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TEST REPORT FROM RADIO FREQUENCY INVESTIGATION LTD.

Test Of: Madge Networks Ltd.
PCI-3 Card

To: FCC Part 15: 1996 Class B

Test Report Serial No:
RFI/EMCB1/RP36498A

This Test Report Is Issued Under The Authority Of Brian Watson, Technical Director:	
Tested By:	**Checked By:**
Report Copy No: 01	
Issue Date: 15 May 1998	**Test Date: 15 April 1998 to 17April 1998**

NTHPC13

Test Of: Madge Networks Ltd.
PCI-3 Card
To: F.C.C. Part 15: 1996 Class B

Table of Contents

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	Madge Networks Ltd
Model Name or Number	PCI-3
Unique Type Identification	151-310-01
Serial Number	C600AB
Country Of Manufacture	UK
F.C.C. ID Number	N/A
Date Of Receipt	15 April 1998

2.2. Description Of EUT

The card (EUT) provides an interface between a personal computer and a Token Ring Network.

2.3. Modifications Incorporated In EUT

None stated by client.

2.4. Additional Information Related To Testing

Power Supply Requirement:	Nominal 115 V, 60 Hz AC Mains Supply 13 Amp (max)
Intended Operating Environment:	Commercial, Light industry
Weight:	100 to 200 g
Dimensions:	PCB 130 mm x 80 mm
Interface Ports:	Two Token Ring Ports: one subminiture-D and one RJ45, either of which may be used at any one time. The subminiture-D supports IBM STP cable. The RJ45 supports either category 3 to 5 STP or category 3 to 5 UTP. The EUT is internal to the support computer and is connected to the PCI bus expansion slot.
Cycle Time:	Less than 1 sec.

Support Equipment (continued)

Description	Mouse
Brand Name	Hewlett Packard
Model Name or Number	M-S34/C3751B
Serial Number	LZB80228397
F.C.C. ID Number	DZL211029
Cable Length And Type	Integral 2 m
Connected to Port	Mouse mini DIN on support PC

Description	Printer
Brand Name	Hewlett Packard
Model Name or Number	C2164A
Serial Number	ES573120MV
F.C.C. ID Number	B94C2164X
Cable Length And Type	Parallel to Centronics 1.5 m
Connected to Port	Parallel port on PC

Description	Media Access Unit (UTP and CAT5 STP cables)
Brand Name	Madge Networks Ltd
Model Name or Number	SmartLAM/UTP
Serial Number	F9A53D
F.C.C. ID Number	Verified
Cable Length And Type	3 m UTP cable or 3 m CAT5 STP cable
Connected to Port	RJ45 socket on EUT

Description	Media Access Unit (IBM STP cable)
Brand Name	Madge Networks Ltd
Model Name or Number	SmartLAM/STP
Serial Number	F05036
F.C.C. ID Number	Verified
Cable Length And Type	2.5 m STP Cable
Connected to Port	9-Pin D-Type on EUT

Support Equipment (continued)

Description	Media Access Unit (UTP and CAT5 STP cables)
Brand Name	Madge Networks Ltd
Model Name or Number	SmartLAM/UTP
Serial Number	178000
F.C.C. ID Number	Verified
Cable Length And Type	3 m UTP cable or 3 m CAT5 STP cable
Connected to Port	RJ45 socket on EUT

4. Deviations From The Test Specification

It should be noted that for the radiated emission testing using the remote network, the monitor, PC and SmartLAM, which were situated remotely to the equipment under test and were all powered via a 230 V, 50 Hz AC.

6. Summary Of Test Results

6.1. Conducted Emissions

Range Of Measurements	Specification Reference	Compliancy Status
AC Powerline Conducted Emissions, 450 kHz to 30 MHz	Section 15 of C.F.R. 47: 1996	Complied

6.2. Radiated Emissions

Range Of Measurements	Specification Reference	Compliancy Status
Electric Field Strength, 30 MHz to 1000 MHz	Section 15 of C.F.R. 47: 1996	Complied

6.3. 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.

7.2. Test Results For AC Mains Conducted Emissions: UTP Cable

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

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

7.2.1.2. 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
0.500	Live	34.2	48.0	13.8	Complied
0.500	Neutral	33.2	48.0	14.8	Complied
0.572	Live	28.8	48.0	19.2	Complied
6.266	Live	38.4	48.0	9.6	Complied
6.280	Neutral	38.2	48.0	9.8	Complied
15.020	Neutral	29.0	48.0	19.0	Complied
16.000	Live	38.8	48.0	9.2	Complied
16.000	Neutral	39.5	48.0	8.5	Complied

7.4. Test Results For AC Mains Conducted Emissions: CAT5 STP Cable

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

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

7.4.1.2. 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
0.499	Live	34.0	48.0	14.0	Complied
0.500	Neutral	33.7	48.0	14.3	Complied
0.570	Live	29.0	48.0	19.0	Complied
0.570	Neutral	28.2	48.0	19.8	Complied
6.265	Neutral	38.4	48.0	9.6	Complied
6.266	Live	38.6	48.0	9.4	Complied
16.000	Live	45.0	48.0	3.0	Complied
16.000	Neutral	45.0	48.0	3.0	Complied

7.6. Test Results For Radiated Emissions: UTP Cable (continued)

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
539.974	Horiz.	35.9	46.0	10.1	Complied
689.967	Horiz.	35.7	46.0	10.3	Complied
751.100	Horiz.	26.4	46.0	19.6	Complied

Notes

1. Due to high ambient signals, close to the relevant frequency shown, a substitution method was carried out to determine the level of the emission. This involved replacing the EUT with a signal generator and radiator on the Open Area Test Site and generating a signal level above the unwanted ambient level of at least 10 dB and measuring this level at the receiver. The signal generator and radiator were then taken to the screened room where the previous EUT scans had been performed and the same signal level used on the Open Area Test Site was generated. This level was again measured at the receiver and noted. The EUT was then configured in the screened room and the emission in question was measured using the relevant detector. The difference in amplitude between the received level on the Open Area Test Site (in dB) and the received level in the screened room (in dB) was subtracted from the maximum level measured from the EUT at the relevant frequency in the screened room. All levels taken on the Open Area Test Site were maximised by varying the antenna height and rotating the turntable by 360 degrees. The measurements taken in the screened room were maximised by rotating the turntable by 360 degrees. All measurements were taken using a Quasi-peak detector.

7.8. Test Results For Radiated Emissions: IBM STP Cable (continued)

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
241.132	Horiz.	32.4	46.0	13.6	Complied
248.185	Horiz.	29.9	46.0	16.1	Complied
255.621	Horiz.	29.8	46.0	16.2	Complied
269.987	Horiz.	38.3	46.0	7.7	Complied
419.980	Horiz.	35.3	46.0	10.7	Complied
479.977	Horiz.	37.6	46.0	8.4	Complied
689.967	Horiz.	35.4	46.0	10.6	Complied
800.066	Horiz.	40.0	46.0	6.0	Complied

Notes

1. Due to high ambient signals, close to the relevant frequency shown, a substitution method was carried out to determine the level of the emission. This involved replacing the EUT with a signal generator and radiator on the Open Area Test Site and generating a signal level above the unwanted ambient level of at least 10 dB and measuring this level at the receiver. The signal generator and radiator were then taken to the screened room where the previous EUT scans had been performed and the same signal level used on the Open Area Test Site was generated. This level was again measured at the receiver and noted. The EUT was then configured in the screened room and the emission in question was measured using the relevant detector. The difference in amplitude between the received level on the Open Area Test Site (in dB) and the received level in the screened room (in dB) was subtracted from the maximum level measured from the EUT at the relevant frequency in the screened room. All levels taken on the Open Area Test Site were maximised by varying the antenna height and rotating the turntable by 360 degrees. The measurements taken in the screened room were maximised by rotating the turntable by 360 degrees. All measurements were taken using a Quasi-peak detector.

7.10. Test Results For Radiated Emissions: CAT5 STP Cable (continued)

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
359.983	Vert.	40.3	46.0	5.7	Complied
479.977	Horiz.	31.4	46.0	14.6	Complied
599.971	Horiz.	37.0	46.0	9.0	Complied
640.053	Vert.	33.3	46.0	12.7	Complied (Note 1)
689.967	Vert.	30.6	46.0	15.4	Complied
782.842	Horiz.	27.1	46.0	18.9	Complied

Notes

1. Due to high ambient signals, close to the relevant frequency shown, a substitution method was carried out to determine the level of the emission. This involved replacing the EUT with a signal generator and radiator on the Open Area Test Site and generating a signal level above the unwanted ambient level of at least 10 dB and measuring this level at the receiver. The signal generator and radiator were then taken to the screened room where the previous EUT scans had been performed and the same signal level used on the Open Area Test Site was generated. This level was again measured at the receiver and noted. The EUT was then configured in the screened room and the emission in question was measured using the relevant detector. The difference in amplitude between the received level on the Open Area Test Site (in dB) and the received level in the screened room (in dB) was subtracted from the maximum level measured from the EUT at the relevant frequency in the screened room. All levels taken on the Open Area Test Site were maximised by varying the antenna height and rotating the turntable by 360 degrees. The measurements taken in the screened room were maximised by rotating the turntable by 360 degrees. All measurements were taken using a Quasi-peak detector.

7.12. Test Results For Radiated Emissions: UTP Cable with Remote Network (continued)

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
269.987	Horiz.	44.8	46.0	1.2	Complied
299.986	Horiz.	32.7	46.0	13.3	Complied
466.679	Vert.	28.7	46.0	17.3	Complied
479.977	Vert.	31.9	46.0	14.1	Complied
689.967	Horiz.	38.0	46.0	8.0	Complied

Appendix 1. Test Equipment Used

Instrument	Manufacturer	Model	RFI No.
Screened Enclosure: Emissions			
Receiver / Spectrum Analyser System	R & S	ESBI	M088
Pulse Limiter	R & S	ESH3-Z2	A287
Biconnical Antenna	EMCO	3104C	A073
Log Spiral Antenna	EMCO	3101	A023
Single Phase LISN	R & S	ESH3-Z5	A191
Site 12	RFI	12	S212
Open Area Test Site			
Receiver	R & S	ESVP	M002
Spectrum Monitor	R & S	EZM	M003
Bilog Antenna	Chase	CBL6111	A259
Narda Attenuator	Narda	771-03	A262
OATS Positioning Controller	R & S	HCC	A276
OATS Antenna Mast	R & S	HCM	A277
Temperature/Humidity Meter	RS Comp	212-214	M117
Site 1	RFI	1	S201

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

A2.1.5. 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

A2.2.7. 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	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

Test Of: Madge Networks Ltd.
PCI-3 Card
To: F.C.C. Part 15: 1996 Class B

DRG\36498JD01ETF02\EMICON

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. Floor mounted equipment is placed on a horizontal earth reference plane.

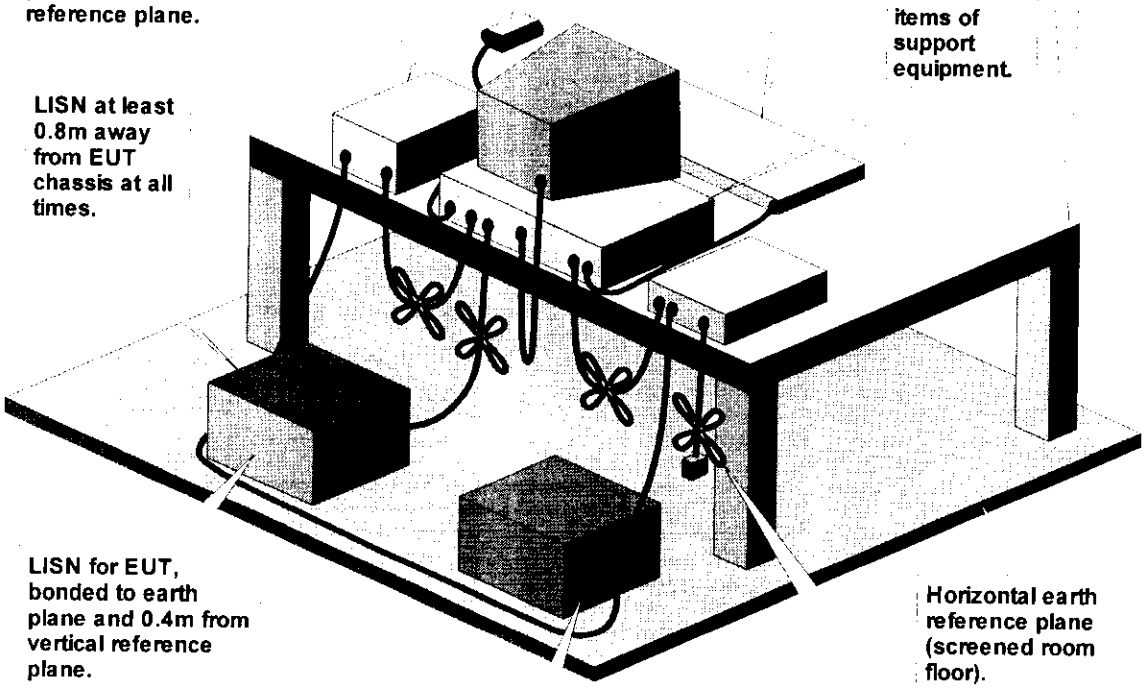
Support equipment in a typical configuration.

Cables of hand operated devices (eg mouse and keyboard) placed as close as possible to host

Wooden support table 1.5m by 1m by 0.8m high above horizontal earth reference plane.

EUT 0.1m from all items of support equipment.

LISN at least 0.8m away from EUT chassis at all times.



LISN for EUT, bonded to earth plane and 0.4m from vertical reference plane.

Horizontal earth reference plane (screened room floor).

Test receiver system.

Control Area

LISN for support items, bonded to earth plane and 0.4m from vertical reference plane.

Cables that hang closer than 0.4m from reference plane non-inductively folded in 0.4m long bundles hanging 0.4 m below table top.

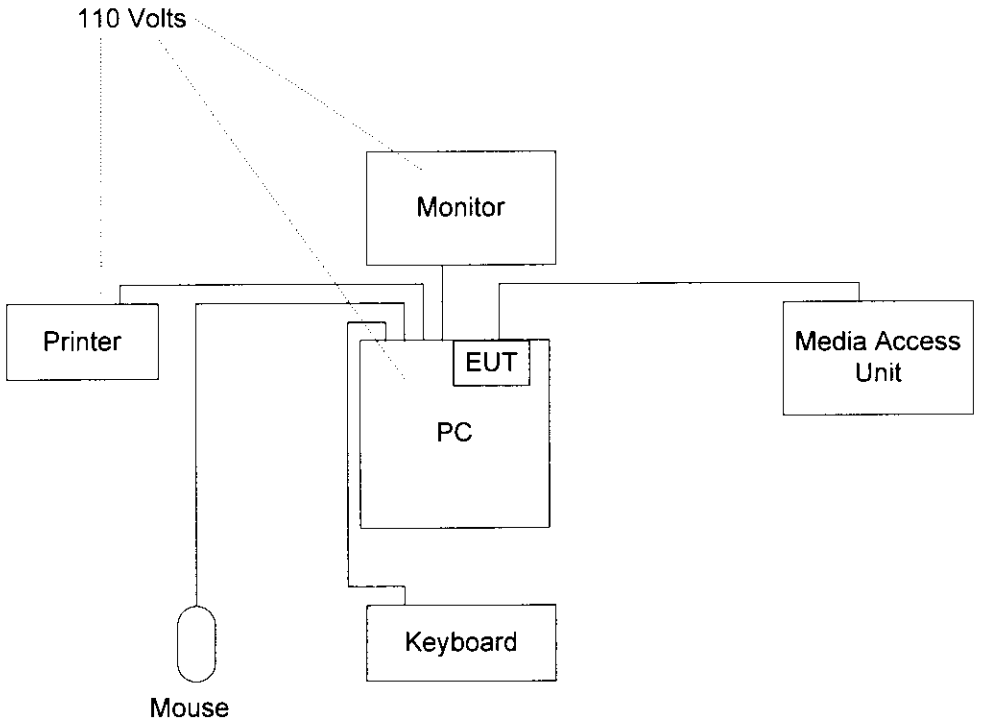
Typical Test Configuration For Conducted Emissions Measurements In Accordance With ANSI C63.4-1992

Tests performed in a screened enclosure

Test Of: Madge Networks Ltd.
PCI-3 Card
To: F.C.C. Part 15: 1996 Class B

DRG\36498JD01ETF02\001

Configuration of EUT and Support Equipment

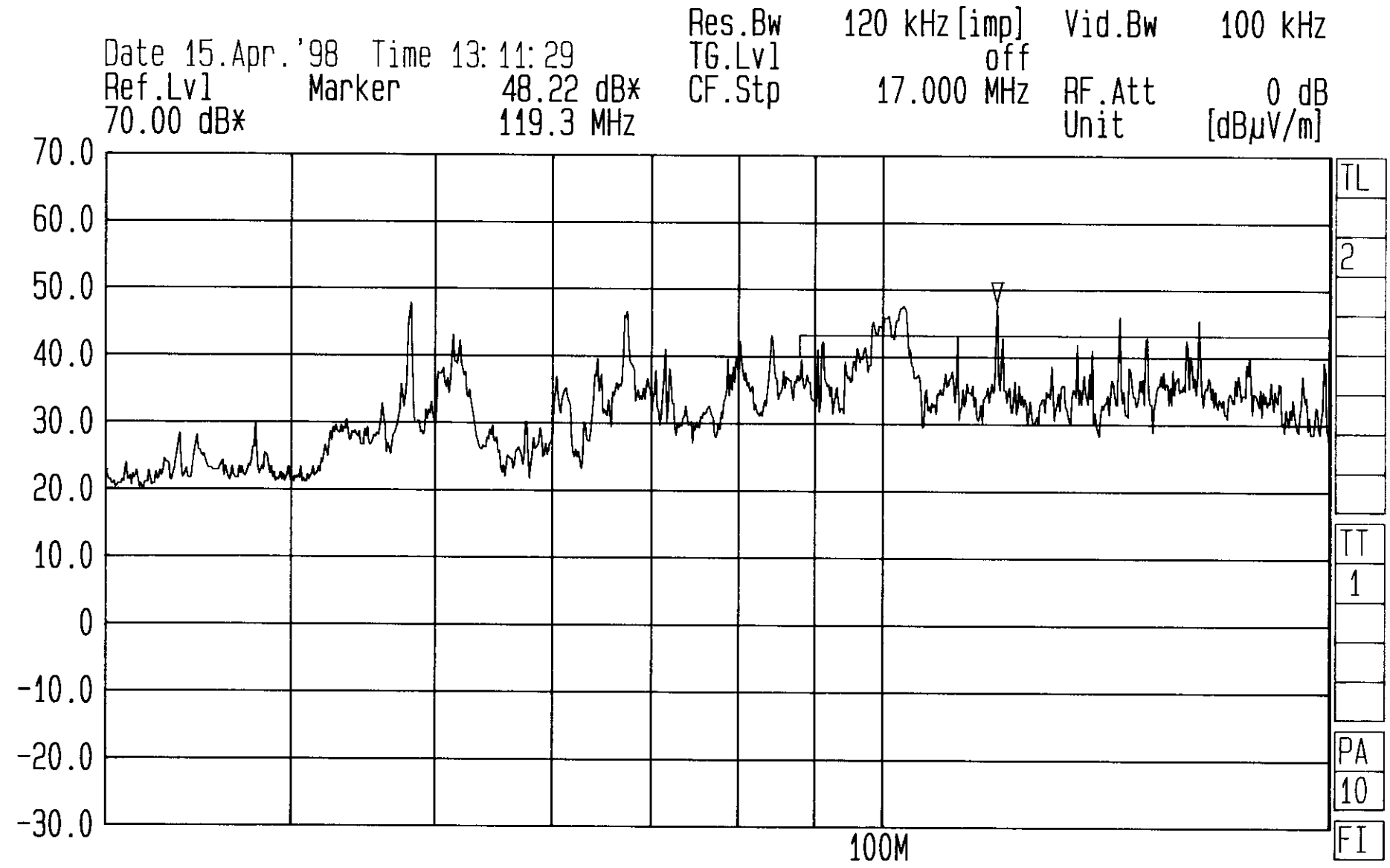


Appendix 4. Graphical Test Results

This appendix contains the following graphs:

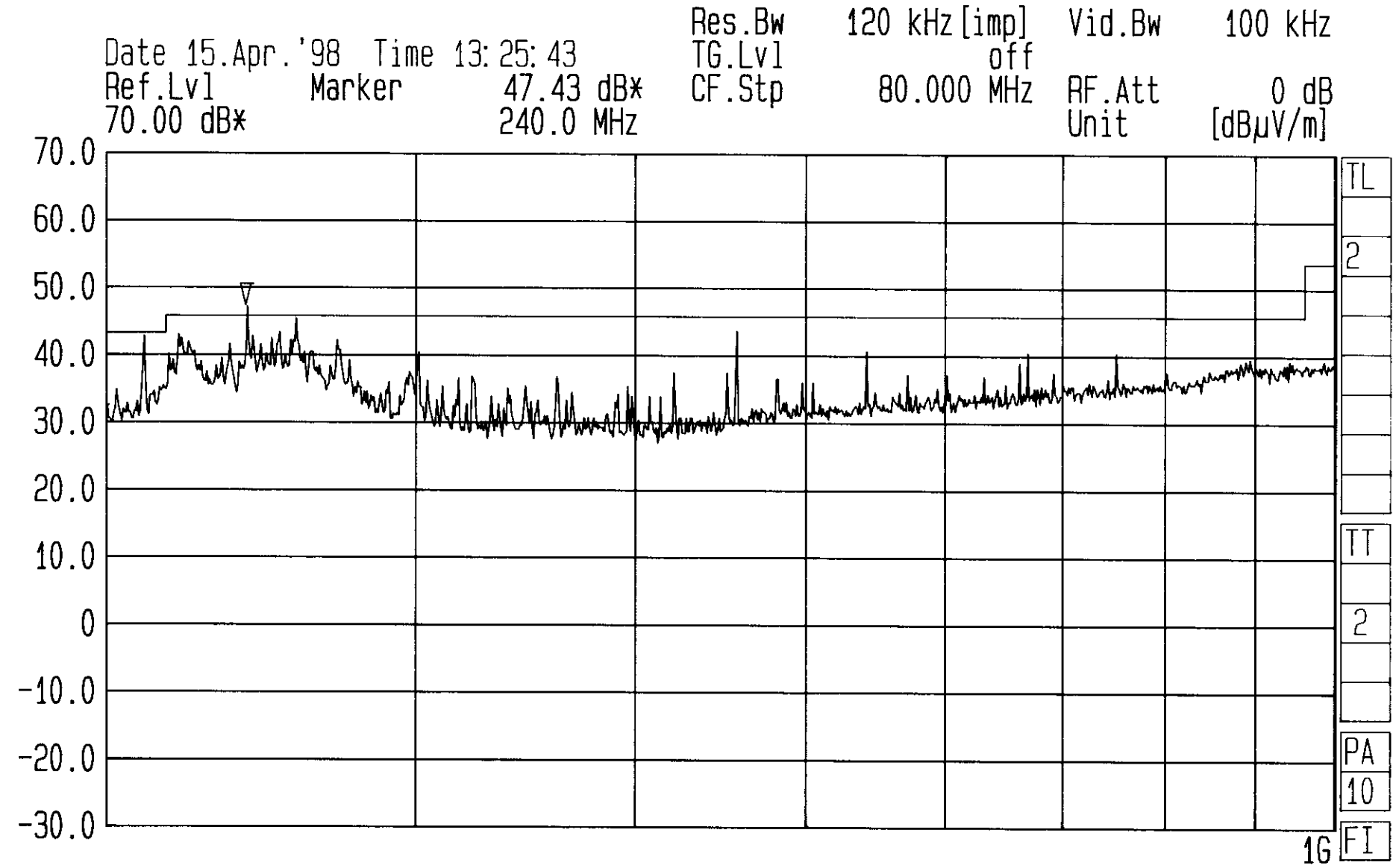
Graph Reference Number	Title
GPH\36948\ETF02\001	Scan of radiated electric field: (30 to 200 MHz) UTP Cable
GPH\36948\ETF02\002	Scan of radiated electric field: (200 to 1000 MHz) UTP Cable
GPH\36948\ETF02\003	Scan of radiated electric field: (30 to 200 MHz) IBM STP Cable
GPH\36948\ETF02\004	Scan of radiated electric field: (200 to 1000 MHz) IBM STP Cable
GPH\36948\ETF02\005	Scan of radiated electric field: (30 to 200 MHz) CAT5 STP Cable
GPH\36948\ETF02\006	Scan of radiated electric field: (200 to 1000 MHz) CAT5 STP Cable
GPH\36948\ETF02\007	Scan of conducted emissions: (450 kHz to 30 MHz) live line, IBM STP Cable
GPH\36948\ETF02\008	Scan of conducted emissions: (450 kHz to 30 MHz) neutral line, IBM STP Cable
GPH\36948\ETF02\009	Scan of conducted emissions: (450 kHz to 30 MHz) live line, UTP Cable
GPH\36948\ETF02\010	Scan of conducted emissions: (450 kHz to 30 MHz) neutral line, UTP Cable
GPH\36948\ETF02\011	Scan of conducted emissions: (450 kHz to 30 MHz) live line, CAT5 STP Cable
GPH\36948\ETF02\012	Scan of conducted emissions: (450 kHz to 30 MHz) neutral line, CAT5 STP Cable
GPH\36948\ETF02\101	Scan of radiated electric field: (30 to 200 MHz) UTP Cable with Remote Network
GPH\36948\ETF02\102	Scan of radiated electric field: (200 to 1000 MHz) UTP Cable with Remote Network

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



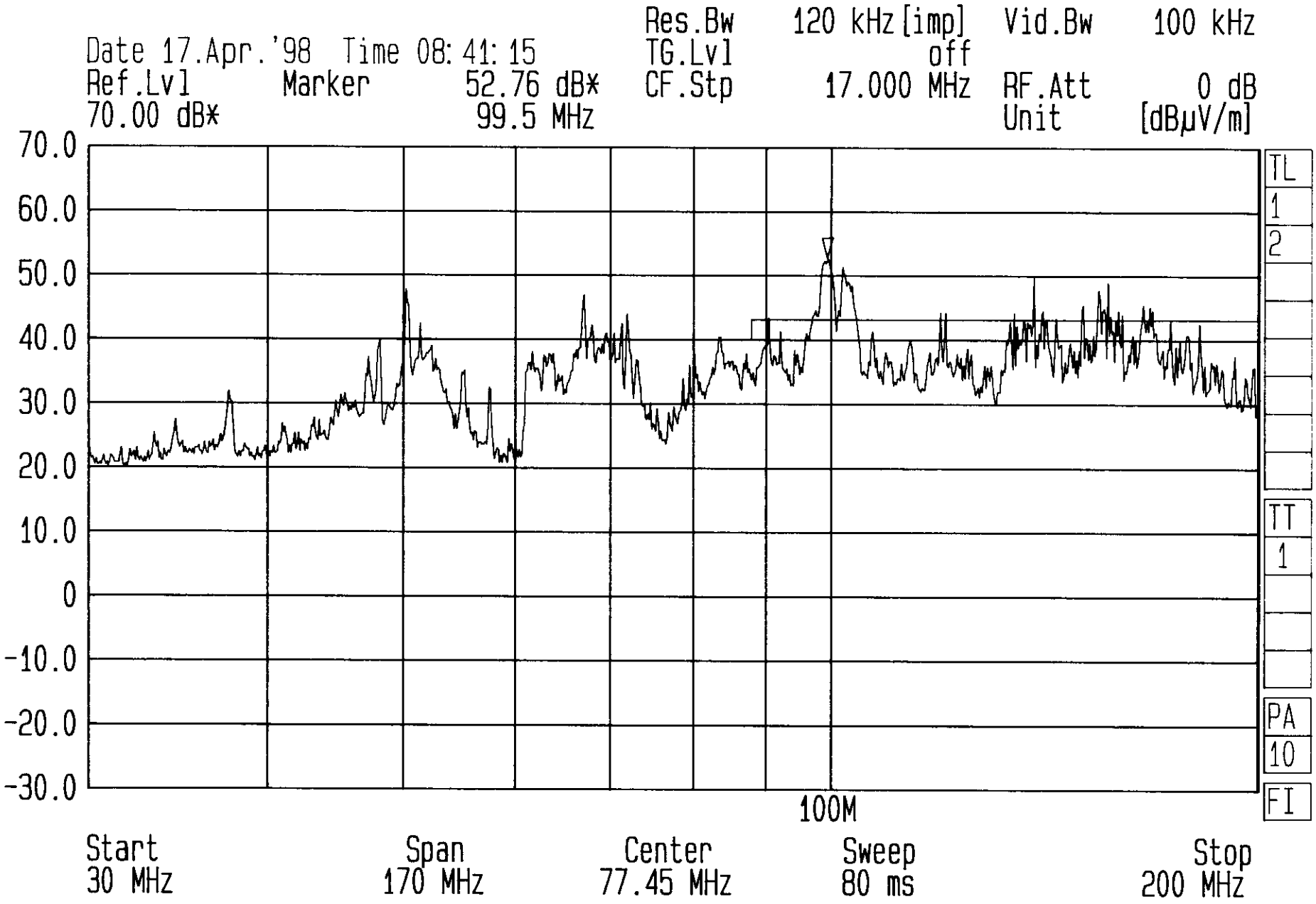
Radiated. Tested by RFI For Madge. EUT: PCI-3 UTP Cable
Limit Lines: QP Limits. 3m Screened Room Scan.

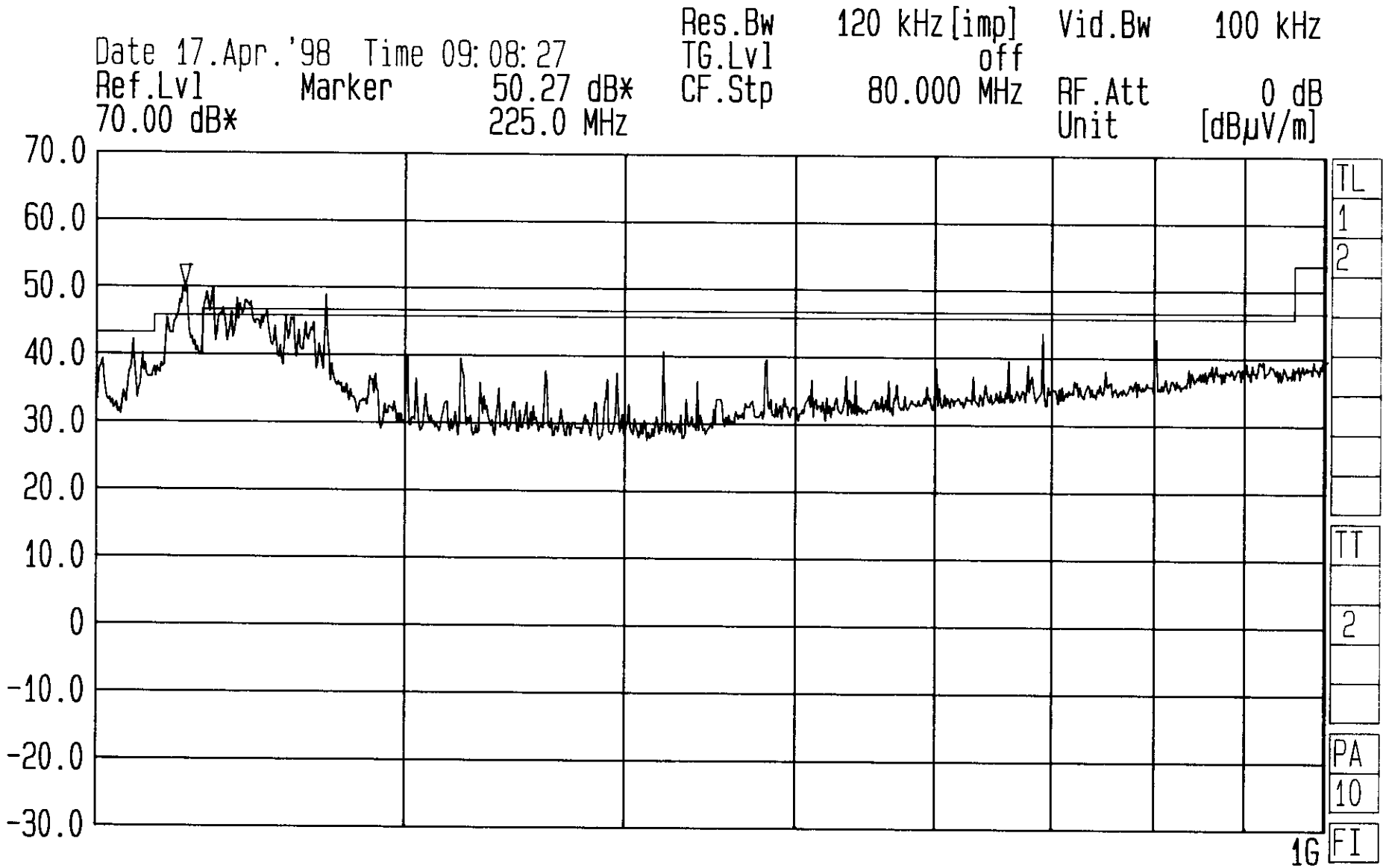
FCC/B
GPH/36498/ETF02/001



Radiated. Tested by RFI For Madge. EUT: PCI-3 UTP Cable
Limit Lines: QP Limits. 3m Screened Room Scan.

FCC/B
GPH/36498/ETF02/002


Res.Bw 120 kHz [imp] Vid.Bw 100 kHz
Date 17.Apr.'98 Time 08:41:15 TG.Lvl off
Ref.Lvl Marker 52.76 dB* CF.Stp 17.000 MHz RF.Att 0 dB
70.00 dB* 99.5 MHz Unit [dBµV/m]
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
-20.0
-30.0
TL
1
2
TT
1
PA
10
FI
100M
Start 30 MHz
Span 170 MHz
Center 77.45 MHz
Sweep 80 ms
Stop 200 MHz
Radiated. Tested by RFI For Madge. EUT: PCI-3 C600AB FCC/B EN55022/B
Limit Lines: QP Limit. 3m Screened Room Scan. IBM STP GPH/36498/ETF02/003



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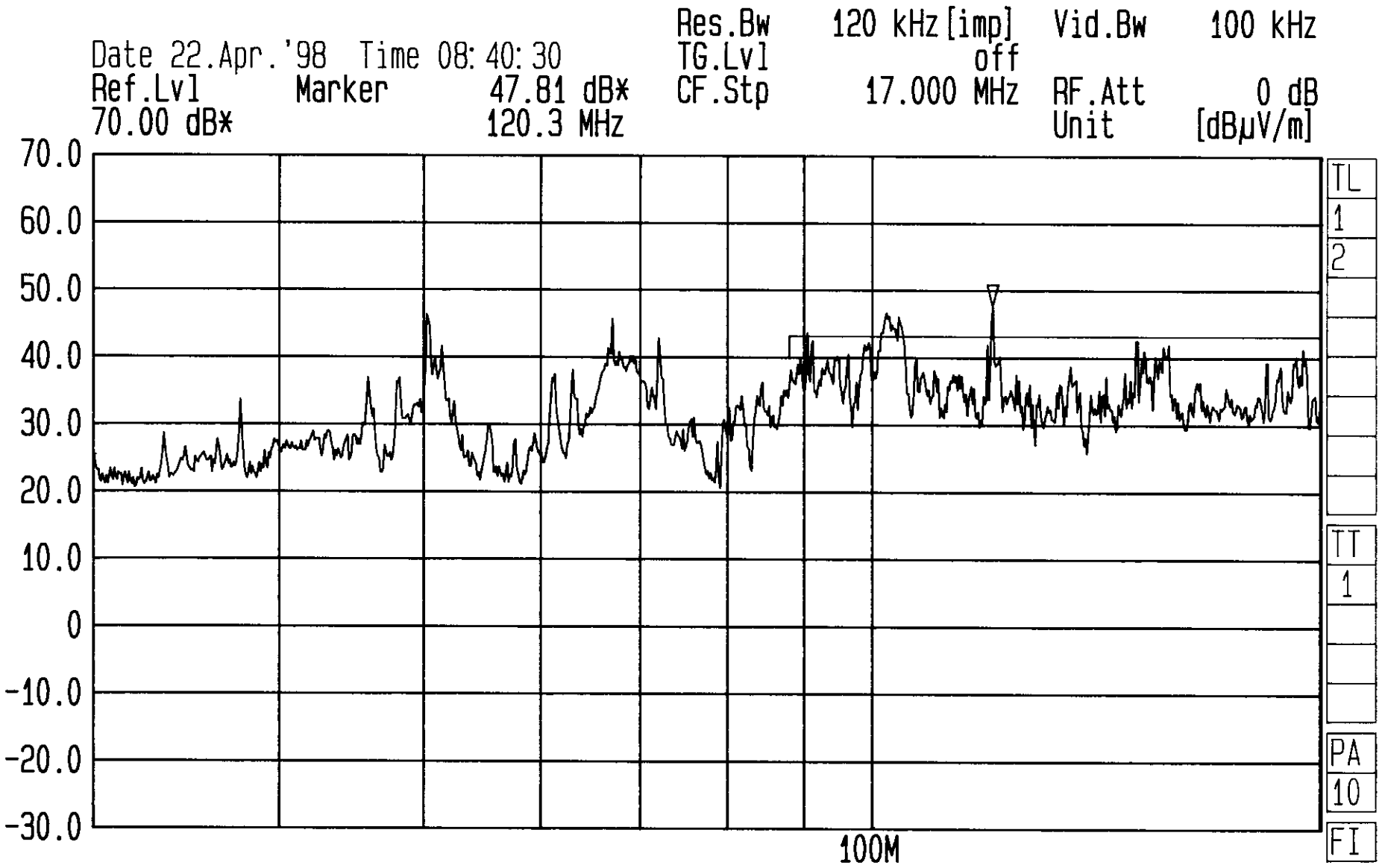

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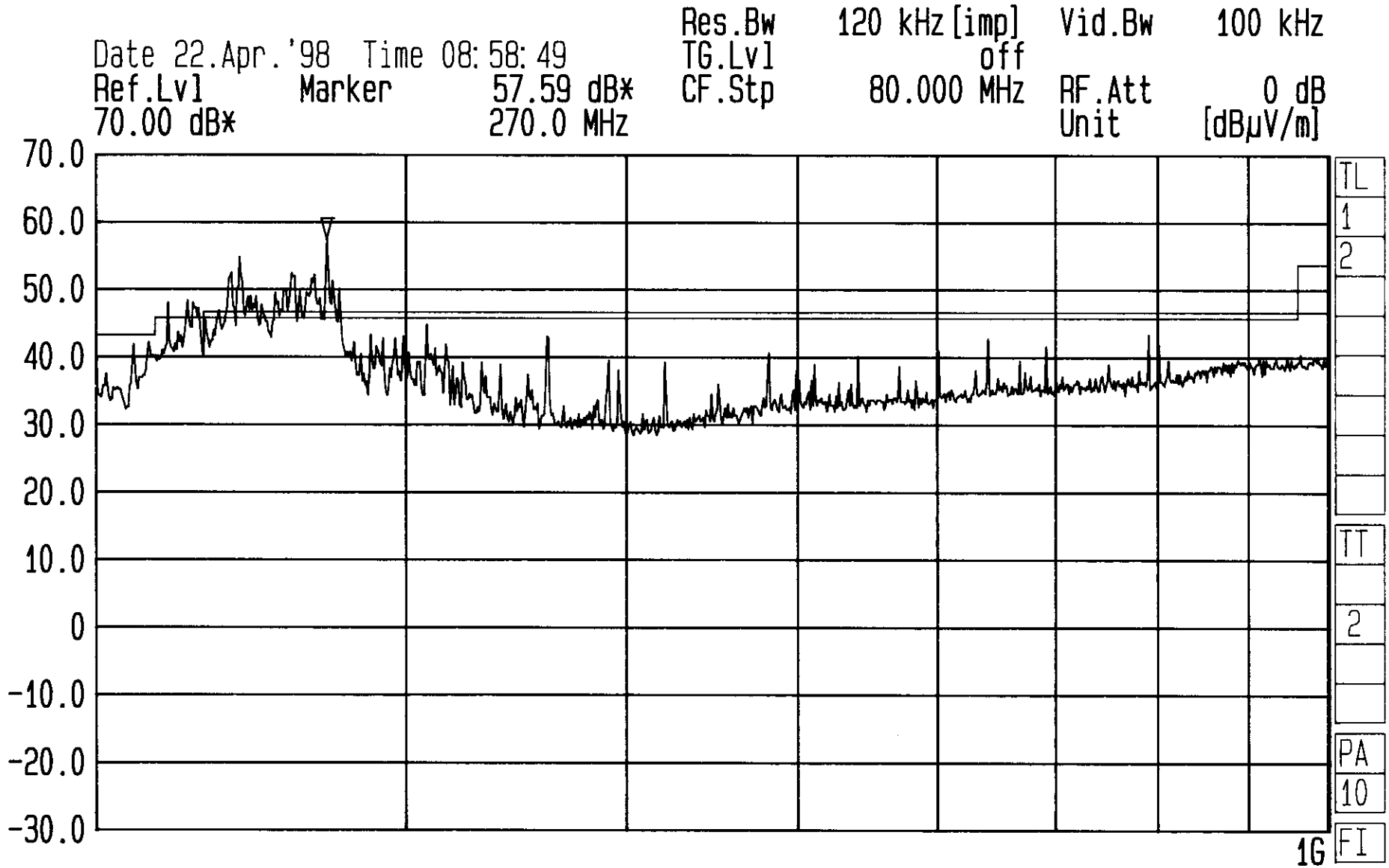
Limit Lines: QP Limits. 3m Screened Room Scan. EN55022/B GPH/36498/ETF02/005



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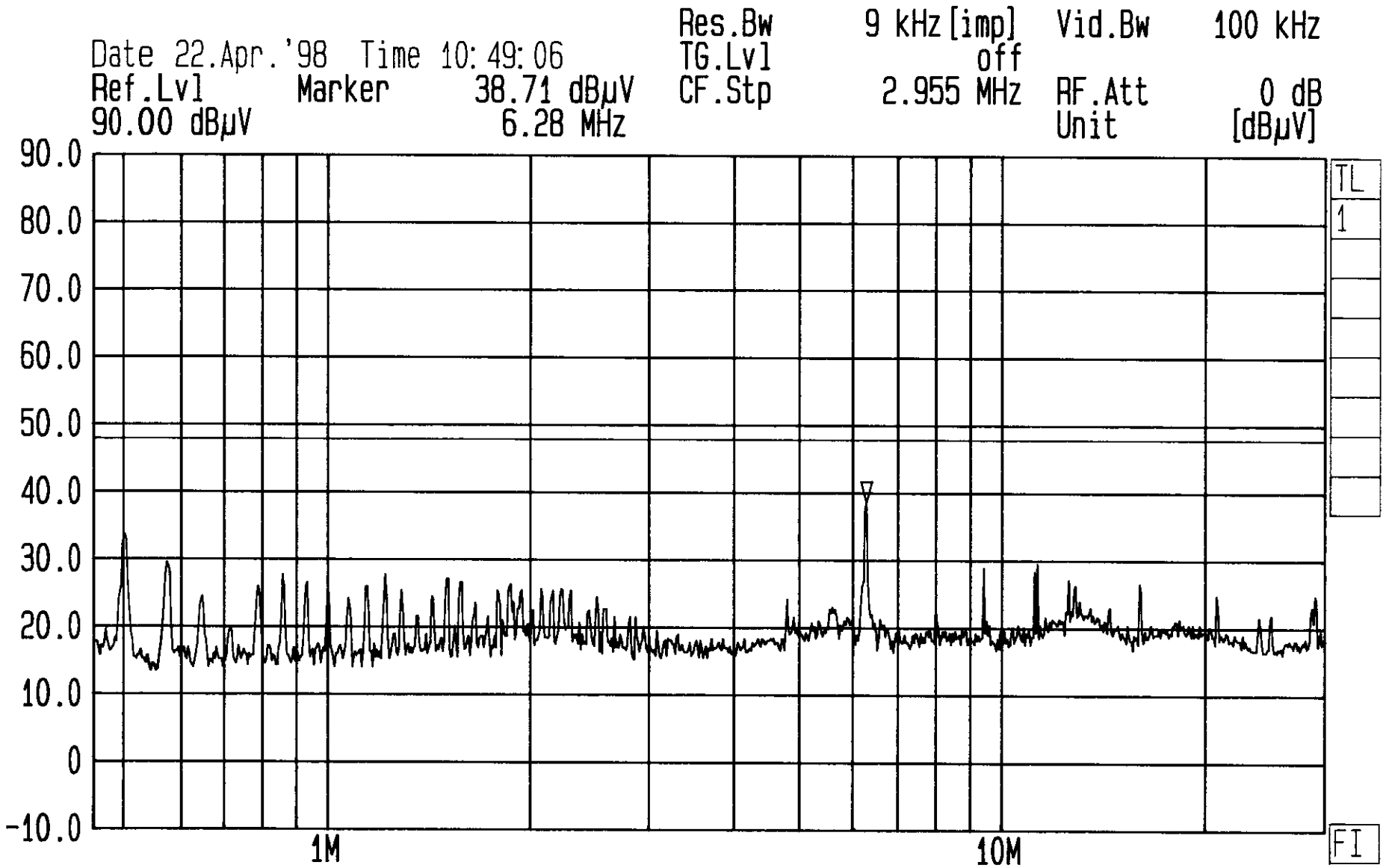
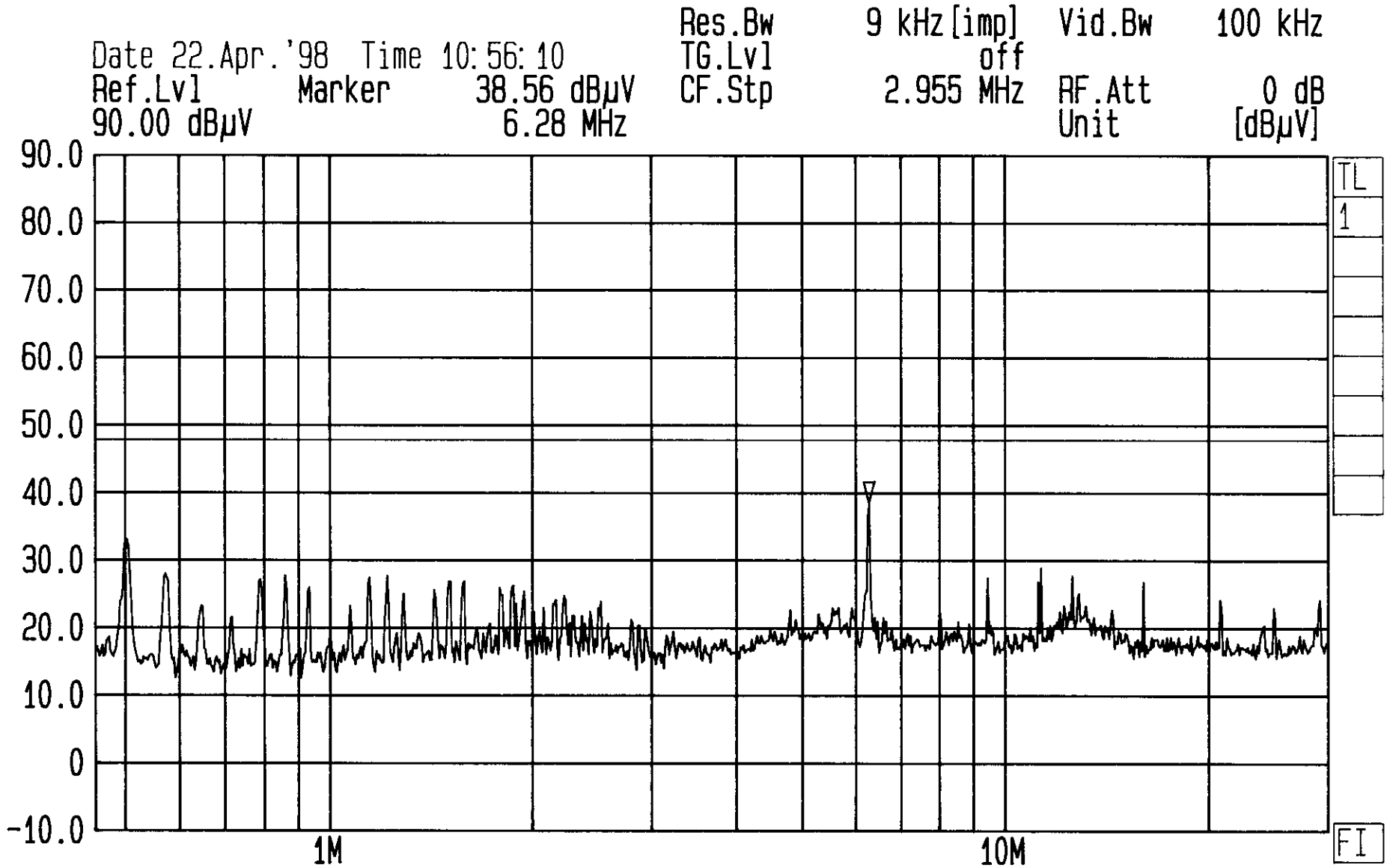
Limit Lines: QP Limits. 3m Screened Room Scan. EN55022/B GPH/36498/ETF02/006



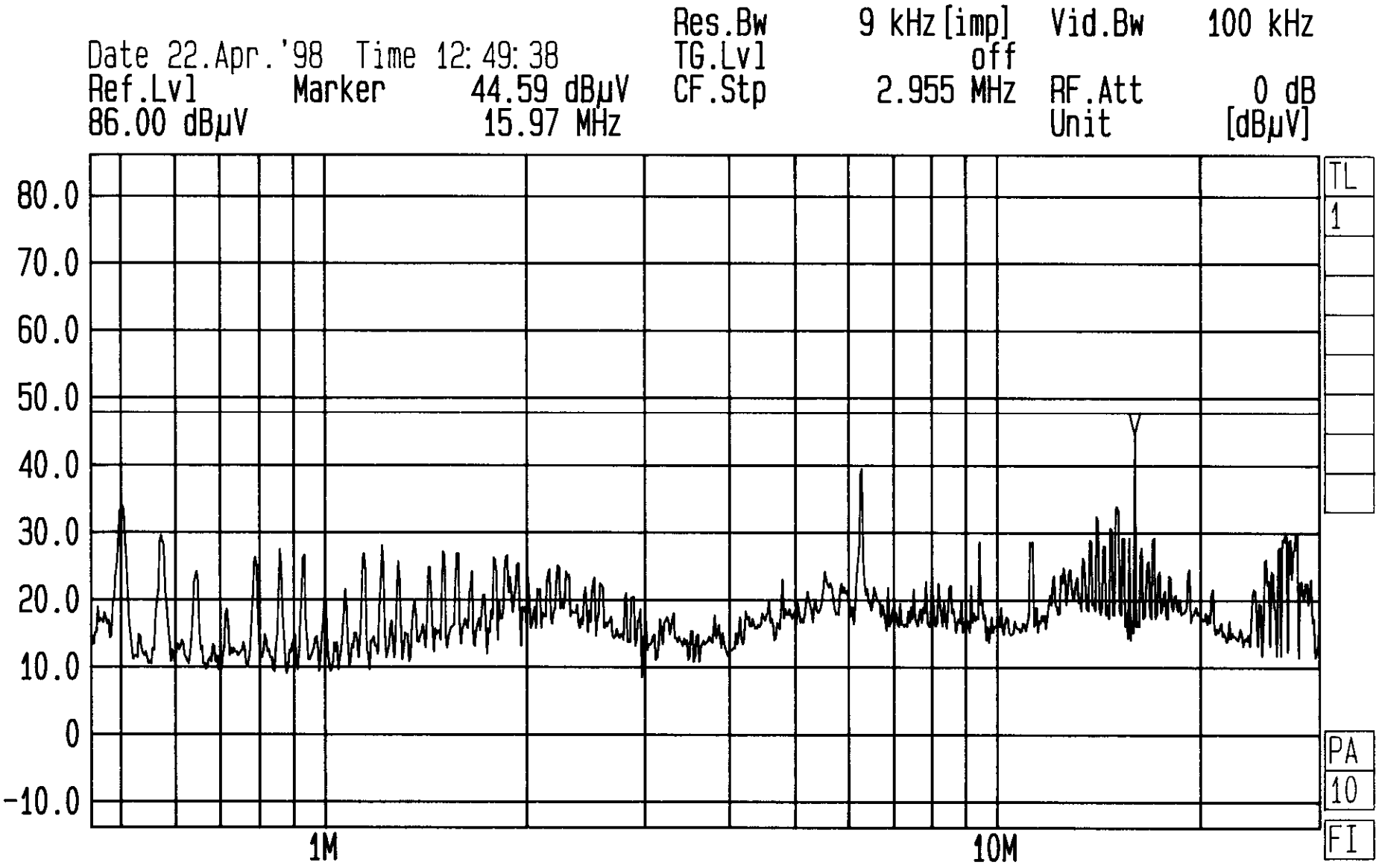
Conducted. Tested by RFI for Madge. EUT: PCI-3 IBM STP Cable. FCC/B

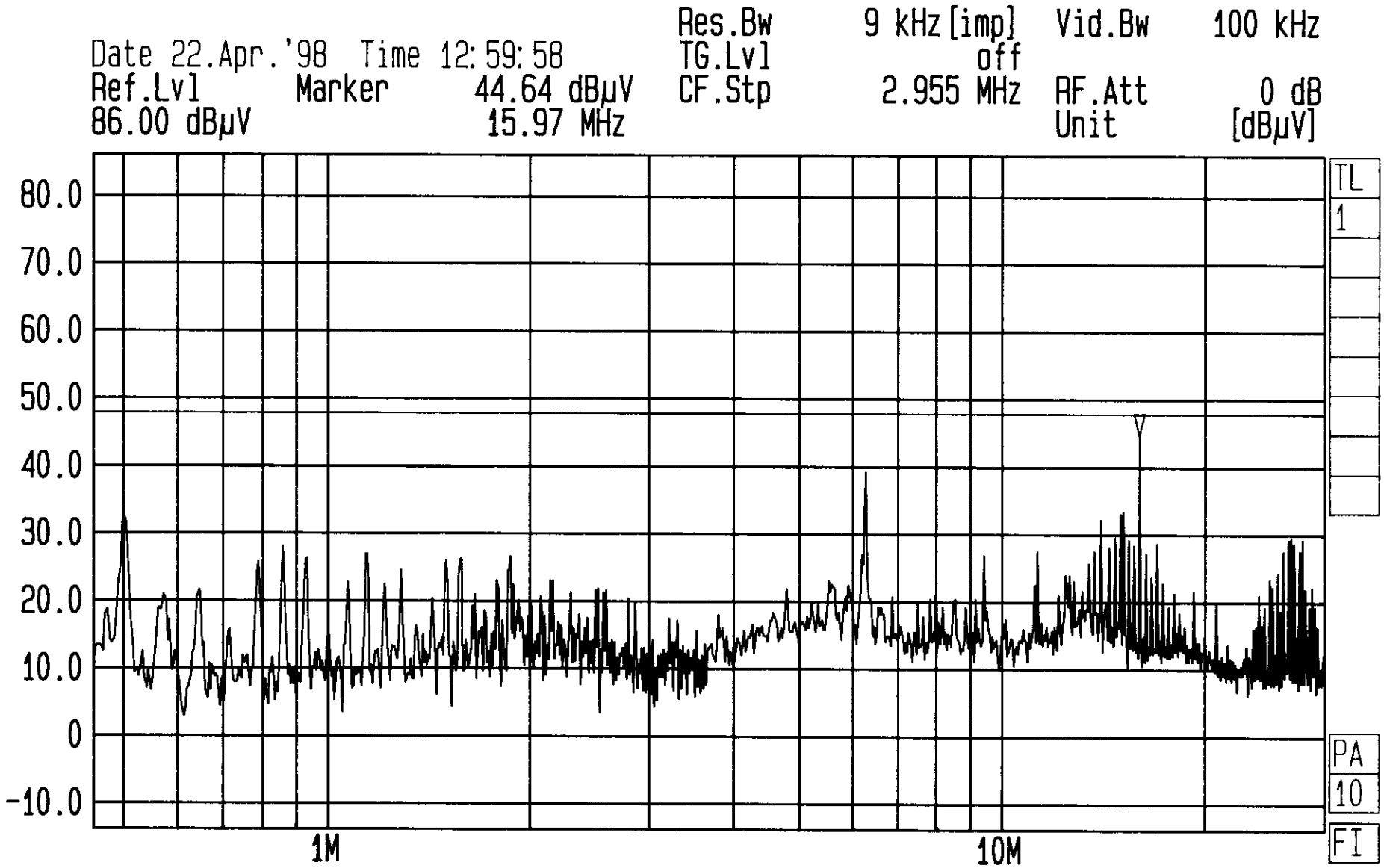
Limit Line: QP Limit. Live Line GPH/36498/ETF02/007

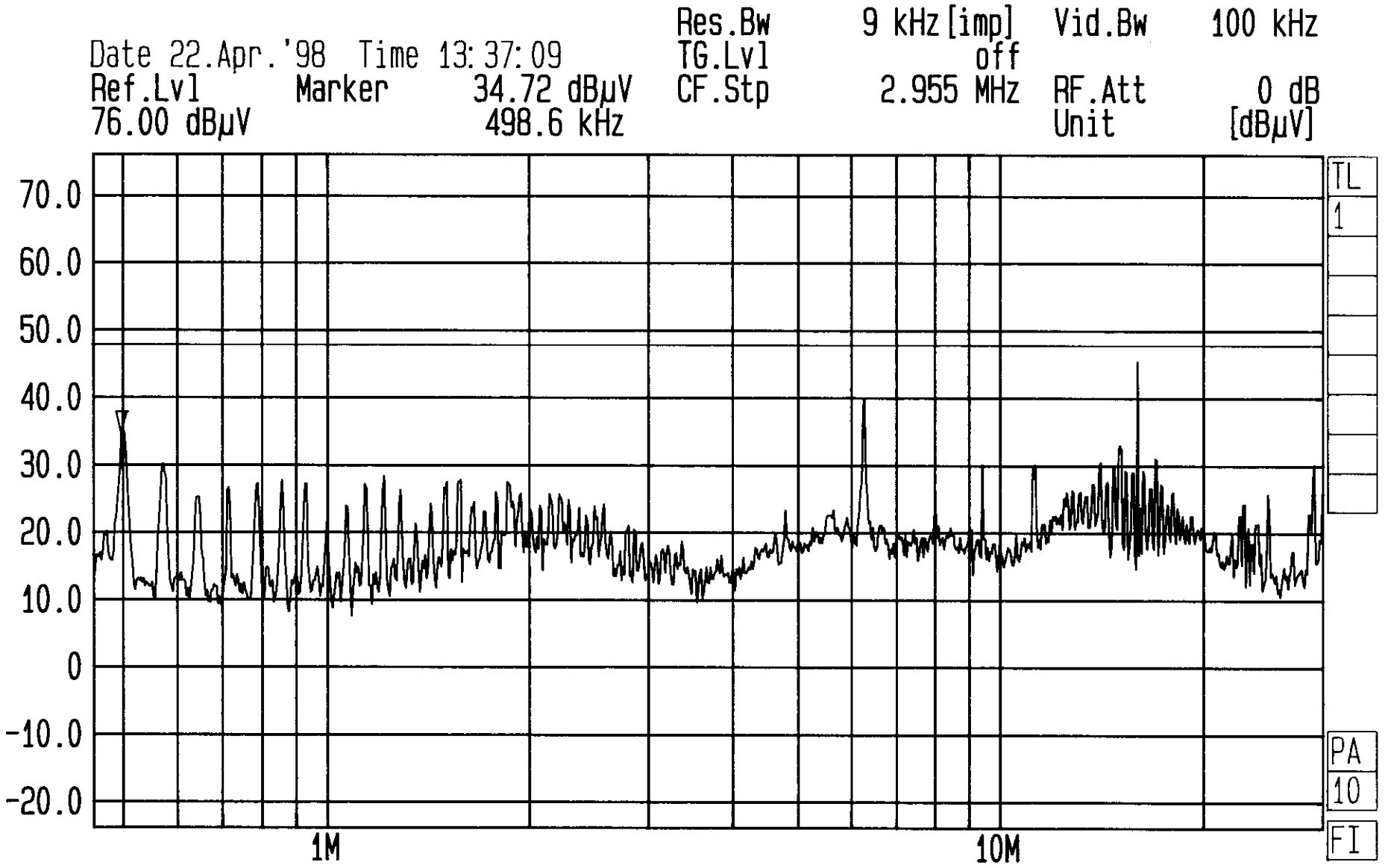


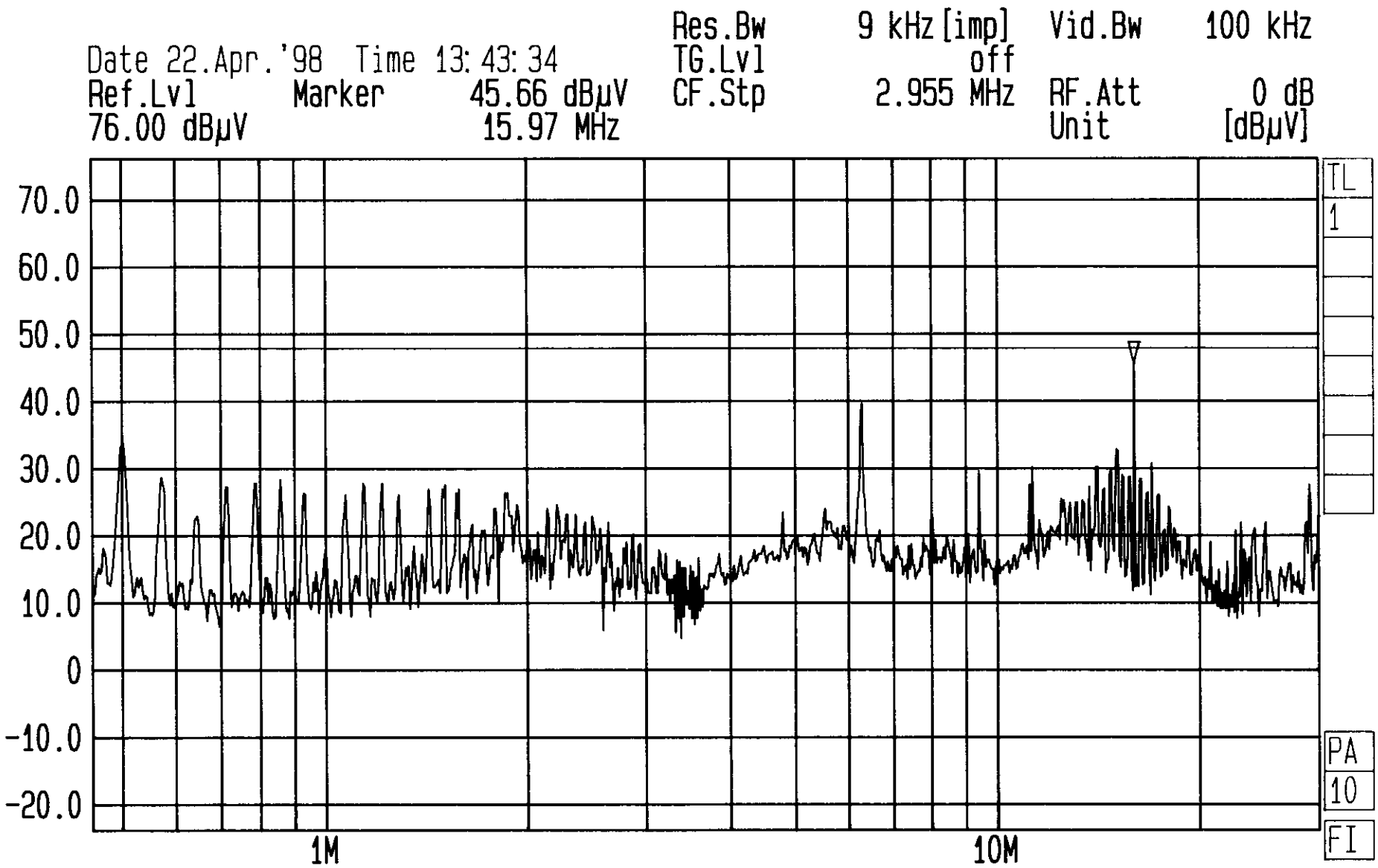
Conducted. Tested by RFI for Madge. EUT: PCI-3 IBM STP Cable. FCC/B

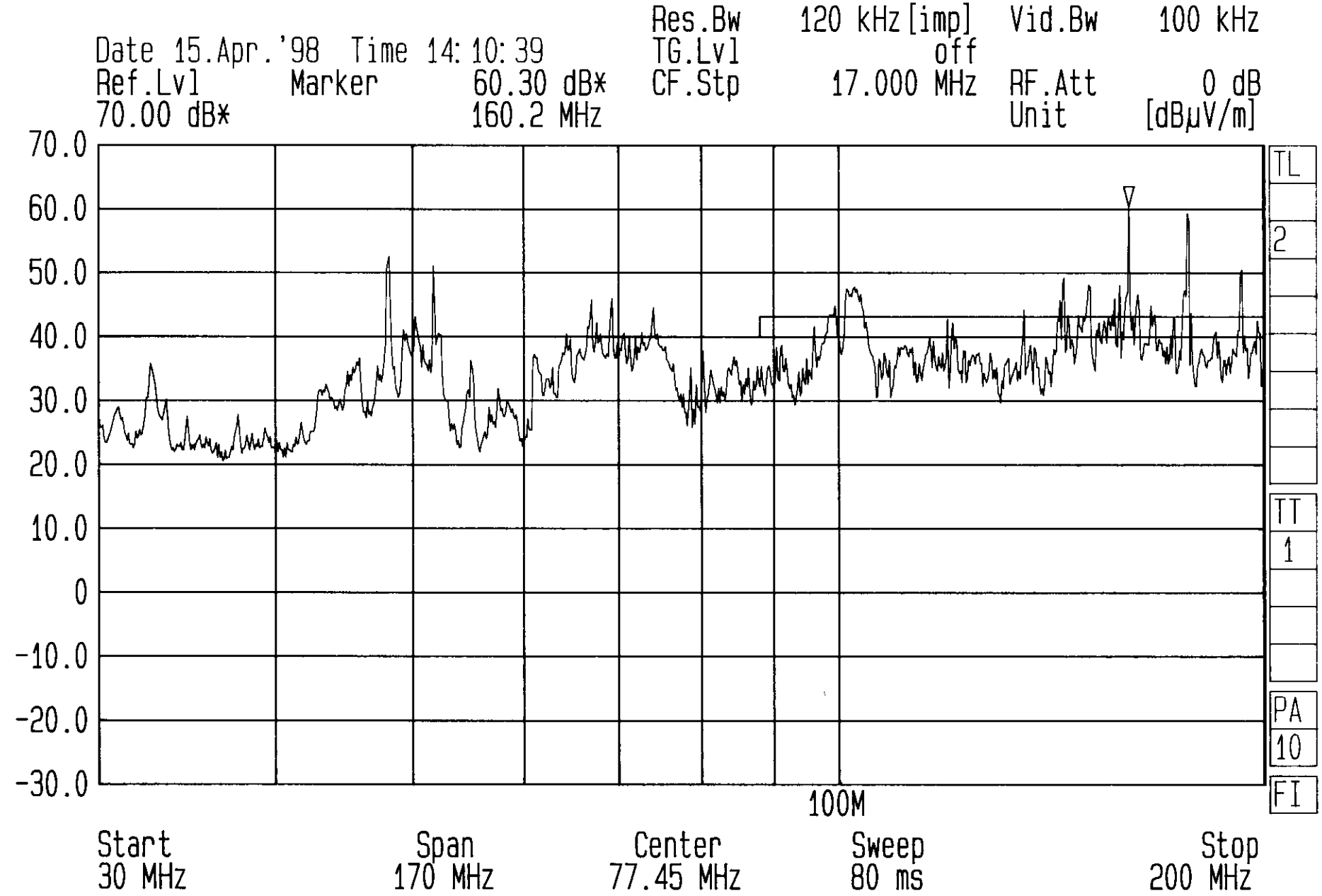
Limit Line: QP Limit. Neutral Line GPH/36498/ETF02/008


Res.Bw 9 kHz [imp] Vid.Bw 100 kHz
Date 22.Apr.'98 Time 12:49:38 TG.Lvl off
Ref.Lvl Marker 44.59 dBµV CF.Stp 2.955 MHz RF.Att 0 dB
86.00 dBµV 15.97 MHz Unit [dBµV]
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
1M
10M
TL
1
PA
10
FI
Start 450 kHz
Span 29.55 MHz
Center 3.67423 MHz
Sweep 2.2 s
Stop 30 MHz
Conducted. Tested by RFI for Madge. EUT: PCI-3 UTP Cable. FCC/B
Limit Line: QP Limit. Live Line GPH/36498/ETF02/009

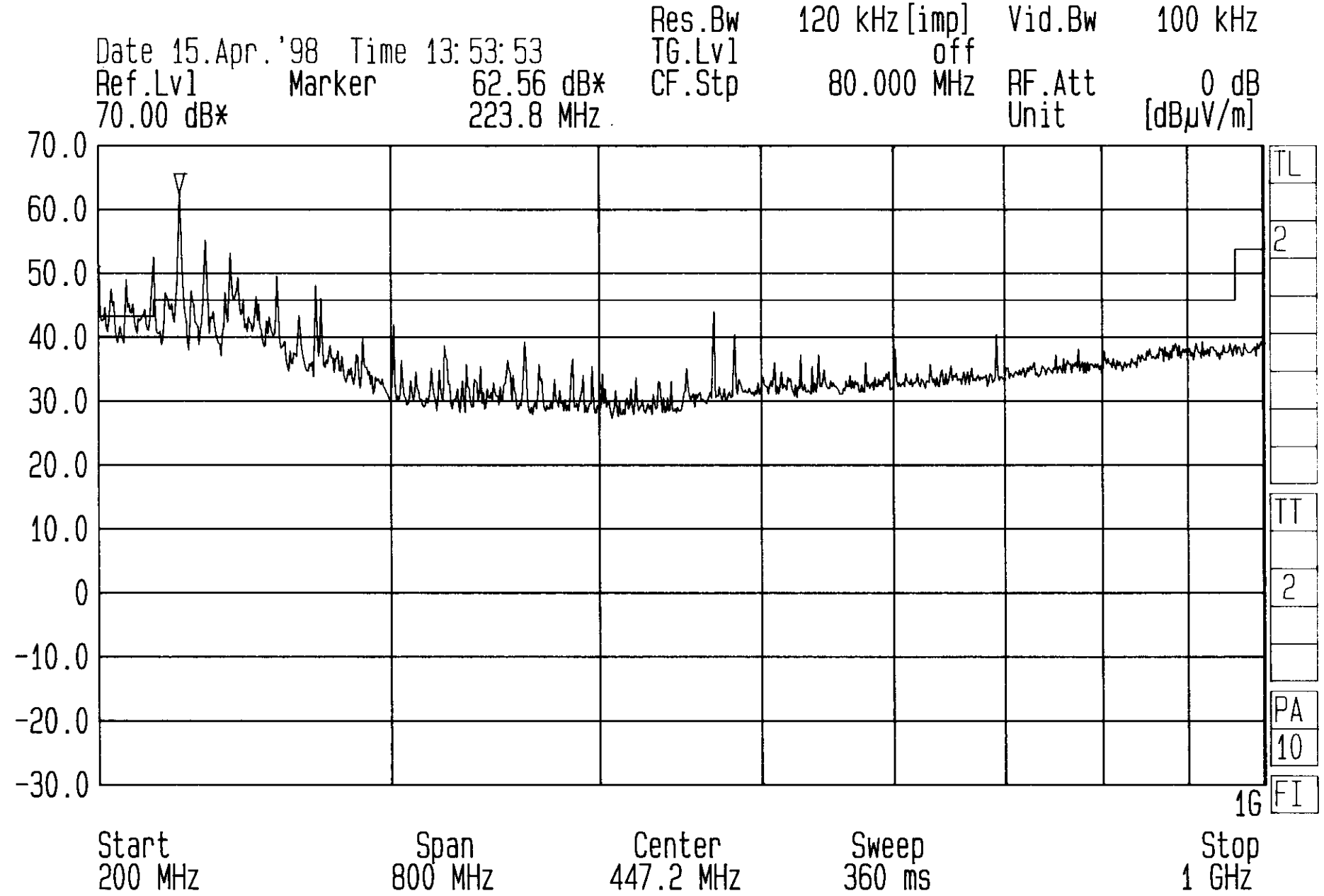

Res.Bw 9 kHz [imp] Vid.Bw 100 kHz
Date 22.Apr.'98 Time 12:59:58 TG.Lvl off
Ref.Lvl Marker 44.64 dBµV CF.Stp 2.955 MHz RF.Att 0 dB
86.00 dBµV 15.97 MHz Unit [dBµV]
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
1M
10M
TL
1
PA
10
FI
Start 450 kHz
Span 29.55 MHz
Center 3.67423 MHz
Sweep 2.2 s
Stop 30 MHz
Conducted. Tested by RFI for Madge. EUT: PCI-3 UTP Cable. FCC/B
Limit Line: QP Limit. Neutral Line GPH/36498/ETF02/010


Res.Bw 9 kHz [imp] Vid.Bw 100 kHz
Date 22.Apr.'98 Time 13:37:09 TG.Lvl off
Ref.Lvl Marker 34.72 dBµV CF.Stp 2.955 MHz RF.Att 0 dB
76.00 dBµV 498.6 kHz Unit [dBµV]
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
-20.0
1M
10M
TL
1
PA
10
FI
Start 450 kHz
Span 29.55 MHz
Center 3.67423 MHz
Sweep 2.2 s
Stop 30 MHz
Conducted. Tested by RFI for Madge.
EUT: PCI-3 ~~UTP~~ and CAT 5 STP Cable.
FCC/B
Limit Line: QP Limit.
Live Line
GPH/36498/ETF02/011


Res.Bw 9 kHz [imp] Vid.Bw 100 kHz
Date 22.Apr.'98 Time 13:43:34 TG.Lvl off
Ref.Lvl Marker 45.66 dBµV CF.Stp 2.955 MHz RF.Att 0 dB
76.00 dBµV 15.97 MHz Unit [dBµV]
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0
-10.0
-20.0
1M
10M
TL
1
PA
10
FI
Start 450 kHz
Span 29.55 MHz
Center 3.67423 MHz
Sweep 2.2 s
Stop 30 MHz
Conducted. Tested by RFI for Madge. EUT: PCI-3 Cat 5 STP FCC/B
Limit Line: QP Limit. Neutral Line GPH/36498/ETF02/012



Radiated. Tested by RFI For Madge. EUT: PCI-3 UTP Cable with Remote Network FCC/B
Limit Lines: QP Limits. 3m Screened Room Scan. GPH/36498/ETF02/101



Radiated. Tested by RFI For Madge. EUT: PCI-3 UTP Cable with Remote Network FCC/B
Limit Lines: QP Limits. 3m Screened Room Scan. GPH/36498/ETF02/102

Appendix 5. Photographs of EUT

This appendix contains the following photographs

Photo Reference Number	Title
PHT\36498\001	Rear view of conducted emissions, UTP cable.
PHT\36498\002	Front view of conducted emissions, UTP cable
PHT\36498\003	Rear view of conducted emissions, IBM STP cable.
PHT\36498\004	Front view of conducted emissions, IBM STP cable
PHT\36498\005	Rear view of conducted emissions, CAT 5 STP cable.
PHT\36498\006	Front view of conducted emissions, CAT 5 STP cable
PHT\36498\007	Front view of radiated emissions, UTP cable
PHT\36498\008	Rear view of radiated emissions, UTP cable
PHT\36498\009	Front view of radiated emissions, IBM STP cable
PHT\36498\010	Rear view of radiated emissions, IBM STP cable
PHT\36498\011	Front view of radiated emissions, CAT 5 STP cable
PHT\36498\012	Rear view of radiated emissions, CAT 5 STP cable
PHT\36498\013	Rear view of radiated emissions, UTP cable with remote network
PHT\36498\014	Front view of radiated emissions, UTP cable with remote network

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

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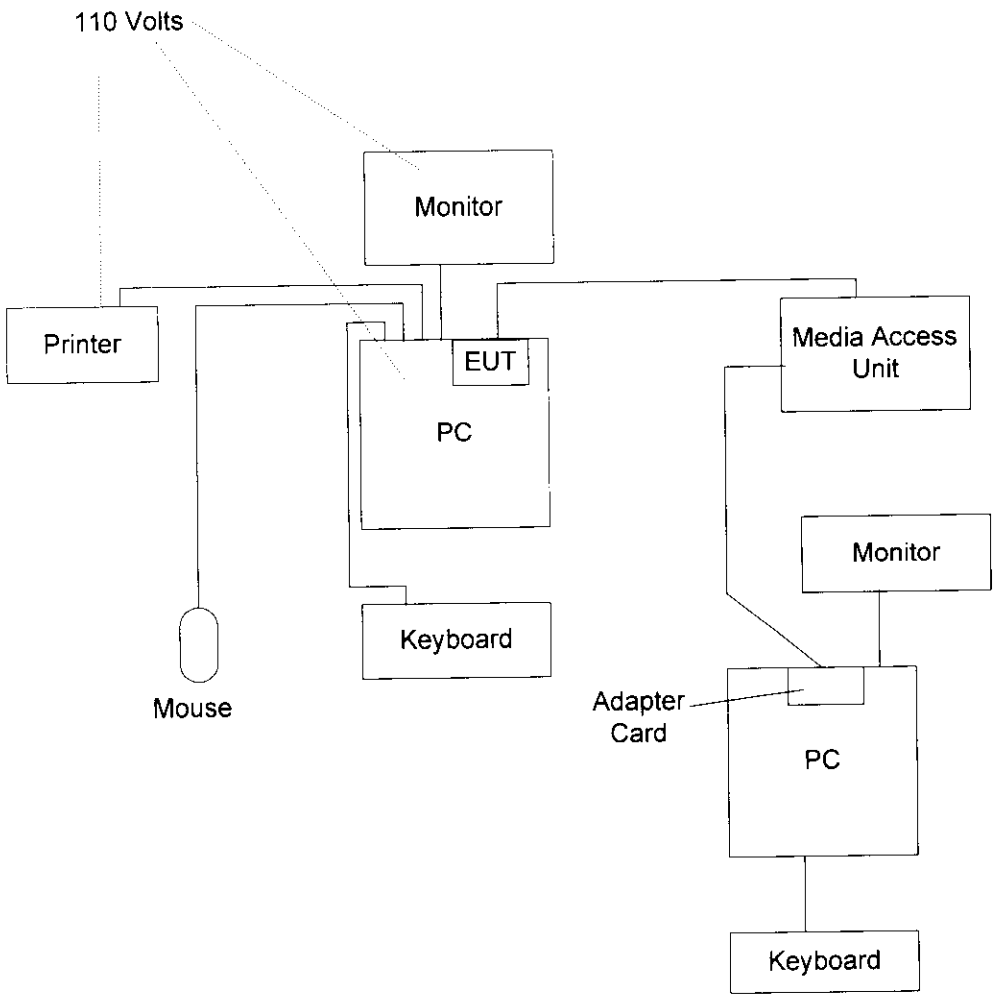
Test Of: Madge Networks Ltd.
PCI-3 Card
To: F.C.C. Part 15: 1996 Class B

DRG\36498JD01ETF02\002

Configuration of EUT and Support Equipment



Test Of: Madge Networks Ltd.
PCI-3 Card
To: F.C.C. Part 15: 1996 Class B

DRG\36498JD01ETF02\EMIRAD

Non-metallic remote controlled antenna tower, vertical range 1m to 4m with remote polarisation control.

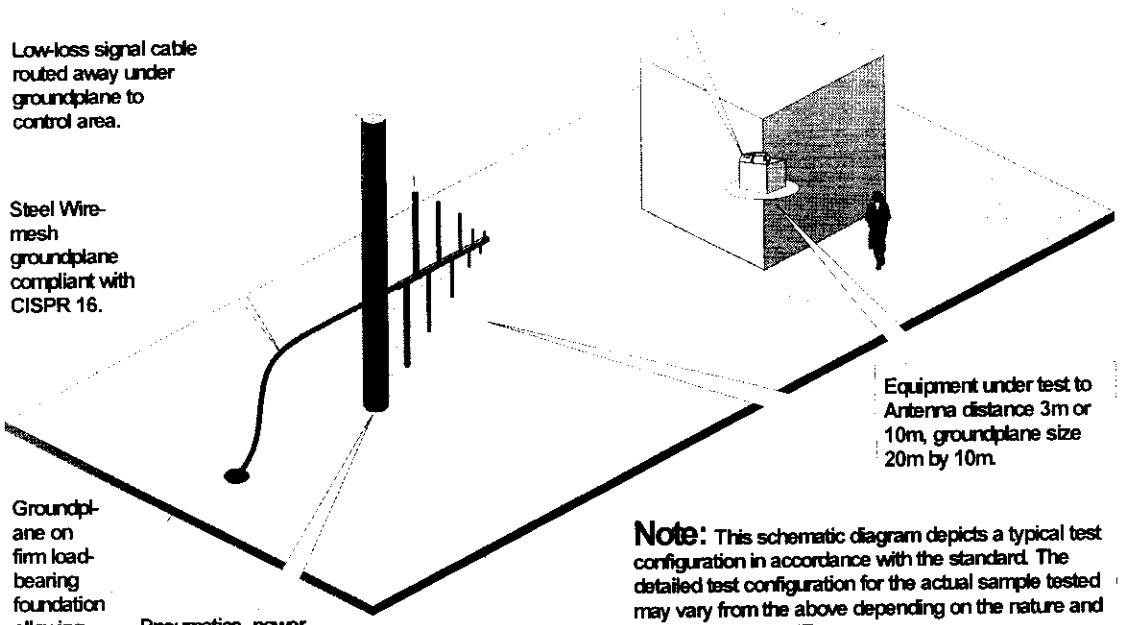
Test antenna, plane-polarised. Antenna factors taken into account in measurement.

Electrical supply to EUT, control lines for turntable and remote monitotring cables all routed underground to control area outside CISPR ellipse.

Non-metallic shelter housing remote controlled turntable, equipment under test and support equipment. Table top equipment mounted on 0.8m wooden spacer table.

Low-loss signal cable routed away under groundplane to control area.

Steel Wire-mesh groundplane compliant with CISPR 16.



Equipment under test to Antenna distance 3m or 10m, groundplane size 20m by 10m.

Groundplane on firm load-bearing foundation allowing fast drainage and durability.

Pneumatics, power and control wires for mast routed under the groundplane from control area.

Groundplane mesh hole size 12mm. Flat to 5mm per metre in length and width.

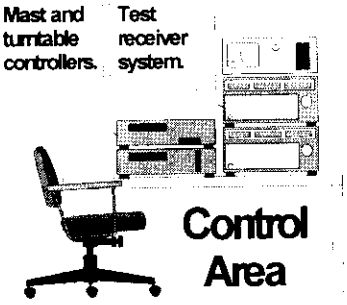
Note: This schematic diagram depicts a typical test configuration in accordance with the standard. The detailed test configuration for the actual sample tested may vary from the above depending on the nature and operation of the EUT.
The test site used by RFI is nominally at ground level.
All electrical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

Mast and turntable controllers.

Test receiver system.



Control Area

Appendix 3. Test Configuration Drawings

This appendix contains the following drawings:

Drawing Reference Number	Title
DRG\36498JD01ETF02\EMICON	Test configuration for measurement of conducted emissions
DRG\36498JD01ETF02\EMIRAD	Test configuration for measurement of radiated emissions
DRG\36498JD01ETF02\001	Schematic diagram of the EUT, and local support equipment and interconnecting cables used for the test
DRG\36498JD01ETF02\002	Schematic diagram of the EUT, remote support equipment and interconnecting cables used for the test

A2.2. Radiated Emissions: FCC Part 15

A2.2.1. Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

A2.2.2. 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.

A2.2.3. 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.

A2.2.4. 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.

A2.2.5. All measurements on the open area test site were performed using broadband antennas.

A2.2.6. 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.

Appendix 2. Measurement Methods

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

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

A2.1.2. 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.

A2.1.3. 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.

A2.1.4. 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.

8. Measurement Uncertainty

8.1. Company Policy, as based on the NAMAS 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 global uncertainties have been calculated in accordance with NAMAS NIS 81 (Edition 1, May 1994) as follows:

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	95%	+/- 4.9 dB

8.3. Measurement uncertainties have been applied in accordance with NAMAS 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 NAMAS document NIS 3003 Edition 8 "The Expression of Uncertainty and Confidence in Measurement" May 1995, which align with international recommendations "Guide to the Expression of Uncertainty in Measurement" ISO/IEC/OIML/BIPM (Prepared by ISO/TAG 4: January 1993).

7.11. Test Results For Radiated Emissions: UTP Cable with Remote Network

7.11.1. Electric Field Strength Measurements

7.11.1.1. The client has stated that the highest clock frequency for the EUT was 32 MHz. Therefore tests were performed up to 1000 MHz.

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

7.11.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses):

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
31.328	Vert.	23.1	40.0	16.9	Complied
47.998	Vert.	27.7	40.0	12.3	Complied
51.124	Vert.	25.7	40.0	14.3	Complied
66.594	Horz.	27.7	40.0	12.3	Complied
68.831	Vert.	24.1	40.0	15.9	Complied
71.588	Horiz.	32.5	40.0	7.5	Complied
95.996	Vert.	32.7	43.5	10.8	Complied
101.650	Vert.	33.8	43.5	9.7	Complied
119.995	Vert.	28.1	43.5	15.4	Complied
134.727	Vert.	20.7	43.5	22.8	Complied
144.001	Vert.	25.1	43.5	18.4	Complied
149.993	Vert.	35.2	43.5	8.3	Complied
160.001	Vert.	27.5	43.5	16.0	Complied
176.001	Vert.	24.1	43.5	19.4	Complied
192.001	Vert.	18.9	43.5	24.6	Complied
197.391	Vert.	17.8	43.5	25.7	Complied
200.004	Vert.	20.9	43.5	22.6	Complied
204.002	Vert.	19.8	43.5	23.7	Complied
208.002	Vert.	18.5	43.5	25.0	Complied
216.157	Horiz.	18.2	46.0	27.8	Complied
224.002	Horiz.	26.7	46.0	19.3	Complied
232.002	Horiz.	22.8	46.0	23.2	Complied
239.989	Horiz.	38.9	46.0	7.1	Complied
256.002	Horiz.	29.4	46.0	16.6	Complied

Please refer to next page for continuation of Radiated Emissions: UTP Cable with Remote Network test results and note description.

7.9. Test Results For Radiated Emissions: CAT 5 STP Cable

7.9.1. Electric Field Strength Measurements

7.9.1.1. The client has stated that the highest clock frequency for the EUT was 32 MHz. Therefore tests were performed up to 1000 MHz.

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

7.9.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses):

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
45.750	Vert.	27.5	40.0	12.5	Complied
50.131	Vert.	25.1	40.0	14.9	Complied
62.931	Vert.	29.5	40.0	10.5	Complied
66.536	Vert.	27.0	40.0	13.0	Complied
71.588	Vert.	24.3	40.0	15.7	Complied
89.996	Vert.	22.1	43.5	21.4	Complied (Note 1)
95.996	Vert.	28.9	43.5	14.6	Complied
102.400	Horiz.	29.7	43.5	13.8	Complied
119.994	Vert.	30.7	43.5	12.8	Complied
135.449	Vert.	20.1	43.5	23.4	Complied
149.993	Vert.	23.1	43.5	20.4	Complied
156.539	Horiz.	18.6	43.5	24.9	Complied
182.926	Horiz.	23.8	43.5	19.7	Complied
194.104	Horiz.	23.1	43.5	20.4	Complied
209.990	Horiz.	40.1	43.5	3.4	Complied
219.323	Horiz.	36.6	46.0	9.4	Complied
228.146	Horiz.	37.0	46.0	9.0	Complied
237.735	Vert.	36.1	46.0	9.9	Complied
240.204	Horiz.	38.4	46.0	7.6	Complied
257.017	Horiz.	36.7	46.0	9.3	Complied
265.695	Horiz.	38.4	46.0	7.6	Complied
269.987	Horiz.	44.3	46.0	1.7	Complied
310.685	Horiz.	30.7	46.0	15.3	Complied

Please refer to next page for continuation of Radiated Emissions: CAT5 STP Cable test results and note description.

7.7. Test Results For Radiated Emissions: IBM STP Cable

7.7.1. Electric Field Strength Measurements

7.7.1.1. The client has stated that the highest clock frequency for the EUT was 32 MHz. Therefore tests were performed up to 1000 MHz.

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

7.7.1.3. The following table lists frequencies at which emissions were measured using a Quasi-Peak detector (results incorporate antenna factors and cable losses):

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
47.997	Vert.	27.5	40.0	12.5	Complied
50.131	Vert.	30.0	40.0	10.0	Complied
51.124	Vert.	24.3	40.0	15.7	Complied
54.810	Vert.	21.7	40.0	18.3	Complied
60.925	Vert.	17.1	40.0	22.9	Complied
66.641	Vert.	19.1	40.0	20.9	Complied
71.587	Vert.	27.1	40.0	12.9	Complied
83.352	Vert.	19.6	40.0	20.4	Complied
90.862	Vert.	29.6	43.5	13.9	Complied
100.091	Vert.	16.7	43.5	26.8	Complied (Note 1)
102.791	Vert.	26.3	43.5	17.2	Complied (Note 1)
106.900	Vert.	26.9	43.5	16.6	Complied
119.944	Vert.	26.7	43.5	16.8	Complied
134.727	Vert.	21.6	43.5	21.9	Complied
139.973	Vert.	21.5	43.5	22.0	Complied
149.993	Horiz.	26.3	43.5	17.2	Complied
157.543	Horiz.	20.5	43.5	23.0	Complied
168.149	Vert.	20.7	43.5	22.8	Complied
181.725	Vert.	19.8	43.5	23.7	Complied
201.870	Horiz.	21.7	43.5	21.8	Complied
209.990	Horiz.	34.9	43.5	8.6	Complied
219.322	Horiz.	29.5	46.0	16.5	Complied
224.103	Horiz.	30.5	46.0	15.5	Complied
232.520	Horiz.	35.2	46.0	10.8	Complied

Please refer to next page for continuation of Radiated Emissions: IBM STP Cable test results and note description.

7.5. Test Results For Radiated Emissions: UTP Cable

7.5.1. Electric Field Strength Measurements

7.5.1.1. The client has stated that the highest clock frequency for the EUT was 32 MHz. Therefore tests were performed up to 1000 MHz.

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 (results incorporate antenna factors and cable losses):

Frequency (MHz)	Ant. Pol.	Q-P Level (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
47.998	Vert.	25.1	40.0	14.9	Complied
51.125	Vert.	23.9	40.0	16.1	Complied
63.997	Vert.	29.5	40.0	10.5	Complied
66.768	Vert.	20.5	40.0	19.5	Complied
71.588	Horiz.	30.6	40.0	9.4	Complied
80.002	Vert.	29.9	40.0	10.1	Complied
85.905	Vert.	30.1	40.0	9.9	Complied
90.861	Horiz.	29.3	43.5	14.2	Complied
102.280	Vert.	35.8	43.5	7.7	Complied (Note 1)
112.002	Vert.	36.9	43.5	6.6	Complied
119.061	Vert.	31.7	43.5	11.8	Complied
134.728	Vert.	23.6	43.5	19.9	Complied
144.003	Vert.	33.2	43.5	10.3	Complied
149.993	Vert.	29.4	43.5	14.1	Complied
162.959	Vert.	22.1	43.5	21.4	Complied
197.391	Horiz.	21.0	43.5	22.5	Complied
209.990	Vert.	32.7	43.5	10.8	Complied
219.783	Vert.	31.1	46.0	14.9	Complied
239.989	Horiz.	37.0	46.0	9.0	Complied
250.529	Vert.	21.1	46.0	24.9	Complied
255.622	Horiz.	30.8	46.0	15.2	Complied
269.987	Horiz.	43.0	46.0	3.0	Complied
299.986	Horiz.	34.1	46.0	11.9	Complied
464.008	Horiz.	30.1	46.0	15.9	Complied

Please refer to next page for continuation of Radiated Emissions: UTP Cable test results and note description.

7.3. Test Results For AC Mains Conducted Emissions: IBM STP Cable

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

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

7.3.1.2. 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
0.500	Live	33.6	48.0	14.4	Complied
0.501	Neutral	32.9	48.0	15.1	Complied
0.572	Neutral	28.3	48.0	19.7	Complied
0.573	Live	28.6	48.0	19.4	Complied
6.266	Live	38.0	48.0	10.0	Complied
6.266	Neutral	38.0	48.0	10.0	Complied

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 NAMAS Document NIS 81 with a confidence level of 95%. Please refer to Section 8 for details of measurement uncertainties.

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 a nominal 115 V, 60 Hz AC mains supply 13 Amp (max)

5.2. Operating Modes

The EUT was tested in the following operating mode: Running at 16 MBit/s.

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: The EUT was sending and receiving to and from the RAM. The printer, monitor, hard and floppy disk drives were all exercised.

All testing was performed with the EUT configured with a UTP cable, CAT5 STP cable and an IBM STP cable.

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

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.

3. Test Specification, Methods And Procedures

3.1. Test Specification

Reference:	FCC Part 15: 1996 Class B
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 (1987)
Title: Specification for Radio Interference measuring apparatus and measurement methods.

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.

Support Equipment (continued)

At the request of the client, a further investigation was performed for the testing of Radiated Emissions only with the following support equipment remotely situated to the EUT and the SmartLAMs listed above removed from the test configuration. The testing was performed with a UTP cable fitted only. The plots from the preliminary scans can be seen under GPH/36498/ETF02/101 and GPH/36498/ETF02/102. The measurement results table can be seen in section 7.11.

Description	PCI Bus PC
Brand Name	Hewlett Packard
Model Name or Number	VL.6/233.SERIES.7 D5711N
Serial Number	FR81114315
F.C.C. ID Number	Tested to comply with FCC Standards- for home and office use.
Cable Length And Type	EUT internal to PC
Connected to Port	PCI bus slot

Description	SVGA Monitor
Brand Name	Philips
Model Name or Number	104S
Serial Number	HD009736283845
F.C.C. ID Number	None
Cable Length And Type	SVGA integral cable
Connected to Port	SVGA port on PC

Description	Keyboard
Brand Name	Digital
Model Name or Number	RT3355TUK
Serial Number	5L55018609
F.C.C. ID Number	AQ6-MTN56Z15
Cable Length And Type	Integral 1.5 m
Connected to Port	Keyboard mini DIN on PC

2.5. Support Equipment

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

Description	PCI Bus PC
Brand Name	Hewlett Packard
Model Name or Number	VL.5/90.SERIES.4
Serial Number	FR60362449
F.C.C. ID Number	HCJVECTRAVL5
Cable Length And Type	EUT internal to PC
Connected to Port	PCI bus slot

Description	SVGA Monitor
Brand Name	Hewlett Packard
Model Name or Number	D2817A
Serial Number	JP55006381
F.C.C. ID Number	ACJ93312120
Cable Length And Type	SVGA cable 2 m
Connected to Port	SVGA port on support PC

Description	Keyboard
Brand Name	Hewlett Packard
Model Name or Number	C4735-60113
Serial Number	J8021F1619
F.C.C. ID Number	Tested to comply with FCC Standards- for home and office use.
Cable Length And Type	Integral 1.5 m
Connected to Port	Keyboard mini DIN on support PC

Test Of: Madge Networks Ltd.
PCI-3 Card
To: F.C.C. Part 15: 1996 Class B

1. Client Information

Company Name:	Madge Networks Ltd
Address:	Desktop Division Wexham Springs Framewood Road Wrexham Slough Berks SL3 6PJ
Contact Name:	Mr C Blackham

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