

Report on the Radio Testing
For
SMK Electronics (Europe) Limited
on
Situo 5 Variation RTS Pure II
Report no. TRA-038923-45-02A
28 March 2018

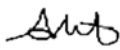
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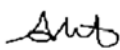
Report Number: TRA-038923-45-02A
Issue: A

REPORT ON THE RADIO TESTING OF A
SMK Electronics (Europe) Limited
Situo 5 Variation RTS Pure II
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.231

TEST DATE: 2018-02-08 to 2018-02-26

Tested by: 

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Date: 28 March 2018

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[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	28 March 2018	Original

2 Summary

TEST REPORT NUMBER:	TRA-038923-45-02A
WORKS ORDER NUMBER:	TRA-038923-00
PURPOSE OF TEST:	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):	47CFR15.231
EQUIPMENT UNDER TEST (EUT):	Situo 5 Variation RTS Pure II
FCC IDENTIFIER:	DWN-SITUOVIIRTS
MANUFACTURER/AGENT:	SMK Electronics (Europe) Limited
ADDRESS:	Unit 6, Parsons Court Welburn Way Aycliffe Business Park Newton Aycliffe Co Durham DL5 6ZE Ireland
CLIENT CONTACT:	Nick Wass ☎ 07768 030151 ✉ nwass@smkeurope.com
ORDER NUMBER:	105770
TEST DATE:	2018-02-08 to 2018-02-26
TESTED BY:	A Longley / A Tosif / A Wong / I Broadwell Element

2.1 Test Summary

<i>Test Method and Description</i>	<i>Requirement Clause 47CFR15</i>	<i>Applicable to this equipment</i>	<i>Result / Note</i>
Deactivation and Period Transmission/Polling	15.231 (a)1,2 & 3	☒	Pass
Field Strength of Fundamental and Spurious Emissions	15.231 (b)	☒	Pass
Occupied bandwidth	15.231 (c)	☒	Pass
AC power line conducted emissions	15.207	☐	Note 1

Specific Note:

1. The EUT is a battery powered device.

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).

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4 Introduction

This report TRA-038923-45-02A presents the results of the Radio testing on a SMK Electronics (Europe) Limited, Situo 5 Variation RTS Pure II to specification 47CFR15 Radio Frequency Devices.

The testing was carried out for SMK Electronics (Europe) Limited 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 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:

Element Hull 3483A

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

§	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
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: Situo 5 Variation RTS Pure II
- Model Number/Type: RXT9000-9406E – Situo 5 variation RTS Pure II FCC
- Software Revision: Not Stated
- Build Level / Revision Number: Not Stated

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

7.3.1 Transmission

The EUT was transmitting modulated carrier.

7.3.2 Reception

Not applicable. The EUT is a transmitter only device.

7.4 EUT Radio Parameters

Frequency of operation:	433.42 MHz
Modulation type:	OOK
Channel bandwidth:	224 kHz
Antenna type:	PCB trace antenna
Nominal Supply Voltage:	3.0 Vdc

7.5 EUT Description

The EUT is a 433.42 MHz remote control transmitter used for controlling motorised blinds.

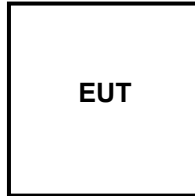
8 Modifications

No modifications were performed during this assessment.

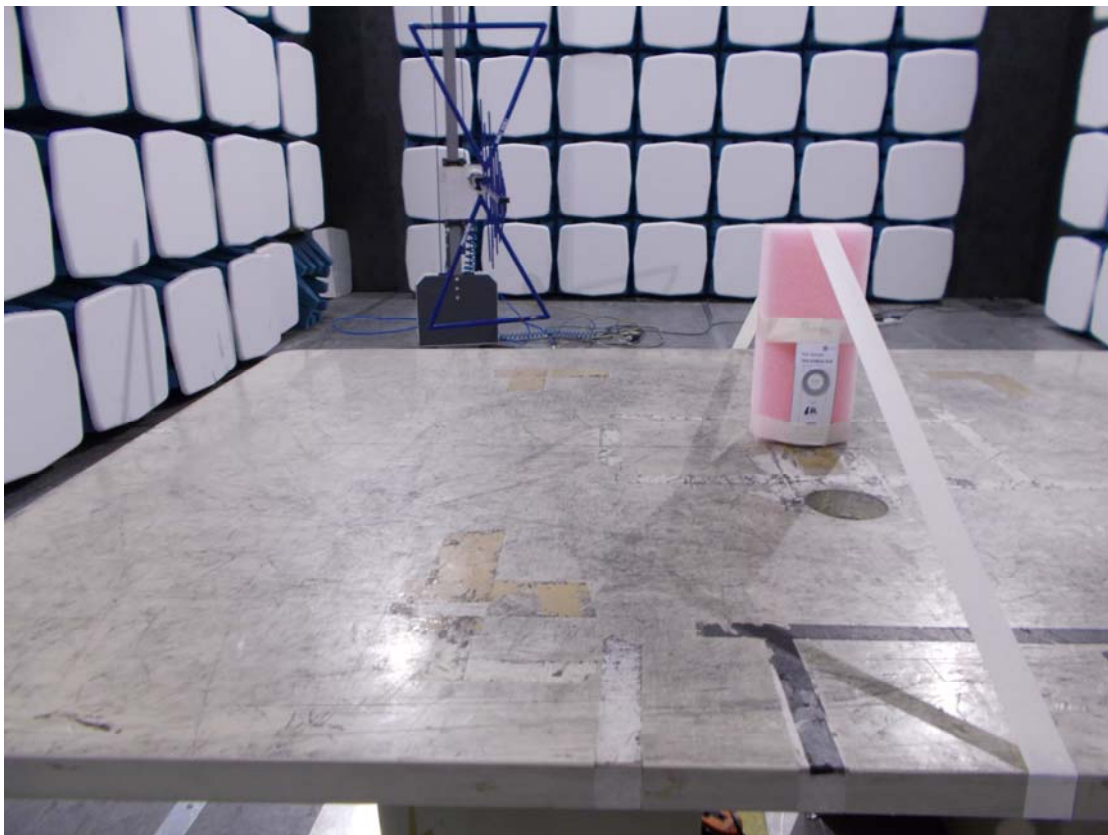
9 EUT Test Setup

9.1 Block Diagram

The devices tested are standalone battery powered devices with no external connections.



9.2 General Set-up Photograph



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 3 V dc from batteries.

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.

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

	Category	Nominal	Variation
☐	Mains	110 V ac +/-2 %	85 % and 115 %
☒	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 2
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Frequency Measured:	433.42 MHz
Deviations From Standard:	None
Measurement BW:	30 MHz to 1 GHz: 120 kHz; Above 1 GHz: 1 MHz
Measurement Detector:	RMS average and Peak

Environmental Conditions (Normal Environment)

Temperature: 16 °C	+15 °C to +35 °C (as declared)
Humidity: 33 %	20 % RH to 75 % RH (as declared)
Supply: 3 Vdc	As declared

11.3 Test Limit

The limits on the field strength of the spurious emissions in the below table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in § 15.209, whichever limit permits a higher field strength.

In addition, the field strength of emissions from intentional radiators shall not exceed the following limits:

Frequency (MHz)	Field strength of fundamental ($\mu\text{V/m}$ at 3 m)	Field strength of spurious emissions ($\mu\text{V/m}$ at 3 m)
40.66-40.70	2,250	225
70-130	1,250	125
130-174	¹ 1,250 to 3,750	¹ 125 to 375
174-260	3,750	375
260-470	¹ 3,750 to 12,500	¹ 375 to 1,250
Above 470	5,000	500

¹ Linear interpolations

General Spurious Limits

Frequency (MHz)	Field Strength ($\mu\text{V/m}$ at 3 m)
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;

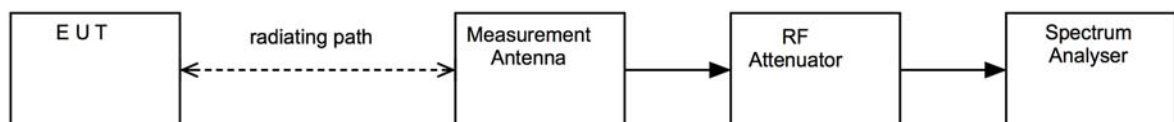
PA is the pre-amplifier gain in dB (where used);

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

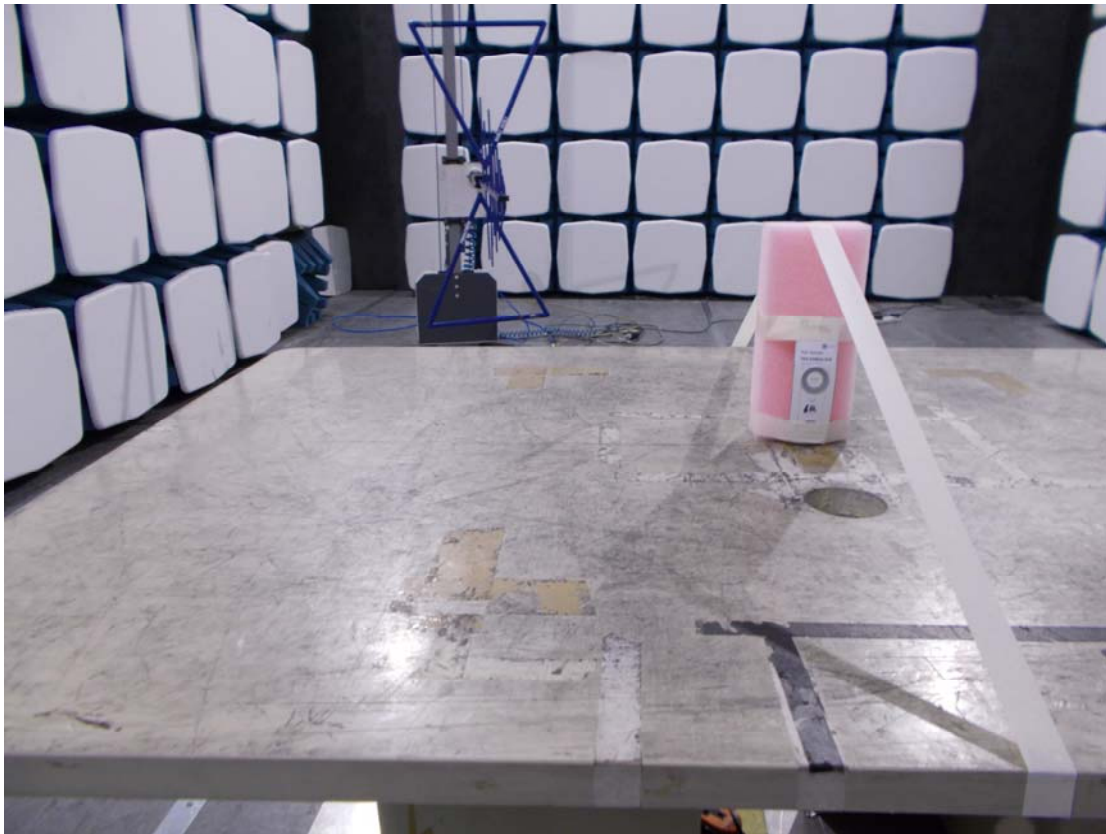
CF is the distance factor in dB (where measurement distance different to limit distance);

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

Figure i Test Setup



11.5 Test Set-up Photograph

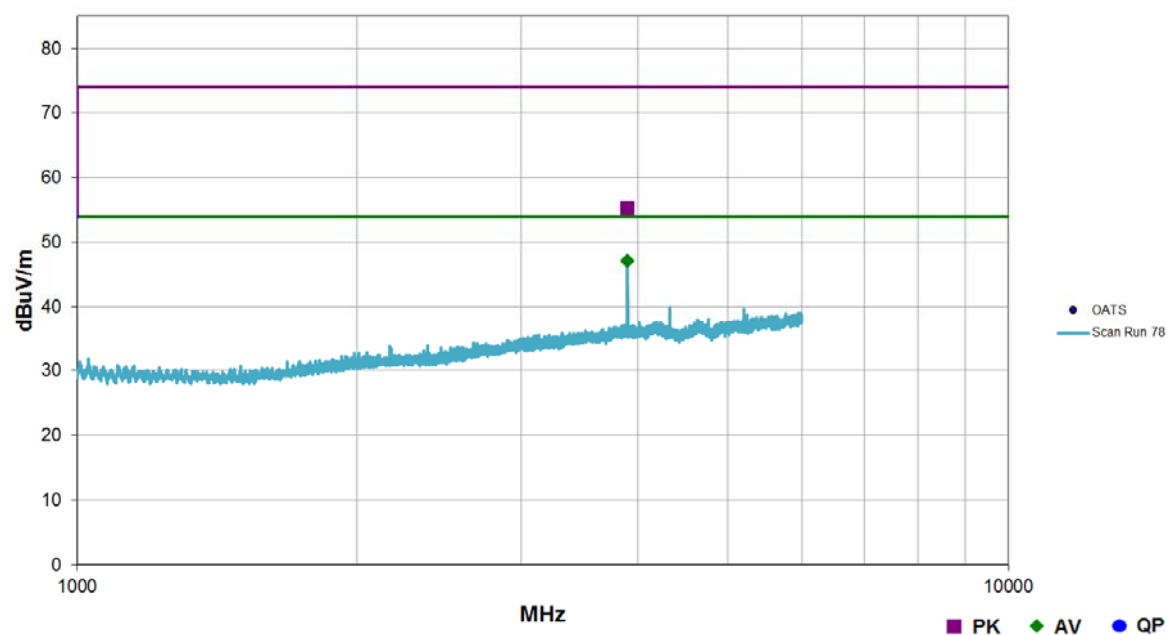
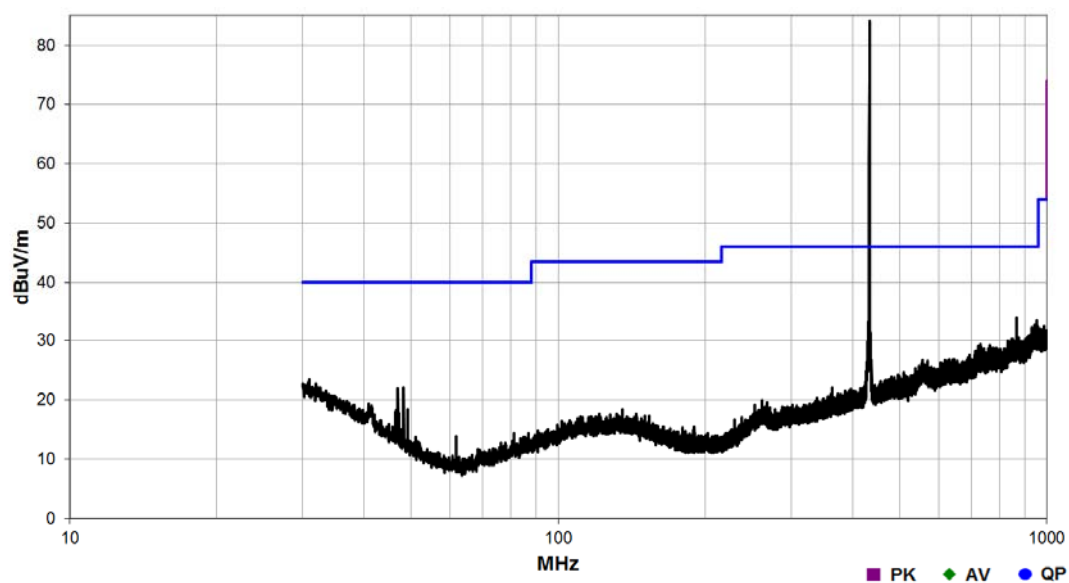


11.6 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
ATS	Rainford	Ferrite Lined Chamber	REF886	2018-07-24
ESG E4438C	Agilent	Vector Signal Generator	REF844	2019-01-30
310	Sonoma	Pre-Amp (9kHz – 1GHz)	REF927	2018-06-30
8449B	Agilent	Pre-Amp (1 – 26.5GHz)	REF913	2020-02-07
3115	EMCO	Horn Antenna	RFG129	2020-02-12
FSU50	R&S	Spectrum Analyser	U544	2018-04-27
3115	EMCO	1-18GHz Horn	L138	2018-04-13
CBL6111B	Chase	Bilog Antenna	REF2218	2019-11-06
N9030A	Agilent	Spectrum Analyser	REF2167	2018-08-17

11.7 Test Results

Detector	Freq. (MHz)	Meas'd Emission (dB μ V)	Cable Loss (dB)	Antenna Factor (dB/m)	Pre-amp Gain (dB)	Field Strength (dB μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
Pk	433.4	61.9	1.9	22.6	N/A	86.4	20893.0	109750
Av	433.4	55.9	1.9	22.6	N/A	80.4	10471.3	10975
Pk	3900.0	54.3	3.8	32.1	35.3	54.9	555.9	5000
Av	3900.0	46.2	3.8	32.1	35.3	46.8	218.8	500



12 Occupied Bandwidth

12.1 Definition

20 dB bandwidth

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 Lab 2
EUT Frequency:	433.42 MHz
Deviations From Standard:	None
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 25 % RH	20 % RH to 75 % RH (as declared)
Supply: 3 Vdc	As declared

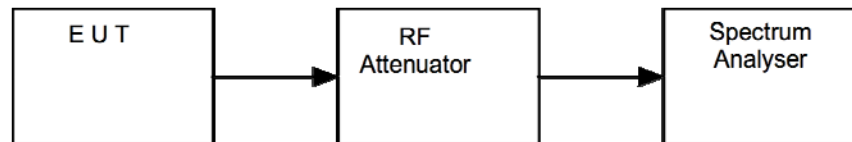
12.3 Test Limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

12.4 Test Method

With the EUT connected as per Figure iii, the bandwidth of the EUT was measured on a spectrum analyser.

Figure iii Test Setup

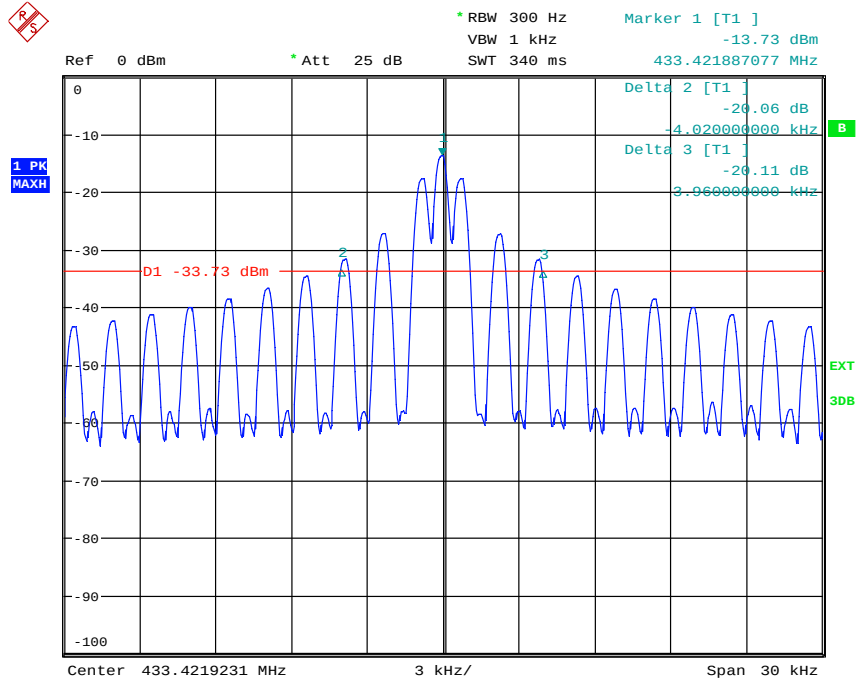


12.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU26	R&S	Spectrum Analyser	REF909	2018-05-08

12.6 Test Results

FCC 15.231				
Channel Frequency (MHz)	F_L (MHz)	F_H (MHz)	20 dB Bandwidth (kHz)	Result
433.42	433.417867	433.425847	7.980	PASS



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13 Deactivation and Period Transmission/Polling

13.1 Test Parameters

Test Location:	Element Hull
Test Chamber:	Wireless Lab 2
EUT Frequency:	433.42 MHz
Deviations From Standard:	None
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 25 % RH	20 % RH to 75 % RH (as declared)
Supply: 3 Vdc	As declared

13.2 Test Limit

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

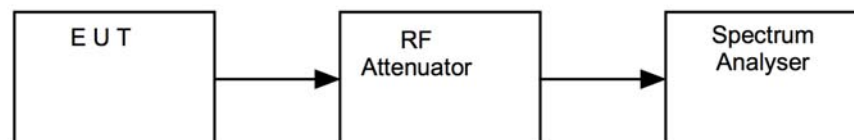
A transmitter activated automatically shall cease transmission within 5 seconds after activation.

Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

13.3 Test Method

With the EUT connected as per Figure iii, the bandwidth of the EUT was measured on a spectrum analyser.

Figure iii Test Setup



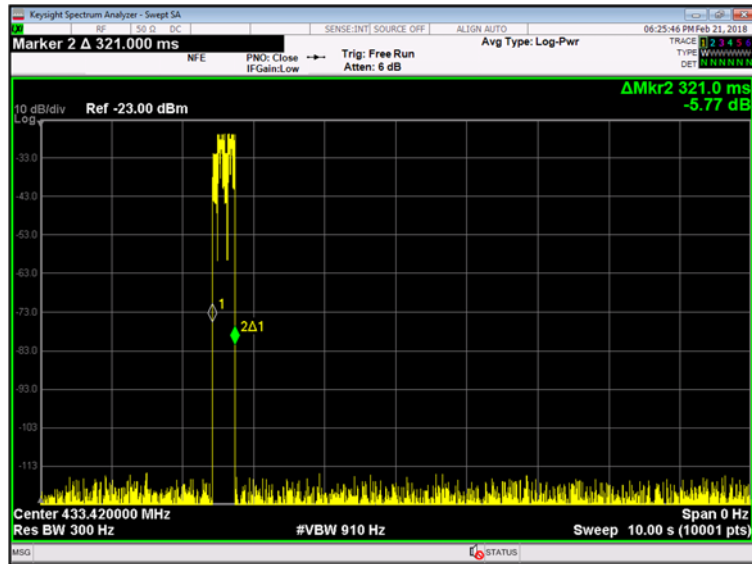
13.4 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU26	R&S	Spectrum Analyser	REF909	2018-05-08

13.5 Test Results

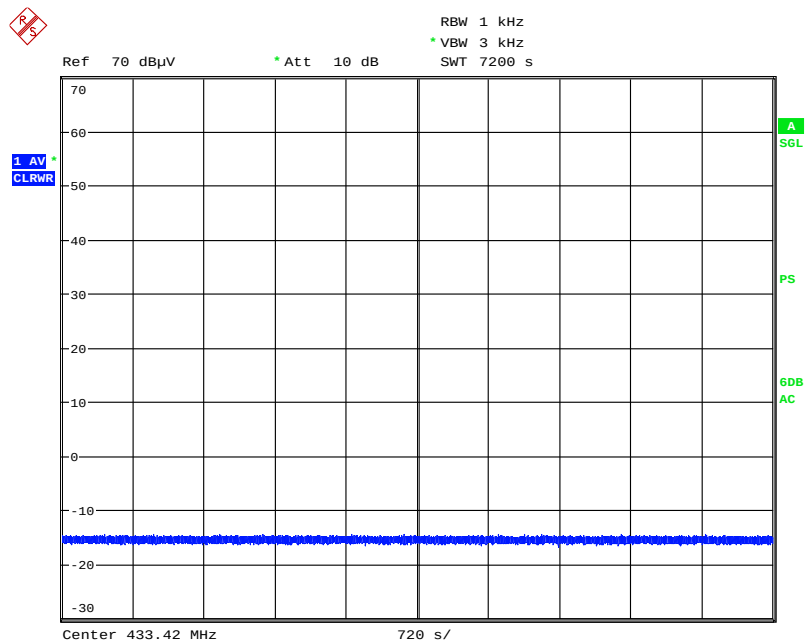
Activation Type	Transmit Time	Limit	Result
Periodic	EUT does not use period transmissions		
Automatic	EUT does not use automatic transmissions		
Manual	321 ms	< 5 Seconds	Pass

The EUT stopped transmitting immediately after the release of button, and didn't transmit again within 5 second.



In the above plot, marker 1 shows the button press, while marker 2 shows the button release.

The EUT was monitored for 2 hours in standby mode; no transmissions were observed during this period.



14 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) = **4.6 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.7 dB**

[2] AC power line conducted emissions

Uncertainty in test result = **3.4 dB**

[3] Occupied bandwidth

Uncertainty in test result = **15.5 %**

[4] Conducted carrier power

Uncertainty in test result (Power Meter) = **1.08 dB**

[5] Conducted / radiated 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**

Uncertainty in test result (30 MHz to 1 GHz) = **4.6 dB**

Uncertainty in test result (1 GHz to 18 GHz) = **4.7 dB**

[6] Power spectral density

Uncertainty in test result (Spectrum Analyser) = **2.48 dB**

15 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 100 MHz to 6 GHz will be determined as follows.

$$\text{SAR Exclusion Threshold (SARET)} = \text{Step 1} + \text{Step 2}$$

Step 1

$$NT = [(MP/TSD^A) * \sqrt{f_{\text{GHz}}}]$$

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

MP = Max Power of channel (mW) (including tune-up tolerance)

TSD^A = Min Test separation Distance or 50mm (whichever is lower) = 5mm (in this case)

We can transpose this formula to allow us to find the maximum power of a channel allowed and compare this to the measured maximum power.

$$= [(NT \times TSD^A) / \sqrt{f_{\text{GHz}}}]$$

For Distances greater than 50 mm Step 2 applies

Step 2

$$(TSD^B - 50\text{mm}) * 10$$

Where:

$$TSD^B = \text{Min Test separation Distance (mm)} = 50$$

Note: Step 2 doesn't apply here as the TSD^A is less than 50 mm

Operating Frequency 433.42 MHz

$$\text{SARET} = [(3.0 \times 5) / \sqrt{0.43342}]$$

$$\text{SARET} = 22.78 \text{ mW}$$

Channel Frequency (MHz)	EIRP (mW)	SAR Exclusion Threshold (mW)	SAR Evaluation
433.42	0.13	22.78	Not Required

Note: EIRP is calculated from peak radiated field strength.