

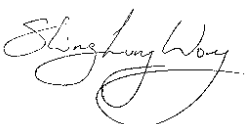


## TEST REPORT FROM RFI GLOBAL SERVICES LTD.

Test Of: Draeger Safety UK  
460MHz Entry Control Board

To: FCC Part 90: 2003

**Test Report Serial No:**  
RF\MPTE1\RP46068JD02A

|                                                                                                                                                                                           |                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>This Test Report Is Issued Under The Authority<br/>Of Richard Jacklin, Operations Director:</b><br> | <b>Checked By: Tony Henriques</b><br> |
| <b>Tested By: Steven Wong</b><br>                                                                      | <b>Release Version No: PDF001</b>                                                                                        |
| <b>Issue Date: 27 September 2004</b>                                                                                                                                                      | <b>Test Dates: 25 August to 08 September 2004</b>                                                                        |

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**RFI GLOBAL SERVICES LTD.**

**TEST REPORT**

**S.No. RFI\MPTE1\RP46068JD02A**

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**Issue Date: 27 September 2004**

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## **1. Client Information**

|                      |                                                                                |
|----------------------|--------------------------------------------------------------------------------|
| <b>Company Name:</b> | Draeger Safety UK                                                              |
| <b>Address:</b>      | Kitty Brewster Estate<br>Blyth<br>Northumberland<br>NE24 4RG<br>United Kingdom |
| <b>Contact Name:</b> | Mr M Berney                                                                    |

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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:                 | DrägerMan PSS Merlin        |
| Model Name or Number:       | 460 MHz Entry Control Board |
| Unique Type Identification: | 33 51144                    |
| Serial Number:              | BRSB-0001                   |
| Country of Manufacture:     | UK                          |
| FCC ID Number:              | SIZ001                      |
| Date of Receipt:            | 25/08/04                    |

### **2.2. Accessories**

The following accessories were supplied with the EUT:

|                         |                                 |
|-------------------------|---------------------------------|
| Description:            | 125 kHz RF Tag Transponder x 12 |
| Brand Name:             | Dräger                          |
| Model Name or Number:   | None Stated                     |
| Serial Number:          | None Stated                     |
| Country of Manufacture: | UK                              |

|                         |                                         |
|-------------------------|-----------------------------------------|
| Description:            | Re-Chargeable 7.2V NiMH Battery pack x2 |
| Brand Name:             | Dräger                                  |
| Model Name or Number:   | 33 51223                                |
| Serial Numbers:         | BRTE-0064 & BRTE-0066                   |
| Country of Manufacture: | UK                                      |

|                         |            |
|-------------------------|------------|
| Description:            | AC Adaptor |
| Brand Name:             | Artesyn    |
| Model Name or Number:   | SSL40-7612 |
| Serial Number:          | ZCDK9082   |
| Country of Manufacture: | China      |

### **2.3. Description Of EUT**

The EUT is a large panel incorporating data only telemetry radio and transponder readers. Operated by fire-fighter control external to fire incident it can communicate with up to 12 Portable Radio Units. The EUT is fitted with an integral antenna and also an external 50Ω RF antenna port. When an antenna is fitted to this antenna port the integral antenna is no longer active and the transmission switches to the external antenna port. Transponder readers operate at 125 kHz.

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## **2.4. Modifications Incorporated In EUT**

During the course of testing the EUT was not modified.

## **2.5. Support Equipment**

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

|                               |              |
|-------------------------------|--------------|
| <b>Description:</b>           | Test Box     |
| <b>Brand Name:</b>            | None Stated  |
| <b>Model Name or Number:</b>  | None Stated  |
| <b>Serial Number:</b>         | None Stated  |
| <b>Cable Length And Type:</b> | 1.5m, 4 Core |
| <b>Connected to Port:</b>     | Data         |

## **2.6. Additional Information Related To Testing**

|                                                    |                                                                                                                           |                       |                                |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------------|
| <b>Power Supply Requirement:</b>                   | Nominal 7.2V NiMH battery supply or an alternative external 12V DC supply via an 110V AC mains adaptor                    |                       |                                |
| <b>Intended Operating Environment:</b>             | Public Emergency Services (Fire)                                                                                          |                       |                                |
| <b>Equipment Category:</b>                         | Base Station                                                                                                              |                       |                                |
| <b>Type of Unit:</b>                               | Transceiver                                                                                                               |                       |                                |
| <b>Interface Ports:</b>                            | Data connection port<br>RS232 Serial interface<br>External 4 pin voltage supply interface<br>External 50Ω RF antenna port |                       |                                |
| <b>Transmit Frequency Range</b>                    | 450 MHz to 470 MHz                                                                                                        |                       |                                |
| <b>Transmit Channels Tested</b>                    | <b>Channel ID</b>                                                                                                         | <b>Channel Number</b> | <b>Channel Frequency (MHz)</b> |
|                                                    | Bottom                                                                                                                    | Not stated            | 450                            |
|                                                    | Middle                                                                                                                    | Not stated            | 460                            |
|                                                    | Top                                                                                                                       | Not stated            | 470                            |
|                                                    | N/A                                                                                                                       | N/A                   | 0.125                          |
| <b>Receive Frequency Range</b>                     | 450 MHz to 470 MHz                                                                                                        |                       |                                |
| <b>Receive Channels Tested</b>                     | <b>Channel ID</b>                                                                                                         | <b>Channel Number</b> | <b>Channel Frequency (MHz)</b> |
|                                                    | Bottom                                                                                                                    | Not stated            | 450                            |
|                                                    | Middle                                                                                                                    | Not stated            | 460                            |
|                                                    | Top                                                                                                                       | Not stated            | 470                            |
| <b>Occupied Bandwidth</b>                          | 11.25 kHz                                                                                                                 |                       |                                |
| <b>Highest Unintentionally Generated Frequency</b> | 470 MHz                                                                                                                   |                       |                                |

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### **3. Test Specification, Methods And Procedures**

#### **3.1. Test Specifications**

|                         |                                                                                                                           |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <b>Reference:</b>       | FCC Part 90: 2003 (Private Land Mobile Radio Services)                                                                    |
| <b>Title:</b>           | Code of Federal Regulations, Part 90 (47CFR90)<br>Private Land Mobile Radio Services                                      |
| <b>Purpose of Test:</b> | 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/TIA-603-B-2002

Title: Land Mobile FM or PM Communications Equipment. Measurement and Performance Standard

ANSI C63.2 (1987)

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 (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: (1999)

Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

DA00-705 (2000)

Title: Filing and Frequency Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

#### **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 Conditions**

During testing, the EUT was powered by an external 12V DC supply obtained from a 110V AC mains adaptor which also charged the integral nominal 7.2V battery supply.

### **5.2. Operating Modes**

The EUT was tested in the following operating modes, unless otherwise stated:

Preliminary radiated spurious emissions pre-scan tests were performed in transmit and receive modes on the highest operating frequency of the EUT (top channel) with the AC adaptor detailed in section 2.2 of this report connected and disconnected. The combination that exhibited the worst case mode of operation was then used to perform final measurements. This was found to be with the EUT connected to the AC adaptor. Final measurements were performed on the top, middle and bottom channels if an emission was identified.

For all other transmit mode measurements the EUT was set to transmit on the top, middle and bottom channels as necessary.

### **5.3. Configuration And Peripherals**

The EUT was tested in the following configuration:

Configured with batteries fitted and AC adaptor attached. The 12 RF tag transponders fitted in the dedicated receptacles on the ECB front panel.

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## 6. Test Results

### Summary Of Part 90 Tests

| Range Of Measurements                                             | Specification Reference                                                     | Port Type         | Compliance Status |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------|-------------------|-------------------|
| Receiver AC Conducted Emissions (150 kHz to 30 MHz)               | C.F.R. 47 FCC Part 15: 2003 Section 15.107                                  | AC Mains          | Complied          |
| Receiver Radiated Spurious Emissions (30 MHz to 2 GHz)            | C.F.R. 47 FCC Part 15: 2003 Section 15.109                                  | Enclosure         | Complied          |
| Transmitter AC Conducted Emissions (150 kHz to 30 MHz)            | C.F.R. 47 FCC Part 15: 2003 Section 15.207                                  | AC Mains          | Complied          |
| Transmitter Carrier Output Power (ERP)                            | C.F.R. 47 FCC Part 90: 2003 Sections 90.205/90.267 TIA-603-B Section 2.2.1  | Antenna Terminals | Complied          |
| Transmitter Carrier Output Power (ERP)                            | C.F.R. 47 FCC Part 90: 2003 Sections 90.205/90.267 TIA-603-B Section 2.2.17 | Antenna           | Complied          |
| Transmitter Occupied Bandwidth (Bandwidth Limitations)            | C.F.R. 47 FCC Part 90: 2003 Sections 90.209/90.267/2.1049                   | Antenna Terminals | Complied          |
| Transmitter Conducted Emissions Masks                             | C.F.R. 47 FCC Part 90: 2003 Sections 90.210 TIA-603-B Section 2.2.13        | Antenna Terminals | Complied          |
| Transmitter Conducted Emissions (Out of Band) (9 kHz to 5 GHz)    | C.F.R. 47 FCC Part 90: 2003 Sections 90.210 TIA-603-B Section 2.2.13        | Antenna Terminals | Complied          |
| Transmitter Radiated Emissions Masks                              | C.F.R. 47 FCC Part 90: 2003 Sections 90.210 TIA-603-B Section 2.2.12        | Antenna           | Complied          |
| Transmitter Radiated Emissions (Out of Band) (30 MHz to 5 GHz)    | C.F.R. 47 FCC Part 90: 2003 Sections 90.210 TIA-603-B Section 2.2.12        | Antenna           | Complied          |
| Transmitter Frequency Stability (Temperature & Voltage Variation) | C.F.R. 47 FCC Part 90: 2003 Sections 90.213/2.1055 TIA-603-B Section 2.2.2  | Antenna Terminals | Complied          |
| Transmitter Transient Frequency Behaviour                         | C.F.R. 47 FCC Part 90: 2003 Sections 90.214 TIA-603-B Section 2.2.19        | Antenna Terminals | Complied          |

### Additional test required for 125 kHz transmitter

| Range Of Measurements                                     | Specification Reference                    | Port Type | Compliance Status |
|-----------------------------------------------------------|--------------------------------------------|-----------|-------------------|
| Transmitter Radiated Spurious Emissions (9 kHz to 30 MHz) | C.F.R. 47 FCC Part 15: 2003 Section 15.209 | Enclosure | Complied          |

### 6.1. Location Of Tests

All the measurements described in this report were performed at the premises of RFI Global Services Ltd., Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

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## **7. Measurements, Examinations And Derived Results**

### **7.1. General Comments**

7.1.1. This section contains test results only.

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.

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## 7.2. Receiver AC Conducted Spurious Emissions: Section 15.107

7.2.1. The EUT was configured as for AC conducted emissions measurements as described in Section 9 of this report.

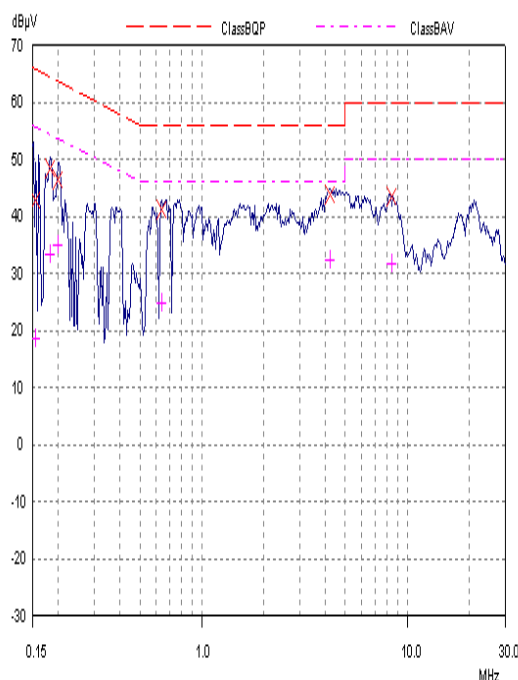
7.2.2. Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

### Results: Quasi-Peak Detector Measurements On Live And Neutral Lines

| Frequency (MHz) | Line    | Q-P Level (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Result   |
|-----------------|---------|------------------------|--------------------|-------------|----------|
| 0.15420         | Live    | 43.0                   | 65.8               | 22.8        | Complied |
| 0.18225         | Live    | 48.3                   | 64.4               | 16.1        | Complied |
| 0.19937         | Neutral | 46.4                   | 63.6               | 17.2        | Complied |
| 0.63759         | Live    | 41.3                   | 56.0               | 14.7        | Complied |
| 4.23714         | Live    | 43.9                   | 56.0               | 12.1        | Complied |
| 8.38202         | Neutral | 43.4                   | 60.0               | 16.6        | Complied |

### Results: Average Detector Measurements On Live And Neutral Lines

| Frequency (MHz) | Line    | Av. Level (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Result   |
|-----------------|---------|------------------------|--------------------|-------------|----------|
| 0.15420         | Neutral | 18.5                   | 55.8               | 37.3        | Complied |
| 0.18225         | Live    | 33.4                   | 54.4               | 21.0        | Complied |
| 0.19937         | Neutral | 35.0                   | 53.6               | 18.6        | Complied |
| 0.63759         | Live    | 24.8                   | 46.0               | 21.2        | Complied |
| 4.23714         | Live    | 32.3                   | 46.0               | 13.7        | Complied |
| 8.38202         | Neutral | 31.7                   | 50.0               | 18.3        | Complied |



Note: this plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

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### 7.3. Receiver Radiated Spurious Emissions: Section 15.109

#### 7.3.1. Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)

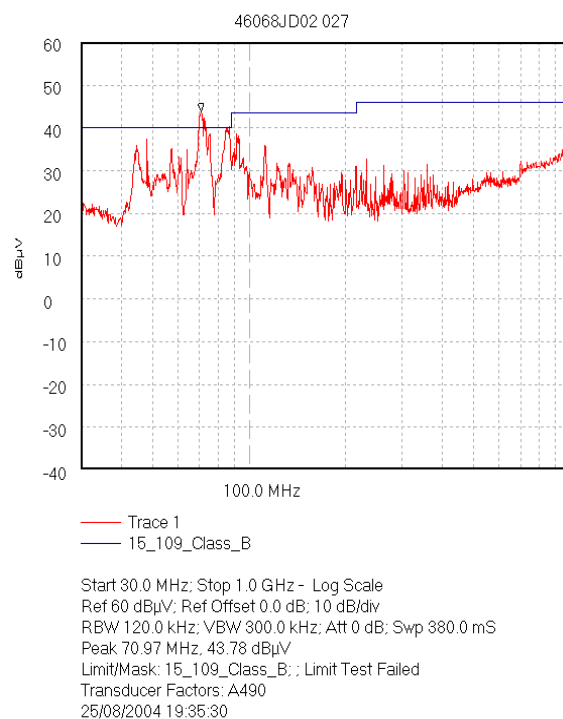
7.3.1.1. The EUT was configured as for receiver radiated emissions testing as described in Section 9 of this report.

7.3.1.2. Tests were performed to identify the maximum receiver or standby radiated emissions levels.

#### Result: Top Channel

| Frequency (MHz) | Ant. Pol. | Q-P Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Margin (dB) | Result   |
|-----------------|-----------|--------------------------|----------------------|-------------|----------|
| 44.564          | Vert.     | 24.9                     | 40.0                 | 15.1        | Complied |
| 48.003          | Vert.     | 27.3                     | 40.0                 | 12.7        | Complied |
| 70.914          | Vert.     | 30.4                     | 40.0                 | 9.6         | Complied |
| 84.655          | Vert.     | 26.2                     | 40.0                 | 13.8        | Complied |
| 92.381          | Horiz.    | 27.7                     | 43.5                 | 15.8        | Complied |
| 111.970         | Vert.     | 24.3                     | 43.5                 | 19.2        | Complied |
| 231.998         | Vert.     | 23.9                     | 46.0                 | 22.1        | Complied |
| 359.973         | Horiz.    | 28.1                     | 46.0                 | 17.9        | Complied |

Note: The preliminary scans showed similar emission levels for each mode below 1 GHz, therefore final radiated emissions measurements were performed with the EUT set to the top channel only.



Note: this plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

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**Receiver Radiated Emissions: Section 15.109 (Continued)****7.3.2. Electric Field Strength Measurements (Frequency Range: 1 to 2 GHz)****Result: Bottom Channel****Highest Peak Level:**

| Frequency (GHz) | Antenna Polarity (H/V) | Peak Detector level (dBμV) | Antenna factor (dB) | Cable loss (dB) | Actual Peak Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Result   |
|-----------------|------------------------|----------------------------|---------------------|-----------------|----------------------------|----------------|-------------|----------|
| 1.620008        | Vert.                  | -1.3                       | 21.6                | 0.7             | 21.0                       | 74.0           | 53.0        | Complied |

**Highest Average Level:**

| Frequency (GHz) | Antenna Polarity (H/V) | Average Detector level (dBμV) | Antenna factor (dB) | Cable loss (dB) | Actual Average Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Result   |
|-----------------|------------------------|-------------------------------|---------------------|-----------------|-------------------------------|----------------|-------------|----------|
| 1.620008        | Vert.                  | -6.1                          | 21.6                | 0.7             | 16.2                          | 54.0           | 37.8        | Complied |

**Result: Middle Channel****Highest Peak Level:**

| Frequency (GHz) | Antenna Polarity (H/V) | Peak Detector level (dBμV) | Antenna factor (dB) | Cable loss (dB) | Actual Peak Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Result   |
|-----------------|------------------------|----------------------------|---------------------|-----------------|----------------------------|----------------|-------------|----------|
| 1.660005        | Vert.                  | 0.9                        | 21.6                | 0.7             | 23.2                       | 74.0           | 50.8        | Complied |

**Highest Average Level:**

| Frequency (GHz) | Antenna Polarity (H/V) | Average Detector level (dBμV) | Antenna factor (dB) | Cable loss (dB) | Actual Average Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Result   |
|-----------------|------------------------|-------------------------------|---------------------|-----------------|-------------------------------|----------------|-------------|----------|
| 1.660005        | Vert.                  | -2.4                          | 21.6                | 0.7             | 19.9                          | 54.0           | 34.1        | Complied |

**Result: Top Channel****Highest Peak Level:**

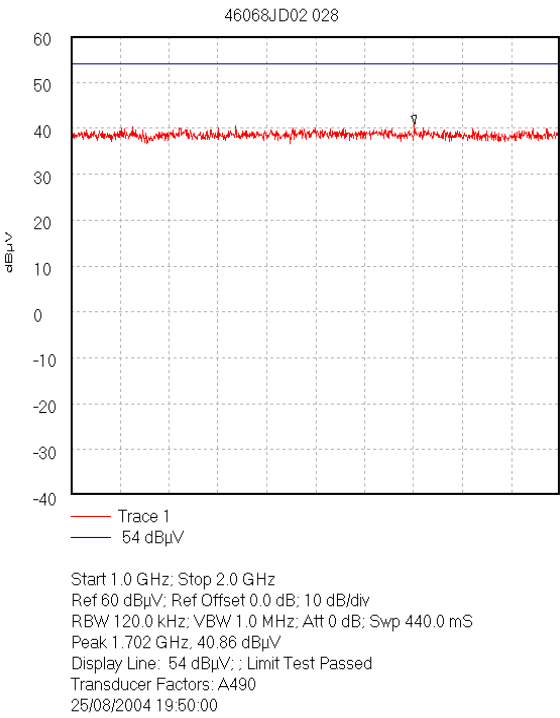
| Frequency (GHz) | Antenna Polarity (H/V) | Peak Detector level (dBμV) | Antenna factor (dB) | Cable loss (dB) | Actual Peak Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Result   |
|-----------------|------------------------|----------------------------|---------------------|-----------------|----------------------------|----------------|-------------|----------|
| 1.701602        | Vert.                  | 2.0                        | 21.6                | 0.7             | 24.3                       | 74.0           | 49.7        | Complied |

**Highest Average Level:**

| Frequency (GHz) | Antenna Polarity (H/V) | Average Detector level (dBμV) | Antenna factor (dB) | Cable loss (dB) | Actual Average Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Result   |
|-----------------|------------------------|-------------------------------|---------------------|-----------------|-------------------------------|----------------|-------------|----------|
| 1.701602        | Vert.                  | 0.5                           | 21.6                | 0.7             | 21.8                          | 54.0           | 32.2        | Complied |

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Receiver Radiated Emissions: Section 15.109 (Continued)



Note: this plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

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#### 7.4. Transmitter AC Conducted Spurious Emissions: Section 15.207

7.4.1. The EUT was configured as for AC conducted emissions measurements as described in Section 9 of this report.

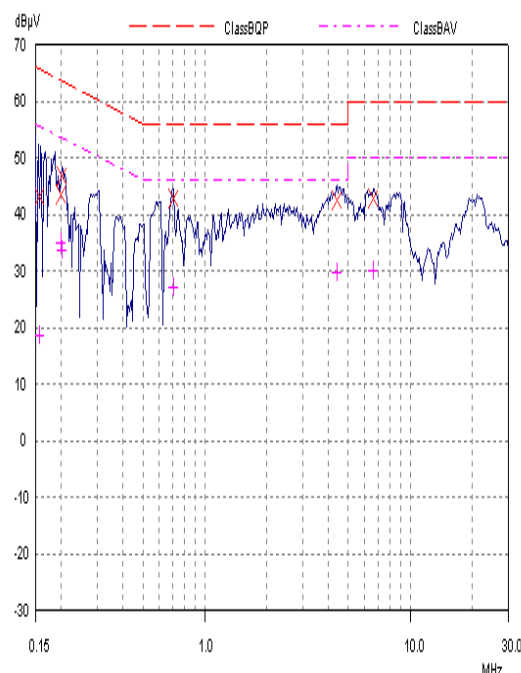
7.4.2. Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

##### Results: Quasi-Peak Detector Measurements On Live And Neutral Lines

| Frequency (MHz) | Line    | Q-P Level (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Result   |
|-----------------|---------|------------------------|--------------------|-------------|----------|
| 0.15708         | Neutral | 43.3                   | 65.6               | 22.3        | Complied |
| 0.19872         | Neutral | 43.6                   | 63.7               | 20.1        | Complied |
| 0.20255         | Neutral | 46.9                   | 63.5               | 16.6        | Complied |
| 0.70808         | Neutral | 42.9                   | 56.0               | 13.1        | Complied |
| 4.44279         | Neutral | 42.5                   | 56.0               | 13.5        | Complied |
| 6.67592         | Neutral | 42.8                   | 60.0               | 17.1        | Complied |

##### Results: Average Detector Measurements On Live And Neutral Lines

| Frequency (MHz) | Line    | Av. Level (dB $\mu$ V) | Limit (dB $\mu$ V) | Margin (dB) | Result   |
|-----------------|---------|------------------------|--------------------|-------------|----------|
| 0.15708         | Live    | 18.4                   | 55.6               | 37.2        | Complied |
| 0.19872         | Neutral | 35.0                   | 53.7               | 18.7        | Complied |
| 0.20255         | Neutral | 33.5                   | 53.5               | 20.0        | Complied |
| 0.70808         | Neutral | 27.0                   | 46.0               | 19.0        | Complied |
| 4.44279         | Neutral | 29.5                   | 46.0               | 16.5        | Complied |
| 6.67592         | Neutral | 30.1                   | 50.0               | 19.9        | Complied |



Note: this plot is a pre-scan and for indication purposes only. For final measurements, see accompanying tables.

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**7.5. Transmitter Carrier Output Power (ERP): Sections 90.205/90.267**

7.5.1. The EUT was configured as for transmitter carrier output measurements as described in Section 9 of this report.

7.5.2. Tests were performed to identify the EUT's maximum conducted transmit power.

7.5.3. The effective radiated power (ERP) was calculated by adding the manufacturer's declared maximum antenna gain to the figure measured for conducted RF output power.

**Results:**

| Channel | Frequency (MHz) | Conducted RF O/P Power (dBm) | Stated Antenna Gain (dB) | ERP (dBm) | ERP Limit (dBm) | Margin (dB) | Result   |
|---------|-----------------|------------------------------|--------------------------|-----------|-----------------|-------------|----------|
| Bottom  | 450             | 25.7                         | 3.0                      | 28.7      | 33.0            | 4.3         | Complied |
| Middle  | 460             | 26.0                         | 3.0                      | 29.0      | 33.0            | 4.0         | Complied |
| Top     | 470             | 25.9                         | 3.0                      | 28.9      | 33.0            | 4.1         | Complied |

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**7.6. Transmitter Carrier Output Power (ERP): Sections 90.205/90.267**

7.6.1. The EUT was configured as for transmitter radiated emissions as described in Section 9 of this report.

7.6.2. Tests were performed to identify the EUT's maximum radiated transmit power.

**Results:**

| Channel | Frequency (MHz) | ERP (dBm) | ERP Limit (dBm) | Margin (dB) | Result   |
|---------|-----------------|-----------|-----------------|-------------|----------|
| Bottom  | 450             | 28.2      | 33.0            | 4.8         | Complied |
| Middle  | 460             | 27.5      | 33.0            | 5.5         | Complied |
| Top     | 470             | 26.5      | 33.0            | 6.5         | Complied |

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**7.7. Transmitter Occupied Bandwidth (Bandwidth Limitations): Sections 90.209/90.267/2.1049**

7.7.1. The EUT was configured as for Occupied Bandwidth measurements as described in Section 9 of this report.

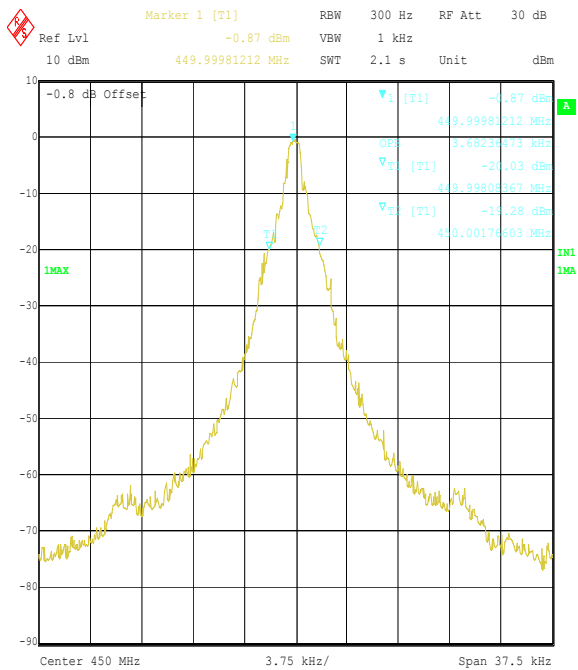
7.7.2. Tests were performed to identify the bandwidth occupied by the fundamental frequency of the EUT.

**Result:**

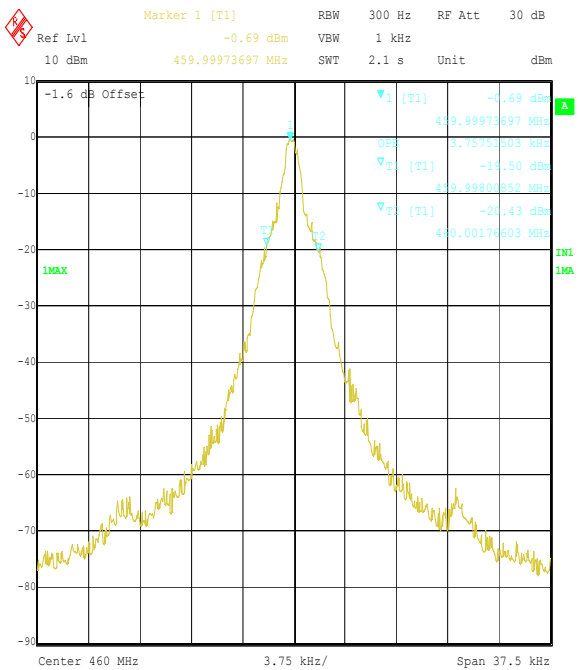
| Channel | Frequency (MHz) | RBW (kHz) | VBW (kHz) | Occupied Bandwidth (kHz) | Limit (kHz) | Margin (kHz) | Result   |
|---------|-----------------|-----------|-----------|--------------------------|-------------|--------------|----------|
| Bottom  | 450             | 0.3       | 1         | 3.682                    | 11.25       | 7.568        | Complied |
| Middle  | 460             | 0.3       | 1         | 3.758                    | 11.25       | 7.492        | Complied |
| Top     | 470             | 0.3       | 1         | 3.758                    | 11.25       | 7.492        | Complied |

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
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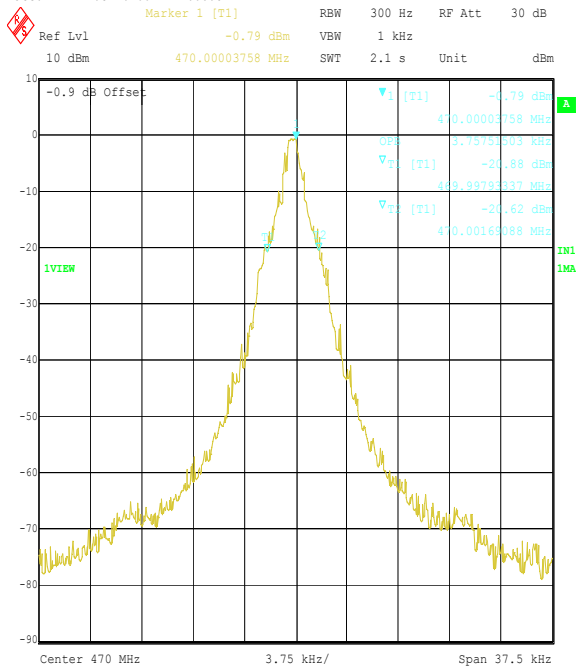
Transmitter Occupied Bandwidth (Bandwidth Limitations): Sections 90.209/90.267/2.1049  
(Continued)



Title: Draeger EUT: Entry Control Board, FCC P90 Occupied Bandwidth  
Comment A: 46068JD02 Bottom Channel.  
Date: 1.SEP.2004 12:08:54



Title: Draeger EUT: Entry Control Board, FCC P90 Occupied Bandwidth  
Comment A: 46068JD02 Middle Channel.  
Date: 1.SEP.2004 12:11:45



Title: Draeger EUT: Entry Control Board, FCC P90 Occupied Bandwidth  
Comment A: 46068JD02 Top Channel.  
Date: 1.SEP.2004 12:14:03

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

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#### **7.8. Transmitter Conducted Emissions Masks: Section 90.210**

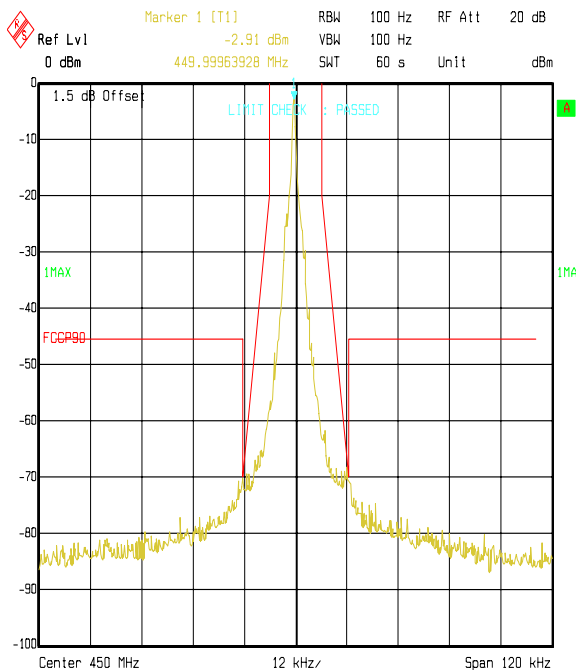
7.8.1. The EUT was configured as for transmitter conducted emissions measurements as described in Section 9 of this report.

7.8.2. Tests were performed to determine compliance with the out of band power requirements at frequencies adjacent to the channel occupied by the fundamental frequency of the EUT.

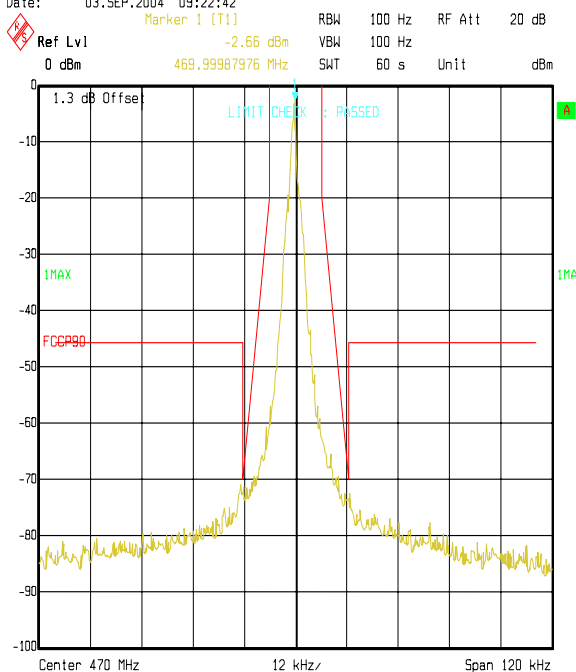
#### **Results:**

Results are presented graphically in the following graphs. As can be seen from the plots the EUT complies with the requirements of relevant part of the regulations.

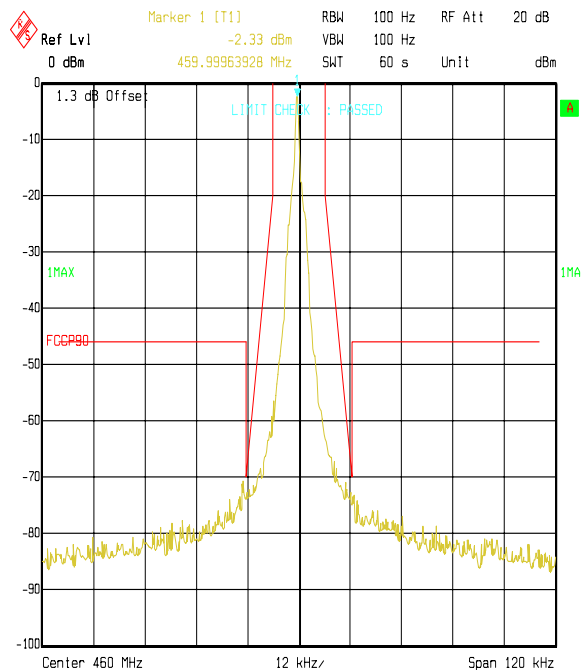
Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

**Transmitter Conducted Emissions Masks: Section 90.210 (Continued)**

Title: Draeger EUT: Entry Control Board. FCC P90.210 Emission Mask  
Comment A: 46068JD02 Bottom Channel  
Date: 03.SEP.2004 09:22:42



Title: Draeger EUT: Entry Control Board. FCC P90.210 Emission Mask  
Comment A: 46068JD02 Top Channel  
Date: 03.SEP.2004 09:14:36



Title: Draeger EUT: Entry Control Board. FCC P90.210 Emission Mask  
Comment A: 46068JD02 Middle Channel  
Date: 03.SEP.2004 09:26:47

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

### **7.9. Transmitter Conducted Emissions (Out of Band): Section 90.210**

7.9.1. The EUT was configured as for transmitter conducted emissions measurements as described in Section 9 of this report.

7.9.2. Tests were performed to identify the maximum transmitter conducted emission levels.

#### **Result: Bottom Channel**

| Frequency (MHz) | Peak Emission Level (dBm) | Peak Emission Level (dBc) | Limit (dBc) | Margin (dB) | Result   |
|-----------------|---------------------------|---------------------------|-------------|-------------|----------|
| 449.950         | -35.7                     | -61.4                     | -45.7       | 15.7        | Complied |
| 450.050         | -35.1                     | -60.8                     | -45.7       | 15.1        | Complied |
| 900.001         | -22.4                     | -48.1                     | -45.7       | 2.4         | Complied |
| 2250.005        | -36.7                     | -62.4                     | -45.7       | 16.7        | Complied |

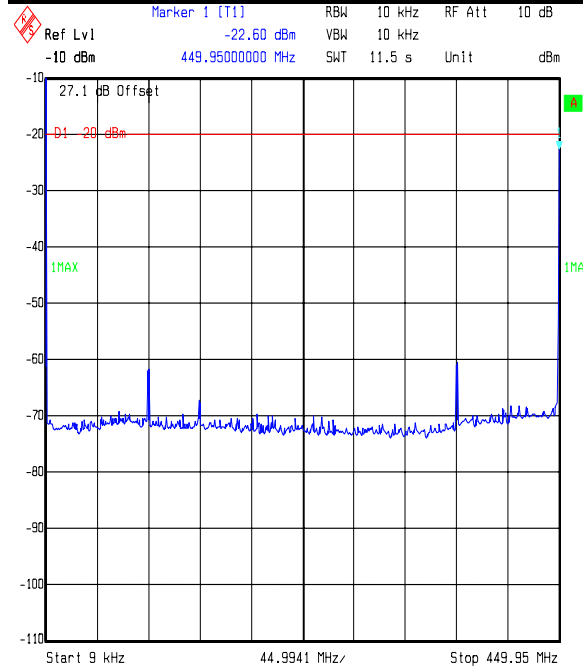
#### **Result: Middle Channel**

| Frequency (MHz) | Peak Emission Level (dBm) | Peak Emission Level (dBc) | Limit (dBc) | Margin (dB) | Result   |
|-----------------|---------------------------|---------------------------|-------------|-------------|----------|
| 459.950         | -35.8                     | -61.8                     | -46.0       | 15.8        | Complied |
| 460.050         | -35.7                     | -61.7                     | -46.0       | 15.7        | Complied |
| 920.002         | -23.3                     | -49.3                     | -46.0       | 3.3         | Complied |
| 2300.125        | -36.3                     | -62.3                     | -46.0       | 16.3        | Complied |

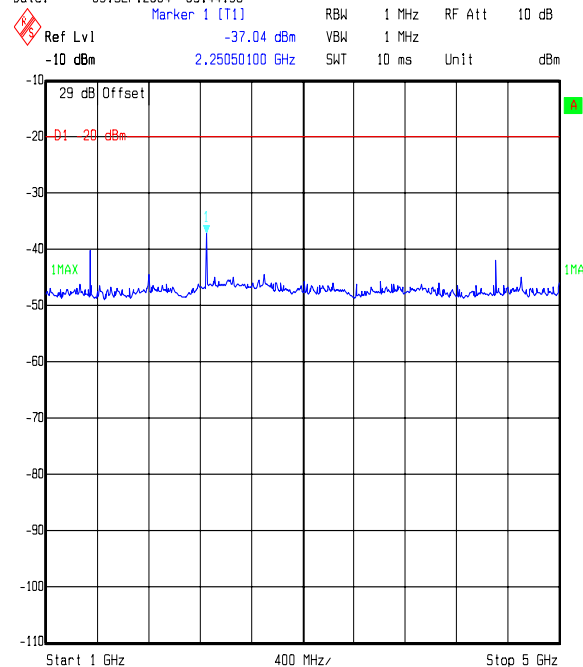
#### **Result: Top Channel**

| Frequency (MHz) | Peak Emission Level (dBm) | Peak Emission Level (dBc) | Limit (dBc) | Margin (dB) | Result   |
|-----------------|---------------------------|---------------------------|-------------|-------------|----------|
| 469.950         | -35.8                     | -61.7                     | -45.9       | 15.8        | Complied |
| 470.050         | -35.1                     | -61.0                     | -45.9       | 15.1        | Complied |
| 940.000         | -24.1                     | -50.0                     | -45.9       | 4.1         | Complied |
| 3758.840        | -39.4                     | -65.3                     | -45.9       | 19.4        | Complied |

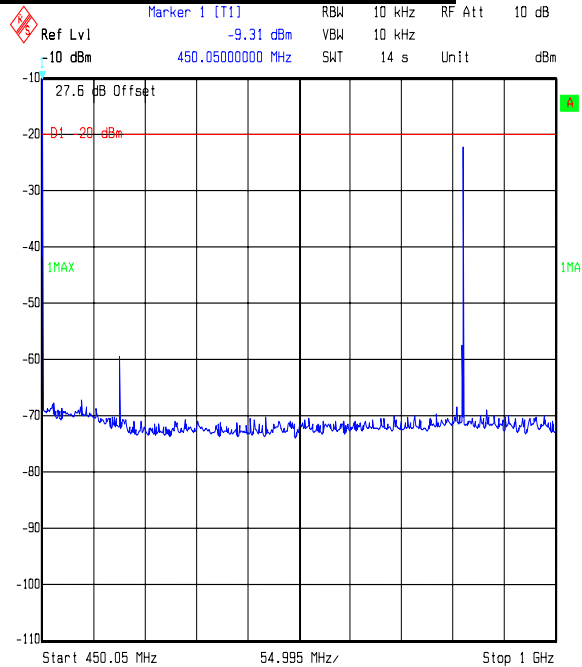
Test Of: Draeger Safety UK  
460MHz Entry Control Board  
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**Transmitter Conducted Emissions (Out of Band): Section 90.210 (Continued)**

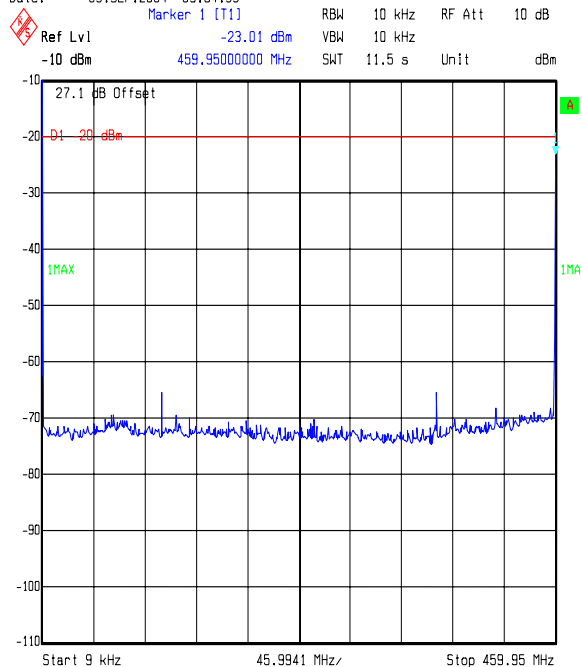
Title: Draeger EUT: Entry Control Board, FCC P90 Cond. Emissions  
Comment A: 46068JD02 Bottom Channel  
Date: 03.SEP.2004 09:44:36



Title: Draeger EUT: Entry Control Board, FCC P90 Cond. Emissions  
Comment A: 46068JD02 Bottom Channel  
Date: 03.SEP.2004 09:56:45



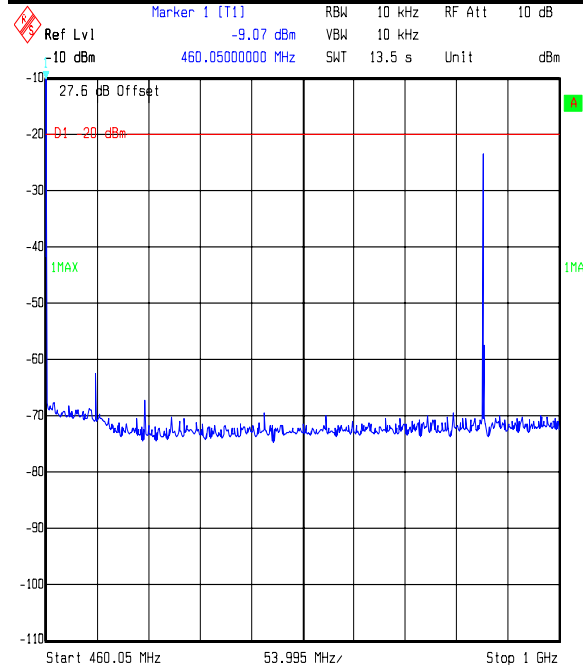
Title: Draeger EUT: Entry Control Board, FCC P90 Cond. Emissions  
Comment A: 46068JD02 Middle Channel  
Date: 03.SEP.2004 09:54:33



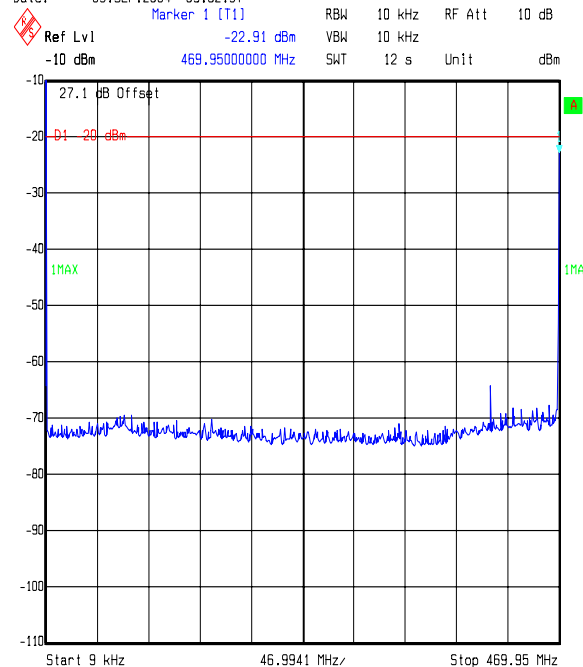
Title: Draeger EUT: Entry Control Board, FCC P90 Cond. Emissions  
Comment A: 46068JD02 Middle Channel  
Date: 03.SEP.2004 09:46:42

Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

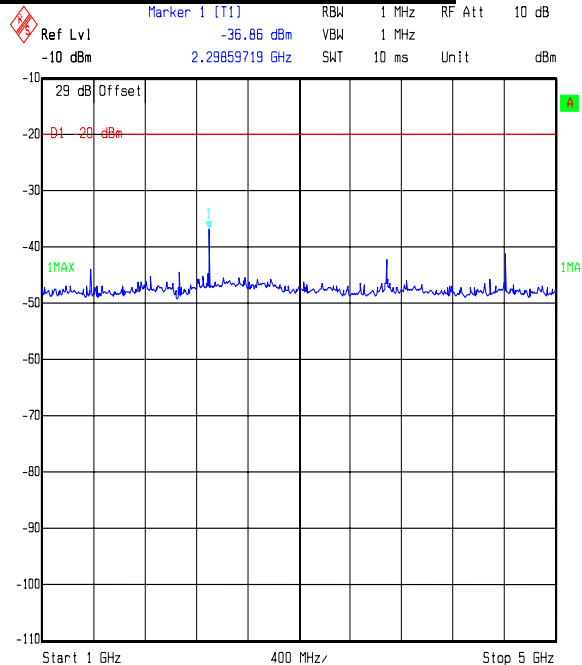
Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

**Transmitter Conducted Emissions (Out of Band): Section 90.210 (Continued)**

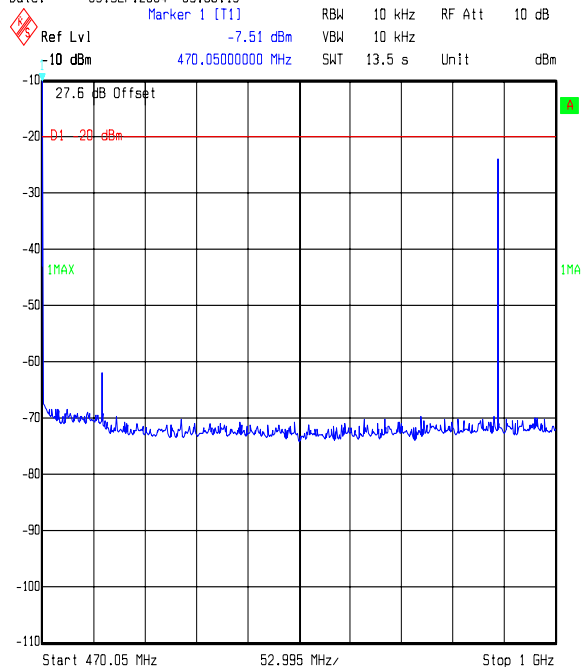
Title: Draeger EUT: Entry Control Board, FCC P90 Cond. Emissions  
Comment A: 46068JD02 Middle Channel  
Date: 03.SEP.2004 09:52:37



Title: Draeger EUT: Entry Control Board, FCC P90 Cond. Emissions  
Comment A: 46068JD02 Top Channel  
Date: 03.SEP.2004 09:47:57



Title: Draeger EUT: Entry Control Board, FCC P90 Cond. Emissions  
Comment A: 46068JD02 Middle Channel  
Date: 03.SEP.2004 09:58:13

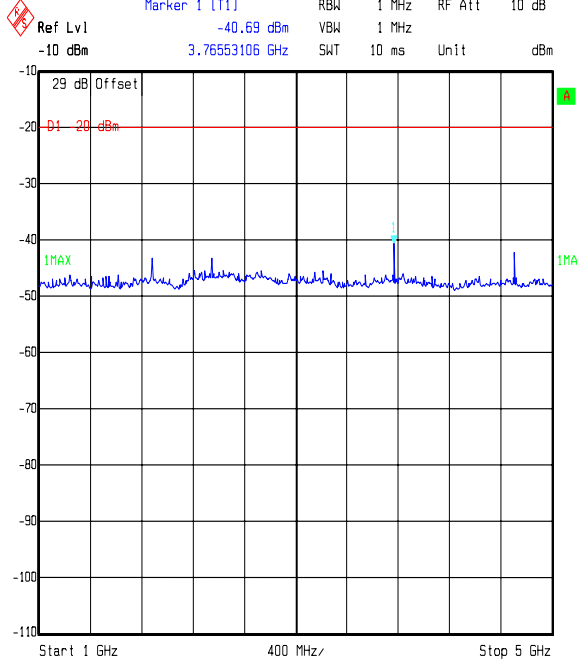


Title: Draeger EUT: Entry Control Board, FCC P90 Cond. Emissions  
Comment A: 46068JD02 Top Channel  
Date: 03.SEP.2004 09:50:59

Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

Transmitter Conducted Emissions (Out of Band): Section 90.210 (Continued)



Title: Draeger EUT: Entry Control Board, FCC P90 Cond. Emissions  
Comment A: 46068JD02 Top Channel  
Date: 03, SEP, 2004 09:59:31

Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Note: Six of the above plots show emissions at 449.95 MHz, 450.05 MHz, 459.95 MHz, 460.05 MHz, 469.95 MHz and 470.05 MHz respectively. These are, in the fact, the fundamental carrier frequencies for each channel. It is confirmed that these carrier frequency emissions lie within the operating frequency band.

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

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#### **7.10. Transmitter Radiated Emissions Masks: Section 90.210**

7.10.1. The EUT was configured as for transmitter radiated emissions measurements as described in Section 9 of this report.

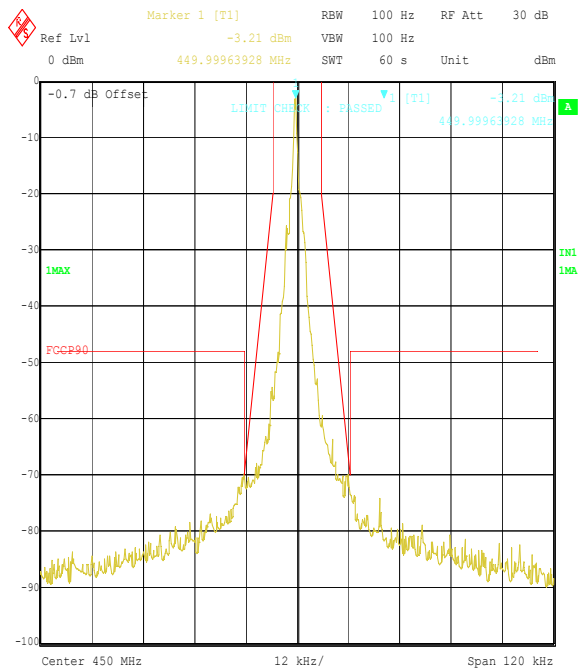
7.10.2. Tests were performed to determine compliance with the out of band power requirements at frequencies adjacent to the channel occupied by the fundamental frequency of the EUT.

#### **Results:**

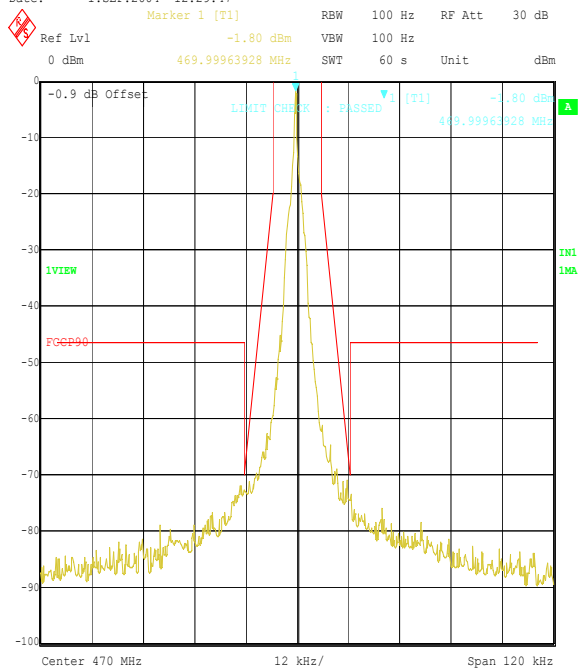
Results are presented graphically in the following graphs. As can be seen from the plots the EUT complies with the requirements of relevant part of the regulations.

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

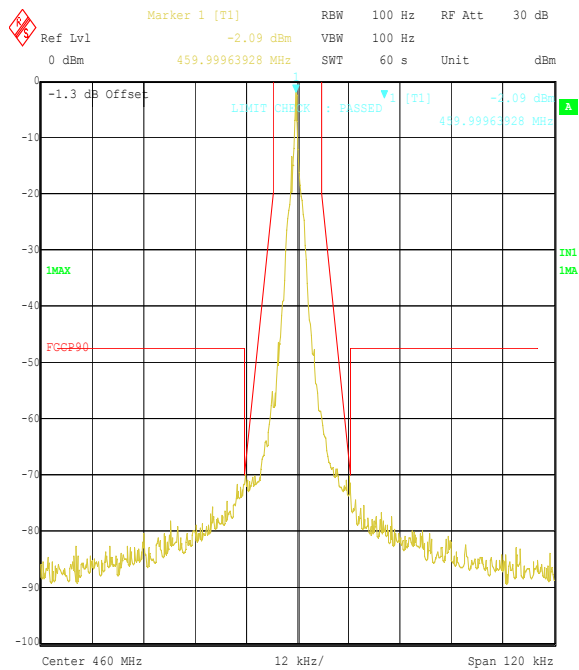
Transmitter Radiated Emissions Masks: Section 90.210 (Continued)



Title: Draeger EUT: Entry Control Board, FCC P90.210 Emission Mask  
Comment A: 46068JD02 Bottom Channel.  
Date: 1.SEP.2004 12:29:47



Title: Draeger EUT: Entry Control Board, FCC P90.210 Emission Mask  
Comment A: 46068JD02 Top Channel.  
Date: 1.SEP.2004 12:17:36



Title: Draeger EUT: Entry Control Board, FCC P90.210 Emission Mask  
Comment A: 46068JD02 Middle Channel.  
Date: 1.SEP.2004 12:22:26

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

### 7.11. Transmitter Radiated Emissions (Out of Band): Section 90.210

7.11.1. The EUT was configured as for transmitter radiated emissions measurements as described in Section 9 of this report.

7.11.2. Tests were performed to identify the maximum transmitter radiated emissions levels.

#### Result: Bottom Channel

| Frequency (MHz) | Peak Emission Level (dBm) | Peak Emission Level (dBc) | Limit (dBc) | Margin (dB) | Result   |
|-----------------|---------------------------|---------------------------|-------------|-------------|----------|
| 344.018         | -69.7                     | -97.9                     | -48.2       | 49.7        | Complied |
| 899.983         | -29.0                     | -57.2                     | -48.2       | 9.0         | Complied |
| 1350.017        | -37.1                     | -65.3                     | -48.2       | 17.1        | Complied |
| 1800.022        | -41.7                     | -69.9                     | -48.2       | 21.7        | Complied |
| 2700.028        | -40.8                     | -69.0                     | -48.2       | 20.8        | Complied |
| 3600.120        | -41.0                     | -69.2                     | -48.2       | 21.0        | Complied |

#### Result: Middle Channel

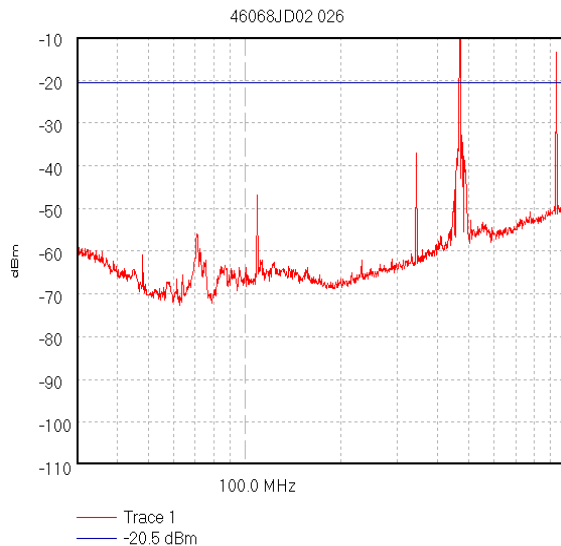
| Frequency (MHz) | Peak Emission Level (dBm) | Peak Emission Level (dBc) | Limit (dBc) | Margin (dB) | Result   |
|-----------------|---------------------------|---------------------------|-------------|-------------|----------|
| 344.018         | -69.7                     | -97.2                     | -47.5       | 49.7        | Complied |
| 920.038         | -27.6                     | -55.1                     | -47.5       | 7.6         | Complied |
| 1380.120        | -40.1                     | -67.6                     | -47.5       | 20.1        | Complied |
| 1840.164        | -42.4                     | -69.9                     | -47.5       | 22.4        | Complied |
| 2759.884        | -43.4                     | -70.9                     | -47.5       | 23.4        | Complied |
| 3680.053        | -38.6                     | -66.1                     | -47.5       | 18.6        | Complied |

#### Result: Top Channel

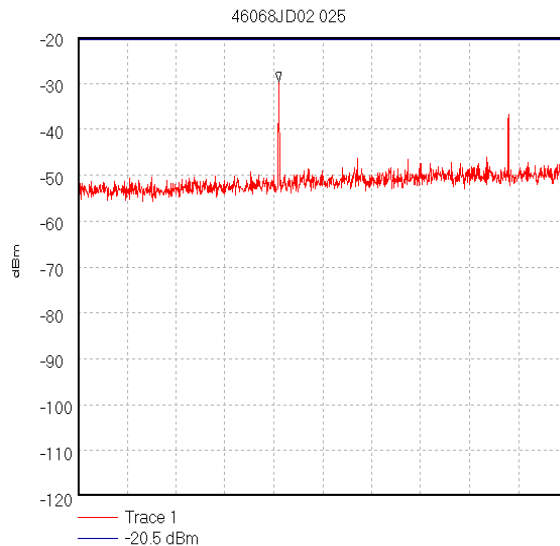
| Frequency (MHz) | Peak Emission Level (dBm) | Peak Emission Level (dBc) | Limit (dBc) | Margin (dB) | Result   |
|-----------------|---------------------------|---------------------------|-------------|-------------|----------|
| 344.018         | -69.7                     | -96.2                     | -46.5       | 49.7        | Complied |
| 940.003         | -24.7                     | -51.2                     | -46.5       | 4.7         | Complied |
| 1409.980        | -42.0                     | -68.5                     | -46.5       | 22.0        | Complied |
| 1879.833        | -45.3                     | -71.8                     | -46.5       | 25.3        | Complied |
| 2819.960        | -46.5                     | -73.0                     | -46.5       | 26.5        | Complied |
| 3759.904        | -32.6                     | -59.1                     | -46.5       | 12.6        | Complied |

Note: Plot 46068JD02 026 shows an emission at 469.608 MHz. This is the fundamental transmission frequency of the top channel i.e. it is the wanted emission and lies within the allowed operating frequency band.

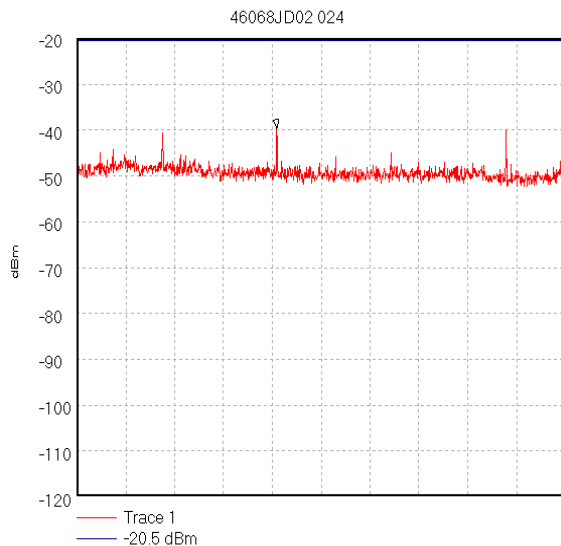
Test Of: Draeger Safety UK  
460MHz Entry Control Board  
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**Transmitter Radiated Emissions (Out of Band): Section 90.210 (Continued)**

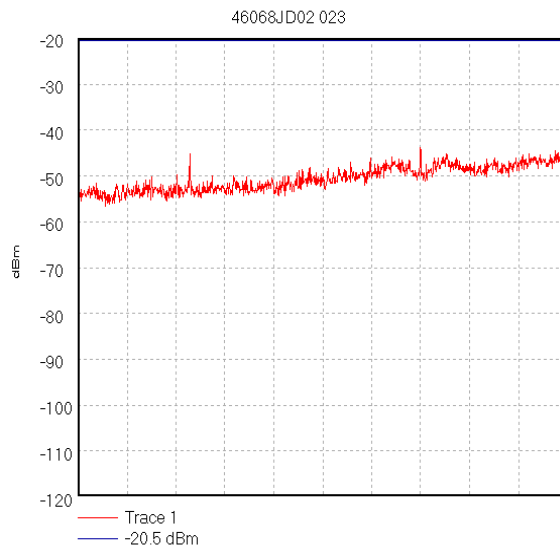
Start 30.0 MHz; Stop 1.0 GHz - Log Scale  
Ref -10 dBm; Ref Offset 9.6 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 540.0 mS  
Peak 469.608 MHz, -6.02 dBm  
Display Line: -20.5 dBm; : Limit Test Passed  
Transducer Factors: A490  
25/08/2004 19:25:20



Start 1.0 GHz; Stop 2.0 GHz  
Ref -20 dBm; Ref Offset 9.6 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 1.41 GHz, -29.59 dBm  
Display Line: -20.5 dBm; : Limit Test Passed  
Transducer Factors: A490  
25/08/2004 19:18:33



Start 2.0 GHz; Stop 4.0 GHz  
Ref -20 dBm; Ref Offset 9.6 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 2.818 GHz, -39.73 dBm  
Display Line: -20.5 dBm; : Limit Test Passed  
Transducer Factors: A490  
25/08/2004 19:13:16



Start 4.0 GHz; Stop 5.0 GHz  
Ref -20 dBm; Ref Offset 9.6 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 4.999 GHz, -43.18 dBm  
Display Line: -20.5 dBm; : Limit Test Passed  
Transducer Factors: A490  
25/08/2004 19:05:35

Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
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### **7.12. Transmitter Frequency Stability (Temperature Variation): Sections 90.213/2.1055**

7.12.1. The EUT was configured as for frequency stability measurements as described in Section 9 of this report.

7.12.2. Tests were performed to identify the maximum frequency error of the EUT with variations in ambient temperature.

#### **Results: Bottom Channel (450.0 MHz)**

| Temp (°C) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|-----------|--------------------------|----------------------|-----------------------|-------------|--------------|----------|
| -30       | 450.00005                | 50                   | 0.1                   | 2.5         | 2.4          | Complied |
| -20       | 450.00005                | 50                   | 0.1                   | 2.5         | 2.4          | Complied |
| -10       | 450.00003                | 30                   | 0.1                   | 2.5         | 2.4          | Complied |
| 0         | 450.00000                | 0                    | 0                     | 2.5         | 2.5          | Complied |
| 10        | 450.00000                | 0                    | 0                     | 2.5         | 2.5          | Complied |
| 20        | 449.99989                | -110                 | 0.2                   | 2.5         | 2.3          | Complied |
| 30        | 449.99977                | -230                 | 0.5                   | 2.5         | 2.0          | Complied |
| 40        | 449.99950                | -500                 | 1.1                   | 2.5         | 1.4          | Complied |
| 50        | 449.99942                | -580                 | 1.3                   | 2.5         | 1.2          | Complied |

#### **Results: Middle Channel (460.0 MHz)**

| Temp (°C) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|-----------|--------------------------|----------------------|-----------------------|-------------|--------------|----------|
| -30       | 460.00004                | 40                   | 0.1                   | 2.5         | 2.4          | Complied |
| -20       | 460.00003                | 30                   | 0.1                   | 2.5         | 2.4          | Complied |
| -10       | 460.00002                | 20                   | <0.1                  | 2.5         | >2.4         | Complied |
| 0         | 459.99998                | -20                  | <0.1                  | 2.5         | >2.4         | Complied |
| 10        | 459.99998                | -20                  | <0.1                  | 2.5         | >2.4         | Complied |
| 20        | 459.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |
| 30        | 459.99976                | -240                 | 0.5                   | 2.5         | 2.0          | Complied |
| 40        | 459.99949                | -510                 | 1.1                   | 2.5         | 1.4          | Complied |
| 50        | 459.99940                | -600                 | 1.3                   | 2.5         | 1.2          | Complied |

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

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**Transmitter Frequency Stability (Temperature Variation) (continued)****Results: Top Channel (470.0 MHz)**

| Temp (°C) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|-----------|--------------------------|----------------------|-----------------------|-------------|--------------|----------|
| -30       | 470.00004                | 40                   | 0.1                   | 2.5         | 2.4          | Complied |
| -20       | 470.00004                | 40                   | 0.1                   | 2.5         | 2.4          | Complied |
| -10       | 470.00002                | 20                   | <0.1                  | 2.5         | >2.4         | Complied |
| 0         | 469.99998                | -20                  | <0.1                  | 2.5         | >2.4         | Complied |
| 10        | 469.99997                | -30                  | 0.1                   | 2.5         | 2.4          | Complied |
| 20        | 469.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |
| 30        | 469.99973                | -270                 | 0.6                   | 2.5         | 1.9          | Complied |
| 40        | 469.99949                | -510                 | 1.1                   | 2.5         | 1.5          | Complied |
| 50        | 469.99939                | -610                 | 1.3                   | 2.5         | 1.2          | Complied |

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

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### **7.13. Transmitter Frequency Stability (Voltage Variation): Sections 90.213/2.1055**

#### **Battery Voltage Variation**

7.13.1. The EUT was configured as for frequency stability measurements as described in Section 9 of this report.

7.13.2. Tests were performed to identify the maximum frequency error of the EUT with variations in supply voltage directly to the EUT i.e. the battery was replaced with a 'dummy' battery allowing direct connection to a DC power supply.

#### **Results: Bottom Channel (450.0 MHz)**

| Supply Voltage (V) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|--------------------|--------------------------|----------------------|-----------------------|-------------|--------------|----------|
| 7.2                | 449.99989                | -110                 | 0.2                   | 2.5         | 2.3          | Complied |
| 5.0                | 449.99985                | -150                 | 0.3                   | 2.5         | 2.2          | Complied |

#### **Results: Middle Channel (460.0 MHz)**

| Supply Voltage (V) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|--------------------|--------------------------|----------------------|-----------------------|-------------|--------------|----------|
| 7.2                | 459.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |
| 5.0                | 459.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |

#### **Results: Top Channel (470.0 MHz)**

| Supply Voltage (V) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|--------------------|--------------------------|----------------------|-----------------------|-------------|--------------|----------|
| 7.2                | 469.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |
| 5.0                | 469.99985                | -150                 | 0.3                   | 2.5         | 2.2          | Complied |

Test Of: Draeger Safety UK  
460MHz Entry Control Board  
To: FCC Part 90: 2003

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#### **7.14. Transmitter Frequency Stability (Voltage Variation): Sections 90.213/2.1055**

##### **AC Adaptor Voltage Variation**

7.14.1. The EUT was configured as for frequency stability measurements as described in Section 9 of this report.

7.14.2. Tests were performed to identify the maximum frequency error of the EUT with variations in supply voltage to the AC adaptor.

##### **Results: Bottom Channel (450.0 MHz)**

| Supply Voltage (V) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|--------------------|--------------------------|----------------------|-----------------------|-------------|--------------|----------|
| 93.5               | 449.99989                | -110                 | 0.2                   | 2.5         | 2.3          | Complied |
| 110.0              | 449.99989                | -110                 | 0.2                   | 2.5         | 2.3          | Complied |
| 126.5              | 449.99989                | -110                 | 0.2                   | 2.5         | 2.3          | Complied |

##### **Results: Middle Channel (460.0 MHz)**

| Supply Voltage (V) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|--------------------|--------------------------|----------------------|-----------------------|-------------|--------------|----------|
| 93.5               | 459.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |
| 110.0              | 459.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |
| 126.5              | 459.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |

##### **Results: Top Channel (470.0 MHz)**

| Supply Voltage (V) | Measured Frequency (MHz) | Frequency Error (Hz) | Frequency Error (ppm) | Limit (ppm) | Margin (ppm) | Result   |
|--------------------|--------------------------|----------------------|-----------------------|-------------|--------------|----------|
| 93.5               | 469.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |
| 110.0              | 469.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |
| 126.5              | 469.99986                | -140                 | 0.3                   | 2.5         | 2.2          | Complied |

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### 7.15. Transmitter Transient Frequency Behaviour: Sections 90.214

7.15.1. The EUT was configured as for transient frequency behaviour measurements as described in Section 9 of this report.

7.15.2. Tests were performed to identify the EUT's transient frequency behaviour.

#### Results:

| Time Intervals | FREQUENCY DIFFERENCE (kHz) |                |             |
|----------------|----------------------------|----------------|-------------|
|                | Bottom Channel             | Middle Channel | Top Channel |
| t1             | 4.8                        | 7.9            | 1.5         |
| t2             | 1.1                        | 1.1            | 1.2         |
| t3             | 10.2                       | 8.2            | 7.1         |

| LIMITS         |                              |                 |
|----------------|------------------------------|-----------------|
| Time Intervals | Maximum frequency difference | Frequency Range |
|                |                              | 421 to 512 MHz  |
| t1             | +/-12.5 kHz                  | ≤10.0 mS        |
| t2             | +/-6.25 kHz                  | ≤25.0 mS        |
| t3             | +/-12.5 kHz                  | ≤10.0 mS        |

Confirm that during the period from the end of t2 to the beginning of t3 the frequency difference does not exceed 2.5 ppm (1125 Hz) of the bottom channel carrier frequency YES

Confirm that during the period from the end of t2 to the beginning of t3 the frequency difference does not exceed 2.5 ppm (1150 Hz) of the middle channel carrier frequency YES

Confirm that during the period from the end of t2 to the beginning of t3 the frequency difference does not exceed 2.5 ppm (1175 Hz) of the top channel carrier frequency YES

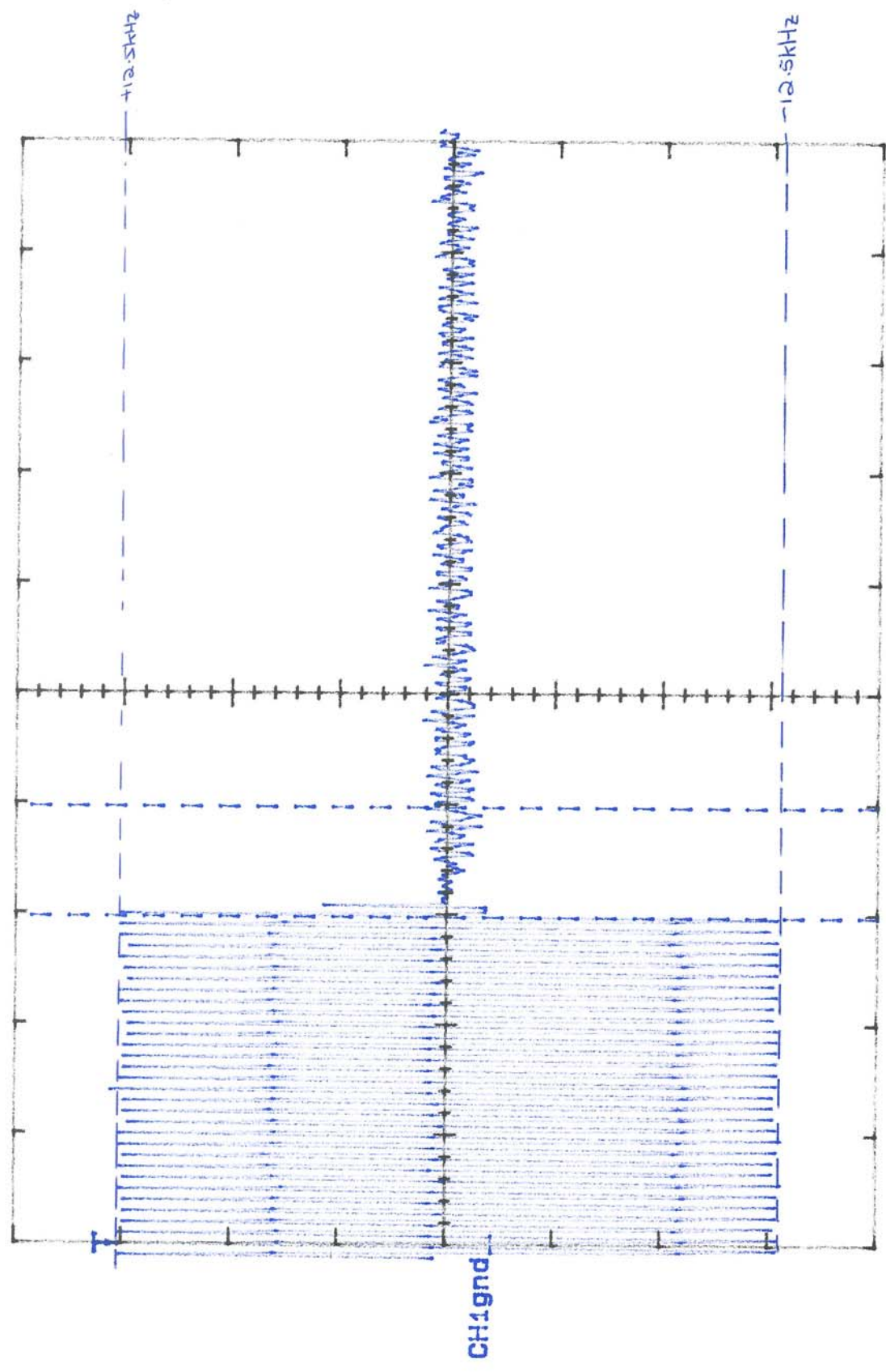
*Note: If the transmitter carrier output power rating is 6 Watts or less the frequency difference during time periods t1 and t3 may exceed the maximum frequency difference for these time periods.*

The following graphs are graphical representations of the above results but are not included in the number of pages in this report.

GRH/460683D02/1001  
Bottom Channel 450MHz

CH1 >100mV A 10ms 26.6mV? VERT

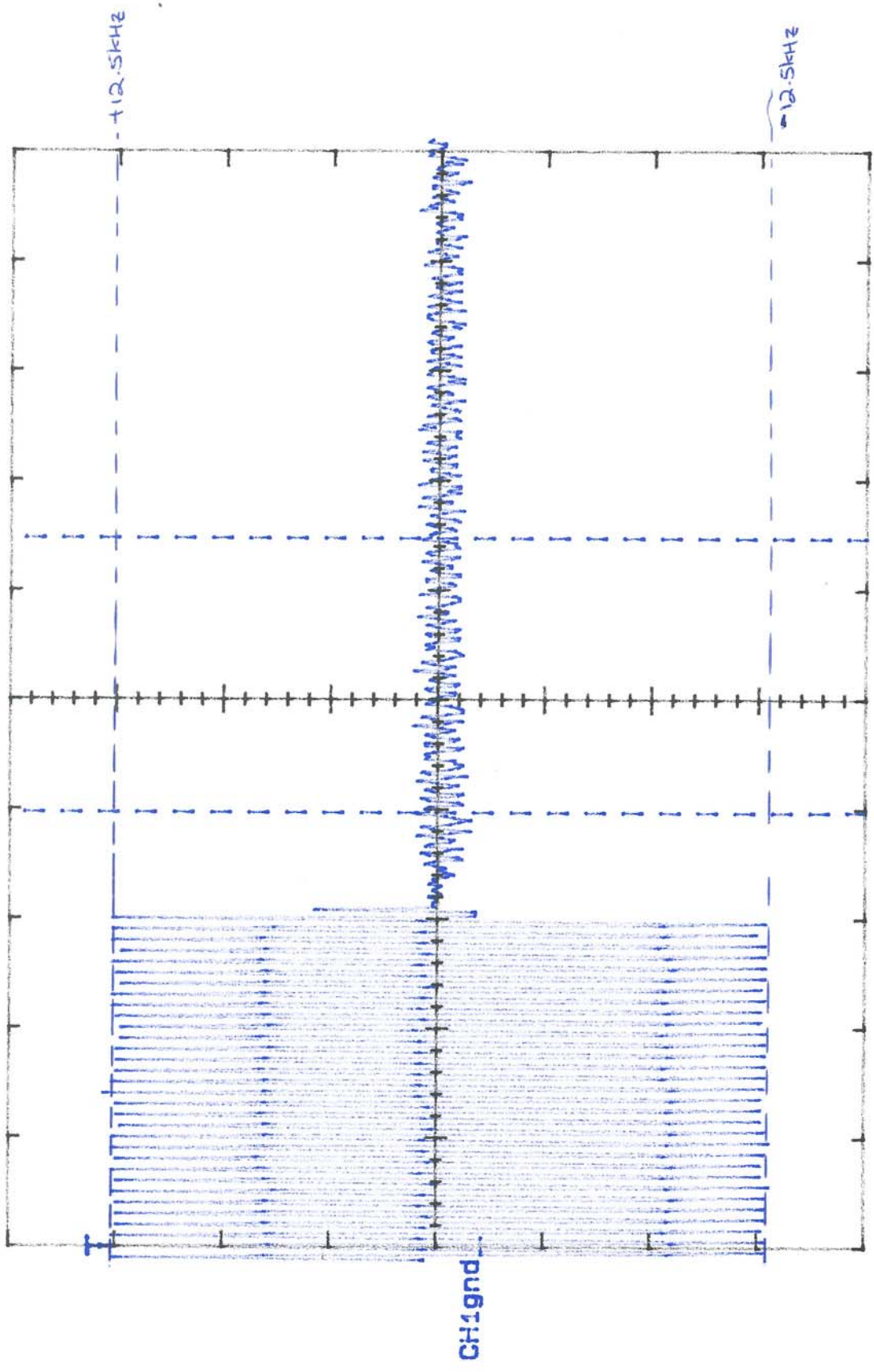
20.000ms



GPH1466855021 T002  
Bottom Channel 450MHz

CH1 >100mV A 10ms 25.6mV? VERT

25.000ms

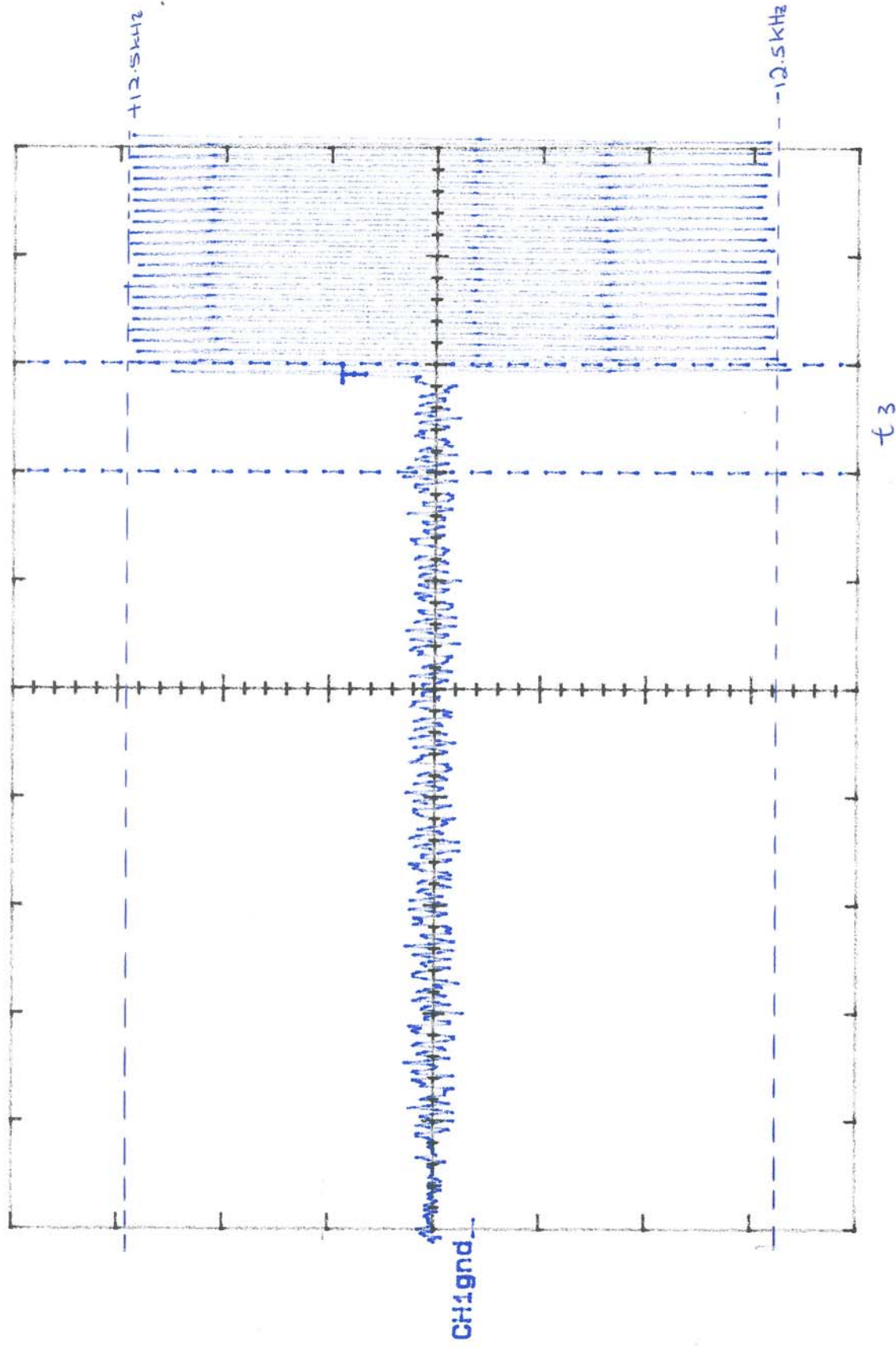


t<sub>2</sub>

C:\H160683202\T003  
Bottom Channel 450MHz

CH1 >100mV A 10ms 26.6mV? VERT

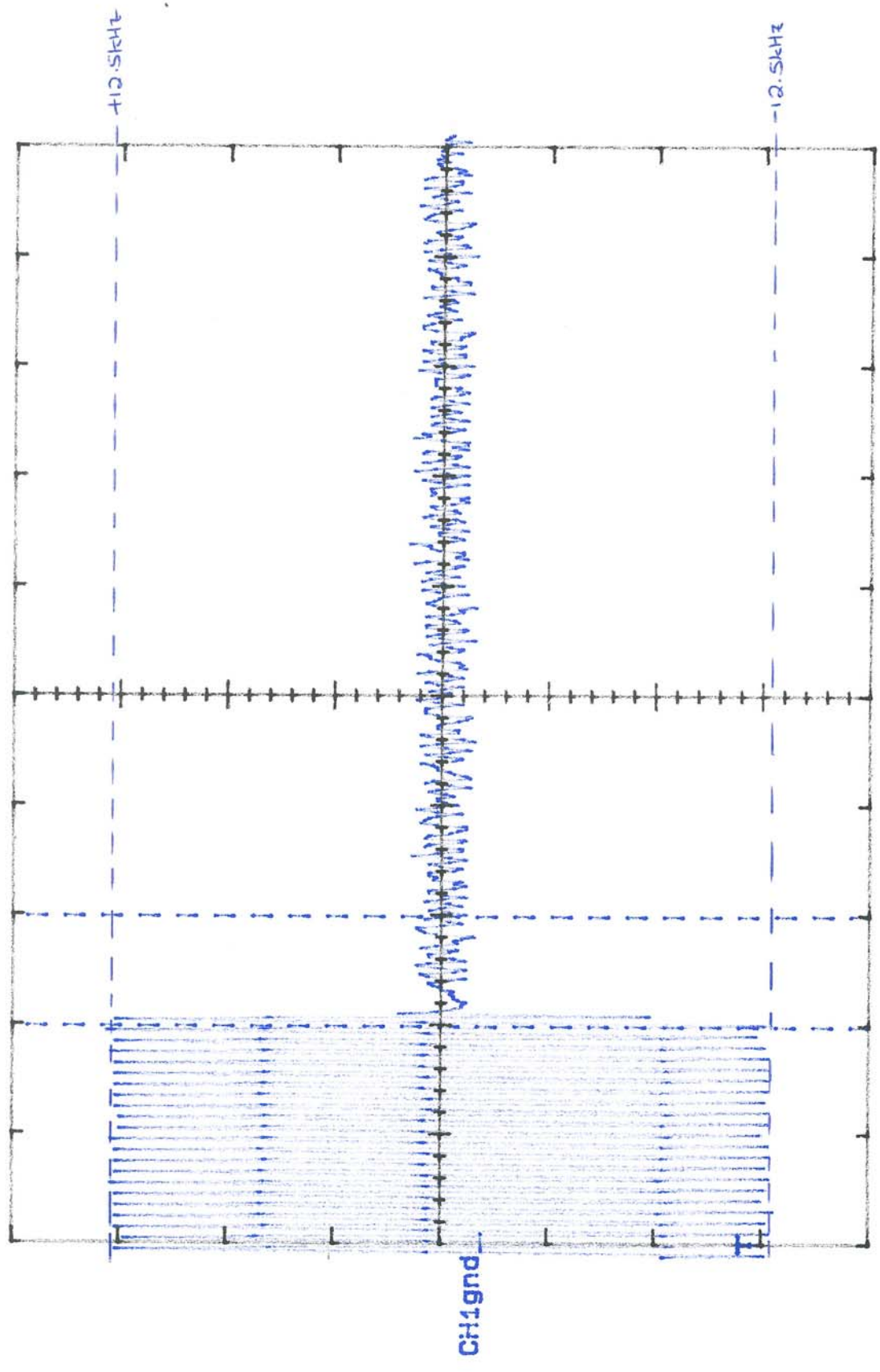
10.000ms



GPH/46685502/T004  
Middle Channel 460 MHz

CH1 >100mV A 10ms 26.6mV? VERT

20.000ms



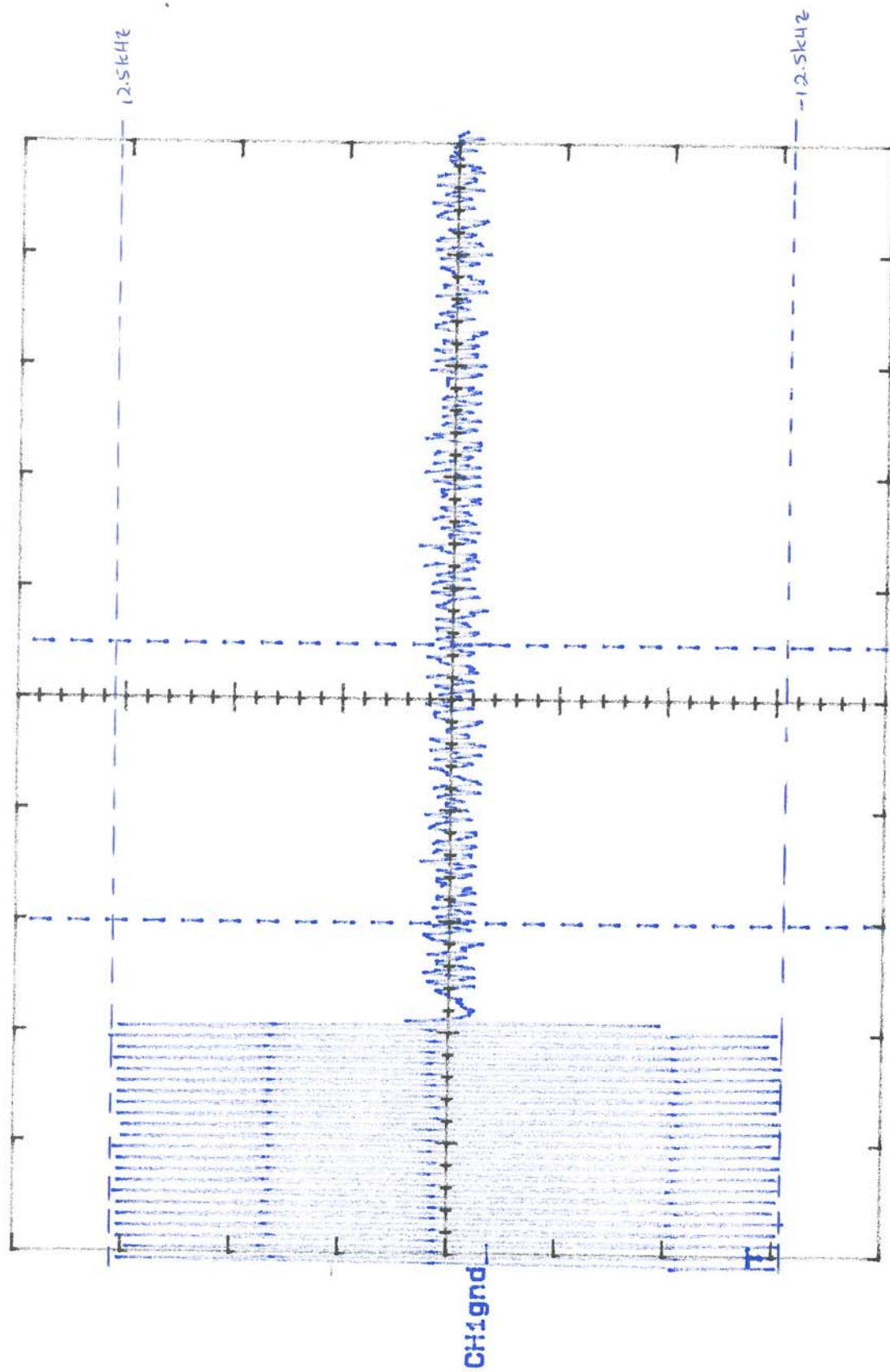
t<sub>1</sub>

GPI1460683002/T0005

Middle Channel 460MHz

CH1 >100mV A 10ms 26.6mV? VERT

25.400ms

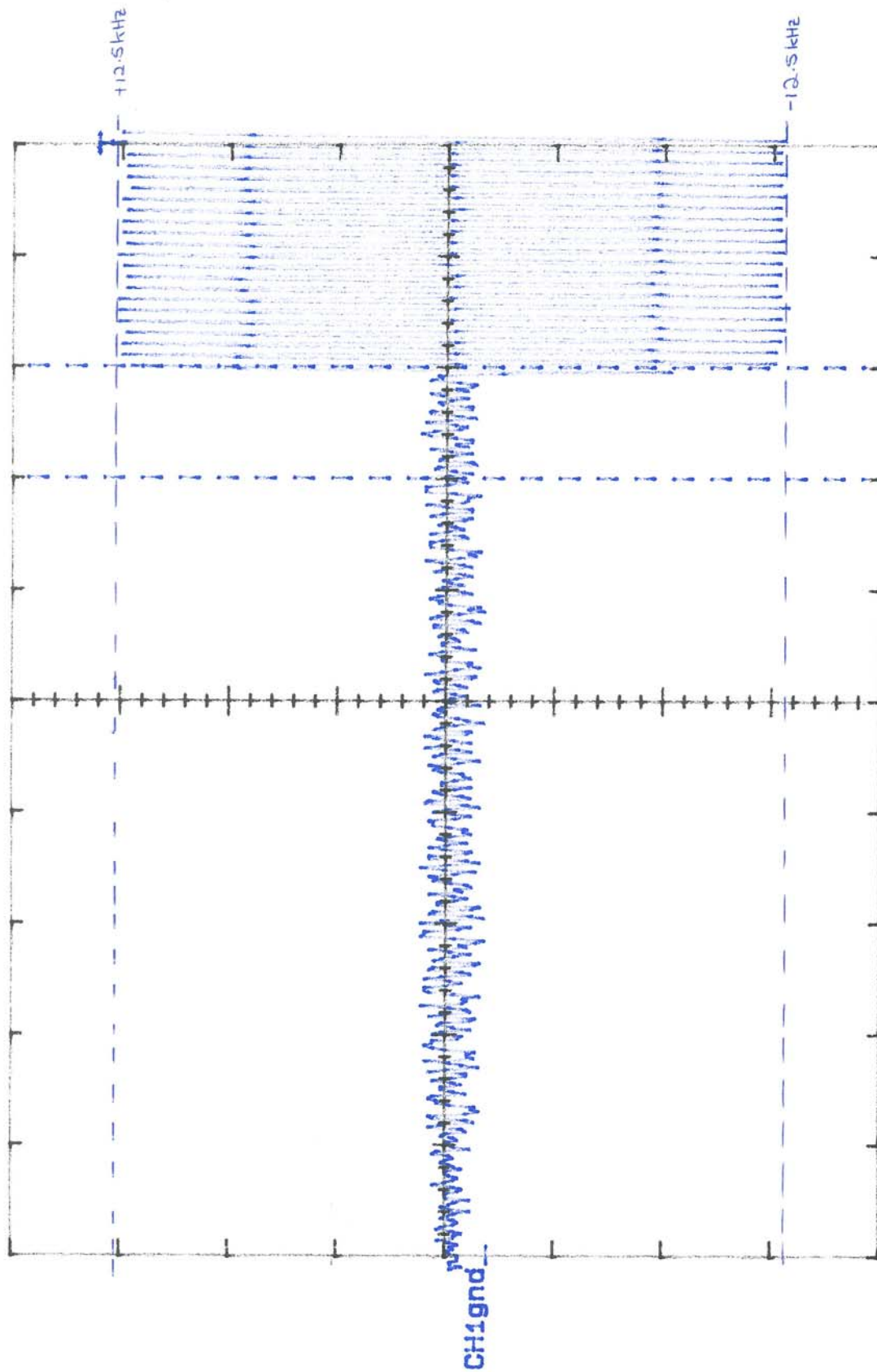


t<sub>2</sub>

GPH/46068 J302/T006  
Middle Channel 460MHz

CH1 >100mV A 10ms 26.6mV? VERT

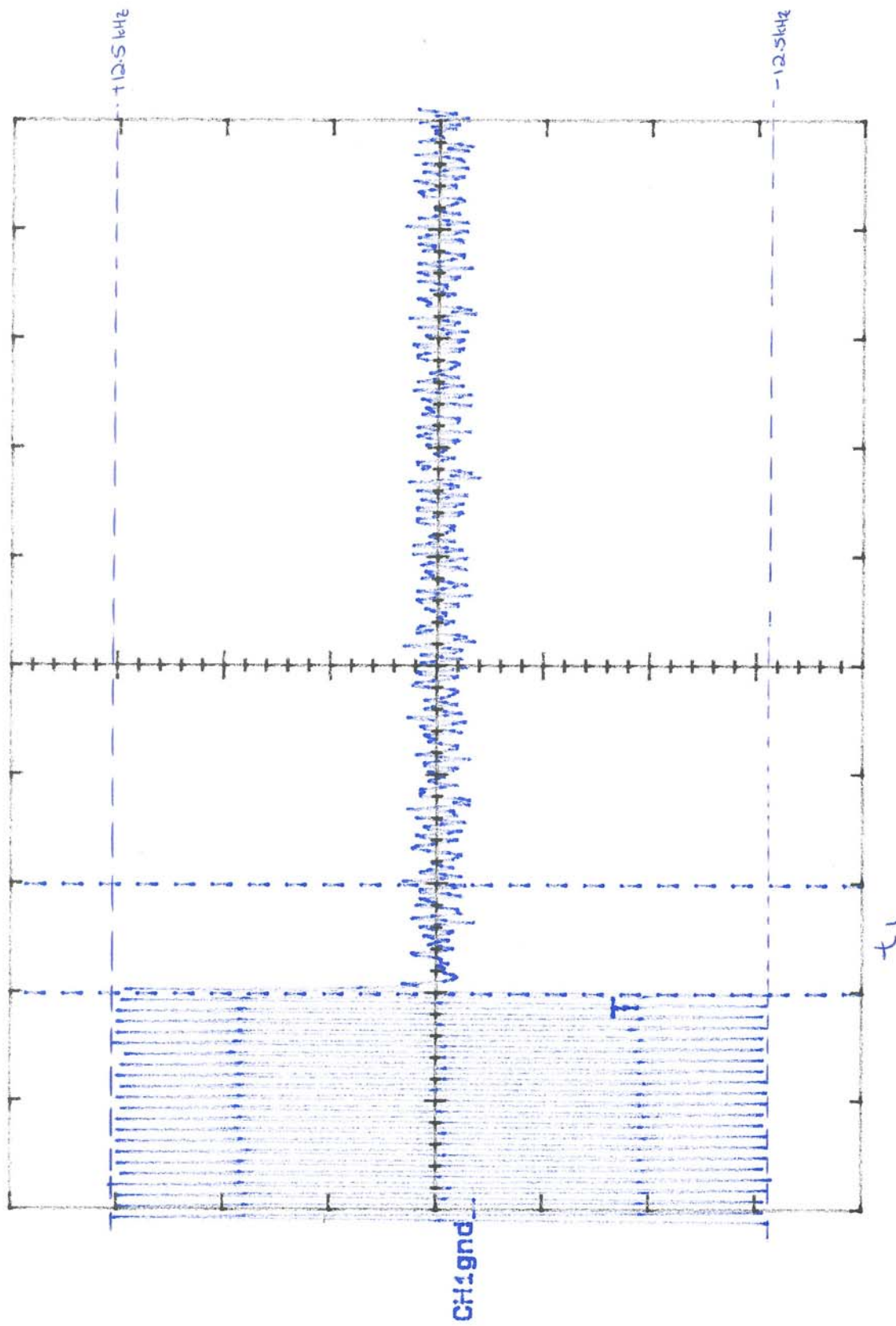
40.000ms



GPH146068J0217007  
Top Channel 470MHz

CH1 >100mV A 10ms 26.6mV? VERT

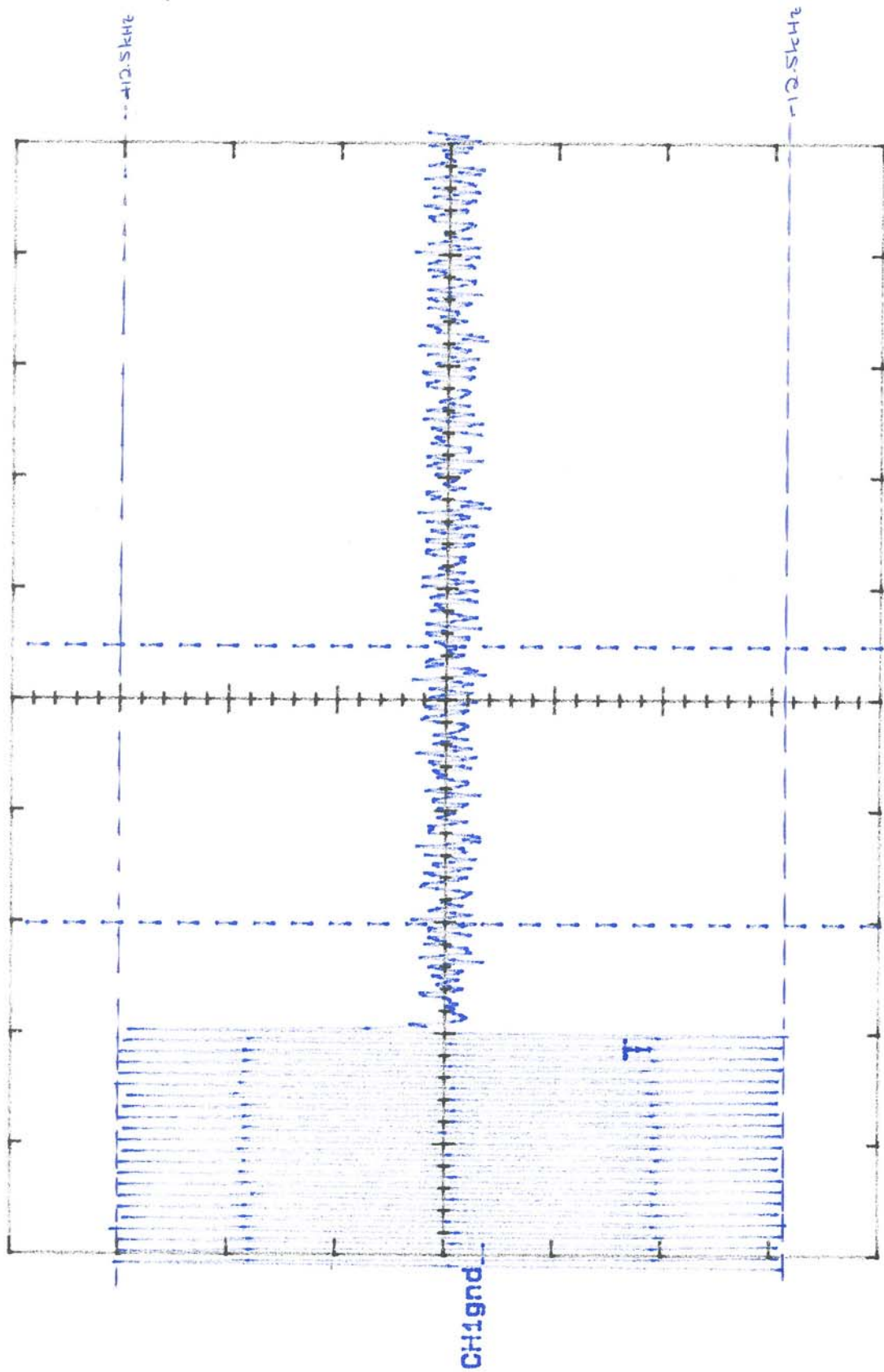
10.000ms



674146068300217008  
Top Channel 470MHz

CH1 >100mV A 10ms 26.6mV? VERT

25.000ms

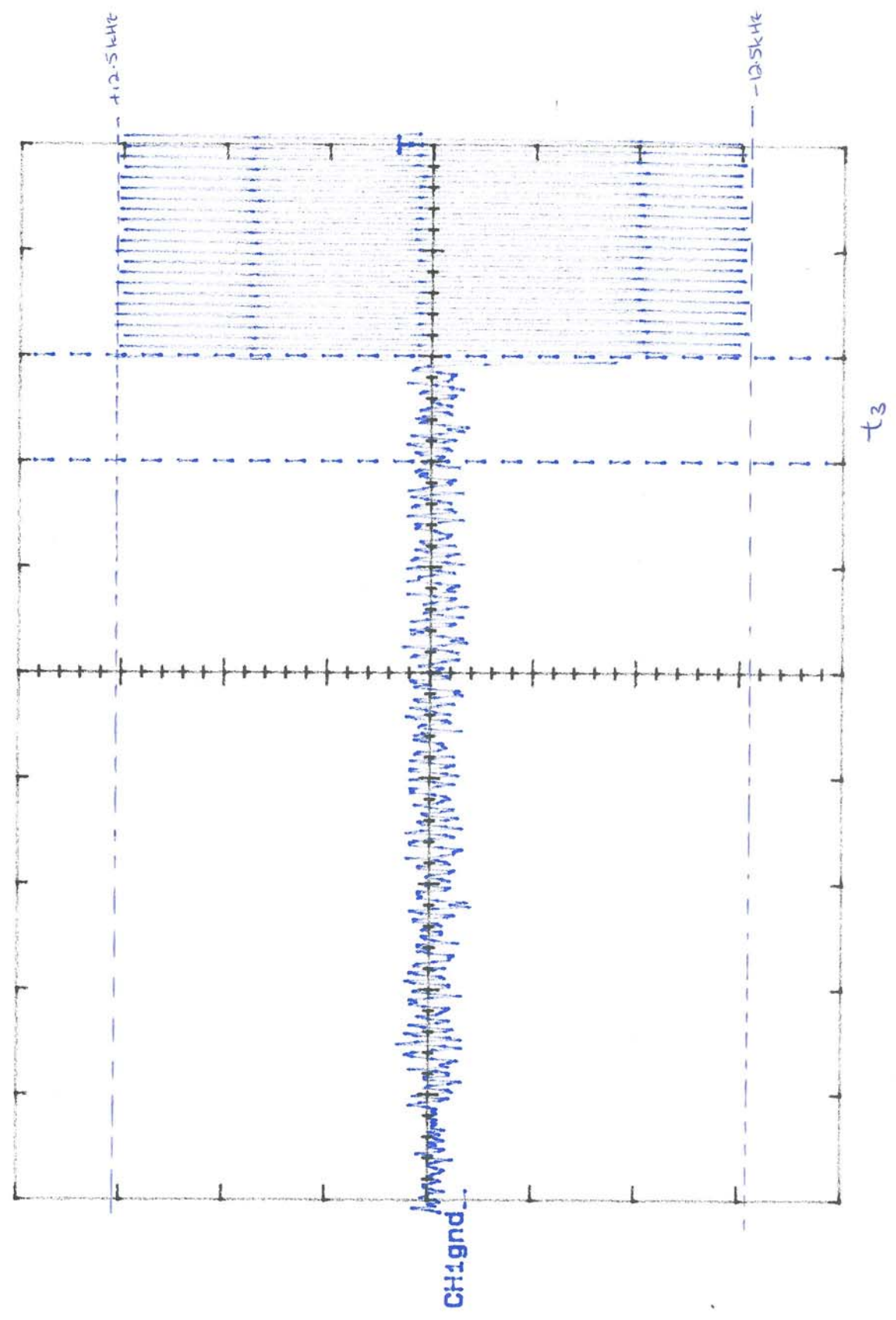


$t_2$

GP1/460685D02/T009  
Top Channel 470MHz

CH1 >100mV A 10ms 26.6mV? VERT

10.000ms



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## Additional test required for 125 kHz transmitter

### 7.16. Transmitter Radiated Spurious Emissions: Section 15.209

#### 7.16.1. Electric Field Strength Measurements (Frequency Range: 0.009 to 30 MHz)

7.16.1.1. The EUT was configured as for receiver radiated emissions testing as described in Section 9 of this report.

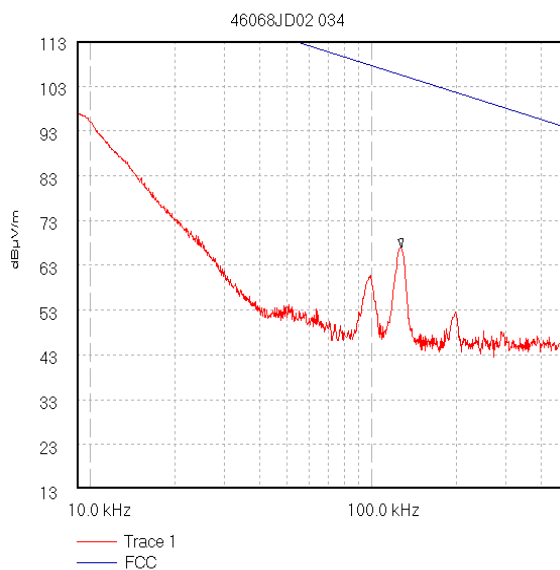
7.16.1.2. Tests were performed to identify the maximum radiated spurious emissions levels.

7.16.1.3. Limits below 30 MHz are specified at test distance of 30 metres, whilst below 0.49 MHz they are specified at a test distance of 300 metres. However as specified by section 15.31 (f)(2), measurements may be performed at a closer distance, and the measured level corrected to the specified measurement distance by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

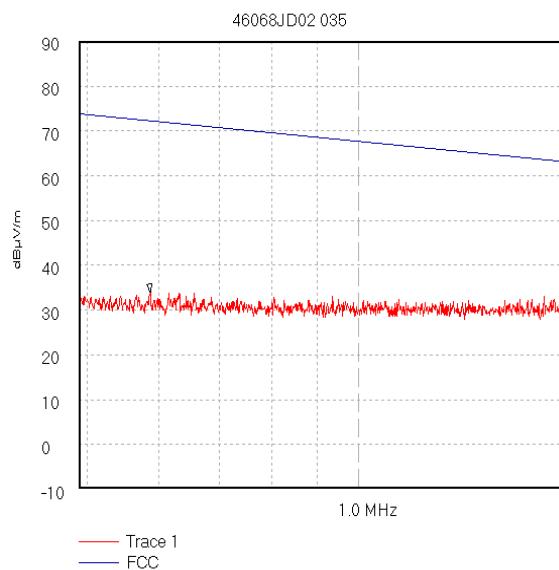
#### Result:

| Frequency (MHz) | Q-P Level (dB $\mu$ V/m) | Limit (dB $\mu$ V/m) | Measurement Distance (m) | Margin (dB) | Result   |
|-----------------|--------------------------|----------------------|--------------------------|-------------|----------|
| 0.1264          | -22.4                    | 25.7                 | *300                     | 48.1        | Complied |

\*The measurement was performed at a test distance of 10m and extrapolated to 300m as detailed above



Start 9.0 kHz; Stop 490.0 kHz - Log Scale  
Ref 113 dB $\mu$ V/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 9.0 kHz; VBW 100.0 kHz; Att 16 dB; Swp 40.0 mS  
Marker 127.00691 kHz, 66.97 dB $\mu$ V/m  
Limit/Mask: FCC; : Limit Test Passed  
26/08/2004 18:24:27

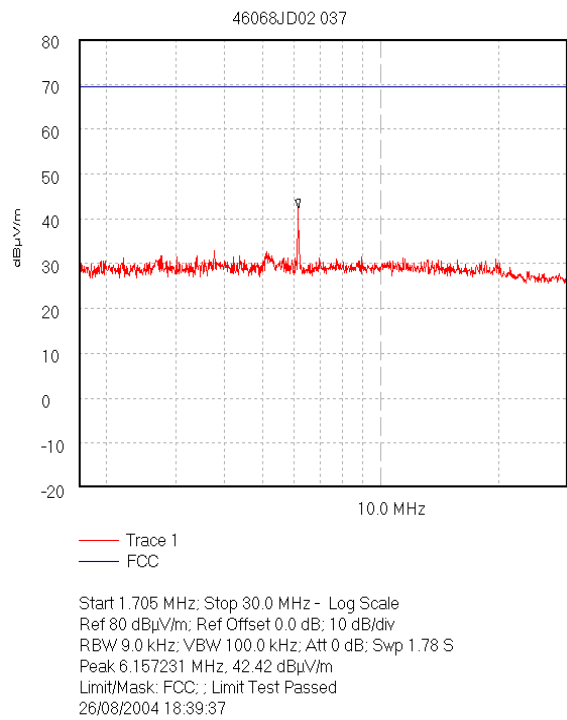


Start 490.0 kHz; Stop 1.705 MHz - Log Scale  
Ref 90 dB $\mu$ V/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 9.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 100.0 mS  
Peak 587.514 kHz, 33.91 dB $\mu$ V/m  
Limit/Mask: FCC; : Limit Test Passed  
26/08/2004 18:32:07

Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

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Transmitter Radiated Spurious Emissions: Section 15.209 (Continued)



*Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.*

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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 measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the 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 the result may need to be taken into account when interpreting the measurement results.

8.4. The reported expanded uncertainties below are based on a standard 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 |
|----------------------------------|----------------------|----------------------|------------------------|
| AC Conducted Spurious Emissions  | 0.15 MHz to 30.0 MHz | 95%                  | +/- 3.25 dB            |
| Radiated Spurious Emissions      | 9 kHz to 30 MHz      | 95%                  | +/- 3.53 dB            |
| Radiated Spurious Emissions      | 30 MHz to 1000 MHz   | 95%                  | +/- 5.26 dB            |
| Radiated Spurious Emissions      | 1 GHz to 18 GHz      | 95%                  | +/- 4.18 dB            |
| Conducted Carrier Output Power   | 9 kHz to 26 GHz      | 95%                  | +/- 1.2 dB             |
| Carrier Output Power (ERP)       | 30 MHz to 1000 MHz   | 95%                  | +/- 1.78 dB            |
| Occupied Bandwidth               | N/A                  | 95%                  | +/- 0.12%              |
| Conducted Emissions Antenna Port | 9 kHz to 26 GHz      | 95%                  | +/- 1.2 dB             |
| Frequency Stability              | Not applicable       | 95%                  | +/- 20 Hz              |
| Transient Frequency Behaviour    | Not applicable       | 95%                  | +/- 10%                |

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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## **9. Measurement Methods – Part 90**

### **9.1. AC Mains Conducted Emissions**

AC mains conducted emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

The test was performed in a shielded enclosure with the equipment arranged as detailed in the standard on a wooden bench using the floor of the screened enclosure as the ground reference plane. The EUT was powered with 110V 60 Hz AC mains supplied via a Line Impedance Stabilisation Network (LISN).

Initial measurements in the form of swept scans covering the entire measurement band were performed in order to identify frequencies on which the EUT was generating interference. In order to minimise the time taken for these swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidths (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

Following the initial scans, a graph was 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 (at individual frequencies) using the appropriate detector function.

The test equipment settings for conducted emissions measurements were as follows:

| Receiver Function | Initial Scan     | Final Measurements         |
|-------------------|------------------|----------------------------|
| Detector Type:    | Peak             | Quasi-Peak (CISPR)/Average |
| Mode:             | Max Hold         | Not applicable             |
| Bandwidth:        | 10 kHz           | 9 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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## **9.2. Receiver Radiated Emissions**

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

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to the upper frequency detailed in Section 15.33(b) were performed within a screened chamber in order to identify frequencies on which the EUT was generating interference. This determined the frequencies from the EUT that required further examination. In order to minimise the time taken for the swept measurements, a peak detector was used in conjunction with the appropriate detector 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 initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. A limit line was set to the specification limit. Levels within 20 dB of this limit were measured where possible, on occasion, the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

An open area test site using the appropriate test distance and measuring receiver with a Quasi-Peak detector was used for measurements below 1000 MHz, for measurements above 1000 MHz average and peak detectors were used.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 - 2001 Clause 5.4.

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 in the horizontal polarisation. 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. The procedure was repeated for the vertical polarisation.

The final field strength was determined as the indicated level in dB $\mu$ V plus cable loss and antenna factor.

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**Radiated Emissions (Continued)**

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

| Receiver Function | Initial Scan<br>(Below 30 MHz) | Final Measurements<br>(Below 30 MHz) |
|-------------------|--------------------------------|--------------------------------------|
| Detector Type:    | Peak                           | Quasi-Peak (CISPR) or Average        |
| Mode:             | Max Hold                       | Not applicable                       |
| Bandwidth:        | 200 Hz or 9 kHz                | 200 Hz or 9 kHz                      |
| Amplitude Range:  | 60 dB                          | 20 dB                                |
| Step Size:        | Continuous sweep               | Not applicable                       |
| Sweep Time:       | Coupled                        | Not applicable                       |

| Receiver Function | Initial Scan                         | Final Measurements<br>Below 1 GHz | Final Measurements<br>Above 1 GHz |
|-------------------|--------------------------------------|-----------------------------------|-----------------------------------|
| Detector Type:    | Peak                                 | Quasi-Peak (CISPR)                | Peak/Average                      |
| Mode:             | Max Hold                             | Not applicable                    | Not applicable                    |
| Bandwidth:        | (120 kHz < 1 GHz)<br>(1 MHz > 1 GHz) | 120 kHz                           | 1 MHz                             |
| Amplitude Range:  | 100 dB                               | 100 dB                            | 100 dB                            |
| Step Size:        | Continuous sweep                     | Not applicable                    | Not applicable                    |
| Sweep Time:       | Coupled                              | Not applicable                    | Not applicable                    |

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### **9.3. Transmitter Carrier Output Power (ERP)**

The EUT and communications analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

A communications analyser was connected to the antenna port of the EUT via a suitable cable. Prior to testing being performed the cable was calibrated for loss at the required frequency. For each frequency the calibrated level of cable loss was noted and then added to the indicated result on the communications analyser to compensate for the losses in the measurement set up.

To determine the transmitter output power, the EUT was operated at maximum power and a result was obtained taken from the display of the communications analyser.

The effective radiated power (ERP) was calculated by adding the manufacturer's declared antenna gain to the figure measured for conducted RF output power.

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#### **9.4. Occupied (20 dB) Bandwidth**

The EUT was connected to a spectrum analyser enabled with an occupied bandwidth function via a direct connection (via suitable attenuation).

Measurements were performed to determine the Occupied Bandwidth in accordance with FCC Part 2.1049. The Occupied Bandwidth was measured from the fundamental emission at the bottom and top channels. The Occupied Bandwidth was measured in line with the requirements of 2.1049 i.e. with the EUT modulated with a signal representing the maximum rated conditions under which it will operate (worst case)

The occupied bandwidth was measured using the built in occupied bandwidth function of the Rohde and Schwarz FSEB or ESIB spectrum analyser. It was set to measure the bandwidth where 99% of the signal power was contained. The analyser automatically configures the measurement bandwidths to make an accurate measurement based on the channel bandwidth and channel spacing of the EUT.

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### **9.5. Transmitter Conducted Emissions**

The EUT and spectrum analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

Spurious emission measurements at the antenna port were performed from the lowest declared frequency to 10 times the highest EUT fundamental frequency.

A spectrum analyser was connected to the antenna port of the EUT via a suitable cable and RF attenuator. The total loss of both the cable and the attenuator was measured and entered as a reference level offset into the measuring receiver to correct for the losses.

The frequency band described above was investigated with the transmitter operating at full power on the bottom, middle and top channels. Any spurious emissions noted were then measured.

The recorded emission level was then calculated as a spurious attenuation level using the following formula as described in TIA-603-B.

$$\text{dB} = 10 \log_{10} \left( \frac{\text{TX power in watts}}{0.001} \right) - \text{spurious level (dBm)}$$

For frequencies further than 12.5 kHz from the centre of the authorised bandwidth (fc) the emissions shall be attenuated by at least  $50 + 10 \log (P \text{ in Watts})$  dB or 70 dB (whichever is the lesser attenuation) relative to the transmitter output power level measured for the channel under test. The tabulated results in the results section of this report show the spurious emission in dBm and as attenuation relative to the carrier in dBc.

For the frequency ranges close to and including the fundamental frequency, plots of the spectral distribution (emission masks) were recorded using a spectrum analyser for the EUT transmitting on bottom, middle and top channels. The method used was in accordance with the methods detailed in FCC Part 90.210.

FCC Part 90.210 states the appropriate emission mask that shall be used for a given channel bandwidth. Measurements were performed using the appropriate emission mask for the channel bandwidth declared i.e. Emission Mask D for a channel bandwidth of 12.5 kHz.

The test equipment settings for conducted antenna port measurements were as follows:

| Receiver Function | Settings                                |
|-------------------|-----------------------------------------|
| Detector Type:    | Peak                                    |
| Mode:             | Max Hold                                |
| Bandwidth:        | As per Part 90.210 <50 kHz away from fc |
| Bandwidth:        | 1 MHz >1 GHz                            |
| Bandwidth:        | 10 kHz <1 GHz                           |
| Amplitude Range:  | 100 dB                                  |
| Sweep Time:       | Coupled                                 |

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### **9.6. Transmitter Radiated Emissions**

The EUT and spectrum analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

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

Initial pre-scans covering the entire measurement band from the lowest generated frequency declared up to 10 times the highest fundamental frequency were performed in order to identify frequencies on which the EUT was generating spurious emissions. This determined the frequencies from the EUT that required further examination. Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m, below 4 GHz; above 4 GHz a 1 m measurement distance was used. A limit line was set to the specification limit. Levels within 20 dB of this limit were measured where possible, on occasion; the receiver noise floor came within the 20 dB boundary. On these occasions, the system noise floor may have been recorded.

For the final measurements the EUT was arranged on a non-conducting turn table on a standard test site compliant with ANSI C63.4 – 2001 Clause 5.4.

An open area test site using the appropriate test distance and spectrum analyser with an peak detector was used for final measurements. All measurements on the open area test site were performed using broadband antennas.

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 in the horizontal polarisation. 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. The procedure was repeated for the vertical polarisation.

Once the final amplitude (maximised) had been obtained and noted, the EUT was replaced by a substitution antenna, and a substitution method applied. The substitution antennas used were a horn antenna for measurements greater than or equal to 1 GHz and a dipole for measurements below 1 GHz. The centre of the substitution antenna was set to approximately the same centre location as the EUT. The substitution antenna was set to the horizontal polarity. The substitution antenna was matched into a signal generator using a 6 dB or greater attenuator. The signal generator was tuned to the EUT's frequency under test.

The test antenna was then raised and lowered to obtain a maximum reading on the spectrum analyser. The level of the signal generator output was then adjusted until the maximum recorded EUT level was observed. The signal generator level was noted. This procedure was repeated with both test antenna and substitution antenna vertically polarised. The EIRP was calculated as:-

$$\text{ERP} = \text{Signal Generator Level} - \text{Cable Loss} + \text{Antenna Gain}$$

Once the ERP was obtained, the difference between it and the level of the fundamental emission for the ERP of the channel under test was noted at the spurious attenuation level in dBc. The following formula was used as described in TIA-603-B.

$$\text{dB} = 10 \log_{10} \left( \frac{\text{TX power in watts}}{0.001} \right) - \text{spurious level (dBm)}$$

For frequencies further than 12.5 kHz from the centre of the authorised bandwidth (fc) the emissions shall be attenuated by at least 50 + 10 log (P in Watts) dB or 70 dB (whichever is the lesser attenuation) relative to the transmitter output power level measured for the channel under test. The tabulated results in the results section of this report show the spurious emission in dBm and as attenuation relative to the carrier in dBc.

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**Transmitter Radiated Emissions (continued)**

For the frequency ranges close to and including the fundamental frequency, plots of the spectral distribution (emission masks) were recorded using a spectrum analyser for the EUT transmitting on bottom, middle and top channels. The method used was in accordance with the methods detailed in FCC Part 90.210.

FCC Part 90.210 states the appropriate emission mask that shall be used for a given channel bandwidth. Measurements were performed using the appropriate emission mask for the channel bandwidth declared i.e. Emission Mask D for a channel bandwidth of 12.5 kHz.

| Receiver Function | Settings                                |
|-------------------|-----------------------------------------|
| Detector Type:    | Peak                                    |
| Mode:             | Max Hold                                |
| Bandwidth:        | As per Part 90.210 <50 kHz away from fc |
| Bandwidth:        | 1 MHz >1 GHz                            |
| Bandwidth:        | 10 kHz <1 GHz                           |
| Amplitude Range:  | 100 dB                                  |
| Sweep Time:       | Coupled                                 |

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### **9.7. Transmitter Frequency Stability**

The EUT and communications analyser were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

The EUT was situated within an environmental test chamber and monitored on the communications analyser via a direct connection.

Measurements were performed with the EUT operating under extremes of temperature in 10 degree increments within the range -30°C to 50°C.

Measurements were also performed at voltage extremes between the declared nominal supply voltage and at the declared endpoint voltage (for hand carried battery operated equipment) or by varying the primary supply voltage from 85% to 115% of the nominal value for all other equipment types.

The requirement was to determine the frequency stability of the device under specified environmental operating conditions.

The EUT was switched off for a minimum of 30 minutes between each stage of testing while the environmental chamber stabilised at the next temperature within the stated temperature range.

Once the environmental chamber had reached thermal equilibrium, the nominal frequency of the EUT was measured and recorded. The recorded frequency was compared to the declared nominal operating frequency of the channel being tested.

The frequency error measured was converted to an error in ppm using the following formula as defined by TIA\_EIA\_603A :-

$$\text{ppm error} = \left( \frac{MCF_{\text{MHz}}}{ACF_{\text{MHz}}} - 1 \right) * 10^6$$

where  $MCF_{\text{MHz}}$  is the measured carrier frequency in MHz  
 $ACF_{\text{MHz}}$  is the assigned carrier frequency in MHz

The measured ppm had to be less than the relevant limits in order to comply.

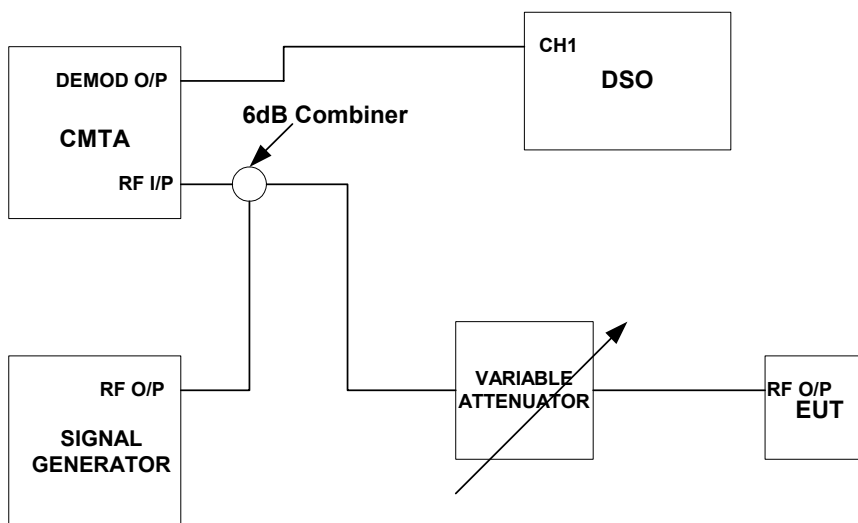
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### 9.8. Transmitter Transient Frequency Behaviour

The EUT and test equipment were configured as per ANSI TIA-603-B, Land Mobile FM or PM Communications Equipment; Measurement and Performance Standards.

The EUT was connected to a communications analyser in the configuration shown in Figure 1 below.

**Figure 1**



The test equipment settings were as follows:

| Oscilloscope Function    | Settings                                      |
|--------------------------|-----------------------------------------------|
| Coupling:                | DC                                            |
| Sweep Time:              | 10ms/Division                                 |
| Trigger Mode:            | Normal                                        |
| Attack Trigger Position: | 1/8 <sup>th</sup> Pre-trigger                 |
| Release Trigger Position | 7/8 <sup>th</sup> Pre-trigger                 |
| Trigger Slope:           | + or – dependant on whether attack or release |

| CMTA Test Receiver Function | Settings                       |
|-----------------------------|--------------------------------|
| Centre Frequency (Set)      | EUT's Nominal Frequency        |
| Channel Spacing:            | 12.5 kHz                       |
| Special Function:           | SPEC 72 (CMTA Squelch disable) |

| Signal Generator Function | Settings                                          |
|---------------------------|---------------------------------------------------|
| Centre Frequency:         | EUT's Nominal Frequency                           |
| Amplitude:                | 30 dB down on EUT's carrier power at the combiner |
| Audio Frequency:          | 1 kHz                                             |
| FM Deviation              | 12.5 kHz                                          |

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### **Appendix 1. Test Equipment Used**

| RFI No.       | Instrument                      | Manufacturer    | Type No.          | Serial No.                            |
|---------------|---------------------------------|-----------------|-------------------|---------------------------------------|
| A007          | Loop Antenna                    | Rohde & Schwarz | HFH2-Z2           | 880 458/020                           |
| A027          | Horn Antenna                    | Eaton           | 9188-2            | 301                                   |
| A030          | Step Attenuator                 | Narda           | 745-69            | 01544                                 |
| A031          | Horn Antenna                    | Eaton           | 91889-2           | 557                                   |
| A059          | Log Periodic Antenna            | EMCO            | 3146              | 8902-2378                             |
| A067          | LISN                            | Rohde & Schwarz | ESH3-Z5           | 890603/002                            |
| A091          | Biconical Antenna               | EMCO            | 3110              | 9008-1182                             |
| A1361         | Pulse Limiter                   | Rohde & Schwarz | ESH3-Z2           | A1361-20112003                        |
| A205          | Power Divider                   | Suhner          | 4901.01.B         | None                                  |
| A258          | Variable Power Supply           | Zenith Electric | SVA 10            | None                                  |
| A259          | Bilog Antenna                   | Chase           | CBL6111           | 1513                                  |
| A392          | 3 dB attenuator                 | Suhner          | 6803.17.B         | None                                  |
| E007          | Environmental Chamber           | Prolan          | PV427H75F<br>30HV | None                                  |
| G513          | Signal Generator                | Rohde & Schwarz | SMH               | 839858/001                            |
| M003          | Spectrum Monitor                | Rohde & Schwarz | EZM               | 883 580/008                           |
| M015          | Radiocommunications<br>Analyser | Rohde & Schwarz | CMTA              | 883 574/003                           |
| M027          | Radiocommunications<br>Analyser | Rohde & Schwarz | CMTA              | 883 574/004                           |
| M028          | Spectrum Analyser               | Rohde & Schwarz | FSB               | 860 001/009 (RF);<br>860 161/007 (DU) |
| M029          | Digital Storage Oscilloscope    | Tektronix       | 2440              | 0120850                               |
| M044          | Test Receiver                   | Rohde & Schwarz | ESVP              | 891 845/026                           |
| M069          | Spectrum Analyser/<br>Receiver  | Rohde & Schwarz | ESMI              | 829 808/007 (DU);<br>827 063/008 (RU) |
| M127          | Spectrum Analyser               | Rohde & Schwarz | FSEB 30           | 842 659/016                           |
| M1124         | Spectrum Analyser               | Rohde & Schwarz | ESIB26            | 100046K                               |
| M128          | DVM                             | Fluke           | 76                | 65340273                              |
| M165          | Thermocouple Meter              | RS Components   | 206-3738          | 63101536                              |
| M505;<br>M506 | Spectrum Analyser/<br>Receiver  | Rohde & Schwarz | ESBI              | 825316/010 (DU) /<br>827060/004 (RU)  |
| S010          | DC Power Supply                 | INSTEK          | PC-3060           | 9401927                               |
| S201          | Site 1                          | RFI             | 1                 |                                       |
| S202          | Site 2                          | RFI             | 2                 | S202-15011990                         |

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

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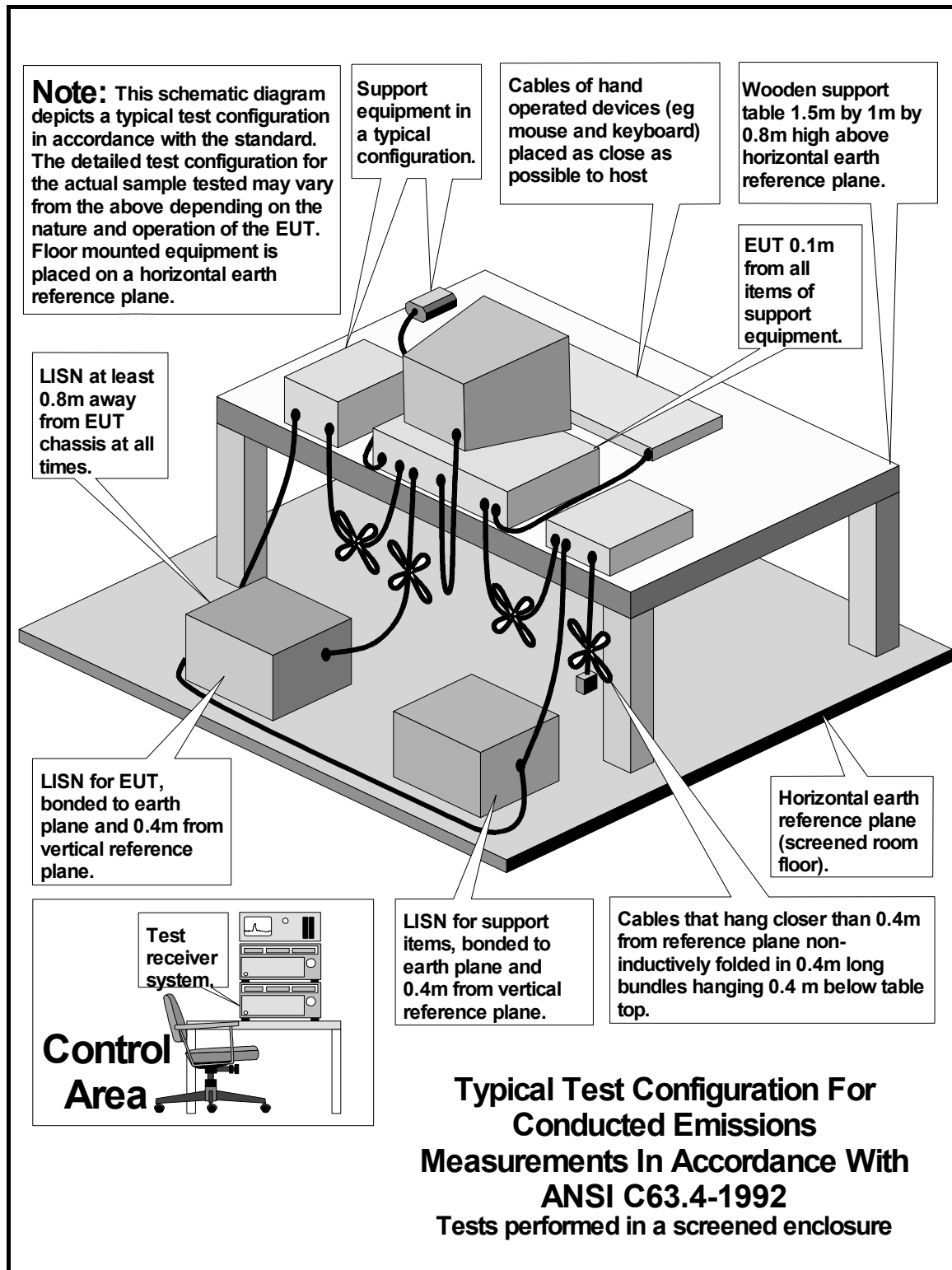
## **Appendix 2. Test Configuration Drawings**

This appendix contains the following drawings:

| Drawing Reference Number | Title                                                     |
|--------------------------|-----------------------------------------------------------|
| DRG\46068JD02\EMICON     | Test configuration for measurement of conducted emissions |
| DRG\46068JD02\EMIRAD     | Test configuration for measurement of radiated emissions  |

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DRG\46068JD02\EMICON



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DRG\46068JD02\EMIRAD

