Report on the Radio Testing

For

Maxam Initiation Systems, S. L

on

RIOTRONIC X+ BLASTER 915

Report no. TRA-049647-45-04B

27th October 2020

Report Number: TRA-049647-45-04B
Issue: B

REPORT ON THE RADIO TESTING OF A
Maxam Initiation Systems, S. L
RIOTRONIC X+ BLASTER 915
WITH RESPECT TO SELECTED CLAUSES OF SPECIFICATION
FCC 47CFR 15.247 & ISED RSS-247

TEST DATE: 2020/09/28 - 2020/10/21

Tested by: D Garvey

Written by: D Garvey
Radio Test Engineer

Approved by: K J Anderson
Principal Engineer, EMC and Radio

Digitally signed by Ken Anderson
Date: 2020.10.27 11:13:26 Z

Date: 27th October 2020

Element Materials Technology Warwick Ltd.
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Company Reg No. 02536659

1 Revision Record

Issue Number	*Issue Date*	*Revision History*
A	02 October 2020	Original
B	27th October 2020	Update after certification check

2 Summary

TEST REPORT NUMBER:	TRA-049647-45-04B
WORKS ORDER NUMBER:	TRA-049647-03
PURPOSE OF TEST:	Certification
TEST SPECIFICATIONS:	47CFR15.247 & RSS-247 – Selected Clauses
EQUIPMENT UNDER TEST (EUT):	RIOTRONIC X+ BLASTER 915
FCC IDENTIFIER:	2AXG5-043007003
ISED IDENTIFIER:	26072-043007003
EUT SERIAL NUMBER:	13-00100012
MANUFACTURER/AGENT:	Maxam Initiation Systems, S.L.
ADDRESS:	Avenida de Partenon 16 28042 Madrid Spain
CLIENT CONTACT:	Jose Vega ☎ +34 667 181 471 ✉ jmvega@maxam.net
ORDER NUMBER:	220J102649
TEST DATE:	2020/09/28 - 2020/10/21
TESTED BY:	D Garvey Element

2.1 Test Summary

Test Method and Description		*Requirement Clause 47CFR15*	*Requirement Clause RSS*	*Applicable to this equipment*	*Result / Note*
Radiated spurious emissions (restricted bands of operation and cabinet radiation)		15.247 (d)	247, 3.3	☒	*Pass Note 1*
AC power line conducted emissions		15.207	Gen, 8.8	☐	*Note 2*
Occupied bandwidth		15.247 (a) (2)	247, 5.2 (a)	☐	*Note 1*
Conducted carrier power	Peak	15.247 (b) (3)	247, 5.4 (d)	☒	*Pass Note 1*
	Max.			☐	
Out of band emissions		15.247 (d)	247, 5.5	☐	*Note 1*
Power spectral density		15.247 (e)	247, 5.2 (b)	☐	*Note 1*
Calculation of duty correction		-	15.35 (c)	☐	*Note 3*

Specific Note:

1. Only limited testing was performed as per client's request
2. Not Applicable as the EUT did not transmit whilst the batteries were being charged
3. Not Applicable as no duty correction was required

General Notes:

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).

3 Contents

4 Introduction

This report TRA-049647-45-04B presents the results of the Radio testing on a Maxam, RIOTRONIC X+ BLASTER 915 to specification 47CFR15 Radio Frequency Devices. RSS-247 - Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

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

☒ Element Hull
Unit E
South Orbital Trading Park
Hedon Road
Hull
HU9 1NJ
UK

☐ Element Skelmersdale
Unit 1
Pendle Place
Skemersdale
West Lancashire
WN8 9PN
UK

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 Numbers:

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.
- ISED RSS-247, Issue 2, February 2017 – Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.
- ISED RSS-Gen, Issue 5, March 2019 – General Requirements for Compliance of Radio Apparatus.
- 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

Radiated spurious emissions testing and Total power were only performed on 1 channel.

6 Glossary of Terms

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

7 Equipment under Test

7.1 EUT Identification

- Name: RIOTRONIC X+ BLASTER 915
- Serial Number: 13-00100012
- Model Number: 043.007.003
- 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.

Not Applicable – No support/monitoring equipment required.

7.3 EUT Mode of Operation

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

7.4 EUT Radio Parameters

7.4.1 General

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

7.4.2 Antennas

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

7.4.3 Product specific declarations

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

7.5 EUT Description

The EUT is a blaster which is used to connect with detonators to perform the blast

8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

9.1 Block Diagram

The following diagram shows basic EUT interconnections:

9.2 General Set-up Photograph

The following photograph shows basic EUT set-up:

9.3 Measurement software

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

Element Emissions R5

10 General Technical Parameters

10.1 Normal Conditions

The EUT was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was 7.4 Vdc from the lithium ion battery.

11 Maximum peak conducted output power

11.1 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.

11.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	Wireless Lab 3
Test Standard and Clause:	ANSI C63.10-2013, Clause 11.9.1
EUT Frequency Measured:	915 MHz
EUT Channel Bandwidths:	500 kHz
Deviations From Standard:	Testing only performed on 1 channel
Measurement BW:	1 MHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	3 MHz
Measurement Detector:	Peak
Voltage Extreme Environment Test Range:	Mains Power = 85 % and 115 % of Nominal (FCC only requirement); Battery Power = new battery.

Environmental Conditions (Normal Environment)

Temperature: 20 °C	+15 ºC to +35 ºC (as declared)
Humidity: 38 % RH	20 % RH to 75 % RH (as declared)

11.3 Test Limit

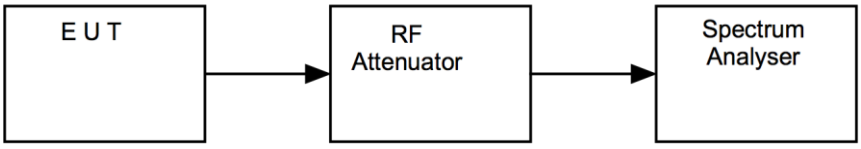
For systems employing digital modulation techniques operating in the bands 902 to 928 MHz, 2400 to 2483.5 MHz and 5725 to 5850 MHz, the maximum peak conducted output power shall not exceed 1 W.

11.4 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



11.5 Test Equipment

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

11.6 Test Results

Modulation: FSK; Power setting: Full				
Channel Frequency (MHz)	***Analyzer Level (dBm)***	***Cable loss (dB)***	***Power (mW)***	***Result***
915	11.66	0.3	15.7	PASS

12 Radiated emissions

12.1 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.

12.2 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
EUT Frequency Measured:	915 MHz
Deviations from Standard:	Testing only performed on 1 channel
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: 21 °C	+15 ºC to +35 ºC (as declared)
Humidity: 38 % RH	20 % RH to 75 % RH (as declared)
Supply: 7.4 Vdc	As declared

12.3 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

Frequency (MHz)	*Field Strength (µV/m at 3 m)*	*Field Strength (dBµV/m at 3 m)*
30 to 88	100	40.0
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

On frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function. On frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. The limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit.

12.4 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:

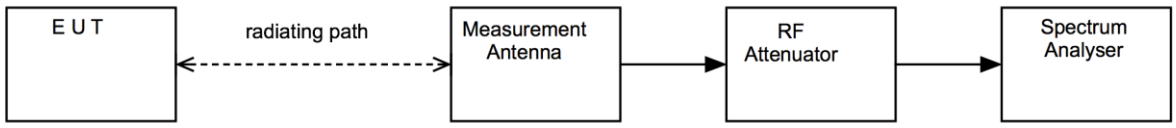
$$FS = PR + CL + AF – PA + DC – CF$$

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



12.5 Test Set-up Photograph

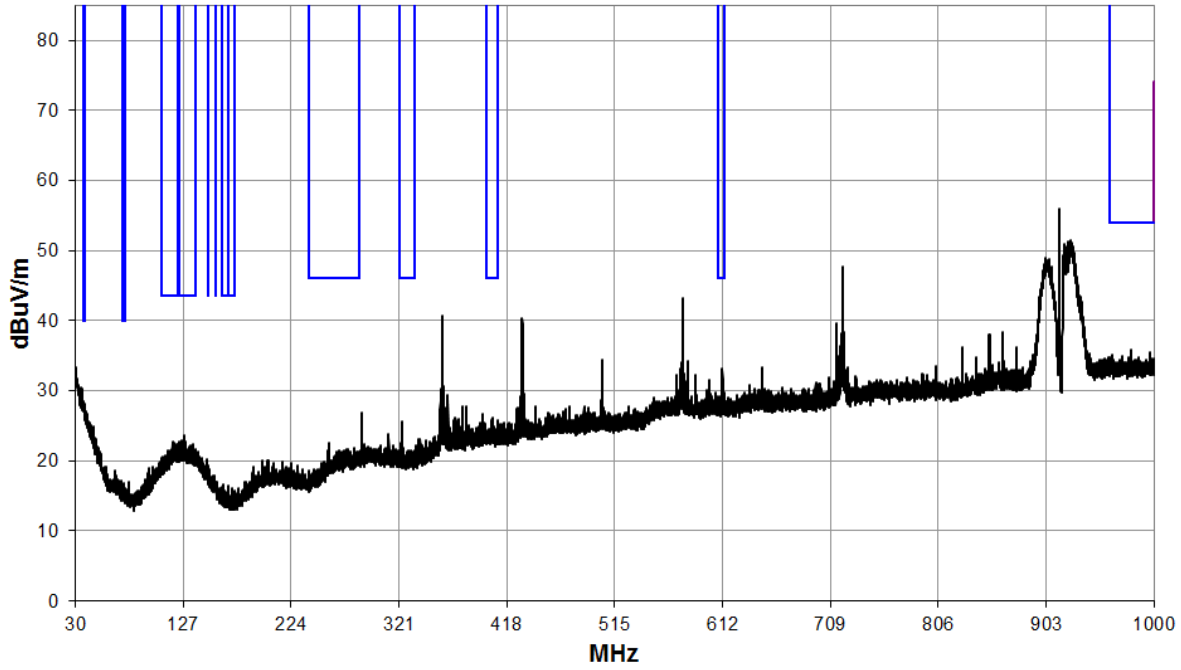
12.6 Test Equipment

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

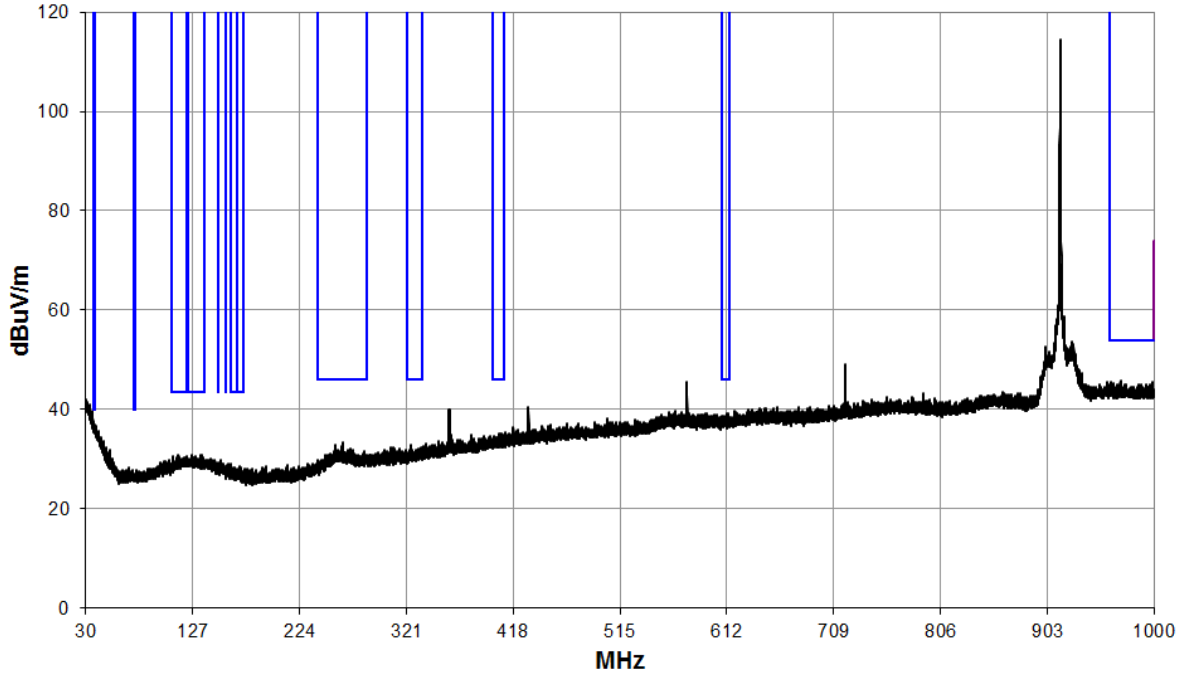
12.7 Test Results

Frequency: 915 MHz; Power Setting: High								
Detector	***Freq. (MHz)***	***Meas'd Emission (dBµV)***	***Factor (dB)***	***Duty Cycle Corr'n (dB)***	***Distance Extrap'n Factor (dB)***	***Field Strength (dBµV/m)***	***Limit (dBµV/m)***	***Margin (dB)***
No emissions within 20 dB of the limit								

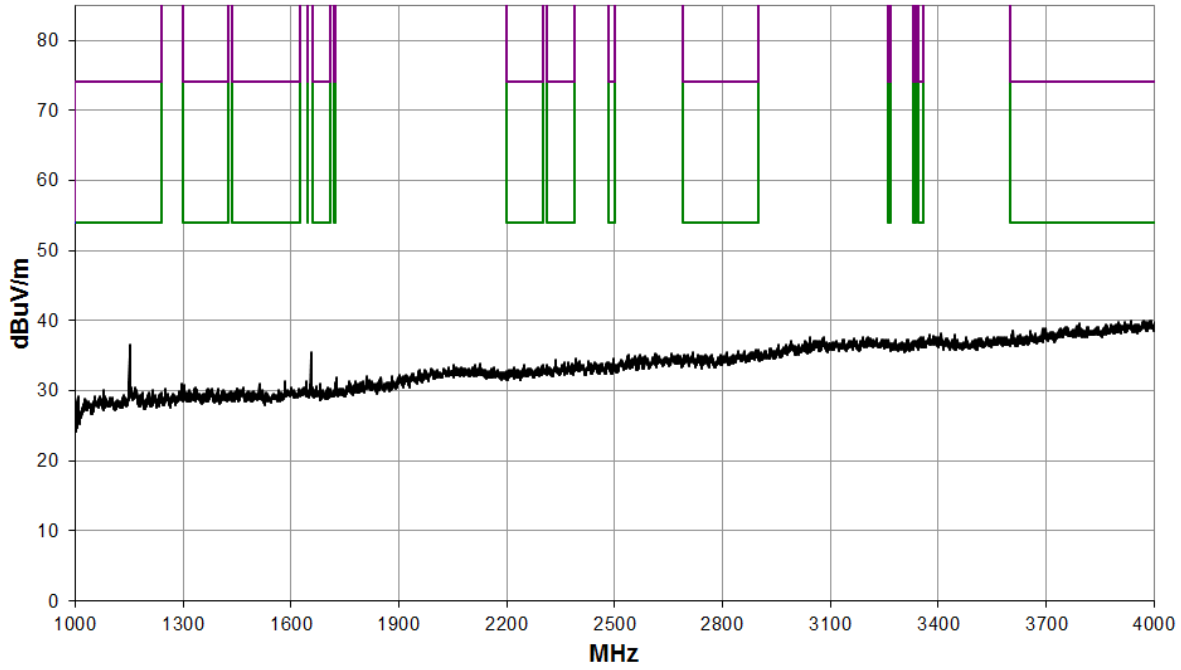
30 MHz to 1 GHz with Notch Filter



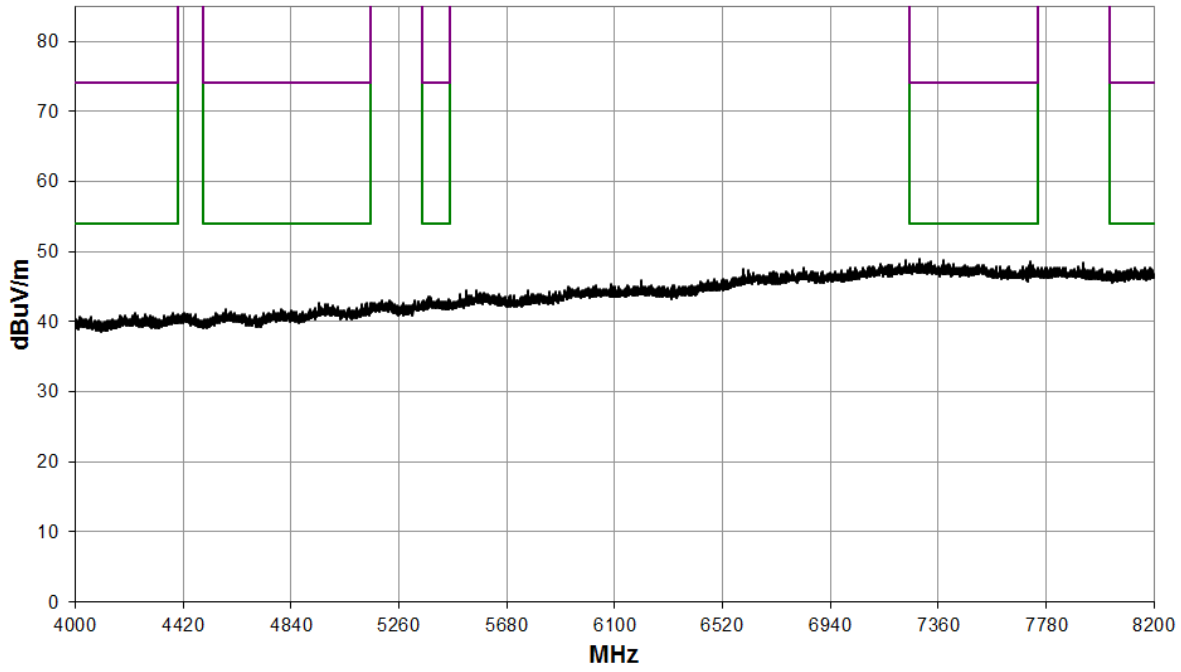
30 MHz to 1 GHz without Notch Filter



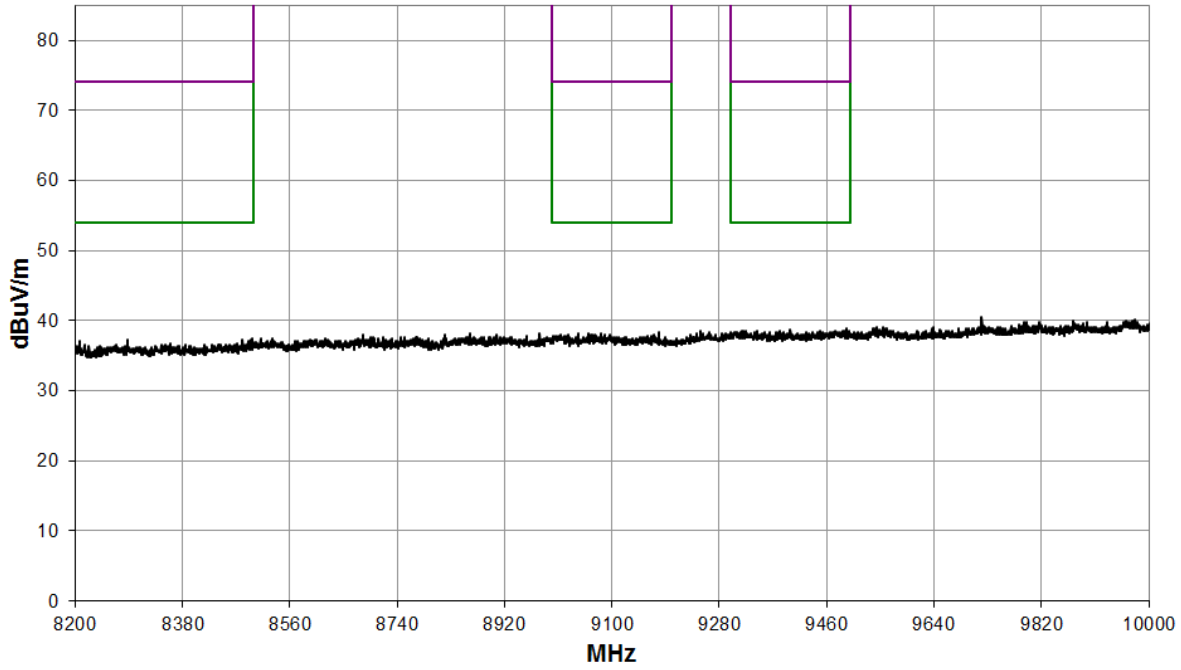
1 GHz to 4 GHz



4 GHz to 8.2 GHz



8.2 GHz to 10 GHz



13 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) = 4.8 dB
Uncertainty in test result (1 GHz to 18 GHz) = 4.5 dB

[2] AC power line conducted emissions

Uncertainty in test result = 3.2 dB

[3] Occupied bandwidth

Uncertainty in test result = 15.6 %

[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 = 3.3 dB
Uncertainty in test result – 8.1 GHz to 15.3 GHz = 4.4 dB

[6] Radiated RF power out-of-band

Uncertainty in test result (30 MHz to 1 GHz) = 4.8 dB
Uncertainty in test result (1 GHz to 18 GHz) = 4.5 dB

[7] Power spectral density

Uncertainty in test result (Spectrum Analyser) = 3.1 dB

[8] ERP / EIRP

Uncertainty in test result (Laboratory) = 4.7 dB

14 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 ≤ 50 mm, is determined as follows.

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

Where,

NT = Numeric Threshold (3.0 for 1-g SAR and 7.5 for 10-g SAR)
TSD_A = Minimum Test separation distance or 50 mm (whichever is lower)
f_{GHz} = Transmit frequency in GHz

Channel Frequency (MHz)	***Maximum Conducted Power (mW)***	***SAR Exclusion Threshold at 10 mm (mW)***	***SAR Evaluation***
915	15.7	31.4	Not Required

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

RF EXPOSURE TECHNICAL BRIEF

RSS-102 issue 5
2.5.1 Exemption Limits for Routine Evaluation – SAR Evaluation

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance.

Channel (MHz)	***EIRP (mW)***	***SAR Exclusion Threshold at a distance of 20 mm (mW)***	***SAR Evaluation***
915	49.7	66.5	Not Required