Report on the FCC and IC Testing of the

Sepura plc, Radio Handset, Model: SC2128

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

Product Service

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Prepared for: Sepura plc
9000 Cambridge Research Park, Beach Drive,
Waterbeach, Cambridge, CB25 9TL,
United Kingdom

FCC ID: XX6SC2128 IC: 8739A-SC2128

COMMERCIAL-IN-CONFIDENCE

Document Number: 75941492-04 | Issue: 01

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Project Management	Natalie Bennett	20 June 2018	
Authorised Signatory	Simon Bennett	20 June 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 90, FCC 47 CFR Part 2, Industry Canada RSS-119 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Testing	Nicolas Salguero Camarena	20 June 2018	
Testing	Graeme Lawler	20 June 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 90: 2017, FCC 47 CFR Part 2: 2017, Industry Canada RSS-119: Issue 12 (2015) and Industry Canada RSS-GEN: Issue 5 (2018)

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Product Service

Contents

1 Report Summary

1.1 Report Modification Record

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

Issue	Description of Change	Date of Issue
1	First Issue	20 June 2018

Table 1

1.2 Introduction

Applicant	Sepura plc
Manufacturer	Sepura plc
Model Number(s)	SC2128
Serial Number(s)	Not Serialised (75941492-TSR0001) Not Serialised (75941492-TSR0002)
Hardware Version(s)	Production
Software Version(s)	SC 1.5
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 90: 2017 FCC 47 CFR Part 2: 2017 Industry Canada RSS-119: Issue 12 (2015) Industry Canada RSS-GEN: Issue 5 (2018)
Order Number Date	PO 008940 24-January-2018
Date of Receipt of EUT	05-March-2018
Start of Test	11-April-2018
Finish of Test	11-June-2018
Name of Engineer(s)	Nicolas Salguero Camarena and Graeme Lawler
Related Document(s)	ANSI C63.26 (2015)

Product Service

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 Industry Canada 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 - Lower Band (806 MHz to 824 MHz)							
2.1	90.205	2.1046	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.26 (2015)
2.2	90.207	2.1047	5.2	-	Types of Emissions	Pass	ANSI C63.26 (2015)
2.3	90.209	2.1049	5.5	6.6	Bandwidth Limitations	Pass	ANSI C63.26 (2015)
2.4	90.210	2.1051	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	ANSI C63.26 (2015)
2.5	90.210	2.1053	5.8	6.13	Radiated Spurious Emissions	Pass	ANSI C63.26 (2015)
2.6	90.210	2.1055	5.3	6.11	Frequency Stability	Pass	ANSI C63.26 (2015)
2.7	90.221	-	5.8	9.1	Adjacent Channel Power	Pass	ANSI C63.26 (2015)
Configuration and Mode: Tetra - Upper Band (851 MHz to 869 MHz)							
2.1	90.205	2.1046	5.4	6.12	Maximum Conducted Output Power	Pass	ANSI C63.26 (2015)
2.2	90.207	2.1047	5.2	-	Types of Emissions	Pass	ANSI C63.26 (2015)
2.3	90.209	2.1049	5.5	6.6	Bandwidth Limitations	Pass	ANSI C63.26 (2015)
2.4	90.210	2.1051	5.8	6.13	Spurious Emissions at Antenna Terminals	Pass	ANSI C63.26 (2015)
2.5	90.210	2.1053	5.8	6.13	Radiated Spurious Emissions	Pass	ANSI C63.26 (2015)
2.6	90.210	2.1055	5.3	6.11	Frequency Stability	Pass	ANSI C63.26 (2015)
2.7	90.221	-	5.8	-	Adjacent Channel Power	Pass	ANSI C63.26 (2015)

Table 2

1.4 Application Form

EQUIPMENT DESCRIPTION	
Model Name/Number	SC2128
Part Number	N/A
Hardware Version	Production
Software Version	SC 1.5
FCC ID (if applicable)	XX6SC2128
Industry Canada ID (if applicable)	8739A-SC2128
Technical Description (Please provide a brief description of the intended use of the equipment)	Portable TETRA Radio for use by the emergency services etc.

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
TETRA	806-824	35	>0	25kHz	Pi/4DQPSK	22K0DXW	806	815	824
TETRA	851-869	35	>0	25kHz	Pi/4DQPSK	22K0DXW	851	860	869
Bluetooth	2402-2480	7.382	2.5	1.0	8PSK, DQPSK, GFSK	1M00F1D	2402	2441	2480
WLAN	2412-2462	17.3	2.5	16.5 22 16.5	802.11g, 802.11b 802.11n.20	16M5D1D 22M0G1D 16M5D1D	2412	2437	2482

UN-INTENTIONAL RADIATOR	
Highest frequency generated or used in the device or on which the device operates or tunes	19.2 MHz
Lowest frequency generated or used in the device or on which the device operates or tunes	
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
External DC	Nominal Voltage	Maximum Current	
	7.4vdc	2A	
Battery	Nominal Voltage	Battery Operating End Point Voltage	
	7.4vdc	6.2vdc	
Can EUT transmit whilst being charged?		Yes ☒ No ☐	

Product Service

EXTREME CONDITIONS					
Maximum temperature	+65	°C	Minimum temperature	-30	°C

Ancillaries
Please list all ancillaries which will be used with the device.
Remote speaker mic, leather cases, pocket clips, earpieces

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

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

Name: Steve Wood

Position held: Product Conformance manager Date: 23/03/18

1.5 Product Information

1.5.1 Technical Description

Portable TETRA Radio for use by the emergency services etc.

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: Not Serialised (75941492-TSR0001)			
0	As supplied by the customer	Not Applicable	Not Applicable
Serial Number: Not Serialised (75941492-TSR0002)			
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: Tetra - Lower Band (806 MHz to 824 MHz)		
Maximum Conducted Output Power	Nicolas Salguero Camarena	UKAS
Types of Emissions	Nicolas Salguero Camarena	UKAS
Bandwidth Limitations	Nicolas Salguero Camarena	UKAS
Spurious Emissions at Antenna Terminals	Nicolas Salguero Camarena	UKAS
Radiated Spurious Emissions	Graeme Lawler	UKAS
Frequency Stability	Nicolas Salguero Camarena	UKAS
Adjacent Channel Power	Nicolas Salguero Camarena	UKAS
Configuration and Mode: Tetra - Upper Band (851 MHz to 869 MHz)		
Maximum Conducted Output Power	Nicolas Salguero Camarena	UKAS
Types of Emissions	Nicolas Salguero Camarena	UKAS
Bandwidth Limitations	Nicolas Salguero Camarena	UKAS
Spurious Emissions at Antenna Terminals	Nicolas Salguero Camarena	UKAS
Radiated Spurious Emissions	Graeme Lawler	UKAS
Frequency Stability	Nicolas Salguero Camarena	UKAS
Adjacent Channel Power	Nicolas Salguero Camarena	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
Industry Canada RSS-GEN, Clause 6.12

2.1.2 Equipment Under Test and Modification State

SC2128, S/N: Not Serialised (75941492-TSR0001) - Modification State 0

2.1.3 Date of Test

12-April-2018

2.1.4 Test Method

The test was performed in accordance with ANSI C63.26, clause 5.2.3.3 for peak and clause 5.2.4.3.1 for average measurements.

2.1.5 Environmental Conditions

Ambient Temperature	20.8 °C
Relative Humidity	41.0 %

2.1.6 Test Results

Tetra - Lower Band (806 MHz to 824 MHz)

Peak/Average	806.0125 MHz		815.0125 MHz		823.9875 MHz	
	Result (dBm)	Result (W)	Result (dBm)	Result (W)	Result (dBm)	Result (W)
Peak	38.02	6.34	37.95	6.237	37.96	6.252
Average	35.28	3.37	35.55	3.589	35.56	3.597

Table 5 - ERP

Tetra - Upper Band (851MHz to 869 MHz)

Peak/Average	851.0125 MHz		860.0125 MHz		868.9875 MHz	
	Result (dBm)	Result (W)	Result (dBm)	Result (W)	Result (dBm)	Result (W)
Peak	37.91	6.18	38.02	6.34	37.99	6.30
Average	35.64	3.66	35.38	3.45	35.67	3.69

Table 6 - ERP

FCC 47 CFR Part 90, Limit Clause 90.205

Frequency (MHz)	Limit
< 25	1000 W
25 to 50	300 W
72 to 76	300 W
150 to 174	Refer to 90.205 (d) of the specification
217 to 220	Refer to 90.259 of the specification
220 to 222	Refer to 90.729 of the specification
421 to 430	Refer to 90.279 of the specification
450 to 470	Refer to 90.205 (h) of the specification
470 to 512	Refer to 90.307 and 90.309 of the specification
758 to 775 and 788 to 805	Refer to 90.541 and 90.542 of the specification
806 to 824, 851 to 869, 869 to 901 and 935 to 940	Refer to 90.635 of the specification
902 to 927.25	LMS systems operating pursuant to subpart M of the specification : 30 W
927.25 to 928	LMS equipment: 300 W
929 to 930	Refer to 90.494 of the specification
1427 to 1429.5 and 1429.5 to 1432	Refer to 90.259 of the specification
2450 to 2483.5	5 W
4940 to 4990	Refer to 90.1215 of the specification
5850 to 5925	Refer to subpart M of the specification
All other frequency bands	On a case by case basis

Table 7 - FCC Limits for Maximum ERP

FCC 47 CFR Part 90, Limit Clause 90.635

<100 W, (<20 dBW or <50 dBm)

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
27.41 to 28 and 29.7 to 50	300	30
72 to 76	No Limit	1
138 to 174	111100	60
217 to 217 and 219 to 220	See SRSP-512 for ERP limit	30*
220 to 222	110	50
406.1 to 430 and 450 to 470	See SRSP-511 for ERP limit	60
768 to 776 and 798 to 806	110	30 3 W ERP for portable equipment
806 to 821, 851 to 866, 821 to 824 and 866 to 869	110	30
896 to 901 and 935 to 940	110	60
929 to 930 and 931 to 932	110	30
928 to 929, 952 to 953, 932 to 932.5 and 941 to 941.5	110	30
932.5 to 935 ad 941.5 to 944	110	30
*Equipment is generally authorised for effective radiated power (ERP) of less than 5 W.		

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 1.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
20dB SMA Attenuator dc - 18GHz	Sealectro	60-674-1020-89	345	12	30-Jun-2018
Multimeter	Fluke	79 Series III	498	12	09-Aug-2018
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	20-Apr-2018
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	19-Feb-2019
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	11-Jul-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Oct-2018
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	6-Mar-2019
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	20-Apr-2018
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon

Table 9

O/P Mon – Output Monitored using calibrated equipment

2.2 Types of Emissions

2.2.1 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

2.2.2 Equipment Under Test and Modification State

SC2128, S/N: Not Serialised (75941492-TSR0001) - Modification State 0

2.2.3 Date of Test

12-April-2018

NOTE: The date and time shown on the spectrum analyser plots are incorrect. The date this test was performed on is recorded in section 2.2.3.

2.2.4 Test Method

The emission designator was declared by the applicant.

Plots of the Emission Spectrum, Transmitter on Time and Transmitter Period were taken to show a representation of the transmissions from the EUT.

2.2.5 Environmental Conditions

Ambient Temperature	21.7 °C
Relative Humidity	40.8 - 40.9 %

2.2.6 Test Results

Tetra - Lower Band (806 MHz to 824 MHz) and Tetra - Upper Band (851 MHz to 869 MHz)

The emission designator declared by the applicant was 22K0DXW.

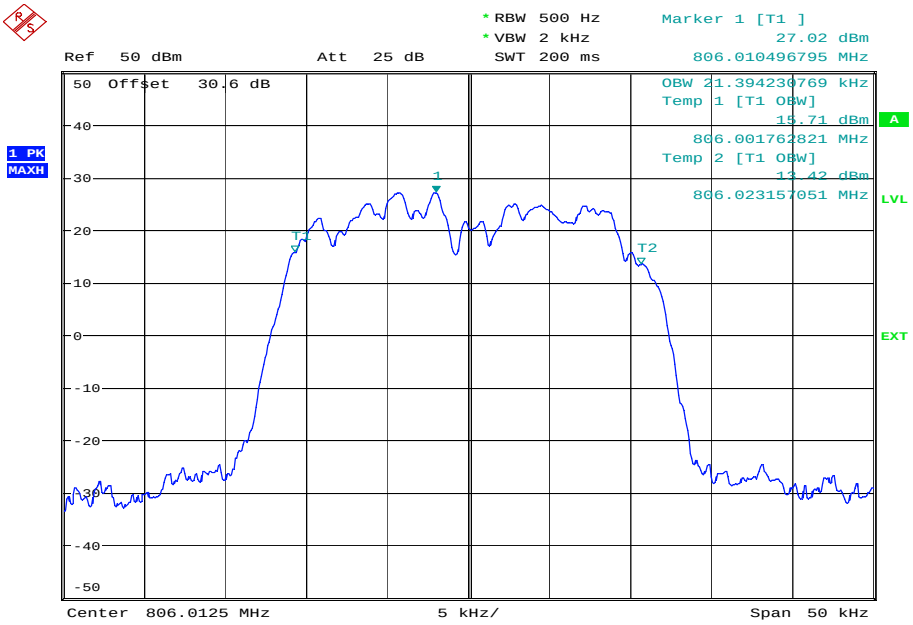

Figure 1 - Frequency Spectrum

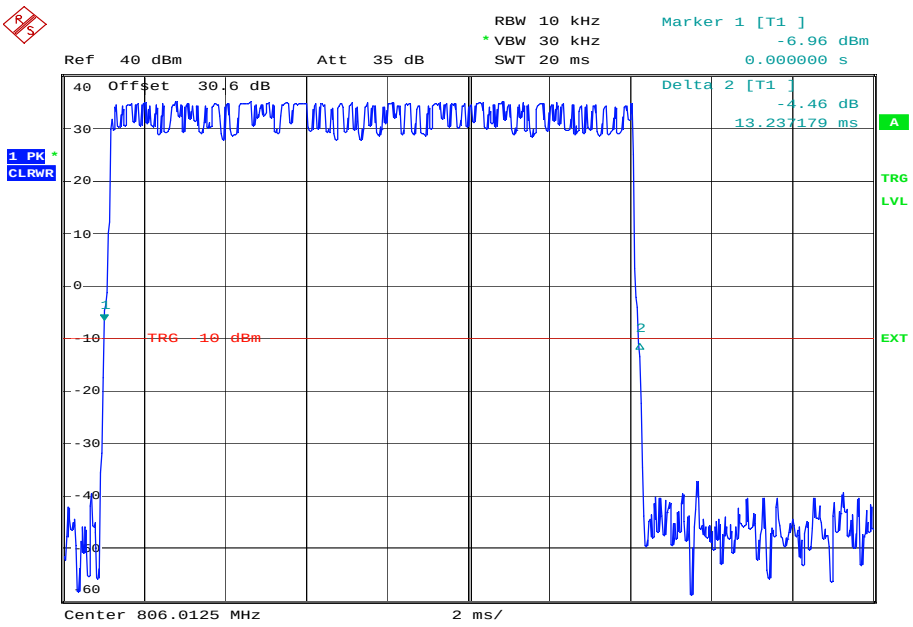

Figure 2 - Transmitter on Time

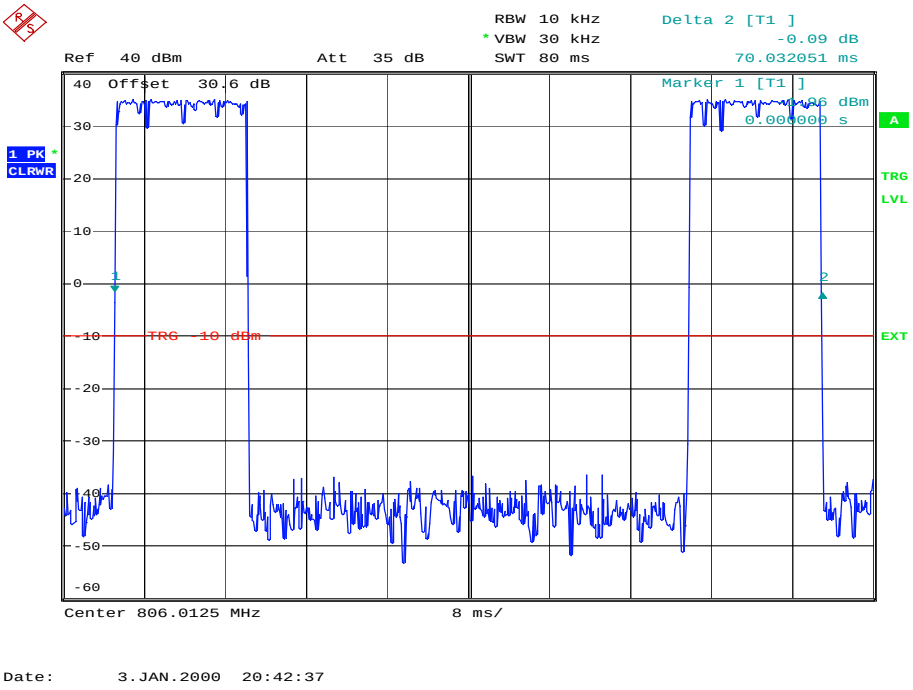

Figure 3 - Transmitter Period

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.

2.2.7 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
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	11-Apr-2018
Multimeter	Fluke	79 Series III	498	12	09-Aug-2018
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	19-Feb-2019
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	11-Jul-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	11-Apr-2018
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon

Table 10

O/P Mon – Output Monitored using calibrated equipment

2.3 Bandwidth Limitations

2.3.1 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
Industry Canada RSS-GEN, Clause 6.6

2.3.2 Equipment Under Test and Modification State

SC2128, S/N: Not Serialised (75941492-TSR0001) - Modification State 0

2.3.3 Date of Test

12-April-2018

2.3.4 Test Method

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

2.3.5 Environmental Conditions

Ambient Temperature	20.9 - 21.3 °C
Relative Humidity	40.7 - 41.3 %

2.3.6 Test Results

Tetra - Lower Band (806 MHz to 824 MHz)

Occupied Bandwidth (kHz)		
806.0125 MHz	815.0125 MHz	823.9875 MHz
21.39	21.39	21.39

Table 11 - 99% Occupied Bandwidth

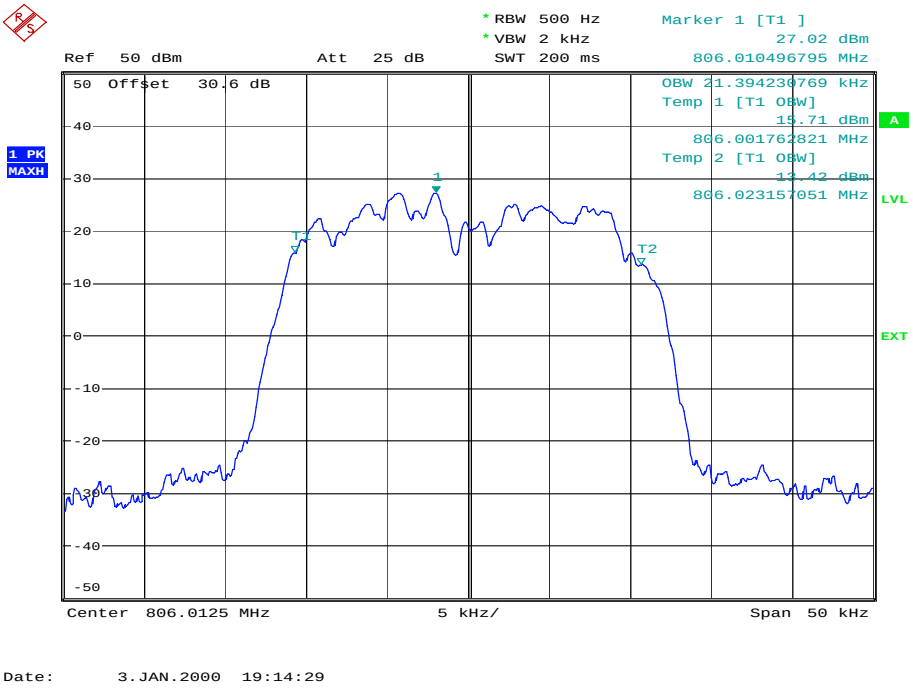

Figure 4 - 806.0125 MHz, Occupied Bandwidth

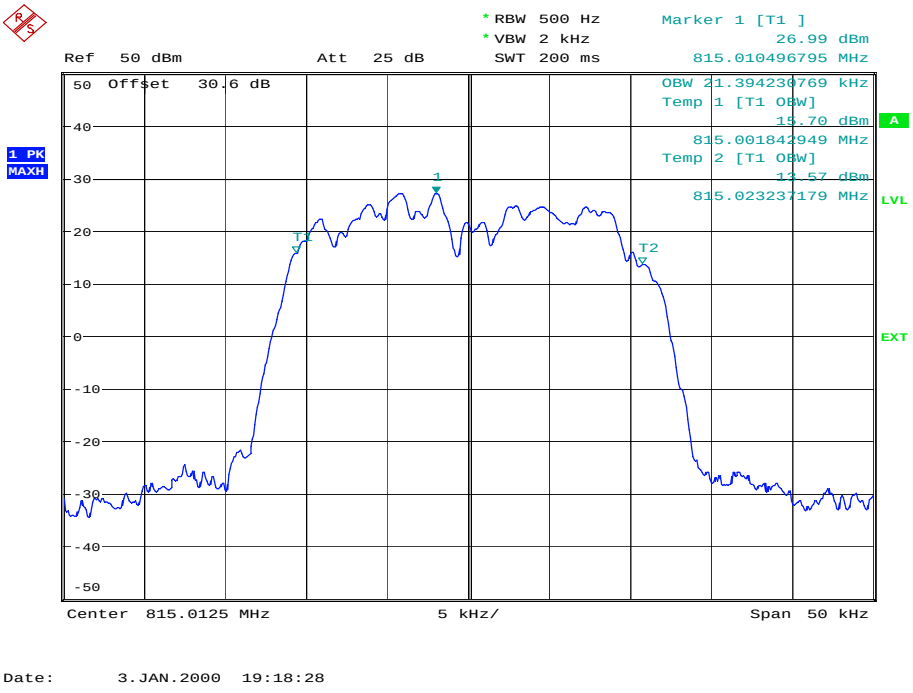

Figure 5 - 815.0125 MHz, Occupied Bandwidth

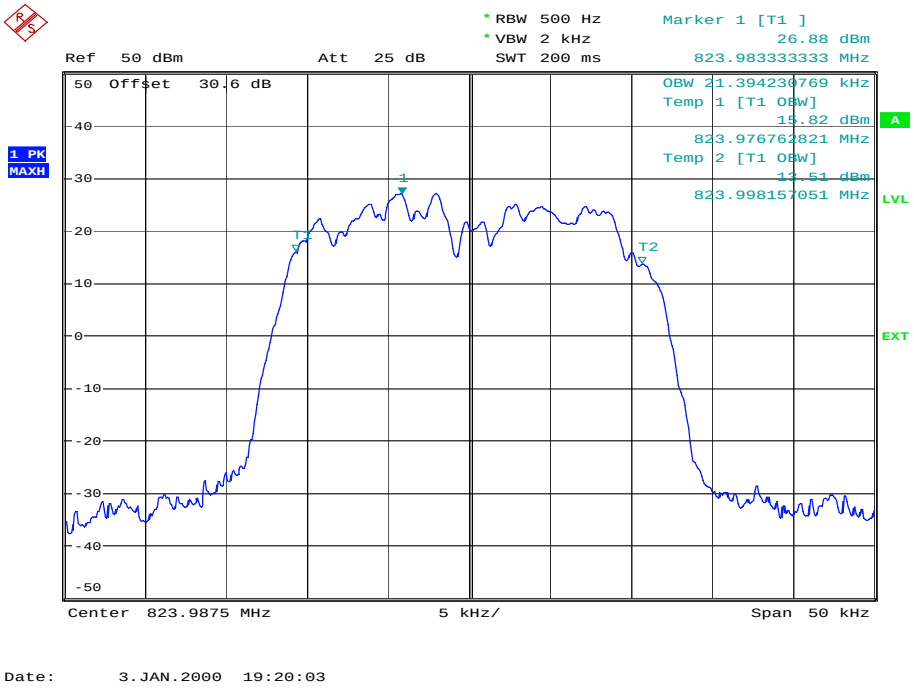

Figure 6 - 823.9875 MHz, Occupied Bandwidth

Tetra - Upper Band (851 MHz to 869 MHz)

Occupied Bandwidth (kHz)		
851.0125 MHz	860.0125 MHz	868.9875 MHz
21.47	21.47	21.96

Table 12 - 99% Occupied Bandwidth

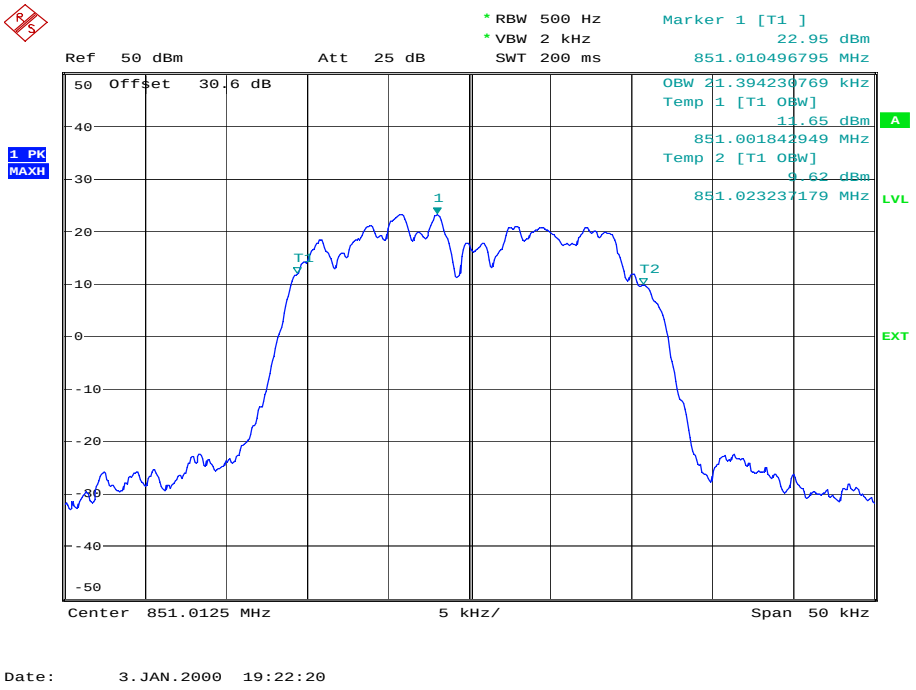

Figure 7 - 851.0125 MHz, Occupied Bandwidth

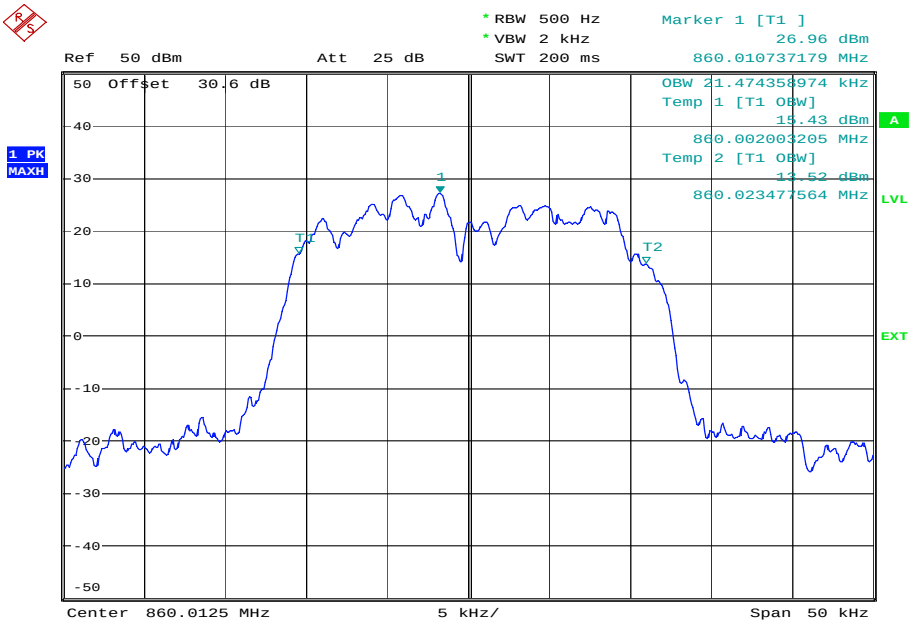

Figure 8 - 860.0125 MHz, Occupied Bandwidth

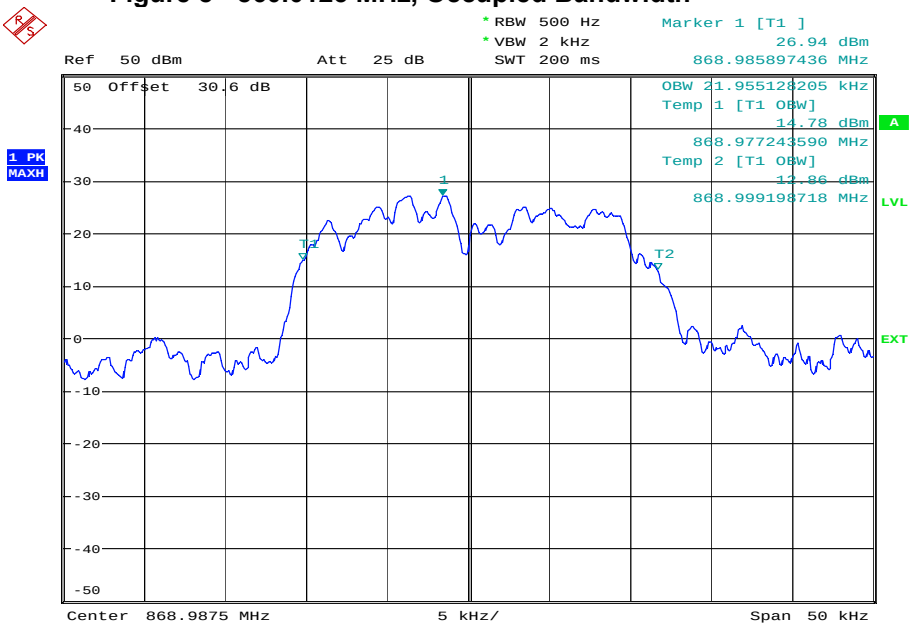

Figure 9 - 868.9875 MHz, Occupied Bandwidth

FCC 47 CFR Part 90, Limit Clause 90.209

22 kHz

NOTE: 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 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

2.3.7 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
Multimeter	Fluke	79 Series III	498	12	09-Aug-2018
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	11-Apr-2018
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	19-Feb-2019
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	11-Jul-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	11-Apr-2018
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon

Table 13

O/P Mon – Output Monitored using calibrated equipment

2.4 Spurious Emissions at Antenna Terminals

2.4.1 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
Industry Canada RSS-GEN, Clause 6.13

2.4.2 Equipment Under Test and Modification State

SC2128, S/N: Not Serialised (75941492-TSR0001) - Modification State 0

2.4.3 Date of Test

12-April-2018 to 11-June-2018

2.4.4 Test Method

For emissions where the frequency is removed less than 250% of the authorized 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 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.

2.4.5 Environmental Conditions

Ambient Temperature	22.5 - 22.7 °C
Relative Humidity	41.0 - 55.5 %

2.4.6 Test Results

Tetra - Lower Band (806 MHz to 824 MHz)

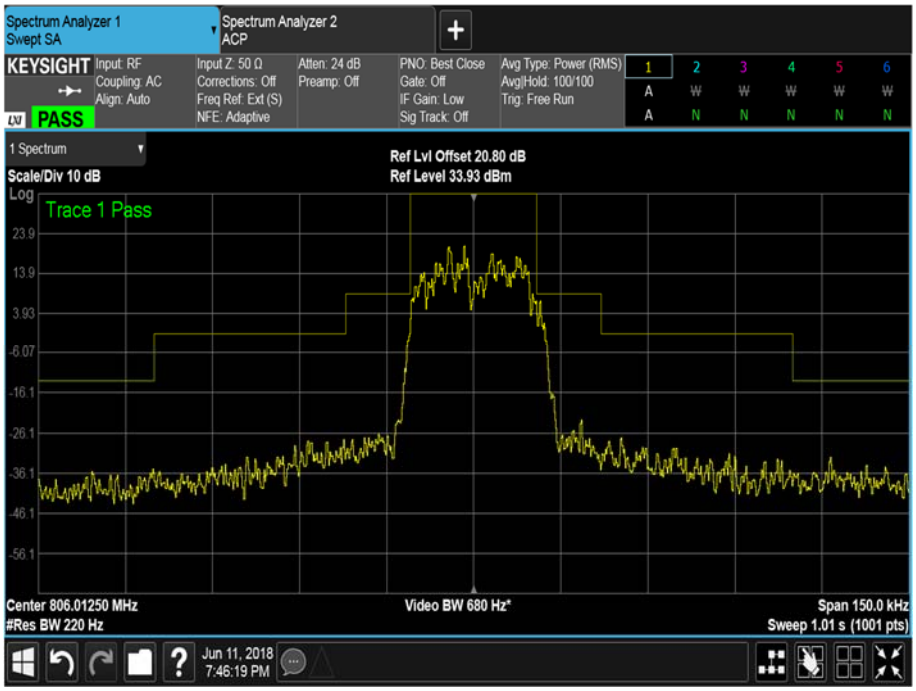

Figure 10 - FCC Emission Mask, 806.01250 MHz

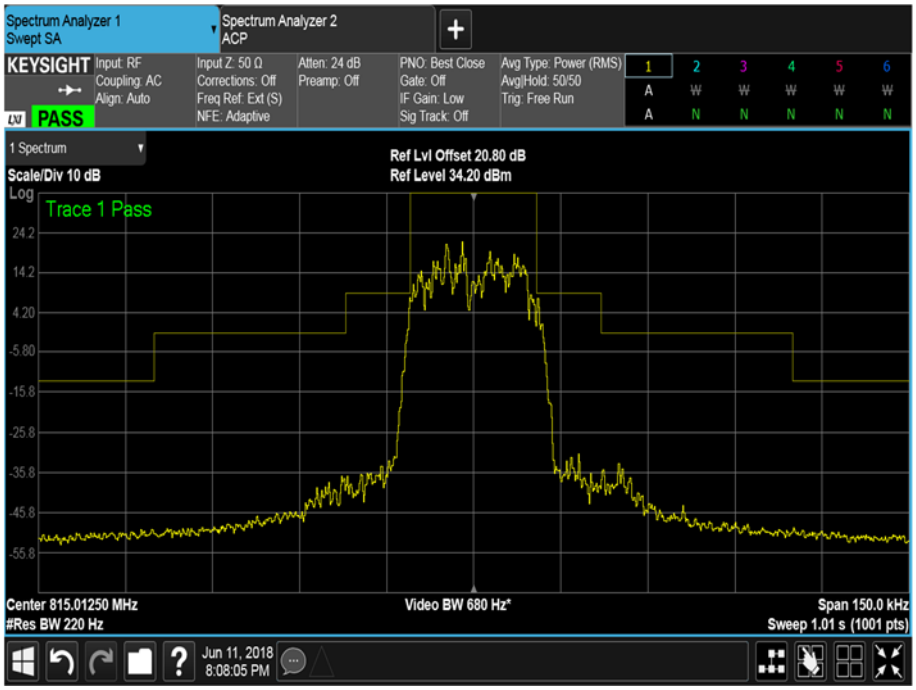

Figure 11 - FCC Emission Mask, 815.01250 MHz

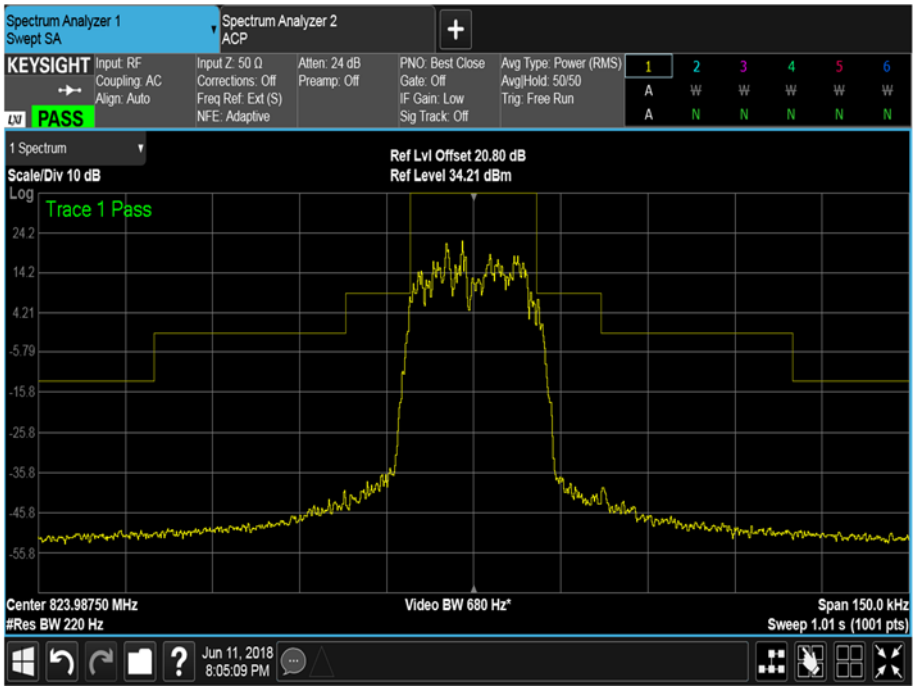

Figure 12 - FCC Emission Mask, 823.98750 MHz

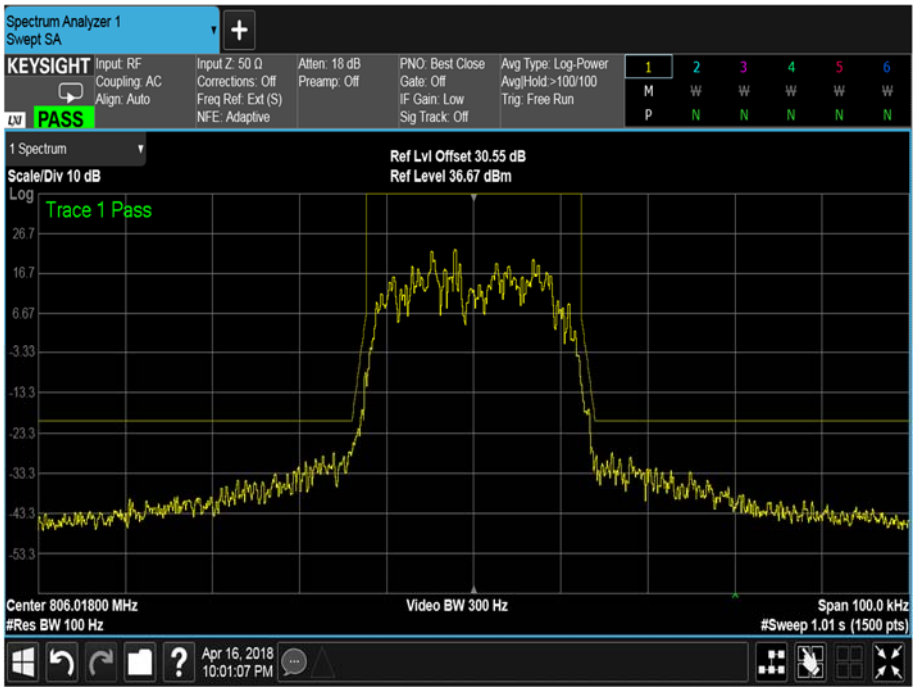

Figure 13 - ISED Emission Mask, 806.01800 MHz

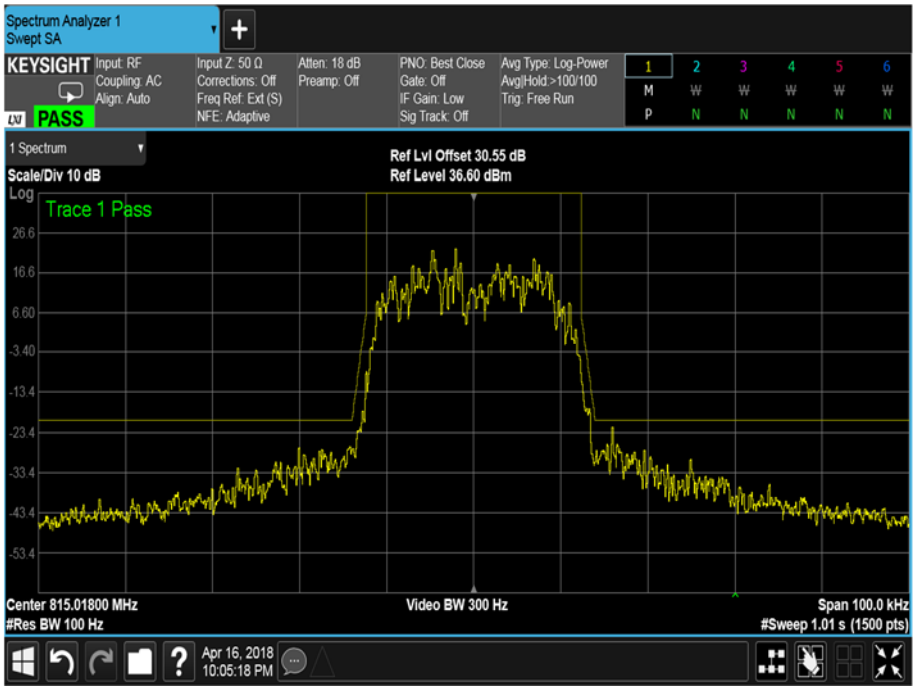

Figure 14 - ISED Emission Mask, 815.01800 MHz

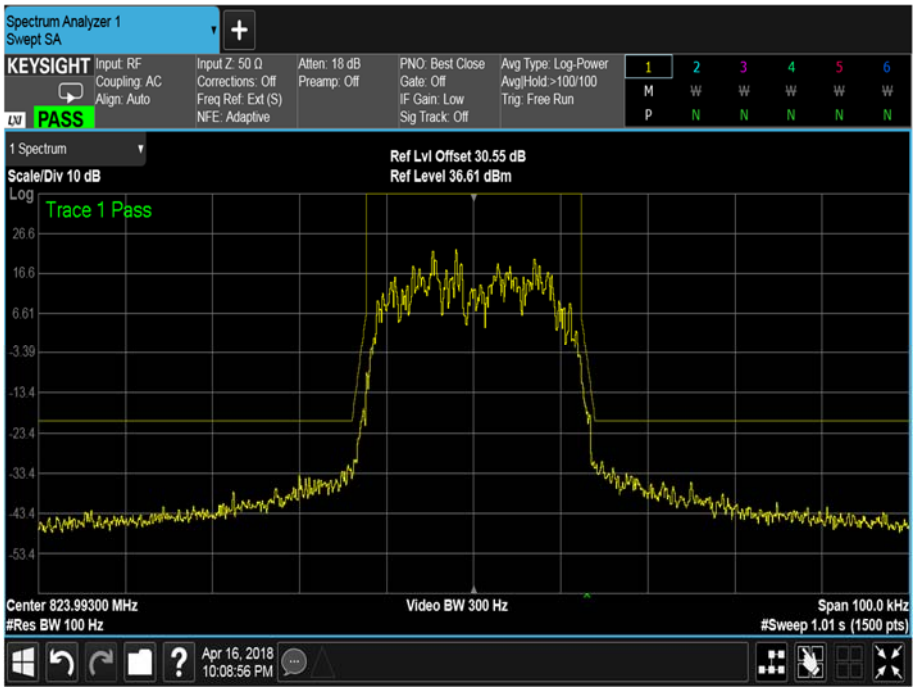

Figure 15 - ISED Emission Mask, 823.99300 MHz

Tetra - Upper Band (851MHz to 869 MHz)

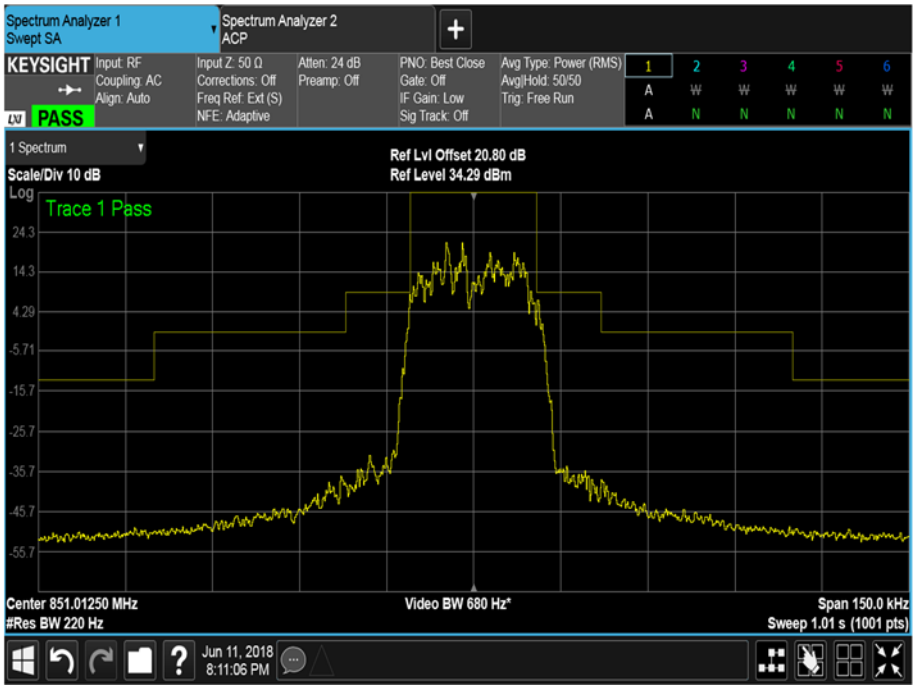

Figure 16 - FCC Emission Mask, 851.01250 MHz

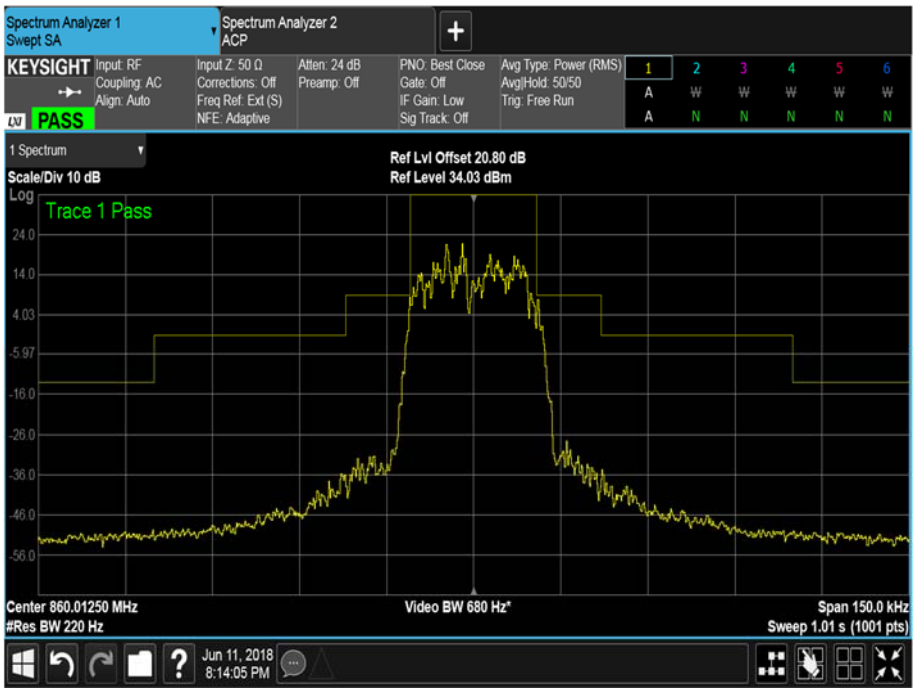

Figure 17 - FCC Emission Mask, 860.0125 MHz

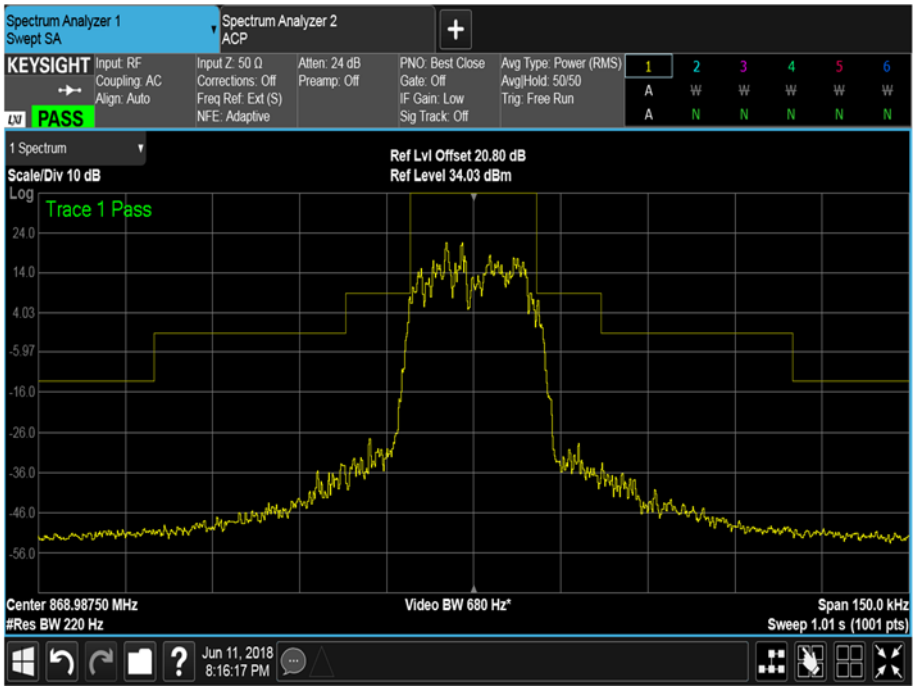

Figure 18 - FCC Emission Mask, 868.98750 MHz

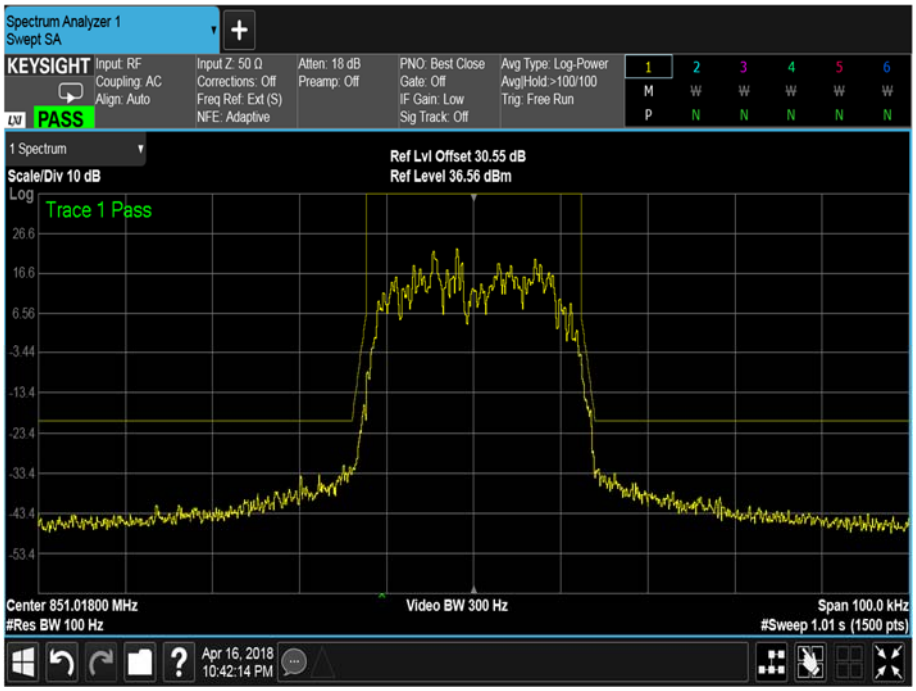

Figure 19 - ISED Emission Mask, 851.01800 MHz

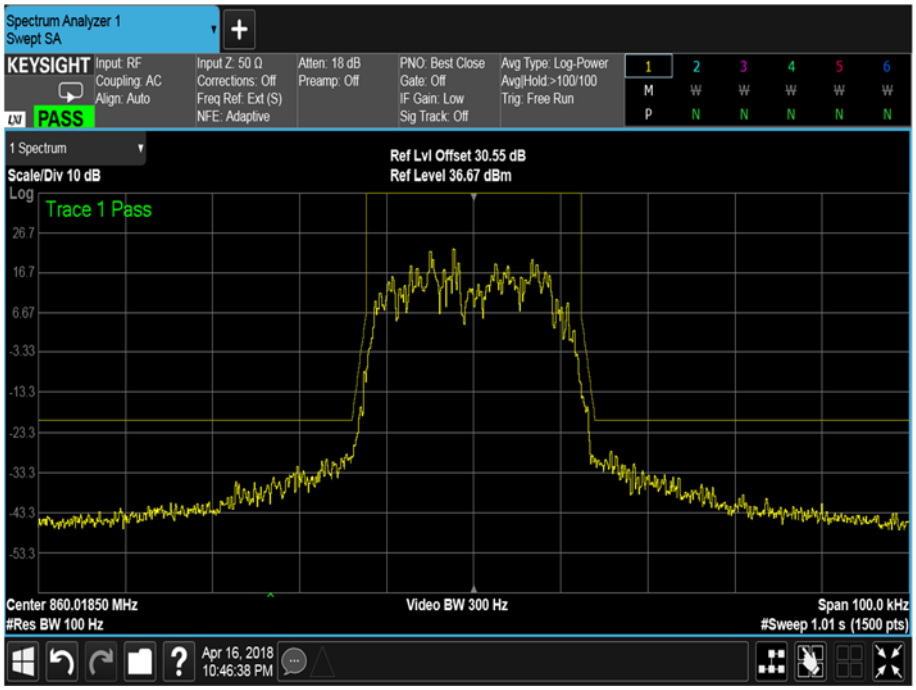

Figure 20 - ISED Emission Mask, 860.01850 MHz

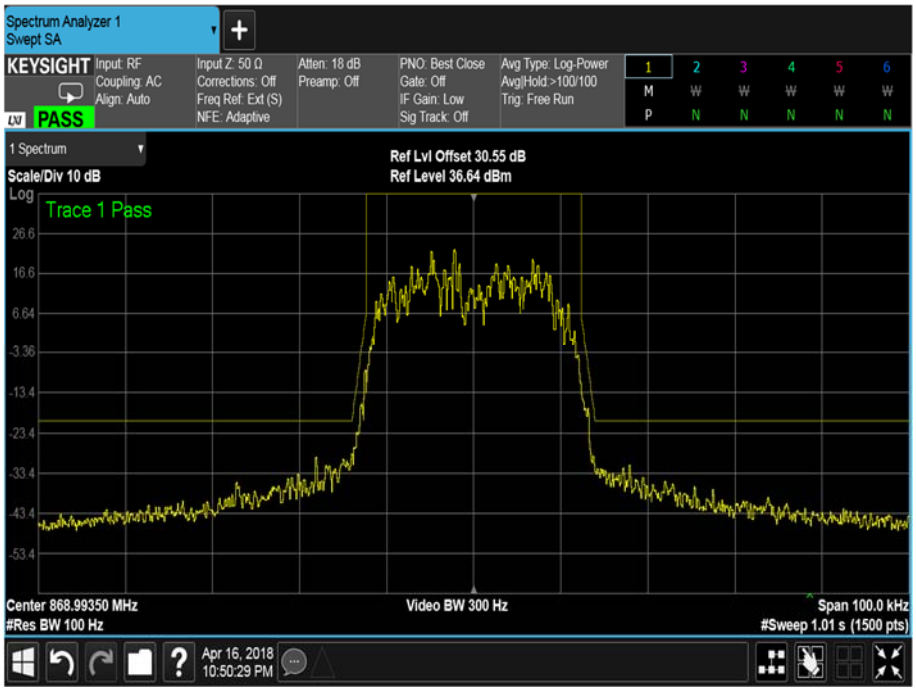

Figure 21 - ISED Emission Mask, 868.99350 MHz

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 Y as per Industry Canada RSS-119 clause 5.8.

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
Multimeter	Fluke	79 Series III	498	12	09-Aug-2018
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	11-Apr-2018
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	19-Feb-2019
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	11-Jul-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	11-Apr-2018
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon

Table 14

O/P Mon – Output Monitored using calibrated equipment

2.5 Radiated Spurious Emissions

2.5.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.210
FCC 47 CFR Part 2, Clause 2.1053
Industry Canada RSS-119, Clause 5.8
Industry Canada RSS-GEN, Clause 6.13

2.5.2 Equipment Under Test and Modification State

SC2128, S/N: Not Serialised (75941492-TSR0002) - Modification State 0

2.5.3 Date of Test

11-April-2018 to 22-April-2018

NOTE: The date and time shown on the spectrum analyser plots are incorrect. The dates this test was performed on is recorded above.

2.5.4 Test Method

Testing was performed in accordance with ANSI C63.26-2015 clause 5.5.

Prescans were performed using the direct field strength method. Any emissions found within 10 dB of the specification limit were formally measured using the substitution method.

The limit line on the prescan plots was calculated from equation c) in clause 5.2.7

Measurements were made in field strength (dBµV/m) and were converted to EIRP using the following correction factor:

$LIMIT_{(Field\ Strength\ at\ 3\ meters)} = LIMIT_{(EIRP)} + 95.2$
82.2 dBµV/m at 3 m = -13 dBm + 95.2 dB.

2.5.5 Environmental Conditions

Ambient Temperature	22.7 °C
Relative Humidity	42.0 %

2.5.6 Test Results

Tetra - Lower Band (806 MHz to 824 MHz)

Frequency (MHz)	Level (dBm)
*	

Table 15 - 806.00950 MHz, Emissions Results

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

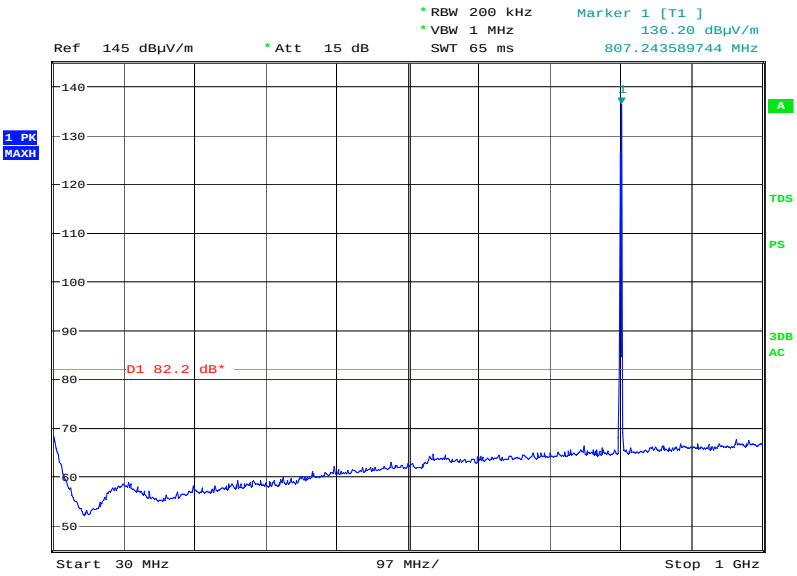

Figure 22 - 806.00950 MHz, 30 MHz to 1 GHz, EUT Orientation X

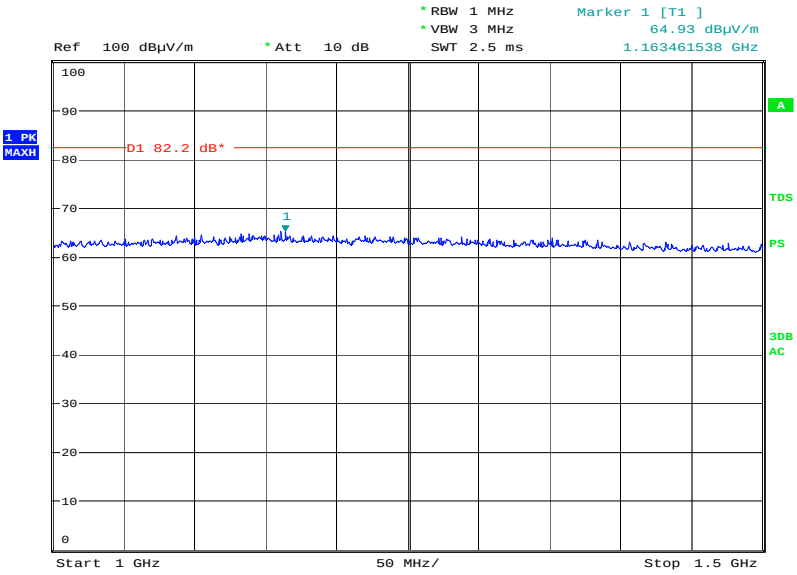

Figure 23 - 806.00950 MHz, 1 GHz to 1.5 GHz, EUT Orientation X

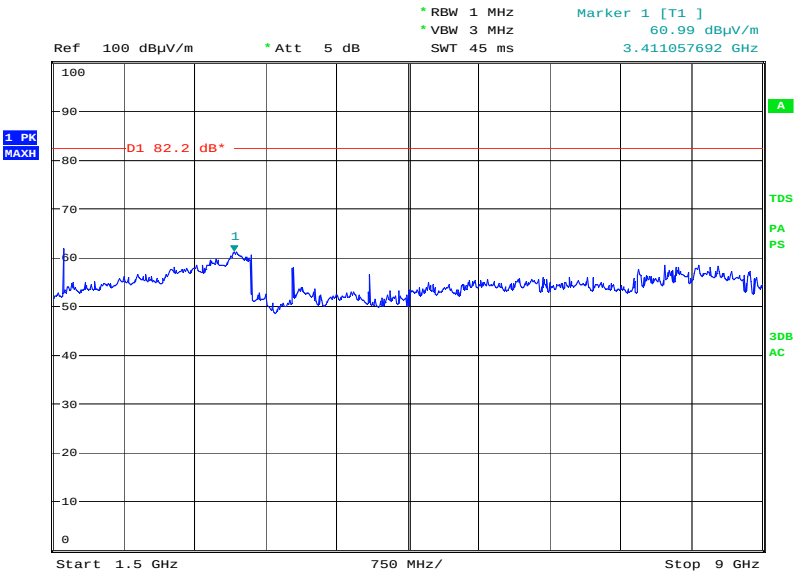

Figure 24 806.00950 MHz, 1 GHz to 9 GHz, EUT Orientation X

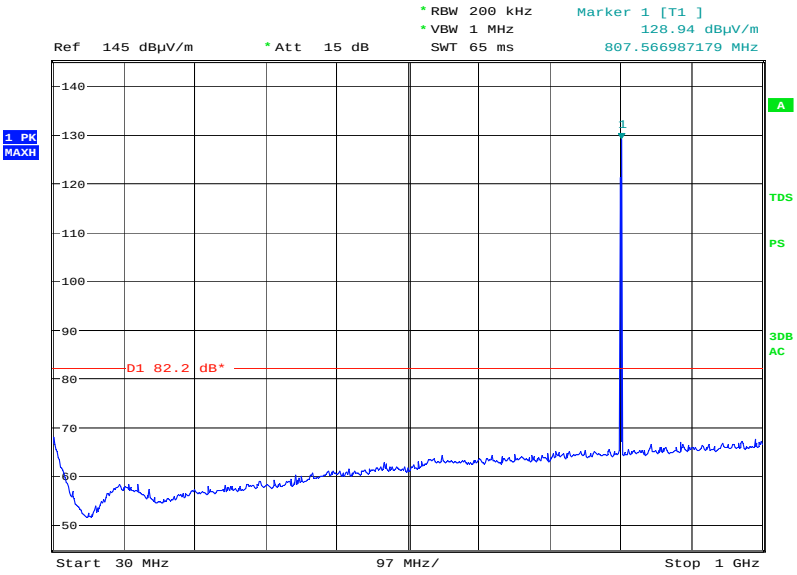

Figure 25 - 806.00950 MHz, 30 MHz to 1 GHz, EUT Orientation Y

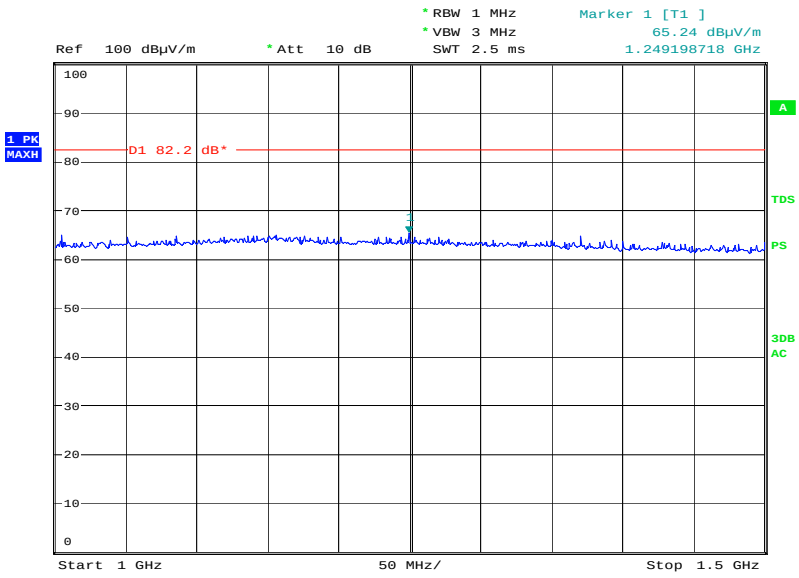

Figure 26 - 806.00950 MHz, 1 GHz to 1.5 GHz, EUT Orientation Y

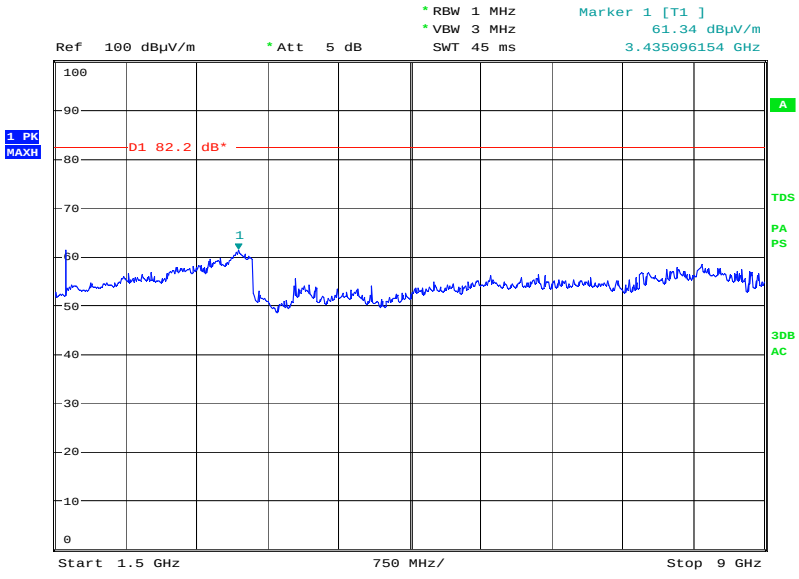

Figure 27 - 806.00950 MHz, 1.5 GHz to 9 GHz, EUT Orientation Y

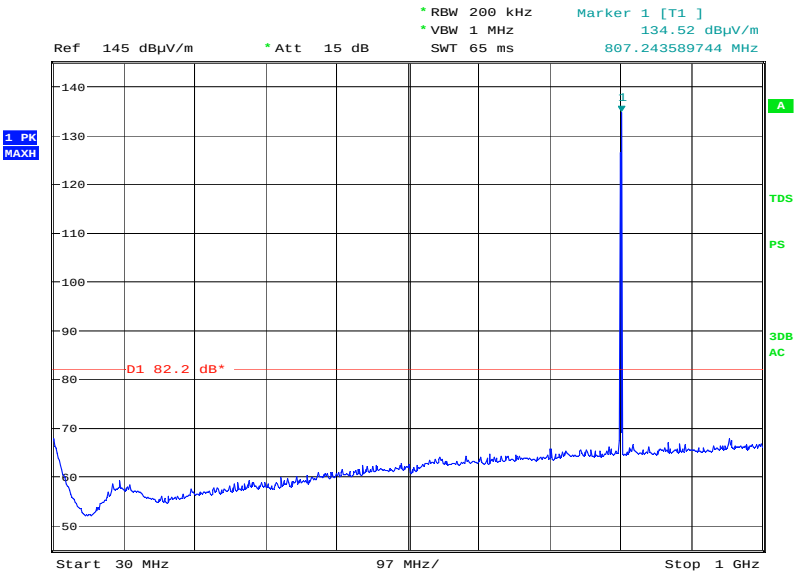

Figure 28 - 806.00950 MHz, 30 MHz to 1 GHz, EUT Orientation Z

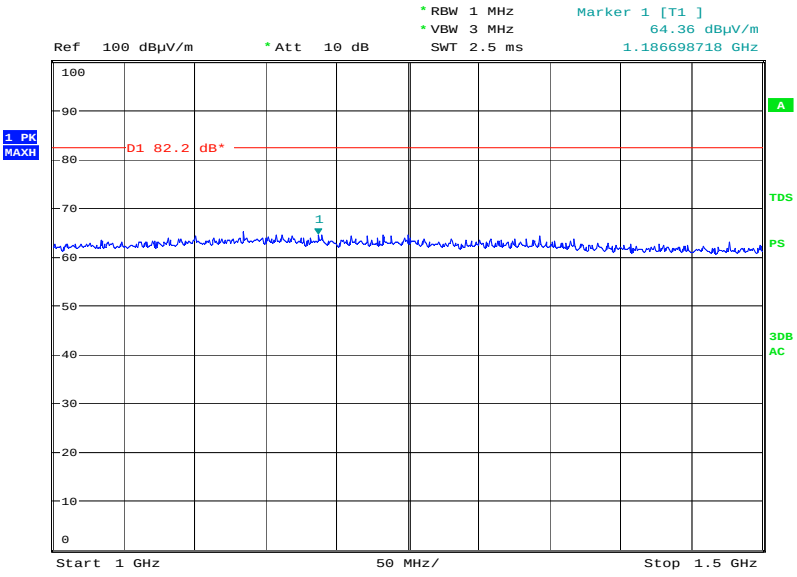

Figure 29 - 806.00950 MHz, 1 GHz to 1.5 GHz, EUT Orientation Z

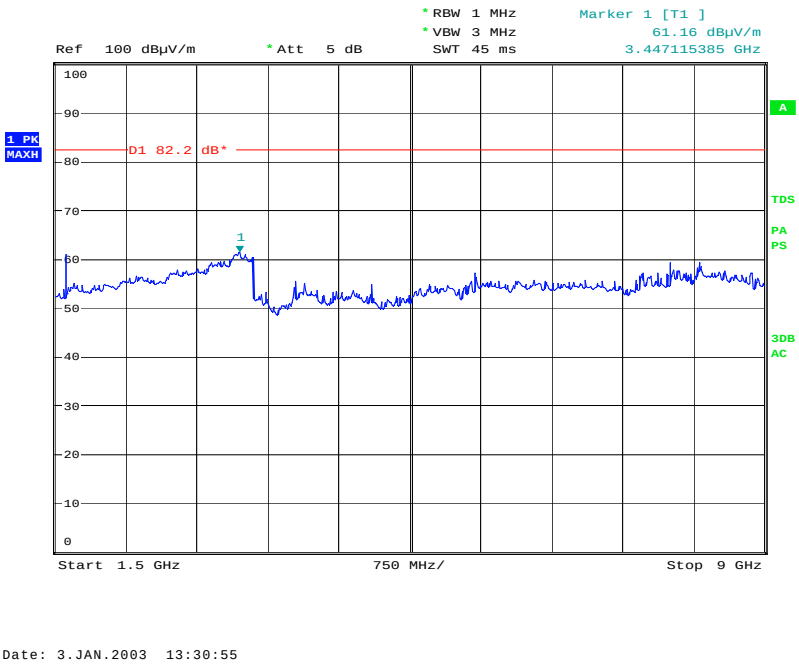

Figure 30 - 806.00950 MHz, 1 GHz to 9 GHz, EUT Orientation Z

Frequency (MHz)	Level (dBm)
*	

Table 16 - 815.00875 MHz - Emissions Results

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

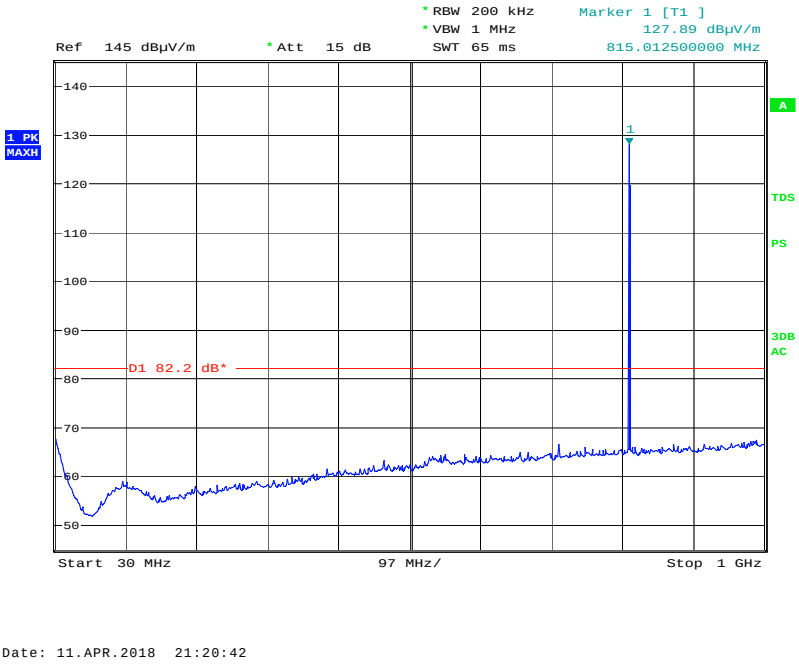

Figure 31 - 815.00875 MHz, 30 MHz to 1 GHz, EUT Orientation X

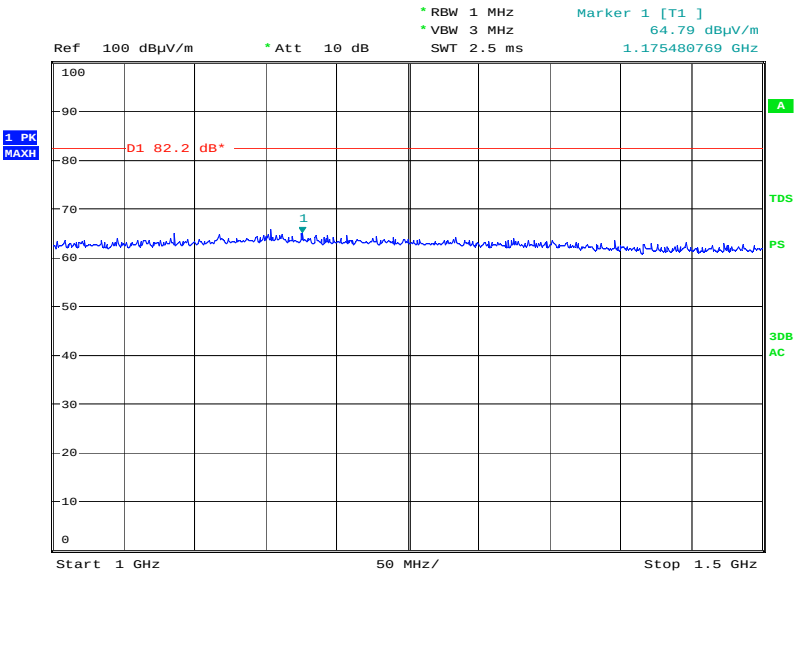

Figure 32 - 815.00875 MHz, 1 GHz to 1.5 GHz, EUT Orientation X

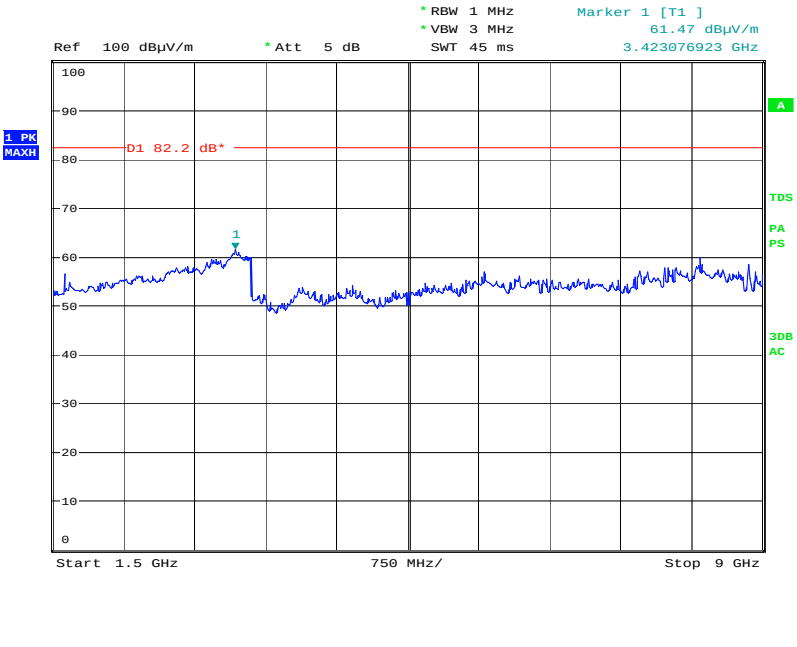

Figure 33 815.00875 MHz, 1 GHz to 9 GHz, EUT Orientation X

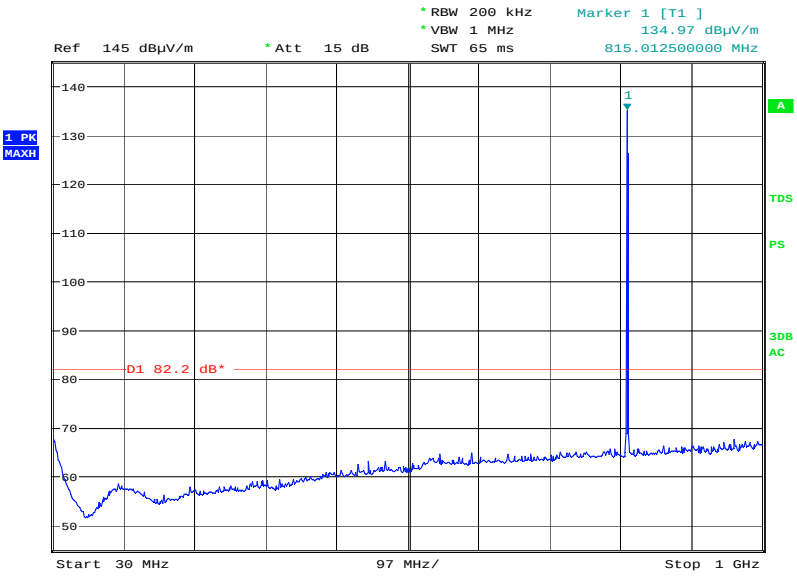

Figure 34 - 815.00875 MHz, 30 MHz to 1 GHz, EUT Orientation Y

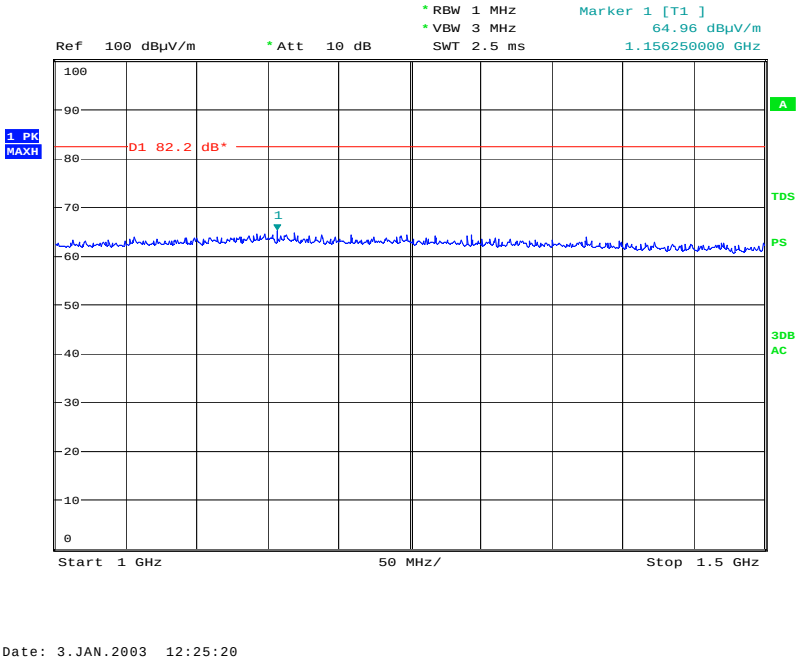

Figure 35 - 815.00875 MHz, 1 GHz to 1.5 GHz, EUT Orientation Y

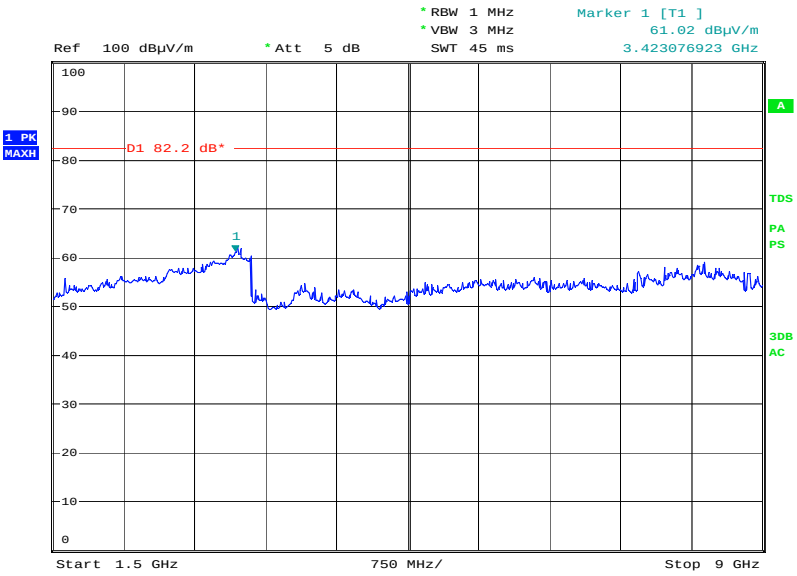

Figure 36 - 815.00875 MHz, 1.5 GHz to 9 GHz, EUT Orientation Y

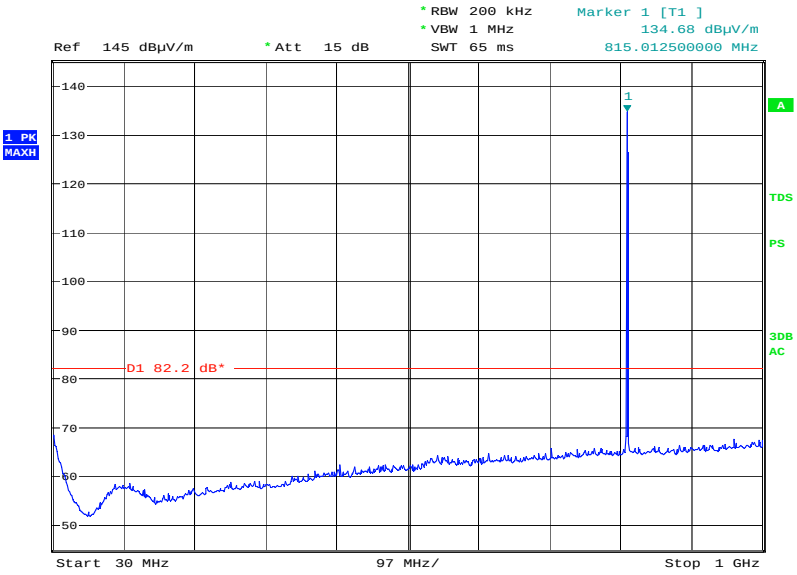

Figure 37 - 815.00875 MHz, 30 MHz to 1 GHz, EUT Orientation Z

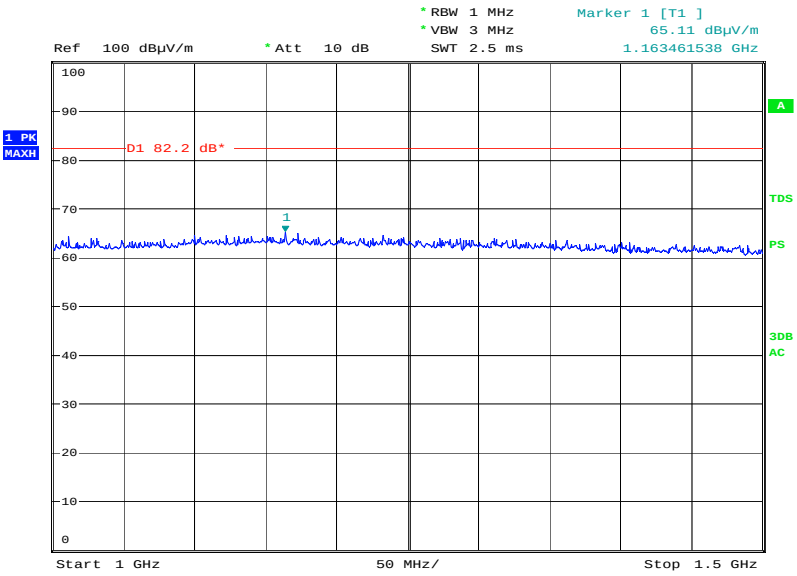

Figure 38 - 815.00875 MHz, 1 GHz to 1.5 GHz, EUT Orientation Z

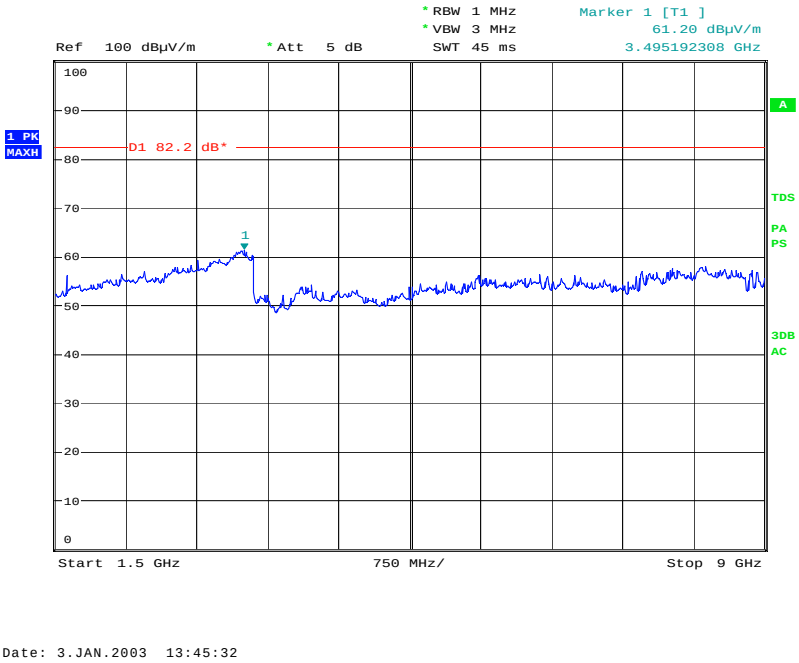

Figure 39 - 815.00875 MHz, 1 GHz to 9 GHz, EUT Orientation Z

Frequency (MHz)	Level (dBm)
*	

Table 17 - 823.98375 MHz - Emissions Results

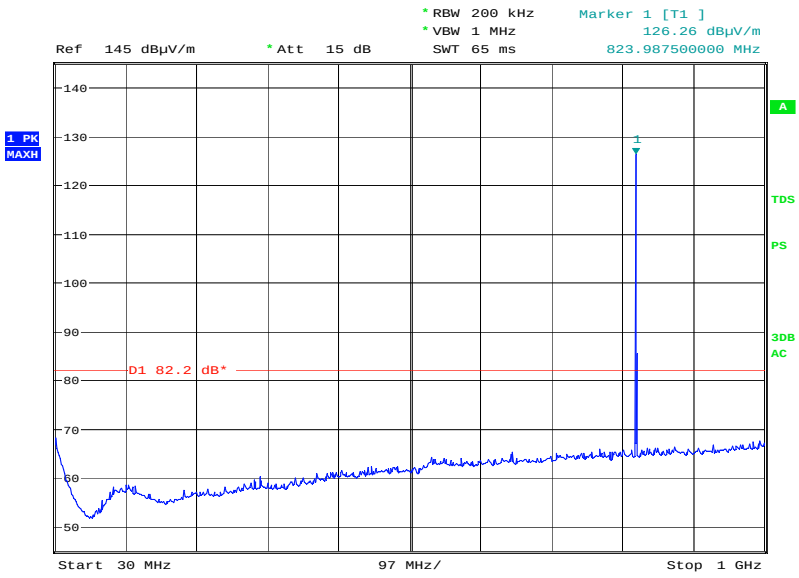

Figure 40 - 823.98375 MHz, 30 MHz to 1 GHz, EUT Orientation X

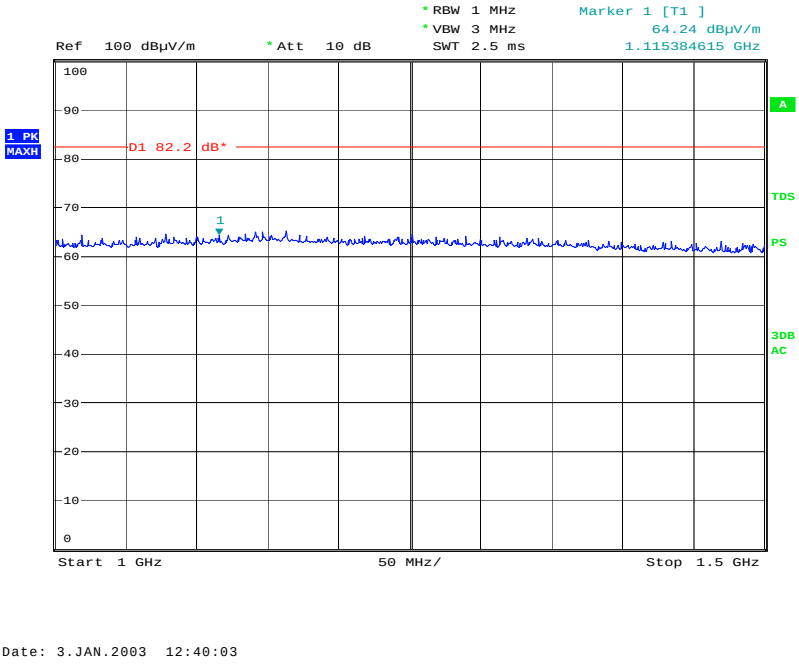

Figure 41 - 823.98375 MHz, 1 GHz to 1.5 GHz, EUT Orientation X

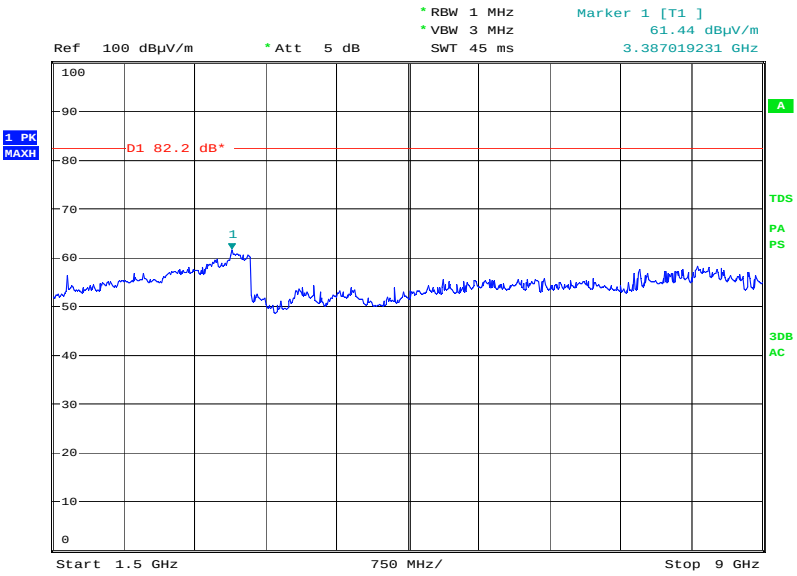

Figure 42 - 823.98375 MHz, 1 GHz to 9 GHz, EUT Orientation X

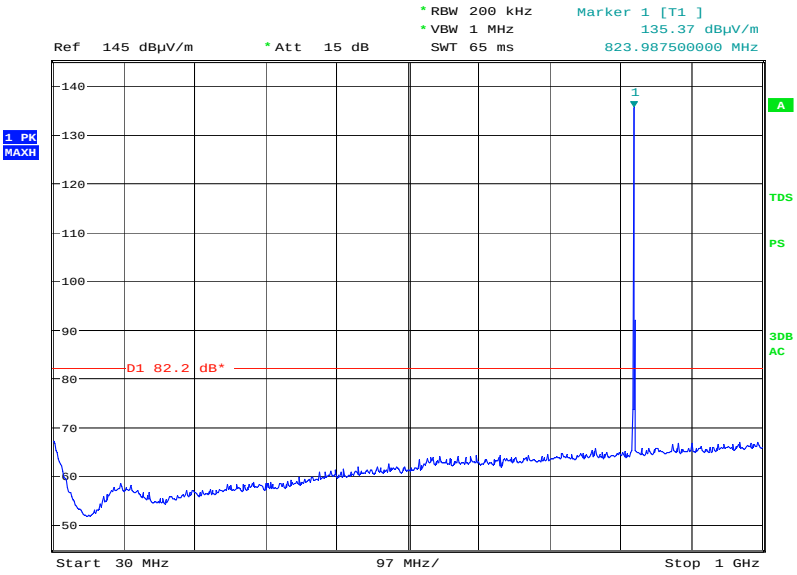

Figure 43 - 823.98375 MHz, 30 MHz to 1 GHz, EUT Orientation Y

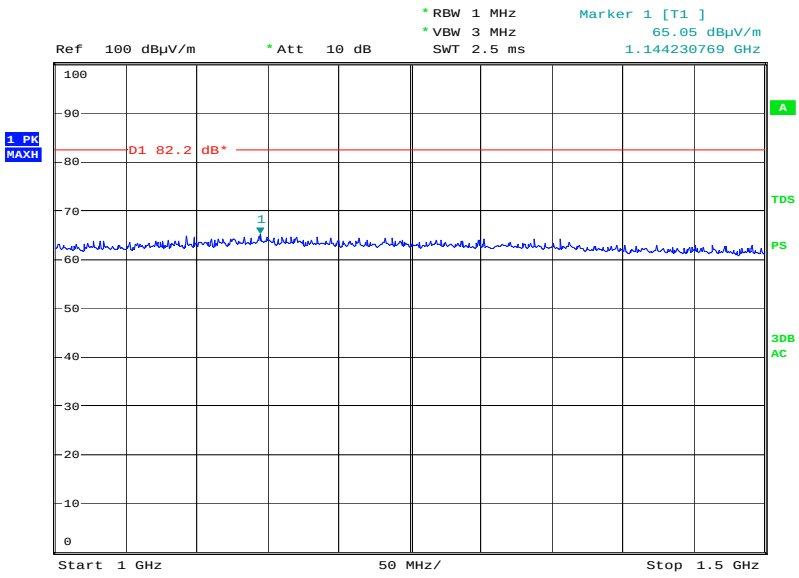

Figure 44 - 823.98375 MHz, 1 GHz to 1.5 GHz, EUT Orientation Y

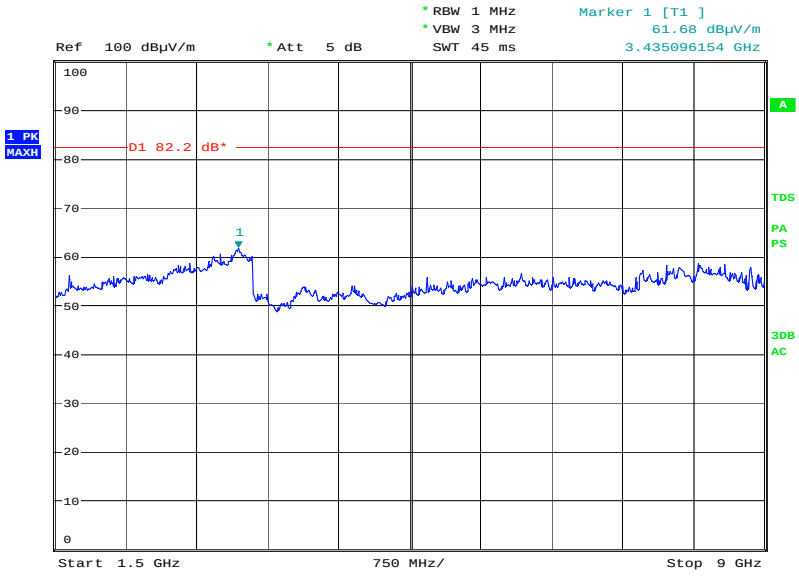

Figure 45 - 823.98375 MHz, 1.5 GHz to 9 GHz, EUT Orientation Y

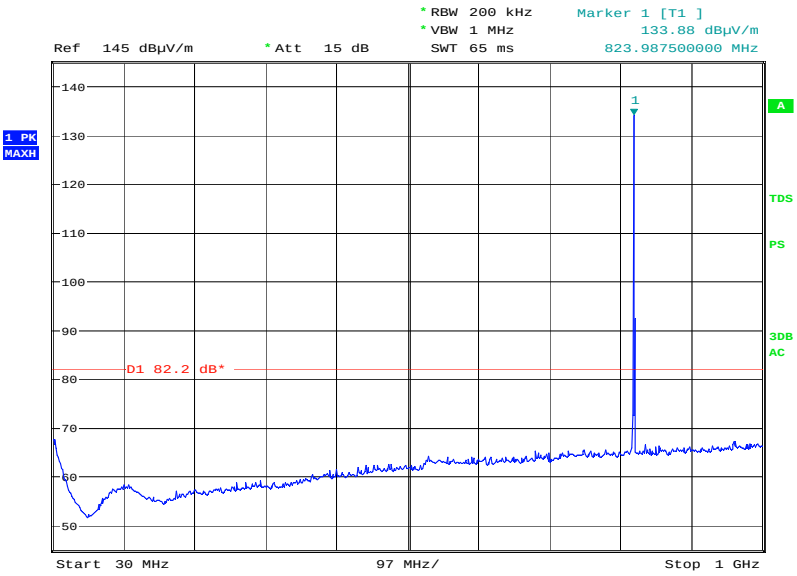

Figure 46 - 823.98375 MHz, 30 MHz to 1 GHz, EUT Orientation Z

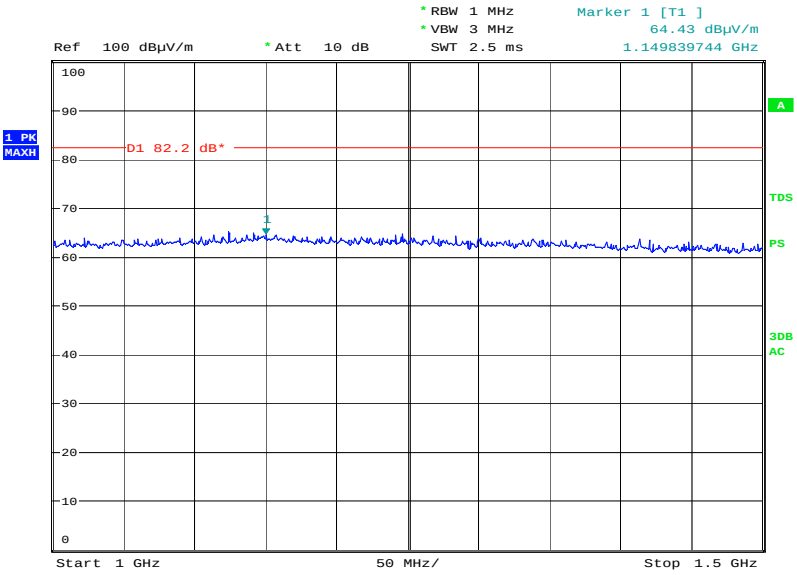

Figure 47 - 823.98375 MHz, 1 GHz to 1.5 GHz, EUT Orientation Z

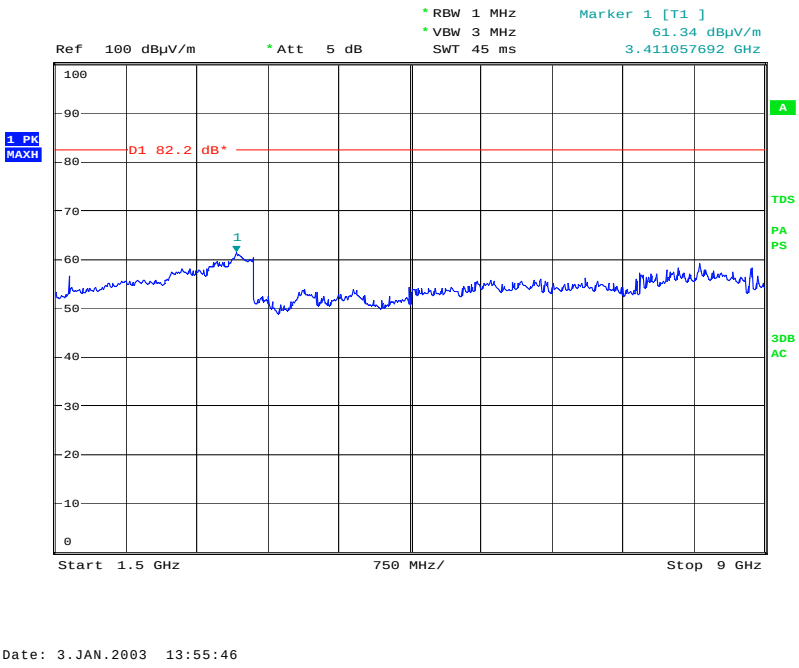

Figure 48 - 823.983750 MHz, 1 GHz to 9 GHz, EUT Orientation Z

Tetra - Upper Band (851 MHz to 869 MHz)

Frequency (MHz)	Level (dBm)
1702.043	-22.60

Table 18 - 851.00950 MHz, Emissions Results

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

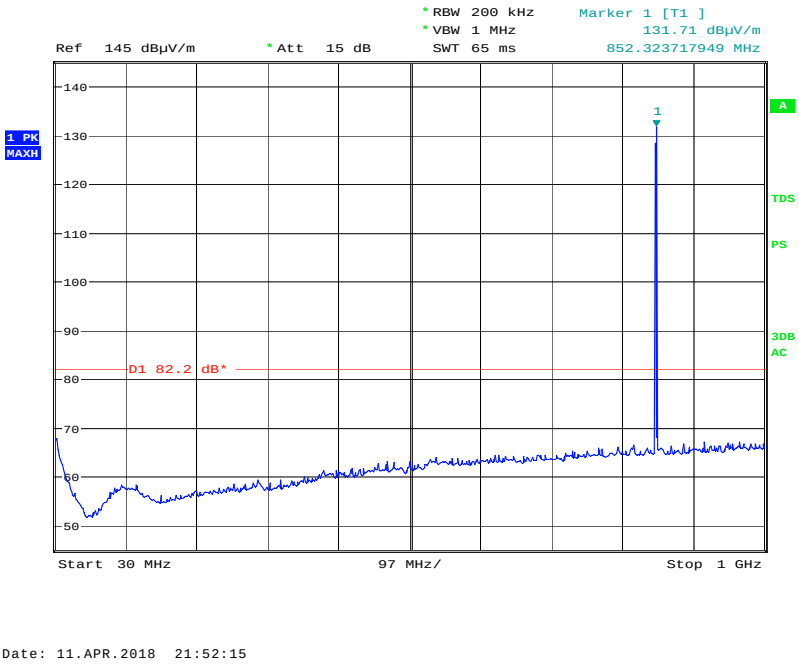

Figure 49 - 851.00950 MHz, 30 MHz to 1 GHz, EUT Orientation X

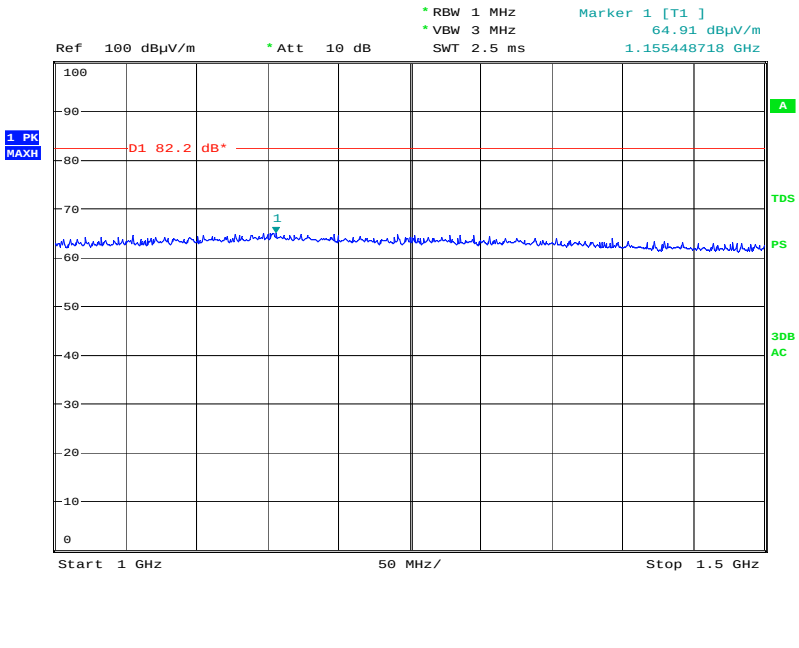

Figure 50 - 851.00950 MHz, 1 GHz to 1.5 GHz, EUT Orientation X

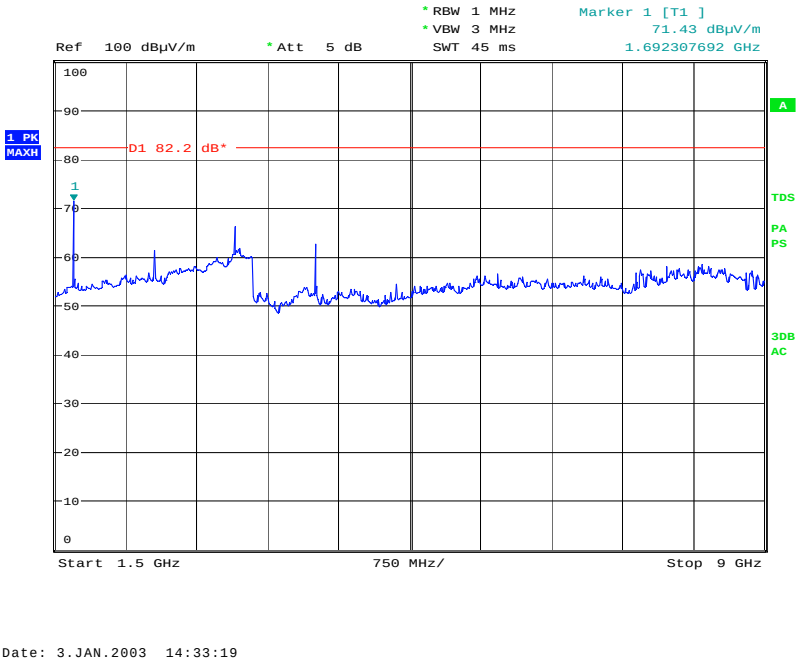

Figure 51 - 851.00950 MHz, 1 GHz to 9 GHz, EUT Orientation X

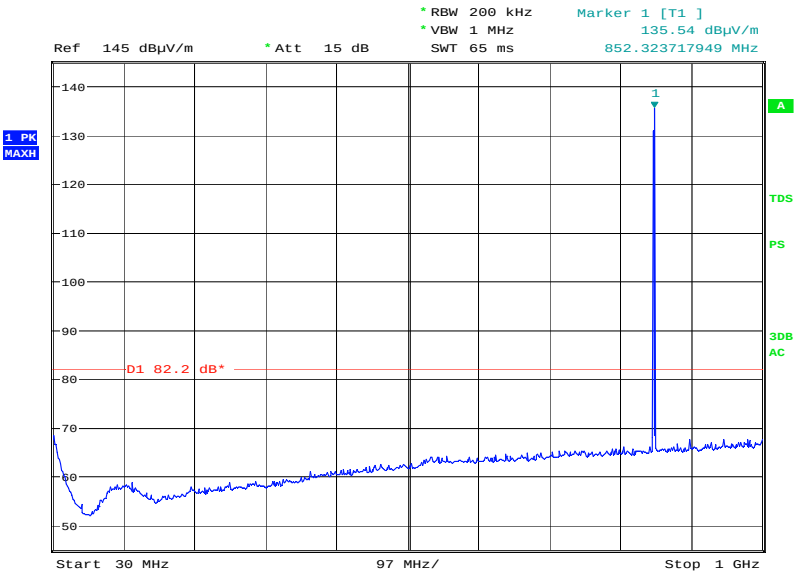

Figure 52 - 851.00950 MHz, 30 MHz to 1 GHz, EUT Orientation Y

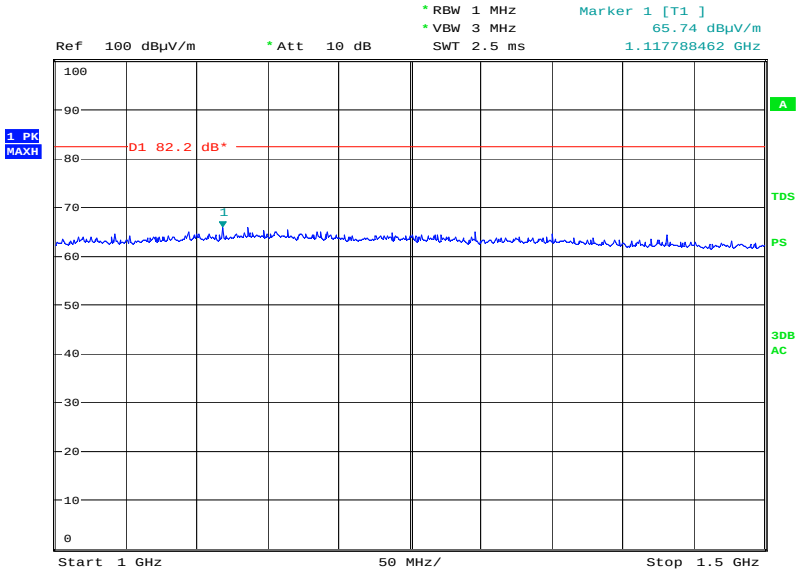

Figure 53 - 851.00950 MHz, 1 GHz to 1.5 GHz, EUT Orientation Y

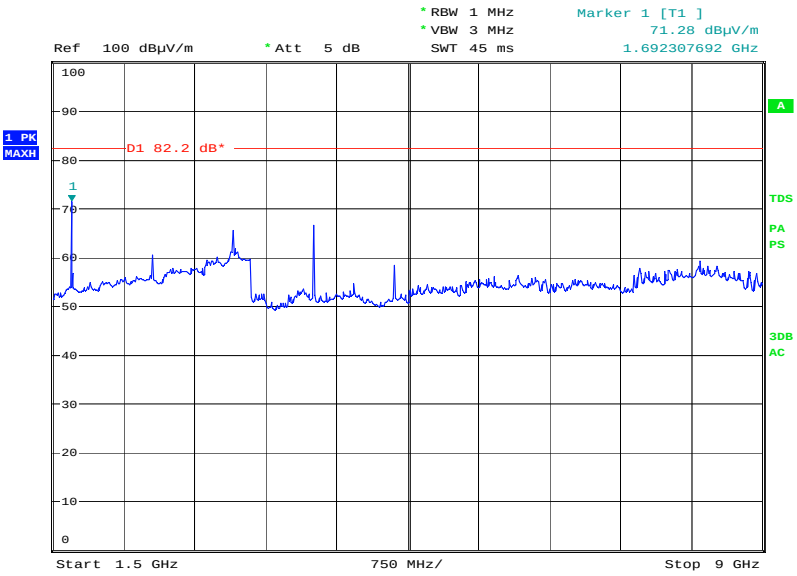

Figure 54 - 851.00950 MHz, 1.5 GHz to 9 GHz, EUT Orientation Y

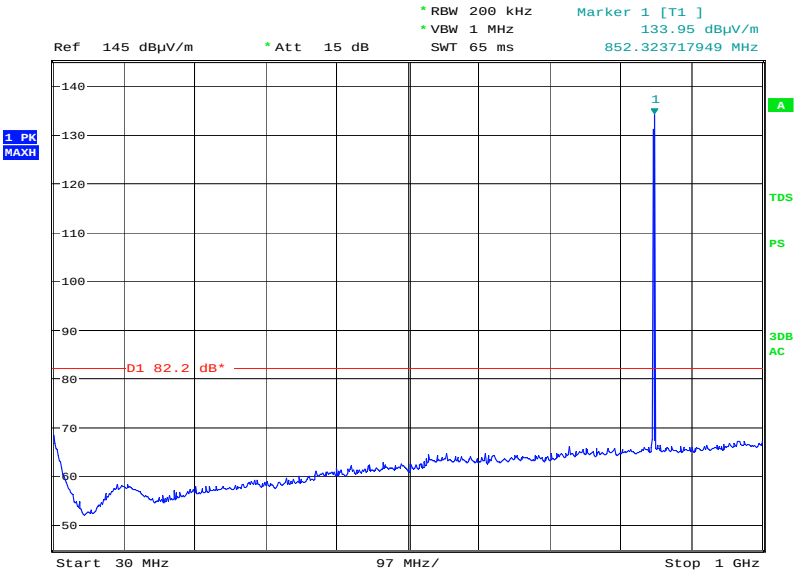

Figure 55 - 851.00950 MHz, 30 MHz to 1 GHz, EUT Orientation Z

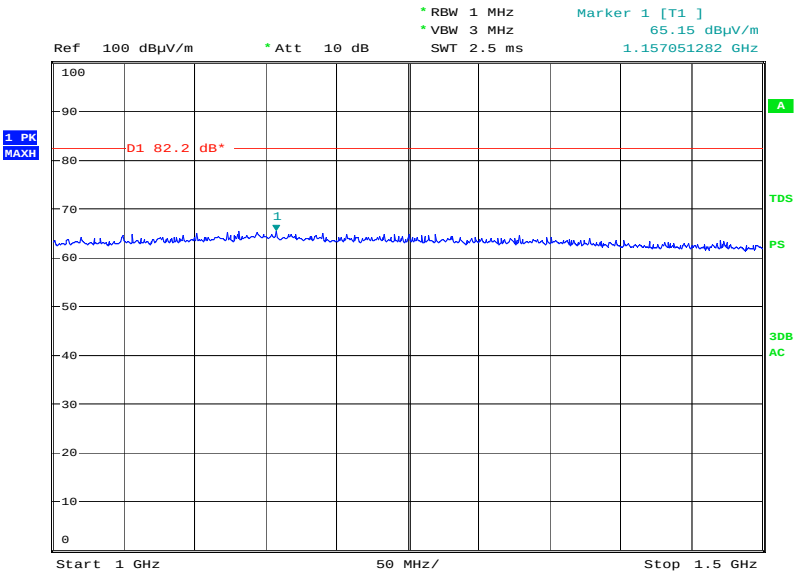

Figure 56 - 851.00950 MHz, 1 GHz to 1.5 GHz, EUT Orientation Z

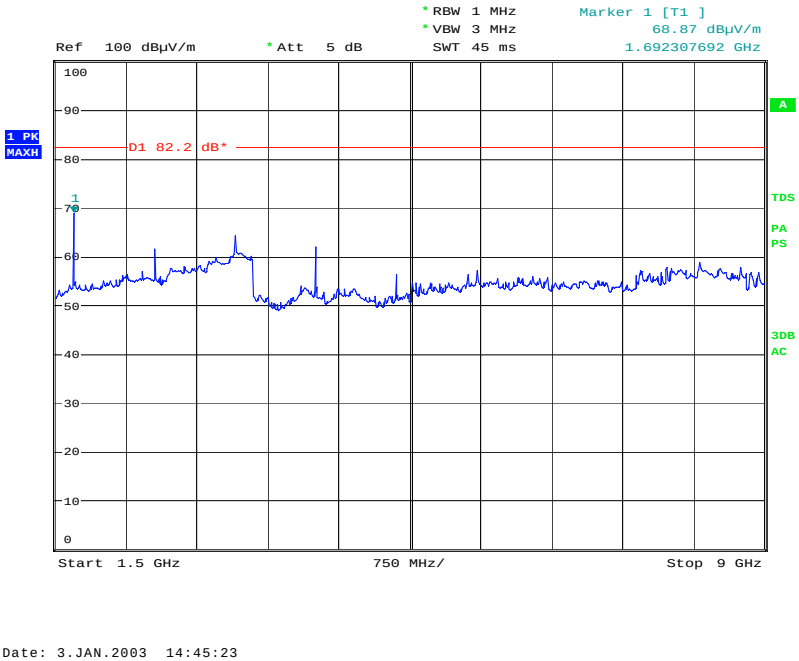

Figure 57 - 851.00950 MHz, 1 GHz to 9 GHz, EUT Orientation Z

Frequency (MHz)	Level (dBm)
*	

Table 19 - 860.00875 MHz - Emissions Results

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

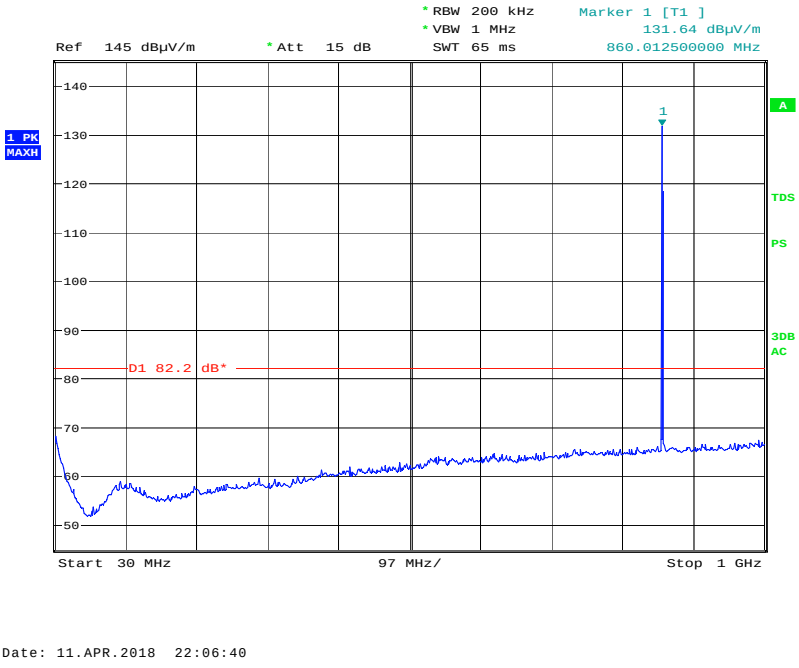

Figure 58 - 860.00875 MHz, 30 MHz to 1 GHz, EUT Orientation X

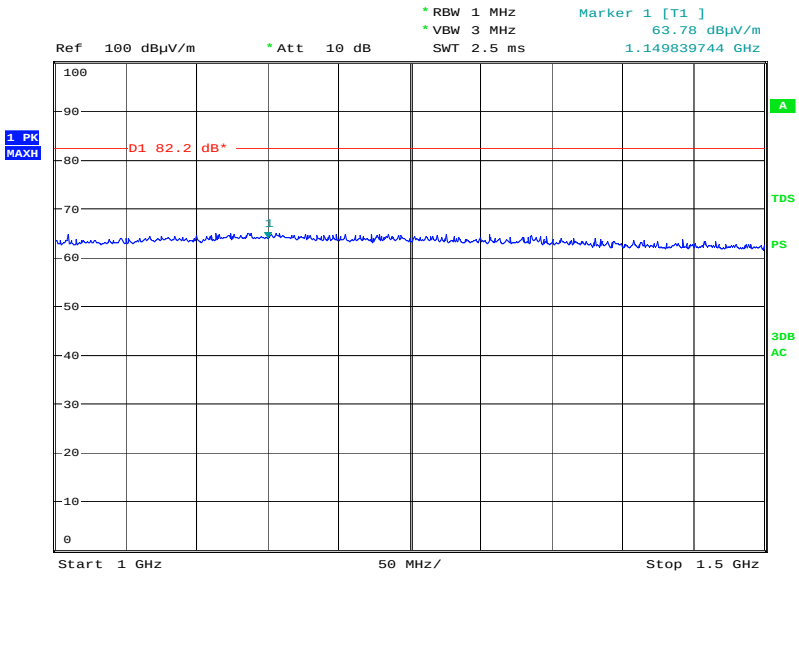

Figure 59 - 860.00875 MHz, 1 GHz to 1.5 GHz, EUT Orientation X

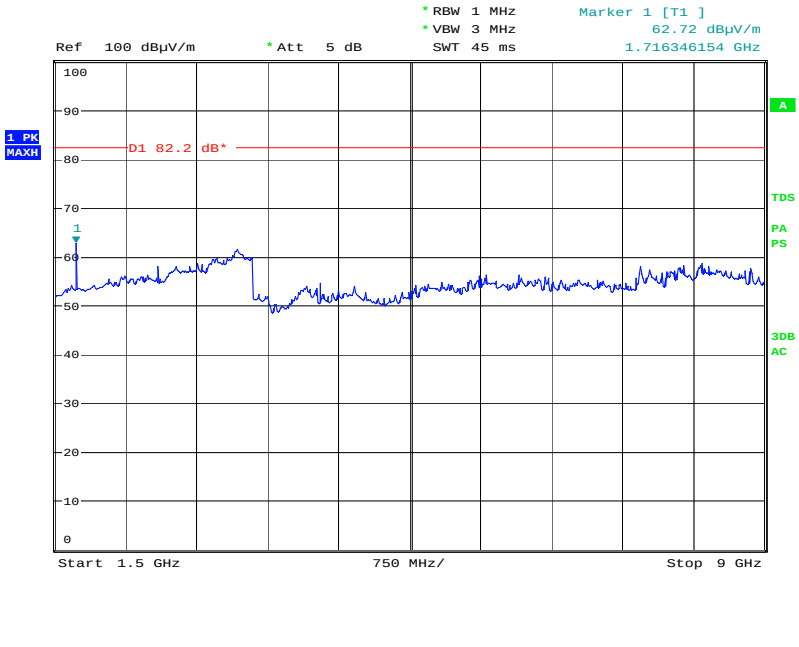

Figure 60 860.00875 MHz, 1 GHz to 9 GHz, EUT Orientation X

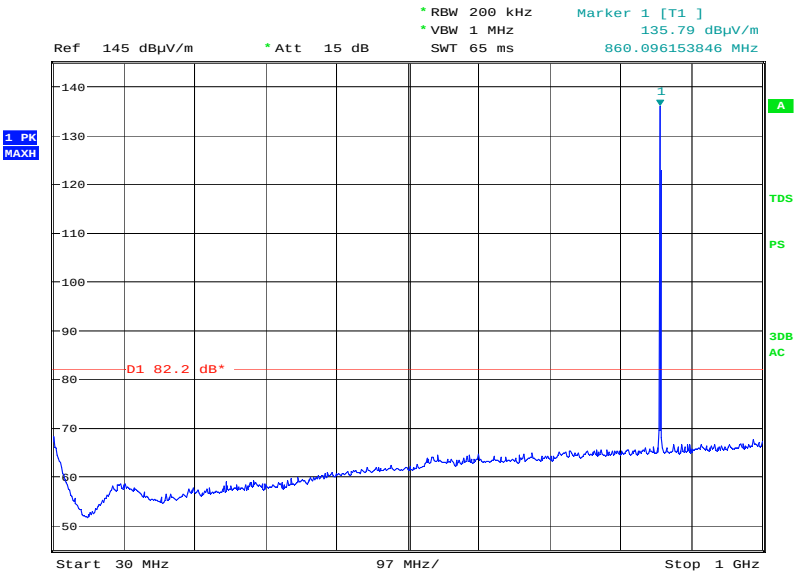

Figure 61 - 860.00875 MHz, 30 MHz to 1 GHz, EUT Orientation Y

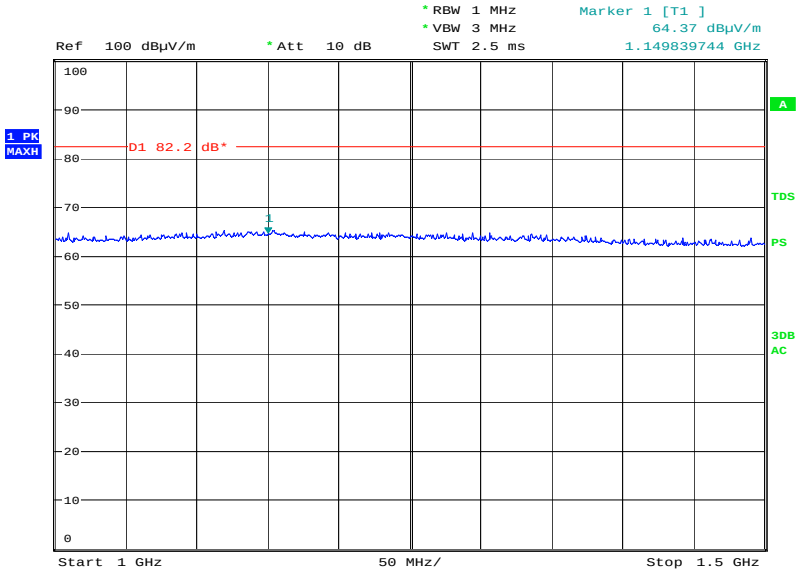

Figure 62 - 860.00875 MHz, 1 GHz to 1.5 GHz, EUT Orientation Y

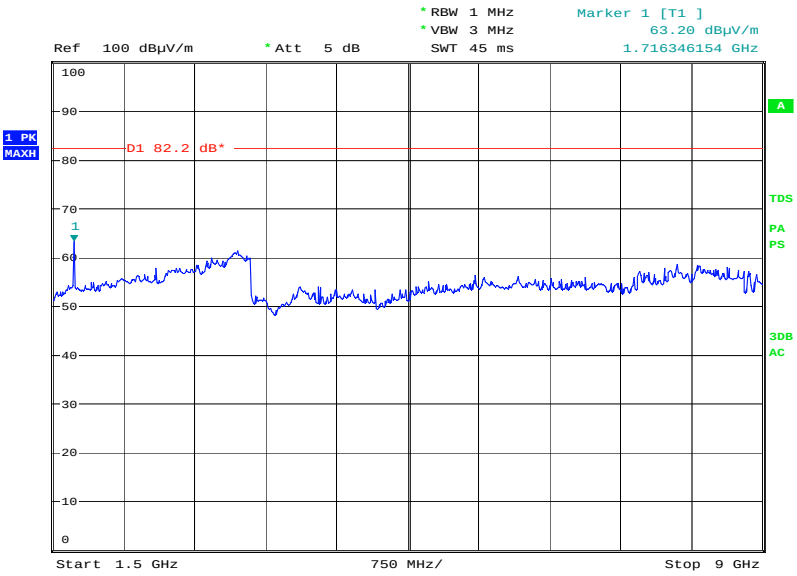

Figure 63 - 860.00875 MHz, 1.5 GHz to 9 GHz, EUT Orientation Y

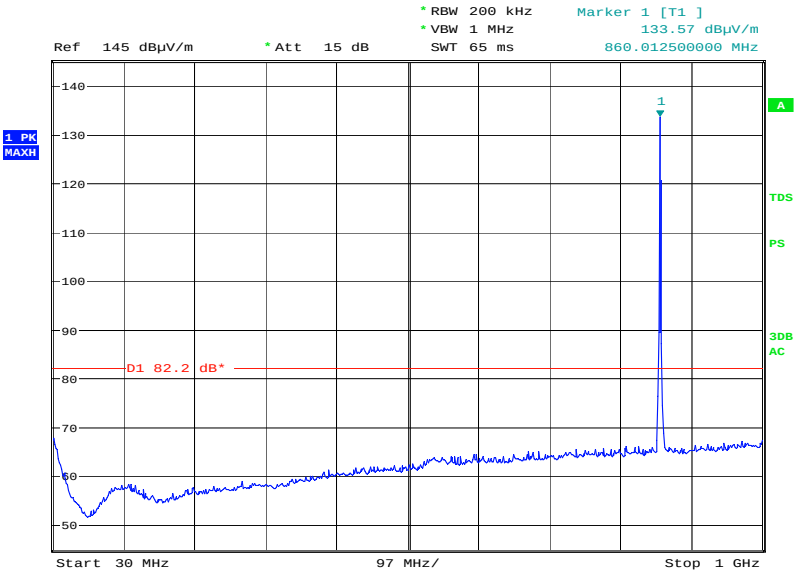

Figure 64 - 860.00875 MHz, 30 MHz to 1 GHz, EUT Orientation Z

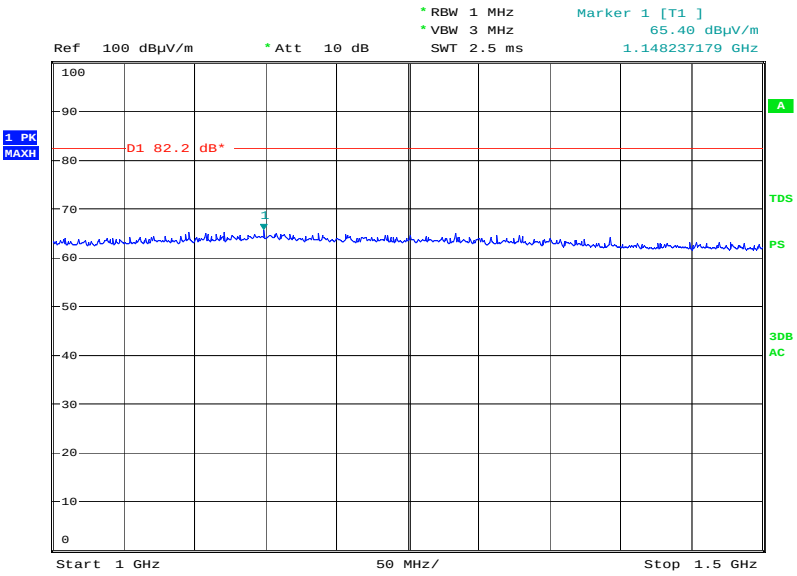

Figure 65 - 860.00875 MHz, 1 GHz to 1.5 GHz, EUT Orientation Z

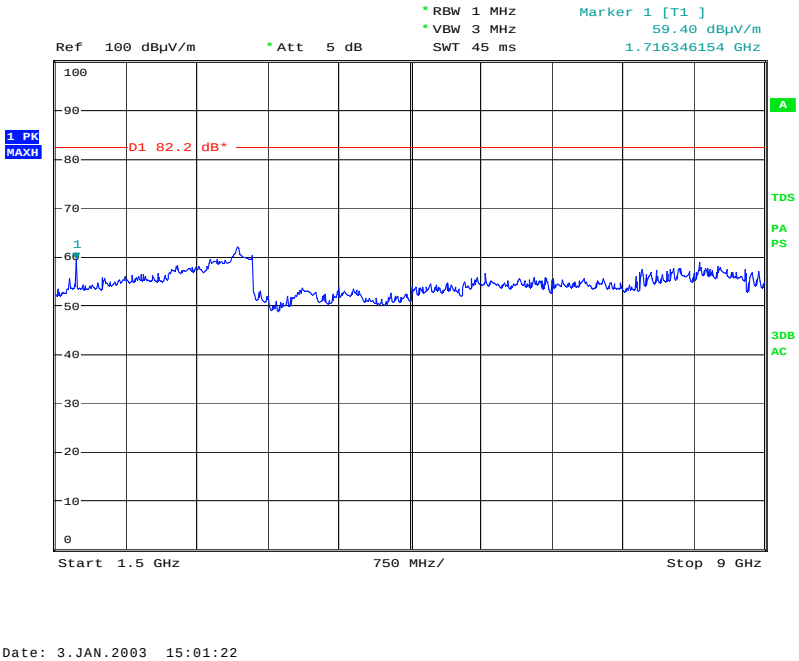

Figure 66 - 860.00875 MHz, 1 GHz to 9 GHz, EUT Orientation Z

Frequency (MHz)	Level (dBm)
*	

Table 20 - 868.98375 MHz - Emissions Results

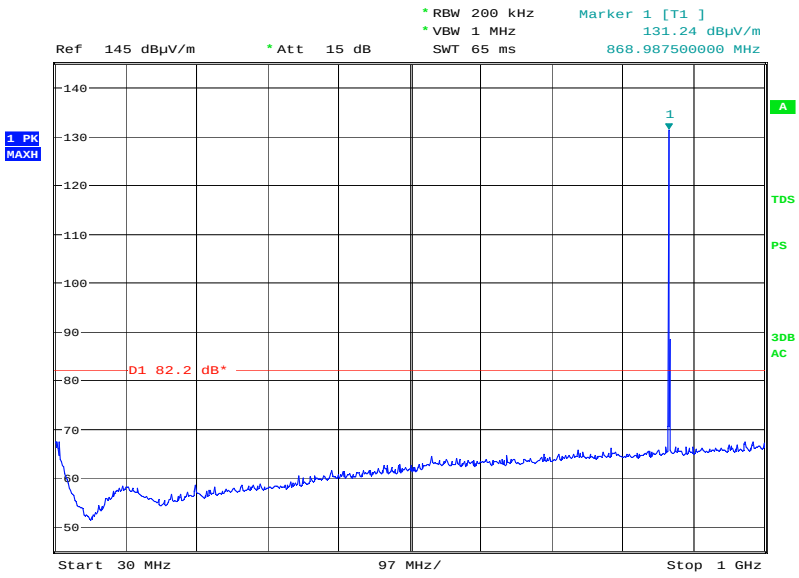

Figure 67 - 868.98375 MHz, 30 MHz to 1 GHz, EUT Orientation X

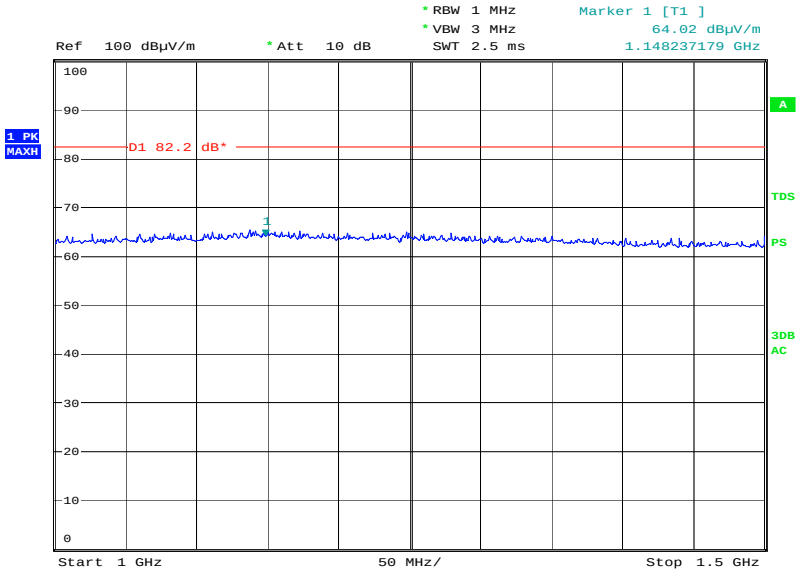

Figure 68 - 868.98375 MHz, 1 GHz to 1.5 GHz, EUT Orientation X

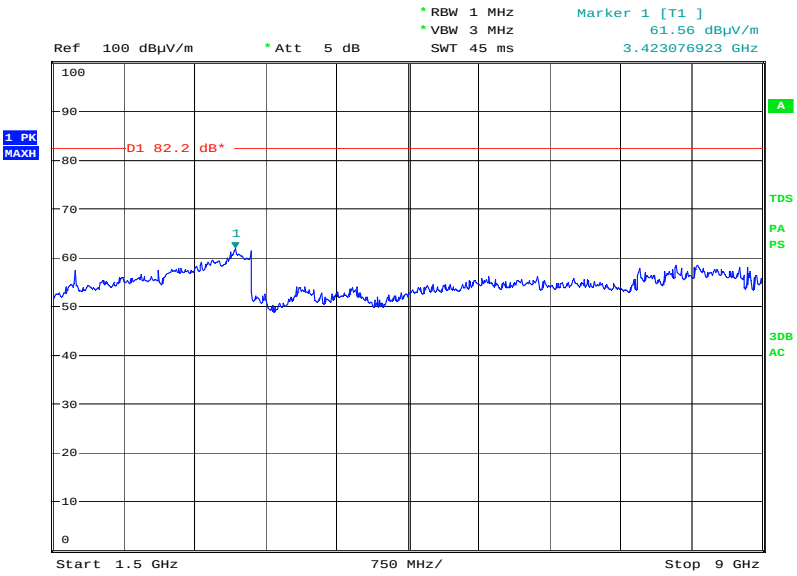

Figure 69 - 868.98375 MHz, 1 GHz to 9 GHz, EUT Orientation X

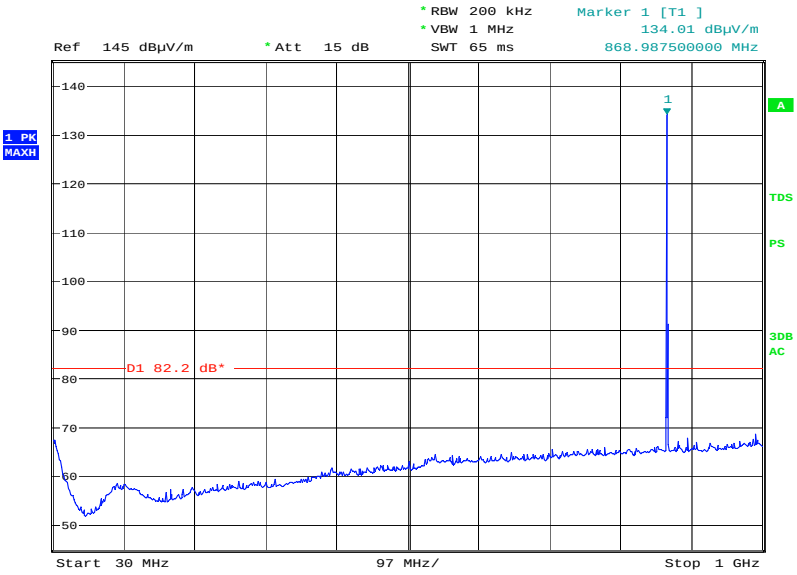

Figure 70 - 868.98375 MHz, 30 MHz to 1 GHz, EUT Orientation Y

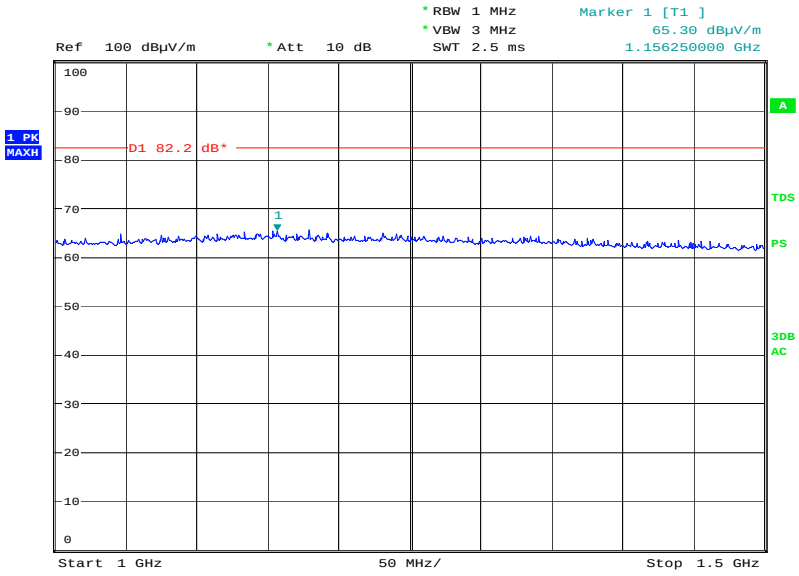

Figure 71 - 868.98375 MHz, 1 GHz to 1.5 GHz, EUT Orientation Y

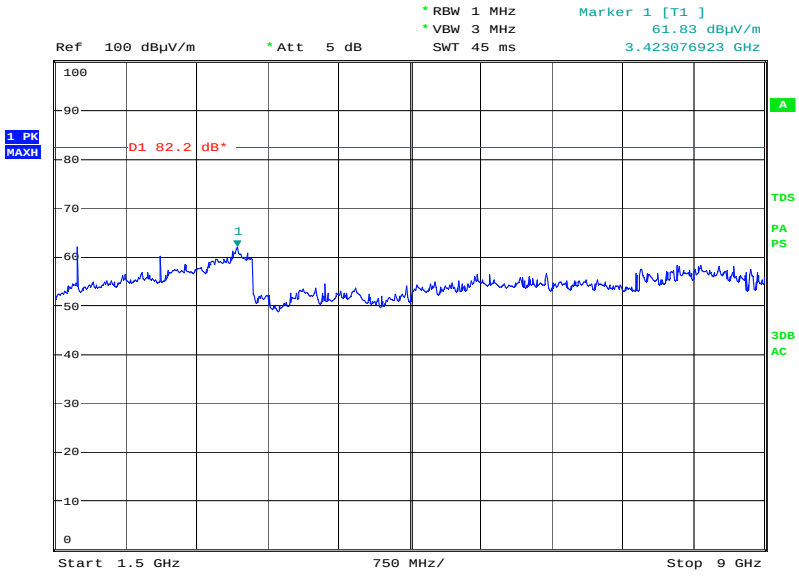

Figure 72 - 868.98375 MHz, 1.5 GHz to 9 GHz, EUT Orientation Y

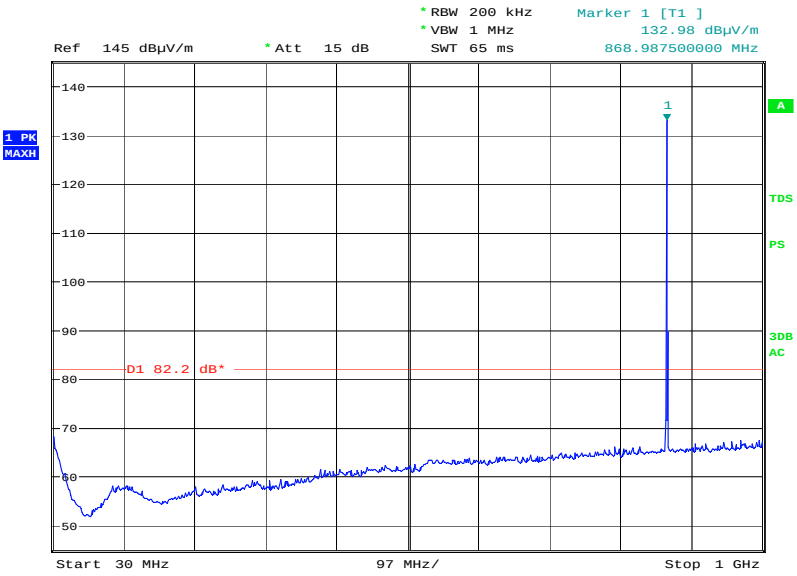

Figure 73 - 868.98375 MHz, 30 MHz to 1 GHz, EUT Orientation Z

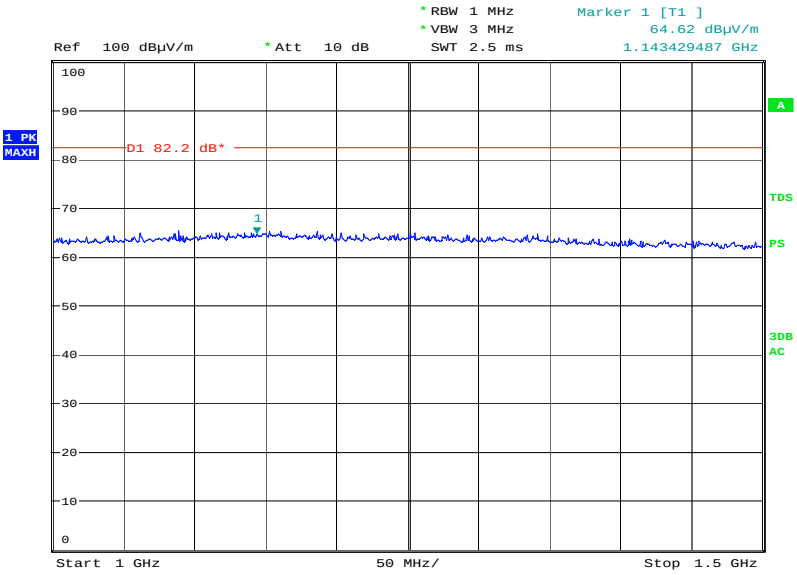

Figure 74 - 868.98375 MHz, 1 GHz to 1.5 GHz, EUT Orientation Z

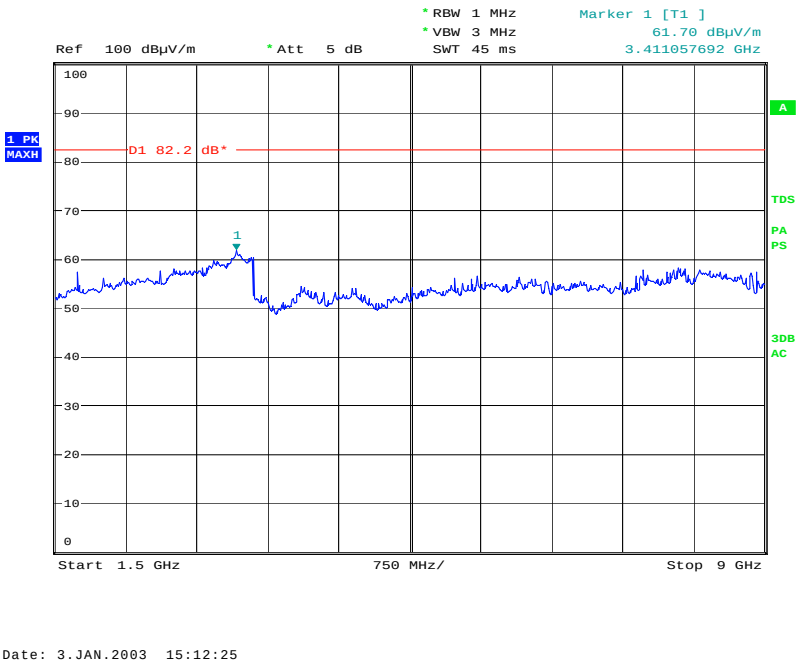

Figure 75 - 868.983750 MHz, 1 GHz to 9 GHz, EUT Orientation Z

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 Y as per Industry Canada RSS-119 clause 5.8.

2.5.7 Test Location and Test Equipment Used

This test was carried out in EMC Chamber 5.

Instrument	Manufacturer	Type No	TE No	Calibration Period (months)	Calibration Due
Antenna (Bilog)	Schaffner	CBL6143	287	24	18-Apr-2018 (See Note 1)
Screened Room (5)	Rainford	Rainford	1545	36	09-Jun-2018
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygromer	Rotronic	A1	2138	12	21-Feb-2019
Filter	Daden Anthony Ass	MH-1500-7SS	2778	12	15-May-2018
Antenna (DRG Horn)	ETS-Lindgren	3115	3125	12	21-Jul-2018
Cable (N-N, 8m)	Rhophase	NPS-2302-8000-NPS	3248	12	02-May-2018
Signal Generator: 10MHz to 20GHz	Rohde & Schwarz	SMR20	3475	12	05-May-2018
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
1501A 4.0M Km Km Cable	Rhophase	KPS-1501A-4000-KPS	4301	12	19-Feb-2019
Cable (Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4526	6	22-May-2018
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	6	15-Aug-2018
Double Ridge Broadband Horn Antenna	Schwarzbeck	BBHA 9120 B	4848	12	12-Feb-2019
N to N cable, 4m	Rhophase	2303-002-TUVS	4849	12	18-Dec-2018

Table 21

TU - Traceability Unscheduled

It was confirmed that this item of equipment was in calibration at the time of use and was not used after 18-Apr-2018.

2.6 Frequency Stability

2.6.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.213
FCC 47 CFR Part 2, Clause 2.1055
Industry Canada RSS-119, Clause 5.3
Industry Canada RSS-GEN, Clause 6.11

2.6.2 Equipment Under Test and Modification State

SC2128, S/N: Not Serialised (75941492-TSR0001) - Modification State 0

2.6.3 Date of Test

13-April-2018 to 17-April-2018

2.6.4 Test Method

The test was performed in accordance with ANSI C63.26, clause 5.6. A spectrum analyser was used to measure the unmodulated carrier frequency.

The EUT was tested using its internal frequency reference, used by the EUT before the AFC is locked onto the base station signal, therefore the appropriate limit to be used is specified in RSS-119 Table 1 (NOTE 2) which is ± 1 kHz.

The following information was provided by the manufacturer:

A reference voltage controlled temperature compensated crystal oscillator (VCTCXO) operating at 19.2 MHz acts as the master reference for both synthesisers and the radio control system. Inherent frequency stability of the VCTCXO is better than 1 part per million. During trunked network operation this reference is frequency locked to the received base station frequency.

In addition to this, the ETSI conformance standard EN 300 394-1 states that the product, when in trunked mode and therefore locked onto the base station carrier signal shall be within ± 100Hz of this signal under normal conditions ie at 20°C.

The manufacturer confirms that during their conformance testing of this product type against the conformance standard the frequency error was typically within +24Hz and -15Hz of the base station carrier frequency, therefore well within specification limits.

2.6.5 Environmental Conditions

Ambient Temperature	21.3 - 22.1 °C
Relative Humidity	37.4 - 45.7 %

2.6.6 Test Results

Tetra - Lower Band (806 MHz to 824 MHz)

Voltage	806.0125 MHz		815.0125 MHz		823.9875 MHz	
	Frequency Error (kHz)	Frequency Error (ppm)	Frequency Error (kHz)	Frequency Error (ppm)	Frequency Error (kHz)	Frequency Error (ppm)
7.4 V DC	0.48	0.596	0.51	0.626	0.51	0.619
6.2 V DC	0.51	0.633	0.51	0.626	0.51	0.619

Table 22 - Frequency Stability Under Voltage Variations

Temperature	806.0125 MHz		815.0125 MHz		823.9875 MHz	
	Frequency Error (kHz)	Frequency Error (ppm)	Frequency Error (kHz)	Frequency Error (ppm)	Frequency Error (kHz)	Frequency Error (ppm)
+50.0 °C	0.54	0.670	0.54	0.663	0.54	0.655
+40 °C	0.48	0.596	0.51	0.626	0.51	0.619
+30 °C	0.42	0.521	0.45	0.552	0.48	0.583
+20 °C	0.39	0.484	0.42	0.515	0.45	0.546
+10 °C	0.42	0.521	0.42	0.515	0.42	0.510
0 °C	0.42	0.521	0.42	0.515	0.42	0.510
-10.0 °C	0.48	0.596	0.45	0.552	0.48	0.583
-20.0 °C	0.42	0.521	0.45	0.552	0.45	0.546
-30.0 °C	0.42	0.521	0.45	0.552	0.45	0.546

Table 23 - Frequency Stability Under Temperature Variations

Tetra - Upper Band (851 MHz to 869 MHz)

Voltage	851.0125 MHz		860.0125 MHz		868.9875 MHz	
	Frequency Error (kHz)	Frequency Error (ppm)	Frequency Error (kHz)	Frequency Error (ppm)	Frequency Error (kHz)	Frequency Error (ppm)
7.4 V DC	0.54	0.635	0.54	0.628	0.54	0.621
6.2 V DC	0.54	0.635	0.54	0.628	0.54	0.621

Table 24 - Frequency Stability Under Voltage Variations

Temperature	851.0125 MHz		860.0125 MHz		868.9875 MHz	
	Frequency Error (kHz)	Frequency Error (ppm)	Frequency Error (kHz)	Frequency Error (ppm)	Frequency Error (kHz)	Frequency Error (ppm)
+50.0 °C	0.57	0.670	0.57	0.663	0.54	0.621
+40 °C	0.54	0.635	0.54	0.628	0.57	0.656
+30 °C	0.51	0.599	0.51	0.593	0.54	0.621
+20 °C	0.48	0.564	0.48	0.558	0.51	0.587
+10 °C	0.48	0.564	0.48	0.558	0.48	0.552
0 °C	0.45	0.529	0.45	0.523	0.45	0.518
-10.0 °C	0.51	0.599	0.51	0.593	0.51	0.587
-20.0 °C	0.48	0.564	0.48	0.558	0.51	0.587
-30.0 °C	0.48	0.564	0.48	0.558	0.51	0.587

Table 25 - Frequency Stability Under Temperature Variations

FCC 47 CFR Part 90, Limit Clause 90.213

Frequency Range (MHz)	Fixed and base stations	Mobile Stations	
		Output Power > 2W	Output Power ≤ 2 W
806-809	1.0	1.5	1.5
809-824	1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5

Table 26 – FCC Frequency Stability Limit

Industry Canada RSS-119, Limit Clause 5.3

Frequency Band (MHz)	Channel Bandwidth (kHz)	Frequency Stability (ppm)		
		Base/Fixed	Mobile Station	
			Output Power > 2W	Output Power ≤ 2 W
806-821/851-866 and 821-824/866-869 (Note 6)	25 (Note 2)	0.1	0.1	0.1
	25	1.5	2.5	2.5
	12.5	1	1.5	1.5
	6.25	0.1	0.4	0.4

Table 27 – Industry Canada Frequency Stability Limit

NOTE 2: This provision is for digital equipment with a channel bandwidth of 25 kHz and an occupied bandwidth greater than 20 kHz. The mobile station's frequency stability values given in Table 1 are for mobile, portable and control transmitters using automatic frequency control (AFC) to lock onto the base station signal. When the mobile, portable and control transmitters are operating without using AFC to lock onto the base station signal, the frequency stability limit shall be better than 1 kHz and the equipment's unwanted emissions measured with maximum frequency shift shall still comply with emission mask Y (Section 5.8.10) at nominal carrier frequency.

NOTE 6: Control stations may operate with the frequency stability specified for associated mobile frequencies.

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
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	20-Oct-2018
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	11-Jul-2018
Thermocouple Thermometer	Fluke	51	3172	12	29-Nov-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	02-Oct-2018
TRUE RMS MULTIMETER	Fluke	179	4006	12	13-Dec-2018
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	06-Mar-2019
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	20-Oct-2018
Climatic Chamber	Aralab	FitoTerm 300E45	4823	-	O/P Mon
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018

Table 28

O/P Mon – Output Monitored using calibrated equipment

2.7 Adjacent Channel Power

2.7.1 Specification Reference

FCC 47 CFR Part 90, Clause 90.221

2.7.2 Equipment Under Test and Modification State

SC2128, S/N: Not Serialised (75941492-TSR0001) - Modification State 0

2.7.3 Date of Test

23-April-2018

2.7.4 Test Method

The test was performed in accordance with FCC 47 CFR Part 90 Clause 90.221

2.7.5 Environmental Conditions

Ambient Temperature	24.4 - 24.5 °C
Relative Humidity	35.6 %

2.7.6 Test Results

Tetra - Lower Band (806MHz to 824 MHz)

Channel	Offset (kHz)	Adjacent Channel Power (dBc)
806.0125 MHz	-25	-56.9
	+25	-56.2
	-50	-65.7
	+50	-65.7
	-75	-67.4
	+75	-67.4
815.0125 MHz	-25	-58.9
	+25	-58.3
	-50	-65.2
	+50	-65.1
	-75	-67.5
	+75	-67.5
823.9875 MHz	-25	-59.8
	+25	-60.1
	-50	-65.7
	+50	-65.6
	-75	-67.2
	+75	-67.2

Table 29 - Adjacent Channel Power

Tetra - Lower Band (851 MHz to 869 MHz)

Channel	Offset (kHz)	Adjacent Channel Power (dBc)
851.0125 MHz	-25	-58.5
	+25	-59.0
	-50	-65.6
	+50	-65.6
	-75	-67.3
	+75	-67.3
860.0125 MHz	-25	-57.1
	+25	-58.3
	-50	-65.7
	+50	-65.7
	-75	-67.4
	+75	-67.4
868.9875 MHz	-25	-57.9
	+25	-57.4
	-50	-65.4
	+50	-65.5
	-75	-67.2
	+75	-67.2

Table 30 - Adjacent Channel Power

FCC Part 90, Limit Clause 90.221(c)

Frequency Offset	Maximum ACP (dBc) for devices < 15W	Maximum ACP (dBc) for devices ≥ 15W
25 kHz	-55	-55
50 kHz	-65	-65
75 kHz	-65	-70

Table 31 - Adjacent Channel Power Limits

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

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
Multimeter	Fluke	79 Series III	498	12	09-Aug-2018
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	20-Oct-2018
Attenuator (30dB/50W)	Aeroflex / Weinschel	47-30-34	3164	12	11-Jul-2018
Hygrometer	Rotronic	I-1000	3220	12	30-Aug-2018
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Oct-2018
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	6-Mar-2019
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	20-Oct-2018
Quad Power Supply	Rohde & Schwarz	HMP4040	4954	-	O/P Mon
EXA	Keysight Technologies	N9010B	4969	12	21-Dec-2018

Table 32

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

Table 33