REPORT ON

EMC Testing of the Radius Sweden AB Model PDR VHF Packet Data Radio
in accordance with EN 301 489-5

COMMERCIAL-IN-CONFIDENCE

Report No OR614388/02 Issue 2 **January 2006**

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TUV Product Service Ltd, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuvps.co.uk; www.babt.com

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January 2006

PREPARED FOR

Radius Sweden AB
Tennvagen 1
SE 371-50 Karlskrona
Sweden

PREPARED BY

J Plummer
Technical Author

APPROVED BY

J Adams
Authorised Signatory

DATED 24th January 2006

This report replaces OR614388/02 Issue 1 to amend the name of the Equipment Under Test.

Product Service

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Product Service

SECTION 1

REPORT SUMMARY

EMC Testing of the Radius Sweden
AB Model PDR VHF Packet Data Radio

1.1 STATUS

EQUIPMENT UNDER TEST	PDR VHF Packet Data Radio
OBJECTIVE	To undertake measurements to determine the Equipment Under Test's (EUT's) compliance with the specification.
NAME AND ADDRESS OF CLIENT	Radius Sweden AB Tennvagen 1 SE 371-50 Karlskrona Sweden
MODEL NUMBER	PDR
SERIAL NUMBER	OS614388-02
TEST SPECIFICATION/DATE/ISSUE	ETSI EN 301 489-1 V1.4.1 (2002-08) ETSI EN 301 489-5 V1.3.1 (2002-08)
NUMBER OF ITEMS TESTED	One
SECURITY CLASSIFICATION OF EUT	Unclassified
INCOMING RELEASE	Not Formally Released
DISPOSAL	Held Pending Disposal
ORDER NUMBER DATE	PTP 109588 14 June 2005
START OF TEST FINISH OF TEST	14 July 2005 20 July 2005
RELATED DOCUMENTS	EN 55022: 1998 + A1: 2000 + A2:2003 EN 61000-3-2: 2000 EN 61000-3-3: 1995 EN 61000-4-2: 1995 + A1: 1998 + A2: 2001 EN 61000-4-3: 2002 EN 61000-4-4: 1995 EN 61000-4-5: 1995 + A1: 2001 EN 61000-4-6: 1996 EN 61000-4-11: 1994

1.2 INTRODUCTION

The information contained in this report is intended to show verification of the Radius Sweden AB Model PDR VHF Packet Data Radio to the requirements of EN 301 489-1 and EN 301 489-5.

1.3 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out is shown below.

Test	Spec Clause	Test Description	Result	Base Standard
2.1	8.2	Radiated Emissions (Enclosure Port)	Pass	EN 55022
	8.3	Conducted Emissions (DC Power Port)	N/A	EN 55022
2.2	8.4	Conducted Emissions (AC Power Port)	Pass	EN 55022
2.3	8.5	Harmonic Current Emissions (AC Power Port)	Pass	EN 61000-3-3
2.4	8.6	Voltage Fluctuations and Flicker (AC Power Port)	Pass	EN 61000-3-2
	8.7	Conducted Emissions (Telecommunications Port)	N/A	EN 55022
2.5	9.2	Immunity to RF Electromagnetic Field (Enclosure Port)	Pass	EN 61000-4-3
2.6	9.3	Immunity to Electrostatic Discharge (Enclosure Port)	Pass	EN 61000-4-2
	9.4	Immunity to Fast Transients Common Mode (DC Power Port)	N/A	EN 61000-4-4
2.7	9.4	Immunity to Fast Transients Common Mode (AC Power Port)	Pass	EN 61000-4-4
2.8	9.4	Immunity to Fast Transients Common Mode (Signal, Telecommunications and Control Port)	Pass	EN 61000-4-4
	9.5	Immunity to RF Common Mode (DC Power Port)	N/A	EN 61000-4-6
2.9	9.5	Immunity to RF Common Mode (AC Power Port)	Pass	EN 61000-4-6
2.10	9.5	Immunity to RF Common Mode (Signal, Telecommunications and Control Port)	Pass	EN 61000-4-6
	9.6	Immunity to Transients and Surges (Vehicular) (DC Power Port)	N/A	ISO 7637 Parts 1 & 2
2.11	9.7	Immunity to Voltage Dips and Interruptions (AC Power Port)	Pass	EN 61000-4-11
2.12	9.8	Immunity to Surges (AC Power Port)	Pass	EN 61000-4-6
	9.8	Immunity to Surges (Telecommunications Port)	N/A	EN61000-4-6

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a PDR UHF Packet Data Radio. A full technical description is held by Radius Sweden.

1.4.2 Modes of Operation

The EUT was operated in the Transmit/Receive Mode for Emission Testing and the Transmit/Receive and Idle Mode for Immunity Testing.

Information on the specific test modes utilised are detailed in the test procedure for each individual test.

1.4.3 Test Configuration

The EUT was powered via a 230V, 50Hz AC Supply.

Transmitting Frequency 140MHz.

Receiving Frequency 140MHz.

Transmitter Power output 2W.

The EUT was configured in accordance with EN 301 489-5 and EN 301 489-1, Clauses 4.2.2, and EN 301 489-5, Clause 4.5 (Angle Modulated Equipment).

1.4.4 Monitoring of Performance

The EUT was tested as a broadcast unit. Data transmitted to the EUT from the master unit was re-broadcast back to the master unit. The returned data was monitored by software for errors. A display of % error was given.

1.4.5 Performance Criteria

Continuous Phenomena applied to Receivers (CT)

The distortion of the audio signal shall be measured during each individual exposure in the test sequence and shall not exceed 25% measured in a post detection bandwidth determined by a first order band pass filter with a 3dB bandwidth of 300Hz to 3kHz, without the use of psophometric weighting filter.

At the conclusion of test the EUT shall operate as intended with no loss of user control functions or stored data, and the communications link shall have been maintained during test.

Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

Continuous Phenomena applied to Receivers (CR)

The distortion of the audio signal shall be measured during each individual exposure in the test sequence and shall not exceed 25% measured in a post detection bandwidth determined by a first order band pass filter with a 3dB bandwidth of 300Hz to 3kHz, without the use of psophometric weighting filter.

At the conclusion of test the EUT shall operate as intended with no loss of user control functions or stored data, and the communications link shall have been maintained during test.

Where the EUT is a transceiver, under no circumstances shall the transmitter operate unintentionally during the test.

Transient Phenomena applied to Transmitters (TT)

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communications link.

At the conclusion of test the EUT shall operate as intended with no loss of user control functions or stored data, and the communications link shall have been maintained during test.

Transient Phenomena applied to Transmitters (TR)

At the conclusion of each exposure the EUT shall operate with no user noticeable loss of the communications link.

At the conclusion of the total test comprising the series of individual exposures the EUT shall operate as intended with no loss of user control functions or stored data, as declared by the manufacturer, and the communications link shall have been maintained during test.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure or open test area as appropriate.

The EUT was powered from a 230V, 50Hz AC supply

The EUT was representatively exercised by configuring the EUT as a broadcast unit. Data was sent to the EUT from a master unit. The slave (EUT) returned the data continuously.

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards were made.

1.7 MODIFICATION RECORD

No modifications were made to the EUT during testing.

SECTION 2

TEST DETAILS

EMC Testing of the Radius Sweden
AB Model PDR VHF Packet Data Radio

2.1 RADIATED EMISSIONS – ENCLOSURE PORT

2.1.1 Specification Reference

EN 301 489-1, Clause 8.2

2.1.2 Equipment Under Test

PDR VHF Packet Data Radio

2.1.3 Date of Test

14 July 2005

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.1” within the Test Equipment Used Table shown in Section 3.1.

2.1.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 55022.

The EUT was set up on a remotely controlled turntable within a semi-anechoic Alternative Open Area Test Site [AOATS], powered up and correct operation verified.

Measurements were made over the frequency range 30MHz to 1GHz at a distance of 3m.

A preliminary profile of the EUT’s emissions was made, the profiling yielding a list of worst case emission frequencies together with the EUT azimuth and antenna polarisation.

Utilising the data gathered during the preliminary profiling, the emissions detected were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emission levels were then formally measured with a CISPR Quasi-Peak detector function and the measured levels recorded.

The levels of emissions generated by the EUT were then compared with the test specification limits to determine EUT compliance.

Measurements were made at 3m and the results extrapolated to 10m.

The test was performed with the EUT in the Transmit/Receive mode of operation.

2.1.6 Environmental Conditions

Ambient Temperature	24.0C
Relative Humidity	39.0%
Atmospheric Pressure	1028mbar

2.1.7 Test Results

The EUT satisfied the Class B requirements of EN 55022 and therefore met the requirements of EN 301 489-1 for Radiated Emissions.

Transmit/Receive Mode

Frequency MHz	Polarity	Height cm	Azimuth degrees	Field Strength at 10m dBµV/m	Specification Limit dBµV/m	Result
94.21	V	100	280	26.5	30.0	Pass
165.33	V	100	106	26.2	30.0	Pass
178.00	V	100	162	24.6	30.0	Pass
194.43	V	100	170	29.0	30.0	Pass

The margin between the specification requirements and all other emissions was 5.4dB or more below the specification limit.

2.2 CONDUCTED EMISSIONS - AC POWER PORT

2.2.1 Specification Reference

EN 301 489-1, Clause 8.4

2.2.2 Equipment Under Test

PDR VHF Packet Data Radio

2.2.3 Date of Test

15 July 2005

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.2” within the Test Equipment Used Table shown in Section 3.1.

2.2.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 55022.

The EUT was set up within a shielded enclosure, powered up and correct operation verified.

Measurements were made on the EUT’s power lines over the frequency range 150kHz to 30MHz.

A preliminary profile of the EUT’s emissions was made, the profiling yielding a list of worst case emission frequencies.

Utilising the data gathered during the preliminary profiling, the emissions detected were then formally measured with CISPR Quasi-Peak and Average detector functions and the measured levels recorded.

The levels of emissions generated by the EUT were then compared with the test specification limits to determine EUT compliance.

The test was performed with the EUT in the Transmit/Receive mode of operation.

2.2.6 Environmental Conditions

Ambient Temperature	22.0°C
Relative Humidity	52.0%
Atmospheric Pressure	1022mbar

2.2.7 Test Results

The EUT satisfied the Class B requirements of EN 55022 and therefore met the requirements of EN 301 489-1 for Conducted Emissions on the AC Power Lines.

Test results are shown in the tables that follow.

2.2.7 Test Results – Continued

Transmit/Receive Mode

Live Line Test Results

Frequency MHz	Average Level dBµV	Average Limit dBµV	Quasi-Peak Level dBµV	Quasi-Peak Limit dBµV
0.155	36.9	55.7	46.9	65.7
0.177	33.2	54.6	43.2	64.6
0.199	29.6	53.7	40.1	63.7
1.984	27.0	46.0	33.1	56.0
2.052	28.7	46.0	35.5	56.0
20.98	28.2	50.0	35.5	60.0

The margin between the specification requirements and all other emissions was 23.5dB or more below the specified Quasi-Peak and 24.0dB or more below the specified Average limit

Return Line Test Results

Frequency MHz	Average Level dBµV	Average Limit dBµV	Quasi-Peak Level dBµV	Quasi-Peak Limit dBµV
0.165	29.7	55.2	37.3	65.2
0.634	25.7	46.0	30.7	56.0
1.264	25.8	46.0	30.6	56.0
1.977	20.9	46.0	26.2	56.0
6.610	22.0	50.0	29.8	60.0
7.008	20.9	50.0	29.7	60.0

The margin between the specification requirements and all other emissions was 30.3dB or more below the specified Quasi-Peak and 26.9dB or more below the specified Average limit

2.3 HARMONIC CURRENT EMISSIONS – AC POWER PORT

2.3.1 Specification Reference

EN 301 489-1, Clause 8.5

2.3.2 Equipment Under Test

PDR VHF Packet Data Radio

2.3.3 Date of Test

15 July 2005

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.3” within the Test Equipment Used Table shown in Section 3.1.

2.3.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-3-2.

The EUT was set up within a test area, powered up and correct operation verified.

Utilising a proprietary Harmonics Analyser the Odd and Even Harmonics generated by the EUT were measured over the frequency range 50Hz to 2kHz.

The levels of emissions generated by the EUT were then compared with the test specification limits to determine EUT compliance.

The test was performed with the EUT in the Transmit/Receive mode of operation.

2.3.6 Environmental Conditions

Ambient Temperature	22.0°C
Relative Humidity	52.0%
Atmospheric Pressure	1023mbar

2.3.7 Test Results

The EUT satisfied the requirements of EN 61000-3-2 and therefore met the requirements of EN 301 489-1 for Harmonic Disturbance on the AC Power Lines

Test results are shown in the following tables

2.3.7 Test Results - continued

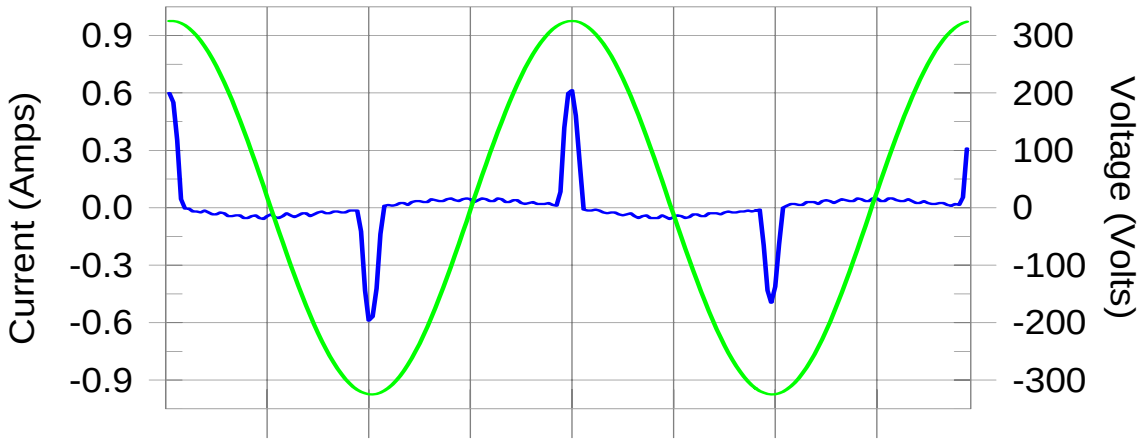
Transmit/Receive Mode

Harmonics – Class-A per Ed. 2.1(Replay) incl. inter-harmonics

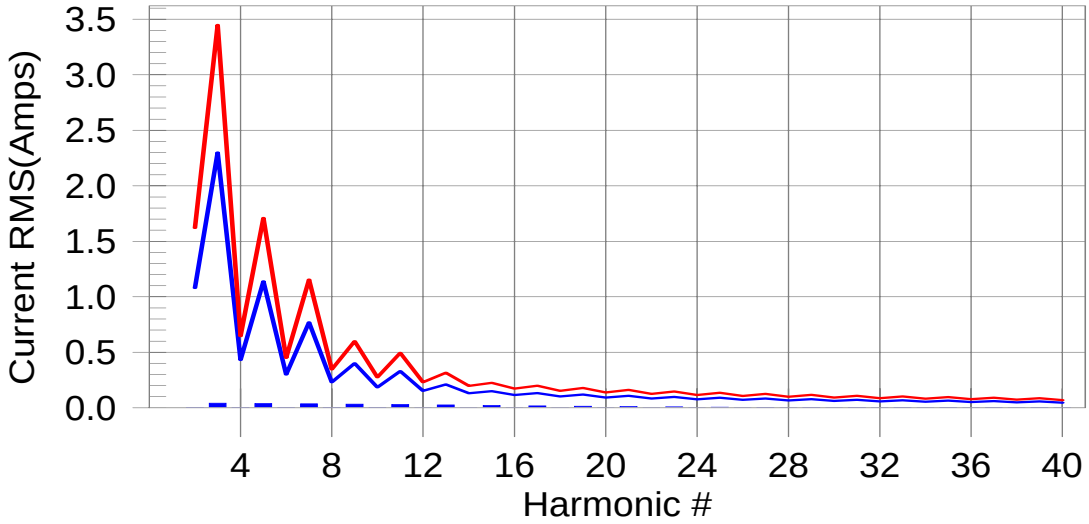
EUT: Radius VHF PDR Tested by: Jason Holcombe
Test category: Class-A per Ed. 2.1 (European limits) Test Margin: 100
Test date: 15/07/2005 Start time: 12:01:18 End time: 12:11:18
Test duration (min): 10Data file name: H-000594.cts_data
Comment: Radius VHF PDR
Customer: OR 614388

Test Result: Pass Source qualification: Normal

Current & voltage waveforms



Harmonics and Class A limit line European Limits



Test result: Pass Worst harmonic was #15 with 9.51% of the limit.

2.3.7 Test Results - continued

Current Test Result Summary (Replay)

EUT: Radius VHF PDR Tested by: Jason Holcombe
Test category: Class-A per Ed. 2.1 (European limits) Test Margin: 100
Test date: 15/07/2005 Start time: 12:01:18 End time: 12:11:18
Test duration (min): 10 Data file name: H-000594.cts_data
Comment: Radius VHF PDR
Customer: OR 614388

Test Result: Pass Source qualification: Normal
THC(A): 0.09 I-THD(pk%): 199.35 POHC(A): 0.016 POHC Limit(A): 0.251
Highest parameter values during test:
V_RMS (Volts): 230.05 Frequency(Hz): 50.00
I_Peak (Amps): 0.634 I_RMS (Amps): 0.115
I_Fund (Amps): 0.053 Crest Factor: 6.581
Power (Watts): 9.8 Power Factor: 0.377

Harm#	Harms(avg)	100%Limit	%of Limit	Harms(max)	150%Limit	%of Limit	Status
2	0.003	1.080	0.3	0.003	1.620	0.21	Pass
3	0.039	2.300	1.7	0.041	3.450	1.19	Pass
4	0.003	0.430	0.6	0.003	0.645	0.48	Pass
5	0.037	1.140	3.3	0.038	1.710	2.23	Pass
6	0.002	0.300	0.8	0.003	0.450	0.60	Pass
7	0.035	0.770	4.5	0.036	1.155	3.08	Pass
8	0.002	0.230	0.9	0.002	0.345	0.71	Pass
9	0.032	0.400	8.0	0.033	0.600	5.43	Pass
10	0.002	0.184	1.0	0.002	0.276	0.79	Pass
11	0.029	0.330	8.7	0.029	0.495	5.88	Pass
12	0.002	0.153	1.1	0.002	0.230	0.83	Pass
13	0.025	0.210	11.9	0.025	0.315	8.04	Pass
14	0.001	0.131	1.1	0.002	0.197	0.83	Pass
15	0.021	0.150	14.1	0.021	0.225	9.51	Pass
16	0.001	0.115	1.1	0.001	0.173	0.79	Pass
17	0.017	0.132	13.1	0.018	0.199	8.81	Pass
18	0.001	0.102	1.0	0.001	0.153	0.74	Pass
19	0.014	0.118	11.5	0.014	0.178	7.78	Pass
20	0.001	0.092	0.9	0.001	0.138	0.68	Pass
21	0.010	0.107	9.7	0.011	0.161	6.55	Pass
22	0.001	0.084	0.8	0.001	0.125	0.64	Pass
23	0.008	0.098	7.8	0.008	0.147	5.34	Pass
24	0.001	0.077	0.8	0.001	0.115	0.60	Pass
25	0.005	0.090	6.0	0.006	0.135	4.17	Pass
26	0.001	0.071	0.8	0.001	0.106	0.62	Pass
27	0.004	0.083	4.8	0.004	0.125	3.32	Pass
28	0.001	0.066	0.8	0.001	0.099	0.62	Pass
29	0.003	0.078	4.3	0.003	0.116	2.96	Pass
30	0.001	0.061	0.9	0.001	0.092	0.64	Pass
31	0.003	0.073	4.3	0.003	0.109	2.93	Pass
32	0.001	0.058	0.9	0.001	0.086	0.68	Pass
33	0.003	0.068	4.6	0.003	0.102	3.13	Pass
34	0.000	0.054	0.9	0.001	0.081	0.67	Pass
35	0.003	0.064	4.7	0.003	0.096	3.23	Pass
36	0.000	0.051	0.9	0.001	0.077	0.67	Pass
37	0.003	0.061	4.6	0.003	0.091	3.14	Pass
38	0.000	0.048	0.9	0.000	0.073	0.65	Pass
39	0.002	0.058	4.2	0.002	0.087	2.86	Pass
40	0.000	0.046	0.7	0.000	0.069	0.53	Pass

2.4 VOLTAGE FLUCTUATIONS AND FLICKER – AC POWER PORT

2.4.1 Specification Reference

EN 301 489-1, Clause 8.6

2.4.2 Equipment Under Test

PDR VHF Packet Data Radio

2.4.3 Date of Test

15 July 2005

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.4” within the Test Equipment Used Table shown in Section 3.1.

2.4.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-3-3.

The EUT was set up within a test area, powered up and correct operation verified.

Utilising a proprietary Flicker Meter the emissions generated by the EUT were measured.

The levels of emissions generated by the EUT were then compared with the test specification limits to determine EUT compliance.

The test was performed with the EUT in the Transmit/Receive mode of operation

2.4.6 Environmental Conditions

Ambient Temperature	22.0°C
Relative Humidity	52.0%
Atmospheric Pressure	1023mbar

2.4.7 Test Results

The EUT satisfied the requirements of IEC 61000-3-3 and therefore met the requirements of EN 301 489-1 for Voltage Fluctuations and Flicker.

Transmit/Receive Mode

Evaluation	Result	Limit
Pst	0.001	No greater than 1.0
dc	0.00%	Shall not exceed 3%
dmax	0.00%	Shall not exceed 4%
d(t) (seconds)	0.00%	Shall not exceed 3% for more than 200ms

2.5 IMMUNITY TO RF ELECTROMAGNETIC FIELDS – ENCLOSURE PORT

2.5.1 Specification Reference

EN 301 489-1, Clause 9.2

2.5.2 Equipment Under Test

PDR VHF Packet Data Radio

2.5.3 Date of Test

18 July 2005

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.5” within the Test Equipment Used Table shown in Section 3.1.

2.5.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-3.

The EUT was set up within a screened enclosure, aligned with the uniform field calibration plane, powered up and correct operation verified.

Due to the size and construction of the EUT, it was deemed unnecessary to apply the test to more than one face, the top was deemed to be the most susceptible face.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

Test Level	:	3V/m
Modulation	:	80% amplitude at 1kHz
Dwell Times	:	3 seconds for each step

The test was performed with the EUT in the Transmit/Receive and Idle modes of operation.

2.5.6 Environmental Conditions

Ambient Temperature	24.0°C
Relative Humidity	50.0%
Atmospheric Pressure	1005mbar

2.5.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of EN 301 489-1 for Immunity to RF Electromagnetic Fields on the Enclosure Port.

2.6 IMMUNITY TO ELECTROSTATIC DISCHARGE- ENCLOSURE PORT

2.6.1 Specification Reference

EN 301 489-1 Clause 9.3

2.6.2 Equipment Under Test

PDR VHF Packet Data Radio

2.6.3 Date of Test

20 July 2005

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.6” within the Test Equipment Used Table shown in Section 3.1.

2.6.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-2.

The EUT was set up on insulators 0.5mm above a Horizontal Coupling Plane within a test area, powered up and correct operation verified.

Air Discharge
At each applicable test point 10 positive and 10 negative Air discharges were applied at each of 2kV, 4kV and 8kV potentials. The interval between discharges was a minimum of 1 second.

Contact Discharge
At each applicable test point 10 positive and 10 negative Contact discharges were applied at each of 2kV, and 4kV potentials. The interval between discharges was a minimum of 1 second

Each vertical sides of the EUT were subjected to Vertical Coupled Plane (VCP) discharges of 2kV and 4kV, 10 positive polarity and 10 negative polarity discharges.

The base of the EUT was subjected to Horizontal Coupled Plane (HCP) discharges of 2kV and 4kV, 10 positive polarity and 10 negative polarity discharges.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

The test was performed with the EUT in the Transmit/Receive and Idle modes of operation.

2.6.6 Environmental Conditions

Ambient Temperature 23.0°C
Relative Humidity 58.0%
Atmospheric Pressure 1015mbar

2.6.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of EN 301 489-1 for Immunity to Electrostatic Discharges on the Enclosure Port.

Details of the points tested and the results are presented in the following tables.

Transmit/Receive Mode

Test Point		Contact Discharge				Air Discharge					
		2kV		4kV		2kV		4kV		8kV	
		+	-	+	-	+	-	+	-	+	-
	Horizontal Coupling Plane	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
	Vertical Coupling Plane	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
A	RS232 Shell	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
B	2 x Screw head (RS232 side)	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
C	2 x Screw head (Antenna side)	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
D	Left hand, Right hand, Front and Back Panel	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
E	Earth Point	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
F	Antenna Connector	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
G	Top Panel PDR	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
H	Antenna Cable	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
I	DC Cable	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
J	AC Cable	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
K	Chassis AC/DC	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
L	AC/DC LED	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
M	AC/DC Volt Adjust	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
N	6 x DC Sunk Screws	N/A	N/A	N/A	N/A	✓*	✓*	✓	✓	✓	✓
O	Negative Terminal Sunk Screw	N/A	N/A	N/A	N/A	✓*	✓*	✓	✓	✓	✓
P	Positive Terminal Sunk Screw	N/A	N/A	N/A	N/A	✓*	✓*	✓	✓	✓	✓

2.6.7 Test Results - continued

Idle Mode

Test Point		Contact Discharge				Air Discharge					
		2kV		4kV		2kV		4kV		8kV	
		+	-	+	-	+	-	+	-	+	-
	Horizontal Coupling Plane	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
	Vertical Coupling Plane	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
A	RS232 Shell	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
B	2 x Screw head (RS232 side)	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
C	2 x Screw head (Antenna side)	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
D	Left hand, Right hand, Front and Back Panel	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
E	Earth Point	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
F	Antenna Connector	✓	✓	✓	✓	N/A	N/A	N/A	N/A	N/A	N/A
G	Top Panel PDR	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
H	Antenna Cable	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
I	DC Cable	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
J	AC Cable	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
K	Chassis AC/DC	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
L	AC/DC LED	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
M	AC/DC Volt Adjust	N/A	N/A	N/A	N/A	✓*	✓*	✓*	✓*	✓*	✓*
N	6 x DC Sunk Screws	N/A	N/A	N/A	N/A	✓*	✓*	✓	✓	✓	✓
O	Negative Terminal Sunk Screw	N/A	N/A	N/A	N/A	✓*	✓*	✓	✓	✓	✓
P	Positive Terminal Sunk Screw	N/A	N/A	N/A	N/A	✓*	✓*	✓	✓	✓	✓

Key to Results

✓ The EUT's performance was not impaired at this test point when the ESD pulse was applied

✓* No discharge occurred at this test point when the ESD pulse was applied.

N/A Test not applicable as defined in the specification.

2.7 IMMUNITY TO FAST TRANSIENTS COMMON MODE - AC POWER PORT

2.7.1 Specification Reference

EN 301 489-1, Clause 9.4

2.7.2 Equipment Under Test

PDR VHF Packet Data Radio

2.7.3 Date of Test

19 July 2005

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.7” within the Test Equipment Used Table shown in Section 3.1.

2.7.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-4.

The EUT was set up within a test area, powered up and correct operation verified.

Utilising a proprietary EFT Generator the test was applied to the EUT’s AC power lines at levels of 0.5 kV & 1kV, the test was applied to the AC power cable conductors in turn for a minimum period of 1 minute. The test was applied for both Positive and Negative going transients.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

The test was performed with the EUT in the Transmit/Receive and Idle modes of operation.

2.7.6 Environmental Conditions

Ambient Temperature	21.0°C
Relative Humidity	55.0%
Atmospheric Pressure	1012mbar

2.7.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of EN 301 489-1 for Immunity to Fast Transients Bursts on the AC Power Port.

2.8 IMMUNITY TO FAST TRANSIENTS COMMON MODE - SIGNAL, TELECOMMUNICATION AND CONTROL PORTS

2.8.1 Specification Reference

EN 301 489-1, Clause 9.4

2.8.2 Equipment Under Test

PDR VHF Packet Data Radio

2.8.3 Date of Test

20 July 2005

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.8” within the Test Equipment Used Table shown in Section 3.1.

2.8.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-4.

The EUT was set up within a test area, powered up and correct operation verified.

Utilising a proprietary EFT Generator the test was applied to the EUT’s Signal and Interconnection Lines via a Capacitive Clamp at levels of 0.25kV & 0.5kV, the test was applied to the antenna cable for a minimum period of 1 minute. The test was applied for both Positive and Negative going transients.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

The test was performed with the EUT in the Transmit/Receive and Idle modes of operation.

2.8.6 Environmental Conditions

Ambient Temperature	22.0°C
Relative Humidity	59.0%
Atmospheric Pressure	1012mbar

2.8.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of EN 301 489-1 for Immunity to Fast Transients Bursts on the Signal, Telecommunications and Control Port.

2.9 IMMUNITY TO RF COMMON MODE - AC POWER PORT

2.9.1 Specification Reference

EN 301 489-1, Clause 9.5

2.9.2 Equipment Under Test

PDR VHF Packet Data Radio

2.9.3 Date of Test

19 July 2005

2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.9” within the Test Equipment Used Table shown in Section 3.1.

2.9.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-6.

The EUT was set up 100mm above a Ground Reference Plane within a shielded enclosure.

Utilising a proprietary Test Generator a CDN was calibrated to produce the required test levels over the frequency range 150kHz to 80MHz.

The EUT was then powered via the CDN and correct operation verified.

The test was applied to the EUT at the previously calibrated levels.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

Test Level	:	3V rms
Modulation	:	80% amplitude at 1kHz
Dwell Times	:	3 seconds for each step

The test was performed with the EUT in the Transmit/Receive and Idle modes of operation.

2.9.6 Environmental Conditions

Ambient Temperature	21.0°C
Relative Humidity	55.0%
Atmospheric Pressure	1012mbar

2.9.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of EN 301 489-1 for Immunity to RF Common Mode on the AC Power Port.

2.10 IMMUNITY TO RF COMMON MODE - SIGNAL, TELECOMMUNICATION AND CONTROL PORTS

2.10.1 Specification Reference

EN 301 489-1, Clause 9.5

2.10.2 Equipment Under Test

PDR VHF Packet Data Radio

2.10.3 Date of Test

19 July 2005

2.10.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.10” within the Test Equipment Used Table shown in Section 3.1.

2.10.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-6.

The EUT was set up 100mm above a Ground Reference Plane within a shielded enclosure, powered up and correct operation verified.

Utilising a proprietary Test Generator a Clamp was calibrated to produce the required test levels over the frequency range 150kHz to 80MHz.

The Clamp was fitted around the cable under test and the test was applied at the previously calibrated levels.

The test was applied to the Antenna Cable.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

Test Level : 3V/m

Modulation : 80% amplitude at 1kHz

Dwell Times : 3 seconds for each step

The test was performed with the EUT in the Transmit/Receive and Idle modes of operation.

2.10.6 Environmental Conditions

Ambient Temperature	21.0°C
Relative Humidity	55.0%
Atmospheric Pressure	1012mbar

2.10.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of EN 301 489-1 for Immunity to RF Common Mode on the Signal, Telecommunications and Control Port.

2.11 IMMUNITY TO VOLTAGE DIPS AND INTERRUPTIONS – AC POWER PORT

2.11.1 Specification Reference

EN 301 489-1, Clause 9.7

2.11.2 Equipment Under Test

PDR VHF Packet Data Radio

2.11.3 Date of Test

20 July 2005

2.11.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.11” within the Test Equipment Used Table shown in Section 3.1.

2.11.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-11.

The EUT was set up in an open test area, powered up and correct operation verified.

Utilising a proprietary Test Set the following “Dips and Interruptions” were applied, each sub-test being applied 3 times at 10 second intervals.

Percentage	Periodicity
30%	For 10ms
60%	For 100ms
>95%	For 5 seconds

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

The test was performed with the EUT in the Transmit/Receive and Idle modes of operation.

2.11.6 Environmental Conditions

Ambient Temperature	22.0°C
Relative Humidity	59.0%
Atmospheric Pressure	1015mbar

2.11.7 Test Results

For the period of test the EUT continued to operate as expected and therefore met the requirements of EN 301 489-1 for Voltage Dips, and Interruptions on AC Power Port.

2.12 IMMUNITY TO SURGES - AC POWER PORT

2.12.1 Specification Reference

EN 301 489-1, Clause 9.8

2.12.2 Equipment Under Test

PDR VHF Packet Data Radio

2.12.3 Date of Test

20 July 2005

2.12.4 Test Equipment Used

The major items of test equipment used for the above tests are identified as “Section 2.12” within the Test Equipment Used Table shown in Section 3.1.

2.12.5 Test Procedure

The test was applied in accordance with the test method requirements of EN 61000-4-5.

The EUT was set up within a test area, powered up and correct operation verified.

Utilising a proprietary Surge Generator the test was applied to the EUT’s power lines at levels of 500V differentially. The test was applied at phase angles of 90, 180 and 270 degrees, 5 positive going and 5 negative surges were applied for each phase angle, the interval between surges being 1 minute.

The performance of the EUT was monitored throughout the period of test and any anomalies/observations were recorded.

The test was performed with the EUT in the Transmit/ Receive and Idle modes of operation.

2.12.6 Environmental Conditions

Ambient Temperature	22.0°C
Relative Humidity	59.0%
Atmospheric Pressure	1015mbar

2.12.7 Test Results

For the period of test the EUT continued to operate as intended and therefore met the requirements of EN 301 489-1 for Surges, Common & Differential Mode on the AC Power Port.

SECTION 3

TEST EQUIPMENT

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No	EMC / INV No	Cal Due Date
Section 2.1				
Spectrum Analyser	Hewlett Packard	8542E	2286	08/02/2006
Bilog Antenna	Schaffner	CBL6143	2965	12/09/2005
Section 2.2				
Test Receiver	Rohde & Schwarz	ESH3	1020	24/09/2005
Spectrum Analyser	Rohde & Schwarz	EZM	1416	TU
LISN	Rohde & Schwarz	ESH2-Z5	1584	12/10/2005
Transient Limiter	Hewlett Packard	11947A	2271	19/08/2005
Sections 2.3 & 2.4				
Harmonic & Flicker System	California Inst	2105-400 HARMOMICS	2979	13/03/2006
Section 2.5				
RF Power Amplifier	Amp Research	100W1000M1A	2239	TU
Signal Generator	Marconi	2031	1979	11/11/2005
Antenna	Schaffner	CLB 6143	2861	TU
Isotropic Field Probe	Amp Research	FP2000	2432	20/06/2006
Isotropic Monitor	Amp Research	FM2000	2381	TU
Directional Coupler	Amp Research	DC6180	2363	TU
Millivoltmeter	Rohde & Schwarz	URV-5	2215	TU
10v Sensor	Rohde & Schwarz	URV-Z2	2531	TU
Load	Diamond Antenna	DL-30N	2991	TU
50 Ohm/15W Load	Diamond Antenna	DL-30N	2803	TU
RF Amplifier	Milmega	ASO822-30L	2848	TU
Spectrum Analyser	Hewlett Packard	8590B	1467	14/10/2005
Section 2.6				
Immunity Test Set	Schaffner	BEST EMC V2.7	2889	31/08/2005
ESD Simulator	Schaffner	BEST ESD	2870	18/11/2005
Sections 2.7 & 2.8				
Immunity Test Set	Schaffner	BEST EMC V2.7	2889	31/08/2005
Capacity Coupling Clamp	Omiran	EFTC 105	2242	

3.2 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No	EMC / INV No	Cal Due Date
Sections 2.9 & 2.10				
Rf Generator + Attenuator	Schaffner	NSG2070-400	2924	30/06/2006
2 X 4dB Attenuator	Schaffner	INA 2070-1	2925	02/07/2006
Coupling Network	Meb Messelektronik	M2-801-CDN	2312	29/06/2006
Calibration Fixture	Meb Messelektronik	M2-801	2304	12/07/2006
Termination	Meb Messelektronik	TRA150	2495	12/07/2006
50 Ohm Load	Diamond Antenna	DL-30N	2982	20/02/2006
Digital Multimeter	R.S Components	IDM101	2900	
Spectrum Analyser	Hewlett Packard	8590B	1467	14/10/2005
Sections 2.11 & 2.12				
Immunity Test Set	Schaffner	BEST EMC V2.7	2889	31/08/2005

TU Traceability Unscheduled

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Conducted Emissions, LISN	150kHz to 30MHz Amplitude	3.2dB*
Radiated E-Field Susceptibility	26MHz to 2.5GHz Test Amplitude	1.4dB†
Conducted Susceptibility	100kHz to 250MHz Amplitude	1.8dB†
Harmonics and Flicker	The test was applied using proprietary equipment that meets the requirements of EN 61000-3-2 and EN 61000-3-3	—
Mains Voltage Variations and Interrupts	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-11	—
Fast Transient Burst	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-4	—
Electrostatic Discharge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-2	—
Surge	The test was applied using proprietary equipment that meets the requirements of EN 61000-4-5	—

Worst case error for both Time and Frequency measurement 12 parts in 10^6.

* In accordance with CISPR 16-4
† In accordance with UKAS Lab 34

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 ACCREDITATION, DISCLAIMER AND COPYRIGHT DETAILS

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).