# TEST REPORT
# FROM
# RADIO FREQUENCY
# INVESTIGATION LTD.

Test Of: Danger Inc.
Tina PDA

To: FCC Part 24 (Partial testing only)

**Test Report Serial No:**
RFI/MPTB1/RP45320JD09

| | |
|---|---|
| **This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director:**  | **Checked By: Tony Henriques**  |
| **Tested By: Steven Wong**  | **Release Version No: PDF01** |
| **Issue Date: 03 March 200403 March 2004** | **Test Dates: 15 January 2004 to 09 February 2004** |

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This report may be copied in full. The results in this report apply only to the sample(s) tested.


| | | |
|---|---|---|
| Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, ENGLAND.<br>Tel: +44 (0) 1256 851193 Fax: +44 (0) 1256 851192 | Registered in England, No. 211 7901.<br>Registered Office: Ewhurst Park, Ramsdell, Basingstoke, Hampshire RG26 5RQ | UKAS TESTING<br>TESTING<br>0644 |

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## Table of Contents

## 1. Client Information

| | |
|---|---|
| **Company Name:** | Danger, Inc |
| **Address:** | 124 University Avenue<br>Palo Alto<br>CA 94031<br>USA |
| **Contact Name:** | Mr Gavin O'Duffy |

# 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)

| | |
|---|---|
| **Brand Name:** | Danger |
| **Model Name or Number:** | Tina PDA |
| **Serial Number:** | PVT C33700147X |
| **IMEI Number:** | 001028000072100 |
| **FCC ID Number:** | P5J-IGKYA |
| **Country of Manufacture:** | Malaysia |
| **Date of Receipt:** | 12 January 2004 |

## 2.2. Description Of EUT

The equipment under test is a GSM 1900 MHz, GPRS, Class 10, Class B-enabled PDA powered by a non-removable lithium-ion battery.

## 2.3. Modifications Incorporated In EUT

During the course of testing the EUT was not modified.

## 2.4. Additional Information Related To Testing

| | | | |
|---|---|---|---|
| **Power Supply Requirement:** | Internal 4.2 V (nominal) non-removable lithium ion battery | | |
| **Power Supply Requirement: (AC Battery Re-Charger)** | Nominal 110 V 60 Hz AC Mains supply | | |
| **Intended Operating Environment:** | Within GSM network coverage | | |
| **Equipment Category:** | Portable | | |
| **Type of Unit:** | Transceiver | | |
| **Interface Ports:** | Head set / camera (2.5mm jack)<br>Power<br>USB Downlink<br>IR Port | | |
| **Highest Fundamental Frequency** | 1909.8 MHz | | |
| **Transmit Frequency Range** | 1850.0 MHz to 1910.0 MHz | | |
| **Transmit Channels Tested** | **Channel ID** | **Channel Number** | **Channel Frequency (MHz)** |
| | Bottom | 512 | 1850.2 |
| | Middle | 660 | 1879.8 |
| | Top | 810 | 1909.8 |
| **Receive Frequency Range** | 1930.0 MHz to 1990.0 MHz | | |
| **Receive Channels Tested** | **Channel ID** | **Channel Number** | **Channel Frequency (MHz)** |
| | Bottom | 512 | 1930.2 |
| | Middle | 660 | 1960.0 |
| | Top | 810 | 1989.8 |
| **Maximum Power Output (EIRP)** | 26.5 dBm | | |

## 2.5. Accessories

The following accessories were supplied with the EUT:

| | |
|---|---|
| **Description:** | Personal Handsfree Kit (PHF) |
| **Brand Name:** | Danger, Inc |
| **Model Name or Number:** | 22-0004-01/SPKR |
| **Serial Number:** | None Stated |
| **Country of Manufacture:** | None Stated |

| | |
|---|---|
| **Description:** | Case |
| **Brand Name:** | None Stated |
| **Model Name or Number:** | 36 - 0002 |
| **Serial Number:** | Not Applicable |
| **Country of Manufacture:** | None Stated |

| | |
|---|---|
| **Description:** | Battery Re-Charger |
| **Brand Name:** | Motorola |
| **Model Name or Number:** | 14-0021-X9 |
| **Serial Number:** | None Stated |
| **Country of Manufacture:** | China |

## 2.6. Support Equipment

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

| | |
|---|---|
| **Description:** | GSM Test Set |
| **Brand Name:** | WillTek |
| **Model Name or Number:** | 42025 |
| **Serial Number:** | 0513018 |
| **Connected to Port:** | RF Link |

| | |
|---|---|
| **Description:** | USB Cable |
| **Brand Name:** | Total Tech, Ltd. |
| **Model Name or Number:** | TTL-MNIB-1.8m-BK |
| **Serial Number:** | Not stated |
| **Cable Length And Type:** | 180 cm |
| **Connected to Port:** | USB downlink port |

# 3. Test Specification, Methods And Procedures

## 3.1. Test Specifications

| | |
|---|---|
| **Reference:** | FCC Part 24 Subpart E: 2002 (Broadband PCS) |
| **Title:** | Code of Federal Regulations, Part 24 (47CFR24)<br>Personal Communication Services. |
| **Comments:** | 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. |
| **Purpose of Test:** | 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 (1987)
Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2001)
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.

## 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.

## 4. Deviations From The Test Specification

None.

# 5. Operation Of The EUT During Testing

## 5.1. Operating Conditions

The EUT was tested in a normal laboratory environment.

During testing, the EUT was powered by its internal lithium-ion battery supply of 4.2V connected to a 110 V 60 Hz AC Mains battery re-charger.

## 5.2. Operating Modes

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

Preliminary radiated scans were performed on the EUT in the previously established worst case configuration (as stated in previous RFI test report RFI/MPTB1/RP44807JD04A) i.e. with the personal handsfree kit accessory and the USB cable connected. Additionally preliminary radiated scans were performed with the other accessories stated in section 2.5 of this report connected and then disconnected. The combination that exhibited the worse case mode of operation was then used to perform final measurements. This was found to be with the EUT connected to its AC battery charger (for below 1 GHz only) and without the case.

**Transmitter Mode:**

For carrier output power and final transmitter radiated measurements, testing was performed at full power on top, middle and bottom channels of the assigned frequency block.

All transmitter radiated spurious pre-scan tests were performed at full power on the top channel of the assigned frequency block. Final measurements were then performed on the top, middle and bottom channels if an emission was identified.

Note: Although the EUT is a Class 10 device it was tested as a Class 8 device in voice mode due to the current non-availability of suitable test equipment required to fully exercise the Class 10 mode.

## 5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

Configured with personal handsfree kit, battery re-charger connected to the AC mains supply* and USB cable

** For radiated emissions measurements below 1 GHz only*

All tests were performed with the EUT connected via an air link to a GSM test set via an access point.

# 6. Summary Of Test Results

| Range Of Measurements | Specification Reference | Port Type | Compliancy Status |
|---|---|---|---|
| Transmitter Effective Isotropic Radiated Power (EIRP) | C.F.R. 47 FCC Part 24: 2002 Section 24.232 | Antenna | Complied |
| Transmitter Out of Band Radiated Emissions | C.F.R. 47 FCC Part 24: 2002 Section 2.1053/24.238 | Antenna | Complied |
| Transmitter Band Edge Radiated Emissions | C.F.R. 47 FCC Part 2: 2002 Section 2.1053/24.238 | Antenna | Complied |

## 6.1. Location Of Tests

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

# 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.

# 8. Test Results

## 8.1. Transmitter Effective Isotropic Radiated Power (EIRP): Section 24.232

8.1.1. The EUT was configured as for Effective Isotropic Radiated Power as described in Section 9 of this report.

8.1.2. Tests were performed to identify the maximum Effective Isotropic Radiated Power (EIRP).

**Results:**

| Channel | Measured Frequency (MHz) | Antenna Polarity | Maximum Transmitter ERP (dBm) | Limit ERP (dBm) | Margin (dB) | Result |
|---|---|---|---|---|---|---|
| Bottom | 1850.2 | Horiz. | 26.5 | 33.0 | 6.5 | Complied |
| Middle | 1879.8 | Horiz. | 26.3 | 33.0 | 6.7 | Complied |
| Top | 1909.8 | Horiz. | 26.2 | 33.0 | 6.8 | Complied |

## 8.2. Transmitter Out of Band Emissions: Section 2.1053/24.238

8.2.1. The EUT was configured as for transmitter radiated emissions testing as described in Section 9 of this report.

8.2.2. Tests were performed to identify the maximum transmitter radiated emission levels.

**Result: Bottom Channel**

| Frequency (MHz) | Peak Emission Level (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| 1914.772 | -41.3 | -13.0 | 28.3 | Complied |
| 3700.600 | -26.3 | -13.0 | 13.3 | Complied |
| 9251.250 | -31.9 | -13.0 | 18.9 | Complied |
| 11101.750 | -30.5 | -13.0 | 17.5 | Complied |
| 18502.144 | -22.7 | -13.0 | 9.7 | Complied |

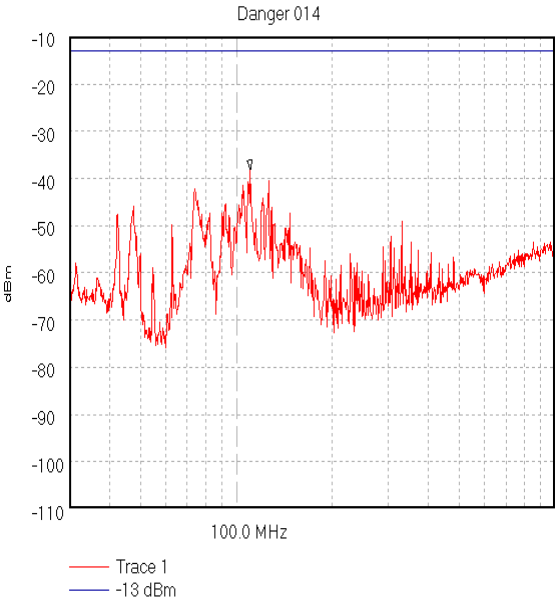
**Result: Middle Channel**

| Frequency (MHz) | Peak Emission Level (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| 1959.650 | -47.5 | -13.0 | 34.5 | Complied |
| 3759.738 | -30.9 | -13.0 | 17.9 | Complied |
| 9398.761 | -30.9 | -13.0 | 17.9 | Complied |
| 11278.922 | -27.8 | -13.0 | 14.8 | Complied |
| 18798.100 | -24.5 | -13.0 | 11.5 | Complied |

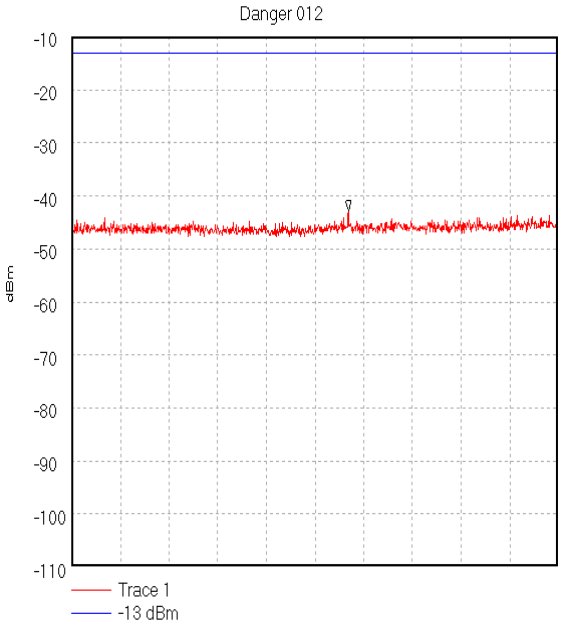
**Result: Top Channel**

| Frequency (MHz) | Peak Emission Level (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| 1912.205 | -19.3 | -13.0 | 6.3 | Complied |
| 3819.683 | -29.2 | -13.0 | 16.2 | Complied |
| 9548.800 | -31.4 | -13.0 | 18.4 | Complied |
| 11458.911 | -29.6 | -13.0 | 16.6 | Complied |
| 19097.588 | -24.4 | -13.0 | 11.4 | Complied |

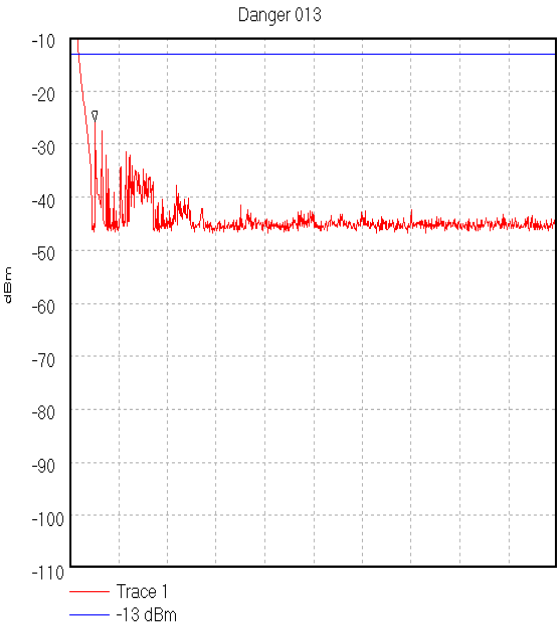
## Transmitter Out of Band Emissions: Section 2.1053/24.238 (Continued)



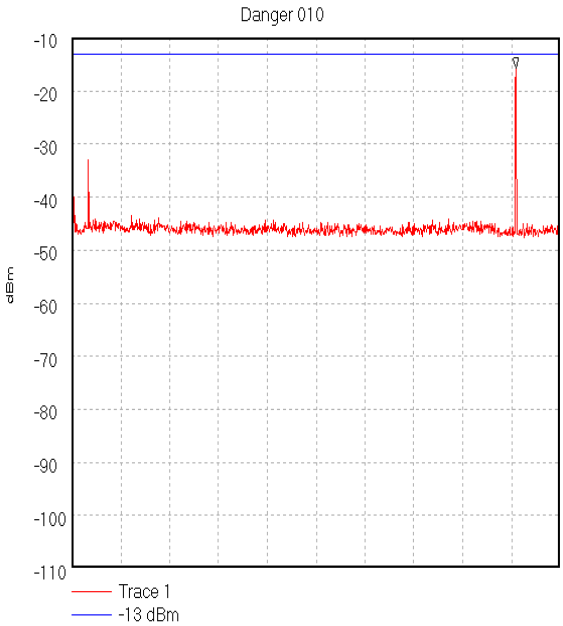

Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref -10 dBm; Ref Offset 11.8 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 20.0 mS
Peak 110.655 MHz, -38.11 dBm
Display Line: -13 dBm;
Transducer Factors: A490
1/15/2004 7:50:30 PM




Start 1.0 GHz; Stop 1.85 GHz
Ref -10 dBm; Ref Offset 37.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 1.483556 GHz, -42.85 dBm
Display Line: -13 dBm;
1/15/2004 7:40:55 PM

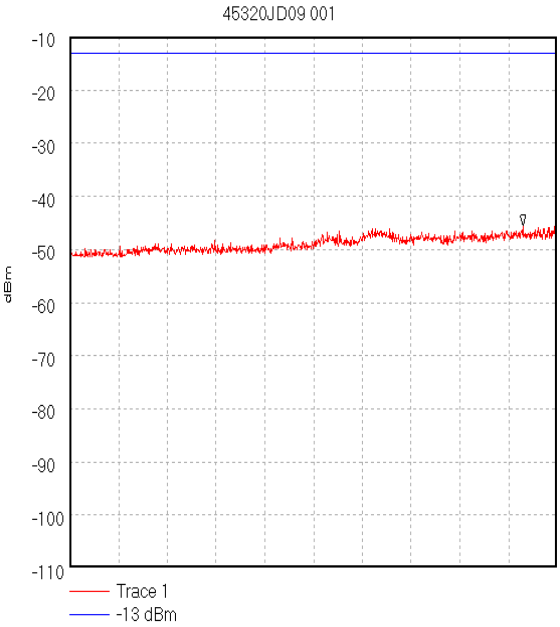



Start 1.91 GHz; Stop 2.0 GHz
Ref -10 dBm; Ref Offset 37.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Marker 1.9147 GHz, -25.74 dBm
Display Line: -13 dBm;
1/15/2004 7:41:33 PM

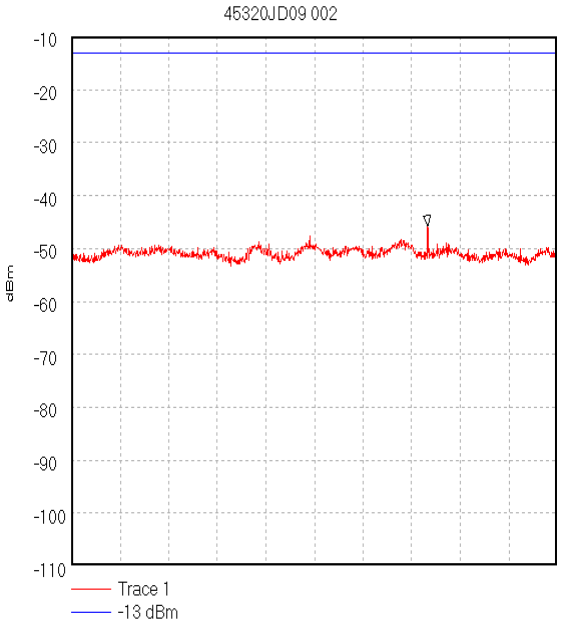



Start 2.0 GHz; Stop 4.0 GHz
Ref -10 dBm; Ref Offset 36.0 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 3.82 GHz, -15.61 dBm
Display Line: -13 dBm;
1/15/2004 7:37:51 PM

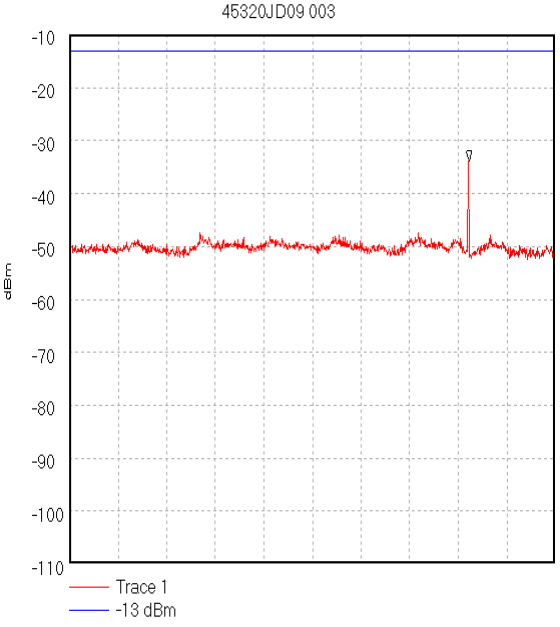
## Transmitter Out of Band Emissions: Section 2.1053/24.238 (Continued)



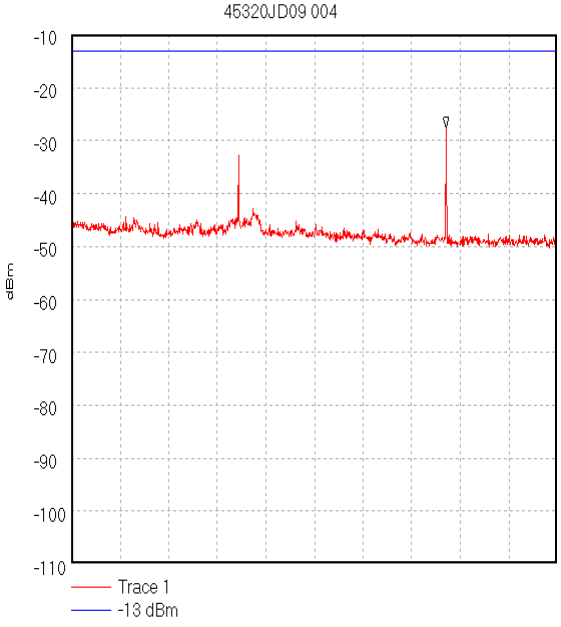

Start 4.0 GHz; Stop 5.0 GHz
Ref -10 dBm; Ref Offset 30.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 4.93 GHz, -45.55 dBm
Display Line: -13 dBm;
09/02/2004 18:26:39




Start 5.0 GHz; Stop 6.0 GHz
Ref -10 dBm; Ref Offset 30.8 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 5.733 GHz, -45.77 dBm
Display Line: -13 dBm;
09/02/2004 18:28:09

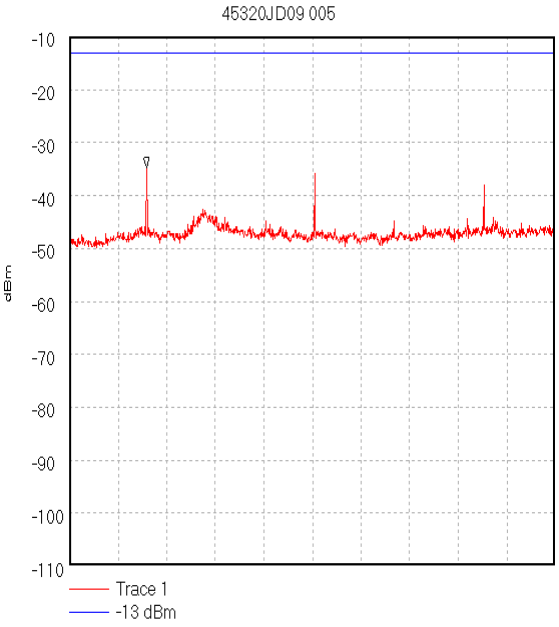



Start 6.0 GHz; Stop 8.0 GHz
Ref -10 dBm; Ref Offset 33.4 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 7.644 GHz, -33.86 dBm
Display Line: -13 dBm;
09/02/2004 18:30:50

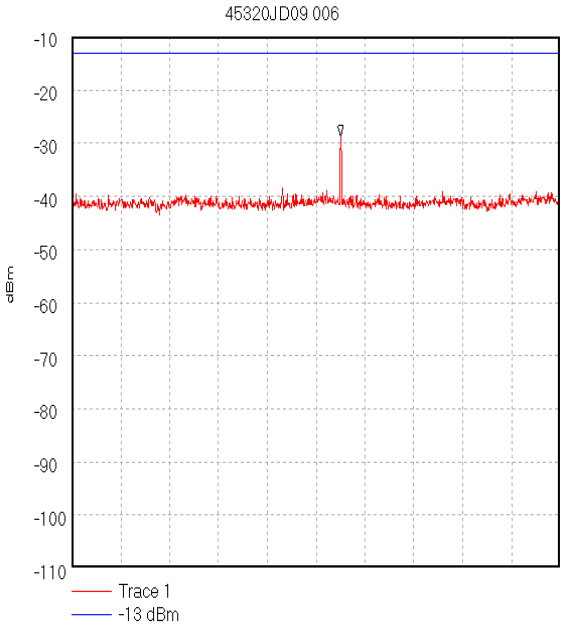



Start 8.0 GHz; Stop 12.5 GHz
Ref -10 dBm; Ref Offset 38.1 dB; 10 dB/div
RBW 1.0 MHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS
Peak 11.47 GHz, -27.64 dBm
Display Line: -13 dBm;
09/02/2004 18:33:42

## Transmitter Out of Band Emissions: Section 2.1053/24.238 (Continued)




Start 12.5 GHz; Stop 18.0 GHz
Ref -10 dBm; Ref Offset 41.9 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 5 dB; Swp 40.0 mS
Peak 13.373889 GHz, -34.75 dBm
Display Line: -13 dBm; ; Limit Test Passed
09/02/2004 18:51:08




Start 18.0 GHz; Stop 20.0 GHz
Ref -10 dBm; Ref Offset 46.7 dB; 10 dB/div
RBW 1000.0 kHz; VBW 1.0 MHz; Att 5 dB; Swp 20.0 mS
Peak 19.102222 GHz, -28.68 dBm
Display Line: -13 dBm; ; Limit Test Passed
09/02/2004 18:53:41

## Transmitter Out of Band Emissions: Section 2.1053/24.238 (Continued)

### Integrated Power Over 1 MHz Strip Band: 1911 to 1912 MHz

1st 1 MHz block immediately outside adjacent frequency block

| 100 kHz Strip Number | Peak Power (nW/100 kHz) | 100 kHz Strip Number | Peak Power (nW/100 kHz) |
|---|---|---|---|
| 1 | 138.357 | 6 | 46.3448 |
| 2 | 73.1141 | 7 | 49.4312 |
| 3 | 87.7003 | 8 | 43.9543 |
| 4 | 58.2343 | 9 | 40.5509 |
| 5 | 63.9736 | 10 | 41.7831 |
| **Total Peak Power:** | | 643.4436 nW/MHz | |

### Integrated Power Over 1 MHz Strip Band: 1912 to 1913 MHz

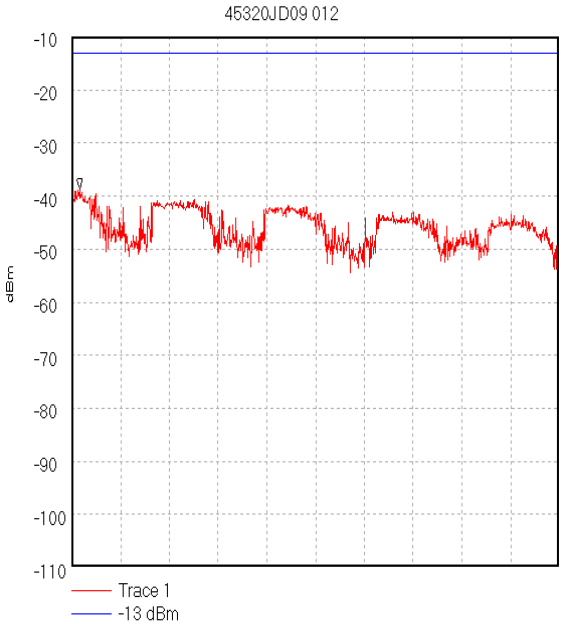
2nd 1 MHz block immediately outside adjacent frequency block

| 100 kHz Strip Number | Peak Power (nW/100 kHz) | 100 kHz Strip Number | Peak Power (nW/100 kHz) |
|---|---|---|---|
| 1 | 56.7831 | 6 | 15.4620 |
| 2 | 26.8844 | 7 | 14.0627 |
| 3 | 25.8467 | 8 | 14.9281 |
| 4 | 21.9736 | 9 | 13.3792 |
| 5 | 18.7523 | 10 | 15.8273 |
| **Total Peak Power:** | | 223.9004 nW/MHz | |

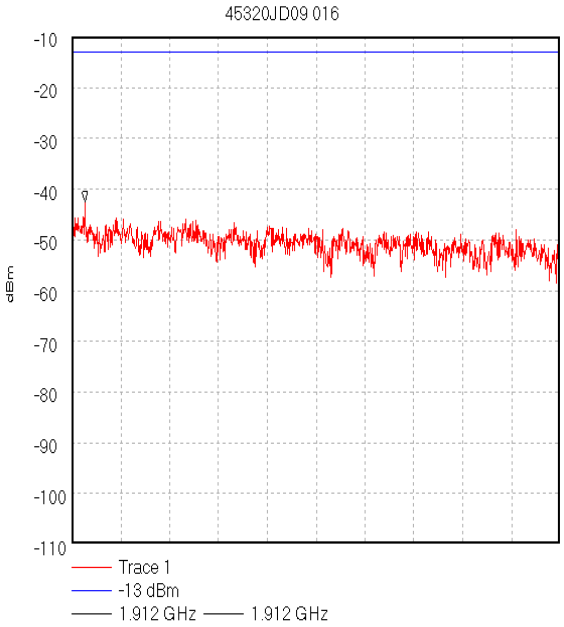
### Result:

| Band (MHz) | Peak Power (dBm/MHz) | Limit (dBm/MHz) | Margin (dB) | Status |
|---|---|---|---|---|
| 1911 to 1912 | -31.9 | -13.0 | -18.9 | Complied |
| 1912 to 1913 | -36.5 | -13.0 | -23.5 | Complied |

## Transmitter Out of Band Emissions: Section 2.1053/24.238 (Continued)




Start 1.911 GHz; Stop 1.912 GHz
Ref -10 dBm; Ref Offset 23.8 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 20.0 mS
Peak 1.911016 GHz, -38.59 dBm
Display Line: -13 dBm; ; Limit Test Passed
09/02/2004 20:04:43




Start 1.912 GHz; Stop 1.913 GHz
Ref -10 dBm; Ref Offset 23.8 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 20.0 mS
Peak 1.912027 GHz, -42.5 dBm
Display Line: -13 dBm; ; Limit Test Passed
09/02/2004 20:35:38

## 8.3. Transmitter Radiated Emissions At Band Edges: Section 2.1053/24.238

8.3.1. The EUT was configured as for transmitter radiated emissions testing described in Section 9 of this report.

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

**Results:**

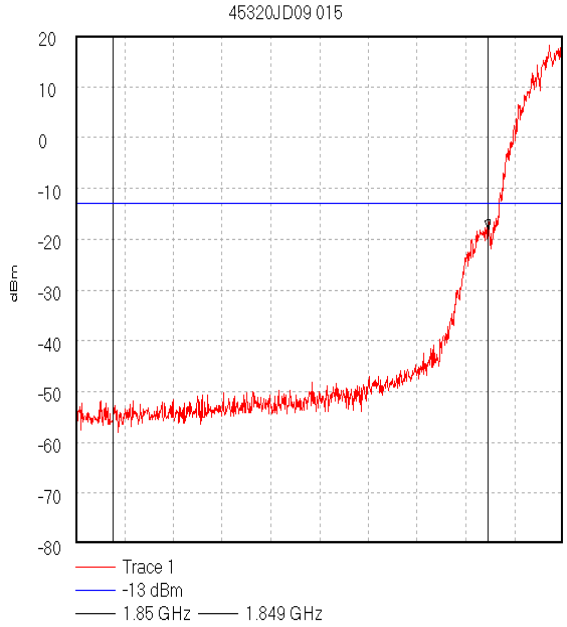
**Bottom Band Edge**

| Frequency (MHz) | Spurious Emission (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| 1850.0 | -18.2 | -13.0 | 5.2 | Complied |

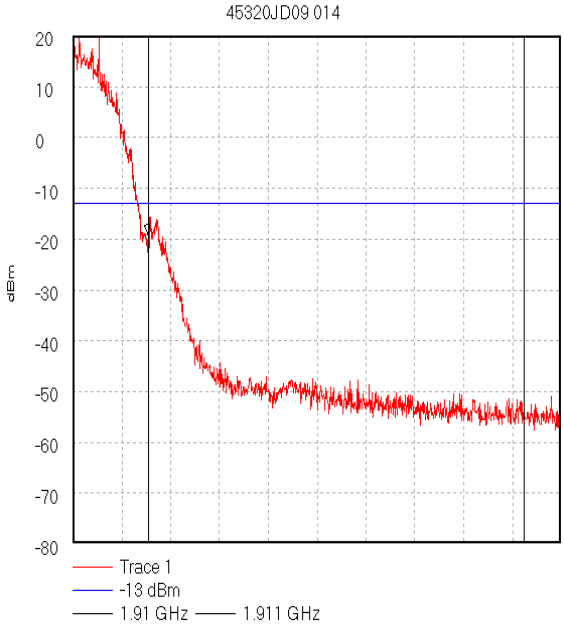
**Top Band Edge**

| Frequency (MHz) | Peak Emission Level (dBm) | Limit (dBm) | Margin (dB) | Result |
|---|---|---|---|---|
| 1910.0 | -19.1 | -13.0 | 6.1 | Complied |

## Transmitter Radiated Emissions At Band Edges: Section 2.1053/24.238 (Continued)




Start 1.8489 GHz; Stop 1.8502 GHz
Ref 20 dBm; Ref Offset 23.8 dB; 10 dB/div
RBW 3.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 440.0 mS
Marker 1.85 GHz, -18.24 dBm
Display Line: -13 dBm;
09/02/2004 20:29:35




Start 1.9098 GHz; Stop 1.9111 GHz
Ref 20 dBm; Ref Offset 23.8 dB; 10 dB/div
RBW 3.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 440.0 mS
Marker 1.909999 GHz, -19.1 dBm
Display Line: -13 dBm;
09/02/2004 20:25:11

# 9. Measurement Methods

## 9.1. Effective Isotropic Radiated Power (EIRP)

EIRP measurements were performed in accordance with the standard, against appropriate limits.

The EIRP was measured with the EUT arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4. The transmitter was fitted with an integral antenna; as such all radiated tests were performed with the unit operating into the integral antenna.

The level of the EIRP was measured using a spectrum analyser.

The test antenna was positioned in the horizontal plane. The EUT was oriented in the X plane. The test antenna was then raised and lowered until a maximum peak was observed. The turntable was then rotated through 360 degrees and the maximum peak reading obtained. The height search was then repeated to take into consideration the new angular position of the turntable. The maximum reading observed was then recorded. This procedure was then repeated with the EUT oriented in the Y and Z planes. The highest reading taken in all 3 planes was recorded. The entire procedure was then repeated with the test antenna set in the Vertical polarity.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a substitution antenna. For EIRP measurements a Horn antenna whose gain was based on an isotropic antenna was used, ERP measurements were done using a dipole. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The EIRP was calculated as:-

EIRP = Signal Generator Level - Cable Loss + Antenna Gain

All measurements were performed using broadband Horn antennas.

## Effective Isotropic Radiated Power (EIRP) (Continued)

Circumstances where the signal generator could not produce the desired power substitution was performed with the signal generator set to 0 dBm. The radiated signal was maximised as previously described. The level indicated on the measuring receiver was noted. The delta between this level and the maximum level for the EUT was calculated and also noted. The EIRP of the signal generator was calculated using the above formulae. The recorded delta was added to the calculated EIRP to obtain the substituted EUT EIRP.

Delta (dB) = EUT – SG

Where:

EUT = Spectrum analyser indicated EUT raw level
SG = Spectrum analyser indicated signal generator raw level

The signal generator actual EIRP is calculated as:

EIRP SG = Signal Generator Level – Cable loss + Antenna Gain

The EUT EIRP is calculated as:

EIRP EUT = EIRP SG + Delta.

The test equipment settings for EIRP measurements were as follows:

| **Receiver Function** | **Setting** |
|---|---|
| Detector Type: | Peak |
| Mode: | Not applicable |
| Bandwidth: | 1 MHz |
| Amplitude Range: | 100 dB |
| Sweep Time: | Coupled |

## 9.2. Transmitter Radiated Emissions

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

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to 10 times the highest fundamental frequency. The scans were performed within a screened chamber in order to identify frequencies on which the EUT was generating spurious. This procedure identified the frequencies from the EUT which required further examination. Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. A limit line was set to the specification limit by characterising the screen room using a known signal source set at exactly the same location as the EUT. The signal source was derived from either a horn antenna or a dipole dependant on the frequency band under investigation. Any levels within 20 dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site using the appropriate test distance and measuring receiver with a Peak detector was used for final measurements at each frequency recorded in the screen room.

The levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m in the vertical polarisation. 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. The procedure was repeated for the horizontal polarisation.

Once the final amplitude (maximised) had been obtained, the EUT was substituted with a substitution antenna. For EIRP measurements a Horn antenna whose gain was based on an isotropic antenna was used, ERP measurements were done using a dipole. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The EIRP was calculated as:-

EIRP = Signal Generator Level - Cable Loss + Antenna Gain

## Transmitter Radiated Emissions (Continued)

The limit in the standard states that emissions shall be attenuated by at least 43+10 log (P) dB below the transmitter power (P), where (P) is the maximum measured fundamental power for the channel under test. This limit always reduces to –13 dBm therefore, the limit line presented on the accompanying plots is set to –13 dBm.

Any spurious measured were then compared to the –13 dBm limit. The requirement is for the emission to be less than –13 dBm. The margin between emission and limit is recorded and should always be positive to indicate compliance.

It should be noted that FCC Part 24.238 states that the 1st MHz band immediately adjacent to the applicants declared frequency block may be measured using a resolution bandwidth of at least 1% of the emission bandwidth. This bandwidth was found by calculating 1% of the bandwidth measured in the transmitter occupied bandwidth section of this report. The next largest available bandwidth above this calculated figure was, therefore, used i.e. 3 kHz.

The measurements in the 2nd and 3rd 1 MHz blocks away from the adjacent 1 MHz block from 1911 MHz to 1912 MHz and 1912 MHz to 1913 MHz were carried out using an analyser span of 1 MHz and a 100 kHz receiver resolution bandwidth (RBW). 10 linear readings were taken for each 100 kHz strip across the 1 MHz band. These readings were integrated to give the emission level in an equivalent 1 MHz bandwidth.

## 10. Measurement Uncertainty

10.1. 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.

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

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

10.4. 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 |
|---|---|---|---|
| Effective Isotropic Radiated Power (EIRP) | Not applicable | 95% | +/- 1.78 dB |
| Radiated Spurious Emissions | 30.0 MHz to 1000.0 MHz | 95% | +/- 5.26 dB |
| Radiated Spurious Emissions | 1.0 GHz to 26.0 GHz | 95% | +/- 1.78 dB |

10.5. 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.

## Appendix 1. Test Equipment Used

| RFI No. | Instrument | Manufacturer | Type No. | Serial No. |
|---|---|---|---|---|
| A027 | Horn Antenna | Eaton | 9188-2 | 301 |
| A031 | 2 to 4 GHz Eaton Horn Antenna | Eaton | 91889-2 | 557 |
| A253 | WG 12 Microwave Horn | Flann Microwave | 12240-20 | 128 |
| A254 | WG 14 Microwave Horn | Flann Microwave | 14240-20 | 139 |
| A255 | WG 16 Microwave Horn | Flann Microwave | 16240-20 | 519 |
| A256 | WG 18 Microwave Horn | Flann Microwave | 18240-20 | 400 |
| A259 | Bilog Antenna | Chase | CBL6111 | 1513 |
| A392 | 3 dB attenuator | Suhner | 6803.17.B | None |
| A425 | Double Ridged Guide Antenna | EMCO | 3116 | 9611-2330 |
| A427 | WG 14 horn | Flann | 14240-20 | 150 |
| A428 | WG 12 horn | Flann | 12240-20 | 134 |
| A429 | WG 16 horn | Flann | 16240-20 | 561 |
| A430 | WG 18 horn | Flann | 18240-20 | 425 |
| A436 | WG 20 horn | Flann | 20240-20 | 330 |
| C1065 | Cable | Rosenberger | UFA210-1-7872 | 0985 |
| C1080 | Cable | Rosenberger | FA210A1030 M5050 | 28464-1 |
| C178 | Cable | Rosenberger | UFA210A-1-1181-70x70 | None |
| C461 | Cable | Rosenberger | UFA210A-1-1182-704704 | 98H0305 |
| C468 | Cable | Rosenberger | UFA210A-1-3937-504504 | 98L0440 |

**Test Equipment Used (Continued)**

| RFI No. | Instrument | Manufacturer | Type No. | Serial No. |
|---|---|---|---|---|
| M003 | Spectrum Monitor | Rohde & Schwarz | EZM | 883 580/008 |
| M023 | ESVP Receiver | Rohde & Schwarz | ESVP | 872 991/027 |
| M028 | FSB Spectrum Analyser | Rohde & Schwarz | FSB | 860 001/009 (RF), 860 161/007 (Display) |
| M069 | ESMI Spectrum Analyser / Receiver | Rohde & Schwarz | ESMI | 829 808/007 (DU) / 827 063/008 (RU) |
| M1069 | Diode Power Sensor | Rohde & Schwarz | NRV-Z2 | 838824/010 |
| S201 | Site 1 | RFI | 1 | |
| S202 | Site 2 | RFI | 2 | S202-15011990 |

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

## Appendix 2. Test Configuration Drawings

This appendix contains the following drawings:

| Drawing Reference Number | Title |
|---|---|
| DRG\45320JD09\EMIRAD | Test configuration for measurement of radiated emissions |

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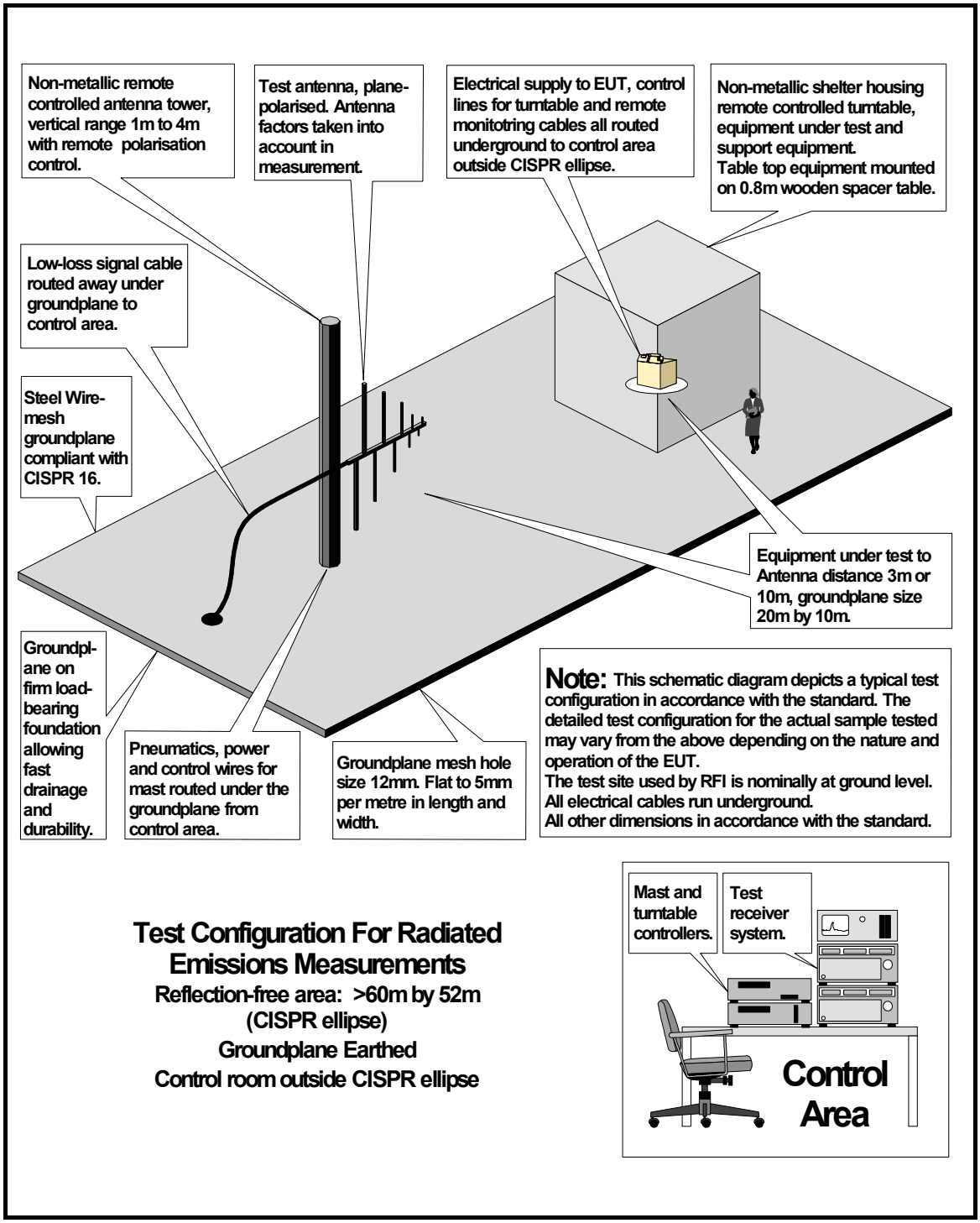
**DRG\45320JD09\EMIRAD**




**Test Configuration For Radiated Emissions Measurements**
**Reflection-free area: >60m by 52m**
**(CISPR ellipse)**
**Groundplane Earthed**
**Control room outside CISPR ellipse**