FCC PART 15 CLASS B

EMI MEASUREMENT AND TEST REPORT

FOR

NMB TECHNOLOGIES

9730 Independence Ave.,
Chatsworth, CA 91311

FCC ID: AQ6-32K15

April 23, 1999

This Report Concerns:	**Equipment Type:**
☒ Original Report	PS/2 Keyboard - Peripheral, ITE

Test Engineer:	Son Tran / Thomas Huang
Test Date:	March 24, 1999
Certified By:	John Y. Chan - Director, Compliance Engineering
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *NMB Technologies*, FCC ID *AQ6-32K15* or the "EUT" as referred to in this report is a standard PS/2 Keyboard with an integrated strain gage pointing device and a PS/2 pass through on a small daughter board for an external mouse. The keyboard microcontroller is a Zilog Z86K15 12 MHz crystal for Philips MCU mouse controller. They both run off of a 4 MHz + / - 10% RC internal oscillator. Inside the plastic enclosure of the keyboard, there is a four -Layered circuit Board with signal & GND islands on top, GND layers in the middle two layers, and signal and GND islands on the bottom layer. The EUT measures 14.5 ”Lx 6.625”Wx 1.0”H.

- The EUT was connected to a Full -Tower host system which provides for one (1) 3.5” floppy drive, one (1) IDE hard drive, one (1) CD-ROM drive, and one (1) AGP video display adapter.

1.2 Objective

This Class B report is prepared on behalf of *NMB Technologies* in accordance with Part 2, Subpart J, and Part 15, Subparts A and B of the Federal Communication Commissions rules and to ICES-003 of the Canadian Interference-Causing Equipment Regulations.

The objective of the manufacturer is to demonstrate compliance with FCC Class B limits for conducted and radiated margin and to ICES-003 requirements for Information Technology Equipment.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals

1.4 Test Methodology

All measurements contained in this report were conducted with ANSI C63.4 –1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 10 meters.

1.5 Test Facility

The Open Area Test site used by Bay Area Compliance Laboratory Corporation to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Suite 2, Sunnyvale, California, USA.

Test sites at Bay Area Compliance Laboratory Corporation has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-674 and R-657. The test sites has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, Bay Area Compliance Laboratory Corporation is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (NVLAP). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, IEC/CISPR 22: 1993, and AS/NZS 3548: Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods under NVLAP Lab Code 200167.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Data
HP	Spectrum Analyzer	8568B	2610A02165	12/6/99
HP	Spectrum Analyzer	8593B	2919A00242	12/20/99
HP	Amplifier	8349B	2644A02662	12/20/99
HP	Quasi-Peak Adapter	85650A	917059	12/6/99
HP	Amplifier	8447E	1937A01046	12/6/99
A.H. System	Horn Antenna	SAS0200/571	261	12/27/99
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/99
Com-Power	Biconical Antenna	AB-100	14012	11/2/99
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/99
Com-Power	LISN	LI-200	12208	12/20/99
Com-Power	LISN	LI-200	12005	12/20/99
BACL	Data Entry Software	DES1	0001	12/20/99

1.7 Equipment Under Test (EUT)

Manufacturer	Description	Model	Serial Number	FCC ID
NMB Technologies	Keyboard	RT3200	T-1 Sample No. 10	AQ6-32K15

1.8 Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Compaq	Motherboard	4300/CDS	P09830P1GFI1K7	DOC
MITSUBISHI	3.5”Floppy Drive	MF355F-3490UC	P412558	DOC
Quantum	Hard Drive	3.5 Series	174720431108	DOC
Compaq	CD-ROM	CR-5850-B	47095	IU09TB060CRB
Diamond	Video Card	Viper V330	None	DOC
Compaq	Power Supply	PS-5281-1C	7003182	DOC
Compaq	Chassis	DP6000	6738BQ64P282	DOC

1.9 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
Compaq	PC System	DESKPRO	6738BQ64P282	DOC
NEC	Monitor	JC-14W1VMA	5122300408	C5F7NFCMC1423B
Microsoft	Mouse	1.1APS2	7368864	C3KKMP5
Citizen	Printer	LSP-10	5047999-82	DLK66TLSP-10
EVEREX	Modem	EV-945	None	E3E5UVEV-945

1.10 External I/O Cabling List and Details

Cable Description	Length (M)	Port/From	To
Shielded Keyboard Cable	2.0	PS 2 /EUT	KB In of Compaq System
Shielded Keyboard Cable	2.0	PS 2 /EUT	Mouse In of Compaq System
Shielded Mouse Cable	1.5	PS 2/EUT	Microsoft Mouse
Shielded Serial Cable	1.5	Serial 1/Host	EVEREX Modem
Shielded Printer Cable	2.0	Parallel/Host	Citizen Printer
Shielded Video Cable	1.8	Video Out/Host	NEC Monitor

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The system was configured for testing in a typical fashion (as normally used by a typical user).

The following I/O ports were also provided by the host system: two serial ports, one parallel port, two USB port, one PS/2 keyboard port, one PS/2 mouse port, one floppy interface connector, and two IDE interface connectors.

Since the EUT has only one operating mode, this mode was used for the final qualification test.

The AGP video card was used for the final qualification test. The parallel port (LPT1), PS/2 mouse and keyboard ports were also tested along with a Compaq power supply.

2.2 EUT Exercise Software

The EUT exercising program used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The software, contained on the hard drive, is started in a DOS window under the Windows 98 operating system. Once loaded, the program sequentially exercises each system component.

The sequence used is as follows:

1. Lines of Hs scrolls across the VGA monitor
2. The printer outputs Hs
3. The modem receives Hs

The complete cycle takes approximately 5 - 10 seconds and the process is continuously repeated.

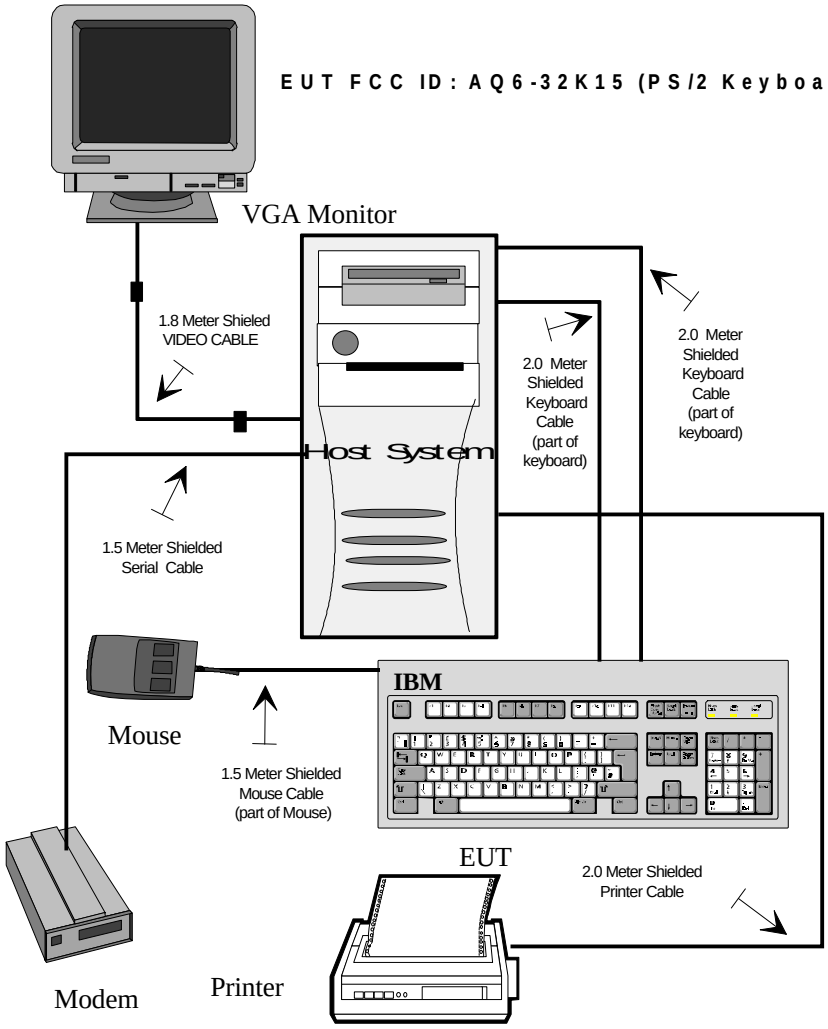
2.3 Special Accessories

As shown in section 2.5, all interface cables used for compliance testing are shielded as normally supplied by INMAC, Y.C. Cable and from their respective support equipment manufacturers. The EUT, and VGA monitor featured shielded metal connectors.

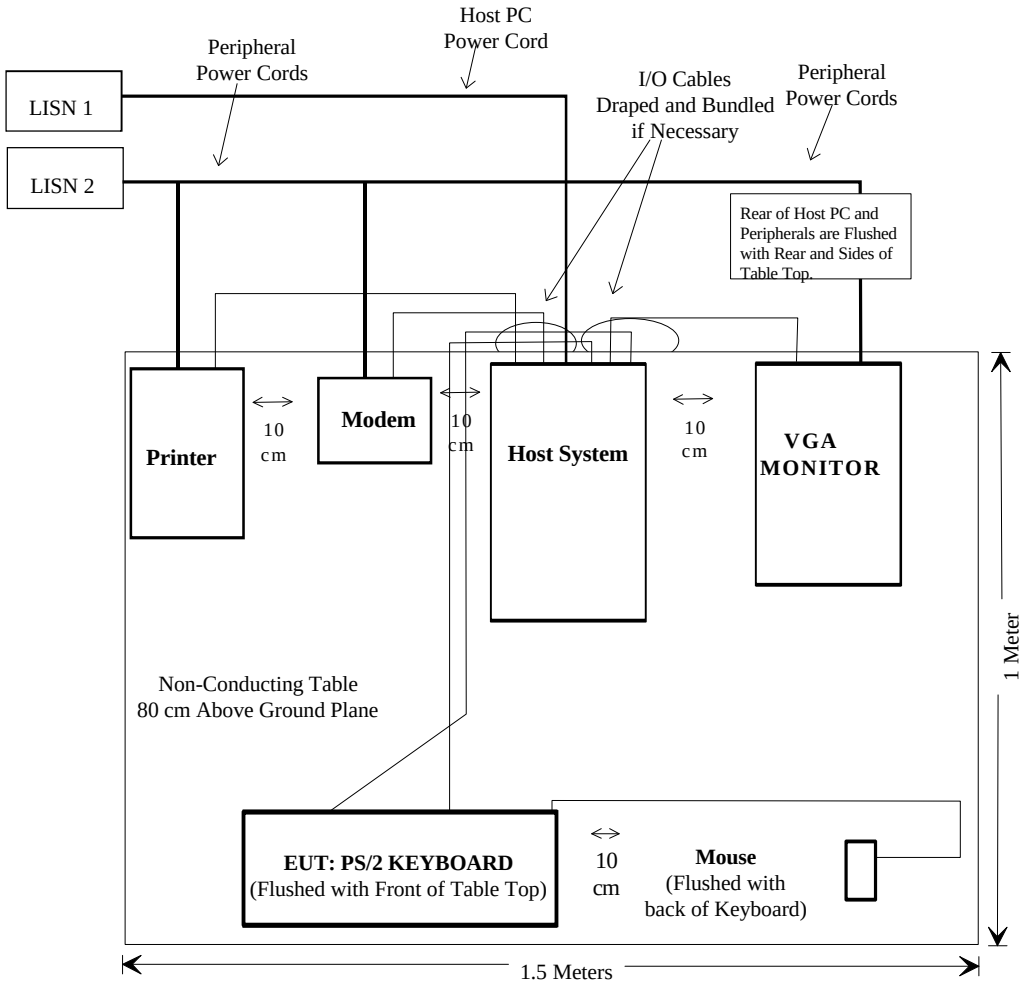
2.4 Block Diagram

Appendix A of this report contains a copy of the EUT's block diagram as reference.

2.5 Configuration of Test System



2.6 Test Setup Block Diagram



2.7 Equipment Modifications

No modification(s) were necessary for the EUT to comply with the applicable standards and limits.

3 - CONDUCTED EMISSIONS TEST DATA

3.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, and LISN.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of any conducted emissions measurement at BACL is $\pm$2.4 dB.

3.2 EUT Setup

The measurement was performed at the **O**pen **A**rea **T**est **S**ite, using the same setup per ANSI C63.4 - 1992 measurement procedure. Specification used was with the EN55022 Class B limits.

The host PC system was connected to a 110 VAC / 60 Hz power source and it was placed center and the back edge of the test table with the VGA monitor on one side of the PC system and a modem with the printer on the other side of the host PC. The rear of the EUT, host system and peripherals were placed flushed with the rear of the tabletop.

The EUT PS/2 keyboard was placed directly in front of the host system, flushed with the front of the tabletop. The mouse was placed on one side of the EUT. The mouse connected to the EUT was placed flushed with the back of the EUT keyboard.

The spacing between the peripherals was 10 centimeters.

Input / Output cables were draped over edge of the test table and bundle when necessary.

3.3 Spectrum Analyzer Setup

The spectrum analyzer was set with the following configurations during the conducted emission test:

Start Frequency	150 kHz
Stop Frequency	30 MHz
Sweep Speed	Auto
IF Bandwidth	100 kHz
Video Bandwidth	100 kHz
Quasi-Peak Adapter Bandwidth	9 kHz
Quasi-Peak Adapter Mode	Normal

3.4 Test Procedure

During the conducted emission test, the EUT power adapter power cord was connected to the auxiliary outlet of the first LISN with the host system, VGA monitor and all support equipment power cords connected to the second LISN.

Since the EUT has only one operating mode, this mode was tested with the COMPAQ Power supply to represent worst case results for the final qualification test. Therefore, these results were used for final test data recorded in the table listed under section 3.6 of this report.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance using all installation combination. All data was recorded in the peak detection mode. Quasi-peak readings were only performed when an emission was found to be marginal (less than -4 dBµV). Quasi-peak readings are distinguished with a "**Qp**".

3.5 Summary of Test Results

According to the data in section 3.6, the EUT complied with the EN55022 Conducted margin for a Class B device and these test results is deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, with the *worst* margin reading of:

-16.4 dBµV at **0.450 MHz** in the ***Line*** mode for the COMPAQ, M/N: PS-5281-1C power supply

3.6 Conducted Emissions Test Data

3.6.1 Test Data for COMPAQ Power Supply, model PS-5281-1C, 0.15 - 30 MHz.

LINE CONDUCTED EMISSIONS				EN55022 CLASS B	
Frequency	Amplitude	Detector	Phase	Limit	Margin
MHz	dBµV	Qp/Ave/Peak	Line/Neutral	dBµV	dB
0.450	40.5	QP	Line	57	-16.4
0.450	39.6	QP	Neutral	57	-17.3
14.090	15.8	QP	Line	60	-44.2
16.060	15.3	QP	Line	60	-44.7
16.090	14.6	QP	Neutral	60	-45.4
14.090	14.4	QP	Neutral	60	-45.6

3.7 Plot of Conducted Emissions Test Data

Plot of Conducted Emissions test data for the COMPAQ power adapter, model PS-5281-1C is presented in Appendix B of this report as reference.

4 - RADIATED EMISSION DATA

4.1 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at BACL is ±4.0 dB.

4.2 EUT Setup

The radiated emission tests were performed in the open area 10 meter test site, using the setup in accordance with the ANSI C63.4 - 1992. The specification used was the EN55022 Class B limits.

The host PC system was connected to a 110 VAC / 60 Hz power source and it was placed center and the back edge of the test table with the VGA monitor on one side of the PC system and a modem with the printer on the other side of the host PC. The rear of the EUT, host system and peripherals were placed flushed with the rear of the tabletop.

The EUT PS/2 keyboard was placed directly in front of the host system, flushed with the front of the tabletop. The mouse was placed on one side of the EUT. The mouse connected to the EUT was placed flushed with the back of the EUT keyboard.

The spacing between the peripherals was 10 centimeters.

Input / Output cables were draped over edge of the test table and bundle when necessary.

4.3 Spectrum Analyzer Setup

According to FCC Rules, 47 CFR 15.33, since the internal processor speed operates below 108 MHz, the system was tested to 1000 MHz.

During the radiated emission test, the spectrum analyzer was set with the following configurations:

Start Frequency	30 MHz
Stop Frequency	1000 MHz
Sweep Speed	Auto
IF Bandwidth	100 KHz
Video Bandwidth	1 MHz
Quasi-Peak Adapter Bandwidth	120 kHz
Quasi-Peak Adapter Mode	Normal
Resolution Bandwidth	1MHz

4.4 Test Procedure

For the radiated emissions test, the EUT, host system, VGA monitor and all support equipment power cords was connected to the AC floor outlet.

Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (less than -4 dBµV), and are distinguished with a "**Qp**" in the data table.

Since the EUT has only one operating mode, this mode was tested with a host system to represent worst case results for the final qualification test. . Therefore, these results were used for final test data recorded in the table listed under section 4.7 of this report as reference.

The parallel port (LPT1), PS/2 mouse and keyboard ports were also tested.

4.5 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dBµV means the emission is 7dBµV below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. - Class B Limit

4.6 Summary of Test Results

According to the data in section 4.7, the EUT complied with the EN55022 Class B standards and these test results is deemed satisfactory evidence of compliance with ICES-003 of the Canadian Interference-Causing Equipment Regulations, and had the worst margin of:

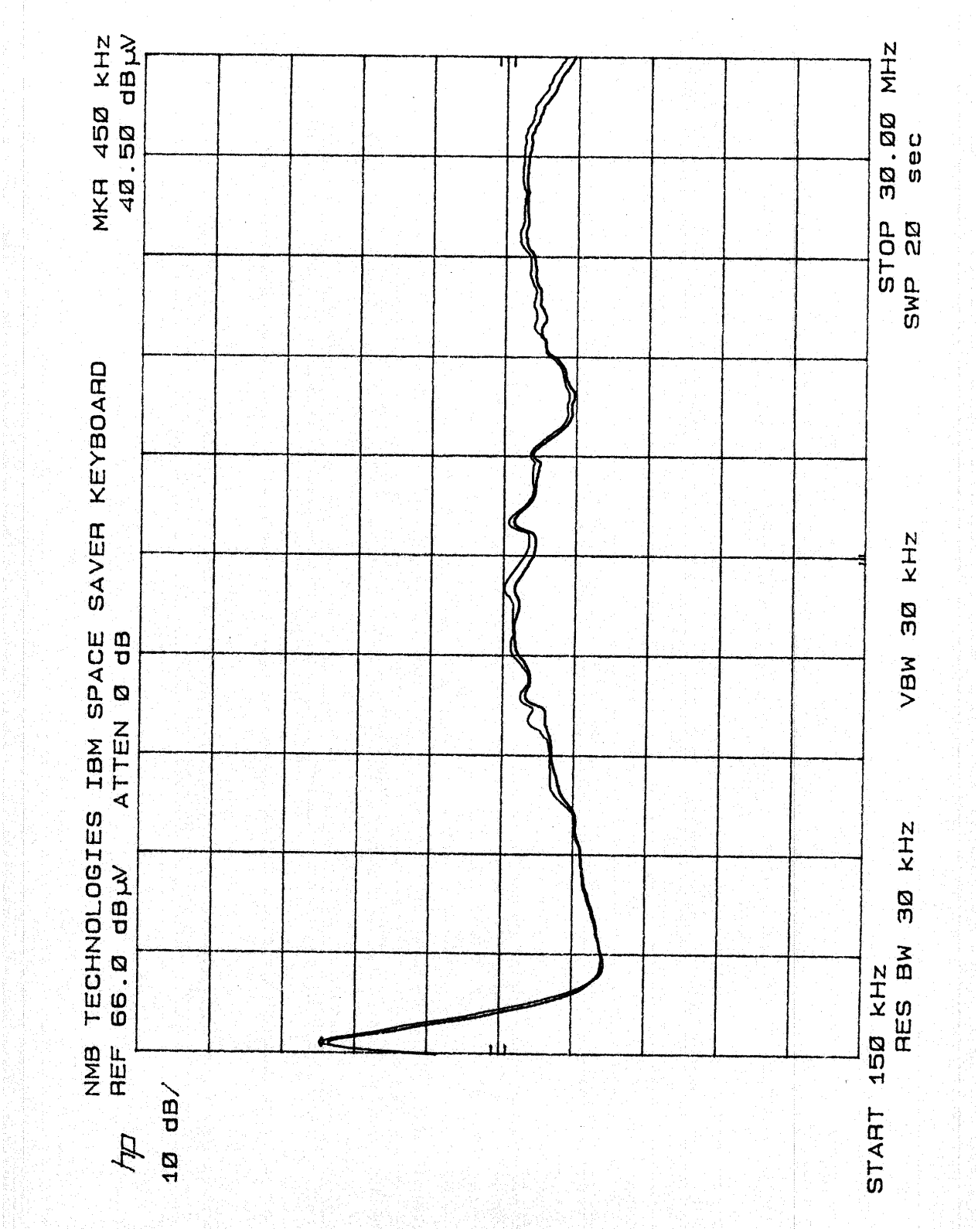
-3.5 dBµV at **144.00 MHz** in the **Vertical** polarization with Full – Tower PC System, 30 to 1000 MHz, 10 meters.

4.7 Radiated Emissions Test Result Data

4.7.1 Primary Test Data for EUT with Full- Tower PC System, 30 to 1000 MHz, 10 meters.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	EN55022 CLASS B	
Freqency MHz	Ampl. dBµV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBµV/m	Cable dB	Amp. dB	Corr. Ampl. dBµV/m	Limit dBµV/m	Margin dB
144.00	32.2	0	1.0	V	11.5	4.0	21.2	26.5	30	-3.5
228.83	25.7	160	1.0	V	17.5	4.8	22.0	26.0	30	-4.0
166.83	30.0	340	1.8	H	13.0	4.2	21.4	25.8	30	-4.2
166.53	29.3	200	1.0	V	13.0	4.2	21.4	25.1	30	-4.9
33.49	29.0	90	1.0	V	14.6	2.3	21.4	24.5	30	-5.5
144.00	30.0	330	1.6	H	11.5	4.0	21.2	24.3	30	-5.7
274.54	28.0	225	1.2	H	18.9	5.5	22.2	30.2	37	-6.8
251.66	28.0	125	1.0	H	18.5	5.1	22.9	28.7	37	-8.3
251.66	27.8	270	1.0	V	18.5	5.1	22.9	28.5	37	-8.5

Appendix A – PLOT OF CONDUCTED EMISSION TEST DATA


NMB TECHNOLOGIES IBM SPACE SAVER KEYBOARD
MKR 450 kHz
40.50 dBµV
REF 66.0 dBµV
ATTEN 0 dB
10 dB/
START 150 kHz
RES BW 30 kHz
VBW 30 kHz
STOP 30.00 MHz
SWP 20 sec

Appendix B – AGENT AUTHORIZATION LETTER

NMB TECHNOLOGIES INC.
NMB Technologies, Inc. • 9730 Independence Avenue • Chatsworth, California 91311 • USA

April 12, 1999

Federal Communications Commission
7435 Oakland Mills Road,
Columbia, Maryland 21046

Sir/Madam,

Reg: FCC grant for AQ6-32K15

This letter is an authorization to accept Bay Area Compliance Lab, Corp., as an agent for NMB Technologies Inc., at 9730 Independence Avenue, Chatsworth, CA. 91311, for a period of one year, to sign applications before the Commission on our behalf, to make representations to you on our behalf, and to receive and exchange data between our company and the commission in connection with certification of the following NMB Technologies Inc., product:

NMB Computer Keyboard with integrated pointing device (Model: RT3200)

Under FCC docket number 20780 and general docket number 80-284 pursuant to part 15, FCC rules and regulations.

Sincerely,

John Guo

John Guo
Manager, Electronic Engineering

JG/gls