

TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Maynetronics Ltd.
LK3A-2 Link Box

To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

Test Report Serial No:
RFI/EMCB1/RP39118ETF02B

This Test Report Is Issued Under The Authority Of Brian Watson Technical Director: 	Checked By: 
Tested By: pp 	Release Version No: PDF01
Issue Date: 22 July 1999	Test Date: 21 June 1999, 24 June 1999 and 8 July 1999

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Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, ENGLAND. Tel: +44 (0) 1256 851193 Fax: +44 (0) 1256 851192	Registered in England, No. 211 7901. Registered Office: Ewhurst Park, Ramsdell, Basingstoke, Hampshire RG26 5RQ	
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RADIO FREQUENCY INVESTIGATION LTD.

EMC Department

Test Report

S.No. RFI/EMCB1/RP39118ETF02B

Page 2 of 34

Issue Date: 22 July 1999

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

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Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

Table of Contents

1. Client Information	4
2. Equipment Under Test (EUT)	5
3. Test Specification, Methods & Procedures.....	7
4. Deviations From The Test Specification	8
5. Operation Of The EUT During Testing.....	9
6. Summary Of Test Results	10
7. Measurements, Examinations And Derived Results	11
8. Measurement Uncertainty	19
Appendix 1. Test Equipment Used	20
Appendix 2. Measurement Methods	21
Appendix 3. Test Configuration Drawings	26
Appendix 4. Graphical Test Results	30
Appendix 5. Photographs of EUT	33

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

1. Client Information

Company Name:	Maynetronics Ltd
Address:	9 Pavilion Rise Ryde PO33 1PA Isle of Wight
Contact Name:	Mr George Mayne

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

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	Maynetronics
Model Name or Number	LK3A-2
Unique Type Identification	Link Unit
Serial Number	620
Country Of Manufacture	UK
F.C.C. ID Number	Awaiting Certification by the FCC
Date Of Receipt	10 June 1999

2.2. Description Of EUT

The equipment under test is a serially interfaced low power transceiver.

2.3. Modifications Incorporated In EUT

For the purpose of the test, the EUT was modified to allow a continuous transmit operation whilst in a transmit mode.

2.4. Additional Information Related To Testing

Power Supply Requirement:	Nominal 115 V, 60 Hz AC Mains Supply 13 Amp (max)
Intended Operating Environment:	Residential, Commercial
Weight:	Less than 1kg
Dimensions:	180mm x 180mm x 85mm
Interface Ports:	Data input and 12 V DC Power
Cycle Time:	Less than 1 sec.

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

2.5. Support Equipment

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

Description	PSU 1
Brand Name	EMS Power
Model Name or Number	9090
Serial Number	None stated
F.C.C. ID Number	None stated
Cable Length And Type	1.5m 2 wire
Connected to Port	12V DC

Description	PSU 2
Brand Name	EMS Power
Model Name or Number	9090
Serial Number	None stated
F.C.C. ID Number	None stated
Cable Length And Type	1.5m 2 wire
Connected to Port	12V DC on Controller Unit

Description	Controller Unit
Brand Name	Maynetronics
Model Name or Number	CT2A
Serial Number	623
F.C.C. ID Number	None stated
Cable Length And Type	14m 2 wire shielded
Connected to Port	Data Input

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

3. Test Specification, Methods & Procedures

3.1. Test Specification

Reference:	FCC Part 15 Subpart C: 1998. Section 15.249
Title:	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices: Digital Devices.
Comments:	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
Purpose of Test:	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

3.2. Methods And Procedures

The methods and procedures used were as detailed in:

ANSI C63.2 (1987)

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

ANSI C63.4 (1992)

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

ANSI C63.5 (1988)

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

ANSI C63.7 (1988)

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

CISPR 16-1 (1993)

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

3.3. Definition Of Measurement Equipment

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

RADIO FREQUENCY INVESTIGATION LTD.

EMC Department

Test Report

S.No. RFI/EMCB1/RP39118ETF02B

Page 8 of 34

Issue Date: 22 July 1999

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

4. Deviations From The Test Specification

None.

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

5. Operation Of The EUT During Testing

5.1. Operating Conditions

The EUT was tested in a normal laboratory environment.

During testing, the EUT was powered by nominal 115 V, 60 Hz AC mains supply 13 Amp (max).

5.2. Operating Modes

The EUT was tested in the following operating mode:

- Transmit Mode. The EUT was set to operate with a continuous unmodulated transmitter carrier.
- Standby Mode.

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

5.3. Configuration And Peripherals

The EUT was tested in the following configuration:

Communicating with a controller unit placed outside the test chamber.

The reason for choosing this configuration was that it was defined by the client as being typical of normal use and likely to be a worst case with regard to EMC.

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

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

6. Summary Of Test Results

6.1. Conducted Emissions

Range Of Measurements	Specification Reference	Compliance Status
AC Powerline Conducted Emissions. 450 kHz to 30 MHz. Transmit Mode.	Section 15.249 of C.F.R. 47: 1998 (Section 15.207).	Complied
AC Powerline Conducted Emissions. 450 kHz to 30 MHz. Standby Mode.	Section 15.107 of C.F.R. 47: 1998 Class B	Complied

6.2. Radiated Emissions

Range Of Measurements	Specification Reference	Compliance Status
Electric Field Strength. 30 MHz to 10000 MHz. Transmit Mode.	Section 15.249 of C.F.R. 47: 1998 (Section 15.209)	Complied
Electric Field Strength. 30 MHz to 5000 MHz. Standby Mode.	Section 15.109 of C.F.R. 47: 1998 Class B	Complied

6.3. Location Of Tests

All the measurements described in this report were performed at the premises of Measurements described in this report were performed at premises of Radio Frequency Investigation Ltd; either at Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England, or at Dunlop House, Dunlop, Ayrshire, KA3 4BD, Scotland.

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

7. Measurements, Examinations And Derived Results

7.1. General Comments

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

7.1.2. The measurement uncertainties stated were calculated in accordance with the requirements of UKAS Document NIS 81 with a confidence level of 95%. Please refer to Section 8 for details of measurement uncertainties.

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

7.2. Test Results For AC Mains Conducted Emissions - Transmit Mode

7.2.1. Quasi-Peak Detector Measurements On Live And Neutral Lines

7.2.1.1. Measurements were performed to the limits specified in Section 15.207 of C.F.R.47: 1998.

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

7.2.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

Frequency (MHz)	Line	Q-P Level (dBµV)	Q-P Limit (dBµV)	Margin (dB)	Result
0.531	Neutral	31.5	48.0	16.5	Complied
4.814	Live	34.0	48.0	14.0	Complied
5.100	Live	36.5	48.0	11.5	Complied
5.190	Neutral	38.7	48.0	9.3	Complied
5.302	Neutral	38.8	48.0	9.2	Complied
5.358	Live	36.0	48.0	12.0	Complied
5.428	Neutral	38.2	48.0	9.8	Complied
14.035	Live	28.2	48.0	19.8	Complied
14.310	Neutral	28.7	48.0	19.3	Complied
17.999	Neutral	31.5	48.0	16.5	Complied
18.095	Live	16.0	48.0	32.0	Complied
21.169	Live	29.0	48.0	19.0	Complied

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

7.3. Test Results For AC Mains Conducted Emissions - Standby Mode

7.3.1. Quasi-Peak Detector Measurements On Live And Neutral Lines

7.3.1.1. Measurements were performed to the limits specified in Section 15.107 Class B of C.F.R.47: 1998.

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

7.3.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

Frequency (MHz)	Line	Q-P Level (dBµV)	Q-P Limit (dBµV)	Margin (dB)	Result
0.541	Neutral	30.1	48.0	17.9	Complied
5.050	Live	36.1	48.0	11.9	Complied
5.157	Neutral	38.4	48.0	9.6	Complied
5.282	Neutral	38.3	48.0	9.7	Complied
5.300	Live	36.7	48.0	11.3	Complied
5.430	Live	36.6	48.0	11.4	Complied
5.518	Neutral	37.4	48.0	10.6	Complied
5.560	Live	33.3	48.0	14.7	Complied
14.397	Neutral	28.9	48.0	19.1	Complied
17.960	Live	29.7	48.0	18.3	Complied
18.089	Neutral	32.3	48.0	15.7	Complied
21.170	Live	28.8	48.0	19.2	Complied

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

7.4. Test Results For Radiated Emissions - Transmit Mode

7.4.1. Electric Field Strength Measurements – Fundamental Transmit Frequency

7.4.1.1. Measurements were performed to the limits specified in Section 15.249 of C.F.R. 47: 1998. Section 15.249 (a) specifies that the maximum field strength level of the fundamental frequency between the range of 902 and 928 MHz must not exceed a level of 50mV/m (94dBuV/m) at a distance of 3m.

7.4.1.2. The following tables lists the field strength level of the fundamental frequency. Measurements were performed using a Quasi-Peak and an Average detector at a test distance of 3m (results incorporate antenna factors and cable losses):

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Q-P Limit (dBμV/m)	Margin (dB)	Result
916.567	Vert.	90.7	94.0	3.3	Complied

Frequency (MHz)	Ant. Pol.	Average Level (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)	Result
916.567	Vert.	84.2	94.0	9.8	Complied

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

7.5. Test Results For Radiated Emissions - Transmit Mode

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

7.5.1.1. Measurements were performed to the limits specified in Section 15.209 of C.F.R.47: 1998.

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

7.5.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

Frequency (MHz)	Ant. Pol.	Q-P Level (dBµV/m)	Q-P Limit (dBµV/m)	Margin (dB)	Result
34.364	Vert.	22.0	40.0	18.0	Complied
50.100	Vert.	26.6	40.0	13.4	Complied
57.583	Vert.	20.3	40.0	19.7	Complied
63.010	Vert.	19.9	40.0	20.1	Complied
74.960	Vert.	17.2	40.0	22.8	Complied
84.121	Vert.	26.5	40.0	13.5	Complied
92.640	Vert.	24.9	43.5	18.6	Complied
106.522	Vert.	27.1	43.5	16.4	Complied
116.113	Vert.	31.1	43.5	12.4	Complied
124.413	Vert.	28.0	43.5	15.5	Complied
135.364	Vert.	20.2	43.5	23.3	Complied
141.627	Vert.	20.4	43.5	23.1	Complied
200.060	Vert.	11.1	43.5	32.4	Complied

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

7.6. Test Results For Radiated Emissions - Standby Mode

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

7.6.1.1. Measurements were performed to the limits specified in Section 15.107 Class B of C.F.R.47: 1998.

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

7.6.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector:

Frequency (MHz)	Ant. Pol.	Q-P Level (dB μ V/m)	Q-P Limit (dB μ V/m)	Margin (dB)	Result
33.183	Vert.	22.1	40.0	17.9	Complied
50.691	Vert.	25.3	40.0	14.7	Complied
56.050	Vert.	23.5	40.0	16.5	Complied
65.328	Vert.	19.9	40.0	20.1	Complied
75.579	Vert.	17.1	40.0	22.9	Complied
84.798	Vert.	27.6	40.0	12.4	Complied
91.123	Vert.	24.8	43.5	18.7	Complied
108.761	Vert.	36.0	43.5	7.5	Complied
116.134	Vert.	34.8	43.5	8.7	Complied
123.507	Vert.	29.5	43.5	14.0	Complied
134.568	Horiz.	20.2	43.5	23.3	Complied
141.941	Vert.	24.8	43.5	18.7	Complied
147.994	Vert.	22.3	43.5	21.2	Complied
164.055	Vert.	18.1	43.5	25.4	Complied
964.370	Vert.	26.2	54.0	27.8	Complied

Test Of: Maynetronics Ltd. LK3A-2 Link Box
 To: FCC Part 15 Subpart C: 1998
 (Intentional Radiators)
 Section 15.249

7.7. Test Results For Radiated Emissions – Transmit Mode

7.7.1. Electric Field Strength Measurements above 1 GHz.

7.7.1.1. Measurements were performed to the limits specified in Section 15.209 of C.F.R.47: 1998.

7.7.1.2. The client has stated that the highest clock frequency for the EUT was 916.5 MHz. Therefore tests were performed up to 10 GHz.

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

7.7.1.4. 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
1.8331	Vert.	23.6	21.7	1.0	46.3	54.0	7.7	Complied
1.8331	Horiz.	23.6	21.7	1.0	46.3	54.0	7.7	Complied
3.6663	Vert.	14.9	21.0	1.5	37.4	54.0	16.6	Complied
3.6663	Horiz.	14.6	21.0	1.5	37.1	54.0	16.9	Complied
4.5828	Vert.	16.1	24.1	1.75	42.0	54.0	12.0	Complied
4.5828	Horiz.	16.0	24.1	1.75	42.0	54.0	12.0	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
1.8331	Vert.	34.5	21.7	1.0	57.2	74.0	16.8	Complied
1.8331	Horiz.	34.5	21.7	1.0	57.2	74.0	16.8	Complied
3.6663	Vert.	25.9	21.0	1.5	48.4	74.0	25.6	Complied
3.6663	Horiz.	25.8	21.0	1.5	48.3	74.0	25.7	Complied
4.5828	Vert.	27.8	24.1	1.75	53.7	74.0	20.3	Complied
4.5828	Horiz.	27.8	24.1	1.75	53.6	74.0	20.4	Complied

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

7.8. Test Results For Radiated Emissions - Standby Mode

7.8.1. Electric Field Strength Measurements above 1 GHz.

7.8.1.1. Measurements were performed to the limits specified in Section 15.109 of C.F.R.47: 1998.

7.8.1.2. The client has stated that the highest clock frequency for the EUT was 916.5 MHz. Therefore tests were performed up to 5 GHz.

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

7.8.1.4. 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
1.96909	Vert.	15.5	21.7	1.1	38.3	54.0	15.7	Complied
1.96909	Horiz.	15.5	21.7	1.1	38.3	54.0	15.7	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
1.96909	Vert.	27.6	21.7	1.1	50.4	74.0	23.6	Complied
1.96909	Horiz.	27.6	21.7	1.1	50.4	74.0	23.6	Complied

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

8. Measurement Uncertainty

8.1. Company Policy, as based on the UKAS Accreditation Standard, M10, paragraph 12.11 (o), states that Test Reports shall include estimated uncertainty of the calibration or test result (this information need only appear in test reports and test certificates where it is relevant to the validity or application of the test result, where a client's instructions so require or where uncertainty affects compliance to a specification or limit).

8.2. The 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. The uncertainty evaluation has been carried out in accordance with UKAS requirements:

Measurement Type	Range	Confidence Level (%)	Calculated Uncertainty
Conducted Emissions	0.15 MHz to 30 MHz	95%	+/- 2.2 dB
Radiated Emissions	30 MHz to 1000 MHz @ 3 m	95%	+/- 4.9 dB
Radiated Emissions	1 GHz to 10 GHz	95%	+/- 4.4 dB

8.3. Measurement uncertainties have been applied in accordance with UKAS document NIS 81 (edition 1, May 1994), and in the absence of any specification criteria, guidance, or code of practice, compliance has been judged on the basis of shared risk.

8.4. In the case of emissions tests, the measured value of the disturbance from the product sample shall be compared directly with the limits. If the measured value is equal to or less than the limit the product is deemed to pass the test.

8.5. In the case of immunity tests, the equipment is deemed to pass the test if it fulfils the stated performance criteria at the required or a higher severity level. The measurement uncertainty has been taken into account in the calibration procedures stated in the relevant basic standard.

8.6. The methods used to calculate the above uncertainties are in line with those used for calibration laboratories contained in UKAS document M 3003 Edition 1 "The Expression of Uncertainty and Confidence in Measurement" December 1997, which align with international recommendations "Guide to the Expression of Uncertainty in Measurement" ISO/IEC/OIML/BIPM (Prepared by ISO/TAG 4: January 1993).

Test Of: Maynetronics Ltd. LK3A-2 Link Box
 To: FCC Part 15 Subpart C: 1998
 (Intentional Radiators)
 Section 15.249

Appendix 1. Test Equipment Used

Instrument	Manufacturer	Model Number	RFI No.
LISN	Rohde & Schwarz	ESH3-Z5	A067
LISN	Rohde & Schwarz	ESH2-Z5	A505
Bi-Con	Rohde & Schwarz	HK116	A513
Log-Spiral	EMCO	3101	A514
Bi-log Antenna	Chase	CBL6111A	A546
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	A559
3 dB attenuator	Narda	757c-3	A610
C503-N-30	Andrew	LOF4 50A	C503
C505-N-50	Andrew		C505
C565-N-3	Rosenberger	UFA 210A-1-1181-70x70	C565
C573-N-N-2	Rosenberger	UFA210A-1-788-50x50	C573
C575-N-N-5	Rosenberger	UFA 210A-1-1968-50x50	C575
50 ohm Co-ax cable N-N 8m	Rosenberger	UFA 210A-1 3148-70x70	C585
Spectrum Monitor	Rohde & Schwarz	EZM	M024
ESVP Receiver	Rohde & Schwarz	ESVP	M044
Analyser Display Unit	Rohde & Schwarz	ESAI-D	M505
RF unit	Rohde & Schwarz	ESBI-RF	M506
Horn Antenna	Eaton	9188-2	A028
Horn Antenna (2 to 4 GHz)	Eaton	91889-2	A031
Horn Antenna (4 to 5 GHz)	Narda	643	A440
Spectrum Analyser / Receiver	Rohde & Schwarz	ESMI	M069
Horn Antenna (5.4 to 8.2 GHz)	Flann	14240-20	A427
Horn Antenna (8.2 to 12.4 GHz)	Narda	640	A437
Cable	Rosenberger	UFA210A-1-1182-704704	C461

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

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

Appendix 2. Measurement Methods

A2.1. AC Mains Conducted Emissions: FCC Part 15

A2.1.1. Measurements were performed at the premises of Radio Frequency Investigation Ltd. Dunlop House, Dunlop, Ayrshire, KA3 4BD, Scotland.

A2.1.2. AC mains conducted emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.1.3. 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 and with the EUT powered via a 60 Hz AC mains supply.

A2.1.4. 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.

A2.1.5. 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.

A2.1.6. The test equipment settings for conducted emissions measurements were as follows:

Receiver Function	Initial Scan	Final Measurements
Detector Type:	Peak	Quasi-Peak (CISPR)*
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

* In some instances an Average detector function may also have been used.

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

A2.2. Radiated Emissions: FCC Part 15 - 30 to 1000 MHz

A2.2.1. Measurements were performed at the premises of Radio Frequency Investigation Ltd. Dunlop House, Dunlop, Ayrshire, KA3 4BD, Scotland.

A2.2.2. Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.2.3. 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.

A2.2.4. 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 receiver with a Quasi-Peak detector.

A2.2.5. 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.

A2.2.6. All measurements on the open area test site were performed using broadband antennas.

A2.2.7. 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° with the antenna height also varied between 1 and 4m. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

A2.2.8. The test equipment settings for radiated emissions measurements were as follows:

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

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

A2.3. Radiated Emissions: FCC Part 15 – 1 to 10 GHz

A2.3.1. Measurements were performed at the premises of Radio Frequency Investigation Ltd. Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ. England.

A2.3.2. Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.3.3. 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.

A2.3.4. 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 receiver with average and peak detectors.

A2.3.5. 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.

A2.3.6. All measurements on the open area test site were performed using broadband antennas.

A2.3.7. 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° with the antenna positioned at a fixed height of 1.5m. At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

A2.3.8. The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	Initial Scan	Final Measurements
Detector Type:	Peak	Peak/Average
Mode:	Max Hold	Not applicable
Bandwidth:	1 MHz	1 MHz
Amplitude Range:	60 dB	20 dB (typical)
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

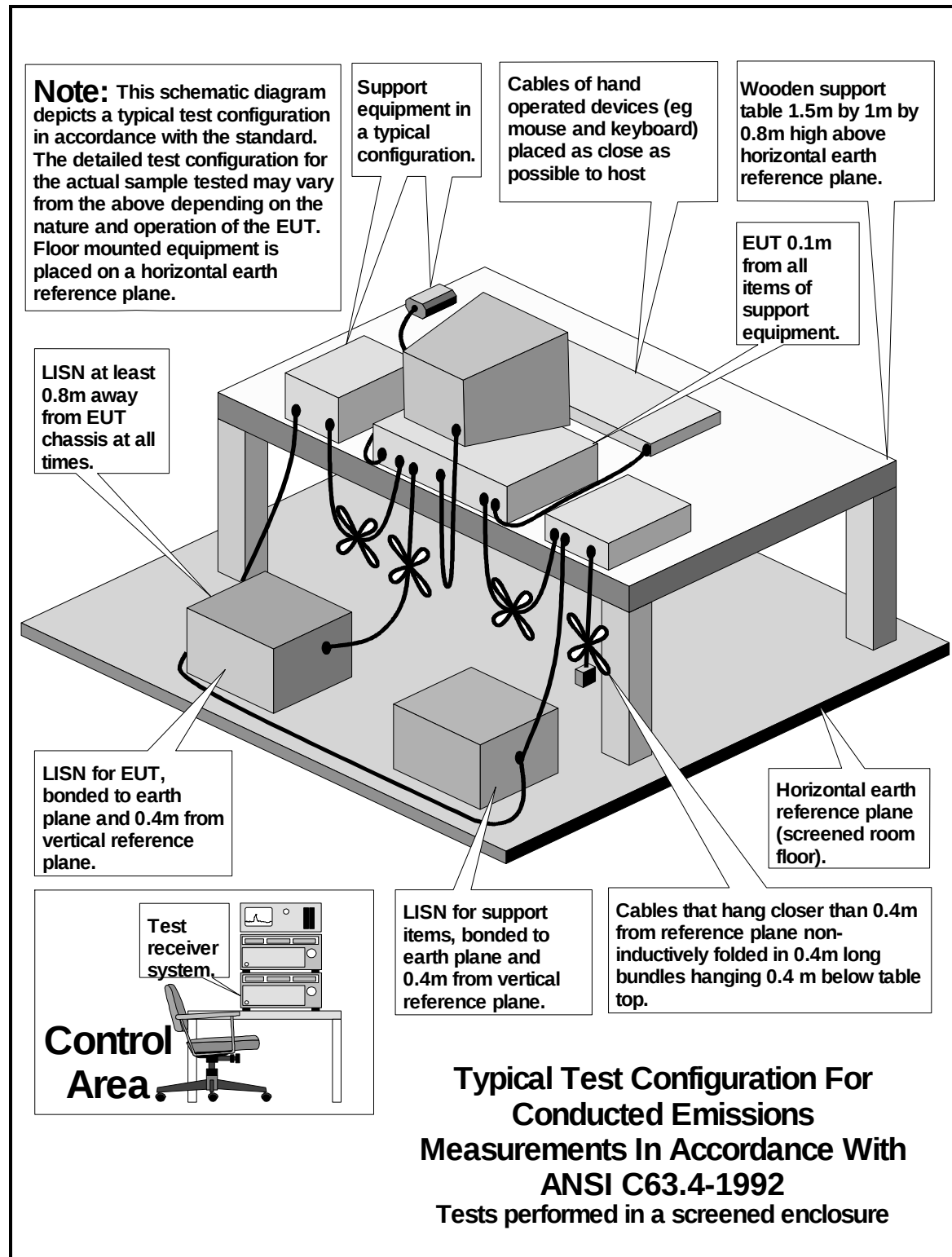
Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\39118ETF02\EMIFCON	Test configuration for measurement of conducted emissions
DRG\39118ETF02\EMIRAD	Test configuration for measurement of radiated emissions
DRG\39118ETF02\001	Schematic Diagram of the EUT, support equipment and interconnecting cables used for the test

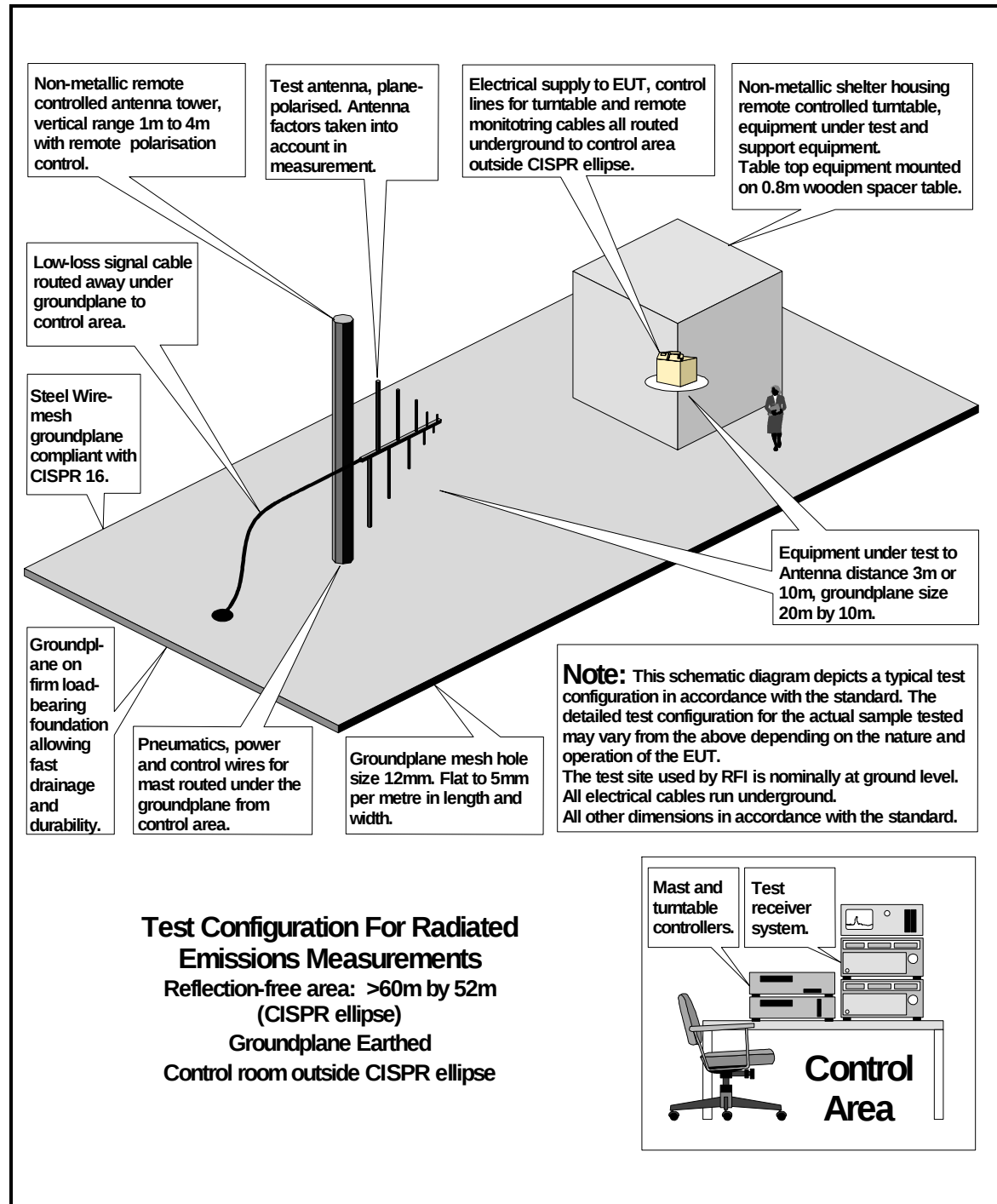
Test Of: Maynetronics Ltd. LK3A-2 Link Box
 To: FCC Part 15 Subpart C: 1998
 (Intentional Radiators)
 Section 15.249

DRG\39118ETF02\EMIFCON



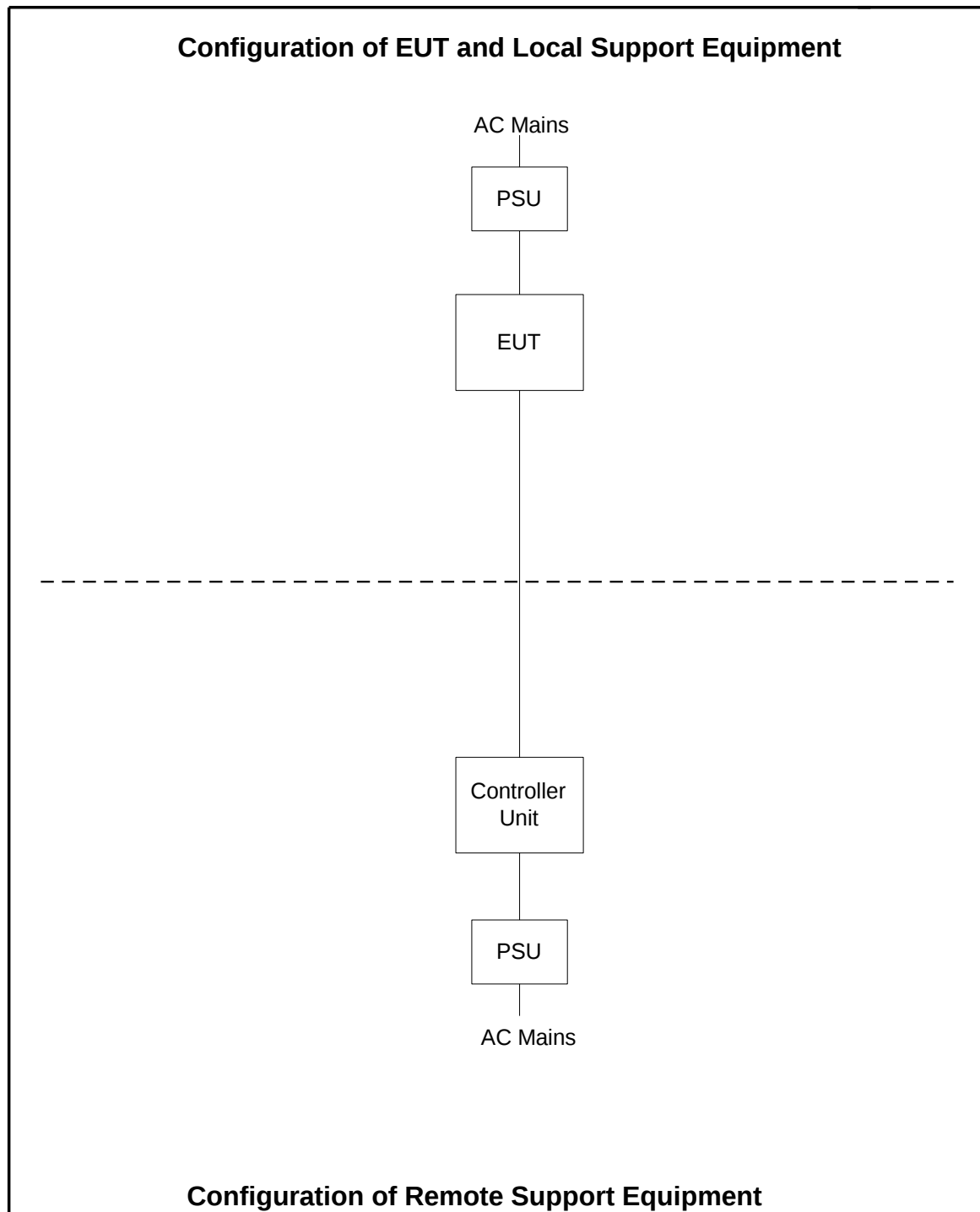
Test Of: Maynetronics Ltd. LK3A-2 Link Box
 To: FCC Part 15 Subpart C: 1998
 (Intentional Radiators)
 Section 15.249

DRG\39118ETF02\EMIRAD



Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

DRG\39118ETF02\001



Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

Appendix 4. Graphical Test Results

This appendix contains the following graphs:

Graph Reference Number	Title
GPH\39118ETF02\001	Scan of Radiated Electric Field: 30 to 200 MHz. Transmit Mode.
GPH\39118ETF02\002	Scan of Radiated Electric Field: 200 to 1000 MHz. Transmit Mode.
GPH\39118ETF02\003	Scan of Radiated Electric Field: 902 to 928 MHz. Transmit Mode.
GPH\39118ETF02\004	Scan of Conducted Emissions: 0.450 to 30 MHz. Transmit Mode. Live Line.
GPH\39118ETF02\005	Scan of Conducted Emissions: 0.450 to 30 MHz. Transmit Mode. Neutral Line.
GPH\39118ETF02\006	Scan of Radiated Electric Field: 30 to 200 MHz. Standby Mode.
GPH\39118ETF02\007	Scan of Radiated Electric Field: 200 to 1000 MHz. Standby Mode.
GPH\39118ETF02\008	Scan of Conducted Emissions: 0.450 to 30 MHz. Standby Mode. Live Line.
GPH\39118ETF02\009	Scan of Conducted Emissions: 0.450 to 30 MHz. Standby Mode. Neutral Line.
GPH\39118ETF02\010	Scan of Radiated Electric Field: 1000 to 2000 MHz. Transmit Mode.
GPH\39118ETF02\011	Scan of Radiated Electric Field: 1000 to 2000 MHz. Standby Mode.
GPH\39118ETF02\012	Scan of Radiated Electric Field: 2000 to 4000 MHz. Standby Mode.
GPH\39118ETF02\013	Scan of Radiated Electric Field: 2000 to 4000 MHz. Transmit Mode.
GPH\39118ETF02\014	Scan of Radiated Electric Field: 4000 to 5000 MHz. Transmit Mode.
GPH\39118ETF02\015	Scan of Radiated Electric Field: 4000 to 5000 MHz. Standby Mode.
GPH\39118ETF02\016	Scan of Radiated Electric Field: 5000 to 6000 MHz. Transmit Mode.

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

Graphical Test Results (continued)

Graph Reference Number	Title
GPH\39118ETF02\017	Scan of Radiated Electric Field: 6000 to 8200 MHz. Transmit Mode.
GPH\39118ETF02\018	Scan of Radiated Electric Field: 8200 to 10000 MHz. Transmit Mode.

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

RADIO FREQUENCY INVESTIGATION LTD.

EMC Department

Test Report

S.No. RFI/EMCB1/RP39118ETF02B

Page 32 of 34

Issue Date: 22 July 1999

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

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Date 21.Jun.'99 Time 10:20:45

Ref.Lvl

70.00 dB*

Res.Bw

TG.Lvl

CF.Stp

120 kHz [imp]

Off

17.000 MHz

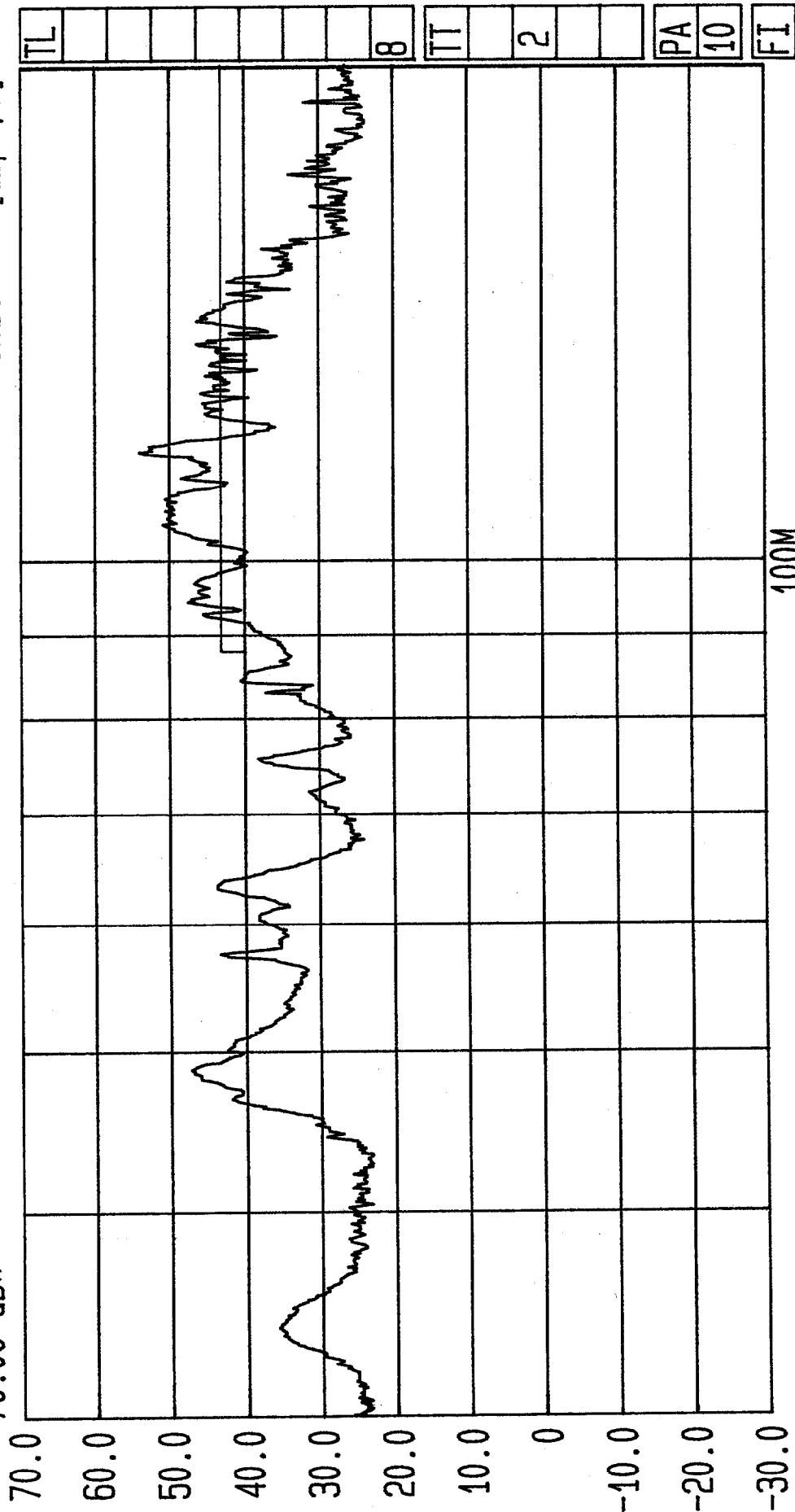
Vid.Bw

3 MHz

RF.Att

0 dB

Unit [dBμV/m]



Start

30 MHz

Span

170 MHz

Center

77.45 MHz

Sweep

80 ms

Stop

200 MHz

Radio Frequency Investigation Ltd. E-Field Prescans @ 3m
EUT: LK3A-2/Cust: Maynetronics/Opco: Transmit/Eng: AB/

GPH/39118E02/001
Spec: FCC 15 part C '98



Date 21.Jun.'99 Time 12:20:51

Ref.Lvl

85.00 dBx

Res.Bw

TG.Lvl

CF.Stp

120 kHz [imp]

Off

80.000 MHz

Vid.Bw

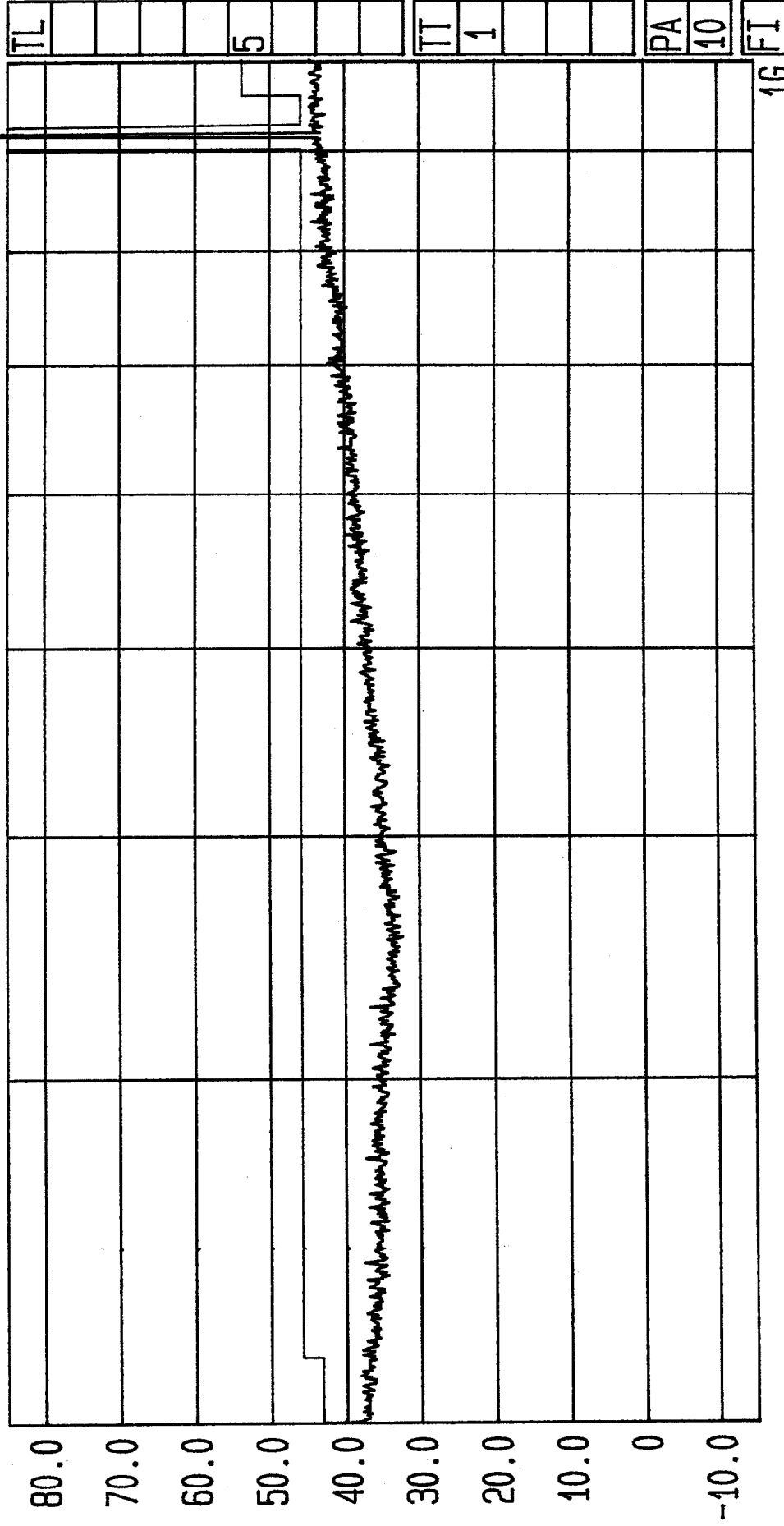
RF.Att

Unit

3 MHz

0 dB

[dBμV/m]



Start 200 MHz Span 800 MHz Center 447.2 MHz Sweep 360 ms Stop 1 GHz

Radio Frequency Investigation Ltd. E-Field Prescans @ 3m

EUT: LK3A-2/Cust: Maynetronics/Opco: Transmit/Eng: AB/

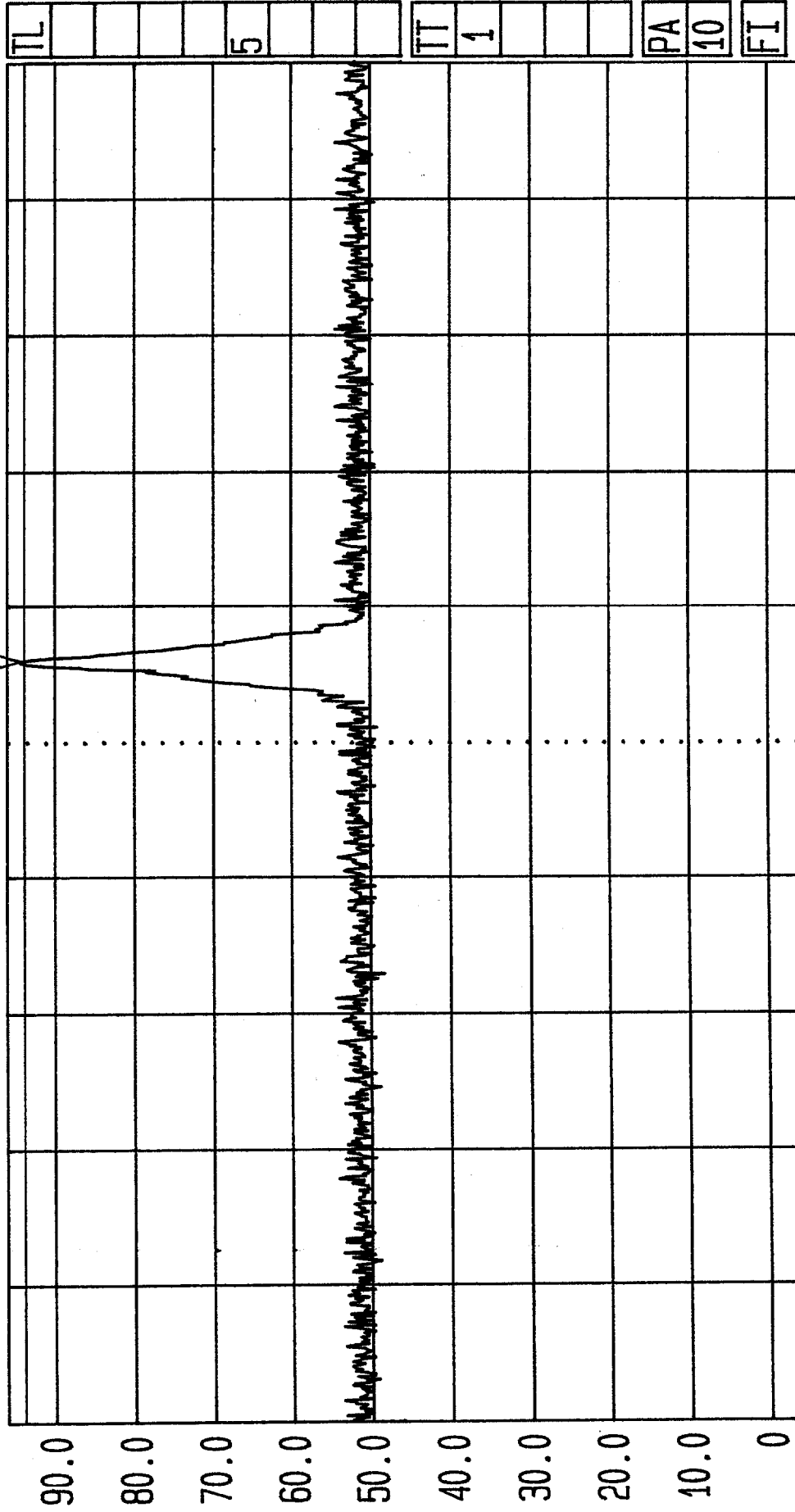
GPH/39118E02/002

Spec: FCC 15 part B 98



Date 21.Jun.'99 Time 12:36:43
Ref.Lvl 96.00 dBx
Marker 94.33 dBx
916.56 MHz

Res.Bw 120 kHz [imp] off
TG.Lvl
CF.Stp 2.600 MHz
Vid.Bw 3 MHz
RF.Att 10 dB
Unit [dBμV/m]



Start 902 MHz
Span 26 MHz
Center 915 MHz
Sweep 20 ms
Stop 928 MHz

Radio Frequency Investigation Ltd. E-Field Prescans @ 3m
EUT: LK3A-2/Cust: Maynetronics/Opco: Transmit/Eng: AB/
GPH/39118E02/003
Spec: FCC 15 part C 98



Date 21.Jun.'99 Time 14:23:13

Ref.Lvl

90.00 dBμV

Res.Bw

TG.Lvl

CF.Stp

9 kHz [imp]

Off

2.955 MHz

Vid.Bw

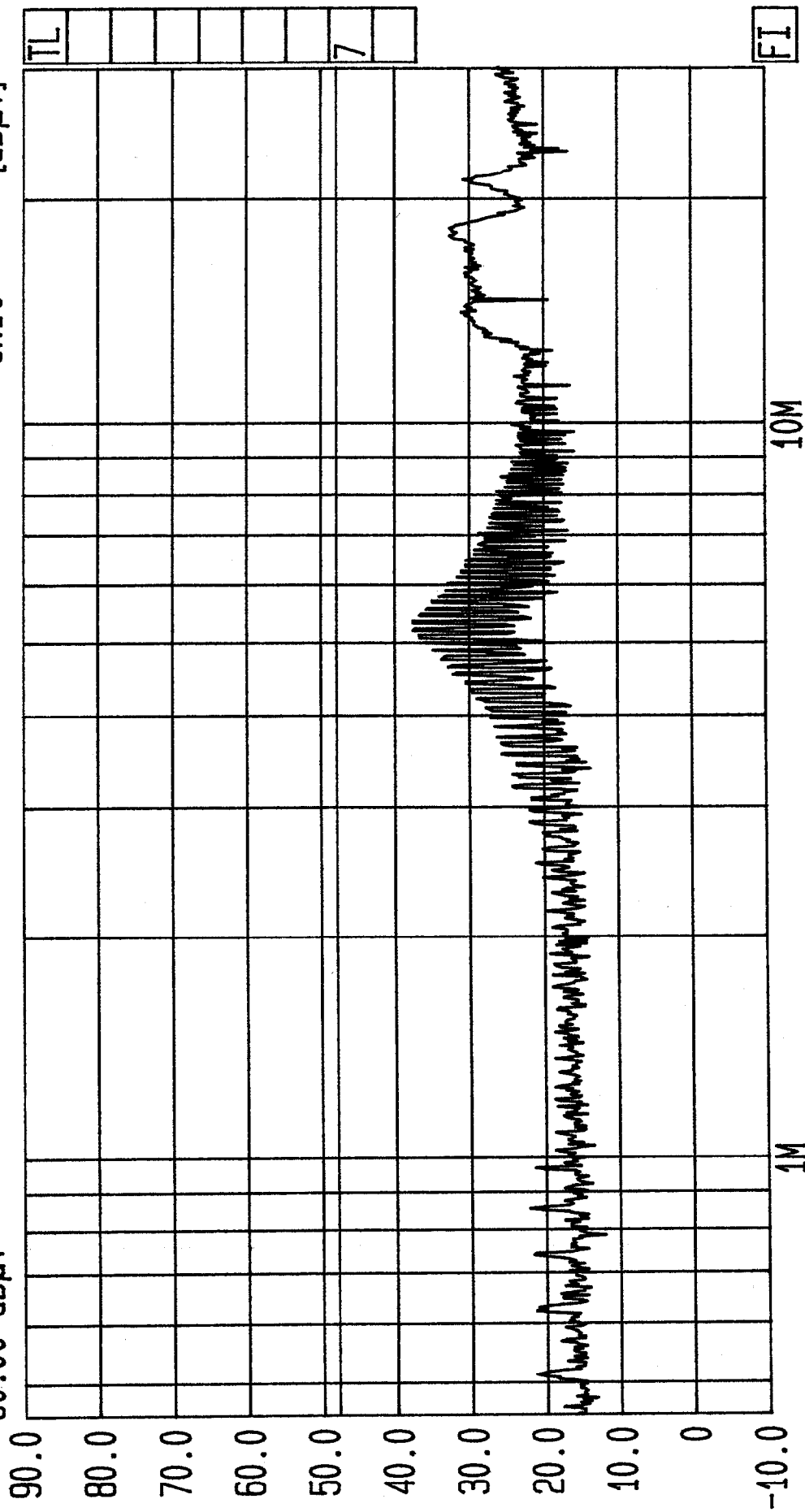
RF.Att

Unit

100 kHz

10 dB

[dBμV]



Start 450 kHz Stop 30 MHz
Sweep 2.2 s
Center 3.67423 MHz
Span 29.55 MHz
Line GPH/39118E02/004
Spec: FCC 15 1998
Radio Frequency Investigation Ltd. Conducted Emissions Live
EUT: LK3A-2/Cust: Maynetronics/Opc: Transmit/Eng: AB/



Date 21. Jun. '99 Time 14:33:24

Ref.Lvl

90.00 dBμV

Res.Bw

TG.Lvl

CF.Stp

9 kHz [imp]

Off

2.955 MHz

Vid.Bw

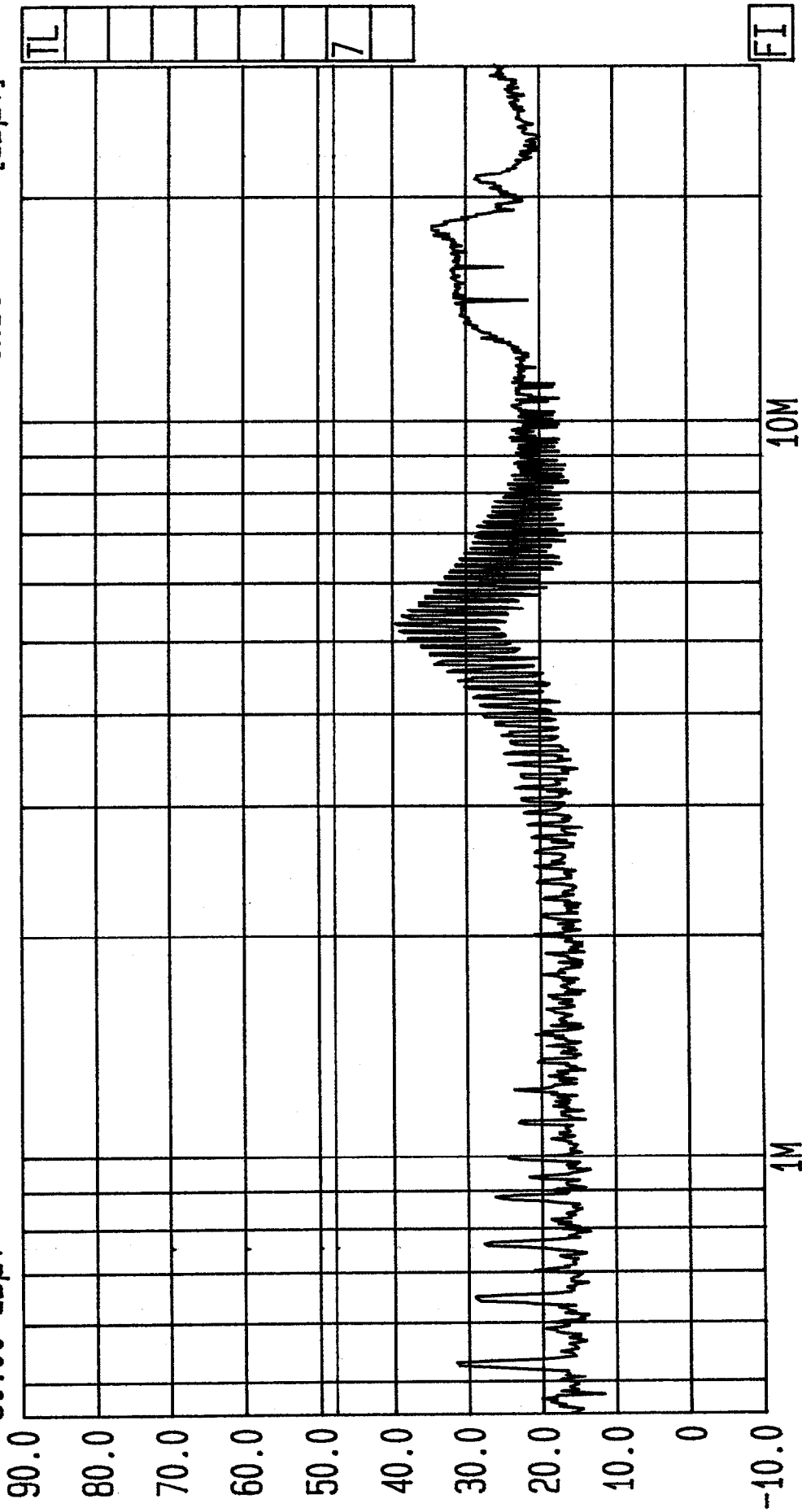
RF.Att

Unit

100 kHz

10 dB

[dBμV]



Start

450 kHz

Span

29.55 MHz

Center

3.67423 MHz

Sweep

2.2 s

Stop

30 MHz

Radio Frequency Investigation Ltd. Conducted Emissions Neutral Line GPH/39148E02/005

EUT: LK3A-2/Cust: Maynetronics/Opc: Transmit/Eng: AB/

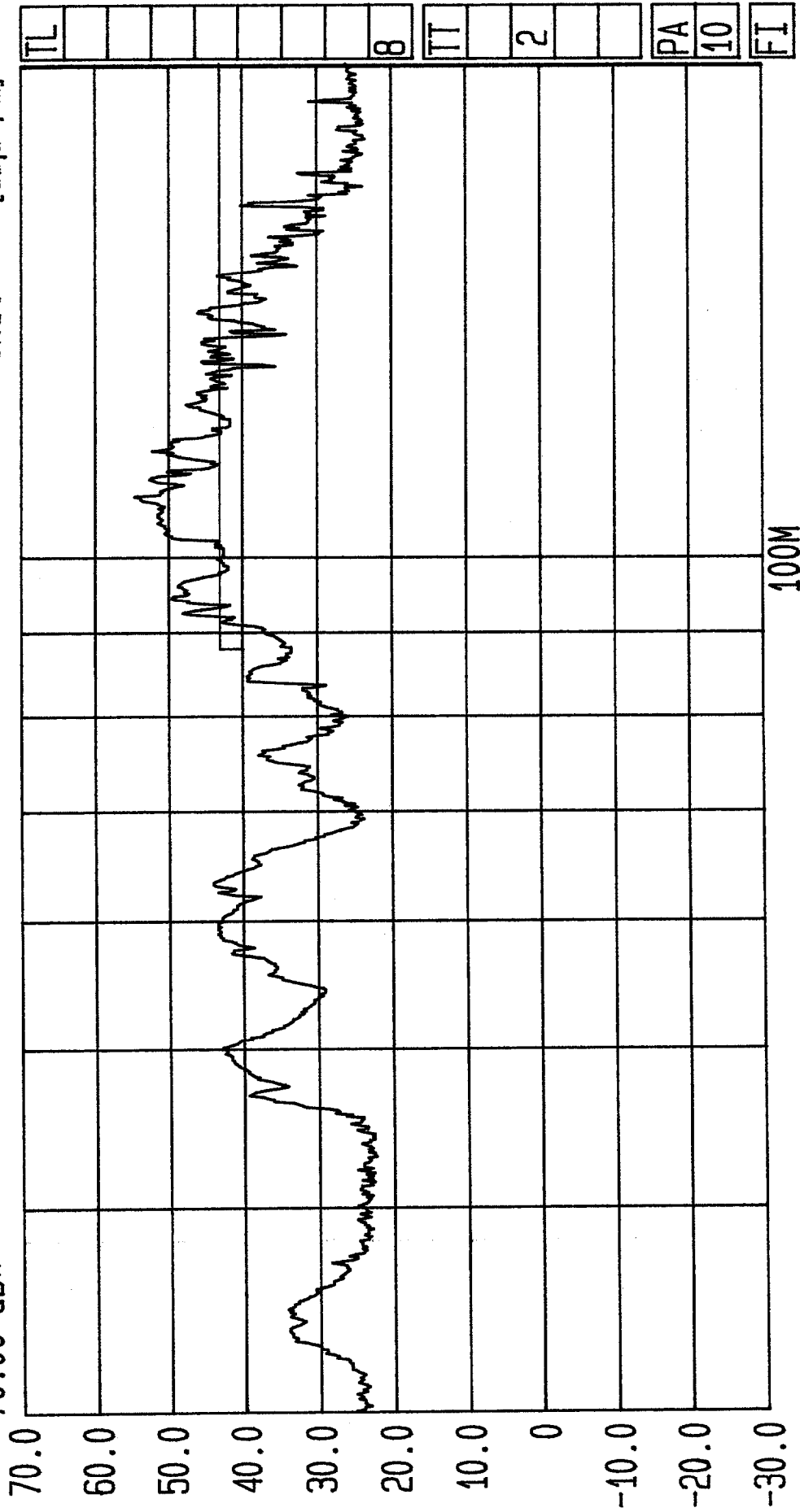
Spec: FCC 15 1998



Date 21. Jun. '99 Time 11:43:55

Ref.Lvl
70.00 dB*

Res.Bw 120 kHz [imp]
TG.Lvl Off
CF.Stp 17.000 MHz
Vid.Bw 3 MHz
RF.Att 0 dB
Unit [dBμV/m]



Start 30 MHz Span 170 MHz Center 77.45 MHz Sweep 80 ms Stop 200 MHz

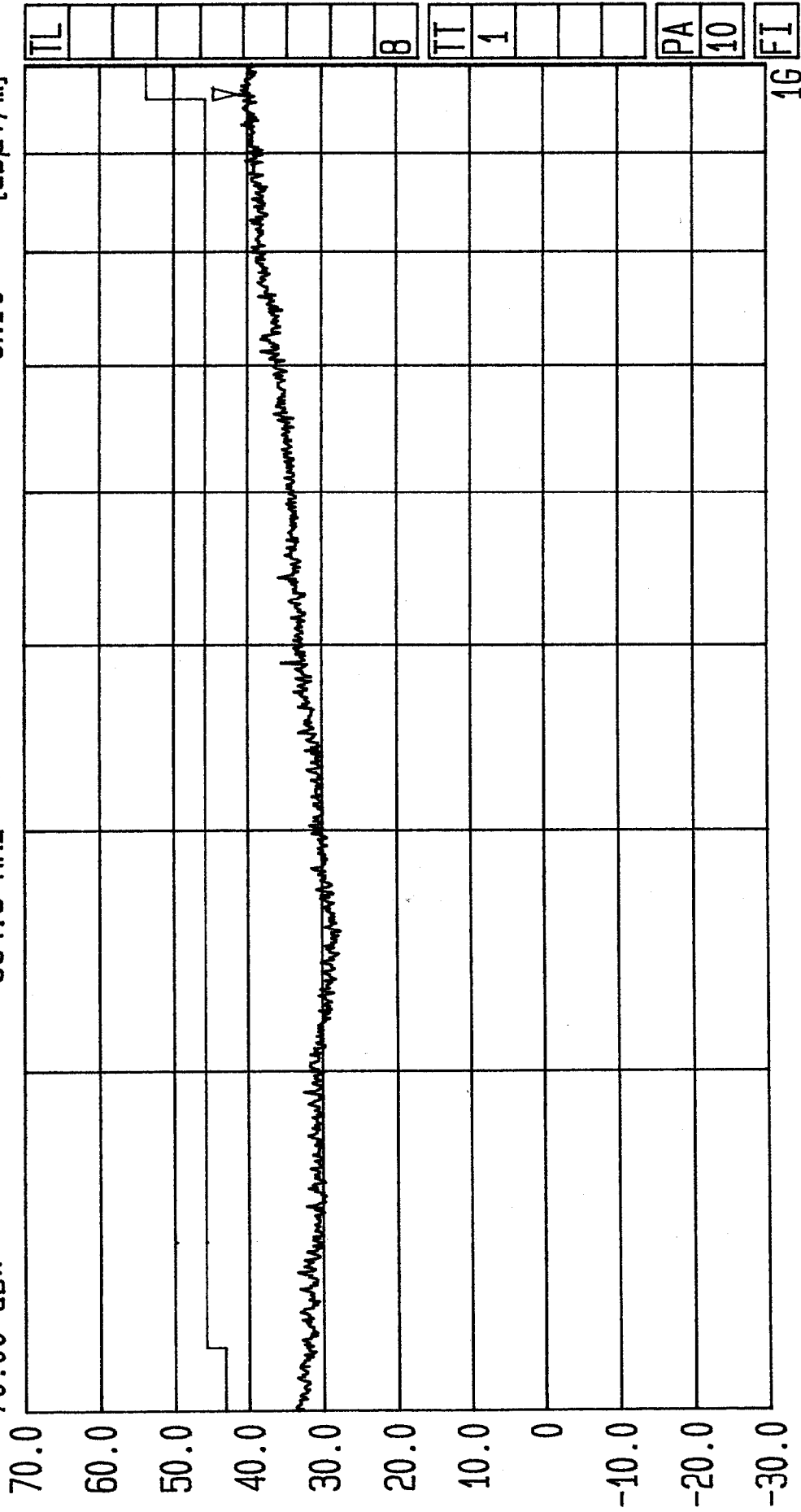
Radio Frequency Investigation Ltd. E-Field Prescans @ 3m
EUT: LK3A-2/Cust: Maynetronics/Opco: Standby/Eng: AB/

GPH/39118E02/Q06
Spec: FCC 15 part B '98



Date 21. Jun. '99 Time 12:09:03
Ref.Lvl 70.00 dB*
Marker 41.51 dB*
964.8 MHz

Res.Bw 120 kHz [imp]
TG.Lvl Off
CF.Stp 80.000 MHz
Vid.Bw 3 MHz
RF.Att 0 dB
Unit [dBμV/m]



Start 200 MHz
Span 800 MHz
Center 447.2 MHz
Sweep 360 ms
Stop 1 GHz

Radio Frequency Investigation Ltd. E-Field Prescans @ 3m
EUT: LK3A-2/Cust: Maynetronics/Opco: Standby/Eng: AB/
GPH/39118E02/007
Spec: FCC 15 part B 98



Date 21.Jun.'99 Time 14:54:24

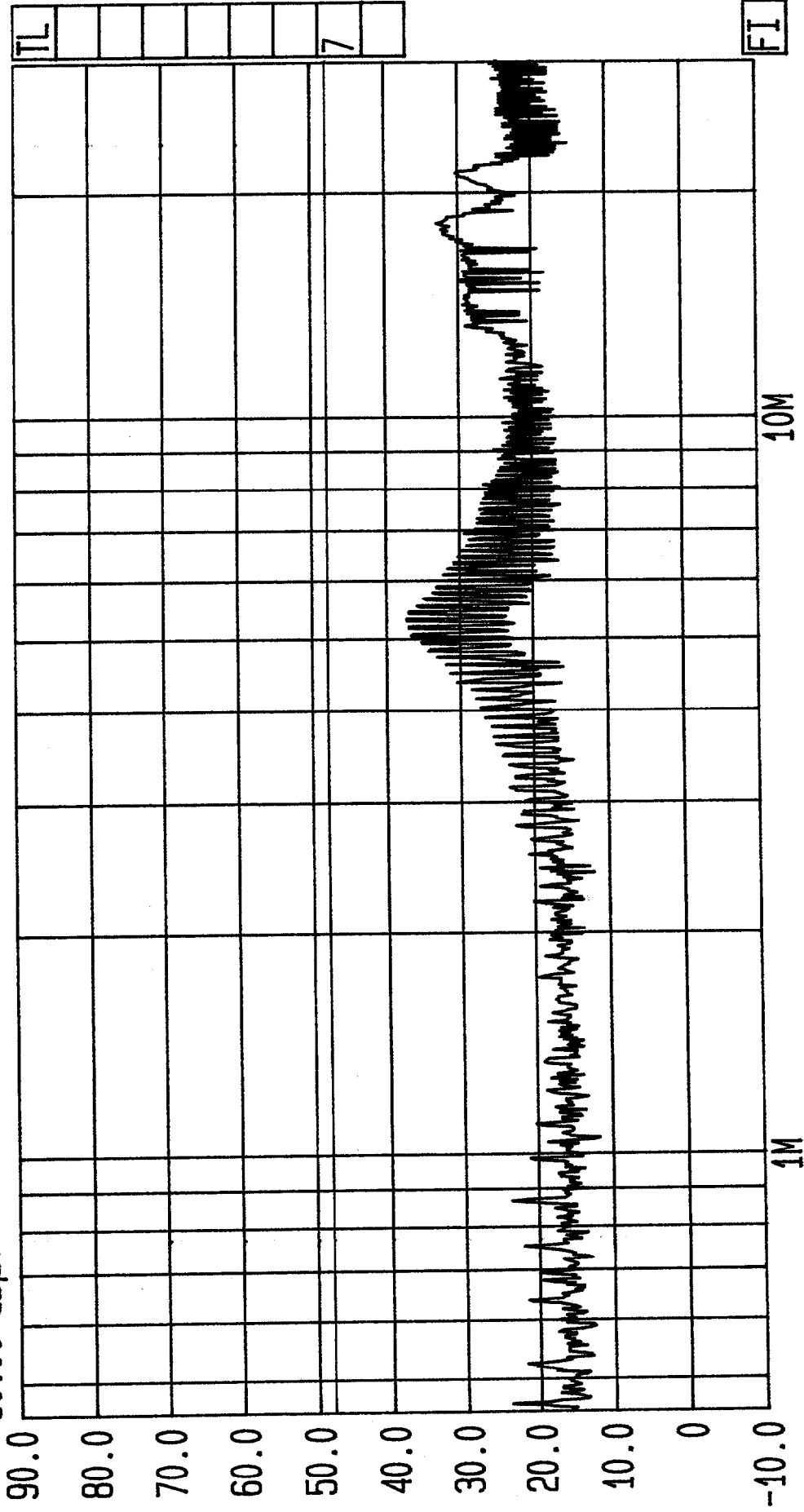
Ref.Lvl

90.00 dBμV

Res.Bw
TG.Lvl
CF.Stp

9 kHz [imp]
Off
2.955 MHz

Vid.Bw 100 kHz
RF.Att 10 dB
Unit [dBμV]



Start 450 kHz
Span 29.55 MHz
Center 3.67423 MHz
Sweep 2.2 s
Stop 30 MHz

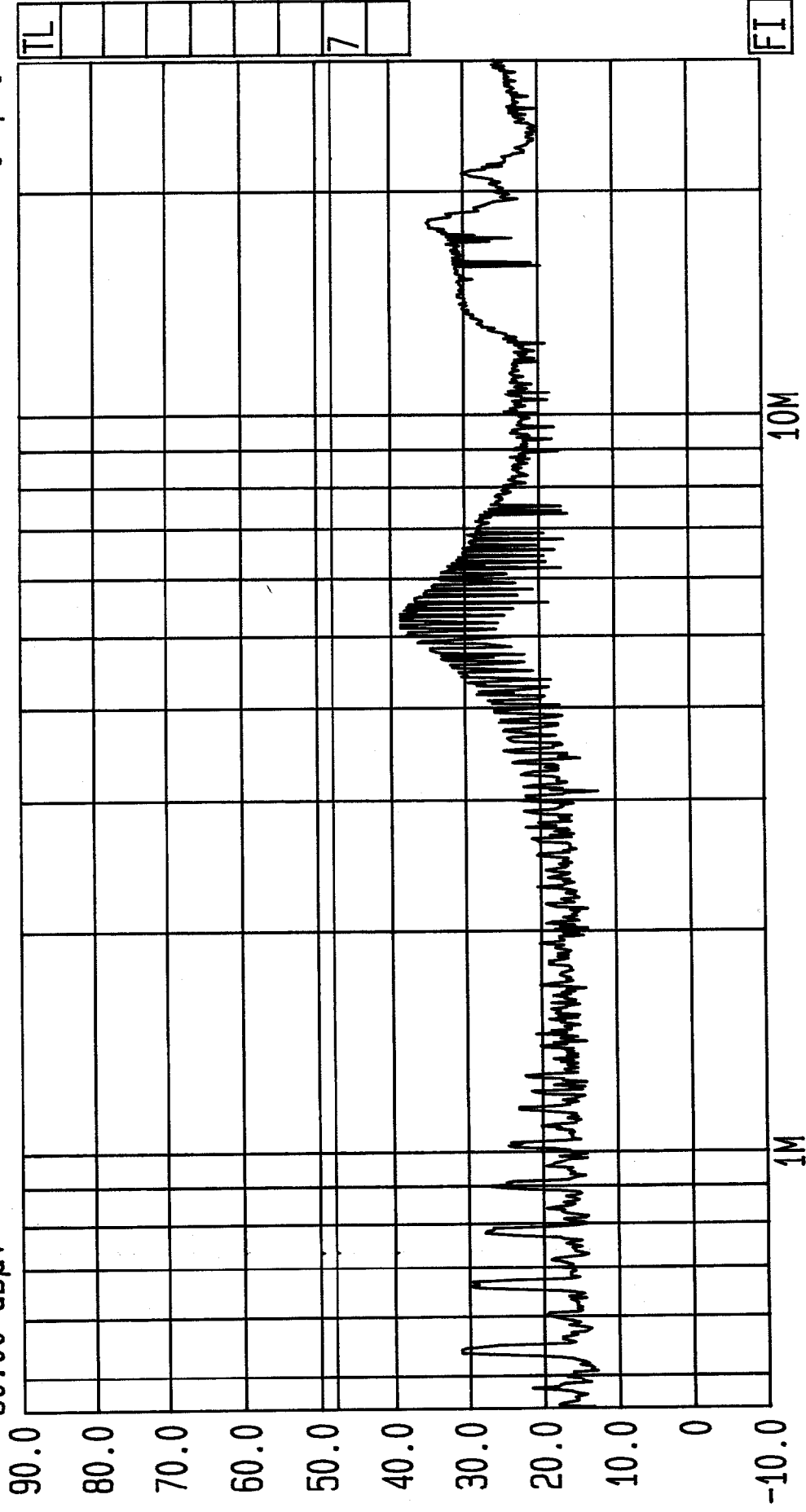
Radio Frequency Investigation Ltd. Conducted Emissions Live
Line GPH/39118E02/008
EUT: LK3A-2/Cust: Maynetronics/Opc: Standby/Eng: AB/
Spec: FCC 15 1998



Date 21.Jun.'99 Time 15:13:47

Ref.LV1
90.00 dBuV

Res.Bw 9 kHz [imp] 100 kHz
TG.LV1 Off
CF.Stp 2.955 MHz
RF.Att 10 dB
Unit [dBuV]

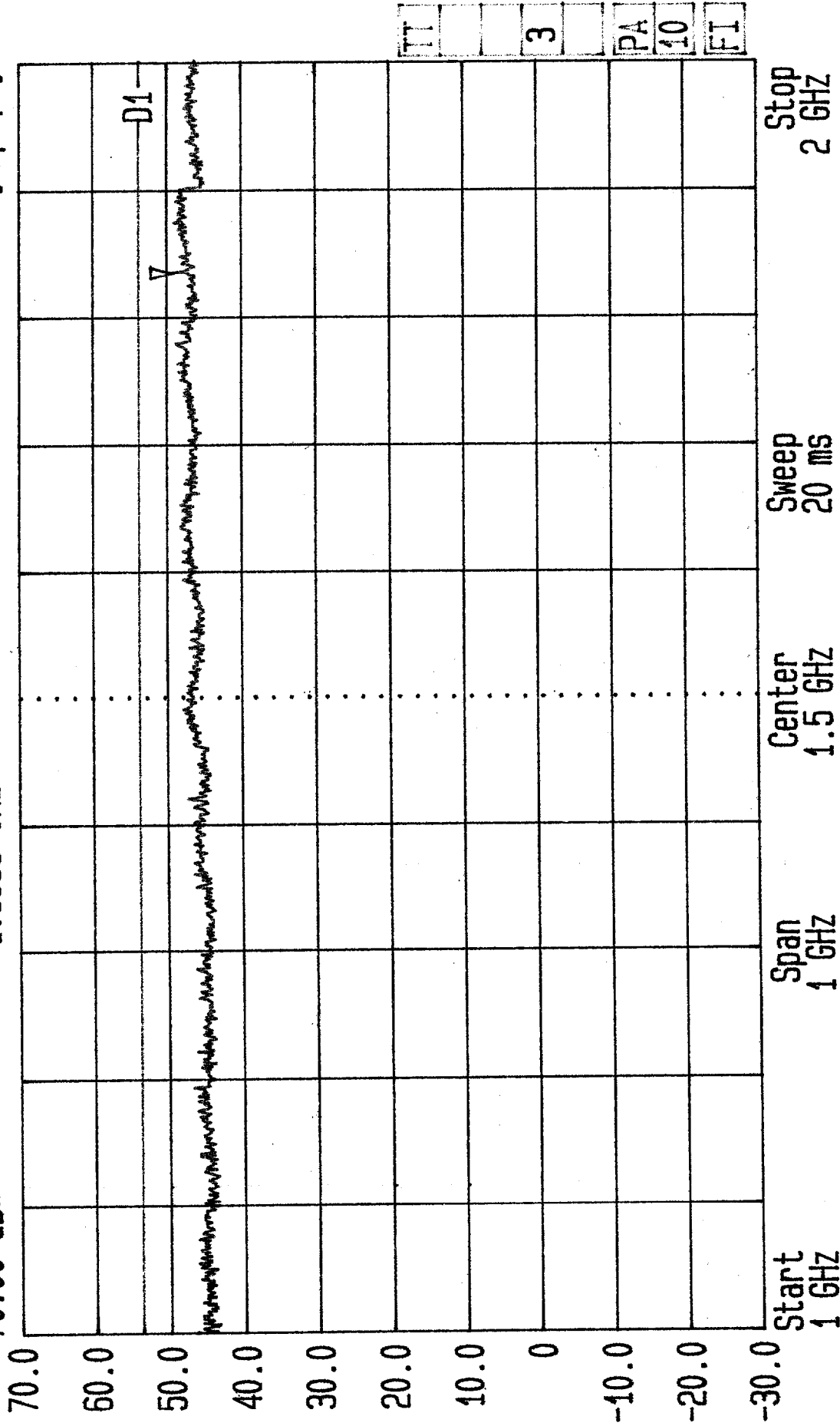


Start 450 kHz Stop 30 MHz
Span 29.55 MHz Sweep 2.2 s
Center 3.67423 MHz
Radio Frequency Investigation Ltd. Conducted Emissions Neutral Line GPH/39118E02/009
EUT: LK3A-2/Cust: Maynetronics/Opco: Standby/Eng: AB/ Spec: FCC 15 1998



Date 08.Jul.'99 Time 11:49:12
Ref.Lvl 70.00 dBx
Marker 49.39 dBx
1.8355 GHz

Res.Bw 1 MHz [imp]
TG.Lvl Off
CF.Stp 100.000 MHz
Vid.Bw 1 MHz
RF.Att 0 dB
Unit [dBuV/m]

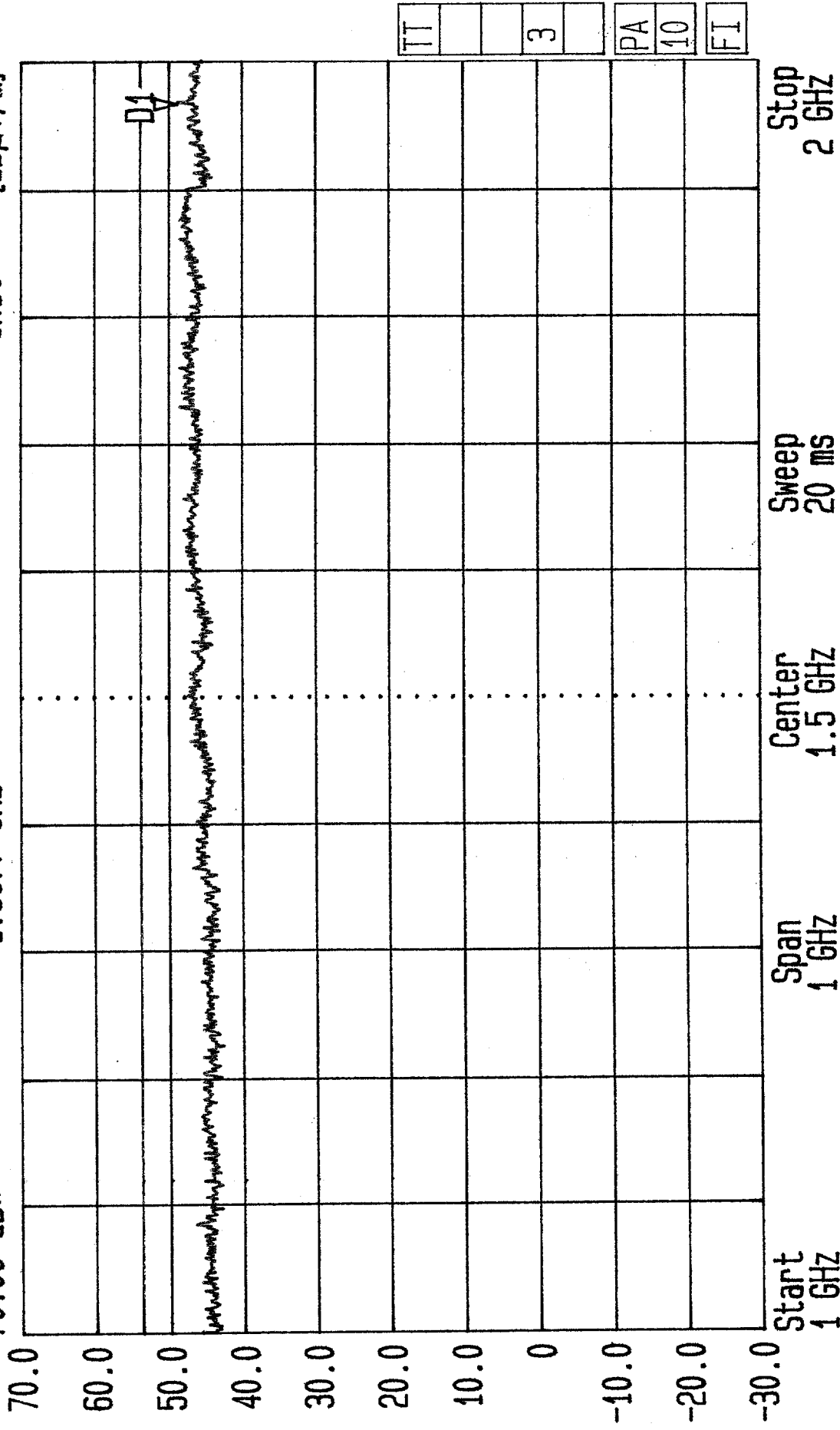


Radiated Emissions. Tested by RFI for Maynetronics Ltd. EUT: LK3A-2
FCC Part 15 Subpart C. Tx Mode. GPH/39118E02/010



Date 08.Jul.'99 Time 11:54:26
Ref.Lvl 70.00 dBx
Marker 49.00 dBx
1.9677 GHz

Res.Bw 1 MHz [imp]
TG.Lvl Off
CF.Stp 100.000 MHz
Vid.Bw 1 MHz
RF.Att 0 dB
Unit [dBuV/m]



TT
3
PA
10
FI

Radiated Emissions. Tested by RFI for Maynetronics Ltd. EUT: LK3A-2
FCC Part 15 Subpart C. Standby Mode GPH/39118E02/011



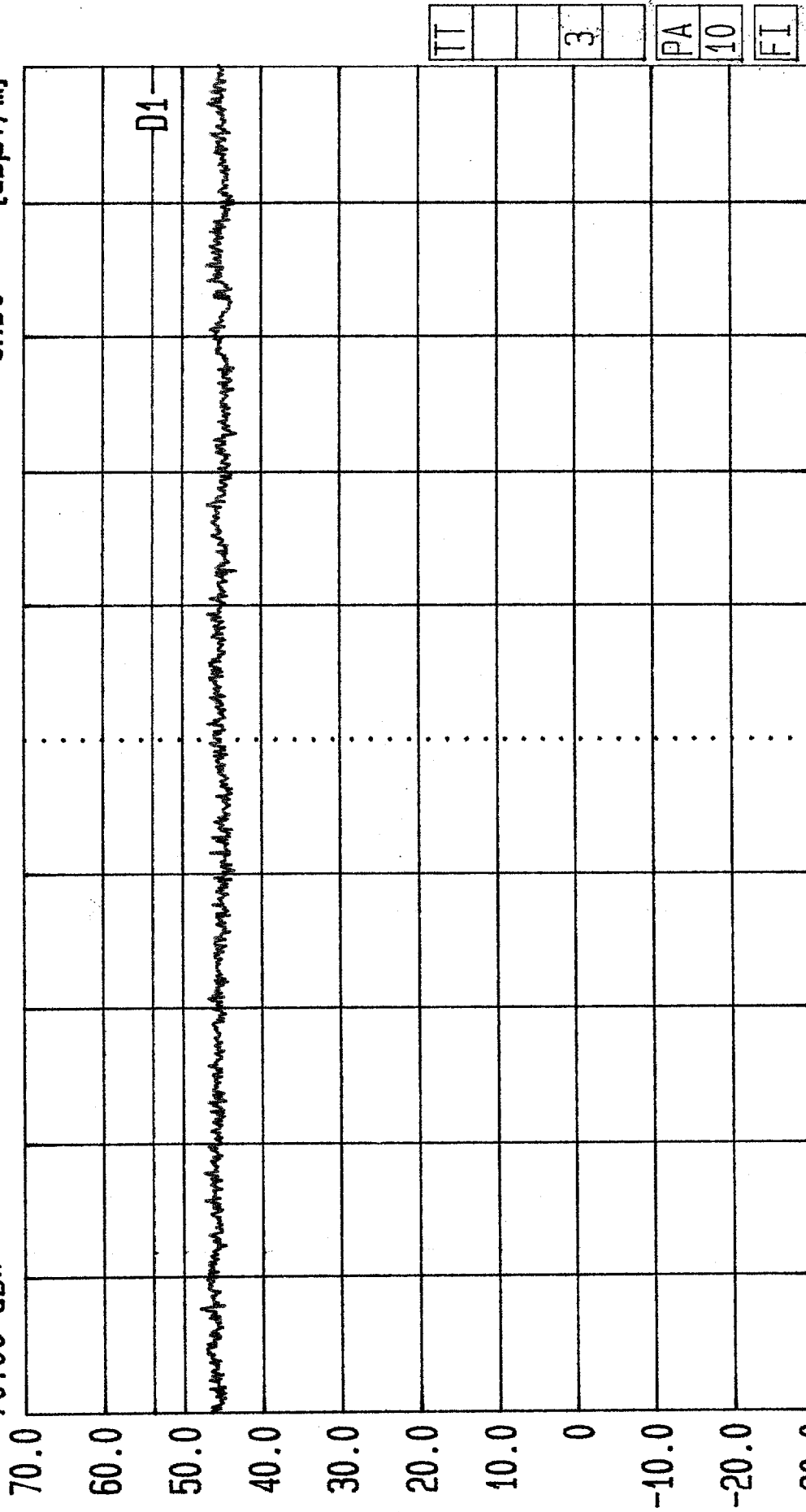
Date 08.Jul.'99 Time 11:59:40

Ref.Lvl
70.00 dBx

Res.BW
TG.Lvl
CF.Stp

1 MHz [imp]
off
200.000 MHz

Vid.BW
RF.Att
Unit
1 MHz
0 dB
[dBμV/m]



Stop
4 GHz

Sweep
20 ms

Center
3 GHz

Span
2 GHz

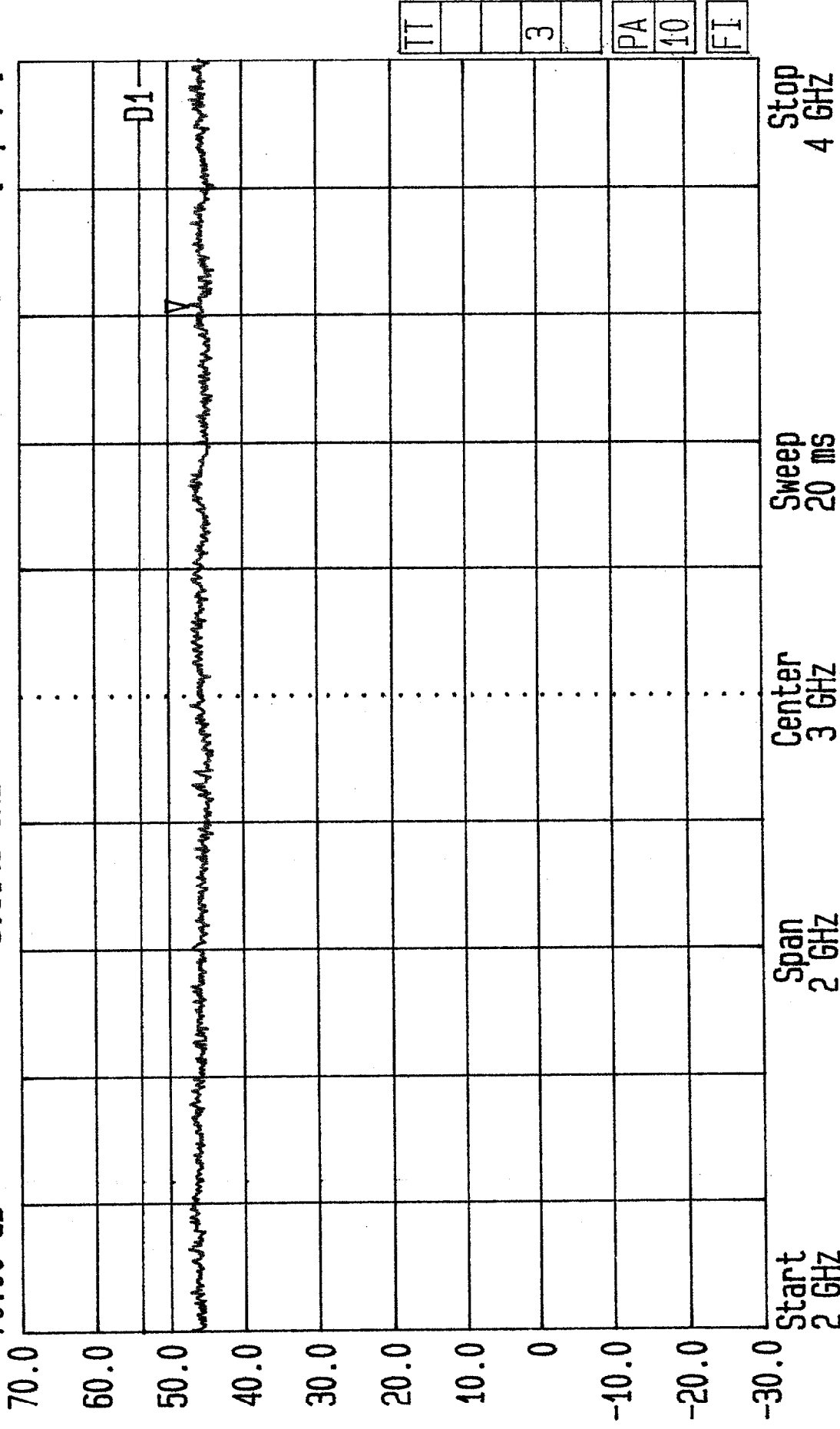
Start
2 GHz

Radiated Emissions. Tested by RFI for Maynetronics Ltd. EUT: LK3A-2
FCC Part 15 Subpart C. Standby Mode GPH/39118E02/012



Date 08.Jul.'99 Time 12:06:20
Ref.Lvl 70.00 dBx
Marker 47.38 dBx
3.6148 GHz

Res.Bw 1 MHz [imp]
TG.Lvl Off
CF.Stp 200.000 MHz
Vid.Bw 1 MHz
RF.Att 0 dB
Unit [dBuV/m]

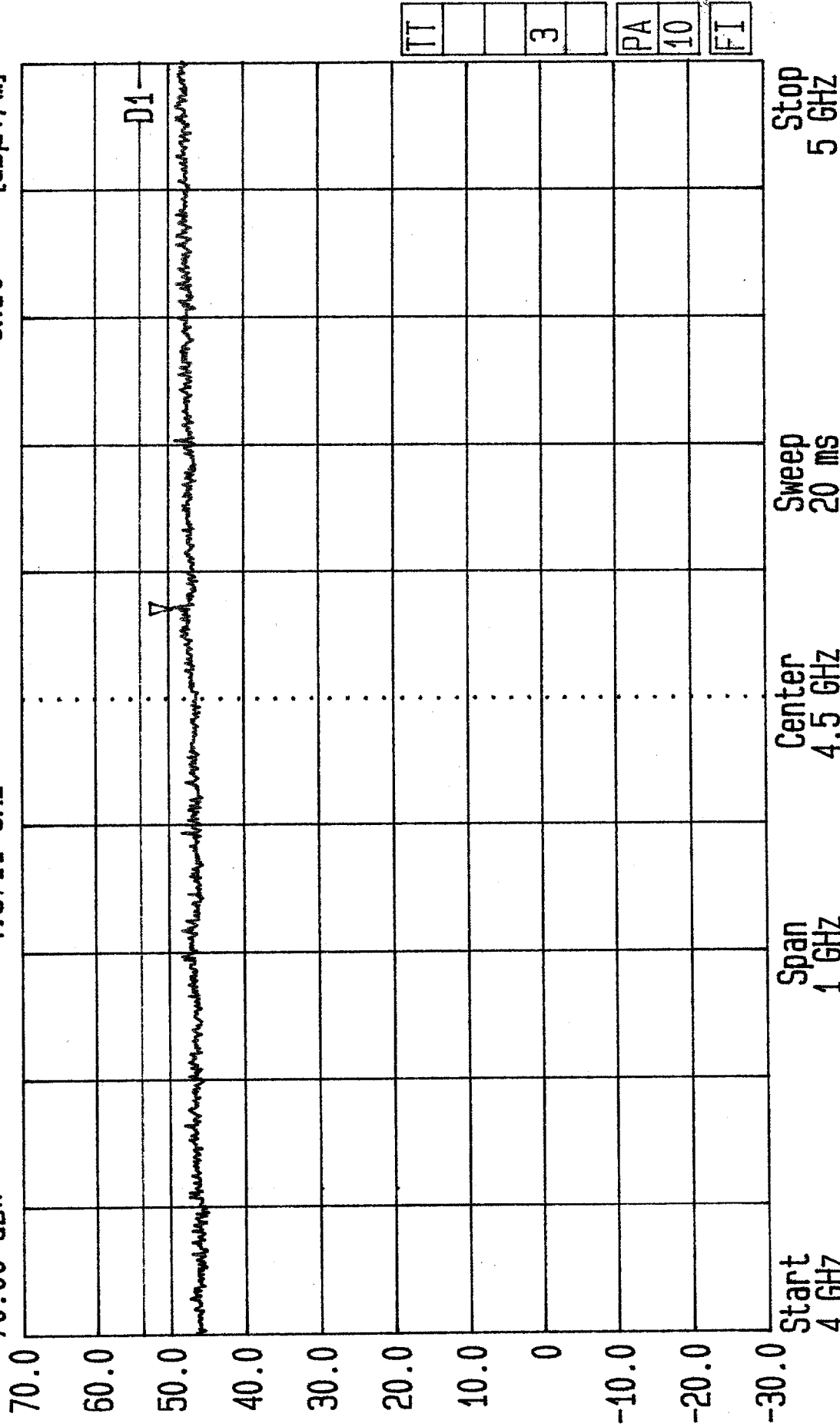


Radiated Emissions: Tested by RFI for Maynetronics Ltd. EUT: LK3A-2
FCC Part 15 Subpart C. Tx Mode
GPH/39118E02/013



Date 08.Jul.'99 Time 14:02:02
Ref.Lvl 70.00 dB*
Marker 49.61 dB*
4.5711 GHz

Res.Bw 1 MHz [imp]
TG.Lvl off
CF.Stp 100.000 MHz
Vid.Bw 1 MHz
RF.Att 0 dB
Unit [dBμV/m]



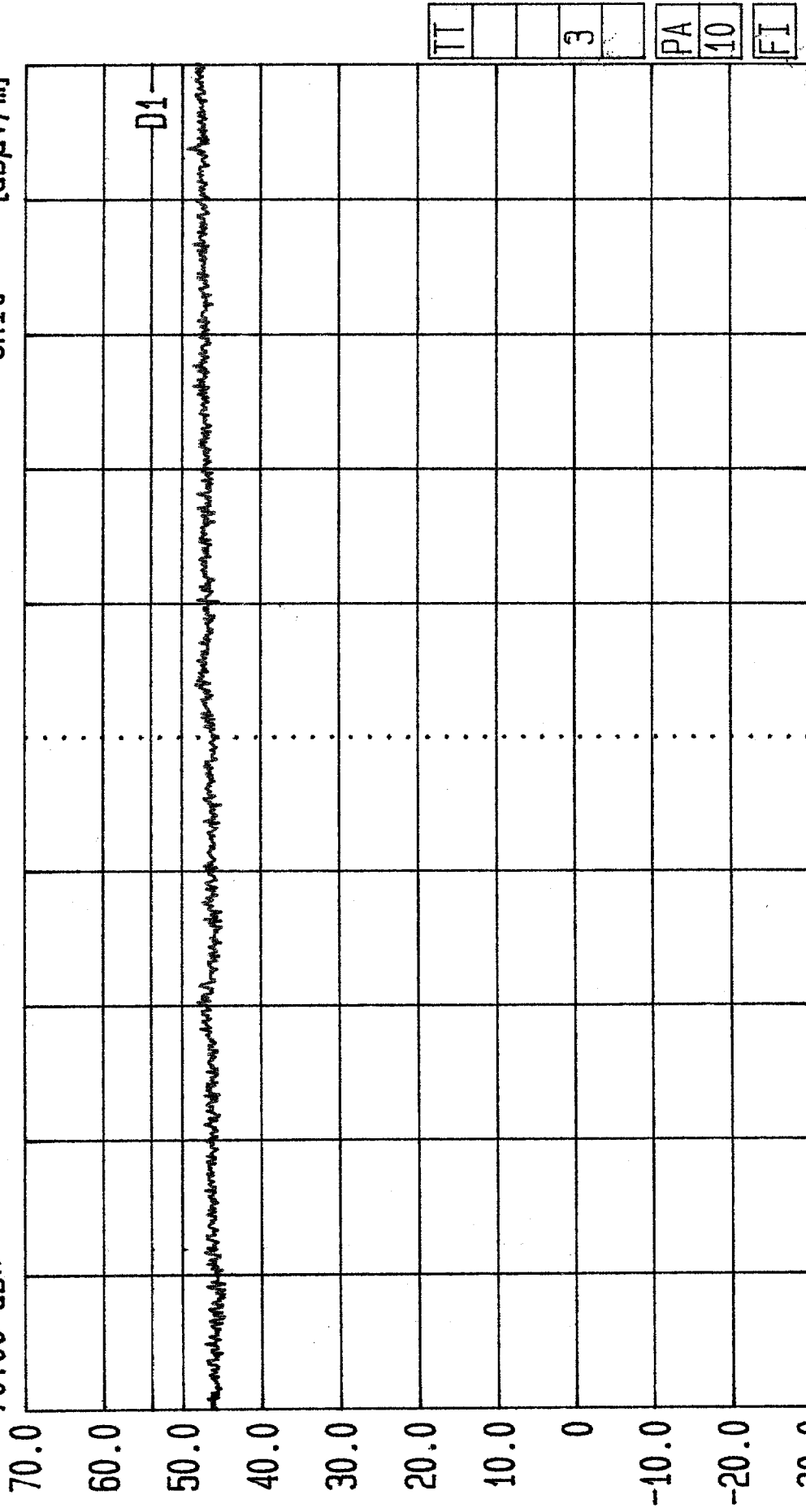
Radiated Emissions. Tested by RFI for Maynetronics Ltd. EUT: LK3A-2
FCC Part 15 Subpart C. Tx Mode GPH/39118E02/014



Date 08.Jul.'99 Time 14:10:23

Ref.Lvl
70.00 dB*

Res.Bw 1 MHz [imp]
TG.Lvl off
CF.Stp 100.000 MHz
Vid.Bw 1 MHz
RF.Att 0 dB
Unit [dBμV/m]



TT
3
PA
10
FI

Start 4 GHz
Stop 5 GHz

Span 1 GHz
Sweep 20 ms

Center 4.5 GHz

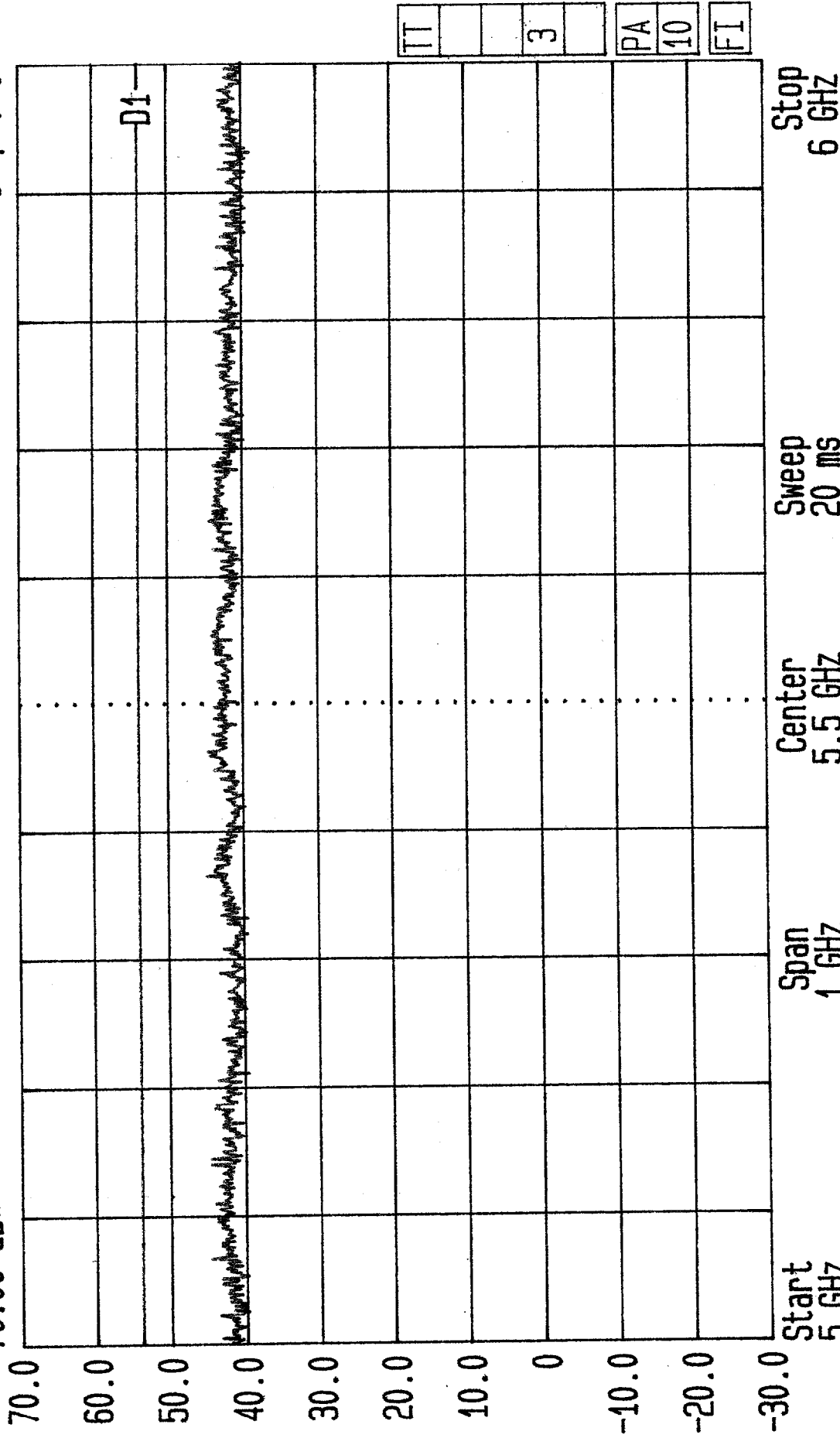
Radiated Emissions: Tested by RFI for Maynetronics Ltd. EUT: LK3A-2
FCC Part 15 Subpart C. Standby Mode GPH/39118E02/015



Date 08.Jul.'99 Time 14:14:59

Ref.Lvl
70.00 dBx

Res.Bw 1 MHz [imp]
TG.Lvl off
CF.Stp 100.000 MHz
Vid.Bw 1 MHz
RF.Att 0 dB
Unit [dBμV/m]



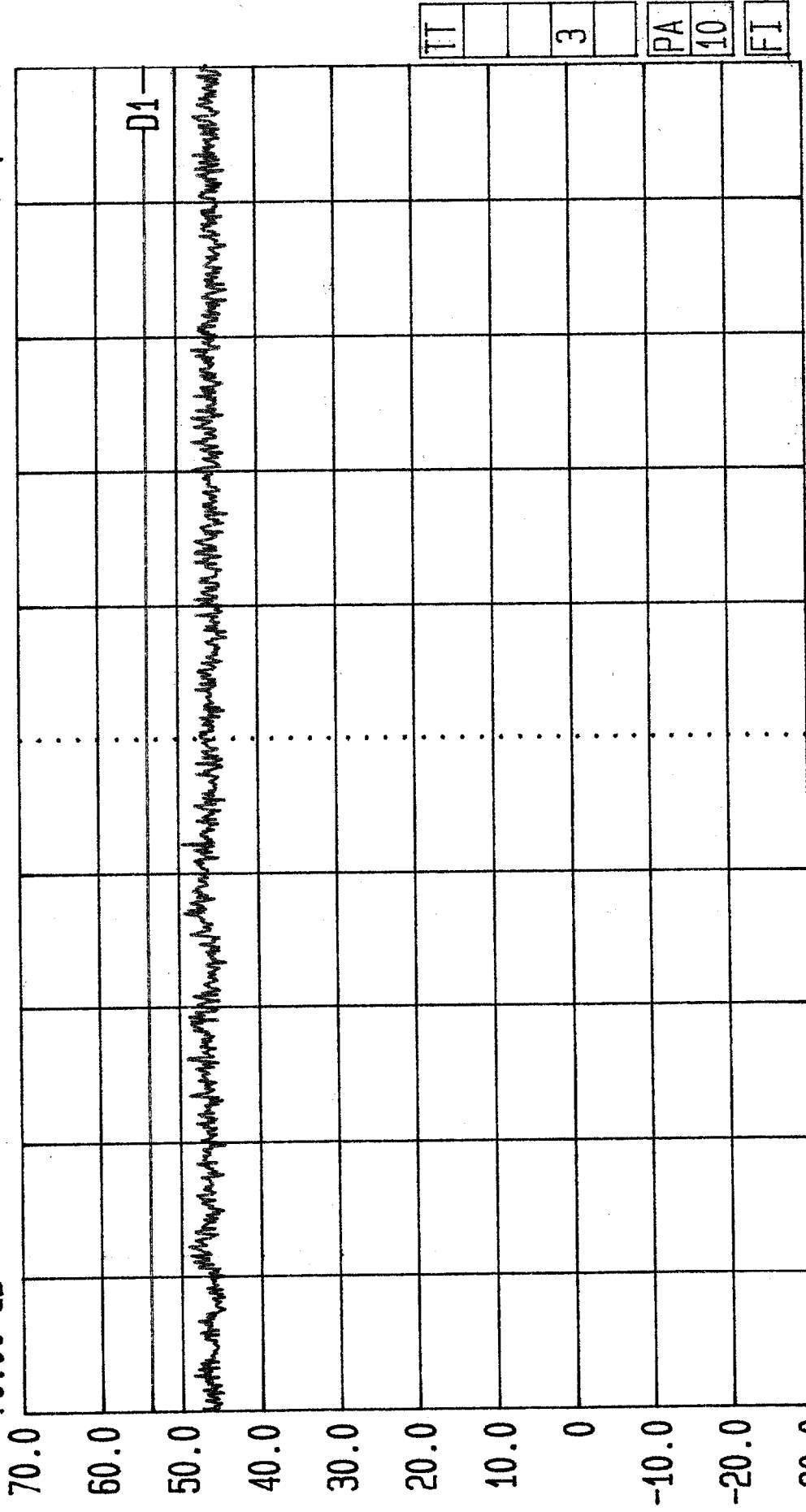
Radiated Emissions. Tested by RFI for Maynetronics Ltd. EUT: LK3A-2
FCC Part 15 Subpart C. Tx Mode GPH/39118E02/016



Date 08.Jul.'99 Time 14:19:36

Ref.Lvl
70.00 dBx

Res.Bw 1 MHz [imp]
TG.Lvl Off
CF.Stp 220.000 MHz
Vid.Bw 1 MHz
RF.Att 0 dB
Unit [dBμV/m]



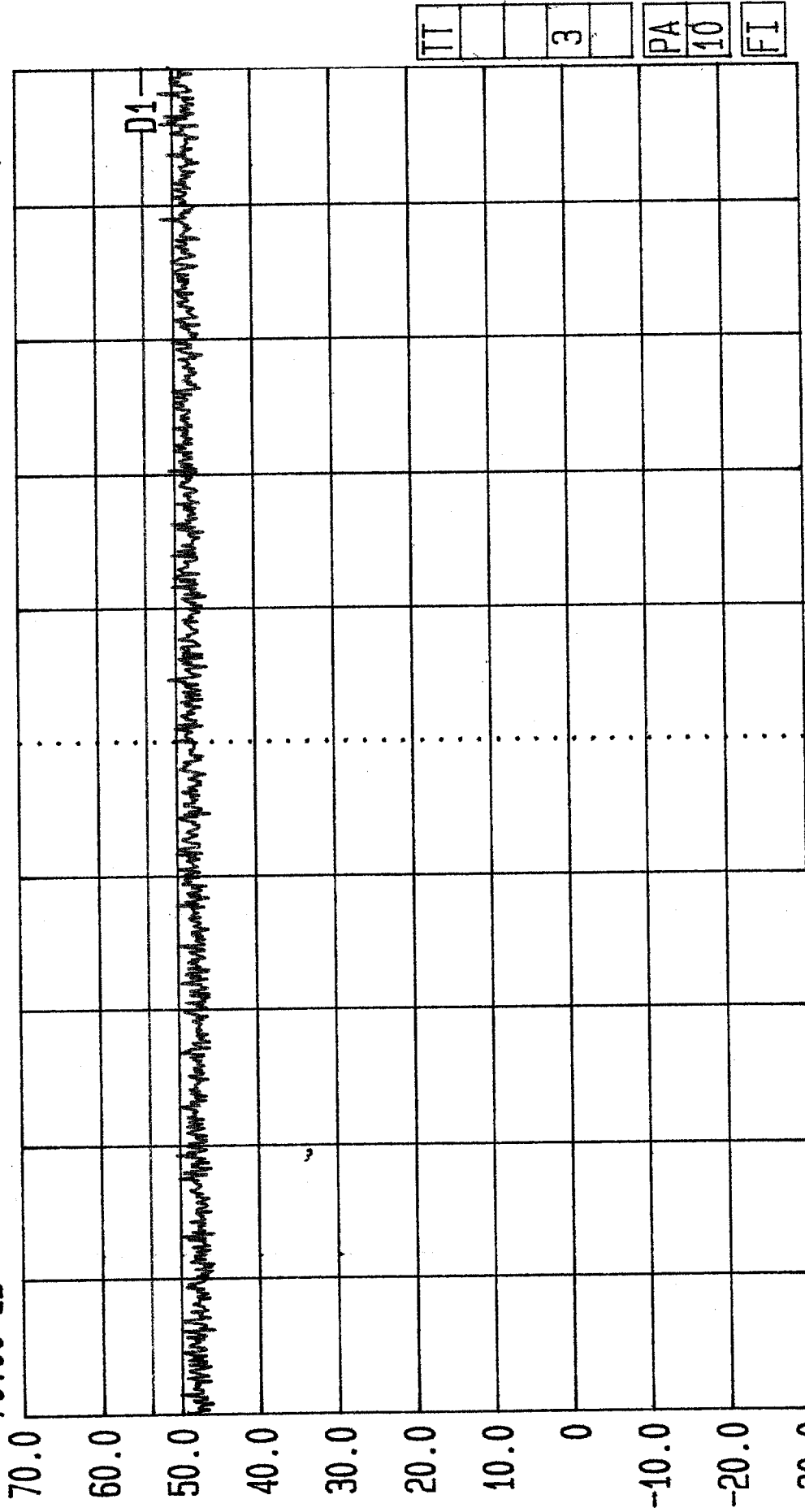
Radiated Emissions. Tested by RFI for Maynetronics Ltd. EUT: LK3A-2
FCC Part 15 Subpart C. Tx Mode GPH/39118E02/017



Date 08.Jul.'99 Time 14:37:17

Ref.Lvl
70.00 dBx

Res.Bw 1 MHz [imp] Vid.Bw 1 MHz
TG.Lvl Off RF.Att 0 dB
CF.Stp 180.000 MHz Unit [dBuV/m]



Radiated Emissions. Tested by RFI for Maynetronics Ltd. EUT: LK3A-2
FCC Part 15 Subpart C. Tx Mode GPH/39118E02/01B

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

Appendix 5. Photographs of EUT

This appendix contains the following photographs:

Photo Reference Number	Title
PHT/39118ETF02/001	Front view of conducted emissions.
PHT/39118ETF02/002	Side view of conducted emissions.
PHT/39118ETF02/003	Front view of radiated emissions.
PHT/39118ETF02/004	Rear view of radiated emissions.

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

RADIO FREQUENCY INVESTIGATION LTD.

EMC Department

Test Report

S.No. RFI/EMCB1/RP39118ETF02B

Page 34 of 34

Issue Date: 22 July 1999

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

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EMC Department

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

PHT/39118ETF02/001 Front view of conducted emissions.



EMC Department

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

PHT/39118ETF02/002 Side view of conducted emissions.



EMC Department

Test Of: Maynetronics Ltd. LK3A-2 Link Box
To: FCC Part 15 Subpart C: 1998
(Intentional Radiators)
Section 15.249

PHT/39118ETF02/003 Front view of radiated emissions.



