



TEST REPORT

Test Report No. : UL-RPT-RP11146275JD06A

Manufacturer : Ei Electronics Ltd
Model No. : EiA600ZW
FCC ID : A5FEIA600ZW
Test Standard(s) : FCC Parts 15.209(a) & 15.249

1. This test report shall not be reproduced in full or partial, without the written approval of UL VS LTD.
2. The results in this report apply only to the sample(s) tested.
3. The sample tested is in compliance with the above standard(s).
4. The test results in this report are traceable to the national or international standards.
5. Version 1.0.

Date of Issue: 06 April 2017

Checked by:

Ian Watch
Senior Engineer, Radio Laboratory

Company Signatory:

Sarah Williams
Senior Engineer, Radio Laboratory,
UL VS LTD



This laboratory is accredited by UKAS.
The tests reported herein have been
performed in accordance with its terms
of accreditation.

UL VS LTD

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG, UK
Telephone: +44 (0)1256 312000
Facsimile: +44 (0)1256 312001

This page has been left intentionally blank.

Table of Contents

1. Customer Information.....	4
2. Summary of Testing.....	5
2.1. General Information	5
2.2. Summary of Test Results	5
2.3. Methods and Procedures	5
2.4. Deviations from the Test Specification	5
3. Equipment Under Test (EUT)	6
3.1. Identification of Equipment Under Test (EUT)	6
3.2. Description of EUT	6
3.3. Modifications Incorporated in the EUT	6
3.4. Additional Information Related to Testing	7
3.5. Support Equipment	7
3.6. Antenna	7
4. Operation and Monitoring of the EUT during Testing	8
4.1. Operating Modes	8
4.2. Configuration and Peripherals	8
5. Measurements, Examinations and Derived Results.....	9
5.1. General Comments	9
5.2. Test Results	10
5.2.1. Transmitter Fundamental Field Strength	10
5.2.2. Transmitter 20 dB Bandwidth	12
5.2.3. Transmitter Radiated Emissions	14
5.2.4. Transmitter Band Edge Radiated Emissions	19
6. Measurement Uncertainty	21
7. Report Revision History	22

1. Customer Information

Company Name:	Ei Electronics Ltd
Address:	Shannon Industrial Estate Shannon Co. Clare Ireland

2. Summary of Testing

2.1. General Information

Specification Reference:	47CFR15.249
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.249
Specification Reference:	47CFR15.209
Specification Title:	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Sections 15.209
Site Registration:	209735
Location of Testing:	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
Test Dates:	26 September 2016 to 21 October 2016

2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.249(a)	Transmitter Fundamental Field Strength	
Part 2.1049	Transmitter 20 dB Bandwidth	
Part 15.249(a)(d)(e)/ 15.209(a)	Transmitter Radiated Emissions	
Part 15.249(d)/ 15.209(a)	Transmitter Band Edge Radiated Emissions	
Key to Results  = Complied  = Did not comply		

2.3. Methods and Procedures

Reference:	ANSI C63.10-2013
Title:	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

2.4. Deviations from the Test Specification

For the measurements contained within this test report, there were no deviations from, additions to, or exclusions from the test specification identified above.

3. Equipment Under Test (EUT)

3.1. Identification of Equipment Under Test (EUT)

Brand Name:	Ei Electronics
Model Name or Number:	EiA600ZW
Test Sample Serial Number:	Marked as "Continuous TX" (<i>Radiated RF sample</i>)
Hardware Version:	EiA600ZW Rev 0
Software Version:	EiA600ZW Rev 0
FCC ID:	A5FEIA600ZW

Brand Name:	Ei Electronics
Model Name or Number:	EiA600ZW
Test Sample Serial Number:	Marked as "Continuous TX" (<i>Conducted RF sample</i>)
Hardware Version:	EiA600ZW Rev 0
Software Version:	EiA600ZW Rev 0
FCC ID:	A5FEIA600ZW

3.2. Description of EUT

The Equipment Under Test was an RF module that installs into an Ei Electronics EiA660W series smoke / heat alarm. The antenna used is a ¼ wave whip and is integral to the EiA660W host device.

It contains two 3 Volt CR123A batteries.

3.3. Modifications Incorporated in the EUT

No modifications were applied to the EUT during testing.

3.4. Additional Information Related to Testing

Tested Technology:	Z-Wave	
Power Supply Requirement:	Nominal	3.0 VDC
Type of Unit:	Transceiver	
Modulation:	FSK	
Transmit Frequency Range:	908.4 MHz	
Transmit Channels Tested:	Channel ID	Channel Frequency (MHz)
	Single Channel	908.4 MHz

3.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

Description:	Multi Sensor Smoke and Carbon Monoxide Alarm
Brand Name:	Ei Electronics
Model Name or Number:	EiA600W
Serial Number:	Not marked or stated

3.6. Antenna

The table below shows the antenna that the manufacturer will use with this product:

Type	¼ wave whip
Stated Gain (dBi)	-6.0

4. Operation and Monitoring of the EUT during Testing

4.1. Operating Modes

The EUT was tested in the following operating mode(s):

- Constantly transmitting on a single fixed frequency at maximum power with 100% duty cycle.

4.2. Configuration and Peripherals

The EUT was tested in the following configuration(s):

- For conducted and radiated measurements, a constant transmit module was placed within the Multi Sensor Alarm EiA660W. The module starts transmission when batteries are inserted into the EiA660W unit.
- Radiated spurious emissions were performed with the EUT in 3 orientations to determine the worst case. There were no ports on the EUT to terminate.
- The EUT marked as "Continuous TX" (*Radiated RF sample*) was used for all radiated tests. The EUT with "Continuous TX" (*Conducted RF sample*) was used for all conducted tests.

5. Measurements, Examinations and Derived Results

5.1. General Comments

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to *Section 6. Measurement Uncertainty* for details.

In accordance with UKAS requirements all the measurement equipment is on a calibration schedule. All equipment was within the calibration period on the date of testing.

5.2. Test Results

5.2.1. Transmitter Fundamental Field Strength

Test Summary:

Test Engineer:	John Ferdinand	Test Date:	21 October 2016
Test Sample Serial Number:	"Continuous TX" (<i>Radiated RF sample</i>)		

FCC Reference:	Part 15.249(a)
Test Method Used:	ANSI C63.10 Section 6.5

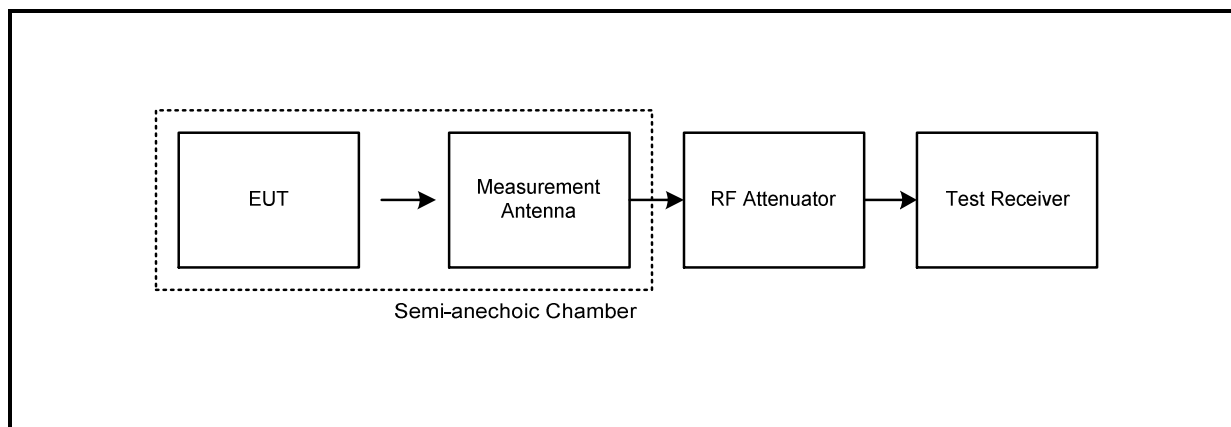
Environmental Conditions:

Temperature (°C):	24
Relative Humidity (%):	37

Note(s):

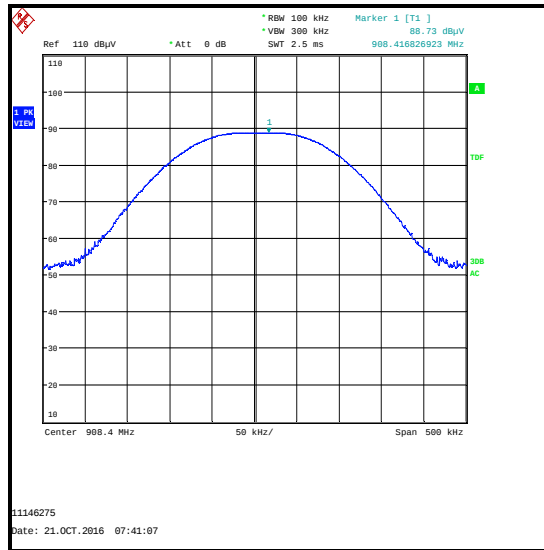
1. The final measured value in the table below incorporates the calibrated antenna factor and cable loss.
2. The measurement of the fundamental shown on the following page was performed using a peak detector.

Test setup:



Results: Peak

Frequency (MHz)	Antenna Polarity	Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
908.417	Horizontal	88.7	94.0	5.3	Complied

Transmitter Fundamental Field Strength (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12

5.2.2. Transmitter 20 dB Bandwidth**Test Summary:**

Test Engineer:	John Ferdinand	Test Date:	26 September 2016
Test Sample Serial Number:	"Continuous TX" (Conducted RF sample)		

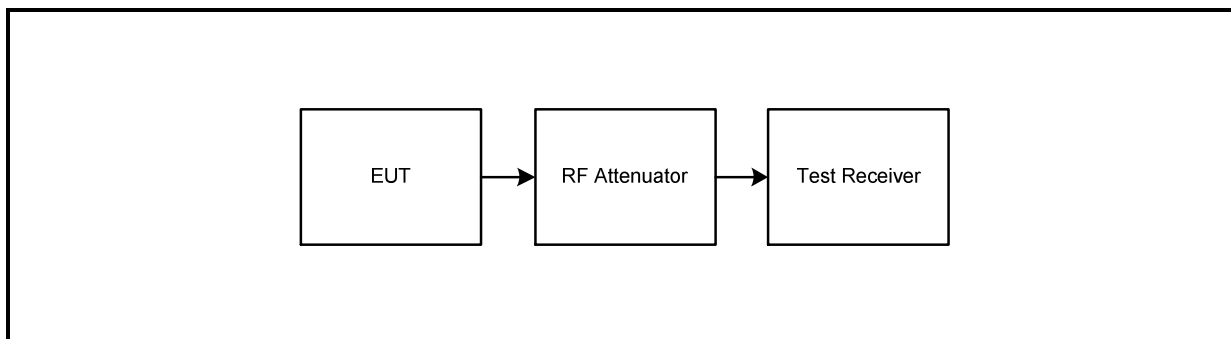
FCC Reference:	Part 2.1049
Test Method Used:	ANSI C63.10 Section 6.9.2

Environmental Conditions:

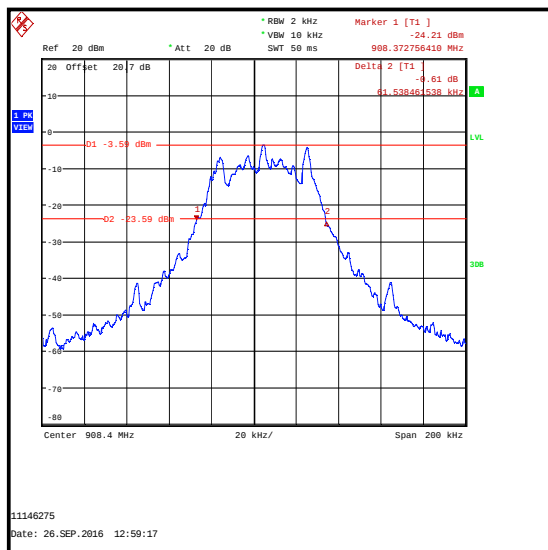
Temperature (°C):	22
Relative Humidity (%):	41

Note(s):

1. For measurements the EUT was transmitting, the test receiver's resolution bandwidth was set to 2 kHz and video bandwidth 10 kHz. A peak detector was used and the trace mode was Max Hold. The span was set to 200 kHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. The result is recorded in the table below.
2. The EUT was connected to the test receiver using suitable attenuation and RF cable.

Test setup:**Results:**

Channel	20 dB Bandwidth (kHz)
Single Channel	61.538

Transmitter 20 dB Bandwidth (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1659	Thermohygrometer	JM Handelspunkt	30.5015.06	Not stated	02 Apr 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A1999	Attenuator	Huber & Suhner	6820.17.B	7101	Calibrated before use	-
G0614	Signal Generator	Rohde & Schwarz	SMB100A	177687	01 May 2017	36
M199	Power Meter	Rohde & Schwarz	NRVS	827023/075	11 Apr 2018	12
M1267	Power Sensor	Rohde & Schwarz	NRV-Z52	100155	11 Apr 2018	12

5.2.3. Transmitter Radiated Emissions**Test Summary:**

Test Engineer:	John Ferdinand	Test Date:	21 October 2016
Test Sample Serial Number:	"Continuous TX" (<i>Radiated RF sample</i>)		

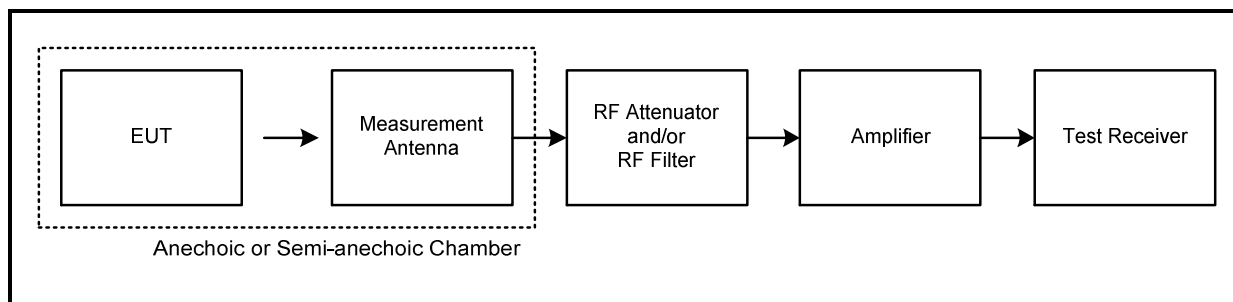
FCC Reference:	Parts 15.249(a)(d)(e) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.5
Frequency Range	30 MHz to 1000 MHz

Environmental Conditions:

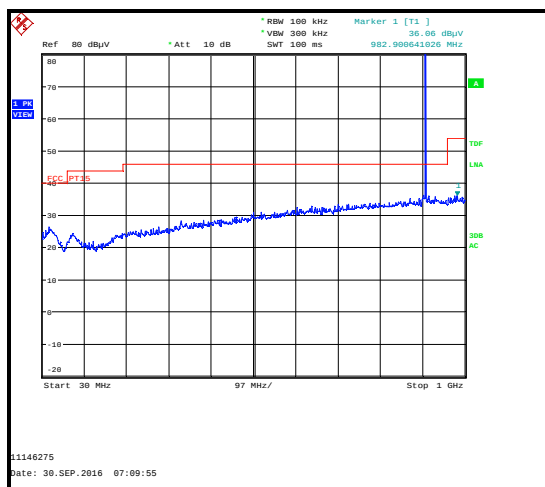
Temperature (°C):	24
Relative Humidity (%):	37

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. The emission shown on the 30 MHz to 1 GHz plot is the EUT fundamental at 908.4 MHz.
3. No spurious emissions were detected above the noise floor of the measuring receiver therefore the highest peak noise floor reading of the measuring receiver was recorded as shown in the table below.
4. Measurements below 1 GHz were performed in a semi-anechoic chamber (Asset Number K0017) at a distance of 3 metres. The EUT was placed at a height of 80 cm above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
5. Pre-scans were performed and markers placed on the highest measured levels. The test receiver resolution bandwidth was set to 100 kHz and video bandwidth 300 kHz. The sweep time was set to auto. A peak detector was used, sweep time was set to auto and trace mode was Max Hold.

Transmitter Radiated Emissions (continued)**Test setup for radiated measurements:****Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Result
982.901	Vertical	36.1	54.0	17.9	Complied

**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12

Transmitter Radiated Emissions (continued)**Test Summary:**

Test Engineer:	John Ferdinand	Test Dates:	30 September 2016 to 03 October 2016
Test Sample Serial Number:	"Continuous TX" (<i>Radiated RF sample</i>)		

FCC Reference:	Parts 15.249(a)(d)(e) & 15.209(a)
Test Method Used:	ANSI C63.10 Sections 6.3 and 6.6
Frequency Range	1 GHz to 10 GHz

Environmental Conditions:

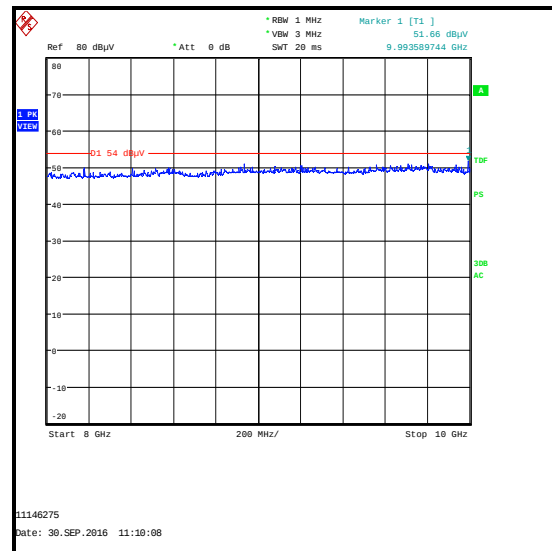
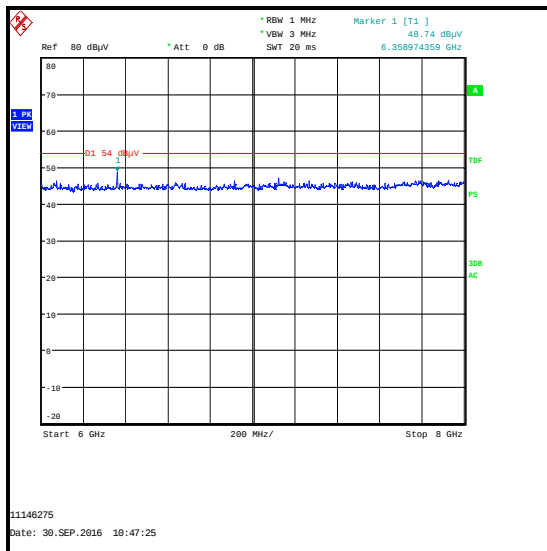
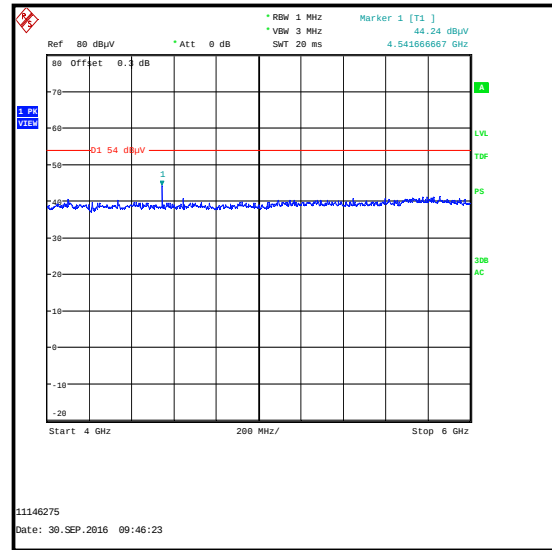
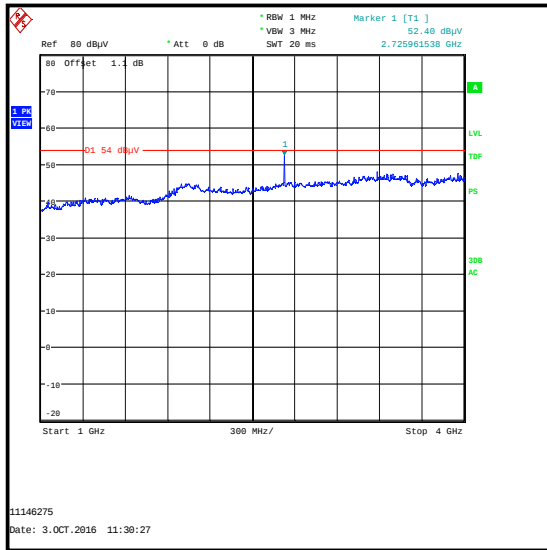
Temperature (°C):	22 to 24
Relative Humidity (%):	39 to 44

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.
2. Pre-scans above 1 GHz were performed in a fully anechoic chamber (Asset Number K0002) at a distance of 3 metres. The EUT was placed at a height of 1.5 metres above the test chamber floor in the centre of the chamber turntable. All measurement antennas were placed at a fixed height of 1.5 metres above the test chamber floor, in line with the EUT. Final measurements above 1 GHz were performed in a semi-anechoic chamber (Asset Number K0001) at a distance of 3 metres. The EUT was placed at a height of 1.5 m above the reference ground plane in the centre of the chamber turntable. Maximum emission levels were determined by height searching the measurement antenna over the range 1 metre to 4 metres.
3. Pre-scans were performed and a marker placed on the highest measured level of the appropriate plot. The test receiver resolution bandwidth was set to 1 MHz and video bandwidth 3 MHz. The sweep time was set to auto.
4. *In accordance with ANSI C63.10 Section 6.6.4.3, if the peak measured value complies with the average limit, it is unnecessary to perform an average measurement.

Results: Peak

Frequency (MHz)	Antenna Polarity	Level (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Result
2725.233	Horizontal	52.5	54.0*	1.5	Complied
4541.840	Horizontal	45.6	54.0*	8.4	Complied
6358.832	Horizontal	50.0	54.0*	4.0	Complied

Transmitter Radiated Emissions (continued)

Note: These plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Transmitter Radiated Emissions (continued)**Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelspunkt	30.5015.13	None stated	21 Dec 2016	12
K0001	5m RSE Chamber	Rainford EMC	N/A	N/A	12 Jan 2017	12
K0002	3m RSE Chamber	Rainford EMC	N/A	N/A	21 Dec 2016	12
M1886	Test Receiver	Rohde & Schwarz	ESU26	100554	21 Mar 2017	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	11 Apr 2017	12
A1534	Pre Amplifier	Hewlett Packard	8449B	3008A00405	19 Dec 2016	12
G0543	Pre Amplifier	Sonoma	310N	230801	09 Dec 2016	12
A1818	Antenna	EMCO	3115	00075692	17 Dec 2016	12
A253	Antenna	Flann	12240-20	128	17 Dec 2016	12
A254	Antenna	Flann	14240-20	139	17 Dec 2016	12
A255	Antenna	Flann	16240-20	519	17 Dec 2016	12
A1817	Antenna	EMCO	3115	00075694	14 Oct 2017	12
A2407	High Pass Filter	AtlanTecRF	AFH-03000	090424010	26 Apr 2017	12
A2467	High Pass Filter	Wainwright Instruments GmbH	WHJE5-920-1000-4000	2	09 Mar 2017	12

5.2.4. Transmitter Band Edge Radiated Emissions**Test Summary:**

Test Engineer:	John Ferdinand	Test Date:	21 October 2016
Test Sample Serial Number:	"Continuous TX" (<i>Radiated RF sample</i>)		

FCC Reference:	Parts 15.249(d) & 15.209
Test Method Used:	ANSI C63.10 Section 6.10.4 & 6.10.5

Environmental Conditions:

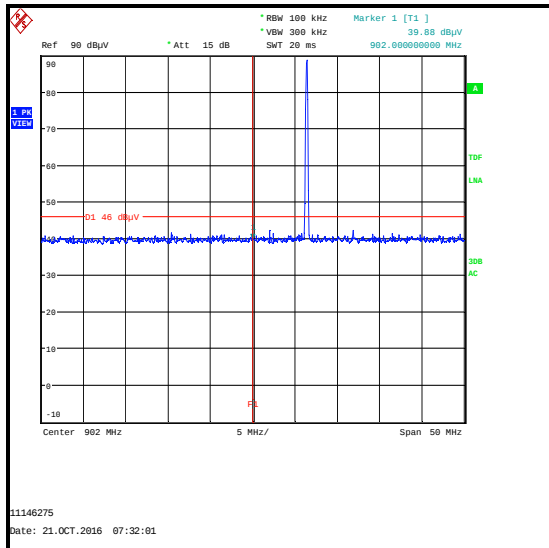
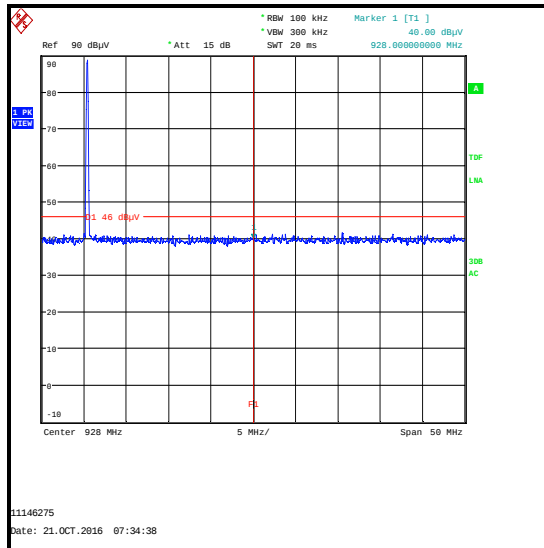
Temperature (°C):	24
Relative Humidity (%):	37

Note(s):

1. The final measured value, for the given emission, in the table below incorporates the calibrated antenna factor and cable loss.

Results: Peak

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
902.000	Horizontal	39.9	46.0	6.1	Complied
928.000	Horizontal	40.0	46.0	6.0	Complied

Transmitter Band Edge Radiated Emissions (continued)**Lower Band Edge Peak Measurement****Upper Band Edge Peak Measurement****Test Equipment Used:**

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M2003	Thermohygrometer	Testo	608-H1	45046641	22 Apr 2017	12
K0017	3m RSE Chamber	Rainford EMC	N/A	N/A	17 May 2017	12
M1995	Test Receiver	Rohde & Schwarz	ESU40	100428	21 Mar 2017	12
A2888	Antenna	Schwarzbeck	VULB 9163	9163-941	07 Apr 2017	12

6. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Fundamental Field Strength	902 MHz to 928	95%	±2.94 dB
20 dB Bandwidth	902 MHz to 928	95%	±4.59 %
Radiated Spurious Emissions	30 MHz to 1 GHz	95%	±5.65 dB
Radiated Spurious Emissions	30 MHz to 10 GHz	95%	±2.94 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty the published guidance of the appropriate accreditation body is followed.

7. Report Revision History

Version Number	Revision Details		
	Page No(s)	Clause	Details
1.0	-	-	Initial Version

--- END OF REPORT ---