

Report on the Radio Testing

For

HWM-Water Ltd

on

USB Transceiver

Report no. TRA-031981-47-02A

11th August 2017

RF922 3.0

Report Number: TRA-031981-47-02A  
Issue: B

REPORT ON THE RADIO TESTING OF A  
HWM-Water Ltd  
USB Transceiver  
WITH RESPECT TO SPECIFICATION  
FCC 47CFR 15.249 ISED RSS-210 Issue 9 August 2016  
RSS Gen Issue 4 November 2014

TEST DATE: 22nd June- 31st July 2017

Written by: S Hodgkinson

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Date: 11th August 2017

Disclaimers:

RF922 3.0



[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

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## 1 Revision Record

<i>Issue Number</i>	<i>Issue Date</i>	<i>Revision History</i>
B	17th August 2017	Original

## 2 Summary

TEST REPORT NUMBER: TRA-031981-47-02A

WORKS ORDER NUMBER: TRA-031981-02

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.

Canada: Testing of radio apparatus for TAC (technical acceptance certificate) per subsections 4(2) of the Radio communication Act and 21(1) of the Radio communication Regulations.

TEST SPECIFICATION(S): 47CFR15.249, ISED RSS-210 Issue 9 August 2016, RSS Gen Issue 4 November 2014

EQUIPMENT UNDER TEST (EUT): USB Transceiver

FCC IDENTIFIER: RUZ-553

IC IDENTIFIER: 10962A-553

EUT SERIAL NUMBER: 25328289

MANUFACTURER/AGENT: HWM-Water Ltd

ADDRESS: Ty Coch House  
Llantarnam Industrial Park  
Cwmbran  
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United Kingdom

CLIENT CONTACT: Andy Earp  
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✉ aearp@hwm-water.com

ORDER NUMBER: 73070

TEST DATE: 22nd June- 31st July 2017

TESTED BY: S Hodgkinson  
Element

## 2.1 Test Summary

<i>Test Method and Description</i>	<i>Requirement Clause</i>		<i>Applicable to this equipment</i>	<i>Result / Note</i>
	<i>RSS</i>	<i>47CFR15</i>		
Radiated spurious emissions	210, B10(b)	15.249(d)	<input checked="" type="checkbox"/>	<i>Pass</i>
AC power line conducted emissions	Gen, 8.8	15.207	<input checked="" type="checkbox"/>	<i>Pass</i>
Occupied bandwidth	Gen, 6.6	15.215(c)	<input checked="" type="checkbox"/>	<i>Pass</i>
Field strength of fundamental	210, B.10(a)	15.249(a)	<input checked="" type="checkbox"/>	<i>Pass</i>
Calculation of duty correction <sup>1</sup>	-	15.35(c)	<input type="checkbox"/>	<i>N/A</i>

### 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-031981-47-02A presents the results of the Radio testing on a HWM-Water Ltd, USB Transceiver to specification 47CFR15 Radio Frequency Devices and ISED RSS-210 Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment.

The testing was carried out for HWM-Water Ltd by Element, at the address(es) detailed below.

<input type="checkbox"/>	Element Hull Unit E South Orbital Trading Park Hedon Road Hull HU9 1NJ UK	<input checked="" 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 North West                      3930B

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 ISED RSS-210, Issue 9 August 2016 Systems Licence-Exempt Radio Apparatus
- 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

<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: USB Transceiver
- Serial Number: 25328289
- Model Number: 553-020-914

### **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.

Toshiba WT8-A Tablet, HP Compaq 6720s

### **7.3 EUT Mode of Operation**

#### **7.3.1 Transmission**

The mode of operation for Tx tests was as follows...

The operating modes were selected via the test software PermaNet 2.49.4  
Channel selection/output power level etc.

## 7.4 EUT Radio Parameters

### 7.4.1 General

<b>Frequency of operation:</b>	914.5MHz
<b>Modulation type(s):</b>	GFSK
<b>Occupied channel bandwidth(s):</b>	129.80kHz
<b>Channel spacing:</b>	Wideband
<b>ITU emission designator(s):</b>	137kF1D
<b>Declared output power(s):</b>	93.8dB $\mu$ V/m
<b>Nominal Supply Voltage:</b>	5Vdc
<b>Duty cycle:</b>	12.5%

### 7.4.2 Antennas

<b>Gain:</b>	2dBi
<b>Mounting:</b>	Integral, the Antenna will be permanently fixed in place, and not removable.

## 7.5 EUT Description

USB Transceiver operating in the 902-928MHz Band, The USB transceiver is part of a water leak detection system.

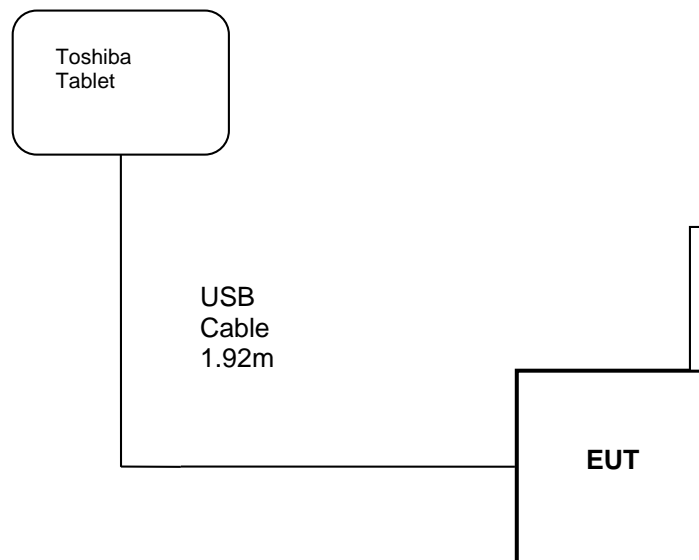
## **8 Modifications**

No modifications were performed during this assessment.

## 9 EUT Test Setup

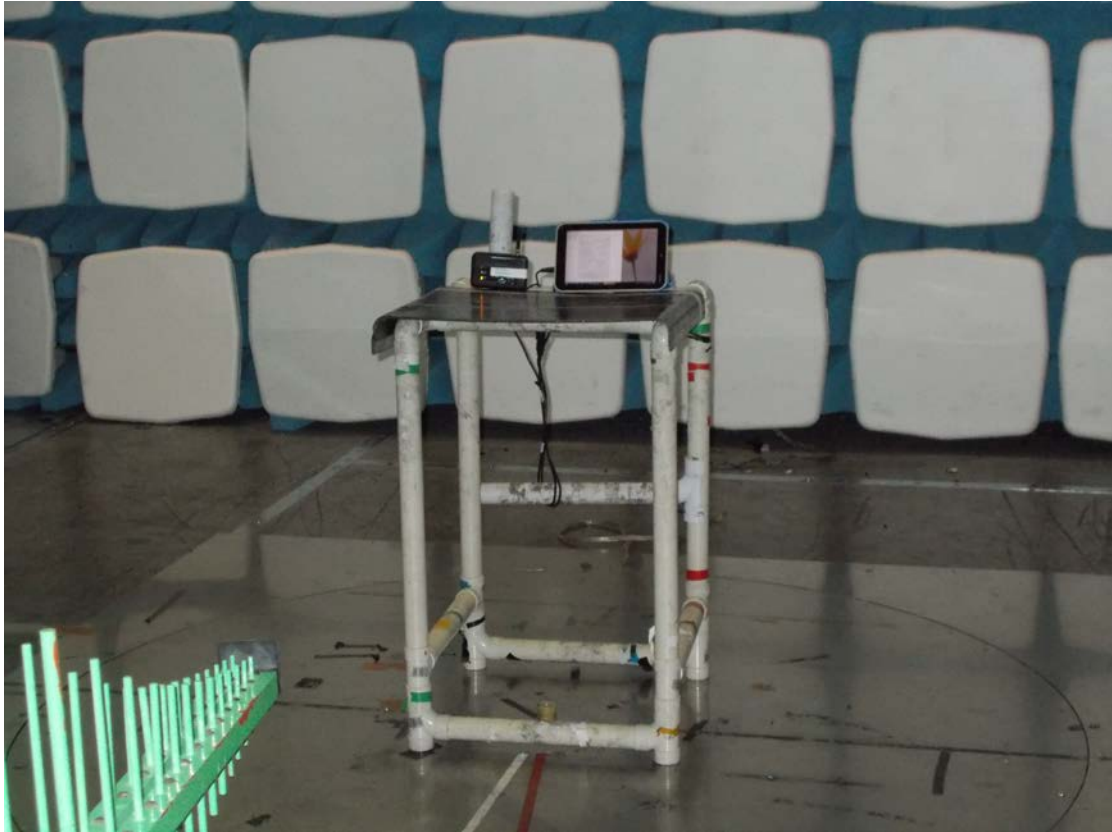
### 9.1 Block Diagram

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

### 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 approx. 5 V dc from tablet or laptop.

### 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 type="checkbox"/>	Battery	New battery	N/A
<input checked="" type="checkbox"/>	USB powered via tablet or Laptop	5Vdc	N/A



## 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 Skelmersdale
Test Chamber:	Chamber 3
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 and 6.6
EUT Channels / Frequencies Measured:	914.5MHz
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

Humidity: 32 % RH

Supply: 5 Vdc via tablet

### 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 metres.

### 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

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.

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 dB $\mu$ V/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 dB $\mu$ V;

CL is the cable loss in dB;

AF is the test antenna factor in dB/m;

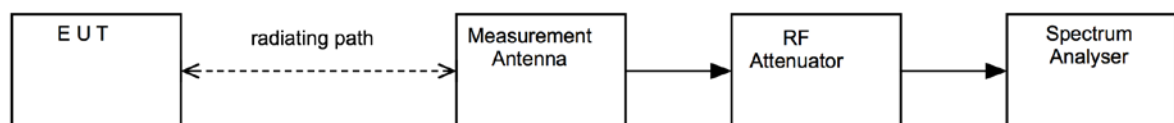
PA is the pre-amplifier gain in dB (where used);

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

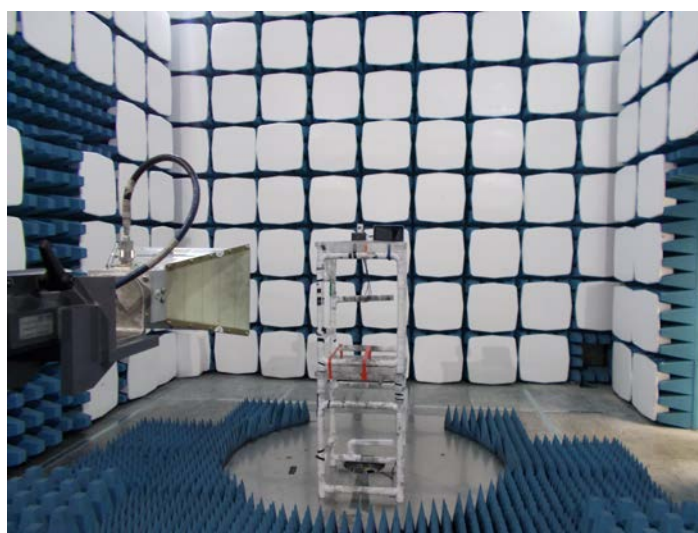
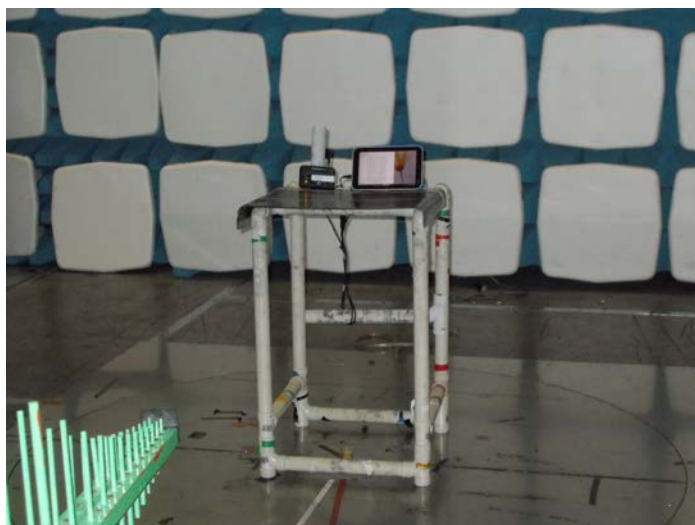
CF is the distance factor in dB (where measurement distance different to limit distance);

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

**Figure i Test Setup**



**11.5 Test Set-up Photograph**

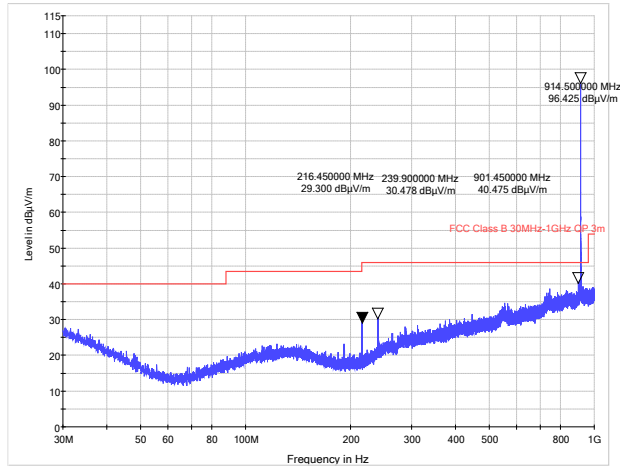


**11.6 Test Equipment**

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
ESVS10	R&S	Receiver	L352	14/07/2017
CBL6112	Chase	Bilog	U420	18/04/2018
FSU46	R&S	Spectrum Analyser	U281	19/06/2018
3115	EMCO	1-18GHz Horn	L139	25/09/2017
8449B	Agilent	Pre Amp	L572	07/02/2018

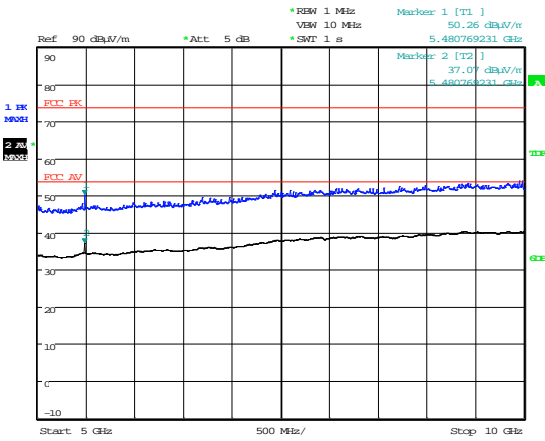
### 11.7 Test Results

#### 30MHz-1GHz

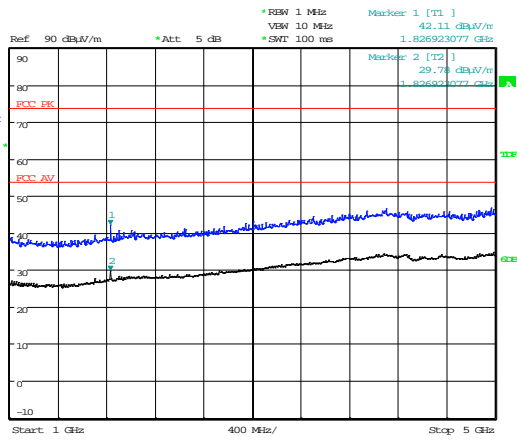


#### 1-5GHz

#### 5-10GHz



Date: 22 JUN 2017 15:52:42



Date: 22 JUN 2017 15:47:40

914.5MHz										
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)
Pk	1829.0	51.29	2.5	26.7	36.2	N/A	N/A	44.30	164.6	5000
Av	1829.0	46.29	2.5	26.7	36.2	N/A	N/A	39.30	92.6	500
Pk	5487.0	49.94	4.3	34.1	36.0	N/A	N/A	52.34	415.4	5000
Av	5487.0	44.36	4.3	34.1	36.0	N/A	N/A	46.76	218.5	500

## 12 AC power-line conducted emissions

### 12.1 Definition

Line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network.

### 12.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Transient Lab 2
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.2
EUT Channels / Frequencies Measured:	914.50MHz
EUT Channel Bandwidths:	Wideband
Deviations From Standard:	None
Measurement BW:	10kHz
Measurement Detectors:	Quasi-Peak and Average,

### Environmental Conditions (Normal Environment)

Temperature:	22 °C
Humidity:	32 % RH
Supply:	110 V ac Laptop 5v dc USB to EUT

### 12.3 Test Limit

A radio apparatus that is designed to be connected to the public utility (AC) power line shall ensure that the radio frequency voltage, which is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz, shall not exceed the limits in Table 3.

**Table 3 – AC Power Line Conducted Emission Limits**

Frequency (MHz)	Conducted limit (dB $\mu$ V)	
	Quasi-Peak	Average**
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

\*The level decreases linearly with the logarithm of the frequency.

\*\*A linear average detector is required.

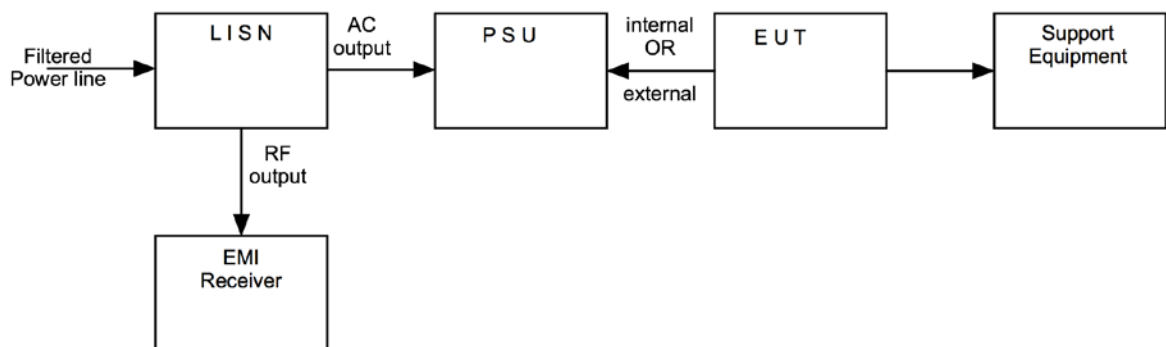
## 12.4 Test Method

With the EUT setup in a screened room, as per section 9 of this report and connected as per Figure ii, the power line emissions were measured on a spectrum analyzer / EMI receiver.

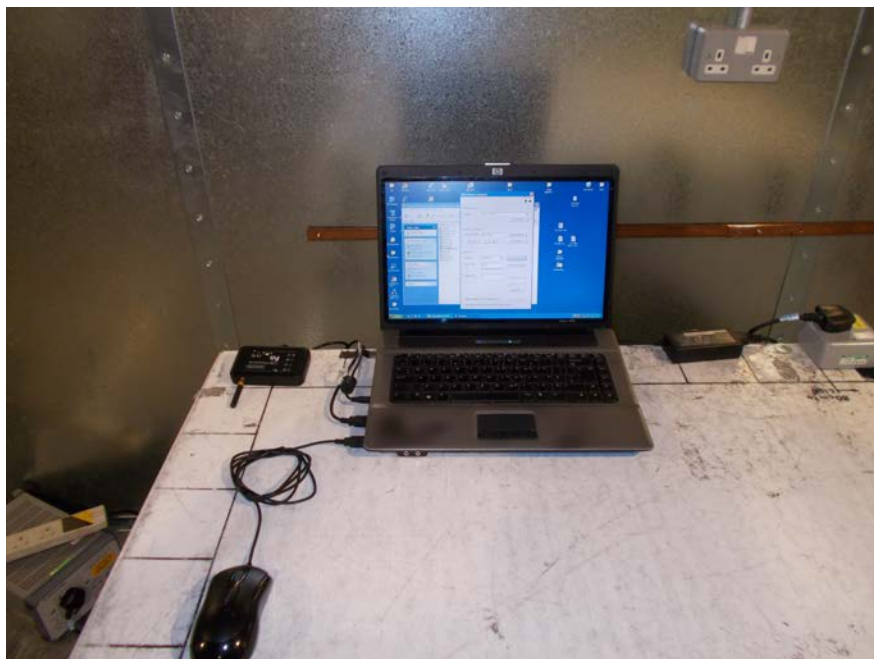
AC power line conducted emissions from the EUT are checked first by preview scans with peak and average detectors covering both live and neutral lines. A spectrum analyzer is used to determine if any periodic emissions are present.

Formal measurements using the correct detector(s) and bandwidth are made on frequencies identified from the preview scans. Final measurements were performed with EUT set at its maximum duty in transmit and receive modes.

**Figure ii Test Setup**



## 12.5 Test Set-up Photograph



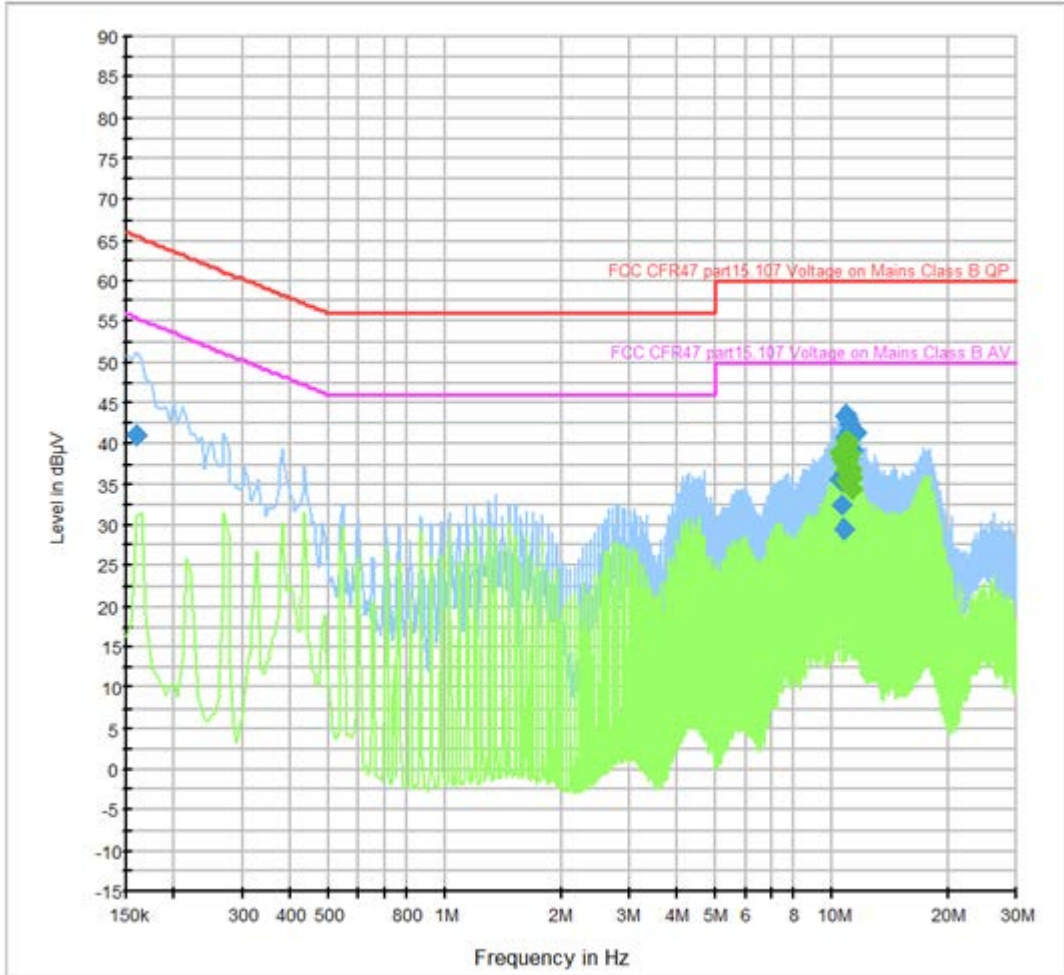
**12.6 Test Equipment**

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
ESHS10	R&S	Receiver	U187	25/10/2017
ENV216	R&S	Lisn	U396	29/06/2017



### 12.7 Test Results

Conducted emissions on Mains 9kHz-30MHz ESHS10 + UH396



Frequency (MHz)	QuasiPeak (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
0.160000	41.0	5000.0	10.000	On	L1	9.6	24.5	65.5	Pass
10.505000	35.6	5000.0	10.000	On	L1	9.8	24.4	60.0	Pass
10.615000	35.5	5000.0	10.000	On	L1	9.8	24.5	60.0	Pass
10.670000	32.5	5000.0	10.000	On	L1	9.8	27.5	60.0	Pass
10.725000	29.5	5000.0	10.000	On	L1	9.8	30.5	60.0	Pass
10.830000	40.8	5000.0	10.000	On	L1	9.8	19.2	60.0	Pass
10.880000	43.6	5000.0	10.000	On	N	9.8	16.4	60.0	Pass
10.935000	43.3	5000.0	10.000	On	N	9.8	16.7	60.0	Pass
10.990000	43.1	5000.0	10.000	On	N	9.8	16.9	60.0	Pass
11.045000	43.1	5000.0	10.000	On	N	9.8	16.9	60.0	Pass
11.100000	42.4	5000.0	10.000	On	N	9.8	17.6	60.0	Pass
11.155000	41.5	5000.0	10.000	On	N	9.8	18.5	60.0	Pass
11.210000	40.8	5000.0	10.000	On	N	9.8	19.2	60.0	Pass
11.265000	39.1	5000.0	10.000	On	N	9.8	20.9	60.0	Pass
11.535000	41.4	5000.0	10.000	On	N	9.9	18.6	60.0	Pass

Frequency (MHz)	Average (dB $\mu$ V)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB $\mu$ V)	Comment
10.555000	38.8	5000.0	10.000	N	9.8	11.2	50.0	Pass
10.610000	38.3	5000.0	10.000	N	9.8	11.7	50.0	Pass
10.665000	38.1	5000.0	10.000	N	9.8	11.9	50.0	Pass
10.720000	37.8	5000.0	10.000	N	9.8	12.2	50.0	Pass
10.775000	37.5	5000.0	10.000	L1	9.8	12.5	50.0	Pass
10.830000	36.5	5000.0	10.000	L1	9.8	13.5	50.0	Pass
10.885000	35.5	5000.0	10.000	L1	9.8	14.5	50.0	Pass
10.935000	40.4	5000.0	10.000	N	9.8	9.6	50.0	Pass
10.990000	40.3	5000.0	10.000	N	9.8	9.7	50.0	Pass
11.045000	39.9	5000.0	10.000	N	9.8	10.1	50.0	Pass
11.100000	38.8	5000.0	10.000	N	9.8	11.2	50.0	Pass
11.155000	38.0	5000.0	10.000	N	9.8	12.0	50.0	Pass
11.210000	36.9	5000.0	10.000	N	9.8	13.1	50.0	Pass
11.265000	36.0	5000.0	10.000	L1	9.8	14.0	50.0	Pass
11.320000	34.4	5000.0	10.000	L1	9.8	15.6	50.0	Pass

## 13 Occupied Bandwidth

### 13.1 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.

### 13.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Radio Lab
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.9
EUT Channels / Frequencies Measured:	914.50MHz
EUT Channel Bandwidths:	Wideband
Deviations From Standard:	None
Measurement BW: (requirement: 1 % to 5 % OBW)	3kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	10kHz
Measurement Span: (requirement 2 to 5 times OBW)	500kHz
Measurement Detector:	Peak

#### **Environmental Conditions (Normal Environment)**

Temperature: 23 °C

Humidity: 32 % RH

Supply: 5.0 V dc via tablet

### **13.3 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:**

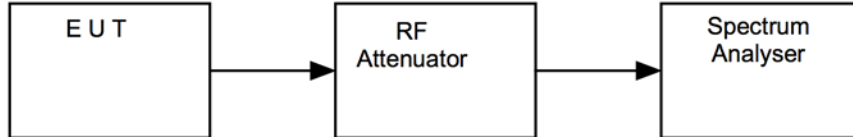
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§ 15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific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

**13.4 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**

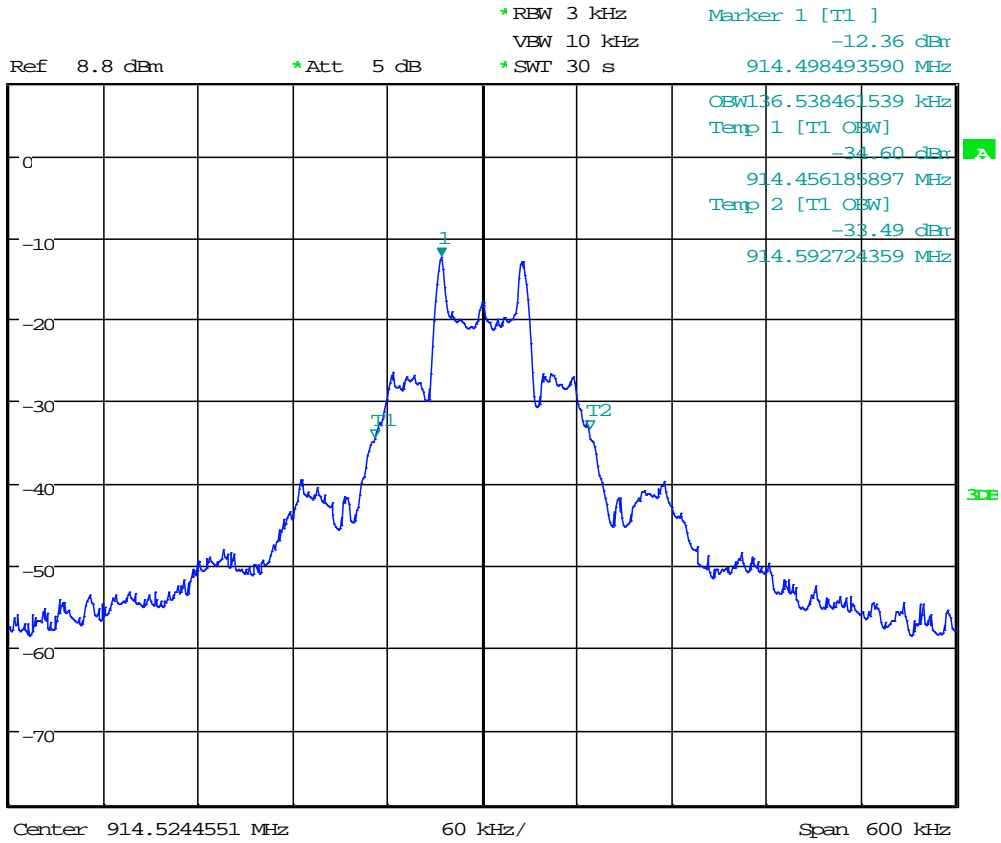


**13.5 Test Equipment**

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
FSU46	R&S	Spectrum Analyser	U281	19/06/2018

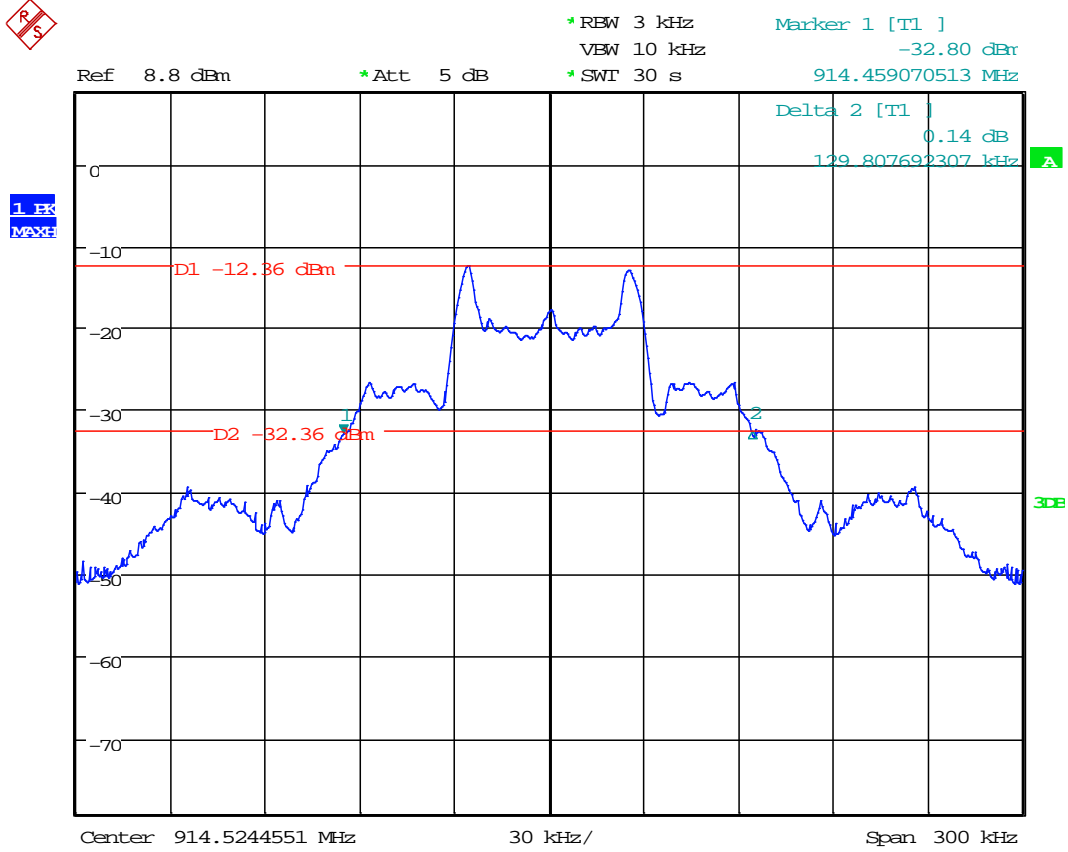
13.6 Test Results

RSS-Gen. 914.5MHz				
Channel Frequency (MHz)	$F_L$ (MHz)	$F_H$ (MHz)	99% Bandwidth (kHz)	Result
914.50	914.456185	914.592724	136.53	PASS



Date: 23.JUN.2017 12:11:10

FCC 15.249. 914.5MHz				
Channel Frequency (MHz)	F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)	20dB Bandwidth (kHz)	Result
914.50	914.459070	914.588878	129.807692	PASS



Date: 23.JUN.2017 11:57:10

## 14 Transmitter output power (fundamental radiated emission)

### 14.1 Definition

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

### 14.2 Test Parameters

Test Location:	Element Skelmersdale
Test Chamber:	Chamber 3
Test Standard and Clause:	ANSI C63.10-2013, Clause 6.5 / 6.6
EUT Channels / Frequencies Measured:	914.50MHz
EUT Channel Bandwidths:	Wideband
Deviations From Standard:	None
Measurement BW:	120kHz
Spectrum Analyzer Video BW: (requirement at least 3x RBW)	
Measurement Detector:	Up to 1 GHz: Quasi-peak Above 1 GHz: Average RMS and 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: 23 °C	+15 °C to +35 °C (as declared)
Humidity: 32 % RH	20 % RH to 75 % RH (as declared)

### 14.3 Test Limit

The field strength measured at 3 metres 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

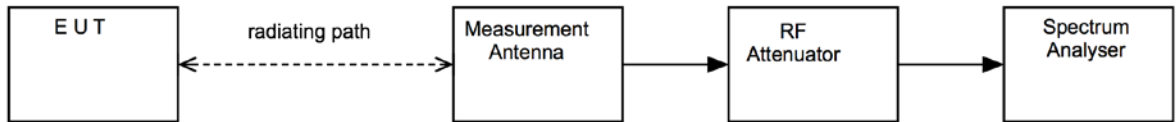


**14.4 Test Method**

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**



**14.5 Test Equipment**

Equipment Type	Manufacturer	Equipment Description	Element No	Due For Calibration
ESVS10	R&S	Receiver	<u>L352</u>	14/07/2017
CBL611/A	Chase	Bilog	<u>U191</u>	23/02/2019

**14.6 Test Results**

<i>Detector</i>	<i>Freq. (MHz)</i>	<i>Meas'd Emission (dBµV)</i>	<i>Cable Loss (dB)</i>	<i>Antenna Factor (dB/m)</i>	<i>Pre-amp Gain (dB)</i>	<i>Duty Cycle Corr'n (dB)</i>	<i>Distance Extrap'n Factor (dB)</i>	<i>Field Strength (dBµV/m)</i>	<i>Field Strength (mV/m)</i>	<i>Limit (mV/m)</i>
QP	914.50	66.4	4.0	23.4	N/A	100	N/A	93.8	48.97	50

## 15 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 %**