

TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit

To: FCC Part 15: 1998 Class B

Test Report Serial No:
RFI/EMCB1/RP40407A

This Test Report Is Issued Under The Authority Of Brian Watson Technical Director: 	Checked By: 
Tested By: 	Release Version No: PDF01
Issue Date: 4 February 2000	Test Date: 12 January 2000

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Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, ENGLAND. Tel: +44 (0) 1256 851193 Fax: +44 (0) 1256 851192	Registered in England, No. 211 7901. Registered Office: Ewhurst Park, Ramsdell, Basingstoke, Hampshire RG26 5RQ	 UKAS TESTING 0644
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1. Client Information

Company Name:	Crowcon Detection Instruments Ltd
Address:	2 Blacklands Way Abingdon Business Park Abingdon Oxfordshire OX14 1DY
Contact Name:	Mr P Basham

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:	Crowcon Detection Instruments Ltd
Model Name or Number:	Vibrating Pager Unit
Unique Type Identification:	None stated by client
Serial Number:	None stated by client
Country of Manufacture:	UK
FCC ID Number:	Not applicable
Date of Receipt:	12 January 2000

2.2. Description Of EUT

The equipment under test was a hand held / body worn vibrating pager.

2.3. Modifications Incorporated In EUT

The client has declared that the EUT has not been modified from what is described by the Model Name and Unique Type Identification stated above.

2.4. Additional Information Related To Testing

Power Supply Requirement:	Internal battery supply of 3 V
Intended Operating Environment:	Light Industry and Heavy Industry
Weight:	80 grams
Dimensions:	75 x 55 x 20mm
Interface Ports:	None

2.5. Support Equipment

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

3. Test Specification, Methods And Procedures

3.1. Test Specification

Reference:	FCC Part 15: 1998 Class B
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 (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 16-1 (1993)

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.

5. Operation Of The EUT During Testing

5.1. Operating Conditions

The EUT was tested in a normal laboratory environment.

During testing, the EUT was powered by an internal battery supply of 3 V.

5.2. Operating Modes

The EUT was tested in the following operating modes:

- Alarm Mode: To activate the EUT correctly, a signal generator, operated at the correct frequency and modulation was placed in the test chamber with the output power adjusted to the minimum level as to allow correct operation of the receiver.
- Standby Mode.

The reason for choosing this mode was that it was defined by the client as being likely to be the worst case with regards EMC.

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

Standalone.

The reason for choosing this configuration was that it was defined by the client as being likely to be the worst case with regards EMC.

NB Section 2 of this report contains a full list of support equipment used and Appendix 3 contains a schematic diagram of the test configuration.

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6. Summary Of Test Results

6.1. Radiated Emissions

Range Of Measurements	Specification Reference	Compliance Status
Electric Field Strength, 30 MHz to 2000 MHz	Section 15 of C.F.R. 47: 1998	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.

7.2. Test Results For Radiated Emissions

7.2.1. Electric Field Strength Measurements: 30 to 1000 MHz

7.2.1.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 2000 MHz.

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

7.2.1.3. Radiated emission preliminary scans were performed with the EUT operated in both an idle and alarm condition. These preliminary scans showed levels were of greater amplitude when the EUT was operated in an alarmed condition. Therefore, final radiated emission measurements were performed in this mode of operation.

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

Frequency (MHz)	Ant. Pol.	Q-P Level (dBmV/m)	Q-P Limit (dBmV/m)	Margin (dB)	Result
418.096	Horiz.	36.2	46.0	9.8	Complied

7.2.2. Electric Field Strength Measurements: 1000 to 2000 MHz

7.2.2.1. The client has stated that the highest clock frequency for the EUT was 418 MHz. Therefore tests were performed up to 2000 MHz.

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

7.2.2.3. Radiated emission preliminary scans were performed up to a frequency of 2 GHz. These initial scans showed that all levels were at least 10dB from the reference limit line. Therefore no final radiated emissions measurements were performed.

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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	Range	Confidence Level	Calculated Uncertainty
Radiated Electric Field Strength Emissions	30 MHz to 1000 MHz	95%	+/- 4.9 dB
Radiated Electric Field Strength Emissions	1000 MHz to 5000 MHz	95%	+/- 4.4 dB

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).

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Appendix 1. Test Equipment Used

Instrument	Manufacturer	Model	RFI No.
Test Receiver	R & S	ESBI	M090
Cable	RFI	None	C409
Bilog Antenna	Chase	CBL6111A	A490
Cable	Rosenberger	UFA 210A-1-0788-50x50	C322
Horn Antenna (1 to 2 GHz)	Eaton Limited	9188-2	A027
Horn Antenna (2 to 4 GHz)	Eaton Limited	91889-2	A031
Horn Antenna (4 to 6 GHz)	Flann	12240-20	A428
Signal Generator	R & S	SMH	G017
OATS Positioning Controller	R & S	HCC	A276
Receiver	R & S	ESVP	M002
Spectrum Monitor	R & S	EZM	M003
Turntable Controller	R.H.Electrical Services	RH351	M173
Antenna	Chase	CBL6111B	A1039

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

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 (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. 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.

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

Receiver Function	Initial Scan Below 1GHz	Final Measurements Below 1GHz
Detector Type:	Peak	Quasi-Peak (CISPR)
Mode:	Max Hold	Not applicable
Bandwidth:	120 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

Receiver Function	Initial Scan Above 1 GHz	Final Measurements Above 1 GHz
Detector Type:	Peak	Peak/Average
Mode:	Max Hold	Not applicable
Bandwidth:	1 MHz	1 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

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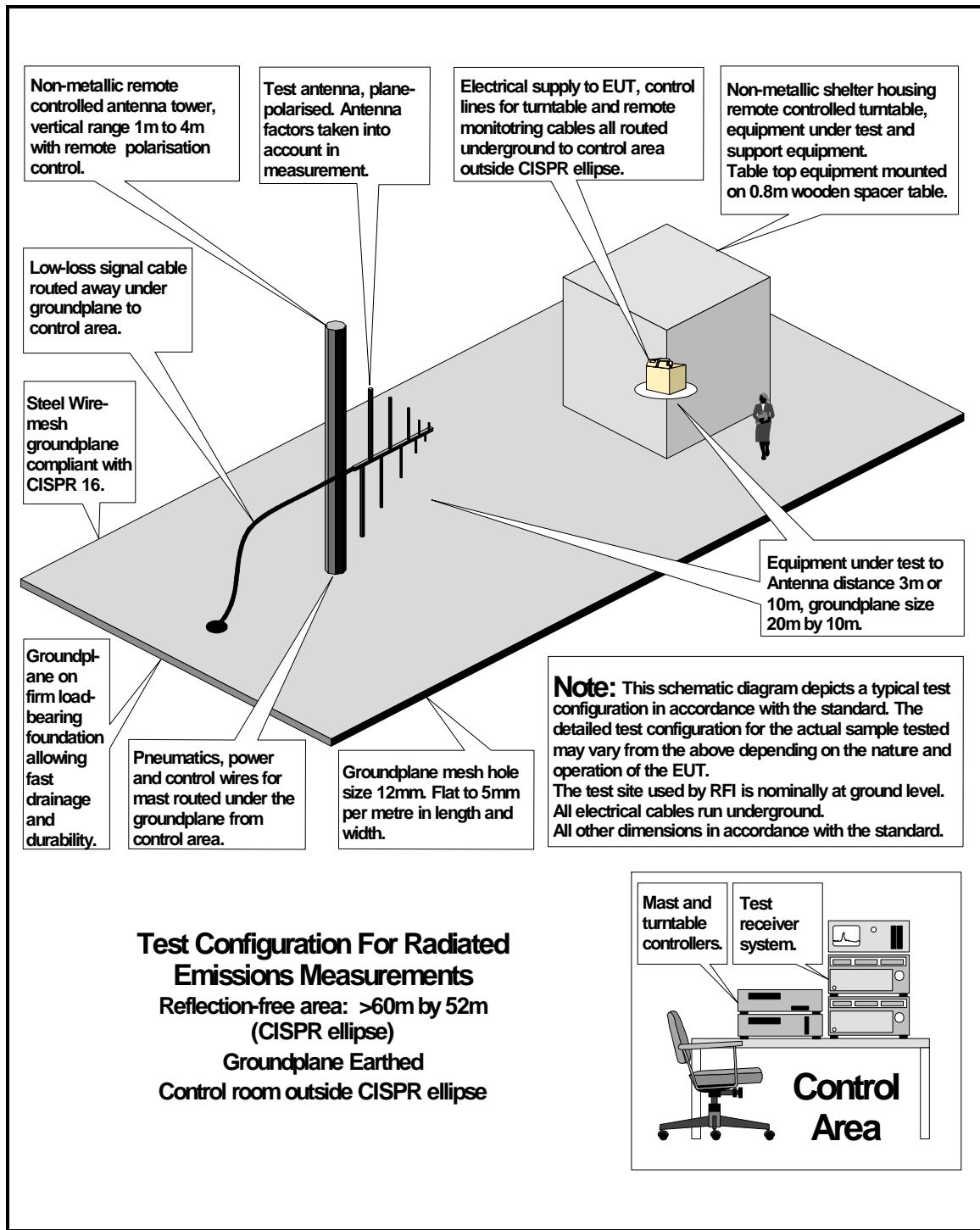
Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\40407ETF01\EMIRAD	Test configuration for measurement of radiated emissions
DRG\40407ETF01\001	Schematic diagram of the EUT, support equipment and interconnecting cables used for the test

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Configuration of EUT

EUT

Appendix 4. Graphical Test Results

This appendix contains the following graphs:

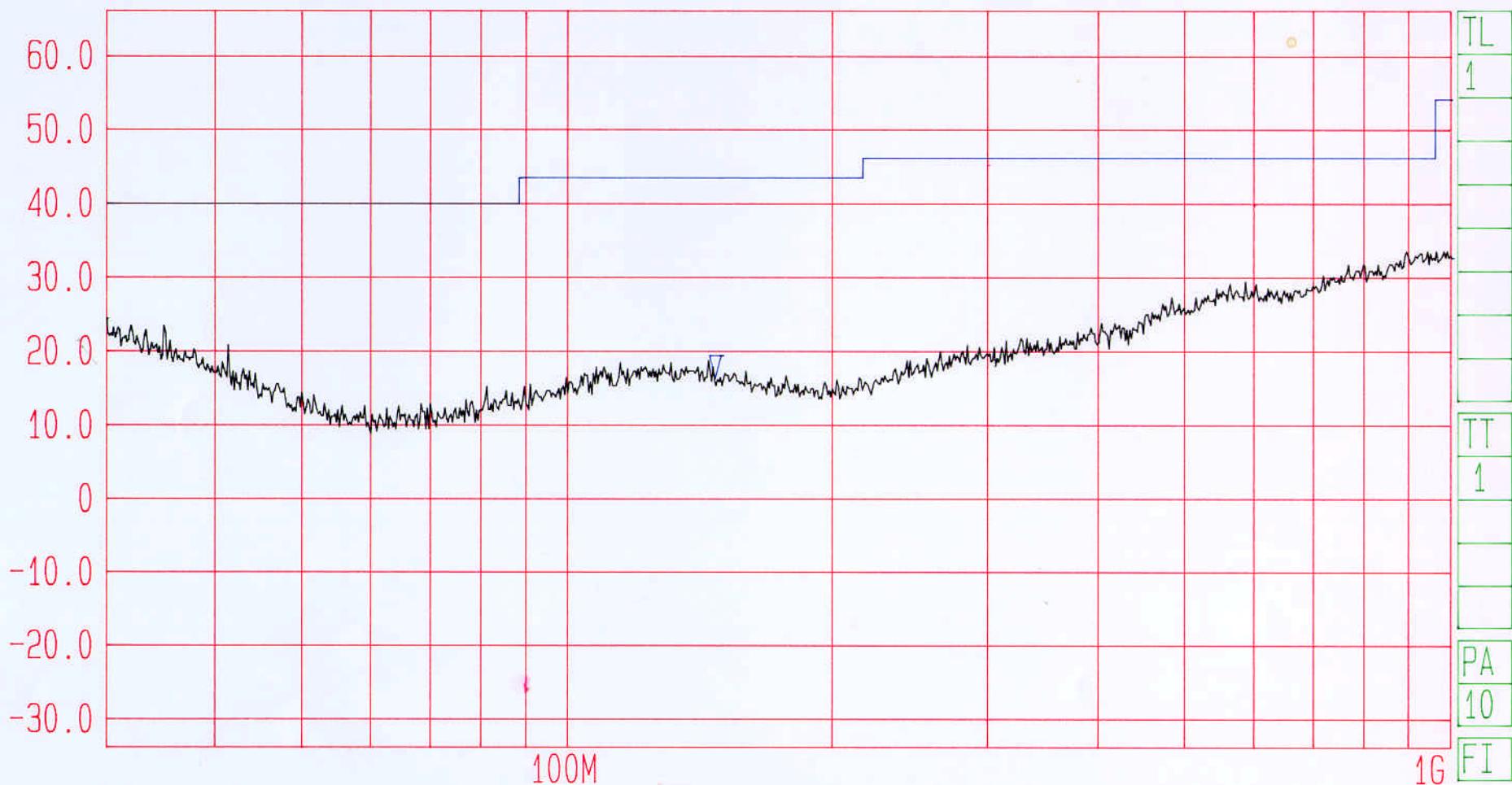
Graph Reference Number	Title
GPH\40407\01\01\001	Scan of radiated electric field: (30 to 1000 MHz), Receiver Idle
GPH\40407\01\01\002	Scan of radiated electric field: (30 to 1000 MHz), Receiver Active (Alarm Mode)
GPH\40407\01\01\003	Scan of radiated electric field: (1 to 2 GHz), Receiver Active (Alarm Mode)
GPH\40407\01\01\004	Scan of radiated electric field: (1 to 2 GHz), Receiver Idle

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



Date 12.Jan.'0 Time 12:05:50
Ref.Lvl Marker 16.08 dB μ V
66.00 dB μ V 146.4 MHz

Res.Bw 120 kHz [imp] Vid.Bw 100 kHz
TG.Lvl off
CF.Stp 97.000 MHz RF.Att 0 dB
Unit [dB μ V]



Start
30 MHz

Radiated Emissions.
FCC Part 15.209.

Span
970 MHz

Tested By RF For Crowcon.
Receiver Idle.

Center
173.2 MHz

Sweep
80 ms

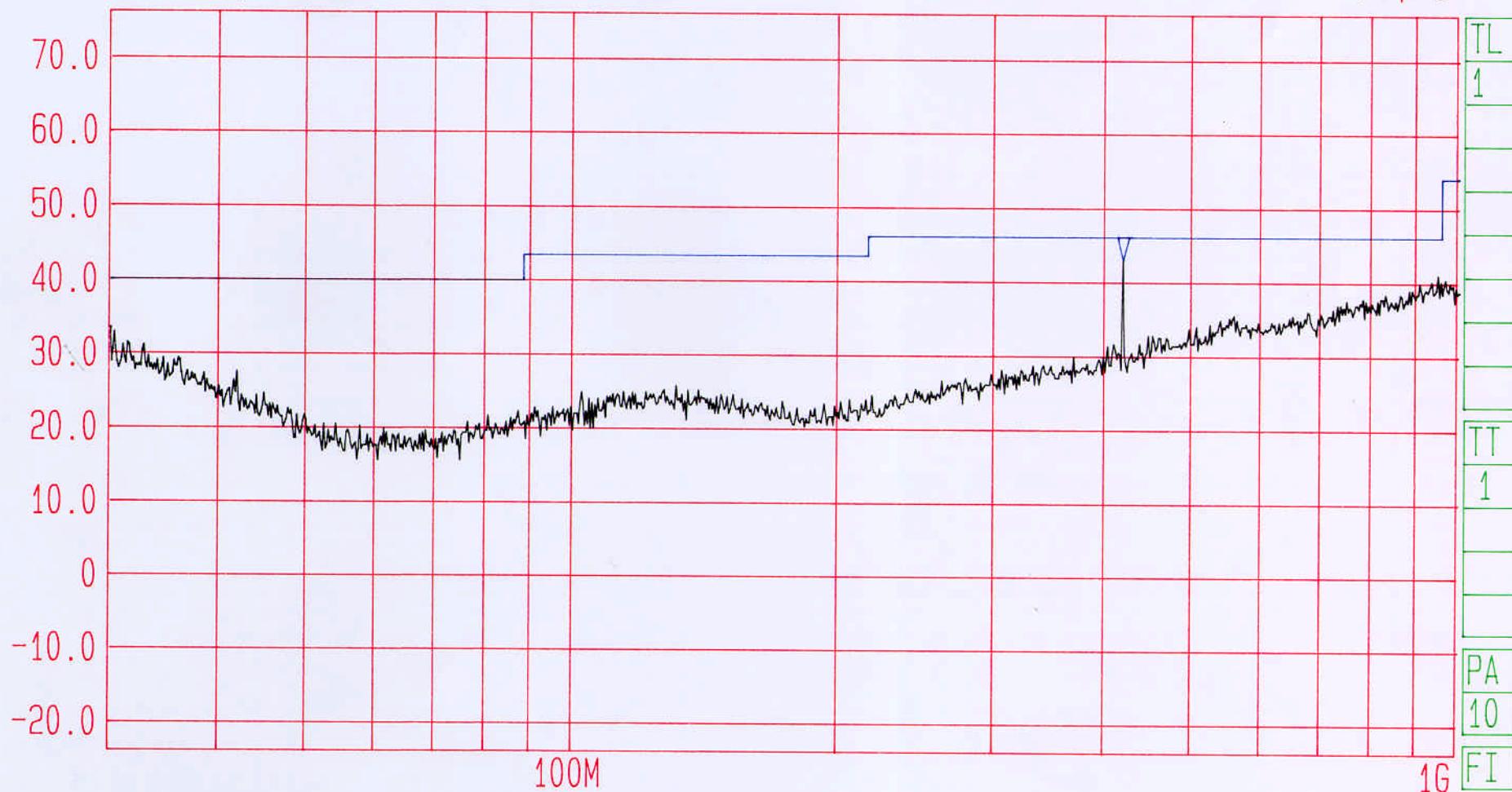
EUT: Gasman 2 Vibrating Pager
GPH: 40407/01/01/001

Stop
1 GHz



Date 12.Jan.'0 Time 15:01:37
Ref.Lvl 76.00 dB μ V Marker 42.97 dB μ V
417.8 MHz

Res.Bw 120 kHz [imp] Vid.Bw 100 kHz
TG.Lvl off
CF.Stp 97.000 MHz RF.Att 0 dB
Unit [dB μ V]



Start
30 MHz

Span
970 MHz

Center
173.2 MHz

Sweep
80 ms

Stop
1 GHz

Radiated Emissions.
FCC Part 15.209.

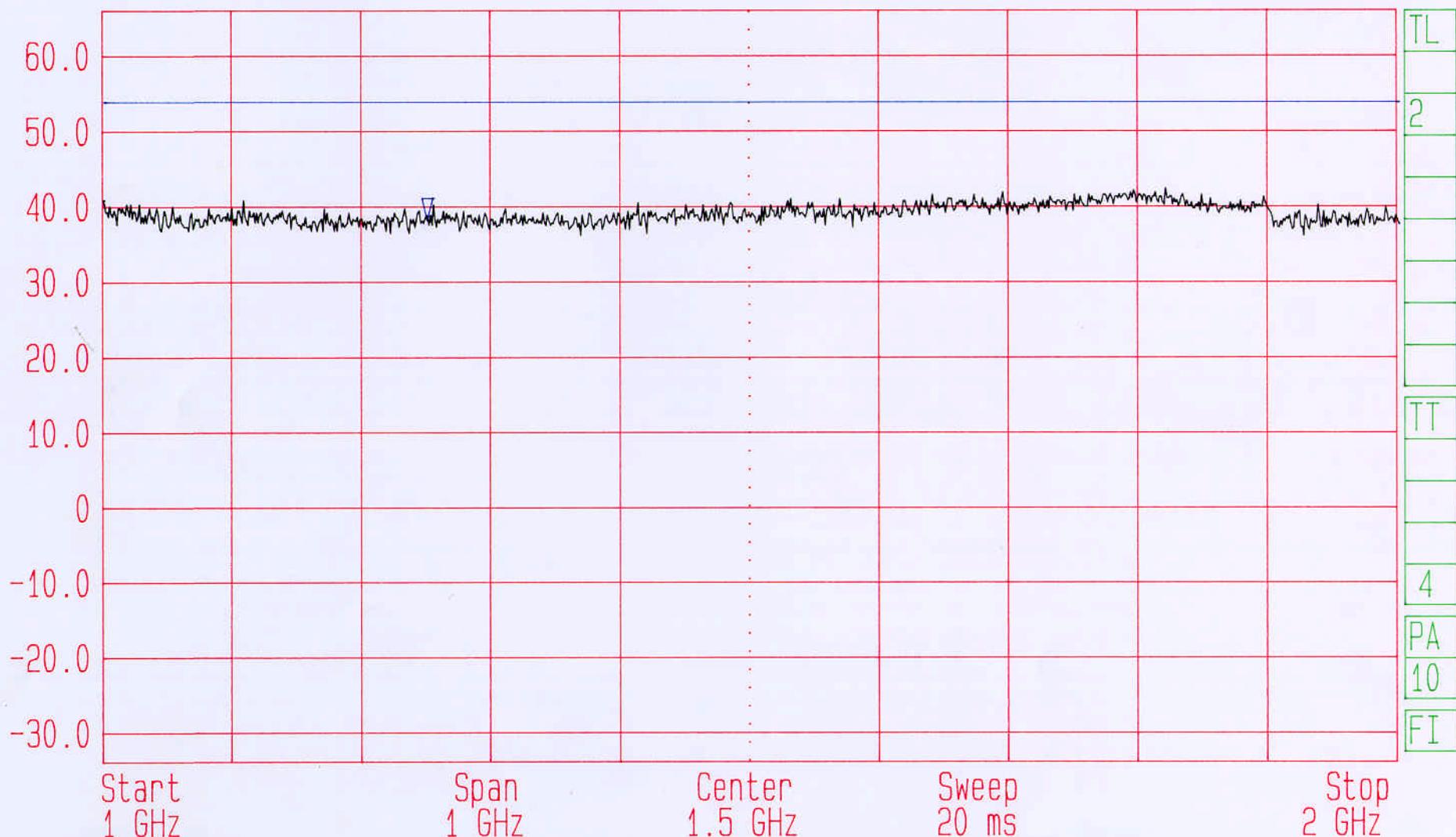
Tested By RF ForCrowncon.
Rx Active

EUT: Gasman 2 Vibrating Pager
GPH: 40407/01/01/003



Date 12.Jan.'0 Time 12:48:55
Ref.Lvl 38.22 dB μ V
Marker 1.2511 GHz
66.00 dB μ V

Res.Bw 1 MHz [imp] Vid.Bw 1 MHz
TG.Lvl off RF.Att 0 dB
CF.Stp 100.000 MHz Unit [dB μ V]



Radiated Emissions.
FCC Part 15.209.

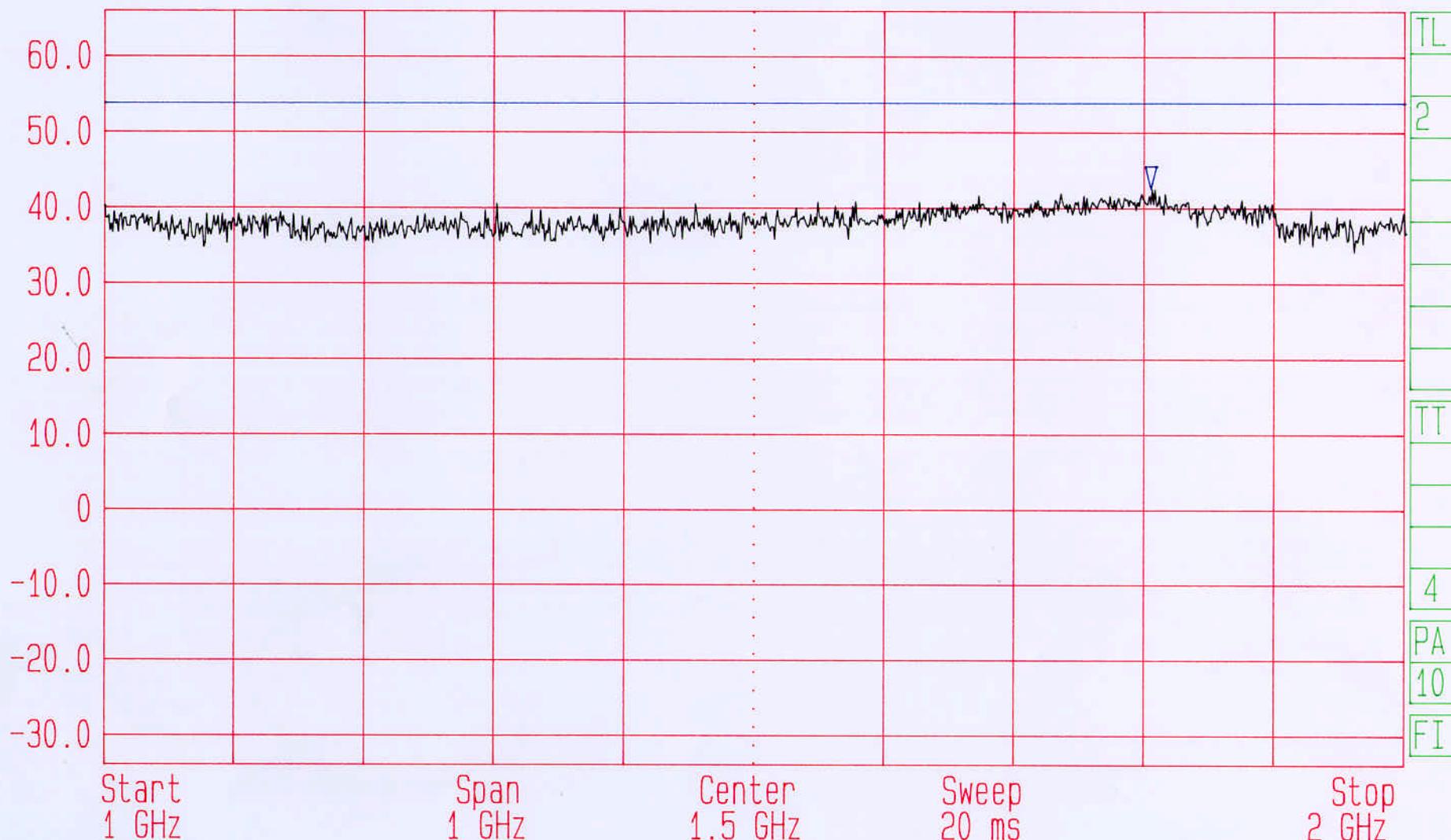
Tested By RF ForCrowncon.
Receiver Active

EUT: Gasman 2 Vibrating Pager
GPH: 40407/01/01/003



Date 12.Jan.'0 Time 12:54:05
Ref.Lvl Marker 42.62 dB μ V
66.00 dB μ V 1.8055 GHz

Res.Bw 1 MHz [imp] Vid.Bw 1 MHz
TG.Lvl off RF.Att Unit 0 dB
CF.Stp 100.000 MHz [dB μ V]



Radiated Emissions.
FCC Part 15.209.

Tested By RF ForCrowcon.
Receiver Idle

EUT: Gasman 2 Vibrating Pager
GPH: 40407/01/01/004

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Appendix 5. Photographs of EUT

This appendix contains the following photographs:

Photo Reference Number	Title
PHT\40407\001	Side view of equipment under test.
PHT\40407\002	Front view of equipment under test.

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

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PHT\40407\001 Side view of equipment under test.



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PHT\40407\002 Front view of equipment under test.

