



# TEST REPORT

**Test Report No. : UL-RPT-RP11146275JD05A V2.0**

**Manufacturer** : Ei Electronics Ltd  
**Model No.** : EiA200ZW  
**FCC ID** : A5FEIA200ZW  
**Test Standard(s)** : FCC Parts 15.209(a) & 15.249

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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 2.0 supersedes all previous versions.

**Date of Issue:** 11 May 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.

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## **UL VS LTD**

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

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**Table of Contents**

<b>1. Customer Information.....</b>	<b>4</b>
<b>2. Summary of Testing.....</b>	<b>5</b>
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
<b>3. Equipment Under Test (EUT) .....</b>	<b>6</b>
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
<b>4. Operation and Monitoring of the EUT during Testing .....</b>	<b>8</b>
4.1. Operating Modes	8
4.2. Configuration and Peripherals	8
<b>5. Measurements, Examinations and Derived Results.....</b>	<b>9</b>
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	20
<b>6. Measurement Uncertainty .....</b>	<b>22</b>
<b>7. Report Revision History .....</b>	<b>23</b>

## **1. Customer Information**

<b>Company Name:</b>	Ei Electronics Ltd
<b>Address:</b>	Shannon Industrial Estate Shannon Co. Clare Ireland

## 2. Summary of Testing

### 2.1. General Information

<b>Specification Reference:</b>	47CFR15.249
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.249
<b>Specification Reference:</b>	47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications): Part 15 Subpart C (Intentional Radiators) - Section 15.209
<b>Site Registration:</b>	209735
<b>Location of Testing:</b>	UL VS LTD, Unit 3 Horizon, Wade Road, Kingsland Business Park, Basingstoke, Hampshire, RG24 8AH, United Kingdom
<b>Test Dates:</b>	29 September 2016 to 02 November 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	✓
<b>Key to Results</b>		
✓ = Complied	✗ = Did not comply	

### 2.3. Methods and Procedures

<b>Reference:</b>	ANSI C63.10-2013
<b>Title:</b>	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)**

<b>Brand Name:</b>	Ei Electronics
<b>Model Name or Number:</b>	EiA200ZW
<b>Test Sample Serial Number:</b>	Marked as "Continuous TX" ( <i>Radiated RF sample</i> )
<b>Hardware Version:</b>	EiA200ZW Rev 0
<b>Software Version:</b>	EiA200ZW Rev 0
<b>FCC ID:</b>	A5FEIA200ZW

<b>Brand Name:</b>	Ei Electronics
<b>Model Name or Number:</b>	EiA200ZW
<b>Test Sample Serial Number:</b>	Marked as "Continuous TX" ( <i>Conducted RF sample</i> )
<b>Hardware Version:</b>	EiA200ZW Rev 0
<b>Software Version:</b>	EiA200ZW Rev 0
<b>FCC ID:</b>	A5FEIA200ZW

#### **3.2. Description of EUT**

The Equipment Under Test was an RF module that installs into an Ei Electronics EiA207 series smoke / Carbon Monoxide alarm. The antenna used is a 1/4 wave whip and is integral to the EiA207 host device.

It contains two 1.5 Volt AAA batteries.

#### **3.3. Modifications Incorporated in the EUT**

No modifications were applied to the EUT during testing.

### **3.4. Additional Information Related to Testing**

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

### **3.5. Support Equipment**

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

<b>Description:</b>	Multi Sensor Smoke and Carbon Monoxide Alarm
<b>Brand Name:</b>	Ei Electronics
<b>Model Name or Number:</b>	EiA207
<b>Serial Number:</b>	Not marked or stated

### **3.6. Antenna**

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

<b>Type</b>	1/4 wave whip
<b>Stated Gain (dBi)</b>	-3.0

## **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 EiA207. The module starts transmission when batteries are inserted into the EiA207 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:	02 November 2016
Test Sample Serial Number:	"Continuous TX" (Radiated RF sample)		

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

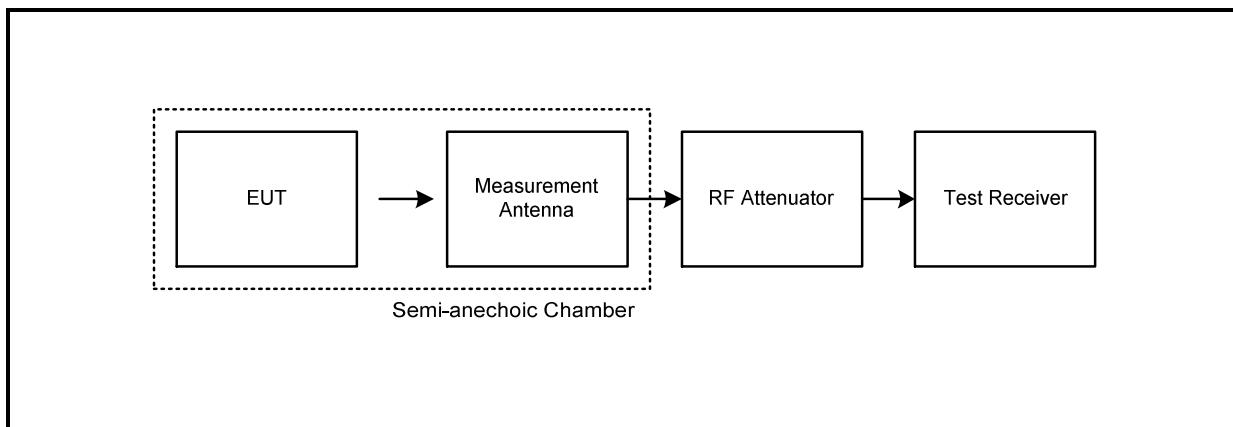
#### **Environmental Conditions:**

Temperature (°C):	22
Relative Humidity (%):	34

#### **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 (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
908.414	Horizontal	92.1	94.0	1.9	Complied

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

Asset No.	Instrument	Manufacturer	Type No.	Serial No.	Date Calibration Due	Cal. Interval (Months)
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	02 Apr 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
A2903	Antenna	Schwarzbeck	VULB 9163	9163-944	22 Aug 2017	12

### **5.2.2. Transmitter 20 dB Bandwidth**

#### **Test Summary:**

<b>Test Engineer:</b>	John Ferdinand	<b>Test Date:</b>	29 September 2016
<b>Test Sample Serial Number:</b>	"Continuous TX" (Conducted RF sample)		

<b>FCC Reference:</b>	Part 2.1049
<b>Test Method Used:</b>	ANSI C63.10 Section 6.9.2

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	21
<b>Relative Humidity (%):</b>	47

#### **Note(s):**

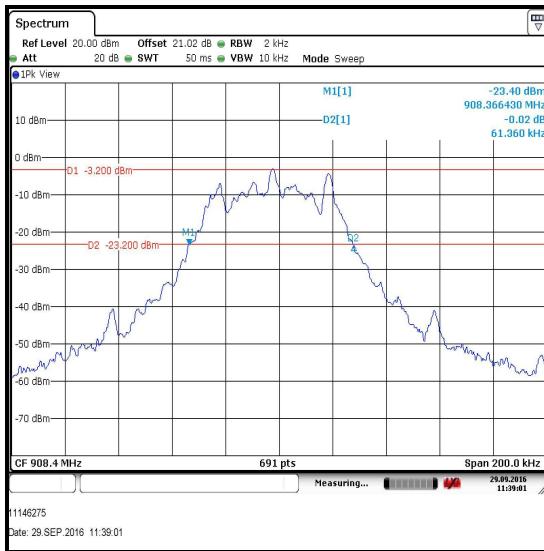
1. For measurements the EUT was transmitting, the signal analyser's resolution bandwidth was set to 2 kHz and video bandwidth 10 kHz. A peak detector was used and the trace mode was Max Hold. The span was set to 200 kHz. Normal and delta markers were placed 20 dB down from the peak of the carrier. The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

#### **Test setup:**



#### **Results:**

Channel	20 dB Bandwidth (kHz)
Single Channel	61.360

**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
M1835	Signal Analyser	Rohde & Schwarz	FSV	103050	26 Feb 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:**

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

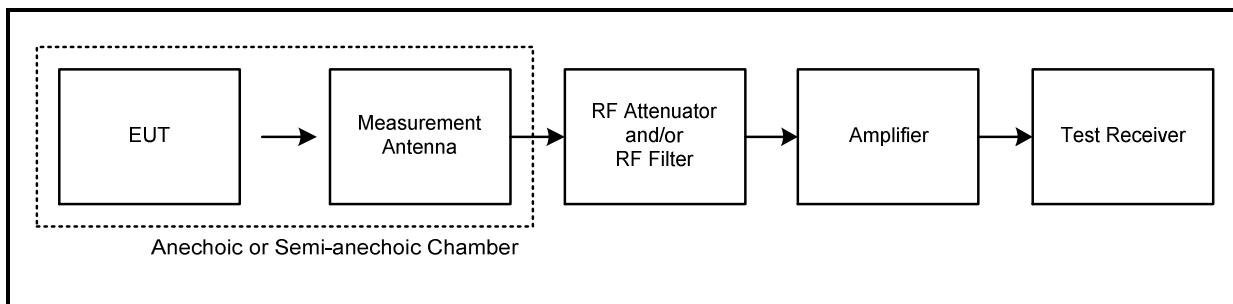
<b>FCC Reference:</b>	Parts 15.249(a)(d)(e) & 15.209(a)
<b>Test Method Used:</b>	ANSI C63.10 Sections 6.3 and 6.5
<b>Frequency Range</b>	30 MHz to 1000 MHz

#### **Environmental Conditions:**

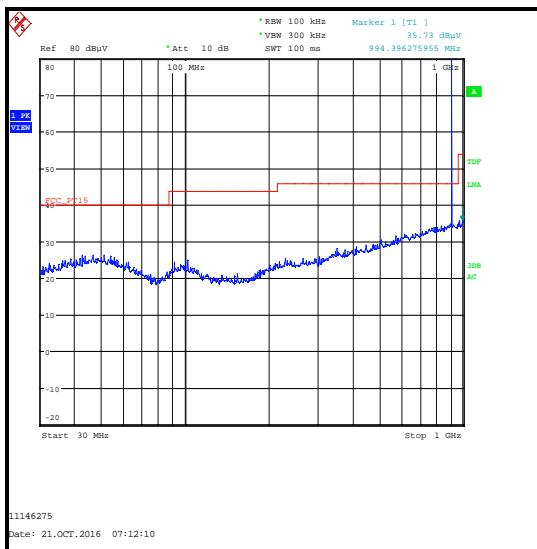
<b>Temperature (°C):</b>	24
<b>Relative Humidity (%):</b>	37

#### **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	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
994.396	Horizontal	35.7	54.0	18.3	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:**

<b>Test Engineer:</b>	John Ferdinand	<b>Test Date:</b>	30 September 2016
<b>Test Sample Serial Number:</b>	"Continuous TX" ( <i>Radiated RF sample</i> )		

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

**Environmental Conditions:**

<b>Temperature (°C):</b>	21
<b>Relative Humidity (%):</b>	38

**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.

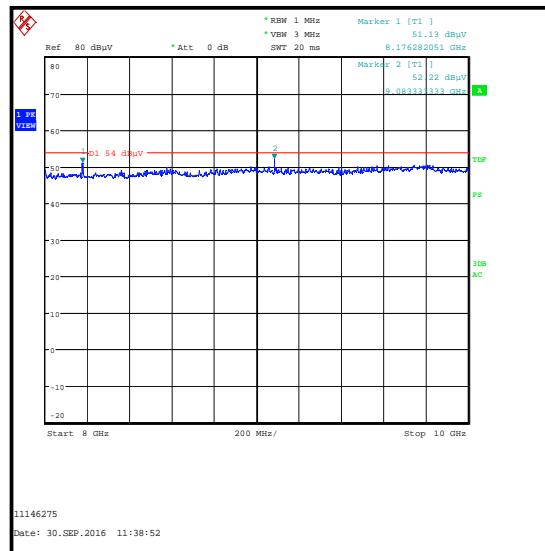
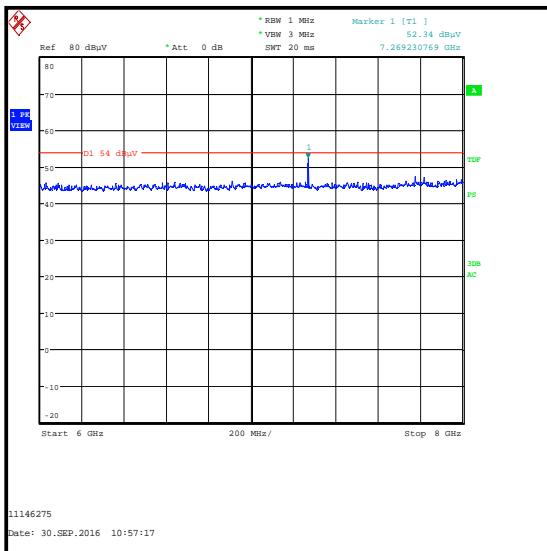
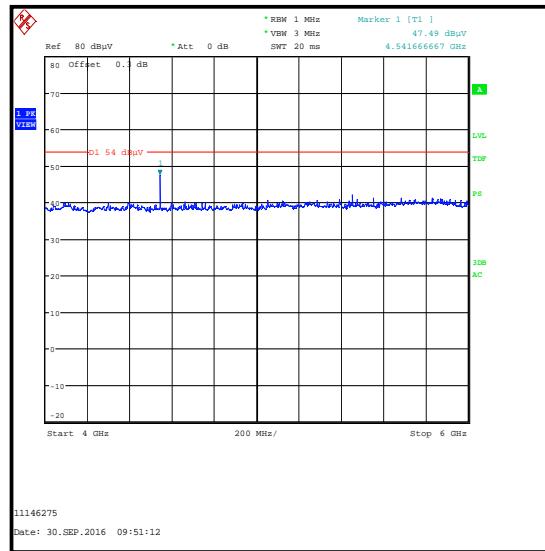
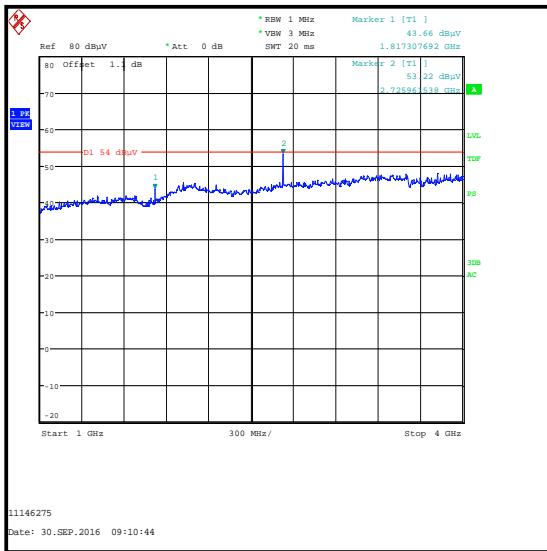
**Transmitter Radiated Emissions (continued)****Results: Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
1816.841	Vertical	43.5	54.0*	10.5	Complied
2725.233	Vertical	55.4	74.0	18.6	Complied
4541.968	Vertical	48.0	54.0*	6.0	Complied
7267.136	Vertical	53.1	54.0*	0.9	Complied
8175.811	Vertical	52.3	54.0*	1.7	Complied
9083.750	Vertical	52.7	54.0*	1.3	Complied

**Results: Average**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
2725.329	Vertical	53.3	54.0	0.7	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 Handelpunkt	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	Sonama	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:	02 November 2016
Test Sample Serial Number:	"Continuous TX" (Radiated RF sample)		

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):	22
Relative Humidity (%):	34

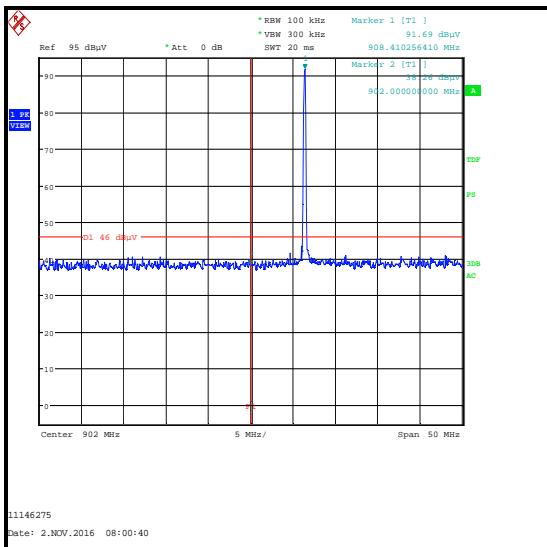
**Note(s):**

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

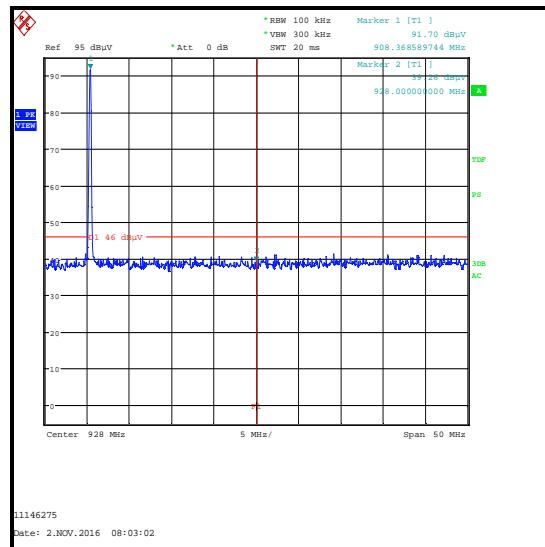
**Results: Peak**

Frequency (MHz)	Antenna Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
902.000	Horizontal	38.3	46.0	7.7	Complied
928.000	Horizontal	39.3	46.0	6.7	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)
M1656	Thermohygrometer	JM Handelpunkt	30.5015.13	Not stated	02 Apr 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
A2903	Antenna	Schwarzbeck	VULB 9163	9163-944	22 Aug 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 MHz	95%	±2.94 dB
20 dB Bandwidth	902 MHz to 928 MHz	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
2.0	7	-	Section 3.6. Changed antenna gain from -6.0 dBi to -3.0 dBi at the customer's request

**--- END OF REPORT ---**