

# TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: ACR1

FCC ID: ZLIACR1

To: FCC Part 15.231: 2010

**Test Report Serial No:**  
RFI-RPT-RP80879JD01A

Version 2.0 supersedes all previous Versions

**This Test Report Is Issued Under The Authority  
Of Chris Guy, Head of Global Approvals:**



|                       |   |
|-----------------------|---|
| <b>Checked By:</b>    | Ian Watch   |
| <b>Signature:</b>     | pp  |
| <b>Date of Issue:</b> | 07 September 2011   |

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## **1. Customer Information**

|                      |  |
|----------------------|--|
| <b>Company Name:</b> | Best S.p.A..                                       |
| <b>Address:</b>      | Via Verdi, 34<br>60043 Cerreto d'Esi (AN)<br>ITALY |

## 2. Summary of Testing

### 2.1. General Information

|                                 |   |
|---------------------------------|---|
| <b>Specification Reference:</b> | 47CFR15.231   |
| <b>Specification Title:</b>     | Code of Federal Regulations Volume 47 (Telecommunications) 2010: Part 15 Subpart C (Radio Frequency Devices) - Section 15.231 |
| <b>Specification Reference:</b> | 47CFR15.209   |
| <b>Specification Title:</b>     | Code of Federal Regulations Volume 47 (Telecommunications) 2010: Part 15 Subpart C (Intentional Radiators) – Section 15.209   |
| <b>Site Registration:</b>       | FCC: 209735   |
| <b>Location of Testing:</b>     | RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.   |
| <b>Test Dates:</b>              | 22 July 2011 to 29 July 2011  |

### 2.2. Summary of Test Results

| FCC Reference (47CFR)   | Measurement                            | Result |
|-------------------------|--|--------|
| Part 15.231(e)          | Transmitter Fundamental Field Strength | ✓      |
| Part 15.231(c)          | Transmitter 20 dB Bandwidth            | ✓      |
| Part 15.231(a)          | Transmitter Timeout                    | ✓      |
| Part 15.35(c)           | Transmitter Duty Cycle                 | Note 1 |
| Part 15.231(b) & 15.209 | Transmitter Radiated Emissions         | ✓      |

**Key to Results**

✓ = Complied   ✘ = Did not comply

*Note 1: The measurement was performed to assist in the calculation of the level of average and emissions as the EUT employs pulsed operation.*

### 2.3. Methods and Procedures

|                   |   |
|-------------------|---|
| <b>Reference:</b> | ANSI C63.4 (2009)   |
| <b>Title:</b>     | 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 |
| <b>Reference:</b> | ANSI C63.10 (2009)  |
| <b>Title:</b>     | American National Standard for Testing 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>              | Best                          |
| <b>Model Name or Number:</b>    | ACR1                          |
| <b>Serial Number:</b>           | 10091039360303851590432200053 |
| <b>Hardware Version Number:</b> | 08080358                      |
| <b>Software Version Number:</b> | 1590                          |
| <b>FCC ID:</b>                  | ZLIACR1                       |

|                                 |                              |
|---------------------------------|------------------------------|
| <b>Brand Name:</b>              | Best                         |
| <b>Model Name or Number:</b>    | ACR1                         |
| <b>Serial Number:</b>           | 1045468160303561590432200358 |
| <b>Hardware Version Number:</b> | 08080358                     |
| <b>Software Version Number:</b> | 1590                         |
| <b>FCC ID:</b>                  | ZLIACR1                      |

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

The equipment under test was a Radio Control for Range Hood which is used as a remote control transmitter.

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

No modifications were applied to the EUT during testing.

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

|                                  |             |                      |
|----------------------------------|-------------|----------------------|
| <b>Power Supply Requirement:</b> | Nominal     | 3.7 V Li-ion battery |
| <b>Type of Unit:</b>             | Transceiver |                      |
| <b>Transmit Frequency Range:</b> | 433 MHz     |                      |

### **3.5. Support Equipment**

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

|                              |            |
|------------------------------|------------|
| <b>Description:</b>          | Battery    |
| <b>Brand Name:</b>           | Duracell   |
| <b>Model Name or Number:</b> | MN21/23    |
| <b>Serial Number:</b>        | Not stated |

## **4. Operation and Monitoring of the EUT during Testing**

### **4.1. Operating Modes**

The EUT was tested in the following operating test modes, unless otherwise stated:

- Continuously transmitting at maximum output power.
- Simultaneously transmitting and receiving.

### **4.2. Configuration and Peripherals**

The EUT was tested in the following configuration:

- Continuous transmission, enabled by pressing a sequence of buttons on the front panel of the EUT in accordance with the instructions provided by the Customer.
- Pulsed operation, which is the default state of the device.
- For Transmitter Fundamental Field Strength, Transmitter 20 dB Bandwidth and Transmitter Radiated Emissions tests, serial number 10091039360303851590432200053 was used. The EUT with serial number 1045468160303561590432200358 was used for all other tests.
- The battery was frequently monitored during testing and changed as required.

## **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.

## **5.2. Test Results**

### **5.2.1. Transmitter Fundamental Field Strength**

#### **Test Summary:**

|                               |                               |                   |              |
|-------------------------------|-------------------------------|-------------------|--------------|
| <b>Test Engineer:</b>         | Patrick Jones                 | <b>Test Date:</b> | 22 July 2011 |
| <b>Test Sample Serial No:</b> | 10091039360303851590432200053 |                   |              |

|                          |  |
|--------------------------|--|
| <b>FCC Part:</b>         | 15.231(e)  |
| <b>Test Method Used:</b> | As detailed in ANSI C63.10 Section 6.10.1 and Sections 6.3 and 6.6 referencing ANSI C63.4 (see note below) |

#### **Environmental Conditions:**

|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 29 |
| <b>Relative Humidity (%):</b> | 30 |

#### **Results: Average Level**

| Frequency (MHz) | Average Level (dB $\mu$ V/m) | Average Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------------------|------------------------------|-------------|----------|
| 433.872         | 67.7                         | 80.8                         | 13.1        | Complied |

#### **Results: Peak Level**

| Frequency (MHz) | Peak Level (dB $\mu$ V/m) | Peak Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|---------------------------|---------------------------|-------------|----------|
| 433.872         | 70.4                      | 100.8                     | 30.4        | Complied |

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

1. The average level was determined by subtracting the duty cycle correction factor of 2.68 dB of from the measured peak level.
2. Measurements were made with the test antenna in the horizontal and vertical planes. The highest level was recorded in the above table.

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

#### **Test Summary:**

|                               |                               |                   |              |
|-------------------------------|-------------------------------|-------------------|--------------|
| <b>Test Engineer:</b>         | Andrew Edwards                | <b>Test Date:</b> | 29 July 2011 |
| <b>Test Sample Serial No:</b> | 10091039360303851590432200053 |                   |              |

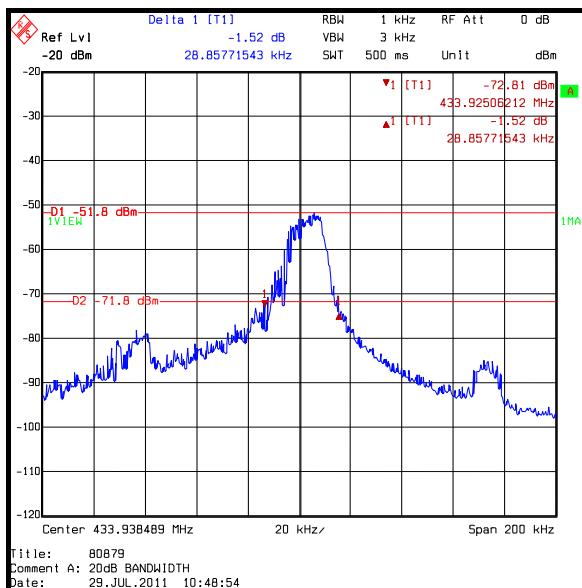
|                          |  |
|--------------------------|--|
| <b>FCC Part:</b>         | 15.231(c)                                |
| <b>Test Method Used:</b> | As detailed in ANSI C63.10 Section 6.9.1 |

#### **Environmental Conditions:**

|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 24 |
| <b>Relative Humidity (%):</b> | 40 |

#### **Results:**

| Transmitter 20 dB Bandwidth (MHz) | Limit (MHz) | Margin (MHz) | Result   |
|-----------------------------------|-------------|--------------|----------|
| 0.028856                          | 1.08484     | 1.05599      | Complied |



### 5.2.3. Transmitter Timeout

### **Test Summary:**

|                               |                              |                   |              |
|-------------------------------|------------------------------|-------------------|--------------|
| <b>Test Engineer:</b>         | Andrew Edwards               | <b>Test Date:</b> | 29 July 2011 |
| <b>Test Sample Serial No:</b> | 1045468160303561590432200358 |                   |              |

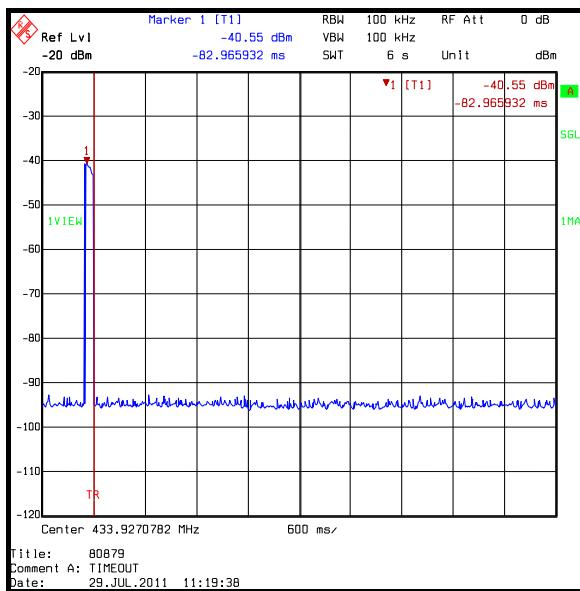
|                          |   |
|--------------------------|---|
| <b>FCC Part:</b>         | 15.231(a)   |
| <b>Test Method Used:</b> | The EUT transmitter was activated and monitored using a spectrum analyser for a period not exceeding 6 seconds. |

## Environmental Conditions:

|                        |    |
|------------------------|----|
| Temperature (°C):      | 25 |
| Relative Humidity (%): | 38 |

## Results:

| Deactivation Time<br>(seconds) | Limit<br>(seconds) |
|--------------------------------|--------------------|
| <0.1                           | 5                  |



### 5.2.4. Transmitter Duty Cycle

#### Test Summary:

|                               |                              |                   |              |
|-------------------------------|------------------------------|-------------------|--------------|
| <b>Test Engineer:</b>         | Andrew Edwards               | <b>Test Date:</b> | 29 July 2011 |
| <b>Test Sample Serial No:</b> | 1045468160303561590432200358 |                   |              |

|                          |  |
|--------------------------|--|
| <b>FCC Part:</b>         | 15.35(c)                               |
| <b>Test Method Used:</b> | As detailed in ANSI C63.10 Section 7.5 |

#### Environmental Conditions:

|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 25 |
| <b>Relative Humidity (%):</b> | 38 |

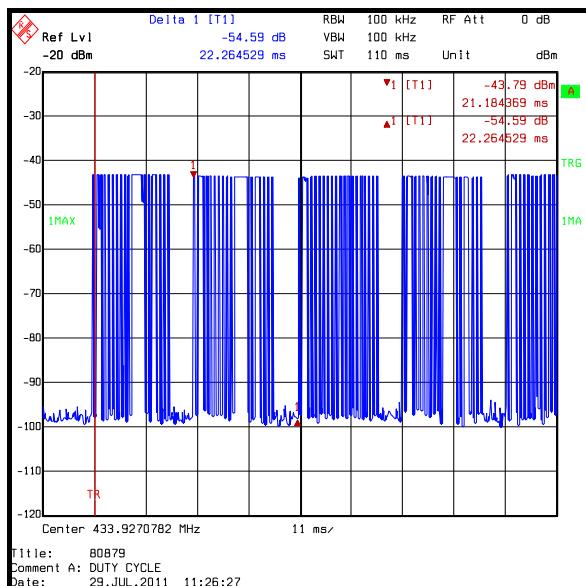
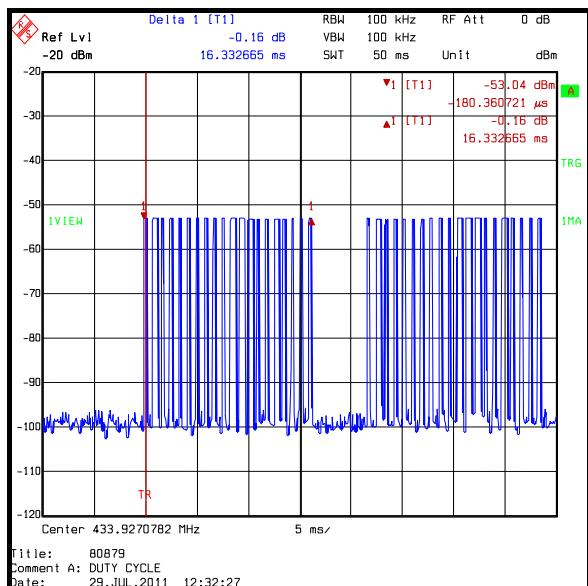
#### Results:

| Pulse Duration<br>(mS) | Duty Cycle<br>(dB) |
|------------------------|--------------------|
| 16.333                 | 2.68               |

| Silent Period<br>(ms) |
|-----------------------|
| 26.5                  |

#### Note(s):

1. In order to assist with the determination of the average level of fundamental and spurious emissions field strength, measurements were made of duty cycle to determine the transmission duration and the silent period time of the transmitter. The transmitter duty cycle was measured using a spectrum analyser in the time domain and calculated by  $20 \log$  (On Time / Period or 100 mS whichever is the lesser)
2. The transmitter on time was measured as 16.333 ms and the transmitter was on for 4.5 times in 100 ms period. The duty cycle was calculated as  $20 \log ((4.5 \times 16.333 \text{ ms}) / 100\text{ms}) = 2.68 \text{ dB}$



### **5.2.5. Transmitter Radiated Emissions**

#### **Test Summary:**

|                               |                               |                   |              |
|-------------------------------|-------------------------------|-------------------|--------------|
| <b>Test Engineer:</b>         | Patrick Jones                 | <b>Test Date:</b> | 22 July 2011 |
| <b>Test Sample Serial No:</b> | 10091039360303851590432200053 |                   |              |

|                          |  |
|--------------------------|--|
| <b>FCC Part:</b>         | 15.231(e) & 15.209   |
| <b>Test Method Used:</b> | As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4 |
| <b>Frequency Range</b>   | 30 MHz to 1 GHz  |

#### **Environmental Conditions:**

|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 29 |
| <b>Relative Humidity (%):</b> | 30 |

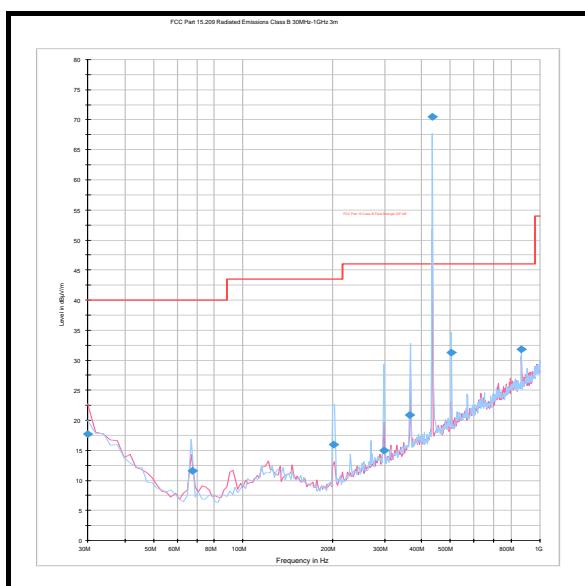
#### **Results: Quasi-Peak**

| Frequency (MHz) | Antenna Polarity | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------------|----------------------|-------------|----------|
| 30.058          | Vertical         | 17.7                 | 40.0                 | 22.3        | Complied |
| 67.487          | Horizontal       | 11.6                 | 40.0                 | 28.4        | Complied |
| 202.548         | Horizontal       | 15.9                 | 43.5                 | 27.6        | Complied |
| 297.540         | Horizontal       | 15.0                 | 46.0                 | 31.0        | Complied |
| 365.114         | Horizontal       | 20.8                 | 46.0                 | 25.2        | Complied |
| 501.427         | Horizontal       | 31.2                 | 46.0                 | 14.8        | Complied |
| 867.753         | Horizontal       | 31.8                 | 46.0                 | 14.2        | Complied |

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

1. The final measured value, for the given emission, in the table above incorporates the calibrated antenna factor and cable loss.
2. Measurements below 1 GHz were performed in a semi-anechoic chamber (RFI Asset Number K0001) 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.
3. The fundamental is shown on the pre-scan plot at approximately 433 MHz.

### **Transmitter Radiated Emissions (continued)**



*Note: This plot is a pre-scan and for indication purposes only. For final measurements, see accompanying table*

### **5.2.6. Transmitter Radiated Emissions**

#### **Test Summary:**

|                               |                               |                   |              |
|-------------------------------|-------------------------------|-------------------|--------------|
| <b>Test Engineer:</b>         | Patrick Jones                 | <b>Test Date:</b> | 22 July 2011 |
| <b>Test Sample Serial No:</b> | 10091039360303851590432200053 |                   |              |

|                          |  |
|--------------------------|--|
| <b>FCC Part:</b>         | 15.231(b) & 15.209   |
| <b>Test Method Used:</b> | As detailed in ANSI C63.10 Sections 6.3 and 6.5 referencing ANSI C63.4 |
| <b>Frequency Range</b>   | 1 GHz to 4.5 GHz   |

#### **Environmental Conditions:**

|                               |    |
|-------------------------------|----|
| <b>Temperature (°C):</b>      | 28 |
| <b>Relative Humidity (%):</b> | 20 |

#### **Results: Peak**

| Frequency (MHz) | Antenna Polarity | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------------|----------------------|-------------|----------|
| 1735.566        | Horizontal       | 50.5                 | 80.8*                | 30.3        | Complied |
| 2169.384        | Horizontal       | 51.2                 | 80.8*                | 29.6        | Complied |
| 2603.262        | Horizontal       | 53.0                 | 80.8*                | 27.8        | Complied |
| 3037.164        | Horizontal       | 51.8                 | 80.8*                | 29.0        | Complied |
| 3471.097        | Horizontal       | 53.7                 | 80.8*                | 27.1        | Complied |
| 3905.110        | Horizontal       | 56.5                 | 74.0                 | 17.5        | Complied |
| 4338.893        | Horizontal       | 46.6                 | 74.0                 | 27.4        | Complied |

\*Part 15.231(b) limit

#### **Results: Average**

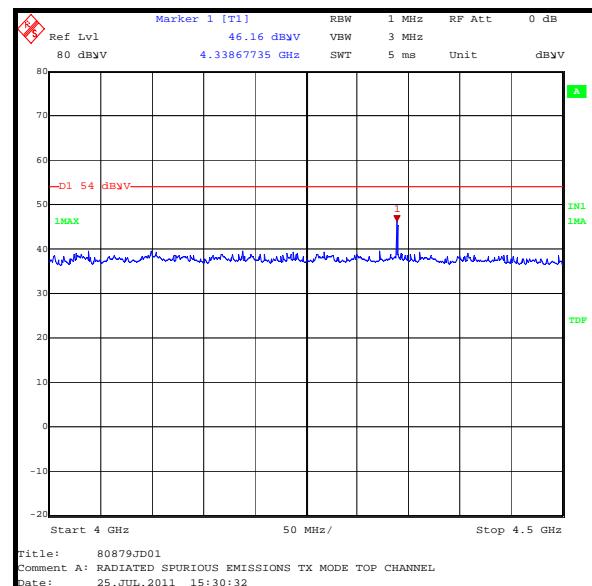
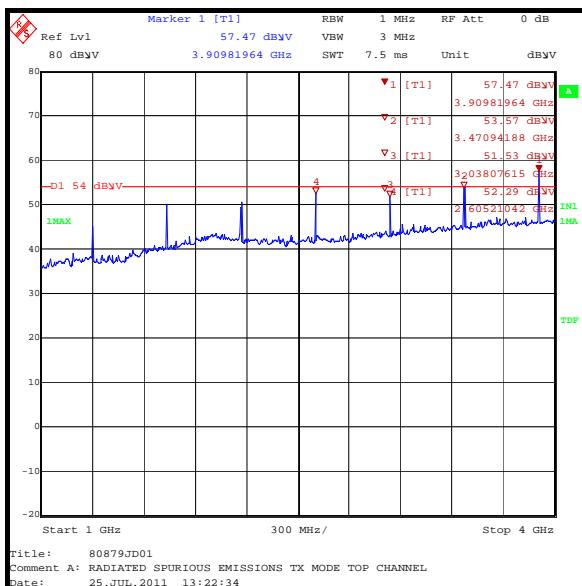
| Frequency (MHz) | Antenna Polarity | Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|----------------------|----------------------|-------------|----------|
| 1735.566        | Horizontal       | 47.8                 | 60.8*                | 13.0        | Complied |
| 2169.384        | Horizontal       | 48.5                 | 60.8*                | 12.3        | Complied |
| 2603.262        | Horizontal       | 50.3                 | 60.8*                | 10.5        | Complied |
| 3037.164        | Horizontal       | 49.1                 | 60.8*                | 11.7        | Complied |
| 3471.097        | Horizontal       | 51.0                 | 60.8*                | 9.8         | Complied |
| 3905.110        | Horizontal       | 53.8                 | 54.0                 | 0.2         | Complied |
| 4338.893        | Horizontal       | 43.9                 | 54.0                 | 10.1        | Complied |

\*Part 15.231(b) limit

## **Transmitter Radiated Emissions (continued)**

**Note(s):**

1. The final measured value, for the given emission, in the table above incorporates the calibrated antenna factor and cable loss.
  2. Part 15.209 general limits were applied to any emissions that were found to be in restricted bands as defined in part 15.209. Part 15.231(b) limits for a device operating at 433 MHz were applied to all other emissions.
  3. In accordance with Part 15.35(c), the average level was calculated by subtracting the duty cycle correction (2.69 dB) from the peak level measured with the EUT constantly transmitting.
  4. Pre-scans above 1 GHz were performed in a fully anechoic chamber (RFI 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 (RFI Asset Number K0001) 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.



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

## **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 |
|----------------------------------|--------------------|----------------------|------------------------|
| AC Conducted Spurious Emissions  | 0.15 MHz to 30 MHz | 95%                  | $\pm 3.72$ dB          |
| Fundamental Field Strength       | 30 MHz to 4.5 GHz  | 95%                  | $\pm 2.94$ dB          |
| 20 dB Bandwidth                  | 30 MHz to 4.5 GHz  | 95%                  | $\pm 0.92$ ppm         |
| Transmitter Timeout / Duty Cycle | 30 MHz to 4.5 GHz  | 95%                  | $\pm 0.29$ ms          |
| Radiated Spurious Emissions      | 30 MHz to 4.5 GHz  | 95%                  | $\pm 2.94$ 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.

## Appendix 1. Test Equipment Used

| RFI No. | Instrument        | Manufacturer    | Type No.  | Serial No.  | Date Calibration Due | Cal. Interval (Months) |
|---------|-------------------|-----------------|-----------|-------------|----------------------|------------------------|
| A1534   | Pre Amplifier     | Hewlett Packard | 8449B     | 3008A00405  | 20 Jun 2012          | 12                     |
| A1818   | Antenna           | EMCO            | 3115      | 00075692    | 05 Sep 2011          | 12                     |
| A1834   | Attenuator        | Hewlett Packard | 8491B     | 10444       | 26 Jul 2012          | 12                     |
| A1974   | High Pass Filter  | AtlanTec        | AFH-01000 | 090000283   | 29 Dec 2011          | 12                     |
| A253    | Antenna           | Flann Microwave | 12240-20  | 128         | 05 Sep 2011          | 12                     |
| A553    | Antenna           | Chase           | CBL6111A  | 1593        | 26 Mar 2012          | 12                     |
| K0001   | 5m RSE Chamber    | Rainford EMC    | N/A       | N/A         | 29 May 2012          | 12                     |
| K0002   | 3m RSE Chamber    | Rainford EMC    | N/A       | N/A         | 05 Sep 2011          | 12                     |
| M1124   | Spectrum Analyser | Rohde & Schwarz | ESI26     | 100046K     | 29 Jun 2012          | 12                     |
| M127    | Spectrum Analyser | Rohde & Schwarz | FSEB 30   | 842 659/016 | 15 Sep 2011          | 12                     |
| M1273   | Test Receiver     | Rohde & Schwarz | ESIB 26   | 100275      | 04 Feb 2012          | 12                     |

**NB** In accordance with UKAS requirements all the measurement equipment is on a calibration schedule.