

# TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Magicard RIO PRO DUO MC using a  
Texas Instruments RI-R6C-001A Reader System IC

FCC ID: XDW3652-0001

To: FCC Part 15.225: 2011 Subpart C

**Test Report Serial No.:**  
RFI-RPT-RP79496JD17A

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



Checked By:	Ian Watch
Signature:	
Date of Issue:	15 December 2011

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## **1. Manufacturers Information**

<b>Company Name:</b>	Ultra Electronics Manufacturing & Card Systems
<b>Address:</b>	Waverley House Hampshire Road Weymouth DT4 9XD United Kingdom

## 2. Summary of Testing

### 2.1. General Information

<b>Specification Reference:</b>	47CFR15.225
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2011: Part 15 Subpart C (Radio Frequency Devices) - Section 15.225
<b>Specification Reference:</b>	47CFR15.107 and 47CFR15.109
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2011: Part 15 Subpart B (Radio Frequency Devices) - Sections 15.107 and 15.109
<b>Specification Reference:</b>	47CFR15.207 and 47CFR15.209
<b>Specification Title:</b>	Code of Federal Regulations Volume 47 (Telecommunications) 2011: Part 15 Subpart C (Intentional Radiators) - Section 15.209
<b>Site Registration:</b>	209735
<b>Location of Testing:</b>	RFI Global Services Ltd, Wade Road, Basingstoke, Hampshire, RG24 8AH.
<b>Test Dates:</b>	28 October 2010 to 07 December 2011

### 2.2. Summary of Test Results

FCC Reference (47CFR)	Measurement	Result
Part 15.107(a)	Receiver/Idle Mode AC Conducted Emissions	✓
Part 15.109	Receiver/Idle Mode Radiated Spurious Emissions	✓
Part 15.207	Transmitter AC Conducted Emissions	✓
Part 15.225(a)(b)(c)(d)	Transmitter Fundamental Field Strength	✓
Part 15.209(a)/15.225(d)	Transmitter Radiated Emissions	✓
Part 15.209(a)/15.225(c)(d)	Transmitter Band Edge Radiated Emissions	✓
Part 2.1049	Transmitter 20 dB Bandwidth	✓
Part 15.225(e)	Transmitter Frequency Stability (Temperature & Voltage Variation)	✓

#### **Key to Results**

= Complied

= Did not comply

### **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>	Magicard RIO PRO
<b>Model Name or Number:</b>	RIO PRO DUO MC (Double sided, Mag Encoder, Smart Encoding)
<b>Serial Numbers:</b>	49C8620 ( <i>sample with standard antenna</i> ) 49C8625 ( <i>sample with 50Ω load replacing antenna</i> )
<b>Hardware Version Number:</b>	PP1
<b>Software Version Number:</b>	V1.03AP
<b>FCC ID:</b>	XDW3652-0001

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

The equipment under test was an ID Card Printer containing a Texas Instruments RI-R6C-001A Reader System IC and a pre-approved OMNIKEY 5321 module.

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

The following modifications were applied to the EUT during testing:

In accordance with FCC KDB174176 and ANSI C63.10 Section 6.2.5, the RFID antenna was disconnected and replaced with a 50Ω dummy load in order to comply with the requirements of the AC conducted emissions test in transmit mode. The standard antenna was connected for all other tests.

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

<b>Tested Technology:</b>	RFID	
<b>Category of Equipment:</b>	Transceiver	
<b>Channel Spacing:</b>	Single channel device	
<b>Transmit Frequency Range:</b>	13.56 MHz	
<b>Receive Frequency Range:</b>	13.56 MHz	
<b>Power Supply Requirement:</b>	Nominal	120 VAC 60 Hz
	Minimum	102 VAC 60 Hz
	Maximum	138 VAC 60 Hz
<b>Tested Temperature Range:</b>	Minimum	-20°C
	Maximum	50°C

### **3.5. Support Equipment**

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

<b>Description:</b>	USB HUB
<b>Brand Name:</b>	Belkin
<b>Model Name or Number:</b>	Not stated
<b>Serial Number:</b>	Not stated

<b>Description:</b>	Router
<b>Brand Name:</b>	D-Link green
<b>Model Name or Number:</b>	DGS-1005D
<b>Serial Number:</b>	DR8SB92000451

<b>Description:</b>	Laptop
<b>Brand Name:</b>	Dell
<b>Model Name or Number:</b>	D520
<b>Serial Number:</b>	CN-ONF743-48643-696-1234

<b>Description:</b>	3 metre Ethernet cable
<b>Brand Name:</b>	Not stated
<b>Model Name or Number:</b>	Not stated
<b>Serial Number:</b>	Not stated

<b>Description:</b>	5 metre USB Cable
<b>Brand Name:</b>	Not stated
<b>Model Name or Number:</b>	Not stated
<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 mode(s):

- The TI RFID module was transmitting at full power with a modulated carrier in RFID test mode.
- The OMNIKEY 5321 module was powered on but not transmitting during all tests.
- Receiver/idle mode tests were performed with both modules powered on but neither module transmitting.

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

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

- Configured using a test mode application on the ID card printer. Test mode was enabled by using the EUT front panel controls as instructed by the Customer. The application was used to enable continuous transmission with a modulated RFID carrier.
- All ports were terminated during emissions tests. The USB port was terminated into a USB hub via a USB cable. The Ethernet port was terminated into an Ethernet hub via an Ethernet cable.
- Sample 49C8625 was used for transmitter AC conducted emissions tests. All other tests were performed with sample 49C8620.

## **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 Uncertainties* for details.

Tests were performed against Parts 15.107 and 15.109 in order to demonstrate that the emissions levels from the printer circuitry, not related to the transmitter operating at 13.56 MHz, were complaint.

## **5.2. Test Results**

### **5.2.1. Receiver/Idle Mode AC Conducted Spurious Emissions**

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	28 October 2010
<b>Test Sample Serial No:</b>	49C8620		

<b>FCC Part:</b>	15.107(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	28

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

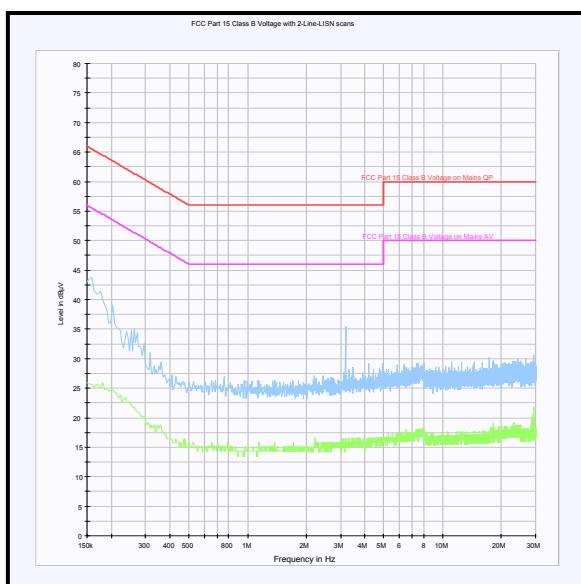
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
Note 1					

#### **Results: Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
Note 1					

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

1. All emissions on Live and Neutral lines were at least 30 dB below the specified limits.



**5.2.2. Receiver/Idle Mode Radiated Spurious Emissions****Test Summary:**

<b>Test Engineer:</b>	Nick Steele & Andrew Edwards	<b>Test Date:</b>	28 October 2010 & 18 May 2011
<b>Test Sample Serial No:</b>	49C8620		

<b>FCC Part:</b>	15.109
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Sections 6.3, 6.4 and 6.5 referencing ANSI C63.4
<b>Frequency Range:</b>	9 kHz to 1000 MHz

**Environmental Conditions:**

<b>Temperature (°C):</b>	26
<b>Relative Humidity (%):</b>	29

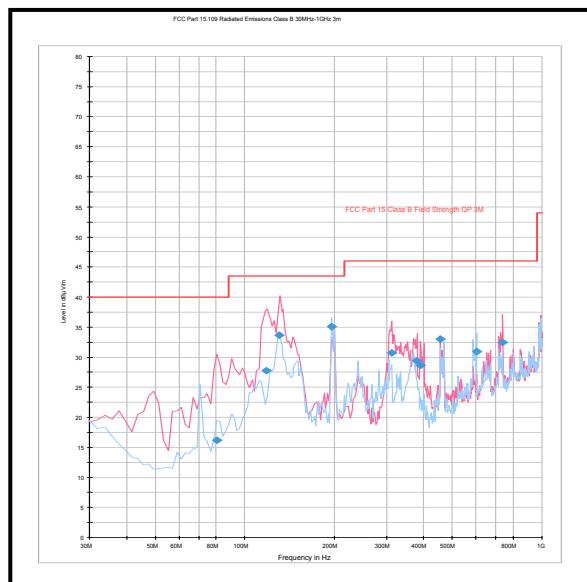
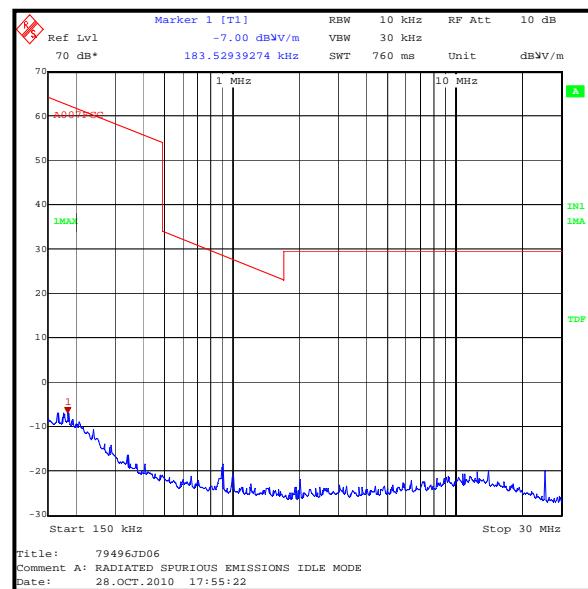
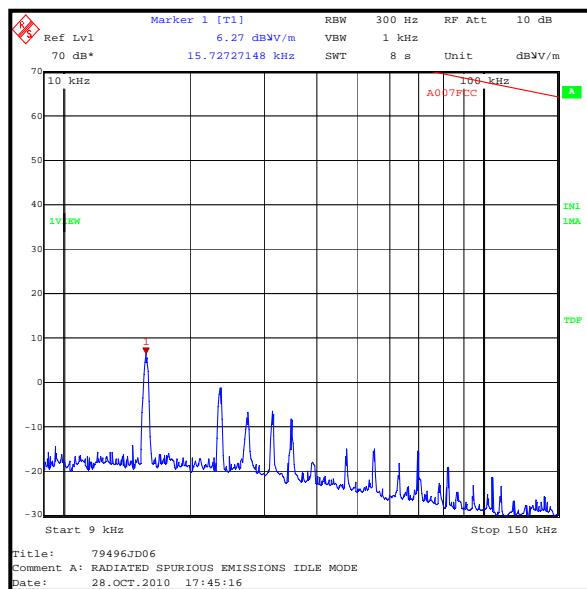
**Results: Quasi Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
80.296	Vertical	16.2	40.0	23.8	Complied
118.096	Vertical	27.7	43.5	15.8	Complied
130.866	Vertical	33.7	43.5	9.8	Complied
195.226	Horizontal	35.1	46.0	8.4	Complied
312.455	Vertical	30.7	46.0	15.3	Complied
379.356	Vertical	29.4	46.0	16.6	Complied
390.288	Vertical	28.6	46.0	17.4	Complied
455.476	Vertical	33.0	46.0	13.0	Complied
602.461	Horizontal	30.9	46.0	15.1	Complied
736.531	Vertical	32.5	46.0	13.5	Complied

**Note(s):**

1. Limits below 30 MHz are specified at a test distance of 30 metres, whilst below 0.49 MHz they are specified at a test distance of 300 metres. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).
2. A transducer factor on the measuring instrument was used to extrapolate the results at 3 metres to a distance of 30 metres where required. A distance extrapolation factor of 40 dB was used.
3. Final measurement values include corrections for antenna factor and cable losses.
4. All emissions on the 9 kHz to 150 kHz plot were investigated and found to be radiating from the test site turntable.
5. All other emissions shown on the pre-scan plots were investigated and found to be >20 dB below the applicable limit or below the measurement system noise floor.

## Receiver/Idle Mode Radiated Spurious Emissions (continued)



**5.2.3. Transmitter AC Conducted Spurious Emissions****Test Summary:**

Test Engineer:	Andrew Edwards	Test Date:	07 December 2011
Test Sample Serial No:	49C8625		

FCC Part:	15.207
Test Method Used:	As detailed in ANSI C63.10 Section 6.2 referencing ANSI C63.4

**Environmental Conditions:**

Temperature (°C):	24
Relative Humidity (%):	26

**Results: Live / Quasi Peak**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
20.823	Live	12.1	60.0	47.9	Complied

**Results: Live / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
28.914	Live	21.5	50.0	28.5	Complied

**Results: Neutral / Quasi Peak**

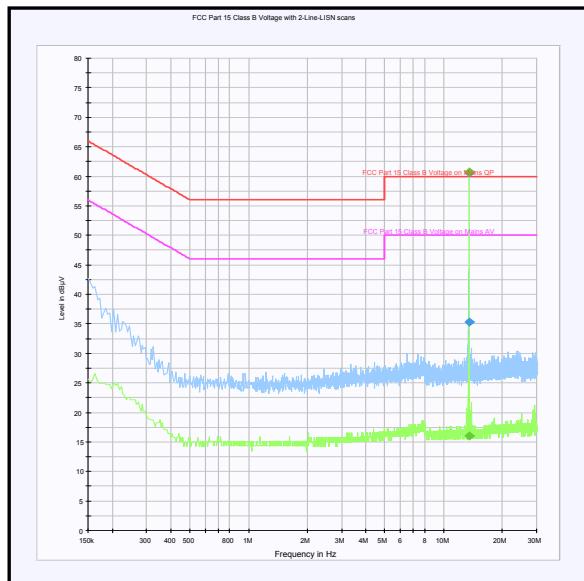
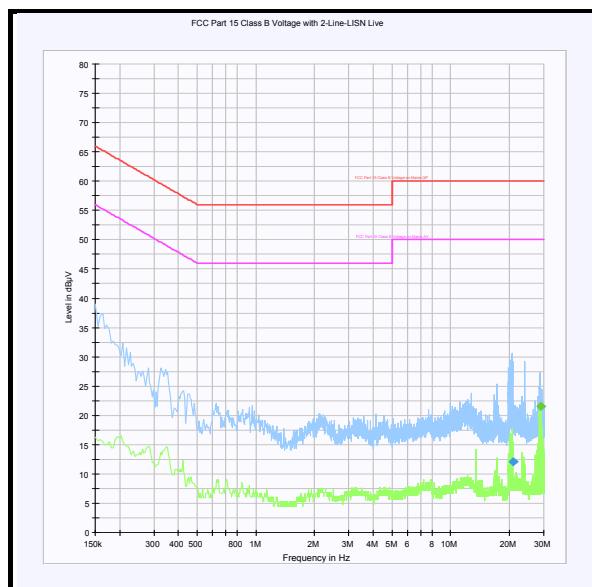
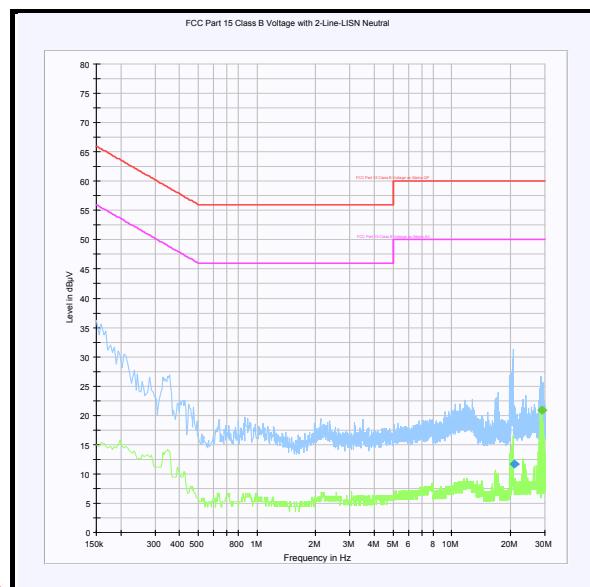
Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
20.819	Neutral	11.7	60.0	48.3	Complied

**Results: Neutral / Average**

Frequency (MHz)	Line	Level (dB $\mu$ V)	Limit (dB $\mu$ V)	Margin (dB)	Result
28.914	Neutral	20.9	50.0	29.1	Complied

**Note(s):**

1. The EUT was initially tested with the standard antenna connected. The carrier at 13.56 MHz was found to be non-compliant as it exceeded the test limit. The Customer modified the EUT by disconnecting the standard antenna and fitting a load with the same electrical properties in accordance with ANSI C63.10 Section 6.2.5 and FCC KDB174176. The test was then repeated and the EUT was found to be compliant.
2. The highest emission levels were recorded in the above tables. All other emissions on the pre-scan plots were investigated and found to be >30 dB below the specified limits.

**Transmitter AC Conducted Spurious Emissions (continued)****Pre-scan test results prior to modification of the EUT (standard antenna)****Live****Neutral****Test results after modification of the EUT (transmitter terminated into  $50\Omega$  load)**

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

### **5.2.4. Transmitter Fundamental Field Strength**

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	18 November 2011
<b>Test Sample Serial No:</b>	49C8620		

<b>FCC Part:</b>	15.225(a)(b)(c)(d)
<b>Test Method Used:</b>	ANSI C63.10 Section 6.4

#### **Environmental Conditions:**

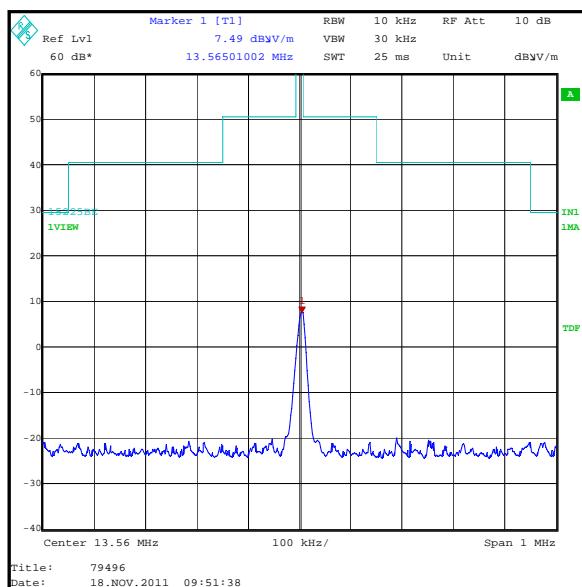
<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	28

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

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit at 30 m (dB $\mu$ V/m)	Margin (dB)	Result
13.56	90° to EUT	7.5	84.0	76.5	Complied

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

1. The limit is specified at a test distance of 30 metres. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).
2. A transducer factor on the measuring instrument was used to extrapolate the results at 3 metres to a distance of 30 metres. A distance extrapolation factor of 40 dB was used.



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

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	18 November 2011
<b>Test Sample Serial No:</b>	49C8620		

<b>FCC Part:</b>	15.225(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Sections 6.3, 6.4 and 6.5 referencing ANSI C63.4
<b>Frequency Range:</b>	9 kHz to 1000 MHz

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	25
<b>Relative Humidity (%):</b>	28

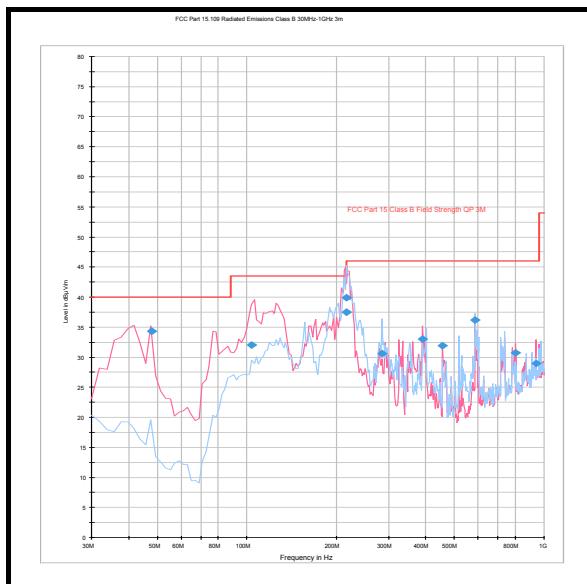
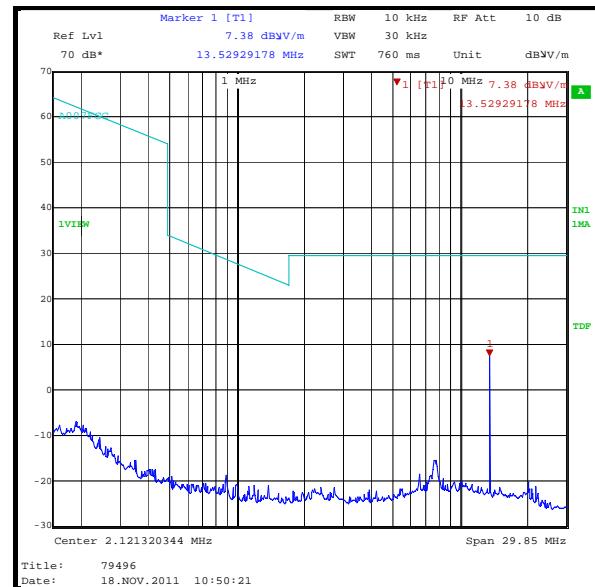
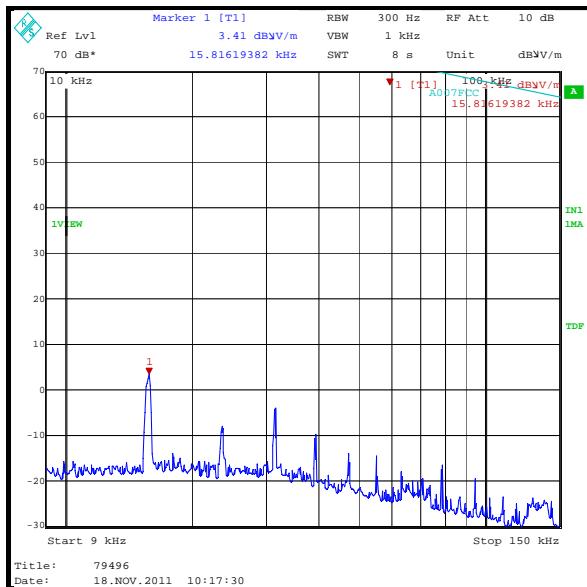
#### **Results: Quasi Peak**

Frequency (MHz)	Antenna Polarity	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
47.990	Vertical	34.3	40.0	5.7	Complied
103.950	Vertical	32.1	43.5	11.4	Complied
216.955	Horizontal	37.5	46.0	8.5	Complied
217.002	Vertical	39.9	46.0	6.1	Complied
284.798	Horizontal	30.6	46.0	15.4	Complied
390.682	Vertical	33.0	46.0	13.0	Complied
455.428	Vertical	31.9	46.0	14.1	Complied
585.418	Horizontal	36.2	46.0	9.8	Complied
803.557	Vertical	30.7	46.0	15.3	Complied
937.627	Vertical	29.0	46.0	17.0	Complied

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

1. Limits below 30 MHz are specified at a test distance of 30 metres, whilst below 0.49 MHz they are specified at a test distance of 300 metres. However, as specified by FCC Section 15.31 (f)(2), measurements may be performed at a closer distance and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40dB/decade).
2. A transducer factor on the measuring instrument was used to extrapolate the results at 3 metres to a distance of 30 metres where required. A distance extrapolation factor of 40 dB was used.
3. Final measurement values include corrections for antenna factor and cable losses.
4. The emission shown at approximately 13.56 MHz is the fundamental.
5. All emissions on the 9 kHz to 150 kHz plot were investigated and found to be radiating from the test site turntable.
6. All other emissions shown on the pre-scan plots were investigated and found to be >20 dB below the applicable limit or below the measurement system noise floor.

## Transmitter Radiated Spurious Emissions (continued)



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

### **5.2.6. Transmitter Band Edge Radiated Emissions**

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	18 November 2011
<b>Test Sample Serial No:</b>	49C8620		

<b>FCC Part:</b>	15.225(c)(d) & 15.209(a)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.9.2

#### **Environmental Conditions:**

<b>Temperature (°C):</b>	23
<b>Relative Humidity (%):</b>	28

#### **Results: Quasi Peak Lower Band Edge**

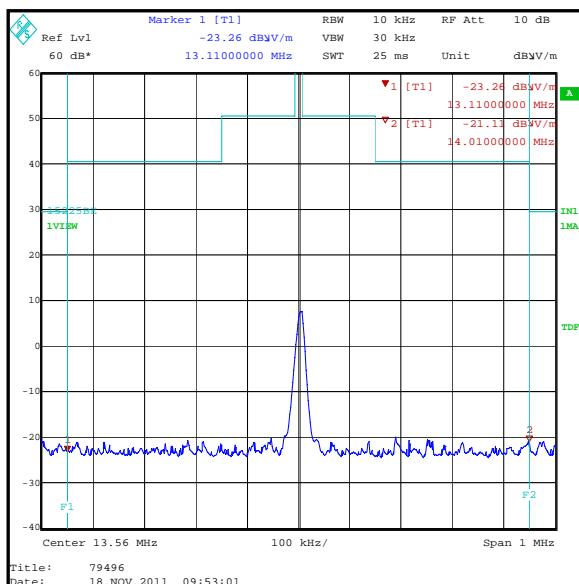
Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
13.11	-23.3	29.5	52.8	Complied

#### **Results: Quasi Peak Upper Band Edge**

Frequency (MHz)	Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
14.01	-21.1	29.5	50.6	Complied

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

1. A transducer factor on the measuring instrument was used to extrapolate the results at 3 metres to a distance of 30 metres where required. A distance extrapolation factor of 40 dB was used.



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

<b>Test Engineer:</b>	Andrew Edwards	<b>Test Date:</b>	28 October 2010
<b>Test Sample Serial No:</b>	49C8620		

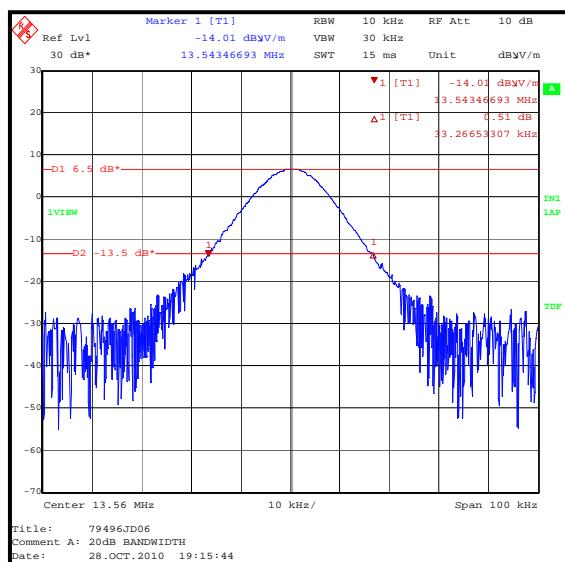
<b>FCC Part:</b>	2.1049
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.9.1

**Environmental Conditions:**

<b>Temperature (°C):</b>	29
<b>Relative Humidity (%):</b>	31

**Results:**

<b>20 dB Bandwidth (kHz)</b>	
	33.267



### **5.2.8. Transmitter Frequency Stability (Temperature & Voltage Variation)**

#### **Test Summary:**

<b>Test Engineer:</b>	Andrew Edwards & Fara Razally	<b>Test Date:</b>	29 October 2010
<b>Test Sample Serial No:</b>	49C8620		

<b>FCC Part:</b>	15.225(e)
<b>Test Method Used:</b>	As detailed in ANSI C63.10 Section 6.8.1 and 6.8.2

#### **Environmental Conditions:**

<b>Ambient Temperature (°C):</b>	28
<b>Ambient Relative Humidity (%):</b>	31

#### **Results: Maximum frequency error of the EUT with variations in ambient temperature**

<b>Temperature (°C)</b>	<b>Time after Start-up</b>			
	<b>0 minutes</b>	<b>2 minutes</b>	<b>5 minutes</b>	<b>10 minutes</b>
-20	13.559904 MHz	13.559908 MHz	13.559910 MHz	13.559909 MHz
20	13.559871 MHz	13.559869 MHz	13.559869 MHz	13.559870 MHz
50	13.559856 MHz	13.559856 MHz	13.559856 MHz	13.559857 MHz

<b>Frequency with Worst Case Deviation (MHz)</b>	<b>Frequency Error (Hz)</b>	<b>Frequency Error (%)</b>	<b>Limit (%)</b>	<b>Margin (%)</b>	<b>Result</b>
13.559856	144	0.001062	0.01	0.008938	Complied

#### **Results: Maximum frequency error of the EUT with variations in nominal operating voltage at an ambient temperature of 20°C**

<b>Supply Voltage (V)</b>	<b>Nominal Frequency (MHz)</b>	<b>Measured Frequency (MHz)</b>	<b>Frequency Error (Hz)</b>	<b>Frequency Error (%)</b>	<b>Limit (%)</b>	<b>Margin (%)</b>	<b>Result</b>
102	13.56	13.559882	118	0.000870	0.01	0.009130	Complied
120	13.56	13.559871	129	0.000951	0.01	0.009049	Complied
138	13.56	13.559882	118	0.000870	0.01	0.009130	Complied

## **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%	±3.25 dB
20 dB Bandwidth	13 MHz to 14 MHz	95%	±0.92 ppm
Frequency Stability	13 MHz to 14 MHz	95%	±0.92 ppm
Radiated Spurious Emissions	9 kHz to 30 MHz	95%	±3.53 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	±2.94 dB
Transmitter Fundamental Field Strength	13 MHz to 14 MHz	95%	±3.53 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)
A1069	Single Phase LISN	Rohde & Schwarz	ESH3-Z5	837469/012	07 Apr 2012	12
A1830	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100668	05 Mar 2012	12
A288	Antenna	Chase	CBL6111A	1589	25 Aug 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	09 Oct 2012	12
M1124	Spectrum Analyser	Rohde & Schwarz	ESI26	100046K	29 Jun 2012	12
M1263	Test Receiver	Rohde & Schwarz	ESIB7	100265	13 Jul 2012	12
M1273	Test Receiver	Rohde & Schwarz	ESIB 26	100275	04 Feb 2012	12
M1568	Magnetic Loop	Rohde & Schwarz	HFH2-Z2	879284/2	27 Jan 2012	12

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