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

for

COMPUTER KEYBOARD
Model: RT7R10
FCC ID: AQ6-7R10K15

Prepared for

LOGITECH, INC.
6505 KAISER DRIVE
FREMONT, CA 94555

Prepared by: _____
RUBY A. HALL

Approved by: _____
JEFF S. KLINGER

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

DATE: AUGUST 20, 1999

	REPORT BODY	APPENDICES				TOTAL
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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: RT7R10 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 Dates:	August 11, 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: RT7R10. 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
André D. Khan	Test Technician
Jeff S. Klinger	Lab Manager

2.4 Date Test Sample was Received

The test sample was received on Aug. 19, 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, Printer and Mouse ports respectively. The EUT was tested in an Idle mode powered on and awaiting data input/output and sending data via keystroke.

It was determined that the emissions were at their highest level when the EUT was operating in the above configuration sending data 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. Note: the EUT was not fully functioning as a production model since the chip which controls the key output was not ready by the test date. The EUT did output data from various keys so when the X key was depressed an 8 would appear on the screen. Because of this, a working keyboard was used to boot up the system and then the EUT was plugged into the Computer.

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 metallic 36 pin Centronics connector at the printer end and a metallic D-25 pin 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.	RT7R10	NONE FCC ID: AQ6-7R10K15
COMPUTER	DELL	MMP	F25LT
MONITOR	VIEWSONIC	1449	3742968085 FCC ID: K351449
MODEM	HAYES	2000US	A02620003419 FCC ID: BFJ2000US
PRINTER	HEWLETT PACKARD	C2184A	CN5A41R10J
MOUSE	MICROSOFT	P/N:X03-60998	FCC ID: C3KKMP5
KEYBOARD (USED TO BOOT UP COMPUTER)	DELL	SK-1000REW	NONE

5.2 EMI Test Equipment

EQUIPMENT TYPE	MANU-FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE
Spectrum Analyzer	Hewlett Packard	8566B	27029A04566	Jun. 19, 1999	Jun. 19, 2000
Quasi-Peak Adapter	Hewlett Packard	85650A	2521A00682	Jun. 19, 1999	Jun. 19, 2000
Preamplifier	Com Power	PA-102	01249	Apr. 12, 1999	Apr. 12, 2000
RF Attenuator	Sertek	412-10	XX02	Sep. 14, 1998	Sep. 14, 1999
LISN	Com Power	LI-200	01777	Jul. 15, 1998	Sep. 15, 1999
LISN	Com Power	LI-200	01778	Jul. 15, 1998	Sep. 15, 1999
LISN	Com Power	LI-200	01779	Jul. 15, 1998	Sep. 15, 1999
LISN	Com Power	LI-200	01781	Jul. 15, 1998	Sep. 15, 1999
Biconical Antenna	Com Power	AB-100	01535	Apr. 16, 1999	Apr. 16, 2000
Log Periodic Antenna	Com Power	AL-100	A101	Apr. 16, 1999	Apr. 16, 2000
Antenna Mast	Com Power	AM-400	N/A	N/A	N/A
Turntable	Com Power	TT-106A	N/A	N/A	N/A
Computer	Hewlett Packard	Pavilion 4530	US91912022	N/A	N/A
Printer	Epson	P950A	A5PY290451	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 along with a quasi-peak adapter. A 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. This final reading is then recorded automatically by the Computer's automated data recording program, which takes into account the cable loss, amplifier gain and antenna factors, so that a true reading is compared to the true limit. 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: RT7R10

Frequency MHz	Emission Level* dBuV	Average Specification Limit dBuV	Delta dB
0.150	50.18**A**	56	-5.82
0.568	42.30	46	-3.70
0.592	42.60	46	-3.40
1.708	38.10	46	-7.90
2.609	38.10	46	-7.90
3.805	38.10	46	-7.90

Table 2.0 RADIATED EMISSION RESULTS
COMPUTER KEYBOARD Model: RT7R10

Frequency MHz	Meter* Reading dBuV/m	Cable loss**	Antenna Factor ** dB/m	Amplifier Gain ** dB	Dist. Factor dB	Corrected Reading dBuV/m	Spec. Limit dBuV/m	Delta dB
42.37	44.10	1.25	13.40	35.90	0	22.84	30	-7.16
63.41	49.10	1.50	10.50	35.83	0	25.27	30	-4.13
72.14	46.40	1.70	10.71	35.74	0	23.06	30	-6.94
80.12	44.70	1.70	10.22	35.90	0	20.72	30	-9.28
276.59	42.50	3.51	18.06	35.49	0	28.58	37	-8.42
373.61	42.00	4.04	17.22	35.45	0	27.81	37	-9.19

Notes:

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

** The factors for the antenna and Preamplifier are attached in Appendix C of this report.

\# Quasi-Peak Reading

A Average Reading

8. CONCLUSIONS

The Computer Keyboard Model: RT7R10 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: RT7R10 FCC ID: AQ6-7R10K15

There were no additional models covered under this report.

APPENDIX C

DIAGRAMS, CHARTS AND PHOTOS

FIGURE 1: CONDUCTED EMISSIONS TEST SETUP

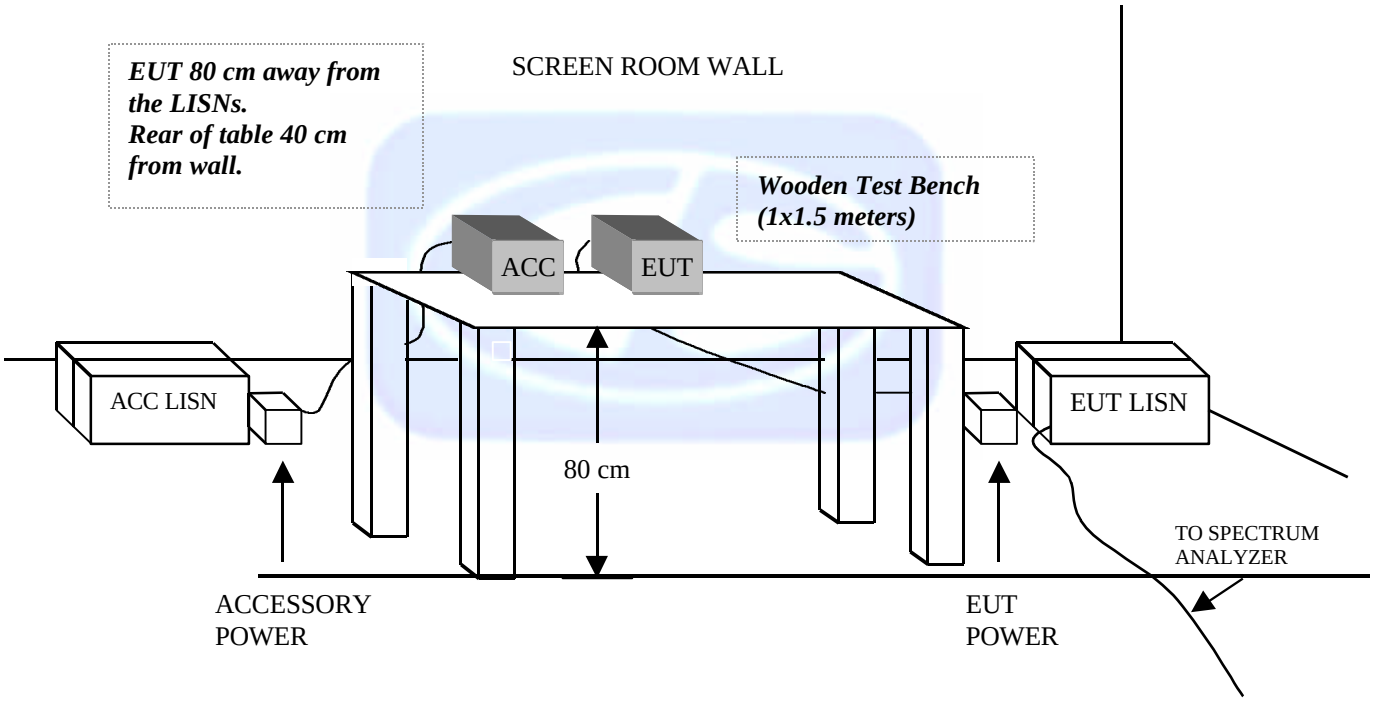
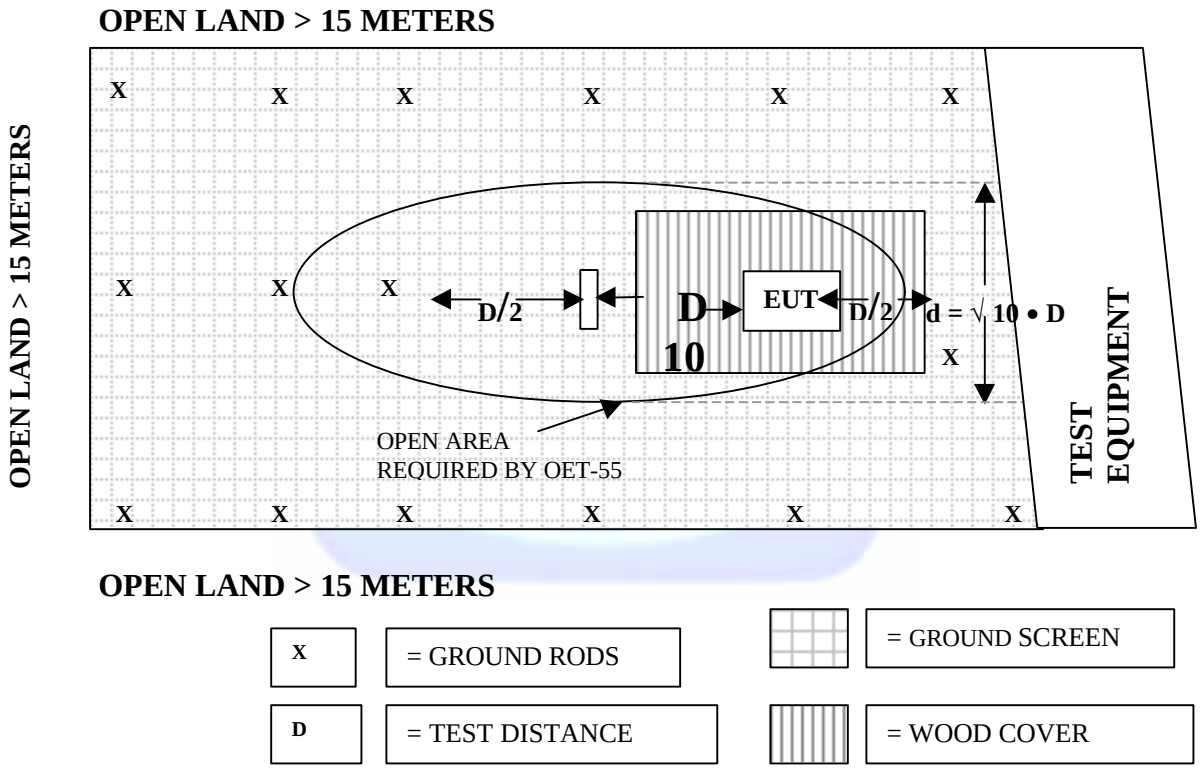
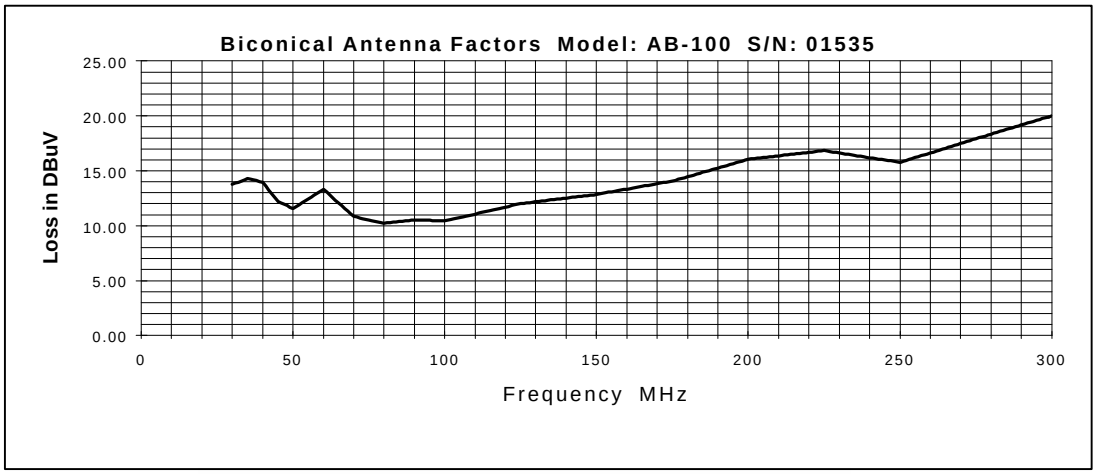
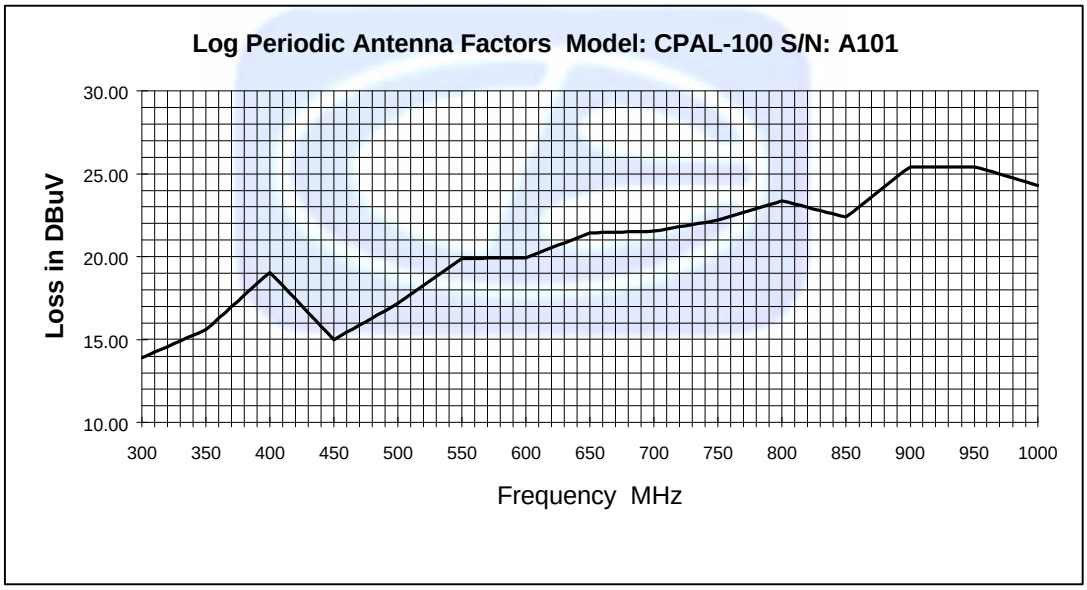
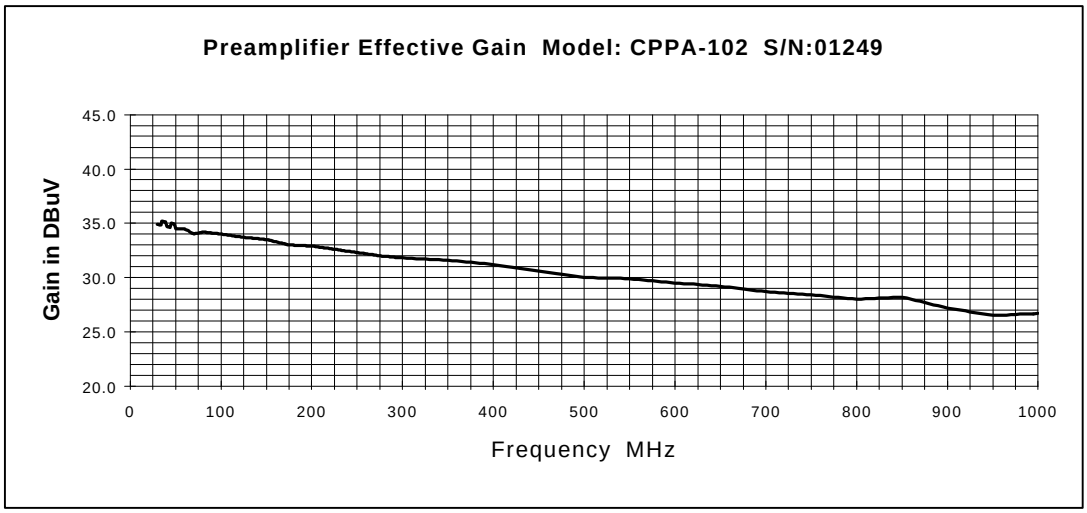


FIGURE 2: PLOT MAP AND LAYOUT OF RADIATED SITE




Biconical Antenna Factors Model: AB-100 S/N: 01535
Loss in DBuV
25.00
20.00
15.00
10.00
5.00
0.00
0
50
100
150
200
250
300
Frequency MHz


Log Periodic Antenna Factors Model: CPAL-100 S/N: A101
Loss in DBuV
30.00
25.00
20.00
15.00
10.00
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
45.0
40.0
35.0
30.0
25.0
20.0
0
100
200
300
400
500
600
700
800
900
1000
Frequency MHz

FRONT VIEW

NMB TECHNOLOGIES, INC.
COMPUTER KEYBOARD
Model: RT7R10
FCC CLASS B USING CISPR LIMITS - RADIATED EMISSIONS – 8-11-99

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

NMB TECHNOLOGIES, INC.
COMPUTER KEYBOARD
Model: RT7R10
FCC CLASS B USING CISPR LIMITS - RADIATED EMISSIONS - 8-11-99

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

FRONT VIEW

NMB TECHNOLOGIES, INC.
COMPUTER KEYBOARD
Model: RT7R10
FCC CLASS B USING CISPR LIMITS - CONDUCTED EMISSIONS - 8-11-99

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

REAR VIEW

NMB TECHNOLOGIES, INC.
COMPUTER KEYBOARD
Model: RT7R10
FCC CLASS B USING CISPR LIMITS - CONDUCTED EMISSIONS - 8-11-99

PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

APPENDIX D
DATA SHEETS

Test location: Compatible Electronics
Customer : NMB TECHNOLOGIES
Manufacturer : SAME
EUT name : KEYBOARD
Specification: Cispr_B Test distance: 10.0 mtrs
Distance correction factor(20*log(test/spec)) :
Test Mode :
QUALIFICATION SCAN
TEST TECH. A.KHAN
TEMP:80 HUMID:75%

Date : 8/11/1999
Time : 11.22
Model: RT7R10
Lab: F
0.00

Pol	Freq MHz	Rdng dBuV	Cable loss dB	Ant factor dB	Amp gain dB	Cor'd rdg = R dBuV	limit = L dBuV/m	Delta R-L dB
1V	42.37	44.10	1.25	13.40	35.90	22.84	30.00	-7.16
2V	50.87	41.80	1.40	11.47	35.90	18.77	30.00	-11.23
3V	59.38	43.30	1.40	10.40	35.90	19.20	30.00	-10.80
4V	63.41	49.10	1.50	10.50	35.83	25.27	30.00	-4.73
5V	72.14	46.40	1.70	10.71	35.74	23.06	30.00	-6.94
6V	76.14	42.20	1.70	10.46	35.82	18.54	30.00	-11.46
7V	80.12	44.70	1.70	10.22	35.90	20.72	30.00	-9.28
8V	174.12	39.50	2.59	14.03	35.61	20.51	30.00	-9.49
9H	42.33	38.20	1.25	13.41	35.90	16.95	30.00	-13.05
10H	50.17	39.10	1.40	11.56	35.90	16.16	30.00	-13.84
11H	72.12	41.10	1.70	10.71	35.74	17.77	30.00	-12.23
12H	80.11	43.20	1.70	10.22	35.90	19.22	30.00	-10.78
13H	117.07	42.20	2.00	11.51	35.80	19.92	30.00	-10.08
14H	157.10	36.50	2.39	13.20	35.74	16.34	30.00	-13.66
15H	174.11	38.90	2.59	14.03	35.61	19.91	30.00	-10.09
16H	276.59	42.50	3.51	18.06	35.49	28.58	37.00	-8.42
17V	336.73	38.30	3.75	15.14	35.40	21.78	37.00	-15.22
18V	371.88	35.90	4.02	17.10	35.44	21.58	37.00	-15.42
19H	336.12	42.30	3.74	15.12	35.40	25.76	37.00	-11.24
20H	373.61	42.00	4.04	17.22	35.45	27.81	37.00	-9.19

COMPATIBLE ELECTRONICS

8/11/1999 15:07:05

NMB TECHNOLOGIES
KEYBOARD RT7R10
110V BLACK LEAD
CISPR 22B
TEST ENGINEER : Andre Khan
ANDRE KHAN

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16 highest peaks above -50.00 dB of AVERAGE limit line
Peak criteria : 4.00 dB, Curve : Peak

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)	
1	0.150	59.20	56.00	3.20	
2	0.283	49.70	50.72	-1.02	
3	0.350	47.20	48.96	-1.76	
4	0.305	48.00	50.09	-2.09	
5	0.366	46.50	48.60	-2.10	SEE AVG. READINGS
6	0.484	43.90	46.27	-2.37	
7	0.505	43.60	46.00	-2.40	
8	0.530	43.10	46.00	-2.90	
9	0.592	42.60	46.00	-3.40	
10	0.568	42.30	46.00	-3.70	
11	1.708	38.10	46.00	-7.90	
12	2.609	38.10	46.00	-7.90	
13	3.805	38.10	46.00	-7.90	
14	1.803	38.00	46.00	-8.00	
15	1.604	37.90	46.00	-8.10	
16	2.710	37.70	46.00	-8.30	

COMPATIBLE ELECTRONICS

8/11/1999 15:07:05

NMB TECHNOLOGIES
KEYBOARD RT7R10
110V BLACK LEAD
CISPR 22B
TEST ENGINEER : Andre' Khan
ANDRE KHAN

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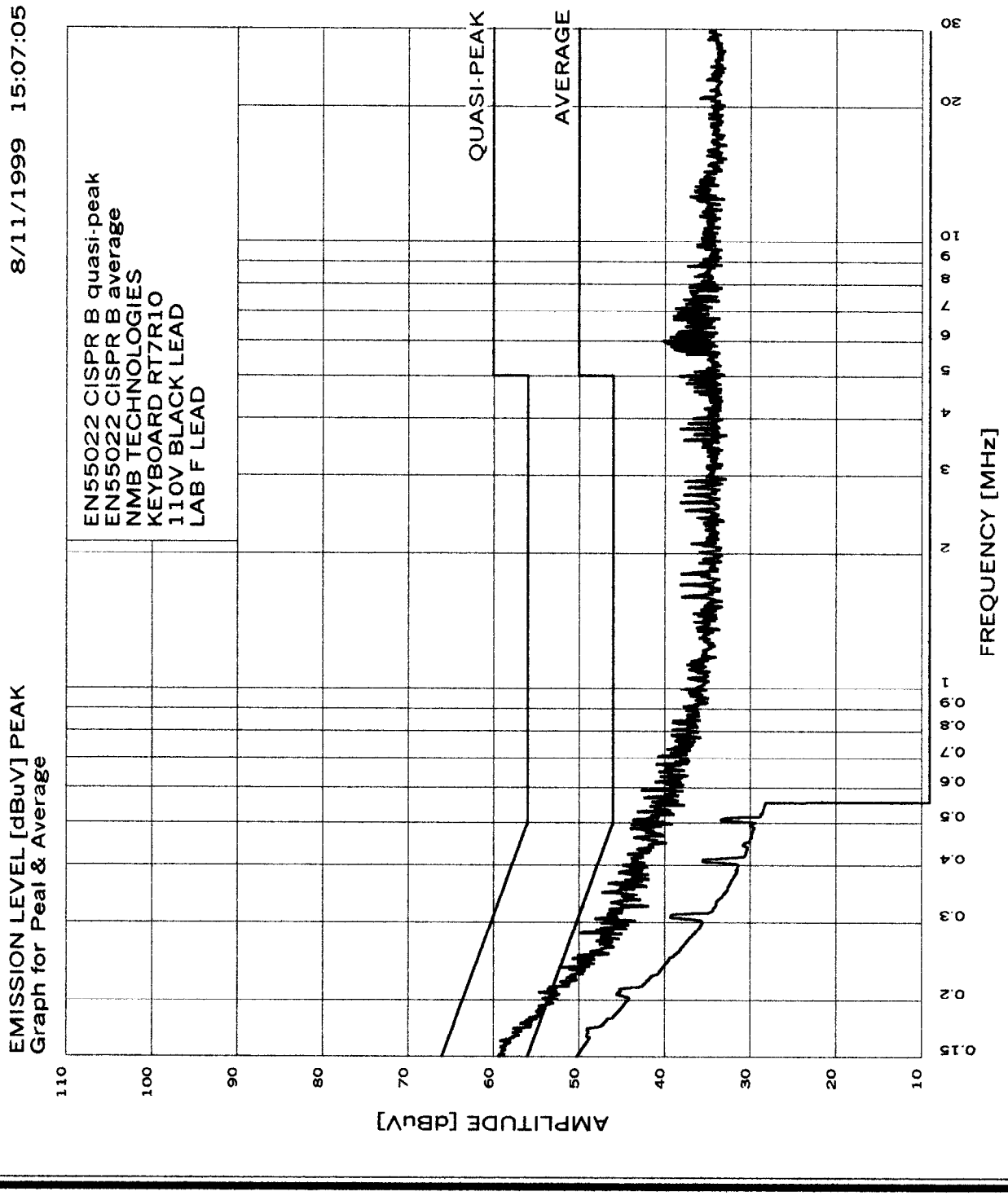
4 highest peaks above -50.00 dB of AVERAGE limit line
Peak criteria : 3.00 dB, Curve : Average

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	0.150	50.18	56.00	-5.82
2	0.309	39.27	50.01	-10.74
3	0.409	35.52	47.67	-12.15
4	0.508	33.43	46.00	-12.57

COMPATIBLE ELECTRONICS



COMPATIBLE ELECTRONICS

8/11/1999 13:48:08

NMB TECHNOLOGIES
KEYBOARD RT7R10
WHITE LEAD 110V
CISPR 22B
TEST ENGINEER : Andre Khan
ANDRE KHAN

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7 highest peaks above -50.00 dB of QUASI-PEAK limit line
Peak criteria : 3.00 dB, Curve : Peak

Peak#	Freq(MHz)	Amp(dBuV)	Limit(dB)	Delta(dB)
1	0.168	50.90	65.07	-14.17
2	4.803	38.90	56.00	-17.10
3	4.603	38.80	56.00	-17.20
4	4.902	38.80	56.00	-17.20
5	4.703	38.50	56.00	-17.50
6	5.905	42.50	60.00	-17.50
7	0.150	47.40	66.00	-18.60

COMPATIBLE ELECTRONICS