

TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Controlled Electronic Management Systems Limited
InfoProx Reader

To: FCC Part 15 Subpart C: 2000
(Sections 15.209 & 15.109)

Test Report Serial No:
RFI/EMCB2/RP42843B
Supersedes Test Report Serial No:
RFI/EMCB1/RP42843B

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: 	Checked By: 
Tested By: 	Release Version No: PDF01
Issue Date: 18 April 2002	Test Date: 21 November 2001

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EMC Department

Test Report

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1. Client Information

1.1. Applicant Details

Company Name:	Controlled Electronic Management Systems Limited
Address:	Unit 4 Ravenhill Business Park Ravenhill Road Belfast BT6 8AW
Contact Name:	Mr David Murphy

1.2. Radio Frequency Investigation Ltd Representative

Contact Name:	Grant Taylor
Address:	Ewhurst Park Ramsdell Basingstoke Hampshire RG26 5RQ

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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 client:

2.1. Identification Of Equipment Under Test (EUT)

Brand Name	CEM
Model Name or Number	InfoProx
Unique Type Identification	ENTRY
Serial Number	000001
Country Of Manufacture	U.K.
Date Of Receipt	20 November 2001

2.2. Description Of EUT

Stand alone proximity card reader (125kHz). Used to control a single door lock, via a relay output for door opening. Door inputs are provided to monitor the state of the door. Door Position, Lock Engaged and Push Button Exit. Another free input is supplied.

2.3. Modifications Incorporated In EUT

The EUT has not been modified from the Model Name or Unique Type Identification number stated above.

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2.4. Additional Information Related To Testing

Equipment Category:	Short Range (Low Power)
Type Of Unit:	Base Station (Fixed Use)
Power Characteristics:	14 dB μ A/m @ 10m
Alignment Range:	
Transmitter	0.125MHz
Receiver	0.125MHz
Allocated Frequency:	
Transmitter	0.125MHz
Receiver	0.125MHz
Power Supply Requirement:	
DC Supply (Volts/Amps)	DC Supply of (Customer supplied) 12V Battery
AC Supply (Volts/Amps)	Not Applicable (Note 1)
Intended Operating Environment:	Commercial
Weight:	Approx. 0.107Kg
Dimensions:	Approx. 0.086 x 0.086 x 0.022 mm
Cycle Time:	Less than 1 sec.

Note 1 The client has stated the power supply requirement for the EUT to be a 12 Volt DC battery therefore the measurement of conducted emissions has not been performed as Section 15.207 (d) states that these measurements are not required for devices which only employ battery power for operation.

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2.5. Support Equipment

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

Description	Door Simulator
Brand Name	Not Applicable – in house test product
Model Name or Number	None Stated
Serial Number	PCB/TESTSIM
Cable Length And Type	Belden 8723 2m
Connected to Port	Inputs and Power supply

Description	12V Battery
Brand Name	Yuasa
Model Name or Number	NP7-12
Serial Number	1010932
Cable Length And Type	Belden 8723 2m
Connected to Port	RS485 7 DC Power

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3. Test Specification, Methods & Procedures

3.1. Test Specification

Reference:	FCC Part 15: 2000 Subpart C (Sections 15.209 & 15.109)
Title:	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Digital Devices.
Comments:	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

3.2. Methods And Procedures

The methods and procedures used were as detailed in:

ANSI C63.2 (1996)

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 (1998)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1 (1999)

Title: Specification for radio disturbance and immunity measuring apparatus and methods. Part 1. Radio disturbance and immunity measuring apparatus.

3.3. Definition Of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

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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 Modes

The EUT was tested in the following operating mode:

Ready

The Card Reader was operating as it would when mounted by a door. i.e. it was ready to accept card swipes. The reader was transmitting the 125kHz signal periodically as follows; On for 10ms, then off for 90ms.

5.2. Configuration And Peripherals

The equipment under test was configured as close to the normal intended use as possible. The measuring equipment used to monitor the output signal of the transmitter was located outside the test environment. Adequate measures were taken to protect the measuring equipment from the radiated fields within the test environment.

The EUT was tested in the following configuration:

The EUT was be powered by a battery and had a Door Simulator connected to the Inputs.

Please refer to Appendix 3 for a Schematic Diagram.

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6. Summary Of Test Results

6.1. Summary Of Tests

Test Name	Specification Reference (Clause Number)	Compliance Status
Radiated Electric Field (10 kHz to 30 MHz)	FCC Part 15.209 of C.F.R. 47: 2000	Complied
Radiated Electric Field (30 MHz to 1000 MHz)	FCC Part 15.109 of C.F.R. 47: 2000	Complied

Note: The client has stated the power supply requirement for the EUT to be a 12 Volt DC battery therefore the measurement of conducted emissions has not been performed as Section 15.207 (d) states that these measurements are not required for devices which only employ battery power for operation.

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.

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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. 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.

7.1.3. The client has declared that the highest clock frequency generated within the device is 24 MHz, therefore radiated emissions testing was performed in accordance with section 15.109 up to 1000 MHz (as specified in section 15.33 (b)).

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7.2. Radiated Electric Field (Frequency Range: 10 kHz to 30 MHz)

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

7.2.2. Measurements were performed in to the limits specified in FCC Part 15.209.

7.2.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector at 10 meters:

Frequency (kHz)	Polarity	Q-P Level (dB _m V/m)	Q-P Limit (dB _m V/m)	Margin (dB)	Result
125.000	0 deg.	54.0	84.7	30.7	Complied

7.2.4. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector at 30 meters:

Frequency (kHz)	Polarity	Q-P Level (dB _m V/m)	Q-P Limit (dB _m V/m)	Margin (dB)	Result
125.000	0 deg.	23.7	65.6	41.9	Complied

Note: The results given in the above tables were taken from measurements performed at a test distance closer than the specified 300 meters (as specified in Section 15.209). The limit stated is calculated by using the square of an inverse linear distance extrapolation factor (40dB/decade). (e.g. $40 \log 300/10$). This is as specified in Section 15.31 (f) (2).

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7.3. Radiated Electric Field: 30 to 1000 MHz

7.3.1. The following table lists the measurement of the radiated emissions using an Quasi-Peak detector function at a test distance of 10m

7.3.2. The highest clock frequency generated within the device is 24 MHz, therefore radiated emissions testing was performed up to 1000 MHz.

7.3.3. Results incorporate antenna factors and cable losses:

Frequency (MHz)	Ant. Pol.	Q-P Level (dB _m V/m)	Q-P Limit (dB _m V/m)	Margin (dB)	Result
99.890	Vert.	22.4	43.5	21.1	Complied
120.010	Vert.	35.3	43.5	8.2	Complied
176.405	Horiz.	13.0	43.5	30.5	Complied
182.903	Horiz.	13.8	43.5	29.7	Complied

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8. Measurement Uncertainty

8.1. 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 measured (the specific quantity subject to measurement) and is only complete when accompanied by a statement regarding the uncertainty of approximation.

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

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

8.4. The expanded uncertainties reported below are based on a standard recognised 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
Radiated Emissions	0.01MHz to 30 MHz	95%	+/- 3.53 dB
Radiated Emissions	30 MHz to 1 GHz	95%	+/- 5.1 dB

8.5. 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

Instrument	Manufacturer	Model Number	RFI No.
Loop Antenna	Rohde & Schwarz	HFH2-Z2	A007
Loop Antenna Tripod	Rohde & Schwarz	HFU-Z	A008
Chase Bilog Antenna	Chase EMC Ltd	CBL6112B	A1037
3 dB attenuator (9)	Suhner	6803.17.B	A392
Bilog Antenna	Chase	CBL6111A	A490
Cable	Rosenberger	UFA210A-1-1181-70x70	C160
Cable	Andrews	None	C342
Cable	Rosenberger	UFA210A-1-1181-70x70	C362
Cable	Rosenberger	RG142XX-001-RFIB	C453
C563-N-2	Rosenberger	UFA 210A-1-0787-70x70	C563
C565-N-3	Rosenberger	UFA 210A-1-1181-70x70	C565
Spectrum Monitor	Rohde & Schwarz	EZM	M003
ESVP Receiver	Rohde & Schwarz	ESVP	M023
Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	M088
Cable	Andrews	None	C342
Cable	RFI	None	C398
ESH3 Receiver	Rohde & Schwarz	ESH3	M032
Temperature/ Humidity Meter	Maplin	Precision Gold	M075
Baro/Hygro/Thermo meter	Oregon Scientific	BA888	M292
Analyser Display Unit	Rohde & Schwarz	ESAI-D	M505
Site 1	RFI	1	S201
Site 9	RFI	9	S209

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

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Appendix 2. Measurement Methods

A2.1. Radiated Emissions: FCC Part 15

A2.1.1. Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

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 6 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 receivers with a Quasi-Peak detector and an average detector (below 1000 MHz), where applicable, for measurements above 1000 MHz average and peak detectors were used.

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. For final measurements on the open area test site, for frequencies between 30 MHz and 1000 MHz where a signal was found, the level 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.

A2.1.7. For final measurements on the open area test site, for frequencies between 9 kHz and 30 MHz where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna angle through 360°. With the antenna set to a fixed height of 1.5 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.

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A2.1.7 The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	Initial Scan Below 30 MHz	Final Measurements Below 30 MHz
Detector Type:	Peak	Quasi-Peak (CISPR)
Mode:	Max Hold	Not applicable
Bandwidth:	200 Hz: (9 kHz to 150 kHz) 10 kHz: (150 kHz to 30 MHz)	200 Hz: (9 kHz to 150 kHz) 9 kHz: (150 kHz to 30 MHz)
Amplitude Range:	60 dB	20 dB (typical)
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

Receiver Function	Initial Scan 30 to 1000 MHz	Final Measurements 30 to 1000 MHz
Detector Type:	Peak	Quasi-Peak (CISPR) or Average
Mode:	Max Hold	Not applicable
Bandwidth:	100 kHz	120 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

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Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

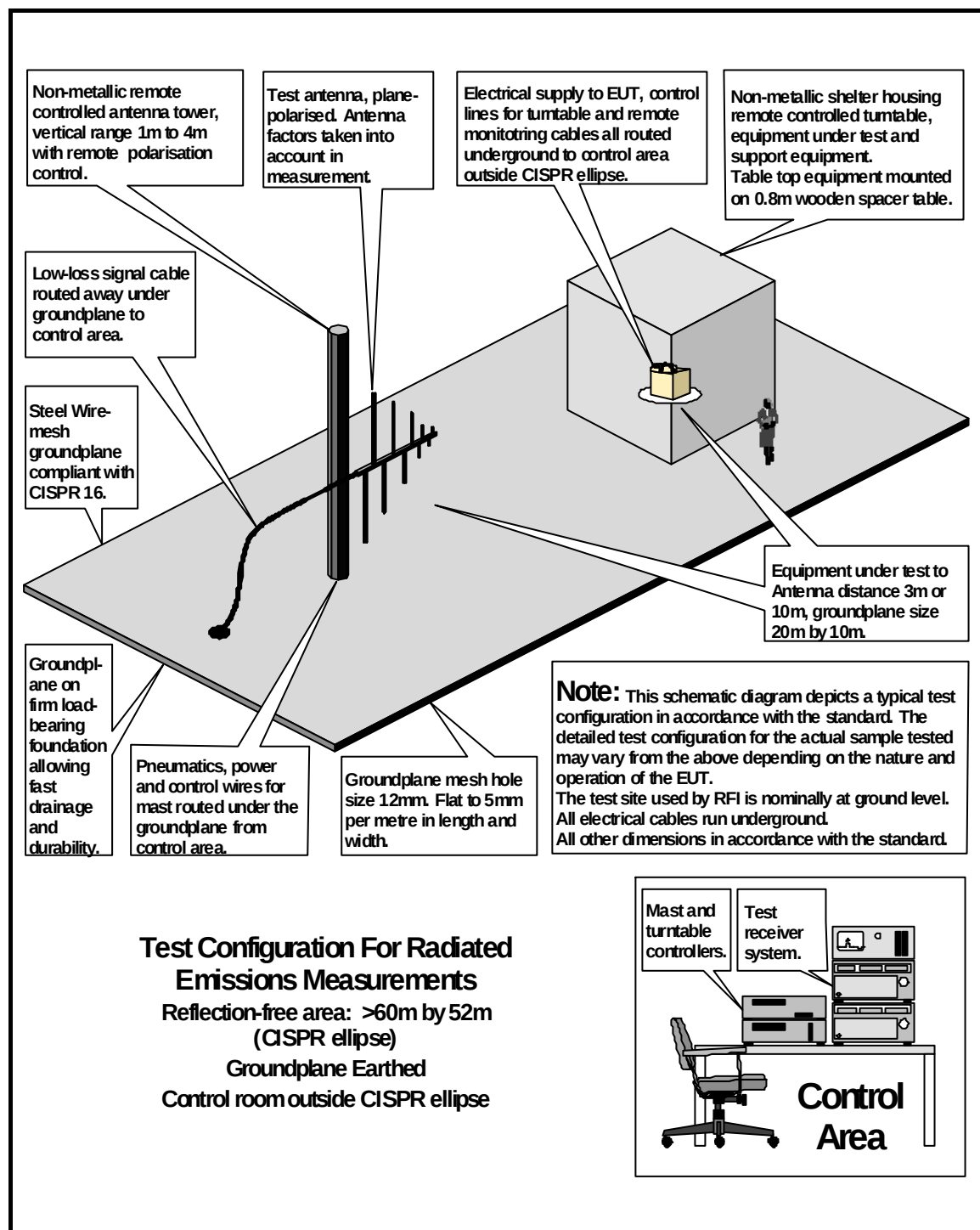
Drawing Reference Number	Title
DRG\42843ETF04\DRECRADI	Test configuration for measurement of radiated emissions
DRG\42843ETF04\001	Schematic Diagram of the EUT, support equipment and interconnecting cables used for the test

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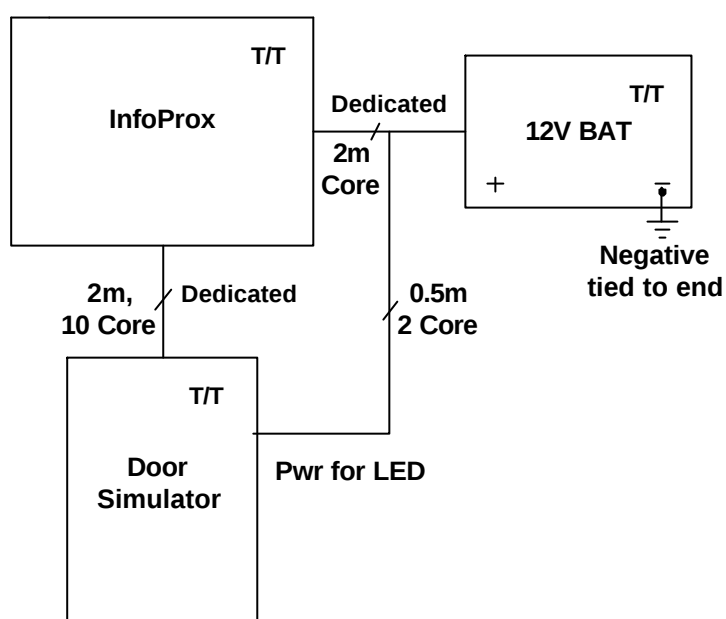
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DRG\42843ETF04\DRECRADI

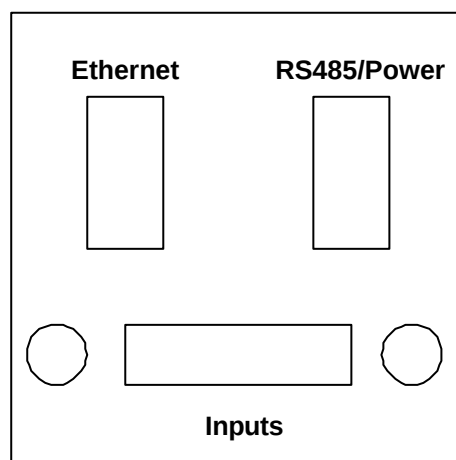


DRG\42843ETF04\001

Configuration of EUT and Local Support Equipment



Back view of EtherProx



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Appendix 4. Graphical Test Results

This appendix contains the following graphs:

Graph Reference Number	Title
GPH\42843ETF04\001	Scan of Radiated Electric Fields
GPH\42843ETF04\002	Scan of Radiated Electric Fields
GPH\42843ETF04\003	Scan of Radiated Electric Fields
GPH\42843ETF04\004	Scan of Radiated Electric Fields

These pages are not included in the total number of pages for this report.



Date 20.Nov.'01 Time 13:52:52

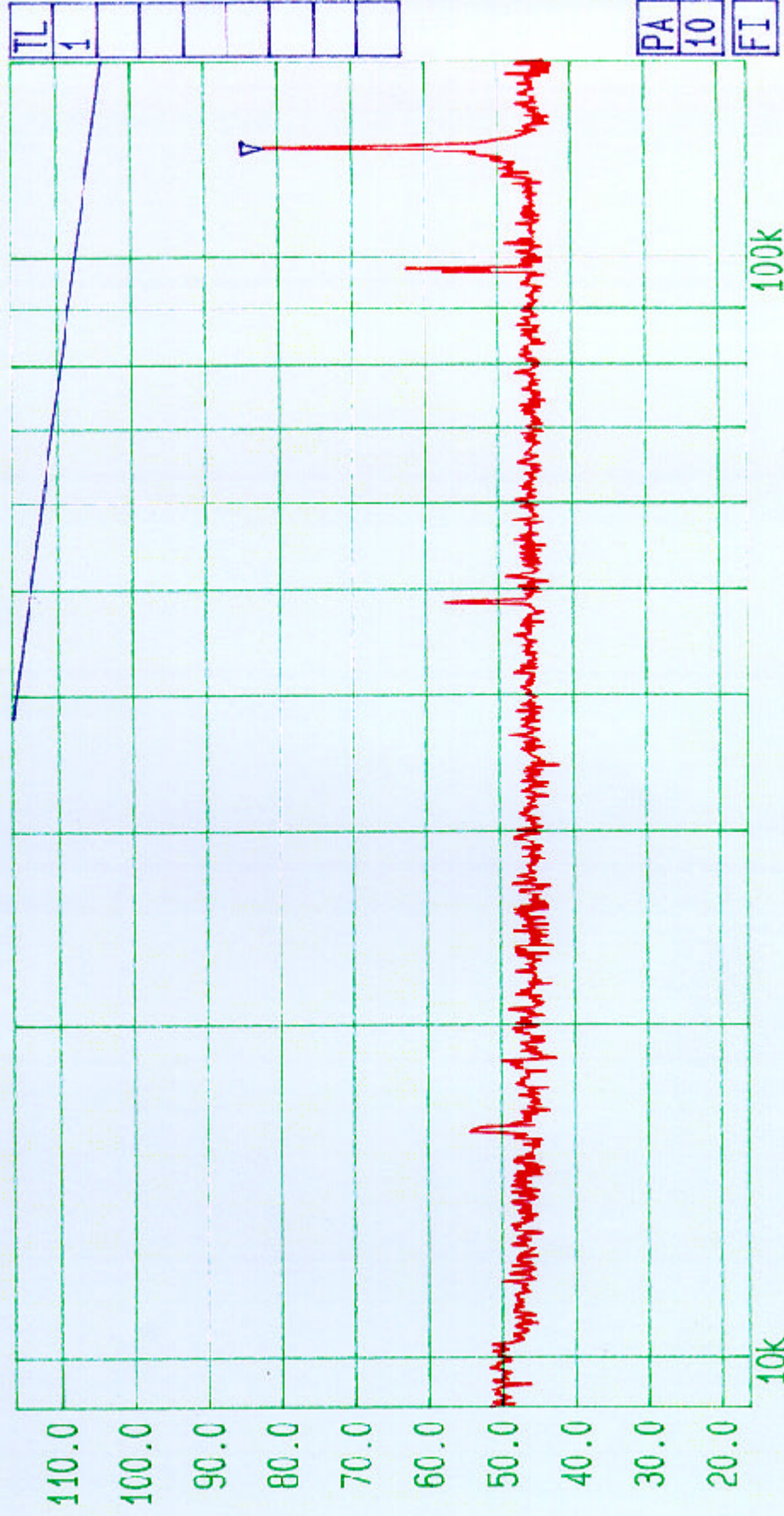
Ref.Lvl Marker

116.00 dB*

81.65 dB*

125.5 kHz

Res.BW 200 Hz [imp]
TG.Lvl Off
CF.Stp 14.100 kHz
Vid.BW 3 kHz
AF.Att 40 dB
Unit [dB μ V/m]



Start
9 kHz

Span
141 kHz

Center
36.742 kHz

Sweep
4.4 s

Stop
150 kHz

Radiated FCC pt15.209
EUT : InfoProx Reader

Tested by RFI for CEM Systems
ENG : AC

3m Screened Room Scan
GPH/42843/04/04/001



Date 20.Nov.'01 Time 13:45:56

Ref.Lvl1 Marker

116.00 dB*

Res.Bw 9 kHz [imp]

TG.Lvl

Off

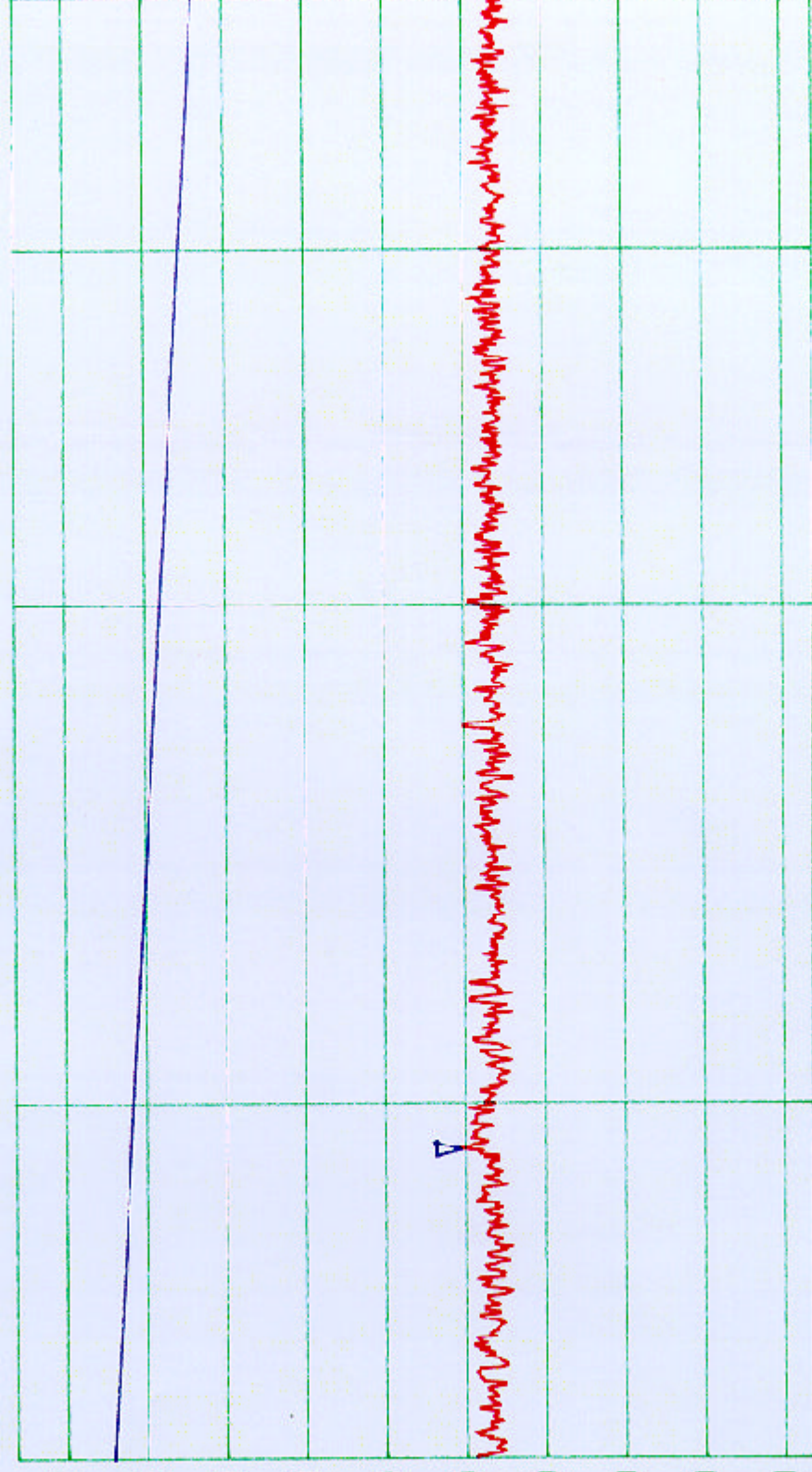
Vid.Bw 100 kHz

RF.Att

40 dB

Unit [dBμV/m]

TL
1



PA
10
FI

Start
150 kHz

Span
340 kHz

Center
271.108 kHz

Sweep
40 ms

Stop
490 kHz

Radiated FCC pt15.209
EUT : InfoProx Reader

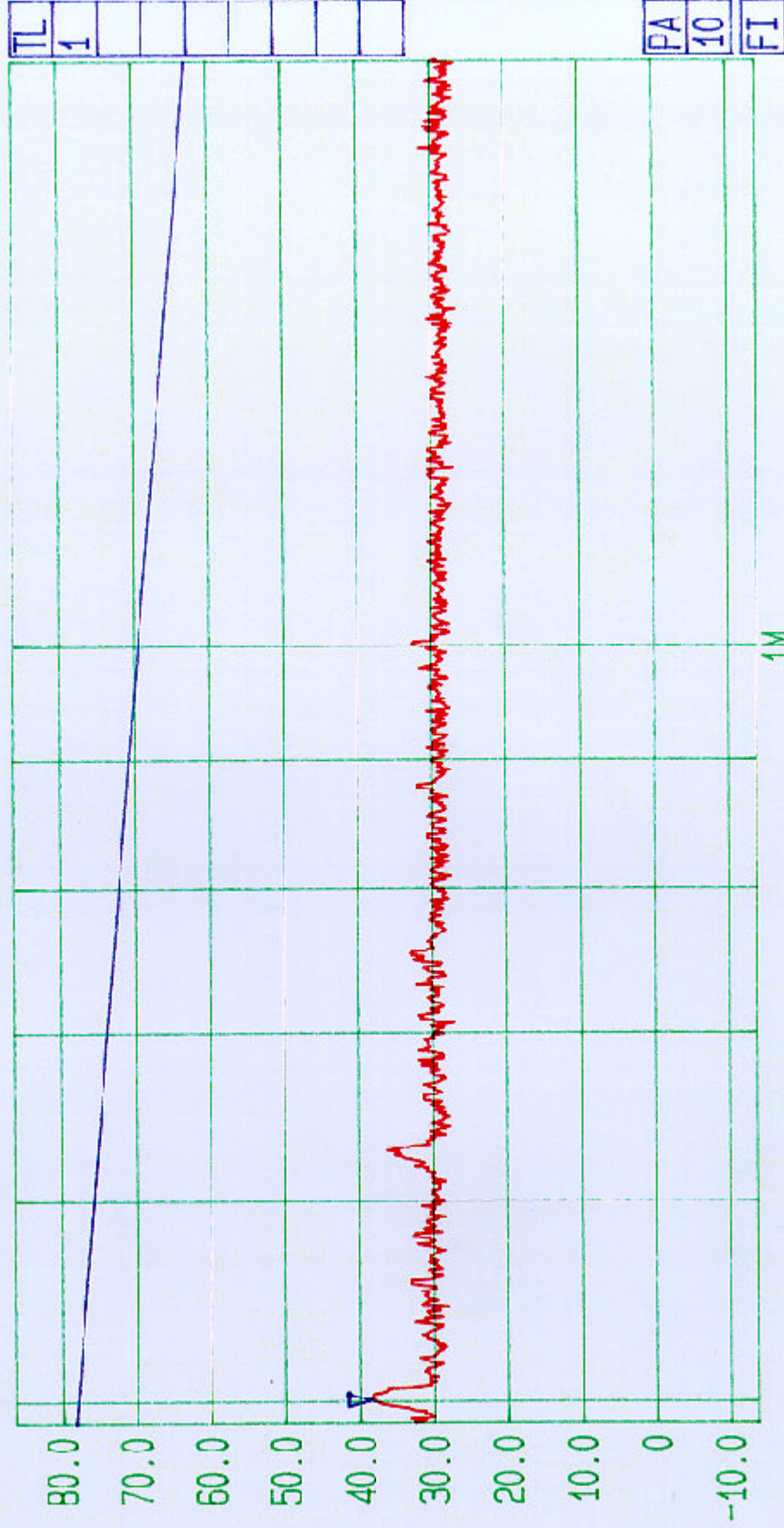
Tested by RFI for CEM Systems
ENG : AC

3m Screened Room Scan
GPH/42843/04/04/002



Date 20.Nov.'01 Time 13:43:17
Ref.Lvl Marker
86.00 dB*

Res.Bw 9 kHz [imp]
TG.Lvl Off
CF.Stp 121.500 kHz
Vid.Bw 100 kHz
RF.Att 0 dB
Unit [dBuV/m]



Start 490 kHz
Span 1.215 MHz
Center 914.029 kHz
Sweep 100 ms
Stop 1.705 MHz
Radiated FCC pt15.209
EUT: InfoProx Reader
Tested by RFI for CEM Systems
ENG: AC
3m Screened Room Scan
GPH/42843/04/04/003



Date 20.Nov.'01 Time 13:26:29

Ref.Lvl Marker

85.00 dB*

34.84 dB*

7.40 MHz

100 kHz

9 kHz [imp]

off

2.829 MHz

0 dB

[dBuV/m]

Vid.Bw

Res.Bw

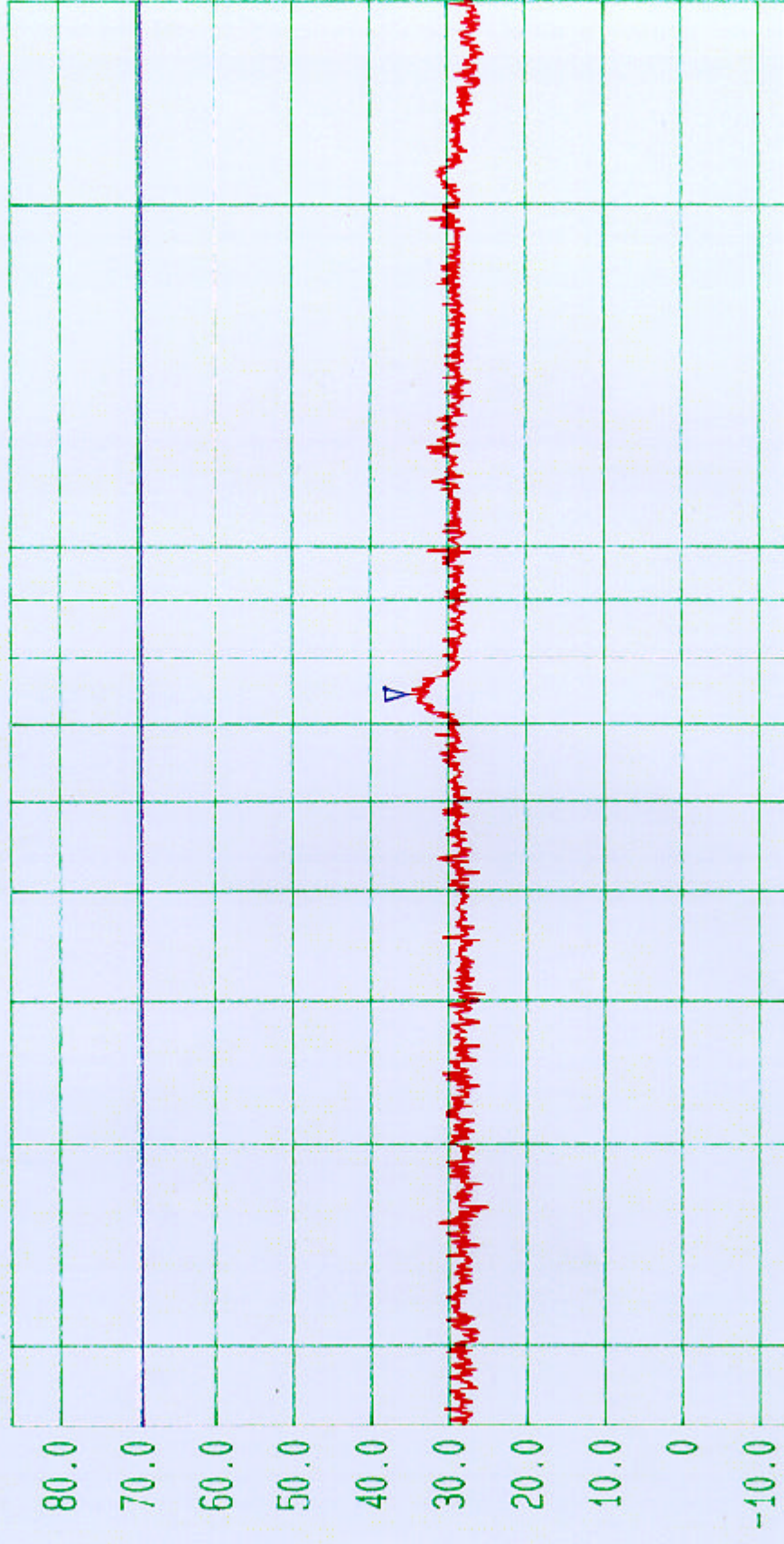
TG.Lvl

CF.Stp

RF.Att

Unit

TL
1



PA
10
FI

Start 1.705 MHz

Span 28.29 MHz

Center 7.151 MHz

Sweep 1.78 s

Stop 30 MHz

Radiated FCC pt15.209
EUT : InfoProx Reader

Tested by RFI for CEM Systems
ENG : AC

3m Screened Room Scan
GPH/42843/04/04/004