

CETECOM Inc.



CETECOM Inc.

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Issued test report consists of 25 Pages

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IC – 3925**

**Test report no.: EMC_381EN489-17_2002
ETSI EN 301 489-17 V1.1.1 (2000-09)
(BCM94306CB)**

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The test results of this test report relate exclusively to the test item specified in 1.5. The CETECOM Inc. USA does not assume responsibility for any conclusions and generalisations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item. The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of the CETECOM Inc USA.

TEST REPORT PREPARED BY:

EMC Engineer: Philip Kim

1.2 Testing laboratory

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1.3 Details of applicant

Name : **Broadcom corporation**
Street : **190 Mathilda Place**
City / Zip Code : **Sunnyvale, 94086**
Country : **USA**
Contact : **Chris McGough**
Telephone : **408-922-5810**
Tele-fax : **408-543-3399**
e-mail : cmcgough@broadcom.com

1.4 Application details

Date of receipt of application : 2002-12-19
Date of receipt test item : 2002-11-21
Date of test : 2002-12-06, 2002-12-13 and 2002-12-14

1.5 Test item

Manufacturer : See Applicant
Model No. : BCM94306CB
Description : [54g Wireless Lan cardbus PC card](#)

Additional information

Frequency : 2412MHz – 2472MHz
Type of modulation : OFDM (orthogonal frequency division multiplexing)
Number of channels : 13
Antenna : 1dBi external antenna
Power supply : From Host
Output power : 16.09dBm (40.64mW) max. EIRP
Extreme temp. Tolerance : 0 to +50 °C


1.6 Test standards: **ETSI EN 301 489-17 V1.1.1 (2002-09)**
ETSI EN 301 489-1 V1.2.1 (2000-08)

2 Technical test


2.1 Summary of test results

No deviations from the technical specification(s) were ascertained in the course of the tests Performed	
Final Verdict: (only "passed" if all single measurements are "passed")	Passed

Technical responsibility for area of testing:

2003-01-10	EMC & Radio	Lothar Schmidt (Manager)	
Date	Section	Name	Signature

Responsible for test report and project leader:

2003-01-10	EMC & Radio	Philip Kim (EMC Engineer)	
Date	Section	Name	Signature

2.2 Test report

TEST REPORT

**Test report no. : EMC_381EN489-17_2002
(BCM94306CB)**

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SUMMARY OF TEST RESULTS

EMISSION (EMI)

EMI Phenomenon	Port	Requirements		EUT set-up	Result	Applicability
		Standard	Basic standard			
Conducted Interference voltage, 0.15 – 30*MHz	AC Mains	ETSI EN 301 489-1, 2000-08 Chap. 8.4	EN 55022:1998 +Corr.2001 + A1:2000	na	Complies	Not Applicable
Radiated Interference Field Strength 30 – 1000*MHz	Enclosure	ETSI EN 301 489-1, 2000-08 Chap. 8.2	EN 55022:1998 +Corr.2001 + A1:2000	na	Complies	Applicable
Harmonic Current Emissions	AC mains input port	ETSI EN 301 489-1, 2000-08 Chap. 8.5	EN 61000-3-2: 2000	na	Complies	Not Applicable
Flicker & Voltage Fluctuation	AC mains input port	ETSI EN 301 489-1, 2000-08 Chap. 8.6	EN 61000-3-3: 2000	na	Complies	Not Applicable

IMMUNITY (EMS)

EMS Phenomenon	Port	Requirements		EUT set-up	Result	Applicability
		Standard	Basic standard			
Electrostatic discharge (ESD)	Enclosure	ETSI EN 301 489-1, 2000-08 Chap. 9.3 --	EN 61000-4-2: 1995 +A1: 1998+A2:2001	na	Complies	Applicable
RF-electro-magnetic field	Enclosure	ETSI EN 301 489-1, 2000-08 Chap. 9.2 --	EN 61000-4-3: 1996 +A1: 1998+A2:2001	na	Complies	Applicable
Fast transients, BURST	Powerline AC / DC	ETSI EN 301 489-1, 2000-08 Chap. 9.4 --	EN 61000-4-4: 1995 +A1: 2001	na	Complies	Not Applicable
Surge	Powerline (1 phase)	ETSI EN 301 489-1, 2000-08 Chap. 9.8 --	EN 61000-4-5: 1995 +A1: 2001	na	Complies	Not Applicable
Transients & Surges vehicular environment	Powerline (car charger)	ETSI EN 301 489-1, 2000-08 Chap. 9.6 --	ISO 7637-1/2:1990 (12/24VDC)	na	Complies	Not Applicable
RF Common mode	Powerline AC/DC signal lines	ETSI EN 301 489-1, 2000-08 Chap. 9.5 --	EN 61000-4-6: 1996 +A1: 2001	na	Complies	Not Applicable
Vol. Dips, interruptions & fluctuations (AC Power)	Input & output AC ports only	ETSI EN 301 489-1, 2000-08 Chap. 9.7 --	EN 61000-4-11: 1994 +A1: 2001	na	Complies	Not Applicable

na=not applicable

GENERAL PERFORMANCE CRITERIA

The performance criteria are:

-performance criteria A for immunity tests with phenomena of a continuous nature;
Communication between the BCM94306CB and BCM94306MP in the form of pings should not drop during the test.

-performance criteria B for immunity tests with phenomena of a transient nature;

N/A

-performance criteria C for immunity tests with power interruptions exceeding a certain time.

N/A

NOTE: For details see subclause 6.2 ETSI EN 301 489-17

**EMISSION TEST:
RADIATED EMISSIONS**

This test assesses the ability of ancilliary equipment to limit their internal noise from being radiated from the enclosure.

According to EMC basic standard (EN 55022)

Measurement according to EMC basic standard, but performed in the anechoic chamber with a reduced measuring distance of 3m. The reduction of the measuring distance and the existing floor absorber are corrected with the chamber factor (Method Dr. Garn, Austrian Research Centre, Seibersdorf). The test results of the anechoic chamber correspond to the 10m-OATS results

Test setup

EUT was setup in an anechoic chamber

Limits

Freq. Range	Limit (Quasi peak)
30MHz – 230MHz	30dB μ V/m
230MHz – 1000MHz	37dB μ V/m

EUT Type and S/N or EUT set-up no.		Set.			
Plot No.	receiving antenna directed to	angle of turntable	polarisation (h / v)	comment (e.g. operating mode or operating mode no.)	result (passed / failed)
1.1	--	0 ° - 360°	h/v	EUT operating mode 3	Passed

Remarks: All measurements were carried out in peak mode. As long as the values stay under the average limit line No QP measurements are carried out.

AC LINE CONDUCTED EMISSIONS

According to EMC basic standard (EN 55022 [7] Class-B)

- 1.For the table top EUT the distance to the reference ground plane (wall) should be 40 cm.
- 2.AC input line plugged into LISN

EUT Operating mode

Tx at middle. channel

Plot no.	Powerline (L,N)	EUT operating mode or operating mode no.	Detector (Peak, AV, QP)	Additional (scan-) information (e.g. Pre-test Fastscan, Maxhold, Final measurement)	Result (passed / failed)
--	L+N		QP	Final measurement	N/A

Note: This test does not apply due to the fact that EUT's power is host dependant.

HARMONIC CURRENT EMISSIONS

This test was performed as per EMC Basic Standard EN 61000-3-2(Dec-2000)

EUT Operating mode

Tx at middle. channel

Plot No.	Port	EUT operating mode or operating mode no.	Result (passed / failed)
--	AC input	Tx at mid. channel	N/A

Note: This test does not apply due to the fact that EUT's power is host dependant.

FLICKER AND VOLTAGE FLUCTUATION

This test was performed as per EMC Basic Standard EN 61000-3-3

EUT Operating mode

Tx at middle. channel

Plot No.	Port	EUT operating mode or operating mode no.	Result (passed / failed)
--	AC input	Tx at mid. channel	N/A

Note: This test does not apply due to the fact that EUT's power is host dependant.

**IMMUNITY TEST:
RADIATED, RF ELECTROMAGNETIC FIELDS**

According to EMC basic standard (EN 61000-4-3[9])

- The distance between the turn-table axis and TX-antenna is 3m.
- Field strength = 3V/m
- Start Frequency = 80MHz Stop Frequency = 1000MHz
- Frequency Step = lin 1MHz
- Modulation = AM, 1KHz, 80%

Failure Criteria

Describe applicable failure criteria for EUT

Example

- 1.Continuous data transfer between EUT and Mini PCI Access Point
- 2.Transmitting following data: 65 bytes from 192.168.1.1 icmp_seg = xxx + H = 255 time = xxx
- 3.If connection drops then the the program will display “Request Timed out”

Failure Criteria observed

Describe how failure criteria was observed

Example

1. Observe continuous scrolling “# ” on the screen

Plot no.	Antenna Polarity	Radiation to	Reaction of the EUT During and after test	Result
5.1	vertical	Front	No reactions recognized	passed
5.2	horizontal	Front	No reactions recognized	passed

Performance criteria A observed

RF COMMON MODE

According to EMC basic standard (EN 61000-4-6[10])
Start Frequency = 150KHz Stop Frequency = 80MHz
Frequency Step = 50KHz in the range of 150KHz – 5MHz
 1% increment in the range of 5MHz – 80MHz
Field strength = 3V/m
Modulation = AM, 1KHz, 80%

Test setup

Injection via CDN or BIC clamp

Failure Criteria

Failure Criteria observed

Plot no.	Injection on	Injection Via	Reaction of EUT during and after test	Result
--	AC input power line	CDN	No reactions recognized	N/A

Performace criteria A observed

Note: This test does not apply due to the fact that EUT's power suupply is host dependant.

ELECTROSTATIC DISCHARGE

According to EMC basic standard (EN 61000-4-2[10])

For the table top EUT the distance to the reference ground plane should be 80 cm.

Direct contact discharge on conducting surfaces of EUT

Indirect air discharge on insulating surfaces of EUT

±2kV, ±4kV direct discharge & ±2kV, ±4kV, ±8KV air discharger

Test setup

Failure Criteria

Failure Criteria observed

10 Single impulses at each test point and for each test voltage

Test voltage	Contact discharge to conducted surfaces and to coupling planes				Air discharge at insulating surfaces	
	Direct contact discharge		Indirect contact discharge		Reaction of EUT / result	
	Reaction of EUT / result		Reaction of EUT / result			
+2 kV	n.r.r.	passed	n.r.r.	passed	n.r.r.	passed
-2 kV	n.r.r.	passed	n.r.r.	passed	n.r.r.	passed
+4 kV	n.r.r.	passed	n.r.r.	passed	n.r.r.	passed
-4 kV	n.r.r.	passed	n.r.r.	passed	n.r.r.	passed
+6 kV	-	-	-	-	-	-
-6 kV	-	-	-	-	-	-
+8 kV	-	-	-	-	n.r.r.	passed
-8 kV	-	-	-	-	n.r.r.	passed

Remarks: n.r.r = no reaction recognized

Performance Criteria A observed

FAST TRANSIENTS COMMON MODE

According to EMC basic standard (EN 61000-4-4[11])

- 1.For the table top EUT the distance to the reference ground plane should be 80 cm.
- 2.The test level for ac mains power input ports shall be 1KV open circuit.

Test setup

Burst on Power Line (direct injection)

Failure Criteria

Failure Criteria observed

Adjustment on UCS 500 M4: Trigger: "AUTO", Burst length: 15 ms				testing time: <input checked="" type="checkbox"/> 60 s for every voltage and polarity <input type="checkbox"/> 120 s for every voltage and polarity				
Testing on power line (direct injection)		reaction of the test object during and after test						result
Test voltage	repetition frequency	L1=> GND (+=> GND)	L2=> GND	L3=> GND	N => GND	PE=> GND	L1, N, => GND	
-0,5 kV	5 kHz	n.r.r.	N/A	N/A	n.r.r.	N/A	n.r.r.	passed
+0,5 kV	5 kHz	n.r.r.	N/A	N/A	n.r.r.	N/A	n.r.r.	passed
-1,0 kV	5 kHz	n.r.r.	N/A	N/A	n.r.r.	N/A	n.r.r.	passed
+1,0 kV	5 kHz	n.r.r.	N/A	N/A	n.r.r.	N/A	n.r.r.	passed
n.r.r = no reaction recognized, N/A = not applicable								

Performance Criteria A observed

Note: This test does not apply due to the fact that EUT's power supply is host dependant.

SURGES COMMON & DIFFERENTIAL MODE (1-phase)

According to EMC basic standard (EN 61000-4-5[14])

- 1.For the table top EUT the distance to the reference ground plane should be 80 cm.
- 2.1KV open circuit for common mode & 0.5KV open circuit for differential mode.

Failure Criteria

Failure Criteria observed

5 pulses for each polarity and test voltage, alternating negative/positive, triggered in case of AC-powerline: 0°, 45°, 90°, 180°, 270° referred to the line frequency (L1), repetition rate is 1 per min.

Test voltage	reaction of the test object during and after test by trigger angle/pulse no. (coupling on DC-lines => trigger angle not relevant)					Result
	0°/pulse no. 1, 2	45°/no. 3, 4	90°/no. 5, 6	180°/no. 7, 8	270°/no. 9, 10	
capacitive coupling on AC lines: L 1 => N or DC lines + => - (R = Ri = 2 Ω / C = 18 μ F)						
-0,5 kV	no reaction	no reaction	no reaction	no reaction	no reaction	passed
+0,5 kV	recognized	recognized	recognized	recognized	recognized	
-1,0 kV	no reaction	no reaction	no reaction	no reaction	no reaction	passed
+1,0 kV	recognized	recognized	recognized	recognized	recognized	
-2,0 kV	N/A	N/A	N/A	N/A	N/A	--
+2,0 kV	N/A	N/A	N/A	N/A	N/A	
- kV	N/A	N/A	N/A	N/A	N/A	--
+ kV	N/A	N/A	N/A	N/A	N/A	

Performance Criteria A observed

Note: This test does not apply due to the fact that EUT's power supply is host dependant.

VOLTAGE DIPS

According to EMC basic standard (EN 61000-4-11 [13])

- 1.For the table top EUT the distance to the reference ground plane should be 80 cm.
- 2.The test level shall be – a vol. Reduction of the supply vol. of 30% for 10ms; 60% for 100ms and >95% for 5000ms

Failure Criteria

Failure Criteria observed

for each test 3 repetitions in an interval of 10 s
 time for decrease or increase of supply voltage: T down/up < 5 μs (due to switching)

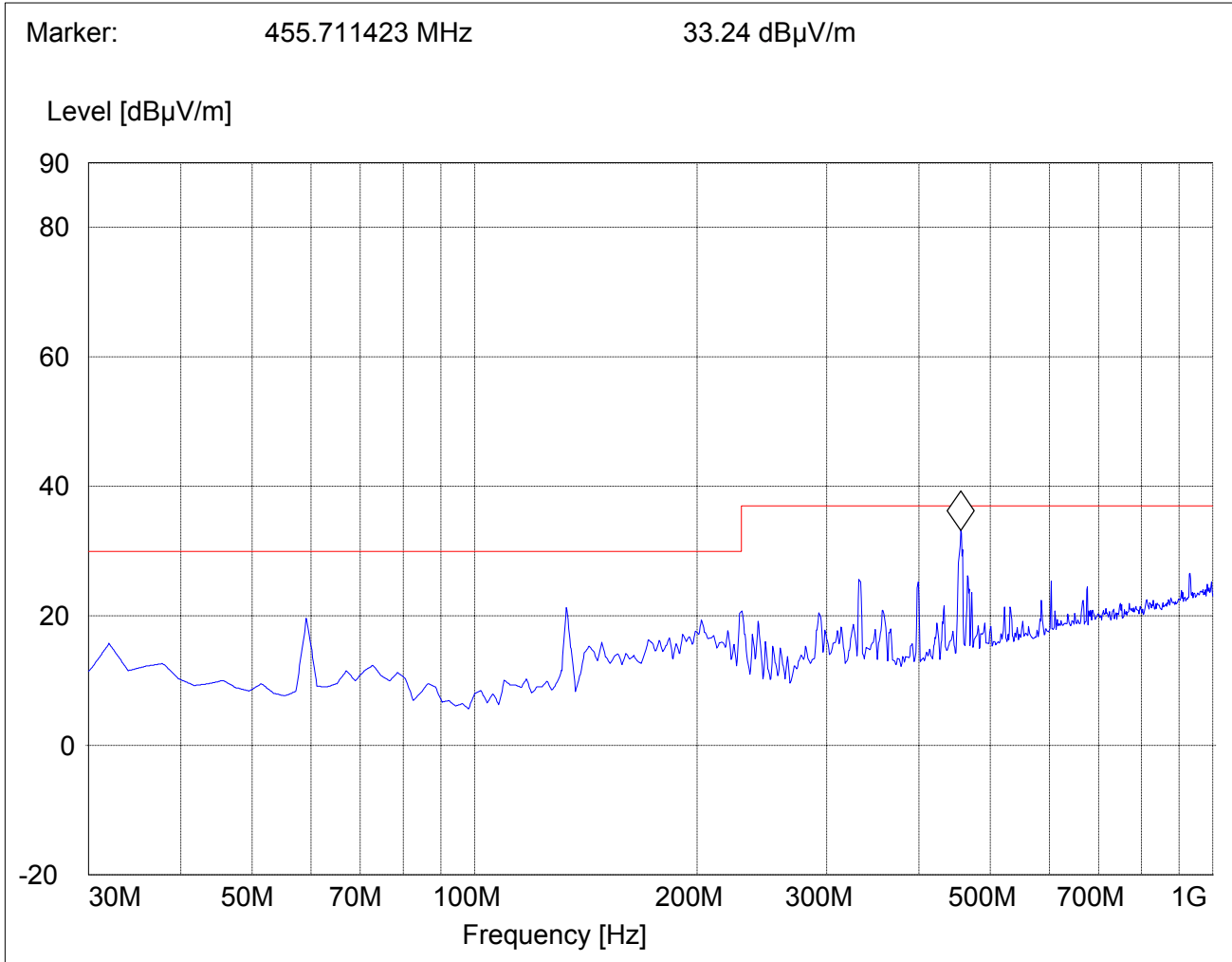
nominal supply voltage	start by trigger angle (AC)	duration of test voltage	test voltage	reaction of EUT during and after test	result
U ₁		T	U ₂		
100% U_N: <input checked="" type="checkbox"/> 230V <input type="checkbox"/>	0°	10 ms	70% U_N <input checked="" type="checkbox"/> 161 V <input type="checkbox"/>	n.r.r – performance criteria A observed	N/A
100% U_N: <input checked="" type="checkbox"/> 230V <input type="checkbox"/>	0°	100 ms	40% U_N <input checked="" type="checkbox"/> 92 V <input type="checkbox"/>	n.r.r – performance criteria A observed	N/A
100% U_N: <input checked="" type="checkbox"/> 230V <input type="checkbox"/>	0°	5000 ms	0% U_N 0 V	performance criteria C observed	N/A

n.r.r – no reaction recognized

Note: This test does not apply due to the fact that EUT’s power supply is host dependant.

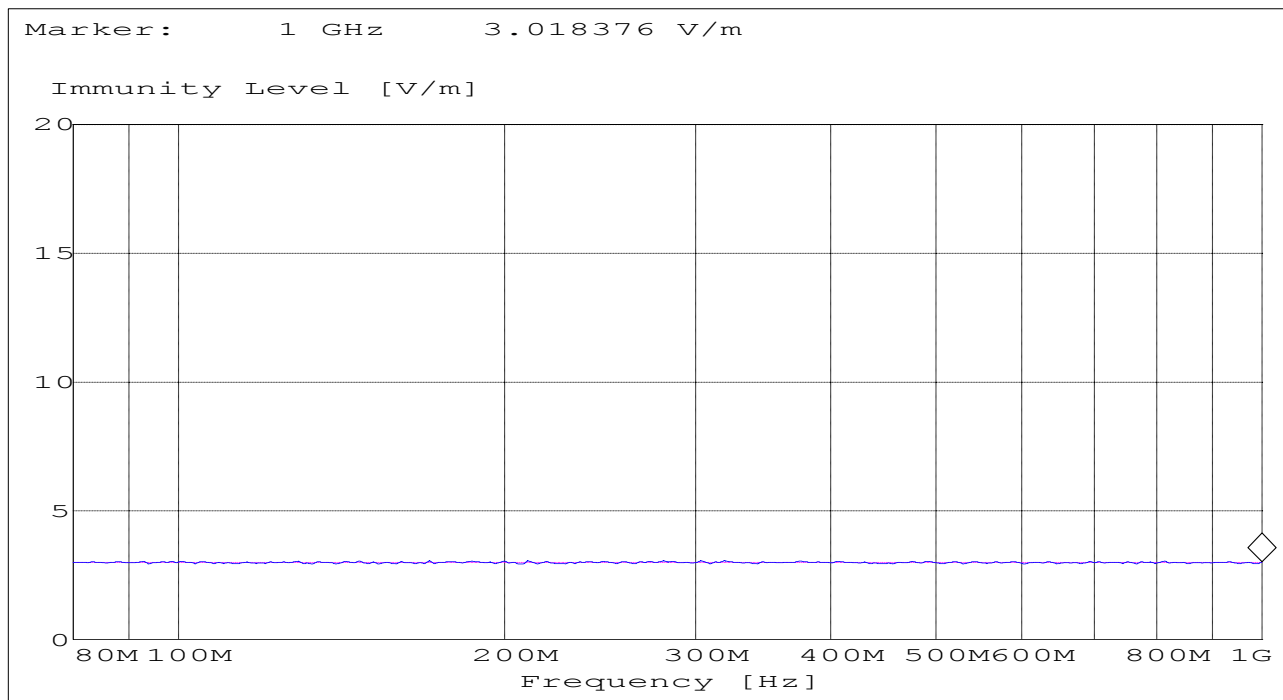
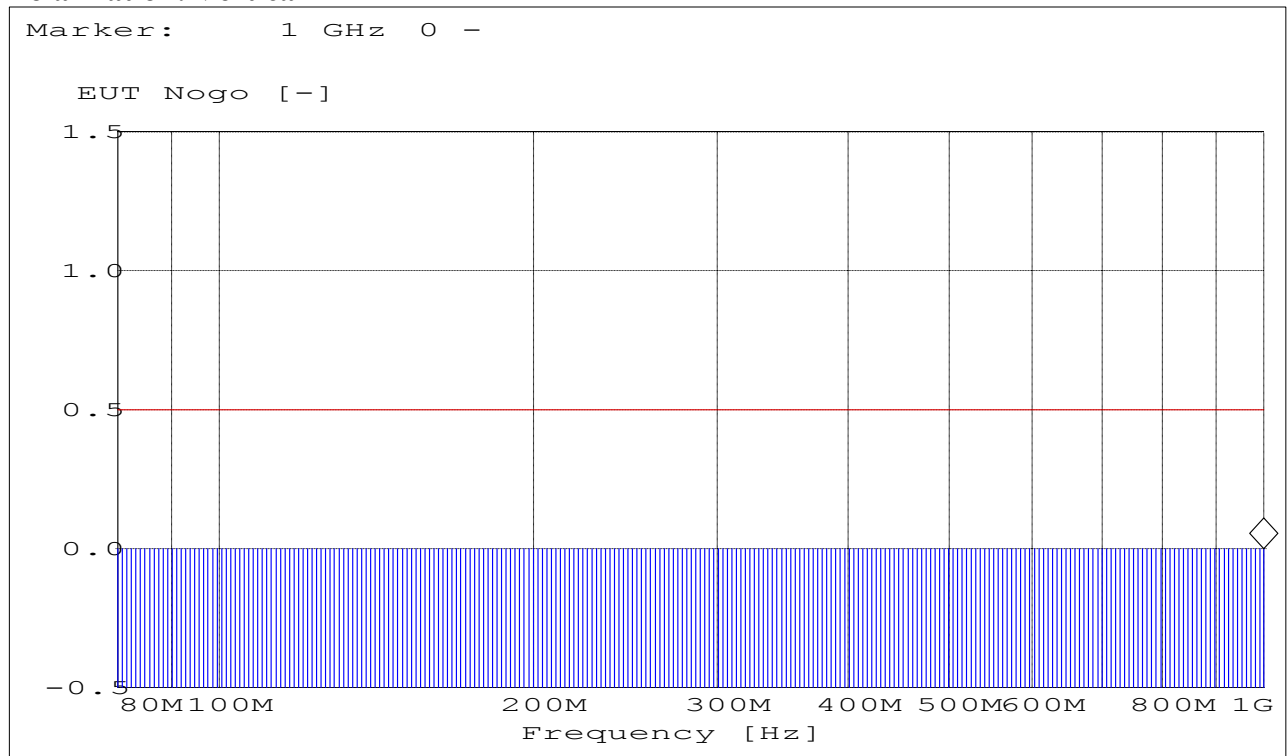
PLOTS

Plot 1.1



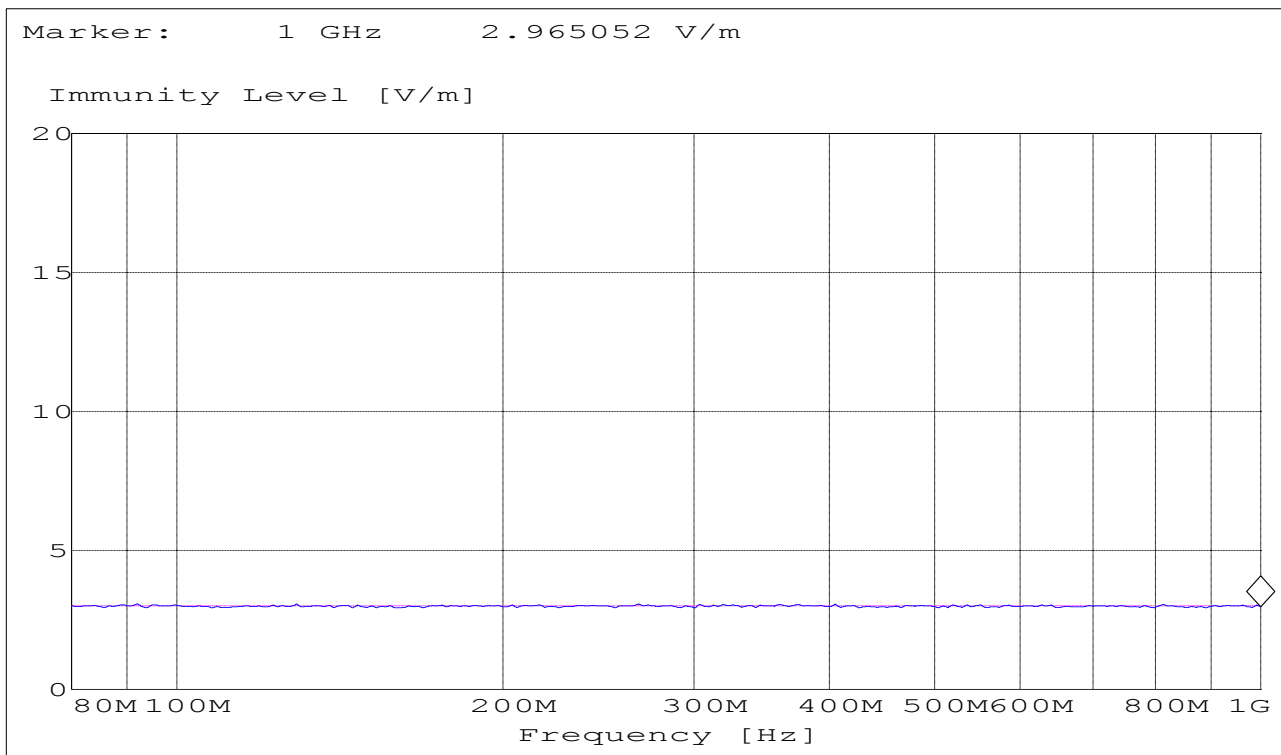
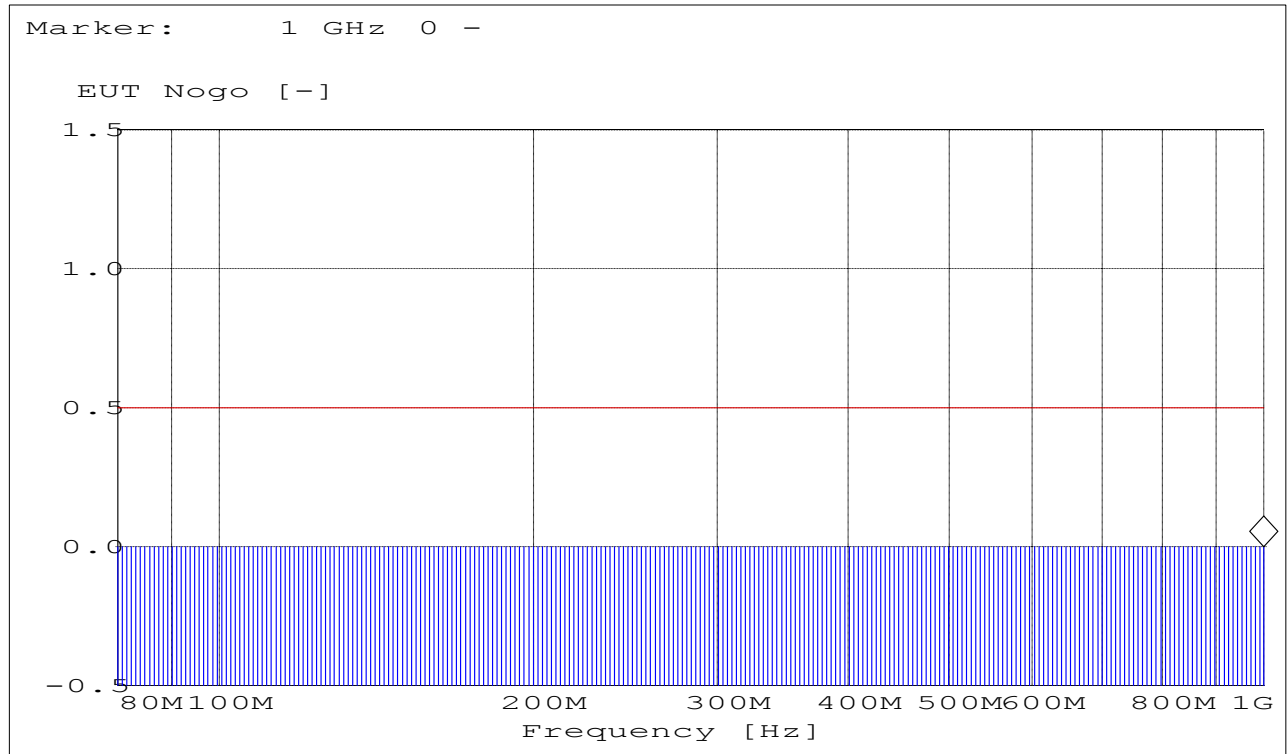
Plot 5.1

Polarization: Vertical



Plot 5.2

Polarization: Horizontal



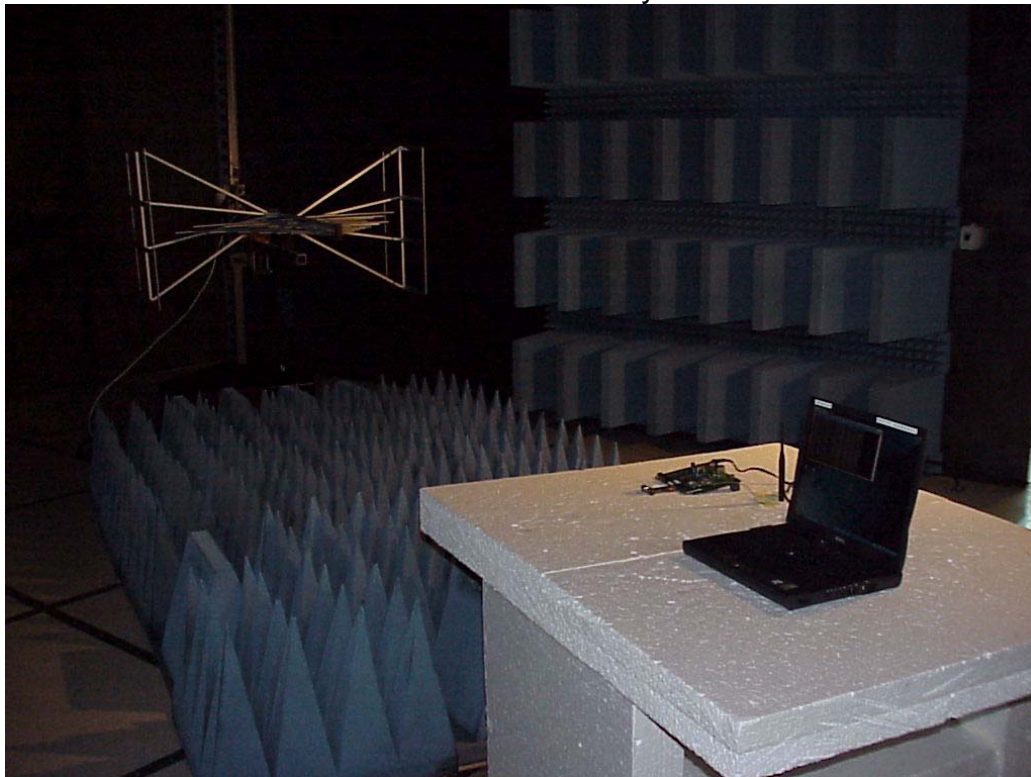
TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

No	Instrument/Ancillary	Manufacturer	Type/Model	Serial No.
1A	Spectrum Analyzer	Rohde & Schwarz	ESIB 40	100107
1B	Digital Radio Comm. Tester	Rohde & Schwarz	CMU 200	101821
1C	Harmonic / Flicker tester	Voltech	PMI	304644
1	Spectrum Analyzer	Rohde & Schwarz	FSEM 30	826880/010
2	Digital Radio Comm. Tester	Rohde & Schwarz	CMD 55	847958/008
5	Audio Analyzer	Rohde & Schwarz	UPL 16	838205/005
6	Signal Generator	Rohde & Schwarz	SMY02	836878/011
7	Power Meter	Rohde & Schwarz	NRVD	836875/020
8	10V Insertion Unit 50ohm	Rohde & Schwarz	URV5-Z2	836029/034
9	10V Insertion Unit 50ohm	Rohde & Schwarz	URV5-Z2	836029/035
10	Power Amplifier	Amplifier Research	250W1000	300031
11	Power Amplifier	Amplifier Research	3051G3	29254
12	Power Amplifier	Amplifier Research	100A 250AM1	28835
13	Climatic Chamber	Votsch	VT4004	G1115
14	Programmable AC Source	Chroma	6520	2098
15	LISN	Rohde & Schwarz	ESH 3-Z6	836154/011
16	LISN	Rohde & Schwarz	ESH3-Z5	836679/003
17	Vertical Coupling Plane	Amplifier Research		28259
18	Immunity Tester	Amplifier Research	UCS 500 M4	28256
19	ESD Gun	Amplifier Research		28256
20	Power Splitter	Hewlett Packard	11667B	645348
21	Pre-Amplifier	Miteq	JS4-00102600	00616
22	Pre-Amplifier	Miteq	AFS4-00101	800-55-LN
23	Notch Filter-1	Weinschel	System integrated	
24	Notch Filter-2	Weinschel	System integrated	
25	Notch Filter-3	Weinschel	System integrated	
22	High Pass Filter	Trilithic Inc.	5HC2700	9926013
23	High Pass Filter	Trilithic Inc.	5HC2700	9926014
24	High Pass Filter	Trilithic Inc.	4HC1600	9922307
25	High Pass Filter	Trilithic Inc.	4HC1600	9922308
26	High Pass Filter-1	Weinschel	System integrated	---
27	High Pass Filter-2	Weinschel	System integrated	---
28	DC Power Supply	Hewlett Packard	E3610A	KR83021224
29	DC Power Supply	Hewlett Packard	E3610A	KR83023316
30	Attenuator	JFW Industries	50FHE-006-200	319740 0051
31	Attenuator	NARDA	776B-10	5173
32	Attenuator	NARDA	770B-10	---
33	Attenuator	Weinschel Corp.	1433-3	MG678
34	V-Network	Rohde & Schwarz	---	836154/04
35	Reference Impd. Network	Voltech	IEC Standard 555	IB27/2233
36	Power Sensor	Rhode & Schwarz	URV5-Z2	DE30807
37	Power Sensor	Rhode & Schwarz	URV5-Z2	DE30808

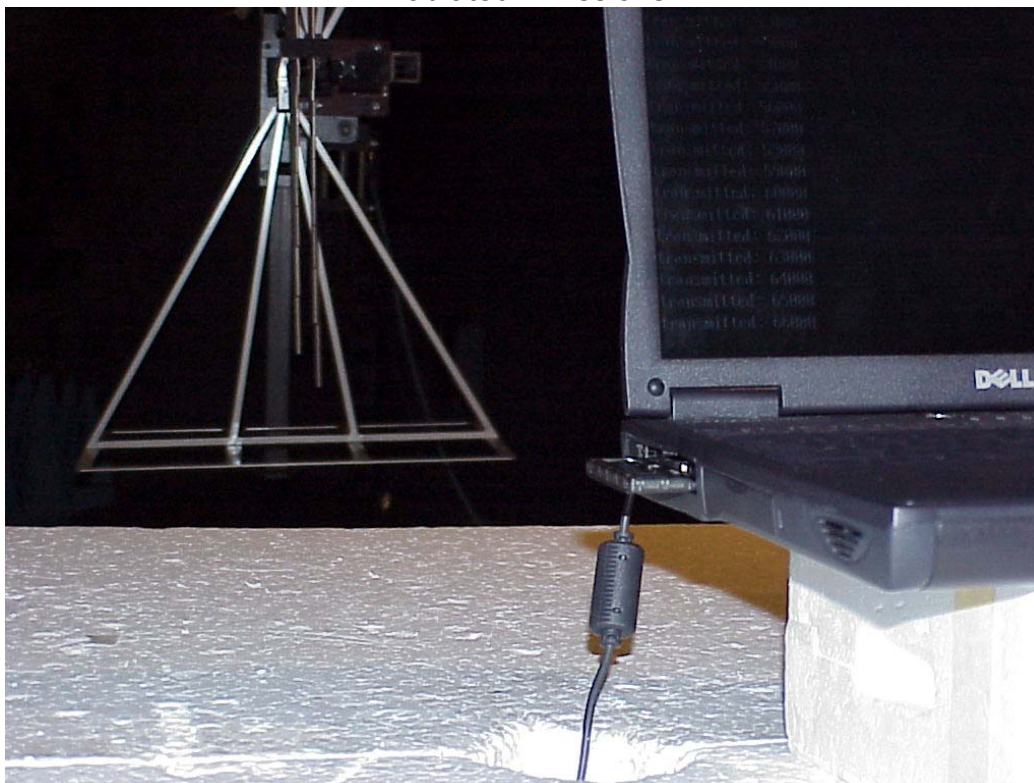
No	Instrument/Ancillary	Manufacturer	Type/Model	Serial No.
38	Log periodic Antenna	EMCO	3148	1186
39	Log periodic Antenna	EMCO	3148	1187
40	Biconical Antenna	EMCO	3109	0005-3250
41	Biconical Antenna	EMCO	3110B	0004-3356
42	Biconical Antenna	EMCO	3110B	0004-3357
43	Biconilog Antenna	EMCO	3141	0005-1186
44	Horn Antenna	Amplifier Research	AT4002A	29068
45	Horn Antenna	AH Systems	SAS-200/571	325
46	Horn Antenna	AH Systems	SAS-200/571	326
47	Horn Antenna	AH Systems	SAS-200/572	141
48	Coupling Clamp 125W	FCC	F-2031-23mm	335
49	Coupling Clamp	Amplifier Research	---	28256
50	Decoupling Clamp	FCC	F-2031-DCN-23mm	111
51	Calibration Fixture	FCC	F-2031-CF-23mm	350
52	Calibration Fixture	FCC	F-BCICF-4	185
53	CDN	FCC	FCC-801-S25	2074
54	CDN	FCC	FCC-801-M2-32A	2056
55	CDN	FCC	FCC-801-S9	2076
56	CDN	FCC	FCC-801-C1-BNC-50	2026
57	CDN	FCC	FCC-801-M3-32A	20100
58	CDN	FCC	FCC-801-T4	2047
59	CDN	FCC	FCC-801-S15	2075
60	CDN	FCC	FCC-801-T2	2048
61	Isotropic Field Probe	Holaday	HI6005	105107
62	Current Probe 10K-500M	FCC	F-52	105
63	Current Probe 10K-230M	FCC	F-120-9A	232
64	Probe Set (9K-1G)	Rohde & Schwarz	H2-14.1026.7744.02	832655/0013
65	Passive Impd. Adaptor	FCC	FCC-801-150-50CDN	20155
66	Passive Impd. Adaptor	FCC	FCC-801-150-50CDN	20156
67	Passive Impd. Adaptor	FCC	FCC-801-150-50CDN	20161
68	Passive Impd. Adaptor	FCC	FCC-801-150-50CDN	20162
69	Passive Impd. Adaptor	FCC	FCC-801-150-50CDN	20163
70	Passive Impd. Adaptor	FCC	FCC-801-150-50CDN	20164
71	Passive Impd. Adaptor	FCC	FCC-801-150-50CDN	20165
72	Passive Impd. Adaptor	FCC	FCC-801-150-50CDN	20166
73	Audio Box TS-SBOX	Rohde & Schwarz	1119.4815.02	338968/001
74	Acoustic Calibrator	Bruel & Kjaer	4231	2253349
75	Mouth Simulator	Bruel & Kjaer	4227	2255310
76	Telephone test head	Bruel & Kjaer	4602B	2255251
77	Probe Microphone	Bruel & Kjaer	4182	1510112
78	Nexus Conditioning Ampl.	Bruel & Kjaer	---	2039582
79	Microphone	Bruel & Kjaer	2669	2039582
80	System Control Interface Unit	Rohde & Schwarz	SCIU	338802/003
81	Directional Coupler Unit	Rohde & Schwarz	DCU	338965/001

PHOTOGRAPHS

Radiated Immunity



Radiated Emissions



ESD

