




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

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

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|--|--|---|
| <p>Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, ENGLAND. Tel: +44 (0) 1256 851193 Fax: +44 (0) 1256 851192</p> | <p>Registered in England, No. 211 7901. Registered Office: Ewhurst Park, Ramsdell, Basingstoke, Hampshire RG26 5RQ</p> |  |
|--|--|---|

RADIO FREQUENCY INVESTIGATION LTD.

EMC Department

**Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B**

TEST REPORT

S.No: RFI/EMCB1/RP40407A

Page 2 of 22

Issue Date: 4 February 2000

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Table of Contents

| | |
|--|----|
| 1. Client Information | 4 |
| 2. Equipment Under Test (EUT)..... | 5 |
| 3. Test Specification, Methods And Procedures | 6 |
| 4. Deviations From The Test Specification..... | 7 |
| 5. Operation Of The EUT During Testing | 8 |
| 6. Summary Of Test Results..... | 9 |
| 7. Measurements, Examinations And Derived Results..... | 10 |
| 8. Measurement Uncertainty..... | 13 |
| Appendix 1. Test Equipment Used..... | 14 |
| Appendix 2. Measurement Methods | 15 |
| Appendix 3. Test Configuration Drawings | 17 |
| Appendix 4. Graphical Test Results | 20 |
| Appendix 5. Photographs of EUT..... | 21 |

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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 |

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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.

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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.

RADIO FREQUENCY INVESTIGATION LTD.

EMC Department

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

TEST REPORT

S.No: RFI/EMCB1/RP40407A

Page 7 of 22

Issue Date: 4 February 2000

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.

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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.

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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 |

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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.

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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).

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit

To: F.C.C. Part 15: 1998 Class B

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.

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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 |

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

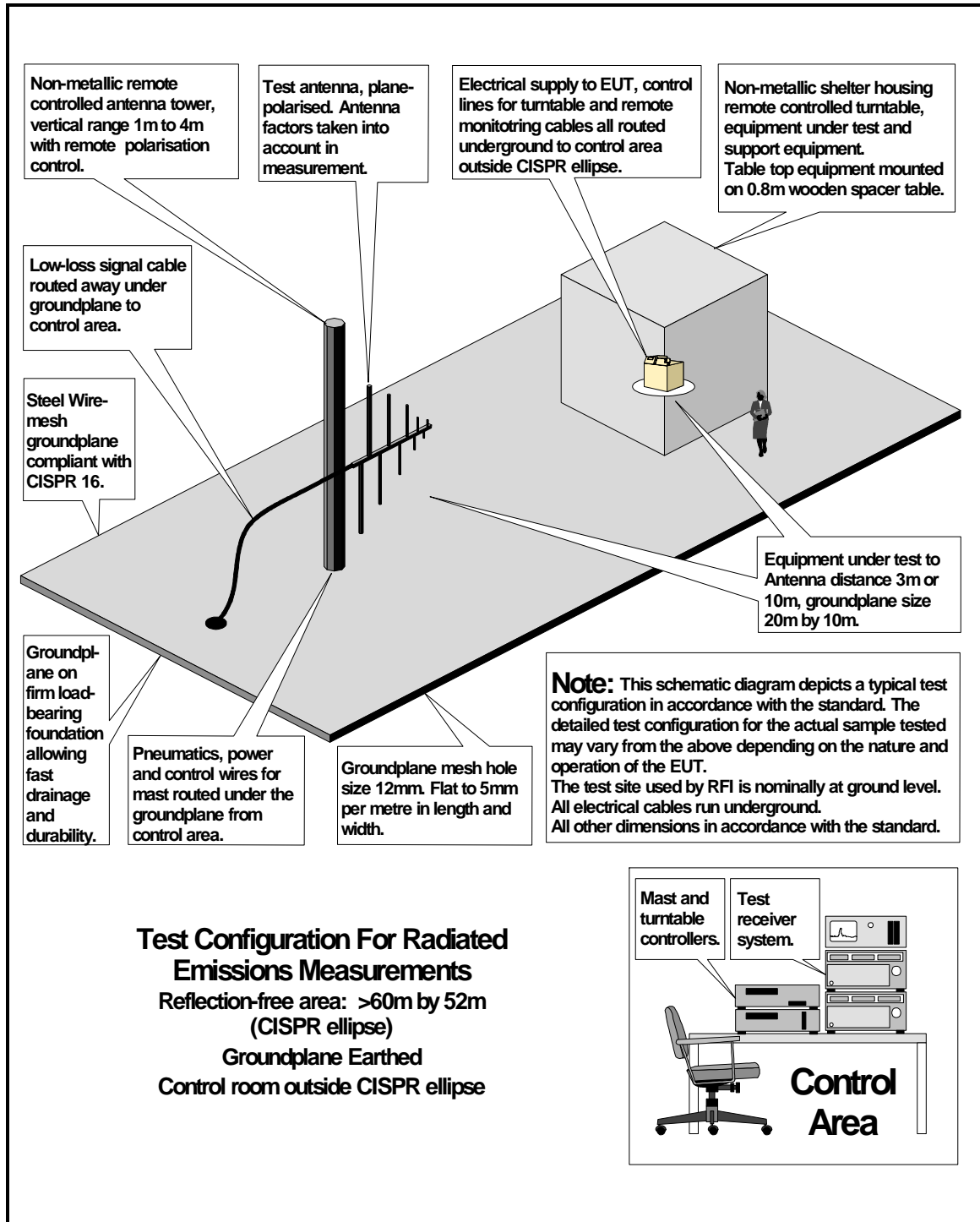
| Drawing Reference Number | Title |
|---------------------------------|--|
| DRG\40407ETF01\EMIRAD | Test configuration for measurement of radiated emissions |
| DRG\40407ETF01\001 | Schematic diagram of the EUT, support equipment and interconnecting cables used for the test |

Test Of: Crowcon Detection Instruments Ltd.

Vibrating Pager Unit

To: F.C.C. Part 15: 1998 Class B

DRG\40407ETF01\EMIRAD



Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

DRG\40407ETF01\001

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.



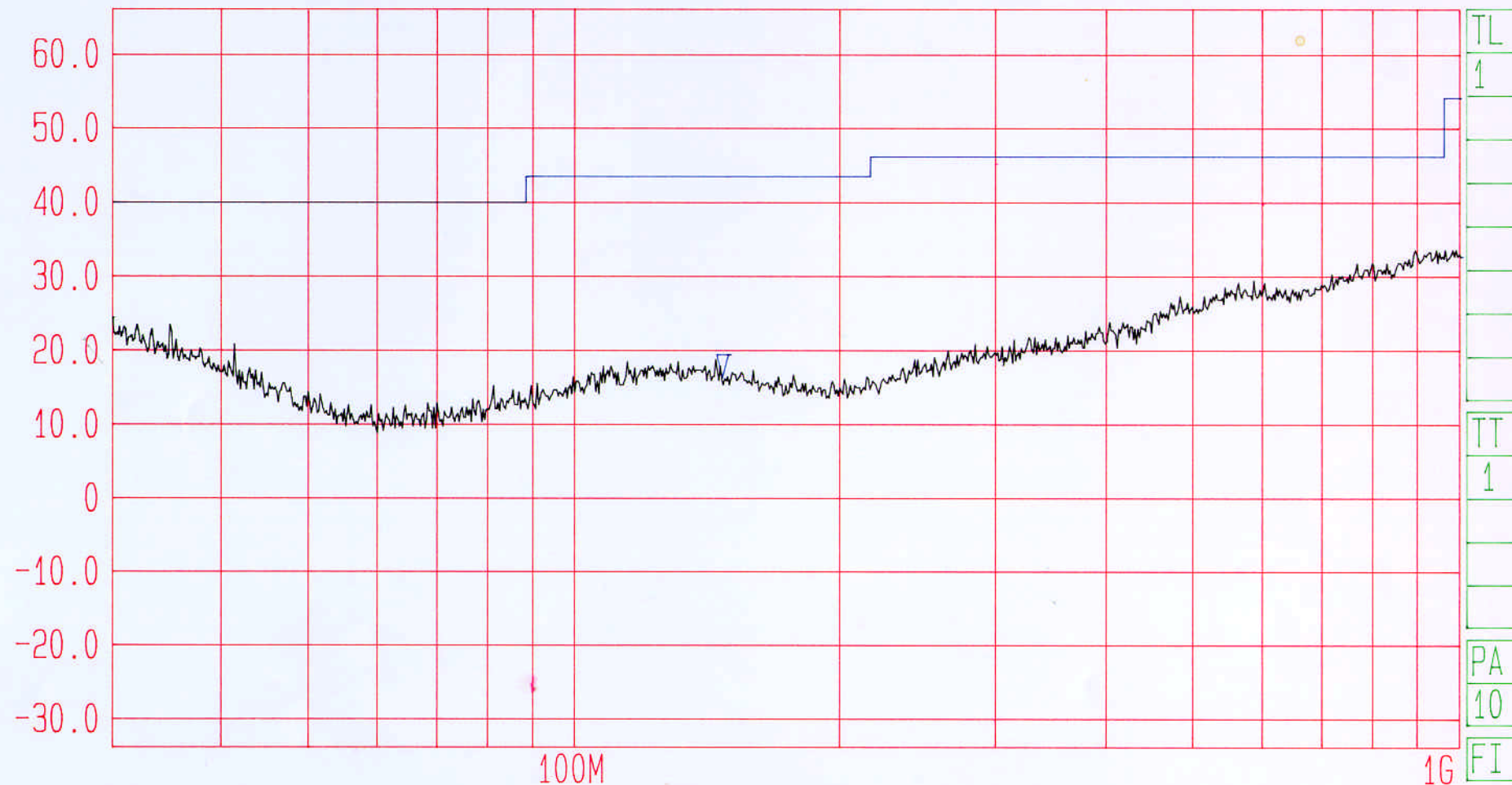
Date 12.Jan.'0 Time 12:05:50

Ref.Lvl 66.00 dBμV
Marker 16.08 dBμV
146.4 MHz

Res.Bw
TG.Lvl
CF.Stp

120 kHz [imp]
off
97.000 MHz

Vid.Bw 100 kHz
RF.Att 0 dB
Unit [dBμV]



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 For Crowcon.
Receiver Idle.

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



Date 12.Jan.'0 Time 15:01:37

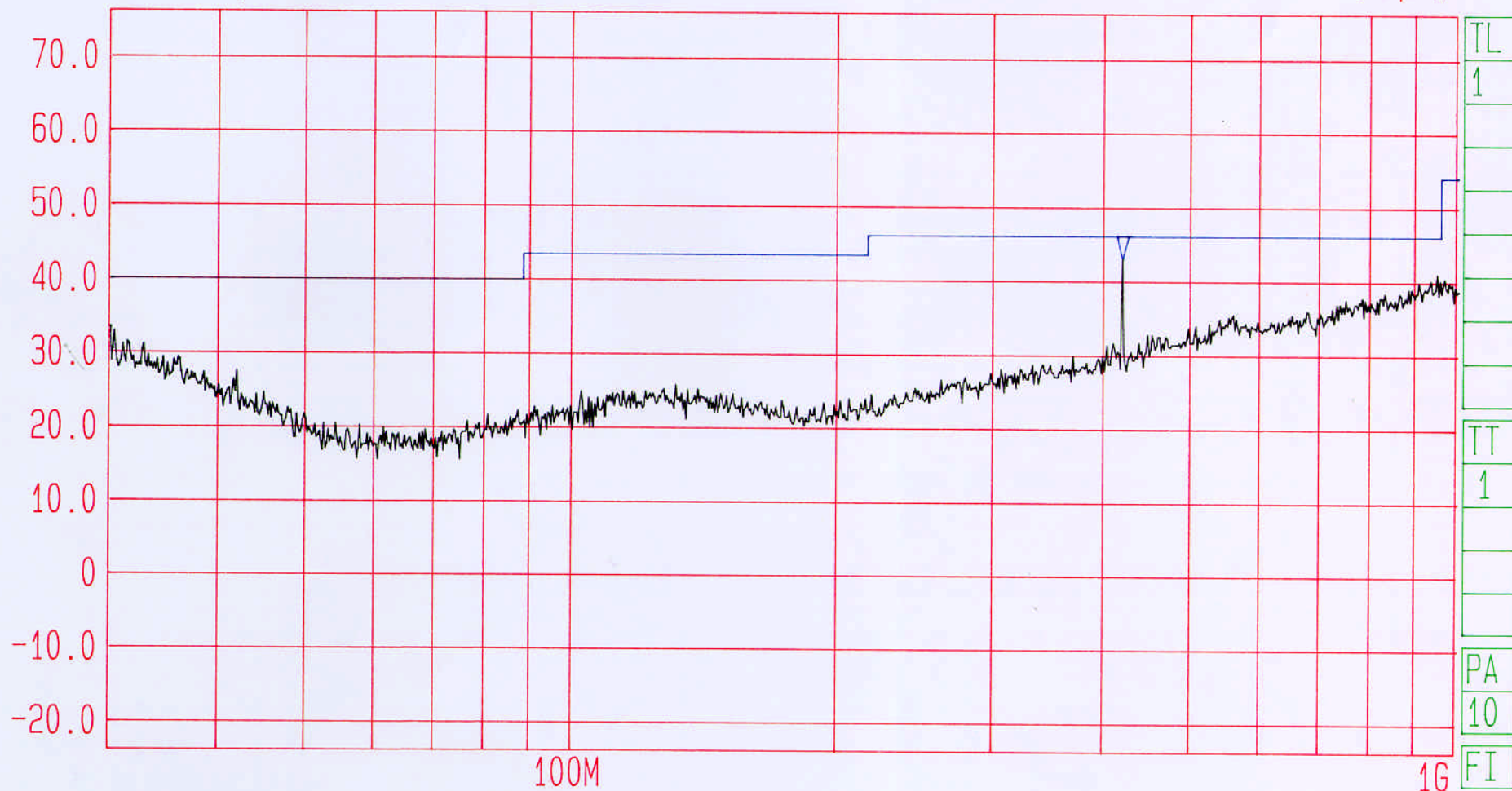
Ref.Lvl 76.00 dBμV
Marker 42.97 dBμV
417.8 MHz

Res.Bw
TG.Lvl
CF.Stp

120 kHz [imp]
off
97.000 MHz

Vid.Bw
RF.Att
Unit

100 kHz
0 dB
[dBμV]



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 ForCrowcon.
Rx Active

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

2



Date 12.Jan.'0 Time 12:48:55

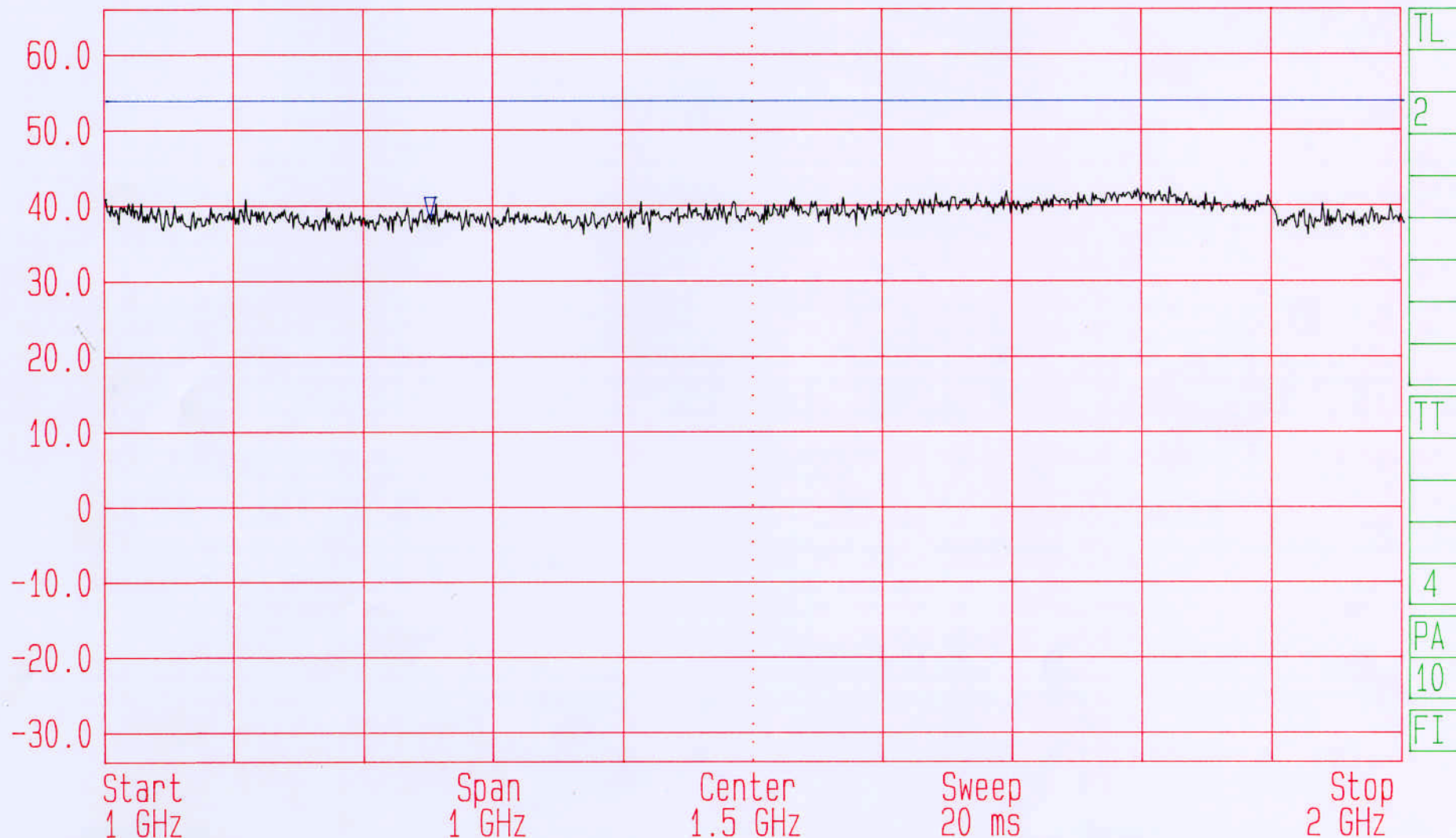
Ref.Lvl 66.00 dBμV
Marker 38.22 dBμV
1.2511 GHz

Res.Bw
TG.Lvl
CF.Stp

1 MHz [imp]
off
100.000 MHz

Vid.Bw
RF.Att
Unit

1 MHz
0 dB
[dBμV]



Radiated Emissions.
FCC Part 15.209.

Tested By RF ForCrowcon.
Receiver Active

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



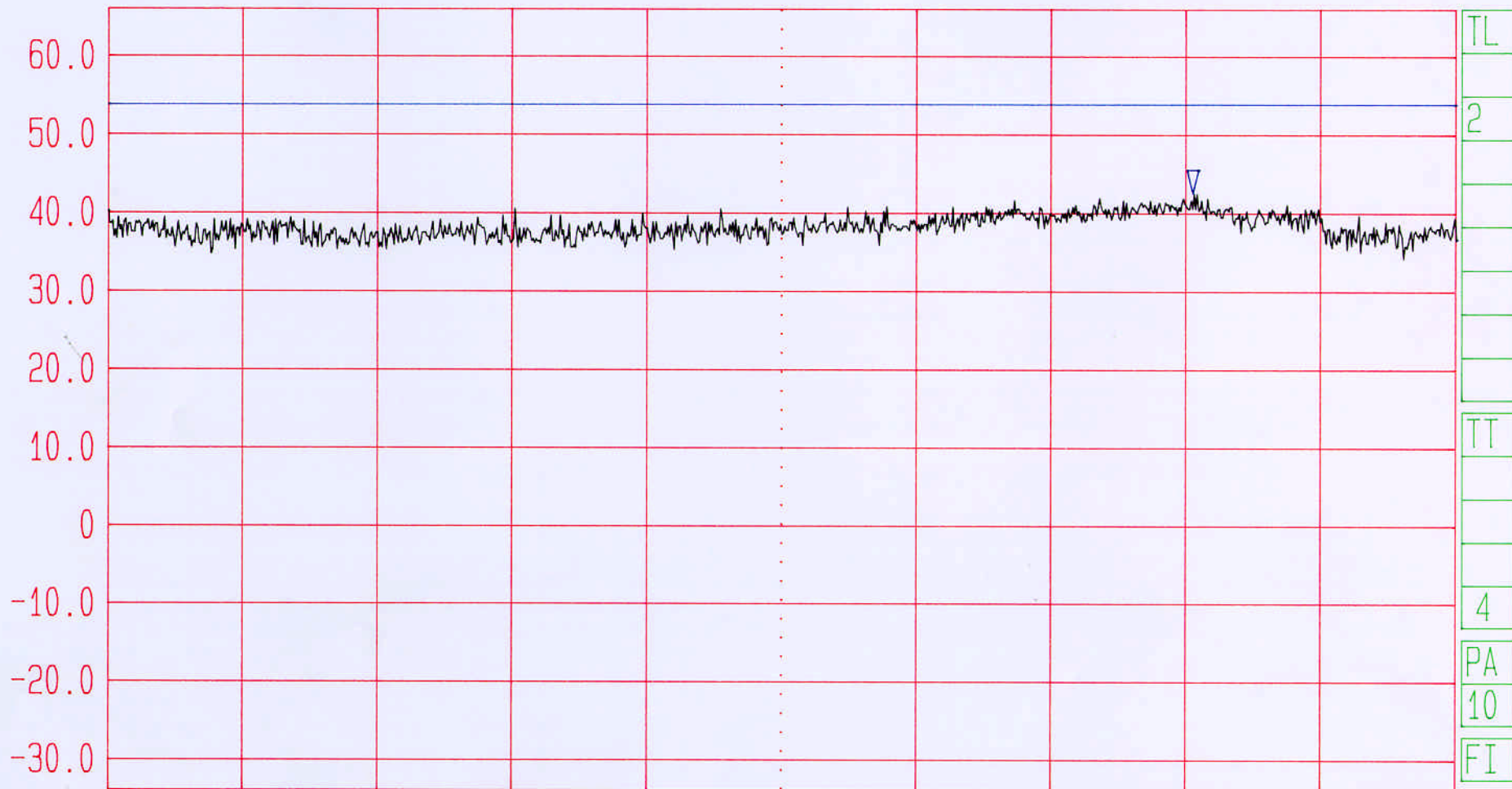
Date 12.Jan.'0 Time 12:54:05

Ref.Lvl 66.00 dBμV
Marker 42.62 dBμV
1.8055 GHz

Res.Bw
TG.Lvl
CF.Stp

1 MHz [imp]
off
100.000 MHz

Vid.Bw 1 MHz
RF.Att 0 dB
Unit [dBμV]



Start 1 GHz Span 1 GHz Center 1.5 GHz Sweep 20 ms Stop 2 GHz

Radiated Emissions.
FCC Part 15.209.

Tested By RF ForCrowcon.
Receiver Idle

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

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.

RADIO FREQUENCY INVESTIGATION LTD.

EMC Department

**Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B**

TEST REPORT

S.No: RFI/EMCB1/RP40407A

Page 22 of 22

Issue Date: 4 February 2000

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EMC Department

Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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



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Test Of: Crowcon Detection Instruments Ltd.
Vibrating Pager Unit
To: F.C.C. Part 15: 1998 Class B

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

