



South Industrial Estate  
Bowburn  
Co. Durham  
DH6 5AD  
United Kingdom  
Telephone: + 44 (0) 191 377 2000  
Fax: + 44 (0) 191 377 2020  
ce.sales.uk@sgsgroup.com

**SGS United Kingdom Ltd.**  
**International Electrical Approvals**

## ***Electromagnetic Compatibility Test Report***

|                            |   |
|----------------------------|---|
| <b>Test of:</b>            | Datasonde 8 kHz/33.6 kHz Low power                        |
| <b>Model Number:</b>       | 10/ND2415-G   |
| <b>Applicant:</b>          | Radiodetection Ltd  |
| <b>Test Type:</b>          | Compliance  |
| <b>Test Specification:</b> | FCC CFR47, part 15.209 for Intentional Radiators.         |
| <b>SGS Serial Number:</b>  | DUR22909/EMC/ST/01/B                                      |
| <b>Date of Receipt:</b>    | 5 <sup>th</sup> March 2001                                |
| <b>Date of Test(s):</b>    | 19 <sup>th</sup> March 2001 – 22 <sup>nd</sup> March 2001 |
| <b>Date of Issue:</b>      | 20 <sup>th</sup> April 2001                               |
| <b>Issue Number:</b>       | 2   |

***Test Engineer***

S. Thompson

***Authorised Signatory***

F. Huggins / A. Reynard / M. Harvey

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**1. Client Information**

**Company Name:** Radiodetection Ltd

**Address:** Western Drive  
Bristol  
BS14 0AZ

**Contact Person:** Norman Prior

**Telephone:** 0117 976 7776

**Facsimile:** 0117 976 7775

**2. Details Of Test Laboratory**

**Company Name:** SGS UK LTD.

**Address:** South Industrial Estate  
Bowburn  
Co. Durham  
DH6 5AD

**Contact Persons:** Mr Alan Reynard

**Telephone:** + 44 191 377 2000

**Facsimile:** + 44 191 377 2020

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### 3. Equipment Under Test (EUT)

#### 3.1 Identification Of EUT

|                                 |   |
|---------------------------------|---|
| Model Number:                   | 10/ND2415-G                                       |
| Unique Identifier:              | IP00002   |
| FCC ID:                         | K68ND2415C  |
| Description of EUT:             | The EUT is a Datasonde                            |
| Fundamental (Carrier) Frequency | 8kHz or 33.6 kHz                                  |
| Internal Clock Frequencies:     | Highest frequency used is 4.608 MHz               |
| Supply Voltage:                 | 3V DC using 2x 'C' size batteries                 |
| Classification:                 | Intentional radiator incorporating digital device |
| Environment Class:              | Class B   |
| Ports present:                  | None – Battery Powered                            |
| Accessories Supplied:           | G2 DrillTrack System *                            |

\* This was used solely to ensure the datasonde was operating correctly and to change the operating frequency of the datasonde. This was not in the test area whilst the tests were conducted.

### 4. Test Specification, Methods and Procedures

#### 4.1 Test Specification(s)

| Specification(s)       | Title  |
|------------------------|--|
| FCC CFR 47 part 15.209 | Code Of Federal Regulations  |
| ANSI C63.4 : 1992      | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz. |

#### 4.2 Purpose Of Test

To perform the relevant tests and assess the product for compliance with the above specification.

### 4.3 Methods and Procedures

The standards listed on the previous page refer to the following tests:

| CFR 47 Clause | Test   |
|---------------|--|
| 15.209        | Radiated Emissions<br>(Intentional Radiator) |

## 5. Deviations or Exclusions from the Test Specifications

There were no deviations from the test specifications.

The scope of the inspection is limited to what is specified in the clients instructions and does not include any other checks or tests such as the electrical (electronic) control systems ability to cope with the implications of the dates falling on, before or after "January 2000".

## **6. Operation of the EUT During Testing / Configuration and Peripherals**

### **6.1 Operation of EUT during testing.**

The EUT was tested whilst transmitting at 33.6 kHz and repeated whilst transmitting at 8 kHz.

### **6.2 Configuration and Peripherals**

No support equipment or peripherals were used during the testing.

## **7. Test Results**

### **7.1 General Comments**

The test methods used are referred to in the individual test results sections of this test report.

### **7.2 Modifications Made to the EUT**

No modifications were made to the EUT during the testing process.

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### 7.3 Summary of Test Results

| CFR 47<br>Clause | Test                             | Result   |
|------------------|----------------------------------|----------|
| 15.209           | Radiated Emissions (Intentional) | Complied |

#### Result

In the configuration tested, the EUT complies with the requirements of Clause 15.209 of CFR 47.

Full details of all tests can be found in the test results section of this report.

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## 7.4 Transmitter Radiated Emissions < 30 MHz - Intentional Radiator

|                 |                |
|-----------------|----------------|
| CFR Clause      | 15.209         |
| Frequency Range | 9 kHz – 30 MHz |

### Operating Mode

The EUT was operating whilst the transmitter frequency was set at 33 kHz and repeated when set to 8 kHz.

### Test Results

#### Worst Case Emissions

##### *Transmitter at 33 kHz*

| Frequency (kHz) | Corrected Peak Measurement (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) |
|-----------------|---|----------------------|
| 33.62           | 14.1                                      | 37.07                |
| 100.24          | -26.66                                    | 14.1                 |
| 133.26          | -24.8                                     | 14.1                 |
| 301.36          | -26.9                                     | 14.1                 |
| 368.6           | -32.72                                    | 14.1                 |
| 877.83          | -61.04                                    | 14.1                 |

##### *Transmitter at 8 kHz*

| Frequency (kHz) | Corrected Peak Measurement (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) |
|-----------------|---|----------------------|
| 8.4             | 24.21                                     | No limit             |
| 25.217          | -11.75                                    | 24.21                |
| 41.917          | -21.73                                    | 24.21                |
| 58.833          | -25.93                                    | 24.21                |
| 75.641          | -28.43                                    | 24.21                |
| 92.441          | -27.86                                    | 24.21                |
| 109.3           | -22.2                                     | 24.21                |
| 126.033         | -28.3                                     | 24.21                |
| 133.175         | -26.3                                     | 24.21                |
| 159.633         | -24.63                                    | 24.21                |

### Test Method

As per ANSI C63.4 : 1992

Measurements were performed at 3m and extrapolated to correct distance of 300m using a factor of 40dB/dec. Hence the correction factor of -80 dB was used. The corrected values are given above.

Frequency Range tested = 9 kHz to 30 MHz (as per sec 15.33 (a)(1)(4) ).

Measurement Detector Details: Peak, 300Hz bandwidth at frequencies below 150 kHz, 10 kHz at frequencies above 150 kHz.

## Radiated Emissions Test Configuration



## Radiated Emissions Environmental Conditions

|                     |                                   |
|---------------------|-----------------------------------|
| Power Supply        | 3V DC using x2 'C' size batteries |
| Temperature         | 8°C                               |
| Relative Humidity   | 49%                               |
| Barometric Pressure | 1011mb                            |

## Radiated Emissions Measurement Uncertainties

|           |          |
|-----------|----------|
| Frequency | ± 200kHz |
| Amplitude | ± 4.6dB  |

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

## Test Equipment Used

| Equipment Type      | Model Number | Last Calibration Date | Calibration Interval |
|---------------------|--------------|-----------------------|----------------------|
| Active loop antenna | EMCO 6152    | 7/8/98                | 3 Years              |
| Spectrum Analyser   | HP 8563E     | 10/5/00               | 1 Year               |

## 7.5 Transmitter Radiated Emissions 30 MHz – 1 GHz - Intentional Radiator

|                 |                |
|-----------------|----------------|
| CFR Clause      | 15.209         |
| Frequency Range | 30 MHz – 1 GHz |

### Operating Mode

The EUT was operating whilst the transmitter frequency was set at 33 kHz and repeated when set to 8 kHz.

### Test Results

#### *Transmitter at 33 kHz*

| Frequency (MHz) | 3m Peak Measurement (dB $\mu$ V/m) | Limit at 3m (dB $\mu$ V/m) |
|-----------------|------------------------------------|----------------------------|
| 109.82          | 18.96                              | 43.52                      |
| 262.67          | 19.17                              | 46.00                      |
| 271.92          | 18.8                               | 46.00                      |
| 400*            | 16.94                              | 46.00                      |
| 600*            | 26.14                              | 46.00                      |
| 850*            | 29.42                              | 46.00                      |

#### *Transmitter at 8 kHz*

| Frequency (MHz) | 3m Peak Measurement (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) |
|-----------------|------------------------------------|----------------------|
| 110.07          | 21.76                              | 43.52                |
| 258.07          | 16.68                              | 46.00                |
| 262.72          | 18.47                              | 46.00                |
| 267.33          | 17.47                              | 46.00                |
| 271.92          | 15.13                              | 46.00                |
| 850*            | 29.42                              | 46.00                |

\* Noise floor figures of test equipment.

### Test Method

As per ANSI C63.4 : 1992

Frequency Range tested = 30 MHz to 1 GHz (as per sec 15.33 (a)(4) ).

Measurement Detector Details: Peak, 300Hz bandwidth at frequencies below 150 kHz, 10 kHz at frequencies above 150 kHz.

The measurement was performed at 3m.

**Radiated Emissions Test Configuration****Radiated Emissions Environmental Conditions**

|                     |                                   |
|---------------------|-----------------------------------|
| Power Supply        | 3V DC using 2x 'C' size batteries |
| Temperature         | 14°C                              |
| Relative Humidity   | 32%                               |
| Barometric Pressure | 989mb                             |

**Radiated Emissions Measurement Uncertainties**

|           |          |
|-----------|----------|
| Frequency | ± 200kHz |
| Amplitude | ± 4.6dB  |

The uncertainties stated are calculated in accordance with the requirements of UKAS with a confidence level of 95%.

**Test Equipment Used**

| Equipment Type    | Model Number | Last Calibration Date | Calibration Interval |
|-------------------|--------------|-----------------------|----------------------|
| Biconilog antenna | EMCO 3142    | 22/6/99               | 2 Years              |
| Spectrum Analyser | HP 8563E     | 10/5/00               | 1 Year               |