

Report on the Radio Testing  
For  
Maxam  
on  
RIOTRONIC X+ Remote 915  
Report no. TRA-049647-45-00B  
27th October 2020

RF915 7.0



Report Number: TRA-049647-45-00B  
Issue: B

REPORT ON THE RADIO TESTING OF A  
Maxam  
RIOTRONIC X+ Remote 915  
WITH RESPECT TO SPECIFICATION  
FCC 47CFR 15.247

TEST DATE: 2020-09-21 to 2020-10-21

Written by:



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Approved by:

Date:

27th October 2020

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Principal Engineer, EMC and  
Radio

Disclaimers:

- [1] THIS DOCUMENT MAY BE REPRODUCED ONLY IN ITS ENTIRETY AND WITHOUT CHANGE  
[2] THE RESULTS CONTAINED IN THIS DOCUMENT RELATE ONLY TO THE ITEM(S) TESTED

## 1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	02 October 2020	Original
B	27th October 2020	Update after certification check

## 2 Summary

TEST REPORT NUMBER:	TRA-049647-45-00B
WORKS ORDER NUMBER:	TRA-049647-03
PURPOSE OF TEST:	USA: Testing of radio frequency equipment per the relevant authorization procedure of chapter 47 of CFR (code of federal regulations) Part 2, subpart J.
TEST SPECIFICATION(S):	47CFR15.247
EQUIPMENT UNDER TEST (EUT):	RIOTRONIC X+ Remote 915
FCC IDENTIFIER:	2AXG5-043008003
EUT SERIAL NUMBER:	16-00100013
MANUFACTURER/AGENT:	Maxam
ADDRESS:	Avenida de Partenon 16 28042 Madrid Spain
CLIENT CONTACT:	Jose Vega ☎ +34 667 181 471 ✉ jmvega@maxam.net
ORDER NUMBER:	220J102649
TEST DATE:	2020-09-21 to 2020-10-21
TESTED BY:	A Longley, D Garvey Element

## 2.1 Test Summary

Test Method and Description		Requirement Clause	Applicable to this equipment	Result / Note
		47CFR15		
Radiated spurious emissions (restricted bands of operation and cabinet radiation)		15.205	<input checked="" type="checkbox"/>	Pass
AC power line conducted emissions		15.207	<input type="checkbox"/>	Note 1
Occupied bandwidth		15.247(a)(2)	<input checked="" type="checkbox"/>	Pass
Conducted carrier power	Peak	15.247(b)(3)	<input checked="" type="checkbox"/>	Pass
	Max.		<input type="checkbox"/>	
Conducted / radiated RF power out-of-band		15.247(d)	<input checked="" type="checkbox"/>	Pass
Power spectral density, conducted		15.247(e)	<input checked="" type="checkbox"/>	Pass
Calculation of duty correction		15.35(c)	<input type="checkbox"/>	Note 2

### Notes:

Note 1: Not Applicable as the EUT did not transmit whilst the batteries were being charged.

Note 2: Not Applicable as no duty correction was required.

The results contained in this report relate only to the items tested, in the condition at time of test, and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only. Any modifications made are identified in Section 8 of this report.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 5.2 of this test report (Deviations from Test Standards).

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## 4 Introduction

This report TRA-049647-45-00B presents the results of the Radio testing on a Maxam, RIOTRONIC X+ Remote 915 to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for Maxam by Element, at the address detailed below.

<input checked="" type="checkbox"/>	Element Hull Unit E South Orbital Trading Park Hedon Road Hull HU9 1NJ UK	<input type="checkbox"/>	Element Skelmersdale Unit 1 Pendle Place Skelmersdale West Lancashire WN8 9PN UK
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This report details the configuration of the equipment, the test methods used and any relevant modifications where appropriate.

All test and measurement equipment under the control of the laboratory and requiring calibration is subject to an established programme and procedures to control and maintain measurement standards. The quality management system meets the principles of ISO 9001, and has quality control procedures for monitoring the validity of tests undertaken. Records and sufficient detail are retained to establish an audit trail of calibration records relating to its test results for a defined period. Under control of the established calibration programme, key quantities or values of the test & measurement instrumentation are within specification and comply with the relevant traceable internationally recognised and appropriate standard specifications, which are UKAS calibrated as such where these properties have a significant effect on results. Participation in inter-laboratory comparisons and proficiency testing ensures satisfactory correlation of results conform to Elements own procedures, as well as statistical techniques for analysis of test data providing the appropriate confidence in measurements.

Throughout this report EUT denotes equipment under test.

### FCC Site Listing:

Element is accredited for the above sites under the US-EU MRA, Designation number UK0009.

### IC Registration Number(s):

Element Hull	3483A
Element North West	3930B

The test site requirements of ANSI C63.4-2014 are met up to 1GHz.

The test site SVSWR requirements of CISPR 16-1-4:2010 are met over the frequency range 1 GHz to 18 GHz.



## **5 Test Specifications**

### **5.1 Normative References**

- FCC 47 CFR Ch. I – Part 15 – Radio Frequency Devices.
- ANSI C63.10-2013 – American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.
- ANSI C63.4-2014 – American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

### **5.2 Deviations from Test Standards**

There were no deviations from the test standard.

## 6 Glossary of Terms

<b>§</b>	denotes a section reference from the standard, not this document
<b>AC</b>	Alternating Current
<b>ANSI</b>	American National Standards Institute
<b>BW</b>	bandwidth
<b>C</b>	Celsius
<b>CFR</b>	Code of Federal Regulations
<b>CW</b>	Continuous Wave
<b>dB</b>	decibel
<b>dBm</b>	dB relative to 1 milliwatt
<b>DC</b>	Direct Current
<b>DSSS</b>	Direct Sequence Spread Spectrum
<b>EIRP</b>	Equivalent Isotropically Radiated Power
<b>ERP</b>	Effective Radiated Power
<b>EUT</b>	Equipment Under Test
<b>FCC</b>	Federal Communications Commission
<b>FHSS</b>	Frequency Hopping Spread Spectrum
<b>Hz</b>	hertz
<b>IC</b>	Industry Canada
<b>ITU</b>	International Telecommunication Union
<b>LBT</b>	Listen Before Talk
<b>m</b>	metre
<b>max</b>	maximum
<b>MIMO</b>	Multiple Input and Multiple Output
<b>min</b>	minimum
<b>MRA</b>	Mutual Recognition Agreement
<b>N/A</b>	Not Applicable
<b>PCB</b>	Printed Circuit Board
<b>PDF</b>	Portable Document Format
<b>Pt-mpt</b>	Point-to-multipoint
<b>Pt-pt</b>	Point-to-point
<b>RF</b>	Radio Frequency
<b>RH</b>	Relative Humidity
<b>RMS</b>	Root Mean Square
<b>Rx</b>	receiver
<b>s</b>	second
<b>SVSWR</b>	Site Voltage Standing Wave Ratio
<b>Tx</b>	transmitter
<b>UKAS</b>	United Kingdom Accreditation Service
<b>V</b>	volt
<b>W</b>	watt
<b>Ω</b>	ohm

## 7 Equipment Under Test

### 7.1 EUT Identification

- Name: RIOTRONIC X+ Remote 915
- Serial Number: 16-00100013
- Model Number: 043.008.003
- Software Revision: Not Applicable
- Build Level / Revision Number: Not Applicable

### 7.2 System Equipment

Equipment listed below forms part of the overall test setup and is required for equipment functionality and/or monitoring during testing. The compliance levels achieved in this report relate only to the EUT and not items given in the following list.

*A Laptop PC was used as part of the Firmware change process necessary to change the EUT operating channel. This Laptop was not connected to the EUT during the tests.*

### 7.3 EUT Mode of Operation

#### 7.3.1 Transmission

The mode of operation for Transmit tests was as follows:

The EUT was set to transmit a continuous modulated signal on the required frequency.

Selection of transmit frequency was performed by re-flashing the EUT firmware with one of 3 variants, each set to power up the EUT set for a different frequency. The firmware versions used are stored in the Element file system under the job number (TRA-09647) Technical Information folder in sub-folders named "FW Remote 1.2.2-x" where "x" is a number and a date as follows:

- 14 (18-09-2020) – 915 MHz
- 15 (21-09-2020) – 902.5 MHz
- 16 (21-09-2020) – 927 MHz

#### 7.3.2 Reception

The mode of operation for Receiver tests was as follows:

Receiver tests were not performed as part of this assessment.

## 7.4 EUT Radio Parameters

### 7.4.1 General

<b>Frequency of operation:</b>	902.5 MHz to 927 MHz
<b>Modulation type(s):</b>	FSK
<b>Occupied channel bandwidth(s):</b>	500 kHz
<b>Channel spacing:</b>	500 kHz
<b>ITU emission designator(s):</b>	567KF1D
<b>Declared output power(s):</b>	27 dBm
<b>Nominal Supply Voltage:</b>	7.4 Vdc
<b>Location of notice for license exempt use:</b>	user manual.
<b>Method of prevention of use on non-US / non-Canadian frequencies:</b>	Not declared
<b>Duty cycle:</b>	Not declared

### 7.4.2 Antennas

<b>Type:</b>	HAS-915TFD
<b>Frequency range:</b>	915 MHz
<b>Impedance:</b>	50 $\Omega$
<b>VSWR:</b>	< 2.0
<b>Gain:</b>	5 dBi
<b>Polarisation:</b>	Linear
<b>Beam width:</b>	N/A
<b>Connector type:</b>	SMA
<b>Length:</b>	196 mm
<b>Weight:</b>	13 g
<b>Environmental limits:</b>	-40 °C to +85 °C
<b>Mounting:</b>	SMA port

### 7.4.3 Product specific declarations

<b>Multiple antenna configuration(s), e.g. MIMO:</b>	Single antenna only
<b>Fixed pt-pt operations (yes/no):</b>	No
<b>Installation manual advice on pt-pt operational restrictions (yes/no):</b>	N/A
<b>Fixed pt-mpt operations (yes/no):</b>	No
<b>Simultaneous tx (yes/no):</b>	N/A

### 7.5 EUT Description

The EUT is a Remote Control which is intended for controlling a RIOTRONIC X+ Blaster 915.

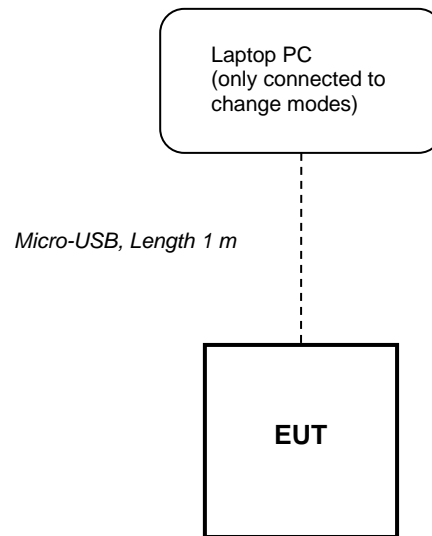
## **8 Modifications**

No modifications were performed during this assessment.

## 9 EUT Test Setup

### 9.1 Block Diagram

The following diagram shows basic EUT interconnections with cable type and cable lengths identified:

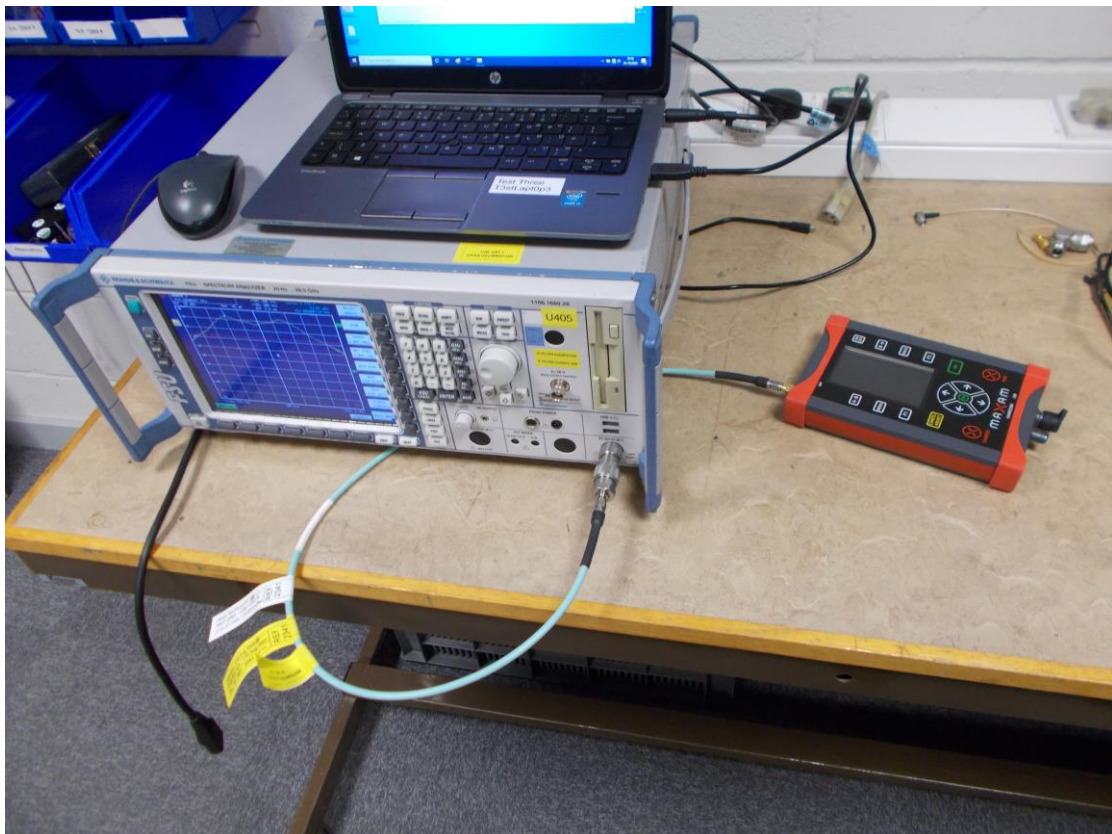


## 9.2 General Set-up Photograph

The following photograph shows basic EUT set-up for radiated measurements:



The following photograph shows basic EUT set-up for conducted measurements:





### **9.3    *Measurement software***

Where applicable, the following software was used to perform measurements contained within this report.

Element Emissions R5 (See Note)  
Element Transmitter Bench Test (See Note)  
ETS Lindgren EMPower V1.0.4.2

Note:

The version of the Element software used is recorded in the results sheets contained within this report.

## 10 General Technical Parameters

### 10.1 Normal Conditions

The E U T was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was 7.4 V dc from the lithium ion battery.

### 10.2 Varying Test Conditions

There are no specific frequency stability requirements for the type of device. The results contained in this report demonstrate that the occupied bandwidth is contained within the authorised band and the manufacturer has declared sufficient frequency stability (refer to section 7.4).

Variation of supply voltage is required to ensure stability of the declared output power. During carrier power testing the following variations were made:

	<b>Category</b>	<b>Nominal</b>	<b>Variation</b>
<input type="checkbox"/>	Mains	110 V ac +/-2 %	85 % and 115 %
<input checked="" type="checkbox"/>	Battery	New battery	N/A

## 11 Radiated emissions

### 11.1 Definitions

#### *Spurious emissions*

Emissions on a frequency or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

#### *Restricted bands*

A frequency band in which intentional radiators are permitted to radiate only spurious emissions but not fundamental signals.

### 11.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Wireless Lab 3
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
Frequencies Measured:	902.5 MHz / 915 MHz / 927 MHz
EUT Channel Bandwidths:	500 kHz
Deviations From Standard:	None
Measurement BW:	30 MHz to 1 GHz: 120 kHz Above 1 GHz: 1 MHz
Measurement Detector:	Up to 1 GHz: quasi-peak Above 1 GHz: RMS average and Peak

### Environmental Conditions (Normal Environment)

Temperature: 22 °C	+15 °C to +35 °C (as declared)
Humidity: 50 % RH	20 % RH to 75 % RH (as declared)
Supply: 7.4 Vdc	As declared

### 11.3 Test Limit

Unwanted emissions that fall within the restricted frequency bands shall comply with the limits specified:

#### General Field Strength Limits for License-Exempt Transmitters at Frequencies above 30 MHz

<i>Frequency (MHz)</i>	<i>Field Strength (<math>\mu</math>V/m at 3 m)</i>
30 to 88	100
88 to 216	150
216 to 960	200
Above 960	500

## 11.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure i, the emissions from the EUT were measured on a spectrum analyzer / EMI receiver.

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst-case determined for function, operation, orientation, etc. for both vertical and horizontal polarisations. Pre-scan plots are shown with a peak detector and 100 kHz RBW.

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

For both horizontal and vertical polarizations, the EUT is then rotated through 360 degrees in azimuth until the highest emission is detected. At the previously determined azimuth the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected, this maximum value is recorded.

Power values measured on the test receiver / analyzer are converted to field strength, FS, in dBμV/m at the regulatory distance, using:

$$FS = PR + CL + AF - PA + DC - CF$$

Where,

PR is the power recorded on the receiver / spectrum analyzer in dBμV;

CL is the cable loss in dB;

AF is the test antenna factor in dB/m;

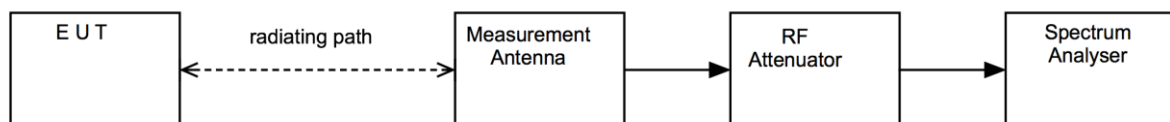
PA is the pre-amplifier gain in dB (where used);

DC is the duty correction factor in dB (where used, e.g. harmonics of pulsed fundamental);

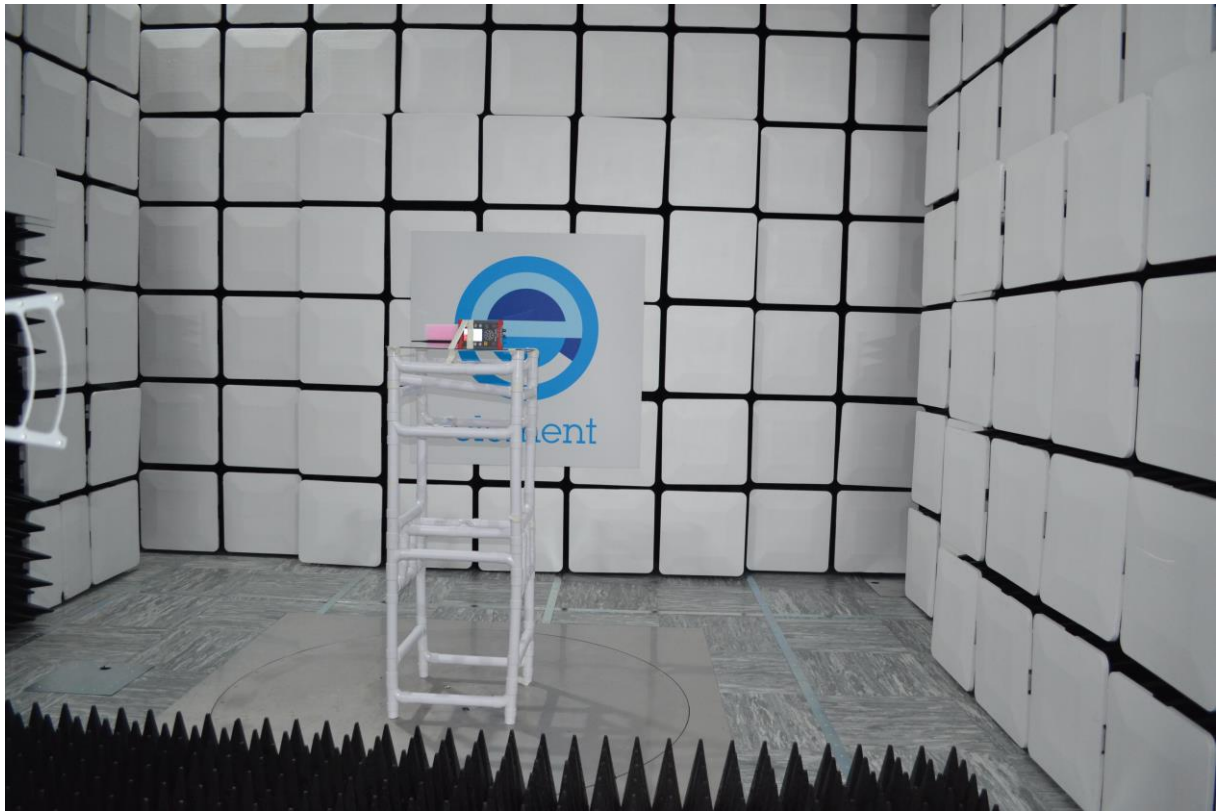
CF is the distance factor in dB (where measurement distance different to limit distance);

This field strength value is then compared with the regulatory limit.

**Figure i Test Setup**



### 11.5 Test Set-up Photograph



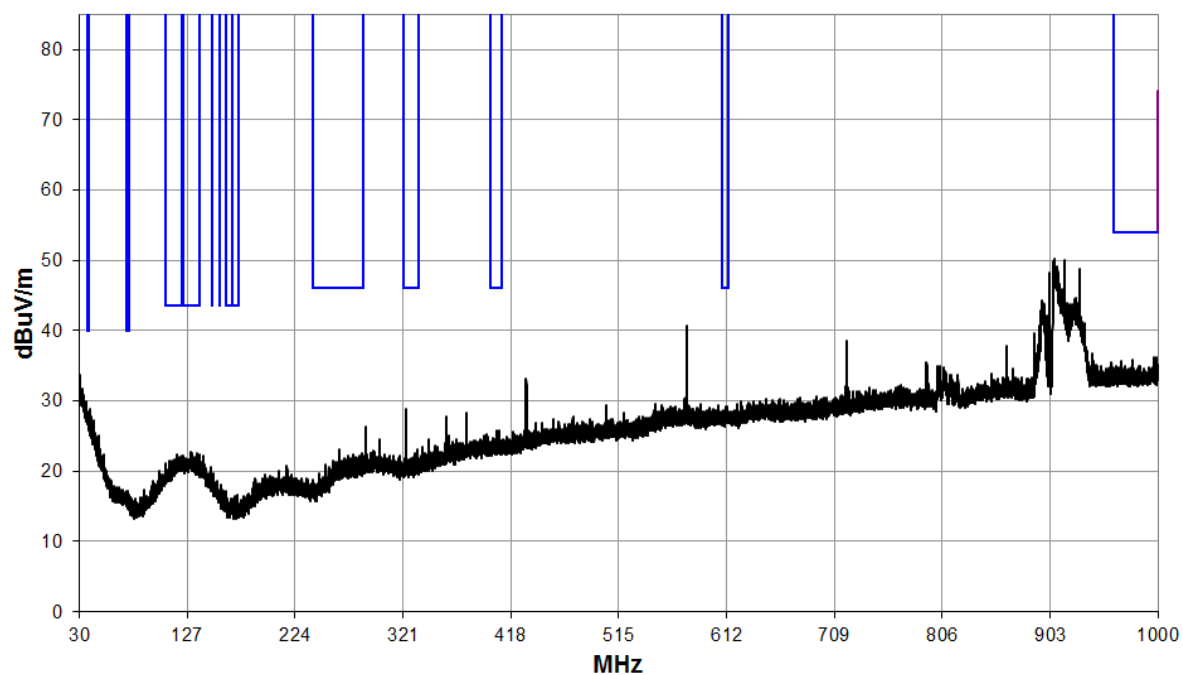
### 11.6 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
Ferrite Lined Chamber	Rainford	Chamber	REF2259	2022-08-03
EMI Test Receiver	R&S	ESW26	REF2235	2021-08-31
Bilog Antenna	Chase	CBL6111B	REF2218	2021-10-23
LB-10180-NF	A Info Inc	Horn Antenna	REF2241	2022-07-13
LB-90-25-C2-SF	A Info Inc	Horn Antenna	REF2243	2022-07-17

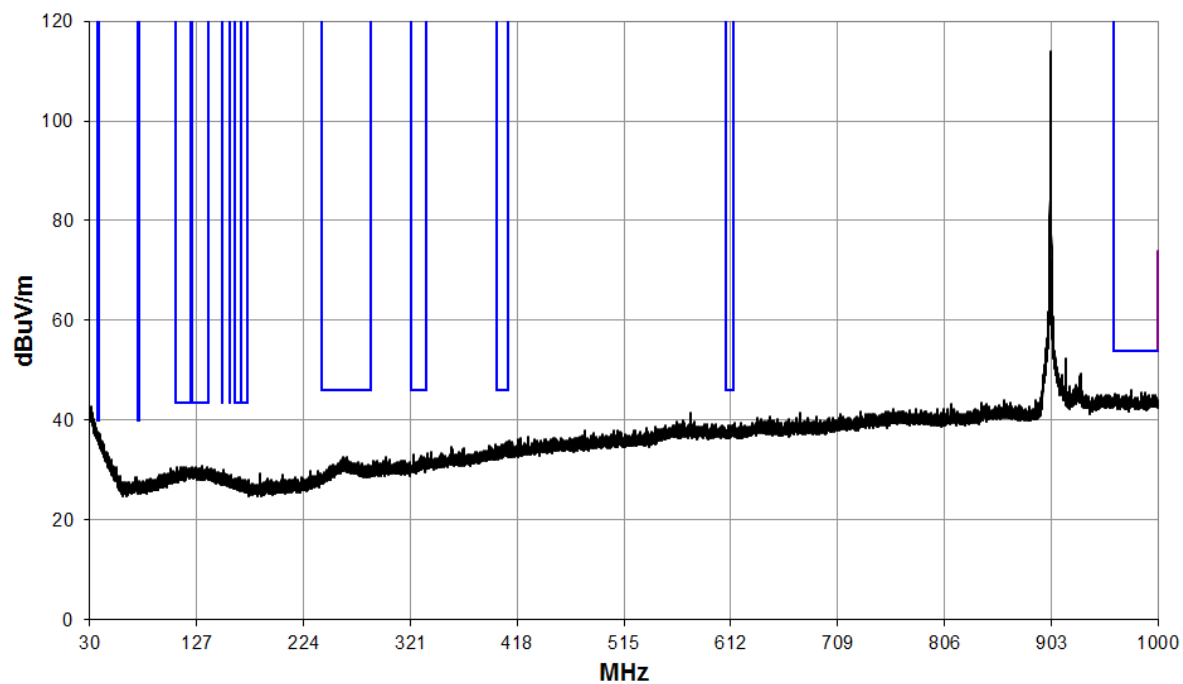
## 11.7 Test Results

High Power; Frequency: 902.5 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No emissions within 20 dB of the limit										

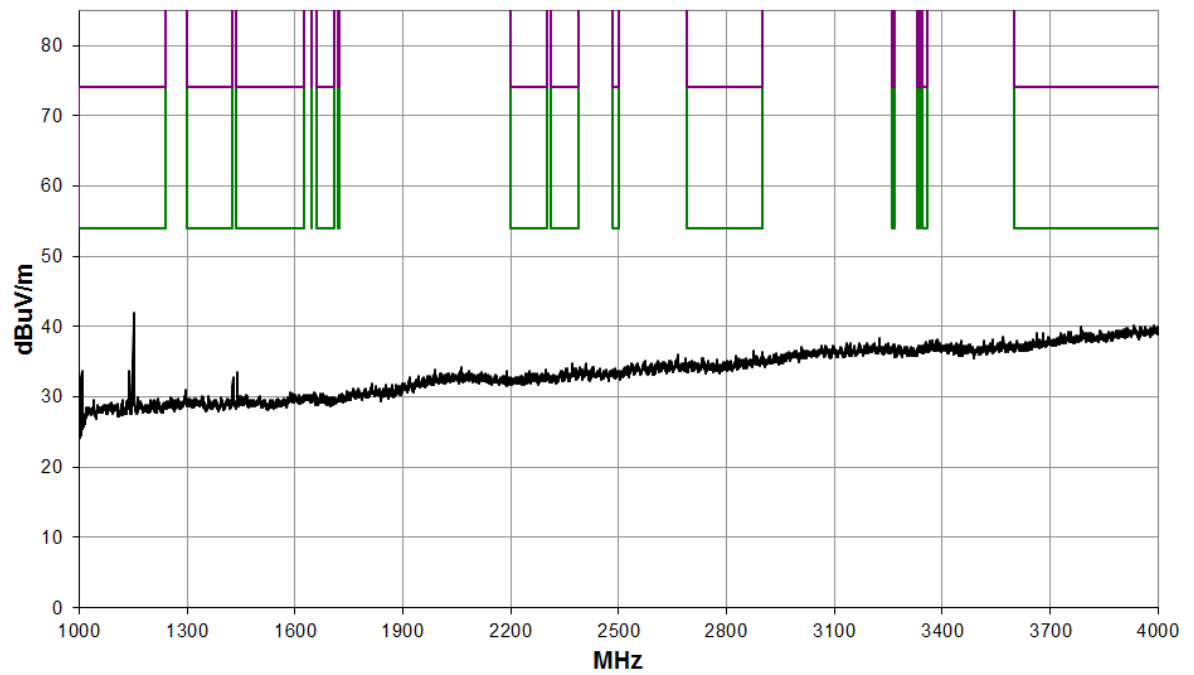
30 MHz to 1 GHz with Notch Filter



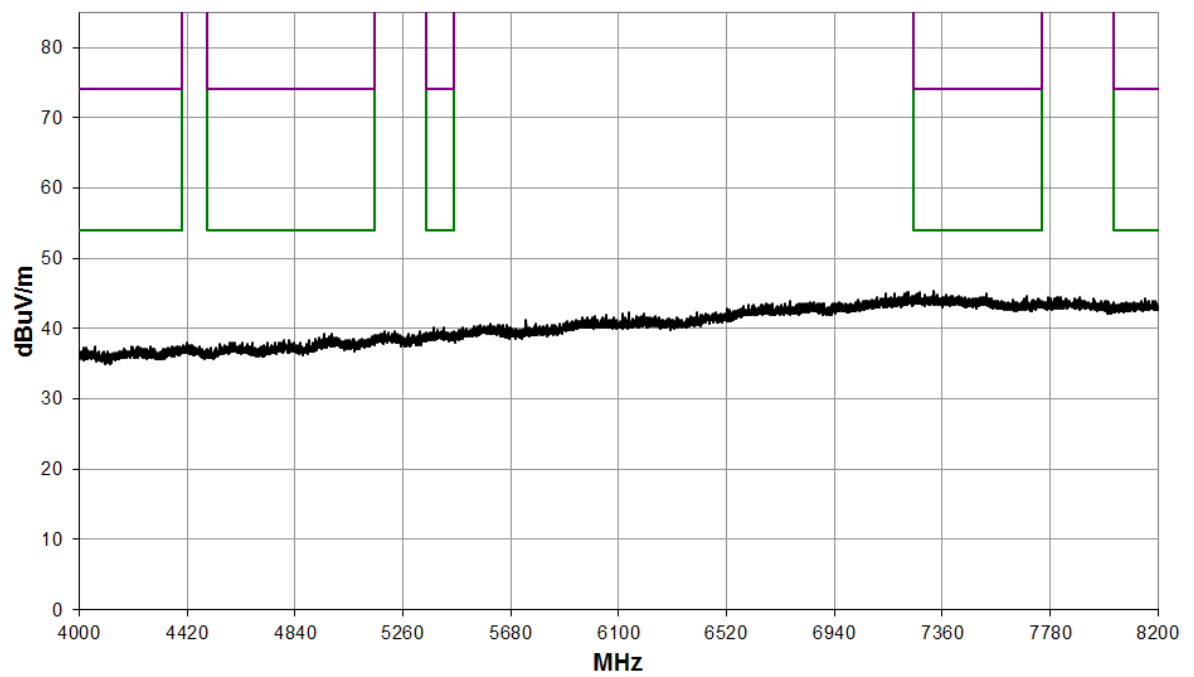
30 MHz to 1 GHz without Notch Filter



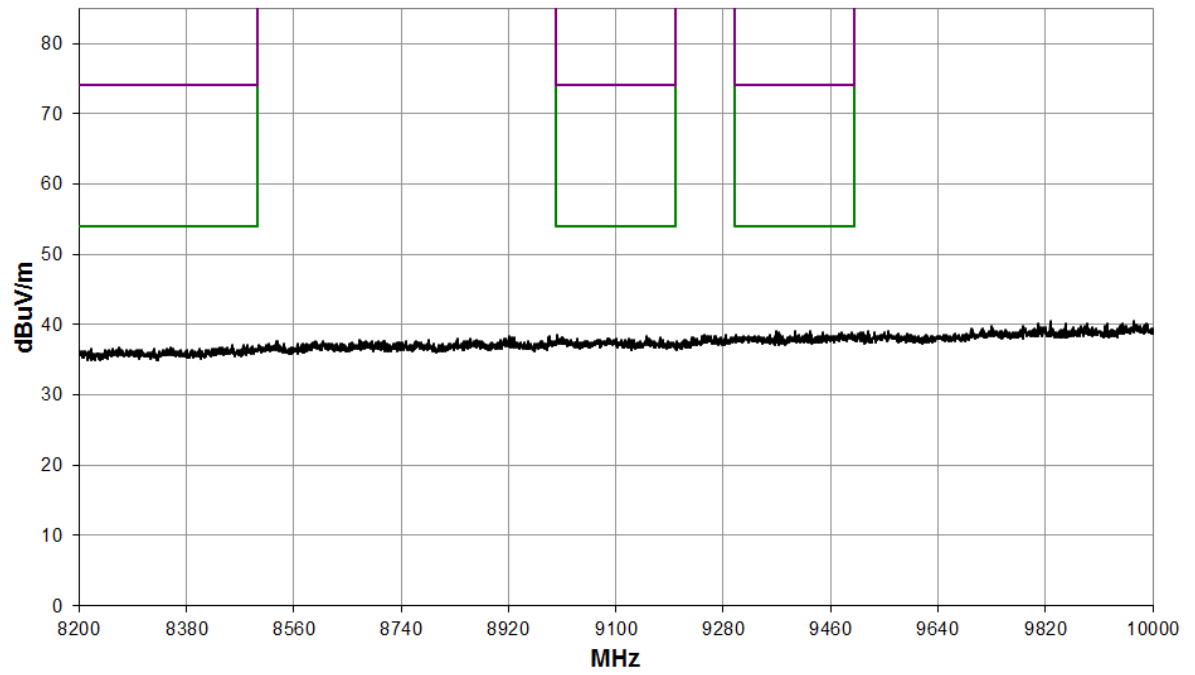
## 1 GHz to 4 GHz



## 4 GHz to 8.2 GHz



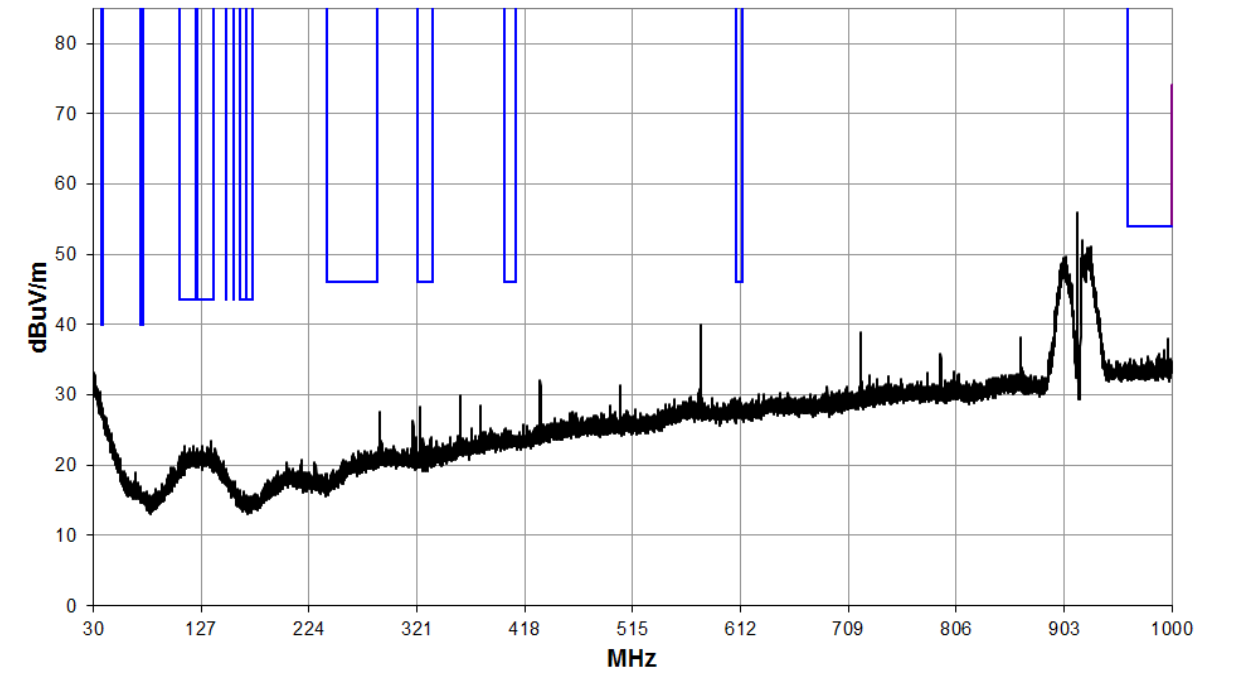
## 8.2 GHz to 10 GHz



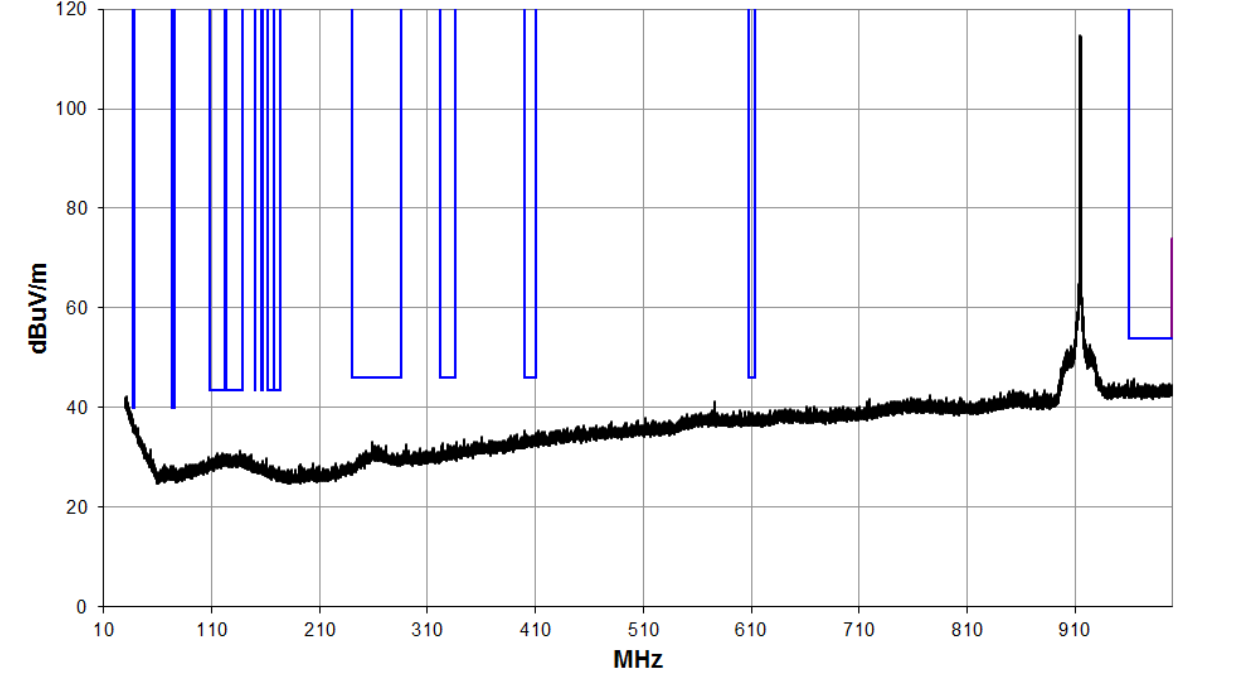


High Power; Frequency 915 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dBμV)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dBμV/m)	Field Strength (μV/m)	Limit (μV/m)
No emissions within 20 dB of the limit										

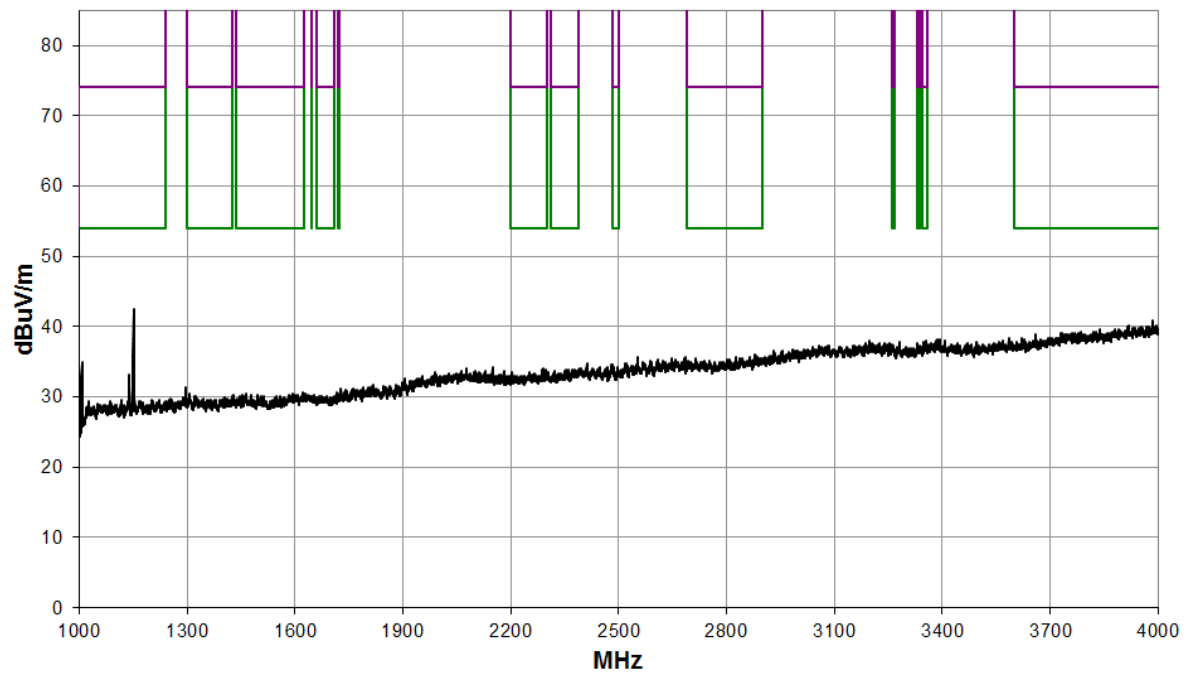
30 MHz to 1 GHz with Notch Filter



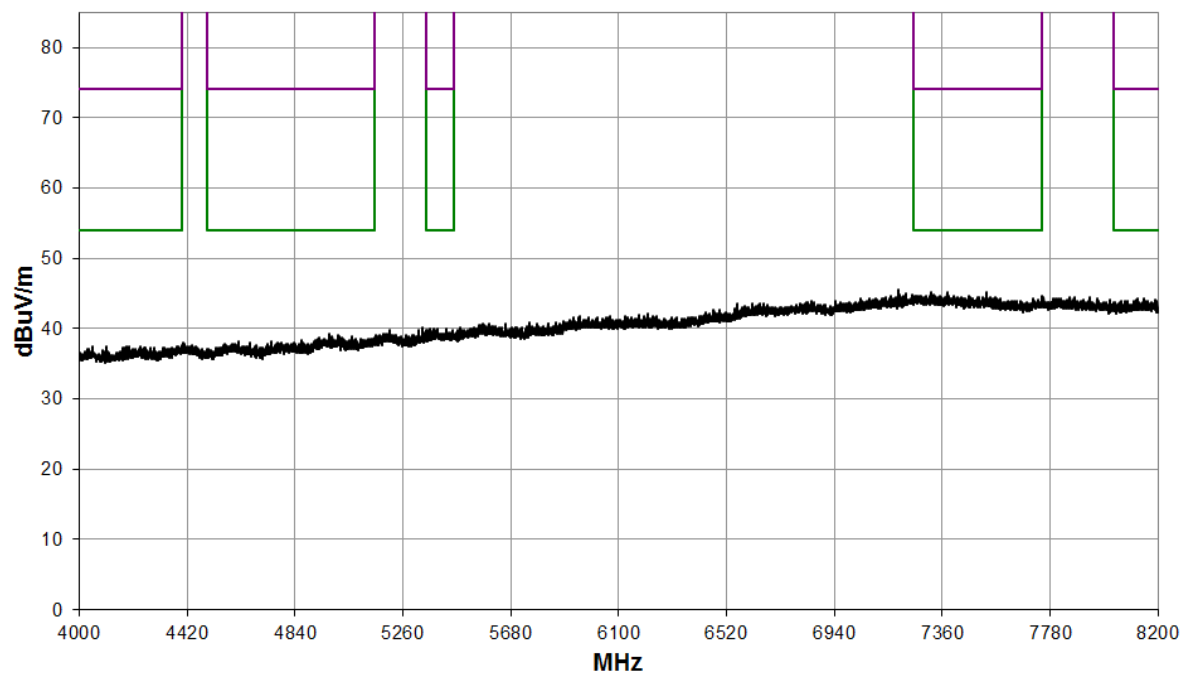
30 MHz to 1 GHz without Notch Filter



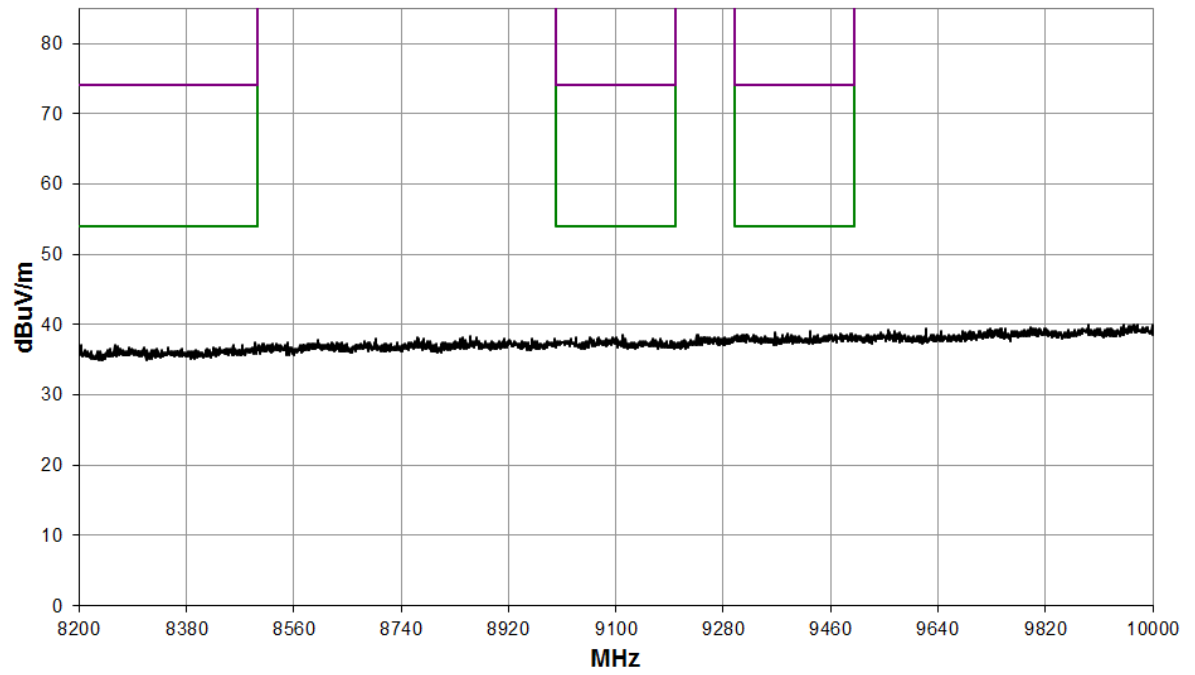
## 1 GHz to 4 GHz



## 4 GHz to 8.2 GHz

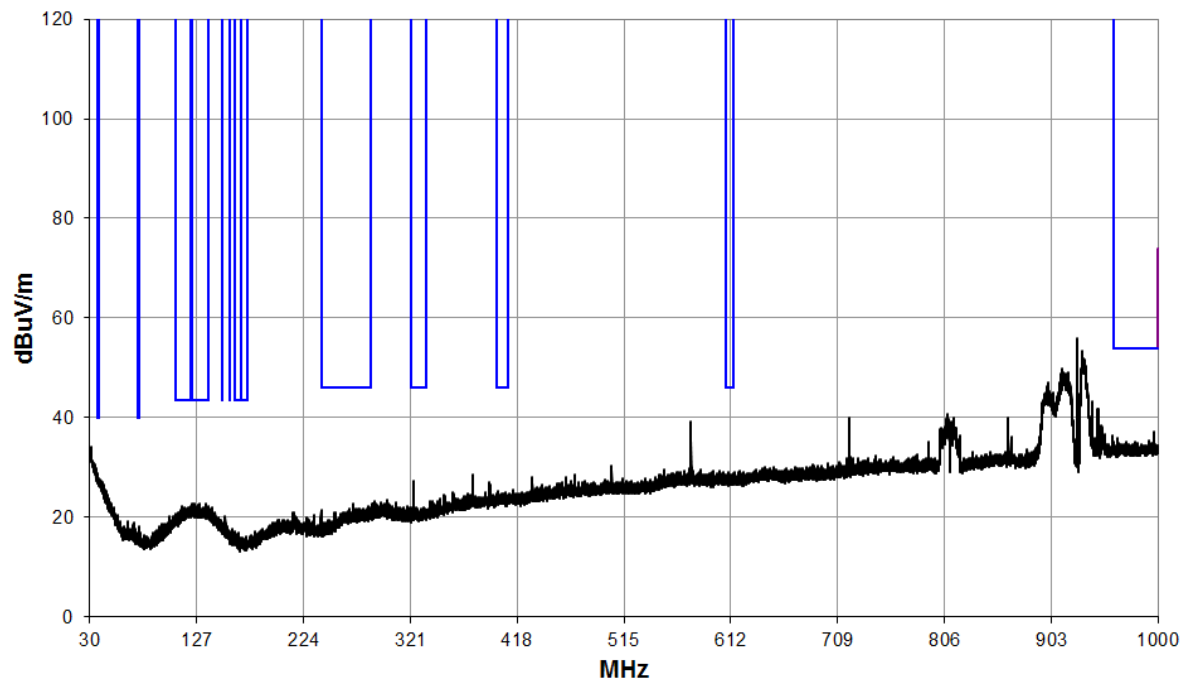


## 8.2 GHz to 10 GHz

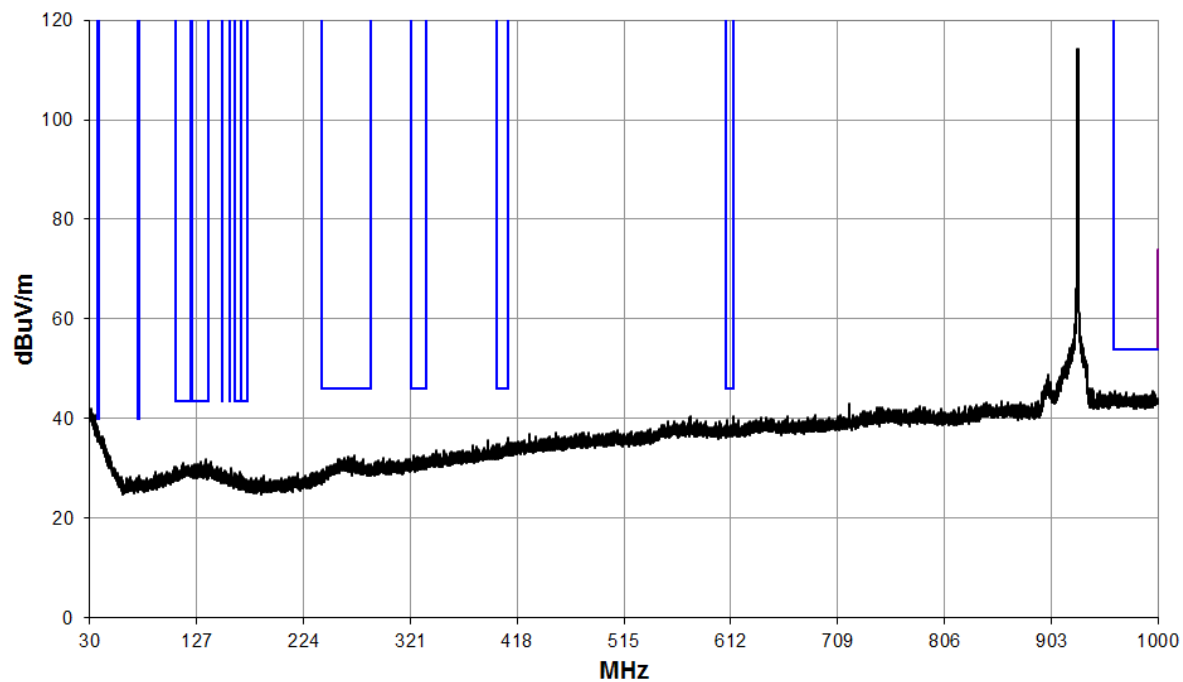


High Power; Frequency: 927 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dB $\mu$ V)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Duty Cycle Corr'n (dB)	Distance Extrap'n Factor (dB)	Field Strength (dB $\mu$ V/m)	Field Strength ( $\mu$ V/m)	Limit ( $\mu$ V/m)
No emissions within 20 dB of the limit										

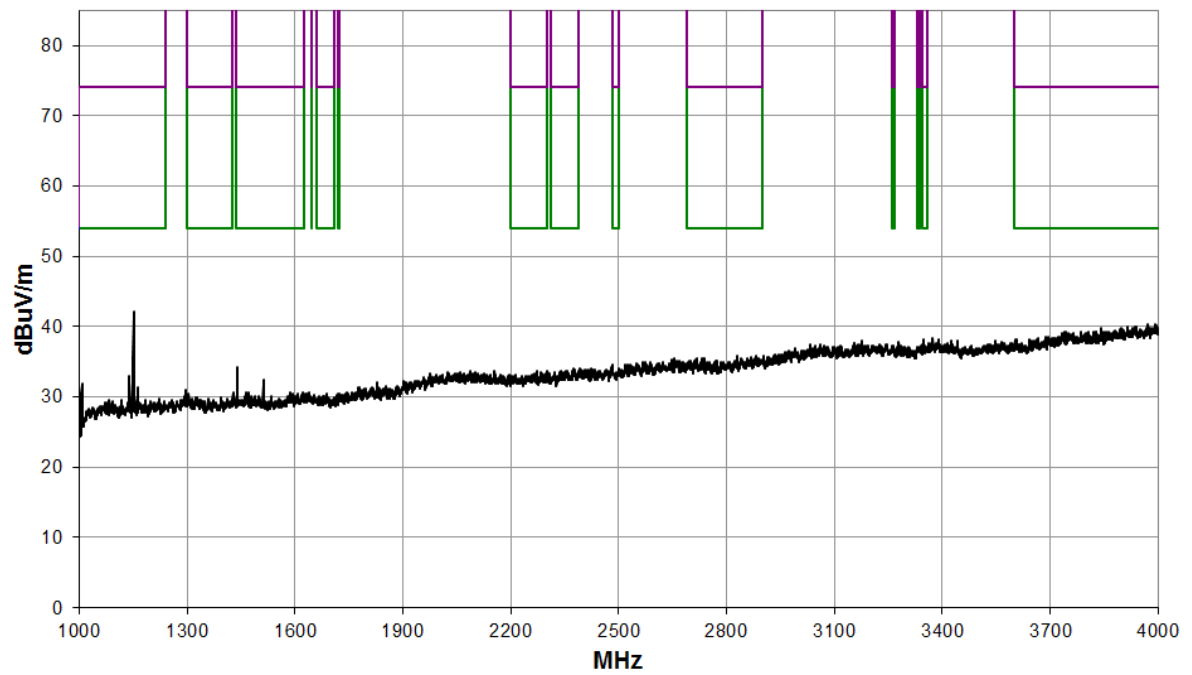
30 MHz to 1 GHz with Notch Filter



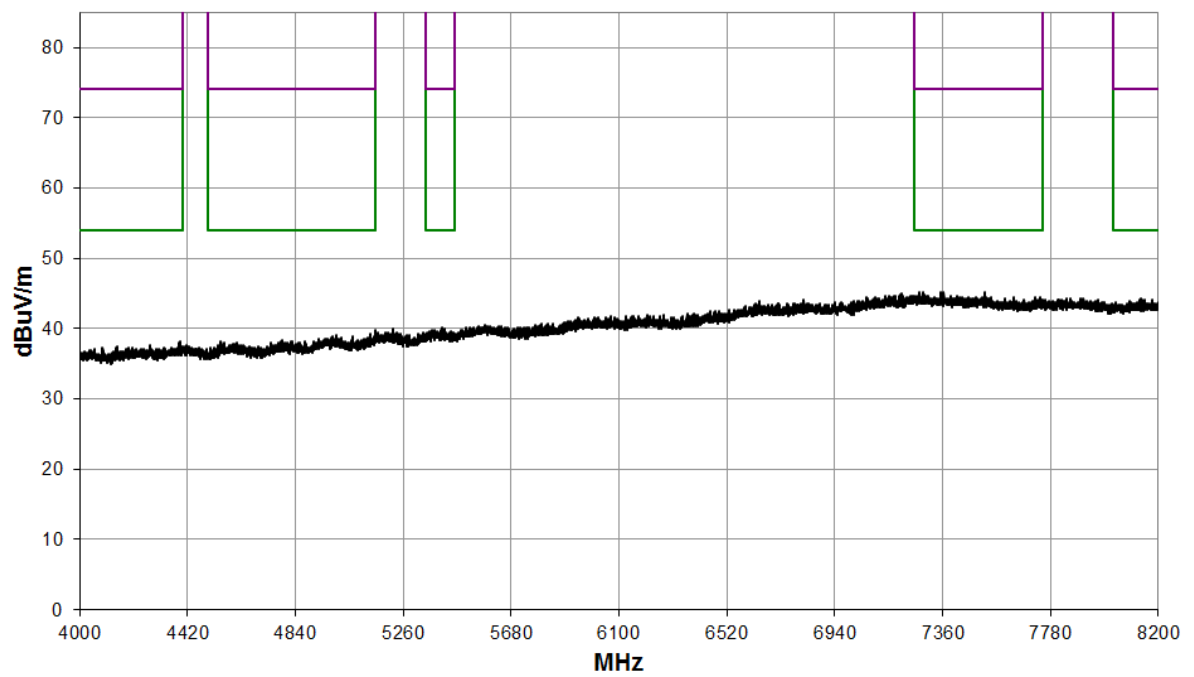
30 MHz to 1 GHz without Notch Filter



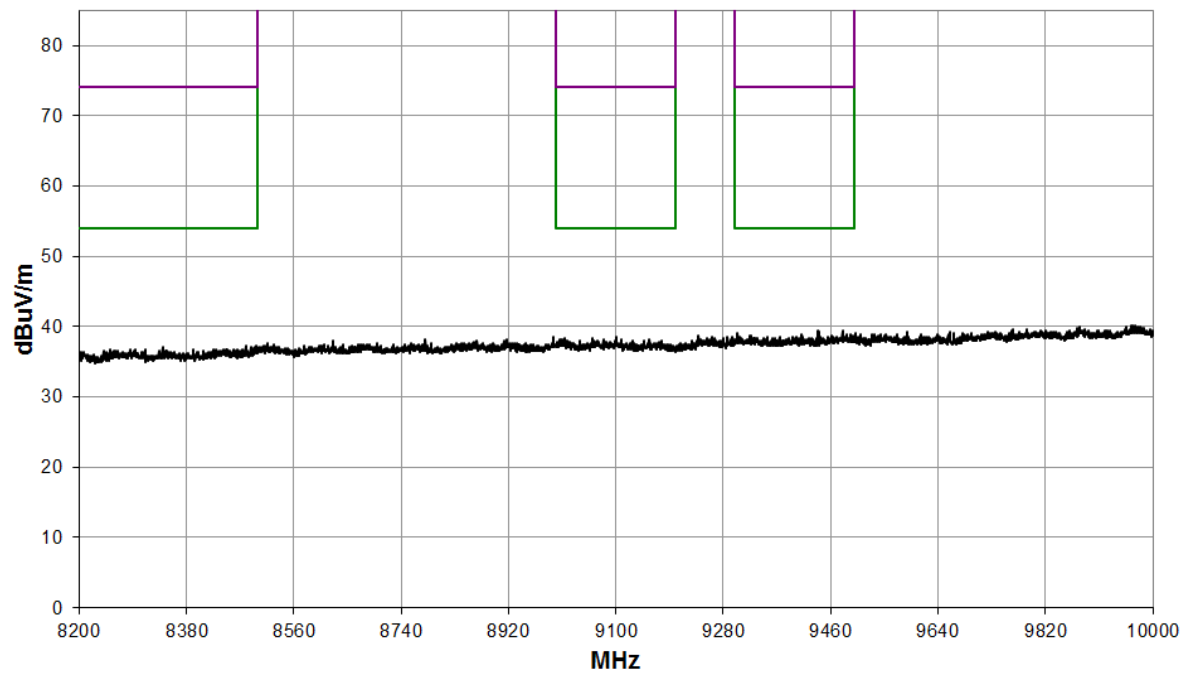
## 1 GHz to 4 GHz



## 4 GHz to 8.2 GHz



## 8.2 GHz to 10 GHz



## 12 Occupied Bandwidth

### 12.1 Definition

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal.

### 12.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Wireless Laboratory 1
Test Standard and Clause:	FCC: ANSI C63.10-2013, Clause 11.8
EUT Frequencies Measured:	902.5 MHz / 915 MHz / 927 MHz
EUT Channel Bandwidths:	500 kHz
EUT Test Modulations:	FSK
Deviations From Standard:	None
Measurement BW:	100 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	300 kHz
Measurement Span: (requirement 2 to 5 times OBW)	2 MHz
Measurement Detector:	Peak

### Environmental Conditions (Normal Environment)

Temperature: 20 °C	+15 °C to +35 °C (as declared)
Humidity: 48 % RH	20 % RH to 75 % RH (as declared)
Supply: 7.4 Vdc	(as declared)

### 12.3 Test Limit

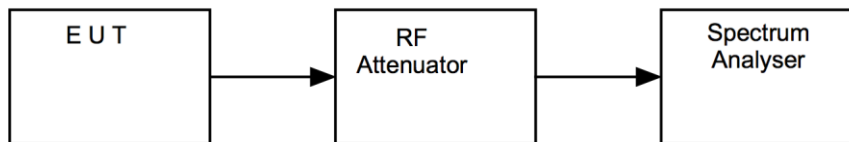
The minimum -6 dB bandwidth shall be at least 500 kHz.

## 12.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iii, the bandwidth of the EUT was measured on a spectrum analyser.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

**Figure iii Test Setup**



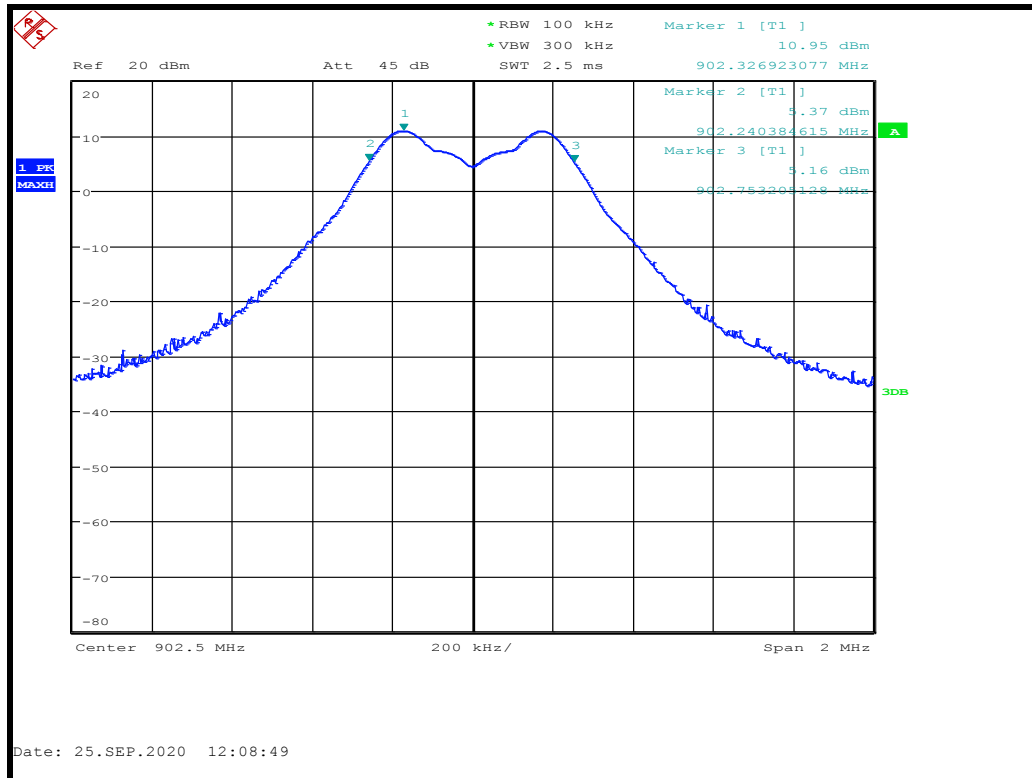
## 12.5 Test Equipment

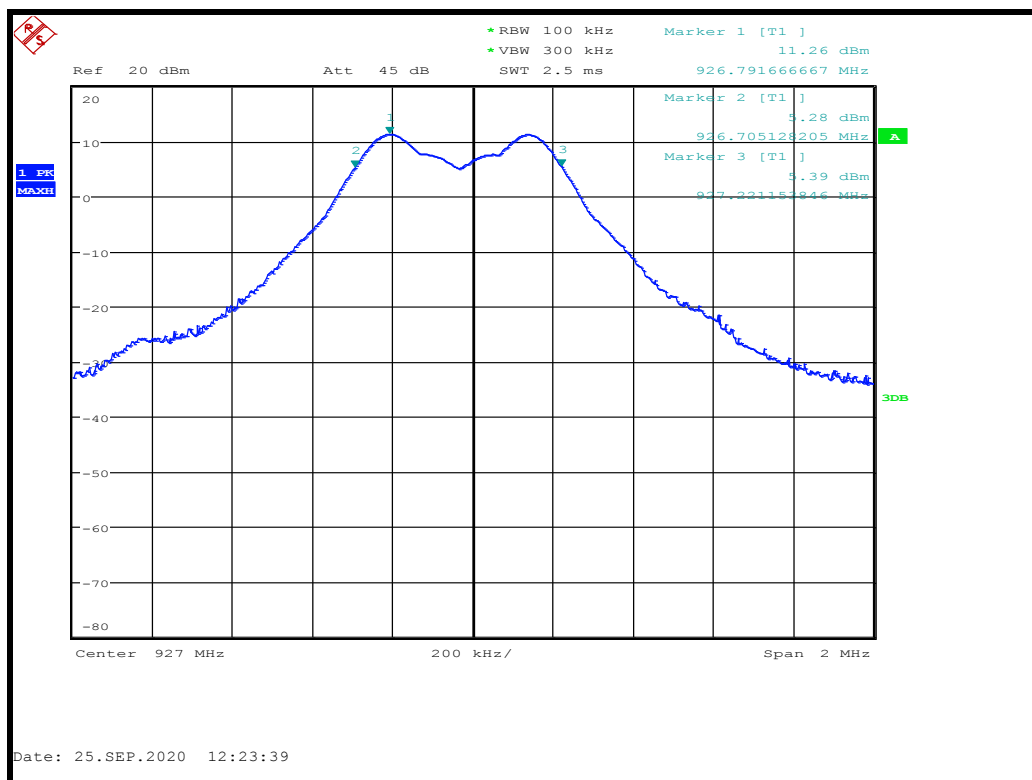
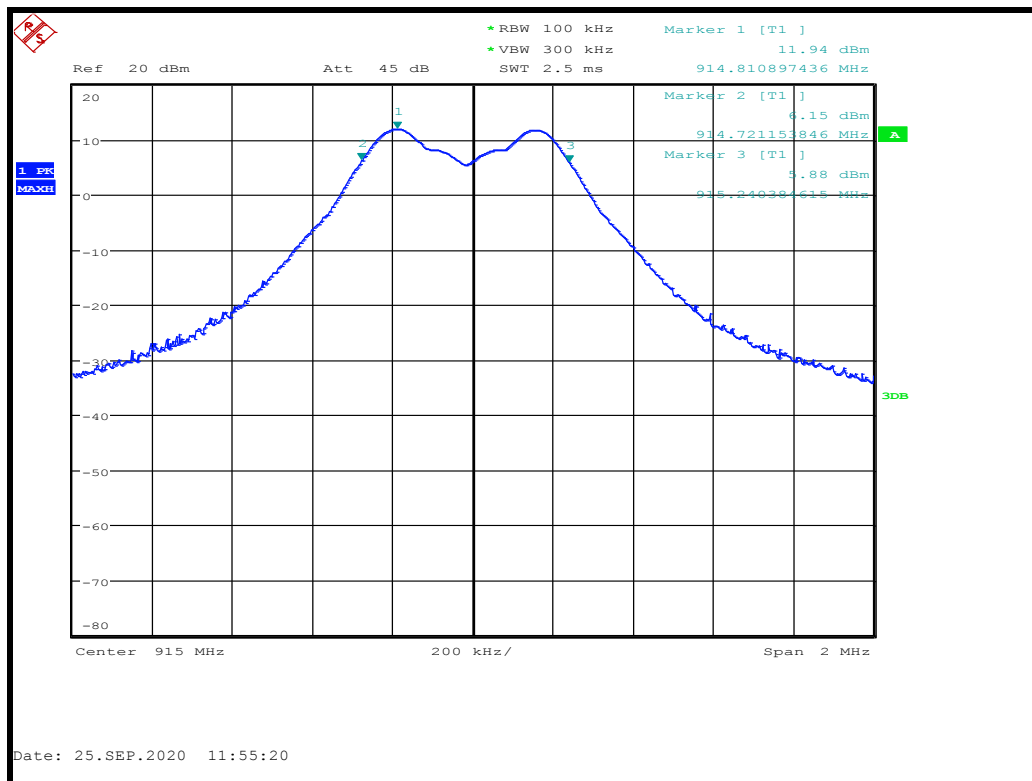
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU26	R&S	Spectrum Analyser	U405	2021-07-17



## 12.6 Test Results

FCC 15.247. Modulation: FSK; Power setting: Full				
Channel Frequency (MHz)	$F_L$ (MHz)	$F_H$ (MHz)	6dB Bandwidth (kHz)	Result
902.5	902.240384615	902.753205128	512.820513	PASS
915	914.721153846	915.240384615	519.230769	PASS
927	926.705128205	927.221153846	516.025641	PASS





## 13 Maximum peak conducted output power

### 13.1 Definition

The maximum peak conducted output power is defined as the maximum power level measured with a peak detector using a filter with width and shape of which is sufficient to accept the signal bandwidth.

The maximum conducted output power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level.

### 13.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Wireless Laboratory 1
Test Standard and Clause:	ANSI C63.10-2013, Clause 11.9.1
EUT Frequencies Measured:	902.5 MHz / 915 MHz / 927 MHz
EUT Channel Bandwidths:	500 kHz
Deviations From Standard:	None
Measurement BW:	1 MHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	3 MHz
Measurement Detector:	Peak
Voltage Extreme Environment Test Range:	Battery Power = Fully Charged Battery.

### Environmental Conditions (Normal Environment)

Temperature: 20 °C	+15 °C to +35 °C (as declared)
Humidity: 48 % RH	20 % RH to 75 % RH (as declared)

### 13.3 Test Limit

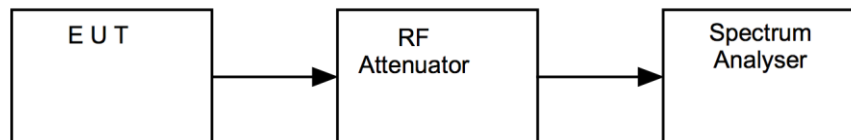
For systems employing digital modulation techniques operating in the bands 902 to 928 MHz, 2400 to 2483.5 MHz and 5725 to 5850 MHz, the maximum peak conducted output power shall not exceed 1 W.

### 13.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure iv, the resolution bandwidth of the spectrum analyser was increased above the EUT occupied bandwidth and the peak emission data noted.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst-case configuration in each bandwidth.

**Figure iv Test Setup**



### 13.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU26	R&S	Spectrum Analyser	U405	2021-07-17

### 13.6 Test Results

<i>Modulation: FSK; Power setting: Full</i>				
<i>Channel Frequency (MHz)</i>	<i>Analyzer Level (dBm)</i>	<i>Cable loss (dB)</i>	<i>Power (mW)</i>	<i>Result</i>
902.5	10.93	0.3	13.3	PASS
915	11.72	0.3	15.9	PASS
927	10.95	0.3	13.3	PASS

## 14 Out-of-band and conducted spurious emissions

### 14.1 Definition

#### *Out-of-band emission.*

Emission on a frequency or frequencies immediately outside the necessary bandwidth that results from the modulation process but excluding spurious emissions.

#### *Spurious emission.*

Emission on a frequency or frequencies that are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products, and frequency conversion products, but exclude out-of-band emissions.

### 14.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Wireless Laboratory 1
Test Standard and Clause:	ANSI C63.10-2013, Clause 11.11
EUT Frequencies Measured:	902.5 MHz / 915 MHz / 927 MHz
EUT Channel Bandwidths:	500 kHz
Deviations From Standard:	None
Measurement BW:	100 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	300 kHz
Measurement Detector:	Peak
Measurement Range:	30 MHz to 10 GHz

### Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 46 % RH	20 % RH to 75 % RH (as declared)
Supply: 7.4 Vdc	(as declared)

### 14.3 Test Limit

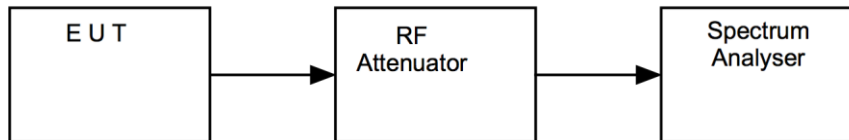
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in FCC 47CFR15.209(a) / RSS-Gen is not required.

#### 14.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure v, the emissions from the EUT were measured on a spectrum analyser.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

**Figure v Test Setup**

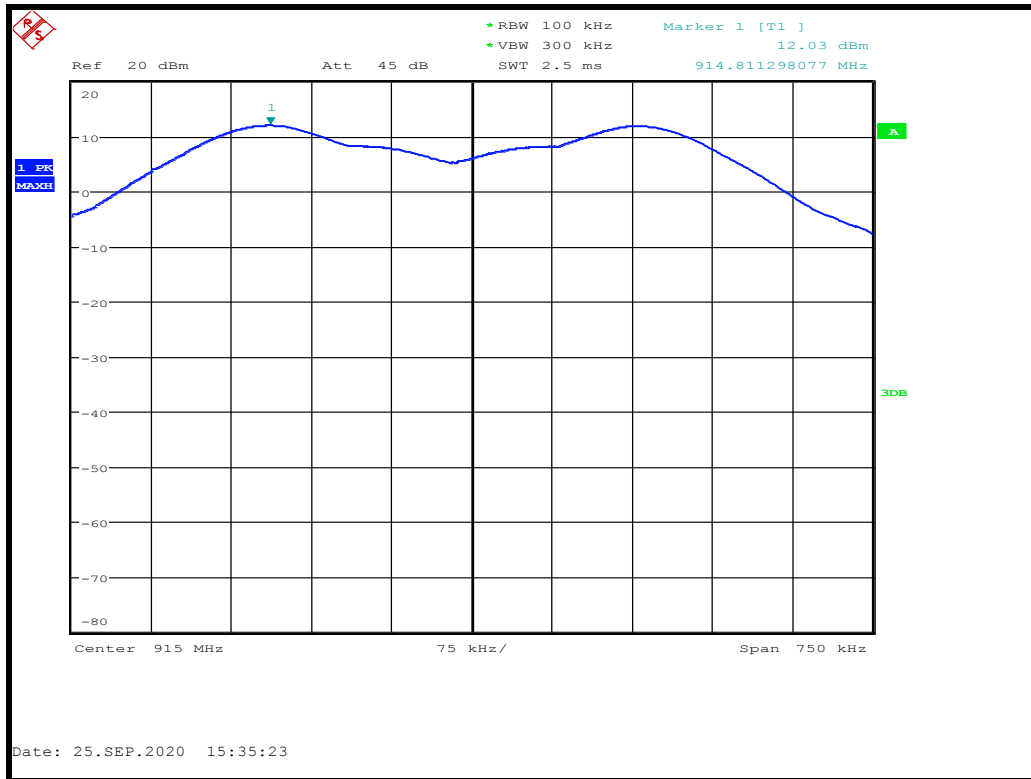


#### 14.5 Test Equipment

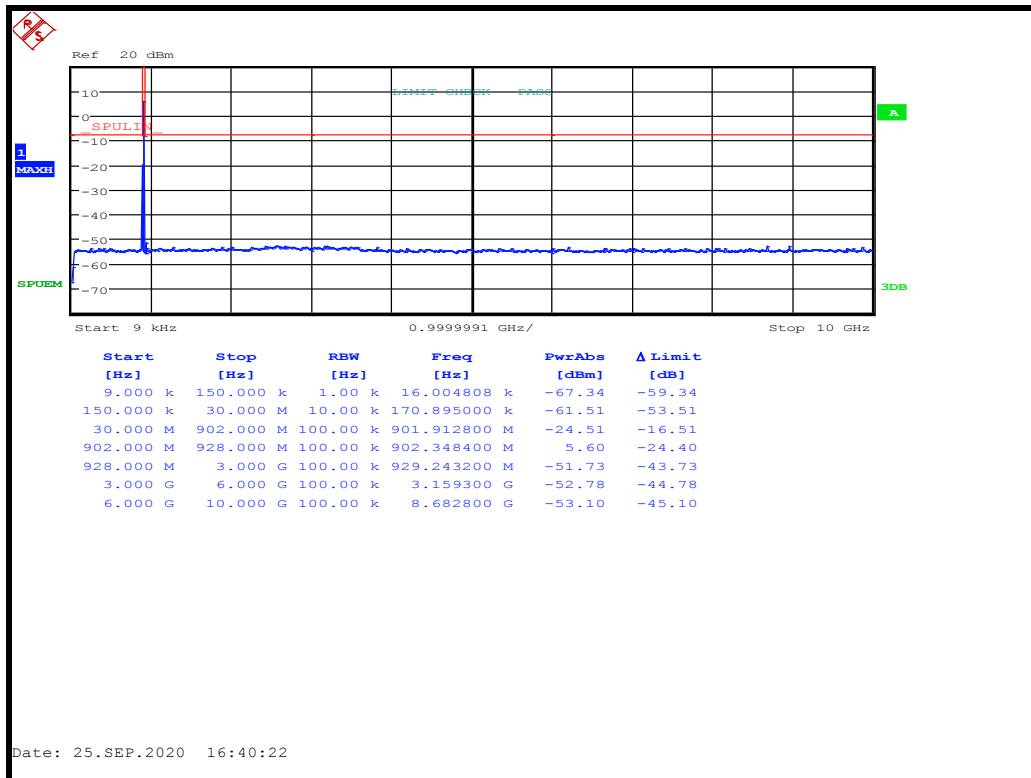
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU26	R&S	Spectrum Analyser	U405	2021-07-17

## 14.6 Test Results

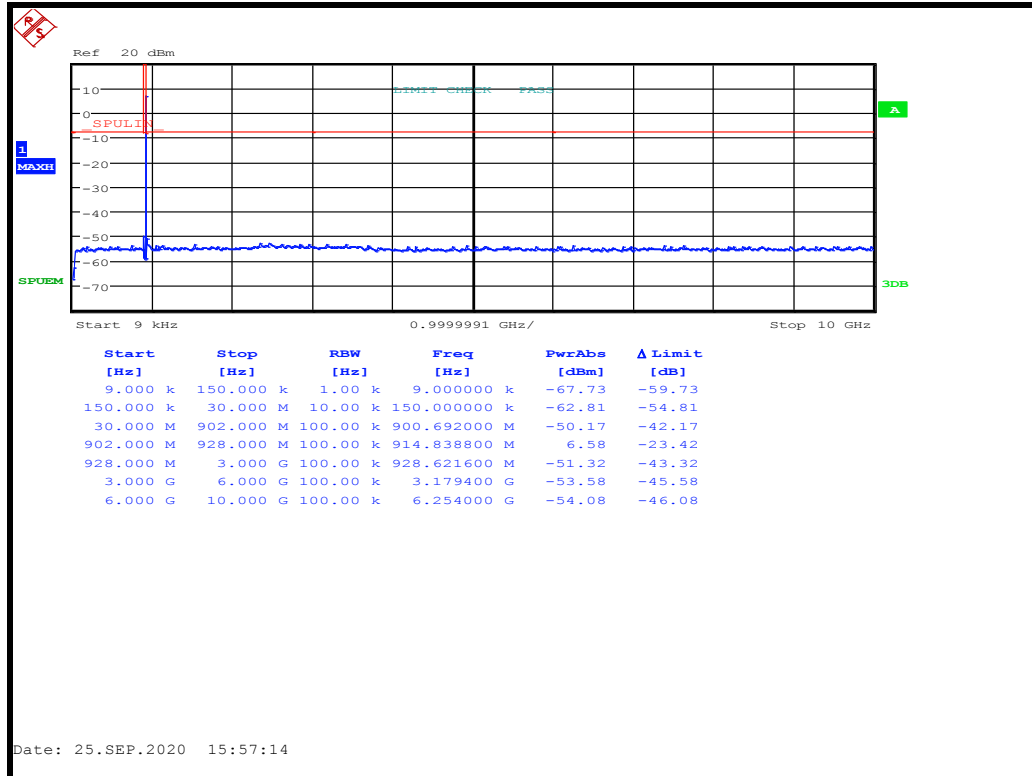
Reference Level Measurement:



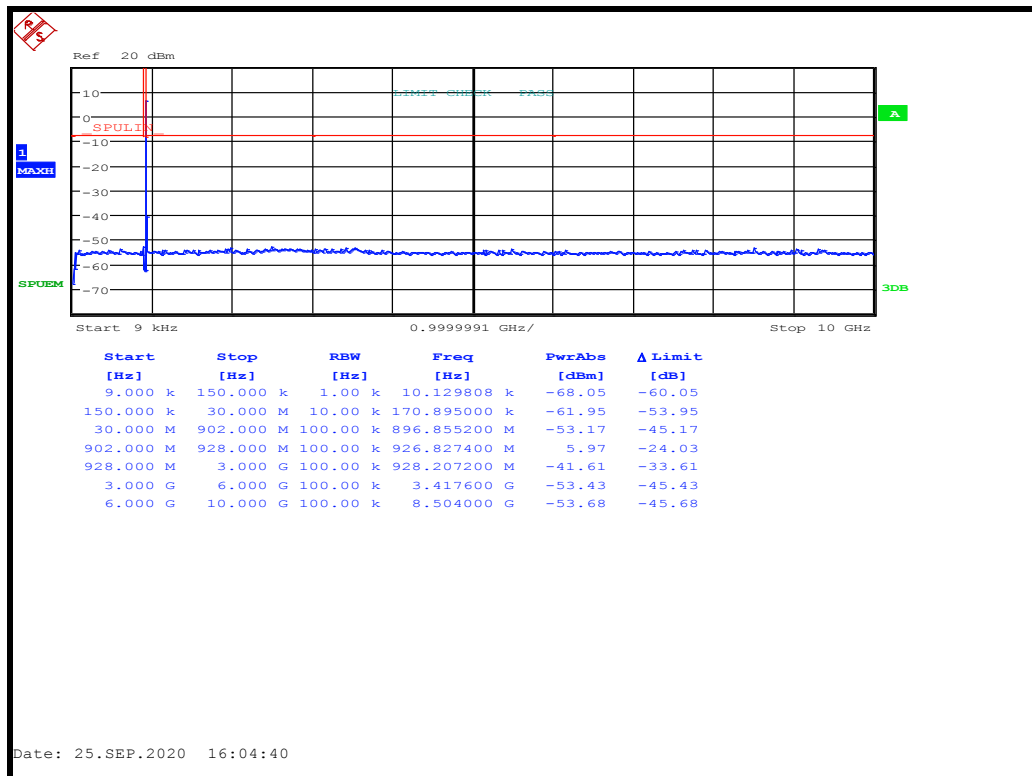
902.5 MHz:



915 MHz:

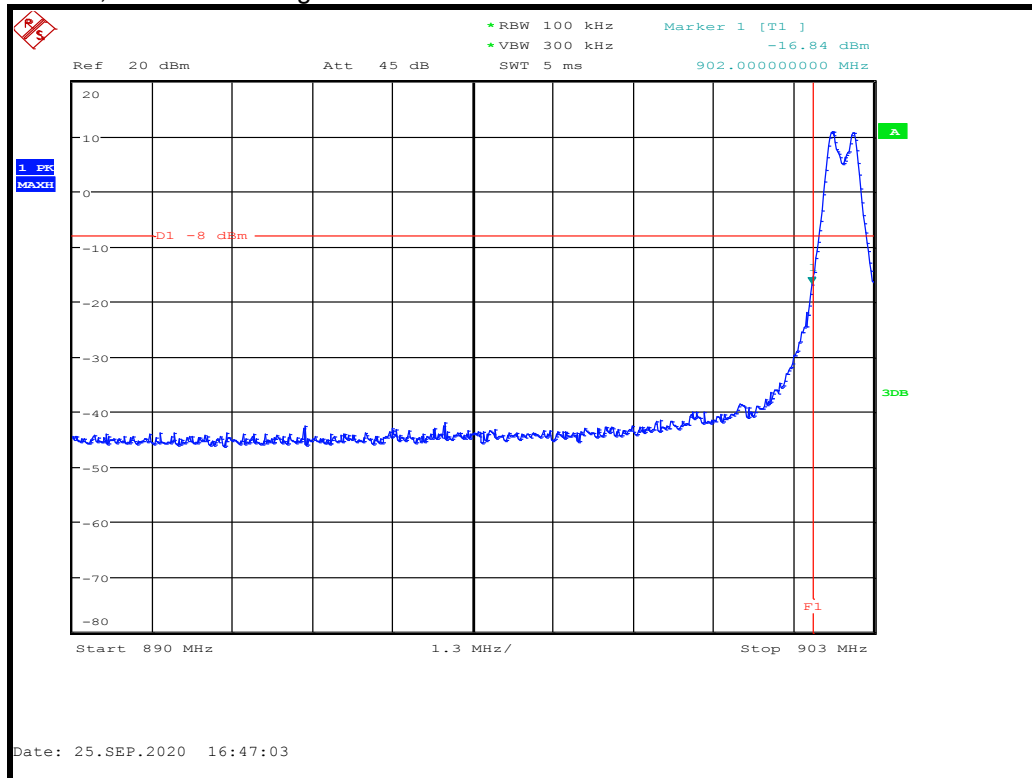


927 MHz:

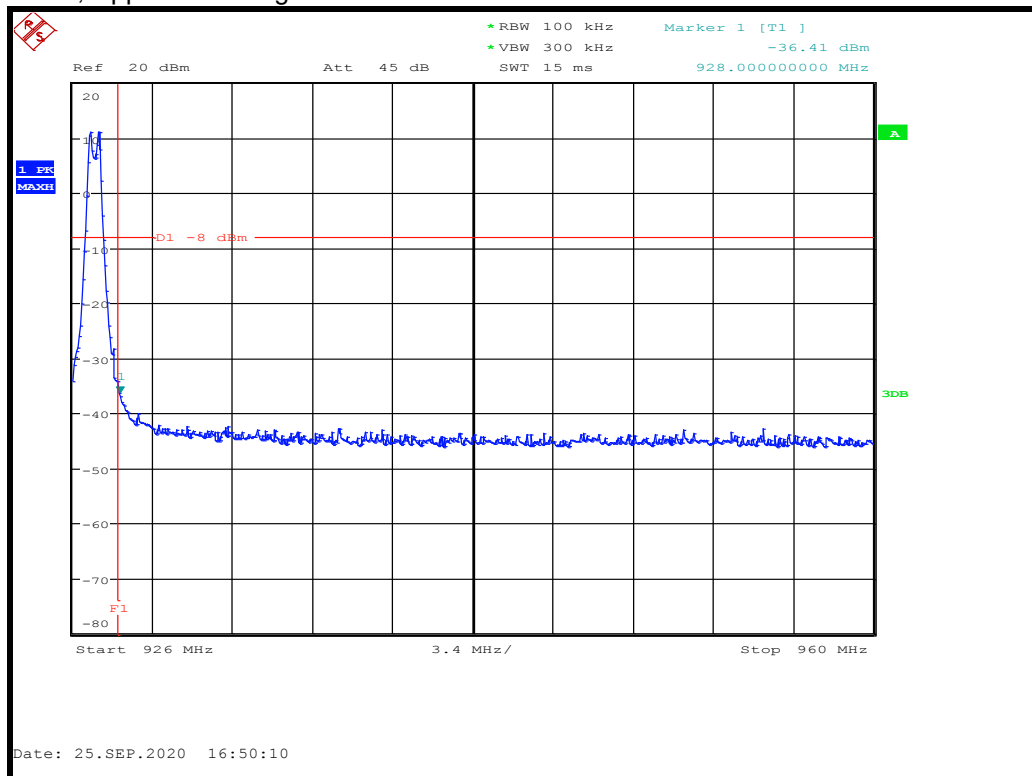




## 902.5 MHz; Lower Band Edge:



## 927 MHz; Upper Band Edge:



## 15 Power spectral density

### 15.1 Definition

The power per unit bandwidth.

### 15.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Wireless Laboratory 1
Test Standard and Clause:	ANSI C63.10-2013, Clause 11.10
EUT Frequencies Measured:	902.5 MHz / 915 MHz / 927 MHz
EUT Channel Bandwidths:	500 kHz
Deviations From Standard:	None
Measurement BW:	3 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	10 kHz
Measurement Span: (requirement 1.5 times Channel BW)	750 kHz
Measurement Detector:	Peak

### Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 47 % RH	20 % RH to 75 % RH (as declared)
Supply: 7.4 V dc	(as declared)

### 15.3 Test Limit

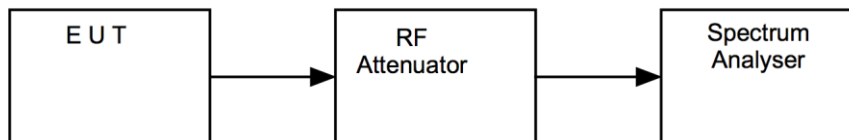
The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 15.4 Test Method

With the EUT setup as per section 9 of this report and connected as per Figure vi, the peak emission of the EUT was measured on a spectrum analyser, with path losses taken into account.

The measurements were performed with EUT set at its maximum duty. All modulation schemes, data rates and power settings were used to observe the worst case configuration in each bandwidth.

**Figure vi Test Setup**



### 15.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU26	R&S	Spectrum Analyser	U405	2021-07-17

### 15.6 Test Results

<i>Modulation: FSK; Power setting: Full</i>				
<i>Channel Frequency (MHz)</i>	<i>Analyzer Level (dBm)</i>	<i>Cable loss (dB)</i>	<i>Power (dBm)</i>	<i>Result</i>
902.5	2.9	0.5	3.4	PASS
915	3.7	0.5	4.2	PASS
927	3.0	0.5	3.5	PASS

## 16 Measurement Uncertainty

### Calculated Measurement Uncertainties

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95 % confidence:

#### [1] Radiated spurious emissions

Uncertainty in test result (30 MHz to 1 GHz) = **4.75 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.46 dB**

#### [2] AC power line conducted emissions

Uncertainty in test result = **3.2 dB**

#### [3] Occupied bandwidth

Uncertainty in test result = **15.58 %**

#### [4] Conducted carrier power

Uncertainty in test result (Spectrum Analyser) = **3.1 dB**

Uncertainty in test result (Power Meter) = **0.9 dB**

#### [5] Conducted RF power out-of-band

Uncertainty in test result – up to 8.1 GHz = **3.31 dB**

Uncertainty in test result – 8.1 GHz to 15.3 GHz = **4.43 dB**

#### [6] Radiated RF power out-of-band

Uncertainty in test result (30 MHz to 1 GHz) = **4.75 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.46 dB**

#### [7] Power spectral density

Uncertainty in test result (Spectrum Analyser) = **3.11 dB**

#### [8] ERP / EIRP

Uncertainty in test result (Laboratory) = **4.71 dB**

Uncertainty in test result (Pershore OATS) = **4.26 dB**

## 17 RF Exposure

### General SAR test reduction & exclusion guidance

#### KDB 447498

#### Section 4.3 General SAR test reduction and exclusion guidance

For Standalone SAR exclusion consideration, when SAR Exclusion Threshold requirement in KDB 447498 is satisfied, standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required.

The SAR Test Exclusion Threshold for frequencies in the range 100 MHz to 6 GHz, and for test separation distance of  $\leq 50$  mm, is determined as follows.

$$\text{SAR Exclusion Threshold (SARET)} = (\text{NT} \times \text{TSD}_A) / \sqrt{f_{\text{GHz}}}$$

Where,

NT = Numeric Threshold (3.0 for 1-g SAR and 7.5 for 10-g SAR)

TSD<sub>A</sub> = Minimum Test separation distance or 50 mm (whichever is lower)

f<sub>GHz</sub> = Transmit frequency in GHz

<i>Channel Frequency (MHz)</i>	<i>Maximum Conducted Power (mW)</i>	<i>SAR Exclusion Threshold at 10 mm (mW)</i>	<i>SAR Evaluation</i>
915	15.9	31.4	Not Required

Therefore standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required.