FCC PART 15, SUBPART B
CLASS B TEST REPORT
TEST METHOD: ANSI C63.4-1992
LIMITS: CISPR 22 CLASS B

for

COMPUTER KEYBOARD
Model: RT3100
FCC ID: AQ6-31K15

Prepared for

NMB TECHNOLOGIES, INC.
9730 INDEPENDENCE AVENUE
CHATSWORTH, CA 91311

Prepared by: _____
RUBY A. HALL

Approved by: _____
JEFF S. KLINGER

COMPATIBLE ELECTRONICS INC.
2337 TROUTDALE DRIVE
AGOURA, CALIFORNIA 91301
(818) 597-0600

DATE: MARCH 17, 1999

	REPORT BODY	APPENDICES				TOTAL
		A	***B***	***C***	***D***	
PAGES	17	2	2	8	5	**34**

TABLE OF CONTENTS

LIST OF APPENDICES

APPENDIX	TITLE
A	Modifications to the EUT
B	Additional Models Covered Under This Report
C	Diagrams, Charts and Photos • Test Setup Diagrams • Antenna and Effective Gain Factors • Radiated and Conducted Emissions Photos
D	Data Sheets

LIST OF TABLES

TABLE	TITLE
1	Conducted Emissions Test Results
2	Radiated Emissions Test Results

LIST OF FIGURES

FIGURE	TITLE
1	Conducted Emissions Test Setup
2	Plot Map And Layout of Test Site

GENERAL REPORT SUMMARY

This electromagnetic emission report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced in any form unless done so in full with the written permission of Compatible Electronics.

This report must not be used to claim product endorsement by NVLAP or any other agency of the U.S. Government.

Device Tested:	Computer Keyboard Model: RT3100 S/N: None
Product Description:	This is a keyboard used for data input on a computer.
Modifications:	The EUT was not modified during the testing.
Manufacturer:	NMB Technologies, Inc. 9730 Independence Avenue Chatsworth, CA 91311
Test Date:	Mar. 16, 1999
Test Specifications:	EMI requirements FCC Title 47, Part 15 Subpart B, CLASS B per CISPR 22 Limits Test Procedure: ANSI C63.4: 1992.
Test Deviations:	The test procedure was not deviated from during the testing.

SUMMARY OF TEST RESULTS

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz - 30 MHz.	Complies with the **Class B** limits of CISPR 22 as called out in FCC Title 47, Part 15 Subpart B.
2	Radiated RF Emissions, 30 MHz - 1000 MHz.	Complies with the **Class B** limits of CISPR 22 as called out in FCC Title 47, Part 15 Subpart B.

1. PURPOSE

This document is a qualification test report based on the Electromagnetic Interference (EMI) tests performed on the Computer Keyboard Model: RT3100. The EMI measurements were performed according to the measurement procedure described in ANSI C63.4: 1992. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test, referred to as EUT hereafter, are within the **Class B** specification limits defined by C.I.S.P.R. Publication 22 for Information Technology Equipment from 150 kHz to 1 GHz. Under paragraph G of Section 15.109 of the Code of Federal Regulations Title 47, part 15 of the FCC rules, the FCC accepts the international standards set forth in C.I.S.P.R. Publication 22.

2. ADMINISTRATIVE DATA

2.1 Location of Testing

The EMI tests described herein were performed at the test facility of Compatible Electronics, 2337 Troutdale Drive, Agoura, California 91301.

2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

2.3 Cognizant Personnel

NMB Technologies, Inc.

Bob Dickerman	Electrical Engineer
John Guo	Manager, Electronic Engineering

Compatible Electronics Inc.

Ruby A. Hall	Test Engineer
Reynald O. Ramirez	Test Technician
Jeff S. Klinger	Lab Manager

2.4 Date Test Sample was Received

The test sample was received on Mar. 16, 1999.

2.5 Disposition of the Test Sample

The test sample remains at Compatible Electronics, Inc.

2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

RF	Radio Frequency
EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Part Number
S/N	Serial Number
HP	Hewlett Packard
ITE	Information Technology Equipment
CML	Corrected Meter Limit
LISN	Line Impedance Stabilization Network

3. APPLICABLE DOCUMENTS

The following documents are referenced or used in the preparation of this EMI Test Report.

SPEC	TITLE
CISPR 22 1993	Limits and methods of measurement of radio interference characteristics of information technology equipment.
CISPR 16 1993	Specification for radio disturbance and immunity measuring apparatus and methods.
FCC Title 47, Subpart B.	FCC Rules - Radio frequency devices (including digital devices).
ANSI C63.4 1992	Methods of measurement of radio-noise emissions from low-voltage electrical and electronic equipment in the range of 9 kHz to 40 GHz.

4. DESCRIPTION OF TEST CONFIGURATION

4.1 Description of Test Configuration - EMI

The EUT was configured in a tabletop configuration. The EUT was connected to a Computer via the Keyboard port. A Monitor, Modem, Printer and Mouse were also connected to the Computer via the Video, Serial, Parallel and Mouse ports respectively. The EUT was tested in an Idle mode powered on and awaiting data input/output and sending data (capital Hs) via keystroke.

It was determined that the emissions were at their highest level when the EUT was operating in the above configuration sending Hs via keystroke. The cables were moved to maximize the emissions. The final conducted as well as radiated data was taken in this mode of operation. All initial investigations were performed with the spectrum analyzer in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix C.

4.1.1 Cable Construction and Termination

Cable 1

This is a 2 meter foil shielded round cable connecting the EUT to the Computer. It has a 6 pin Mini DIN metallic connector at the Computer end, and is hardwired at the EUT end. The shield of the cable was grounded to the chassis via the connector.

Cable 2

This is a 1.5 meter braid and foil shielded round cable connecting the Monitor to the Computer. It has a D-15 pin metallic connector at the Computer end, and is hardwired at the Monitor end. The shield of the cable was grounded to the chassis via the connector. The cable was bundled to a length of 1 meter.

Cable 3

This is a 1.5 meter braid and foil shielded round cable connecting the Printer to the Computer. It has a 36 pin metallic Centronics connector at the Printer end, and a D-25 pin metallic connector at the Computer end. The shield of the cable was grounded to the chassis via the connectors. The cable was bundled to a length of 1 meter.

Cable 4

This is a 1.5 meter braid and foil shielded round cable connecting the Modem to the Computer. It has a D-25 pin metallic connector at the Modem end, and a D-9 pin metallic connector at the Computer end. The shield of the cable was grounded to the chassis via the connectors. The cable was bundled to a length of 1 meter.

Cable 5

This is a 2 meter foil shielded round cable connecting the Mouse to the Computer. It has a 6 pin Mini DIN metallic connector at the Computer end, and is hardwired at the Mouse end. The shield of the cable was grounded to the chassis via the connector.

5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

5.1 EUT and Accessory List

EQUIPMENT TYPE	MANUFACTURER	MODEL	SERIAL NUMBER
COMPUTER KEYBOARD (EUT)	NMB TECHNOLOGIES, INC.	RT3100	None FCC ID: AQ6-31K15
COMPUTER	DELL	MMP	F25LT
MONITOR	VIEWSONIC	1449	3742968085 FCC ID: K351449
MODEM	HAYES	2000US	A02620003419 FCC ID: BFJ2000US
PRINTER	HEWLETT PACKARD	C2184A	CN5A41R10J FCC ID: B94C2184X
MOUSE	MICROSOFT	P/N:X03-60998	FCC ID: C3KKMP5

5.2 EMI Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Spectrum Analyzer	Hewlett Packard	8566A	27029A04566	Jun. 23, 1998	Jun. 23, 1999
Quasi-Peak Adapter	Hewlett Packard	85650A	2648A15161	Mar. 09, 1999	Mar. 09, 2000
EMI Receiver	Hewlett Packard	8546A	3325A00140	Mar. 04, 1999	Mar. 04, 2000
Preamplifier	Com Power	PA-102	01249	Apr. 20, 1998	Apr. 20, 1999
RF Attenuator	Sertek	412-10	XX02	Sep. 14, 1998	Sep. 14, 1999
LISN	Com Power	LI-200	01777	Jul. 15, 1998	Jul. 15, 1999
LISN	Com Power	LI-200	01778	Jul. 15, 1998	Jul. 15, 1999
LISN	Com Power	LI-200	01779	Jul. 15, 1998	Jul. 15, 1999
LISN	Com Power	LI-200	01781	Jul. 15, 1998	Jul. 15, 1999
Biconical Antenna	Com Power	AB-100	01535	Apr. 17, 1998	Apr. 17, 1999
Log Periodic Antenna	Com Power	AL-100	A101	Apr. 16, 1998	Apr. 16, 1999
Antenna Mast	Com Power	AM-400	N/A	N/A	N/A
Turntable	Com Power	TT-106A	N/A	N/A	N/A
Computer	Area Electronics	B1	5581	N/A	N/A
Printer	Hewlett Packard	C4568A	SG212S11903Q	N/A	N/A

6. TEST SITE DESCRIPTION

6.1 Test Facility Description

Please refer to section 2.1 and 7.1.2 of this report for EMI test location.

6.2 EUT Mounting, Bonding and Grounding

The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

The EUT was grounded only through the Computer's chassis.

7. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

7.1 RF Emissions

7.1.1 Conducted Emissions Test

The spectrum analyzer was used as a measuring meter. The data was collected with the spectrum analyzer in the peak detect mode with the "Max Hold" feature activated. The quasi-peak was used only where indicated in the data sheets. A 10 dB attenuation pad was used for the protection of the spectrum analyzer input stage, and the spectrum analyzer offset was adjusted accordingly to read the actual data measured. The LISN output was read by the spectrum analyzer. The output of the second LISN was terminated by a 50 ohm termination. The effective measurement bandwidth used for the conducted emissions test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI C63.4: 1992. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The initial test data was taken in manual mode while scanning the frequency ranges of 0.15 MHz to 1.6 MHz, 1.6 MHz to 5 MHz and 5 MHz to 30 MHz. The conducted emissions from the EUT were maximized for operating mode as well as cable and peripheral placement. Once a predominant frequency (within 12 dB of the limit) was found, it was more closely examined with the spectrum analyzer span adjusted to 1 MHz.

The final data was collected under program control by the computer in several overlapping sweeps by running the spectrum analyzer at a minimum scan rate of 10 seconds per octave. The six highest emissions are listed in Table 1.

7.1.2 Radiated Emissions Test

The spectrum analyzer was used as a measuring meter. The Preamplifier was used to increase the sensitivity of the instrument. The spectrum analyzer was used in the peak detect mode with the "Max Hold" feature activated. In this mode, the spectrum analyzer records the highest measured reading over all the sweeps. The quasi-peak was used only for those readings which are marked accordingly on the data sheets. The effective measurement bandwidth used for the radiated emissions test was 120 kHz.

Broadband biconical and log periodic antennas were used as transducers during the measurement. The biconical antenna was used from 30 MHz to 300 MHz, and the log periodic antenna was used from 300 MHz to 1 GHz. The frequency spans were wide (30 MHz to 88 MHz, 88 MHz to 216 MHz, 216 to 300 MHz and 300 MHz to 1 GHz) during preliminary investigations. The final data was taken with a frequency span of 1 MHz. Furthermore, the frequency span was reduced during the preliminary investigations as deemed necessary.

The open field test site of Compatible Electronics, Inc. was used for radiated emission testing. This test site is set up according to ANSI C63.4: 1992. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength).

The presence of ambient signals was verified by turning the EUT off. In case an ambient signal was detected, the measurement bandwidth was reduced temporarily and verification was made that an additional adjacent peak did not exist. This ensures that the ambient signal does not hide any emissions from the EUT. The EUT was tested at a 10 meter test distance to obtain final test data. The six highest emissions are listed in Table 2.

7.1.3 RF Emissions Test Results

Table 1.0 CONDUCTED EMISSION RESULTS (110V)
COMPUTER KEYBOARD Model: RT3100

Frequency MHz	Emission Level* dBuV	Average Specification Limit dBuV	Delta dB
.1589	51.35	55.56	-4.21
5.914	40.62	50.00	-9.38
6.018	39.67	50.00	-10.33
6.311	39.73	50.00	-10.27
6.719	42.66	50.00	-7.34
6.818	40.56	50.00	-9.44

Table 2.0 RADIATED EMISSION RESULTS
COMPUTER KEYBOARD Model: RT3100

Frequency MHz	Meter* Reading dBuV/m	Effective Gain ** dB	Antenna Factor ** dB/m	Distance Factor dB	Corrected Reading dBuV/m	Spec. Limit dBuV/m	Delta dB
40.03	49.5	35.7	11.6	0	25.4	30	-4.6
64.05	52.5#	35.3	10.7	0	27.9	30	-2.1
128.55	49.5	34.8	11.5	0	26.2	30	-3.8
137.70	48.6	34.7	12.2	0	26.1	30	-3.9
170.06	46.9	34.4	14.8	0	27.3	30	-2.7
210.05	43.8	34.0	16.7	0	26.5	30	-3.5

Notes:

* The complete emissions data is given in Appendix D of this report.

** The effective gain factor includes the cable loss. The correction factors for the antenna and effective gain are attached in Appendix C of this report.

\# Quasi-Peak Reading

7.1.4 Sample Calculations

The Preamplifier was used to increase the sensitivity of the spectrum analyzer. A correction factor for the antenna, preamplifier, cable loss and a distance factor (if any), must be applied to the meter reading before a true field strength reading can be obtained. For greater efficiency and convenience, instead of using these correction factors for each meter reading, the specification limit was modified to reflect these correction factors at each frequency, so that the meter readings can be compared directly to the modified specification limit, referred to henceforth as the corrected meter reading limit (CML).

The equation can be derived in the following manner:

Corrected Meter Reading = meter reading + F - G

where: F = antenna factor
G = effective gain (amplifier gain - cable loss)

Therefore, the equation for determining the corrected meter reading limit is:

CML = spec. limit - F + G

A table of corrected meter reading limits was used to permit immediate comparison of the meter reading and determine if the emission level exceeded the specification limit at that frequency. The correction factors for the antenna and the effective gain are attached in Appendix C of this report. The data sheets are attached in Appendix D.

The distance factor D is 0 when the test is performed at a distance of 10 meters.

8. CONCLUSIONS

The Computer Keyboard Model: RT3100 meets all of the **Class B** specification limits defined by C.I.S.P.R. Publication 22 for Information Technology Equipment from 150 kHz to 1 GHz. Under paragraph G of section 15.109 of the Code of Federal Regulations Title 47, Part 15, of the FCC Rules, the FCC accepts the international standards set forth in C.I.S.P.R. Publication 22.

APPENDIX A

MODIFICATIONS TO THE EUT

MODIFICATIONS TO THE EUT

There were no modifications made to the EUT during the test.

APPENDIX B

ADDITIONAL MODELS COVERED UNDER THIS REPORT

ADDITIONAL MODELS COVERED UNDER THIS REPORT

USED FOR THE PRIMARY TEST	COMPUTER KEYBOARD Model: RT3100

There were no additional models covered under this report.

APPENDIX C

DIAGRAMS, CHARTS AND PHOTOS

FIGURE 1: CONDUCTED EMISSIONS TEST SETUP

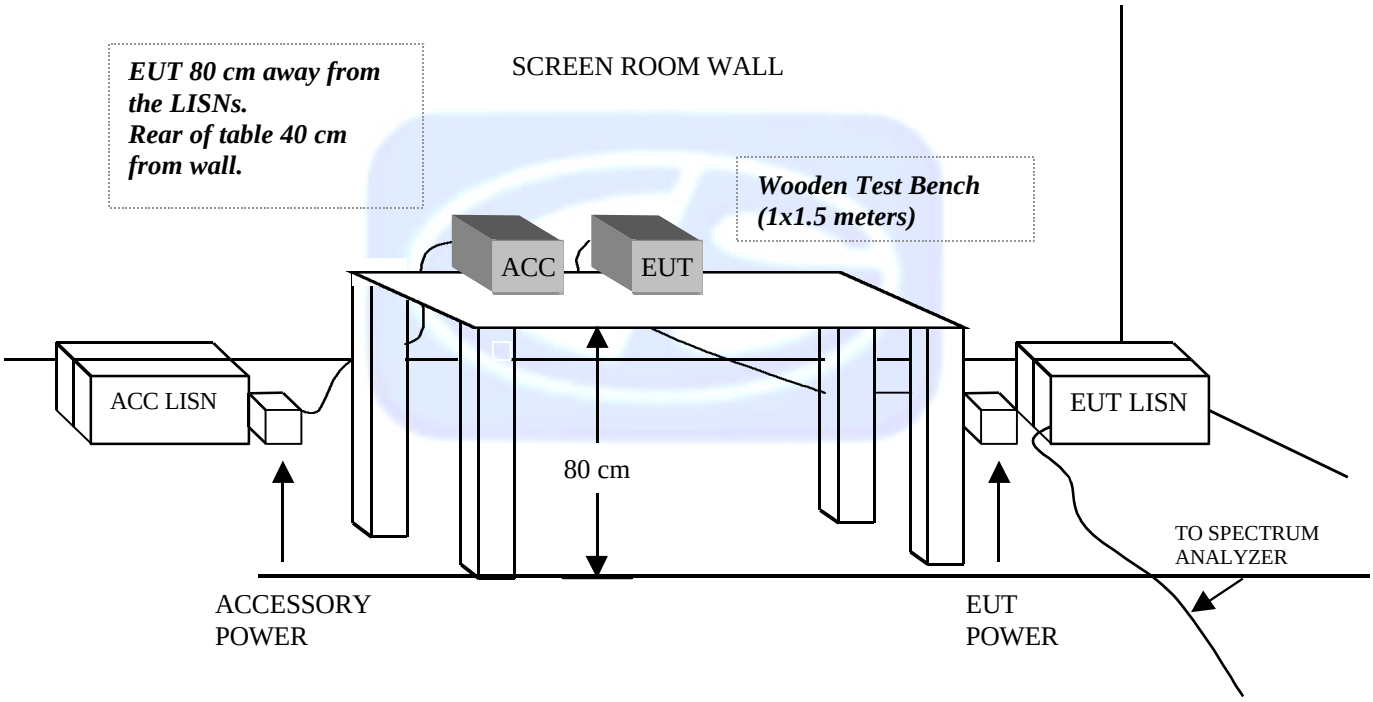
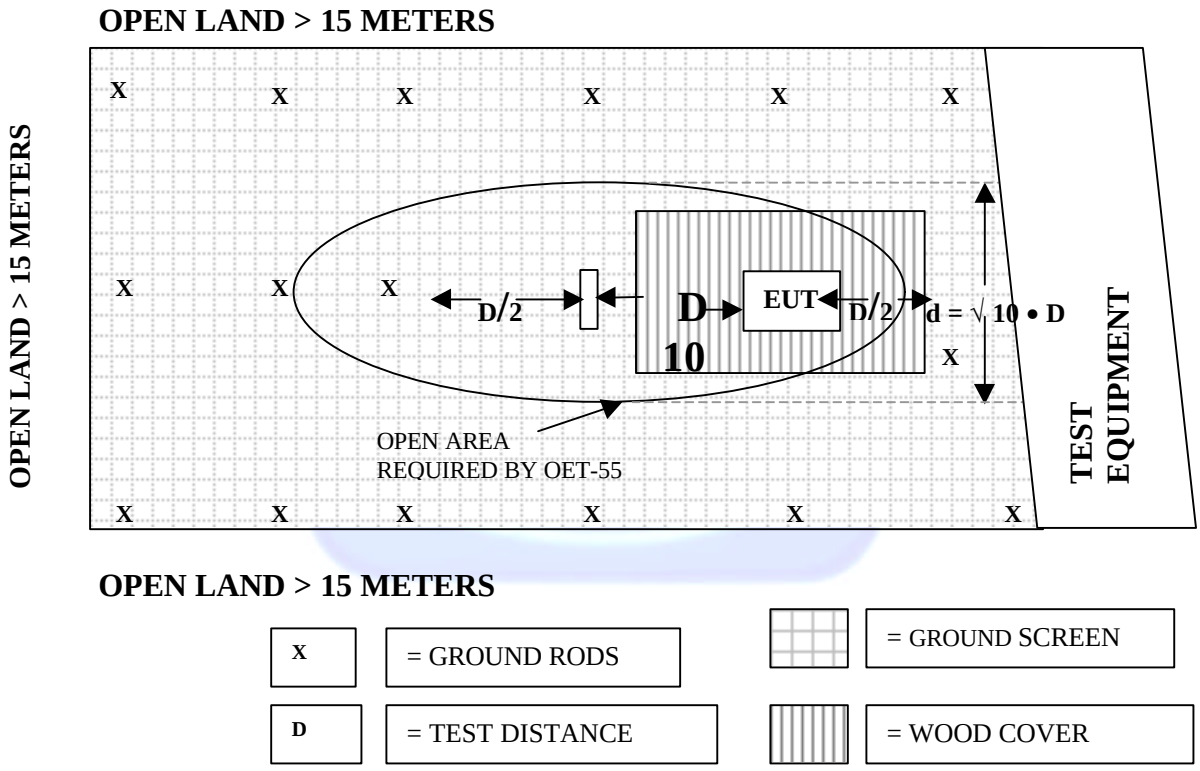
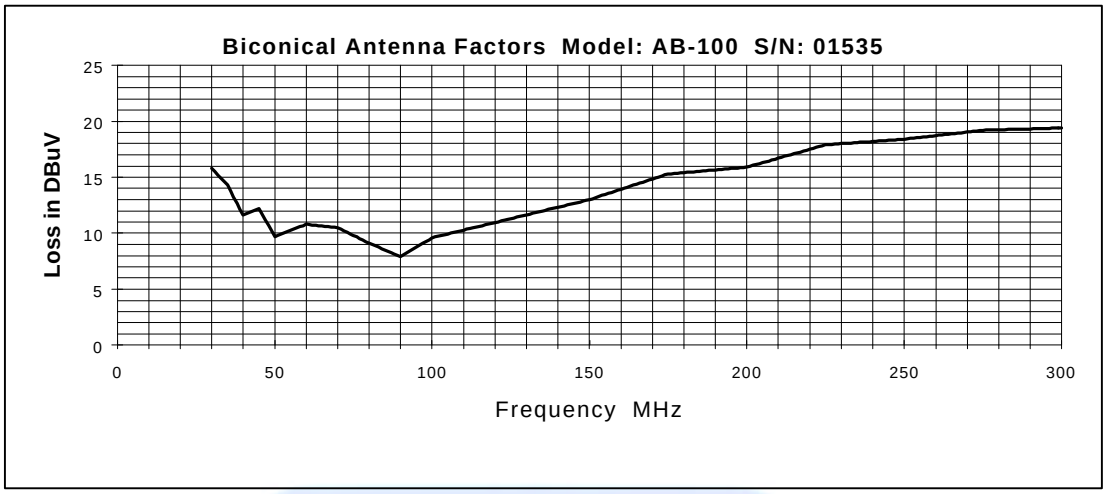
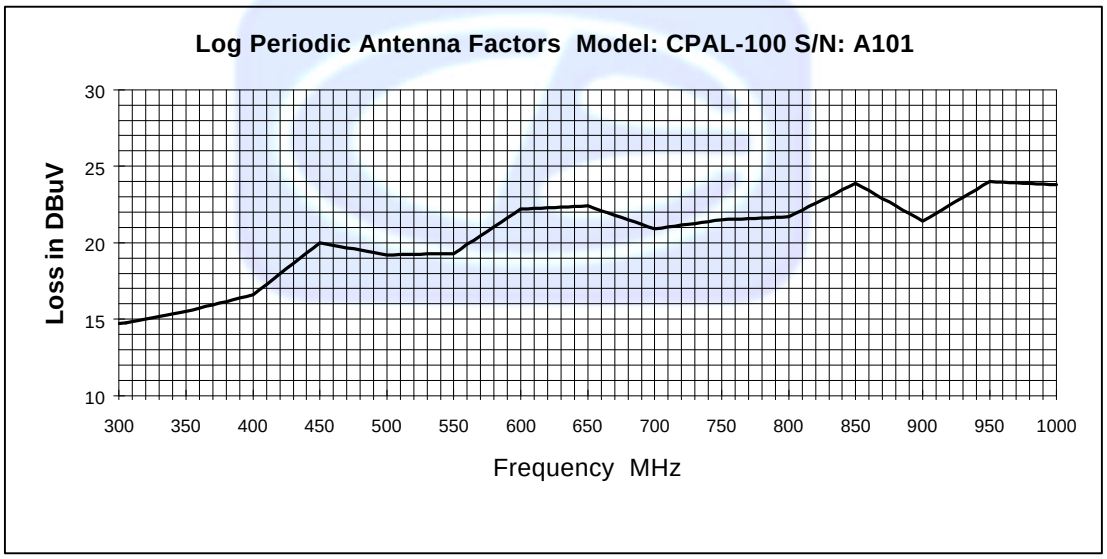
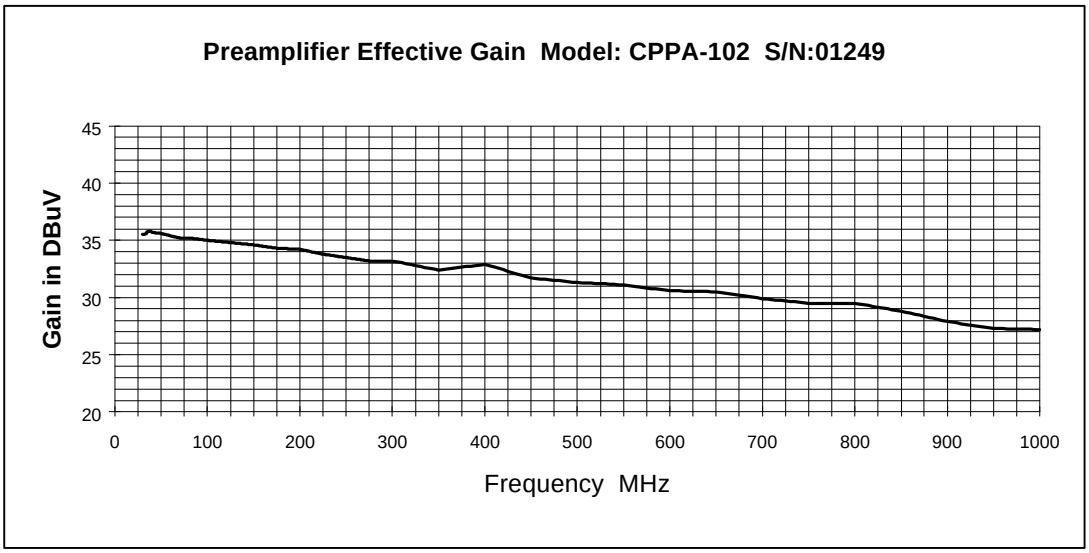


FIGURE 2: PLOT MAP AND LAYOUT OF RADIATED SITE




Biconical Antenna Factors Model: AB-100 S/N: 01535
Loss in DBuV
25
20
15
10
5
0
0
50
100
150
200
250
300
Frequency MHz


Log Periodic Antenna Factors Model: CPAL-100 S/N: A101
Loss in DBuV
30
25
20
15
10
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
Frequency MHz


Preamplifier Effective Gain Model: CPPA-102 S/N:01249
Gain in DBuV
45
40
35
30
25
20
0
100
200
300
400
500
600
700
800
900
1000
Frequency MHz

FRONT VIEW

NMB TECHNOLOGIES, INC.
COMPUTER KEYBOARD
Model: RT3100
FCC CLASS B USING CISPR LIMITS - RADIATED EMISSIONS - 3-16-99

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

NMB TECHNOLOGIES, INC.
COMPUTER KEYBOARD
Model: RT3100
FCC CLASS B USING CISPR LIMITS - RADIATED EMISSIONS - 3-16-99

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

FRONT VIEW

NMB TECHNOLOGIES, INC.
COMPUTER KEYBOARD
Model: RT3100
FCC CLASS B USING CISPR LIMITS - CONDUCTED EMISSIONS - 3-16-99

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

NMB TECHNOLOGIES, INC.
COMPUTER KEYBOARD
Model: RT3100
FCC CLASS B USING CISPR LIMITS - CONDUCTED EMISSIONS - 3-16-99

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

APPENDIX D
DATA SHEETS

RADIATED EMISSIONS

COMPANY NAME: NMB TECHNOLOGIES **DATE:** 2-16-99

EUT: KEYBOARD **EUT S/N:**

EUT MODEL: RT3100 **LOCATION:** ☐ BREA ☐ SILVERADO ☑ AGOURA

SPECIFICATION: CISPR 22 **CLASS:** B **TEST DISTANCE:** 10m **LAB:** F

ANTENNA: ☐ LOOP ☑ BICONICAL ☑ LOG ☐ HORN **POLARIZATION:** ☑ VERT ☐ HORIZ

☑ QUALIFICATION ☐ ENGINEERING ☐ MFG. AUDIT **ENGINEER:** R. O RAMIREZ

NOTES: 4.01 MHz

Frequency (MHz)	Peak Reading (dBuV/m)	Quasi-Peak (dBuV/m)	Antenna Height (meters)	Azimuth (degrees)	Delta * (dB)	Corrected Limit (dBuV/m)	Comments
40.03	49.5		1.0	0°	-4.6	54.1	MODEM
64.05	56.9	52.5	2.0	90°	-2.1	54.6	
130.04	45.4		1.0	0°	-7.8	53.2	
168.52	41.9		1.0	90°	-7.8	49.7	
170.06	46.9		1.0	90°	-2.7	49.6	
210.05	43.8		1.0	90°	-3.5	47.3	
334.25	45.3		1.0	270°	-9.0	54.3	
305.13	44.1		2.0	0°	-11.2	55.3	
310.03	42.2		1.0	270°	-12.9	55.1	
311.07	38.9		1.0	270°	-16.2	55.1	
390.07	43.8		1.0	0°	-9.6	53.4	
391.71	41.1		1.0	0°	-12.3	53.4	

* DELTA = METER READING - CORRECTED LIMIT

RADIATED EMISSIONS

COMPANY NAME: NMB TECHNOLOGIES **DATE:** 3-16-99

EUT: KEYBOARD **EUT S/N:**

EUT MODEL: RT 3100 **LOCATION:** ☐ BREA ☐ SILVERADO ☑ AGOURA

SPECIFICATION: CISPR 22 **CLASS:** B **TEST DISTANCE:** 10m **LAB:** F

ANTENNA: ☐ LOOP ☑ BICONICAL ☑ LOG ☐ HORN **POLARIZATION:** ☐ VERT ☑ HORIZ

☑ QUALIFICATION ☐ ENGINEERING ☐ MFG. AUDIT **ENGINEER:** R. O RAMIREZ

NOTES: TEMP. 62°F

HUMID. ~~38~~ 47%.

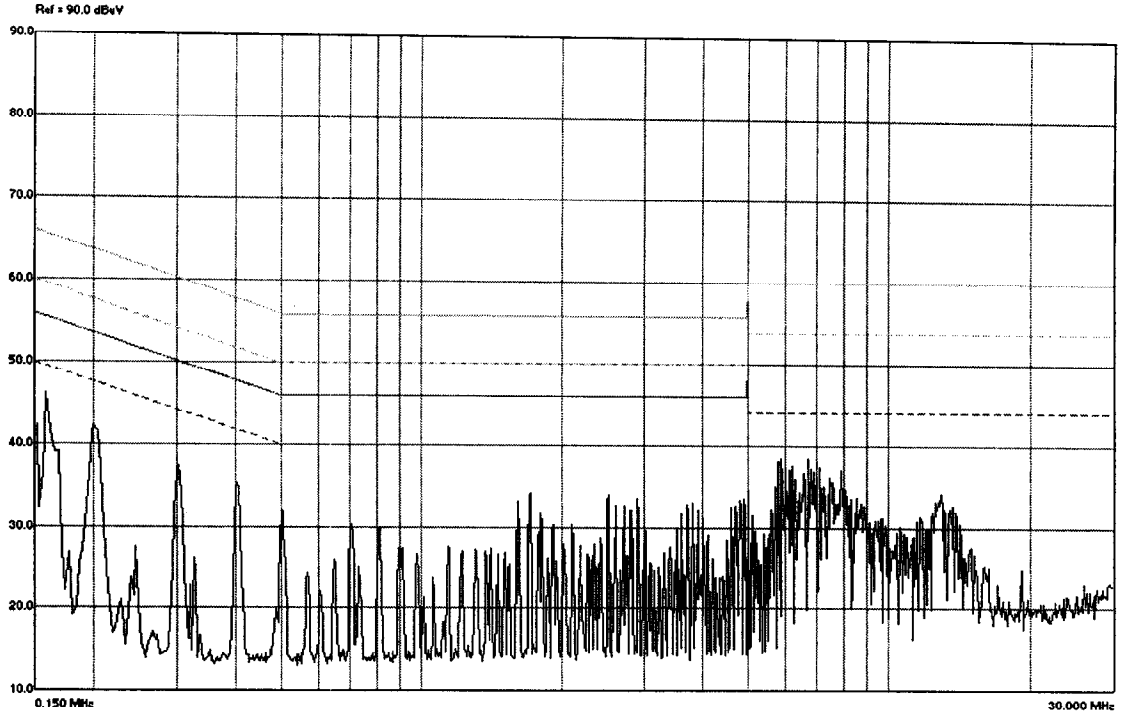
Frequency (MHz)	Peak Reading (dBuV/m)	Quasi-Peak (dBuV/m)	Antenna Height (meters)	Azimuth (degrees)	Delta * (dB)	Corrected Limit (dBuV/m)	Comments
64.29	50.2		4.0	270°	-4.4	54.6	
80.36	50.2		4.0	90°	-5.9	56.1	
120.48	48.3		4.0	90°	-5.5	53.8	
128.55	49.5		4.0	90°	-3.8	53.3	
130.04	48.1		4.0	270°	-5.1	53.2	
137.70	48.6		4.0	180°	-3.9	52.5	
370.05	39.5		4.0	90°	-14.2	53.7	
391.72	40.7		4.0	180°	-12.7	53.4	

* DELTA = METER READING - CORRECTED LIMIT

DATE: 3/16/99

GENERAL COMMENTS:

CISPR 22 CLASS B
NMB TECHNOLOGIES, INC.
KEYBOARD
M/N: RT3100
110VAC BLACK LEAD



SIX HIGHEST READINGS:

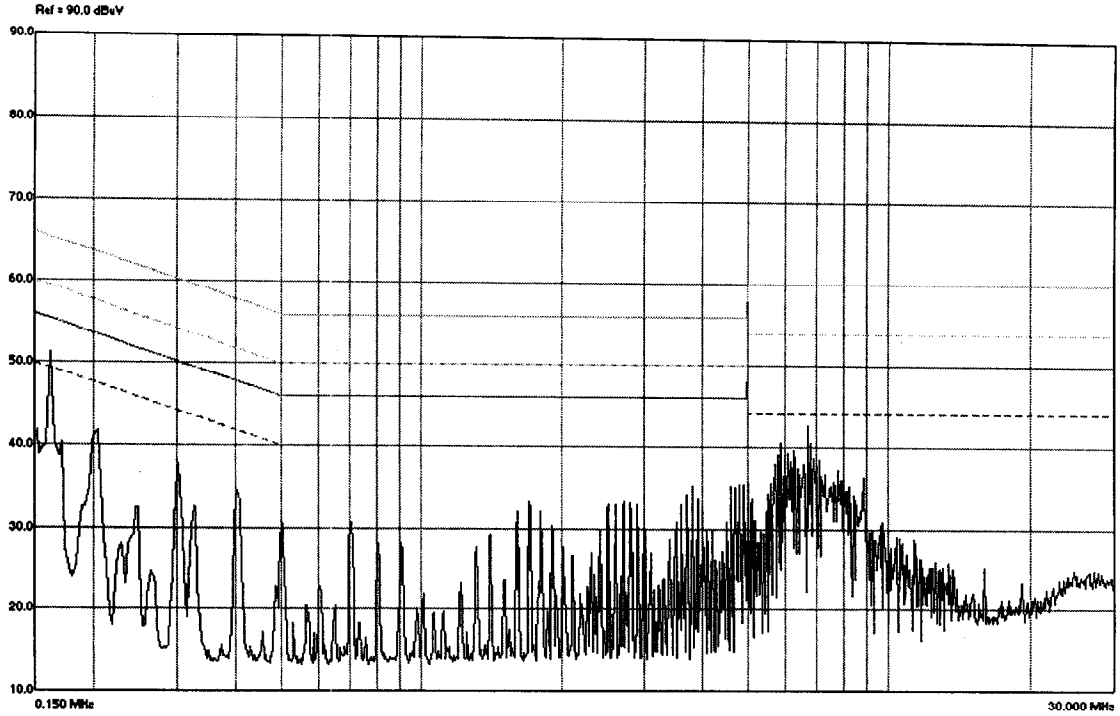
Frequency (MHz)	Peak (dBuV)	DelLim-Pk (dB)
0.155970	46.24	-9.47
0.197760	42.29	-11.45
1.705185	34.23	-11.77
2.514120	34.07	-11.93
5.925975	38.49	-11.51
6.722970	38.45	-11.55

Test Engineer's Signature: Reynaldo Rey

DATE: 3/16/99

GENERAL COMMENTS:

CISPR 22 CLASS B
NMB TECHNOLOGIES, INC.
KEYBOARD
M/N: RT3100
110VAC WHITE LEAD



SIX HIGHEST READINGS:

Frequency (MHz)	Peak (dBuV)	DelLim-Pk (dB)
0.158955	51.35	-4.21
5.914035	40.62	-9.38
6.018510	39.67	-10.33
6.311040	39.73	-10.27
6.719985	42.66	-7.34
6.818490	40.56	-9.44

Test Engineer's Signature: Reynaldo Rey