TEST REPORT
FROM
RADIO FREQUENCY
INVESTIGATION LTD.

Test Of: Raytheon Marine Pathfinder R75RC
To: FCC Part 80 and FCC Part 2

[Leisure Marine Equipment]

Test Report Serial No:
RFI/MICB2/RP38756JD01

This Test Report Is Issued Under The Authority Of Brian Watson Technical Director:	**Checked By:**
Written By:	**Release Version No: PDF 03**
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1. Client Information

Company Name:	Raytheon Marine Ltd
Address:	Anchorage Park Portsmouth Hants PO3 5TD
Contact Name:	Mr C Bird

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:	Raytheon
Model Name or Number:	'Pathfinder' R75RC radar, comprising: 5S, (Scanner) R70RC, (Display)
Unique Type Identification:	M92654 (Scanner) M92672 (Display) M92693 (Array)
Serial Number:	005 (Scanner) EMC004 (Display)
Country of Manufacture:	England
FCC ID Number:	ASLMTX5
Date of Receipt:	6 April 1999

2.2. Description Of EUT

Scanner unit: 4kW X band radar unit with 48 inch open array antenna.
Display unit: 7 inch C.R.T. with HSB and chart facility.

2.3. Modifications Incorporated In EUT

None stated by client.

2.4. Additional Information Related To Testing

Power Supply Requirement:	Nominal 12, 24 and 32V dc Supplies
Intended Operating Environment:	Leisure Marine Vessels
Weight:	Scanner 24 kg; Array 6 kg, Display 4.3 kg
Dimensions:	Scanner 300 x 420 x 320 mm CRT Display 240mm x 220mm x 260mm
Interface Ports:	Scanner to Display Power and 2 x NMEA IN Seatalk NMEA OUT HSB, point-to-point

2.5. Support Equipment

No support equipment was required to exercise the EUT during testing.

3. Test Specification, Methods & Procedures

3.1. Test Specification

Reference:	FCC Part 80 and FCC Part 2
Title:	Code of Federal Regulations, Part 80 (47CFR) Stations in the maritime services Code of Federal Regulations, Part 2 (47CFR) Frequency Allocations and radio treaty matters; general rules and regulations
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 verification.

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 (1992)
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 (1987)
Title: Specification for Radio Interference measuring apparatus and measurement methods.

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

2.987(d) Modulation characteristics – *Other types of equipment.* No curves supplied.

5. Operation Of The EUT During Testing

5.1. Operating Conditions

5.1.1. 9kHz to 1GHz: The EUT was located in a covered turntable site on the 3m open area test site environment for radiated emissions.

5.1.2. 1GHz to 95GHz: The EUT was located in a covered 3m open area test site for radiated emissions.

5.1.3. The EUT was located in a laboratory environment for all other tests.

5.1.4. During testing, the EUT was powered by a Nominal 12V dc supply.

5.2. Operating Modes

The EUT was tested in the following operating modes:

5.2.1. Radiated emissions: Transmitting into a non-reflective load with the transmitter set to a 450ns pulse width, 1.6kHz PRF. This mode was defined by the client as being likely to be the worst case with regards EMC.

5.2.2. Variation of transmit frequency with voltage and temperature: The transmitter was set to the half nautical mile range and the six nautical mile range, 60ns and 1000ns pulse width.

5.2.3. For other testing, the pulse widths were: 60ns (0.5 mile range), 90ns (0.5 mile range), 150ns (0.75 mile range), 250ns (1.5 mile range), 350ns (1.5 mile range), 450ns (3 mile range), 600ns (3 mile range), 1000ns (6 mile range).

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

5.3.1. The EUT was in a typical configuration.

5.3.2. This mode was defined by the client as being likely to be the worst case with regards emissions.

5.3.3. Appendix 1 of this report contains a full list of test equipment used and Appendix 3 contains a schematic diagram of the test configuration.

6. Summary Of Test Results

6.1. Summary Of Tests

6.1.1. Radiated Spurious Emissions

Frequency Range	Specification Reference	Compliance Status
9kHz to 95GHz	2.993 and 80.211(f)	Complied

6.1.2. Conducted Spurious Emissions

Frequency Range	Specification Reference	Compliance Status
9kHz to 100GHz	2.1051 and 80.211(f)	Complied

6.1.3. RF Power Output

6.1.3.1. Peak Power

Nominal Pulse Width Range (ns)	Specification Reference	Compliance Status
60 to 1000	2.985(a) and 80.215(a)	Complied

6.1.3.2. Average Power

Nominal Pulse Width Range (ns)	Specification Reference	Compliance Status
60 to 1000	2.985(a) and 80.215(a)	Complied

6.1.3.3. Pulse Width

Nominal Pulse Width Range (ns)	Specification Reference	Compliance Status
60 to 1000	2.985(a) and 80.215(a)	Complied

6.1.3.4. PRF

Nominal Pulse Width Range (ns)	Specification Reference	Compliance Status
60 to 1000	2.987(d)	Complied

6.1.4. Variation of Frequency with Voltage

6.1.4.1. 60ns

Nominal Pulse Width (ns)	Specification Reference	Compliance Status
60	2.995(d)	Complied

6.1.4.2. 1000ns

Nominal Pulse Width (ns)	Specification Reference	Compliance Status
1000	2.995(d)	Complied

6.1.5. Variation of Frequency with Temperature

6.1.5.1. 60ns

Nominal Pulse Width (ns)	Specification Reference	Compliance Status
60	2.995(a)	Complied

6.1.5.2. 1000ns

Nominal Pulse Width (ns)	Specification Reference	Compliance Status
1000	2.995(a)	Complied

6.1.6. Occupied Bandwidth

Nominal Pulse Width Range (ns)	Specification Reference	Compliance Status
60 to 1000	2.1049(i) and 80.205(a)	Complied

6.1.7. Transmitter Frequency Tolerance

Nominal Pulse Width Range (ns)	Specification Reference	Compliance Status
60 to 1000	80.209(b)	Complied

6.2. 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. Details of the test methods and procedures can be found in Appendix 2 of this report.

7.1.2. The measurement uncertainties stated were calculated in accordance with the requirements of NAMAS Document NIS 81 with a confidence level of 95%. Please refer to Section 8 for details of measurement uncertainties.

7.1.3. The client declared the highest clock frequency of the EUT as 9.4GHz. Consequently, the tests were performed up to 95GHz (above tenth harmonic).

7.2. Field Strength Measurements

7.2.1. Magnetic Field Strength Measurements (Frequency Range: 9kHz to 30MHz) Electric Field Strength Measurements (Frequency Range: 30MHz to 1GHz)

7.2.1.1. Plots of the initial scans can be found in Appendix 4.

7.2.1.2. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (The results incorporate antenna factors and cable losses):

Frequency (kHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
31.720	H	81.34	134.84	53.5	Pass
63.100	H	69.36	134.84	65.5	Pass
95.000	H	65.35	134.84	69.5	Pass
126.300	H	63.19	134.84	71.7	Pass

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1]: M090, C483, A008, A007, C364, L003, L004, L005.

7.2.3. Electric Field Strength Measurements – CRT System (Frequency Range: 1GHz to 95GHz)

7.2.3.1. The client declared the highest clock frequency of the EUT as 9.4GHz. Consequently, the tests were performed up to 95GHz (above tenth harmonic).

7.2.3.2. Plots of the initial scans can be found in Appendix 4.

7.2.3.3. The following tables list frequencies at which emissions were measured using Peak detector functions.

Highest Peak Level:

Frequency Span Range (GHz)	Actual Peak Level (dBµV/m)	Peak Limit (dBµV/m)	Result
1.0 to 2.0	109.43	134.84	Pass
2.0 to 4.0	112.50	134.84	Pass
4.0 to 6.0	115.30	134.84	Pass
6.0 to 8.2	115.68	134.84	Pass
8.2 to 12.5	129.70	134.84	Pass
12.5 to 18.0	113.09	134.84	Pass
18.0 to 26.5	117.81	134.84	Pass
26.5 to 40.0	94.02	134.84	Pass
40.0 to 60.0	87.85	134.84	Pass
60.0 to 75.0	96.77	134.84	Pass
75.0 to 95.0	130.48	134.84	Pass

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1]: L003, L004, L005, M072, A031, A027, G046, C182, C184, M076C, M076D, M152, M150, M151, A440, A427, A429, A437, A438, RFI001, RFI002, RFI003.

7.3. Conducted Emissions

7.3.1. Peak Detector Measurements On RF port

7.3.1.1. Plots of the scans can be found in Appendix 4.

7.3.1.2. The following table lists frequencies at which emissions or the highest noise floor were measured using a Peak detector:

450ns Pulse

Frequency (GHz)	Level (dBm)	Limit (dBm)	Margin (dB)	Result
9kHz to 150kHz	<-32.0	-13.0	19.0	Complied
150kHz to 30MHz	<-31.2	-13.0	18.2	Complied
0.03 to 1.0	<-32.9	-13.0	19.9	Complied
1.0 to 8.0	<-31.4	-13.0	18.4	Complied
8.0 to 9.0	<-35.6	-13.0	22.6	Complied
9.5 to 12.0	<-38.5	-13.0	25.5	Complied
12.0 to 20.0	<-30.5	-13.0	17.5	Complied
20.0 to 26.5	<-34.9	-13.0	21.9	Complied
26.5 to 40.0	<-27.3	-13.0	14.3	Complied
40.0 to 60.0	<-63.2	-13.0	50.2	Complied
60.0 to 75.0	<-54.2	-13.0	41.2	Complied
75.0 to 100.0	<-35.6	-13.0	22.6	Complied

Note 1: For plots around the measurement, please refer to graphical results in Apendix 4 of this test report.

Note 2: The design of the RF coupling from the magnetron to the antenna (a RF coupled stub inside the cavity to a tuned antenna) formed an effective high pass / bandpass filter arrangement. The peak energy level of radar requires considerable attenuation in order to prevent the analyser from going into compression. This limits the maximum dBc figure that can be obtained without changing the RBW of the analyser. Since the signal is wideband compared to the RBW, it is critical to the measurement accuracy that the RBW settings remain consistent throughout the testing where possible.

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1]: M072, C228, A246, M076A, M076B, M076C, M076D.

7.4. Average Power Summary.

Pulse Width (ns)	Peak Power (kW)	P.R.F (Hz)	Pulse Width (ns)	Average Power (Watts)
60	1.521	2.9895	62.874	0.286
90	1.950	2.9940	89.820	0.524
150	2.344	2.9985	149.701	1.052
250	2.780	2.9895	252.495	2.098
350	2.838	1.9920	341.317	1.930
450	2.917	1.6000	443.114	2.068
600	2.931	1.1947	596.806	2.090
1000	3.006	0.7397	986.028	2.192

The following sub sections detail the results required to make the above calculation.

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1]: L001, L002, L005, C171, M072, C228, A246, A223, M029, A239, P003.

7.4.1. Peak Power

These measurements were performed with the HP Power Analyzer and sensor connected to the EUT via a 26 dB coupler, 20 dB in line Attenuator and microwave coax cable.

Pulse Width (ns)	Measured Power (dBm)	Corrected Power, Peak (kW)
60	61.82	1.521
90	62.90	1.950
150	63.70	2.344
250	64.44	2.780
350	64.53	2.838
450	64.65	2.917
600	64.67	2.931
1000	64.78	3.006

7.4.2. Pulse width

7.4.2.1. Plots can be found in Appendix 4.

In order to determine the characteristics of the various pulses, a power analyzer was connected, through a HP detector and an attenuator to the test set up.

Nominal Pulse Width (ns)	Measured Pulse Width (ns)
60	62.874
90	89.820
150	149.701
250	252.495
350	341.317
450	443.114
600	596.806
1000	986.028

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1] M072, A388, M058, C171, L003, L005.

7.4.2.2. PRF

7.4.2.3. Plots can be found in Appendix 4.

In order to determine the characteristics of the various pulses, an oscilloscope was connected, through an HP detector and an attenuator to the test set up.

Pulse Width (ns)	Measured P.R.F. (kHz)
60	2.9895
60	2.9940
150	2.9985
250	2.9895
350	1.9920
450	1.6000
600	1.1947
1000	0.7397

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1] M029, A388, M058, C171, L003, L005.

7.5. Variation of frequency with voltage

7.5.1. Plots can be found in Appendix 4.

7.5.2. The frequency of the EUT was measured at each voltage.

60ns

% of nominal Volts	Volts (dc)	Measured frequency (GHz)	Delta from 9.41 GHz in (MHz)
85	10.2	9.385582	-24.41
100	12.0	9.384666	-25.33
115	27.6	9.385097	-24.90

1000ns

% of nominal Volts	Volts (dc)	Measured frequency (GHz)	Delta from 9.41 GHz in (MHz)
85	10.2	9.385224	-24.78
100	12.0	9.385413	-24.59
115	27.6	9.384923	-25.08

Battery End Point: 10.2 Volts

Note: The equipment can be operated from 12 or 24 Volts sources without requiring any changes. Therefore the testing was performed at 85 % of the lowest to 115 % of the highest operating Voltage

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1] M072, A388, M058, C171, L003, L005.

7.6. Variation of frequency with Temperature

The EUT was cooled to –20 °C. After 30 minutes the EUT was turned on and allowed to stabilise until there was no measurable frequency change. The frequency was recorded and the chamber temperature stepped up by 10 °C. This process was repeated until the EUT was at + 50 °C.

60ns Pulse

Temperature °C	Measured frequency (GHz)	Delta from 9.41 GHz in MHz
-20	9.3882242	-21.78
-10	9.3877220	-22.28
0	9.388397	-21.60
+10	9.390155	-19.85
+20	9.389215	-20.79
+30	9.388122	-21.88
+40	9.389419	-20.58
+50	9.387464	-22.54

1000ns Pulse

Temperature °C	Measured frequency (GHz)	Delta from 9.41 GHz in MHz
-20	9.3928037	-17.20
-10	9.392095	-17.90
0	9.392223	-17.78
+10	9.391822	-18.18
+20	9.391120	-18.88
+30	9.390190	-19.81
+40	9.389523	-20.48
+50	9.387993	-20.07

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1]: M072, A388, M058, C171, L003, L005.

7.7. Occupied Bandwidth

7.7.1. Plots can be found in Appendix 4.

7.7.2.The storage mode of the R&S FSM spectrum analyser does not show internal detail of the pulse. Other analyser settings were attempted in order to obtain a more "dense" pattern. The one presented here proved to be the optimum.

7.7.3.The 99.5% power bandwidth was measured for each pulse mode using the special function option on the spectrum analyser.

Nominal Pulse Width (ns)	99.5% Power Bandwidth (MHz)
60	75.756
90	60.756
150	49.756
250	27.956
350	19.333
450	16.711
600	12.578
1000	10.489

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1]: E011, M072, A388, M058, C171, L003, L005.

7.8. Transmitter Frequency Tolerance

7.8.1.Specification: 80.209 (b) – "*When pulse modulation is used in land and ship radar stations operating in the bands above 2.4GHz the frequency at which maximum emission occurs must be within the authorised bandwidth and must not be closer than **1.5/T MHz** to the upper and lower limits of the authorised bandwidth where "T"is the pulse duration in microseconds.*"

7.8.2. Calculation

Authorised Bandwidth: 9300MHz to 9500MHz

Specification Limits **[Lower]** 9300 + 1.5/T
[Upper] 9500 - 1.5/T

Transmitter Frequency Tolerances
FCC ID ASLMTX5

Nominal Pulse Width (ns)	Actual Pulse Width (µs)	Specification Limits (MHz)	
		Lower	Upper
60	0.0629	9323.85	9476.15
90	0.0898	9316.70	9516.70
150	0.1497	9310.02	9489.98
250	0.2525	9305.94	9494.06
350	0.3413	9304.39	9495.61
450	0.4431	9303.39	9496.61
600	0.5968	9302.51	9497.49
1000	0.9860	9301.52	9498.48

From examining the transmitter frequency data from Variation of Frequency with Voltage and Variation of Frequency with Temperature results pages, it can be seen that the transmitter is within the calculated specification.

Test Equipment Used: [Listed under RFI asset numbers – See Appendix 1]: E011, M072, A388, M058, C171, L003, L005.

8. Measurement Uncertainty

8.1. Company Policy, as based on the NAMAS Accreditation Standard, M10, paragraph 12.11 (o), states that Test Reports shall include estimated uncertainty of the calibration or test result (this information need only appear in test reports and test certificates where it is relevant to the validity or application of the test result, where a client's instructions so require or where uncertainty affects compliance to a specification or limit).

8.2. The global uncertainties have been calculated in accordance with NAMAS NIS 81 (Edition 1, May 1994) as follows:

Measurement Type	Confidence Level	Calculated Uncertainty
Radiated Emissions: Electric Field Strength 30MHz to 1000MHz	95%	+ 3.5 / -3.3 dB
Radiated Emissions: Electric Field Strength 1GHz to 100 GHz	95%	± 4.2 dB
Conducted Power	95%	±0.5 dB
Frequency Accuracy	95%	±0.8 ppm

8.3. Measurement uncertainties have been applied in accordance with NAMAS document NIS 81 (edition 1, May 1994), and in the absence of any specification criteria, guidance, or code of practice, compliance has been judged on the basis of shared risk.

8.4. In the case of emissions tests, the measured value of the disturbance from the product sample shall be compared directly with the limits. If the measured value is equal to or less than the limit the product is deemed to pass the test.

8.5. In the case of immunity tests, the equipment is deemed to pass the test if it fulfils the stated performance criteria at the required or a higher severity level. The measurement uncertainty has been taken into account in the calibration procedures stated in the relevant basic standard.

8.6. The methods used to calculate the above uncertainties are in line with those used for calibration laboratories contained in NAMAS document NIS 3003 Edition 8 "The Expression of Uncertainty and Confidence in Measurement" May 1995, which align with international recommendations "Guide to the Expression of Uncertainty in Measurement" ISO/IEC/OIML/BIPM (Prepared by ISO/TAG 4: January 1993).

Appendix 1. Test Equipment Used

RFI Number	Device	Manufacturer	Model No	Serial No
A023	Conical Log Spiral Antenna	EMCO	3101	3118
A024	Biconical Antenna	EMCO	3104C	3540
A026	Compressor	Airmaster	POP 8/56	10916
A027	1 to 2GHz Horn antenna	Eaton	9188-2	301
A031	2 to 4GHz Horn antenna	Eaton	91889-2	557
A201	18 to 16.5GHz Horn	FMI	20240-20	266
A202	40 to 60GHz Horn	FMI	24240-20	116
A203	26.5 to 40GHz Horn	FMI	22240-20	343
A223	Diode Detector	HP	8474B	01841
A234	Co-axial switch	RS	651-650	None
A246	30 dB coaxial attenuator	Suhner	6830-17-B	None
A253	4 to 6GHz Microwave horn	FMI	12240-20	128
A254	6 to 8.2GHz Horn	FMI	14240-20	139
A255	8.2 to 12.5GHz Horn	FMI	16240-20	519
A256	12.5 to 18GHz Horn	FMI	18240-20	400
A259	Bilog antenna	Chase	CBL 6111	1513
A276	OATS positioning controller	R&S	HCC	None
A277	OATS antenna mast	R&S	HCM	None
A324	10 dB coaxial attenuator	Suhner	6820.17.B	None
A239	6 dB coaxial attenuator	Suhner	6806-17-B	
A331	20 dB waveguide 22 attenuator	FMI	22081-20	45
A347	Waveguide 25 100mm straight	FMI	25441	None
A348	Waveguide 27 100mm straight	FMI	27441	None
A388	20 dB coaxial attenuator	Suhner	6820.17.B	None
A393	20 dB coaxial attenuator	Suhner	6820.17.B	None
A427	W.G.14 Horn	Flann	14240-20	150
A429	W.G.16 Horn	Flann	16240-20	561
A437	W.G.16 Horn	Narda	640	8601
A438	W.G.18 Horn	Narda	439	8508
A440	W.G.12 Horn	Narda	643	8611

C170	3M N-type terminated cable	Rosenberger	None	None
C171	3M N-type terminated cable	Rosenberger	None	None
C181	2 metre SMA terminated cable	Rosenberger	A 3035 81 518	None
C183	2 metre SMA terminated cable	Rosenberger	UFA210A-1-0787-30X34	1039
C326	Cable	Rosenberger	UFA 210A-1-3	9600203
C327	Cable	Rosenberger	UFA 210A-1-3	96C0218
E011	Environmental Chamber	DE	WIR3-40	11-96-A2103
G051	Signal Generator	Gigatronix	7100/.01-20	749472
M002	Receiver	R&S	ESVP	882 402/001
M003	Spectrum monitor	R&S	EZM	881334/007
M004	Spectrum Monitor	R&S	EZM	881334/009
M023	Receiver	R&S	ESVP	872991/027
M024	Spectrum monitor	R&S	EZM	873 952/006
M029	500M sample/sec oscilloscope	Tektronix	2440	0120850
M058	Digital Multi Meter	Fluke	79	54940691
M069	Spectrum Analyser	R&S	ESMI	8/007 (DU)/827 063/00
M072	26.5GHz Spectrum Analyser	R&S	FSM	862967/010
M074	Thermometer / Humidity meter	Maplin	Precision Gold	None
M076	Harmonic Mixer Set	R&S	FS-Z16	831 337/002
M117	Temperature/humidity meter	RS	212-124	None
M122	Digital Multimeter	Fluke	77	64910017
M133	Humidity/temperature meter	RS	None	None
M150	RF Power Sensor	Boonton	51072	28754
M151	Power Meter	Boonton	4220	33402BE
RFI001	4 to 6GHz Horn	FMI	12240-20	134
RFI002	50 to 75GHz Horn	FMI	25240-20	None
RFI003	75 to 110GHz Horn	FMI	27240-20	None
RFI004	Waveguide 27 100mm straight	FMI	27000	None
RME001	40dB waveguide coupler	Mitec Europe	M0907-7-40F-11-11	2712-1 issue 1
RME002	Waveguide load	Mitec Europe	EM2190	3731-1
S013	HovAir Turntable	HovAir	None	None

L001	Peak Power Analyzer	HP	HP 8991A	3248A00128
L002	Peak Power Sensor	HP	HP 84812A	3318A01050
L003	26 dB W.G. coupler	Mitec Europe	M0907-7-26F-11-11	3728-1
L004	Horn antenna	CMT	TX90-1A	942117-001
L005	W.G. Load	Ferranti	16TE33	030

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

Abbreviations:

FMI:	Flann Microwave Instruments
R&S:	Rohde and Schwarz
RS:	Radio Spares Components
DE:	Design Environmental
HP:	Hewlett Packard
RFI:	Radio Frequency Investigation Ltd.

Please Note: All client supplied equipment ("L00*x*"in the above table) was fully checked by Radio Frequency Investigation Ltd. personnel prior to use.

Appendix 2. Measurement Methods

A2.1. Radiated Emissions [9kHz to 1GHz]

A2.1.1. Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for a Quasi-Peak detector.

A2.1.2. 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, and for the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

A2.1.3. 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. A tolerance line was set 20 dB below the specification limit and levels above the tolerance line were re-tested on the open area test site, at the appropriate distance, using a measuring receiver with a Quasi-Peak detector.

A2.1.4. For the main (final) measurements the EUT was arranged on a non-conducting table on an open area test site, as detailed in the specification.

A2.1.5. All measurements on the open area test site were performed using broadband antennas.

A2.1.6. On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m. 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.

A2.2. Radiated Emissions [1GHz to 95GHz]

A2.2.1 Calculating Radiated Emissions Limit Line

In defining the 134.84dBuV/m limit for the product, the product was placed on the open area test site table with the measuring equipment located at a distance of three metres.

The 48 inch open array antenna was fitted as representative of normal operation and the magnetron disconnected. The magnetron was replaced with a waveguide to coaxial adaptor and connected to a signal generator.

The signal generator was unable to reproduce the actual peak power output of the intentional radiator – measured as 2.917kW by conducted methods. Consequently, a level of 2.917mW was reproduced at the antenna port and the level on the spectrum analyser offset by +60dB.

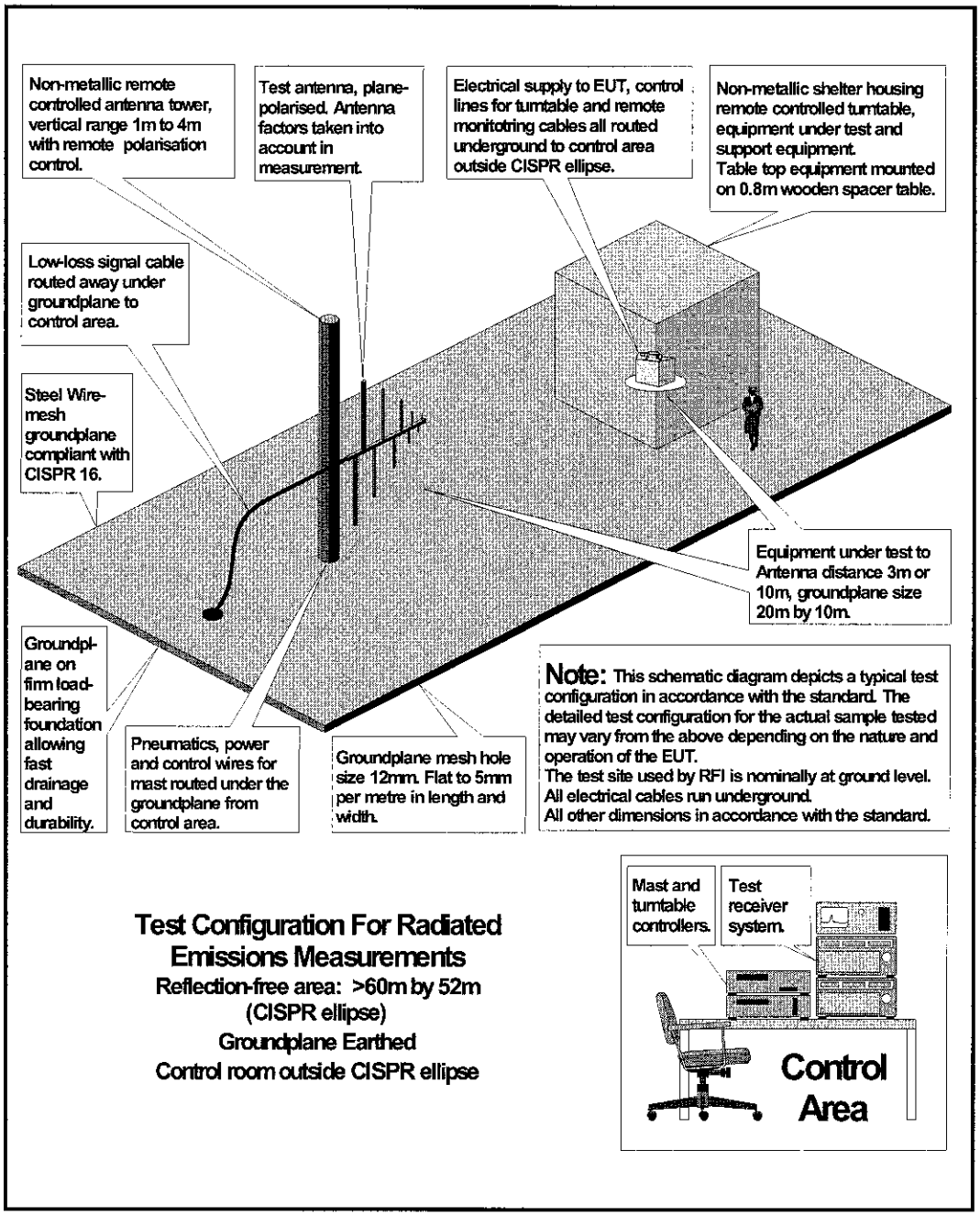
The non-reflective load was then connected to the transmitter system and the substitution measurement performed.

Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\38756\EMIRAD	Test configuration for measurement of radiated electric field
DRG\38756\001	Schematic of EUT and associated components for all conducted measurements
DRG\38756\002	Diagram of the EUT and measurement antenna for frequencies above 1GHz

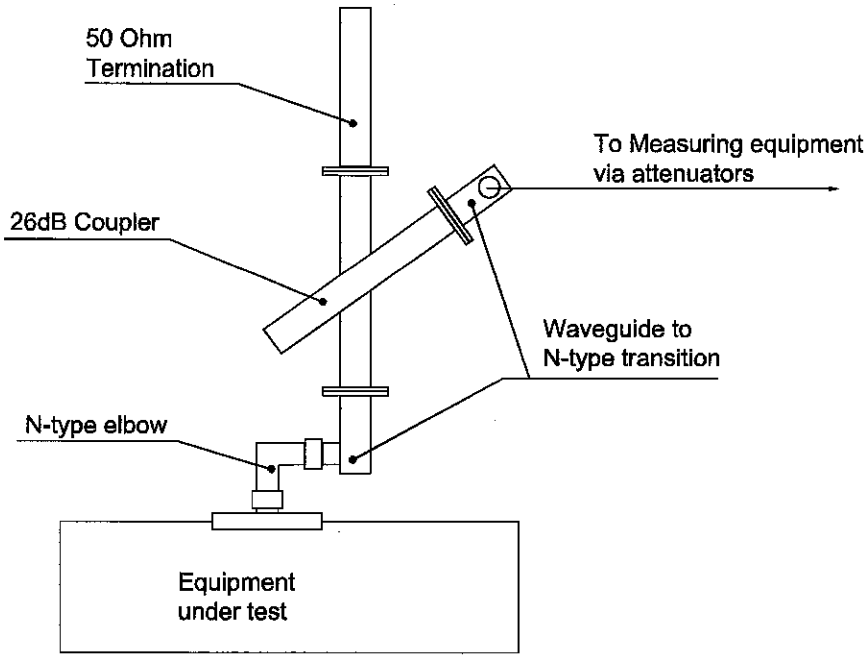
DRG\38756\EMIRAD



Test Configuration For Radiated Emissions Measurements

Reflection-free area: >60m by 52m
(CISPR ellipse)
Groundplane Earthed
Control room outside CISPR ellipse

DRG\38756\001



DRG\38756\002