TEST REPORT
FROM
RFI GLOBAL SERVICES LTD

Test of: Orthogon Systems.
Spectra 58100

To: FCC Part 15.247: 2004 (Subpart C)

Test Report Serial No:
RFI\MPTE3\RP47705JD01A

Supersedes Test Report Serial No:
RFI/EMC2/RP47705JD01A

This Test Report Is Issued Under The Authority Of Andrew Brown, Operations Manager: **pp**	
Tested By: Fara Razally	**Checked By: Nigel Davison**
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1. Client Information

Company Name:	Orthogon Systems.
Address:	Unit A1 Linhay Business Park Eastern Road Ashburton Devon TQ13 7UP
Contact Name:	Mr C Fisher

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:	ODU
Brand Name:	Spectra
Model Name or Number:	2302/3
MAC Address:	E2303080017E
Country of Manufacture:	United Kingdom
FCC ID:	QWP58100
Date of Receipt:	16 June 2005

Description:	PIDU
Brand Name:	Spectra
Model Name or Number:	E083105A
MAC Address:	PS004 Rev. E02
Country of Manufacture:	China
FCC ID:	QWP58100
Date of Receipt:	16 June 2005

2.2. Description of EUT

The equipment under test is a high-speed wireless Ethernet bridge system, operating in the 5.8 GHz band.

The following statement was made by Orthogon Systems at the time of the test:

"A system is currently approved to FCC 15.247 (FCC ID QWP58100).
This system comprises identical hardware at each end of the link. Each end of the link has a power indoor unit (PIDU) and an outdoor unit (ODU) containing all the microwave parts."

2.3. Modifications Incorporated in EUT

The EUT was fitted with a grounding connection, within the ODU, connecting the board ground to the metal casing of the ODU.

2.4. Additional Information Related to Testing

Power Supply Requirement:	Nominal 115 V 60 Hz AC mains supply.		
Intended Operating Environment:	Commercial		
Equipment Category:	Broadband Radio Access Network, Fixed Link		
Type of Unit:	Base Station (Fixed Use)		
Interface Ports:	1. Network Ethernet on PIDU 2. PIDU to ODU 3. AC input		
Transmit Frequency Range:	5742 MHz to 5832 MHz		
Transmit Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	1	5742
	Middle	5	5792
	Top	10	5832
Receive Frequency Range:	5742 MHz to 5832 MHz		
Receive Channels Tested:	**Channel ID**	**Channel Number**	**Channel Frequency (MHz)**
	Bottom	1	5742
	Middle	5	5792
	Top	10	5832

2.5. Support Equipment

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

Description:	Laptop
Brand Name:	Compaq
Model Name or Number:	E700
Serial Number:	1J01DC64D014
Cable Length and Type:	Not connected during test
Connected to Port:	Not connected during test

3. Test Results

Reference:	FCC Part 15.247: 2004 Subpart C
Title:	Code of Federal Regulations, Part 15.247 (47CFR22) (Intentional Radiators operating within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz)

3.1. Methods and Procedures

The methods and procedures used were as detailed in:

ANSI/TIA-603-B-2003
Land Mobile Communications Equipment, Measurements and performance Standards

ANSI C63.2 (1987)
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.

3.2. 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

Partial testing only, to satisfy the requirements for permissive change.

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 mode tests, the EUT was put into “master” mode.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration:

The ODU was connected to the PIDU by a 1.0m Cat 5 cable.
A laptop was used to configure the EUT but then removed during the test.

6. Summary of Test Results

Range of Measurements	Specification Reference	Port Type	Compliancy Status
Transmitter AC Conducted Emissions (150 kHz to 30 MHz)	C.F.R. 47 FCC Part 15: 2004 Section 15.207	AC Mains	Complied
Transmitter Radiated Emissions	C.F.R. 47 FCC Part 15: 2004 Sections 15.247(d) & 15.209(a)	Antenna	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.

7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

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.

7.1.1. Testing was previously performed under Job Number 47402JD01. At client request, partial testing to FCC Part 15.247: 2004 was performed, only to satisfy the requirements of permissive change.

7.1.2. The client stated that it was not possible to set the device into a standby mode and thus FCC 15.107 and 15.109 were not performed. Only FCC Part 15.207 and 15.209 were performed.

7.2. Test Results

7.2.1. Transmitter AC Conducted Spurious Emissions: Section 15.207

The EUT was configured for ac conducted emission measurements as described in section 9 of this report.

Tests were performed to identify the maximum emission levels present on the ac mains line of the EUT.

Results: Top Channel

Quasi-Peak Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.17944	Neutral	44.99	64.51	19.52	Complied
0.23964	Live	46.28	62.11	15.83	Complied
0.35784	Neutral	39.73	58.78	19.04	Complied
0.42164	Neutral	36.43	57.42	20.99	Complied
0.53807	Neutral	32.67	56.00	23.33	Complied
0.89955	Neutral	31.35	56.00	24.65	Complied
1.20010	Neutral	30.87	56.00	25.13	Complied
4.86261	Neutral	26.68	56.00	29.32	Complied
27.42489	Live	36.63	60.00	23.37	Complied

Average Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Level (dBμV)	Limit (dBμV)	Margin (dB)	Result
0.17944	Neutral	39.30	54.51	15.21	Complied
0.23964	Live	41.71	52.11	10.40	Complied
0.35784	Neutral	37.65	48.78	11.12	Complied
0.42164	Live	34.85	47.42	12.57	Complied
0.53807	Neutral	31.35	46.00	14.65	Complied
0.89955	Neutral	30.08	46.00	15.92	Complied
1.20010	Neutral	29.14	46.00	16.86	Complied
4.86261	Neutral	21.60	46.00	24.40	Complied
27.42489	Live	33.03	50.00	16.97	Complied

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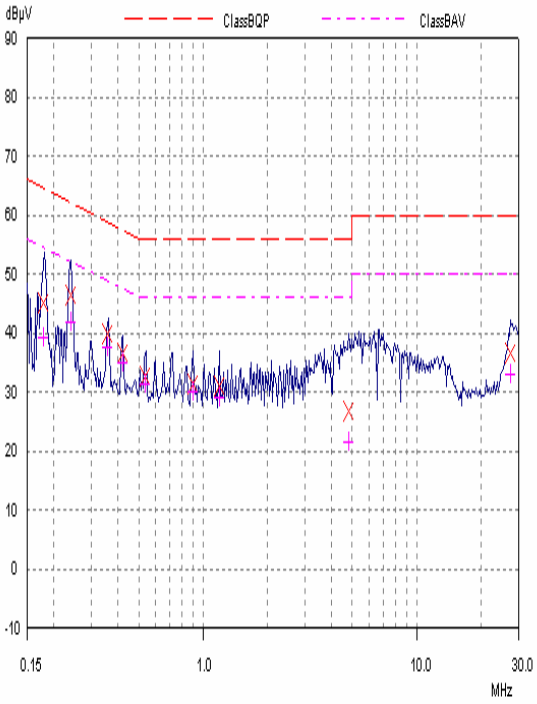
Transmitter AC Conducted Spurious Emissions: Section 15.207 (Continued)



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

7.2.2. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions occurring in the restricted bands)

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

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

Results:

Top Channel

Frequency (MHz)	Antenna Polarity	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
399.999	Horiz	43.7	46.0	2.3	Complied

7.2.3. Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions outside the restricted bands)

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

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

EIRP = 30.6 dBm/100kHz, This was the output power as measured in a 100 kHz bandwidth in accordance with FCC Part 15.247 (d) and corrected to a field strength using $E = \sqrt{(30xPxG)}/d$ where E is the equivalent field strength, P is the radiated EIRP G is the antenna gain and d is the test distance.

Results:

Top Channel

Frequency (MHz)	Antenna Polarity	Peak Level (dBμV/m)	-20 dBc Limit (dBμV/m)	Margin (dB)	Result
360.003	Horiz	22.0	105.8	83.8	Complied
375.004	Horiz	27.4	105.8	78.4	Complied
439.972	Vert	35.2	105.8	70.6	Complied
499.175	Vert	17.3	105.8	88.5	Complied
520.000	Vert	11.2	105.8	94.6	Complied
560.002	Vert	17.3	105.8	88.5	Complied

Note(s):

1. *The preliminary scans showed similar emission levels for each mode below 1 GHz, therefore final radiated emissions measurements were performed with the EUT set to the top channel only.*

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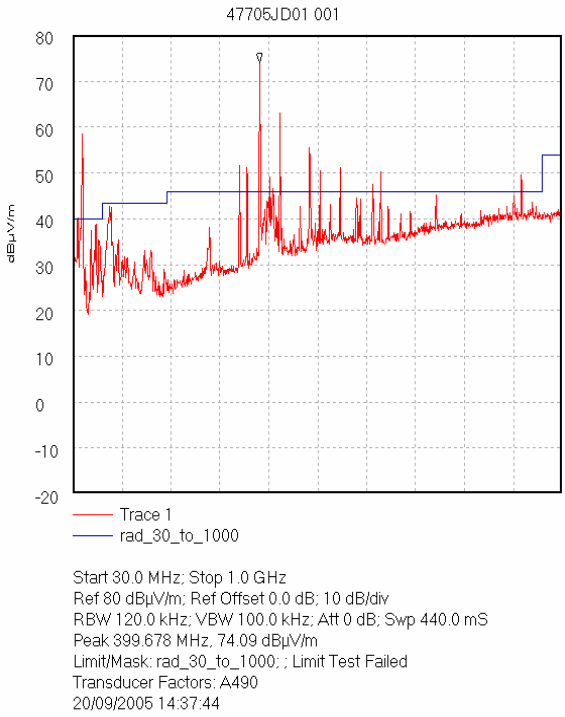
Transmitter Radiated Emissions: Section 15.247(d) and 15.209(a) - Electric Field Strength Measurements: 30 to 1000 MHz (emissions outside the restricted bands) (Continued)



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

8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

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

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

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
AC Conducted Spurious Emissions	0.15 MHz to 30 MHz	95%	±3.25 dB
Radiated Spurious Emissions	30 MHz to 1000 MHz	95%	± 5.26 dB
Radiated Spurious Emissions	1 GHz to 40 GHz	95%	±1.78 dB

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

9. Measurement Methods

9.1. 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 110V 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

9.2. 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.

Where an emission fell inside a restricted band, measurements were made at the appropriate test distance using a measuring receiver with a quasi peak detector for measurements below 1000 MHz and an average and peak detector for measurements above 1000 MHz. A peak detector was used for all other measurements.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2003 Clause 5.4.

All measurements on the open area test site were performed using broadband antennas in both vertical and horizontal polarisations.

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.

Radiated Emissions (Continued)

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 dBμV plus cable loss and antenna factor.

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

Receiver Function	Initial Scan	Final Measurements <1 GHz	Final Measurements ≥1 GHz
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

Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A1069	ESH3-Z5	Rohde & Schwarz	ESH3-Z5	837469/012
A1259	Insertion Unit	R&S	URY-Z2	892 021/48
A1360	ESH3-Z2 Pulse Limiter	Rohde & Schwarz	ESH3-Z2	A1360-20112003
A276	OATS Positioning Controller	Rohde & Schwarz	HCC	
A288	Bilog Antenna	Chase	CBL6111A	1589
A392	3 dB attenuator (9)	Suhner	6803.17.B	None
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M023	ESVP Receiver	Rohde & Schwarz	ESVP	872 991/027
M090	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:838494/005 RU:836833/001
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
S012	D.C. PSU	INSTEK	PS-6010	9564304
S201	Site 1	RFI	1	
S212	Site 12	RFI	12	

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\47705JD01\EMIRAD	Test configuration for measurement of radiated emissions.

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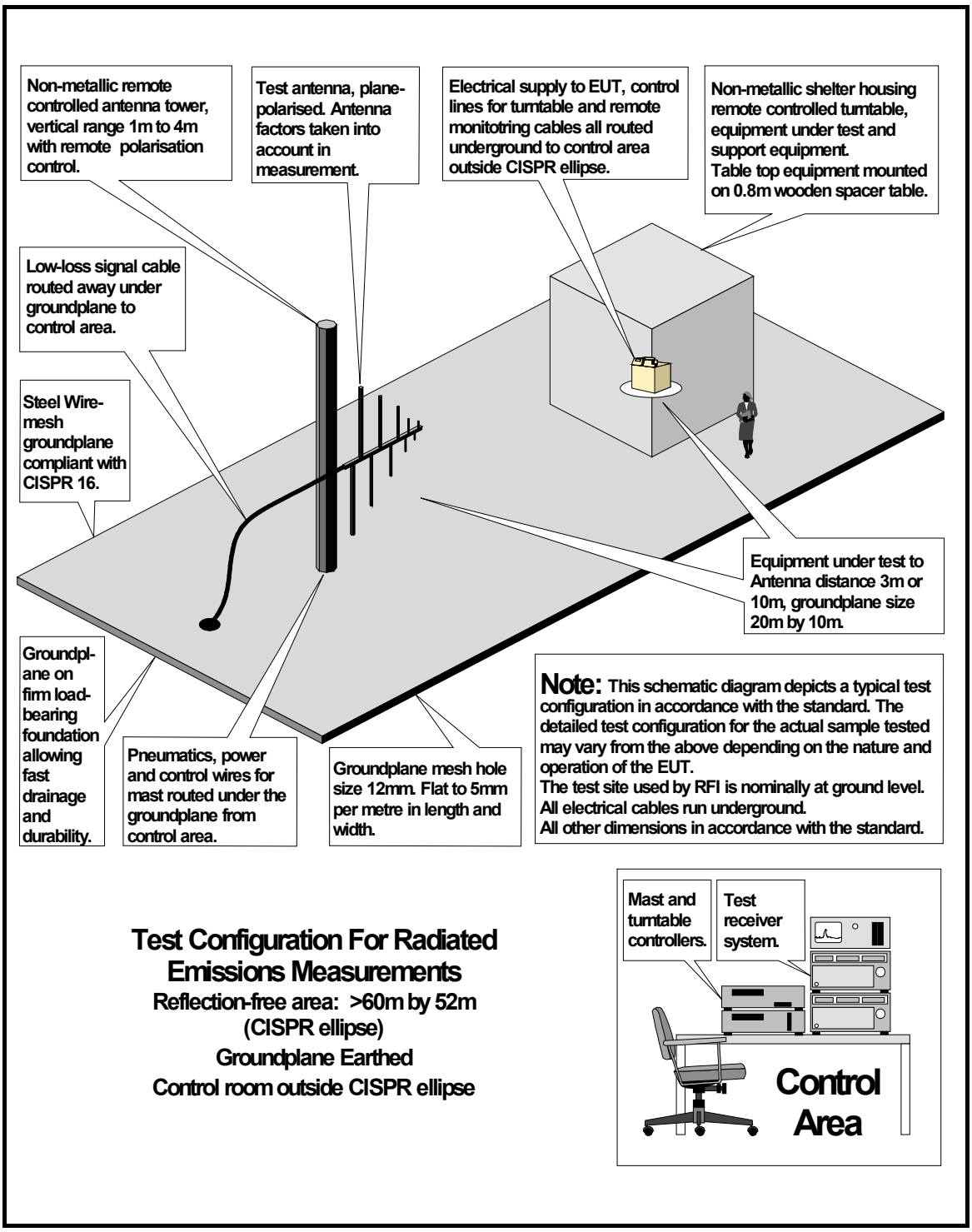
DRG\47705JD01\EMIRAD



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

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