

# TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: e2v technologies Ltd.  
DA5823-033 Mass Movement Sensor

To: FCC Part 15.245

**Test Report Serial No:**  
RFI/MPTB2/RP45946JD03A

**Supersedes Test Report Serial No:**  
RFI/MPTB1/RP45946JD03A

<b>This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director:</b>  	<b>Checked By: Tony Henriques</b>  
<b>Tested By: Adam Miller</b>  	<b>Release Version No: PDF001</b>
<b>Issue Date: 03 August 2004</b>	<b>Test Dates: 08 March 2004 to 09 March 2004</b>

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Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, ENGLAND. Tel: +44 (0) 1256 851193 Fax: +44 (0) 1256 851192	Registered in England, No. 211 7901. Registered Office: Ewhurst Park, Ramsdell, Basingstoke, Hampshire RG26 5RQ	
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### **1. Customer Information**

<b>Company Name:</b>	e2v technologies Ltd.
<b>Address:</b>	Waterhouse Lane Chelmsford Essex CM1 2QU
<b>Contact Name:</b>	Mr Neil Barker

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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 customer:

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

<b>Brand Name:</b>	e2v
<b>Model Name or Number:</b>	DA5823-033
<b>Serial Number:</b>	DA5823-033-040507-00062
<b>FCC ID Number:</b>	PW9DA58233
<b>Country of Manufacture:</b>	UK
<b>Date of Receipt:</b>	08 March 2004

### **2.2. Description Of EUT**

The equipment under test is volumetric microwave Doppler radar sensor that operates at 2.45 GHz and is intended for automotive applications.

### **2.3. Modifications Incorporated In EUT**

During the course of testing the EUT was not modified.

### **2.4. Additional Information Related To Testing**

<b>Power Supply Requirement:</b>	External DC (Vehicle) supply of 12 Volts		
<b>Intended Operating Environment:</b>	In vehicle		
<b>Equipment Category:</b>	Mobile		
<b>Type of Unit:</b>	Transceiver		
<b>Interface Ports:</b>	DC connector (JAE) ILAG5-5PK-S3L2-LB		
<b>Frequency Range</b>	Fixed, Single frequency		
<b>Channel Tested</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	N/A	N/A	2452
<b>Occupied Bandwidth</b>	140 kHz		
<b>Maximum Fieldstrength @ 3 metres</b>	85.4 dB $\mu$ V/m		

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## **2.5. Support Equipment**

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

<b>Description:</b>	Programming Box*
<b>Brand Name:</b>	e2v
<b>Model Name or Number:</b>	None stated
<b>Serial Number:</b>	None stated
<b>Cable Length And Type:</b>	0.25m multicore
<b>Connected to:</b>	Interface Unit

*\*Used to set the EUT only, not present during testing*

<b>Description:</b>	Interface unit
<b>Brand Name:</b>	e2v
<b>Model Name or Number:</b>	None stated
<b>Serial Number:</b>	None stated
<b>Cable Length And Type:</b>	0.4m multicore
<b>Connected to:</b>	EUT & DC Power

<b>Description:</b>	DC Power Supply
<b>Brand Name:</b>	Instek
<b>Model Name or Number:</b>	PC-3060
<b>Serial Number:</b>	S010
<b>Connected to:</b>	Interface unit

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

#### **3.1. Test Specification**

<b>Reference:</b>	FCC Part 15 Subpart C: 2003 (Section 15.245)
<b>Title:</b>	Code of Federal Regulations, Part 15 (47CFR15) 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 (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.

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**

None.

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## **5. Operation Of The EUT During Testing**

### **5.1. Operating Conditions**

During testing, the EUT was powered by a 12V DC power supply

### **5.2. Operating Modes**

The EUT was operated in its normal operation (sensing movement)

### **5.3. Configuration And Peripherals**

The EUT was tested in the following configuration:

Connected to a DC power supply via the supplied interface box

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## **6. Summary Of Test Results**

Range Of Measurements	Specification Reference	Port Type	Compliancy Status
Transmitter Fundamental Field-Strength	C.F.R. 47 FCC Part 15: 2003 Section 15.245(b)	Antenna	Complied
Transmitter 20 dB Bandwidth	C.F.R. 47 FCC Part 2: 2003 Section 2.1049	Antenna	Complied
Transmitter Radiated Spurious Emissions	C.F.R. 47 FCC Part 15: 2003 Sections 15.245(b) & 15.209	Antenna	Complied
Transmitter Band Edge Radiated Emissions	C.F.R. 47 FCC Part 15: 2003 Sections 15.245(b) & 15.209	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.

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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. Transmitter Fundamental Field-Strength: Section 15.245(b)**

7.2.1. The EUT was configured as for radiated emissions testing as described in section 9 of this report.

7.2.2. Tests were performed to identify the maximum fieldstrength of the fundamental frequency.

#### **Peak Level Result:**

Frequency (MHz)	Antenna Polarity	Peak Detector level (dB $\mu$ V/m)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
2447.142	Horiz.	63.5	20.6	1.3	85.4	134.0	48.6	Complied

#### **Average Level Result:**

Frequency (MHz)	Antenna Polarity	Average Detector level (dB $\mu$ V/m)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
2447.142	Horiz.	37.8	20.6	1.3	59.7*	114.0	54.3	Complied

*\*Note: As the EUT employs pulsed operation (whose pulse train does not exceed 0.1 seconds), the average level of the fundamental was found by measuring the peak level of the fundamental and correcting it with the calculated duty cycle correction factor of -25.7 dB using the procedure detailed in ANSI C63.4-2001 Annex I.4 j).*

*This was calculated as follows:*

*Duty cycle = on time/100 milliseconds or period (whichever is the lesser)*

*On time = 44.44 microseconds (from Duty Cycle plot DC01)*

*Duty cycle = 44.44 / 862.22 microseconds (862.22 microseconds being the pulse period from Duty Cycle plot DC02)*

*Duty cycle = 0.052 or 5.2%*

*To obtain correction factor in dB i.e. to correct the peak reading to the average value of the fundamental in dB:*

*20 x log (0.052) = -25.7 dB*

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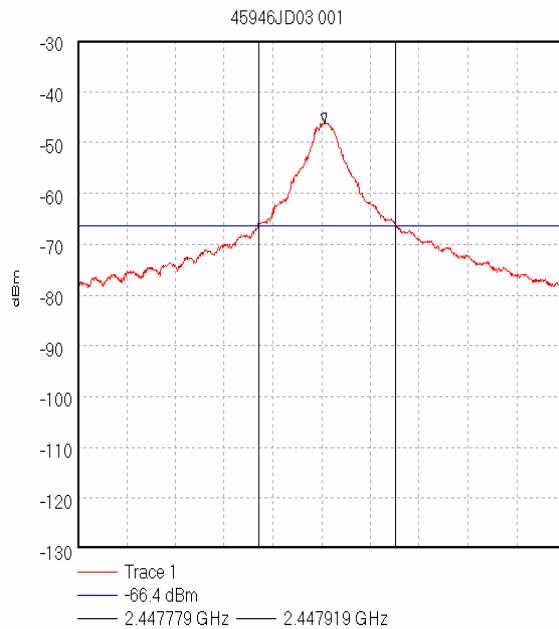
### **7.3. Transmitter 20 dB Bandwidth: Section 2.1049**

7.3.1. The EUT was configured as for 20 dB bandwidth measurements as described in Section 9 of this report.

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

#### **Results:**

Transmitter 20 dB Bandwidth (kHz)
140



Start 2.447594 GHz; Stop 2.448094 GHz  
Ref -30 dBm; Ref Offset 0.0 dB; 10 dB/div  
RBW 10.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 20.0 mS  
Peak 2.447847 GHz, -46.25 dBm  
Display Line: -66.4 dBm;  
08/03/2004 14:24:21

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#### **7.4. Transmitter Radiated Emissions: Section 15.245(b) and 15.209**

##### **7.4.1. Electric Field Strength Measurements: 30 to 1000 MHz.**

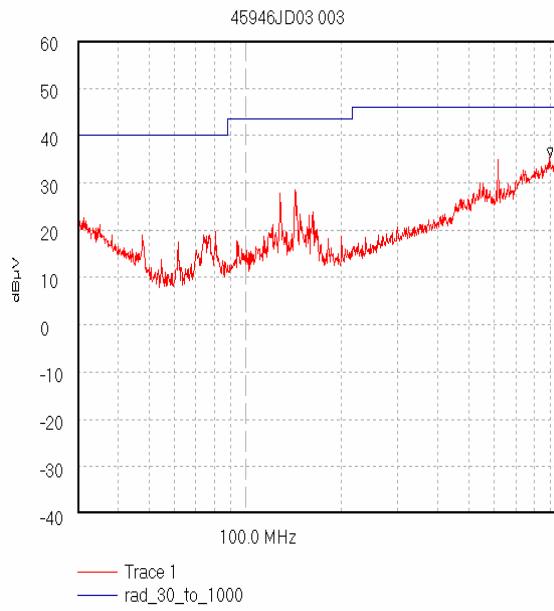
7.4.1.1. The EUT was configured as for radiated emissions testing as described in Section 9 of this report.

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

##### **Results:**

Frequency (MHz)	Antenna. Polarity	Peak Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)	Result
896.647*	Vert.	35.5	46.0	10.5	Complied

*\*Note: No spurious emissions were detected emanating from the EUT; therefore, the highest peak reading of the ambient background emissions was recorded as shown in the table above.*



Start 30.0 MHz; Stop 1.0 GHz - Log Scale  
Ref 60 dB $\mu$ V; Ref Offset 0.0 dB; 10 dB/div  
RBW 120.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 380.0 mS  
Peak 896.647 MHz, 35.47 dB $\mu$ V  
Limit/Mask: rad\_30\_to\_1000; ; Limit Test Passed  
Transducer Factors: A490  
3/8/2004 11:03:38 AM

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

*Note: The emissions at 125.0, 144.3, 162.8, 619.3 and 896.6 MHz are ambient background emissions, which do not emanate from the EUT.*

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### Transmitter Radiated Emissions (Continued)

#### 7.4.2. Electric Field Strength Measurements: 1.0 to 25.0 GHz

##### Highest Peak Level:

Frequency (MHz)	Antenna Polarity	Peak Detector level (dB $\mu$ V/m)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
4892.395	Horiz.	34.5	24.2	1.8	60.5	74.0	13.5	Complied
7338.666	Horiz.	32.6	26.9	2.2	61.7	74.0	12.3	Complied
9785.026	Horiz.	19.0	30.5	2.5	52.0	84.0	32.0	Complied
12231.175	Horiz.	28.7	30.7	2.9	62.2	74.0	11.8	Complied
14677.515	Horiz.	17.0	33.7	3.2	53.9	84.0	30.1	Complied
19569.664	Horiz.	4.9	37.0	3.6	45.5	74.0	28.5	Complied
22015.661	Horiz.	0.2	37.0	3.7	40.9	74.0	33.1	Complied

##### Highest Average Level:

Frequency (MHz)	Antenna Polarity	Average Detector level (dB $\mu$ V/m)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
4892.395	Horiz.	8.8	24.2	1.8	34.8*	54.0	19.2	Complied
7338.666	Horiz.	7.0	26.9	2.2	36.0*	54.0	18.0	Complied
9785.026	Horiz.	-6.7	30.5	2.5	26.3*	64.0	37.7	Complied
12231.175	Horiz.	3.0	30.7	2.9	36.5*	54.0	17.5	Complied
14677.515	Horiz.	-8.7	33.7	3.2	28.2*	64.0	35.8	Complied
19569.664	Horiz.	-20.8	37.0	3.6	19.8*	54.0	34.2	Complied
22015.661	Horiz.	-25.5	37.0	3.7	15.2*	54.0	38.8	Complied

\*Note: As the EUT employs pulsed operation (whose pulse train does not exceed 0.1 seconds), the average level of each emission was found by measuring the peak level of the emission and correcting them with the calculated duty cycle correction factor of -25.7 dB using the procedure detailed in ANSI C63.4-2001 Annex I.4 j).

This was calculated as follows:

Duty cycle = on time/100 milliseconds or period (whichever is the lesser)

On time = 44.44 microseconds (from Duty Cycle plot DC01)

Duty cycle = 44.44 / 862.22 microseconds (862.22 microseconds being the pulse period from Duty Cycle plot DC02)

Duty cycle = 0.052 or 5.2%

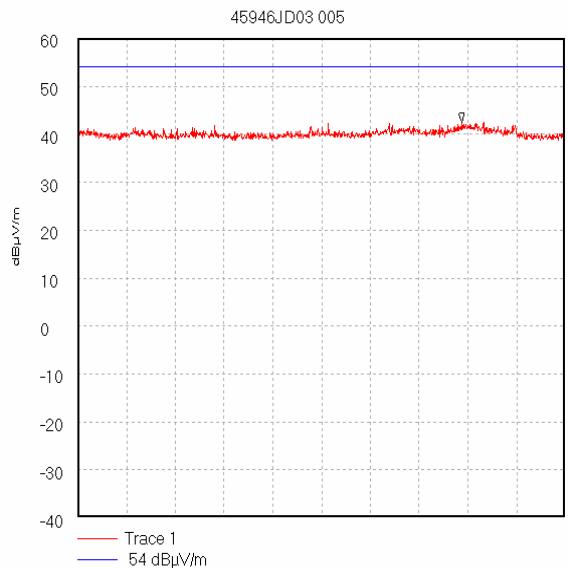
To obtain correction factor in dB i.e. to correct the peak reading to the average value of the emission in dB:

$20 \times \log (0.052) = -25.7 \text{ dB}$

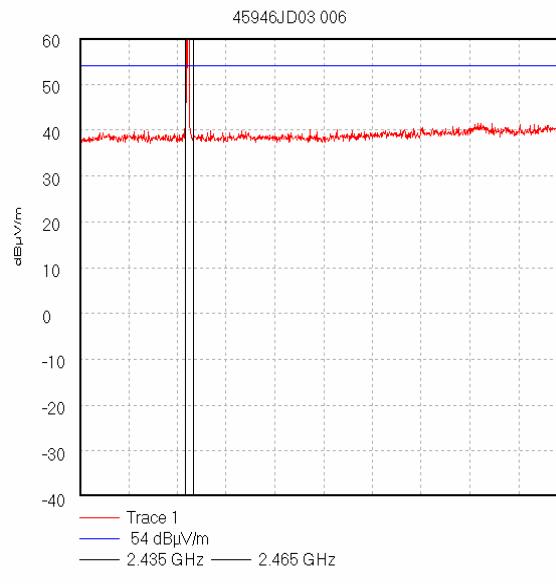
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### Transmitter Radiated Emissions (Continued)

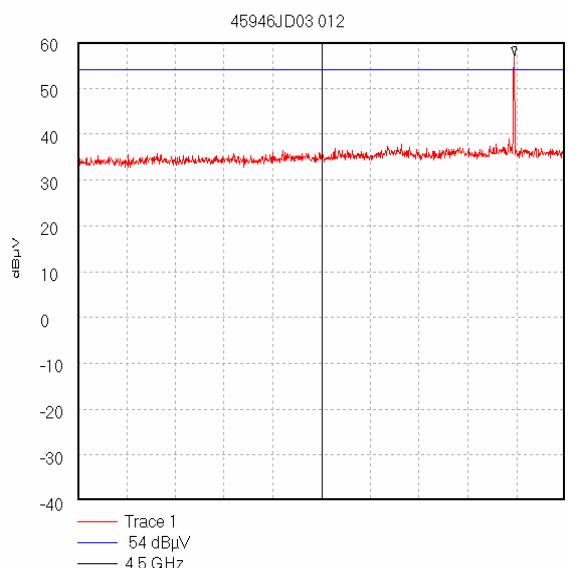
*Note: the following plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*



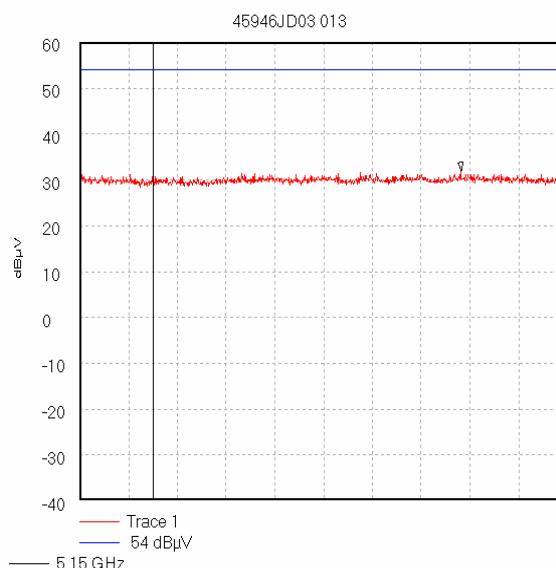
Start 1.0 GHz; Stop 2.0 GHz  
Ref 60 dB $\mu$ V/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 1.788 GHz, 42.43 dB $\mu$ V/m  
Display Line: 54 dB $\mu$ V/m; Limit Test Passed  
3/8/2004 11:25:21 AM



Start 2.0 GHz; Stop 4.0 GHz  
Ref 60 dB $\mu$ V/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 2.444 GHz, 63.98 dB $\mu$ V/m  
Display Line: 54 dB $\mu$ V/m; Limit Test Failed  
3/8/2004 11:31:40 AM



Start 4.0 GHz; Stop 5.0 GHz  
Ref 60 dB $\mu$ V; Ref Offset 2.2 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 4.896 GHz, 57.19 dB $\mu$ V  
Display Line: 54 dB $\mu$ V; Limit Test Failed  
09/03/2004 11:08:21



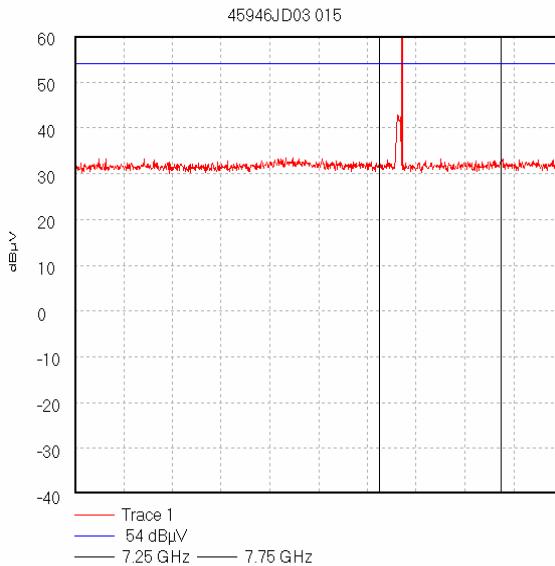
Start 5.0 GHz; Stop 6.0 GHz  
Ref 60 dB $\mu$ V; Ref Offset 2.2 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 5.782 GHz, 32.02 dB $\mu$ V  
Display Line: 54 dB $\mu$ V; Limit Test Passed  
09/03/2004 11:10:02

*Note: the frequency lines shown on plots 45946JD03 012 & 013 show the start and finish of restricted frequency band 4.5 to 5.15 GHz*

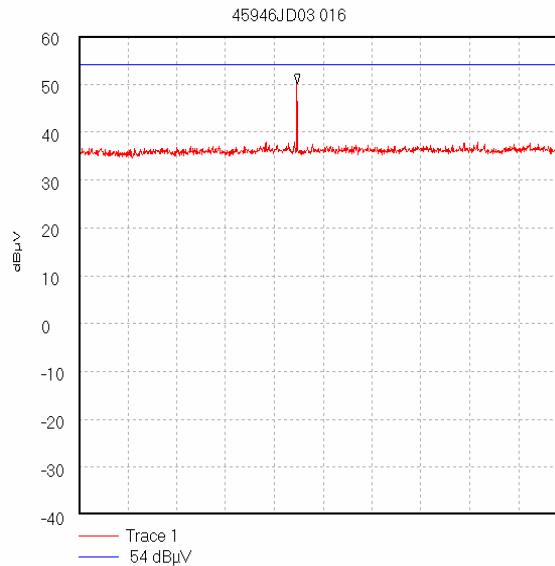
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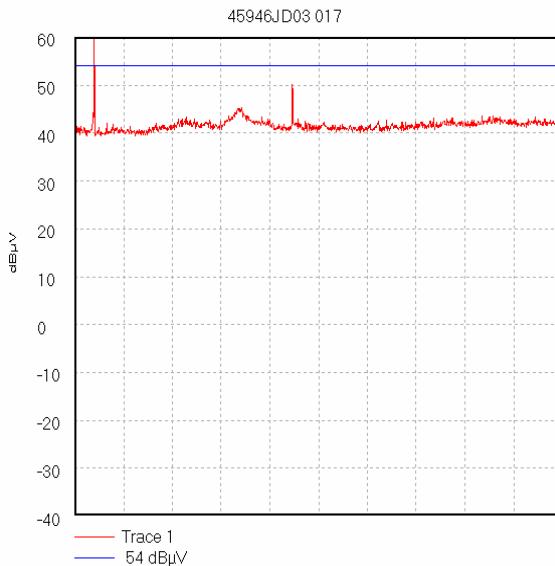
**Transmitter Radiated Emissions (Continued)**



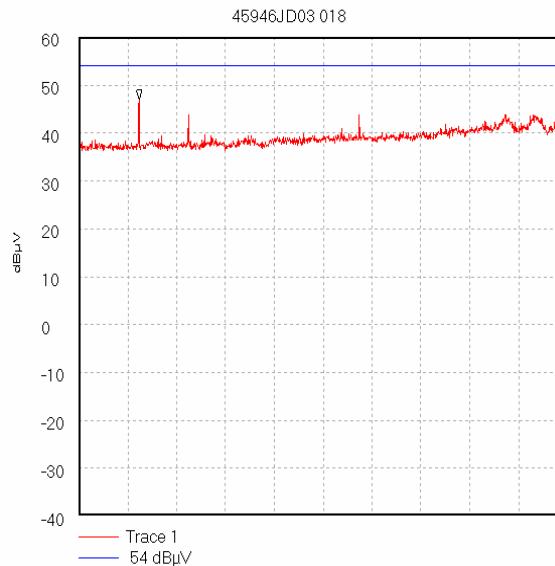
Start 6.0 GHz; Stop 8.0 GHz  
Ref 60 dB $\mu$ V; Ref Offset 2.3 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 7.342 GHz, 62.03 dB $\mu$ V  
Display Line: 54 dB $\mu$ V; ; Limit Test Failed  
09/03/2004 11:43:51



Start 8.0 GHz; Stop 12.0 GHz  
Ref 60 dB $\mu$ V; Ref Offset 2.2 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 40.0 mS  
Peak 9.787 GHz, 50.05 dB $\mu$ V  
Display Line: 54 dB $\mu$ V; ; Limit Test Passed  
09/03/2004 11:51:15



Start 12.0 GHz; Stop 18.0 GHz  
Ref 60 dB $\mu$ V; Ref Offset 3.6 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 40.0 mS  
Peak 12.24 GHz, 61.01 dB $\mu$ V  
Display Line: 54 dB $\mu$ V; ; Limit Test Failed  
09/03/2004 13:14:37



Start 18.0 GHz; Stop 25.0 GHz  
Ref 60 dB $\mu$ V; Ref Offset 5.0 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 60.0 mS  
Peak 18.863 GHz, 46.98 dB $\mu$ V  
Display Line: 54 dB $\mu$ V; ; Limit Test Passed  
09/03/2004 13:30:30

*Note: the frequency lines shown on plot 45946JD03 015 shows the start and finish of restricted frequency band 7.25 to 7.75 GHz*

*Note: The emission at 18.863 GHz shown on plot 45946JD03 018 is a background ambient emission which does not emanate from the EUT.*

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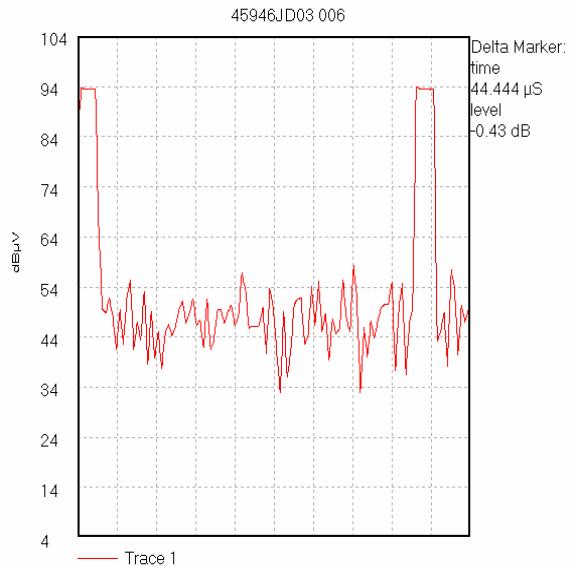
### Transmitter Radiated Emissions (Continued)

#### Duty Cycle Plots

DC01

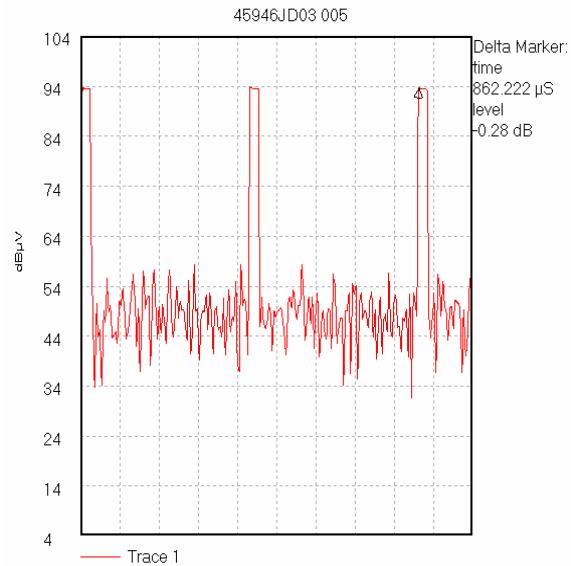
DC02

##### Transmit On Time



Start 2.447864 GHz; Stop 2.447864 GHz  
Ref 104 dBµV; Ref Offset 27.0 dB; 10 dB/div  
RBW 689.655172 kHz; VBW 1.0 MHz; Att 10 dB; Swp 1.0 mS  
Marker 862.222 µS, 93.97 dBµV  
Delta 906.666 µS, 93.54 dBµV  
08/03/2004 15:10:29

##### Pulse Period



Start 2.447864 GHz; Stop 2.447864 GHz  
Ref 104 dBµV; Ref Offset 27.0 dB; 10 dB/div  
RBW 689.655172 kHz; VBW 1.0 MHz; Att 10 dB; Swp 2.0 mS  
Marker 862.222 µS, 94.0 dBµV  
Delta 1.724444 mS, 93.72 dBµV  
08/03/2004 15:06:42

*Note: The Duty Cycle Plots above incorrectly show the Resolution Bandwidth (RBW) to be 689.655172 kHz. This is due to a glitch in the software used to transpose the on-screen image on the spectrum analyser to the PC holding the soft copy of the plot. It is confirmed that the measurements were made using a Resolution Bandwidth of 1 MHz.*

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### **7.5. Transmitter Radiated Emissions At Band Edges: Section 15.245(b) and 15.209**

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

7.5.2. Tests were performed to identify the maximum radiated band edge emission levels.

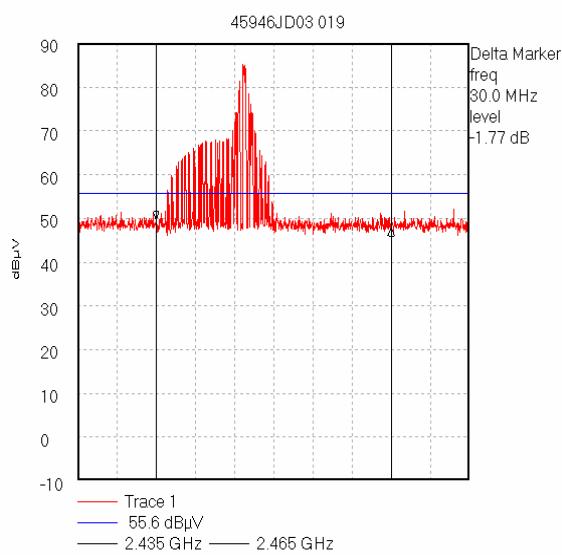
7.5.3. As previously calculated, a duty cycle correction factor of -25.7 dB was applied to the peak measurements in order to calculate the average levels given in the table below.

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

Frequency (MHz)	Antenna Polarity	Peak Detector level (dB $\mu$ V/m)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
2435	Horiz.	27.7	20.6	1.3	49.6	74.0	24.4	Complied
2465	Horiz.	27.4	20.6	1.3	49.3	74.0	24.7	Complied

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

Frequency (MHz)	Antenna Polarity	Average Detector level (dB $\mu$ V/m)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
2435	Horiz.	2.0	20.6	1.3	23.9	54.0	30.1	Complied
2465	Horiz.	1.7	20.6	1.3	23.6	54.0	30.4	Complied



Start 2.425 GHz; Stop 2.475 GHz  
Ref 90 dB $\mu$ V; Ref Offset 1.6 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 5 dB; Spw 20.0 mS  
Marker 2.435 GHz, 49.55 dB $\mu$ V  
Delta 2.465 GHz, 47.78 dB $\mu$ V  
Display Line: 55.6 dB $\mu$ V; ; Limit Test Failed  
09/03/2004 14:50:18

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## **8. Measurement Methods**

### **8.1. 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 from of swept scans in a shielded enclosure were preformed in order to identify 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 at a measurement distance of 3 m. Following the initial scans, graphs were produced giving an overview of the emissions from the emissions from the EUT plotted against the appropriate specification limit. Any emissions within 20 dB of the limit were then measured on the open area test site, except in 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 turntable on a standard test site complaint 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 1m and 4m 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 of the EUT. At this point the horn was ;locked off and the turntable was again rotated 360° t maximise the target signal. It should be noted that the receive 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 horns.

At this point, any signal 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 under 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.

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### **Radiated Field Strength Emissions (Continued)**

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

<b>Receiver Function</b>	<b>Initial Scan</b>	<b>Final Measurements Below 1 GHz</b>	<b>Final Measurements Above 1 GHz</b>
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak / Average
Mode:	Max Hold	Not Applicable	Max Hold
Bandwidth:	(120 KHz < 1 GHz) (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

### **Duty Cycle Correction factor procedure**

As the EUT employs pulsed operation the average level of emission was found by measuring the peak level of the emission and correcting it with the duty cycle correction factor, which was obtained as follows:

The EUT (in its normal operating mode) was switched on, transmitting its pulse train continuously. A spectrum analyzer was set to the transmitter carrier frequency with its Resolution Bandwidth (RBW) set wide enough to encompass all significant spectral components, an RBW of 1 MHz was used. The Video Bandwidth was set to 1 MHz. The frequency span was set to 0 Hz. The sweep time was set to a period long enough to capture the entire pulse train period including the Transmit On Time pulse. The Transmit On Time pulsewidth was measured and a plot taken.

The sweep time was then extended to cover a period in excess of the entire pulse train period to demonstrate whether or not the pulse train exceeded 100 ms. A sweep time of 2 ms was sufficient to demonstrate this. A plot of this was taken.

If the pulse train was less than 100 ms, including blanking intervals, the duty cycle was calculated by averaging the sum of the pulse widths over one complete pulse train. If the pulse train exceeded 100 ms, the duty cycle was calculated by averaging the sum of the pulsewidths over the 100 ms width with the highest average value. The duty cycle is the value of the sum of the pulse widths in one period (or 100 ms), divided by the length of the period (or 100 ms) i.e. Duty cycle = on time/100 milliseconds or period (whichever is the lesser).

To obtain the duty cycle correction factor in dB i.e. to correct the peak reading to the average value of the emission in dB the following formula was used:

*Correction factor in dB = 20 x log (Duty cycle in linear terms)*

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### **8.2. Transmitter 20 dB Bandwidth**

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

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 culture the profile of the signal. The peak level was than determined, and a reference line was drawn 20 dB below the peak level. The bandwidth was determined at these points where the 20 dB reference crossed the profile of the emissions.

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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".

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
20 dB 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.
A027	Horn Antenna	Eaton	9188-2	301
A031	2 to 4 GHz Eaton Horn Antenna	Eaton	91889-2	557
A1037	Chase Bilog Antenna	Chase EMC Ltd	CBL6112B	2413
A254	WG 14 Microwave Horn	Flann Microwave	14240-20	139
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
A553	Bi-log Antenna	Chase	CBL6111A	1593
C1078	Rosenberger 3m Cable	Rosenberger	FA210A1030 M5050	28464-2
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)
M505	Analyser Display Unit	Rohde & Schwarz	ESAI-D	825316/010
M506	RF unit	Rohde & Schwarz	ESBI-RF	827060/004
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.

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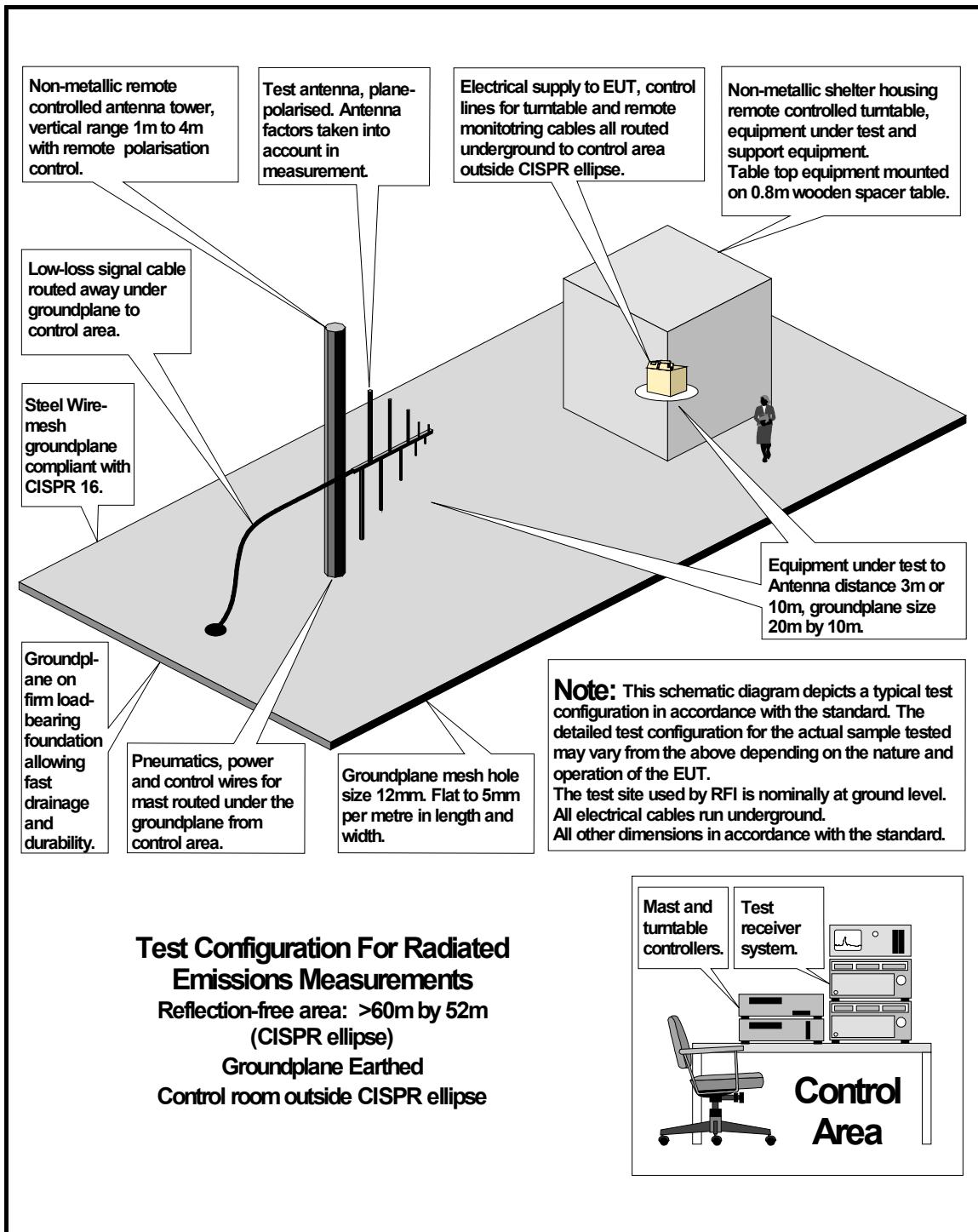
## **Appendix 2. Test Configuration Drawings**

This appendix contains the following drawings:

<b>Drawing Reference Number</b>	<b>Title</b>
DRG\45946JD03\EMIRAD	Test configuration for measurement of radiated emissions
DRG\45946JD03\001	Schematic diagram of the EUT, support equipment and interconnecting cables used for the test

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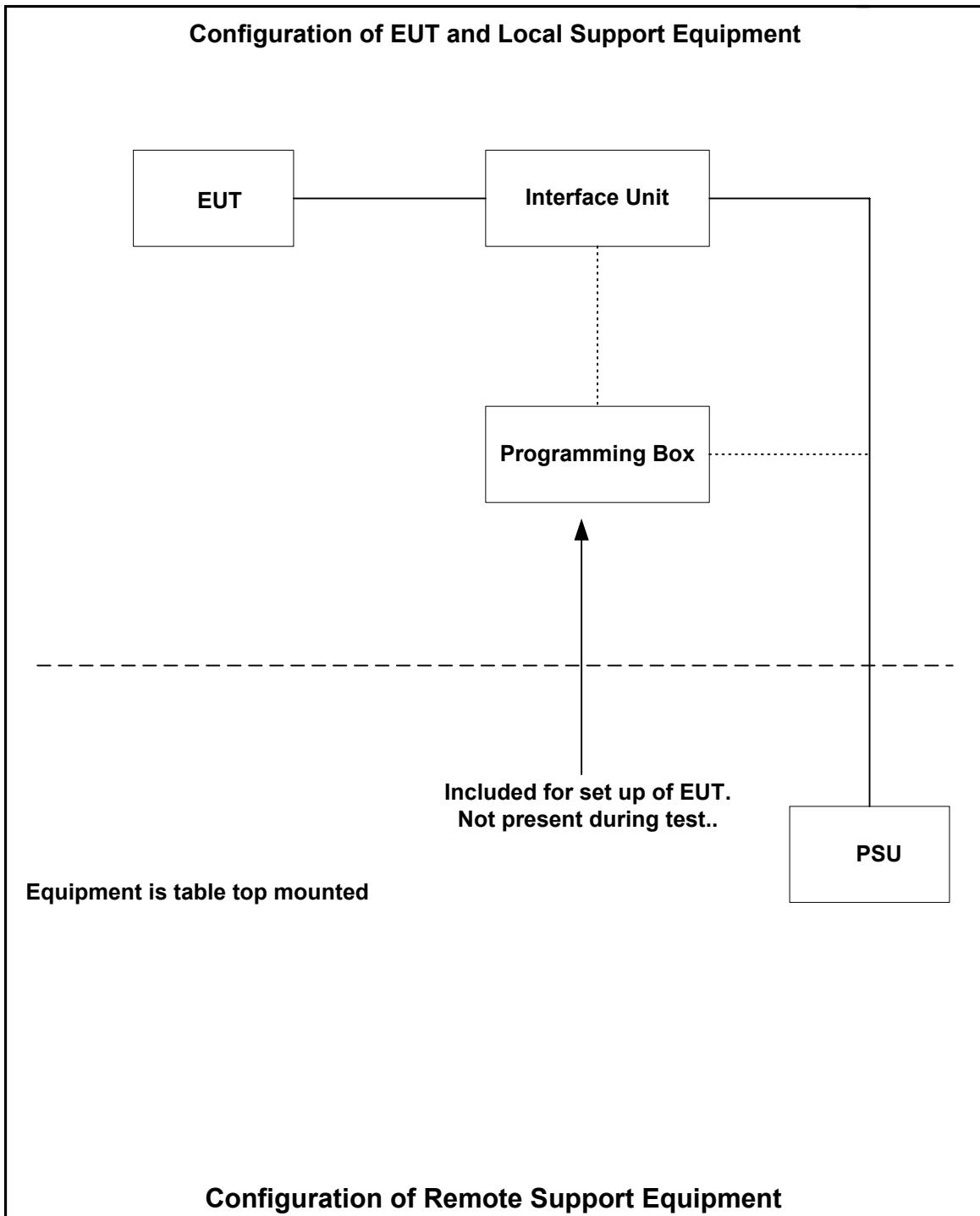
DRG\45946JD03\EMIRAD



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DRG\45946JD03\001



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