



**PROCESSING GAIN MEASUREMENTS IN
ACCORDANCE WITH TITLE 47 CFR, PART 15
(OCTOBER 1, 2000) AND ANSI C63.4-1992 ON A
2.4 GHZ LOW POWER WLAN PCMCIA CARD,
BRAND APPLE, TYPE 630-37XX.**

FCC report layout endorsed by the FCC by
Public Notice of March 11, 1992.

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Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

MEASUREMENT/TECHNICAL REPORT

APPLE COMPUTER, LTD

FCC ID: IMRAPPC2411R

Date: October 23, 2001

This report concerns:	Verification / Notification / Certification		
Equipment type:	2.4 GHz spread spectrum radio device		
Deferred grant requested per 47 CFR 0.457(d)(1)(ii)?	No		
If yes defer until:	Not applicable		
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	Country	:	The Netherlands
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The data taken for this test and report herein was done in accordance with Title 47 CFR, Part 15 (October 1, 2000). TNO Certification EPS, location Niekerk, The Netherlands, certifies that the data is accurate and contains a true representation of the test results of the Equipment Under Test (EUT) on the date of the test noted in the test report. I have reviewed the test report and find it to be an accurate description of the test(s) performed and the EUT so tested.

Date: October 23, 2001

Signature:

O.H. Hoekstra
TNO Certification EPS



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Manufacturer: Apple Computer, Ltd
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Type: 630-37XX
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1 General Information.

1.1 Product description.

The product tested (EUT) is a 2.4 GHz low power RLAN PCMCIA card, brand Apple, type 630-37XX.

1.2 Related submittal(s)/grant(s).

None.

1.3 Test methodology.

The processing gain is measured using the CW jamming margin method. A signal generator is stepped in 50 kHz increments across the passband of the system. The passband of the receiver is defined as being 14 MHz.

At each point the generator level required to produce a Bit Error Rate equivalent to $BER=1.0 \times 10^{-5}$ is recorded as the Jammer level (J). The output power of the transmitter is measured at the same point and recorded as Signal (S). The Jammer to Signal ratio (J/S) is then calculated with 20% of the worst measurement results discarded. The lowest remaining J/S ratio is used to calculate the processing gain using formula:

$$G_p = (S/N)_o + M_j + L_{sys}$$

where the $(S/N)_o$ value is declared by the manufacturer and L_{sys} is defined as having a maximum value of 2.0 dB.

1.4 Block diagram of test setup.

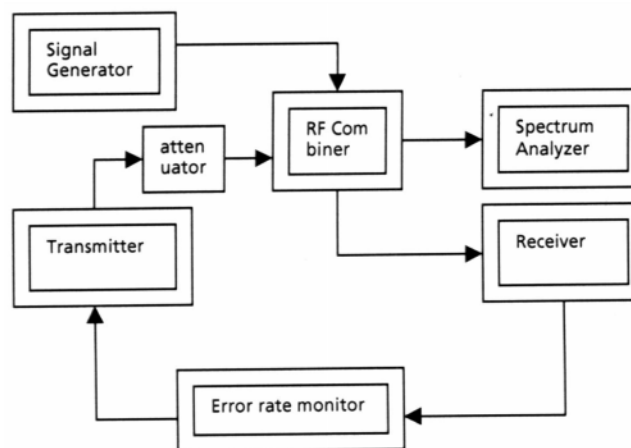


Figure 1 - Block diagram processing gain test setup

1.5 Test facility.

The FCC has declared that the measurement facilities located at TNO Certification EPS, location Niekerk, 9822 TL Smidshornerweg 18, The Netherlands, have been reviewed and found to be in compliance with the requirements of Title 47 CFR, Part 2, section 2.948 (previously Title 47 CFR, Part 15, section 15.38) of the FCC rules per August 4, 1994.



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1.6 List of measurement equipment.

Inventory number	Description	Marketing name	Type
12471	Biconical antenna 20MHz-200MHz	EATON	94455-1
12473	Log-per antenna 200-1000MHz	EATON	96005
12475	Loop antenna	EMCO	6502/2
12476	Antenna mast	EMCO	TR3
12477	Antenna mast 1-4 mtr	Poelstra	--
12478	Control unit / portable turn table	TNO	DFO
12483	Guidehorn	EMCO	3115
12484	Guidehorn	EMCO	3115
12486	Spectrum analyzer	Anritsu	MS2601A
12488	Guidehorn 18-26.5 GHz	EMCO	RA42-K-F-4B-C
12491	Measuring receiver 0.01Mhz-30MHz	R&S	ESH3
12492	Measuring receiver 20MHz-1300MHz	R&S	ESVP-
12493	EZM Spectrum Monitor	R&S	EZM
12494	Measuring receiver 20MHz-1000 MHz	R&S	ESV-
12497	Spectrum analyzer	HP	8592A
12498	Rejectfilter	K&L	3TNF-100/200-N
12499	Rejectfilter	K&L	3TNF-50/100-N
12500	Rejectfilter	K&L	3TNF-250/500-N
12501	Rejectfilter	K&L	3TNF-25/50-N
12507	Artificial mains network 3-phase	R&S	ESH2-Z5
12516	Signalgenerator 100kHz-1000MHz	R&S	SMX
12519	RF amplifier	ENI	603L
12524	Signalgenerator	R&S	SMHU
12525	POCSAG generator	TNO	SMF-3
12527	Signalgenerator 100kHz-1000 MHz	R&S	SMG
12528	ERMES generator	TNO	--
12533	Signalgenerator	MARCONI	2032
12538	Attenuator 100W/20dB	Bird electronic	8340-200
12545	Directional coupler	HP	HP778D
12546	Measuring cable to plateau	--	RG 213
12548	Meas.cable 2 metre, color:green	Radiall	R287571005
12549	Oscilloscope 20 MHz	KENWOOD	CS-8010
12553	Communication Analyzer	R&S	CMTA 84
12558	Communication Analyzer	R&S	CMTA 54
12559	Digital storage oscilloscope	Le Croy	9310M
12560	DC Power Supply 20A/60V	DELTA	SM6020
12561	DC Power Supply 20A/70V	DELTA	SM7020D
12567	Plotter	HP	7440A
12605	Calibrated dipole 28MHz-1GHz	Emco	3121c
12607	Calibrated attenuator set	HP	HP11581a
12608	HF milliwattmeter	HP	HP435a
12609	Power sensor 10MHz-18GHz	HP	HP8481A
12620	Spectrum analyzer	Advantest	R4131B
12635	Measurement platform	WOLFF	--
12636	Plastic measurement room	Polyforce	--
12640	Temperature chamber	Heraeus	VEM03/500
13078	Wideband Pre-Amplifier (1GHz-5GHz)	Miteq	AMF3D0100503010
13313	Impuls limiter	R&S	ESH3Z2.357...
13452	Digital multi meter	HP	34401A
13664	Spectrum analyzer	HP	HP8593E
13886	Open Area Test Site	Comtest	--
14051	Anechoic room	Comtest	--
14277	Antennamast 4m	Heinrich Deisel	HD100
14278	Controller OATS	Heinrich Deisel	MA240
14340	Biconilog antenna 20MHz - 1100MHz	EMCO	3143
14351	Biconilog	EMCO	9143



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Inventory number	Description	Marketing name	Type
14450	2.4 GHz bandrejectfilter	BSc	xn-1783
14987	Stripline cell	Marconi	TC5010
15232	Tektronics storage scope	Tektronics	--
15453	Magnetic loop	Chase	--
15633	Biconilog Testantenna	Chase	CBL 6111B
15667	Measuring receiver 9kHz - 2750MHz	R&S	ESCS30
99012	ITU-R recomm. 559-2 noise generator	TNO	--
99040	Attenuator 25W/20dB	Bird electronic	8340-200
99041	Attenuator 25W/10dB	BIRD	8340-100
99042	Attenuator 10W/3dB	Bird electronic	8304-030-N
99043	Attenuator 25W/20dB	Bird electronic	8340-200
99044	Attenuator 10W/3dB	Bird electronic	8304-030-N
99045	DC Power Supply 3A/30V	DELTA	E030/3
99046	Fluke Multimeter	John Fluke	12
99050	Wideband Pre-Amplifier (5GHz-10GHz)	Miteq	AMF3D0501004010
99055	Non-conducting support	TNO	--
99056	Isolating transformer 1:1	TNO	--
99061	Non-conducting support 150cm	TNO	--
99068	Detector N-F/BNC-F	Radiall	R451576000
99069	Cable 5m RG214	TNO	--
99070	Cable 15m RG214	TNO	--
99071	Cable 10m RG214	TNO	--
99076	Bandpassfilter 4-10GHz	Reactel	7AS-7G-6G-511
99077	Regulating trafo	RFT	LTS006
99079	RF Combiner	R&S	DVU 4
99108	Turntable OATS	Heinrich Deisel	HD050
99111	Magnetic loop power supply	Chase	--
99112	Tripod	Chase	--
99115	Voltage probe	Schwarzbeck	TK9416



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1.7 Description of tested EUT.

Unit title	:	2.4 GHz low power RLAN PCMCIA card
Model number	:	630-37XX
Serial number	:	Not applicable
FCC ID number	:	IMRAPPC2411R
Frequency range	:	2412-2462 MHz
Description/details	:	2.4 GHz spread spectrum radio device
Power supply	:	+3.3 VDC
Cabinet & Screening	:	Metal/plastic
Interface cables connected	:	None
Method of screening	:	Not applicable
Method of grounding	:	Not applicable
Operating configuration	:	Constantly receiving data

Applicant's information

Applicant's representative	:	M. Kriege
Company	:	Apple Computer, Ltd.
Address	:	6 Infinite Loop
Postal code and city	:	Cupertino, CA 95014-2084
Country	:	U.S.A.
Telephone number	:	+1 408 974 6131
Fax number	:	+1 408 974 2071



2 Theoretical processing gain calculations.

Data rate (Mbps)	Modulation type	Symbol rate (Mpsps)	Chip rate (Mcps)	Chip/symbol ratio	Theoretical PG	(S/N) _o (dB)	L _{sys} (dB)	Calculated J/S (dB)	Allowed J/S (dB)
2	DQPSK	1	11	11:1	10.4	13.3	2.0	-4.9	-5.3
11	CCK	1.375	8	8:1	9.0	17.0	2.0	-10.0	-9.0

Table 1

Explanation of theoretical processing gain calculations.

BER = 1.E-5, Data rate = 2 Mbps

Chip rate = 11 Mcps/s, Symbol rate = 1 Msymbols/s, Bit rate = 2 Mbits/s

Ratio chip/symbol = 11:1

Theoretical processing gain: $G_p = 10\log(11) = 10.4$ dB

$E_b/N_0 = 10.3$ dB

$(S/N)_o = E_s/N_0 = E_b/N_0 + \text{correction factor for 2 bits/symbol} = 10.3 \text{ dB} + 10\log(2) \text{ dB} = 10.3 \text{ dB} + 3.0 \text{ dB} = 13.3 \text{ dB}$

$L_{sys} = 2.0$ dB max.

$G_p = (S/N)_o + M_j + L_{sys}$

Calculated $M_j = J/S = G_p - (S/N)_o - L_{sys} = 10.4 \text{ dB} - 13.3 \text{ dB} - 2.0 \text{ dB} = -4.9 \text{ dB}$

Allowed J/S for 10 dB PG = $G_p - (S/N)_o - L_{sys} = 10.0 \text{ dB} - (S/N)_o - L_{sys} = 10.0 \text{ dB} - 13.3 \text{ dB} - 2.0 \text{ dB} = -5.3 \text{ dB}$

BER = 1.E-5, Data rate = 11 Mbps

Chip rate = 11 Mcps/s, Symbol rate = 1.375 Msymbols/s, Bit rate = 11 Mbits/s

Ratio chip/symbol = 8:1

Theoretical processing gain: $G_p = 10\log(8) = 9.0$ dB

$E_b/N_0 = 8.0$ dB

$(S/N)_o = E_s/N_0 = E_b/N_0 + \text{correction factor for 8 bits/symbol} = 8.0 \text{ dB} + 10\log(8) \text{ dB} = 8.0 \text{ dB} + 9.0 \text{ dB} = 17.0 \text{ dB}$

$L_{sys} = 2.0$ dB max.

$G_p = (S/N)_o + M_j + L_{sys}$

Calculated $M_j = J/S = G_p - (S/N)_o - L_{sys} = 9.0 \text{ dB} - 17.0 \text{ dB} - 2.0 \text{ dB} = -10.0 \text{ dB}$

Allowed J/S for 10 dB PG = $G_p - (S/N)_o - L_{sys} = 10.0 \text{ dB} - (S/N)_o - L_{sys} = 10.0 \text{ dB} - 17.0 \text{ dB} - 2.0 \text{ dB} = -9.0 \text{ dB}$

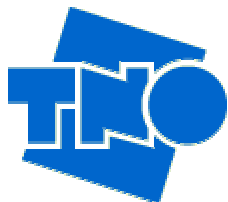


3 Processing gain test results.

3.1 Test results at a bitrate of 2 Mbps.

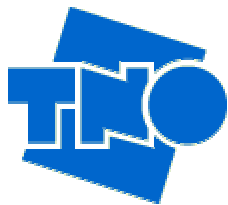
Pass band : $f_0 \pm 7$ MHz
Channel : nr. 7 = 2442.0 MHz

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
1	2449.00	-51.70	-52.00	0.30
2	2448.95	-51.50	-52.00	0.50
3	2448.90	-51.40	-52.00	0.60
4	2448.85	-51.30	-52.00	0.70
5	2448.80	-51.10	-52.00	0.90
6	2448.75	-50.90	-52.00	1.10
7	2448.70	-50.80	-52.00	1.20
8	2448.65	-50.60	-52.00	1.40
9	2448.60	-50.40	-52.00	1.60
10	2448.55	-52.00	-52.00	0.00
11	2448.50	-51.10	-52.00	0.90
12	2448.45	-51.60	-52.00	0.40
13	2448.40	-51.60	-52.00	0.40
14	2448.35	-51.90	-52.00	0.10
15	2448.30	-51.00	-52.00	1.00
16	2448.25	-51.10	-52.00	0.90
17	2448.20	-51.50	-52.00	0.50
18	2448.15	-51.40	-52.00	0.60
19	2448.10	-51.40	-52.00	0.60
20	2448.05	-51.60	-52.00	0.40
21	2448.00	-51.20	-52.00	0.80
22	2447.95	-51.50	-52.00	0.50
23	2447.90	-51.40	-52.00	0.60
24	2447.85	-51.10	-52.00	0.90
25	2447.80	-51.30	-52.00	0.70
26	2447.75	-51.00	-52.00	1.00
27	2447.70	-51.00	-52.00	1.00
28	2447.65	-50.90	-52.00	1.10
29	2447.60	-51.00	-52.00	1.00
30	2447.55	-51.40	-52.00	0.60
31	2447.50	-51.40	-52.00	0.60
32	2447.45	-52.00	-52.00	0.00
33	2447.40	-52.10	-52.00	-0.10
34	2447.35	-52.40	-52.00	-0.40
35	2447.30	-51.80	-52.00	0.20
36	2447.25	-53.00	-52.00	-1.00
37	2447.20	-52.80	-52.00	-0.80
38	2447.15	-52.80	-52.00	-0.80
39	2447.10	-52.70	-52.00	-0.70
40	2447.05	-51.90	-52.00	0.10
41	2447.00	-51.20	-52.00	0.80
42	2446.95	-50.90	-52.00	1.10
43	2446.90	-50.80	-52.00	1.20
44	2446.85	-50.70	-52.00	1.30



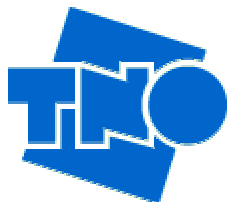
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Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
45	2446.80	-50.80	-52.00	1.20
46	2446.75	-51.50	-52.00	0.50
47	2446.70	-51.20	-52.00	0.80
48	2446.65	-51.50	-52.00	0.50
49	2446.60	-51.80	-52.00	0.20
50	2446.55	-51.80	-52.00	0.20
51	2446.50	-52.00	-52.00	0.00
52	2446.45	-51.00	-52.00	1.00
53	2446.40	-50.90	-52.00	1.10
54	2446.35	-50.80	-52.00	1.20
55	2446.30	-51.30	-52.00	0.70
56	2446.25	-51.60	-52.00	0.40
57	2446.20	-51.70	-52.00	0.30
58	2446.15	-52.20	-52.00	-0.20
59	2446.10	-52.50	-52.00	-0.50
60	2446.05	-52.80	-52.00	-0.80
61	2446.00	-53.20	-52.00	-1.20
62	2445.95	-52.70	-52.00	-0.70
63	2445.90	-53.00	-52.00	-1.00
64	2445.85	-52.70	-52.00	-0.70
65	2445.80	-52.90	-52.00	-0.90
66	2445.75	-53.40	-52.00	-1.40
67	2445.70	-53.00	-52.00	-1.00
68	2445.65	-53.30	-52.00	-1.30
69	2445.60	-52.00	-52.00	0.00
70	2445.55	-51.80	-52.00	0.20
71	2445.50	-51.50	-52.00	0.50
72	2445.45	-51.20	-52.00	0.80
73	2445.40	-51.10	-52.00	0.90
74	2445.35	-51.20	-52.00	0.80
75	2445.30	-53.00	-52.00	-1.00
76	2445.25	-53.10	-52.00	-1.10
77	2445.20	-53.70	-52.00	-1.70
78	2445.15	-54.30	-52.00	-2.30
79	2445.10	-54.70	-52.00	-2.70
80	2445.05	-54.50	-52.00	-2.50
81	2445.00	-54.60	-52.00	-2.60
82	2444.95	-53.90	-52.00	-1.90
83	2444.90	-53.50	-52.00	-1.50
84	2444.85	-52.90	-52.00	-0.90
85	2444.80	-53.30	-52.00	-1.30
86	2444.75	-52.50	-52.00	-0.50
87	2444.70	-53.30	-52.00	-1.30
88	2444.65	-52.60	-52.00	-0.60
89	2444.60	-52.30	-52.00	-0.30
90	2444.55	-52.00	-52.00	0.00
91	2444.50	-51.60	-52.00	0.40
92	2444.45	-52.10	-52.00	-0.10
93	2444.40	-51.70	-52.00	0.30
94	2444.35	-52.70	-52.00	-0.70
95	2444.30	-54.20	-52.00	-2.20
96	2444.25	-54.60	-52.00	-2.60



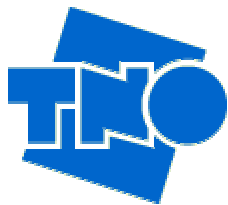
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Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
97	2444.20	-54.90	-52.00	-2.90
98	2444.15	-54.80	-52.00	-2.80
99	2444.10	-54.80	-52.00	-2.80
100	2444.05	-54.60	-52.00	-2.60
101	2444.00	-54.20	-52.00	-2.20
102	2443.95	-52.90	-52.00	-0.90
103	2443.90	-53.30	-52.00	-1.30
104	2443.85	-52.40	-52.00	-0.40
105	2443.80	-52.60	-52.00	-0.60
106	2443.75	-52.70	-52.00	-0.70
107	2443.70	-53.00	-52.00	-1.00
108	2443.65	-53.50	-52.00	-1.50
109	2443.60	-53.70	-52.00	-1.70
110	2443.55	-53.80	-52.00	-1.80
111	2443.50	-53.60	-52.00	-1.60
112	2443.45	-53.80	-52.00	-1.80
113	2443.40	-53.10	-52.00	-1.10
114	2443.35	-53.40	-52.00	-1.40
115	2443.30	-54.70	-52.00	-2.70
116	2443.25	-54.90	-52.00	-2.90
117	2443.20	-54.60	-52.00	-2.60
118	2443.15	-54.30	-52.00	-2.30
119	2443.10	-54.40	-52.00	-2.40
120	2443.05	-53.70	-52.00	-1.70
121	2443.00	-54.00	-52.00	-2.00
122	2442.95	-53.10	-52.00	-1.10
123	2442.90	-53.60	-52.00	-1.60
124	2442.85	-53.30	-52.00	-1.30
125	2442.80	-53.70	-52.00	-1.70
126	2442.75	-54.00	-52.00	-2.00
127	2442.70	-54.50	-52.00	-2.50
128	2442.65	-53.60	-52.00	-1.60
129	2442.60	-52.80	-52.00	-0.80
130	2442.55	-51.50	-52.00	0.50
131	2442.50	-50.90	-52.00	1.10
132	2442.45	-49.60	-52.00	2.40
133	2442.40	-48.50	-52.00	3.50
134	2442.35	-47.10	-52.00	4.90
135	2442.30	-47.40	-52.00	4.60
136	2442.25	-47.70	-52.00	4.30
137	2442.20	-47.60	-52.00	4.40
138	2442.15	-47.60	-52.00	4.40
139	2442.10	-48.30	-52.00	3.70
140	2442.05	-50.20	-52.00	1.80
141	2442.00	-51.90	-52.00	0.10
142	2441.95	-52.30	-52.00	-0.30
143	2441.90	-53.10	-52.00	-1.10
144	2441.85	-53.90	-52.00	-1.90
145	2441.80	-54.20	-52.00	-2.20
146	2441.75	-54.40	-52.00	-2.40
147	2441.70	-55.50	-52.00	-3.50
148	2441.65	-55.50	-52.00	-3.50



Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
149	2441.60	-54.50	-52.00	-2.50
150	2441.55	-53.90	-52.00	-1.90
151	2441.50	-53.30	-52.00	-1.30
152	2441.45	-53.10	-52.00	-1.10
153	2441.40	-52.60	-52.00	-0.60
154	2441.35	-53.20	-52.00	-1.20
155	2441.30	-54.80	-52.00	-2.80
156	2441.25	-54.90	-52.00	-2.90
157	2441.20	-55.10	-52.00	-3.10
158	2441.15	-54.70	-52.00	-2.70
159	2441.10	-54.30	-52.00	-2.30
160	2441.05	-54.40	-52.00	-2.40
161	2441.00	-54.60	-52.00	-2.60
162	2440.95	-52.80	-52.00	-0.80
163	2440.90	-53.30	-52.00	-1.30
164	2440.85	-52.90	-52.00	-0.90
165	2440.80	-52.80	-52.00	-0.80
166	2440.75	-52.90	-52.00	-0.90
167	2440.70	-53.70	-52.00	-1.70
168	2440.65	-54.60	-52.00	-2.60
169	2440.60	-54.40	-52.00	-2.40
170	2440.55	-54.40	-52.00	-2.40
171	2440.50	-53.80	-52.00	-1.80
172	2440.45	-53.90	-52.00	-1.90
173	2440.40	-53.80	-52.00	-1.80
174	2440.35	-54.30	-52.00	-2.30
175	2440.30	-54.90	-52.00	-2.90
176	2440.25	-54.70	-52.00	-2.70
177	2440.20	-54.30	-52.00	-2.30
178	2440.15	-54.00	-52.00	-2.00
179	2440.10	-54.00	-52.00	-2.00
180	2440.05	-53.50	-52.00	-1.50
181	2440.00	-52.70	-52.00	-0.70
182	2439.95	-51.60	-52.00	0.40
183	2439.90	-51.70	-52.00	0.30
184	2439.85	-51.60	-52.00	0.40
185	2439.80	-52.50	-52.00	-0.50
186	2439.75	-53.80	-52.00	-1.80
187	2439.70	-54.00	-52.00	-2.00
188	2439.65	-54.50	-52.00	-2.50
189	2439.60	-54.00	-52.00	-2.00
190	2439.55	-54.10	-52.00	-2.10
191	2439.50	-53.50	-52.00	-1.50
192	2439.45	-53.60	-52.00	-1.60
193	2439.40	-53.20	-52.00	-1.20
194	2439.35	-52.80	-52.00	-0.80
195	2439.30	-53.20	-52.00	-1.20
196	2439.25	-52.90	-52.00	-0.90
197	2439.20	-52.60	-52.00	-0.60
198	2439.15	-52.10	-52.00	-0.10
199	2439.10	-51.50	-52.00	0.50
200	2439.05	-51.80	-52.00	0.20



Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
201	2439.00	-51.60	-52.00	0.40
202	2438.95	-51.80	-52.00	0.20
203	2438.90	-51.90	-52.00	0.10
204	2438.85	-51.80	-52.00	0.20
205	2438.80	-52.80	-52.00	-0.80
206	2438.75	-53.70	-52.00	-1.70
207	2438.70	-53.90	-52.00	-1.90
208	2438.65	-53.80	-52.00	-1.80
209	2438.60	-53.10	-52.00	-1.10
210	2438.55	-52.70	-52.00	-0.70
211	2438.50	-52.00	-52.00	0.00
212	2438.45	-51.10	-52.00	0.90
213	2438.40	-51.30	-52.00	0.70
214	2438.35	-50.80	-52.00	1.20
215	2438.30	-51.60	-52.00	0.40
216	2438.25	-51.40	-52.00	0.60
217	2438.20	-51.00	-52.00	1.00
218	2438.15	-52.20	-52.00	-0.20
219	2438.10	-51.90	-52.00	0.10
220	2438.05	-52.50	-52.00	-0.50
221	2438.00	-52.40	-52.00	-0.40
222	2437.95	-51.30	-52.00	0.70
223	2437.90	-51.50	-52.00	0.50
224	2437.85	-51.60	-52.00	0.40
225	2437.80	-52.10	-52.00	-0.10
226	2437.75	-51.70	-52.00	0.30
227	2437.70	-51.00	-52.00	1.00
228	2437.65	-51.10	-52.00	0.90
229	2437.60	-50.90	-52.00	1.10
230	2437.55	-51.20	-52.00	0.80
231	2437.50	-51.30	-52.00	0.70
232	2437.45	-51.10	-52.00	0.90
233	2437.40	-51.00	-52.00	1.00
234	2437.35	-51.10	-52.00	0.90
235	2437.30	-51.70	-52.00	0.30
236	2437.25	-51.30	-52.00	0.70
237	2437.20	-51.20	-52.00	0.80
238	2437.15	-50.70	-52.00	1.30
239	2437.10	-50.10	-52.00	1.90
240	2437.05	-48.60	-52.00	3.40
241	2437.00	-47.70	-52.00	4.30
242	2436.95	-51.40	-52.00	0.60
243	2436.90	-51.00	-52.00	1.00
244	2436.85	-51.10	-52.00	0.90
245	2436.80	-51.70	-52.00	0.30
246	2436.75	-52.20	-52.00	-0.20
247	2436.70	-52.40	-52.00	-0.40
248	2436.65	-52.60	-52.00	-0.60
249	2436.60	-52.70	-52.00	-0.70
250	2436.55	-52.60	-52.00	-0.60
251	2436.50	-52.10	-52.00	-0.10
252	2436.45	-52.00	-52.00	0.00



Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
253	2436.40	-51.80	-52.00	0.20
254	2436.35	-52.40	-52.00	-0.40
255	2436.30	-52.50	-52.00	-0.50
256	2436.25	-52.90	-52.00	-0.90
257	2436.20	-52.10	-52.00	-0.10
258	2436.15	-52.00	-52.00	0.00
259	2436.10	-52.10	-52.00	-0.10
260	2436.05	-51.80	-52.00	0.20
261	2436.00	-51.50	-52.00	0.50
262	2435.95	-51.20	-52.00	0.80
263	2435.90	-51.40	-52.00	0.60
264	2435.85	-51.80	-52.00	0.20
265	2435.80	-52.10	-52.00	-0.10
266	2435.75	-52.00	-52.00	0.00
267	2435.70	-52.80	-52.00	-0.80
268	2435.65	-55.20	-52.00	-3.20
269	2435.60	-52.80	-52.00	-0.80
270	2435.55	-53.40	-52.00	-1.40
271	2435.50	-56.00	-52.00	-4.00
272	2435.45	-54.90	-52.00	-2.90
273	2435.40	-51.40	-52.00	0.60
274	2435.35	-52.90	-52.00	-0.90
275	2435.30	-52.50	-52.00	-0.50
276	2435.25	-54.20	-52.00	-2.20
277	2435.20	-54.60	-52.00	-2.60
278	2435.15	-52.00	-52.00	0.00
279	2435.10	-51.60	-52.00	0.40
280	2435.05	-51.80	-52.00	0.20
281	2435.00	-51.80	-52.00	0.20

Table 2



Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Results of the processing gain measurements, carried out in accordance with Title 47 CFR, Part 15, section 15.247, in the configuration and operation mode(s) as stated in this testreport, are depicted in table 2.

After 20% of the worst measurement results have been discarded it shows that the worst remaining value of the J/S ratio is -1.8 dB (=Mj).

Measured processing gain is: $G_p = 13.3 \text{ dB} + (-1.8 \text{ dB}) + 2.0 \text{ dB} = 13.5 \text{ dB}$ (for 2.0 Mb/s modulation)

Test engineer: P.A.J.M. Robben, B.Sc.E.E.

Tester signature:

A handwritten signature in blue ink, appearing to be 'P.A.J.M. Robben'.

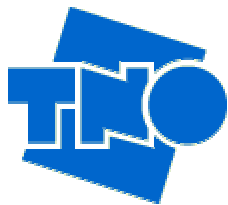
Date: October 17, 2001



3.2 Test results at a bitrate of 11 Mbps.

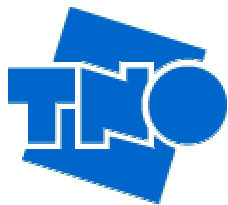
Pass band : $f_0 \pm 7$ MHz
Channel : nr. 7 = 2442.0 MHz

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
1	2449.00	-53.20	-52.00	-1.20
2	2448.95	-52.90	-52.00	-0.90
3	2448.90	-53.70	-52.00	-1.70
4	2448.85	-53.30	-52.00	-1.30
5	2448.80	-54.70	-52.00	-2.70
6	2448.75	-55.00	-52.00	-3.00
7	2448.70	-54.30	-52.00	-2.30
8	2448.65	-54.50	-52.00	-2.50
9	2448.60	-54.30	-52.00	-2.30
10	2448.55	-54.20	-52.00	-2.20
11	2448.50	-54.00	-52.00	-2.00
12	2448.45	-53.50	-52.00	-1.50
13	2448.40	-53.00	-52.00	-1.00
14	2448.35	-52.80	-52.00	-0.80
15	2448.30	-53.20	-52.00	-1.20
16	2448.25	-53.50	-52.00	-1.50
17	2448.20	-53.90	-52.00	-1.90
18	2448.15	-54.40	-52.00	-2.40
19	2448.10	-56.00	-52.00	-4.00
20	2448.05	-55.20	-52.00	-3.20
21	2448.00	-55.60	-52.00	-3.60
22	2447.95	-55.90	-52.00	-3.90
23	2447.90	-56.00	-52.00	-4.00
24	2447.85	-56.40	-52.00	-4.40
25	2447.80	-56.70	-52.00	-4.70
26	2447.75	-56.50	-52.00	-4.50
27	2447.70	-56.70	-52.00	-4.70
28	2447.65	-56.90	-52.00	-4.90
29	2447.60	-57.20	-52.00	-5.20
30	2447.55	-57.50	-52.00	-5.50
31	2447.50	-58.70	-52.00	-6.70
32	2447.45	-59.00	-52.00	-7.00
33	2447.40	-57.50	-52.00	-5.50
34	2447.35	-57.70	-52.00	-5.70
35	2447.30	-58.60	-52.00	-6.60
36	2447.25	-58.40	-52.00	-6.40
37	2447.20	-58.40	-52.00	-6.40
38	2447.15	-58.30	-52.00	-6.30
39	2447.10	-58.10	-52.00	-6.10
40	2447.05	-57.80	-52.00	-5.80
41	2447.00	-56.00	-52.00	-4.00
42	2446.95	-56.70	-52.00	-4.70
43	2446.90	-57.00	-52.00	-5.00
44	2446.85	-56.60	-52.00	-4.60
45	2446.80	-56.70	-52.00	-4.70
46	2446.75	-56.50	-52.00	-4.50



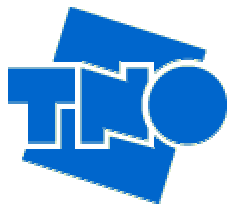
Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
47	2446.70	-57.80	-52.00	-5.80
48	2446.65	-57.90	-52.00	-5.90
49	2446.60	-57.90	-52.00	-5.90
50	2446.55	-57.10	-52.00	-5.10
51	2446.50	-57.20	-52.00	-5.20
52	2446.45	-56.70	-52.00	-4.70
53	2446.40	-58.70	-52.00	-6.70
54	2446.35	-56.90	-52.00	-4.90
55	2446.30	-56.10	-52.00	-4.10
56	2446.25	-56.30	-52.00	-4.30
57	2446.20	-56.40	-52.00	-4.40
58	2446.15	-56.10	-52.00	-4.10
59	2446.10	-56.80	-52.00	-4.80
60	2446.05	-57.20	-52.00	-5.20
61	2446.00	-58.00	-52.00	-6.00
62	2445.95	-59.70	-52.00	-7.70
63	2445.90	-60.20	-52.00	-8.20
64	2445.85	-60.80	-52.00	-8.80
65	2445.80	-61.30	-52.00	-9.30
66	2445.75	-60.80	-52.00	-8.80
67	2445.70	-62.00	-52.00	-10.00
68	2445.65	-61.70	-52.00	-9.70
69	2445.60	-60.80	-52.00	-8.80
70	2445.55	-59.60	-52.00	-7.60
71	2445.50	-59.40	-52.00	-7.40
72	2445.45	-58.90	-52.00	-6.90
73	2445.40	-59.10	-52.00	-7.10
74	2445.35	-58.70	-52.00	-6.70
75	2445.30	-59.00	-52.00	-7.00
76	2445.25	-59.20	-52.00	-7.20
77	2445.20	-59.40	-52.00	-7.40
78	2445.15	-59.90	-52.00	-7.90
79	2445.10	-60.10	-52.00	-8.10
80	2445.05	-59.90	-52.00	-7.90
81	2445.00	-60.70	-52.00	-8.70
82	2444.95	-60.60	-52.00	-8.60
83	2444.90	-60.30	-52.00	-8.30
84	2444.85	-59.90	-52.00	-7.90
85	2444.80	-58.90	-52.00	-6.90
86	2444.75	-58.80	-52.00	-6.80
87	2444.70	-58.60	-52.00	-6.60
88	2444.65	-57.70	-52.00	-5.70
89	2444.60	-58.00	-52.00	-6.00
90	2444.55	-57.70	-52.00	-5.70
91	2444.50	-58.80	-52.00	-6.80
92	2444.45	-59.60	-52.00	-7.60
93	2444.40	-60.40	-52.00	-8.40
94	2444.35	-60.30	-52.00	-8.30
95	2444.30	-60.50	-52.00	-8.50
96	2444.25	-61.90	-52.00	-9.90
97	2444.20	-61.20	-52.00	-9.20
98	2444.15	-61.00	-52.00	-9.00



Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
99	2444.10	-61.20	-52.00	-9.20
100	2444.05	-60.90	-52.00	-8.90
101	2444.00	-60.80	-52.00	-8.80
102	2443.95	-60.70	-52.00	-8.70
103	2443.90	-60.70	-52.00	-8.70
104	2443.85	-60.50	-52.00	-8.50
105	2443.80	-60.50	-52.00	-8.50
106	2443.75	-59.90	-52.00	-7.90
107	2443.70	-59.80	-52.00	-7.80
108	2443.65	-60.00	-52.00	-8.00
109	2443.60	-59.90	-52.00	-7.90
110	2443.55	-60.10	-52.00	-8.10
111	2443.50	-60.30	-52.00	-8.30
112	2443.45	-60.70	-52.00	-8.70
113	2443.40	-60.30	-52.00	-8.30
114	2443.35	-60.20	-52.00	-8.20
115	2443.30	-60.10	-52.00	-8.10
116	2443.25	-60.60	-52.00	-8.60
117	2443.20	-60.50	-52.00	-8.50
118	2443.15	-60.70	-52.00	-8.70
119	2443.10	-60.30	-52.00	-8.30
120	2443.05	-60.80	-52.00	-8.80
121	2443.00	-60.40	-52.00	-8.40
122	2442.95	-60.60	-52.00	-8.60
123	2442.90	-61.10	-52.00	-9.10
124	2442.85	-60.80	-52.00	-8.80
125	2442.80	-61.00	-52.00	-9.00
126	2442.75	-60.60	-52.00	-8.60
127	2442.70	-60.80	-52.00	-8.80
128	2442.65	-61.00	-52.00	-9.00
129	2442.60	-60.90	-52.00	-8.90
130	2442.55	-61.70	-52.00	-9.70
131	2442.50	-61.10	-52.00	-9.10
132	2442.45	-62.00	-52.00	-10.00
133	2442.40	-62.20	-52.00	-10.20
134	2442.35	-62.10	-52.00	-10.10
135	2442.30	-63.00	-52.00	-11.00
136	2442.25	-63.80	-52.00	-11.80
137	2442.20	-62.50	-52.00	-10.50
138	2442.15	-62.10	-52.00	-10.10
139	2442.10	-61.40	-52.00	-9.40
140	2442.05	-61.30	-52.00	-9.30
141	2442.00	-61.20	-52.00	-9.20
142	2441.95	-60.80	-52.00	-8.80
143	2441.90	-61.00	-52.00	-9.00
144	2441.85	-60.80	-52.00	-8.80
145	2441.80	-60.70	-52.00	-8.70
146	2441.75	-60.90	-52.00	-8.90
147	2441.70	-61.20	-52.00	-9.20
148	2441.65	-60.10	-52.00	-8.10
149	2441.60	-59.40	-52.00	-7.40
150	2441.55	-61.20	-52.00	-9.20



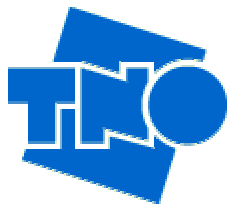
Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
151	2441.50	-61.30	-52.00	-9.30
152	2441.45	-60.80	-52.00	-8.80
153	2441.40	-60.30	-52.00	-8.30
154	2441.35	-60.10	-52.00	-8.10
155	2441.30	-59.60	-52.00	-7.60
156	2441.25	-58.80	-52.00	-6.80
157	2441.20	-59.50	-52.00	-7.50
158	2441.15	-59.50	-52.00	-7.50
159	2441.10	-59.80	-52.00	-7.80
160	2441.05	-60.20	-52.00	-8.20
161	2441.00	-61.80	-52.00	-9.80
162	2440.95	-61.80	-52.00	-9.80
163	2440.90	-60.50	-52.00	-8.50
164	2440.85	-60.60	-52.00	-8.60
165	2440.80	-60.60	-52.00	-8.60
166	2440.75	-60.40	-52.00	-8.40
167	2440.70	-60.50	-52.00	-8.50
168	2440.65	-60.90	-52.00	-8.90
169	2440.60	-60.70	-52.00	-8.70
170	2440.55	-60.50	-52.00	-8.50
171	2440.50	-60.60	-52.00	-8.60
172	2440.45	-60.70	-52.00	-8.70
173	2440.40	-60.60	-52.00	-8.60
174	2440.35	-60.70	-52.00	-8.70
175	2440.30	-61.40	-52.00	-9.40
176	2440.25	-60.60	-52.00	-8.60
177	2440.20	-60.10	-52.00	-8.10
178	2440.15	-59.30	-52.00	-7.30
179	2440.10	-59.10	-52.00	-7.10
180	2440.05	-59.20	-52.00	-7.20
181	2440.00	-57.50	-52.00	-5.50
182	2439.95	-57.00	-52.00	-5.00
183	2439.90	-56.80	-52.00	-4.80
184	2439.85	-57.20	-52.00	-5.20
185	2439.80	-58.90	-52.00	-6.90
186	2439.75	-58.80	-52.00	-6.80
187	2439.70	-59.20	-52.00	-7.20
188	2439.65	-59.00	-52.00	-7.00
189	2439.60	-60.70	-52.00	-8.70
190	2439.55	-60.50	-52.00	-8.50
191	2439.50	-59.10	-52.00	-7.10
192	2439.45	-60.30	-52.00	-8.30
193	2439.40	-59.20	-52.00	-7.20
194	2439.35	-59.30	-52.00	-7.30
195	2439.30	-59.40	-52.00	-7.40
196	2439.25	-59.10	-52.00	-7.10
197	2439.20	-58.50	-52.00	-6.50
198	2439.15	-58.80	-52.00	-6.80
199	2439.10	-59.00	-52.00	-7.00
200	2439.05	-59.70	-52.00	-7.70
201	2439.00	-59.70	-52.00	-7.70
202	2438.95	-60.40	-52.00	-8.40



Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
203	2438.90	-59.20	-52.00	-7.20
204	2438.85	-58.90	-52.00	-6.90
205	2438.80	-60.80	-52.00	-8.80
206	2438.75	-62.80	-52.00	-10.80
207	2438.70	-61.40	-52.00	-9.40
208	2438.65	-60.20	-52.00	-8.20
209	2438.60	-59.40	-52.00	-7.40
210	2438.55	-58.60	-52.00	-6.60
211	2438.50	-56.20	-52.00	-4.20
212	2438.45	-56.00	-52.00	-4.00
213	2438.40	-55.80	-52.00	-3.80
214	2438.35	-55.60	-52.00	-3.60
215	2438.30	-56.20	-52.00	-4.20
216	2438.25	-57.30	-52.00	-5.30
217	2438.20	-57.70	-52.00	-5.70
218	2438.15	-57.30	-52.00	-5.30
219	2438.10	-57.10	-52.00	-5.10
220	2438.05	-57.80	-52.00	-5.80
221	2438.00	-58.20	-52.00	-6.20
222	2437.95	-57.80	-52.00	-5.80
223	2437.90	-59.00	-52.00	-7.00
224	2437.85	-58.80	-52.00	-6.80
225	2437.80	-58.70	-52.00	-6.70
226	2437.75	-58.20	-52.00	-6.20
227	2437.70	-57.70	-52.00	-5.70
228	2437.65	-56.30	-52.00	-4.30
229	2437.60	-56.40	-52.00	-4.40
230	2437.55	-56.20	-52.00	-4.20
231	2437.50	-56.00	-52.00	-4.00
232	2437.45	-55.80	-52.00	-3.80
233	2437.40	-55.70	-52.00	-3.70
234	2437.35	-55.50	-52.00	-3.50
235	2437.30	-55.60	-52.00	-3.60
236	2437.25	-55.00	-52.00	-3.00
237	2437.20	-54.80	-52.00	-2.80
238	2437.15	-54.90	-52.00	-2.90
239	2437.10	-54.70	-52.00	-2.70
240	2437.05	-54.70	-52.00	-2.70
241	2437.00	-55.20	-52.00	-3.20
242	2436.95	-57.80	-52.00	-5.80
243	2436.90	-58.20	-52.00	-6.20
244	2436.85	-58.50	-52.00	-6.50
245	2436.80	-59.20	-52.00	-7.20
246	2436.75	-59.90	-52.00	-7.90
247	2436.70	-59.60	-52.00	-7.60
248	2436.65	-59.70	-52.00	-7.70
249	2436.60	-60.20	-52.00	-8.20
250	2436.55	-58.90	-52.00	-6.90
251	2436.50	-60.50	-52.00	-8.50
252	2436.45	-60.50	-52.00	-8.50
253	2436.40	-58.80	-52.00	-6.80
254	2436.35	-58.30	-52.00	-6.30



Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Step	Frequency (MHz)	J (dBm)	S (dBm)	J/S (dB)
255	2436.30	-56.70	-52.00	-4.70
256	2436.25	-56.80	-52.00	-4.80
257	2436.20	-55.80	-52.00	-3.80
258	2436.15	-56.70	-52.00	-4.70
259	2436.10	-57.20	-52.00	-5.20
260	2436.05	-57.20	-52.00	-5.20
261	2436.00	-57.20	-52.00	-5.20
262	2435.95	-57.80	-52.00	-5.80
263	2435.90	-57.60	-52.00	-5.60
264	2435.85	-57.30	-52.00	-5.30
265	2435.80	-57.00	-52.00	-5.00
266	2435.75	-56.40	-52.00	-4.40
267	2435.70	-56.60	-52.00	-4.60
268	2435.65	-56.20	-52.00	-4.20
269	2435.60	-56.10	-52.00	-4.10
270	2435.55	-55.80	-52.00	-3.80
271	2435.50	-55.60	-52.00	-3.60
272	2435.45	-56.50	-52.00	-4.50
273	2435.40	-55.70	-52.00	-3.70
274	2435.35	-56.00	-52.00	-4.00
275	2435.30	-55.40	-52.00	-3.40
276	2435.25	-55.40	-52.00	-3.40
277	2435.20	-55.80	-52.00	-3.80
278	2435.15	-56.60	-52.00	-4.60
279	2435.10	-55.20	-52.00	-3.20
280	2435.05	-55.10	-52.00	-3.10
281	2435.00	-54.40	-52.00	-2.40

Table 3



Description of EUT: 2.4 GHz low power RLAN PCMCIA card
Manufacturer: Apple Computer, Ltd
Brand mark: Apple
Type: 630-37XX
FCC ID: IMRAPPC2411R

Results of the processing gain measurements, carried out in accordance with Title 47 CFR, Part 15, section 15.247, in the configuration and operation mode(s) as stated in this testreport, are depicted in table 3.

After 20% of the worst measurement results have been discarded it shows that the worst remaining value of the J/S ratio is -8.6 dB (=Mj).

Measured processing gain is: $G_p = 17.0 \text{ dB} + (-8.6 \text{ dB}) + 2.0 \text{ dB} = 10.4 \text{ dB}$ (for 11.0 Mb/s modulation)

Test engineer: P.A.J.M. Robben, B.Sc.E.E.

Tester signature:

A handwritten signature in blue ink, appearing to be 'P.A.J.M. Robben'.

Date: October 23, 2001