

Report on the Radio Testing

For

Accesso Technology Group PLC

on

Qband+

Report no. TRA-032154-00-45-01A

11th January 2017

RF922 3.0

Report Number: TRA-032154-00-45-01A
Issue: A

REPORT ON THE RADIO TESTING OF A
Accesso Technology Group PLC
Qband+
WITH RESPECT TO SPECIFICATION
FCC 47CFR 15.249 & IC RSS-210 Annex 2.9

TEST DATE: 4th - 6th January 2017

Written by: A Tosif

A Tosif
Radio Test Engineer

Approved by:

J Charters
Department Manager- Radio

Date: 11th January 2017

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

RF922 3.0

1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
A	11th January 2017	Original

2 Summary

TEST REPORT NUMBER: TRA-032154-00-45-01A

WORKS ORDER NUMBER: TRA-032154-00

PURPOSE OF TEST: Certification

TEST SPECIFICATION(S): 47CFR15.249 & RSS-210 Annex 2.9

EQUIPMENT UNDER TEST (EUT): Qband+

FCC IDENTIFIER: 2AKCMP2600-915

IC IDENTIFIER: 21963-P2600-915

EUT SERIAL NUMBER: 037001119000076

MANUFACTURER/AGENT: Accesso Technology Group PLC

ADDRESS: Unit 5
The Pavilions
Ruscombe Park
Twyford
Berkshire
RG10 9NN
United Kingdom

CLIENT CONTACT: Tony Underwood
☎ TPS01189 347446
✉ tony.underwood@accesso.com

ORDER NUMBER: 1213

TEST DATE: 4th - 6th January 2017

TESTED BY: A Tosif
Element

2.1 Test Summary

Test Method and Description	Requirement Clause		Applicable to this equipment	Result / Note
	RSS	47CFR15		
Radiated spurious emissions	210, A2.9(b)	15.249(d)	<input checked="" type="checkbox"/>	Pass
AC power line conducted emissions	Gen, 8.8	15.207	<input type="checkbox"/>	N/A (See Note 1)
Occupied bandwidth	Gen, 6.6	15.215(c)	<input checked="" type="checkbox"/>	Pass
Field strength of fundamental	210, A2.9(a)	15.249(a)	<input checked="" type="checkbox"/>	Pass

Notes:

1. EUT is a battery powered device.

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-032154-00-45-01A presents the results of the Radio testing on an Accesso Technology Group PLC, Qband+ to specification 47CFR15 Radio Frequency Devices and RSS-210 Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.

The testing was carried out for Accesso Technology Group PLC by Element, at the address (es) detailed below.

<input checked="" type="checkbox"/>	Element Hull Unit E South Orbital Trading Park Hedon Road Hull HU9 1NJ UK	<input type="checkbox"/>	Element North West Unit 1 Pendle Place Skemersdale 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

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

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.
- Industry Canada RSS-210, Issue 8, December 2010 – Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.
- Industry Canada RSS-Gen, Issue 4, November 2014 – General Requirements for Compliance of Radio Apparatus.

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
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: Qband+
- Serial Number: 037001119000076
- Model Number: P2600-915
- 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

EUT transmitting permanent modulated carrier on bottom, middle and top channels as required.

7.4 EUT Radio Parameters

Frequency of operation:	902.5 - 927.5 MHz
Modulation type(s):	LoRa
ITU emission designator(s):	131KX1D
Nominal Supply Voltage:	3 Vdc (CR3032 internal battery)
Antenna:	Integral (VISHAY VJ5601M915MXBSR)
Warning against use of alternative antennas in user manual (yes/no):	N/A (fixed internal antenna)

7.5 EUT Description

The EUT contains a 915 MHz LoRa radio and a 2.4 GHz Bluetooth Low Energy radio. This report only covers 915 MHz LoRa radio.

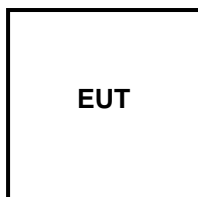
8 Modifications

No modifications were performed during this assessment.

9 EUT Test Setup

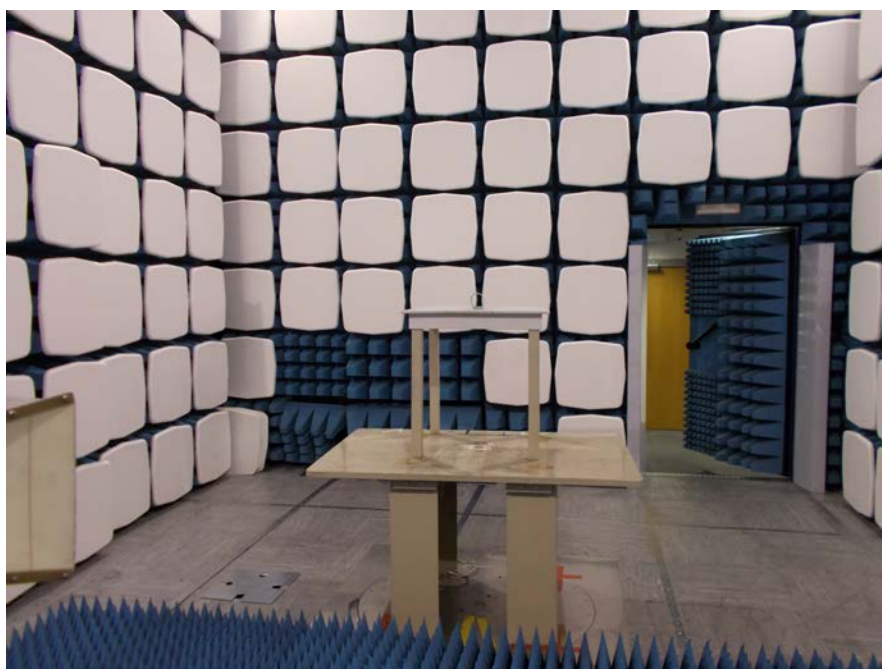
9.1 Block Diagram

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:



10 General Technical Parameters

The EUT was tested under the normal environmental conditions of the test laboratory, except where otherwise stated. The normal power source applied was approx. 3 V dc (via CR3032 internal battery)

11 Radiated emissions

11.1 Definitions

Out-of-band emissions

Emissions on a frequency or frequencies immediately outside the necessary bandwidth which result from the modulation process, but exclude spurious emissions.

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:	REF886
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Channels / Frequencies Measured:	902.5 MHz / 915.0 MHz / 927.5 MHz
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: 23 °C	+15 °C to +35 °C (as declared)
Humidity: 29 % RH	20 % RH to 75 % RH (as declared)
Supply: 3 V dc	as declared

11.3 Test Limit

Except for harmonics, out-of-band emissions shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in FCC 47CFR15.209 / RSS-Gen {see table below}, whichever is less stringent.

Harmonics shall be limited to a maximum level of 0.5 mV/m measured at 3 meters.

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

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

n.b. per FCC 47CFR15.35 (b) / RSS-Gen 8.1, peak limit is 20 dB above average.

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, 1GHz and 500kHz > 1GHz.

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;

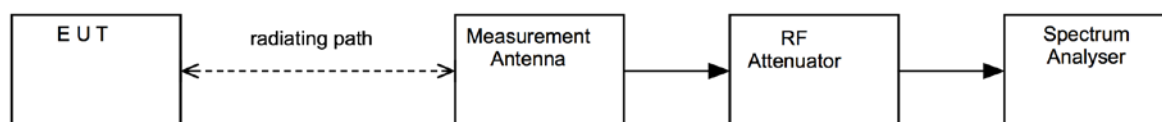
PA is the pre-amplifier gain in dB (where used);

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

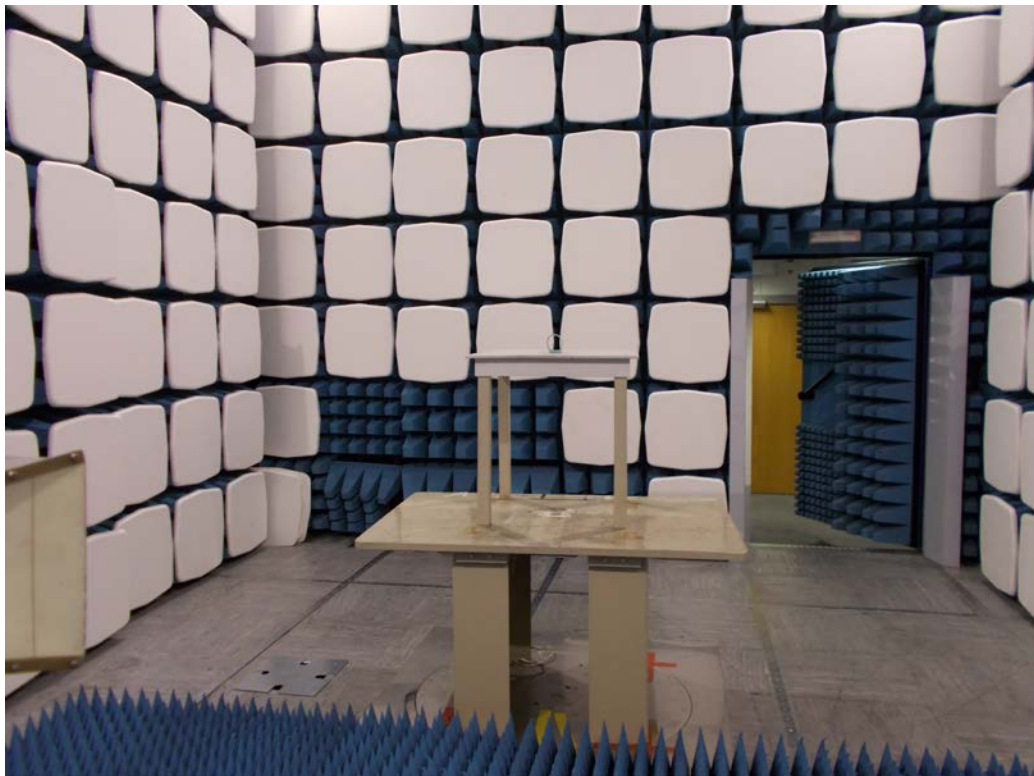
CF is the distance factor in dB (where measurement distance different to limit distance);

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

Figure i Test Setup



11.5 Test Set-up Photograph

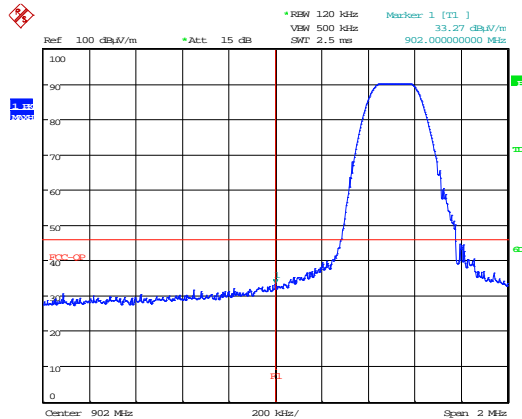
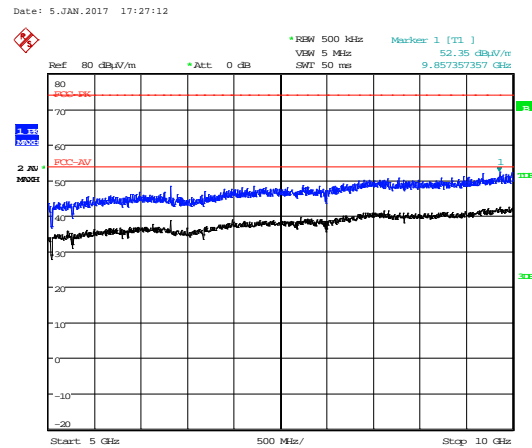
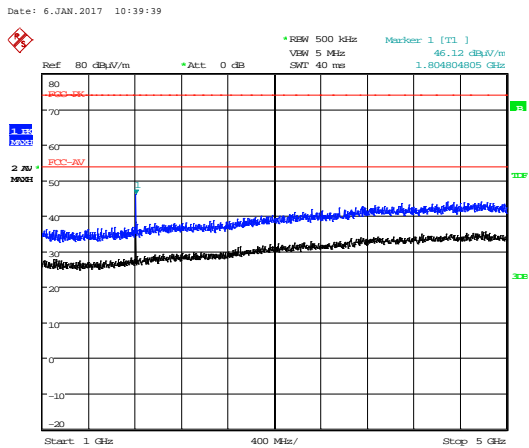
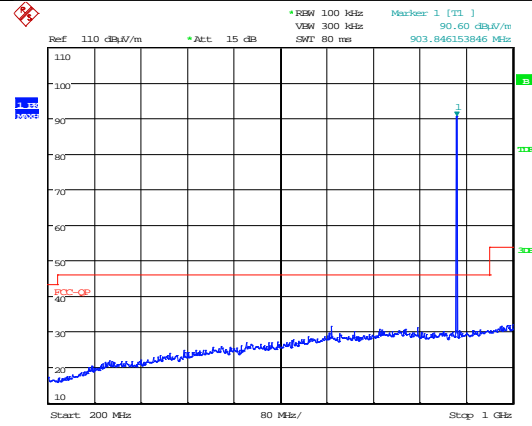
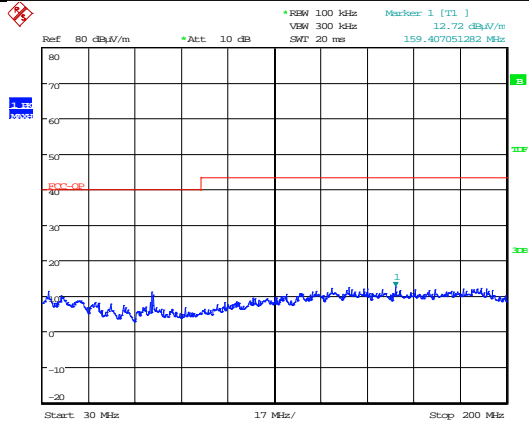


11.6 Test Equipment

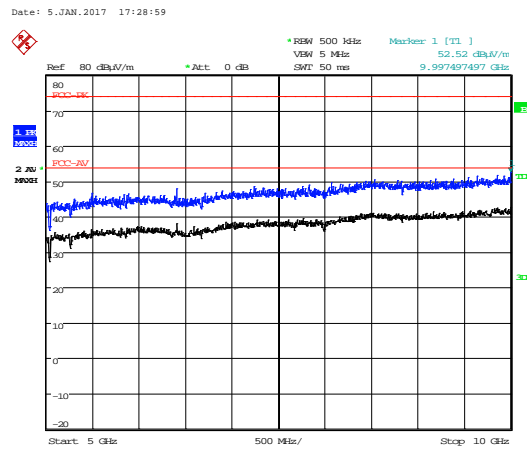
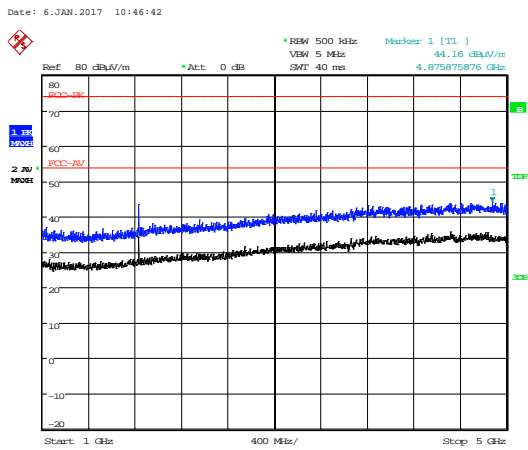
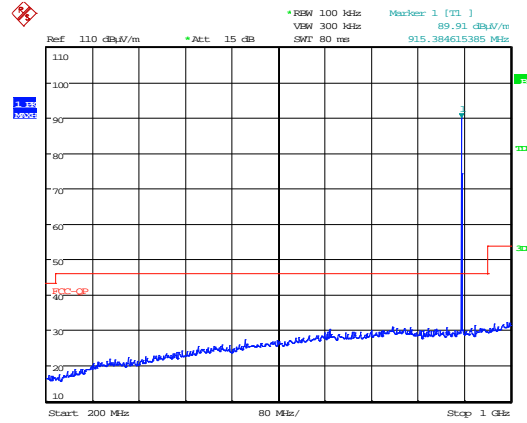
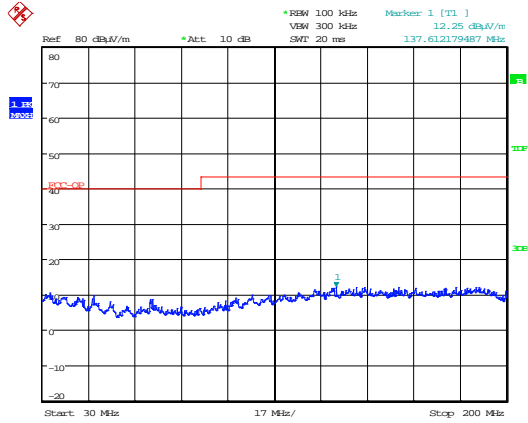
Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
ATS	Rainford	Ferrite Lined Chamber	REF886	21/07/17
310	Sonoma	Pre-Amp (9kHz – 1GHz)	REF927	30/06/18
ESVS20	R&S	EMI Test Receiver	RFG126	23/05/17
3109	EMCO	Biconical Antenna	RFG095	17/05/19
3146	EMCO	Log Periodic Antenna	RFG191	17/05/19
8449B	Agilent	Pre-Amp (1 – 26.5GHz)	REF913	02/02/18
3115	EMCO	Horn Antenna	RFG129	09/02/18
FSU46	R&S	Spectrum Analyser	REF910	05/07/17

11.7 Test Results

Channel: 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)
Av	1805.0	51.1	3.4	27.0	35.0	0.0	0.0	46.5	210.6	500.0
Pk	6317.8	49.4	6.3	34.5	35.4	0.0	0.0	54.8	548.3	5000.0
Av	6317.8	41.6	6.3	34.5	35.4	0.0	0.0	47.1	225.2	500.0



Channel: 915.0 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)
Av	1830.0	47.1	3.5	27.1	35.0	0.0	0.0	42.7	136.0	500.0
Pk	6404.9	49.8	6.1	34.4	35.4	0.0	0.0	54.9	555.3	5000.0
Av	6404.9	42.7	6.1	34.4	35.4	0.0	0.0	47.8	244.3	500.0



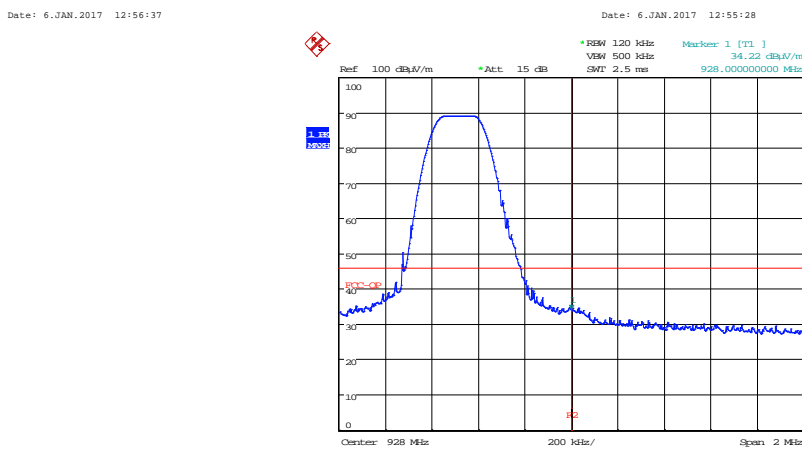
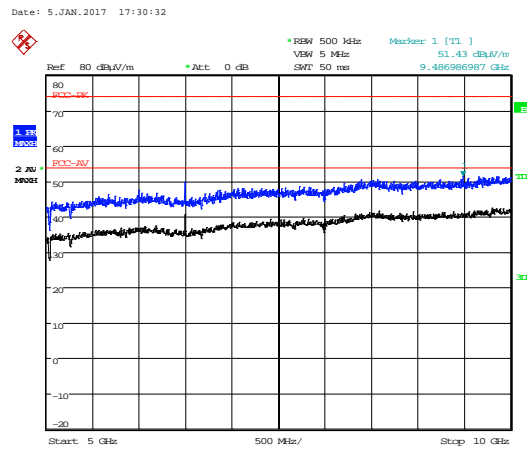
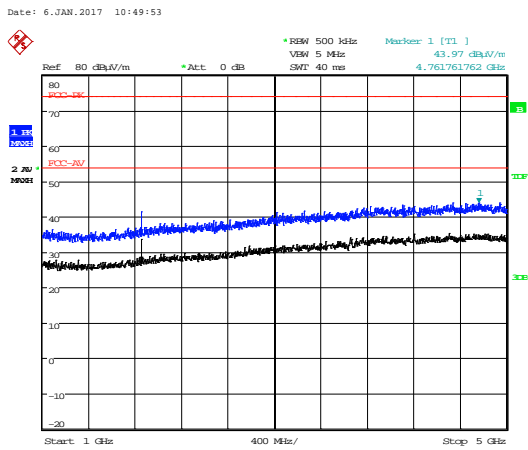
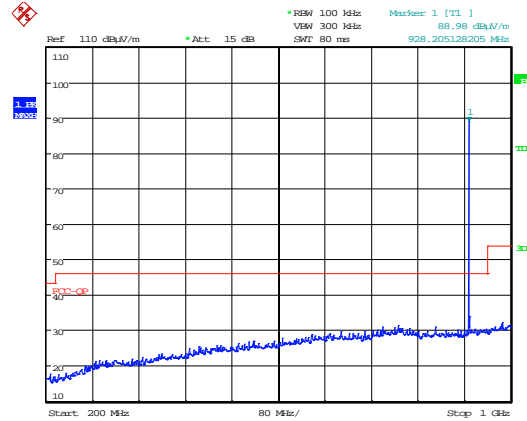
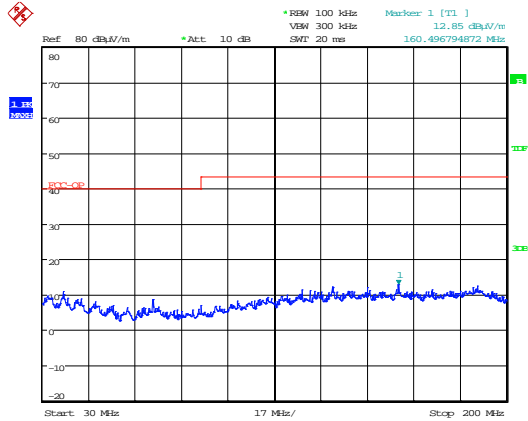
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Date: 6.JAN.2017 13:01:17

Channel: 927.5 MHz										
Detector	Freq. (MHz)	Meas'd Emission (dB μ 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 μ V/m)	Field Strength (μ V/m)	Limit (μ V/m)
Av	1855.0	45.7	3.4	27.3	35.0	0.0	0.0	41.3	116.6	500.0
Pk	6492.7	51.1	5.9	34.4	35.4	0.0	0.0	56.0	628.1	5000.0
Av	6492.7	44.9	5.9	34.4	35.4	0.0	0.0	49.7	306.6	500.0



Date: 5.JAN.2017 17:38:32

12 Occupied Bandwidth

12.1 Definitions

Occupied bandwidth

The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5 % of the emitted power. This is also known as the *99 % emission bandwidth*. For transmitters in which there are multiple carriers, contiguous or non-contiguous in frequency, the occupied bandwidth is to be the sum of the occupied bandwidths of the individual carriers.

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:	REF886
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.9
EUT Channels / Frequencies Measured:	902.5 MHz / 915.0 MHz / 927.5 MHz
EUT Test Modulations:	LoRa
Deviations From Standard:	None
Measurement BW: (requirement: 1 % to 5 % OBW)	5 kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	20 kHz
Measurement Span: (requirement 2 to 5 times OBW)	500 kHz
Measurement Detector:	Peak

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 30 % RH	20 % RH to 75 % RH (as declared)
Supply: 3 V dc	as declared

12.3 Test Limit

Industry Canada:

If the frequency stability of the license-exempt radio apparatus is not specified in the applicable standard (RSS), measurement of the frequency stability is not required provided that the occupied bandwidth of the license-exempt radio apparatus lies entirely outside the restricted bands and the prohibited TV bands of 54 to 72 MHz, 76 to 88 MHz, 174 to 216 MHz, 470 to 608 MHz and 614 to 806 MHz.

Federal Communications Commission:

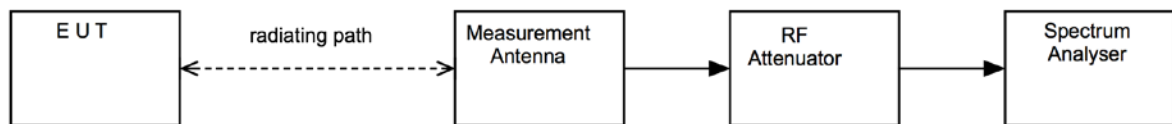
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

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

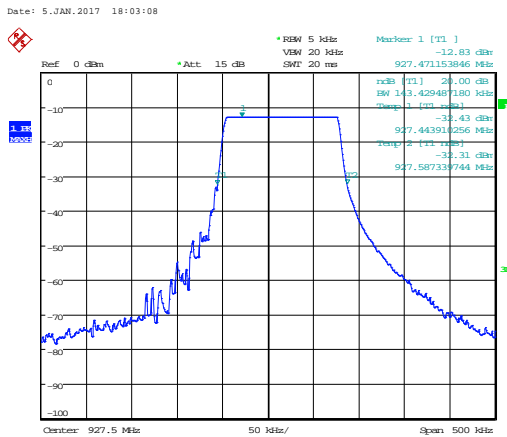
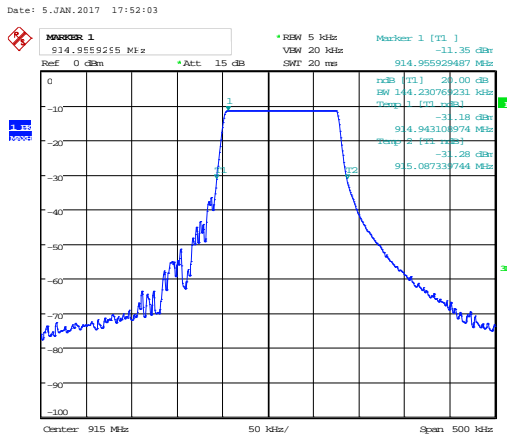
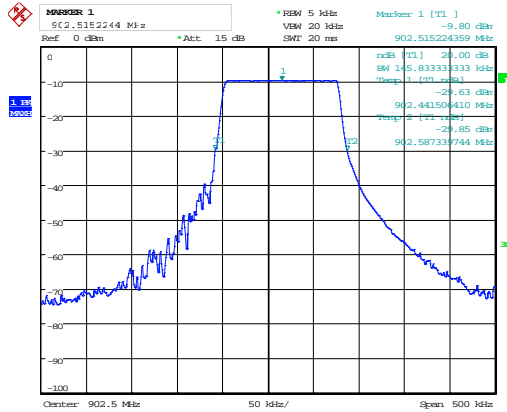


12.5 Test Equipment

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
ATS	Rainford	Ferrite Lined Chamber	REF886	21/07/17
310	Sonoma	Pre-Amp (9kHz – 1GHz)	REF927	30/06/18
3146	EMCO	Log Periodic Antenna	RFG191	17/05/19
FSU46	R&S	Spectrum Analyser	REF910	05/07/17

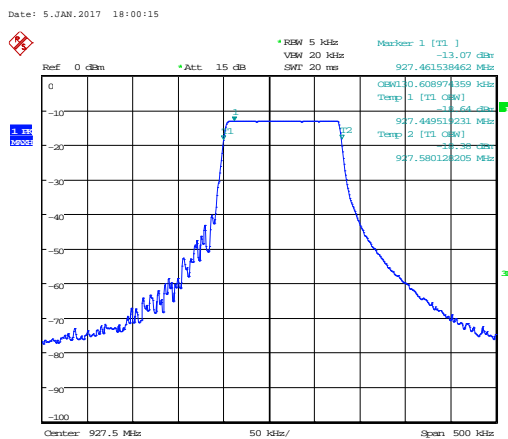
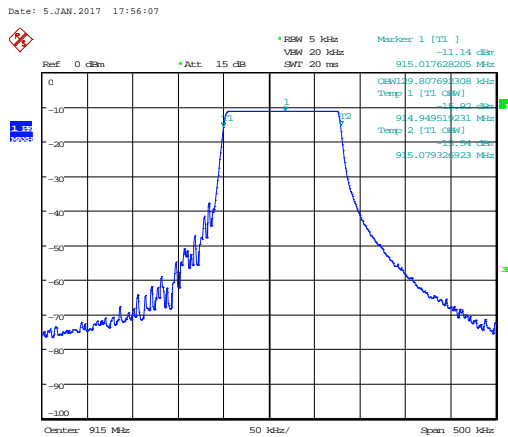
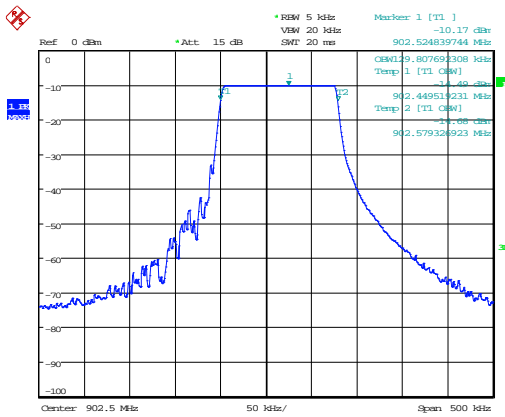
12.6 Test Results

FCC 15.249				
Channel Frequency (MHz)	F_L (MHz)	F_H (MHz)	20dB Bandwidth (kHz)	Result
902.5	902.441506	902.587340	145.833	PASS
915.0	914.943109	915.087340	144.231	PASS
927.5	927.443910	927.587340	143.429	PASS



Date: 5.JAN.2017 18:05:58

RSS-210				
Channel Frequency (MHz)	F_L (MHz)	F_H (MHz)	99% Bandwidth (kHz)	Result
902.5	902.449519	902.579327	129.808	PASS
915.0	914.949519	915.079327	129.808	PASS
927.5	927.449519	927.580128	130.609	PASS



Date: 5.JAN.2017 18:10:04

13 Transmitter output power (fundamental radiated emission)

13.1 Definition

The RF power dissipated in the standard output termination when operating under the rated duty cycle selected by the applicant for approval.

13.2 Test Parameters

Test Location:	Element Hull
Test Chamber:	REF886
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 / 6.6
EUT Channels / Frequencies Measured:	902.5 MHz / 915.0 MHz / 927.5 MHz
Deviations From Standard:	None
Measurement BW:	120 kHz
Measurement Detector:	Quasi-peak

Environmental Conditions (Normal Environment)

Temperature: 21 °C	+15 °C to +35 °C (as declared)
Humidity: 30 % RH	20 % RH to 75 % RH (as declared)

13.3 Test Limit

The field strength measured at 3 meters shall not exceed the limits in the following table:

Field Strength Limits for License-Exempt Transmitters for Any Application

<i>Fundamental frequency (MHz)</i>	<i>Field strength (mV/m at 3 m)</i>	<i>Detector</i>
902 to 928	50	Quasi-Peak
2400 to 2483.5	50	Average RMS
5725 to 5875	50	Average RMS

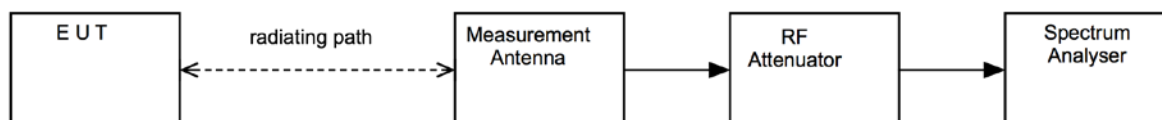
n.b. per FCC 47CFR15.249 (e) / RSS-Gen 8.1, peak limit is 20 dB above average.

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
ATS	Rainford	Ferrite Lined Chamber	REF886	21/07/17
310	Sonoma	Pre-Amp (9kHz – 1GHz)	REF927	30/06/18
ESVS20	R&S	EMI Test Receiver	RFG126	23/05/17
3146	EMCO	Log Periodic Antenna	RFG191	17/05/19

13.6 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 (mV/m)	Limit (mV/m)
QP	902.5	97.9	3.3	21.7	31.8	91.1	35.7	50.0
QP	915.0	97.8	3.3	21.7	31.7	91.1	35.7	50.0
QP	927.5	96.5	3.3	21.7	31.6	89.8	31.0	50.0

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] Carrier power

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

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

[2] 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**

[3] AC power line conducted emissions

Uncertainty in test result = **3.4 dB**

[4] Occupied bandwidth

Uncertainty in test result = **15.5 %**

[5] Maximum frequency error

Uncertainty in test result (Power Meter) = **0.113 ppm**

Uncertainty in test result (Spectrum Analyser) = **0.265 ppm**

[6] Duty cycle

Uncertainty in test result = **7.98 %**

15 RF Exposure

16 General SAR test reduction & exclusion guidance / MPE Calculation

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

$$\text{NT} = \left[\frac{\text{MP}}{\text{TSD}^A} \right] * \sqrt{f_{\text{GHz}}}$$

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.

$$= \left[\frac{\text{NT} * \text{TSD}^A}{\sqrt{f_{\text{GHz}}}} \right]$$

For Distances Greater than 50 mm Step 2 applies

Step 2

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

Where:

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

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

Operating Frequency 902.5 MHz

$$\text{SARET} = \left[\frac{(3.0 * 5)}{\sqrt{0.9025}} \right]$$

$$\text{SARET} = 15.79 \text{ mW}$$

Operating Frequency 915.0 MHz

$$\text{SARET} = \left[\frac{(3.0 * 5)}{\sqrt{0.9150}} \right]$$

$$\text{SARET} = 15.68 \text{ mW}$$

Operating Frequency 927.5 MHz

$$\text{SARET} = \left[\frac{(3.0 * 5)}{\sqrt{0.9275}} \right]$$

$$\text{SARET} = 15.58 \text{ mW}$$

Channel Frequency (MHz)	EIRP (mW)	SAR Exclusion Threshold (mW)	SAR Evaluation
902.5	0.38	15.79	Not Required
915.0	0.38	15.68	Not Required
927.5	0.29	15.58	Not Required

Note: EIRP is calculated from maximum radiated field strength.

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

MPE Calculation

Prediction of MPE limit at a given distance

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits. As the 20cm separation specified under FCC rules may not be achievable under normal operation of the EUT, an RF exposure calculation is needed to show the minimum distance required to be less than the power density limit, as required under FCC rules.

Equation from IEEE C95.1

$$S = \frac{EIRP}{4\pi R^2} \text{ re - arranged } R = \sqrt{\frac{EIRP}{S 4\pi}}$$

Where:

S = power density

R = distance to the centre of radiation of the antenna

EIRP = EUT Maximum power

Result

Prediction Frequency (MHz)	Maximum EIRP (mW)	Power density limit (S) (mW/cm ²)	Distance (R) cm required to be less than the power density limit
902.5	0.38	0.60	0.23
915.0	0.38	0.61	0.23
927.5	0.29	0.62	0.20

Note: EIRP is calculated from maximum radiated field strength.

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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 Frequency (MHz)	EIRP (mW)	SAR Exclusion Threshold at distance of ≤ 5 mm (mW)	SAR Evaluation
902.5	0.38	16.37	Not Required
915.0	0.38	16.25	Not Required
927.5	0.29	16.13	Not Required

Note: EIRP calculated from maximum radiated field strength.