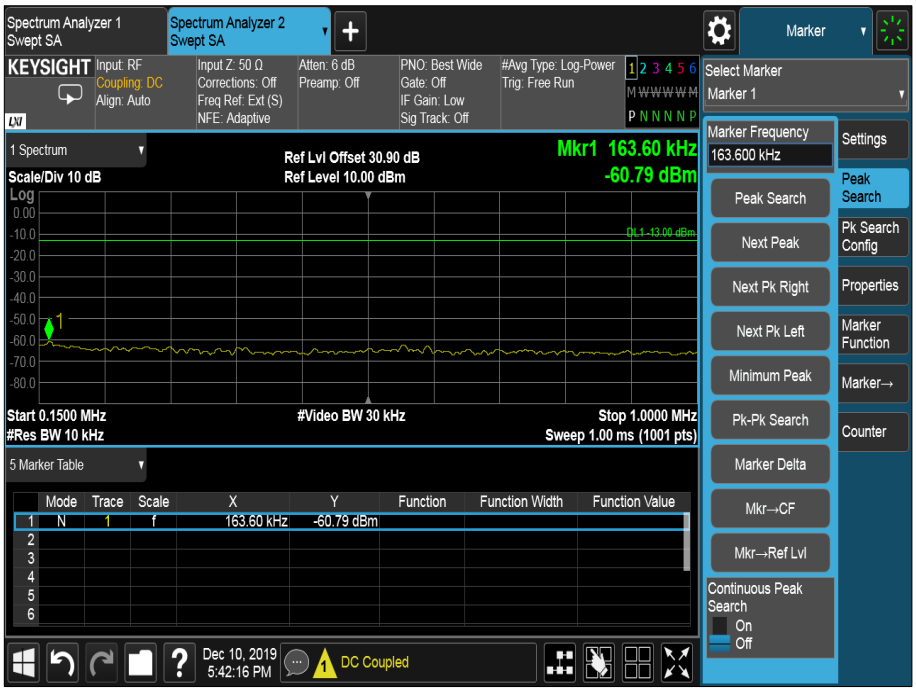

Figure 35 - 860.000 MHz, 150 kHz to 1 MHz

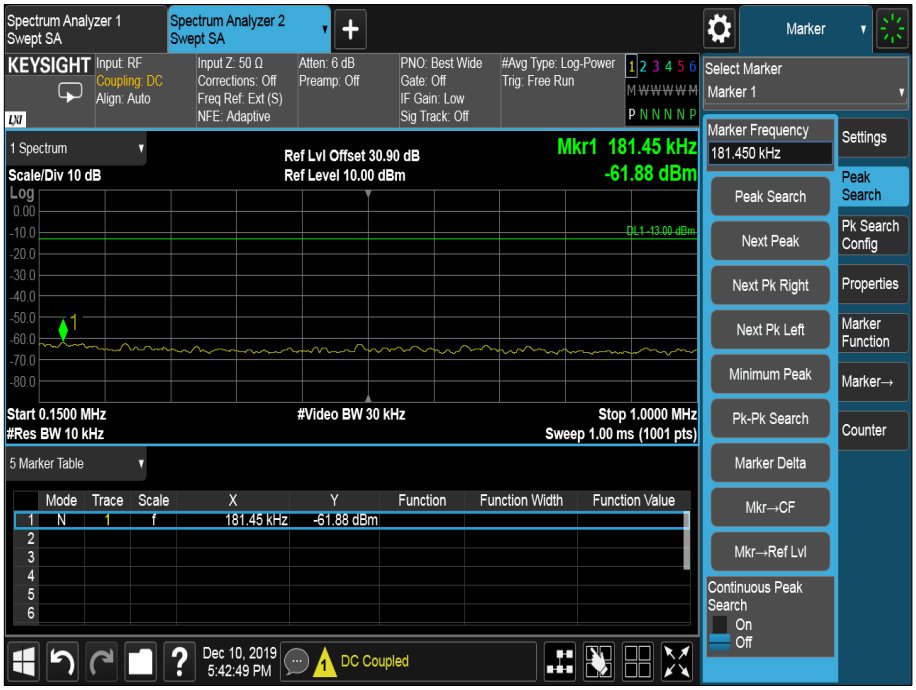

Figure 36 - 868.975 MHz - 150 kHz to 1 MHz

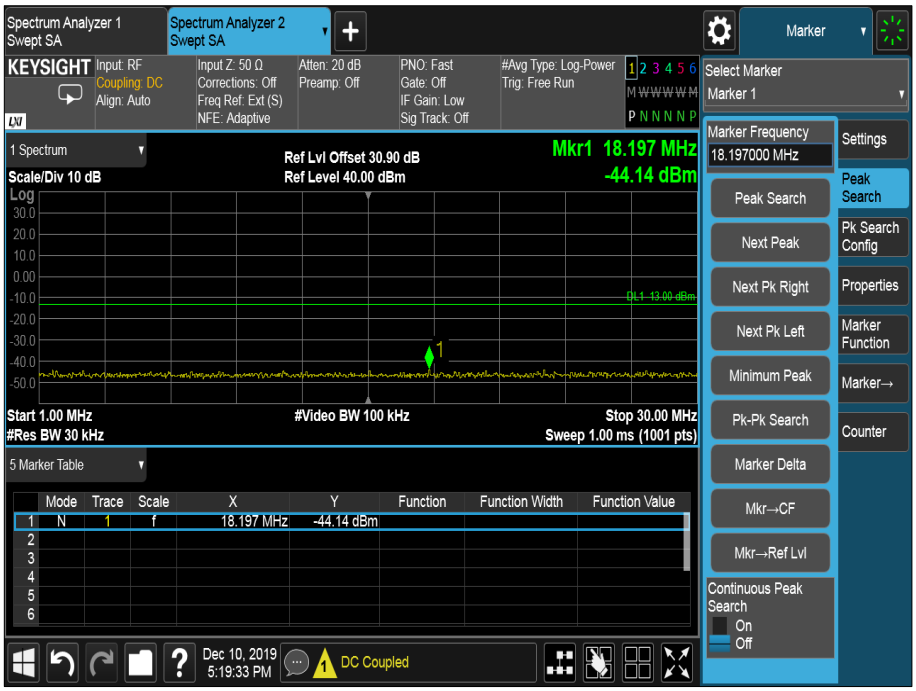

Figure 37 - 851.025 MHz, 1 MHz to 30 MHz

Figure 38 - 860.000 MHz, 1 MHz to 30 MHz

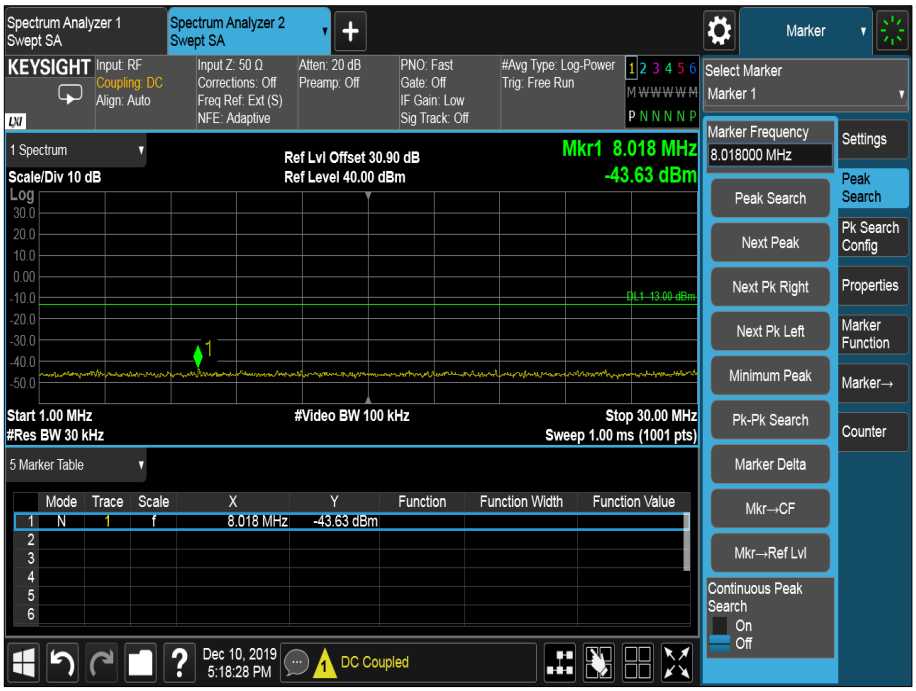

Figure 39 - 868.975 MHz - 1 MHz to 30 MHz

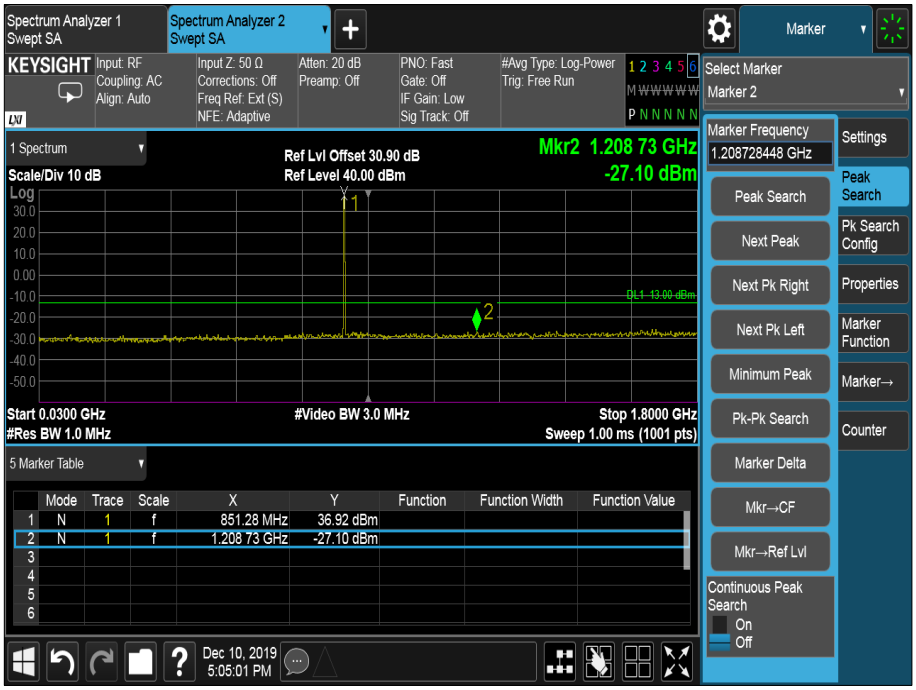

Figure 40 - 851.025 MHz, 30 MHz to 1.8 GHz

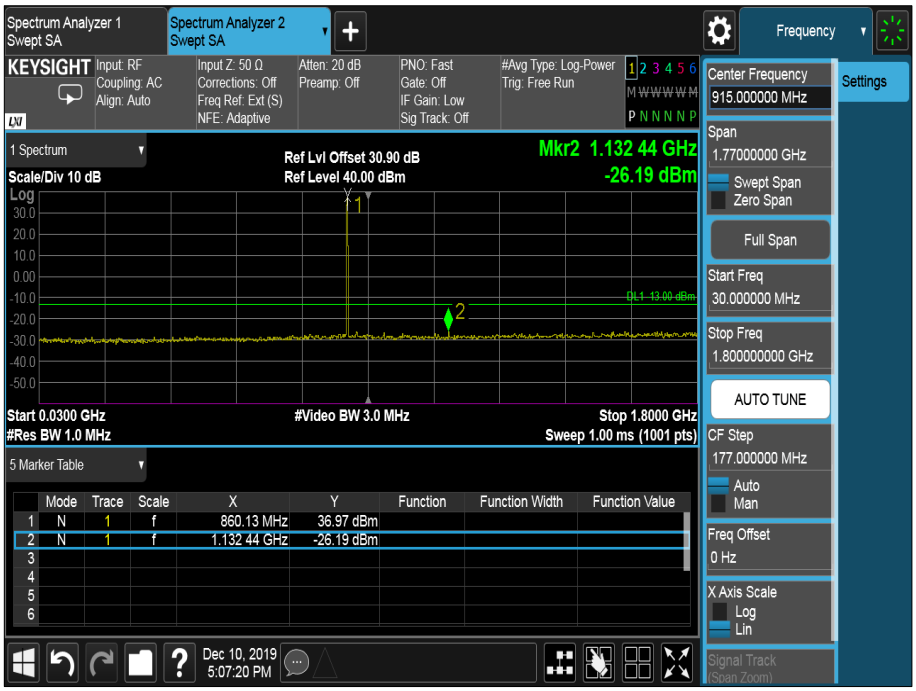

Figure 41 - 860.000 MHz, 30 MHz to 1.8 GHz

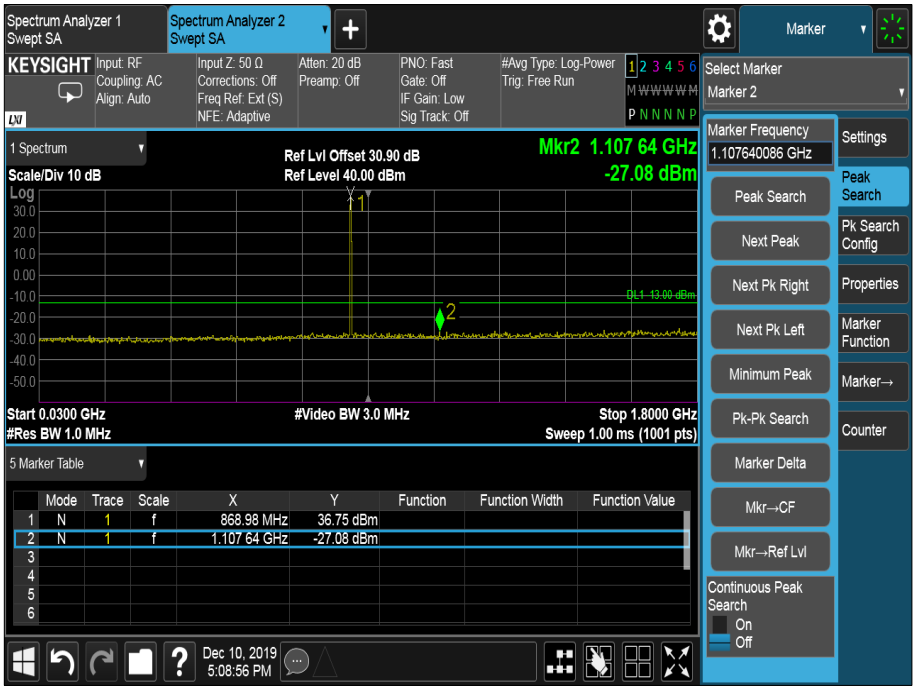

Figure 42 - 868.975 MHz - 30 MHz to 1.8 GHz

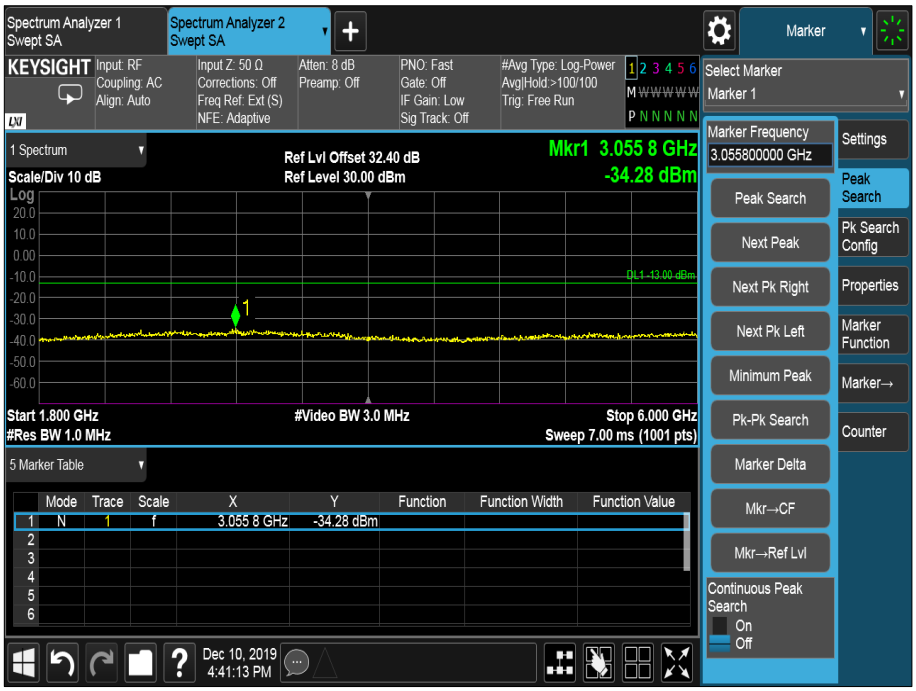

Figure 43 - 851.025 MHz, 1.8 GHz to 6 GHz

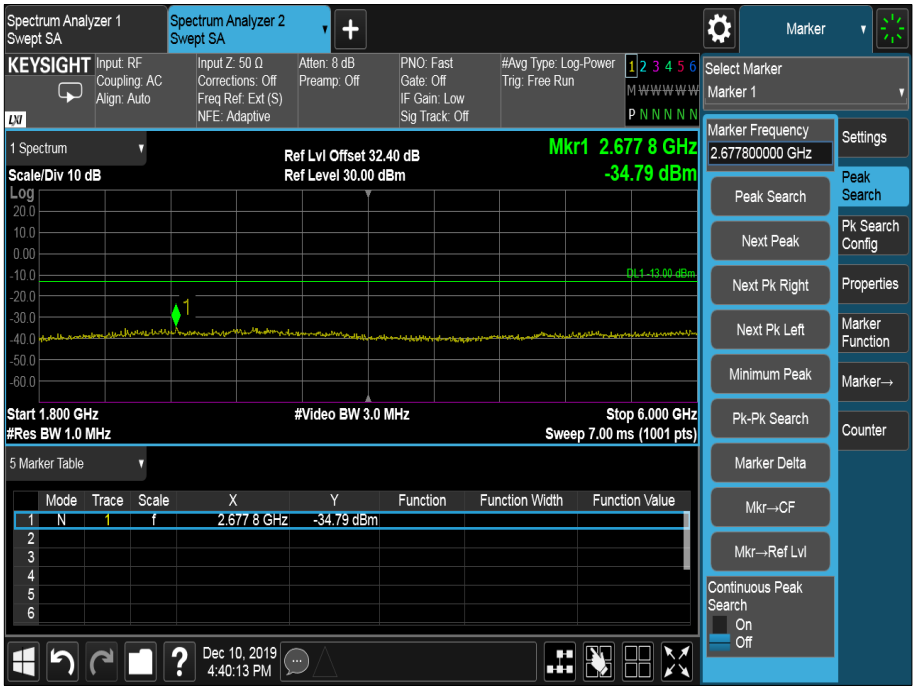

Figure 44 - 860.000 MHz, 1.8 GHz to 6 GHz

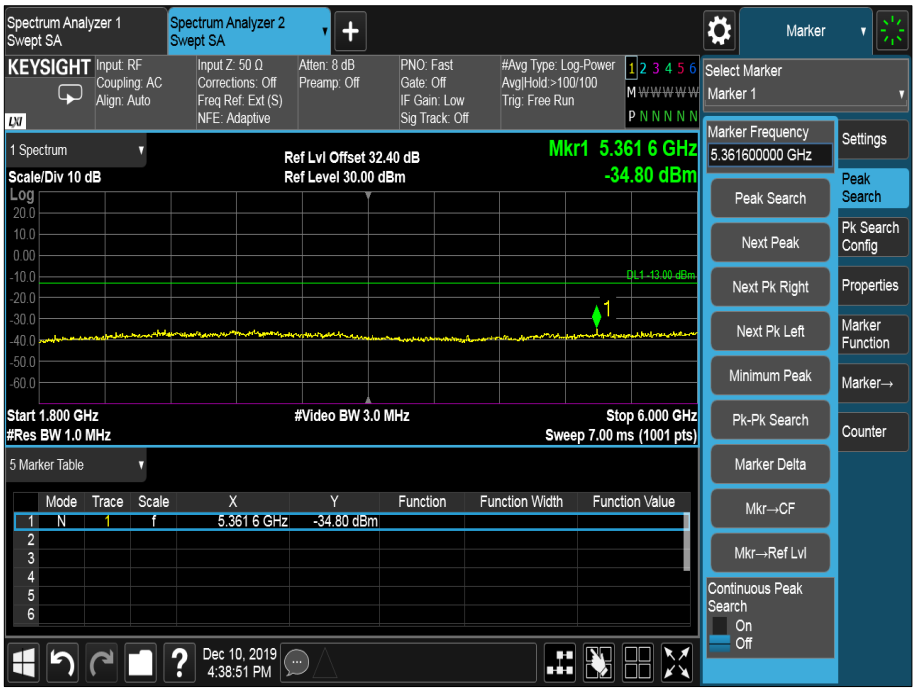

Figure 45 - 868.975 MHz - 1.8 GHz to 6 GHz

Figure 46 - 851.025 MHz, 6 GHz to 10 GHz

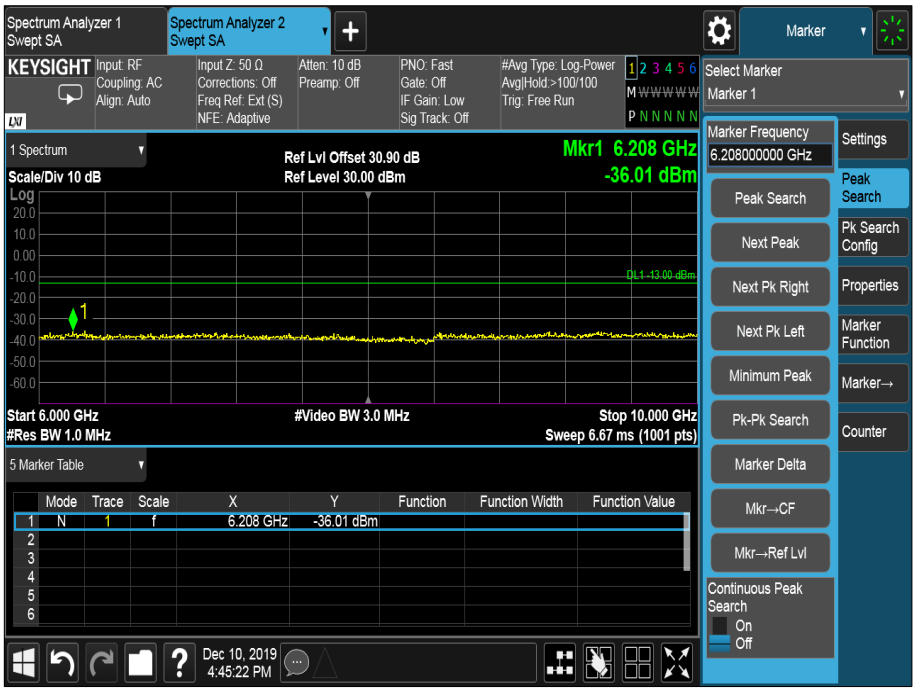

Figure 47 - 860.000 MHz, 6 GHz to 10 GHz

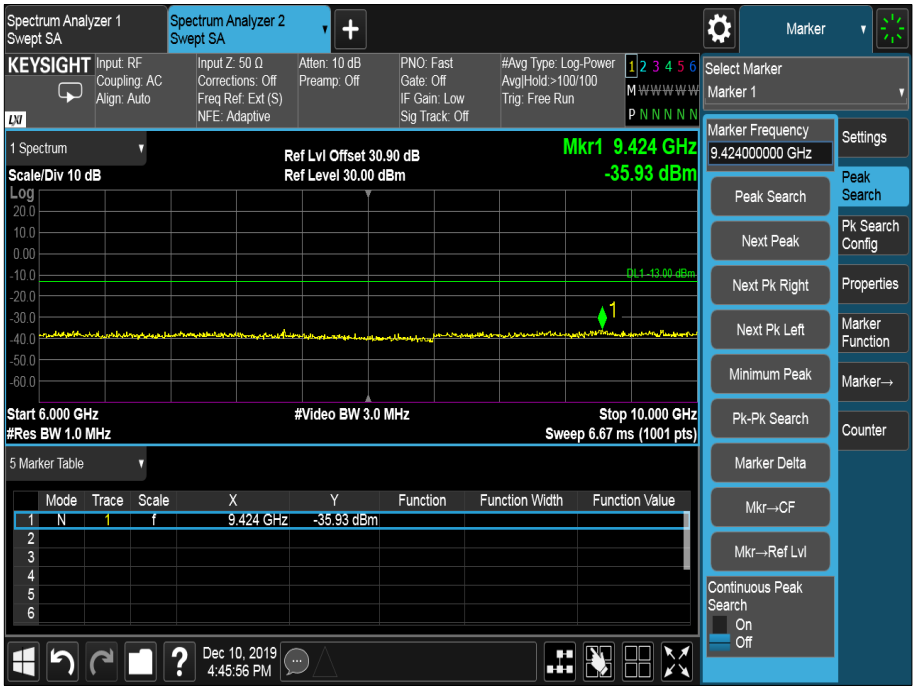

Figure 48 - 868.975 MHz - 6 GHz to 10 GHz

FCC 47 CFR Part 90, Limit Clause 90.210

The EUT shall comply with emission mask B as per FCC 47 CFR Part 90.210.

Industry Canada RSS-119, Limit Clause 5.8

The EUT shall comply with emission mask B as per Industry Canada RSS-119 clause 5.8.

2.3.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Fluke	75 Mk3	455	12	11-Oct-2020
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	16-Apr-2020
Hygromer	Rotronic	A1	2138	12	05-Mar-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	12-Nov-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
High Pass filter	Wainwright	WHKX12-1290-1500-18000-80SS	4961	-	O/P Mon
EXA	Keysight Technologies	N9010B	4968	24	21-Dec-2019
Network Analyser	Keysight Technologies	E5063A	5018	12	20-May-2020
Electronic Calibration Module	Keysight Technologies	85093C	5188	12	21-May-2020

Table 13

O/P Mon – Output Monitored using calibrated equipment

2.4 Frequency Stability

2.4.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.210
FCC 47 CFR Part 2, Clause 2.1055
Industry Canada RSS-119, Clause 5.3
ISEDC RSS-GEN, Clause 6.11

2.4.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001947GKE03R - Modification State 0

2.4.3 Date of Test

09-December-2019 to 13-December-2019

2.4.4 Test Method

This test was performed in accordance with ANSI C63.26, clause 5.6. and the requirements of FCC CFR 47 Part 2.1055 (a)(2), (d)(1).

The EUT was set to transmit on maximum power with an unmodulated carrier on bottom, middle and top channels. The EUT was connected to a spectrum analyser using an external 10 MHz frequency reference. The difference between the frequency of the fundamental and the frequency of the assigned channel in accordance with the manufacturer's documentation was recorded. In accordance with 2.1055, the temperature was varied from -20°C to +50° in 10° steps at nominal voltage and at 20 ˚C for both minimum and maximum voltage extremes.

2.4.5 Environmental Conditions

Ambient Temperature	22.5 - 23.5 °C
Relative Humidity	36.9 - 48.1 %

2.4.6 Test Results

TETRA 809 MHz to 824 MHz - Transmit High capacity battery

Voltage	Frequency Error (ppm)		
	806.025 MHz	815.000 MHz	823.975 MHz
6.2 V DC	0.365	0.364	0.345
7.4 V DC	0.360	0.367	0.341

Table 14 - Frequency Stability Under Voltage Variations

Temperature	Frequency Error (ppm)		
	806.025 MHz	815.000 MHz	823.975 MHz
+50.0 °C	0.457	0.471	0.462
+40.0 °C	0.476	0.456	0.482
+30.0 °C	0.547	0.536	0.528
+20.0 °C	0.521	0.558	0.530
+10.0 °C	0.639	0.672	0.623
0 °C	0.538	0.547	0.538
-10.0 °C	0.563	0.540	0.566
-20.0 °C	0.545	0.573	0.538
-30.0 °C	0.191	0.172	0.174

Table 15 - Frequency Stability Under Temperature Variations

TETRA 851 MHz to 869 MHz - Transmit High capacity battery

Voltage	Frequency Error (ppm)		
	851.025 MHz	860.000 MHz	868.975 MHz
6.2 V DC	0.356	0.383	0.342
7.4 V DC	0.357	0.379	0.344

Table 16 - Frequency Stability Under Voltage Variations

Temperature	Frequency Error (ppm)		
	851.025 MHz	860.000 MHz	868.975 MHz
+50.0 °C	0.463	0.463	0.457
+40.0 °C	0.469	0.476	0.455
+30.0 °C	0.541	0.531	0.518
+20.0 °C	0.561	0.564	0.534
+10.0 °C	0.629	0.626	0.632
0 °C	0.535	0.545	0.539
-10.0 °C	0.555	0.557	0.560
-20.0 °C	0.549	0.545	0.499
-30.0 °C	0.172	0.179	0.170

Table 17 - Frequency Stability Under Temperature Variations

FCC 47 CFR Part 90, Limit Clause 90.213

806 to 809 MHz: 1.5 ppm
809 to 824 MHz: 2.5 ppm
851 to 854 MHz 1.5 ppm
854 to 869 MHz 2.5 ppm

Industry Canada RSS-199, Limit Clause 5.3

2.5 ppm

2.4.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Fluke	75 Mk3	455	12	11-Oct-2020
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	16-Apr-2020
Hygromer	Rotronic	A1	2138	12	05-Mar-2020
Climatic Chamber	TAS	Micro 225	2892	-	O/P Mon
Thermocouple Thermometer	Fluke	51	3174	12	07-Feb-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	12-Nov-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
EXA	Keysight Technologies	N9010B	4968	24	21-Dec-2019
Network Analyser	Keysight Technologies	E5063A	5018	12	20-May-2020

Table 18

O/P Mon – Output Monitored using calibrated equipment

2.5 Adjacent Channel Power

2.5.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.221

2.5.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001947GKE03R - Modification State 0

2.5.3 Date of Test

10-December-2019 to 11-December-2019

2.5.4 Test Method

The Adjacent Channel Power test was performed conducted on the modulated carrier output from the EUT, measured using a spectrum analyser. The spectrum analyser was set to the transmit frequency, span to measure the 3 channels below and above the carrier. The signal was averaged over 200 sweeps and measured using the Adjacent Channel Power function of the spectrum analyser. The traces were recorded.

2.5.5 Environmental Conditions

Ambient Temperature	22.2 - 22.3 °C
Relative Humidity	34.6 - 36.5 %

2.5.6 Test Results

TETRA 809 MHz to 824 MHz - Transmit High capacity battery

Offset (kHz)	Adjacent Channel Power (dB)		
	806.025 MHz	815.000 MHz	823.975 MHz
-25	-59.96	-61.80	-61.82
+25	-61.02	-61.93	-61.48
-50	-68.96	-69.60	-69.33
+50	-69.13	-69.55	-69.34
-75	-74.89	-74.56	-74.24
+75	-75.13	-74.78	-74.48

Table 19 - Adjacent Channel Power

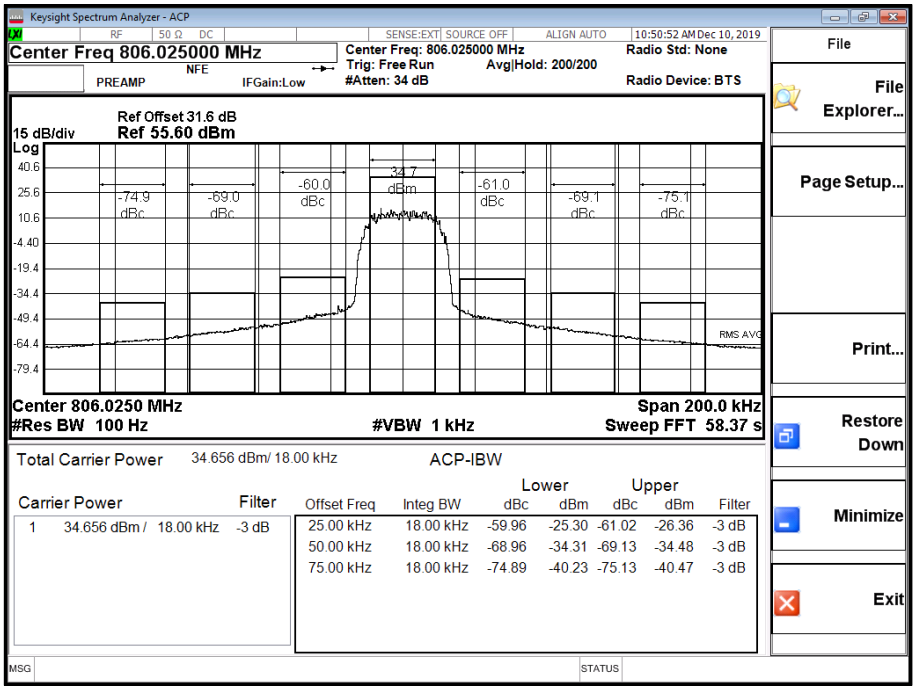

Figure 49 - Adjacent Channel Power - 806.025 MHz

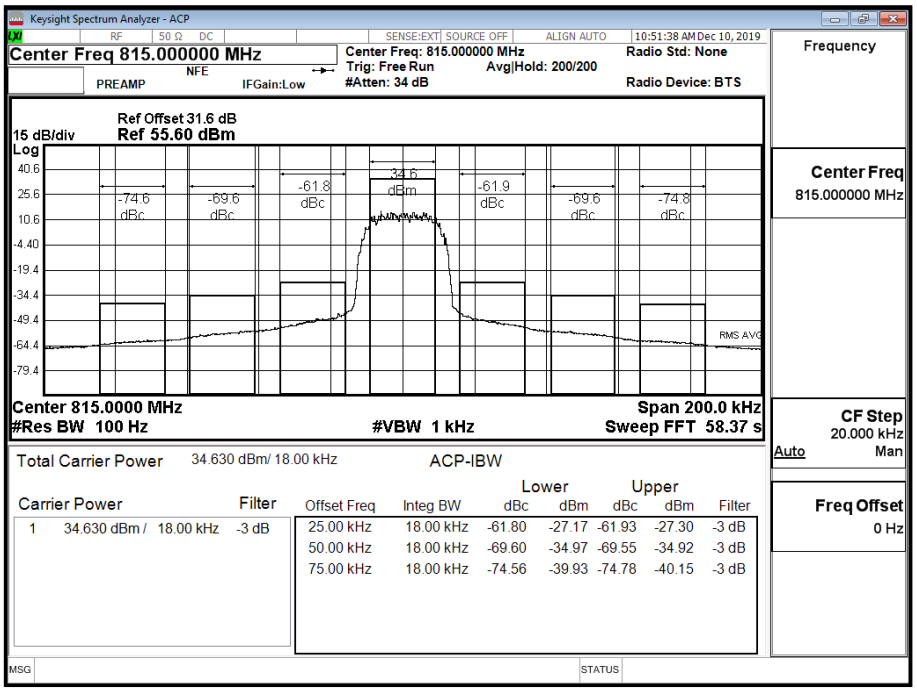

Figure 50 - Adjacent Channel Power - 815.000 MHz

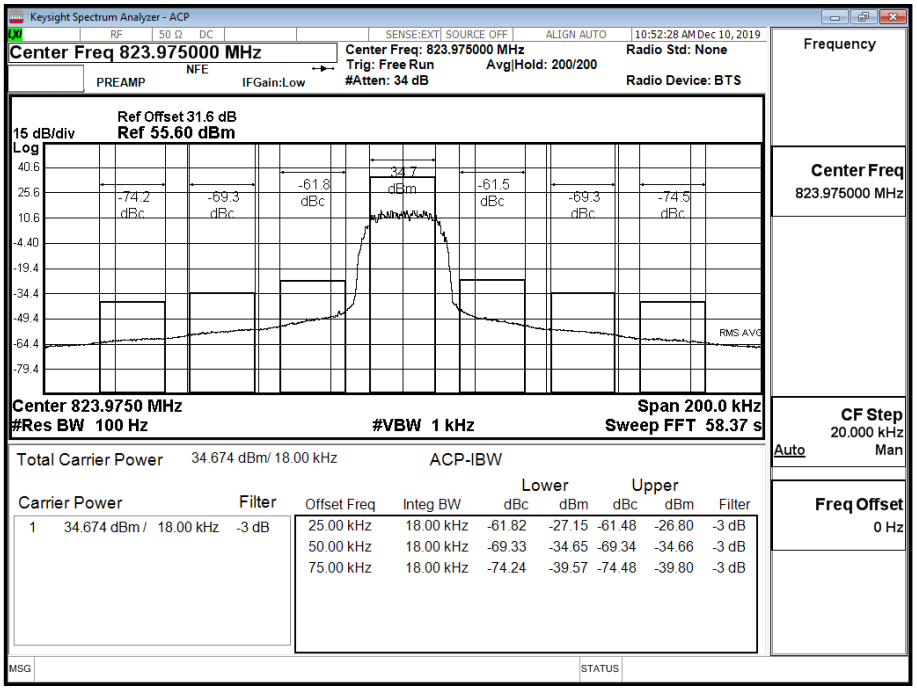

Figure 51 - Adjacent Channel Power - 823.975 MHz

TETRA 851 MHz to 869 MHz - Transmit High capacity battery

Offset (kHz)	Adjacent Channel Power (dBc)		
	851.025 MHz	860.000 MHz	868.975 MHz
-25	-60.95	-61.31	-61.75
+25	-60.34	-60.52	-60.96
-50	-68.62	-68.95	-69.16
+50	-68.6	-68.76	-69.09
-75	-73.77	-74.07	-74.17
+75	-74.06	-74.07	-74.49

Table 20 - Adjacent Channel Power

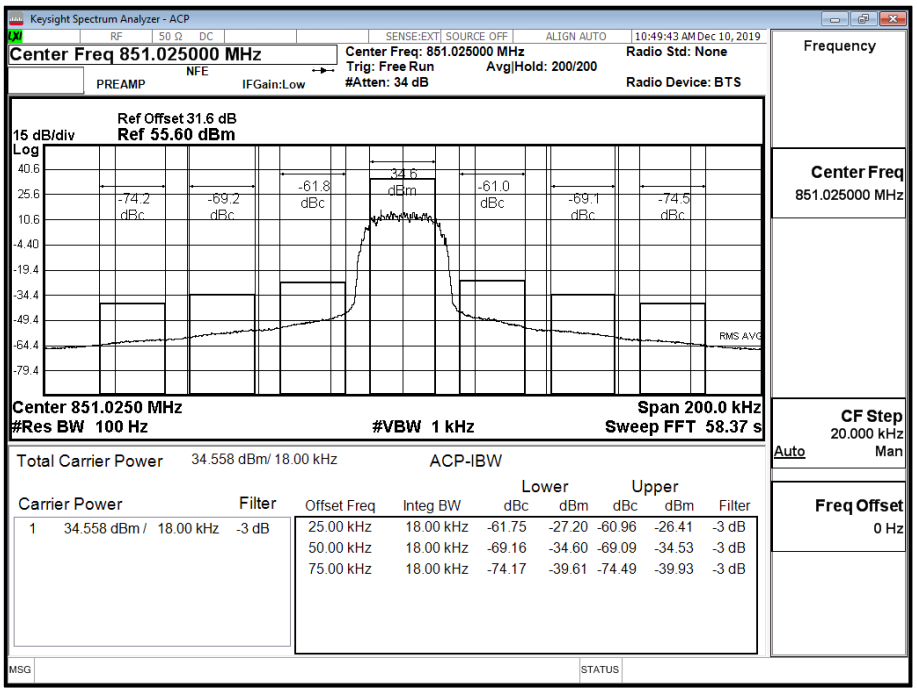

Figure 52 - Adjacent Channel Power - 851.025 MHz

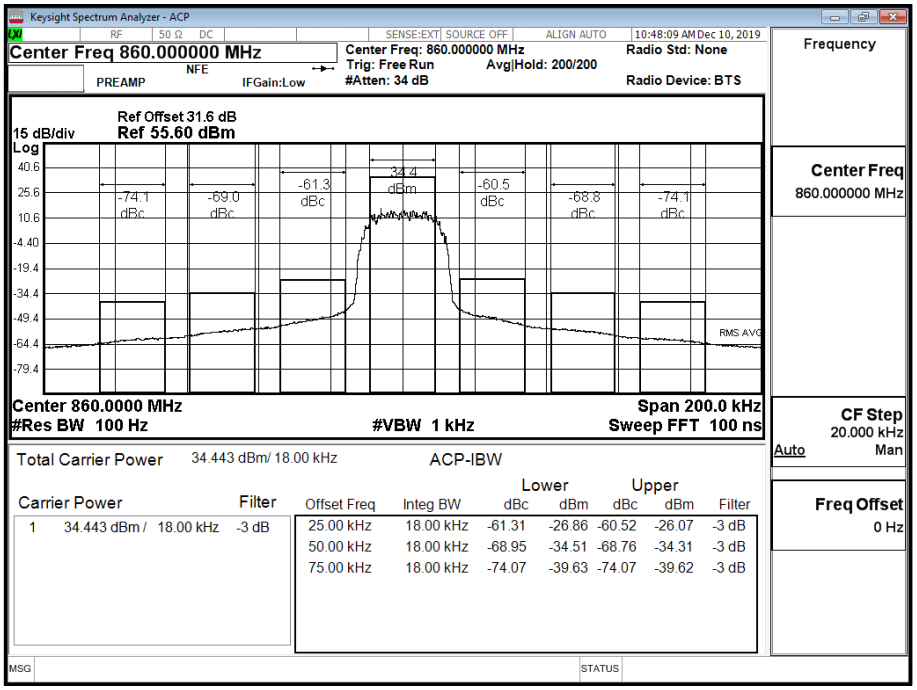

Figure 53 - Adjacent Channel Power - 860.000 MHz

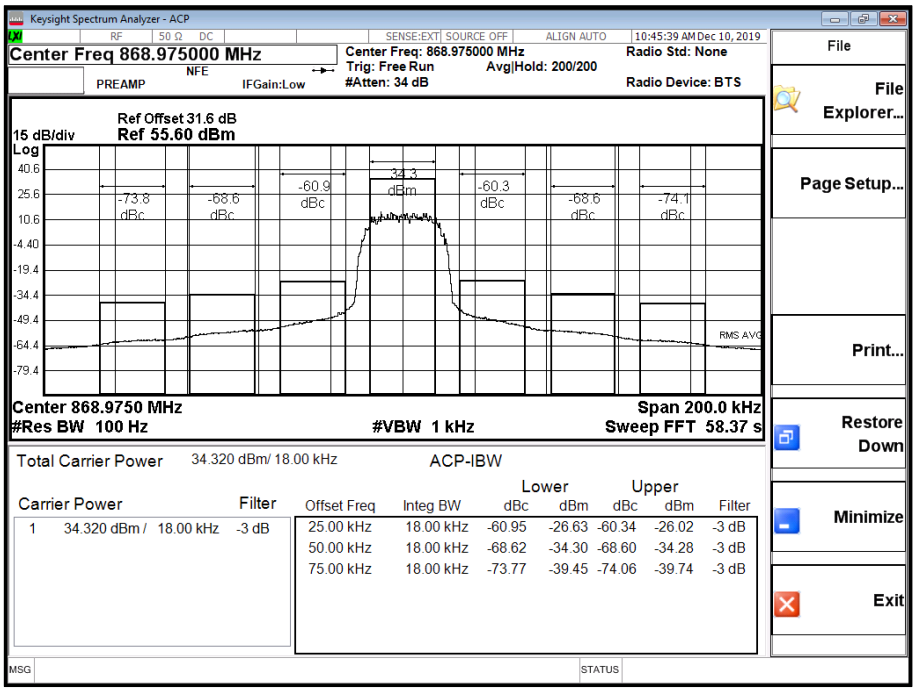

Figure 54 - Adjacent Channel Power - 868.975 MHz

FCC Part 90, Limit Clause 90.221(c)

Frequency Offset	Maximum ACP (dBc) for devices ≤ 1W	Maximum ACP (dBc) for devices > 1W
25 kHz	-55	-55
50 kHz	-65	-65
75 kHz	-65	-70

Table 21 - Adjacent Channel Power Limits

NOTE: In any case, no requirement in excess of -36 dBm shall apply.

Industry Canada RSS-119

Not required for 806-824 and 851-870 MHz

2.5.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Fluke	75 Mk3	455	12	11-Oct-2020
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	16-Apr-2020
Hygromer	Rotronic	A1	2138	12	5-Mar-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	12-Nov-2020
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	21-Oct-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
Network Analyser	Keysight Technologies	E5063A	5018	12	20-May-2020

Table 22

O/P Mon – Output Monitored using calibrated equipment

2.6 Types of Emissions

2.6.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.207
FCC 47 CFR Part 2, Clause 2.1047
Industry Canada RSS-119, Clause 5.2

2.6.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001947GKE03R - Modification State 0

2.6.3 Date of Test

18-December-2019

2.6.4 Test Method

This test was performed on middle frequency using a modulated carrier output from the EUT and measured on a spectrum analyser. The signal level was referenced to the power test measured in the anechoic chamber and offset in the spectrum analyser. The spectrum analyser was set to the transmit frequency. The burst measurements were made in zero span mode and the frequency spectrum with a span sufficient to show the transmitters response. The signal was maximised and stabilised for >1minute and the marker function of the spectrum analyser was used. The trace plots were recorded.

2.6.5 Environmental Conditions

Ambient Temperature	23.4 - 24.2 °C
Relative Humidity	42.1 - 42.6 %

2.6.6 Test Results

TETRA 809 MHz to 824 MHz - Transmit High capacity battery

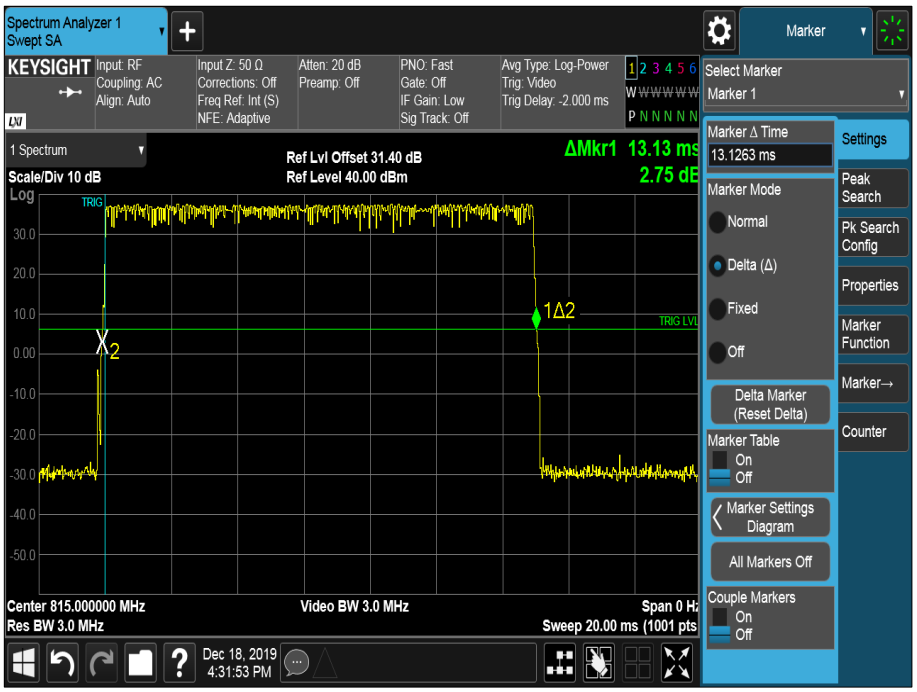

Figure 55 - Burst Length

Figure 56 - Burst Period

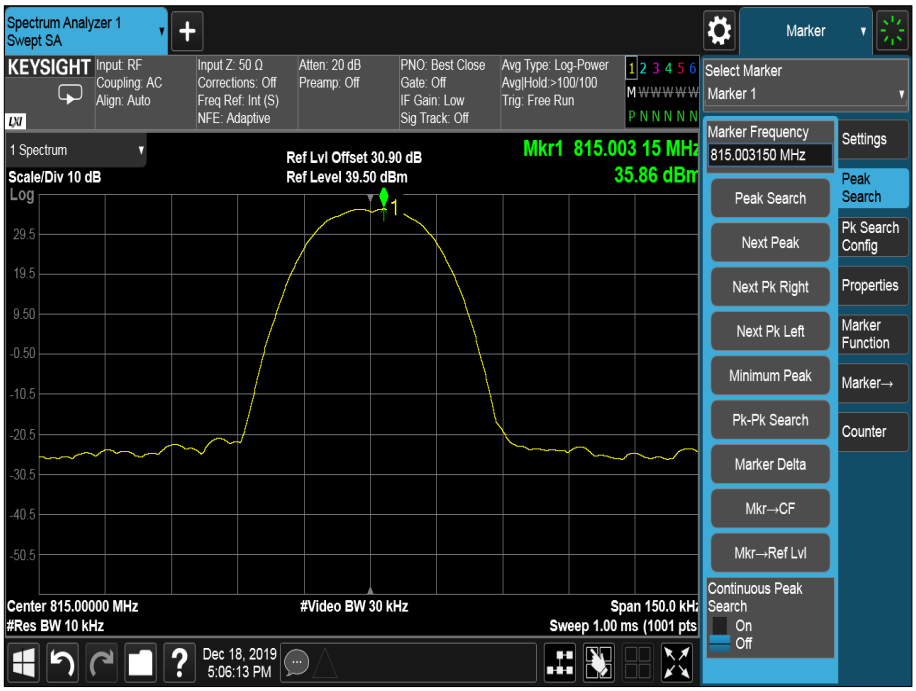

Figure 57 - Frequency Spectrum

TETRA 851 MHz to 869 MHz - Transmit High capacity battery

Figure 58 - Burst Length

Figure 59 - Burst Period

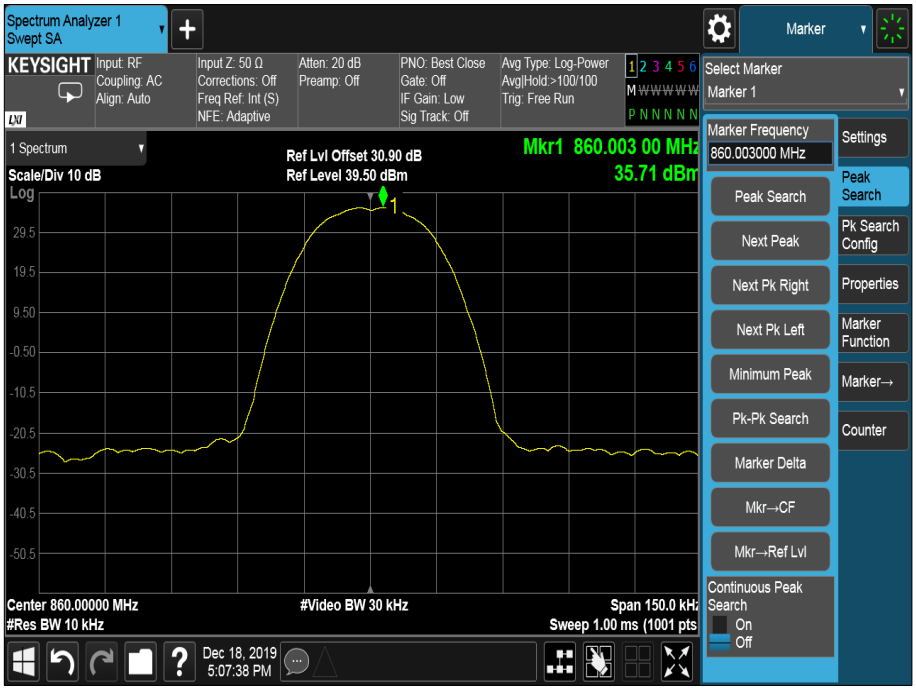

Figure 60 - Frequency Spectrum

FCC 47 CFR Part 90, Limit Clause 90.207

As per FCC Part 90.207 (b) through (n).

FCC 47 CFR Part 2, Limit Clause 2.1047

Voice modulated communication equipment. A curve or equivalent data showing the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz shall be submitted. For equipment required to have an audio low-pass filter, a curve showing the frequency response of the filter, or of all circuitry installed between the modulation limiter and the modulated stage shall be submitted.

Equipment which employs modulation limiting. A curve or family of curves showing the percentage of modulation versus the modulation input voltage shall be supplied. The information submitted shall be sufficient to show modulation limiting capability throughout the range of modulating frequencies and input modulating signal levels employed.

Industry Canada RSS-119, Limit Clause 5.3

Equipment that operates in the bands 768-776 MHz and 798-806 MHz shall use digital modulation. Mobile and portable transmitters that operate in these bands may have analogue modulation capability only as a secondary mode in addition to their primary digital mode. However, mobile and portable transmitters that operate only on the low-power channels as defined in SRSP-511 may employ any type of modulation.

2.6.7 Test Location and Test Equipment Used

This test was carried out in RF Laboratory 2.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Multimeter	Fluke	75 Mk3	455	12	11-Oct-2020
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	16-Apr-2020
Hygromer	Rotronic	A1	2138	12	05-Mar-2020
Frequency Standard	Spectracom	SecureSync 1200-0408-0601	4393	6	16-Apr-2020
1 metre K-Type Cable	Florida Labs	KMS-180SP-39.4-KMS	4520	12	12-Nov-2020
Quad Power Supply	Rohde & Schwarz	HMP4040	4955	-	O/P Mon
EXA	Keysight Technologies	N9010B	4968	24	21-Dec-2019

Table 23

O/P Mon – Output Monitored using calibrated equipment

2.7 Radiated Spurious Emissions

2.7.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.210
FCC 47 CFR Part 2, Clause 2.1051
Industry Canada RSS-119, Clause 5.8
ISEDC RSS-GEN, Clause 6.13

2.7.2 Equipment Under Test and Modification State

SC2028, S/N: 1PR001925GK63ZJ - Modification State 0

2.7.3 Date of Test

17-December-2019

2.7.4 Test Method

A preliminary profile of the Spurious Radiated Emissions was obtained up to the 10th harmonic 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.

Testing was performed in accordance with ANSI C63.26, clause 5.5.

Prescans and final measurements were performed using the direct field strength method.
The Regulatory limit of -13dBm / MHz has been converted to a field strength limit in accordance with ANSI C63.26 clause 5.2.7 equation c)

Example calculation
E (dBuV/m) = EIRP (dBm) - 20log(d) + 104.8 where (d) is the measurement distance.
E (dBuV/m) = -13 - 20log(3) + 104.8
E (dBuV/m) = 82.26

2.7.5 Environmental Conditions

Ambient Temperature	18.5 °C
Relative Humidity	37.0 %

2.7.6 Test Results

TETRA 809 MHz to 824 MHz - Transmit High capacity battery

Frequency (MHz)	Level (dBm)
*	

Table 24 - 806.025 MHz - Emissions Results

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

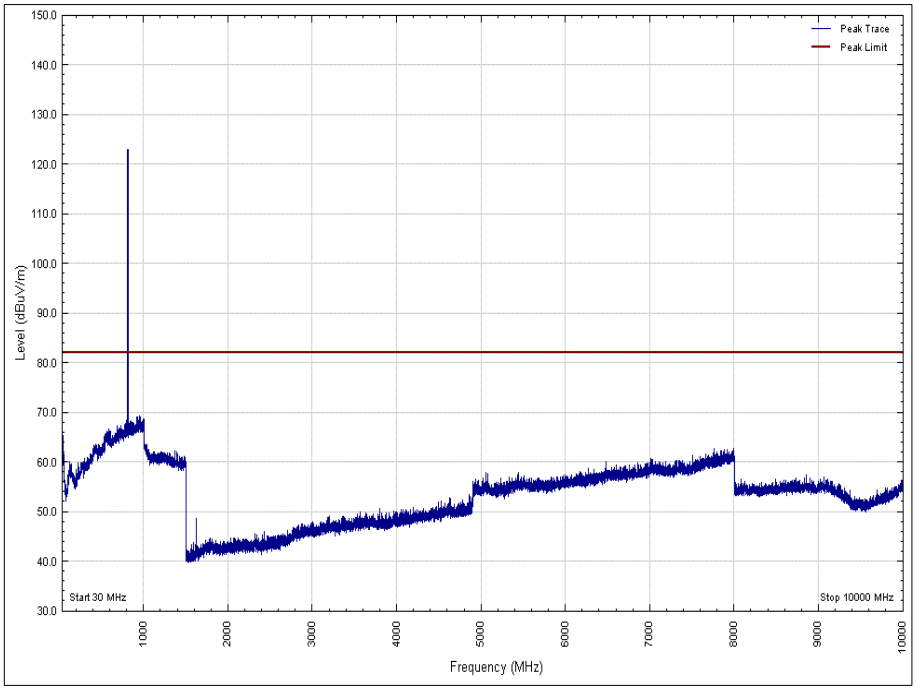

Figure 61 - 806.025 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation X

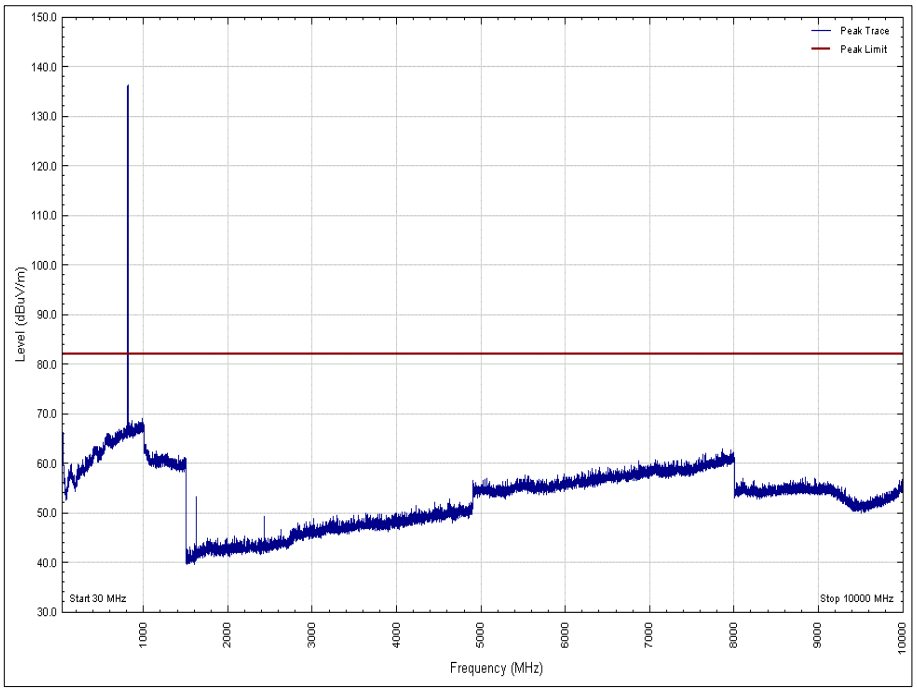

Figure 62 - 806.025 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation X

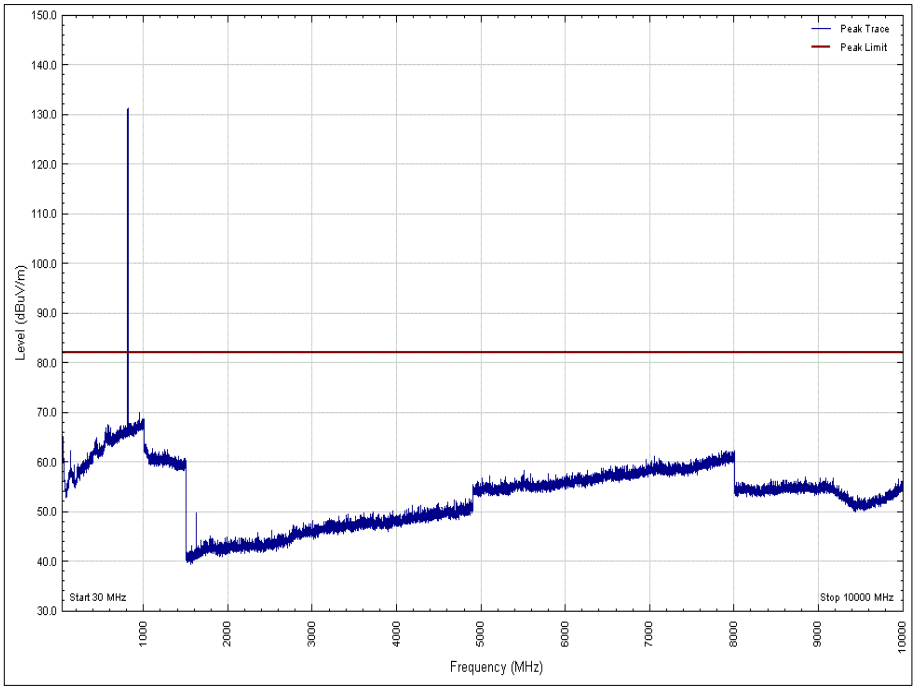

Figure 63 - 806.025 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Y

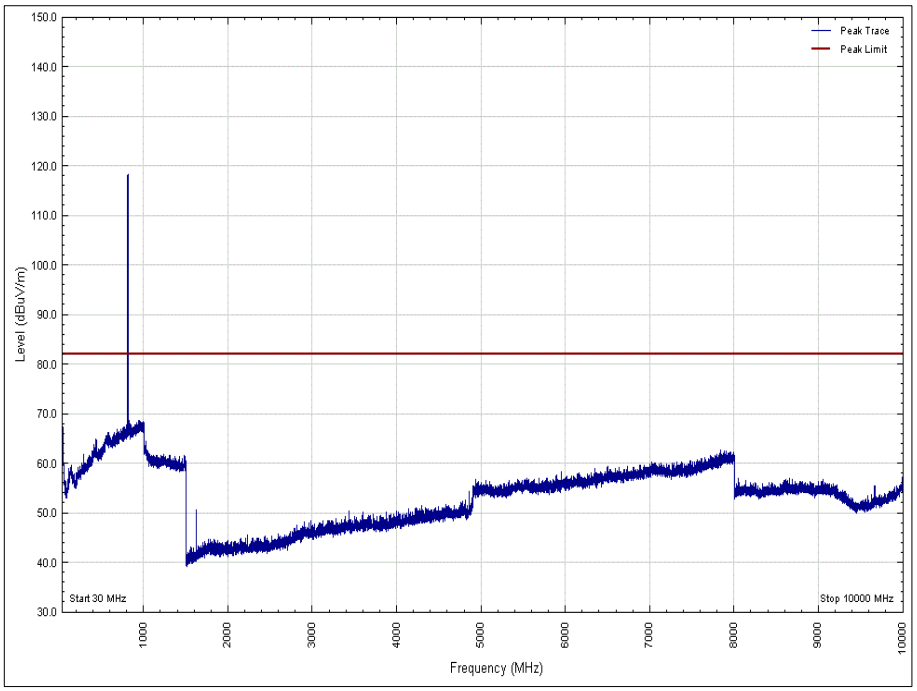

Figure 64 - 806.025 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Y

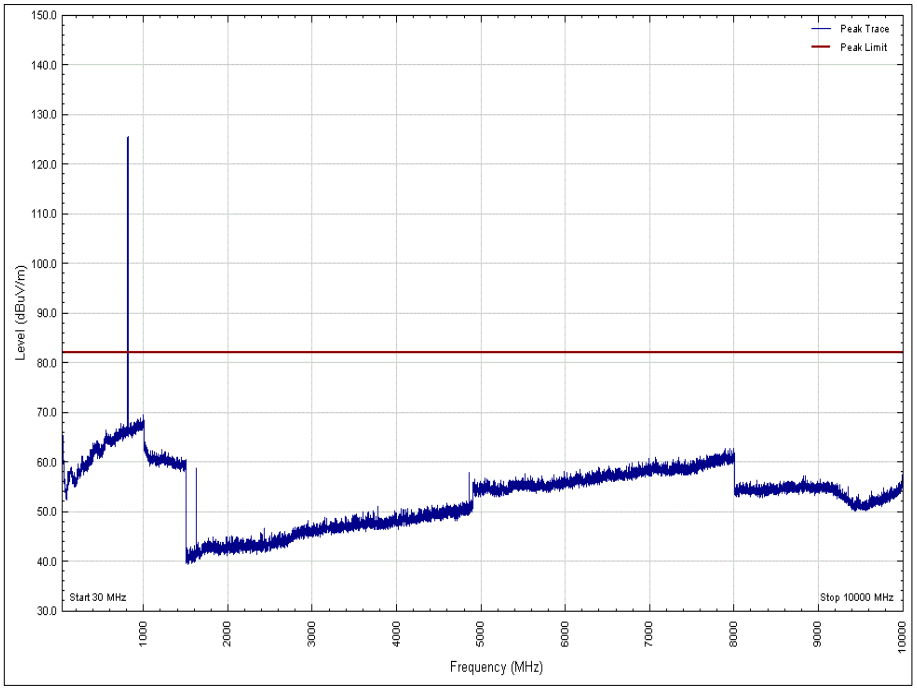

Figure 65 - 806.025 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Z

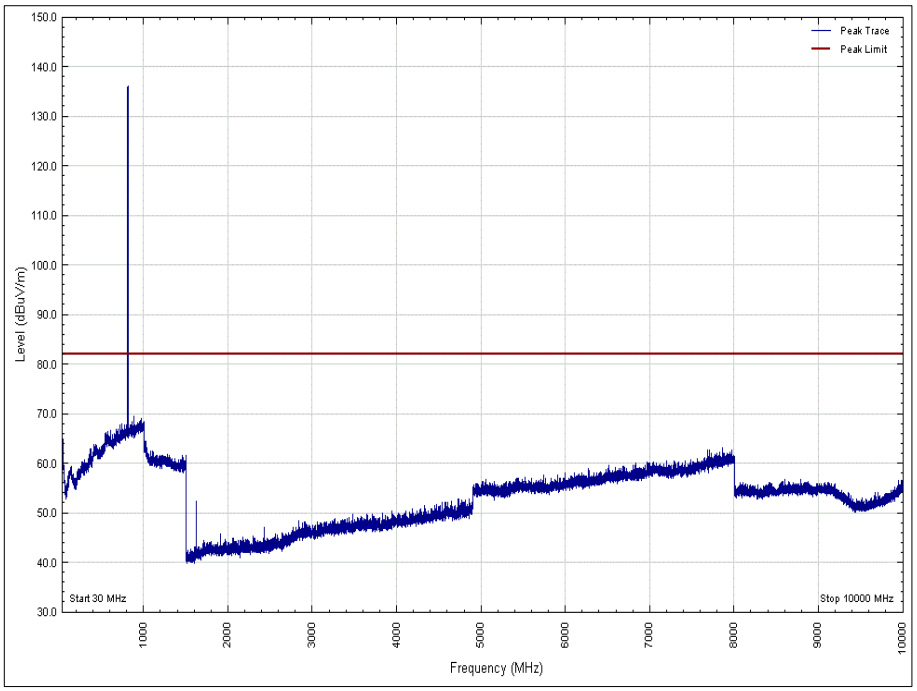

Figure 66 - 806.025 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Z

Frequency (MHz)	Level (dBm)
*	

Table 25 - 815.000 MHz - Emissions Results

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

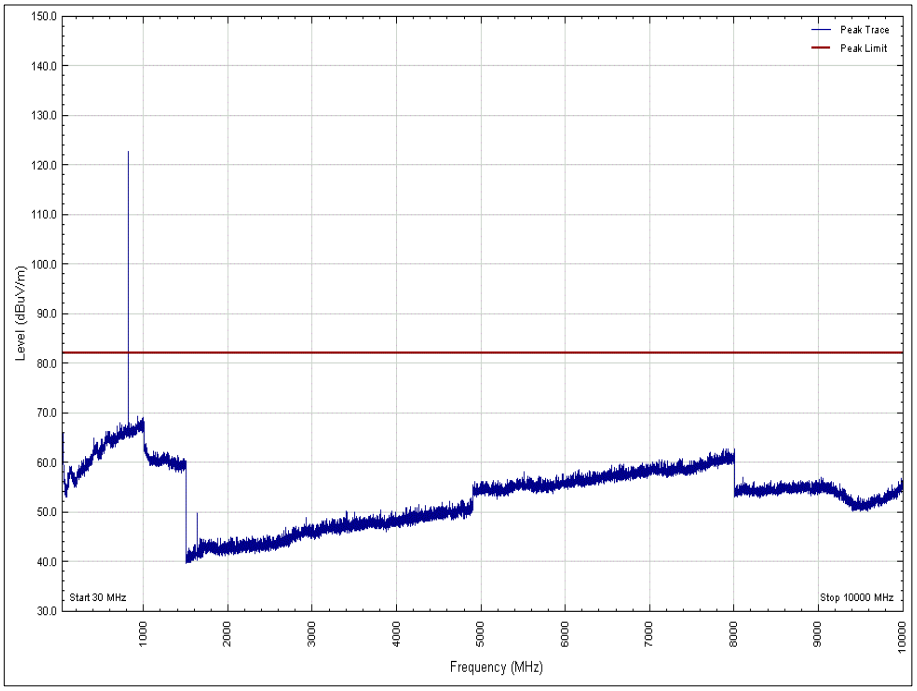

Figure 67 - 815.000 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation X

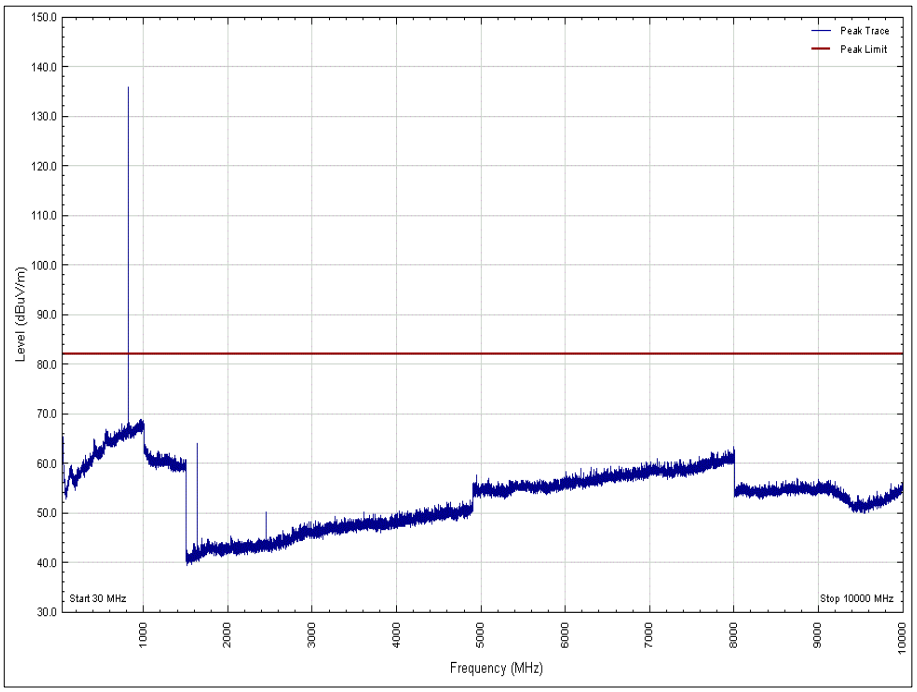

Figure 68 - 815.000 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation X

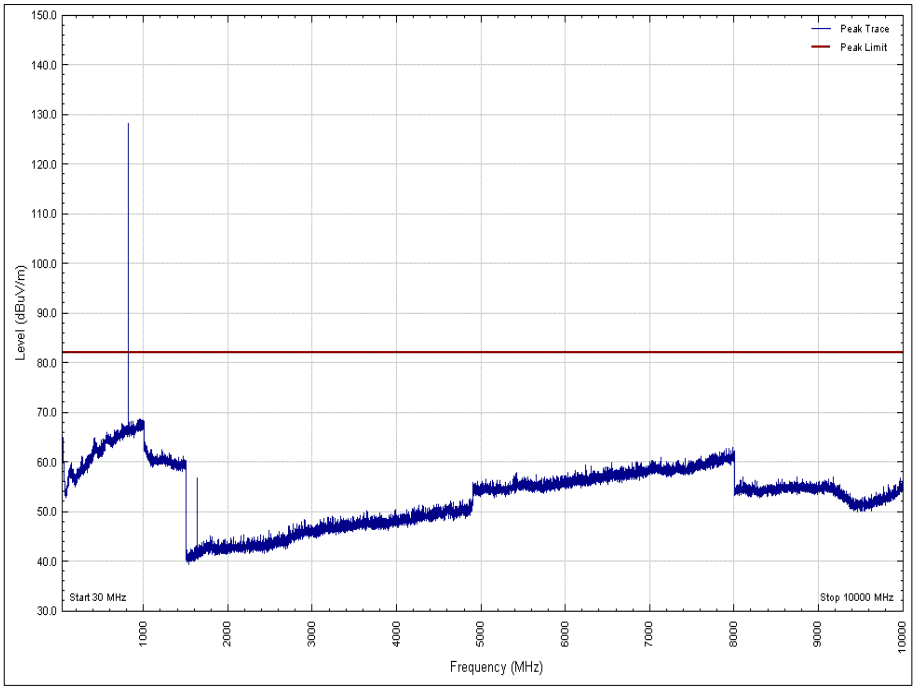

Figure 69 - 815.000 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Y

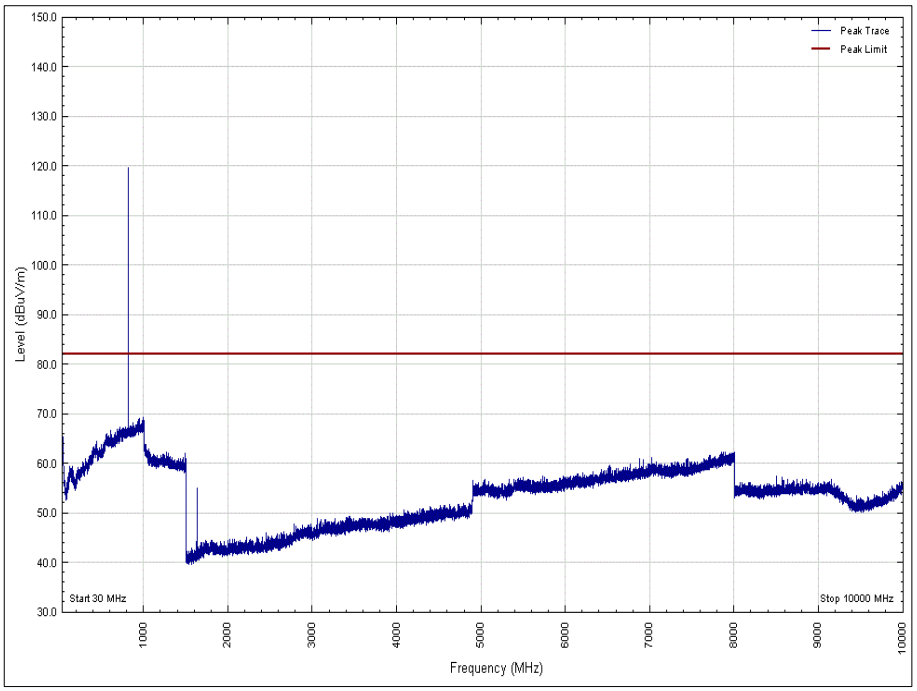

Figure 70 - 815.000 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Y

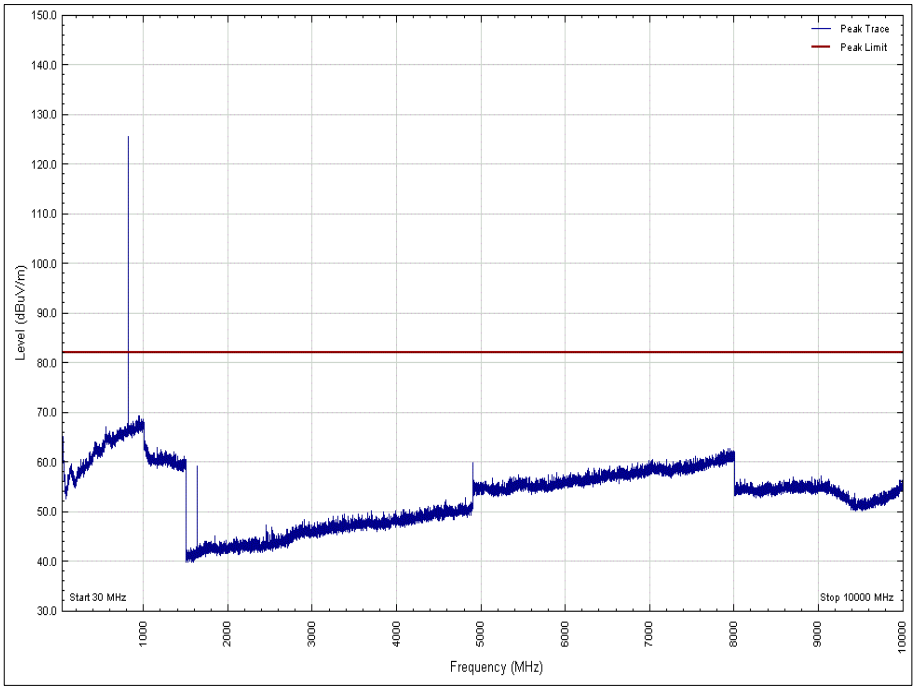

Figure 71 - 815.000 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Z

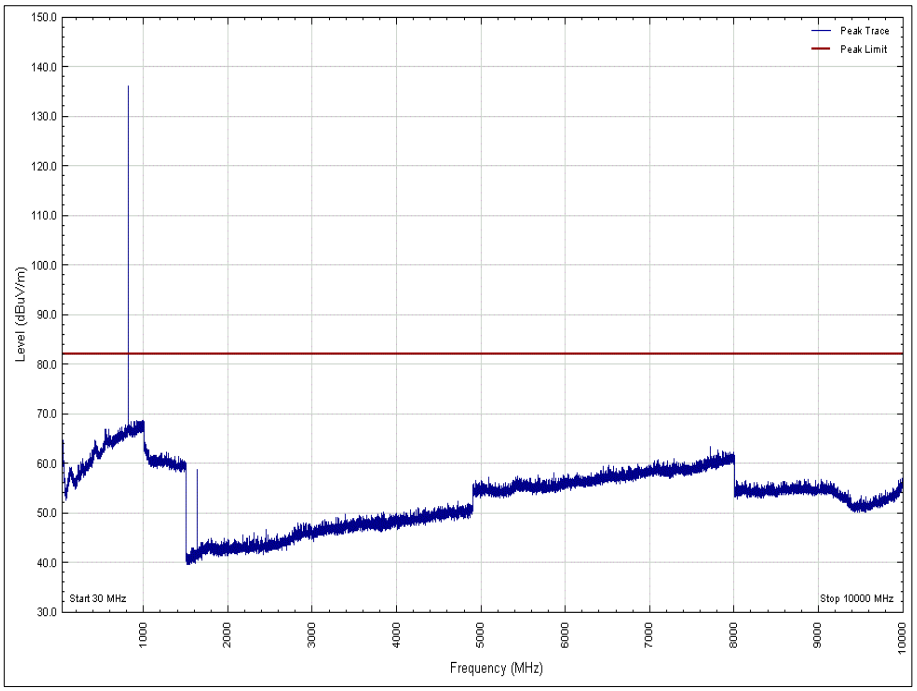

Figure 72 - 815.000 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Z

Frequency (MHz)	Level (dBm)
*	

Table 26 - 815.000 MHz - Emissions Results

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

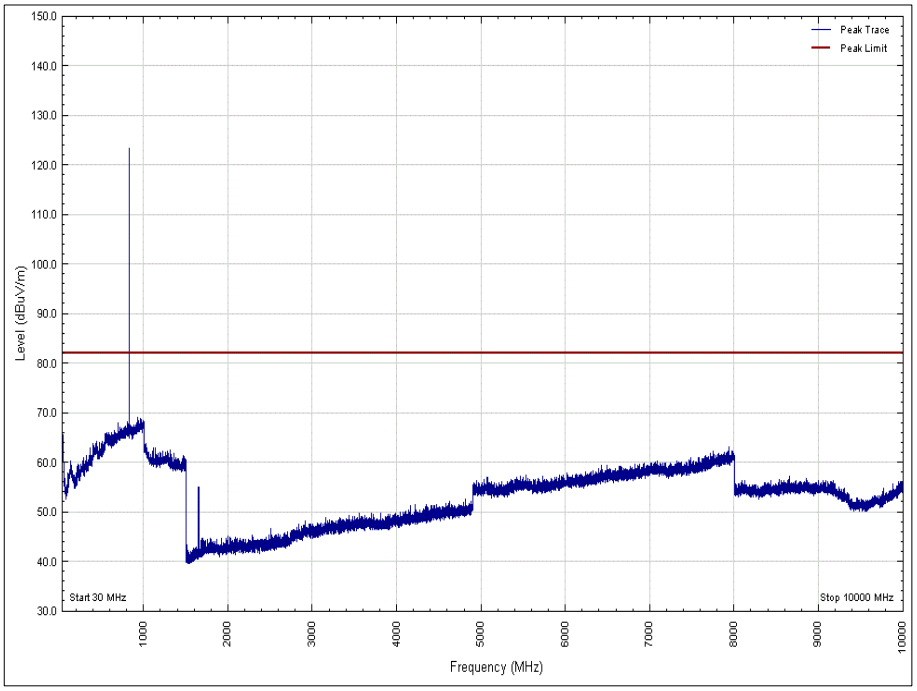

Figure 73 - 823.975 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation X

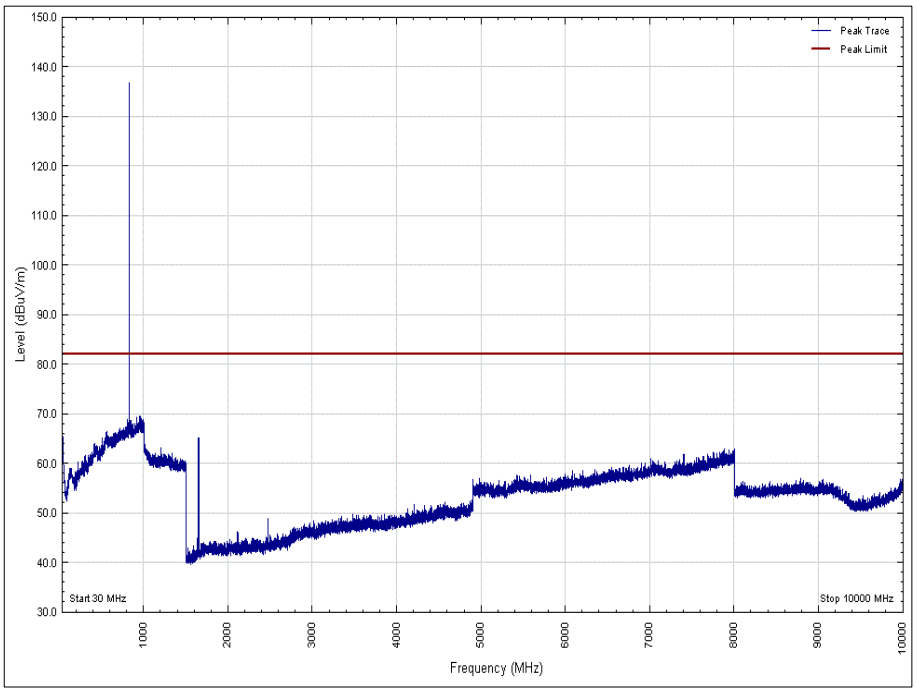

Figure 74 - 823.975 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation X

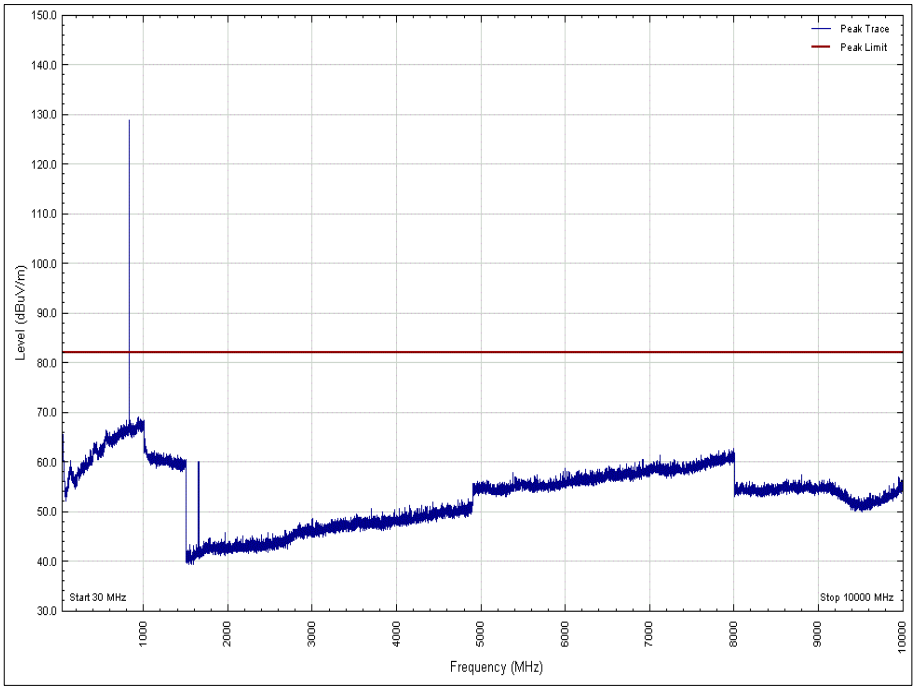

Figure 75 - 823.975 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Y

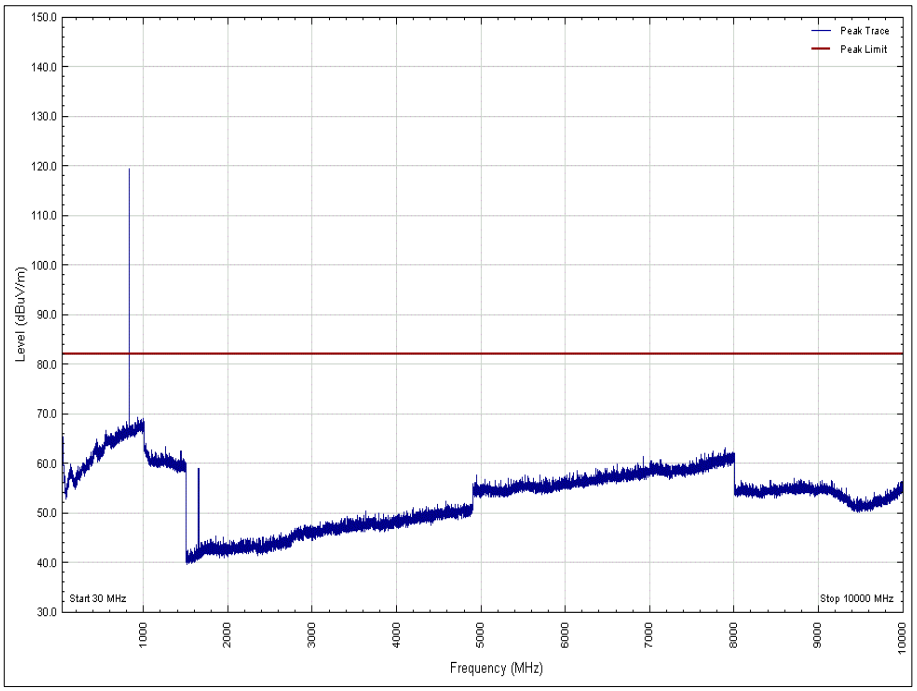

Figure 76 - 823.975 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Y

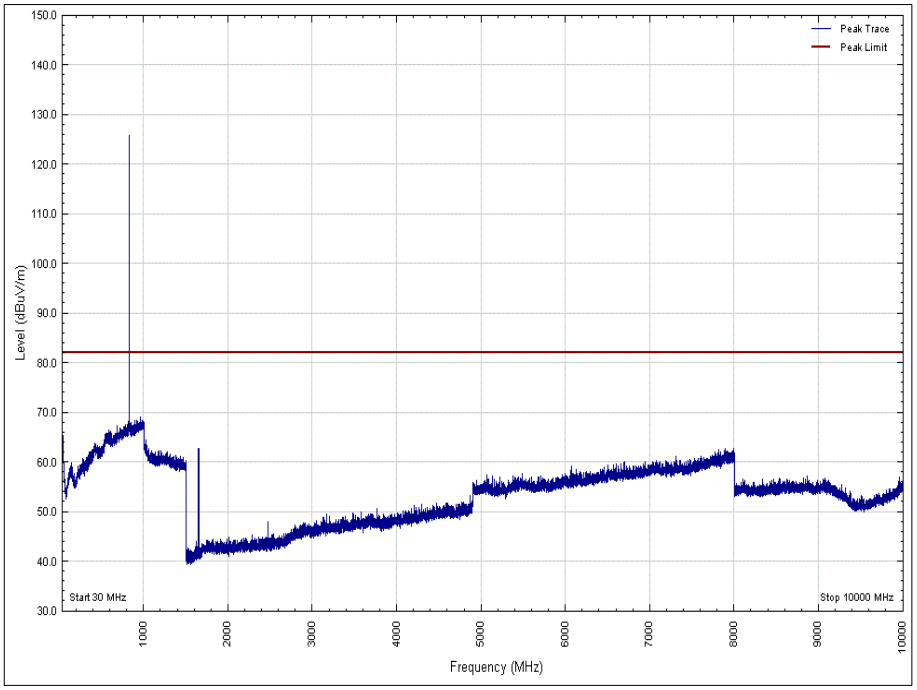

Figure 77 - 823.975 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Z

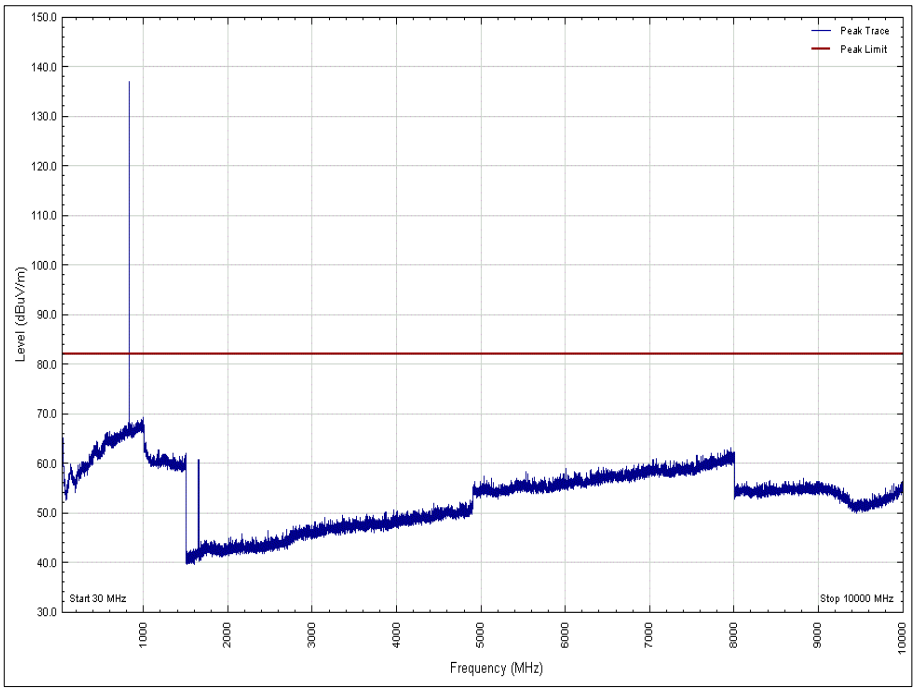

Figure 78 - 823.975 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Z

TETRA 851 MHz to 869 MHz - Transmit High capacity battery

Frequency (MHz)	Level (dBm)
*	

Table 27 - 851.025 MHz - Emissions Results

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

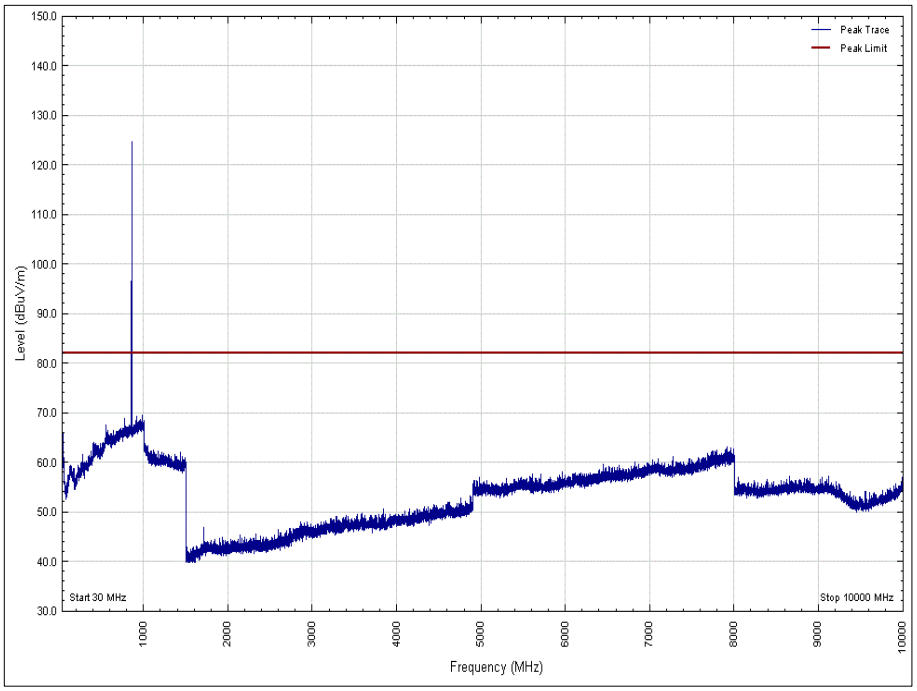

Figure 79 - 851.025 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation X

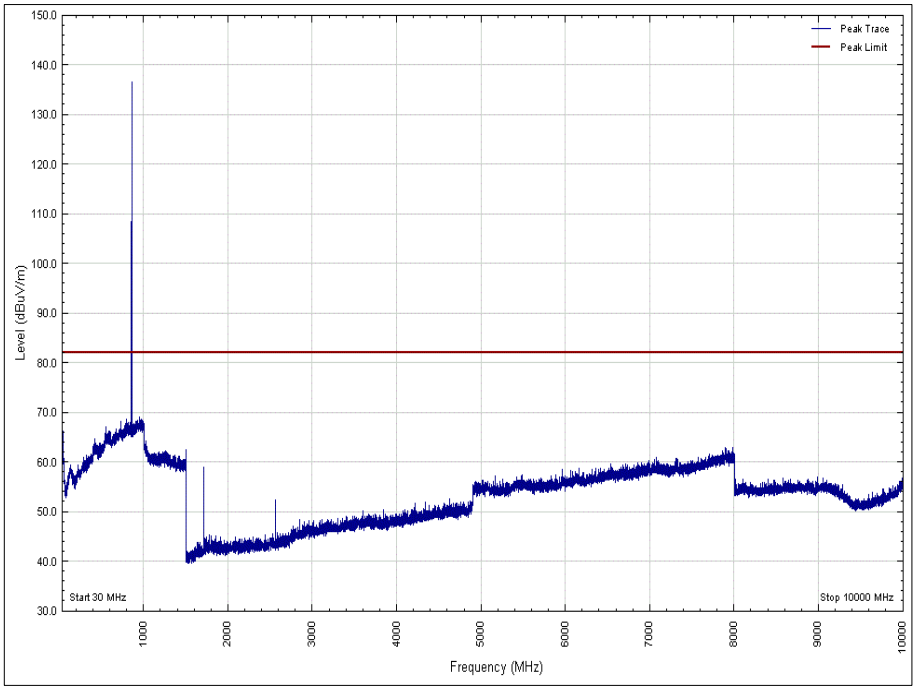

Figure 80 - 851.025 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation X

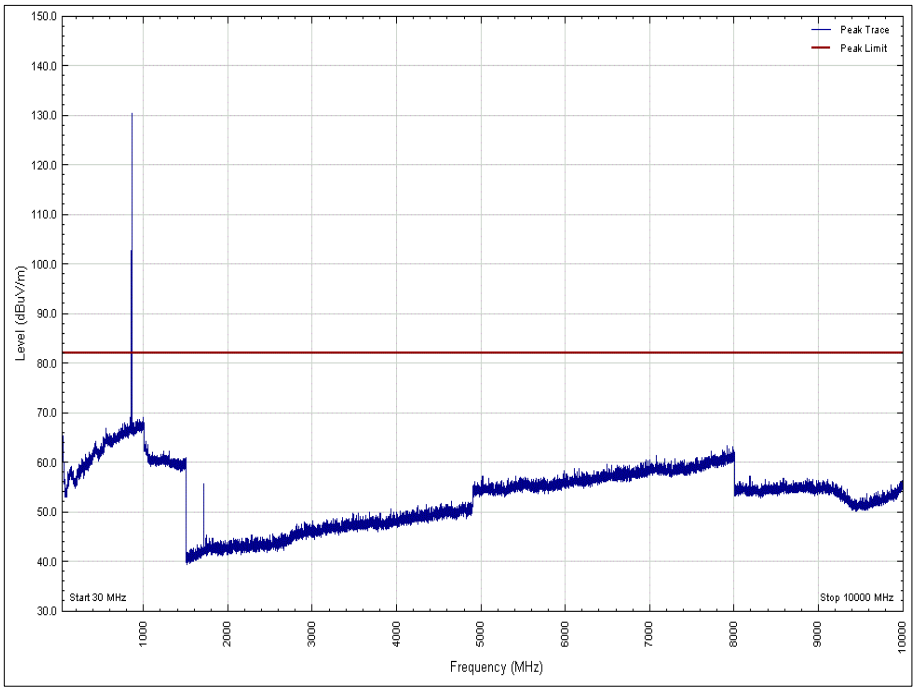

Figure 81 - 851.025 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Y

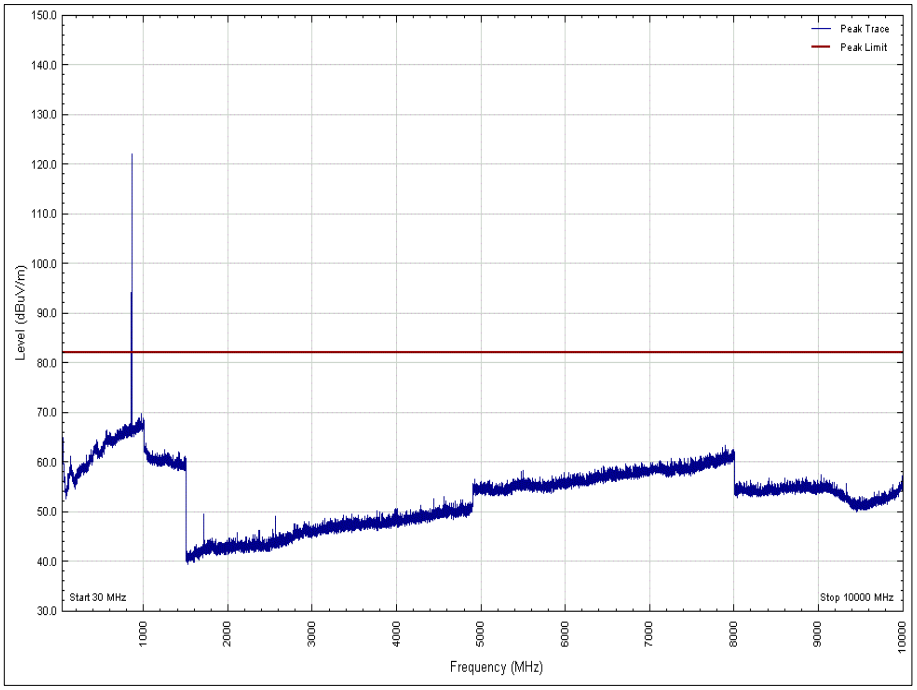

Figure 82 - 851.025 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Y

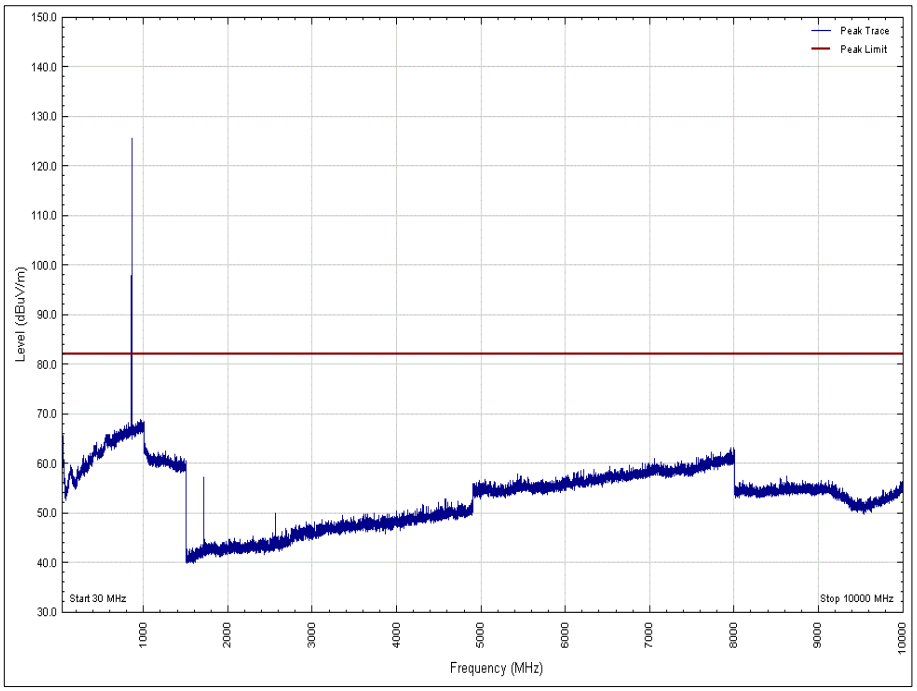

Figure 83 - 851.025 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Z

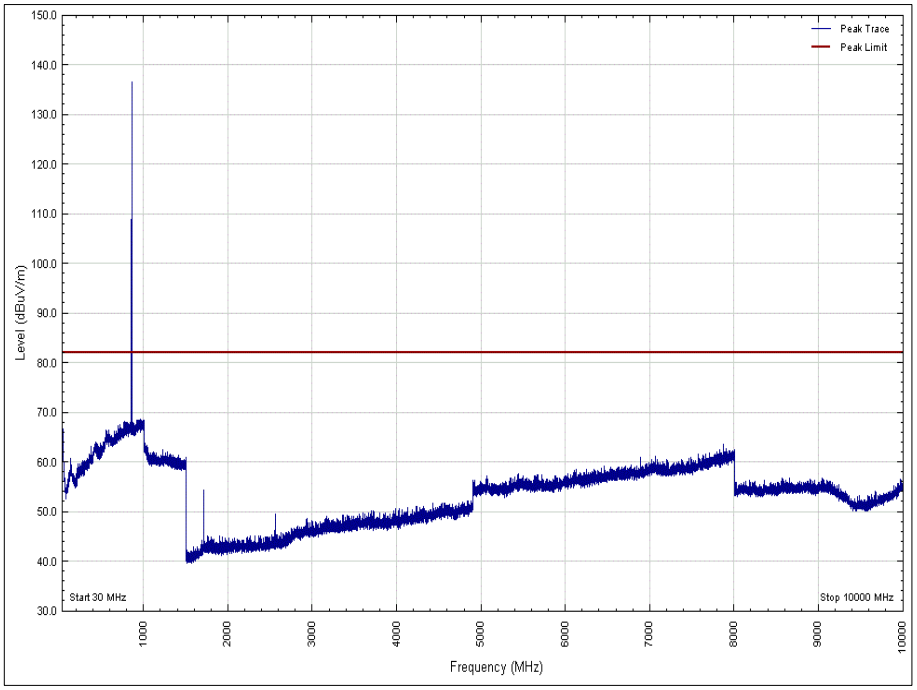

Figure 84 - 851.025 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Z

Frequency (MHz)	Level (dBm)
*	

Table 28 - 860.000 MHz - Emissions Results

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

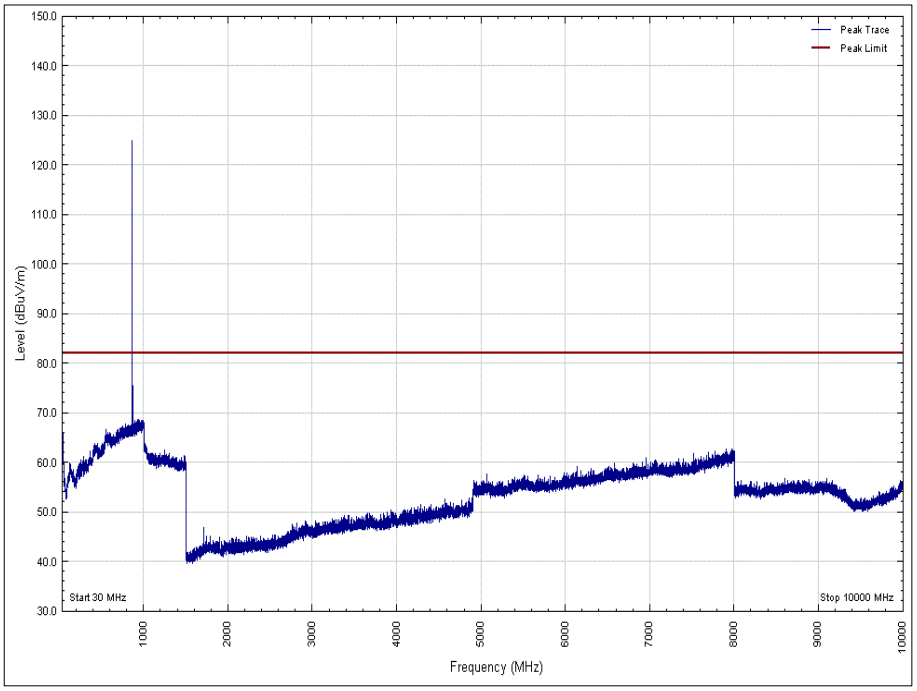

Figure 85 - 860.000 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation X

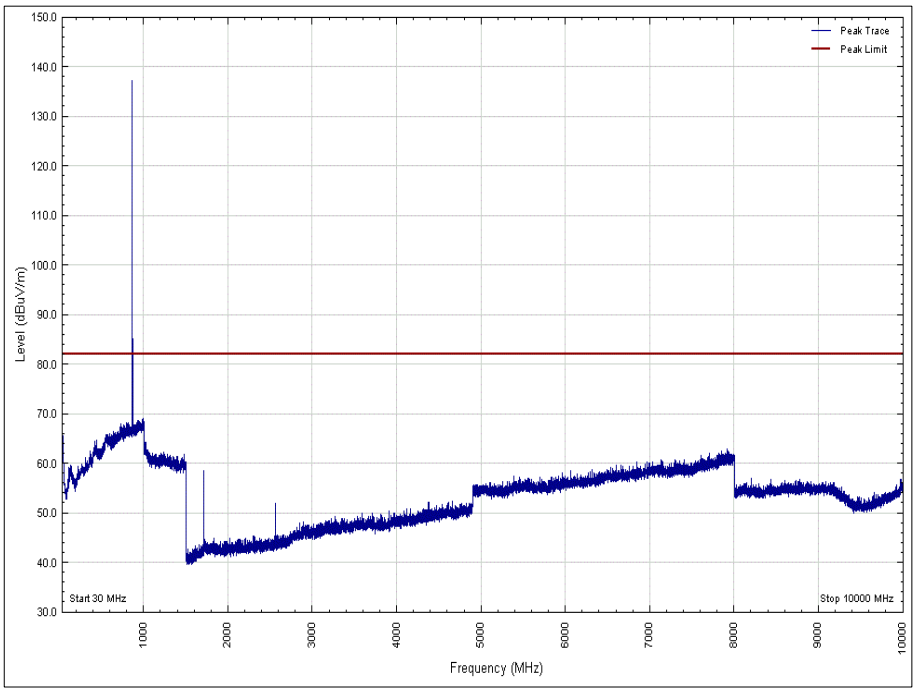

Figure 86 - 860.000 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation X

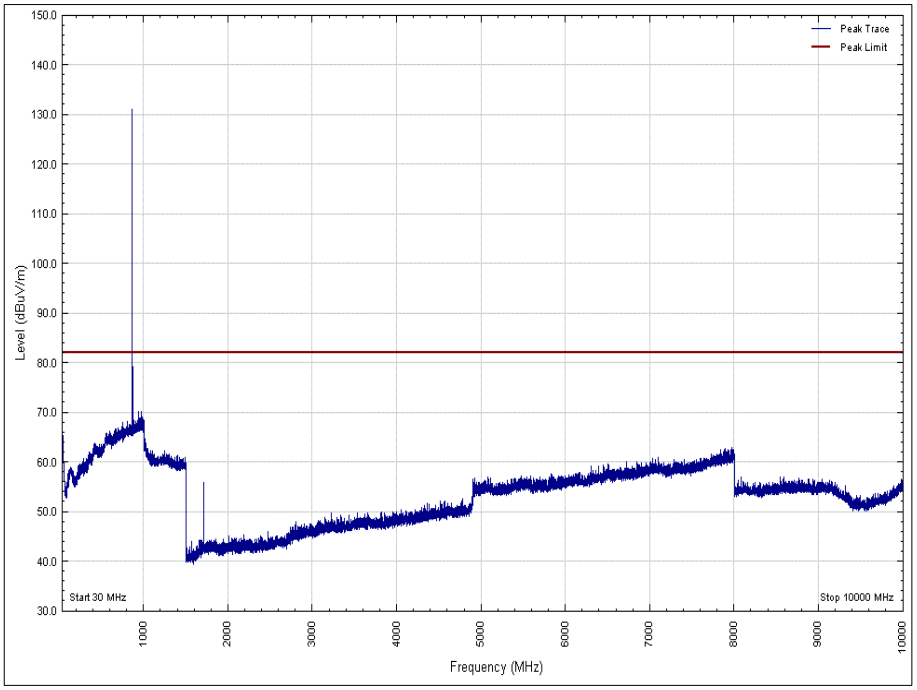

Figure 87 - 860.000 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Y

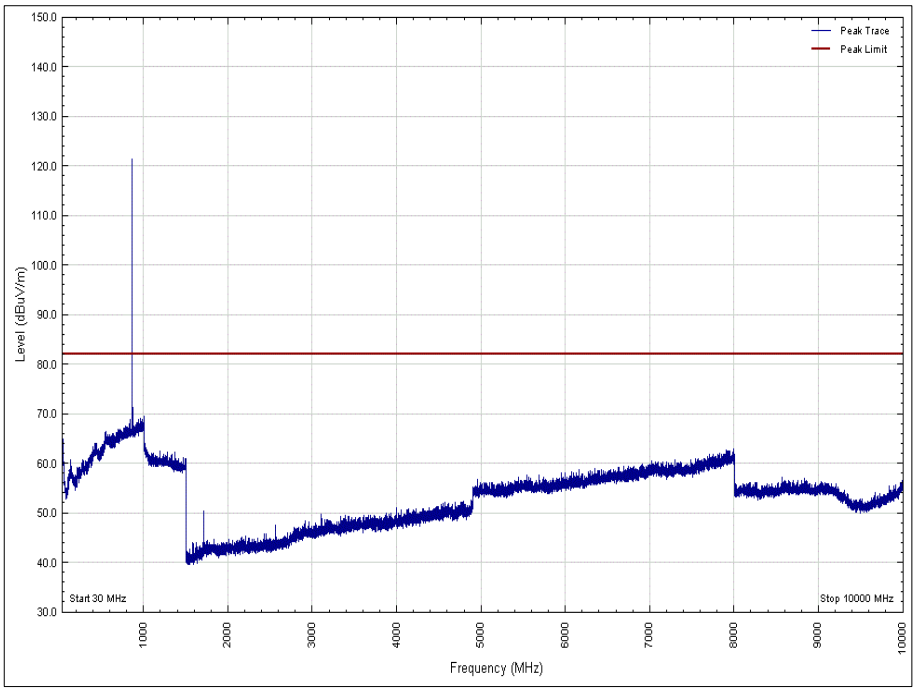

Figure 88 - 860.000 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Y

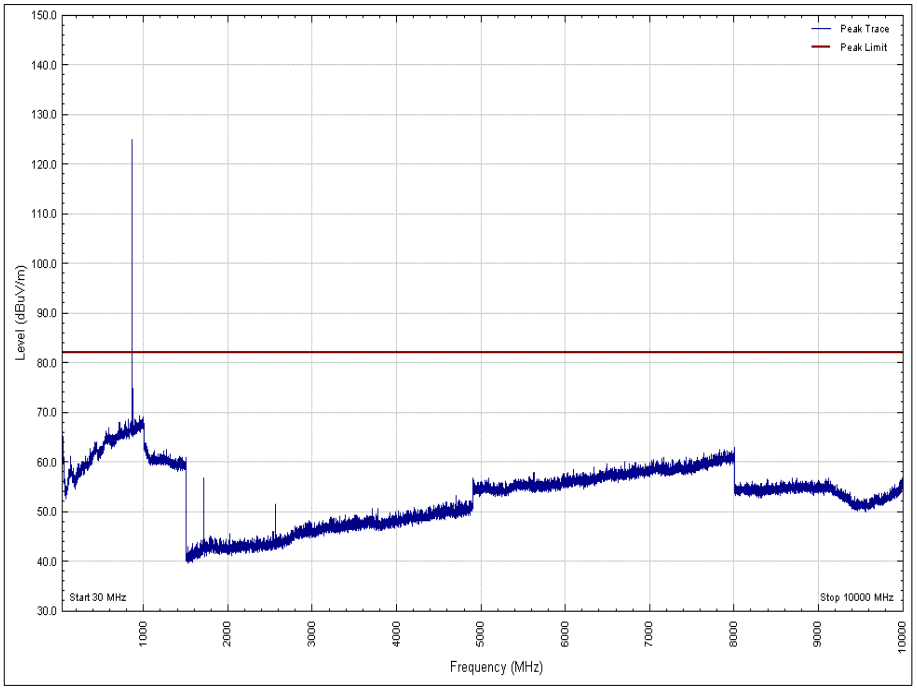

Figure 89 - 860.000 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Z

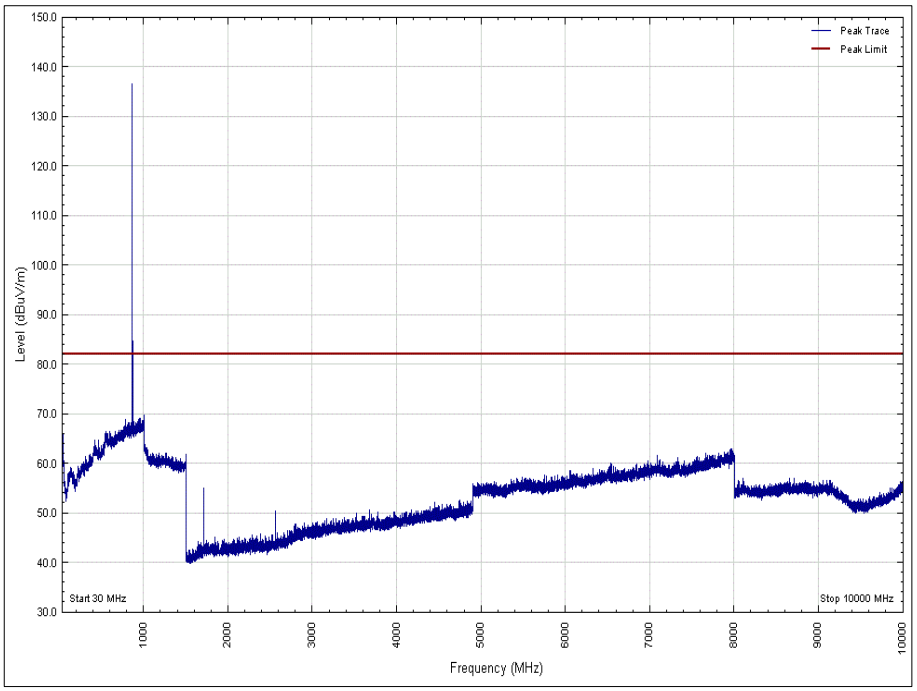

Figure 90 - 860.000 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Z

Frequency (MHz)	Level (dBm)
*	

Table 29 - 860.000 MHz - Emissions Results

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

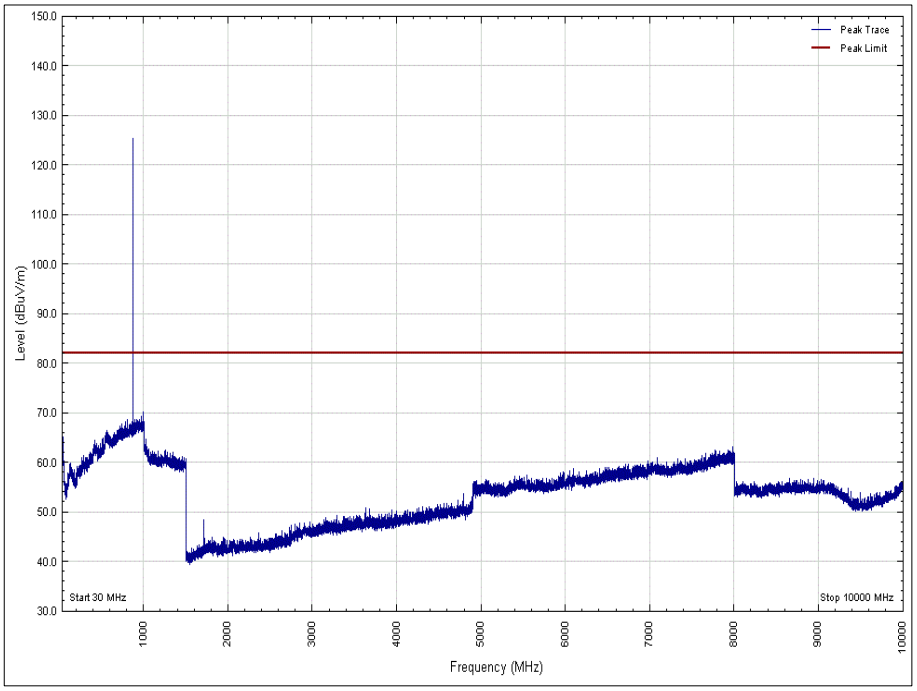

Figure 91 - 868.975 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation X

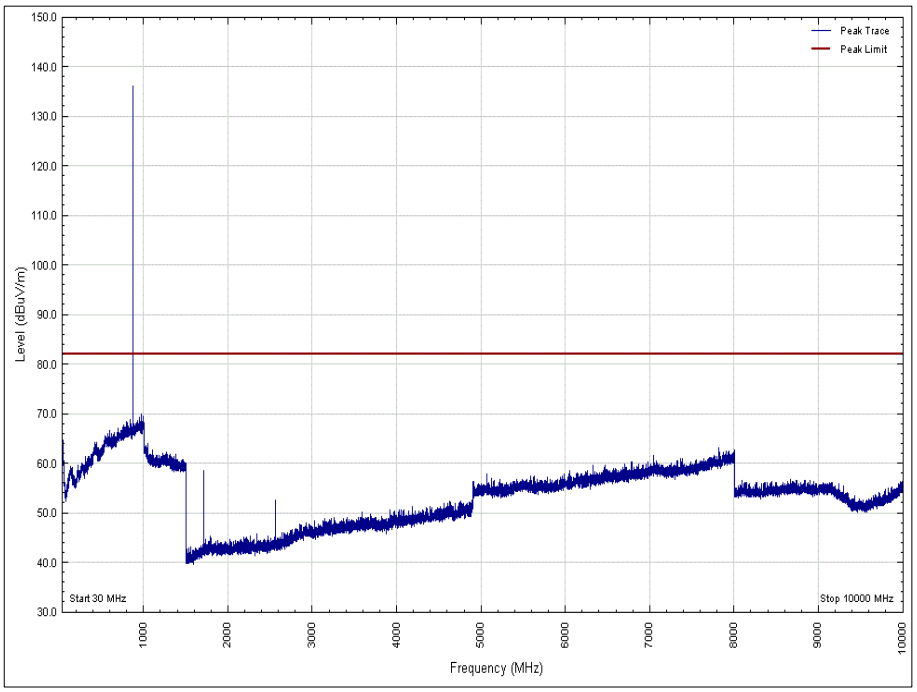

Figure 92 - 868.975 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation X

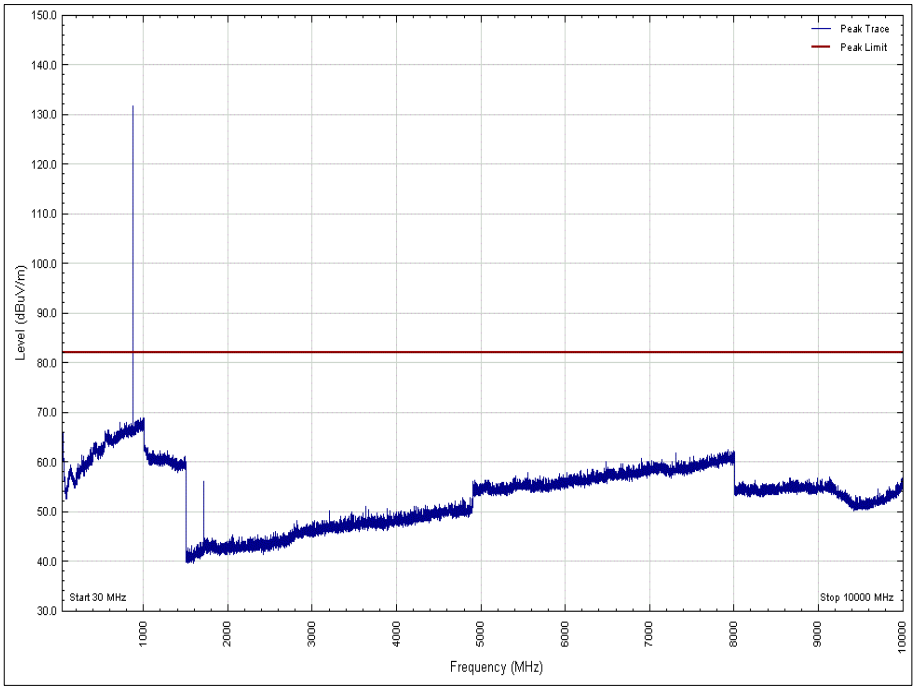

Figure 93 - 868.975 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Y

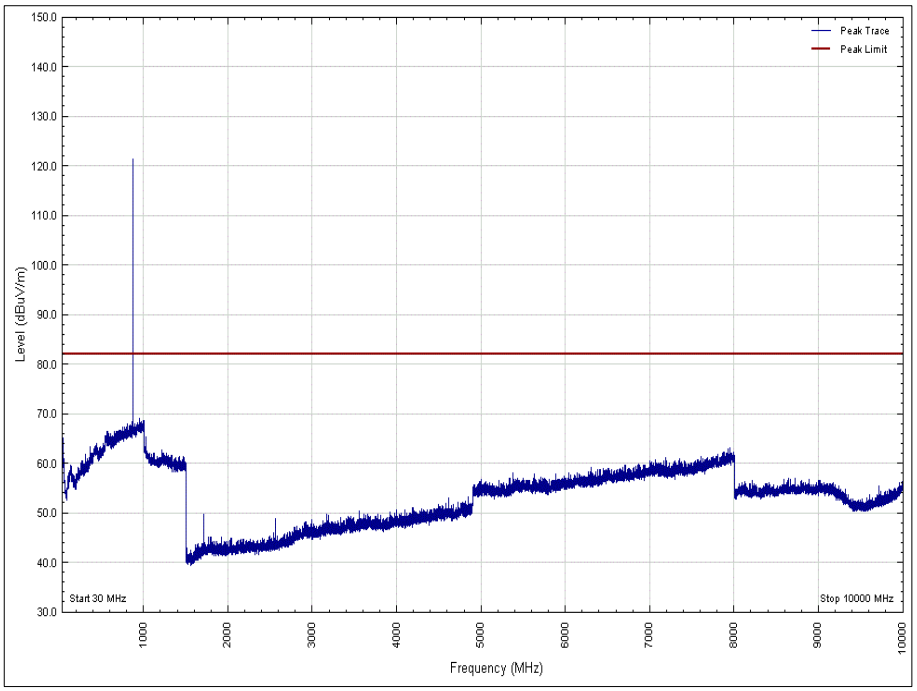

Figure 94 - 868.975 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Y

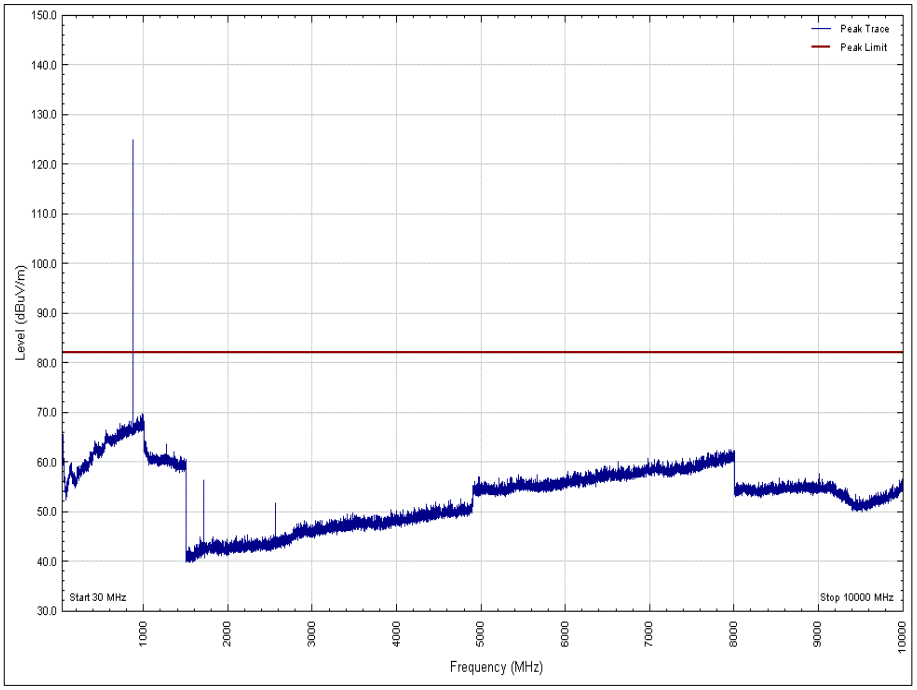

Figure 95 - 868.975 MHz - 30 MHz to 10 GHz - Vertical, EUT Orientation Z

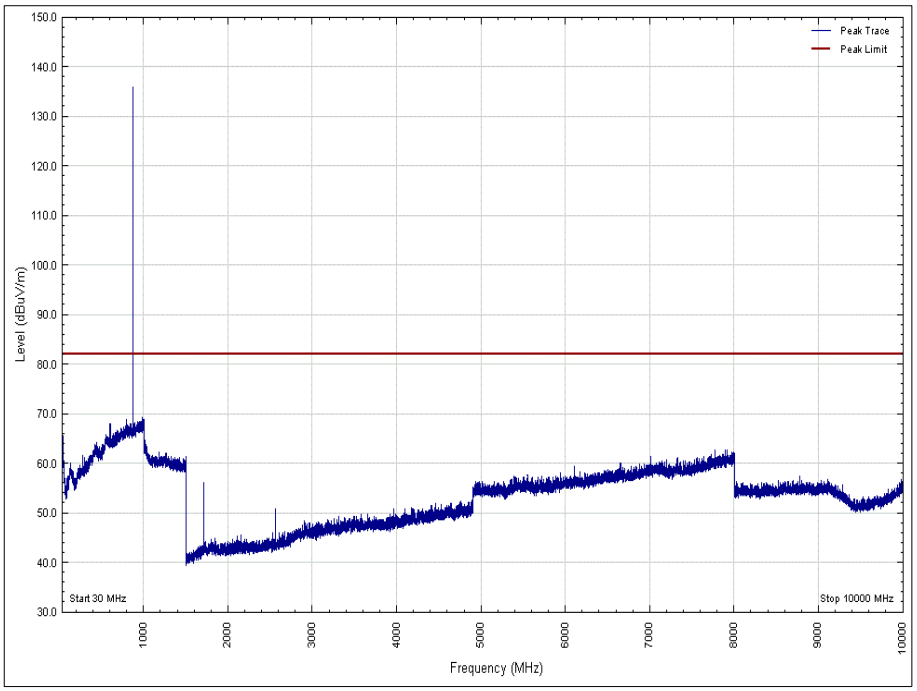

Figure 96 - 868.975 MHz - 30 MHz to 10 GHz - Horizontal, EUT Orientation Z

FCC 47 CFR Part 90, Limit Clause 90.210

The EUT shall comply with emission mask B as per FCC 47 CFR Part 90.210.

Industry Canada RSS-119, Limit Clause 5.8

The EUT shall comply with emission mask B as per Industry Canada RSS-119 clause 5.8.

2.7.7 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
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna with permanent attenuator (Bilog)	Chase	CBL6143	2904	24	30-Sep-2021
Comb Generator	Schaffner	RSG1000	3034	-	TU
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	12	08-Nov-2020
Mast Controller	Maturo Gmbh	NCD	4810	-	TU
Tilt Antenna Mast	Maturo Gmbh	TAM 4.0-P	4811	-	TU
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	11-Mar-2020
High Pass filter	Wainwright	WHKX12-1290-1500-18000-80SS	4961	-	O/P Mon
Hygrometer	Rotronic	HP21	4989	12	02-May-2020
Network Analyser	Keysight Technologies	E5063A	5018	12	20-May-2020
EmX Emissions Software	TUV SUD	EmX	5125	-	Software
8 Meter Cable	Teledyne	PR90-088-8MTR	5212	12	30-Aug-2020
EMI Test Receiver	Rohde & Schwarz	ESW44	5382	12	08-Oct-2020

Table 30

O/P Mon – Output Monitored using calibrated equipment
TU - Traceability Unscheduled

3 Photographs

3.1 Test Setup Photographs

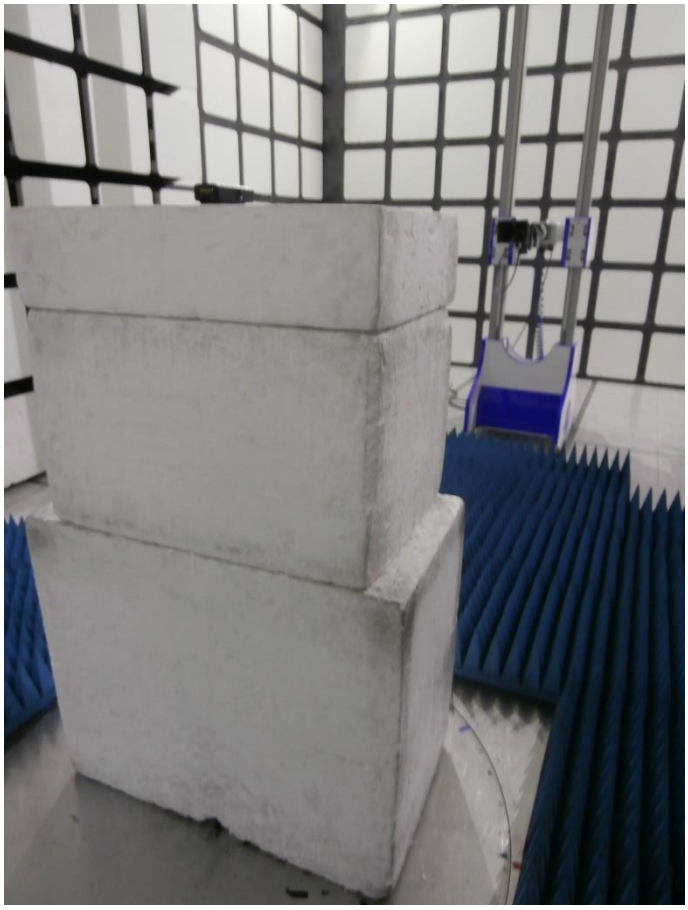

Figure 97 – Radiated Emission Setup, EUT Orientation X

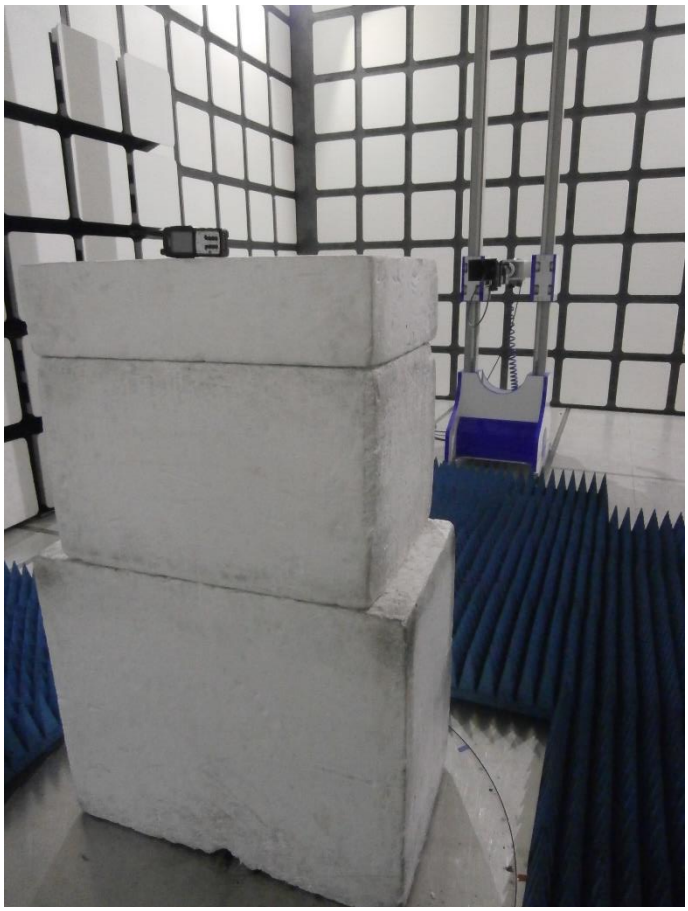

Figure 98 – Radiated Emission Setup, EUT Orientation Y

Figure 99 – Radiated Emission Setup, EUT Orientation Z

4 Measurement Uncertainty

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

Test Name	Measurement Uncertainty
Maximum Conducted Output Power	± 3.2 dB
Bandwidth Limitations	± 58.05 Hz
Spurious Emissions at Antenna Terminals	± 3.45 dB
Frequency Stability	± 11 Hz
Transient Frequency Behaviour	± 0.2 Hz
Adjacent Channel Power	± 3.0 dB
Types of Emissions	-
Radiated Spurious Emissions	30 MHz to 1 GHz: ± 5.2 dB 1 GHz to 18 GHz: ± 6.3 dB

Table 31

Measurement Uncertainty Decision Rule

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.