




## TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: Datalogic S.p.A  
OM3000 910 MHz using Star-Module FCC ID OMJ0015

To: FCC Part 15.249

**Test Report Serial No:**  
RFI/RPT/RP48701JD01A

|   |  |
|---|--|
| <b>This Test Report Is Issued Under The Authority<br/>Of Andrew Brown, Operations Manager:</b><br><br>pp.  |  |
| <b>Tested By: Petr Hajek</b><br><br>   | <b>Checked By: Michael Derby</b><br><br> |
| <b>Report Copy No:</b>  |  |
| <b>Issue Date: 09 January 2007</b>  | <b>Test Dates: 18 December 2006 to 21 December 2006</b>  |

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The results in this report apply only to the sample(s) tested.

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Registered in England and Wales. Company number: 2117901

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## **1. Client Information**

|                      |   |
|----------------------|---|
| <b>Company Name:</b> | Datalogic S.p.A   |
| <b>Address:</b>      | Via Candini, 2<br>Lippo di Calderara di Reno<br>Bologna<br>40012<br>Italy |
| <b>Contact Name:</b> | Mr P Guerzoni   |

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## **2. Equipment Under Test (EUT)**

The following information (with the exception of the Date of Receipt) has been supplied by the client:

### **2.1. Identification of Equipment Under Test (EUT)**

|                         |                   |
|-------------------------|-------------------|
| Description:            | Cradle            |
| Brand Name:             | Dragon            |
| Model Name or Number:   | OM – 3000 910 MHz |
| Serial Number:          | A06P00503         |
| FCC ID:                 | OMJ0015           |
| Country of Manufacture: | Italy             |
| Date of Receipt:        | 18 December 2006  |

### **2.2. Accessories**

The following accessories were supplied with the EUT:

|                        |                           |
|------------------------|---------------------------|
| Description:           | AC/DC Power Supply        |
| Brand Name:            | Alpha Electronica         |
| Model Number:          | PG 12-10 F                |
| Serial Number:         | None stated               |
| Cable Length and Type: | 2m 2 core and 2.5m 2 core |
| Connected to Port:     | DC connector to AC supply |

|                         |                  |
|-------------------------|------------------|
| Description:            | Bar Code Reader  |
| Brand Name:             | Dragon           |
| Model Name or Number:   | M131/D 910 MHz   |
| Serial Number:          | A06P00055        |
| FCC ID:                 | OMJ0015          |
| Country of Manufacture: | Italy            |
| Date of Receipt:        | 18 December 2006 |

### **2.3. Description of EUT**

The equipment under test is a cradle for a bar code reader, with radio capability.

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

During the course of testing the EUT was not modified.

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**2.5. Additional Information Related to Testing**

|  |  |                                |
|--|--|--------------------------------|
| <b>Power Supply Requirement:</b>       | Nominal 115 V 60 Hz AC Mains Supply, to a DC Supply of 12 V  |                                |
| <b>Intended Operating Environment:</b> | Commercial<br>Light Industry   |                                |
| <b>Equipment Category:</b>             | Short Range (Low Power)<br>Limited Modular Transmitter Approval  |                                |
| <b>Type of Unit:</b>                   | Base Station (Fixed Use)<br>Portable (Standalone battery powered device)   |                                |
| <b>Interface Ports:</b>                | Contact connectors, direct to Bar Code Reader<br>DC input connector, to AC/DC supply<br>RS232 connector, on 1.5m multicore cable |                                |
| <b>Transmitter Frequency Range:</b>    | 909.955 MHz to 910.045 MHz   |                                |
| <b>Transmitter Channels Tested:</b>    | <b>Channel ID</b>  | <b>Channel Frequency (MHz)</b> |
|  | Single   | 909.955 to 910.045             |
| <b>Receiver Frequency Range:</b>       | 909.955 MHz to 910.045 MHz   |                                |
| <b>Receiver Channels Tested:</b>       | <b>Channel ID</b>  | <b>Channel Frequency (MHz)</b> |
|  | Single   | 909.955 to 910.045             |

The EUT operates on a single channel with frequency modulation, between 909.955 MHz and 910.045 MHz.

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## **2.6. Support Equipment**

|                               |                          |
|-------------------------------|--------------------------|
| <b>Description:</b>           | Laptop                   |
| <b>Brand Name:</b>            | Dell                     |
| <b>Model Number:</b>          | Latitude D610            |
| <b>Serial Number:</b>         | CN-0D4571-48643-544-5681 |
| <b>Cable Length and Type:</b> | Serial 1.5m              |
| <b>Connected to Port:</b>     | Serial port              |

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### **3. Test Specification, Methods and Procedures**

#### **3.1. Test Specifications**

|                         |   |
|-------------------------|---|
| <b>Reference:</b>       | FCC Part 15 Subpart C: 2006 (Sections 15.249).  |
| <b>Title:</b>           | Code of Federal Regulations, Part 15 (47CFR215)<br>Radio Frequency Devices.   |
| <b>Comments:</b>        | A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules. |
| <b>Purpose of Test:</b> | To determine whether the equipment complied with the requirements of the specification for the purposes of certification.   |

#### **3.2. Methods and Procedures**

The methods and procedures used were as detailed in:

ANSI C63.2 (1996)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2003)

Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)

Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

DA00-705 (2000)

Title: Filing and Frequency Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

#### **3.3. Definition of Measurement Equipment**

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.



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#### **4. Deviations from the Test Specification**

There were no deviations from the test specification.

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## **5. Operation of the EUT During Testing**

### **5.1. Operating Modes**

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

During the transmit tests, the EUT was continuously transmitting.

During the non-transmit tests tests, the EUT transmitter was off and the battery was charging.

### **5.2. Configuration and Peripherals**

The EUT was tested in the following configuration:

During conducted AC emissions tests, the EUT was tested with the bar code reader.

During radiated measurements, the EUT was tested stand alone.

The EUT was connected to a laptop computer via the RS232 link.

The EUT was powered through the AC battery charger.

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## **6. Summary of Test Results**

| Range of Measurements   | Section Reference                | Port Type | Compliance Status |
|---|----------------------------------|-----------|-------------------|
| Receiver AC Conducted Spurious Emissions (150 kHz to 30 MHz)    | Section 15.107                   | AC Mains  | Complied          |
| Receiver Radiated Spurious Emissions                            | Section 15.109                   | Enclosure | Complied          |
| Transmitter Fundamental Fieldstrength                           | Section 15.249(a)                | Antenna   | Complied          |
| Transmitter 20 dB Bandwidth                                     | Section 2.1049                   | Antenna   | Complied          |
| Transmitter Radiated Spurious Emissions                         | Section 15.249(a)(d)(e) & 15.209 | Antenna   | Complied          |
| Transmitter Band Edge Radiated Emissions                        | Section 15.249(d) & 15.209       | Antenna   | Complied          |
| Transmitter AC Conducted Spurious Emissions (150 kHz to 30 MHz) | Section 15.109                   | AC Mains  | Complied          |

### **6.1. Location of Tests**

All the measurements described in this report were performed at the premises of RFI Global Services Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

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## **7. Measurements, Examinations and Derived Results**

### **7.1. General Comments**

7.1.1. This section contains test results only.

7.1.2. 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 8 for details of measurement uncertainties.

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## 7.2. Test Results

### 7.2.1. Receiver AC Conducted Spurious Emissions: Section 15.107

7.2.1.1. The EUT was configured for AC conducted emissions measurements, as described in Section 8 of this report.

7.2.1.2. Tests were performed to identify the maximum emission levels on the AC mains line of the EUT.

#### Results:

#### Quasi-Peak Detector Measurements on Live and Neutral Lines

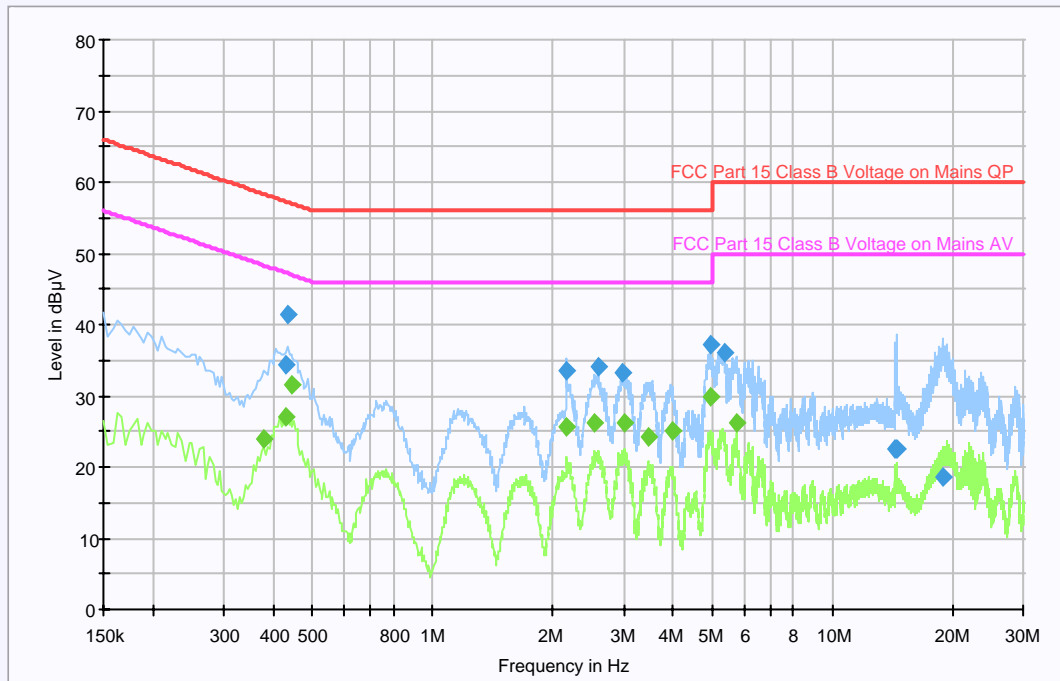
| Frequency (MHz) | Line | Level (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Result   |
|-----------------|------|--------------------|--------------------|-------------|----------|
| 0.430           | Live | 34.5               | 57.3               | 22.8        | Complied |
| 0.434           | Live | 41.5               | 57.2               | 15.7        | Complied |
| 2.150           | Live | 33.6               | 56.0               | 22.4        | Complied |
| 2.598           | Live | 34.0               | 56.0               | 22.0        | Complied |
| 2.982           | Live | 33.4               | 56.0               | 22.6        | Complied |
| 4.970           | Live | 37.3               | 56.0               | 18.7        | Complied |
| 5.362           | Live | 36.0               | 60.0               | 24.0        | Complied |
| 14.326          | Live | 22.6               | 60.0               | 37.4        | Complied |
| 14.526          | Live | 22.4               | 60.0               | 37.6        | Complied |
| 18.890          | Live | 18.7               | 60.0               | 41.3        | Complied |

#### Average Detector Measurements on Live and Neutral Lines

| Frequency (MHz) | Line | Level (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Result   |
|-----------------|------|--------------------|--------------------|-------------|----------|
| 0.378           | Live | 24.0               | 48.3               | 24.3        | Complied |
| 0.430           | Live | 27.0               | 47.3               | 20.3        | Complied |
| 0.442           | Live | 31.5               | 47.0               | 15.5        | Complied |
| 2.162           | Live | 25.7               | 46.0               | 20.3        | Complied |
| 2.546           | Live | 26.3               | 46.0               | 19.7        | Complied |
| 3.026           | Live | 26.1               | 46.0               | 19.9        | Complied |
| 3.446           | Live | 24.3               | 46.0               | 21.7        | Complied |
| 3.970           | Live | 25.0               | 46.0               | 21.0        | Complied |
| 4.938           | Live | 29.9               | 46.0               | 16.1        | Complied |
| 5.750           | Live | 26.2               | 50.0               | 23.8        | Complied |

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### Receiver AC Conducted Spurious Emissions: Section 15.107 (Continued)



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

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### **7.2.2. Receiver Radiated Spurious Emissions: Section 15.109**

### **7.2.3. Electric Field Strength Measurements (Frequency Range: 30 MHz to 1000 MHz)**

7.2.3.1. The EUT was configured for radiated emissions testing, as described in Section 8 of this report.

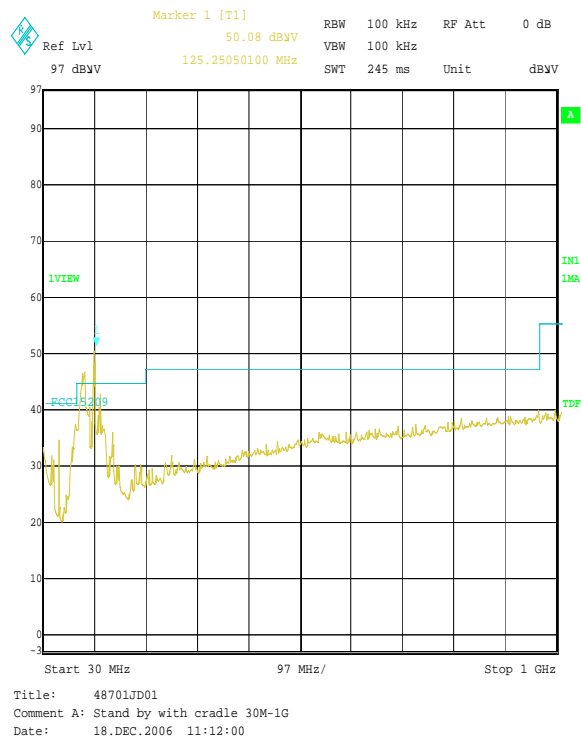
7.2.3.2. Tests were performed to identify the maximum receiver or standby radiated emission levels.

#### **Results:**

| Frequency (MHz) | Antenna Polarity | Q-P Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|--------------------------|----------------------|-------------|----------|
| 60.531          | Vertical         | 11.6                     | 40.0                 | 28.4        | Complied |
| 109.028         | Vertical         | 25.9                     | 43.5                 | 17.6        | Complied |
| 125.381         | Vertical         | 31.5                     | 43.5                 | 12.0        | Complied |
| 132.995         | Vertical         | 20.2                     | 43.5                 | 23.3        | Complied |
| 163.076         | Vertical         | 13.0                     | 43.5                 | 30.5        | Complied |

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**Receiver Radiated Spurious Emissions: Section 15.109 (Continued)**



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



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**7.2.4. Receiver Radiated Spurious Emissions: Section 15.109 (Continued)****7.2.5. Electric Field Strength Measurements (Frequency Range: 1 GHz to 5 GHz)****Results:****Highest Peak Level:**

| Frequency (MHz) | Antenna Polarity | Detector Level (dB $\mu$ V) | Antenna Factor (dB) | Actual Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|-----------------------------|---------------------|-----------------------------|----------------------|-------------|----------|
| 1.8396          | Horizontal       | 43.1                        | -11.6               | 31.5                        | 74.0                 | 42.5        | Complied |
| 2.6973          | Horizontal       | 41.7                        | -11.2               | 30.5                        | 74.0                 | 43.5        | Complied |

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

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### **7.2.6. Transmitter AC Conducted Spurious Emissions: Section 15.107**

7.2.6.1. The EUT was configured for AC conducted emissions measurements, as described in Section 8 of this report.

7.2.6.2. Tests were performed to identify the maximum emission levels on the AC mains line of the EUT.

### **Results:**

#### **Quasi-Peak Detector Measurements on Live and Neutral Lines**

| Frequency (MHz) | Line    | Level (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Result   |
|-----------------|---------|--------------------|--------------------|-------------|----------|
| 0.378           | Live    | 36.0               | 58.3               | 22.3        | Complied |
| 0.426           | Neutral | 39.3               | 57.3               | 18.0        | Complied |
| 0.438           | Live    | 41.7               | 57.1               | 15.4        | Complied |
| 0.502           | Live    | 33.9               | 56.0               | 22.1        | Complied |
| 2.082           | Neutral | 32.3               | 56.0               | 23.7        | Complied |
| 2.154           | Neutral | 32.1               | 56.0               | 23.9        | Complied |
| 2.574           | Neutral | 32.9               | 56.0               | 23.1        | Complied |
| 2.950           | Neutral | 31.6               | 56.0               | 24.4        | Complied |
| 4.018           | Neutral | 30.9               | 56.0               | 25.1        | Complied |
| 4.922           | Live    | 36.8               | 56.0               | 19.2        | Complied |

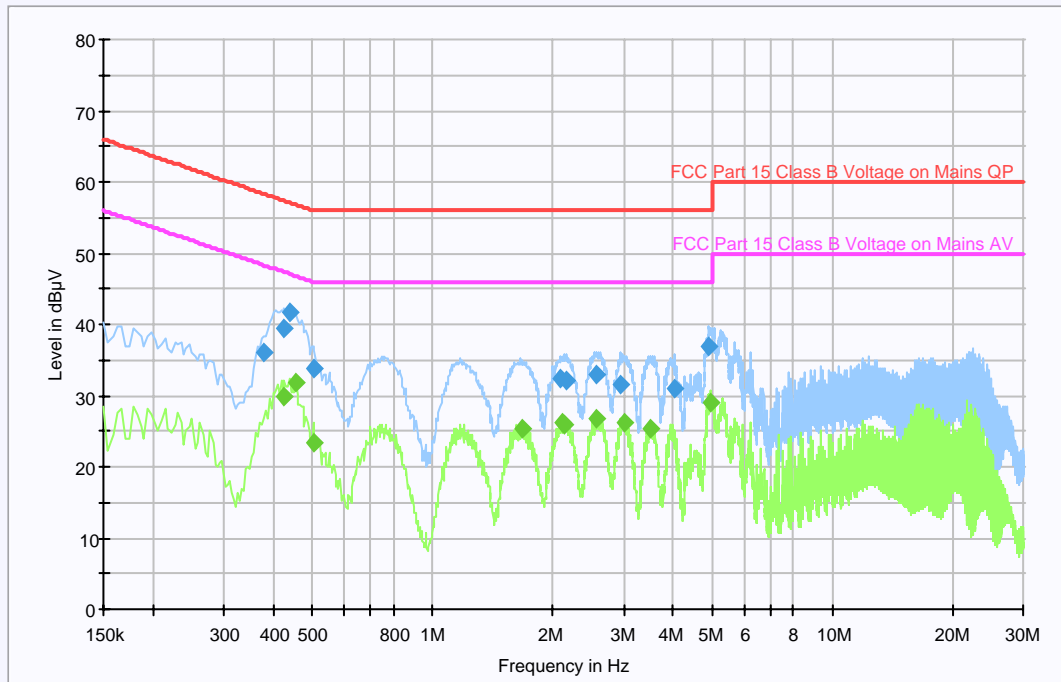
#### **Average Detector Measurements on Live and Neutral Lines**

| Frequency (MHz) | Line    | Level (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Result   |
|-----------------|---------|--------------------|--------------------|-------------|----------|
| 0.426           | Neutral | 29.9               | 47.3               | 17.4        | Complied |
| 0.454           | Live    | 31.7               | 46.8               | 15.1        | Complied |
| 0.502           | Neutral | 23.4               | 46.0               | 22.6        | Complied |
| 1.666           | Live    | 25.3               | 46.0               | 20.7        | Complied |
| 2.098           | Live    | 26.2               | 46.0               | 19.8        | Complied |
| 2.142           | Live    | 25.8               | 46.0               | 20.2        | Complied |
| 2.554           | Live    | 26.7               | 46.0               | 19.3        | Complied |
| 3.010           | Live    | 26.3               | 46.0               | 19.7        | Complied |
| 3.502           | Live    | 25.5               | 46.0               | 20.5        | Complied |
| 4.966           | Live    | 29.1               | 46.0               | 16.9        | Complied |

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**Receiver AC Conducted Spurious Emissions: Section 15.107 (Continued)**



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

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**7.2.7. Transmitter Fundamental Fieldstrength Section 15.249(a)**

7.2.7.1. The EUT was configured for radiated emissions testing, as described in Section 8 of this report.

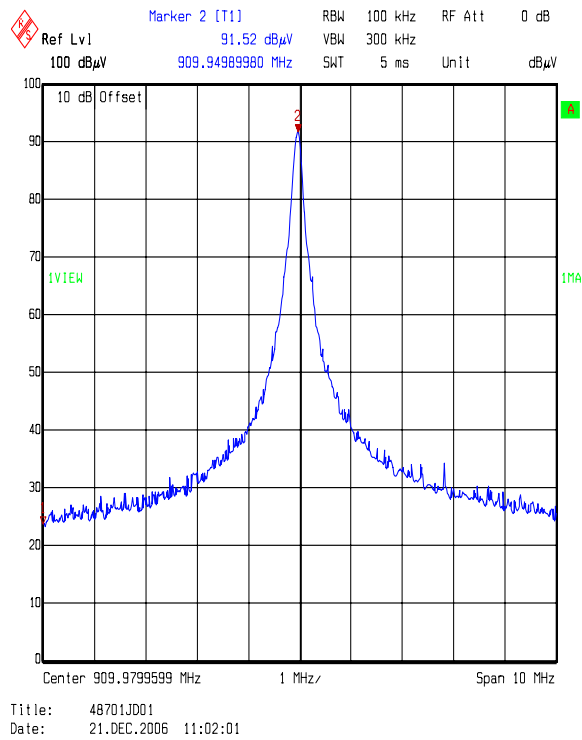
7.2.7.2. Tests were performed to identify the maximum field strength of the fundamental frequency.

**Results:****AC Powered Devices**

| Frequency (MHz) | Antenna Polarity | Input Voltage (AC) | Q-P Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|--------------------|--------------------------|----------------------|-------------|----------|
| 909.955         | Vertical         | 110.0              | 91.9                     | 94.0                 | 2.1         | Complied |
| 909.955         | Vertical         | 93.5               | 91.2                     | 94.0                 | 2.8         | Complied |
| 909.955         | Vertical         | 126.5              | 91.2                     | 94.0                 | 2.8         | Complied |

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**Transmitter Fundamental Fieldstrength Section 15.249(a)(Continued)**



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**7.2.8. Transmitter 20 dB Bandwidth: Section 2.1049**

7.2.8.1. The EUT was configured for 20 dB bandwidth measurements, as described in Section 8 of this report.

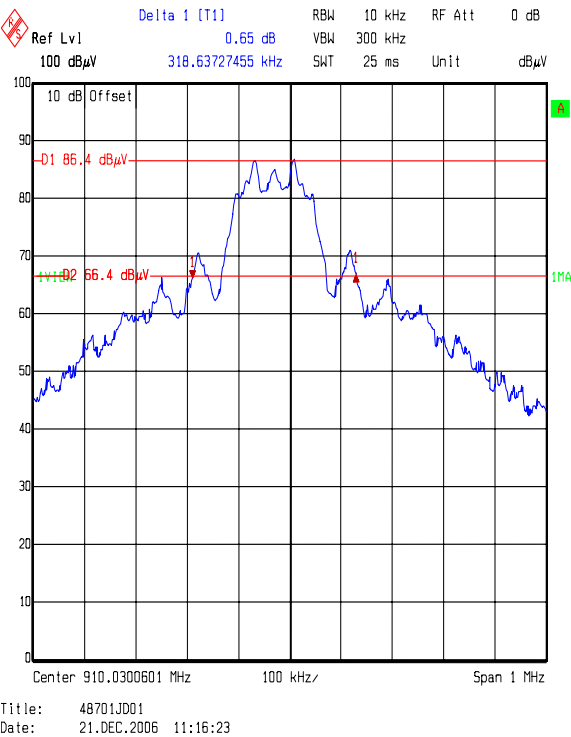
7.2.8.2. Tests were performed to identify the 20 dB bandwidth.

**Results:**

| Transmitter 20 dB Bandwidth<br>(kHz) |
|--------------------------------------|
| 318.637                              |

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Transmitter 20 dB Bandwidth: Section 2.1049 (Continued)





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**7.2.9. Transmitter Radiated Emissions: Section 15.249(a)(d)(e) & Section 15.209****7.2.10. Electric Field Strength Measurements: 30 MHz to 1000 MHz**

7.2.10.1. The EUT was configured for radiated emissions testing, as described in Section 8 of this report.

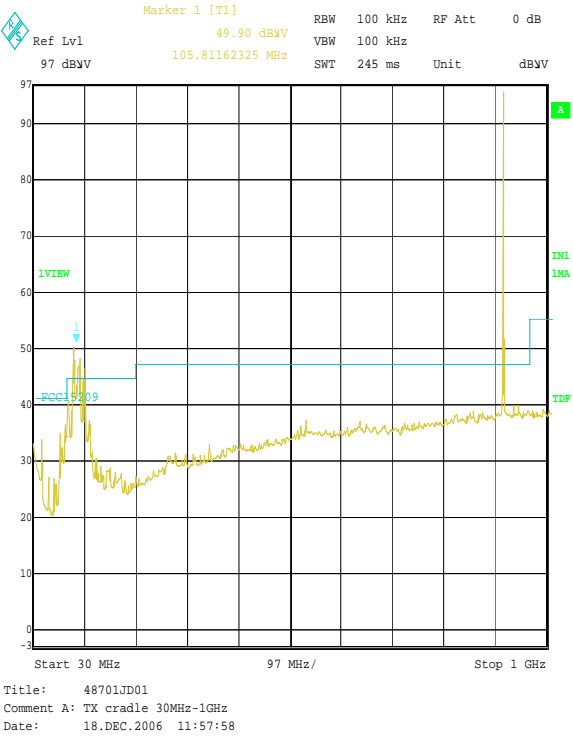
7.2.10.2. Tests were performed to identify the maximum radiated spurious emission levels.

**Results:**

| Frequency (MHz) | Antenna Polarity | Q-P Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|--------------------------|----------------------|-------------|----------|
| 46.401          | Vertical         | 26.0                     | 40.0                 | 14.0        | Complied |
| 118.482         | Vertical         | 36.1                     | 43.5                 | 7.4         | Complied |
| 127.063         | Vertical         | 35.3                     | 43.5                 | 8.2         | Complied |

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**Transmitter Radiated Emissions: Section 15.249(a)(d)(e) & Section 15.209 (Continued)**



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

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### **Transmitter Radiated Emissions: Section 15.249(a)(d)(e) & Section 15.209 (Continued)**

#### **7.2.11. Electric Field Strength Measurements (Frequency Range: 1 GHz to 10 GHz)**

##### **Results:**

##### **Highest Peak Level:**

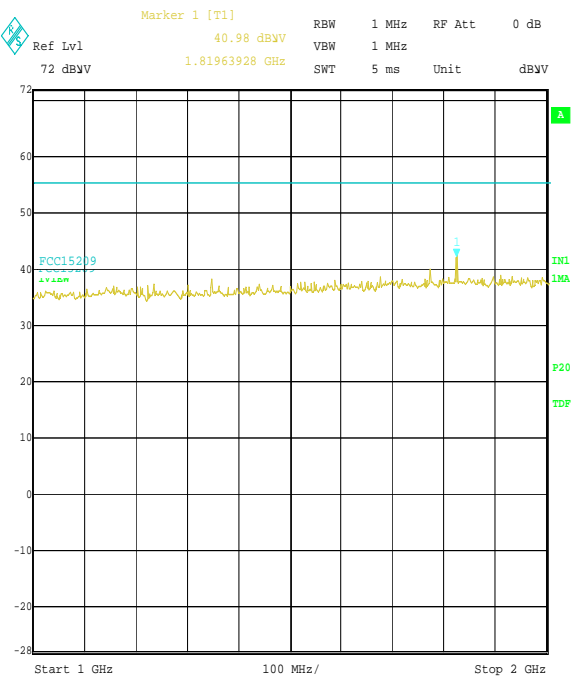
| Frequency (MHz) | Antenna Polarity | Detector Level (dB $\mu$ V) | Antenna Factor (dB) | Actual Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|-----------------------------|---------------------|-----------------------------|----------------------|-------------|----------|
| 1.8201          | Vertical         | 51.5                        | -11.6               | 39.9                        | 74.0                 | 34.1        | Complied |
| 3.6398          | Vertical         | 62.1                        | -10.2               | 51.9                        | 74.0                 | 22.1        | Complied |
| 4.5497          | Vertical         | 60.4                        | -6.4                | 54.0                        | 74.0                 | 20.0        | Complied |
| 5.4598          | Vertical         | 56.8                        | -5.6                | 51.2                        | 74.0                 | 22.8        | Complied |
| 6.3698          | Vertical         | 50.1                        | -3.5                | 46.6                        | 74.0                 | 27.4        | Complied |
| 7.2795          | Vertical         | 46                          | -4.4                | 41.6                        | 74.0                 | 32.4        | Complied |

##### **Highest Average Level:**

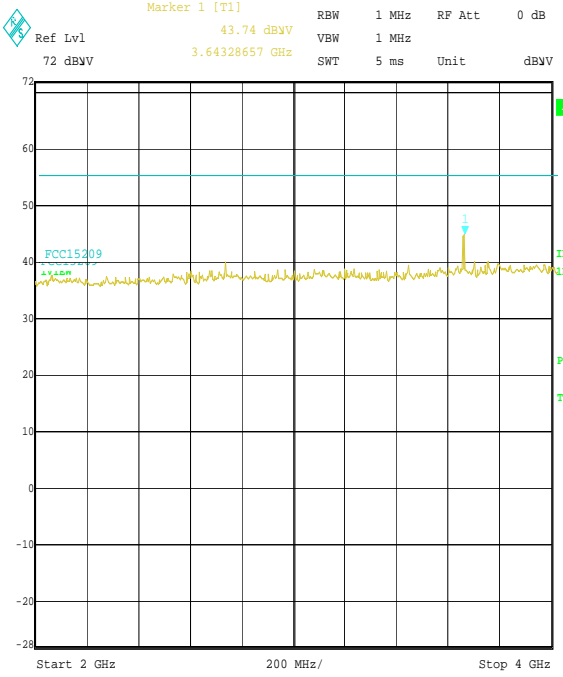
| Frequency (MHz) | Antenna Polarity | Detector Level (dB $\mu$ V) | Antenna Factor (dB) | Actual Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|------------------|-----------------------------|---------------------|-----------------------------|----------------------|-------------|----------|
| 1.8201          | Vertical         | 46.9                        | -11.6               | 34.9                        | 54.0                 | 19.1        | Complied |
| 3.6398          | Vertical         | 59.7                        | -10.2               | 49.5                        | 54.0                 | 4.5         | Complied |
| 4.5497          | Vertical         | 59.9                        | -6.4                | 53.5                        | 54.0                 | 0.5         | Complied |
| 5.4598          | Vertical         | 55.7                        | -5.6                | 50.1                        | 54.0                 | 3.9         | Complied |
| 6.3698          | Vertical         | 47.6                        | -3.5                | 44.1                        | 54.0                 | 9.9         | Complied |
| 7.2795          | Vertical         | 42.3                        | -4.4                | 37.9                        | 54.0                 | 16.1        | Complied |

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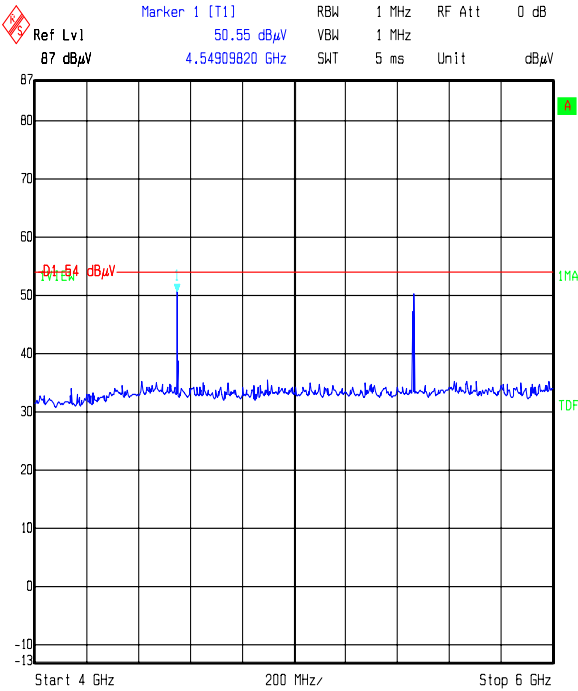
Transmitter Radiated Emissions: Section 15.249(a)(d)(e) & Section 15.209 (Continued)



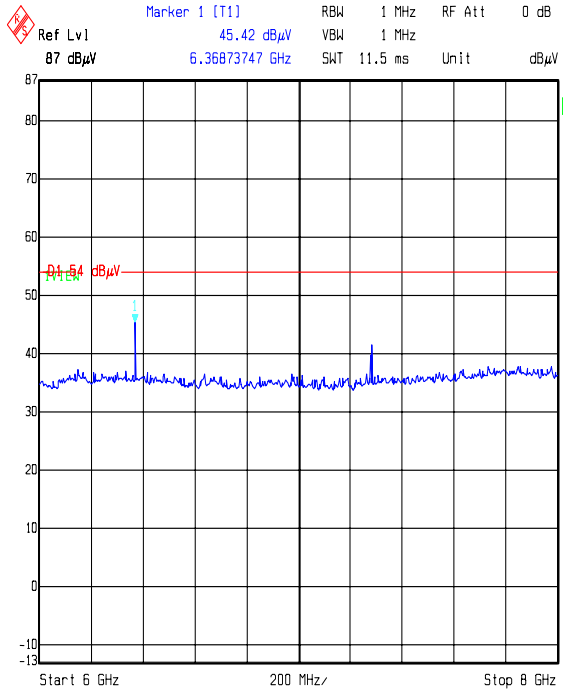
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Comment A: TX cradle 1GHz-2GHz  
Date: 18.DEC.2006 12:21:54



Title: 48701JD01  
Comment A: TX cradle 2GHz-4GHz  
Date: 18.DEC.2006 12:12:15

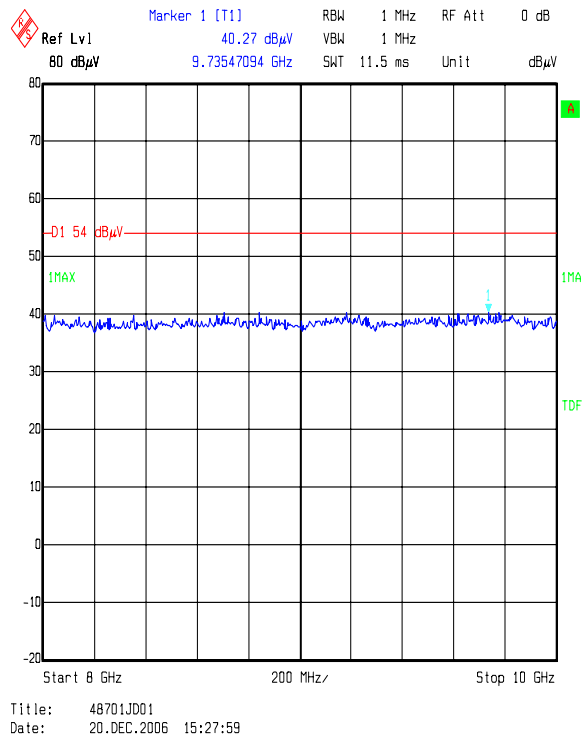


Title: 48701JD01  
Date: 20.DEC.2006 13:14:53



Title: 48701JD01  
Date: 20.DEC.2006 14:35:17

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

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**7.2.12. Transmitter Radiated Emissions at Band Edges: Section 15.249(d) & 15.209**

7.2.12.1. The EUT was configured for transmitter radiated emissions testing, as described in Section 8 of this report.

7.2.12.2. Tests were performed to identify the maximum emissions level at the band edges of the frequency band that the EUT will operate over.

**Results:****Bottom Band Edge**

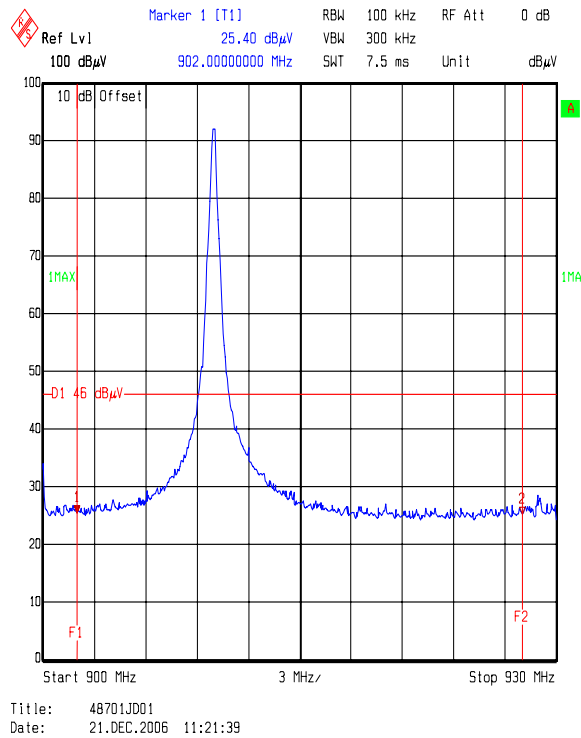
| Frequency (MHz) | Q-P Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|--------------------------|----------------------|-------------|----------|
| 902             | 25.4                     | 46.0                 | 20.6        | Complied |

**Top Band Edge**

| Frequency (MHz) | Q-P Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|--------------------------|----------------------|-------------|----------|
| 928             | 24.2                     | 46.0                 | 21.8        | Complied |

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**Transmitter Radiated Emissions at Band Edges: Section 15.249(d) & 15.209 (Continued)**



*Note: During this measurement, the transmit signal was modulated.*

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## **8. Measurement Methods**

### **8.1. AC Mains Conducted Emissions**

AC mains conducted emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

The test was performed in a shielded enclosure with the equipment arranged as detailed in the standard on a wooden bench using the floor of the screened enclosure as the ground reference plane. The EUT was powered with 115V 60 Hz AC mains supplied via a Line Impedance Stabilisation Network (LISN).

Initial measurements in the form of swept scans covering the entire measurement band were performed in order to identify frequencies on which the EUT was generating interference. In order to minimise the time taken for these swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidths (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

Following the initial scans, a graph was produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested (at individual frequencies) using the appropriate detector function.

The test equipment settings for conducted emissions measurements were as follows:

| Receiver Function | Initial Scan     | Final Measurements         |
|-------------------|------------------|----------------------------|
| Detector Type:    | Peak             | Quasi-Peak (CISPR)/Average |
| Mode:             | Max Hold         | Not applicable             |
| Bandwidth:        | 10 kHz           | 9 kHz                      |
| Amplitude Range:  | 60 dB            | 20 dB                      |
| Measurement Time: | Not applicable   | > 1 s                      |
| Observation Time: | Not applicable   | > 15 s                     |
| Step Size:        | Continuous sweep | Not applicable             |
| Sweep Time:       | Coupled          | Not applicable             |



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## 8.2. Radiated Emissions

Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Initial measurements covering the entire measurement band in the form of swept scans in a shielded enclosure were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which the EUT should be re-measured in full on the open area test site. In order to minimise the time taken for the swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. Any emission within 20 dB of the limit were then measured on the open area test site, except in cases where the noise floor was within 20 dB of the limit, in these cases the highest point of the noise floor was measured.

In either case the measurement was made at the appropriate distance using a measuring receiver with a Quasi-Peak detector for measurements below 1000 MHz and an Average detector for measurements above 1000 MHz. For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4.

All measurements on the open area test site were performed using broadband antennas.

On the open area test site, at each frequency where a signal was to be measured, the trace was maximised by rotating a turntable through 360°. The angle at which the maximum signal was observed was locked out. For frequencies below 1000 MHz the test antenna was varied in height between 1 m and 4 m in order to further maximise the target emission.

For frequencies above 1000 MHz where a horn antenna was used, height searching was performed to locate the optimal height of the horn with respect to the EUT. At this point the horn was locked off and the turntable was again rotated through 360° to maximise the target signal. It should be noted that the received signal from the EUT would diminish very quickly after it exits the beam width of the horn antenna, for this reason it may not be necessary to fully height search with the horns.

At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

Scans were performed to the upper frequency limits as stated in Section 15.33

The final field strength was determined as the indicated level in dB $\mu$ V plus cable loss and antenna factor.

The test equipment settings for radiated emissions measurements were as follows:

| Receiver Function | Initial Scan                         | Final Measurements<br>Below 1 GHz | Final Measurements<br>Above 1 GHz |
|-------------------|--------------------------------------|-----------------------------------|-----------------------------------|
| Detector Type:    | Peak                                 | Quasi-Peak (CISPR)                | Peak / Average                    |
| Mode:             | Max Hold                             | Not applicable                    | Max Hold                          |
| Bandwidth:        | (120 kHz < 1 GHz)<br>(1 MHz > 1 GHz) | 120 kHz                           | 1 MHz                             |
| Amplitude Range:  | 100 dB                               | 100 dB                            | 100 dB                            |
| Step Size:        | Continuous sweep                     | Not applicable                    | Not applicable                    |
| Sweep Time:       | Coupled                              | Not applicable                    | Not applicable                    |

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### **8.3. Transmitter 20 dB Bandwidth**

The EUT and spectrum analyser was configured for transmitter radiated emissions measurements.

To determine the occupied bandwidth, a resolution bandwidth of 10 kHz was used, which is greater than 1% of the 20 dB bandwidth. A video bandwidth of at least the same value was used. The analyser was set for a maximum hold scan to capture the profile of the signal. The peak level was then determined, and a reference line was drawn 20 dB below the peak level. The bandwidth was determined at the points where the 20 dB reference crossed the profile of the emission.

Measurements were performed to determine the Occupied Bandwidth in accordance with FCC Part 2.1049. The Occupied Bandwidth was measured from the fundamental emission at the bottom and top channels. The Occupied Bandwidth was measured in line with the requirements of 2.1049 i.e. with the EUT modulated with a signal representing the maximum rated conditions under which it will operate (worst case)

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## **9. Measurement Uncertainty**

9.1. 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.

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

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

9.4. 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            |
| Occupied Bandwidth              | N/A                | 95%                  | +/- 0.12 %             |
| Radiated Spurious Emissions     | 30 MHz to 1000 MHz | 95%                  | +/- 5.26 dB            |
| Radiated Spurious Emissions     | 1 GHz to 40 GHz    | 95%                  | +/- 1.78 dB            |

9.5. 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.

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### Appendix 1. Test Equipment Used

| RFI No. | Instrument                   | Manufacturer                     | Type No.          | Serial No.     | Date Last Calibrated   | Cal. Interval |
|---------|------------------------------|----------------------------------|-------------------|----------------|------------------------|---------------|
| A088    | Y20 HM Variable Transformer  | Zenith                           | Y20-HM            | 9029           | Calibrated during test | -             |
| A1037   | Green Bilog Antenna          | Chase EMC Ltd                    | CBL6112 B         | 2413           | 20 Sep 2006            | 12            |
| A1069   | Single Phase LISN            | Rohde & Schwarz                  | ESH3-Z5           | 837469/012     | 31 Jan 2006            | 12            |
| A1360   | ESH3-Z2 Pulse Limiter        | Rohde & Schwarz                  | ESH3-Z2           | A1360-20112003 | 06 Sep 2006            | 12            |
| A1515   | 1.0 to 4.4 GHz Horn Antenna  | Stoddart Aircraft Radio Co., Inc | 92341-1           | 0436           | 17 Nov 2006            | 12            |
| A1534   | Preamplifier 1-26.5 GHz      | Hewlett Packard                  | 8449B OPT H02     | 3008A00405     | 6 Oct 2006             | 12            |
| A254    | WG 14 Microwave Horn         | Flann Microwave                  | 14240-20          | 139            | 17 Nov 2006            | 36            |
| A259    | Bilog Antenna                | Chase                            | CBL6111           | 1513           | 03 Mar 2006            | 12            |
| A392    | DC to 18 GHz attenuator      | Suhner                           | 6803.17. B        | None           | Calibrated during test | -             |
| A428    | WG 12 Microwave Horn Antenna | Flann                            | 12240-20          | 134            | 17 Nov 2006            | 36            |
| A429    | WG 16 Microwave Horn Antenna | Flann                            | 16240-20          | 561            | 17 Nov 2006            | 36            |
| C1079   | UFA210A Rosenberger Cable    | Rosenberger                      | FA210A1 010M505 0 | 28462-1        | 22 Jan 2006            | 12            |

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**Test Equipment Used (Continued)**

| RFI No. | Instrument                | Manufacturer           | Type No.                 | Serial No.  | Date Last Calibrated   | Cal. Interval |
|---------|---------------------------|------------------------|--------------------------|-------------|------------------------|---------------|
| C1081   | UFA210A Rosenberger Cable | Rosenberger            | FA210A1 020M505 0        | 28463-2     | 14 Feb 2006            | 12            |
| C1167   | 3m N-Type Cable           | Rosenberger Micro-Coax | FA210A1 0300070 70       | 43190-01    | Calibrated during test | -             |
| C151    | Cable                     | Rosenberger            | UFA210 A-1- 1181- 70x70  | None        | 22 Sep 2006            | 12            |
| C363    | 3m                        | Rosenberger            | RG142                    | None        | 29 Jan 2006            | 12            |
| C375    | Cable                     | Rosenberger            | RG400                    | None        | Calibrated during test | -             |
| C398    | BNC-BNC cable             | RFI                    | None                     | None        | 30 Jan 2006            | 12            |
| C461    | DC to 18GHz Rosenberger   | Rosenberger            | UFA210 A-1- 1182- 704704 | 98H0305     | 30 Jan 2006            | 12            |
| M023    | ESVP Receiver             | Rohde & Schwarz        | ESVP                     | 872 991/027 | 10 Apr 2006            | 12            |
| M024    | EZM Spectrum Monitor      | Rohde & Schwarz        | EZM                      | 873 952/006 | Calibrated during test | -             |
| M1229   | Digital Multimeter        | Fluke                  | 179                      | 87640015    | 06 Mar 2006            | 12            |
| M1242   | Spectrum Analyser         | Rohde & Schwarz, Inc.  | FSEM30                   | 845986_022  | 08 Sep 2006            | 12            |
| M1263   | EMI Test Receiver         | Rohde & Schwarz        | ESIB7                    | 100265      | 12 Jan 2006            | 12            |
| M127    | 20 Hz to 7 GHz.           | Rohde & Schwarz        | FSEB 30                  | 842 659/016 | 07 Aug 2006            | 12            |

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

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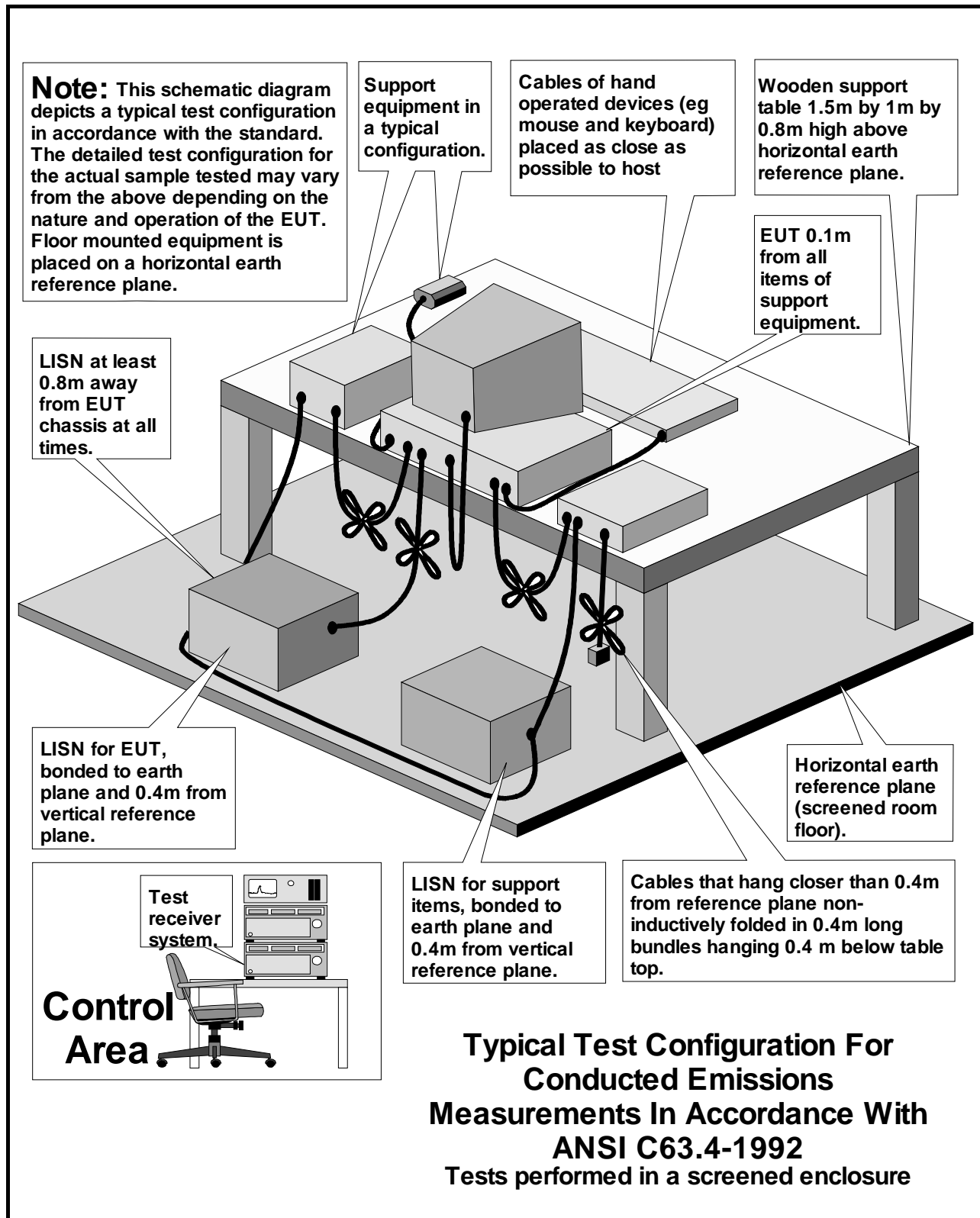
## **Appendix 2. Test Configuration Drawings**

This appendix contains the following drawings:

| <b>Drawing Reference Number</b> | <b>Title</b>   |
|---------------------------------|--|
| DRG\48701JD01A\EMICON           | Test configuration for measurement of conducted emissions. |
| DRG\48701JD01A\EMIRAD           | Test configuration for measurement of radiated emissions.  |

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DRG\48701JD01A\EMICON



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DRG\48701JD01A\EMIRAD

