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:
RFI\MPTE1\RP46068JD02A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: 	**Checked By: Tony Henriques** 
Tested By: Steven Wong 	**Release Version No: PDF001**
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Test Of: Draeger Safety UK
460MHz Entry Control Board
To: FCC Part 90: 2003

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1. Client Information

Company Name:	Draeger Safety UK
Address:	Kitty Brewster Estate Blyth Northumberland NE24 4RG United Kingdom
Contact Name:	Mr M Berney

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:	BRSH-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 When an antenna is fitted to this antenna port the integral antenna is no longer active and the transmission switches to the external antenna port.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.

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:

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

2.6. Additional Information Related To Testing

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

3. Test Specification, Methods And Procedures

3.1. Test Specifications

Reference:	FCC Part 90: 2003 (Private Land Mobile Radio Services)
Title:	Code of Federal Regulations, Part 90 (47CFR90) Private Land Mobile Radio Services
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

3.2. Methods And Procedures

The methods and procedures used were as detailed in:

ANSI/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.

4. Deviations From The Test Specification

None.

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.

6. Test Results

Summary Of Part 90 Tests

Range Of Measurements	Specification Reference	Port Type	Compliancy 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	Compliancy 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.

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.

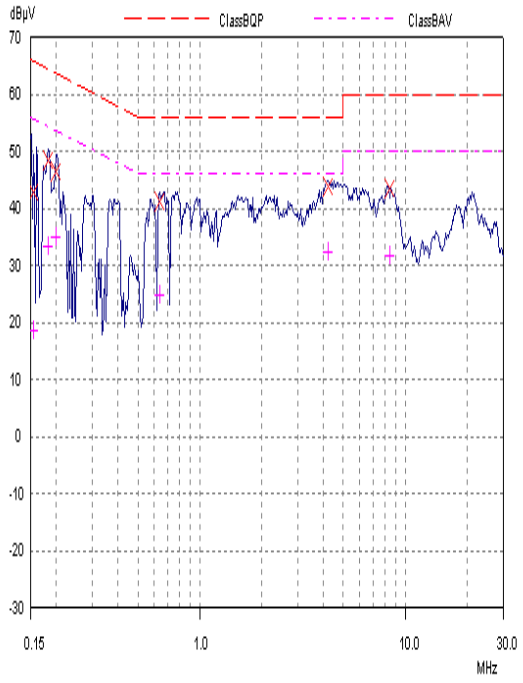
7.2.2. Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

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

Frequency (MHz)	Line	Q-P Level (dBµV)	Limit (dBµV)	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 (dBµV)	Limit (dBµV)	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)

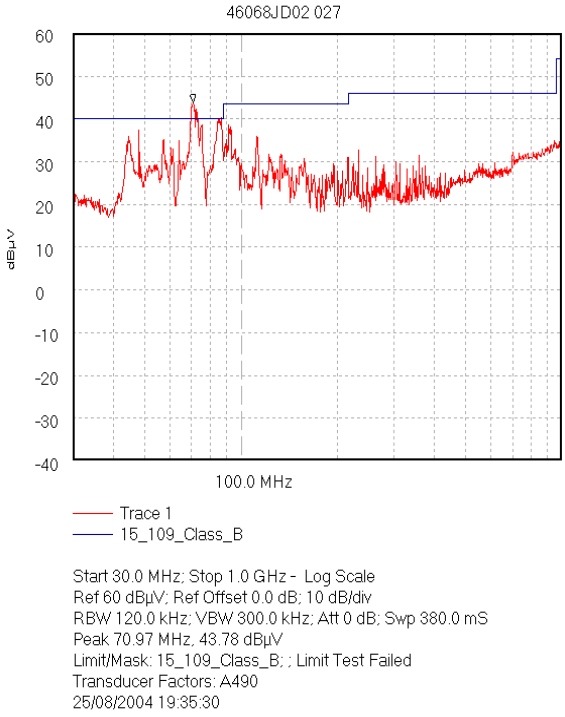
7.3.1.1. The EUT was configured as for receiver radiated emissions testing as described in Section 9 of this report.

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 (dBµV/m)	Limit (dBµV/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.

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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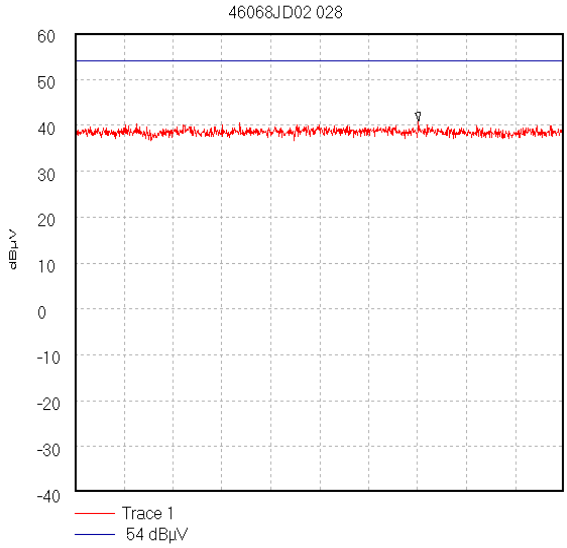
Receiver Radiated Emissions: Section 15.109 (Continued)



Start 1.0 GHz; Stop 2.0 GHz
Ref 60 dBµV; Ref Offset 0.0 dB; 10 dB/div
RBW 120.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 440.0 mS
Peak 1.702 GHz, 40.86 dBµV
Display Line: 54 dBµV; ; Limit Test Passed
Transducer Factors: A490
25/08/2004 19:50:00

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

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.

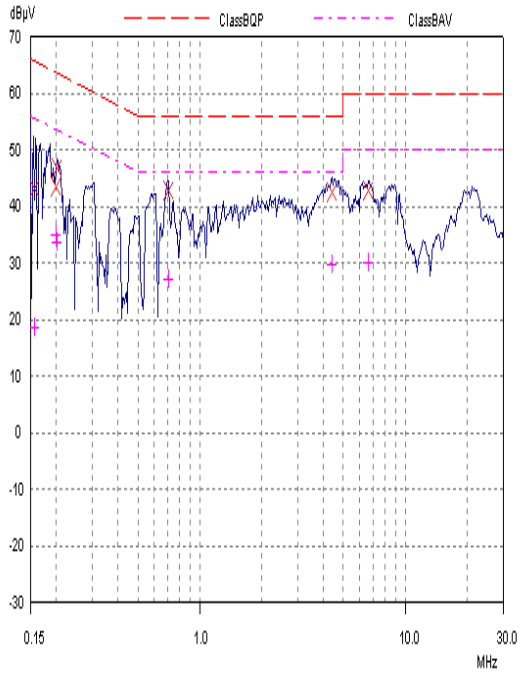
7.4.2. Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

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

Frequency (MHz)	Line	Q-P Level (dBµV)	Limit (dBµV)	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 (dBµV)	Limit (dBµV)	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.

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

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

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

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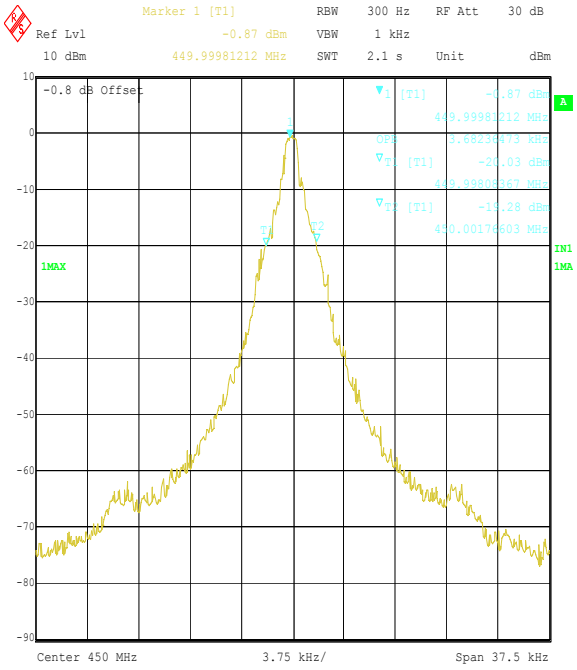
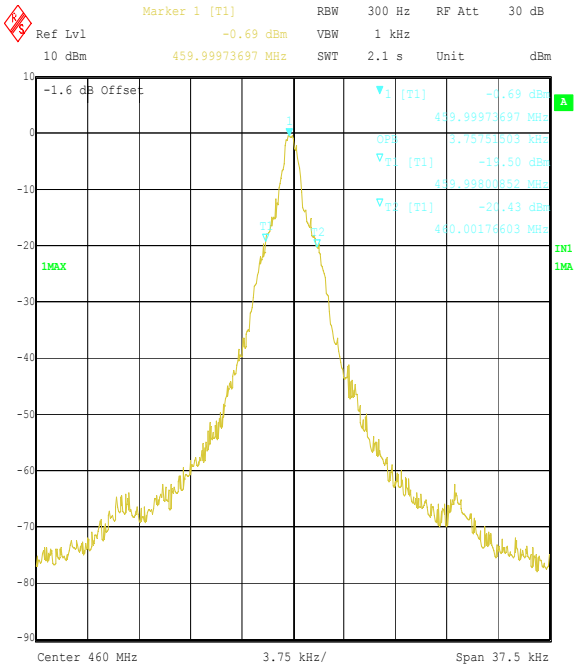
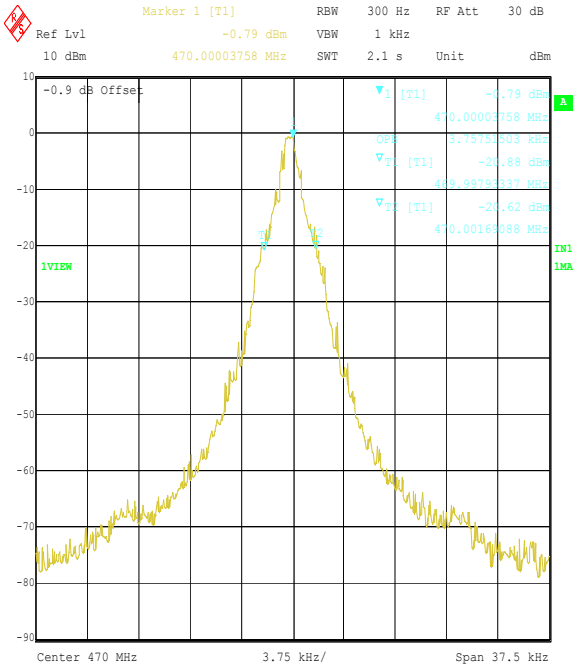
Transmitter Occupied Bandwidth (Bandwidth Limitations): Sections 90.209/90.267/2.1049 (Continued)



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

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.

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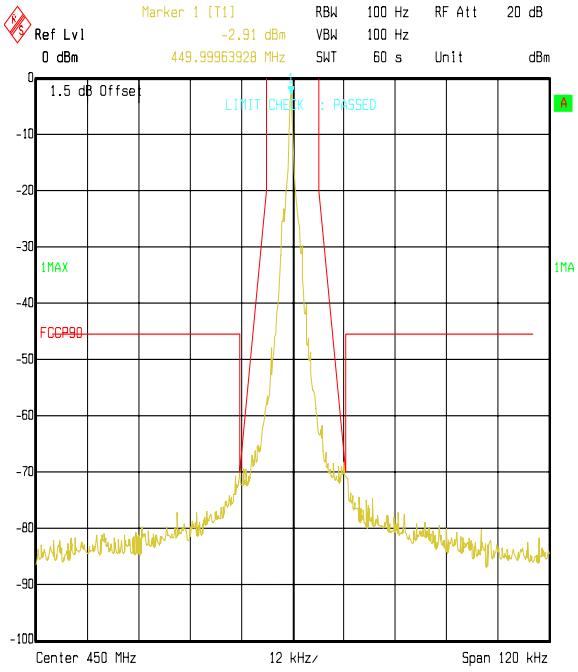
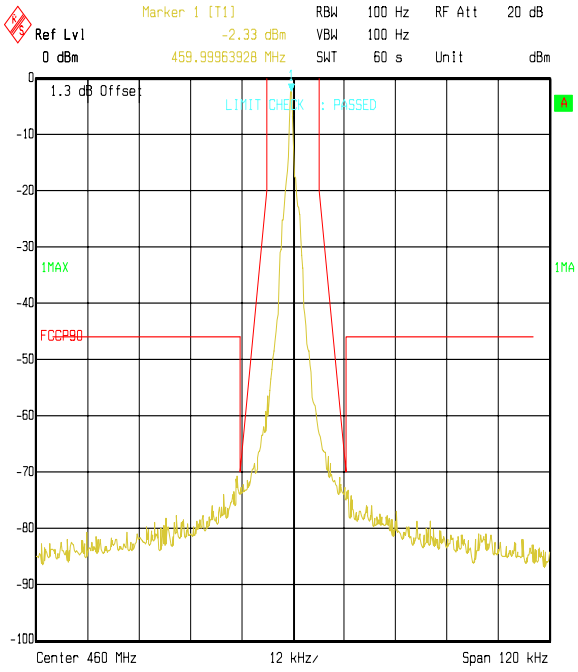
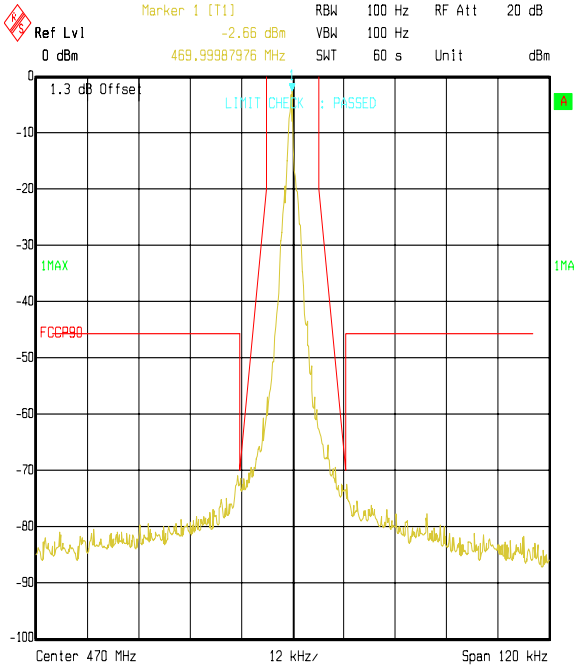
Transmitter Conducted Emissions Masks: Section 90.210 (Continued)



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



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



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

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

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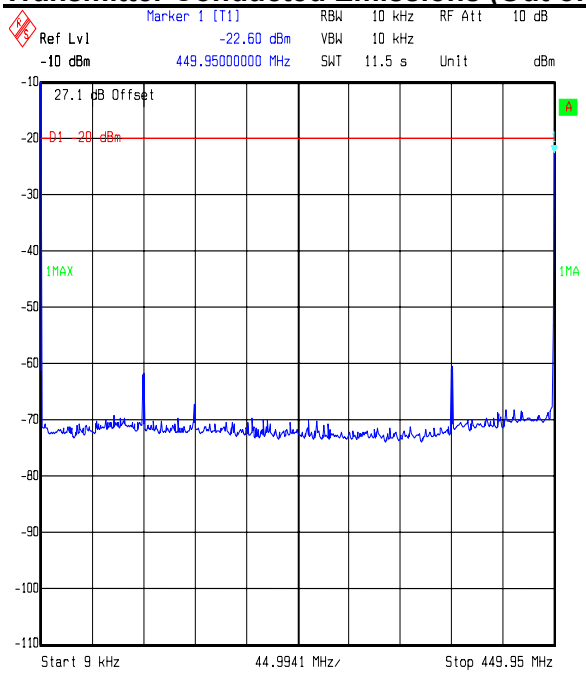
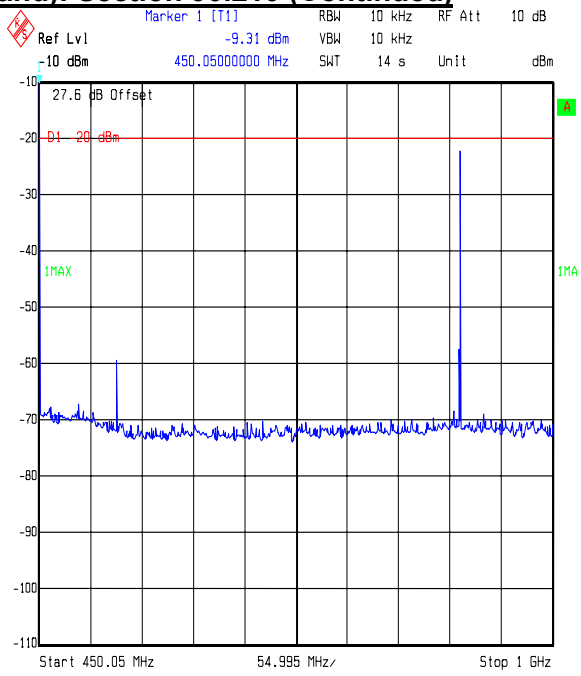
To: **FCC Part 90: 2003**

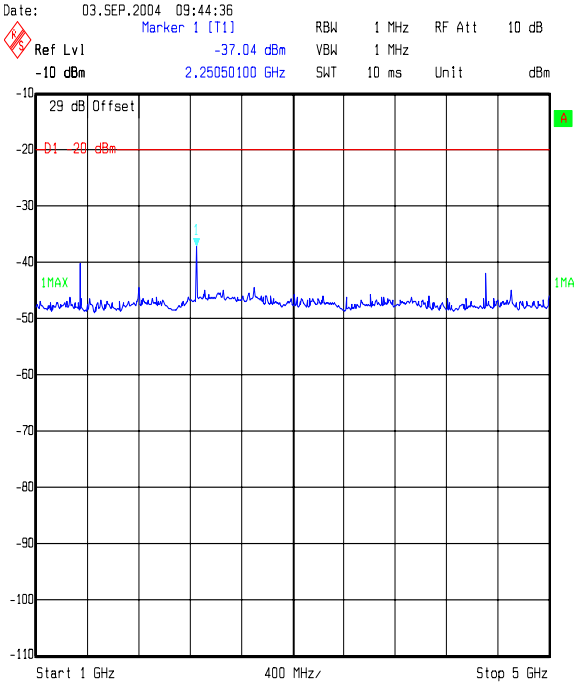
Transmitter Conducted Emissions (Out of Band): Section 90.210 (Continued)



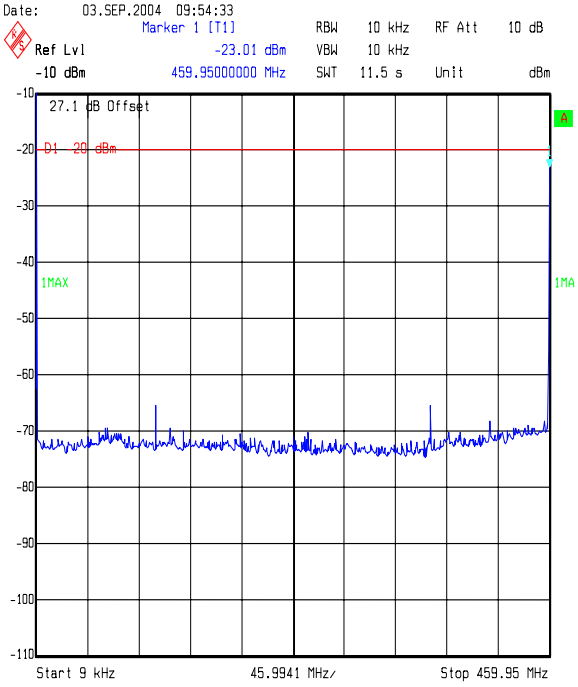
Title: Dreager EUT: Entry Control Board. FCC P90 Cond. Emissions
Comment A: 46068JD02 Bottom Channel
Date: 03.SEP.2004 09:44:36



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



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

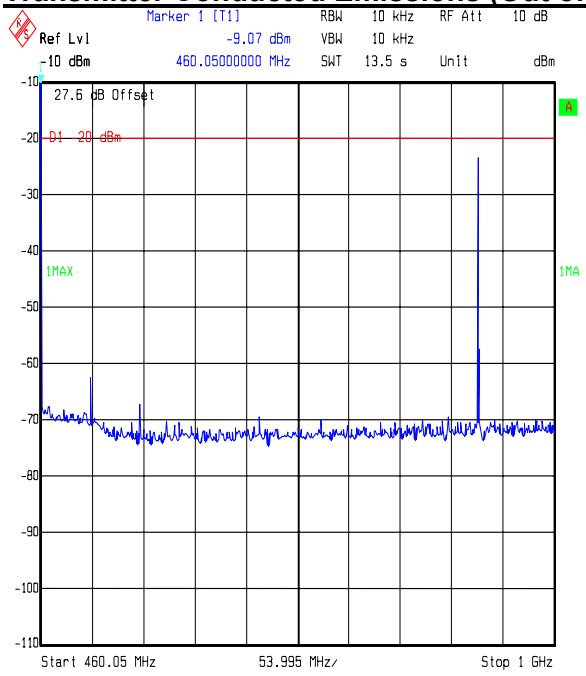


Title: Dreager EUT: Entry Control Board. FCC P90 Cond. Emissions
Comment A: 46068JD02 Middle Channel
Date: 03.SEP.2004 09:46:42

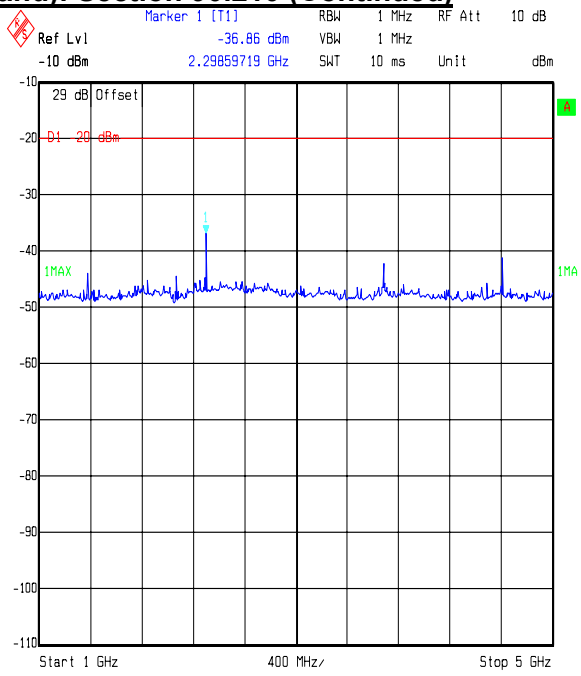
Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

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

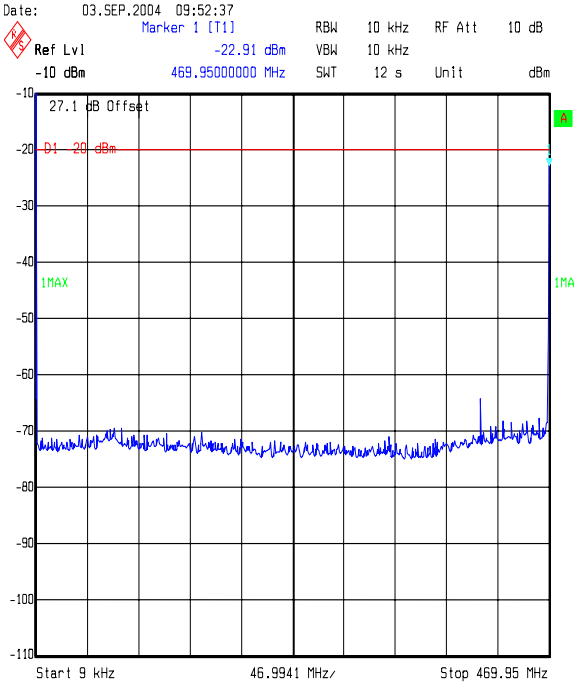
Transmitter Conducted Emissions (Out of Band): Section 90.210 (Continued)



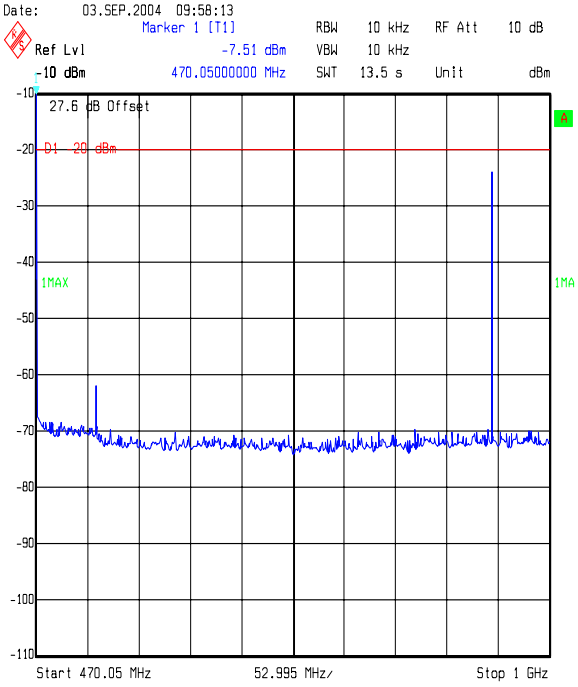
Title: Dreager EUT: Entry Control Board. FCC P90 Cond. Emissions
Comment A: 46068JD02 Middle Channel
Date: 03.SEP.2004 09:52:37



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



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

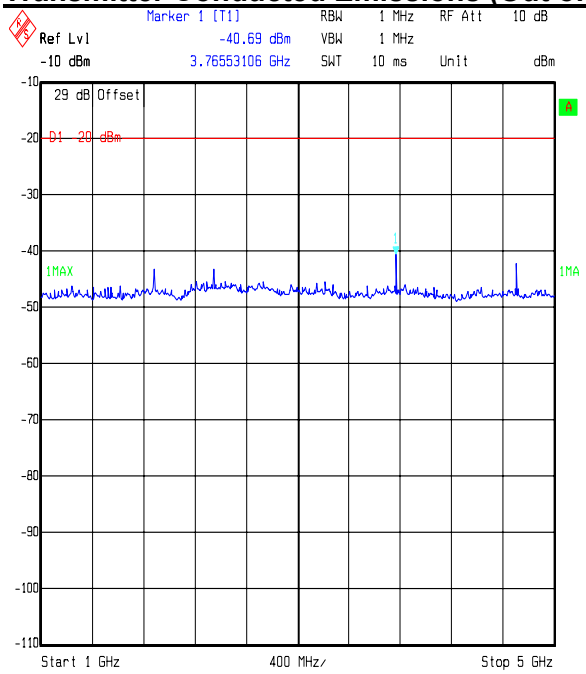


Title: Dreager EUT: Entry Control Board. FCC P90 Cond. Emissions
Comment A: 46068JD02 Top Channel
Date: 03.SEP.2004 09:50:59

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: Dreager 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.

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.

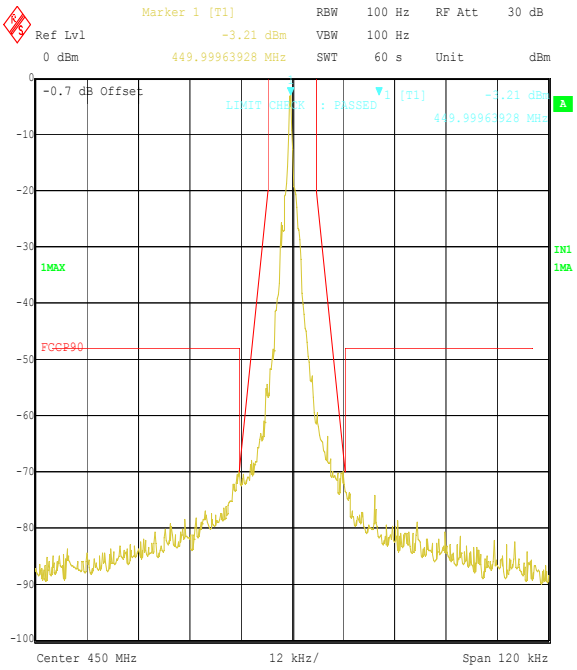
7.10.2. Tests were performed to determine compliance with the out of band power requirements at frequencies adjacent to the channel occupied by the fundamental frequency of the EUT.

Results:

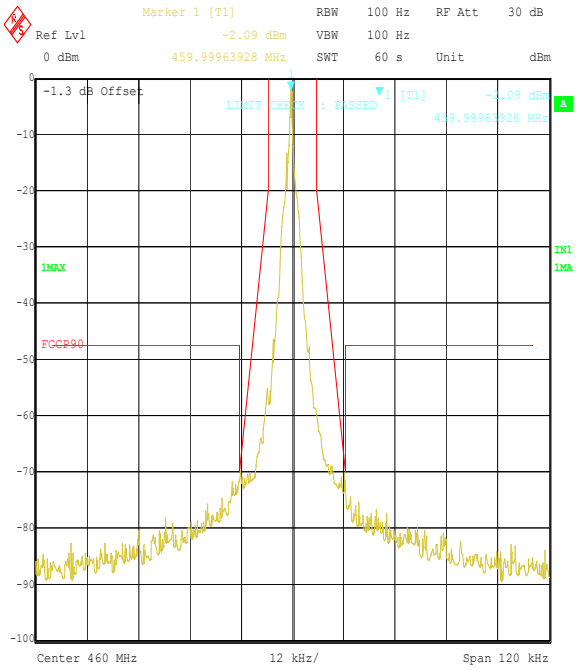
Results are presented graphically in the following graphs. As can be seen from the plots the EUT complies with the requirements of relevant part of the regulations.

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

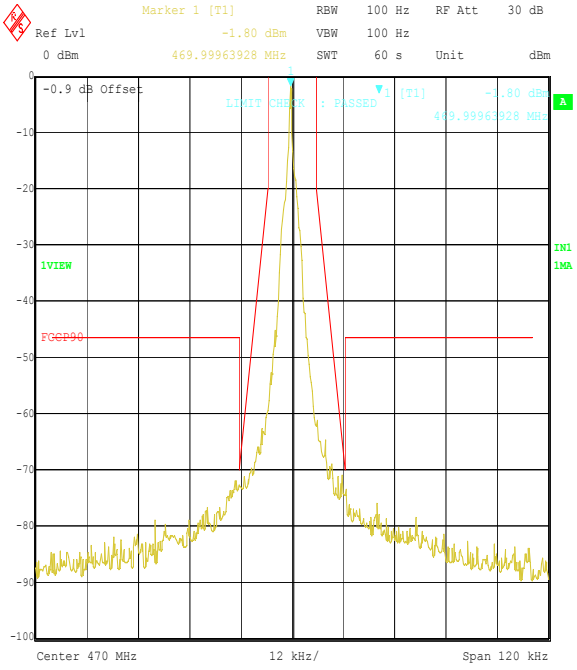
Transmitter Radiated Emissions Masks: Section 90.210 (Continued)



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 Middle Channel.
Date: 1.SEP.2004 12:22:26



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

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

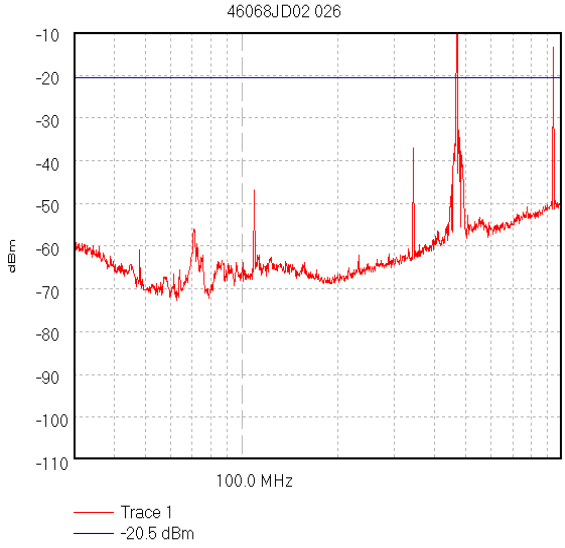
Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
344.018	-69.7	-97.2	-47.5	49.7	Complied
920.038	-27.6	-55.1	-47.5	7.6	Complied
1380.120	-40.1	-67.6	-47.5	20.1	Complied
1840.164	-42.4	-69.9	-47.5	22.4	Complied
2759.884	-43.4	-70.9	-47.5	23.4	Complied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

Result: Top Channel

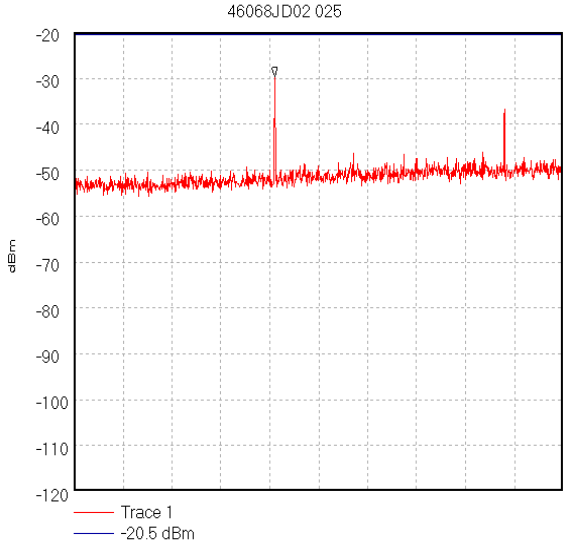
Frequency (MHz)	Peak Emission Level (dBm)	Peak Emission Level (dBc)	Limit (dBc)	Margin (dB)	Result
344.018	-69.7	-96.2	-46.5	49.7	Complied
940.003	-24.7	-51.2	-46.5	4.7	Complied
1409.980	-42.0	-68.5	-46.5	22.0	Complied
1879.833	-45.3	-71.8	-46.5	25.3	Complied
2819.960	-46.5	-73.0	-46.5	26.5	Complied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

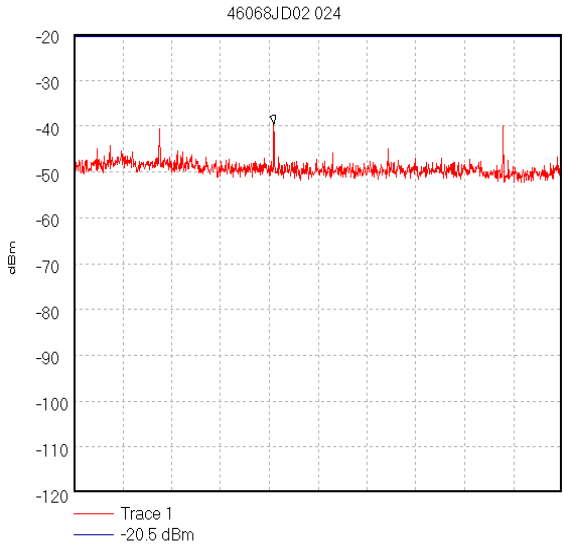
Transmitter Radiated Emissions (Out of Band): Section 90.210 (Continued)



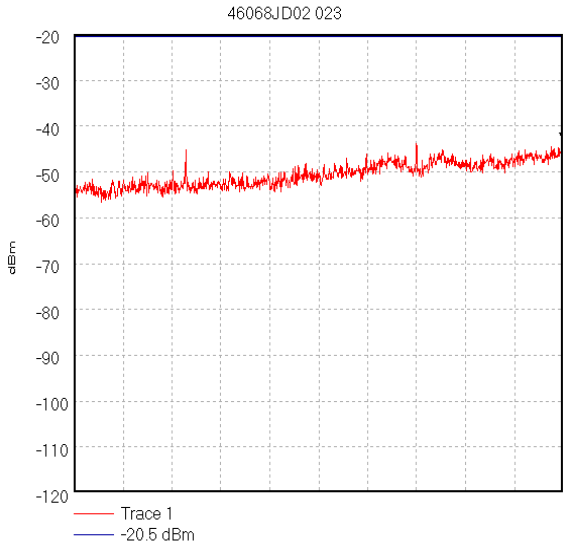
Start 30.0 MHz; Stop 1.0 GHz - Log Scale
Ref -10 dBm; Ref Offset 9.6 dB; 10 dB/div
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 540.0 mS
Peak 469.608 MHz, -6.02 dBm
Display Line: -20.5 dBm; ; Limit Test Passed
Transducer Factors: A490
25/08/2004 19:25:20



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.

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

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

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

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

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

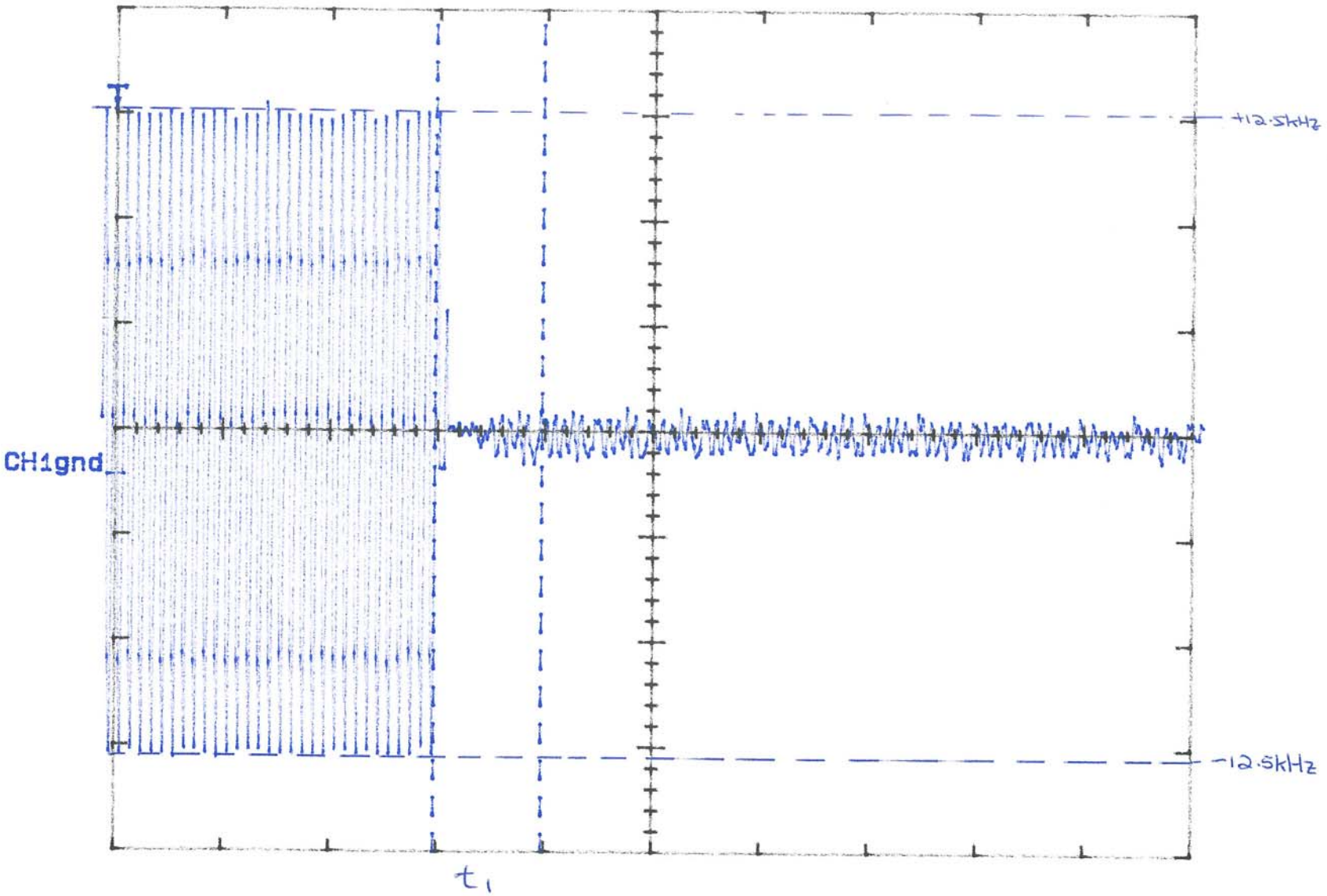
Note: If the transmitter carrier output power rating is 6 Watts or less the frequency difference during time periods t1 and t3 may exceed the maximum frequency difference for these time periods.

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

GPH|460685D02|Too:
Bottom Channel 450MHz

CH1 >100mV A 10ms 26.6mV? VERT

10.000ms

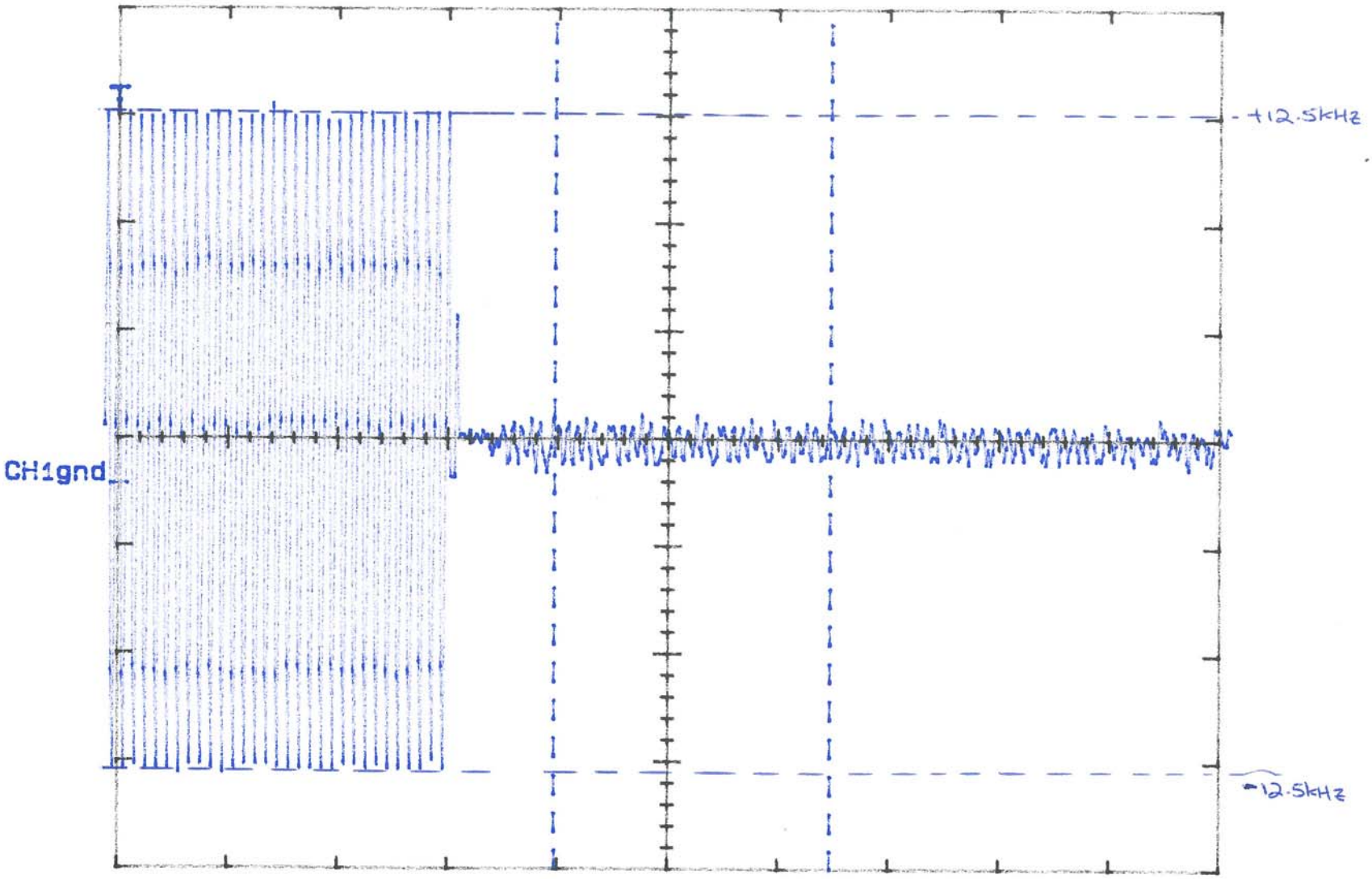


GPH|46068JD02|T002

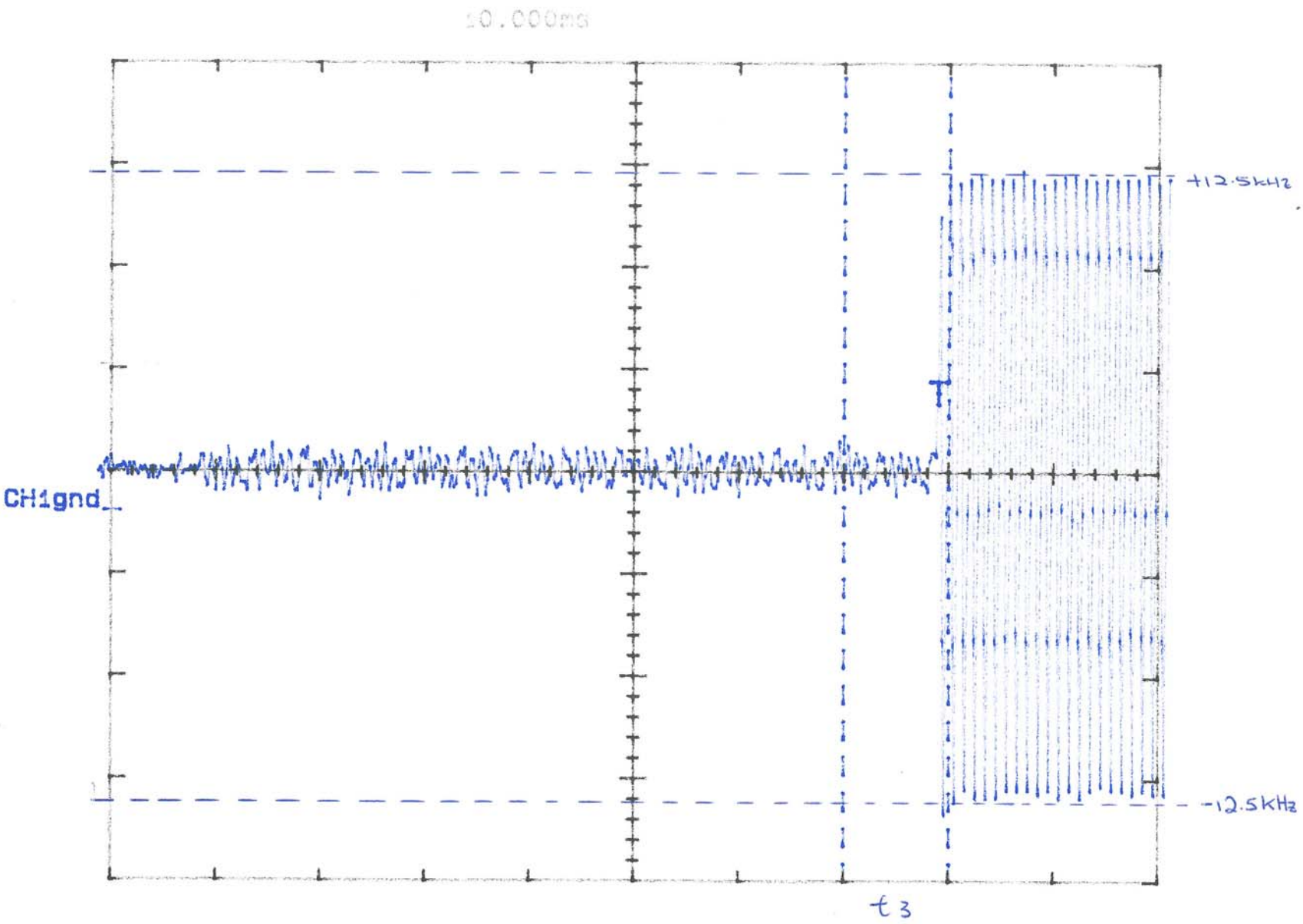
Bottom Channel 450MHz

CH1 >100mV A 10ms 26.6mV? VERT

25.000ms

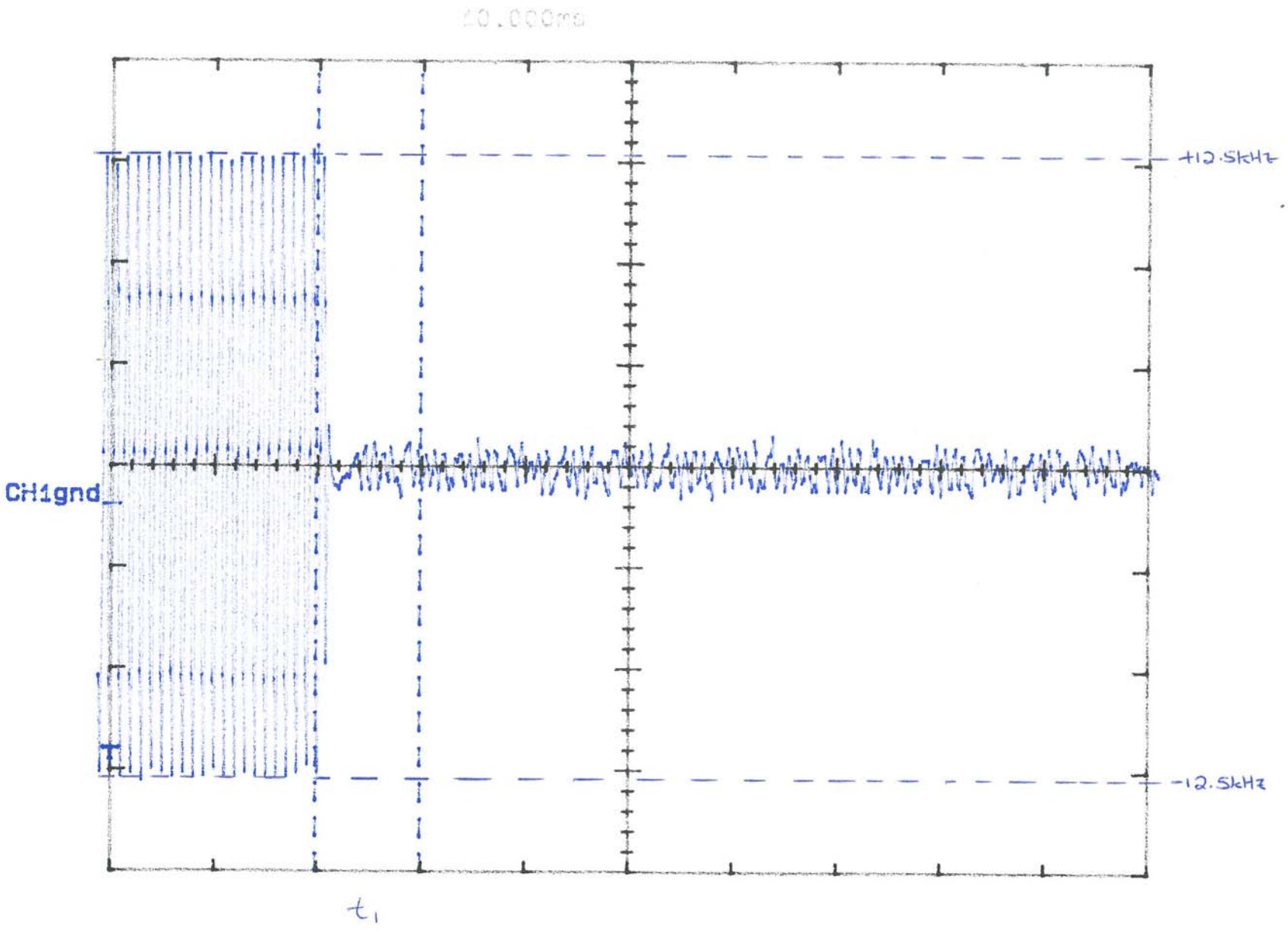


GPH/4606BJD02/T003
Bottom Channel 450MHz



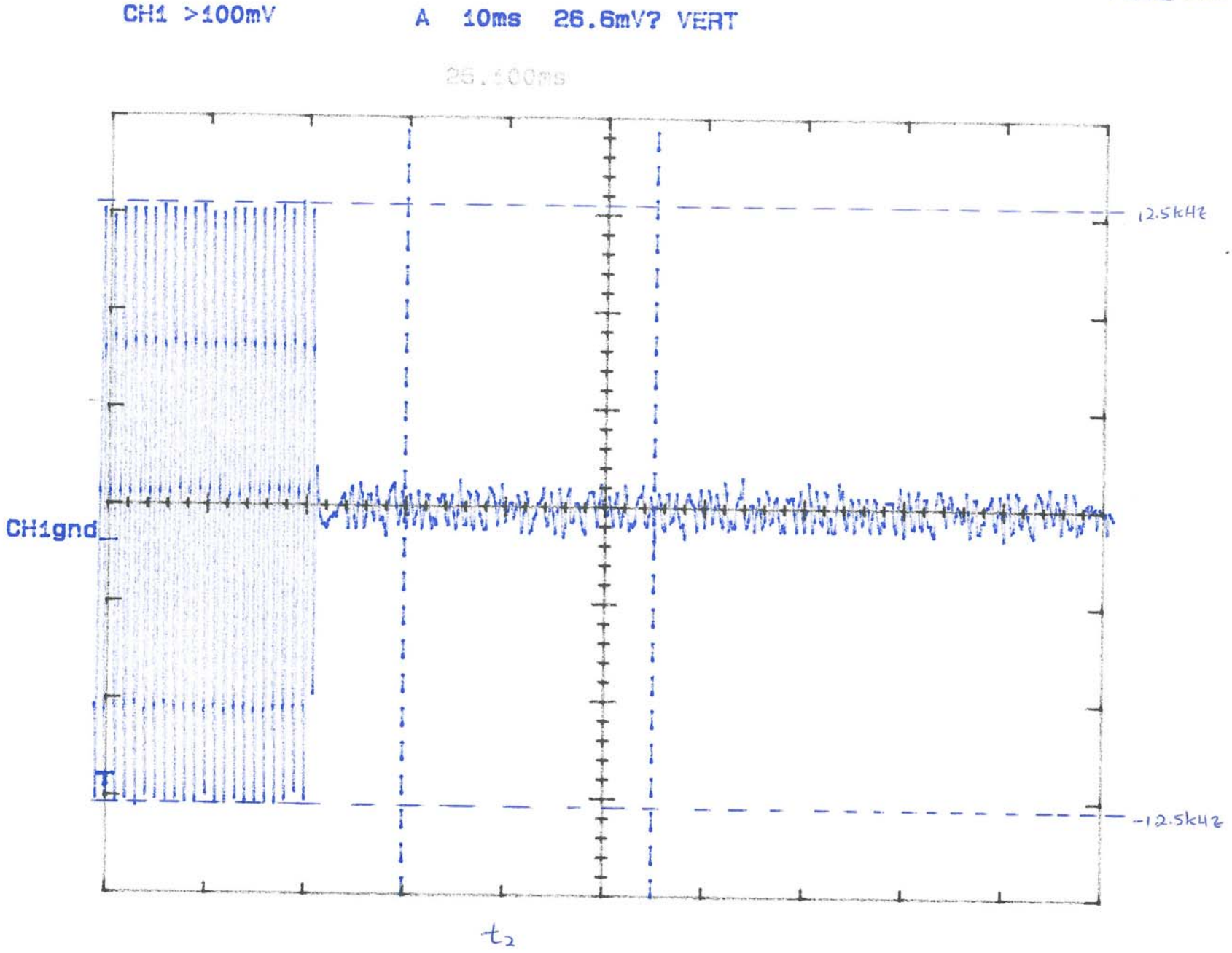
GPH/466685D02/T004
Middle Channel 460 MHz

CH1 >100mV A 10ms 26.6mV? VERT

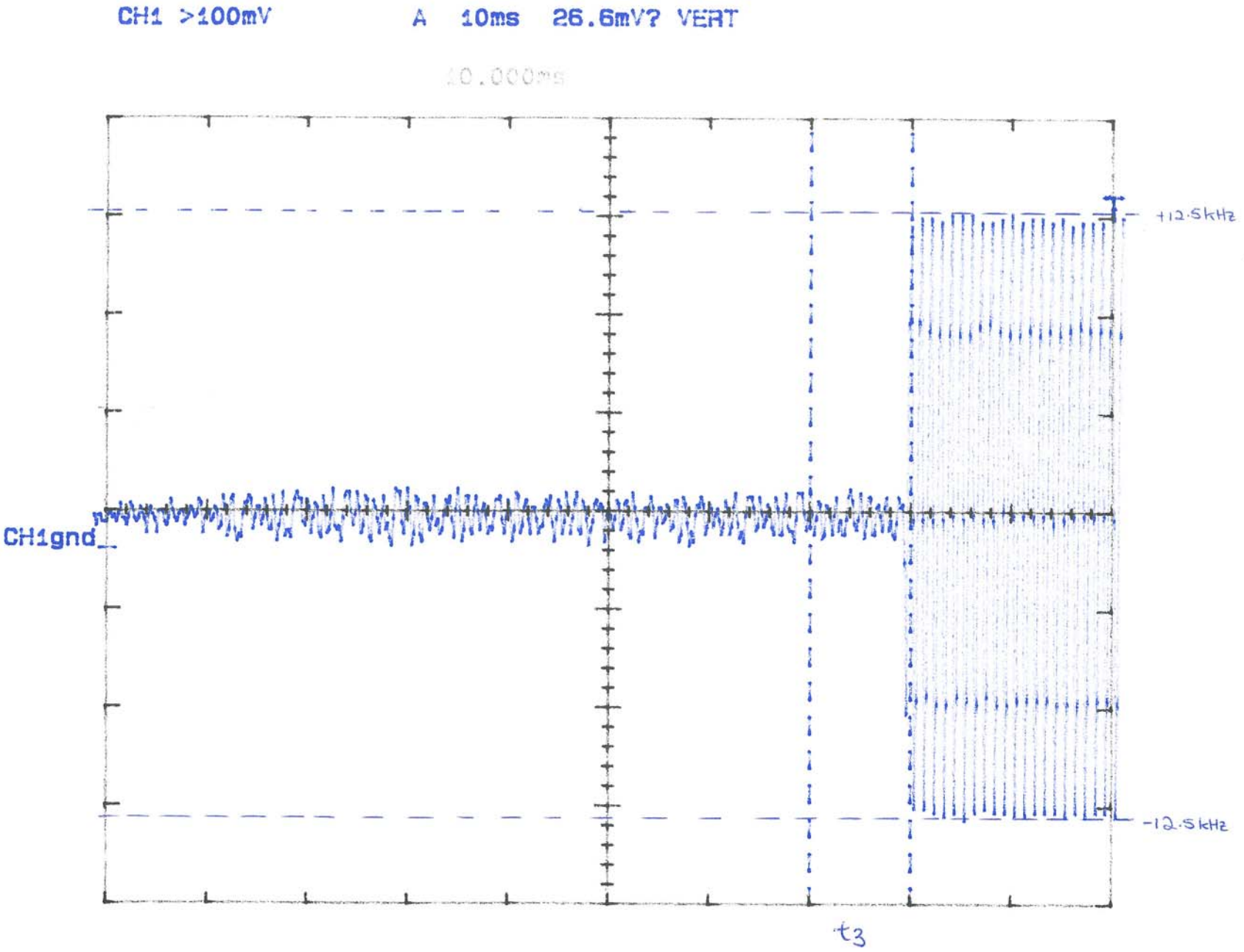


GPH/4606BJD02/T005

Middle Channel 460MHz



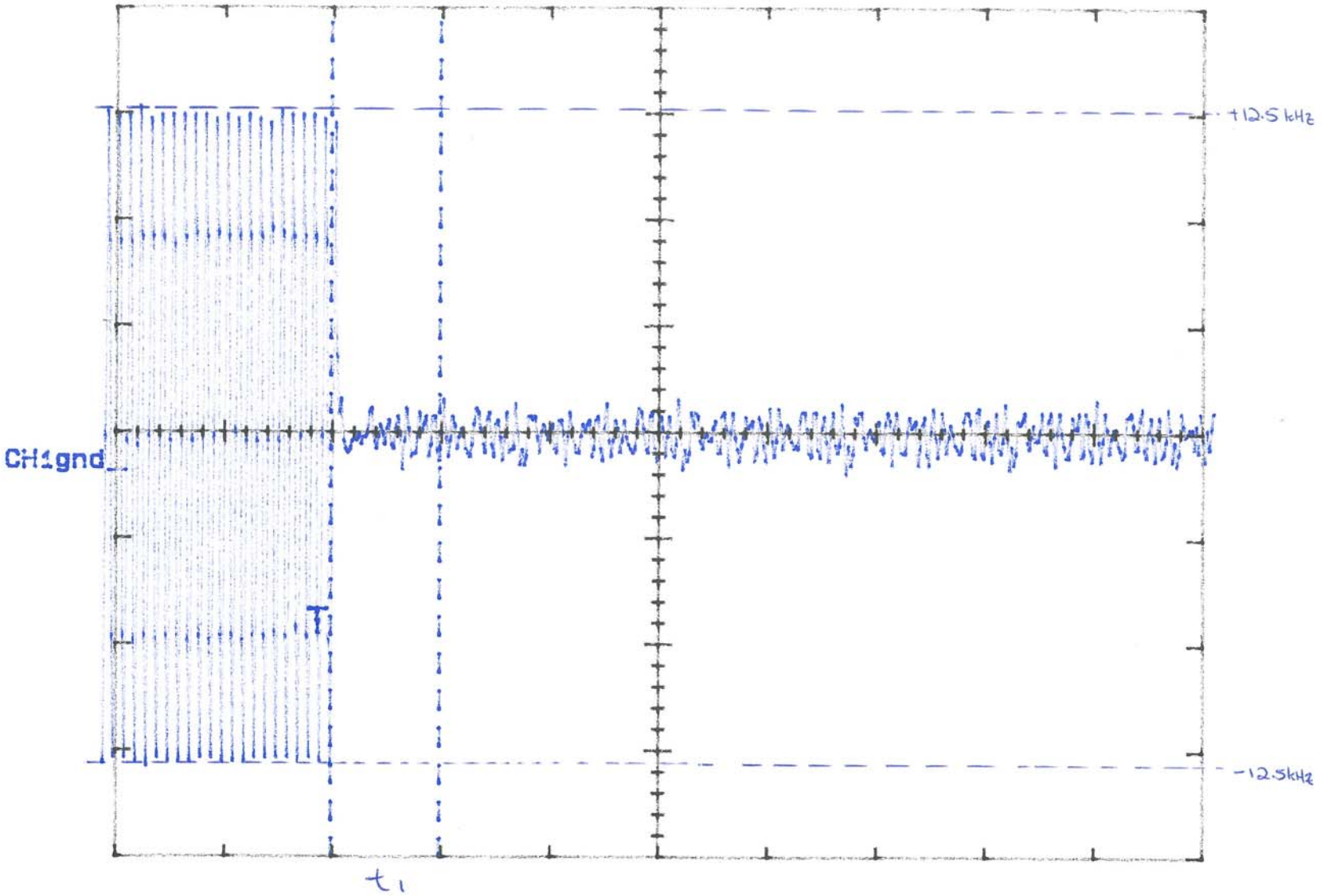
GPH|460G8JD02|T006
Middle Channel 460MHz



GPH|4606BJD02|T007
Top Channel 470MHz

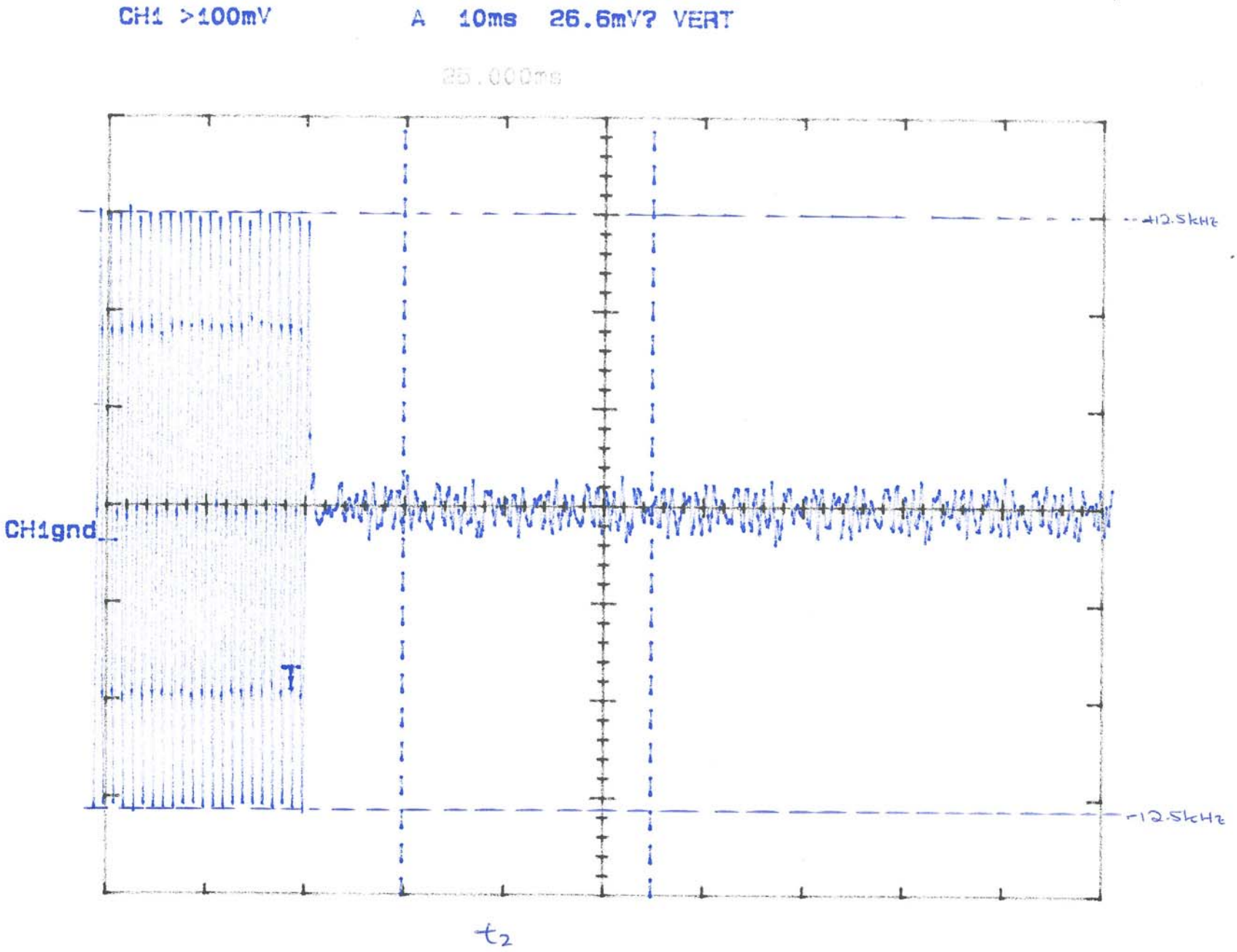
CH1 >100mV A 10ms 26.6mV? VERT

10.000ms



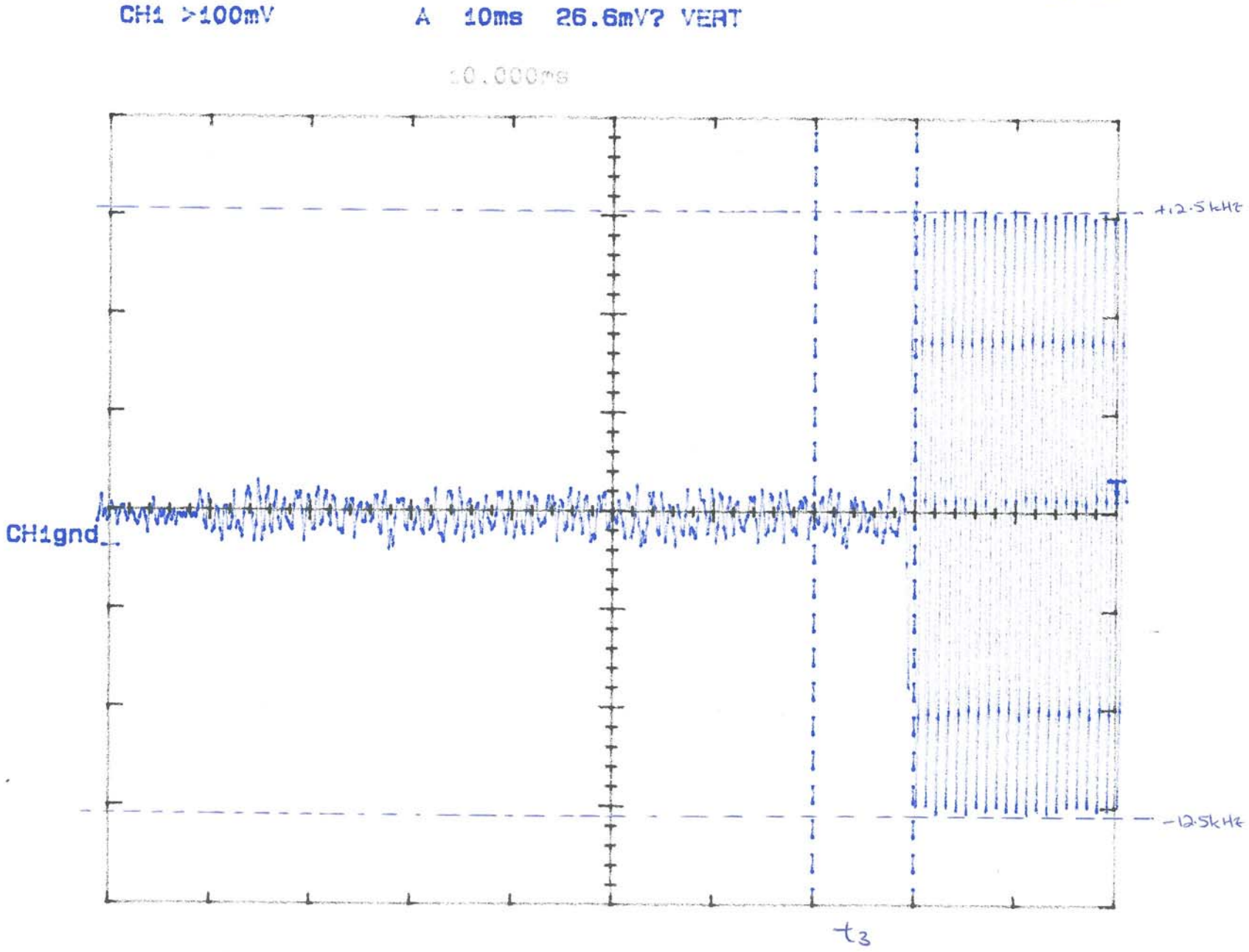
GPH/4668J002/T008

Top Channel 470MHz



GPM/46068JD02/T009

Top Channel 470MHz



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

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.

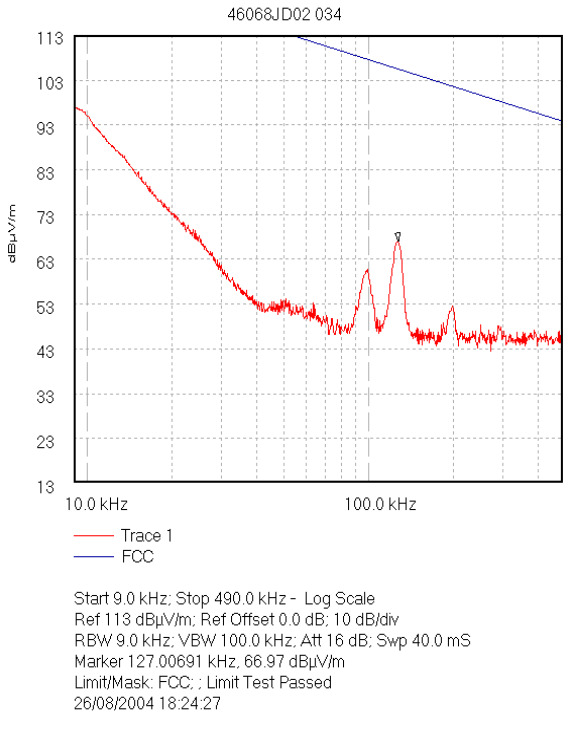
7.16.1.2. Tests were performed to identify the maximum radiated spurious emissions levels.

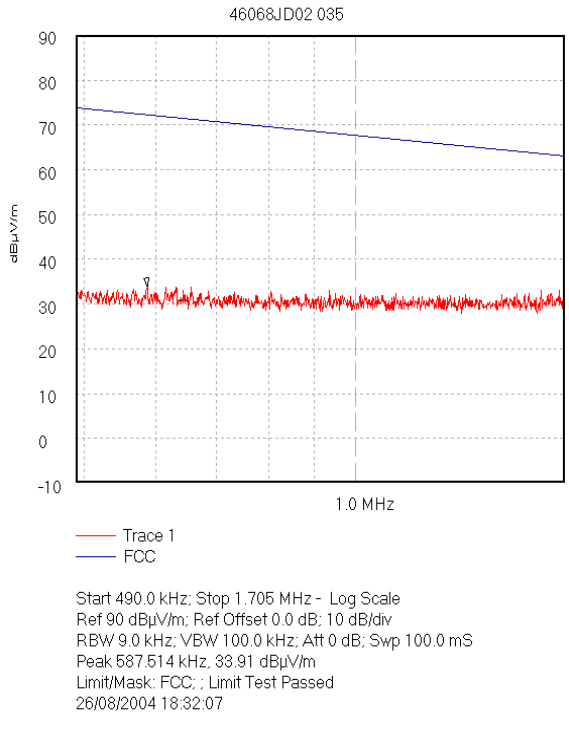
7.16.1.3. Limits below 30 MHz are specified at test distance of 30 metres, whilst below 0.49 MHz they are specified at a test distance of 300 metres. However as specified by section 15.31 (f)(2), measurements may be performed at a closer distance, and the measured level corrected to the specified measurement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

Result:

Frequency (MHz)	Q-P Level (dBµV/m)	Limit (dBµV/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*

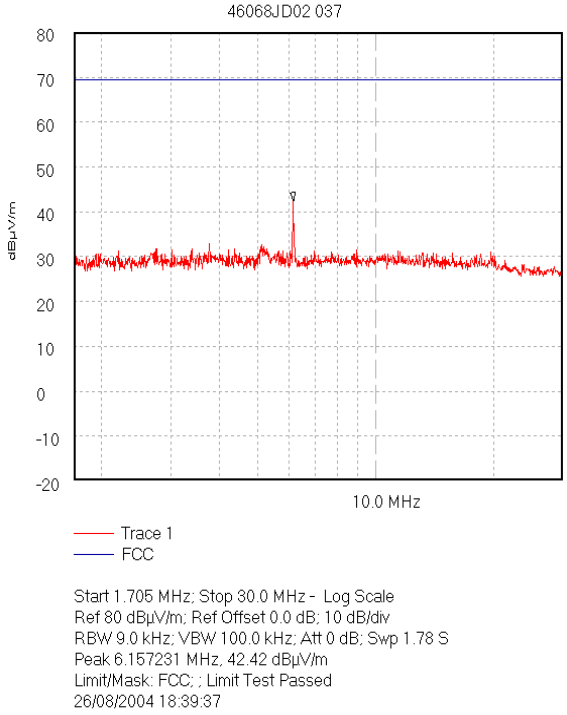




Note: these plots are pre-scans and for indication purposes only. For final measurements, see accompanying tables.

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

Transmitter Radiated Spurious Emissions: Section 15.209 (Continued)



Start 1.705 MHz; Stop 30.0 MHz - Log Scale
Ref 80 dBµV/m; Ref Offset 0.0 dB; 10 dB/div
RBW 9.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 1.78 S
Peak 6.157231 MHz, 42.42 dBµV/m
Limit/Mask: FCC; ; Limit Test Passed
26/08/2004 18:39:37

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

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.

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

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 dBμV plus cable loss and antenna factor.

Radiated Emissions (Continued)

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

Receiver Function	**Initial Scan (Below 30 MHz)**	**Final Measurements (Below 30 MHz)**
Detector Type:	Peak	Quasi-Peak (CISPR) 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 Below 1 GHz**	**Final Measurements Above 1 GHz**
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak/Average
Mode:	Max Hold	Not applicable	Not applicable
Bandwidth:	(120 kHz < 1 GHz) (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

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.

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.

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.

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

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.

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

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 then 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:-

ERP = Signal Generator Level - Cable Loss + 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.

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

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.

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

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 :-

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

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

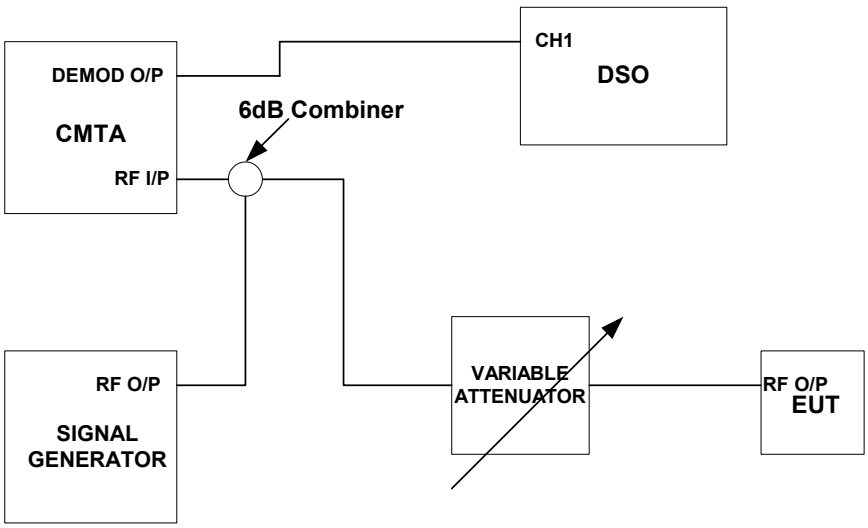
The measured ppm had to be less then the relevant limits in order to comply.

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:	1/8th Pre-trigger
Release Trigger Position	7/8th 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

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 30HV	None
G513	Signal Generator	Rohde & Schwarz	SMH	839858/001
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M015	Radiocommunications Analyser	Rohde & Schwarz	CMTA	883 574/003
M027	Radiocommunications Analyser	Rohde & Schwarz	CMTA	883 574/004
M028	Spectrum Analyser	Rohde & Schwarz	FSB	860 001/009 (RF); 860 161/007 (DU)
M029	Digital Storage Oscilloscope	Tektronix	2440	0120850
M044	Test Receiver	Rohde & Schwarz	ESVP	891 845/026
M069	Spectrum Analyser/ Receiver	Rohde & Schwarz	ESMI	829 808/007 (DU); 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; M506	Spectrum Analyser/ Receiver	Rohde & Schwarz	ESBI	825316/010 (DU) / 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.

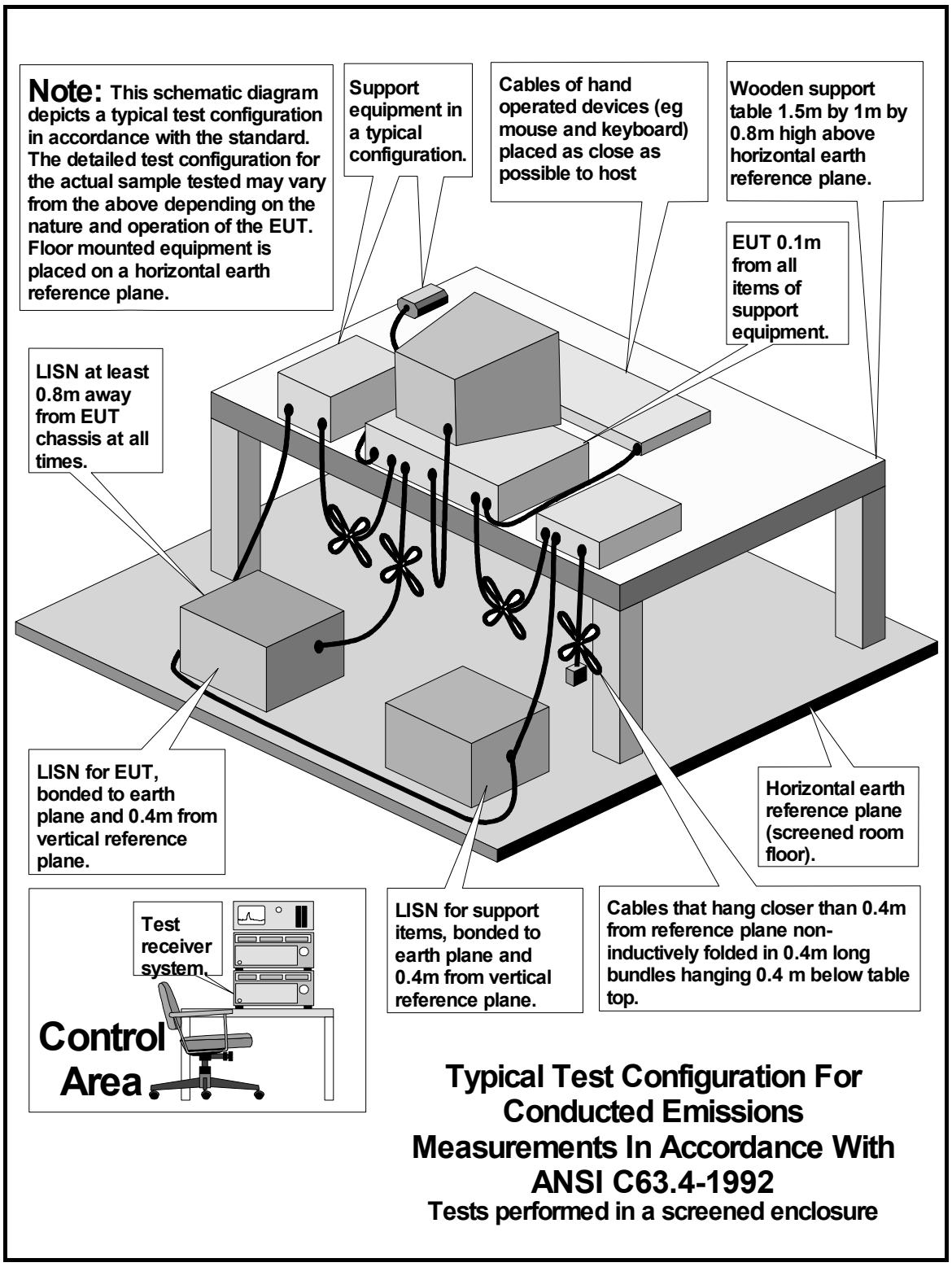
Appendix 2. Test Configuration Drawings

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

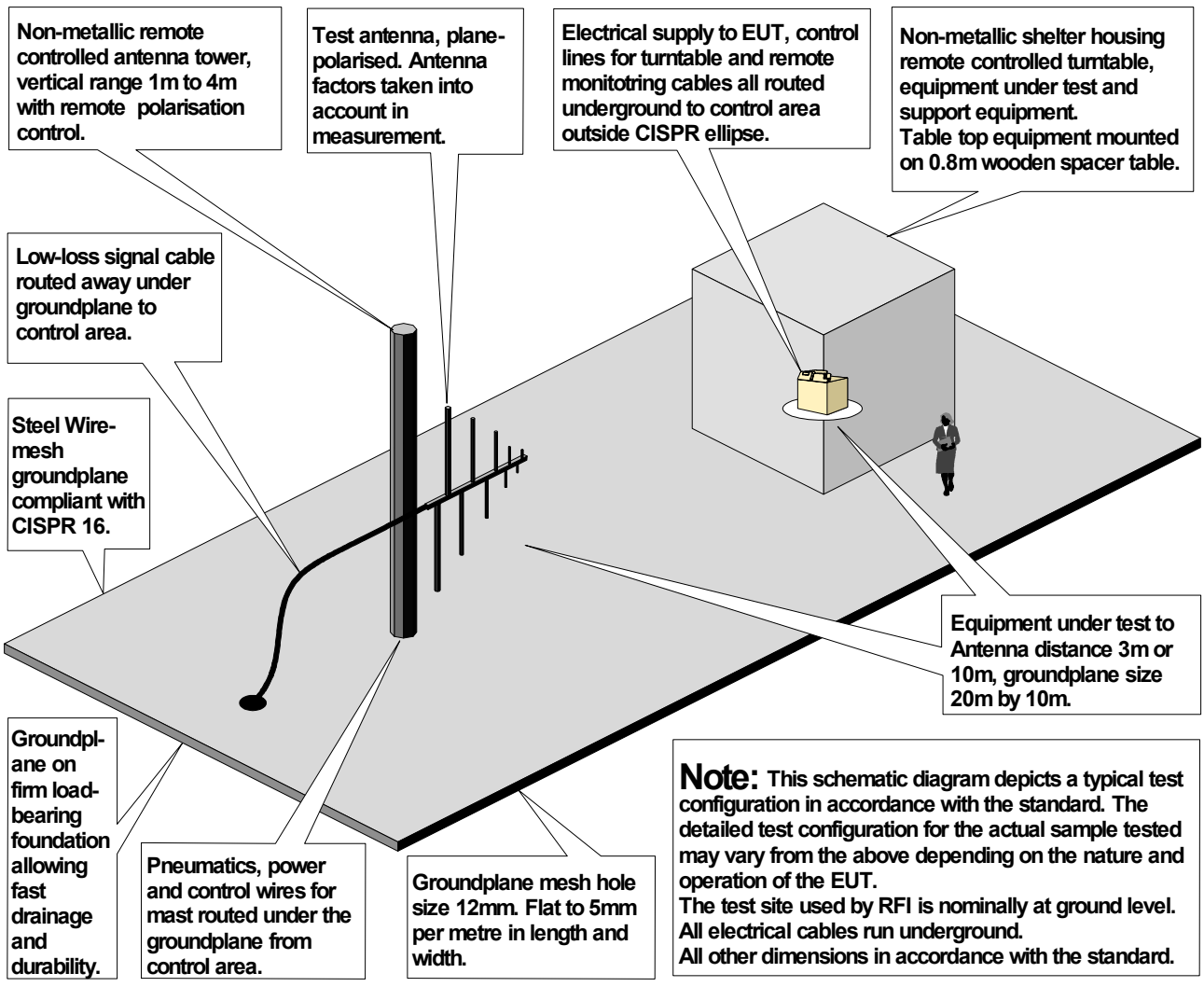
Test Of: Draeger Safety UK
460MHz Entry Control Board
To: FCC Part 90: 2003

DRG\46068JD02\EMICON



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

DRG\46068JD02\EMIRAD



Note: This schematic diagram depicts a typical test configuration in accordance with the standard. The detailed test configuration for the actual sample tested may vary from the above depending on the nature and operation of the EUT.
The test site used by RFI is nominally at ground level.
All electrical cables run underground.
All other dimensions in accordance with the standard.

Test Configuration For Radiated Emissions Measurements

Reflection-free area: >60m by 52m (CISPR ellipse)

Groundplane Earthed

Control room outside CISPR ellipse