FCC PART 15 CLASS B

EMI MEASUREMENT AND TEST REPORT

FOR

NMB TECHNOLOGIES

9730 Independence Ave.,
Chatsworth, CA 91311

FCC ID: AQ6-RT2900

August 30, 2000

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

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Test Date:	April 28, 2000
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *NMB Technologies*, Model *RT2900* or the "EUT" as referred to in this report is a standard Keyboard which could bring users closer and keeps users in touch with desktop world. The EUT measures 17.9 ”Lx 6.12”Wx 1.25”H.

- The EUT was connected to a Mid -Tower host system which provides for one (1) 3.5” floppy drive, one (1) IDE hard drive, one (1) CD-ROM drive, one (1) IBM motherboard, and one (1) modem card.

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 Part 15 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 200167-0.

1.6 Test Equipment List

Manufacturer	Description	Model	Serial Number	Cal. Due Data
HP	Spectrum Analyzer	8568B	2610A02165	12/6/00
HP	Spectrum Analyzer	8593B	2919A00242	12/20/00
HP	Amplifier	8349B	2644A02662	12/20/00
HP	Quasi-Peak Adapter	85650A	917059	12/6/00
HP	Amplifier	8447E	1937A01046	12/6/00
A.H. System	Horn Antenna	SAS0200/571	261	12/27/00
Com-Power	Log Periodic Antenna	AL-100	16005	11/2/00
Com-Power	Biconical Antenna	AB-100	14012	11/2/00
Solar Electronics	LISN	8012-50-R-24-BNC	968447	12/28/00
Com-Power	LISN	LI-200	12208	12/20/00
Com-Power	LISN	LI-200	12005	12/20/00
BACL	Data Entry Software	DES1	0001	12/20/00

1.7 Equipment Under Test (EUT)

Manufacturer	Description	Model	Serial Number	FCC ID
NMB	Keyboard	RT2900	41100077/41100081	AQ6-RT2900

1.8 Host System Configuration List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
IBM	Motherboard	V72MA 98125	11S9133B10002A M707FZ	DOC
Panasonic	3.5”Floppy Drive	N4847	JU-256A276P	DOC
Maxtor	Hard Drive	90845D4	A4153EBC C 108	DOC
LG	CD-ROM	CR-8322B	11S36L8727ZJ17C M302121	IU09TB060CRB
EVER	Power Supply	FSP 145-50NI	W17178420 (9843)	DOC
N/A	Modem Card	FB WS-5614PS3	9118302548-03 WS-5614PS3	L40WS-5614PS3
IBM	Chassis	520	AM 707AR	None

1.9 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number	FCC ID
IBM	Mouse	13H6690	073537	DOC
Citizen	Printer	LSP-10	5047999-82	DLK66TLSP-10
Voxon	Monitor	MO-D1428	E971002490	LFVDX-1448
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	Keyboard/EUT	Keyboard Port/PC System
Shielded Mouse Cable	1.8	Mouse Port/Host	Mouse
Shielded Video Cable	1.5	Video Port/Host	Voxon Monitor
Shielded Printer Cable	2.8	Parallel Port/Host	CITIZEN Printer
Shielded Serial Cable	2.0	Serial /Host	EVEREX Modem

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 an EVER 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, H pattern, 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 scroll across the VGA monitor.
2. The modem(s) receives Hs.
3. The printer output Hs.

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

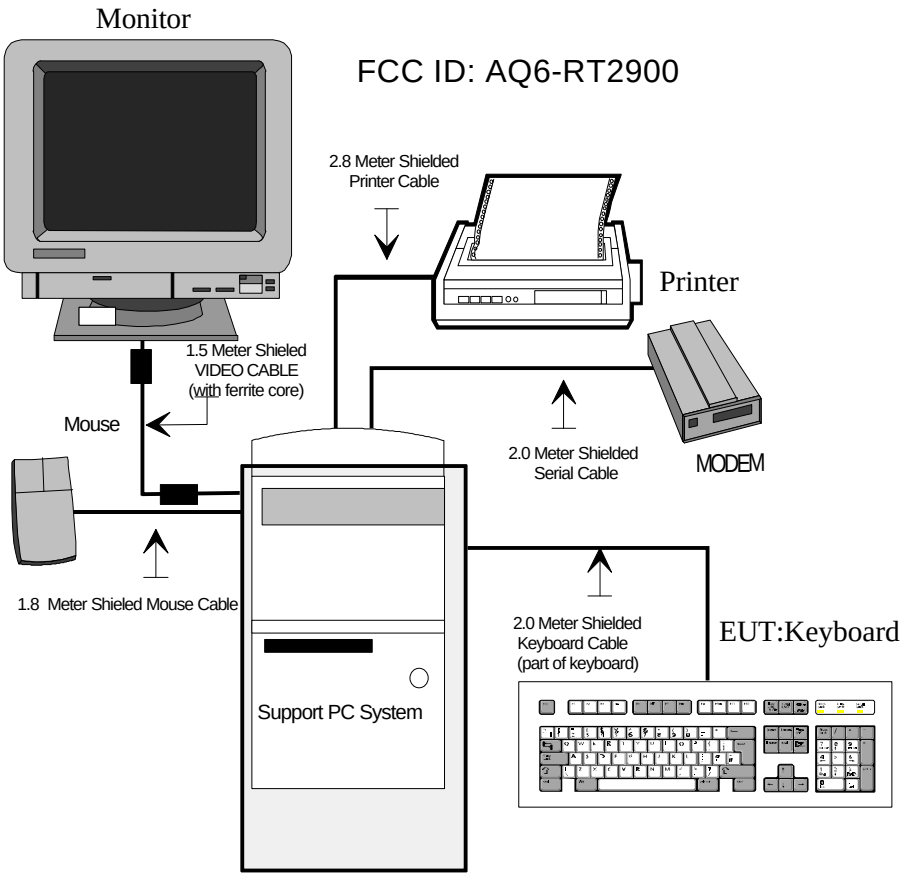
2.3 Special Accessories

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, modem, printer and VGA monitor featured shielded metal connectors.

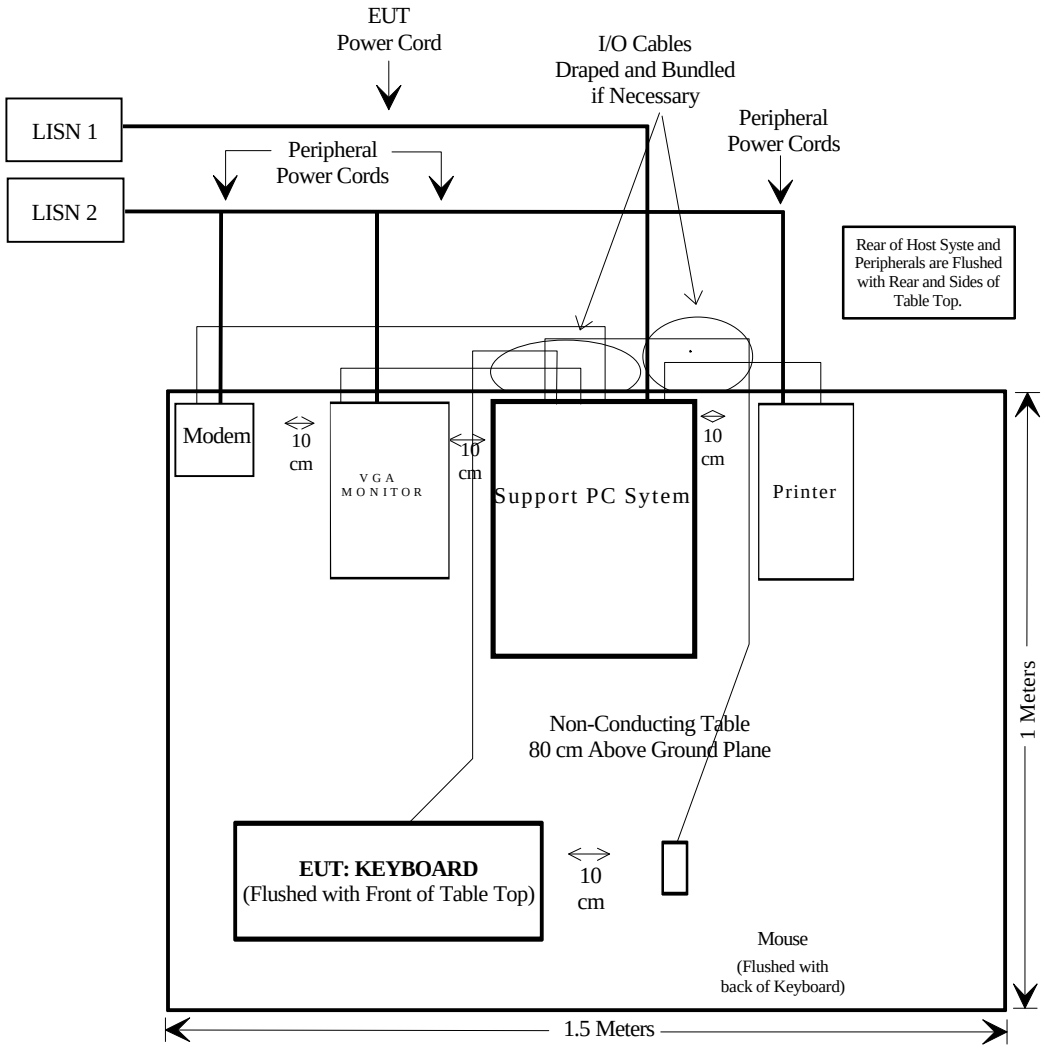
2.4 Block Diagram

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, the modem and the printer were placed on the other side of the Host PC system. The rear of the host system and peripherals were placed flushed with the rear of the tabletop.

The EUT keyboard was placed directly in front of the host system. The mouse was placed on one side of the EUT. The mouse connected to the host PC was flushed with the back of the test table.

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 EVER 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:

-10.6 dBmV at **0.480 MHz** in the ***Neutral*** mode for the EVER, M/N: FSP 145-50NI power supply

3.6 Conducted Emissions Test Data

3.6.1 Test Data for EVER Power Supply, model FSP 145-50NI, 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
0.480	45.7	QP	Neutral	56.34	-10.6
0.420	46.2	QP	Line	57.45	-11.2
15.700	32.9	QP	Neutral	60.00	-27.1
15.520	32.6	QP	Line	60.00	-27.4
28.210	27.7	QP	Neutral	60.00	-32.3
28.210	25.2	QP	Line	60.00	-34.8

3.7 Plot of Conducted Emissions Test Data

Plot of Conducted Emissions test data for the EVER power adapter, model FSP 145-50NI 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 $\pm$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, the modem and the printer were placed on the other side of the Host PC system. The rear of the host system and peripherals were placed flushed with the rear of the tabletop.

The EUT keyboard was placed directly in front of the host system. The mouse was placed on one side of the EUT. The mouse connected to the host PC was flushed with the back of the test table.

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:

-5.9 dBmV at **76.17 MHz** in the **Horizontal** polarization with Mid – Tower PC System, 10 meters.

-7.5 dBmV at **114.42 MHz** in the **Horizontal** polarization with Mid – Tower PC System, 10 meters.

4.7 Radiated Emissions Test Result Data

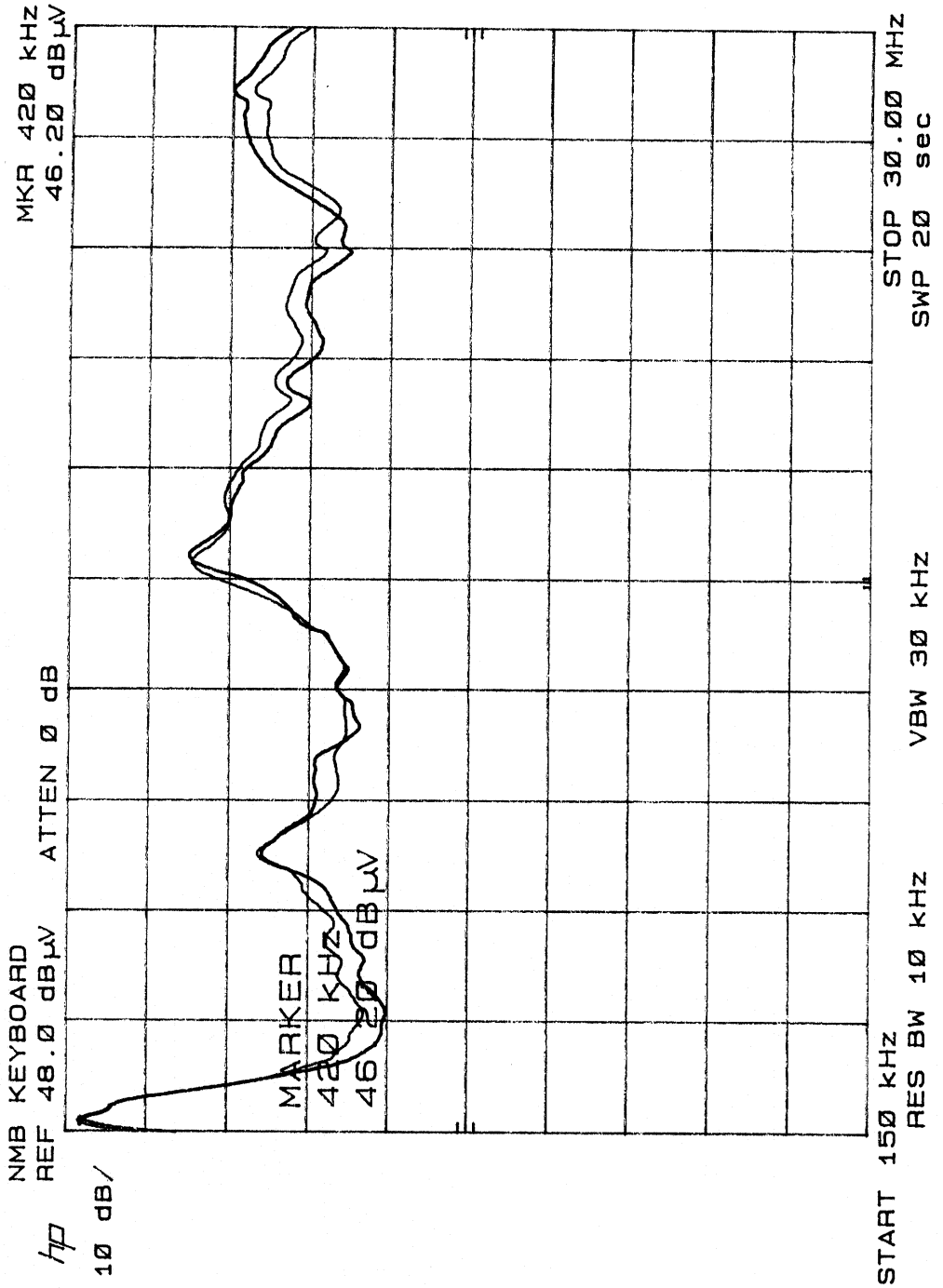
4.7.1 Primary Test Data for EUT with Keyboard Serial No. 41100077, Mid- Tower PC System, 10 meters.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	EN55022 CLASS B	
Freqency MHz	Ampl. dBmV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBmV/m	Cable dB	Amp. dB	Corr. Ampl. dBmV/m	Limit dBmV/m	Margin dB
76.17	33.0	270	2.3	H	8.9	3.2	21.0	24.1	30	-5.9
84.18	33.3	250	2.3	H	8.8	3.0	21.0	24.1	30	-5.9
88.20	30.5	270	1.2	V	9.9	3.1	20.9	22.6	30	-7.4
84.18	31.2	0	1.2	V	9.2	3.0	21.0	22.4	30	-7.6
80.16	31.0	0	1.2	V	9.2	3.0	21.0	22.2	30	-7.8
88.21	31.1	90	2.3	H	8.7	3.1	20.9	22.0	30	-8.0
80.19	30.8	270	2.3	H	8.8	3.0	21.0	21.6	30	-8.4
76.16	29.0	0	1.2	V	8.6	3.2	21.0	19.8	30	-10.2

4.7.2. Primary Test Data for EUT with Keyboard Serial No. 41100081, Mid- Tower PC System, 10 meters.

INDICATED		TABLE	ANTENNA		CORRECTION FACTOR			CORRECTED AMPLITUDE	EN55022 CLASS B	
Freqency MHz	Ampl. dBmV/m	Angle Degree	Height Meter	Polar H/ V	Antenna dBmV/m	Cable dB	Amp. dB	Corr. Ampl. dBmV/m	Limit dBmV/m	Margin dB
114.42	30.6	90	2.2	H	10.3	3.0	21.4	22.5	30	-7.5
114.42	29.8	270	1.1	V	10.4	3.0	21.4	21.8	30	-8.2
72.05	29.3	0	2.2	H	9.2	2.9	21.3	20.1	30	-9.9
72.25	29.3	270	1.1	V	8.1	2.9	21.3	19.0	30	-11.0
76.28	27.0	0	1.1	V	8.6	3.2	21.0	17.8	30	-12.2
76.28	24.6	90	2.2	H	8.9	3.2	21.0	15.7	30	-14.3

Appendix A – PLOT OF CONDUCTED EMISSION TEST DATA


NMB KEYBOARD
REF 48.0 dBµV
ATTEN 0 dB
10 dB/
MKR 420 kHz
46.20 dBµV
MARKER
420 kHz
46.20 dBµV
START 150 kHz
RES BW 10 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

August 9, 2000

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

Sir/Madam,

Reg: FCC grand for AQ6-RT2900

This letter is an authorization to accept Bay Area Compliance Lab. Corporation as an agent for NMB Technologies Inc., at 9730 Independence Avenue, Chasworth CA. 91311 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 (Model: RT2900)

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

Sincerely,

John Guo
Manager, Electronic Engineering