

TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Quantel Ltd.
2116-22-018 Hand Control and
2116-29-018 Hand Control Dock

To: FCC Part 15: 2000
Sections 15.249 and 15.109

Test Report Serial No:
RFI/EMCB1/RP42535A

This Test Report Is Issued Under The Authority Of Richard Jacklin, Operations Director: 	Checked By: 
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RADIO FREQUENCY INVESTIGATION LTD.

EMC Department

TEST REPORT

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Test Of: Quantel Ltd.

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FCC Part 15: 2000 Class A Section 15.249 and 15.109

1. Client Information

Company Name:	Quantel Ltd.
Address:	31 Turnpike Road Newbury Berkshire RG14 2NX.
Contact Name:	Mr. D. Bowman.

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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:	Quantel
Model Name or Number:	Hand Control
Unique Type Identification:	2116-22-018
Serial Number:	252553/3
Country of Manufacture:	United Kingdom
FCC ID Number:	None stated
Date of Receipt:	02 October 2001

Brand Name:	Quantel
Model Name or Number:	Hand Control Dock
Unique Type Identification:	2116-29-018
Serial Number:	820254/1
Country of Manufacture:	United Kingdom
FCC ID Number:	None stated
Date of Receipt:	02 October 2001

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2.2. Description Of EUT

The Hand Control is a hand held (mouse/puck type) control low power radio transmitter. It uses 5 push button switches, a switch joystick, analog joystick and inertial sensors as some of the control functions for Quantel iQ series video editing/effects equipment

The Hand Control Dock is the radio receiver for the data transmitted from the Hand Control. Hand Control Data received by the Hand Control Dock is passed to the Quantel iQ mainframe by an RS485 serial data link.

The Hand Control Dock is connected to the iQ control system by a 4 way (2 tw/pr) power/data cable. As well as being the receiver for Hand Control data it provides a parking bay and battery charging point for the Hand Control.

The Hand Control and Hand Control Dock are component parts of the Quantel iQ Control Station which is used to control the various editing, retouching, animation, clip loading, payout and data entry functions of the Quantel iQ video editing/effects system.

2.3. Modifications Incorporated In EUT

When the Hand Control functionality is set to transfer switch status data to the iQ system via the LP radio link and Hand Control Dock, a change of switch status data causes the Hand Control to transmit the switch status data packet for one second.

In order that the radiated power level of the RF module may easily be measured, the Hand Control can be loaded with a test version of firmware, which causes it to transmit full time.

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2.4. Additional Information Related To Testing

Power Supply Requirement:	Internal battery supply of 2.5 V DC (Hand Control) External supply of 24 V DC (Hand Control Dock)
Current Rating	2 Amps
Intended Operating Environment:	Commercial, Light Industrial and controlled EMC
Weight:	<150g
Dimensions:	L160 x W60 x H40
Interface Ports:	RS485 Serial Data Interface (Hand Control Dock Only)
Type of Device	Cordless Hand Control
Antenna Details	Permanently attached antenna
Type of Modulation	FM
Number of Tx Channels	1
Method of Frequency Generation	SAW stabilised oscillator
Category of Receiver	Superheterodyne Highest Local Oscillator Frequency: 914.5 MHz

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2.5. Support Equipment

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

Description:	iQ control station Tablet
Brand Name:	Quantel
Model Name or Number:	2116-21-006
Serial Number:	250316-5
FCC ID Number:	None stated by client
Cable Length And Type:	3m 2 tw/pr power/data cable. Quantel part no 2116-54-010
Connected to Port:	w/s port of control station PSU module

Description:	iQ control station Control Interface/PSU
Brand Name:	Quantel
Model Name or Number:	2116-25-006
Serial Number:	252888-4
FCC ID Number:	None stated by client
Cable Length And Type:	200m CAT5 straight data cable
Connected to Port:	Mainframe RS485 data port

Description:	Tower PC
Brand Name:	DAN
Model Name or Number:	P200
Serial Number:	307900.005
FCC ID Number:	None stated by client
Cable Length And Type:	up to 200m CAT5 straight data cable
Connected to Port:	M/F port on control interface/PSU

Description:	Keyboard
Brand Name:	DELL
Model Name or Number:	AT102
Serial Number:	K9207-049755
FCC ID Number:	GYUM97SK
Cable Length And Type:	2m multicore screened
Connected to Port:	keyboard port of PC

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Support Equipment (continued)

Description:	Mouse
Brand Name:	Microsoft
Model Name or Number:	45713
Serial Number:	1523614
FCC ID Number:	C3KSMP1
Cable Length And Type:	1.5m multicore
Connected to Port:	mouse port of PC

Description:	Monitor
Brand Name:	DAN
Model Name or Number:	CD-1764TR
Serial Number:	309448 004255
FCC ID Number:	None stated by client
Cable Length And Type:	1.5m multicore SVGA cable
Connected to Port:	SVGA port of PC

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3. Test Specification, Methods And Procedures

3.1. Test Specification

Reference:	FCC Part 15: 2000 (Sections 15.249 and 15.109)
Title:	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Digital Devices.
Comments:	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification

3.2. Methods And Procedures

The methods and procedures used were as detailed in:

ANSI C63.2 (1987)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (1992)

Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1 (1993)

Title: Specification for radio disturbance and immunity measuring apparatus and methods. Part 1. Radio disturbance and immunity measuring apparatus.

3.3. Definition Of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

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4. Deviations From The Test Specification

None.

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5. Operation Of The EUT During Testing

5.1. Operating Conditions

The EUT was tested in a normal laboratory environment.

During testing, the Hand Control was powered by an internal battery supply of 2.5V DC supply.

During testing, the Hand Control Dock was powered by an external supply of 24V DC.

5.2. Operating Modes

The EUT was tested in the following operating mode:

Running diagnostic interrogation software on the PC, which accesses and logs the status of all of the component parts of the control station.

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

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

All connected and responding to diagnostic interrogation. The EUT was configured, connected to the relevant support equipment, as shown in the diagram given in Appendix 3 of this report.

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

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

6. Summary Of Test Results

6.1. Radiated Emissions

Range Of Measurements	Specification Reference	Compliance Status
Electric Field Strength, 30 MHz to 10000 MHz	Section 15 of C.F.R. 47: 2000	Complied

6.2. Location Of Tests

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

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7. Measurements, Examinations And Derived Results

7.1. General Comments

7.1.1. This section contains test results only. Details of the test methods and procedures can be found in Appendix 2 of this report.

7.1.2. 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. Test Results For Radiated Emissions (30 to 1000 MHz): Hand Control in Transmit Mode.**7.2.1. Electric Field Strength Measurements**

7.2.1.1. Measurements were performed FCC Part 15.249.

7.2.1.2. The client has stated that the highest clock frequency for the EUT was 914.5 MHz. Therefore tests were performed up to 10 GHz.

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

7.2.1.4. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector, at a test measurement distance of 3 meters (results incorporate antenna factors and cable losses):

7.2.1.5. The indicated emission at 914.501 MHz is the fundamental frequency.

Frequency (MHz)	Ant. Pol.	Q-P Level (dB _m V/m)	Limit (dB _m V/m)	Margin (dB)	Result
125.245	Vert.	14.4	43.5	29.1	Complied
258.052	Vert.	19.8	46.0	26.2	Complied
914.501	Horiz	37.7	94.0	56.3	Complied

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7.3. Test Results For Radiated Emissions (30 to 10000 MHz): Hand Control Dock and Hand Control in Standby Mode.

7.3.1. Electric Field Strength Measurements

7.3.1.1. Measurements were performed to FCC Part 15.109 Class A (Unintentional-Radiators).

7.3.1.2. The client has stated that the highest clock frequency for the EUT was 914.5 MHz. Therefore tests were performed up to 10 GHz.

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

7.3.1.4. The following was performed using a Quasi-Peak detector, at a test measurement distance of 3 meters (results incorporate antenna factors and cable losses):

7.3.1.5. There were no spurious emissions detected within 20 dB of the limit for this mode and in this frequency band. Therefore no measurements were taken in accordance with FCC Part 15.31 (o)

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7.4. Test Results For Radiated Emissions (1 GHz to 4 GHz): Hand Control in Transmit Mode.**7.4.1. Electric Field Strength Measurements**

7.4.1.1. Measurements were performed to FCC Part 15.249.

7.4.1.2. The client has stated that the highest clock frequency for the EUT was 914.5 MHz. Therefore tests were performed up to 10 GHz.

7.4.1.3. All emissions above 1 GHz were measured at a distance of 1m, this is in accordance with FCC Part 15. 31(f)(1), therefore a correction factor of -9.5 dB was used to correct the measured value. The correction factor was calculated as follows where 1 and 3 are the respective test distances:-

$$20 \log \frac{1}{3} = \text{Correction Factor}$$

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

7.4.1.5. The following tables list frequencies at which emissions were measured using Peak and Average detector functions:

Highest Average Level:

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB _{mV})	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB _{mV/m})	Average Limit (dB _{mV/m})	Average Margin (dB)	Result
1818.111	Vert.	8.5	21.7	0.8	31.0	53.9	22.9	Complied
3619.828	Vert.	14.2	21.0	1.2	36.4	53.9	17.5	Complied

Highest Peak Level:

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB _{mV})	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB _{mV/m})	Peak Limit (dB _{mV/m})	Peak Margin (dB)	Result
1818.111	Vert.	18.5	21.7	0.8	41.0	73.9	32.9	Complied
3619.828	Vert.	24.5	21.0	1.2	46.7	73.9	27.2	Complied

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7.5. Test Results For Radiated Emissions (1 GHz to 4 GHz): Hand Control Dock and Hand Control in Standby Mode.**7.5.1. Electric Field Strength Measurements**

7.5.1.1. Measurements were performed to FCC Part 15.109 Class A (Unintentional-Radiators).

7.5.1.2. The client has stated that the highest clock frequency for the EUT was 914.5 MHz. Therefore tests were performed up to 10 GHz.

7.5.1.3. All emissions above 1 GHz were measured at 1m, this is in keeping with FCC Part 15. 31(f)(1). Therefore a correction factor of -9.5 dB was used to correct the measured value. The correction factor was calculated as follows where 1 and 3 are the respective test distances:-

$$20 \log \frac{1}{3} = \text{Correction Factor}$$

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

7.5.1.5. The following tables list frequencies at which emissions were measured using Peak and Average detector functions:

Highest Average Level:

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBmV/m)	Average Limit (dBmV/m)	Average Margin (dB)	Result
1801.4443	Vert.	15.9	21.7	0.8	38.4	53.9	15.5	Complied
3626.1333	Vert.	14.5	21.0	1.18	36.7	53.9	17.2	Complied

Highest Peak Level:

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBmV/m)	Peak Limit (dBmV/m)	Peak Margin (dB)	Result
1801.4443	Vert.	26.5	21.7	0.8	49.0	73.9	24.9	Complied
3626.1333	Vert.	24.5	21.0	1.18	46.7	73.9	27.2	Complied

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7.6. Test Results For Radiated Emissions (4 GHz to 10 GHz): Hand Control Standby Mode**7.6.1. Electric Field Strength Measurements**

7.6.1.1. Measurements were performed to FCC Part 15.109 Class A (Unintentional-Radiators).

7.6.1.2. The client has stated that the highest clock frequency for the EUT was 914.5 MHz. Therefore tests were performed up to 10 GHz.

7.6.1.3. All emissions above 1 GHz were measured at 1m, this is in keeping with FCC Part 15. 31(f)(1). Therefore a correction factor of -9.5 dB was used to correct the measured value. The correction factor was calculated as follows where 1 and 3 are the respective test distances:-

$$20 \log \frac{1}{3} = \text{Correction Factor}$$

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

7.6.1.5. The following tables list frequencies at which emissions were measured using Peak and Average detector functions:

Highest Average Level:

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBmV/m)	Average Limit (dBmV/m)	Average Margin (dB)	Result
4.5020	Horiz.	16.9	24.2	1.21	42.3	53.9	11.6	Complied
5.1727	Horiz.	15.5	24.4	1.66	41.6	53.9	12.3	Complied
6.54655	Horiz.	14.6	26.9	1.52	43.0	53.9	10.9	Complied
9.48055	Vert.	12.0	30.7	1.65	44.4	53.9	9.5	Complied

Highest Peak Level:

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBmV/m)	Peak Limit (dBmV/m)	Peak Margin (dB)	Result
4.5020	Horiz.	27.0	24.2	1.21	52.4	73.9	21.5	Complied
5.1727	Horiz.	25.5	24.4	1.66	51.6	73.9	22.3	Complied
6.54655	Horiz.	25.5	26.9	1.52	53.4	73.9	20.5	Complied
9.48055	Vert.	21.5	30.7	1.65	53.9	73.9	20.0	Complied

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7.7. Test Results For Radiated Emissions (4 GHz to 10 GHz): Hand Control Transmit Mode.**7.7.1. Electric Field Strength Measurements**

7.7.1.1. Measurements were performed to FCC Part 15.249

7.7.1.2. The client has stated that the highest clock frequency for the EUT was 914.5 MHz. Therefore tests were performed up to 10 GHz.

7.7.1.3. All emissions above 1 GHz were measured at 1m, this is in keeping with FCC Part 15. 31(f)(1). Therefore a correction factor of -9.5 dB was used to correct the measured value. The correction factor was calculated as follows where 1 and 3 are the respective test distances:-

$$20 \log \frac{1}{3} = \text{Correction Factor}$$

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

7.7.1.5. The following tables list frequencies at which emissions were measured using Peak and Average detector functions:

Highest Average Level:

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB _{mV})	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB _{mV/m})	Average Limit (dB _{mV/m})	Average Margin (dB)	Result
4.897770	Horiz.	19.6	24.2	1.21	45.0	53.9	8.9	Complied
5.864444	Vert.	14.1	24.4	1.66	40.2	53.9	13.7	Complied
6.53111	Vert.	13.9	26.9	1.52	42.3	53.9	11.6	Complied
9.942290	Horiz.	9.9	30.7	1.65	42.3	53.9	11.7	Complied

Highest Peak Level:

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB _{mV})	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB _{mV/m})	Peak Limit (dB _{mV/m})	Peak Margin (dB)	Result
4.89777	Horiz.	29.5	24.2	1.21	54.9	73.9	19.0	Complied
5.864444	Vert.	24.5	24.4	1.66	50.7	73.9	23.3	Complied
6.53111	Vert.	24.5	26.9	1.52	52.9	73.9	21.0	Complied
9.942290	Horiz.	20.5	30.7	1.65	52.9	73.9	21.0	Complied

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7.8. Test Results For Radiated Emissions (4 GHz to 10 GHz): Hand Control Dock. Standby Mode.**7.8.1. Electric Field Strength Measurements**

7.8.1.1. Measurements were performed to FCC Part 15.109 Class A (Unintentional-Radiators).

7.8.1.2. The client has stated that the highest clock frequency for the EUT was 914.5 MHz. Therefore tests were performed up to 10 GHz.

7.8.1.3. All emissions above 1 GHz were measured at 1m, this is in keeping with FCC Part 15. 31(f)(1). Therefore a correction factor of -9.5 dB was used to correct the measured value. The correction factor was calculated as follows where 1 and 3 are the respective test distances:-

$$20 \log \frac{1}{3} = \text{Correction Factor}$$

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

7.8.1.5. The following tables list frequencies at which emissions were measured using Peak and Average detector functions:

Highest Average Level:

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dBmV/m)	Average Limit (dBmV/m)	Average Margin (dB)	Result
4.98647	Vert.	18.8	24.2	1.21	44.2	53.9	9.7	Complied
5.10108	Vert.	16.2	24.4	1.66	42.3	53.9	11.6	Complied
6.25472	Vert.	13.7	26.9	1.52	42.1	53.9	11.8	Complied
9.47619	Horiz.	12.0	30.7	1.65	44.4	53.9	9.5	Complied

Highest Peak Level:

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dBmV)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dBmV/m)	Peak Limit (dBmV/m)	Peak Margin (dB)	Result
4.98647	Vert.	29.5	24.2	1.21	54.9	73.9	19.0	Complied
5.10108	Vert.	26.5	24.4	1.66	52.6	73.9	21.3	Complied
6.25472	Vert.	23.5	26.9	1.52	51.9	73.9	22.0	Complied
9.47619	Horiz.	21.5	30.7	1.65	53.9	73.9	20.0	Complied

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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
Radiated Emissions	30 MHz to 1000 MHz @ 1m and 3m	95%	+/- 5.26 dB
Radiated Emissions	30 MHz to 1000 MHz @ 10m	95%	+/- 5.1 dB
Radiated Emissions	1 GHz to 18 GHz	95%	+/- 4.18 dB

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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Appendix 1. Test Equipment Used

Instrument	Manufacturer	Model	RFI No.
Horn Antenna	Eaton	9188-2	A027
Horn Antenna	Eaton	91888-2	A028
2 to 4 GHz Eaton Horn Antenna	Eaton	91889-2	A031
WG 14 Microwave Horn	Flann Microwave	14240-20	A254
WG 16 Microwave Horn	Flann Microwave	16240-20	A255
OATS Positioning Controller	Rohde & Schwarz	HCC	A276
3 dB attenuator (9)	Suhner	6803.17.B	A392
WG 14 horn	Flann	14240-20	A427
WG 12 horn	Flann	12240-20	A428
Bilog Antenna	Chase	CBL6111A	A490
Cable	RFI	None	C055
Cables	Rosenberger	UFA210A-1-1181-70x70	C160
Cable	RFI	None	C334
C564-N-2	Rosenberger	UFA 210A-1-0787-70x70	C564
Spectrum Monitor	Rohde & Schwarz	EZM	M003
ESVP Receiver	Rohde & Schwarz	ESVP	M023
ESMI Spectrum Analyser / Receiver	Rohde & Schwarz	ESMI	M069
Thermometer/Humidity Meter	Maplin	Precision Gold	M075
Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	M088
Turntable Controller	R.H.Electrical Services	RH351	M173
Baro/Hygro/Thermo meter	Oregon Scientific	BA888	M292
Site 1	RFI	1	S201
Site 2	RFI	2	S202
Site 9	RFI	9	S209

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

Test Of: Quantel Ltd.**2116-22-018 Hand Control and 2116-29-018 Hand Control Dock****To: FCC Part 15: 2000 Class A Section 15.249 and 15.109**

Appendix 2. Measurement Methods

A2.1. Radiated Emissions: FCC Part 15

A2.1.1. Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.1.2. Initial measurements covering the entire measurement band in the form of swept scans in a shielded enclosure were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which the EUT should be re-measured in full on the open area test site. In order to minimise the time taken for the swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and for the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

A2.1.3. The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested on the open area test site, at the appropriate distance, using a measuring receivers with a Quasi-Peak detector (below 1000 MHz), where applicable, for measurements above 1000 MHz average and peak detectors were used.

A2.1.4. For the main (final) measurements the EUT was arranged on a non-conducting table on an open area test site, as detailed in the specification.

A2.1.5. All measurements on the open area test site were performed using broadband antennas.

A2.1.6. On the open area test site, at each frequency where a signal was found, the levels were maximised by initially rotating the turntable through 360° and then varying the antenna height between 1 m and 4 m. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

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

Receiver Function	Initial Scan	Final Measurements Below 1GHz	Final Measurements Above 1 GHz
Detector Type:	Peak	Quasi-Peak (CISPR)	Peak/Average
Mode:	Max Hold	Not applicable	Not applicable
Bandwidth:	100 kHz < 1000MHz 1MHz > 1000MHz	120 kHz	1 MHz
Amplitude Range:	60 dB	20 dB	20 dB (typical)
Measurement Time:	Not applicable	> 1 s	> 1 s
Observation Time:	Not applicable	> 15 s	> 15 s
Step Size:	Continuous sweep	Not applicable	Not applicable
Sweep Time:	Coupled	Not applicable	Not applicable

Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

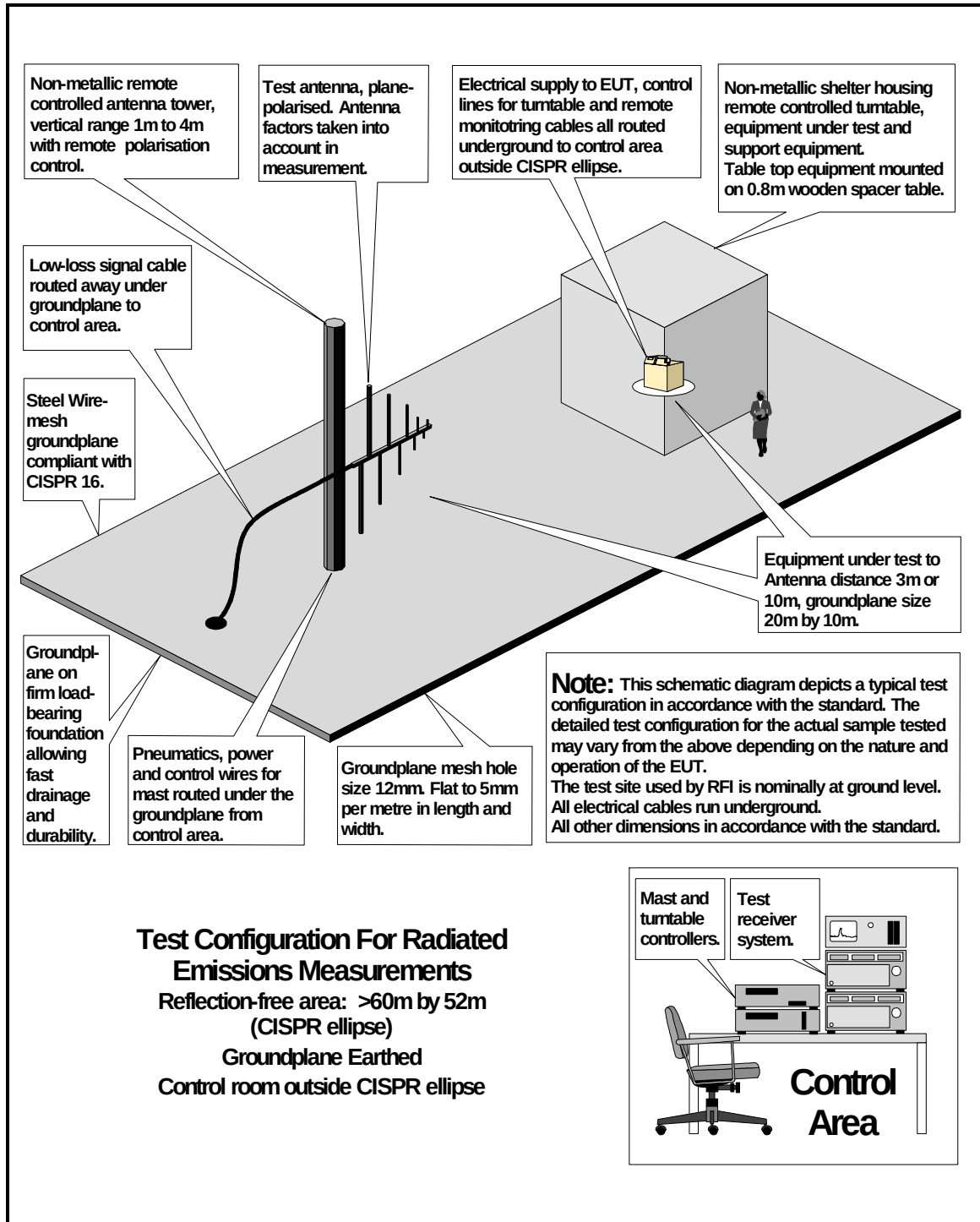
Drawing Reference Number	Title
DRG\42535JD01\JD02\EMIRAD	Test configuration for measurement of radiated emissions
DRG\42535JD01\JD02\001	Schematic diagram of the EUT, support equipment and interconnecting cables used for the test

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DRG\42535JD01\JD02\EMIRAD

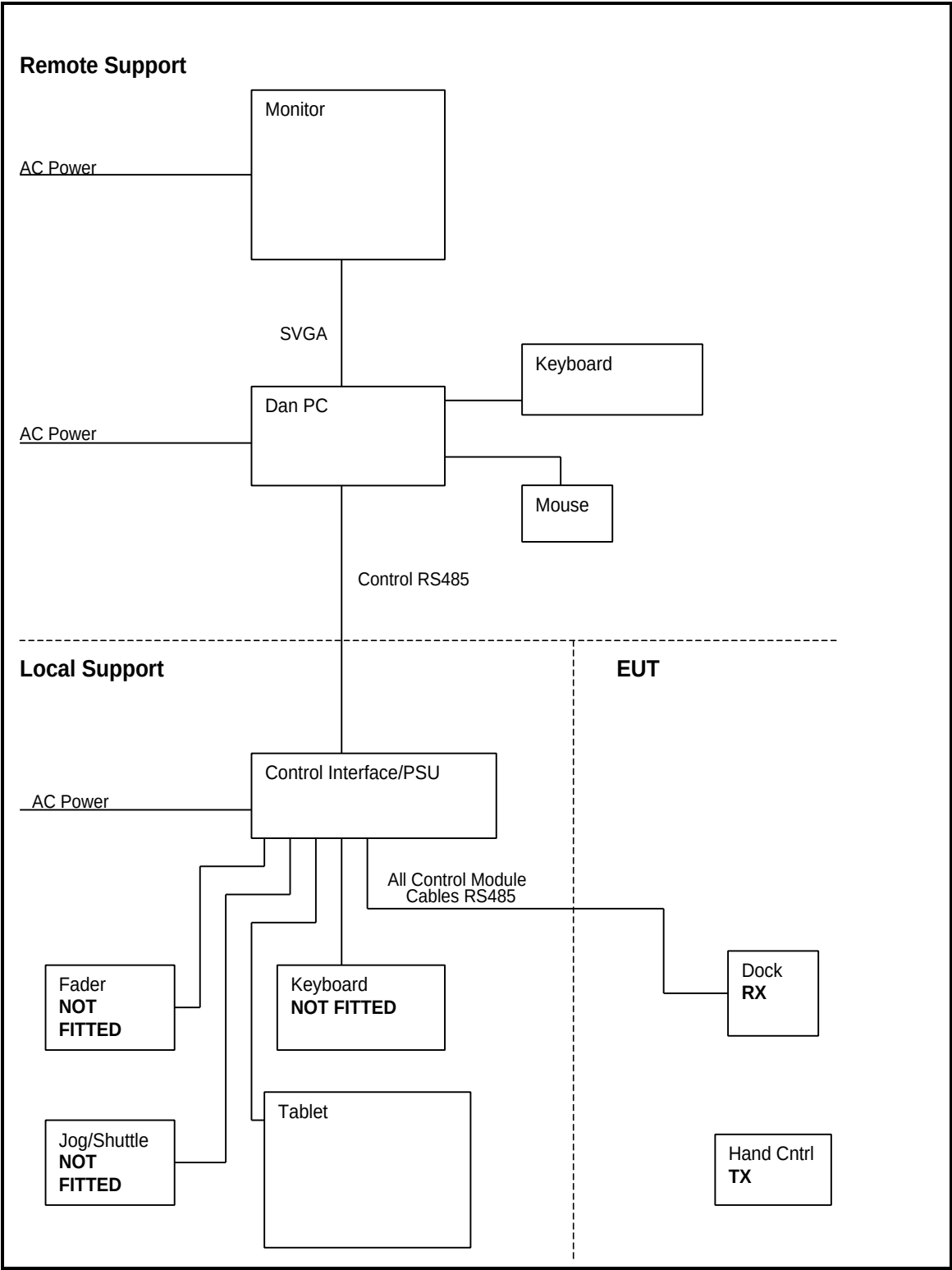


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DRG\42535JD01\JD02\001



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Appendix 4. Graphical Test Results

This appendix contains the following graphs:

Graph Reference Number	Title
GPH\42535JD02\RE01	Radiated Emissions (4GHz to 5 GHz) EUT: Hand Control
GPH\42535JD02\RE02	Radiated Emissions (5 GHz to 6 GHz) Transmit Mode EUT: Hand Control
GPH\42535JD02\RE03	Radiated Emissions (4 GHz to 5 GHz) Standby Mode EUT: Hand Control
GPH\42535JD02\RE04	Radiated Emissions (5 GHz to 6 GHz) Standby Mode EUT: Hand Control
GPH\42535JD02\RE05	Radiated Emissions (6 GHz to 8 GHz) Standby Mode EUT: Hand Control
GPH\42535JD02\RE06	Radiated Emissions (6 GHz to 8 GHz) Transmit Mode EUT: Hand Control
GPH\42535JD02\RE07	Radiated Emissions (8 GHz to 10 GHz) Transmit Mode EUT: Hand Control
GPH\42535JD02\RE08	Radiated Emissions (8 GHz to 10 GHz) Standby Mode EUT: Hand Control
GPH\42535JD03\RE09	Radiated Emissions (8 GHz to 10 GHz) EUT: Hand Control Dock
GPH\42535JD03\RE10	Radiated Emissions (6 GHz to 8 GHz) EUT: Hand Control Dock
GPH\42535JD03\RE11	Radiated Emissions (5 GHz to 6 GHz) EUT: Hand Control Dock
GPH\42535JD03\RE12	Radiated Emissions (4 GHz to 5 GHz) EUT: Hand Control Dock
GPH\42535JD03\RE13	Radiated Emissions (928 MHz to 1 GHz) EUT: Hand Control Dock
GPH\42535JD03\RE14	Radiated Emissions (928 MHz to 1 GHz) EUT: Hand Control Dock and Hand Control

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

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EMC Department

TEST REPORT

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Issue Date: 20 November 2001

Test Of: Quantel Ltd.

2116-22-018 Hand Control and 2116-29-018 Hand Control Dock

To: FCC Part 15: 2000 Class A Section 15.249 and 15.109

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Date 02.Oct.'01 Time 17:10:27

Ref.Lvl 67.00 dB*
Marker 35.42 dB*
4.9955 GHz

Res.Bw

1.0 MHz [3dB]

Vid.Bw

1 MHz

TG.Lvl

off

CF.Stp

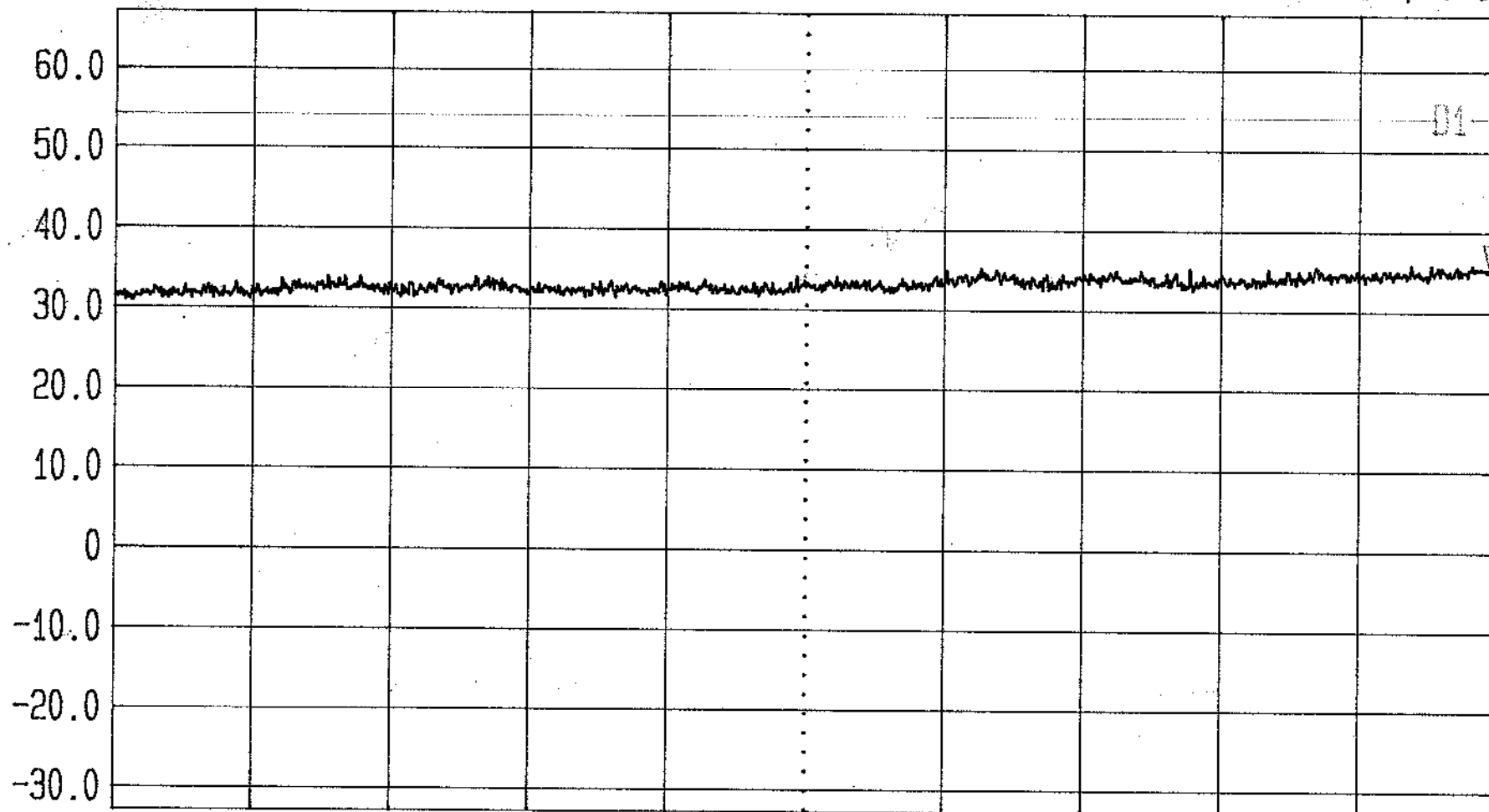
100.000 MHz

RF.Att

5 dB

Unit

[dBμV/m]



Start
4 GHz

Span
1 GHz

Center
4.5 GHz

Sweep
20 ms

Stop
5 GHz

Radiated Emissions Testing For Quantel by RFI Ltd.

EUT : Hand Control

OPCOND : Transmit Mode

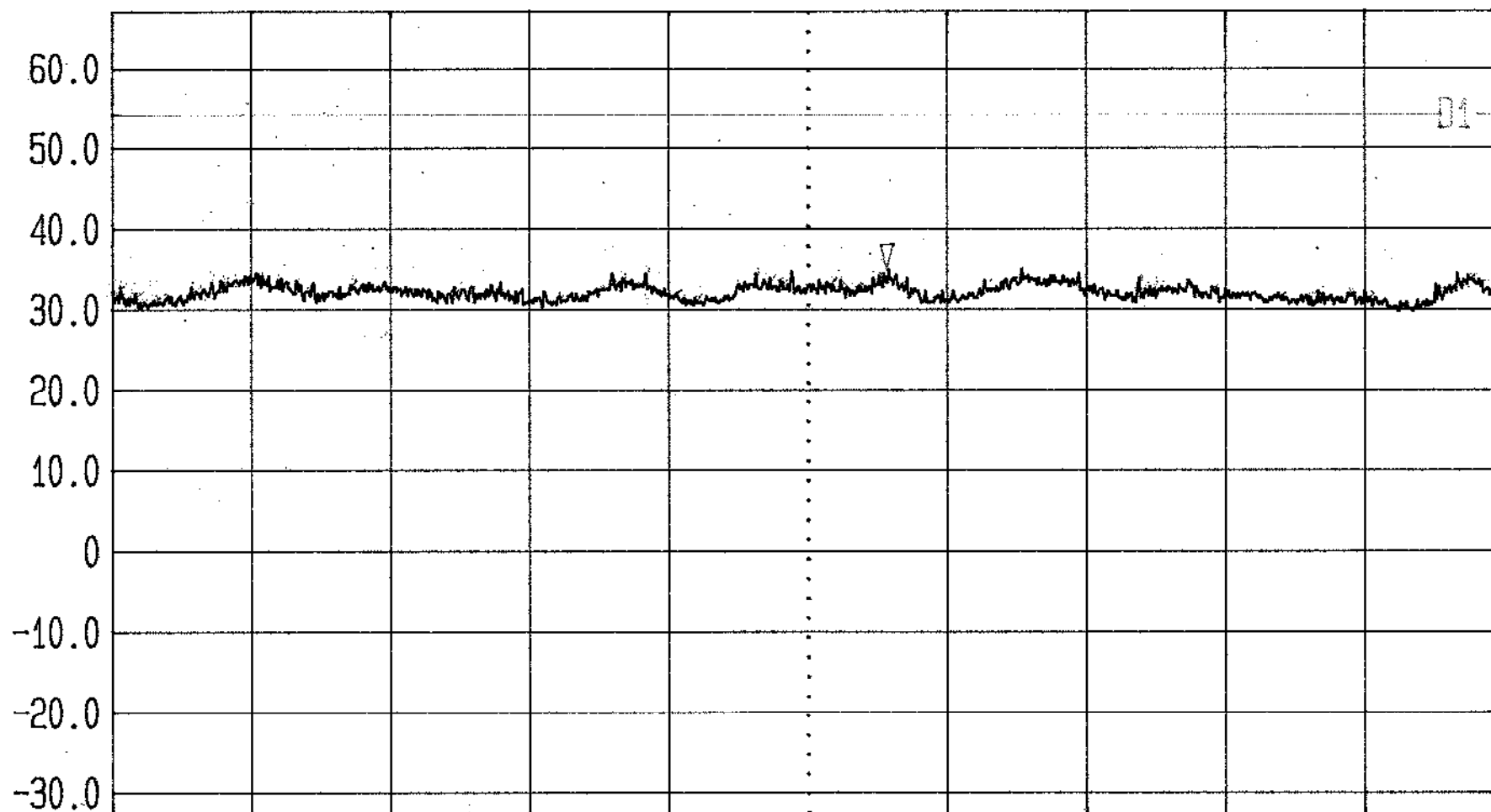
SPEC : FCC Part 15.249

GPH/42535/02/RE001

Date 03.Oct.'01 Time 10:03:31

Ref.Lvl 67.00 dB*
Marker 34.96 dB*
5.5577 GHz

Res.Bw 1.0 MHz [3dB]
TG.Lvl off
CF.Stp 100.000 MHz
Vid.Bw 1 MHz
RF.Att 5 dB
Unit [dBμV/m]



Start 5 GHz Span 1 GHz Center 5.5 GHz Sweep 20 ms Stop 6 GHz

Radiated Emissions Testing For Quantel by RFI Ltd.
EUT: Hand Control OPCOND: Transmit Mode

SPEC: FCC Part 15.249
GPH/42535/02/RE002

Date 03.Oct.'01 Time 10:09:40

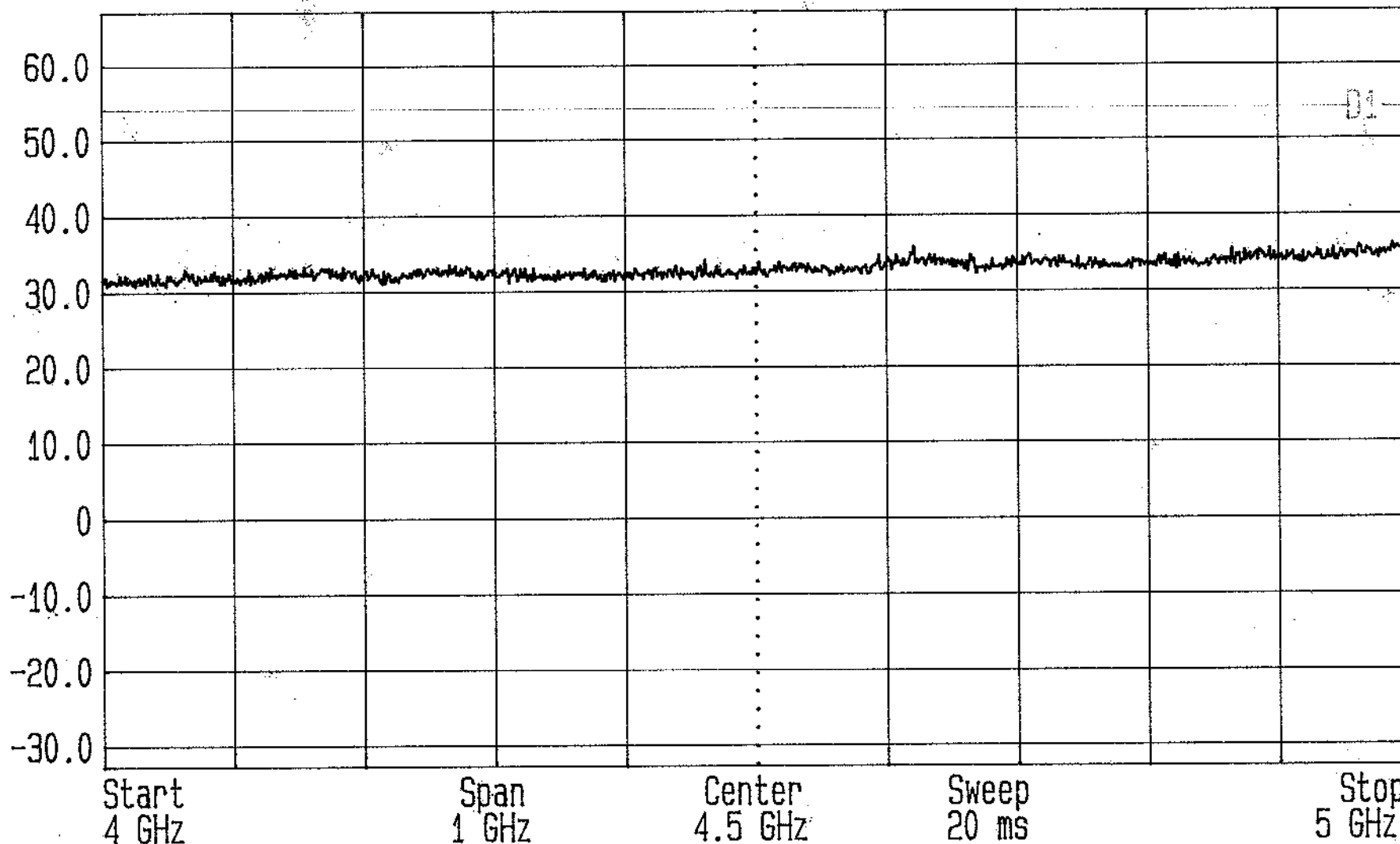
Ref.Lvl 67.00 dB*
Marker 35.31 dB*
5.0000 GHz

Res.Bw
TG.Lvl
CF.Stp

1.0 MHz [3dB]
off
100.000 MHz

Vid.Bw
RF.Att
Unit

1 MHz
5 dB
[dBμV/m]

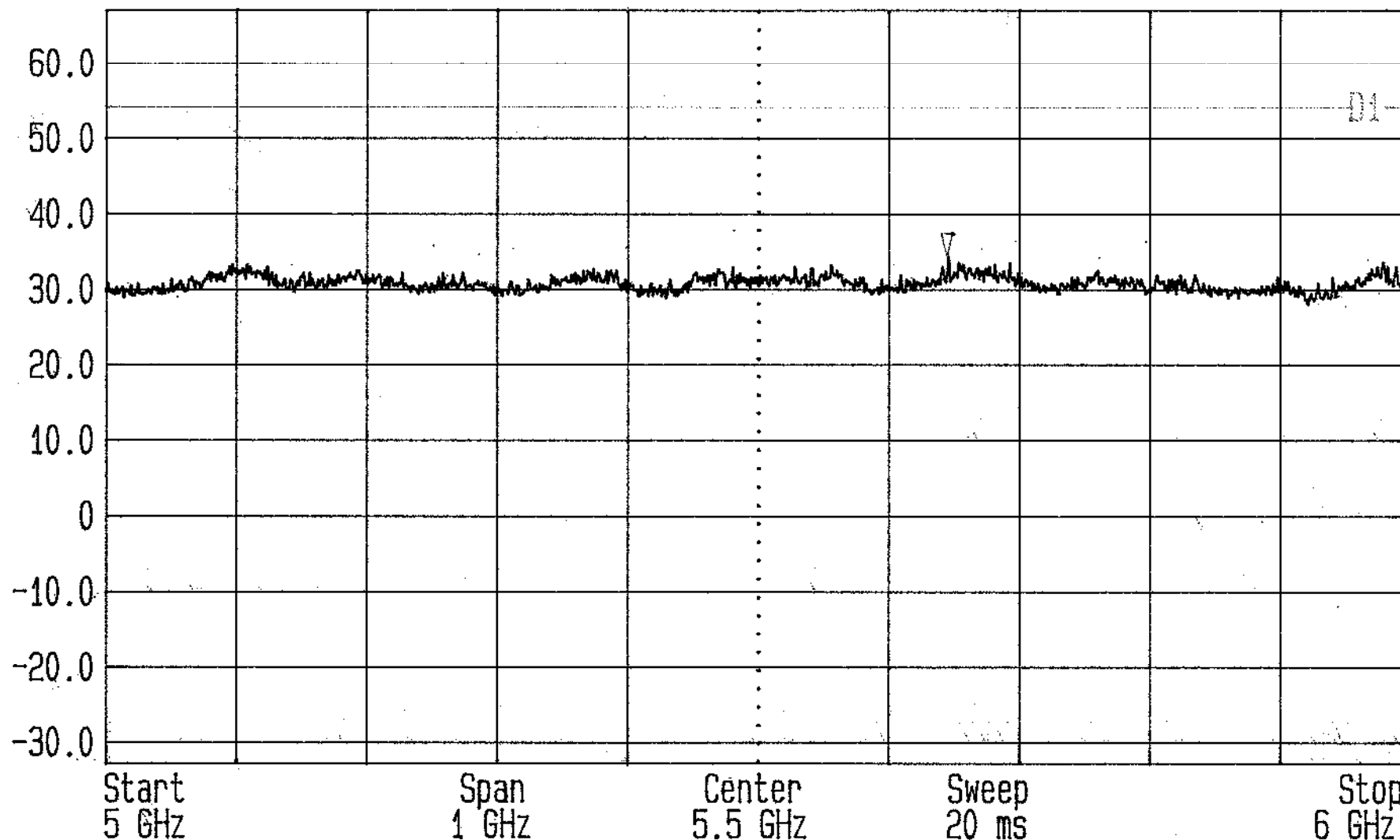


Radiated Emissions Testing For Quantel by RFI Ltd.
EUT : Hand Control
OPCOND : Standby Mode

SPEC : FCC Part 15.109
GPH/42535/02/REC03

Date 03.Oct.'01 Time 10:16:15
Ref.Lvl 67.00 dB*
Marker 34.48 dB*
5.6455 GHz

Res.Bw 1.0 MHz [3dB]
TG.Lvl off
CF.Stp 100.000 MHz
Vid.Bw 1 MHz
RF.Att 5 dB
Unit [dB μ V/m]

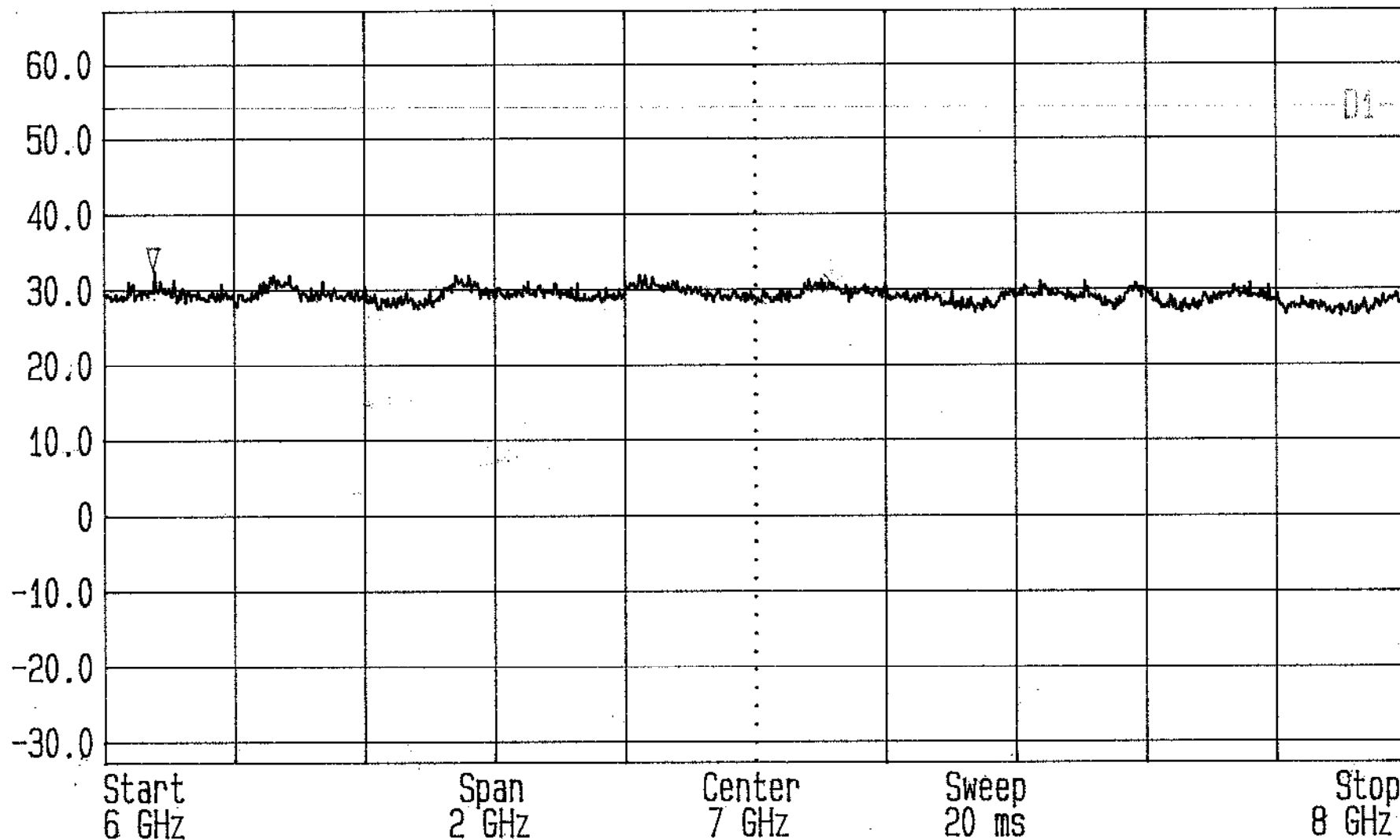


Radiated Emissions Testing For Quantel by RFI Ltd.
EUT : Hand Control
OPCOND : Standby Mode

SPEC : FCC Part15.109
GPH/42535/02/RE004

Date 03.Oct.'01 Time 10:21:29
Ref.Lvl 67.00 dBx
Marker 32.52 dBx
6.0777 GHz

Res.Bw 1.0 MHz [3dB]
TG.Lvl off
CF.Stp 200.000 MHz
Vid.Bw 1 MHz
RF.Att 5 dB
Unit [dBμV/m]



Radiated Emissions Testing For Quantel by RFI Ltd.
EUT : Hand Control OPCOND : Standby Mode

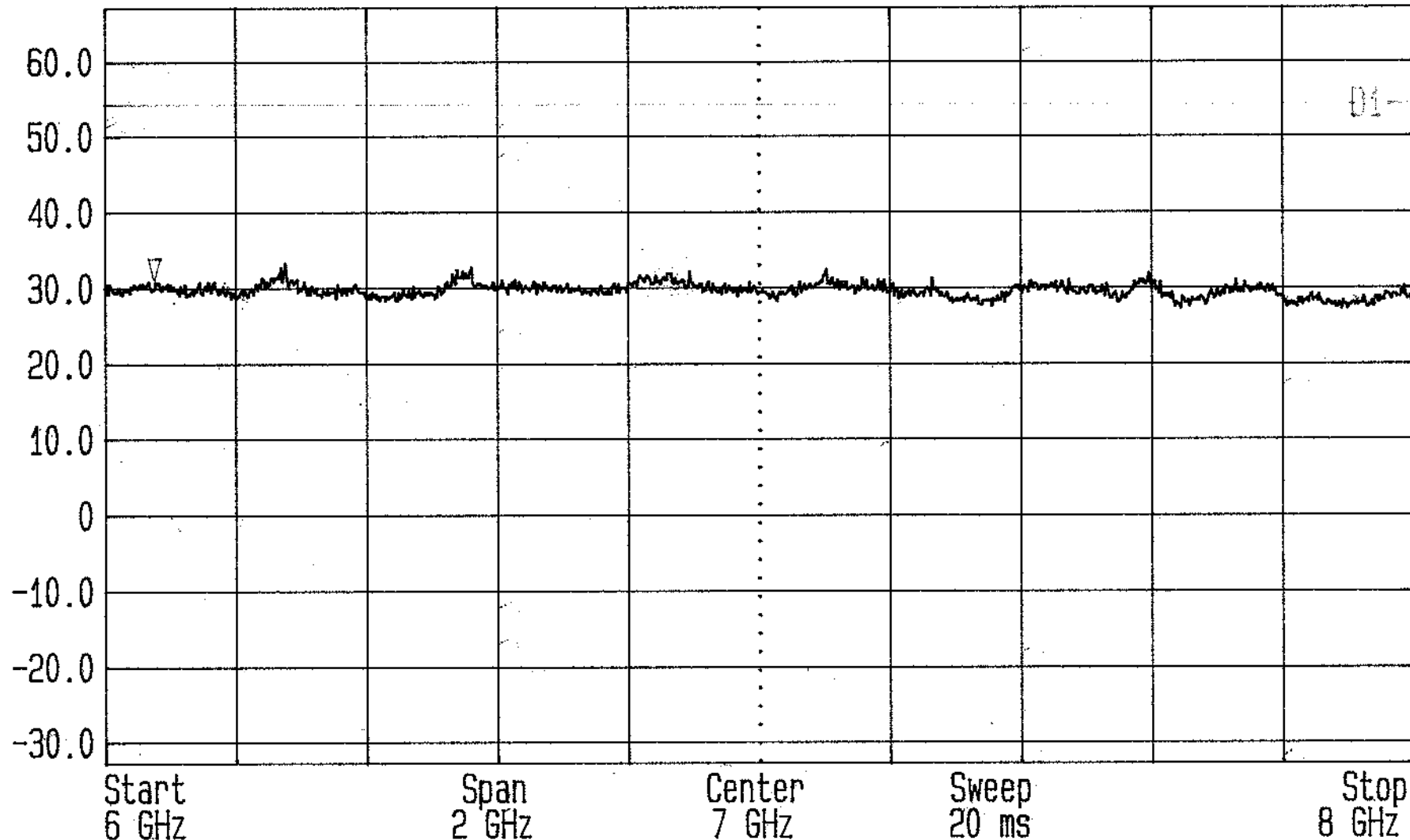
SPEC : FCC Part 15.109
GPH/42535/02/RE005

Date 03.Oct.'01 Time 10:57:49

Ref.Lvl 67.00 dBx
Marker 30.77 dB*
6.0777 GHz

Res.Bw 1.0 MHz [3dB]
TG.Lvl off
CF.Stp 200.000 MHz

Vid.Bw 1 MHz
RF.Att 5 dB
Unit [dBμV/m]

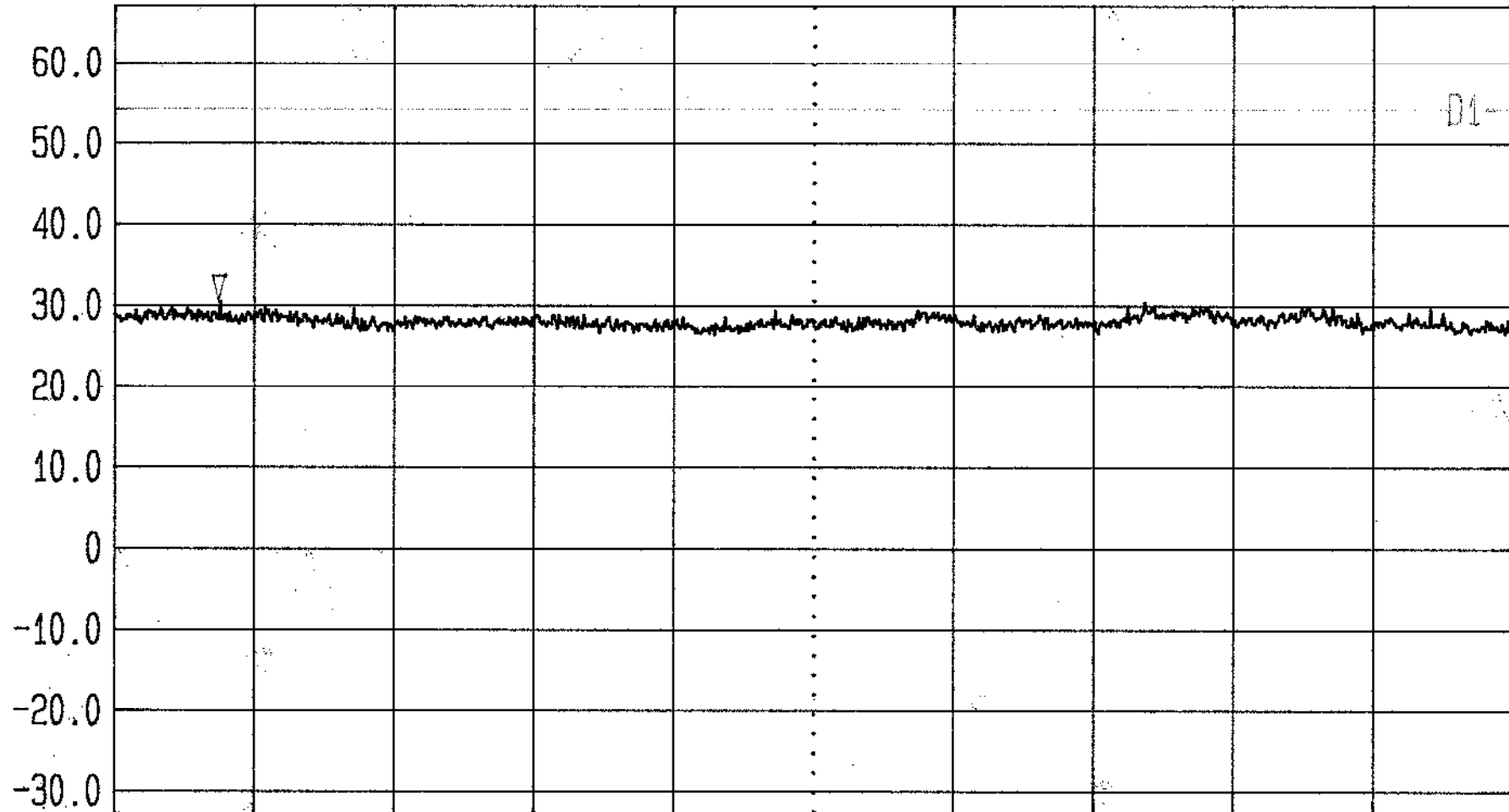


Radiated Emissions Testing For Quantel by RFI Ltd.
EUT: Hand Control OPCOND: Transmit Mode

SPEC: FCC Part 15.249
GPH/42535/02/RE006

Date 03.Oct.'01 Time 14:14:37
Ref.Lvl 67.00 dB* Marker 30.57 dB*
8.1511 GHz

Res.Bw 1.0 MHz [3dB] TG.Lvl off
CF.Stp 200.000 MHz RF.Att 5 dB
Unit [dBμV/m]



Radiated Emissions Testing For Quantel by RFI Ltd.
EUT : Hand Control OPCOND : Transmit Mode

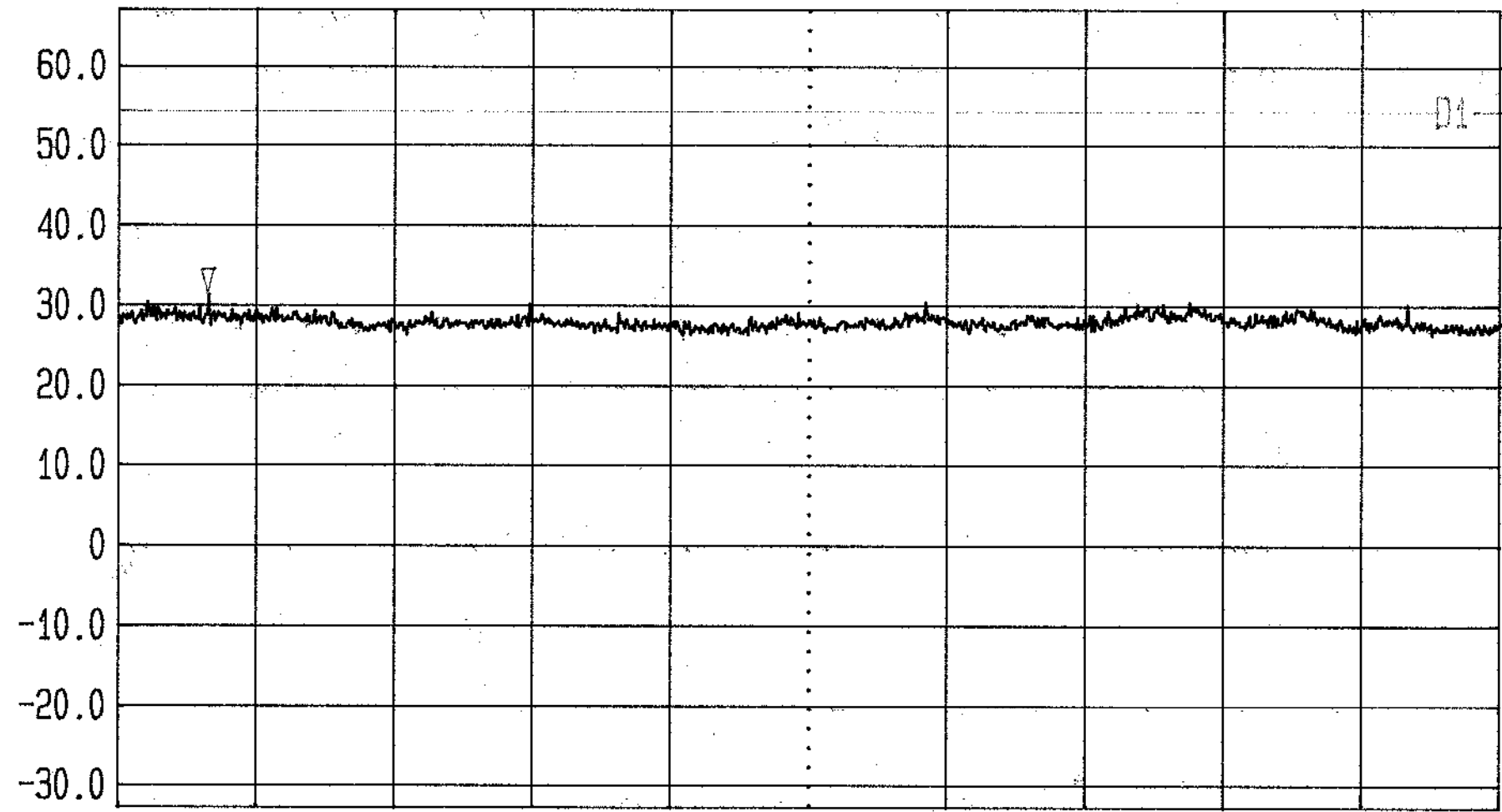
SPEC : FCC Part15.249
GPH/42535/02/RF007

Date: 03.Oct.'01 Time 11:18:38

Ref.Lvl 67.00 dB* Marker 31.23 dB*
8.1311 GHz

Res.Bw 1.0 MHz [3dB]
TG.Lvl off
CF.Stp 200.000 MHz

Vid.Bw 1 MHz
RF.Att 5 dB
Unit [dBμV/m]



Radiated Emissions Testing For Quantel by RFI Ltd.
EUT: Hand Control OPCOND: Standby Mode

SPEC: FCC Part 15.109
GPH/42535/02/HE008

Date 03.Oct.'01 Time 11:50:30

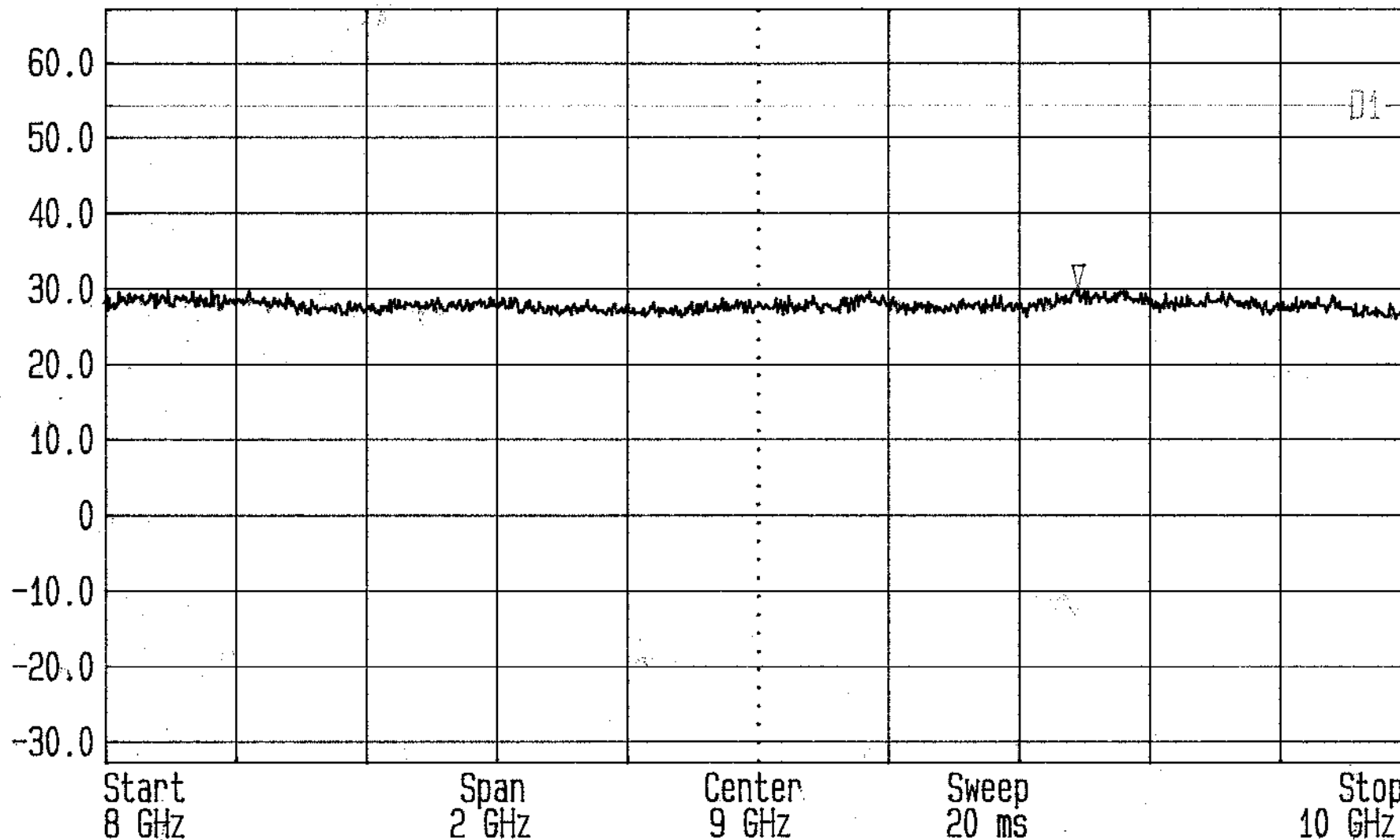
Ref.Lvl 67.00 dB*
Marker 29.80 dB*
9.4911 GHz

Res.Bw
TG.Lvl
CF.Stp

1.0 MHz [3dB]
off
200.000 MHz

Vid.Bw
RF.Att
Unit

1 MHz
5 dB
[dBμV/m]



Radiated Emissions Testing For Quantel by RFI Ltd.
EUT: Hand Control Dock

SPEC: FCC Part 15.109
GPH/42535/02/RF009

Date 03.Oct.'01 Time 11:57:40

Ref.Lvl 67.00 dB*
Marker 32.11 dB*
6.2755 GHz

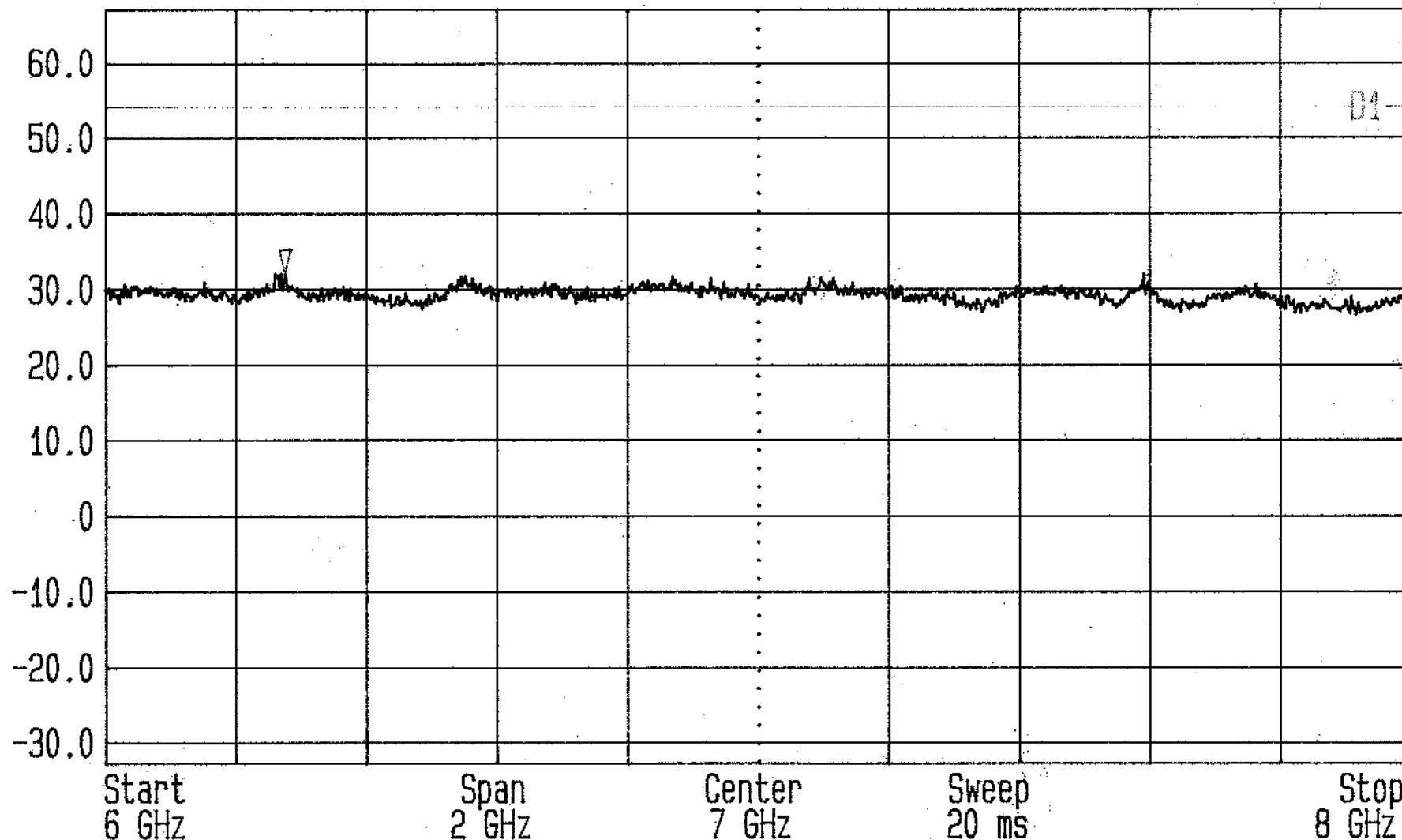
Res.Bw
TG.Lvl
CF.Stp

1.0 MHz [3dB]
off
200.000 MHz

Vid.Bw
RF.Att
Unit

1 MHz

5 dB
[dBμV/m]



Radiated Emissions Testing For Quantel by RFI Ltd.
EUT : Hand Control Dock

SPEC : FCC Part 15.109
GPH/42535/02/REC10

Date 03.Oct.'01 Time 12:03:45

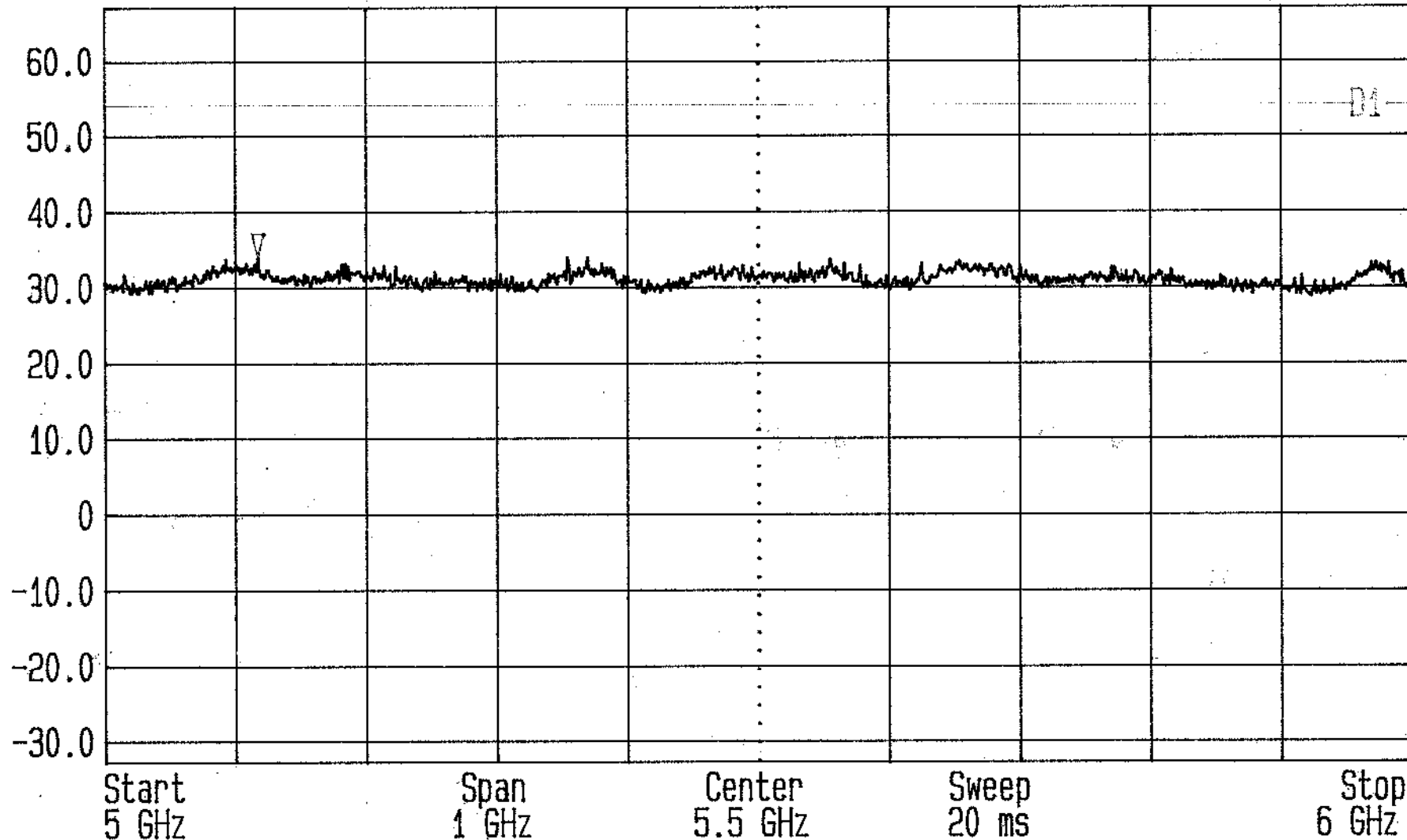
Ref.Lvl 67.00 dBx
Marker 34.12 dBx
5.1177 GHz

Res.Bw
TG.Lvl
CF.Stp

1.0 MHz [3dB]
off
100.000 MHz

Vid.Bw
RF.Att
Unit

1 MHz
5 dB
[dBμV/m]

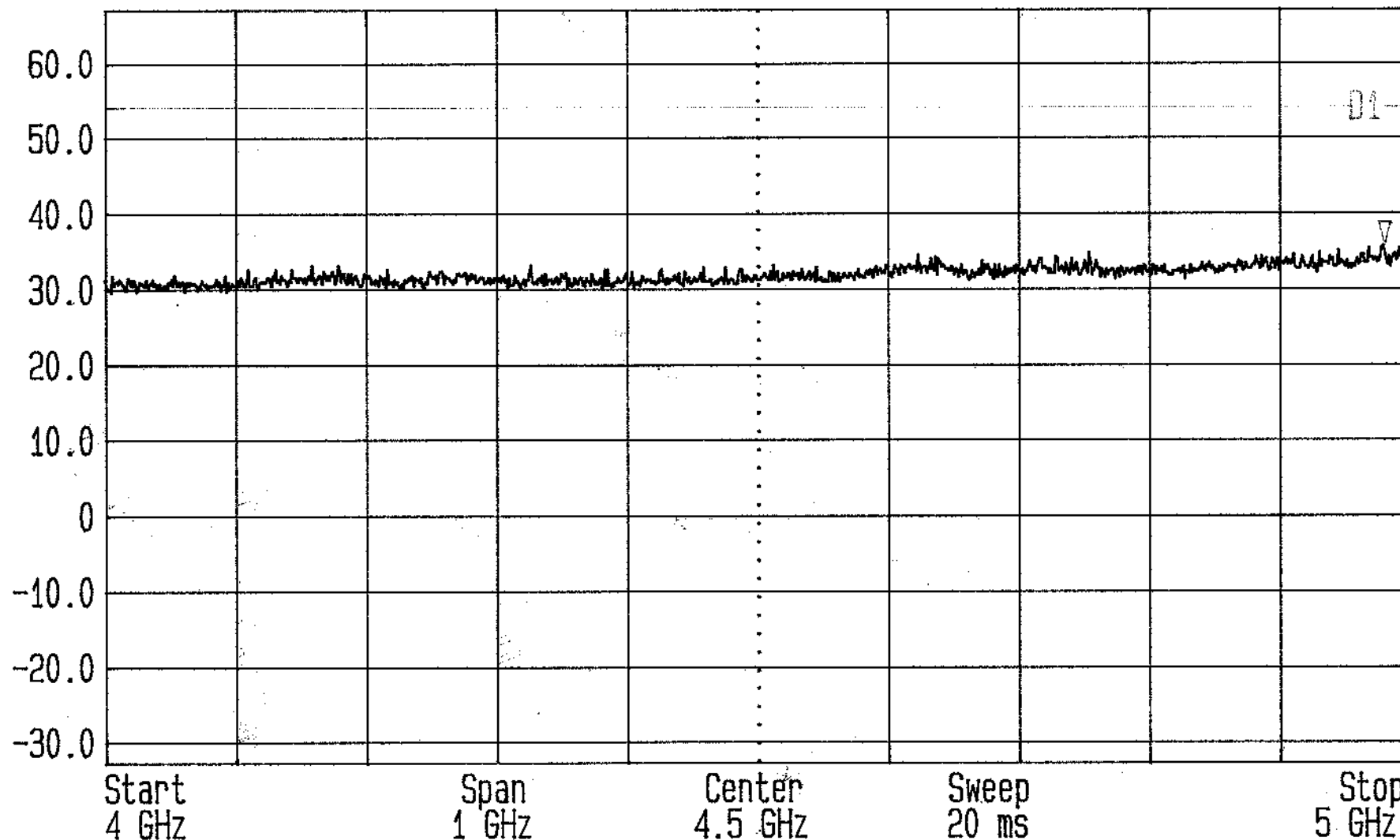


Radiated Emissions Testing For Quantel by RFI Ltd.
EUT : Hand Control Dock

SPEC : FCC Part 15.109
GPH/42535/02/RE011

Date 03.Oct.'01 Time 12:09:05
Ref.Lvl 67.00 dB* Marker 35.87 dB*
4.9800 GHz

Res.Bw 1.0 MHz [3dB] Vid.Bw 1 MHz
TG.Lvl off
CF.Stp 100.000 MHz RF.Att 5 dB
Unit [dBμV/m]



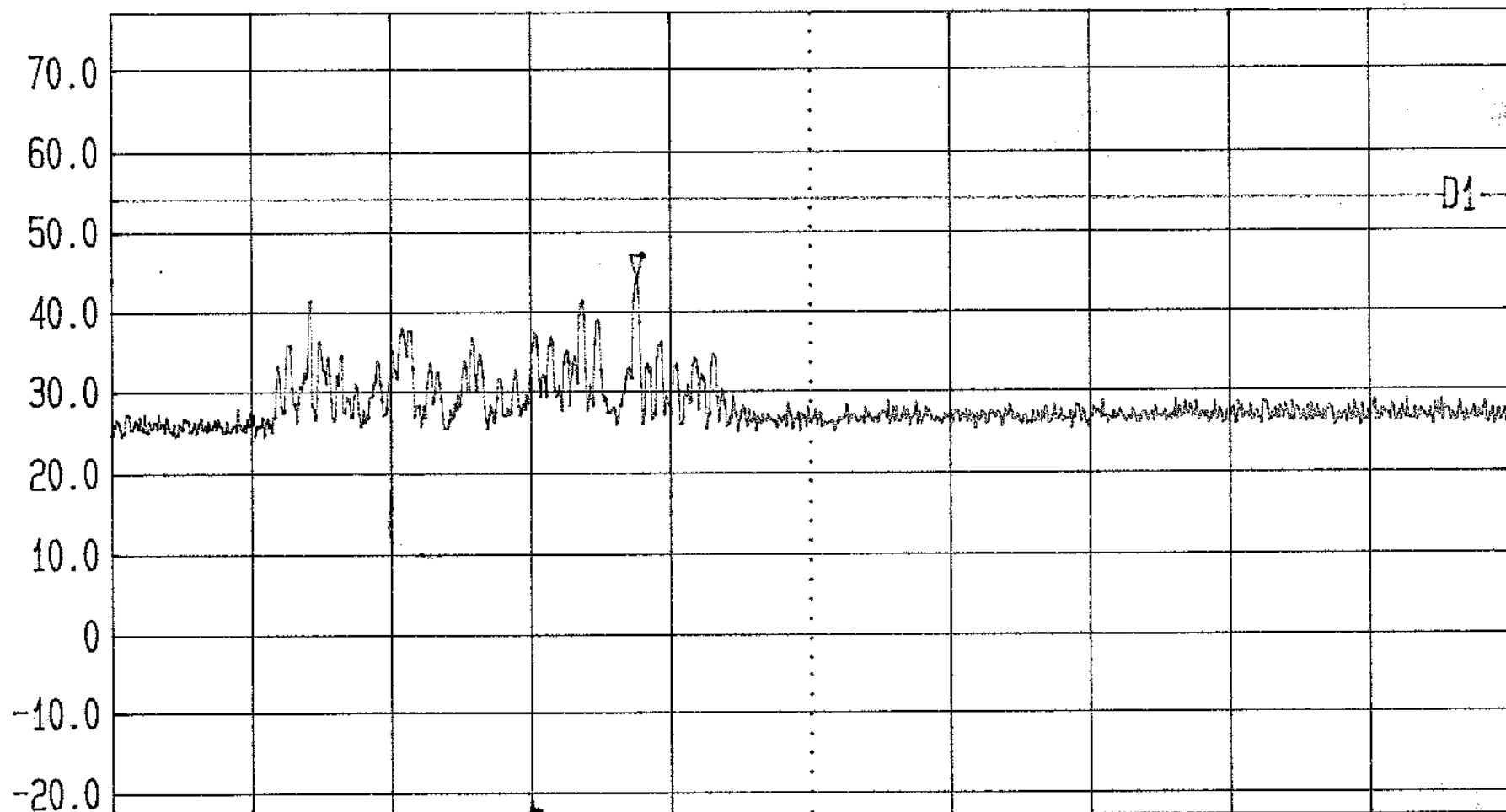
Radiated Emissions Testing For Quantel by RFI Ltd.
EUT : Hand Control Dock

SPEC : FCC Part 15.109
GPH/42535/02/RE012



Date 03.Oct.'01 Time 17:03:32
Ref.Lvl 77.00 dBx
Marker 43.71 dBx
955.04 MHz

Res.Bw 120 kHz [imp]
TG.Lvl off
CF.Stp 7.200 MHz
Vid.Bw 3 MHz
RF.Att 10 dB
Unit [dBμV/m]



Start 928 MHz Span 72 MHz Center 964 MHz Sweep 40 ms Stop 1 GHz

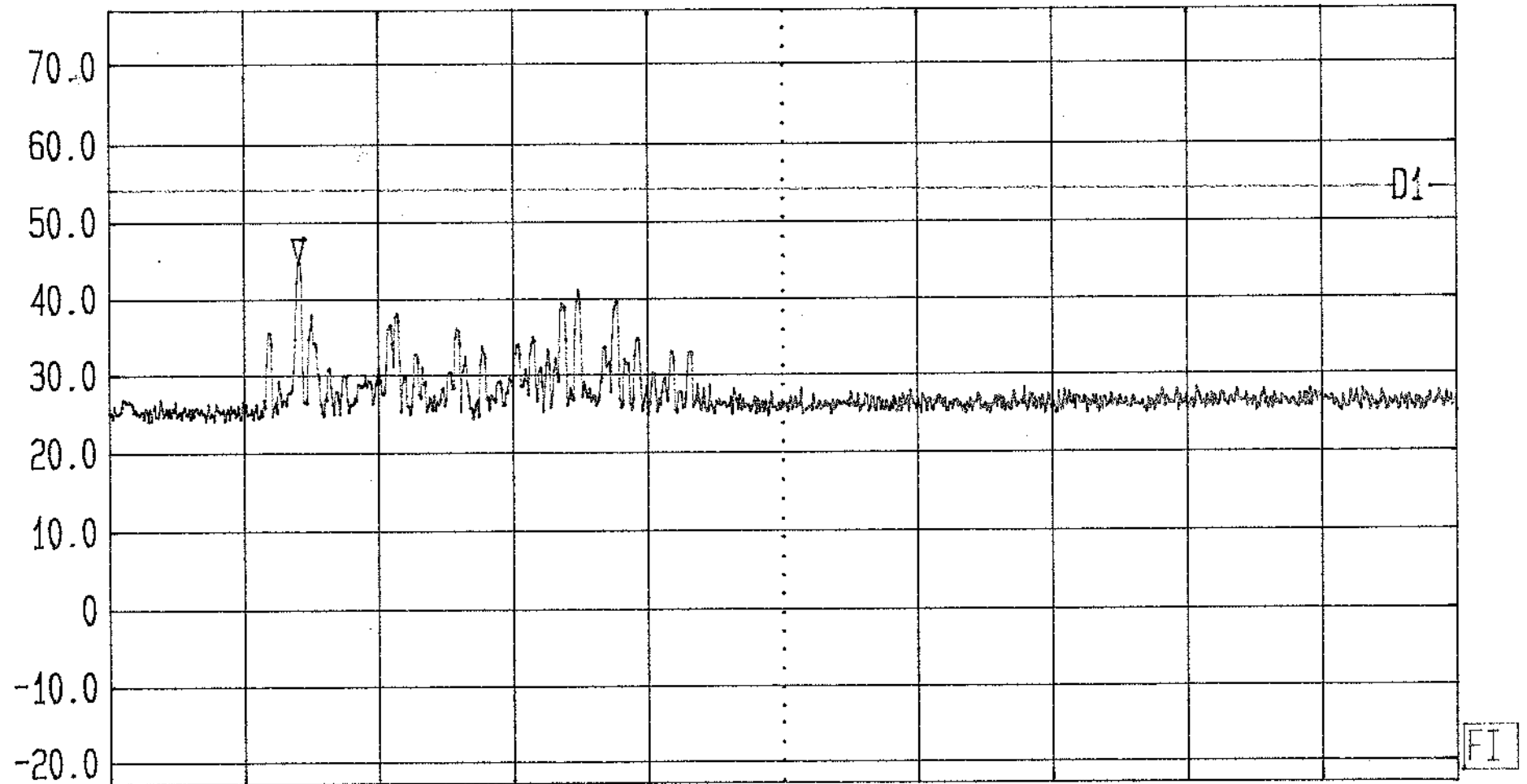
Radiated Emissions for Quantel by RFI Ltd.
EUT : Hand Control Transmit Mode

SPEC : FCC Part 15.209
GPH/42535/JD02/RE13



Date 04.Oct.'01 Time 10:15:56
Ref.Lvl 77.00 dBx
Marker 44.73 dBx
938.08 MHz

Res.Bw 120 kHz [imp]
TG.Lvl off
CF.Stp 7.200 MHz
Vid.Bw 100 kHz
RF.Att 10 dB
Unit [dBμV/m]



Start 928 MHz Span 72 MHz Center 964 MHz Sweep 40 ms Stop 1 GHz

Radiated Emissions testing for Quantel by RFI L td.
EUT : Hand Control Dock+ Hand Control

SPEC : FCC Part 15.109
GPH/42535/JD03/RE14

Test Of: Quantel Ltd.**2116-22-018 Hand Control and 2116-29-018 Hand Control Dock****To: FCC Part 15: 2000 Class A Section 15.249 and 15.109**

Graphical Test Results (continued)

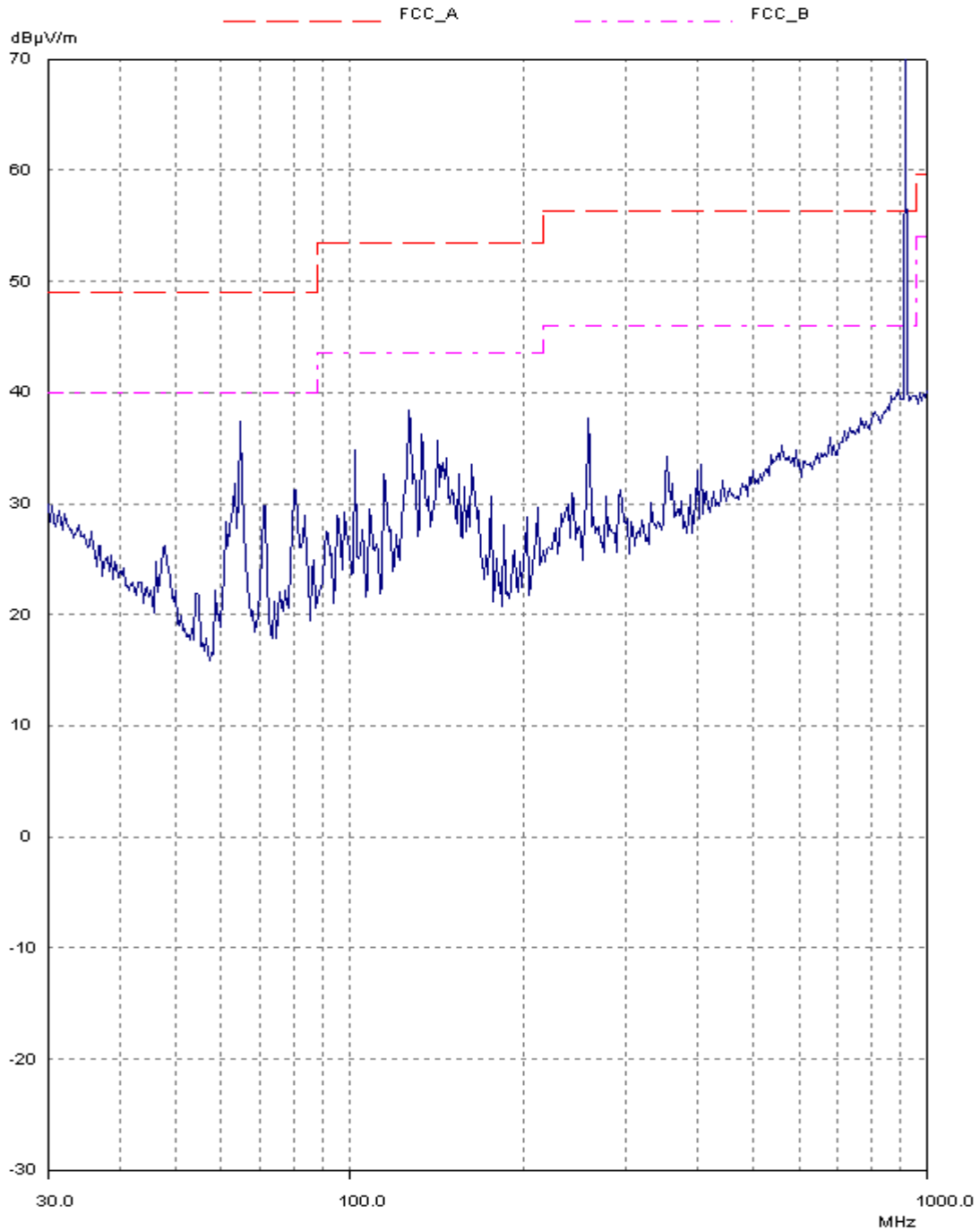
Graph Reference Number	Title
GPH\42535JD02\RE15	Radiated Emissions (30 MHz to 1 GHz) EUT: Hand Control in Transmit Mode.
GPH\42535JD03\RE16	Radiated Emissions (30 MHz to 1 GHz) EUT:- Hand Control and Hand Control Dock in Standby Mode.
GPH\42535JD03\RE17	Radiated Emissions (1 GHz to 2 GHz) EUT: Hand Control and Hand Control Dock in Standby Mode.
GPH\42535JD03\RE18	Radiated Emissions (1 GHz to 2 GHz) EUT: Hand Control in Transmit Mode.
GPH\42535JD03\RE19	Radiated Emissions (2 GHz to 4 GHz) EUT: Hand Control in Transmit Mode.
GPH\42535JD03\RE20	Radiated Emissions (2 GHz to 4 GHz) EUT: Hand Control and Hand Control Dock in Standby Mode.

Test Of: Quantel Ltd.

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GPH\42535JD03\RE15

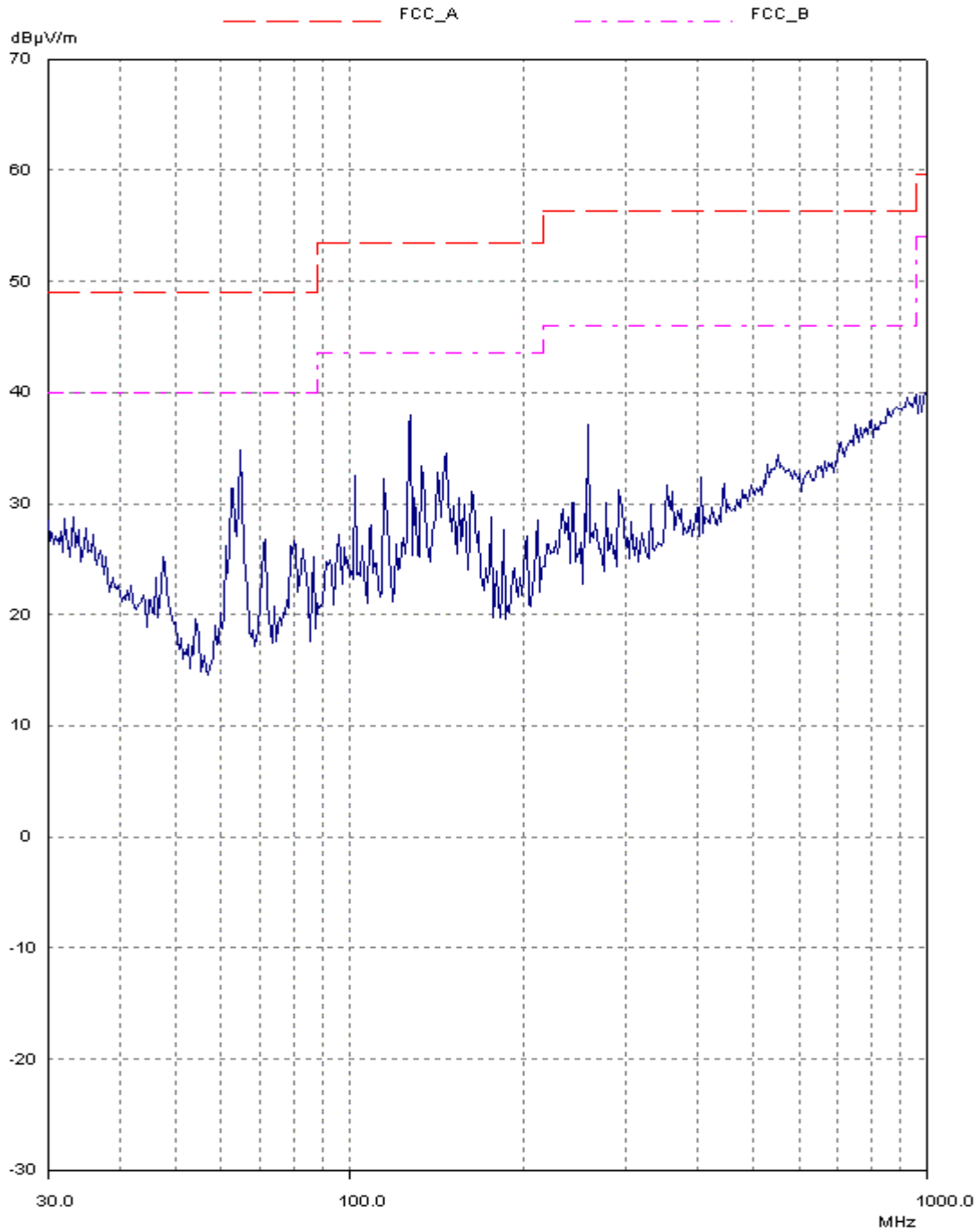


Test Of: Quantel Ltd.

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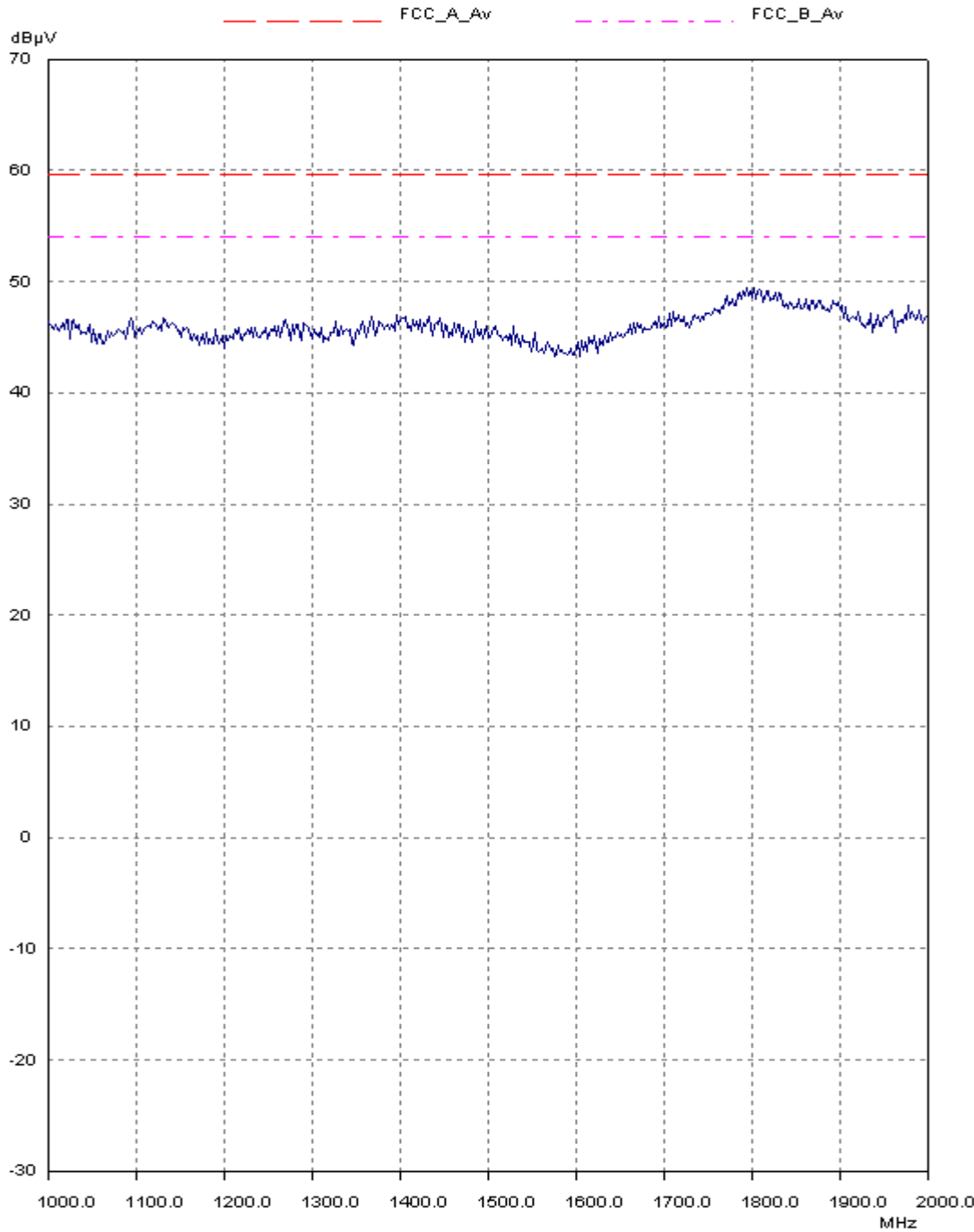
GPH\42535JD03\RE16



EMC Department

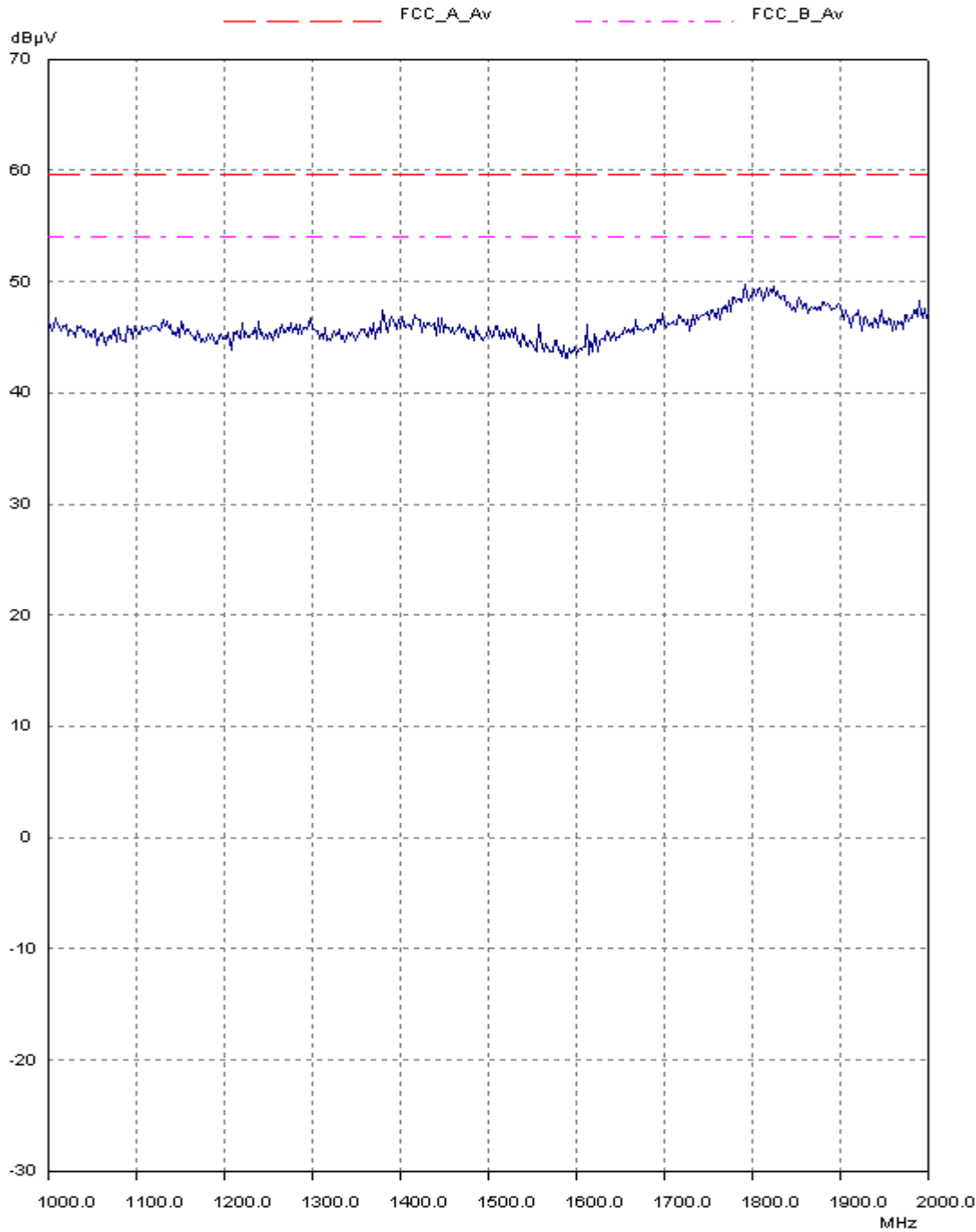
Test Of: Quantel Ltd.
2116-22-018 Hand Control and 2116-29-018 Hand Control Dock
To: FCC Part 15: 2000 Class A Section 15.249 and 15.109

GPH\42535JD03\RE17



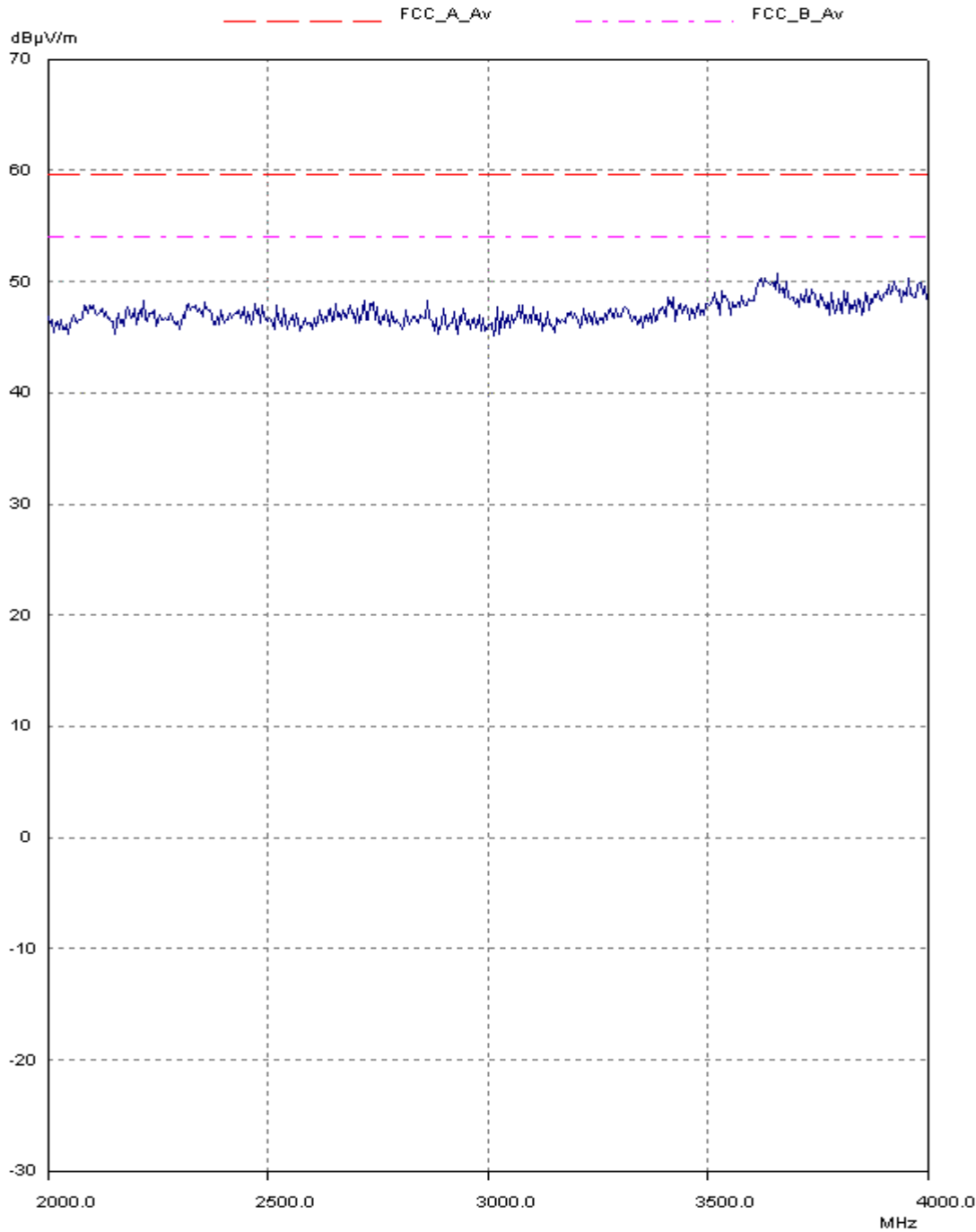
Test Of: Quantel Ltd.
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GPH\42535JD03\RE18



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GPH\42535JD03\RE19



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GPH\42535JD03\RE20

