Microtec Tower Personal Computer Vesper 6233

Electromagnetic Compatibility FCC Test Report

1. INTRODUCTION

This report documents the tests performed on the equipment described in 3.1 as well as the test results.

The following tests were carried out in accordance with the *USA Code of Federal Regulation 47, Federal Communications Commission, Part 15, Class B*:

1. Electromagnetic Compatibility (EMC) Test on:

FCC 47 CFR, Part 15 Unintentional Generator	**General Test Results**
↳ Radiated and Conducted Emission **(Class B)**	⇒ **Positive (Refer to 4.4 and 5)**

1.1. Test laboratory and dates

- EMC Laboratory of NMi Brasil Ltda.
- From August 18th through August 20th, 1998

1.2. Coverage and Responsibility

NMi Brasil is responsible for the data and results presented into this report, valid only for the tested sample described in 3.1 '*Equipment under Test (EUT)*', not taking any responsibility for the extrapolation of those results for equipment similar to the EUT, for differences introduced by the manufacturing process or changes of internal parts or changes of project eventually implemented.

2. DESCRIPTION OF THE EQUIPMENT

2.1. Product Family

The Microtec Tower Personal Computer Vesper 6233 is the top line of the Vesper 6XXX tower product family. Table 1 shows its main configuration. Photo 1, Photo 2 and Photo 3 present the EUT views, the last one showing its rear panel with all connection ports available.

Part / Piece	Manufacturer	Size	Part-Number / Model
Processor	Intel Corporation.	233 MHz	B80522P233512
Memory	Elitegroup Computer Systems, Inc.	32 MB	Not Available
Video	DataExpert	2 MB	S3-375/775

3. EQUIPMENT UNDER TEST AND CONFIGURATIONS

3.1. Equipment under Test (EUT)

Table 7 describes the Equipment under Test (EUT).

EUT	Manufacturer	Model	S/N	Cabinet
Tower Personal Computer	Microtec	Vesper 6233	BZ8284V02A	DS4

Table 7 - Description of the Equipment under Test (EUT)

Microtec supplied the above information and takes responsibility for the accuracy and completeness of the characterization of the parts tested.

3.2. Test Configurations

3.2.1. EMC Test Configurations and Support Equipment

All possible configurations have been evaluated and the worst case configuration for each test has been selected and is reported herein. Table 8 shows the support equipment.

EUT	Manufac.	Model	S/N	FCC ID
Video	IBM	G50	66-14065	ANO 6543
Keyboard	NMB	RT2258TWBR	12782041	AQ6-MTN71BZL5DIP
Mouse	Mitsumi	ECM-53902	0918377	EW4ECM-53902
Scanner	TCÊ	S410	CX7D000121	HWF96AB306P
Digital Video Camera	Kodak	DVC300	7480210172625225	E4BT1
Digital Camera System	Ricoh	RDC-2E	103777	n/c
Loop Back	n/c	COM2	n/c	n/c

Table 8 - Support Equipment

3.2.2. Exerciser Software during EMC Tests

The EUT was exercised with "Amidiag 5.22". This software is a menu driven tool meant for several test purposes. The configuration used exercises all parts and ports of the EUT in loop mode.

4. RADIATED AND CONDUCTED EMISSION TESTS

4.1. Standards

Radiated and Conducted Emission tests were based on the Part 1, Part 2 and Part 15 of Title 47 of the USA Code of Federal Regulation, regulated by the Federal Communications Commission, for class B Unintentional Radiators. The Test Site was characterized and shown

to comply to the ANSI C63.4:1992 requirements and is listed by FCC under the trade name of INMETRO[1], proprietary of the laboratories.

The limits for FCC 47 CFR, Part 15 Unintentional Generator Class B Radiated Emissions, as applicable for the EUT can be found in Table 9 and for Conducted Emissions in Table 10.

Frequency Band (MHz)	Quasi-Peak Limit (dBµV/m)
30 ~ 88	40
88 ~ 216	43.5
216 ~ 960	46
960 ~ 2000	54

Table 9 - Limits for to FCC 47 CFR, pt15 Class B Radiated Emissions

Frequency Band (MHz)	Quasi-Peak (dBµV)
0.45 ~ 30	48

Table 10 - Limits for to FCC 47 CFR, pt15 Class B Conducted Emissions

4.2. EMC Test Equipment List

The following equipment listed in Table 11 and Table 12 was used for radiated and conducted tests respectively. All equipment has been calibrated and is within its due date at the time the tests was performed.

EQUIPMENT LIST for RADIATED EMISSIONS TEST - EMC SAC			
Description	Model	Serial Number	Manufacturer
Semi-Anechoic EMC Chamber	10 meters	N/A	Ray Proof
Quasi Peak Adapter	85650A	3145A01616	Hewlett Packard
Spectrum Analyzer Display	85662A	3144A20501	Hewlett Packard
Spectrum Analyzer	8566B	3138A07516	Hewlett Packard
Attenuator/Switch Driver	11713A	2508A09627	Hewlett Packard
Pre-Amplifier	8449B op H02	3008A00249	Hewlett Packard
RF Preselector	85685A	3146A01318	Hewlett Packard
Amplifier	8447D	2944A06750	Hewlett Packard
Amplifier	8447D	2944A06555	Hewlett Packard
Preamplifier	8449B	3008A00398	Hewlett Packard
Antenna Mast Controller	1051-12	9009-1523	EMCO
Antenna Mast Controller	1050	1351	EMCO
Log-Periodic Antenna	3146	8901-2324	EMCO

[1] INMETRO Instituto Nacional de Metrologia, Normalização e Qualidade Industrial
Ministério da Indústria, do Comércio e do Turismo, Brasil

Biconical Antenna	3104C	9001-4189	EMCO
Horn Antenna	3115	9508-4539	EMCO
PC for Test Automation	9000/300	several	Hewlett Packard

Table 11 - Test Equipment List for Radiated Emissions Tests

EQUIPMENT LIST for CONDUCTED EMISSIONS TESTS - EMC Test Room			
Description	**Model**	**Serial Number**	**Manufacturer**
Conducted Emissions Test Room	ANSI C63.4	N/A	N/A
Quasi Peak Adapter	85650A	2811A01257	Hewlett Packard
Spectrum Analyzer Display	85662A	2848A17508	Hewlett Packard
Spectrum Analyzer	8568B	2841A04521	Hewlett Packard
RF Preselector	85685A	3010A01170	Hewlett Packard
Line Imped. Stabilization Network (LISN)	3825/2	9502-2317	EMCO
Line Imped. Stabilization Network (LISN)	3825/2	8904-1484	EMCO
PC for Test Automation	PS-2	236101822	IBM

Table 12 - Test Equipment List for Conducted Emissions Tests

4.3. Test Procedures

4.3.1. Radiated Emissions

The test procedures herein can be split in two parts: EMI scan used to determine the worst case and final measurements.

The EMI scan consists of placing the equipment on the wooden table according to the recommendation of the test standards described in 4.1, exercising it according to what would be expected as an average use of the EUT, scan the best antenna height for maximum radiated emission and read the output without azimuth scan or quasi-peak measurements. Even though this is an incomplete measurement, for a small equipment compared to the measurement area, it generates data that can be compared for the purposes of determining which configuration(s) generate more emission.

The final peak measurement consists of placing the equipment on the wooden table according to the recommendation of the test standards described in 4.1, exercising it according to what would be expected as an average use of the EUT, scan the best antenna height for maximum radiated emission and read the output with azimuth scan (turntable rotation), while maximizing the output. The final measurement will be only the maximum radiated field on the frequency range of consideration. The above is called peak measurement and is then followed by the quasi-peak measurement, which is the only one under consideration for the standard in order to conform to the limits.

The quasi-peak measurement procedure consists of tuning the EMI Receiver into one of the spot frequencies, which are those that the peak measurement found to be close to or crossing the limit, scan the best antenna height for maximum radiated emission and read the output. The turntable is than rotated for azimuth scan. If a higher level is measured, the

antenna height is then re scanned at that point and the maximum output is logged. This procedure is repeated until the technician assures the maximum radiated emission is read for the specific spot frequency. The entire quasi-peak procedure is then repeated for the next spot frequency until all frequencies have been measured.

The whole procedure is then repeated for the other antenna polarization so that both vertical and horizontal polarization are measured.

It is important to understand that in all cases the graphical and tabular outputs in this section is calculated to reflect the compensation of the antenna factor, cable loss and amplifier gain. The actual calculation is as follows:

E = V + K , where:

- "E" is the final value of the electrical field in dBμV/m;
- "V" is the voltage readied by the EMI Receiver at its input, in dBμV;
- "K" is the total correction factor, which consists of the computation of the cable loss (C - in dB), antenna factor (AF - in dB/m), and amplifier gain into the circuit (A - in dB). Then, K = C + AF - A.

4.3.2. Conducted Emission Test Procedure

The EUT is placed on the wooden table in the conducted test room in the same fashion used for radiated emissions test and is connected to the AC outlet through a Line Impedance Stabilization Network (LISN) as required by the standards of 4.1. The reading output of the LISN is connected to the EMI Receiver and any other output is properly terminated.

The measurement consists in reading the output peak measurement, maximizing it using the Max-Hold function of the spectrum analyzer for the frequency range of consideration. This measurement can be done for each AC line or maximizing the reading of all AC phases. Unless otherwise noted in the test results, the test is carried out maximizing all phases (Phase and Neutral for single phase connections, Phase 1 and Phase 2 for two phases, etc.). The quasi-peak measurement is then carried out.

The quasi-peak measurement procedure consists of tuning the EMI Receiver into one of the spot frequencies, which are those that the peak measurement found to be close to or crossing the quasi-peak and/or average limits, turn on the quasi-peak detector and log the maximum output of the number of lines under consideration. The average measurement is also performed for the same frequency by using the spectrum analyzer filters and time constants. Unless otherwise noted in the test results, the quasi-peak measurement is carried out maximizing the reading of all phases (Phase and Neutral for single phase connections, Phase 1 and Phase 2 for two phases, etc.). This procedure is repeated until the technician assures the maximum conducted emission is read for the specific spot frequency.

The entire quasi-peak and average measurement procedure is than repeated for the next spot frequency until all frequencies have been measured.

Conf.	Freq.	E_{QP}	QP_{limit}	Margin	Auxiliary Data						P/F
	(MHz)	(dBµV/m)	(dBµV/m)	(dB)	P	Az (°)	h (m)	AF	G/L	Graphic #	
1	69,79	39,3	40,0	-0,7	H	71,79	3,40	8,02	23,00	Graphic 1	Pass
1	335,23	45,1	46,0	-0,9	H	181,79	1,00	14,64	20,70	Graphic 1	Pass
1	74,07	38,0	40,0	-2,0	H	241,82	2,77	7,09	22,96	Graphic 1	Pass
1	82,85	37,8	40,0	-2,2	H	82,06	2,40	6,88	22,89	Graphic 1	Pass
1	301,78	42,9	46,0	-3,1	H	291,63	1,00	14,81	20,70	Graphic 1	Pass
1	702,01	41,8	46,0	-4,2	H	198,31	1,00	21,02	20,51	Graphic 1	Pass
1	935,61	38,8	46,0	-7,2	H	17,00	1,32	22,99	19,02	Graphic 1	Pass
1	224,07	37,4	46,0	-8,6	H	148,74	1,55	11,37	21,26	Graphic 1	Pass
1	69,79	34,6	40,0	-5,4	V	146,70	3,78	8,02	23,00	Graphic 2	Pass
1	82,85	34,0	40,0	-6,0	V	352,52	2,13	6,88	22,89	Graphic 2	Pass
1	935,61	39,4	46,0	-6,6	V	0,00	1,00	22,99	19,02	Graphic 2	Pass
1	335,23	37,9	46,0	-8,1	V	352,52	1,00	14,64	20,70	Graphic 2	Pass
1	74,33	31,2	40,0	-8,8	V	342,03	2,43	7,03	22,96	Graphic 2	Pass
1	30,53	31,1	40,0	-8,9	V	0,00	1,76	13,14	23,34	Graphic 2	Pass
1	82,28	28,3	40,0	-11,7	V	352,52	2,13	6,81	22,90	Graphic 2	Pass
1	737,3	33,9	46,0	-12,1	V	0,00	1,91	21,17	20,43	Graphic 2	Pass
1	48,14	26,1	40,0	-13,9	V	352,50	3,62	10,83	23,17	Graphic 2	Pass
1	31,4	21,5	40,0	-18,5	V	0,00	1,76	12,89	23,32	Graphic 2	Pass
1	1169,4	45,7	54,0	-8,3	H	173,80	1,15	26,87	21,50	Graphic 3	Pass
1	1053,3	41,6	54,0	-12,4	V	352,00	2,04	26,69	22,80	Graphic 4	Pass

Conf.	Description
1	Original (refer to 3.2.1 EMC Test Configurations and Support Equipment)

Legend	Description
E_{QP}	Maximum Quasi-Peak voltage: $E_{QP} = E_{QP\_measured} + AF - G/L$ Where: $E_{QP\_measured}$ is the maximum quasi-peak reading AF is the Antenna Factor G/L is the total gain (of amplifiers) and loss (of cables, etc).
QP_{limit}	Quasi-Peak limit.
Az	Azimuth of the maximum reading
h	Antenna height of the maximum reading
Graphic	Graphic number of the maximum reading
Margin	$QP_{limit} - E_{QP}$

Table 13 - Radiated Emissions test according to FCC pt 15, Class B - Maximum Measured Values.

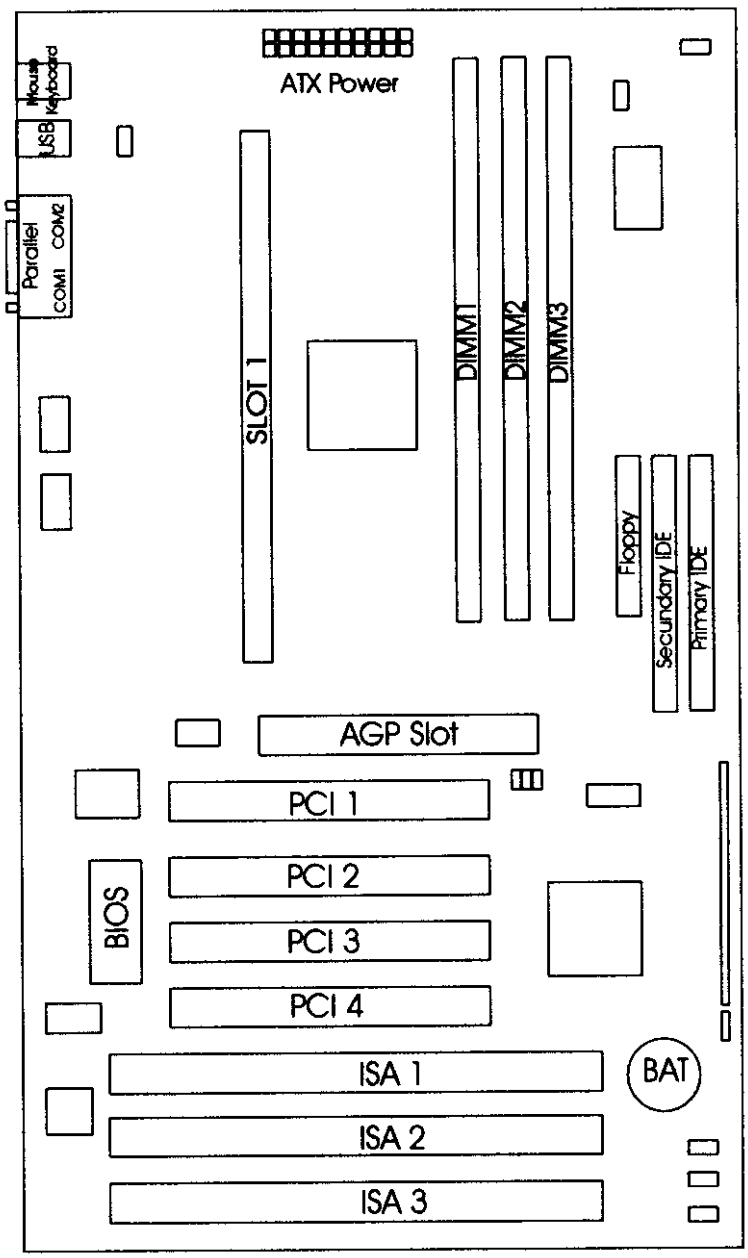


Figure 1 - Microtec Tower Personal Computer Vesper 6233 Main Board drawing

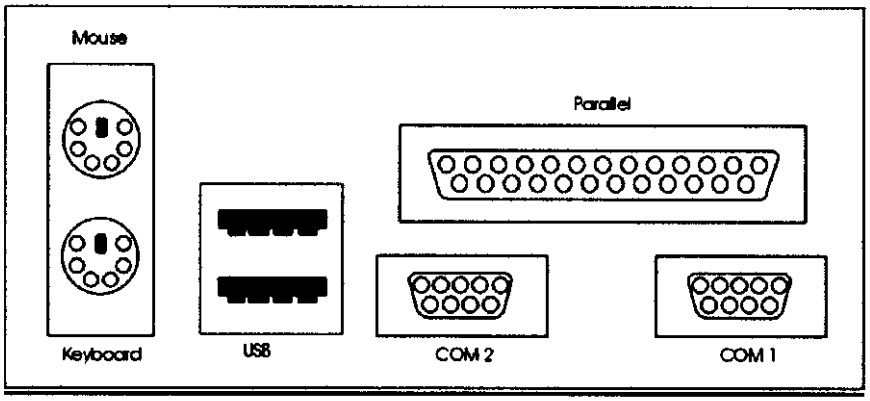
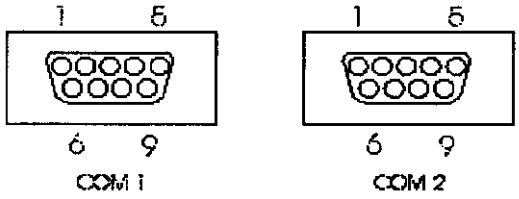


Figure 2 - External connections available at the Microtec Tower Personal Computer Vesper 6233

2.2.2.1.SERIAL PORT CONNECTORS: COM1 & COM2

The mainboard has two 9-pin male DIN connectors for serial ports COM1 and COM2. These two ports are 16550A high-speed communication ports that send/receive 16 bytes FIFOs. You can attach a mouse or a modem cable directly into these connectors.

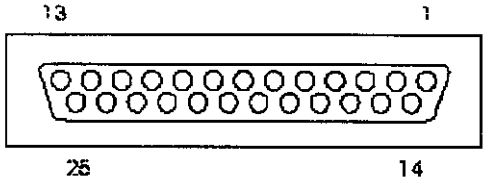


PIN	SIGNAL
1	DCD (Data Carry Detect)
2	SIN (Serial In or Receive Data)
3	SOUT (Serial Out or Transmit Data)
4	DTR (Data Terminal Ready)
5	GND
6	DSR (Data Set Ready)
7	RTS (Request To Send)
8	CTS (Clear To Send)
9	RI (Ring Indicate)

Table 2 - Serial Ports pin definition

2.2.2.2. PARALLEL PORT CONNECTOR: LPT

The mainboard provides a 25-pin female Centronic connector for LPT. A parallel port is a standard printer port that also supports Enhanced Parallel Port (EPP) and extended capabilities Parallel Port (ECP). See connector and pin definition below:



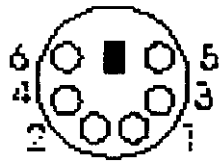
LPT

PIN	SIGNAL	PIN	SIGNAL
1	Strobe	14	Auto Feed #
2	Data0	15	ERR#
3	Data1	16	INIT#
4	Data2	17	SLIN#
5	Data3	18	GND
6	Data4	19	GND
7	Data5	20	GND
8	Data6	21	GND
9	Data7	22	GND
10	ACK#	23	GND
11	Busy	24	GND
12	PE	25	GND
13	Select		

Table 3 - Parallel port (Standard Centronic type) pin definition

2.2.2.3.MOUSE CONNECTOR.

The mainboard provides a standard PS/2 mouse mini DIN connector for attaching a PS/2 mouse. You can plug a PS/2 mouse display into this connector. The connector location and pin definition are shown below:



PS/2

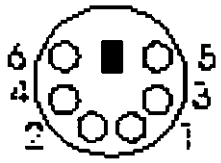
PIN	SIGNAL
1	Data
2	NC

3	GND
4	VCC
5	Clock
6	NC

Table 4 - Mouse port pin definition

2.2.2.4. KEYBOARD CONNECTOR.

The mainboard provides a standard PS/2 keyboard mini DIN connector for attaching a keyboard. You can plug a keyboard cable directly to this connector.

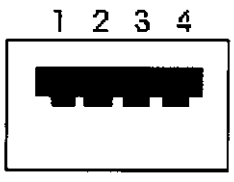


PS/2

PIN	SIGNAL
1	Data
2	NC
3	GND
4	VCC
5	Clock
6	NC

Table 5 - Keyboard connector pin definition

2.2.2.5.USB CONNECTOR.



USB

The mainboard provides a UHCI (Universal Host Controller Interface) Universal Serial Bus root for attaching USB devices like: keyboard, mouse and others USB devices. You can plug the USB device directly to this connector.

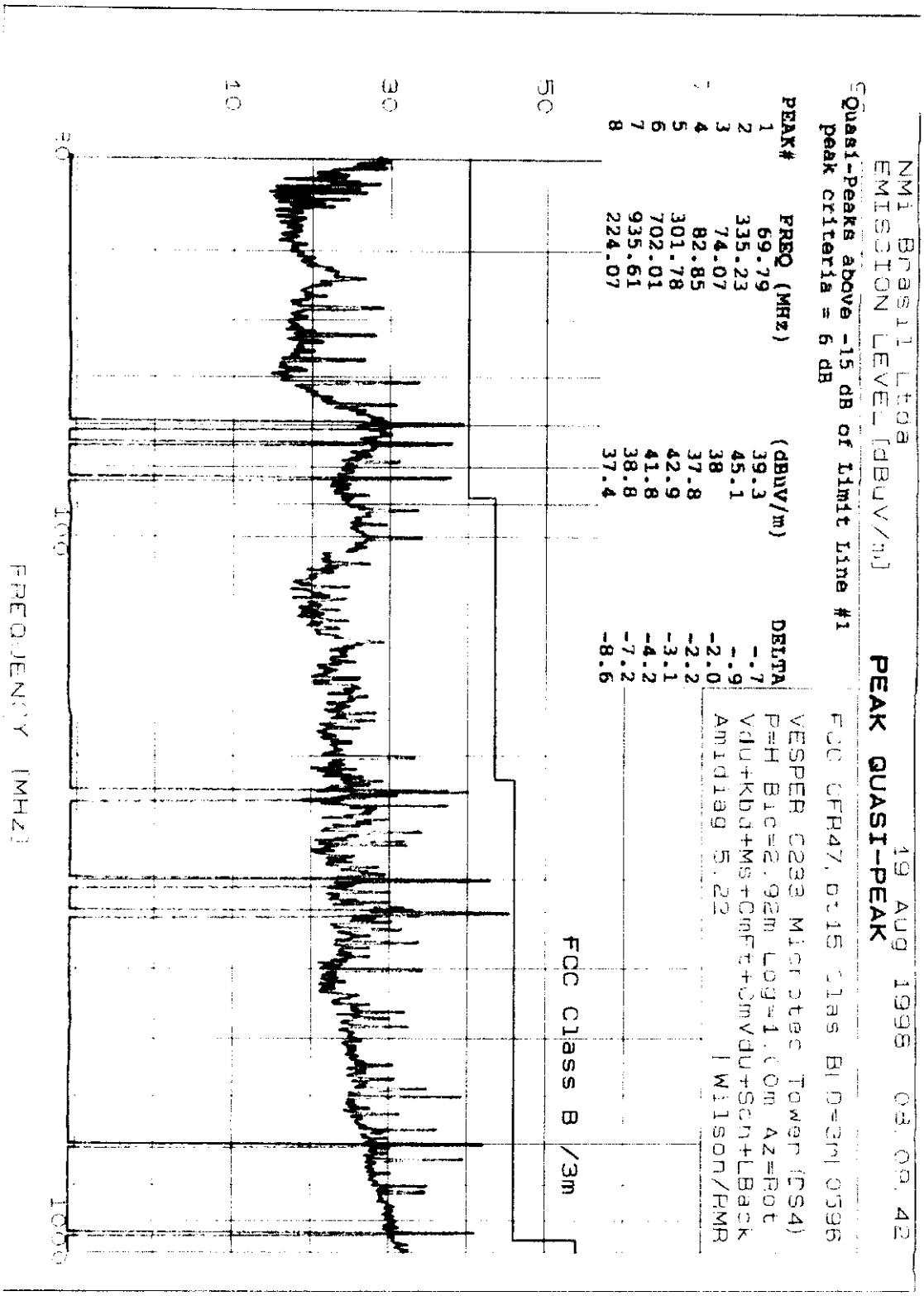
PIN	SIGNAL
1	VCC
2	-Data0
3	GND
4	+Data0

Table 6 - USB Connector pin definition

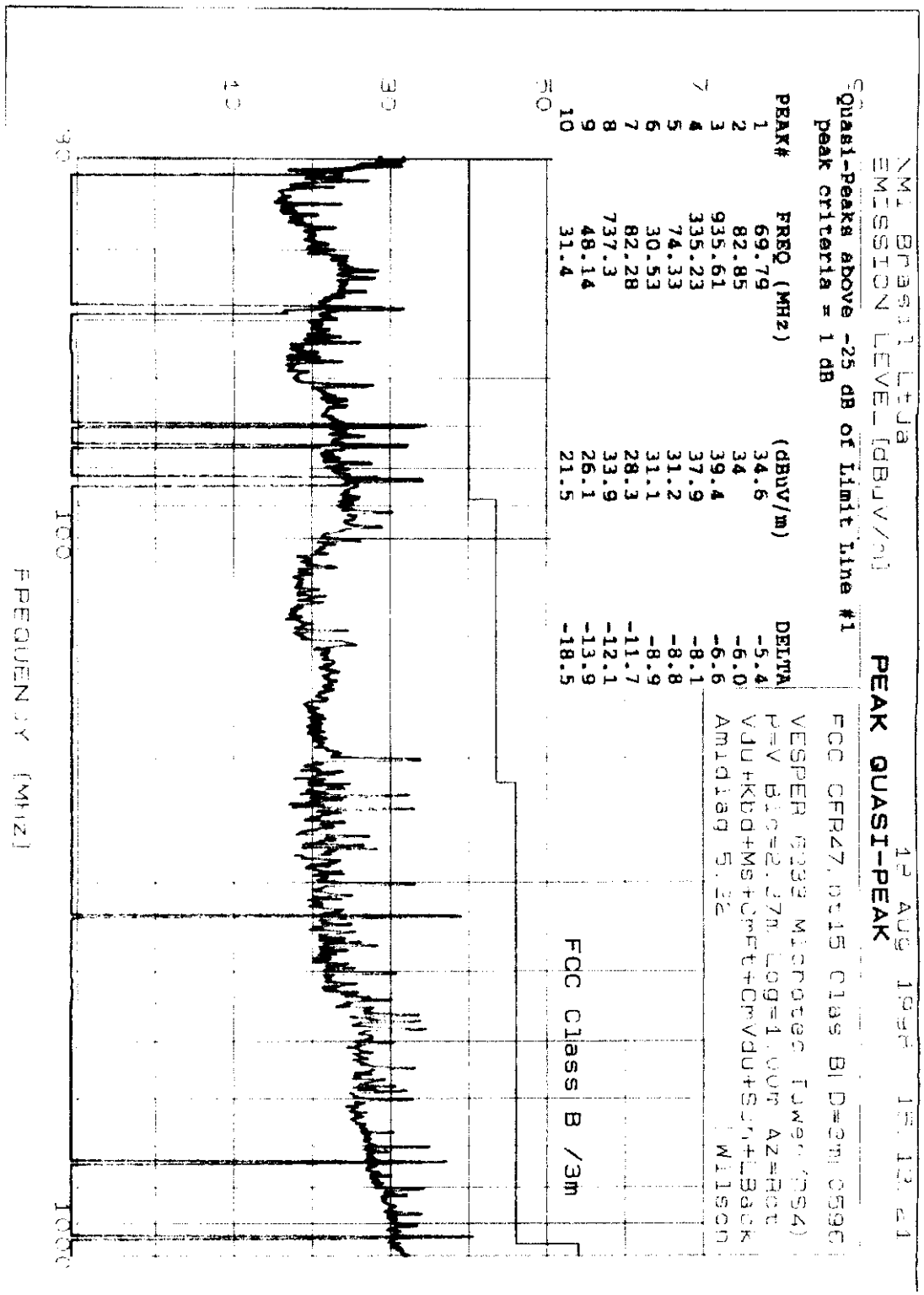
2.2.3. Microtec Tower Personal Computer Vesper 6233 Assembly

Photo 6 to Photo 11show all details of the Microtec Tower Personal Computer Vesper 6233 assembly, with the following details:

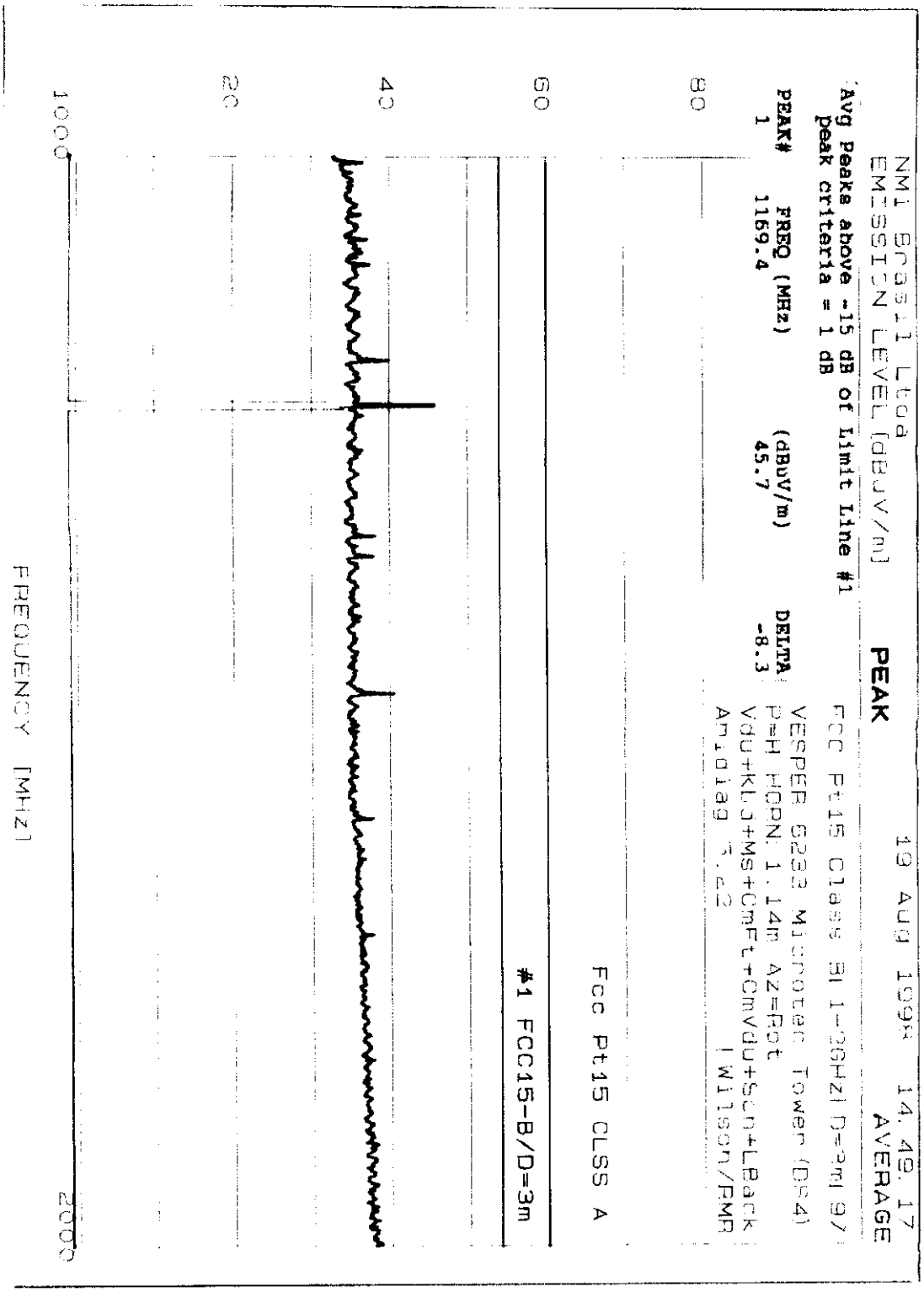
- Photo 6 - Detailed view of the Microtec Tower Personal Computer Vesper 6233 assembled
- Photo 7 - Detailed view of the Microtec Tower Personal Computer Vesper 6233 without the Main Board
- Photo 8 - Detail of Power Supply and power supply cables routing
- Photo 9 - Video Card - Component side
- Photo 10 - Video Card - Solder side
- Photo 11 - Cabinet cover with pre mounted gasket



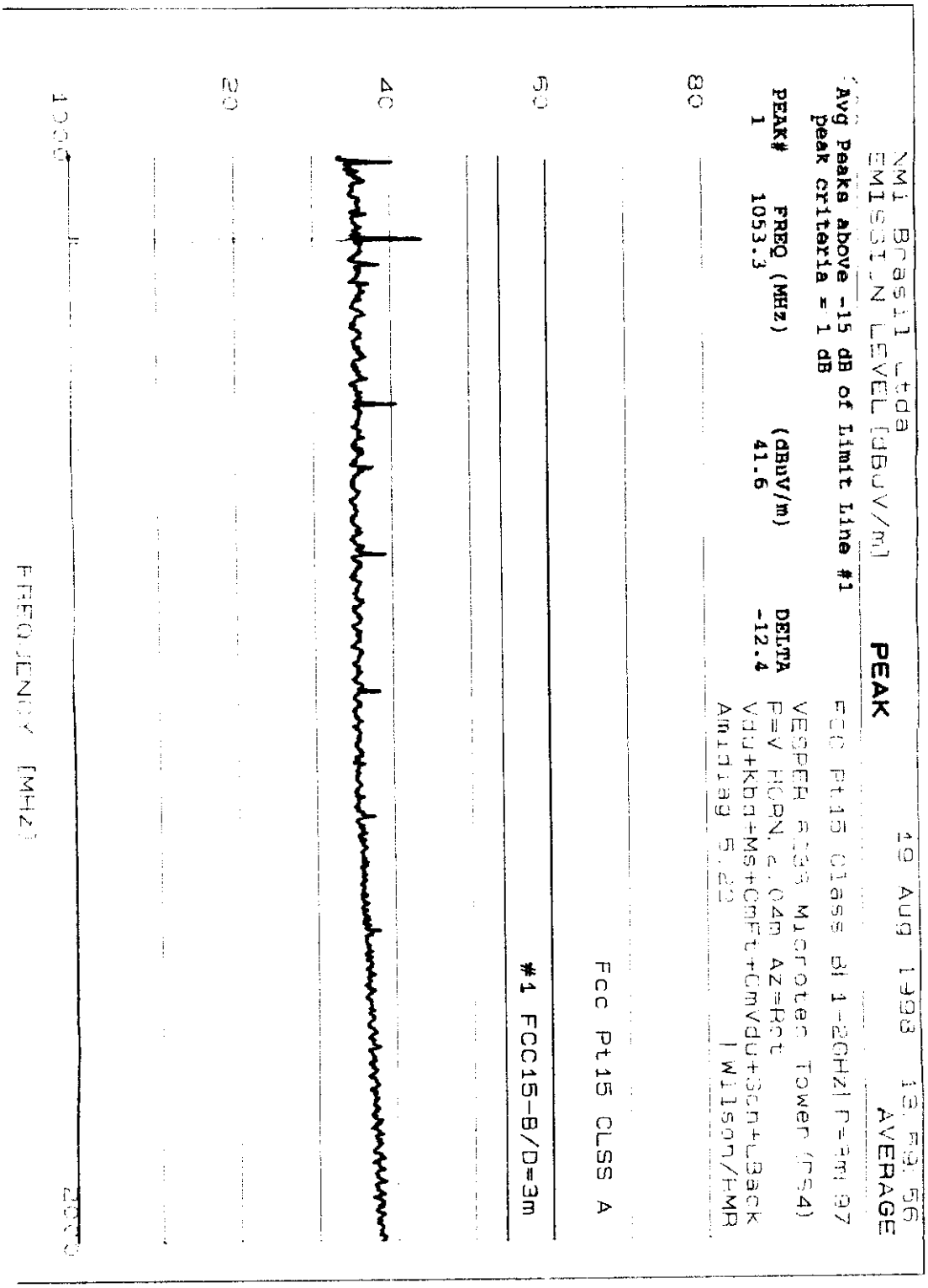
Graphic 1 - Radiated Emissions according to FCC CFR47, pt15 Class B - 30 to 1000 MHz Horizontal Polarization - Microtec Tower Personal Computer Vesper 6233



Graphic 2 - Radiated Emissions according to FCC CFR47, pt15 Class B - 30 to 1000 MHz Vertical Polarization - Microtec Tower Personal Computer Vesper 6233



Graphic 3 - Radiated Emissions according to FCC CFR47, pt15 Class B - 1000 to 2000 MHz Horizontal Polarization - Microtec Tower Personal Computer Vesper 6233



Graphic 4 - Radiated Emissions according to FCC CFR47, pt15 Class B - 1000 to 2000 MHz Vertical Polarization - Microtec Tower Personal Computer Vesper 6233

4.4.2. Conducted Emissions Test Results

The EUT described in 3.1 was installed into the Conducted EMI Test Room according to 2.2. Photo 17 is added to help identify the configuration tested.

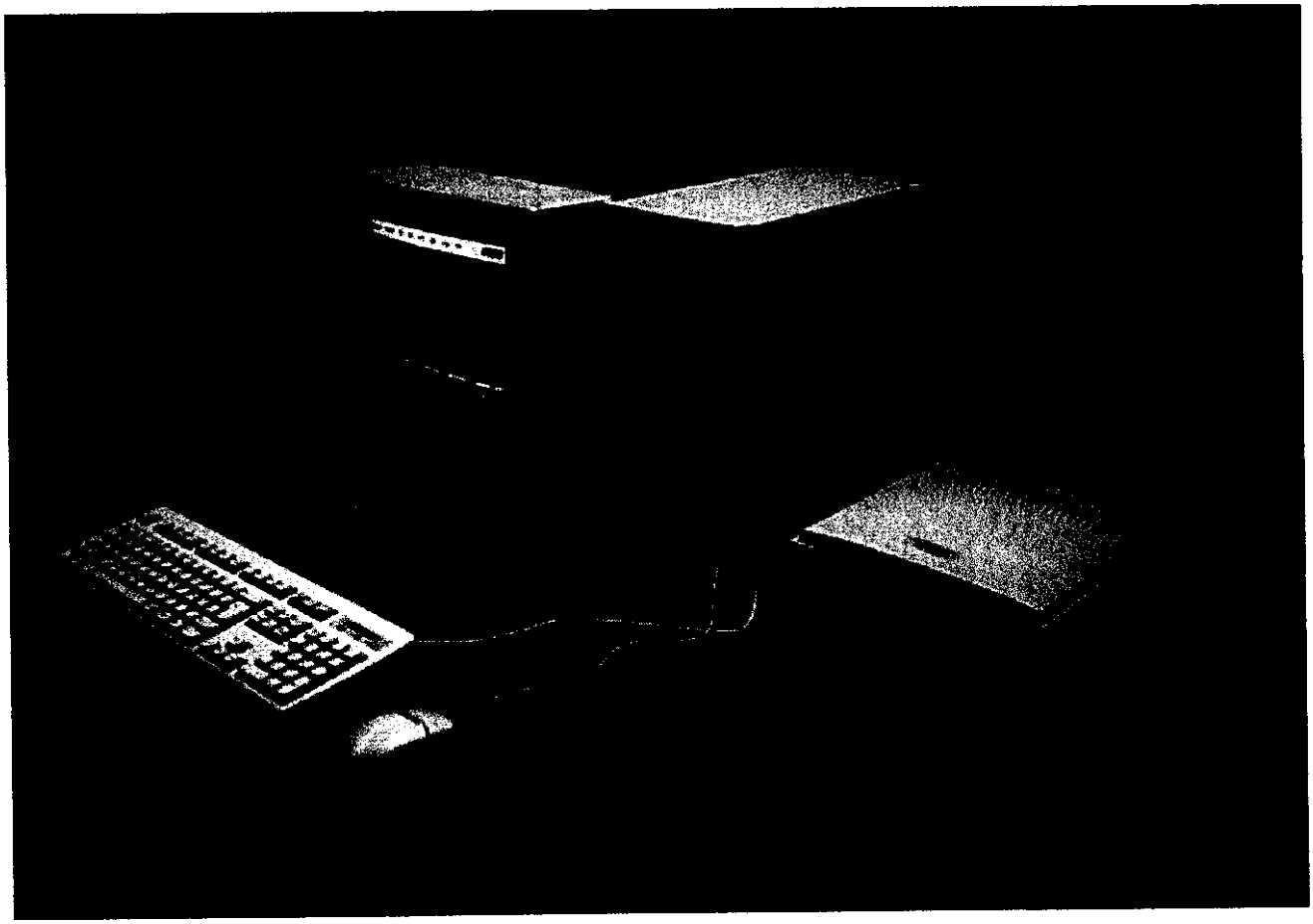
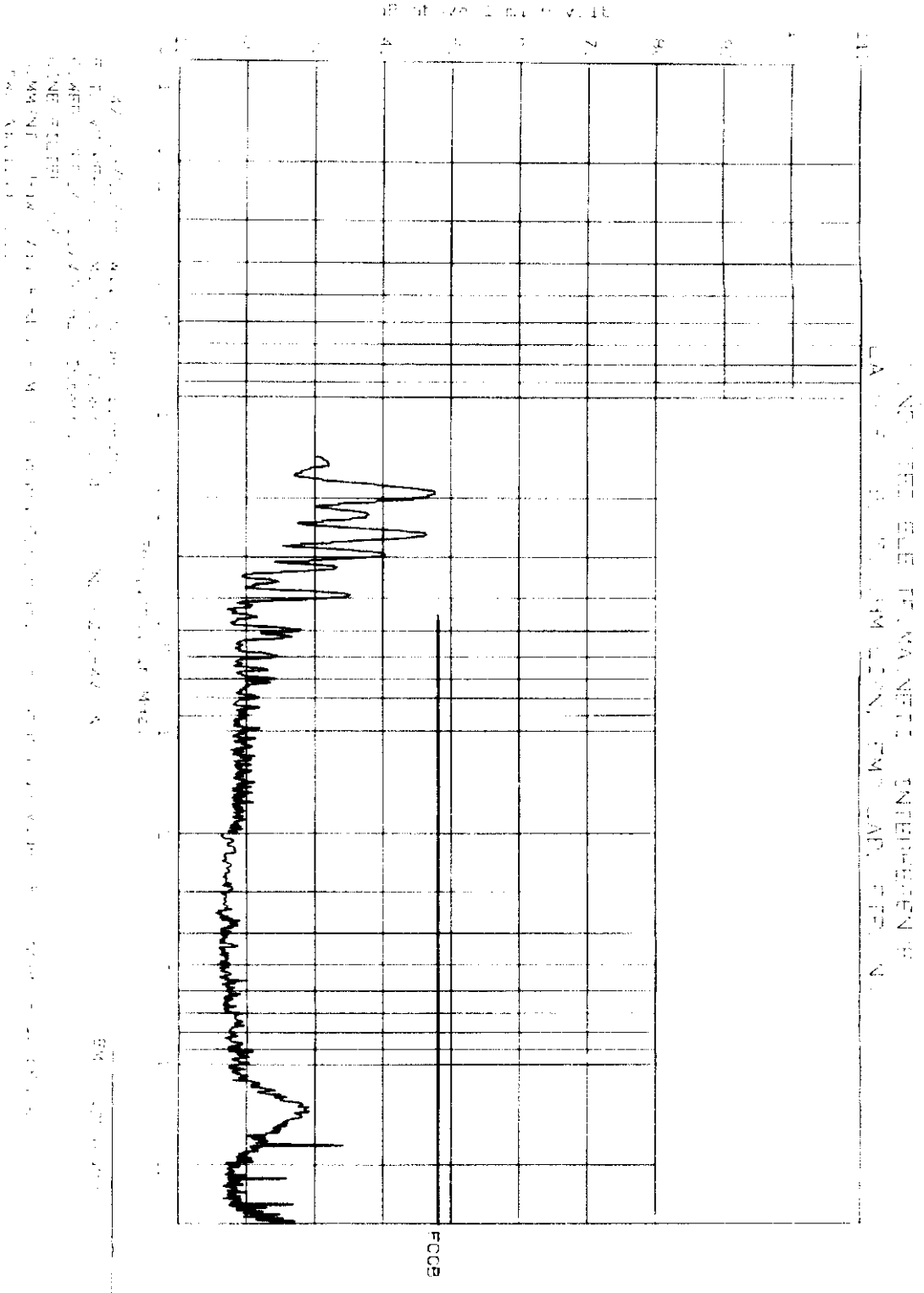


Photo 17 - Photo of the EUT stand alone in the Conducted EMI Test Room

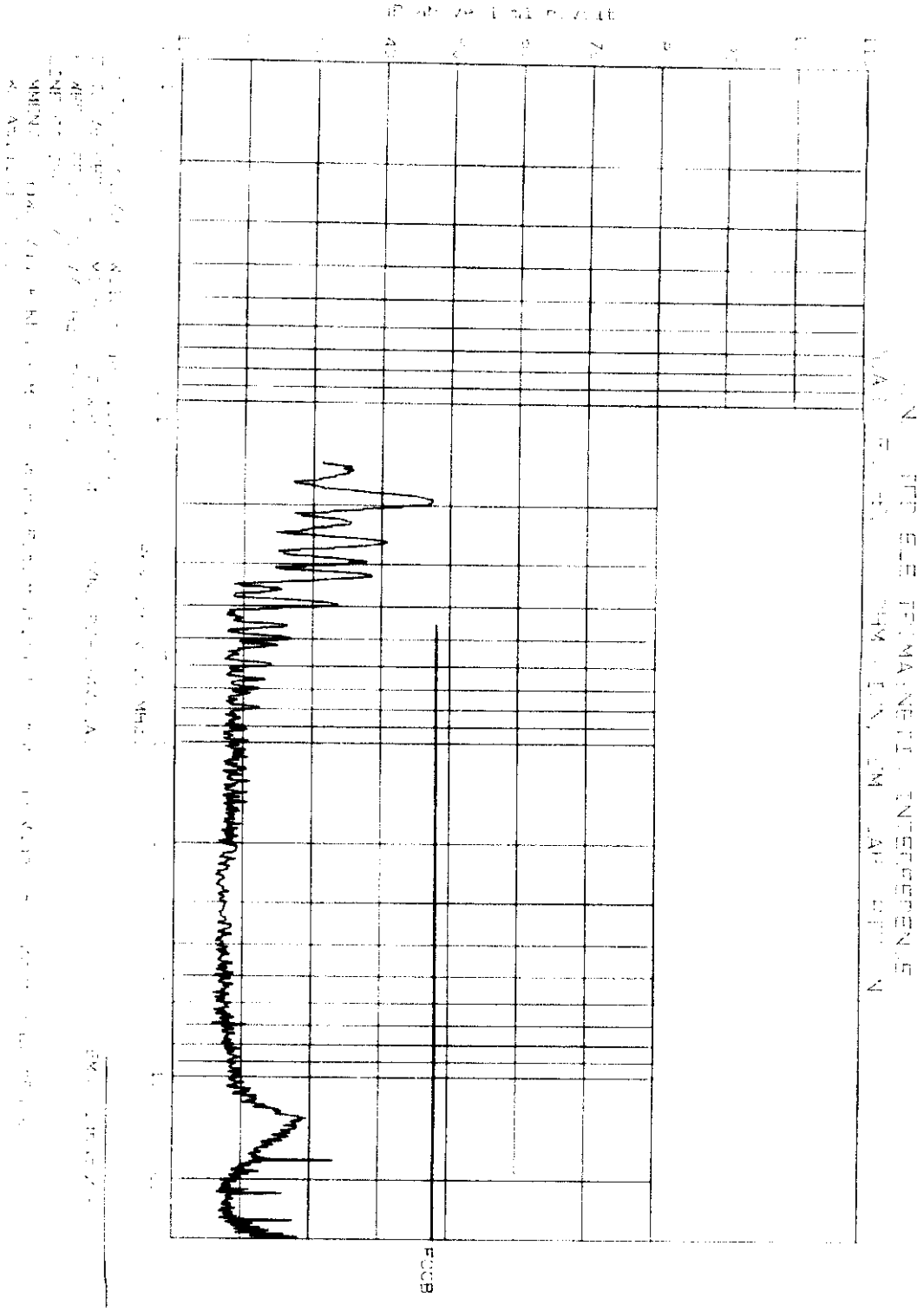
AC Voltage	Freq. (MHz)	$E_{QP\ meas.}$ (dBµV)	QP_{limit} (DbµV)	$E_{Av\ meas.}$ (dBµV)	Av_{limit} (dBµV)	Margin (dB)	Graphic	P/F
127V/60Hz	n/c	n/c	n/c	n/c	n/c	n/c	Graphic 5	Pass
220V/60Hz	n/c	n/c	n/c	n/c	n/c	n/c	Graphic 6	Pass

Legend	Description
$E_{QP\_measured}$	Maximum Quasi-Peak voltage measured.
QP_{limit}	Quasi-Peak limit.
$E_{Av\_measured}$	Maximum Average voltage measured.
Av_{limit}	Average limit.

Table 14 - Conducted Emissions test according to FCC 47 CFR, pt15 Class B - Maximum Measured Values.



Graphic 5 - Conducted Emission Scan according to FCC CFR47, pt15 Class B - AC: 127 V / 60 - Microtec Tower Personal Computer Vesper 6233.



Graphic 6 - Conducted Emission Scan according to FCC CFR47, pt15 Class B - AC: 220 V / 60 Hz - Microtec Tower Personal Computer Vesper 6233.

5. CONCLUSION

The Microtec Tower Personal Computer Vesper 6233 comply with :

- Radiated and Conducted limits and tests according to the FCC 47 CFR, pt15 Class B.

According to 1.2, the results of this document are valid only for the units and conditions tested and any extrapolation of those results to other units is the unique responsibility of Microtec Sistemas Indústria e Comércio S/A. The manufacturer is also responsible for the implementation of the modifications needed to comply to the above standards.


NMi